VOLUME 12

RIDER

TELEVISION MANUAL

JOHN F. RIDER

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MODEL NUMBERS Model numbers may have suffix letter "N"	TV Chassis	Picture Tube	TV Tuner	Record Changer	Radio	Tone Control
17DX10, 17DX11, 17DX12	19B1	17BP4A	94D52-1 or 94D52-2	. . . . .	. . . .	No
121DX10, 121DX12, 121DX16, 121DX17	19C1	20DP4A	94D46-2	. . . . .	. . . .	Yes
121DX11	19F1A	21WP4 or 21WP4X	94D46-2 or 94D46-3	. . . . .	. . . .	No
121DX12A, 121DX16A, 121DX17A	19C1	20DP4A	94D46-2	. . . . .	. . . .	Yes
	19F1	21WP4 or 21WP4X	94D46-2 or 94D46-3	. . . . .	. . . .	Yes
121DX16L, 121DX17L	19K1	21ZP4A	94D46-2 or 94D46-3	. . . . .	. . . .	Yes
221DX15, 221DX16, 221DX17, 221DX26, 221DX38	19C1	20DP4A	94D46-2	. . . . .	. . . .	Yes
221DX15A, 221DX16A, 221DX17A	19C1	20DP4A	94D46-2	. . . . .	. . . .	Yes
	19F1	21WP4 or 21WP4X	94D46-2 or 94D46-3	. . . . .	. . . .	Yes
221DX15L, 221DX16L, 221DX17L, 221DX26L	19K1	21ZP4A	94D46-2 or 94D46-3	. . . . .	. . . .	Yes
221DX26A	19F1	21WP4	94D46-2 or 94D46-3	. . . . .	. . . .	Yes
221DX38A	19C1	20DP4A	94D46-2	. . . . .	. . . .	Yes
	19F1	21WP4 or 21WP4X	94D46-2 or 94D46-3	. . . . .	. . . .	Yes
222DX15	19H1	21EP4A	94D46-2	. . . . .	. . . .	Yes
321DX15, 321DX16, 321DX17	19E1	20DP4A	94D46-2	RC600	Built-in AM	Yes
321DX15A, 321DX16A, 321DX17A	19E1	20DP4A	94D46-2	RC600	Built-in AM	Yes
	19G1	21WP4 or 21WP4X	94D46-2 or 94D46-3	RC600	Built-in AM	Yes
321DX15L, 321DX16L, 321DX17L	19N1	21ZP4A	94D46-2 or 94D46-3	RC600	Built-in AM	Yes
321DX25B, 321DX26B, 321DX27B	19E1	20DP4A	94D46-2	RC600	Built-in AM	Yes
	19G1	21WP4 or 21WP4X	94D46-2 or 94D46-3	RC600	Built-in AM	Yes
321DX26	19E1	20DP4A	94D46-2	RC600	Built-in AM	Yes

SPECIFICATIONS

Picture Tube

Direct View Electromagnetic. See Model Identification Chart for different picture tubes used.

Operating Voltage

110-120 volts. 60 cycles, AC.

Wattage

185 watts for all models.

Input Impedance and Transmission Line

300-ohm balanced (between antenna terminals).

Note that 72 ohm coaxial cable may be used by connecting the outer conductor to the chassis and the inner conductor to either antenna terminal. In weak signal areas, the use of coaxial cable should be avoided.

Antenna

All models equipped with a built-in TV antenna. TV-Radio models equipped with a built-in radio antenna.

Intermediate Frequencies

Video 25.75 MC. Sound 21.25 MC.
Intercarrier Sound 4.5 MC.
Radio 455 KC. (TV-Radio models).

Fuse Location

The horizontal output circuit is fused with a 3/8 amp., 250 volt fuse, part number 84A4-3. The fuse is located on the top side of the chassis. See tube location illustrations.

Record Changer

Model RC600 record changer is used in combination models. The changer model number is on the top rear of the changer pan and also on the changer model label on the underside of the changer.

TELEVISION CHASSIS DIFFERENCES

All 19 series chassis employ the same basic television circuitry. The 19B1, 19C1, 19F1, 19F1A, 19H1 and 19K1 chassis are used in "television only" models. The 19E1, 19G1 and 19N1 chassis are used in "combination" models.

The 19B1 chassis uses a 17″ rectangular picture tube (17BP4A). The 19C1 and 19E1 chassis use a 20″ rectangular picture tube (20DP4A). The 19F1, 19F1A, and 19G1 chassis use a 21″ rectangular picture tube (21WP4 or 21WP4X). The 19H1 chassis uses a 21″ cylindrical faced rectangular picture tube (21EP4A). The 19K1 and 19N1 chassis use a 21″ rectangular picture tube (21ZP4A).

A tone control is used in all 19 series chassis with exception of the 19B1 and 19F1A chassis. The 19E1, 19G1 and 19N1 chassis use a PM speaker. The 19B1, 19C1, 19F1, 19F1A and 19H1 chassis use an EM speaker or a PM speaker with a filter choke mounted to it. All chassis use PM focusing.

The 19B1 chassis uses the 94D52-1 or 94D52-2 TV tuner having a 6BC5 pentode tube as an RF amplifier. All other chassis in the 19 series chassis use the 94D46-2 or 94D46-3 cascode TV tuner using a twin triode 6BZ7 tube as an RF amplifier.

TUBE COMPLEMENT

V101	*6BZ7 or 6BC5	RF Amplifier
V102	6J6	Oscillator and Mixer
V201	6AU6	Sound IF Amplifier
V202	6AL5	Ratio Detector
V203	6AV6	AM Detector, AVC, Sound Amplifier in combination sets; Sound Amplifier in TV only sets
V204	†6Y6G or 6AS5	Sound Output
V301	6CB6	1st IF Amplifier
V302	6CB6	2nd IF Amplifier
V303	6U8	3rd IF Amplifier; Vertical Oscillator
V304	6AL5	Video Detector, AGC
V305	6CB6	Video Amplifier
V306	§	Picture Tube
V401	12AU7	Sync Separator, Sync Clipper
V402	6S4	Vertical Output
V403	6SN7GT	Hor. Oscillator Control, Horizontal Oscillator
V404	6BQ6GT	Horizontal Output
V405	1B3GT	High Voltage Rectifier
V406	6AX4GT	Damper
V501	5U4G	Rectifier
V701	6BE6	Converter (AM Radio)
V702	6BA6	IF Amplifier (AM Radio)

* 6BZ7 tube used in 94D46-2 and 94D46-3 tuners. 6BC5 tube used in 94D52-1 and 94D52-2 tuners.

† 6Y6G tube used in combination sets. 6AS5 tube used in TV only sets.

§ See "Model Identification Chart" on front page for different picture tubes used.

NEW FEATURES

New TV Tuners (part Nos. 94D52-1, 94D52-2, 94D46-2 and 94D46-3): New improved TV tuners are used. The 94D52-1 and 94D52-2 (pentode type) TV tuners are used in models having a 17″ picture tube. The 94D46-2 and 94D46-3 tuners (cascode type) are used in models having a 20″ or 21″ picture tube.

These new improved TV tuners feature high sensitivity and high signal to noise ratio. This is made possible by improved tuner circuitry. The circuits in the RF stage of the 94D52-1 and 94D52-2 tuners have been optimized for the 6BC5 tube and the circuits of the 94D46-2 and 94D46-3 tuners have been optimized for the 6BZ7 tube.

The 94D46-3 cascode TV tuner is used in all later production chassis (Run 6 and higher), with exception of the 19B1 chassis. The 94D52-2 pentode TV tuner is used in later production 19B1 chassis (Run 6 and higher).

TV tuners 94D46-2 and 94D46-3 are identical, with exception of shaft length. TV tuners 94D52-1 and 94D52-2 are identical with exception of shaft length.

DX Range Finder Control: A DX Range Finder control (AGC delay circuit) is used in all 19 series chassis. This control is a potentiometer located at the rear of the chassis to enable adjustment of receiver sensitivity to suit the signal conditions in any local or fringe area.

Improved Video Amplifier: Improved circuitry and use of the 6CB6 tube as a video amplifier have resulted in improved picture definition with greater range of contrast.

Tone Control: A tone control is used in all chassis with exception of the 19B1 and 19F1A.

Horizontal Oscillator Circuit: Pulse Width Modulation is used for control or horizontal oscillator frequency. Better control of oscillator frequency has increased the "hold-in" range of the oscillator and improved noise immunity and sync stability in weak signal high noise level areas over previous circuits of this type. The improved horizontal oscillator circuit also provides better drive to the horizontal output stage.

Horizontal Output Circuit: An improved horizontal output circuit, using a high efficiency auto-transformer provides second anode voltage (approximately 15,000 volts) for good picture definition. A new tube (6AX4GT) is used in the damper circuit.

Improved Width and Linearity Control: The width control and horizontal linearity controls are of the slider type. Use of slider type controls has made adjustment faster and more accurate.

PM Focus: A PM focus assembly is used in all 19 series chassis. Use of the PM focus assembly provides good line focus and minimizes the defocusing effect on the electron beam due to voltage variation.

Vertical Retrace Blanking Circuit: A vertical retrace blanking circuit is used in later production sets (stamped Run 5 and higher). Vertical retrace blanking is achieved by applying the pulse voltage appearing at the secondary of the output transformer to the grid of the picture tube.

HIGH VOLTAGE WARNING

High voltages are present throughout the horizontal output, damper and second anode supply circuits. No attempt should be made to make measurements from high voltage points in these circuits with ordinary test equipment. See Voltage Data.

Warning: Operation of the set outside of the cabinet or with cabinet back removed involves a shock hazard. Exercise normal high voltage precautions.

PICTURE TUBE REPLACEMENT

Picture tube replacement for these receivers is similar to that of other chassis using a rectangular glass picture tube. Make picture adjustments as instructed on pages 3 to 4. Instructions for adjusting curvature correcting magnets used with 21EP4A (21" cylindrical faced) picture tube in 19H1 sets is given on page 3.

REMOVABLE PICTURE WINDOW

All models using the 19 series television chassis have picture windows which can be easily removed from the front of the cabinet for cleaning the inside of the window, picture tube and picture tube mask. Two types of picture window mountings are used. A removable molding in used in wood cabinet models. Removable corner brackets are used in plastic cabinet models. Instructions for removing and cleaning the picture window, picture tube and picture tube mask is given below.

REMOVING PICTURE WINDOW FOR CLEANING

If the picture window has a removable molding (at the top), remove the window by first removing the Phillips head screws and molding at the top of the picture window. Pull the top of the window away from the cabinet slightly and lift it up out of the channel at the bottom.

After cleaning the window, picture tube and picture tube mask as instructed below, install the window by placing the bottom edge in the channel and replace the molding. Use care when tightening screws on molding to prevent stripping.

If the picture window has removable corner brackets, first remove the two brackets at the top of the window. Then, while holding the window, loosen the screws on the bottom brackets. Allow the window to tilt out slightly at the top until it can be grasped and lifted free of the cabinet.

After cleaning, install the window by setting it in position and mounting the corner brackets. Use care when tightening bracket mounting screws to prevent stripping or cracking glass.

CLEANING GLASS PICTURE WINDOW

Clean the picture mask using a soft cloth, dampened in mild soapy water. Clean the picture window and the face of the picture tube using a soft cloth, dampened with your favorite window cleaner. Wipe dry using a chamois or soft, lint free cloth. Only use cloths which are just dampened as presence of moisture or water inside the set may cause damage. Install the window as instructed above.

INSTALLATION and SERVICE ADJUSTMENTS

When installing, each set should be checked for DX Range Finder adjustment (generally set on zero), picture centering, picture tilt, shaded corners, proper size, linearity, etc., to insure best performance. It is especially important that Ion Trap adjustment be checked, and that the Channel Slugs be adjusted upon installation or servicing of every set to insure ease of tuning. Make all checks and adjustments as instructed on the following pages.

For best results, all checks or adjustments should be made using a transmitted television test pattern. A mirror placed in front of the picture tube screen will be of help in observing the picture while making adjustments at the rear of the chassis. Removing the TV back disconnects the interlocking line cord; use a separate line cord (part number 89A22-1) when servicing. See "High Voltage Warning" on page.

INDIVIDUAL CHANNEL SLUG ADJUSTMENT USING A TELEVISION SIGNAL

Individual channel oscillator adjustment of every receiver should be checked upon installation or servicing. If this adjustment is properly made, it is possible to tune from one station to another by merely turning the CHANNEL control. With correct channel adjustment, best picture will be located at the approximate center of the range of the TUNING control. However, this may not necessarily be maximum sound output.

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.

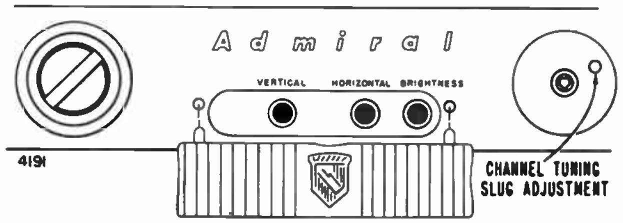


Figure 1. Control Panel on 19B1 Sets. Channel knob is removed.

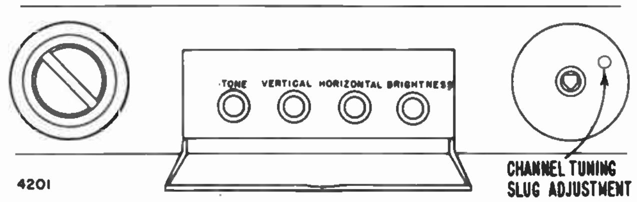


Figure 2. Control Panel on 19C1, 19F1, *19F1A, 19H1 and 19K1 sets. Channel knob is removed.
****19F1A sets have no Tone control.***

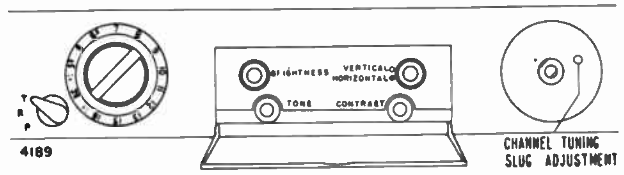


Figure 3. Control Panel on 19E1, 19G1 and 19N1 Sets. Channel knob is removed.

b. Set the CHANNEL knob for a station in operation. Set all other controls for a normal picture.

c. Remove the CHANNEL knob.

d. Set TUNING control at center of its range by rotating it approximately half-way. At this setting, the hole in the TUNING knob will coincide with the hole in the control panel.

e. Insert a 1/8" blade, NON-METALLIC tool in the hole adjacent to the channel tuning shaft (see illustration). For each channel in operation, carefully adjust the channel slug for best picture with clear detail. (Note that this may not be the point at which the sound is loudest.) Be sure that the Tuning control is set at the center of its range before adjusting each channel slug. Generally, only slight rotation of the slug will be required; turning the slug in too far will cause it to fall into the coil. (If the slug falls into the coil, remove the chassis from the cabinet and remove the coil. Move the retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace slug and reset retaining spring.)

ION TRAP ADJUSTMENT

To prolong the life of the picture tube, it is important that this adjustment be made upon installation, after adjusting the picture positioning lever, or after repositioning the focus coil.

Set the BRIGHTNESS control (at front of set) for normal brightness.

Position the ion trap on the picture tube close to the base. Starting from this point, very carefully move the ion trap forward or backward and at the same time, rotate it slightly in either direction until maximum brightness is produced.

Reset the BRIGHTNESS control for normal brightness. Adjust the FOCUS control (at the rear of set) for good focus. Readjust the ion trap for maximum brightness.

Note that there may be two locations where the brightest picture can be produced. The second ion trap location, which is further away from the tube base, should not be used or tube damage will result.

Important: If the corners of the picture are shaded, be sure the ion trap has been properly adjusted. Do not sacrifice picture brightness when adjusting the ion trap to remove shaded corners. To eliminate shaded corners, see the discussion under "Check Picture Centering". Be sure to readjust the ion trap each time after adjusting the picture positioning lever or repositioning the focus assembly. Tighten the ion trap mounting screw (if used).

DX RANGE FINDER ADJUSTMENT

This control is at the rear of the set, near the right side.

This control is used to improve TV reception in fringe areas and in areas where there is interference.

The DX RANGE FINDER should be at the "0" position, if satisfactory pictures can be obtained by using the operating controls on the front of the set.

Where the TV signal strength is weak, the picture can often be improved by turning the DX RANGE FINDER part way to the right or, if necessary, all the way to "300".

Snow (noise) in the picture can sometimes be minimized by careful adjustment of the DX RANGE FINDER.

Caution: If the DX RANGE FINDER is turned too far to the right for a strong signal, the picture may bend (overload).

If the signal strength changes, it may be desirable to change the setting of the DX RANGE FINDER; however, it is generally possible to set it at a single compromise position which gives reasonable reception for the different signal strengths.

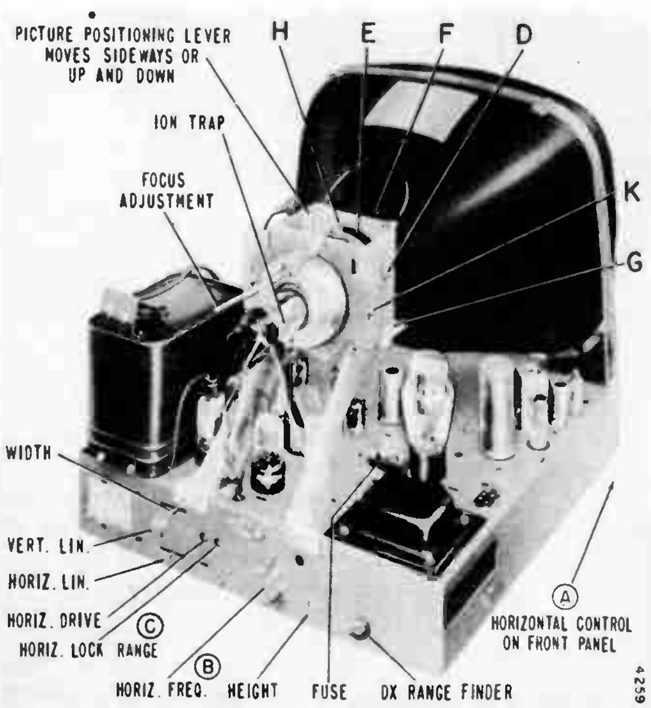


Figure 4. Rear View of Chassis Showing Adjustment Locations.

It is important to keep the DX RANGE FINDER setting as low as possible consistent with satisfactory pictures.

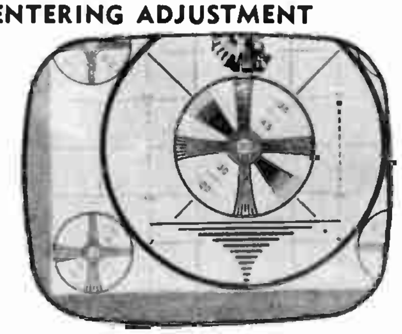
ADJUSTING CURVATURE CORRECTING MAGNETS FOR SETS USING A 21EP4A (21") PICTURE TUBE

If either side of the picture has excessive curvature (pin cushion effect) or if corners of the picture are bent inwardly, this can be minimized by adjustment of the correcting magnets located on the yoke bracket. Either side of the picture can be adjusted individually by using the magnet on that side of the picture tube. A picture or test pattern having straight vertical lines near the sides can be used for making adjustment; the pattern from a cross-hatch generator is preferable. IMPORTANT: A cross-hatch generator which is not capable of locking the picture in both horizontal and vertical sync is not suitable. Adjust as follows:

a. Set the receiver controls for normal picture. Be sure that the picture is centered properly and vertical linearity adjustment is made.
b. Check the radial position of the magnet brackets. The magnet brackets are generally set so that the mounting screw is centered in the curved slot. It should only be necessary to change from this setting if the curvature at the side of the picture is not centered with respect to the side of the picture tube.
c. Move the correcting magnet against the deflection yoke bracket. While observing the vertical lines on the same side of the picture that the magnet is located, slowly move the magnet forward until curvature of vertical lines near the side is minimized. If the magnets are moved too far forward, the corners of the picture will bend inwardly or become shaded.

PICTURE CENTERING ADJUSTMENT

If the picture is off center, it can be centered by using the picture positioning lever, and when necessary, repositioning the focus assembly around the picture tube neck. Follow the instructions given below. ***Note that the picture positioning lever can be moved sideways, or up and down.***



Picture Not Centered; Adjust Picture Positioning Lever.

Centering the Picture

a. Adjust ion trap as instructed on preceding page.
b. Adjust the picture positioning lever (sideways, or up and down) for correct picture centering. If centering is not done with a test pattern, it may be necessary to reduce picture height and width to determine correct centering.
c. Readjust the ion trap.

Difficulty in Centering the Picture

a. Adjust ion trap as instructed on preceding page.
b. Slightly loosen the two screws "K" which hold the focus assembly to the yoke bracket. Center focus assembly around the tube neck; tighten screws.
c. Center the picture with the picture positioning lever. If the picture cannot be centered with the lever, it may be necessary to locate the focus assembly slightly off center and then center the picture with picture positioning lever.
d. Readjust the ion trap.

Difficulty in Eliminating Shaded Corners

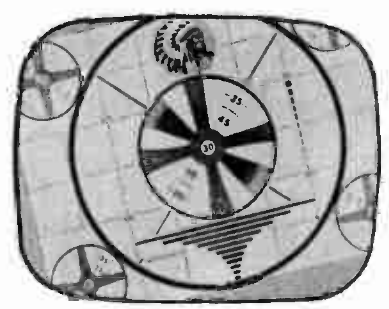
a. Loosen screws "G", then move the yoke support bracket forward until rubber grommet "F" is firmly against the flare of the picture tube.
b. Move the deflection yoke coil "E" as far forward as possible. In some cases, it may be necessary to loosen the two screws "D", move the bracket up or down, and then move the deflection yoke coil as far forward as possible.
c. Adjust ion trap as instructed on preceding page.
d. Shaded corners may also result from use of the wrong ion trap. These picture tubes use ion trap 94A15-3. The part number is stamped on the magnet.

FOCUS ADJUSTMENT

Focus adjustment can be made without removing the cabinet back from the receiver by rotating the shaft extending from the rear of the focus assembly. Set the Picture control for normal picture and the Brightness control at slightly above average brightness. Rotate the control shaft to the right or to the left until the picture is in sharp focus. Slight rotation in either direction should generally bring the picture into focus. If the picture was greatly off focus, readjust the ion trap.

PICTURE TILT ADJUSTMENT

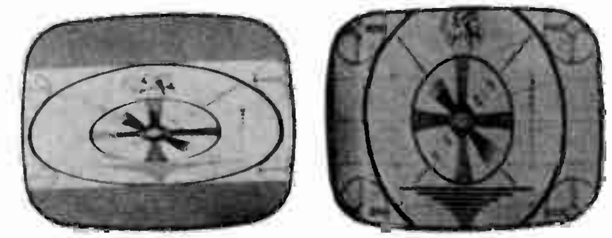
If the picture is tilted, loosen the wing screw "H" on the deflection yoke coil "E" and slightly rotate the yoke until the picture is straight. Before tightening the wing screw, be sure that the yoke is moved as far forward as possible, otherwise corners of the picture may become shaded.



Picture Tilted; Adjust Deflection Yoke Coil.

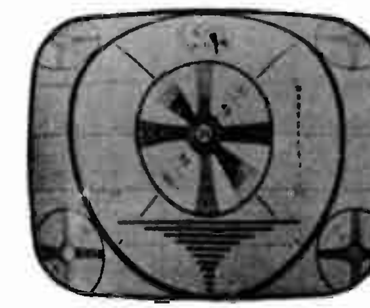
HEIGHT AND VERTICAL LINEARITY ADJUSTMENT

If the picture is of incorrect height (vertical size), adjust the HEIGHT control. This adjustment will affect the vertical linearity of the picture. If necessary, alternately adjust the VERT. LIN control and HEIGHT control. Note that the upper portion of the picture is affected mostly by the Vertical Linearity control; the lower portion by the Height control.



Incorrect Height; Alternately Adjust HEIGHT and VERT. LIN. Controls.

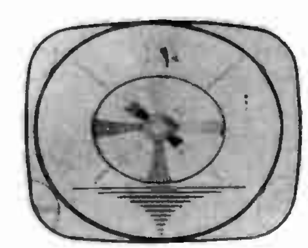
If the large circle in the test pattern appears cramped or flattened at top or bottom (non-linear vertically), correct by alternately adjusting the VERT. LIN. control and the HEIGHT control.



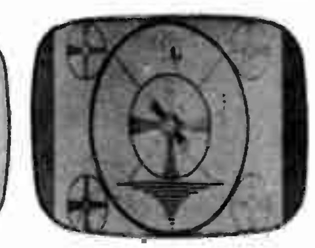
Top or Bottom of Picture Cramped or Flattened; Adjust VERT. LIN. and HEIGHT.

WIDTH ADJUSTMENT

If the picture is too wide or too narrow, adjust the WIDTH adjustment lever by moving it to the left or to the right until the picture just fills the picture tube screen.



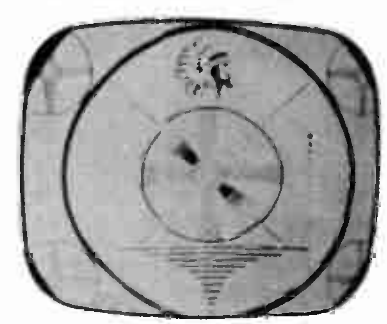
Too Much Width; Adjust WIDTH.



Not Enough Width; Adjust WIDTH.

HORIZONTAL LINEARITY ADJUSTMENT

If the large circle in the center of the test pattern has a cramped or flattened appearance at either side (non-linear horizontally), adjust the HORIZ. LIN. by moving it to the left or to the right as required. Note that the Horizontal Drive and



Side of Picture Cramped or Flattened; Adjust HORIZ. LIN.

the Width adjustment also affect linearity. Be sure that these adjustments are set correctly if difficulty is encountered when making the horizontal linearity adjustment.

HORIZONTAL DRIVE ADJUSTMENT

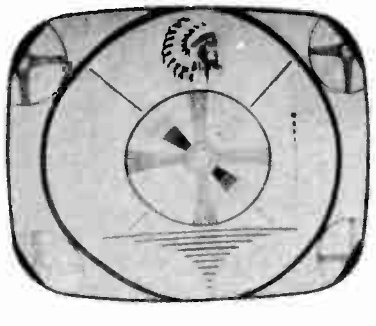
If this adjustment is not properly made, it may be difficult to obtain sufficient picture width and brightness. Adjust as follows:

a. Turn the CHANNEL control to an unused channel. (This adjustment may be made on a channel in operation, but results will not be as accurate.)

b. Set BRIGHTNESS control at a lower than average setting. Turn PICTURE control completely to the left.

c. Turn the HORIZONTAL control (front panel) completely to the left.

d. Turn the HORIZ. DRIVE screw out (to the left) as far as possible while still maintaining slight tension



Vertical Line; Adjust HORIZ. DRIVE.

on the trimmer plate. If a white vertical line (or lines) appears on the screen, slowly turn the HORIZ. DRIVE screw in, until the line(s) just disappears.

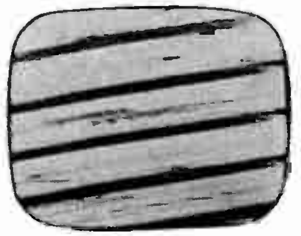
Do not use the Horizontal Drive to obtain correct width or linearity. If necessary, make the Width and Horizontal Linearity adjustments.

SIMPLIFIED HORIZONTAL SYNC ADJUSTMENT

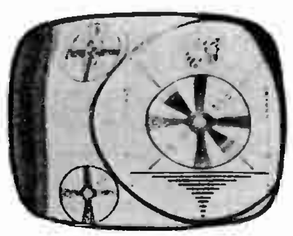
A receiver which requires horizontal sync adjustment can be corrected only by following in exact detail the step-by-step procedure given here.

Check whether adjustment is necessary by rotating the HORIZONTAL control (A) on the front panel from one end to the other; the picture should hold as follows:

a. For strong or medium signals, the picture should remain in sync over the entire rotation of the HORIZONTAL control. Horizontal sync adjustment is required if the picture falls out of sync, bends at the top (jitters), or doubles up on the side. See illustrations below.



Picture Out of Horizontal Sync.



Bending or Jitter at Top of Picture.

b. For weak or fringe area signals, the picture should remain in sync over ½ to ¾ of the rotation of the HORIZONTAL control. Horizontal sync adjustment is required if the picture falls out of sync, bends at the top (jitters), or doubles up on the side. See illustrations below.

Adjust Horizontal Sync as follows:

1. Set the DX Range Finder at "0" position (see figure 5) and set the PICTURE control (contrast on front panel) for normal picture.

2. Important: Before making these adjustments, be sure that the picture can be made to sync vertically (remain stationary up and down) as lack of both vertical and horizontal sync is an indication of trouble in the sync circuits. If replacement of tubes V401 and V403 does not eliminate sync trouble; see Service Hints For Horizontal Sync on page 5.

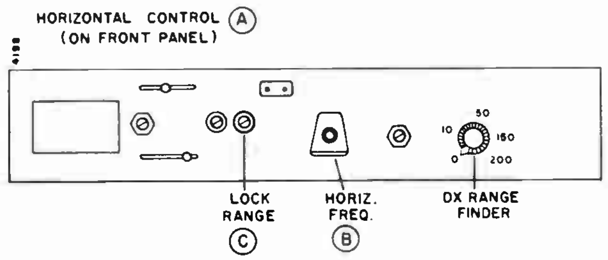


Figure 5. Rear View of Chassis Showing Horizontal Sync Adjustments.

3. With the picture in sync, rotate HORIZONTAL control (A) on front panel from one end to the other. If picture does not hold sync as described in paragraphs "a" or "b" at left, set the HORIZONTAL control (A) at the point where the picture just loses sync or becomes unstable, and slowly adjust the HORIZONTAL FREQUENCY (B) until the picture just falls back into sync. It may require several turns of adjustment (B). Repeat this procedure until the picture holds as described in paragraphs "a" or "b" at left. If the picture can be made to hold sync with adjustment of (B), adjustment is complete; otherwise proceed with step 4.

4. If the picture cannot be made to hold sync as described in paragraphs "a" or "b" at left, turn the LOCK RANGE adjustment (C) clockwise until tight, then back it out ½ turn for strong and medium signals. If signals are generally very weak, turn it out a full turn from the tight position.

5. Recheck step 3.

6. If horizontal sync is still unsatisfactory, carefully repeat entire procedure. Try replacing tube V403. It may be necessary to make complete Horizontal Oscillator Alignment (using an oscilloscope) as instructed.

COMPLETE HORIZONTAL OSCILLATOR ALIGNMENT
(Requires Oscilloscope)

1. IMPORTANT: Set the DX RANGE FINDER at "0" position (see figure 5) and set the PICTURE control (contrast on front panel) for normal picture.

2. In some chassis (stamped Run 1 or lower), the HORIZONTAL control (A) may be wired in reverse. If so, it will be impossible to make adjustment properly by following the instructions below.

   To determine whether the control wiring is reversed, check the lug to which blue wire is connected. The blue wire should connect to the lug nearest bottom edge of the chassis and the 68,000 ohm resistor R425 should connect to the lug nearest the top of the chassis. If wiring is reversed, change the two connections in accordance with the information given here.

3. IMPORTANT: Connect oscilloscope high side through a **10 mmfd. condenser** to terminal marked "C" or "2" on the horizontal blocking transformer T404. (See figure 6.) It is important to use short leads and a very low capacity condenser (at least 10 mmfd.) to avoid loading the circuit and thus distorting the waveform.

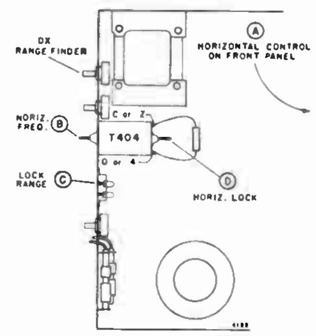


Figure 6. Bottom View of Chassis Showing Horizontal Sync Adjustments.

4. Set the oscilloscope sweep to 15.75 KC or a submultiple of it.

5. Adjust the HORIZONTAL LOCK slug (D) (see figure 6) until the oscilloscope waveform pattern appears as in figure 7. The rounded and pointed peaks

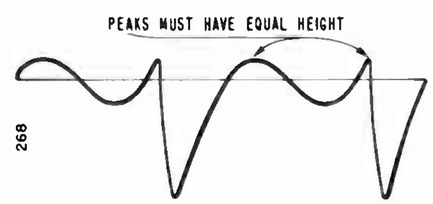


Figure 7. Horizontal Oscillator Waveform.

of the waveform must have equal height. The picture must be kept in sync to obtain the proper oscilloscope waveform pattern. Keep the picture in sync by adjusting the HORIZONTAL FREQUENCY (B) and/or the LOCK RANGE trimmer (C). If the picture still will not sync, check for a defective tube, components, or wiring, before continuing further. See Service Hints on Horizontal Instability And Tearing In Picture on page 5.

6. Disconnect the oscilloscope leads.

7. Set the HORIZONTAL control (A) fully counterclockwise to break sync. If the picture does not go out of sync, momentarily interrupt the channel selector, or adjust the HORIZONTAL FREQUENCY (B) until several bars appear sloping downward to the left. (See figure 8.)

8. Slowly turn the HORIZONTAL control (A) clockwise and note the least number of bars present before the picture falls into sync. If two or three bars are present, the LOCK RANGE trimmer is set properly, so reset the HORIZONTAL control (A) to maximum counterclockwise and adjust the HORIZONTAL FREQUENCY (B) until the picture falls back into sync.

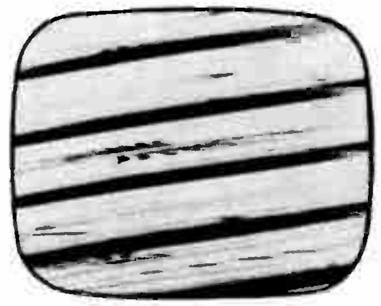


Figure 8. Picture Out of Horizontal Sync.

9. If more than three bars are present, adjust the LOCK RANGE trimmer (C) slightly clockwise. If less than 2 bars are present, adjust the LOCK RANGE trimmer (C) counterclockwise. Repeat steps 7 and 8.

10. Rotate HORIZONTAL control (A) on the front panel from one end to the other. The picture should hold sync as follows:

    a. For strong or medium signals, the picture should remain in sync over the entire rotation of the HORIZONTAL control. If it falls out of sync, bends at the top (jitters), or doubles up on the side; sync adjustment is required; see step 11 below.

    b. For weak or fringe area signals, the picture should remain in sync over ½ to ¾ of the rotation of the HORIZONTAL control. If it falls out of sync, bends at the top (jitters), or doubles up on the side; sync adjustment is required; see step 11 below.

11. If picture does not hold sync as described in paragraphs "a" or "b" above, set the HORIZONTAL control (A) at the point where the picture just loses sync or becomes unstable and adjust the HORIZONTAL FREQUENCY (B) until the picture just falls back into sync. It may require several turns of adjustment (B). Repeat this procedure until the picture holds as described in paragraphs "a" or "b" of step 10.

SERVICE HINTS

Also see Production Changes in this Manual.

TROUBLE SHOOTING

The television chassis covered in this Service Manual are newly designed sets incorporating the latest in television circuitry. New features incorporated in the 19 series chassis are outlined in paragraph on "New Features" on page 1. Important: Since there are many differences in these chassis over earlier model Admiral receivers, it is important to remember the following when servicing or installing these receivers.

All chassis have a "DX Range Finder Control" (AGC delay circuit). This control is a potentiometer located at the rear of the chassis to enable adjustment of receiver sensitivity to suit the signal conditions in any local or fringe area. Incorrect adjustment of this control in a strong signal area, may result in picture bending, excessive contrast and poor sync. Information on the adjustment of the DX Range Finder control is given on page 3.

The sound output tube V204 (6Y6G or 6AS5) functions as a voltage dropping tube in addition to being a sound output tube. The cathode of the sound output tube operates at approximately 140 volts above chassis ground for TV operation. If the sound output stage becomes defective, B+ voltage to the TV tuner, sync separator and clipper, video amplifier and AGC delay circuit will be affected.

In chassis stamped Run 2 or lower, the first and second IF amplifiers V301 and V302 are in series. The cathode of V302 is operated at approximately 120 volts above chassis ground. If either V301 and V302 become defective, B+ voltage to the other stage will be affected.

In chassis stamped Run 3 and higher (except 19B1), B+ voltage to the first and second IF amplifiers V301 and V302 is in parallel. When making voltage measurements in chassis (except 19B1) stamped Run 3 and higher, it is important to note that the plate and screen voltages at the first and second IF amplifier stages V301 and V302, may vary over a wide range, depending on the strength of the TV signal. The voltages shown on the schematics are taken with the antenna disconnected and antenna terminals shorted; see Voltage Data on schematic pages.

In sets using the 94D46-2 or 94D46-3 cascode tuner, the triode sections of the RF stages (V101) are in series. The cathode of the second triode section is operated at approximately 130 volts above chassis ground. If the tube should be come defective or be removed from the socket, there will be no B+ voltage on the plate of the first triode section. See B+ distribution diagrams, figures 9 and 10.

The horizontal oscillator circuit utilizes pulse width modulation for control of the horizontal oscillator frequency. Information on servicing the horizontal oscillator and horizontal oscillator control circuit is given in paragraph "Service Hints for Horizontal Sync". Note: An oscilloscope is required for alignment of the horizontal oscillator waveform. Information on alignment of the horizontal oscillator is given on page 4.

When servicing these chassis in the shop, it is important that the correct type of speaker or speaker substitute be used. The 19B1, 19C1, 19F1, 19F1A and 19H1 chassis use an EM speaker with output transformer, or a PM speaker with an output transformer and filter choke mounted to it. 19E1, 19G1 and 19N1 chassis stamped with the letter "T" at the rear of the chassis, use a permanent magnet (PM) speaker with the output transformer mounted on the television chassis. 19E1, 19G1 and 19N1 chassis without the letter "T" use a permanent magnet (PM) speaker with the output transformer mounted directly on the speaker. Use of an incorrect speaker will result in no B+ voltage or weak and distorted sound.

B+ DISTRIBUTION IN TELEVISION CHASSIS

Figures 9 and 10 illustrate the basic B+ distribution used in these chassis. The B+ distribution in chassis stamped Run 2 or lower is shown in figure 9. The B+ distribution in chassis stamped Run 3 and higher is shown in figure 10. Note: There are variations in the B+ circuits of TV and combination models and TV models using a different RF amplifier tube (V101) in the TV tuner. Alternate connections for the RF amplifier tube (V101) is shown in figure 9. See "Television Chassis Differences", and "Trouble Shooting" information.

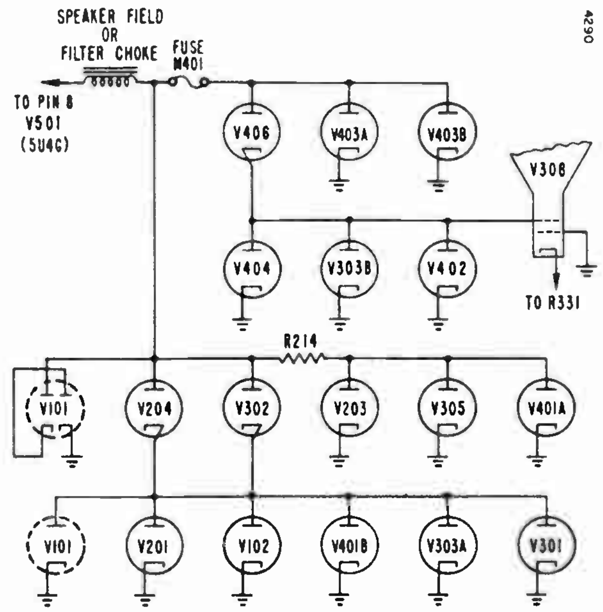


Figure 9. B+ Distribution in Chassis Stamped Run 2 or Lower.

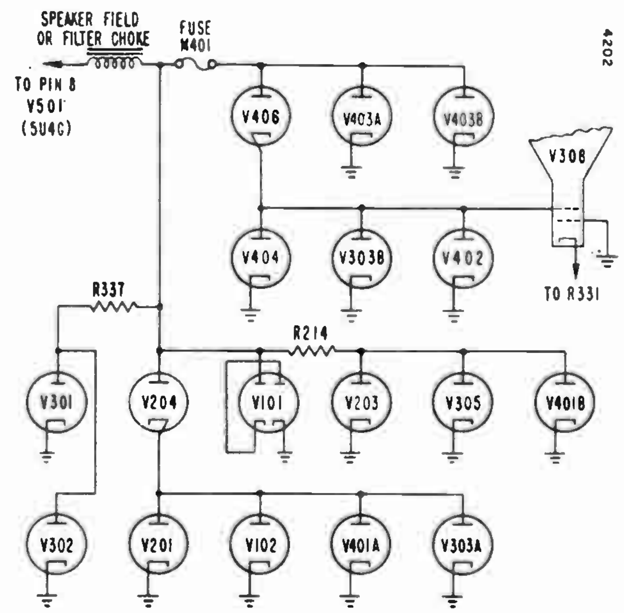


Figure 10. B+ Distribution in All Chassis (except 19B1) Stamped Run 3 and Higher.

SERVICE HINTS FOR HORIZONTAL SYNC

The horizontal oscillator control circuit controls the horizontal oscillator by a method called "Pulse Width Modulation". This method is so called, because the width of the pulse applied to the grid of the horizontal oscillator control section determines the length of time that current flows through this section. The duration of current flow through the control section determines the DC control voltage applied to the grid of horizontal oscillator, thereby controlling the frequency.

The waveshape applied to the grid of the horizontal oscillator control section is formed by combining a partially integrated pulse from the horizontal oscillator output and the horizontal sync pulse. If these two pulses combine properly, the waveshape shown in figure 11 will be developed and the horizontal oscillator will be in sync.

With no sync input, the waveform at the horizontal oscillator control grid should appear as shown in figure 12. Since the horizontal oscillator control voltage is dependent upon a waveshape formed at the horizontal output stages (V404, V405 and V406), a defective component in one of these stages may cause sync trouble. If the waveform shown in figure 12 can be obtained, this will indicate proper operation of the horizontal sweep circuit.

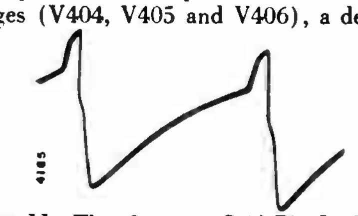


Figure 11. Waveform on Grid Pin 1 of V403 With Sync Pulse.

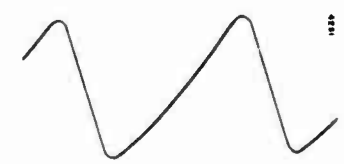


Figure 12. Waveform on Grid Pin 1 of V403 Without Sync Pulse.

When the horizontal oscillator is out of sync, it may be difficult to observe this waveform (figure 12) on an oscilloscope due to the presence of out-of-phase sync pulses. In this case, remove the sync separator and sync clipper tube V401. If the waveshape shown in figure 12 is obtained, place the sync and separator tube back into its socket. Then, remove the horizontal oscillator and control tube V403 (6SN7GT). Conventional, well-shaped sync pulses should appear at control grid (pin 1) of V403.

If there are no sync pulses, or the pulses are of low or varying amplitude, accompanied with noise, the sync circuits should be checked. However, if the sync pulses are well-shaped and of constant amplitude, the horizontal oscillator may be misaligned. Place V403 back into its socket and make the "Horizontal Oscillator Alignment" given on page 4.

If it is impossible to sync the picture, or obtain the correct waveform at terminal "C", check for a defective component. See the following paragraphs.

HORIZONTAL INSTABILITY AND TEARING IN PICTURE

Horizontal instability, tearing or bending may be due to misadjustment of the DX Range Finder or horizontal sync adjustments; or it may be due to a faulty tube or defective components. If causes of trouble have been checked as instructed in the following steps and the chassis is Run 2 or lower, make the circuit changes described under the heading below on "Circuit Changes to Reduce Bending and Improve Horizontal Sync".

Make checks as follows:

a. Check to see if trouble is due to misadjustment of the DX Range Finder control. Set control at "0", use this setting unless a higher setting gives better results. See figure 5.

b. Check horizontal sync adjustment as instructed under "Simplified Horizontal Sync Adjustment" on page 7. If difficulty is experienced in making Horizontal Sync adjustment, continue with the following steps.

c. Replace the horizontal oscillator tube V403 (6SN7GT). Try tubes of different brands. Repeat Horizontal Sync adjustment.

d. Check resistors (R420, R421, R422, R423, R424 and R428). These resistors should be within 5% tolerance of the values shown in the parts list and on the schematic. Also, check condenser C418 (.01 mfd.) for correct capacity. If this condenser is suspected as being faulty, it should be replaced with a .01 mfd, 400 volt, 10% condenser, part number 64A2-16.

e. Check condenser C417 by substitution. Use a 270 mmfd, 10% mica condenser, part numbr 65B21-271.

f. Check condensers C413 and C416 for either open or short.

g. If tapping the horizontal oscillator transformer T404 causes erratic operation, a cracked adjustment slug in the transformer may be the cause. If transformer T404 is suspected as being the cause of the trouble, it should be replaced.

h. If after following each of the above steps, horizontal difficulties are still present, and the set is Run 2 or lower, it is suggested that circuit changes be made as described in the section below.

CIRCUIT CHANGES TO REDUCE BENDING AND IMPROVE HORIZONTAL SYNC

(Applies to chassis stamped Run 2 or lower.)

Making the following circuit changes to an early production chassis, will minimize bending of the picture at high contrast control settings in strong signal areas and improve horizontal sync in medium fringe areas.

IMPORTANT: Before making changes below, check whether bending or sync trouble is due to faulty tubes, defective components, misadjustment of the DX Range Finder control, or horizontal sync adjustment. See pages 3 and 4 for information on adjustment.

Add changes as follows:

1. Check connections to the DX Range Finder control R315. Be sure that the center terminal is grounded and that the white wire goes to the terminal of the DX Range Finder nearest the bottom edge of the chassis. Connect a wire lead from pin 1 of V304 (6AL5) to the remaining terminal of the Range Finder control. See figure 14.

2. In chassis using a 6AS5 sound output tube (V204), change resistor R212 from 3,600 ohms to 1,500 ohms, ½ watt, 5%. In chassis using a 6Y6G sound output tube (V204), change resistor R212 from 4,700 ohms to 2,000 ohms, ½ watt, 5%.

3. In chassis using a 6AS5 sound output tube (V204), change resistor R213 from 1,100 ohms to 910 ohms, ½ watt, 5%. In chassis using a 6Y6G sound output tube, change resistor R218 from 2,000 ohms to 1,500 ohms, ½ watt, 5%.

4. In some areas, it may be beneficial to increase the sync pulse level by changing the sync take-off on the video amplifier plate load. Disconnect resistor R327 (2,700 ohms) from the junction of resistors R325 and R326 (2,700 ohms). Reconnect R327 to the junction of R325 (2,700 ohms) and peaking coil L306. See figure 14.

5. Make the Run 4 change, which consists of connecting a 8,200 ohm resistor (R443) in series with resistor R407 (between terminal 3 of the vertical integrator couplate and pin 1 of V401B). See figure 14.

6. Since step 1 above is effective only with the DX Range Finder set at "0", use this setting unless a higher setting gives better results.

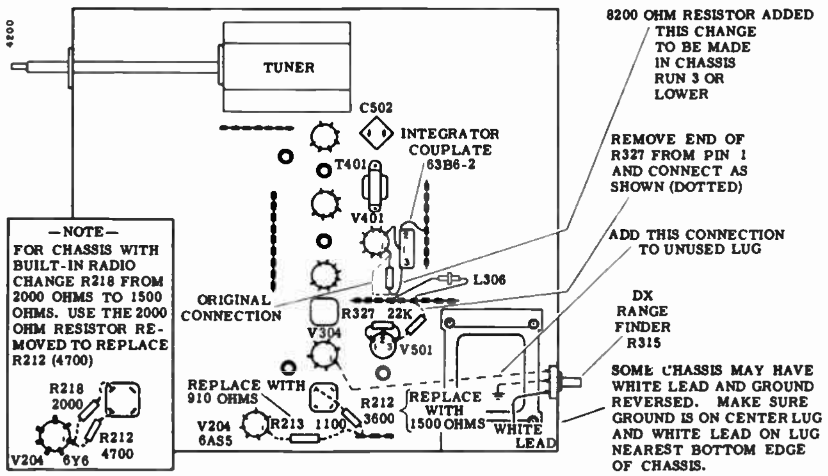


Figure 14. Bottom View of Chassis Showing Simplified Circuit Changes for Reducing Bending and Improving Horizontal Sync in Chassis Stamped Run 2 or Lower.

EXCESSIVE SNOW IN PICTURE DUE TO FAULTY TUBES

Excessive snow in the picture can be caused by faulty tubes in the receiver. Check receiver as follows:

Short circuit the antenna terminals and turn the Picture control (contrast) fully clockwise.

Connect a vacuum tube voltmeter from test point "V" to chassis. Set the channel selector on an unassigned channel. If the voltmeter reading exceeds .6 volt negative, excessive receiver (tube) noise is indicated. This condition can usually be corrected by tube substitution. Substitute tubes in the following order: Video detector tube V304, RF oscillator tube V102, RF amplifier tube V101 and IF amplifier tubes V301, V302 and V303.

Corona or arcing in the second anode supply can also cause a high noise reading at the video detector resulting in excessive snow in weak signal areas.

If the above does not eliminate excessive snow and the chassis is stamped Run 2 or lower, see the "Snow Changes" listed under Run 3 Production Change on page 16. Note: Since this portion of the Run 3 change is rather involved, we do not recommend that it be made in the field. However, if it is desired to make the changes, complete instructions can be obtained by writing the Service Department of the Admiral Corporation at 201 E. North Water Street, Chicago 2, Illinois.

MISCELLANEOUS TROUBLE DUE TO FAULTY TUBES

Faulty tubes cause the majority of receiver troubles. The list below contains most common troubles which are generally due to faulty tubes.

a. Poor fringe area reception due to low B plus voltage. Check the 5U4G tube.

b. Poor fringe area reception due to low sensitivity. Check the 6BC5 and 6BZ7 tubes, if used in the receiver.

c. Picture and sound separated due to IF oscillation. Check the 6CB6 and 6U8 tubes.

d. Picture bending caused by leakage between tube elements. Check the 6BC5 and 6CB6 tubes.

e. Poor sync stability, usually more noticeable in vertical circuit. Check 12AU7 tube.

f. Washed out picture due to negative grid current. Check 6CB6 tube.

VERTICAL JITTER AND POOR INTERLACE

Vertical jitter and poor interlace may occur in early production receivers, if the red lead (terminal 3) of the deflection yoke T403B is dressed too close to the grid circuit of the vertical output tube V402 (6S4). The red lead to the deflection yoke should be dressed against the chassis and as far away from the grid circuit of the vertical output tube as possible.

ADDING VERTICAL RETRACE BLANKING CIRCUIT TO AN EARLY PRODUCTION CHASSIS

All 19 series chassis stamped Run 5 and higher, have a vertical retrace blanking circuit incorporated for eliminating retrace lines. A schematic of the retrace blanking circuit and detailed instructions for adding this change to an early production receiver, is given in the paragraphs below. The following parts are required:

Sym.	Description	Part No.
C427	.01 mfd, 600 volts, condenser	64B 9-13
C428	.01 mfd, 400 volts, condenser	64B 9-32
R445	56,000 ohms, ½ watt, resistor	60B 8-563
R444	2700 ohms, ½ watt, resistor	60B 8-272

1. Locate the red wire between pin 10 of the picture tube and the junction of the black lead of T403A (vertical deflection yoke) and the red lead of T402 (vertical output transformer).

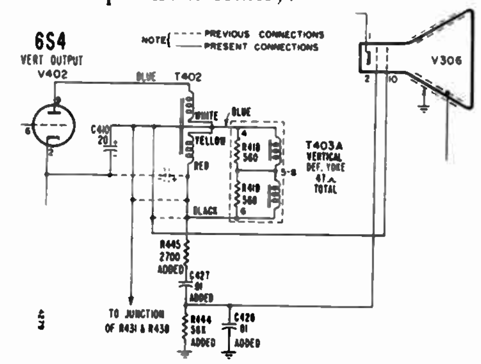


Figure 13. Vertical Output and Picture Tube Circuit With Vertical Blanking Added.

2. Locate the bare wire between the junction of R431 (820,000 ohms) and R438 (1200 ohms) and the junction of the black lead of T403A and red lead of T402.

3. Disconnect the red wire and the bare wire from their common junction point. Reconnect both of these leads to the junction of the 7.5 ohm winding and the 100 ohm winding of T402 (common point of the white and yellow leads). See figure 13.

4. Locate the red (positive) lead from C410 (20 mfd) and the junction of the black lead of T403A and red lead of T402. Disconnect the red wire from this junction and reconnect to junction of 7.5 ohm and 100 ohm winding of T402.

5. Locate the green wire from pin 2 of the picture tube and disconnect from chassis ground. Connect green wire to a .01 mfd., 600 volt condenser. Connect the other end of this condenser to a 2700 ohm, ½ watt resistor. Connect the other end of the resistor to the junction of the red lead of T402 and the black lead of T403A.

6. At the junction of the .01 mfd., 600 volt condenser and the green wire from pin 2 of the picture tube (connected in step 5) connect a 56,000 ohm resistor to chassis ground. Connect a .01 mfd., 400 volt across the 56,000 ohm resistor.

WARNING: Do not use any of the unused lugs of V402 (6S4) tube socket for the points. These lugs are connected to the internal tube structure of the 6S4 tube.

INSUFFICIENT HEIGHT

If adjustment of the Height and Vertical Linearity controls does not provide sufficient height, try replacing the vertical output tube V402 (6S4). Insufficient height can also be due to a weak vertical oscillator tube V303 (6U8).

ELIMINATING AUDIO HUM

Strong (60 cycle) audio hum in these receivers can be due to any one of the causes listed below, which can easily be corrected.

1. Hum may be due to coupling between components in the audio input circuit and the AC wiring. Check the 117 volt AC leads to the On-Off switch. These leads should dress away as far as possible from the grid circuit of the sound amplifier V203. In models using tone control R214, dress the lead between the control and the plate (pin 7) of V203 away from the AC leads.
2. Check position of condenser C209 (.01 mfd.) in the sound amplifier circuit (V203) to make certain that it is not too close to the 117 volt AC wiring or On-Off switch. If C209 is a tubular paper condenser, the outside foil terminal should be connected to the junction of resistor R207 (47,000 ohms) and condenser C208 (.0022 mfd.).
3. Check the B+ (power supply) circuits for an open or under capacity electrolytic condenser. Especially check filter condenser C501, 60 mfd., 350 volts.
4. If the receiver is a TV only model using a 10″ electro-magnetic (EM) speaker, it may be possible that the speaker is the cause of excessive hum. The speaker may be checked by substituting another speaker of the same type. The original 10″ electro-magnetic (EM) speaker part number 78B75-1, can be checked by substituting a permanent magnet (PM) speaker with the filter choke attached such as part number 78B80-1.

SOUND BARS IN PICTURE

Sound bars noticeable at high volume levels, may be caused by heavy audio currents being induced in the B+ circuits. This can be due to the location or the routing of leads to electrolytic condenser C215. Condenser C215 is the single section electrolytic condenser (80 mfd, 350 volts) which is mounted at the center of the chassis.

To minimize the possibility of sound bars in the picture, the mounting and routing of leads to electrolytic condenser C215 were changed. In later production sets, electrolytic condenser C215 is mounted in parallel and in front of the 9 lug terminal strip near the center of the chassis. When mounted this way, the terminals of condenser C215 face away from the TV tuner, thus permitting the negative lead C215 to connect directly to the cathode of the sound output tube V204.

TOUCH-UP OF RATIO DETECTOR SECONDARY USING TELEVISION SIGNAL (A8, BOTTOM SLUG OF T201)

*Adjustment A8 is accessible through the ¼″ hole (just below T201) in bottom of the cabinet or the chassis mounting shelf, located toward the left side facing the rear of the set. See figure 22. Removal of the chassis is therefore not required. ***Adjustment need be made on one channel only.*** Proceed as follows:

a. Turn set on and allow about 15 minutes for warm up.
b. Tune set for normal picture and sound.
c. Carefully insert a non-metallic alignment tool through the opening in cabinet bottom below T201. An alignment tool with a screwdriver blade or hexagonal end is required depending on the transformer used, see * note below. When the alignment tool engages the bottom tuning slug A8, adjust the slug for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about ¼ to ½ turn.

ALIGNMENT OF 4.5 MC TRAP A9, USING A TELEVISION SIGNAL

Beat interference (4.5 MC) appears in picture as very fine vertical or diagonal lines, very close together, having a "gauze-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

The trap can be tuned by watching the picture and adjusting slug A9 for minimum 4.5 MC interference. If greater accuracy is required, the trap should be adjusted as instructed in step 3 of the "4.5 MC Sound IF and Trap Alignment" procedure on page 11.

SERVICING RADIO TUBES AND DIAL LIGHT IN COMBINATION MODELS

The radio tubes can be serviced without removing the TV chassis from the cabinet. The radio tubes can be reached through the opening in the underside of the chassis shelf.

The dial light can be serviced by removing the tuning knobs and plastic control panel. A number 44 dial light (part number 81A1-5) is used in sets stamped Run 5 or lower; a number 47 dial light (part number 81A1-8) is used in sets stamped Run 6 or higher.

* If ratio detector transformer (T201) has hollow hexagonal core slugs, bottom slug adjustment A8 can be made from top of chassis, if you use alignment tool (part number 98A30-7; available at Admiral Distributor). Bottom slug (A8) can be reached through the hole in the core of the upper slug (A10).

TELEVISION TUNER SERVICE

SERVICING TV TUNER CHANNEL COILS

The cabinets of later production sets have been provided with a rectangular cut-out in the chassis shelf just below the TV tuner. This access opening will permit servicing of the tuner channel coils or for installing UHF channel coils without removal of the chassis from the cabinet.

To gain access to the underside of the tuner, it is necessary to remove the screen covering from over the cut-out in the chassis shelf. Then remove the bottom shield from the bottom of the tuner. After servicing the channel coils, carefully replace the tuner shield. Replace the metal screen, using staples or thumb tacks to secure it to the cabinet.

SERVICING STATIONARY CONTACTS OF TV TUNER

A rectangular opening is provided at the side of the chassis for convenience in servicing the stationary contacts of the TV tuner or for making voltage or resistance measurements.

To gain access to the stationary contacts of the TV tuner, it is necessary to remove the mounting screws from the side cover plate on the tuner and unsolder the soldered joint grounding the cover plate to the tuner. Reassemble the cover plate in the same manner.

REMOVING CHANNEL COILS

Insert a screwdriver blade between the coil retainer spring and the turret end plate. Twist the blade away from the turret and lift the end of the coil upward.

CLEANING CONTACTS

Remove several sets of coils from turret and rotate turret to position making contact points of contact plate accessible for cleaning.

Using a small, stiff brush and carbon tetrachloride, clean contact surfaces of stationary contacts.

Remove accumulated dust or grease from stationary contacts and contact plate with a soft canvas cloth dampened with carbon tetrachloride. Accumulated rosin may be removed with a soft cloth dampened with alcohol.

Clean contact surfaces of rotating coils in same manner.

TUNER LUBRICATION

In general the lubrication applied to points of wear or friction at time of manufacture should make lubrication seldom, if ever necessary. However, should tuner lubrication become necessary, it is important that the correct amount and type of lubricant be used.

Using a clean brush, apply a film of switch contact oil (Admiral part number 98A64-1 or Viscosity Oil Co.

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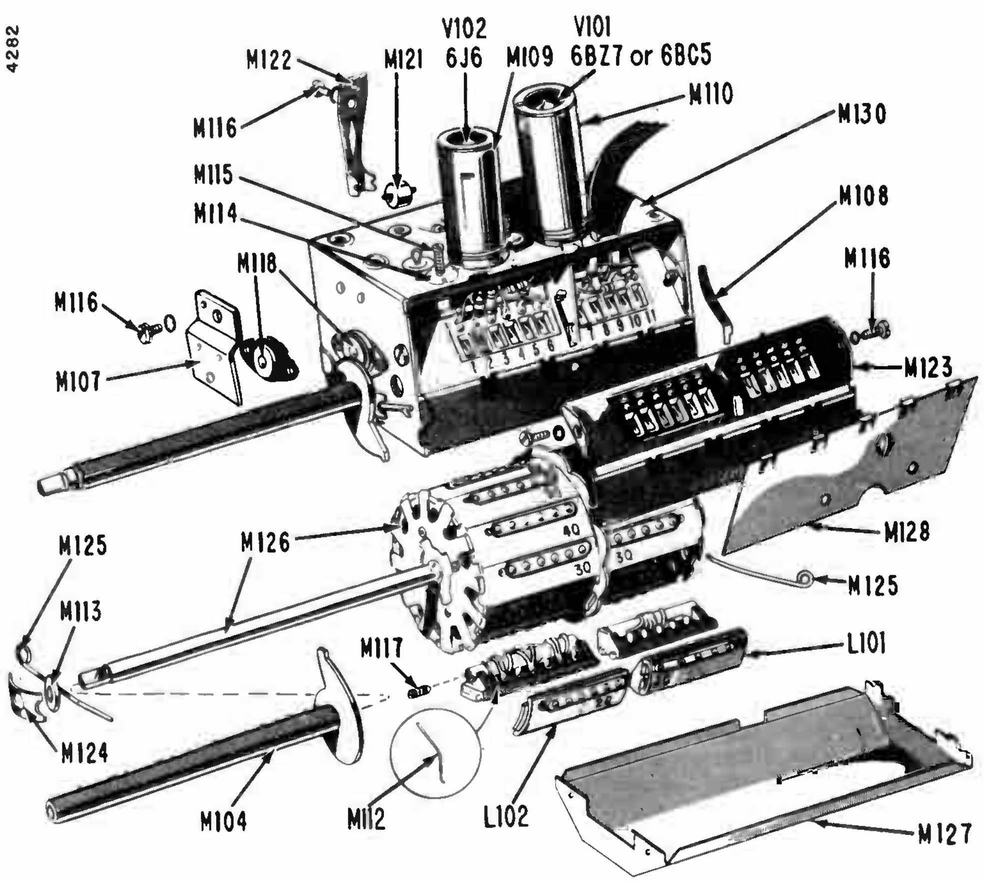


Figure 15. Exploded View. TV Tuners 94D52-1, 94D52-2, 94D46-2 and 94D46-3. For description of parts, see page 14.

#7069) to the surfaces of the coil contacts and stationary contact points.

Lubricate bearing surfaces of all other moving parts with light vaseline or preferably Admiral part #98A64-2 or Viscosity Oil Co. #8857 lubricant.

CAUTION: ***Do not use lubriplate or any similar lubricant containing zinc or cadmium.***

ADJUSTING CONTACT SPRINGS

Should the stationary contact springs make poor contact due to insufficient tension, remove several sets of coils from the turret. Rotate the turret to position making the bottom of the contact strip accessible for observation. With a narrow blade screwdriver, adjust the contact spring tension by carefully bending the spring inward until highest point on the spring extends about 9/64 of an inch above the plastic surface of the contact plate. With correct tension of the contact spring, the spring should clear the flat surface of the turret coil by about 1/64 of an inch.

OSCILLATOR SLUGS IN TOO FAR

If HF oscillator slugs "fall into" coil form, remove the channel coil, move the slug retaining spring M112 aside, and tap the coil assembly until the slug slips forward. Set the slug retaining spring into position; it should rest firmly against the slug.

REMOVING TUNER TURRET ASSEMBLY

a. Remove retaining bracket M107 in front of the tuner.
b. Remove rotor shaft assembly M104, rotor contact spring M124 and fibre washer M113. For reassembly, note order of parts removal.
c. Remove front and rear turret retaining springs M125 by pressing straight end away from tab on chassis.
d. Using a screwdriver blade at the side of the tuner, press the detent spring M122 and roller M121 away from the turret detent plate.
e. Grasp tuner shaft and slip out of end plate bearings.

REPLACEMENT OF THE UNGROUNDED STATOR PLATE OF TUNING CONTROL

Stator plate M118 (part number 94A45-86) is replaced with wiring lead and trimmer condenser C110 attached, because it is difficult to solder the wire lead to the silver plated surface on the ceramic stator plate disc.

To replace the stator plate, remove the turret assembly. Remove mounting rivets from stator plate by drilling out or clipping them out with diagonal wire cutters. Remove trimmer screw M115 and locking nut M114 from trimmer condenser C110. Unsolder wiring lead connecting trimmer to terminal on contact plate.

Assemble the replacement stator plate (M118) by placing the ceramic button over the 3/8" hole in the chassis with the wiring lead extending into the chassis. Place the mounting bracket over the ceramic button and mount securely using #4x3/16 round head machine screws with #4-40x3/16 hex nuts and #4 shake proof lock washers. Mount trimmer condenser C110 in chassis and solder wire lead to its original terminal on the contact plate making this lead as short as possible. Dress wiring lead from ceramic stator plate to trimmer condenser C110 so it does not come in contact with the turret drum. After replacement of the stator plate, adjust trimmer condenser C110 (overall oscillator adjustment).

REMOVING CONTACT PLATE ASSEMBLY M123

a. Remove turret.
b. Remove the mounting screws at the front and rear of Contact Plate and Bracket Assembly M123.
c. Unsolder both ends of contact plate assembly. Press outward the front and rear tuner chassis end plates.
d. To free contact plate assembly, release the contact plate tabs by pushing them away from the slots in the end plates.
e. Unsolder all connections to contact plate. Unsolder the solder joint holding contact plate to the center partition of the tuner chassis.
f. Reassemble in the same manner.

INTERCHANGEABILITY OF 20DP4A, 21ZP4A, 21WP4 and 21WP4X PICTURE TUBES

Some of the above picture tubes can be used as interchangeable replacements and others cannot, as described below.

The 21EP4A picture tube used in the 19H1 chassis and the 21ZP4A picture tube used in 19K1 and 19N1 chassis are not interchangeable with other tubes because of the larger cabinet space required by these tubes.

The 21WP4 or 21WP4X picture tubes used in 19F1, 19F1A and 19G1 chassis and the 20DP4A picture tube used in the 19C1 and 19E1 chassis can all be used as interchangeable replacements. However, the front tube supports may have to be cut down or padded to keep the tube the same distance above chassis as the original tube. Use the measured distance between the original tube and chassis for obtaining proper alignment of the replacement tube and the picture mask. Final alignment should be checked with chassis installed in the cabinet.

The deflection yoke housing must be moved forward or backward so that the rubber neck grommet will fit tightly against the cone of the picture tube. If it cannot be moved forward far enough, the slots in the yoke housing may have to be elongated or new holes can be drilled in the diagonal yoke housing support brackets.

The original tube mounting strap can generally be used.

PRODUCTION CHANGES

Production changes are coded RUN 1, RUN 2, etc., as given in the headings below. Run number (stamped on chassis) indicates that this chassis has the change(s) incorporated which are explained under that particular run number heading below, as well as all changes (lower run numbers) made prior to that time. At the start of production chassis were stamped RUN 1; a few chassis were not stamped with a Run number.

CHANGE TO INCREASE BRIGHTNESS

Run 2 and higher in all 19 series chassis

The following changes were made in the cathode circuit of picture tube V306 for increased brightness.

Resistor R330 was changed from 470,000 ohms to 180,000 ohms, 1/2 watt, part number 60B8-184. Condenser C316 was changed from .01 mfd. to .22 mfd. 400 volts, part number 64B8-24.

CHANGE TO ELIMINATE BENDING AND IMPROVE HORIZONTAL SYNC AND CHANGE TO REDUCE SNOW IN FRINGE AREAS

Run 3 in 19B1, 19C1, 19E1, 19F1, 19F1A, 19G1, 19H1, and 19K1 Chassis

Bending and Sync Changes

The following changes were made to eliminate possible bending at the top of the picture and to improve horizontal sync. If it is desired to make these changes to chassis stamped Run 2 or lower, see heading on "Circuit Changes to Reduce Bending and Improve Horizontal Sync" on page 6.

In early production chassis (with exception of 19B1), the B+ voltage to the 1st and 2nd IF amplifiers V301 and V302 is effectively in series. In later production sets, B+ voltage to the 1st and 2nd IF amplifier stages is in parallel. This makes it possible to apply AGC voltage to the 1st and 2nd IF amplifiers of later production sets, thus allowing the receiver to operate under a wider range of signal conditions without the possibility of overloading.

The circuit changes that were made to the IF amplifiers and AGC circuit of later production sets are as follows: The screen (pin 6) of 2nd IF tube V302 and terminal 2 of 2nd IF transformer T302 connect to common B+ through resistor R312 (1,000 ohms). Condenser C319 (.001 mfd.) is connected from terminal 2 of T302 to chassis.

The control grid (pin 1) of 2nd IF amplifier V302 is returned to AGC through T301 and decoupling resistor R309 (1,000 ohms). Condenser C318 (.001 mfd.) is connected from terminal 3 of T301 to chassis. The suppressor grid (pin 7) of V302 is connected directly to chassis. The cathode (pin 2) of V302 returns to chassis through R336 (68 ohms).

Overloading of the video amplifier and possible sync instability has been eliminated by the following circuit changes:

The B+ voltage at the screen (pin 6) of the video amplifier V305 (6CB6) was increased by lowering the value of resistors R212 and R213 in the grid and cathode circuits of sound output tube V204.

Resistor R212 was changed from 3,600 ohms to 1,500 ohms in sets using a 6AS5 tube for V204, and was changed from 4,700 ohms to 2,000 ohms in sets using a 6Y6 G tube for V204.

Resistor R213 was changed from 1,100 to 910 ohms in sets using a 6AS5 tube for V204 and from 2,000 ohms to 1,500 ohms in sets using a 6Y6G tube for V204.

Increased sync pulse input to the sync circuits is obtained by the following changes made to the video amplifier plate circuit. Resistor R326 was changed from 2,700 ohms to 5,600 ohms, 1 watt. Resistor R325 (2,700 ohms) was omitted.

Snow Changes

(This portion of Run 3 production change does not apply to the 19B1 chassis.)

The circuit changes described below are rather involved. Generally, we do not recommend that they be made in the field. However, if snow is still excessive after making the checks given under the heading of "Excessive Snow Due to Faulty Tubes" on page 6, and it is desired to make the changes below, instructions may be obtained by writing the Service Department of the

Admiral Corporation at 201 E. North Water street, Chicago 2, Illinois.

To reduce the amount of snow (front end noise) in the picture the AGC voltage to the tuner has been reduced with respect to the AGC voltage to the 1st and 2nd IF stages by applying a small positive voltage from voltage divider network.

The voltage divider network consisting of R301 (3.3 megohms), R333 (15 megohms), R334 (2.2 megohms) and R338 (56,000 ohms) was added in the circuit between B+, the AGC diode V304 and the DX Range Finder control R315.

One terminal of DX Range Finder R315 connects to the R338 (56,000 ohms). Resistor R317 connecting to pin 7 of diode V304 was changed from 820,000 ohms to 470.000 ohms. The delayed AGC bias developed at the AGC diode (½ of V304) is thus controlled by both the Contrast (picture) control and the DX Range Finder control. This provides a means of eliminating entirely the delay on the AGC diode in a very strong signal area and also a means of adjusting the AGC delay to a suitable value for best picture with minimum of snow in weak signal or intermediate fringe areas.

RESISTOR R443 ADDED TO IMPROVE HORIZONTAL SYNC STABILITY

Run 4 in all 19 Series Chassis

Later production sets using vertical integrator couplate, part number 63B6-2, have an 8,200 ohm, ½ watt resistor (R443) connected between terminal 3 of the couplate and pin 1 of sync separator tube V401 (12AU7). The integrator couplate contains components R407, R408, R409, C403, C404 and C405.

Adding resistor R443 to the circuit has increased the sync level by squaring up the sync pulses, thereby improving horizontal sync instability.

To install resistor R443 (8,200 ohms) remove the number three lead of integrator couplate 63B6-2 from pin 1 of V401 (12AU7). Connect resistor R443 between the number three lead of the couplate and pin 1 of V401 (12AU7).

VERTICAL RETRACE BLANKING CIRCUIT ADDED

Run 5 in all 19 Series Chassis

A vertical retrace blanking circuit was added to eliminate retrace lines. The vertical retrace blanking circuit consisting of components R444 (2,700 ohms), R445 (56,000 ohms), C427 (.01 mfd.) and C428 (.01 mfd.), is shown in schematic figure 13.

Vertical retrace blanking is achieved by applying the pulse voltage appearing at the low side (red lead) of the vertical output transformer T402 to the grid (pin 2) of the picture tube V306.

Detailed instructions for eliminating retrace lines in early production receivers are given on page 6.

TV TUNER SHAFT LENGTH INCREASED

Run 6 in All 19 Series Chassis

The TV tuners used in chassis stamped Run 6 and higher, have a longer shaft length. This increase in shaft length was made to make the chassis adaptable for installation of a separate UHF tuner.

The 94D46-3 cascode TV tuner is used in all later production chassis (Run 6 and higher), with exception of the 19B1 chassis. The 94D52-2 pentode TV tuner is used in later production 19B1 chassis (Run 6 and higher).

TV tuners 94D46-2 and 94D46-3 are identical, with exception of shaft length. TV tuners 94D52-1 and 94D52-2 are identical, with exception of shaft length.

DIFFERENT INTEGRATOR AND SYNC COUPLATE USED

Run 7 in All 19 Series Chassis

Integrator couplate, part number 63B6-11 has replaced integrator couplate, part number 63B6-2 used in earlier production sets. The circuit of both couplates is the same with the exception that resistor R407 (22,000 ohms), is not contained in couplate 63B6-11. Resistor R407 is connected externally from terminal 3 of couplate 63B6-11 to pin 1 of V401B. This change in integrator couplates has improved horizontal sync stability by increasing the amplitude and squaring up the sync pulses.

To replace couplate 63B6-2 with couplate 63B6-11, omit resistor R443 (8.200 ohms) if used between pin 1 of V401B and terminal 3 of the couplate. Connect resistor R407 (22,000 ohms, ½ watt) between pin 1 of V401B and terminal 3 of couplate 63B6-11.

Sync couplate, part number 63B6-8 has replaced sync couplate part number 63B6-4 used in early production sets. Couplate 63B6-4 contains resistors R328, R329 and condenser C315. Couplate 63B6-8 contains resistor R329 and condensers C315 and C317. This change in sync couplates has simplified circuit wiring by reducing the number of components.

To replace couplate 63B6-4 with couplate 63B6-8, change resistor R327 from 22,000 ohms to 27,000 ohms. Remove condenser C317 (.01 mfd.). Connect couplate 63B6-8 between resistor R327 and pin 7 of V401A.

CHANGE IN TOLERANCE OF COMPONENTS IN THE HORIZONTAL OSCILLATOR CIRCUIT V403

In some Run 2 Chassis and all Chassis Run 3 and higher

Changes were made to horizontal oscillator circuit V403 of later production sets to minimize possible variation of horizontal oscillator performance due to parts tolerances and variation in electrical characteristics of some brands of 6SN7 tubes. By reducing the permissible tolerance of components R422, R423, R428 and C418, the operation of the horizontal oscillator circuit becomes less critical.

In later production sets (stamped Run 3 and higher), tolerance of resistors R422 (330,000 ohms), R423 (82,000 ohms) and R428 (150,000 ohms) were changed from 10% to 5% tolerance. Condenser C418 (.01 mfd.) was changed from 20% to 10% tolerance.

In cases where it is difficult to make satisfactory Horizontal Sync Adjustment, the components in the horizontal oscillator circuit should be checked for correct value as mentioned in the preceding paragraph and on page 5, under Horizontal Instability And Tearing In Picture.

RESISTORS R214 AND R215 REPLACED BY ONE RESISTOR IN SOME LATER PRODUCTION 19E1, 19G1 and 19N1 CHASSIS

In later production chassis, resistors R214 and R215, 2,200 ohms, 2 watt, were replaced by a single wire wound resistor, 1,200 ohms, 5 watt, part number 61A1-10.

CHANGE TO PREVENT FUSE FAILURE IN TV-RADIO CHASSIS

Run 8 in 19E1, 19G1 and 19N1 Chassis

The circuit location of fuse M401 (⅜ amp. 250 V.) has been changed to prevent possible fuse failure when function switch S701 is rotated from Radio to TV position. Fuse failure may occur if all contacts of switch section S701C make simultaneous contact, thus applying a sudden surge of current through the fuse.

Schematic figure 33 shows the fuse location in early sets and schematic figure 35 shows the fuse location in later sets having this production change. This change can be made to an early set by simply interchanging the red and blue leads connecting to switch section S701C. With this change made, the red lead should connect to terminal "h" of S701C and the blue lead should connect to terminal "g" of S701C.

CHANGE IN SIZE OF FUSE M401

To prevent possibility of fuse failure, due to momentary line voltage surges, fuse M401 was changed from a ¼ ampere, 250-volt fuse to a ⅜ ampere, 250-volt fuse, part number 84A4-3. Fuse replacement should be made only with a ⅜ ampere, 250-volt fuse, part number 84A4-3.

CHANGE IN PILOT LIGHT AND VOLTAGE DROPPING RESISTOR R707

In later production combination sets, a different pilot light and pilot light series dropping resistor is used.

Early production sets stamped Run 5 or lower use a number 44 pilot light (part number 81A1-5) and voltage dropping resistor R707 is 4.7 ohms, ½ watt, part number 60B28-11. In later production sets stamped Run 6 and higher, a number 47 pilot light (part number 81A1-8) is used and voltage dropping resistor R707 is 10 ohms, ½ watt, part number 60B28-100.

MECHANICAL CHANGE IN RADIO TUNER USED IN 19E1, 19G1 and 19N1 CHASSIS

Mechanical changes were made to the later production radio tuner sub-chassis used in combination models. The dimensions of the radio chassis were altered slightly and the mounting position of the gang condenser was changed.

Early production radio tuners used gang condenser (part number 68B53) which mounts in a vertical position. Later production radio tuners use gang condenser (part number 68B53-1) which mounts in a horizontal position.

TELEVISION ALIGNMENT PROCEDURE

GENERAL

Complete alignment consists of the following individual procedures and should be performed in this sequence.

a. IF Amplifier and Trap Alignment.
b. IF Response Curve Check.
c. 4.5 MC Sound IF and Trap Alignment.
d. RF and Mixer Alignment.
e. Over-all RF and IF Response Curve Check.
f. HF Oscillator Adjustment.

TEST EQUIPMENT

To properly service this receiver, it is recommended that the following test equipment be available.

IMPORTANT: Many service instruments do not meet the requirements given below. A list of recommended equipment is available from Admiral Distributor.

Oscilloscope

Standard oscilloscope, preferably one with a wide band vertical deflection, vertical sensitivity at least .5 volt (RMS) per inch.

Signal (Marker) Generator

4.5 MC frequency.
18 to 30 MC frequency range.
50 to 90 MC frequency range.
170 to 225 MC frequency range.

Must have a built-in calibration crystal for checking dial accuracy.

Sweep Generator

Sweep generator must provide sweep frequencies from
18 to 30 MC range: } with at least
50 to 90 MC range: } 10 MC sweep width.
170 to 225 MC range: }
Output: adjustable; at least one-tenth volt maximum.
Output impedance: 300 ohms balanced to ground.

A sweep generator not having constant output voltage over the swept range and linear sweep, will produce curves which are widely different from the ideal curves shown in the following pages. If repeated difficulty is encountered in obtaining these curves, the sweep generator should be checked. A simple check is to observe the response curve for a set that is in alignment.

Before suspecting the generator, be sure the alignment instructions in this manual have been followed carefully.

Vacuum-Tube Voltmeter

Preferably with low range (3 volt) DC zero center scale and a high voltage probe (30,000 volt range).

ALIGNMENT TOOLS

The following alignment tools are required. They can be obtained from the Admiral Distributor under the part numbers listed below:

Metal alignment screwdriver part number 98A30-9.
Non-metallic (fiber) alignment screwdriver (11½" long, ⅛" diameter) part number 98A30-10.

Non-metallic alignment wrench (9" long, for hexagon core IF slugs) part number 98A30-12.

IMPORTANT ALIGNMENT HINTS

The following suggestions should be performed if difficulty is experienced during the alignment procedure.

1. IF CIRCUIT INSTABILITY: When spot frequency aligning the IF amplifiers, the VTVM pointer may swing when the hand is placed too near the IF transformers. When viewing the IF response curve on an oscilloscope, the curve may change shape with hand capacity, especially when aligning A2 (3rd IF transformer T303). To correct either of these conditions, the following alignment hints should be tried:

(a) Check the generator output leads to be certain that the unshielded portion (especially the grounded lead) be as short as practicable.

(b) Be sure that a decoupling network is used at the video detector output and that the leads on the network are kept as short as possible (See figure 21).

(c) Construct a special tube shield as shown in figure 16. This is made from an ordinary tube shield and four 10,000 ohm resistors. Keep the spacing between the two halves of the shield at a minimum (1/8 inch).

(d) The use of a non-metallic alignment tool, approximately eight inches long (part number 98A30-12), will permit adjustment without coming too near to the transformers.

2. RECEIVER OVERLOADING WHEN CHECKING THE OVER-ALL RESPONSE CURVE: Due to the inherent high sensitivity of these receivers, it is very easy to cause overloading in the third IF amplifier stage. In some cases, generator leakage alone is enough to produce a response curve on the oscilloscope. To prevent overloading, do the following:

(a) Be certain that the generator output attenuators are set at a minimum.

(b) Some generators have a built-in pad in the output table to be used when viewing the over-all response curve. Be sure that the pad in the cable is properly connected in the circuit. Refer to the generator instruction manual for details.

(c) If a pad is not built in, the 12 db pad shown below in figure 17 can be constructed and connected between the generator and the antenna terminals.

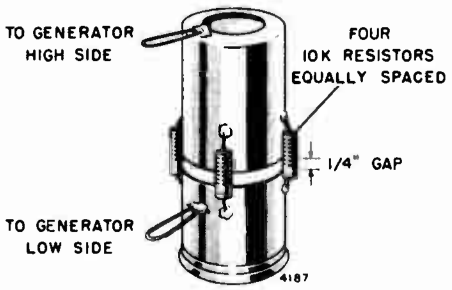


Figure 16. Special Tube Shield for IF Alignment and IF Response Curve Check.

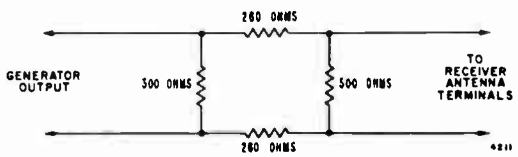


Figure 17. Illustration of 12 db Attenuation Pad for Viewing Over-all RF-IF Response Curve.

IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope)

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Set Channel selector on Channel 12 or an unassigned high channel. Picture control fully to the left. Connect negative of 4½ volt bias battery to test point "T"; positive to chassis.	Connect high side to 6J6 mixer-osc. special tube shield, see fig. 16. Connect low side to bottom part of tube shield. Set sweep frequency to 23MC, and sweep width approximately 7MC.	If an external marker generator is used, loosely couple high side to sweep generator lead on tube shield, low side to chassis. Marker frequencies indicated on IF Response Curve.	Connect to test point "V" through a decoupling filter, see figs. 21 and 22. Marker pips on scope will be more distinct if a condenser from 100 mmfd. to 1000 mmfd. is connected across the oscilloscope input.	Check curve obtained against ideal response curve in fig. 18. Note tolerances on curve. Keep marker and sweep outputs at very minimum to prevent overloading. A reduction in sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touchup with IF slugs as instructed below. *Important:* If curve changes shape with hand capacity, see section 1 of "Alignment Hints" on page *10*.

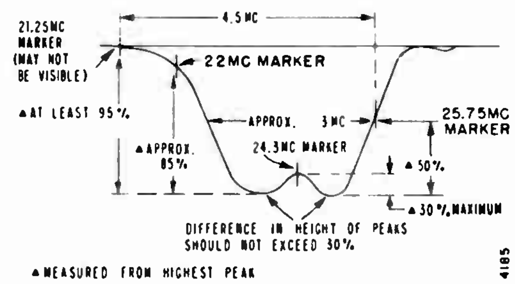


Figure 18. Ideal IF Response Curve.

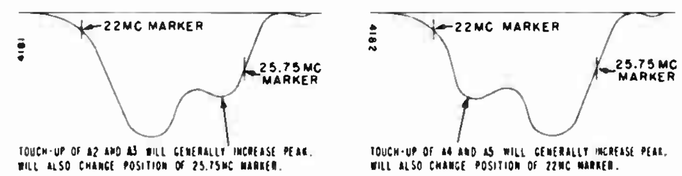


Figure 19. IF Response Curves, Incorrect Shape.

If it is necessary to adjust for approximate equal peaks and marker location, carefully adjust alignment slugs as instructed under the above figures. It should not be necessary to turn the slugs more than one turn in either direction.

If the curve cannot be made to resemble the response curve shown at left, repeat all steps under "IF Amplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carefully made. If a satisfactory curve cannot be obtained after repeating these steps, it may be necessary to change IF amplifier tubes or check for a defective circuit component to be sure that each stage is operating properly.

IF AMPLIFIER AND TRAP ALIGNMENT

- Connect bias battery; negative to test point "T", see figure 22, positive to chassis. A 4½ volt battery is required for all steps below.
- Disconnect antenna. Connect a jumper wire across the antenna terminals.
- Set Channel selector to Channel 12 or other unassigned high channel, to prevent interference during alignment.
- Set the Picture control fully to the left (counterclockwise).
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use lowest DC scale on VTVM.

Step	Signal Gen. Freq.	VTVM and Signal Generator Connections	Instructions	Adjust
1	*27.25 MC	VTVM high side to test point "V" through a decoupling filter; see figs. 21 and 22, common to chassis. Generator high side to 6J6 (V102) special tube shield. Connect low side to bottom part of the tube shield, see figure 16.	Connect a 4½ volt bias battery to test point "T".	A1 for minimum.
2	25.3 MC		Use lowest DC scale on VTVM. When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less. If unstable, refer to section 1 of the "Alignment Hints" above.	A2 and A3 for maximum.
3	23.1 MC			A4 and A5 for maximum.
4	*27.25 MC			Repeat step 1 above.
5	To insure correct IF alignment, make the "IF Response Curve Check" given on opposite page.			

* Before proceeding, be sure to check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation.

ALIGNMENT HINT

After becoming familiar with alignment procedure, some servicemen simplify subsequent alignment of sets by merely using the essential alignment data given in figures below.

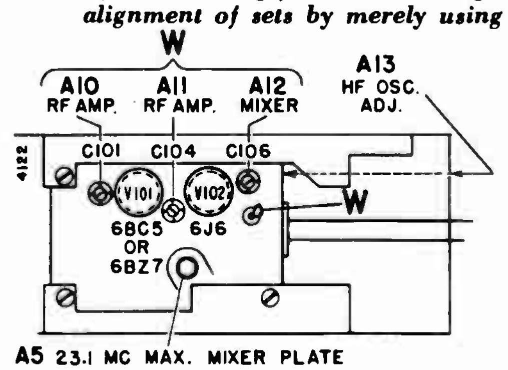


Figure 20. Top View of TV Tuner Showing Adjustment Locations.

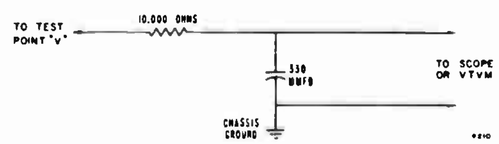


Figure 21. Decoupling Filter.

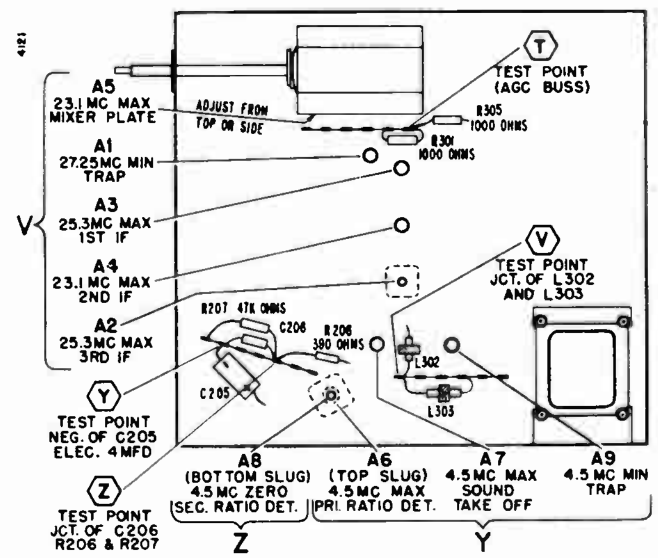


Figure 22. Bottom View of Chassis Showing Test Point Connections and IF Alignment Data.

4.5 MC SOUND IF AND TRAP ALIGNMENT

See page 7 for touch-up of ratio detector using television signal without test equipment.

a. Connect signal generator high side to pin 2 of V304 (6AL5) through a .01 mfd. condenser, connect low side to chassis.

b. Allow about 15 minutes for receiver and test equipment to warm up.

c. Set Picture control fully to the left (counterclockwise).

d. Use a NON-METALLIC alignment tool. If Ratio Det. Transformer (T201) has hollow core slugs, bottom slug adjustment A8 can be made from top of chassis, if you use alignment tool #98A30-12 obtainable from Admiral Distributor.

Step	Signal Gen. Freq. (MC)	VTVM Connections	Instructions	Adjust
	When using a signal generator, be sure to check it against a crystal calibrator or other frequency standard for accurate frequency calibration at 4.5 MC. Accuracy required is within one kilocycle. IMPORTANT: If a signal generator and frequency standard are not available, alignment can be made using a TV station signal. Tune in a station and follow steps 1, 2 and 3 below. If necessary use a higher scale on the VTVM.			
1	Set to exactly 4.5 MC	High side to test point "Y"; common to chassis.	Use lowest DC scale on VTVM.	A6 and A7 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt).
2		High side to test point "Z"; common to chassis.	Use zero center scale on VTVM, if available.	A8 for zero on VTVM (the correct zero point is located between a positive and a negative maximum). If A6 was far off, repeat step 1.
3		High side to test point "Y"; common to chassis.	Connect a 10 mmfd. condenser from pin 5 of V305 (6CB6) to pin 7 of V201 (6AU6). Use lowest DC scale on VTVM.	A9 for minimum.

RF AND MIXER ALIGNMENT FOR SETS USING TV TUNERS 94D52-1 AND 94D52-2

(These tuners use a 6BC5 tube for RF amplifier V101.)

a. Connect negative of 4½ volt bias battery to test point "T", positive to chassis. If it is difficult to obtain a curve of sufficient amplitude, remove battery and connect a wire jumper from test point "T" to chassis.

b. Connect sweep generator (with 300 ohm output) to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.

c. Connect oscilloscope through a 10,000 ohm resistor to test point "W" on tuner (fig. 24). Keep scope leads away from chassis.

d. Set channel selector to Channel 10.

e. Allow about 15 minutes for receiver to warm up and test equipment.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	193.25 MC (Video Carrier) 197.75 MC (Sound Carrier)	Sweeping Channel 10. See frequency table at right.	Alternately adjust A10, A11 and A12 (figure 24) as required. Adjusting A11 will generally shift the center of the response curve in relation to the video and sound carrier markers. A10 and A12 should be alternately adjusted for best gain with flat top appearance. Consistent with proper band width and correct marker location, response curve should have maximum amplitude and flat top appearance; see figure 23.
2	Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve shown in fig. 23. In general, the adjustment performed in step 1 is sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for the weak channel as a compromise adjustment to favor this particular channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.

RF AND MIXER ALIGNMENT FOR SETS USING TV TUNERS 94D46-2 AND 94D46-3

(These tuners use a 6BZ7 tube for RF amplifier V101.)

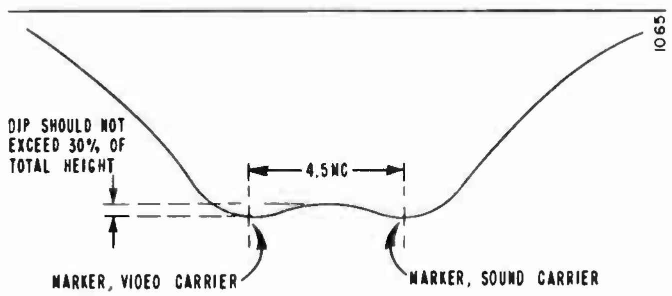
a. Connect negative of 4½ volt bias battery to AGC buss (test point "T"), positive to chassis. If it is difficult to obtain a curve of sufficient amplitude, remove battery and connect a wire jumper from test point "T" to chassis.

b. Connect sweep generator (with 300 ohm output) to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.

c. Connect oscilloscope through a 10,000 ohm resistor to test point "W" on tuner (figure 24). Keep scope leads away from chassis.

d. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	193.25 MC (Video Carrier) 197.75 MC (Sound Carrier)	Sweeping Channel 10. See frequency table below.	Alternately adjust A11 and A12 (figure 24) as required to obtain equal peak amplitudes and symmetry, consistent with flat top appearance, proper band width and correct marker location; see figure 23.
2	83.25 MC (Video Carrier) 87.75 MC (Sound Carrier)	Sweeping Channel 6. See frequency table below.	Adjust A10 as required to obtain curve having maximum amplitude and flat top appearance consistent with proper band width and correct marker location; see figure 23. After completing adjustment, recheck adjustment of step 1.
3	Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve shown below. In general, the adjustment performed in steps 1 and 2 are sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for a weak high channel as a compromise adjustment to favor the particular channel. Repeat step 2 for the weak low channel to favor the particular low channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.



Full skirt of curve will not be visible unless generator sweep width extends beyond 10 MC.
Figure 23. RF Response Curve.

FREQUENCY TABLE

Channel Number	Channel Freq., MC	Video Carrier, MC	Sound Carrier, MC	HF Osc., MC
2	54- 60	55.25	59.75	81
3	60- 66	61.25	65.75	87
4	66- 72	67.25	71.75	93
5	76- 82	77.25	81.75	103
6	82- 88	83.25	87.75	109
7	174-180	175.25	179.75	201
8	180-186	181.25	185.75	207
9	186-192	187.25	191.75	213
10	192-198	193.25	197.75	219
11	198-204	199.25	203.75	225
12	204-210	205.25	209.75	231
13	210-216	211.25	215.75	237

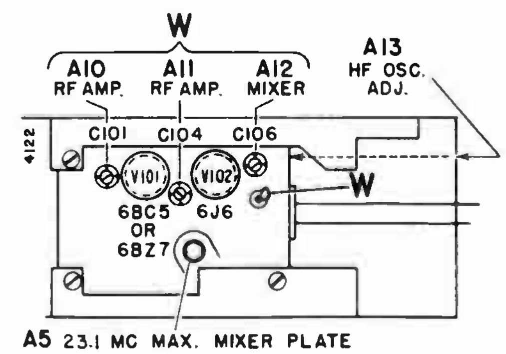


Figure 24. Top of TV Tuner, Showing Adjustment Location.

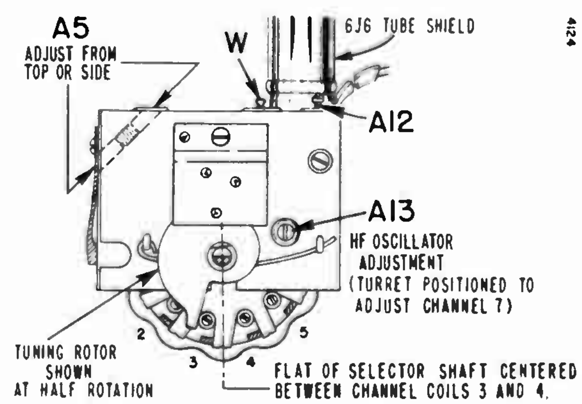


Figure 25. Front View of TV Tuner.

OVER-ALL RF AND IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope)

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Picture control fully to the left. Channel selector on Channel 10 or other unassigned high channel. Connect negative of 4½ volt bias battery to test point "T", positive to chassis.	Connect to antenna terminals. Set generator to sweep channel selected. See frequency table on page 11. Keep generator output as low as possible, to prevent overloading. See section 2 of "Alignment Hints" on page 10.	If an external marker generator is used, loosely couple high side to sweep generator lead. Marker frequencies are shown in frequency table on page 11.	Connect to point "V" through a decoupling filter; see figs. 21 and 22.	Compare the response curve obtained against the ideal curve shown in figure 26. If the curve is not within tolerance, touch up the IF slug as instructed below. It should never be necessary to turn slugs more than one turn in either direction. If the curve is satisfactory on the channel checked, all other channels should also be satisfactory. IMPORTANT: When sweep output is reduced, response curve amplitude on scope should also decrease, but curve shape should remain the same. If curve shape changes, reduce sweep output and/or the scope gain until the shape does not change. See section 2 of "Alignment Hints", on page 10.

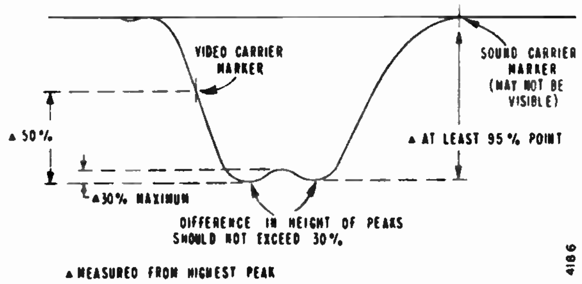


Figure 26. Ideal Over-all RF and IF Response Curve.

Note that video carrier (marker) on the "Over-all RF-IF Response Curve" will appear on the opposite side of the curve as compared to the "IF Response Curve" figure 18. This is due to action of the mixer tube.

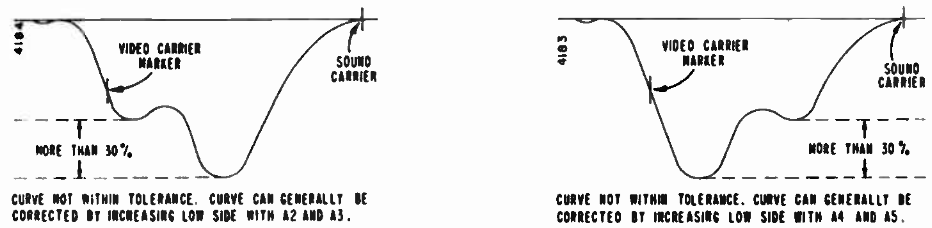


Figure 27. Over-all RF and IF Response Curves, Incorrect Shape.

HF OSCILLATOR ADJUSTMENT

(Using a signal generator)

It is always advisable to make HF oscillator adjustments using a Television Signal as instructed on page 2. If a Television Signal is not available, HF oscillator adjustment can be made using a crystal calibrated signal generator. Make adjustments as follows:

Receiver Control Settings	Signal Generator	Instructions
Set Channel selector for each channel to be adjusted. Set "Tuning" control at half rotation. Turn volume control fully to the right (clockwise).	Connect to antenna terminals. Set generator to exact frequency of HF oscillator. See frequency table on page 11. *Set generator for maximum output.*	Connect a wire jumper from test point "W" on the tuner to test point "Z". See figure 22. Remove the ratio detector tube V202 (6AL5). Carefully adjust the oscillator slug A13 on each channel until a whistle (beat) is heard in the speaker of the receiver.

SERVICING RADIO TUNER IN 19E1, 19G1 AND 19N1 MODELS

SERVICING RADIO TUBES AND DIAL LIGHT

The radio tubes and radio dial light can be serviced without removing the TV chassis from the cabinet. The radio tubes can be reached through the opening cut in the underside of the chassis shelf.

The dial light can be serviced by removing the tuning knobs and plastic control panel.

A number 44 dial light (part number 81A1-5) is used in sets stamped Run 5 or lower; a number 47 dial light (part number 81A1-8) is used in sets stamped Run 6 and higher.

REMOVING RADIO TUNER

The radio tuner is mounted at the front apron of the chassis. Alignment, taking voltage readings or an inspection of the underside of the radio tuner can be performed without complete removal of the radio tuner from the TV chassis. To gain access to the underside of the radio tuner, disconnect the tuning drive cord, remove the self-tapping screws at the rear of the radio tuner.

DIAL STRINGING

Dial stringing for the gang tuning control is shown below.

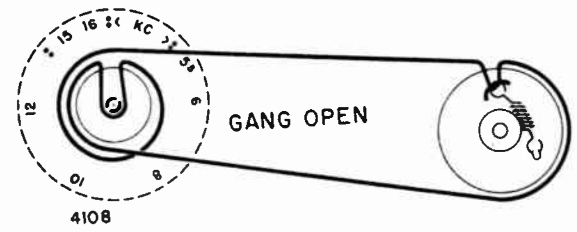


Figure 28. Dial Stringing for 19E1, 19G1 and 19N1 Chassis.

ALIGNMENT OF RADIO TUNER

The radio tuner in television and radio chassis should be aligned as instructed under "Radio Alignment Procedure" below.

The radio alignment trimmers are accessible without disassembly of the radio tuner from the TV chassis. The figure at right shows the locations of radio alignment trimmers.

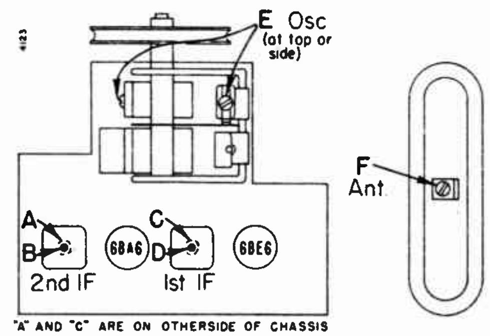


Figure 29. Radio Trimmer Locations.

RADIO ALIGNMENT PROCEDURE

- Connect output meter across speaker voice coil.
- Turn receiver Volume control fully on.
- Function switch in "Radio" position.
- Use lowest output setting of signal generator that gives a satisfactory reading on meter.
- Use a NON-METALLIC alignment tool for IF adjustments.
- Repeat adjustments to insure good results.

Step	Connect Signal Generator	Dummy Antenna Between Radio and Signal Generator	Signal Generator Frequency	Receiver Dial Setting	Adj. Trimmers in Following Order to Max.
1	Gang condenser antenna stator	.1 MFD	455 KC	Tuning gang wide open	*A-B (2nd IF) *C-D (1st IF)
2	"	"	1620 KC	"	E (oscillator)
3	Place generator lead close to loop of set to obtain adequate signal. No actual connection (signal by radiation).		1400 KC	Tune in signal	§F (antenna)

* Adjustments A and C made from underside of chassis. See figure 29 for trimmer locations.
§ AM antenna trimmer may not peak if antenna leads are not properly routed or separated.

PARTS LIST

Electrical components have symbols in 100 series, 200 series, etc., according to location on schematic. Order parts by part number and description from Admiral Distributor.

CHASSIS PARTS

RESISTORS

Sym.	Description	Part No.
R101	15,000 ohms, ½ watt	98A 45-67
R102	47,000 ohms, ½ watt	98A 45-17
R103	100,000 ohms, ½ watt in 94D46-2 and 94D46-3 tuners	94C 37-87
	2,200 ohms, ½ watt in 94D52-1 and 94D52-2 tuners	98A 45-19
R104	1,500 ohms, ½ watt in 94D46-2 and 94D46-3 tuners	60B 8-152
	1,000 ohms, ½ watt in 94D52-1 and 94D52-2 tuners	94C 37-86
R105	10,000 ohms, ½ watt in 94D46-2 and 94D46-3 tuners	98A 45-18
	4,700 ohms, ½ watt in 94D52-1 and 94D52-2 tuners	98A 45-20
R106	220,000 ohms, ½ watt	98A 45-21
R107	10,000 ohms, ½ watt	98A 45-18
R108	8,200 ohms, ½ watt in 94D46-2 and 94D46-3 tuners	60B 8-822
	6,800 ohms, ½ watt in 94D52-1 and 94D52-2 tuners	60B 8-682
R109	15,000 ohms, ½ watt	98A 45-67
R110	100,000 ohms, ½ watt	94C 37-87
R111	160,000 ohms, ½ watt	60B 8-164
R201	470,000 ohms, ½ watt	60B 8-474
R202	68 ohms, ½ watt, carbon only	60B 28-44
R203	330 ohms, ½ watt	60B 8-331
R204	10,000 ohms, ½ watt	60B 8-103
R205	10,000 ohms, ½ watt	60B 8-103
R206	390 ohms, ½ watt	60B 8-391
R207	47,000 ohms, ½ watt	60B 8-473
R208A	1 megohms, **Volume**	75B 11-21
R208B	1,000 ohms, **Picture** (R208 includes switch S501)	
‡R209	4.7 megohms, ½ watt	60B 8-475
†R210	470,000 ohms, ½ watt	60B 8-474
†R211	1 megohm, ½ watt	60B 8-105
R212	4,700 ohms, ½ watt, 5% (in comb. sets, stamped Run 2 or lower)	60B 7-472
	2,000 ohms, ½ watt, 5% (in comb. sets, stamped Run 3 and higher)	60B 7-202
	3,600 ohms, ½ watt, 5% (in TV only sets, stamped Run 2 or lower)	60B 7-362
	1,500 ohms, ½ watt, 5% (in TV only sets, stamped Run 3 and higher)	60B 7-152
R213	1,100 ohms, ½ watt, 5% (in chassis stamped Run 2 or lower)	60B 7-112
	910 ohms, ½ watt, 5% (in chassis stamped Run 3 and higher)	60B 7-911

† Component may be part of couplate, part number 63B6-5. Replace with exact duplicate or individual componets.
‡ Component may be part of couplate, part number 63B6-10. Replace with exact duplicate or individual components.

Sym.	Description	Part No.
R214	2,200 ohms, 2 watt in early comb. sets	60B 20-222
	1,200 ohms, 5 watt in later comb. sets	61A 1-10
	1,200 ohms, 1 watt in TV only sets	60B 14-122
	(R214 and R215 are single resistor in later 19E1, 19G1 and 19N1 sets, see production change).	
R215	2,200 ohms, 2 watt	60B 20-222
R216	2 megohms, **Tone control**	75B 13-22
R217	82,000 ohms, ½ watt	60B 8-823
R218	2,000 ohms, ½ watt, 5% (in chassis stamped Run 2 or lower)	60B 7-202
	1,500 ohms, ½ watt, 5% (in chassis stamped Run 3 and higher)	60B 7-152
R219	2,500 ohms, 7.5 watt	61A 1-23
R220	15,000 ohms, ½ watt	60B 8-153
R221	15,000 ohms, 5 watt	61A 1-7
R222	1,000 ohms, 2 watt	60B 20-102
R223	470 ohms, ½ watt	60B 8-471
R224	47,000 ohms, ½ watt	60B 8-473
R225	1 megohm, **Volume** (R225 includes switch S501)	75C 2-16
R301	1,000 ohms, ½ watt (in chassis stamped Run 2 or lower)	60B 8-102
	3.3 megohms, ½ watt (in chassis stamped Run 3 and higher)	60B 8-335
R302	8,200 ohms, ½ watt, 5%	60B 7-822
R303	47 ohms, ½ watt, carbon only	60B 28-45
R304	330 ohms, ½ watt	60B 8-331
R305	1,000 ohms, ½ watt	60B 8-102
R306	22,000 ohms, ½ watt	60B 8-223
R307	330 ohms, ½ watt	60B 8-331
R309	330 ohms, ½ watt (in chassis stamped Run 2 or lower)	60B 8-331
	1,000 ohms, ½ watt (in chassis stamped Run 3 and higher)	60B 8-102
R310	100 ohms, ½ watt, in sets using 94D46-2 and 94D46-3 tuners	60B 28-19
	68 ohms, ½ watt, in sets using 94D52-1 and 94D52-2 tuners (R310 is carbon resistor only)	60B 28-44
R311	10,000 ohms, ½ watt, 5%	60B 7-103
R312	330 ohms, ½ watt (in chassis stamped Run 2 or lower)	60B 8-331
	1,000 ohms, ½ watt (in chassis stamped Run 3 and higher)	60B 8-102
R313	100 ohms, ½ watt	60B 8-101
R314	330 ohms, ½ watt	60B 8-331
R315	2 megohms, **DX Range Finder control**	75B 1-53
R316	33,000 ohms, ½ watt	60B 8-333
R317	820,000 ohms, ½ watt (in chassis stamped Run 2 or lower)	60B 8-824
	470,000 ohms, ½ watt (in chassis stamped Run 3 and higher)	60B 8-474

Sym.	Description	Part No.
R318	4,700 ohms	Part of L302
R319	5,600 ohms, ½ watt	60B 8-562
R320	1 megohm, ½ watt	60B 8-105
R321	1,000 ohms, **Picture control**	See R208B
R322	33,000 ohms, ½ watt	60B 8-333
R323	33,000 ohms	Part of L305
R324	10,000 ohms	Part of L306
R325	2,700 ohms, ½ watt	60B 8-272
R326	2,700 ohms, ½ watt (in chassis stamped Run 2 or lower)	60B 8-272
	5,600 ohms, 1 watt (in chassis stamped Run 3 and higher)	60B 14-562
R327	22,000 ohms, ½ watt	60B 8-223
	27,000 ohms, ½ watt	60B 8-273
	(R327 is 22,000 ohms when couplate 63B6-4 is used and 27,000 ohms when couplate 63B6-8 is used. See Run 7 production change on page 17.)	
*R328	15,000 ohms, ½ watt	60B 8-153
*R329	270,000 ohms, ½ watt	60B 8-274
R330	180,000 ohms, ½ watt (R330 was 470,000 ohms in early sets)	60B 8-184
R331	100,000 ohms, **Brightness control**	75B 13-25
R332	1,000 ohms, **Picture control**	75B 13-21
R333	15 megohms, ½ watt	60B 8-156
R334	2.2 megohms, ½ watt	60B 8-225
R335	1,000 ohms, ½ watt	60B 8-102
R336	68 ohms, ½ watt, carbon only	60B 28-44
R337	4,500 ohms, 5 watt	61A 1-24
R338	56,000 ohms, ½ watt	60B 8-563
R401	2.7 megohms, ½ watt	60B 8-275
R402	12,000 ohms, ½ watt	60B 8-123
R403	47,000 ohms, ½ watt	60B 8-473
R404	2.7 megohms, ½ watt	60B 8-275
R405	33,000 ohms, 2 watt in comb. sets	60B 20-333
	18,000 ohms, 1 watt in "TV only" sets	60B 14-183
R406	15,000 ohms, ½ watt in comb. sets	60B 8-153
	22,000 ohms, ½ watt in "TV only" sets	60B 8-223
§R407	22,000 ohms, ½ watt (See Run 7 production change on page 17.)	60B 8-223
§R408	8,200 ohms, ½ watt	60B 8-822
§R409	8,200 ohms, ½ watt	60B 8-822
R410	1.2 megohms, ½ watt	60B 8-125
R411	1.5 megohms, **Vertical Hold**	75B 13-26
R412	10,000 ohms, ½ watt, 5%	60B 7-103
R413	1 megohm, ½ watt	60B 8-105
R414	2.5 megohms, **Height**	75B 13-3
R415	1 megohm, ½ watt	60B 8-105
R416	3,000 ohms, **Vert. Lin.**	75B 13-7
R417	820 ohms, ½ watt	60B 8-821
R418	560 ohms, ½ watt	60B 8-561
R419	560 ohms, ½ watt	60B 8-561
R420	330,000 ohms, ½ watt	60B 8-334
R421	820,000 ohms, ½ watt	60B 8-824
R422	330,000 ohms, ½ watt, 5%	60B 7-334
R423	82,000 ohms, ½ watt, 5%	60B 7-823
R424	3,900 ohms, ½ watt	60B 8-392
R425	68,000 ohms, ½ watt	60B 8-683
R426	50,000 ohms, **Hor. Hold**	75B 13-23
R427	22,000 ohms, ½ watt	60B 8-223
R428	150,000 ohms, ½ watt, 5%	60B 7-154
R429	8,200 ohms, ½ watt	60B 8-822
R430	150,000 ohms, ½ watt	60B 8-154
R431	820,000 ohms, ½ watt	60B 8-824
R432	82,000 ohms, ½ watt	60B 8-823

Sym.	Description	Part No.
R433	1 megohm, ½ watt	60B 8-105
R434	68 ohms, ½ watt, carbon only	60B 28-44
R435	47 ohms, 1 watt	60B 14-470
R436	82 ohms, ½ watt, carbon only	60B 28-31
R437	8,200 ohms, 2 watt	60B 20-822
R438	1,200 ohms, 2 watt	60B 20-122
R439	1,000 ohms, 2 watt	60B 20-102
R440	1,000 ohms, ½ watt	60B 8-102
R441A	1.5 megohms, **Vert. Hold**	75B 17-3
R441B	50,000 ohms, **Hor. Hold**	
R442	4.7 ohms, ½ watt, carbon only	60B 28-11
R443	8,200 ohms, ½ watt	60B 8-822
	(R443 used only when couplate is part number 63B6-2.) See Run 7 production change on page 17.)	
R444	2,700 ohms, ½ watt	60B 8-272
R445	56,000 ohms, ½ watt	60B 8-563
R501	270,000 ohms, 1 watt	60B 14-274
R701	22,000 ohms, ½ watt	60B 8-223
R702	10,000 ohms, 1 watt	60B 14-103
R703	150 ohms, ½ watt	60B 8-151
R704	27,000 ohms, 1 watt	60B 14-273
R706	1 megohm, ½ watt	60B 8-105
R707	4.7 ohms, ½ watt	60B 28-11
	10 ohms, ½ watt	60B 28-100
	(R707 is 4.7 ohms when #44 pilot light is used and 10 ohms when #47 pilot light is used. See production change on page 9.)	

CONDENSERS

Sym.	Description	Part No.
C101	3 to 9 mmfd, ceramic trimmer	98A 45-96
C102	.001 mfd, min, ceramic	98A 45-24
C103	800 mmfd, min, ceramic feed-thru in 94D46-2 and 94D46-3 tuners	94C 37-90
	150 mmfd, ceramic N470 in 94D52-1 and 94D52-2 tuners	94D 52-86
C104	.5 to 3 mmfd, N470 ceramic trimmers	98A 45-23
C105	47 mmfd, ceramic, N1400 temp. coeff. in 94D46-2 and 94D46-3 tuners	94D 47-50
	120 mmfd, 5% ceramic, N750 temp. coeff. in 94D52-1 and 94D52-2 tuners	98A 45-25
C106	.5 to 3 mmfd, ceramic trimmer	98A 45-23
C107	10 mmfd, 5% ceramic, N750 temp. coeff.	98A 45-64
C108	10 mmfd, 5%, cer, N750 temp. coeff.	98A 45-64
C109	5 mmfd, 5%, cer, N750 temp. coeff.	94D 47-52
C110	Tuning Rotor	94D 46-87
C111	.001 mfd, min, ceramic	98A 45-24
C112	6.8 mmfd, 3%, ceramic, NPO temp. coeff.	94D 47-53
C113	120 mmfd, silver mica	98A 45-78
C114	800 mmfd, min, ceramic feed-thru	94C 37-90
C115	800 mmfd, min, ceramic feed-thru	94C 37-90
C116	800 mmfd, min, ceramic feed-thru	94C 37-90
C117	800 mmfd, min, ceramic feed-thru	94C 37-90
C118	3 mmfd, 3%, ceramic	94D 47-54
C119	1.5 mmfd, ceramic	94D 46-84
C120	47 mmfd, ceramic, N1400 temp. coeff.	94D 47-50
C201	6.8 mmfd, cer, N330 temp. coeff.	65C 6-71
C202	20 mmfd, 5%, ceramic	65C 6-51
C203	.005 mfd, min, ceramic	65C 10-1
C204	180 mmfd, 5%, N030 temp. coeff.	65C 6-59
C205	4 mfd, 50 volts, electrolytic	67A 4-9
C206	500 mmfd, ceramic	65C 6-6

* Component may be part of couplate, part number 63B6-4 or 63B6-8. Replace with exact duplicate or individual components.
§ Component may be part of couplate, part number 63B6-2 or 63B6-11. Replace with exact duplicate or individual components.

Sym.	Description	Part No.
C208	.0022 mfd, 600 volts, paper	64B 9-17
C209	.01 mfd, 400 volts, paper	64B 9-13
‡C211	50 mmfd, ceramic	65C 6-4
†C212	.01 mfd, 400 volts, paper	64B 8-13
C213A	20 mfd, 150 volts, electrolytic	67C 15-23
C213B	60 mfd, 200 volts, electrolytic	
C213C	40 mfd, 350 volts, electrolytic	
C213D	60 mfd, 350 volts, electrolytic	
C214	.01 mfd, 400 volts, paper, in sets with tone control	64B 9-13
	.022 mfd, 400 volts, paper, in sets without tone control	64B 9-11
C215	80 mfd, 350 volts, electrolytic	67C 15-64
C216	.01 mfd, 400 volts, paper	64B 9-13
‡C217	.01 mfd, 400 volts, paper	64B 8-13
C218	.005 mfd, 600 volts, paper	64B 9-15
C219	.0022 mfd, 600 volts, paper	64B 9-17
C220	100 mmfd, ceramic	65C 6-3
C301	.001 mfd, min, ceramic	65C 6-41
C302	.001 mfd, min, ceramic	65C 6-41
C303	2.2 mmfd, ceramic	65C 6-86
C304	15 mmfd, ceramic	65C 6-50
C305	.001 mfd, min, ceramic	65C 6-41
C306A	.0015 mfd. dual ceramic	65A 17-2
C306B	.0015 mfd. dual ceramic	
C307	.005 mfd, ceramic	65C 10-1
C308A	.004 mfd. dual ceramic	65A 17-1
C308B	.004 mfd. dual ceramic	
C309	120 mmfd, ceramic	65C 6-66
C310	27 mmfd, ceramic	65C 6-87
C311	.22 mfd, 200 volts, paper (in chassis stamped Run 2 or lower)	64B 8-24
	.47 mfd, 100 volts, paper (in chassis stamped Run 3 and higher)	64A 10-1
C312	.001 mfd, min, ceramic	65C 6-41
C313	.1 mfd, 400 volts, paper	64B 9-7
C314	6.8 mmfd, cer, N330 temp. coeff.	65C 6-71
*C315	150 mmfd, mica	65B 21-151
C316	.22 mfd, 400 volts, paper (C316 was .1 mfd, in early sets)	64B 8-24
*C317	.01 mfd, 400 volts, paper (See Run 7 production change on page 17.)	64B 9-13
C318	.001 mfd, min, ceramic	65C 6-41
C319	.001 mfd, min, ceramic	65C 6-41
C401	.01 mfd, min, ceramic	65C 10-3
C402	82 mmfd, 500 volts, mica	65B 21-820
§C403	.002 mfd, 600 volts, paper	64B 5-14
§C404	.005 mfd, 600 volts, paper	64B 5-12
§C405	.0047 mfd, 500 volts, mica	65B 21-472
C406	.0047 mfd, 500 volts, mica	65B 21-472
C407	.047 mfd, 600 volts, paper	64A 2-14
C408	.1 mfd, 600 volts, paper	64B 9-7
C409A	100 mfd, 50 volts, electrolytic	67C 15-22
C409B	80 mfd, 350 volts, electrolytic	
C410	20 mfd, 475 volts, electrolytic	67A 21-1
C411A	10 to 160 mmfd. **Hor. Lock Range control**	66A 32-3
C411B	10 to 160 mmfd. **Hor. Drive control**	
C412	68 mmfd, 500 volts, mica	65B 21-680
C413	.1 mfd, 200 volts, paper	64B 9-7
C414	.47 mfd, 100 volts, paper	64B 9-72
C415	.022 mfd, 400 volts, paper	64B 9-11
C416	.047 mfd, 400 volts, paper	64B 9-9
C417	270 mmfd, mica	65B 21-271
C418	.01 mfd, 400 volts, 10% paper	64B 2-16
C419	820 mmfd, 500 volts, mica	65B 21-821
C420	680 mmfd, 500 volts, mica	65B 21-681
C421	.1 mfd, 200 volts, paper	64B 9-7
C422	.047 mfd, 400 volts, paper	64A 2-14
C423	.047 mfd, 400 volts, paper	64A 2-14
C424	.047 mfd, 400 volts, paper	64A 2-14
C425	47 mmfd, 5%, 1,500 volts, mica	65B 1-64
C426	.1 mfd, 400 volts, paper	64B 9-7
C427	.01 mfd, 600 volts, paper	64B 9-13
C428	.01 mfd, 400 volts, paper	64B 9-32
C501	Electrolytic	See C213D
C502	Electrolytic	See C409B
C701	5 mmfd, mica	65B 1-62
C702	2 to 20 mmfd, trimmer	66B 8-5
C704	47 mmfd, ceramic	65C 6-79
C705	.1 mfd, 400 volts, paper	64A 3-15
C706	.1 mfd, 400 volts, paper (C706 was .1 mfd, 200 volts in early sets)	64A 3-15
C707	.005 mfd, min, ceramic	65C 10-1
C708	.1 mfd, 400 volts, paper	64B 9-7
C709	100 mmfd, ceramic	65C 6-3
C716A	420 mmfd, max. gang (Used in later sets. See production change on page 9.)	68B 53-1
C716B	104.7 mmfd, max. gang	
C716A	420 mmfd, max. gang (Used in early sets. See production change on page 9.) Note: Dial drum spot welded to gang.	68B 53
C716B	108 mmfd, max. gang	

COILS, TRANSFORMERS

Sym.	Description	Part No.
L101	Antenna Coil (Stamped 2Q, 3Q, etc.) — For the 94D 46-2 and 94D 46-3 TV tuners only	
	for Channel #2	94D 46-52
	for Channel #3	94D 46-53
	for Channel #4	94D 46-54
	for Channel #5	94D 46-55
	for Channel #6	94D 46-56
	for Channel #7	94D 46-57
	for Channel #8	94D 46-58
	for Channel #9	94D 46-59
	for Channel #10	94D 46-60
	for Channel #11	94D 46-61
	for Channel #12	94D 46-62
	for Channel #13	94D 46-63
L102	Mixer—Osc. Coil (Stamped 2Q, 3Q, etc.) — For the 94D 46-2 and 94D 46-3 TV tuners only	
	for Channel #2	94D 46-72
	for Channel #3	94D 46-73
	for Channel #4	94D 46-74
	for Channel #5	94D 46-75
	for Channel #6	94D 46-76
	for Channel #7	94D 46-77
	for Channel #8	94D 46-78
	for Channel #9	94D 46-79
	for Channel #10	94D 46-80
	for Channel #11	94D 46-81
	for Channel #12	94D 46-82
	for Channel #13	94D 46-83
L101	Antenna Coil (Stamped 2H, 3H, etc.) — For 94D 52-1 and 94D 52-2 TV tuners only	
	for Channel #2	94D 52-52
	for Channel #3	94D 52-53
	for Channel #4	94D 52-54
	for Channel #5	94D 52-55
	for Channel #6	94D 52-56
	for Channel #7	94D 52-57
	for Channel #8	94D 52-58
	for Channel #9	94D 52-59
	for Channel #10	94D 52-60
	for Channel #11	94D 52-61
	for Channel #12	94D 52-62
	for Channel #13	94D 52-63
L102	Mixer—Osc. Coil (Stamped 2H, 3H, etc.) — For 94D 52-1 and 94D 52-2 TV tuners only	
	for Channel #2	94D 52-72
	for Channel #3	94D 52-73
	for Channel #4	94D 52-74
	for Channel #5	94D 52-75
	for Channel #6	94D 52-76
	for Channel #7	94D 52-77
	for Channel #8	94D 52-78
	for Channel #9	94D 52-79
	for Channel #10	94D 52-80
	for Channel #11	94D 52-81
	for Channel #12	94D 52-82
	for Channel #13	94D 52-83
L103	Mixer Plate Coil	94D 46-85
L104	Heater RF Choke	98A 45-13
L105	Heater RF Choke	98A 45-14
L109	Mixer Plate Choke	94D 46-86
L201	Sound Take-Off Coil	72B 99-7
L301	Trap Coil includes (C303, C304)	72C 96-23
L302	Video Peaking Coil (wound on R318)	73A 5-15
L303	Video Peaking Coil	73A 5-7
L304	Trap Coil	72B 99-6
L305	Video Peaking Coil (wound on R323)	73A 5-13
L306	Video Peaking Coil (wound on R324)	73A 5-9
L307	Heater RF Choke	73A 2-5
L401	**Hor. Lock control**	Part of T404
L402	**Width control**	94A 49-1
L403	**Hor. Linearity control**	94A 50-1
L501	Filter Choke	74B 18-2
L702	Oscillator Coil	69A 52-4
L704	AM Antenna, Iron Core	69C 155-2
T201	Ratio Detector Transformer	72B 68-1
T202	Audio Output Transformer	79A 8
T301	1st IF Transformer in sets using 94D46-2 and 94D46-3 tuners	72C 96-25
	1st IF Transformer in sets using 94D52-1 and 94D52-2 tuners	72C 96-21
T302	2nd IF Transformer	72C 96-22
T303	3rd IF Transformer	72B 107-1
T401	Vert. Blocking Oscillator Transformer	79A 18-4
T402	Vert. Output Transformer	79D 40-2
T403	Deflection Yoke	94C 51-1
T404	Hor. Blocking Oscillator Transformer (includes **Hor. Freq. control L401**)	69B 110
T405	Hor. Output Transformer	79D 41-1
T501	Power Transformer	80C 35-1
T701	1st IF Transformer	72B 28-7
T702	2nd IF Transformer	72B 28-7

MISC. PARTS FOR 94D46-2, 94D46-3, 94D52-1 and 94D52-2 TV TUNERS

See page 7 for parts illustration.

Sym.	Description	Part No.
M104	Shaft Shell & Rotor Assy. (Sharp Tuning) with 6" long shaft shell for 94D46-2 and 94D52-1 tuners	94D 46-87
	with 6¾" long shaft shell for 94D46-3 and 94D52-2 tuners	94D 46-90
M107	Bracket, Sharp Tuning Rotor Retaining	98A 45-95
M108	Spring, Detent Plate Grounding	98A 45-94
M109	Shield, Tube (Slotted) for 6J6	98A 45-73
M110	Shield, Tube plain, for 6BC5	87A 7-7
	plain, for 6BZ7	94C 37-94
M112	Spring, Slug Retaining (Osc. coil)	98A 45-52
M113	Washer, Fibre Spacer (¼" ID x ½" OD)	98A 45-63
M114	Nut, Locking Spring (for trimmers)	98A 45-31
M115	Screw, Trimmer (4-36 x ⅝")	98A 45-33
M116	Screw, Bracket Mtg. (6-32 x ¼")	98A 45-62
M117	Slug, Oscillator Coil Tuning	98A 45-88
M118	Stator Plate (ungrounded); Silver with Ceramic Insulator, for Sharp Tuning C111 (includes mtg. bracket)	98A 45-86
M121	Roller, Detent (⅜" dia., 3/32" dia. bearing)	98A 45-82
M122	Spring, Detent (2 1/16" long)	98A 45-81
M123	Contact Plate and Bracket Assembly	98A 45-84
M124	Spring, Sharp Tuning Rotor Contact (Flat bronze 1 1/16" x ½")	98A 45-83
M125	Spring, Front and Rear Turret Shaft (Wire 2¾" long, 3/16" dia.)	98A 45-85
M126	Turret and Shaft Assembly (less coils) with 6⅞" shaft for 94D46-2 and 94D52-1 tuners	94D 46-88
	with 7¾" shaft for 94D 46-3 and 94D52-2 tuners	94D 46-91
M127	Shield, Bottom	94C 37-92
M128	Shield, Side	94C 37-93
	Socket, Tube (mica filled) miniature, 7 pin	94C 37-95
	miniature, 9 pin	94C 37-96
M130	Tuner, Television (complete) cascode type (in sets with 20" or 21" picture tube) for sets Run 5 or lower	94D 46-2
	for sets Run 6 and higher	94D 46-3
	pentode type (in sets with 17" picture tube) for sets Run 5 or lower	94D 52-1
	for sets Run 6 and higher	94D 52-2
	(See Run 6 production change on page 9.)	

MISCELLANEOUS CHASSIS PARTS

For picture tube mtg. parts, see separate headings.

Sym.	Description	Part No.
M201	Speaker Socket	87A 4-1
M202	Speaker Plug (2 pin)	88A 5-5
	Speaker Plug (4 pin)	88B 22-1
M203	Speaker	See Cabinet Parts List
M401	Horiz. Output Fuse, ⅜ amp, 250 volts	84A 4-3
	Fuse Holder	84A 5-1
M501	Interlock Socket (Male)	89A 22-2
M502	Line Cord, with interlock socket	89A 22-1
M701	Socket, Phono Input	88A 1
S501	Switch, On-Off Power (S.P.S.T.)	Part of R208 or R225
S701	Switch, Function (complete)	77C 43
	Bracket, Tuner Shaft (Bakelite)	32A 170-1
	Clip, Tube Cap for 6BQ6GT tube	88A 16-17
	for 1B3GT tube	19A 54
	Corona Ring	15A 853
	Connector Lead, 2nd Anode for 17" Picture tube	88A 16-16
	for 20" Picture tube	88A 16-18
	Control Shaft, Focus Assembly (nylon)	94C 53-50
	Focus Assembly, PM	94C 53-1
	Fuse, ⅜ amp, 250 volts	84A 4-3
	Fuse Holder	84A 5-1
	Ion Trap	94A 15-3

* Component may be part of couplate, part number 63B6-4 or 63B6-8. Replace with exact duplicate or individual components.

§ Component may be part of couplate, part number 63B6-2 or 63B6-11. Replace with exact duplicate or individual components.

† Component may be part of couplate, part number 63B6-5. Replace with exact duplicate or individual componets.

‡ Component may be part of couplate, part number 63B6-10. Replace with exact duplicate or individual components.

Description	Part No.
Knob, DX Range Finder	33A 23-4
Plastic Tubing (for 2nd anode lead)	96B 18-2-16-0
Pilot Light (#44)	81A 1-5
Pilot Light Socket	82A 18-1
Shield, Tube	
for 7 pin miniature tube	
plain type	87A 7-17
slotted type	98A 45-73
for 9 pin miniature tube	87A 7-12
Shield, H.V. Compartment	15D 855
Shield, Mica Filled (for mtg. 1B3GT tube socket)	33B 91
Socket, Tube	
miniature bakelite (7 pin)	87A 3-7
miniature bakelite (7 pin) for 6AS5	87A 33-1
octal, plain	87A 5-1
octal, twist-lock (for 1B3GT)	87A 36
miniature (9 pin) for 6S4	87A 14-2
miniature (9 pin) for 6U8 and 12AU7	87A 37-1
picture tube (17")	87A 32-6
picture tube (20")	87A 32-7
Tuner, Television (complete)	
cascode type (in sets with 20" or 21" pic. tube)	
for sets Run 5 or lower	94D 46-2
for sets Run 6 and higher	94D 46-3
pentode type (in sets with 17" picture tube)	
for sets Run 5 or lower	94D 52-1
for sets Run 6 and higher	94D 52-2
(See Run 6 production change on page 9.)	

MISC. RADIO PARTS FOR 19E1, 19G1 and 19N1 CHASSIS

Sym.	Description	Part No.
M701	Socket, Phono Input	88A 1
M706	Socket, Phono Motor	88A 8-7
S701	Switch, Function (complete)	77C 43
	Clip, IF Transformer Mounting	72B 28-10
	Dial Cord (30" length needed)	50A 1-3
	Drum, Gang	A3797
	Grommet, Gang Mounting	12B 1-2
	Lock Washer, Osc. Coil & Gang (#6 I.T.)	3B 1-25-24
	Pilot Light #44	81A 1-5
	Pilot Light #47	81A 1-8
	Pilot Light Shield	82A 5-3
	Screw, Drum Set (#6-32x⅛ Allen Hd.)	1A 43-14
	Sleeve, Tuning (includes drum)	AA231
	Socket, Pilot Light	82A 18-1
	Socket, Tube, 7 pin miniature	87A 3-7
	Spacer Sleeve (for gang mounting)	29A 2-1-24
	Spring, Dial Cord Tension	19C 1-5
	Spring, Tube Retaining	19A 56-4
	Washer, Vellutex (oscillator coil mtg.)	5A 1-21

PARTS FOR MOUNTING 17BP4 (17") PICTURE TUBE

Description	Part No.
Bracket, Web Strap Clamping	15A 787
Bracket, Strap (supports yoke coil)	15A 572
Bracket, Tie Rod Mounting	15B 859
Bracket, Tube Stop	15A 856
Bracket, Yoke Housing	15C 613-1
Bracket, Yoke Housing Support	
right side (facing rear)	15C 860-1
left side (facing rear)	15C 860-2
Connector Lead, 2nd Anode	88A 16-16
Fibre Support (for 2nd anode lead)	32A 178-1
Ion Trap	94A 15-3
Nut (#8-32x⅛) for threaded end of tie rod	2A 1-15-24
Plastic Tubing (used between 2nd anode lead and chassis)	96B 18-2-16-0
Rubber Collar (mounts over picture tube neck)	12B 40
Rubber Strip, Adhesive (1/16x¾x2)	12B 5-6
Rubber Strip, Adhesive (1/32x2¾x1¼)	12A 39-12
Rubber Strip, Adhesive (1/16x1⅝x1⅝)	12A 39-17
Screw, Wing (for deflection yoke)	1A 101-1-24
Tie Rod (#8-32 thread)	28A 63-1
Tube Support (front of tube)	33B 93
Webbing, Picture Tube Mounting Strap (44" length)	50A 3-6

PARTS FOR MOUNTING 20DP4A (20") PICTURE TUBE

Description	Part No.
Bracket, Strap and Spade Bolt Mounting	15A 858
Bracket, Strap (supports yoke coil)	15A 572
Bracket, Tie Rod Mounting	15B 862
Bracket, Tube Stop	15A 857
Bracket, Yoke Housing	15C 613-1
Bracket, Yoke Housing Support	
right side (facing rear)	15C 861-1
left side (facing rear)	15C 861-2
Connector Lead, 2nd Anode	88A 16-18
Fibre Support (for 2nd anode lead)	32A 178-2
Ion Trap	94A 15-3
Nut, Tube Mounting Strap (¼-20 Hex.)	2A 1-23-24
Nut for threaded end of tie rod (#8-32x⅛)	2A 1-15-24
Plastic Tubing (used between 2nd anode lead and chassis)	96B 18-2-16-0
Rubber Channel (used under metal strap)	
36" length	12A 47-4
Rubber Collar (used over picture tube neck)	12B 40
Rubber Strip, Adhesive (1/32x2¾x1¼)	12A 39-12
Rubber Strip, Adhesive (1/16x1⅝x1⅝)	12A 39-17
Screw, Wing (for deflection yoke)	1A 101-1-24
Strap and Spade Bolt Assembly	A3762
Tie Rod (#8-32 thread)	28A 64-1
Tube Front Support	33B 89

PARTS FOR MOUNTING 21WP4 OR 21WP4X (21") PICTURE TUBE

Description	Part No.
Bracket, Strap and Spade Bolt Mounting	15A 858
Bracket, Strap (supports yoke coil)	15A 572
Bracket, Tie Rod Mounting	15B 862-1
Bracket, Tube Stop	15A 857
Bracket, Yoke Housing	15C 613-1
Bracket, Yoke Housing Support	
for 21WP4 tube	
right side (facing rear)	15C 867-2
left side (facing rear)	15C 867-1
for 21WP4X tube	
right side (facing rear)	15C 861-1
left side (facing rear)	15C 861-2
Connector Lead, 2nd Anode	88A 16-18
Fibre Support (for 2nd anode lead)	32A 183
Ion Trap	94A 15-3
Nut, Tube Mounting Strap (¼-20 Hex.)	2A 1-23-24
Nut for threaded end of tie rod (#8-32x⅛)	2A 1-15-24
Plastic Tubing (used between 2nd anode lead and chassis)	96B 18-2-16-0
Rubber Channel (used under metal strap)	
36" length	12A 47-4
Rubber Collar (mounts over picture tube neck)	12B 40
Rubber Strip, Adhesive (1/32x2¾x1¼)	12A 39-12
Rubber Strip, Adhesive (1/16x1⅝x1⅝)	12A 39-17
Screw, Wing (for deflection yoke)	1A 101-1-24
Strap and Spade Bolt Assembly	
for 21WP4 tube	A3846
for 21WP4X tube	A3742
Tie Rod (#8-32 thread)	
for 21WP4 tube	28A 40-4
for 21WP4X tube	28A 64-1
Tube Support (front of tube)	33B 108

PARTS FOR MOUNTING 21EP4A (21") PICTURE TUBE

Description	Part No.
Bracket, Strap (supports yoke coil)	15A 572
Bracket, Strap and Spade Bolt Mounting	15B 878
Bracket, Tie Rod Mounting	15B 862-1
Bracket, Tube Stop	
on sides of tube	15A 808
on front of chassis	15B 876
Bracket, Yoke Housing	15C 613-1
Bracket, Yoke Housing Support	
right side (facing rear)	15C 877-1
left side (facing rear)	15C 877-2
Connector Lead, 2nd Anode	88A 16-18
Fibre Support (for 2nd Anode lead)	32A 183
Ion Trap	94A 15-3
Lever, Picture Positioning	15B 574
Magnet, Correcting (with mtg. bracket)	A3614
Nut, Tube Mounting Strap (¼-20 Hex.)	2A 1-23-24
Nut for threaded end of tie rod (8-32x⅛ Hex.)	2A 1-15-24
Plastic Tubing (used between 2nd anode lead and chassis)	96B 18-12-16-0
Rubber Channel (used under metal strap)	
26" length	12B 47-2
5" length	12B 47-7
Rubber Collar (used over picture tube neck)	12B 40
Rubber Strip, Adhesive (1/32x2¾x1¼)	33A 39-12
Rubber Strip, Adhesive (1/32x1½x½)	12A 39-14
Rubber Strip, Adhesive (1/32x3½x1½)	12A 39-16
Rubber Strip, Adhesive (1/16x1¼x3)	12B 5-36
Screw, Wing (for deflection yoke)	1A 101-1-24
Spring, Tube Grounding	19A 23-2
Strap and Spade Bolt Assembly	A3617
Tie Rod	
sides of tube (#8-32 thread)	28B 52-6
bottom of tube (#8-32 thread)	28A 64-3
Tube Support (front)	33B 97

PARTS FOR MOUNTING 21ZP4A (21½") PICTURE TUBE

Description	Part No.
Bracket, Strap and Spade Bolt Mounting	15B 878
Bracket, Strap (supports yoke coil)	15A 572
Bracket, Tie Rod Mounting	15B 862-1
Bracket, Tube Stop	15B 896
Bracket, Yoke Housing	15C 613-1
Bracket, Yoke Housing Support	
right side (facing rear)	15C 877-1
left side (facing rear)	15C 877-2
Connector Lead, 2nd Anode	88A 16-18
Fibre Support (for 2nd anode lead)	32A 183
Ion Trap	94A 15-3
Nut, Tube Mounting Strap (¼-20 HH)	2A 1-23-24
Nut for threaded end of tie rod (#8-32 x ⅛)	2A 1-15-24
Plastic Tubing (used between 2nd anode lead and chassis)	96B 18-2-16-0
Rubber Channel (used under metal strap)	
26" length	12A 47-2
5" length	12A 47-7
Rubber Collar (used over picture tube neck)	12B 40
Rubber Strip, Adhesive (1/32 x 2¾ x 1¼)	12A 39-12
Rubber Strip, Adhesive (1/32 x 3½ x 1½)	12A 39-16
Rubber Strip, Adhesive (1/16 x 1¼ x 3)	12B 5-36
Screw, Wing (for deflection yoke)	1A 101-1-24
Spring Tube Grounding	19A 23-2
Strap and Spade Bolt Assembly	A3909
Tie Rod (#8-32 thread)	
bottom tube	28A 64-3
sides of tube	28B 52-6
Tube Front Support	33B 97

TUNING KNOBS and ASSOCIATED PARTS

Description	Part No.
Knob, Radio Tuning	
"Tuning"	33D 88-19
"T-R-P" (TV-Radio-Phonograph)	33B 90-4
Knob, Television Tuning	
maroon, "Channel"	
with gold inserts	33C 53-23
less inserts	33C 53-26
less inserts for 17DX12 only	33C 53-5
maroon, "Tuning"	
with gold ring	33D 88-21
less gold ring	33D 88-23
less gold ring for 17DX12 only	33C 53-6
maroon, "Off-Volume"	
2¼" diameter, with gold inserts	33C 53-24
2⅛" diameter, with gold inserts	33C 53-25
less inserts	33C 53-27
less inserts for 17DX12 only	33C 53-7
maroon, "Picture"	
with gold ring	33D 88-20
less gold ring	33D 88-22
less gold ring for 17DX12 only	33C 53-8
maroon, "Vertical"	33A 92-3
brown, "Channel" (with gold insert)	33C 53-29
brown, "Tuning"	33C 53-18
brown, "Off-Volume" (with gold insert)	33C 53-31
brown, "Picture"	33C 53-20
ebony, "Channel"	33C 53-1
ebony, "Tuning"	33C 53-2
ebony, "Off-Volume"	33C 53-3
ebony, "Picture"	33C 53-4
ebony, "DX Range Finder"	33A 23-4
Spring, TV Knob Tension	
for "Off-Volume" knob	18A 43-2
for "Tuning" knob	18A 43-1
for "Channel" knob	18A 43-3
Washer, Felt (used behind Tuning knob)	5A 4-14
Washer, Fibre (used behind Volume knob)	
for TV only models	5A 1-36
for combination models	5A 1-38

CABINET PARTS

Description	17DX10 Walnut	17DX11 Ebony	17DX12 Mahog.	121DX10 Walnut	121DX11 Ebony	121DX12 121DX12A Mahog.
Back, Cabinet	A3777	A3777	A3777	A3763	A3763	A3763
Baffle Board, Speaker	A3015	A3015	A3015	A3544	A3544	A3544
Bell, Cabinet Back 4" diameter	32B 148-15	32B 148-15	32B 148-15	32B 148-16	32B 148-16	32B 148-16
5" diameter	....	....	....	....	32B 196-16	32B 196-16
Bracket (for mtg. picture window)	15A 847-3	15A 847-1	15A 847-2	15B 849-3	15B 849-1	15B 849-2
Cabinet, Plastic	34E 61-6	34E 61-4	34E 61-5	34E 57-3	34E 57-1	34E 57-2
Carton and Fillers	44B 263	44B 263	44B 263	44B 266	44B 266	44B 266
Control Panel (less door)	....	....	....	23D 131-1	23D 131-8	23D 131-1
Control Panel Door	23B 130	23B 130	23B 130	23D 131-3	23D 131-3	23D 131-3
Control Panel Door Spring	18A 62	18A 62	18A 62	19A 70	19A 70	19A 70
Grille Cloth	36C 3-20	36C 3-20	36C 3-20	36C 3-106	36C 3-106	36C 3-106
Hinge Plate (for cabinet back)	....	....	....	15A 816	15A 816	15A 816
Knobs, Tuning	See "Tuning Knobs and Associated Parts" on page 15.					
Line Cord and Interlock Socket	89A 22-1	89A 22-1	89A 22-1	89A 22-1	89A 22-1	89A 22-1
Rubber Strip, Adhesive	12A 39-10	12A 39-10	12A 39-10	12A 39-11	12A 39-11	12A 39-11
Screw, Mtg. Control Panel #4x7/16" R.H.S.T.S.	....	....	....	1A 69-4-57	1A 69-4-57	1A 69-4-57
#4x5/8" R.H.S.T.S.	....	....	....	1A 69-6-57	1A 69-6-57	1A 69-6-57
Screw, Mtg. Control Panel Door Spring #4x1/4" R.H.S.T.	1A 69-1-57	1A 69-1-57	1A 69-1-57	....	....	....
Screw, Mtg. Picture Window #8x1" O.H.S.T.	1A 95-24-58	1A 95-24-58	1A 95-24-58	1A 95-24-57	1A 95-24-57	1A 95-24-57
Speaker, 5" EM	78B 74-1	78B 74-1	78B 74-1	78B 74-1	78B 74-1	78B 74-1
Speed Nut (for mtg. pic. window)	2A 22	2A 22	2A 22	2A 22	2A 22	2A 22
Support Channel (cabinet repair)	15A 955	15A 955	15A 955	15A 952	15A 952	15A 952
Tubing, Plastic (1⅜" long, used over 19A70 door spring)	....	....	....	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0
Window, Picture, Glass	21B 65-1	21B 65-1	21B 65-1	21B 65-2	21B 65-2	21B 65-2

CABINET PARTS

Description	121DX16 121DX16A Mahog.	121DX17 121DX17A Blond	221DX15 221DX15A Walnut	221DX16 221DX16A Mahog.	221DX17 221DX17A Blond	221DX26 221DX26A Mahog.
Back, Cabinet	A3764	A3764	A3764	A3764	A3764	A3764
Baffle Board, Speaker	A3544	A3544	....	....	....	....
Bell, Cabinet Back	32B 148-16	32B 148-16	32B 148-16	32B 148-16	32B 148-16	32B 148-16
Bracket, Mask Retainer	15A 848	15A 848	15A 848	15A 848	15A 848	15A 848
*Cabinet, Wood	*35E 227-2	*35E 227-2	*35E 222-1	*35E 222-2	*35E 222-3	*35E 223-2
Carton and Fillers	44B 264	44B 264	44B 268	44B 268	44B 268	44B 262
Control Panel (less door)	23D 131-4	23D 131-4	23D 131-4	23D 131-4	23D 131-4	23D 131-4
Control Panel Door	23D 131-3	23D 131-3	23D 131-3	23D 131-3	23D 131-3	23D 131-3
Control Panel Door Spring	19A 70	19A 70	19A 70	19A 70	19A 70	19A 70
Decals, Cabinet Refinishing	....	....	....	....	....	35E 223-57
*Doors (matched set of 2 front doors)	....	....	....	....	....	*35E 223-51
§Door Catch and Strike Plate	....	....	....	....	....	See § footnote below.
Door Handle	....	....	....	....	....	37A 39-1
Grille, Metal	.. ..	....	....	....	36B 40	36B 42
Grille Cloth	36C 3-106	36C 3-157	36C 3-131	36C 3-131	36C 3-132	36C 3-136
§Hinge, Cabinet (pair)	....	....	....	....	....	See § footnote below.
Knobs, Tuning	See "Tuning Knobs and Associated Parts" on page 15.					
*Legs (2 legs and cross member)	35E 227-21	35E 227-22	....	....	....	....
Line Cord and Interlock Socket	89A 22-1	89A 22-1	89A 22-1	89A 22-1	89A 22-1	89A 22-1
Molding, Removable (for pic. window)	35E 227-51	35E 227-52	35E 222-50	35E 222-51	35E 222-52	35E 223-55
Plastic Trim (fits around edge of window mask)	33A 85-3	33A 85-3	33A 85-3	33A 85-3	33A 85-3	33A 85-3
Rubber Strip, Adhesive (1/16x1/4x2½")	12B 5-27	12B 5-27	12B 5-27	12B 5-27	12B 5-27	12B 5-27
Screw, Mtg. Control Panel #4x3/8" R.H.W.S.P.H.	1A 7-9-57	1A 7-9-57	1A 7-9-57	1A 7-9-57	1A 7-9-57	1A 7-9-57
#4x5/8" R.H.W.S.P.H.	1A 7-11-57	1A 7-11-57	1A 7-11-57	1A 7-11-57	1A 7-11-57	1A 7-11-57
Screw, Mtg. Window Molding #6x1" O.H.W.S.P.H.	1A 15-28-59	1A 15-28-59	1A 15-28-59	1A 15-28-59	1A 15-28-59	1A 15-28-59
Speaker, 5" EM	78B 74-1	78B 74-1	....	....	....	....
Speaker, 10" EM	....	....	78B 75-1	78B 75-1	78B 75-1	78B 75-1
Speaker, 10" PM (with choke)	....	....	78B 80-1	78B 80-1	78B 80-1	78B 80-1
Swivel Caster Set of 4 casters, less sockets	....	....	94A 27-120	94A 27-120	94A 27-120	94A 27-120
Single Caster, less socket	....	....	37A 77-1	37A 77-1	37A 77-1	37A 77-1
Tubing, Plastic (1¾" long, used over 19A70 door spring)	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0
Window, Picture, Glass	21B 62-7	21B 62-7	21B 62-7	21B 62-7	21B 62-7	21B 62-7
Window Mask, Metal	23D 128	23D 128	23D 128	23D 128	23D 128	23D 128
Window Mask Grounding Spring	18A 64	18A 64	18A 64	18A 64	18A 64	18A 64

* To insure proper matching and fit, also specify cabinet manufacturer's code letters (usually burned or stamped on back rail of cabinet). Wood parts are supplied only if old part cannot be repaired. When ordering, describe condition of old part in detail.

§ Order these parts using the part number given in Cabinet Hinge Ordering Data, Form No. S379. Otherwise, return old part, or send an outline tracing (exact size) of part and note finish (brass, bronze, etc.).

CABINET PARTS

Description	121DX16L Mahog.	121DX17L Blond	221DX15L Walnut	221DX16L Mahog.	221DX17L Blond	221DX26L Mahog.
Back, Cabinet (complete)	A3891	A3891	A3891	A3891	A3891	A3891
Bell, Cabinet Back	32B 148-16	32B 148-16	32B 148-16	32B 148-16	32B 148-16	32B 148-16
Bracket, Mask Retainer	15A 848	15A 848	15A 848	15A 848	15A 848	15A 848
*Cabinet, Wood	*35E 246-2	*35E 246-3	*35E 242-1	*35E 242-2	*35E 242-3	*35E 243-2
Carton and Fillers	44C 282	44C 282	44C 279	44C 279	44C 279	44C 280
Control Panel (less door)	23D 133-4	23D 133-4	23D 133-4	23D 133-4	23D 133-4	23D 133-4
Control Panel Door	23D 133-5	23D 133-5	23D 133-5	23D 133-5	23D 133-5	23D 133-5
Control Panel Door Spring	19A 70	19A 70	19A 70	19A 70	19A 70	19A 70
Decals, Cabinet Refinishing	....	....	....	....	....	35E 243-57
*Doors (Matched set of 2 front doors)	....	....	....	....	....	*35E 243-51
§Door Catch and Strike Plate	See § footnote below.					
Door Handle	....	....	....	....	....	37A 39
Grille, Metal	....	....	....	....	36B 40-1	36B 42
Grille Cloth	36C 3-106	36C 3-157	36C 3-152	36C 3-152	36C 3-153	36C 3-136
§Hinge, Cabinet (pair)	See § footnote below.					
Knobs, Tuning	See "Tuning Knobs and Associated Parts" on page 15.					
*Legs (2 legs and cross member)	35E 227-21	35E 227-22	....	....	....	....
Line Cord and Interlock Socket	89A 22-1	89A 22-1	89A 22-1	89A 22-1	89A 22-1	89A 22-1
Molding, Removable (for pic. window)	35E 246-51	35E 246-52	....	....	....	35E 243-55
Plastic Trim (fits around edge of window mask)	33A 85-4	33A 85-4	33A 85-4	33A 85-4	33A 85-4	33A 85-4
Rubber Strip, Adhesive (1/16x¼x2½")	12B 5-27	12B 5-27	12B 5-27	12B 5-27	12B 5-27	12B 5-27
Screw, Mtg. Control Panel						
#4x⅜" PRH WS	1A 7-9-57	1A 7-9-57	1A 7-9-57	1A 7-9-57	1A 7-9-57	1A 7-9-57
#4x⅝" PRH WS	1A 7-11-57	1A 7-11-57	1A 7-11-57	1A 7-11-57	1A 7-11-57	1A 7-11-57
Speaker						
5" EM	78B 74-1	78B 74-1	....	....	....	....
10" EM	....	....	78B 75-1	78B 75-1	78B 75-1	78B 75-1
10" PM (with choke)	....	....	78B 80-1	78B 80-1	78B 80-1	78B 80-1
Swivel Caster						
Set of 4 casters, less sockets	....	....	94A 27-120	94A 27-120	94A 27-120	94A 27-120
Single Casters, less socket	....	....	37A 77-1	37A 77-1	37A 77-1	37A 77-1
Tubing, Plastic (1⅜" long, used over 19A70 door spring)	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0
Window, Picture, Glass	21B 65-4	21B 65-4	21B 65-4	21B 65-4	21R 65-4	21B 65-4
Window Mask, Metal	23D 145	23D 145	23D 145	23D 145	23D 145	23D 145

* To insure proper matching and fit, also specify cabinet manufacturer's code letters (usually burned or stamped on back rail of cabinet). Wood parts are supplied only if old part cannot be repaired. When ordering, describe condition of old part in detail.

§ Order these parts using the part number given in Cabinet Hinge Ordering Data, Form No. S379. Otherwise, return old part, or send an outline tracing (exact size) of part and note finish (brass, bronze, etc.).

CABINET PARTS FOR MODELS 221DX38 and 221DX38A

Description	221DX38 221DX38A Maple
Back, Cabinet	A3764
Bracket, Mask Retainer	15A 848
*Cabinet, Wood	*35E 235-1
Carton and Fillers	44C 270
Control Panel Plate (includes 18A62)	A3852
Control Panel Door	23B 130
Control Panel Door Spring (mounted on control panel plate)	18A 62
*Doors (matched set of 2 front doors)	*35E 235-50
§Door Catch and Strike Plate	See § footnote below.
Door Escutcheon (less key)	
left side (facing front)	37A 86-1
right side (facing front)	37A 86-2
Door Escutcheon Key	37A 86-3
Grille Cloth	36C 3-143
§Hinge, Cabinet (pair)	See § footnote below.

Description	221DX38 221DX38A Maple
Knobs, Tuning	See "Tuning Knobs and Associated Parts" on page 15.
Line Cord and Interlock Socket	89A 22-1
Molding, Removable (for picture window)	35E 235-53
Plastic Trim (fits around edge of picture window mask)	33A 85-3
Rubber Strip, Adhesive (1/16x¼x2½)	12B 5-27
Screw, Mtg. Control Panel Plate (#4x¼" R.H.W.S.P.H.)	1A 7-8-59
Screw, Mtg. Window Molding (#6x1" O.H.W.S.P.H.)	1A 15-28-59
Speaker, 10" EM	78B 75-1
Swivel Caster	
Set of 4 casters, less sockets	94A 27-120
Single Caster, less socket	37A 77-1
Window, Picture, Glass	21B 62-7
Window Mask, Metal	23D 128
Window Mask Grounding Spring	18A 64

CABINET PARTS

Description	321DX15 321DX15A Walnut	321DX16 321DX16A Mahog.	321DX17 321DX17A Blond	321DX26 Mahog.
Back, Cabinet	A3764	A3764	A3764	A3764
Baffle Board, Speaker	....	....	....	A3767
Base, Cabinet	....	....	....	35E 232-2
Bell, Cabinet Back	32B 148-16	32B 148-16	32B 148-16	32B 148-16
Bracket, Mask Retainer	15A 848	15A 848	15A 848	15A 848
*Cabinet, Wood	*35E 224-1	*35E 224-2	*35E 224-3	*35E 227-5
Carton and Fillers	44B 261	44B 261	44B 261	44B 264
Clamp, Phono Lead Retaining	....	....	....	11B 12-3
Control Panel (less door)	23D 129-1	23D 129-1	23D 129-1	23D 129-1
Control Panel Door	23D 129-5	23D 129-5	23D 129-5	23D 129-5
Control Panel Door Spring	19A 70	19A 70	19A 70	19A 70
Decals, Cabinet Refinishing	....	....	....	35E 223-56
*Doors (matched set of 2 front doors)	*35E 224-50	*35E 224-51	*35E 224-52	....
*Door, Cabinet Base	....	....	....	*35E 232-51
§Door Catch and Strike Plate	See § footnote below.			
Door Handle	37A 79-1	37A 79-1	37A 79-1	37A 69-1

* To insure proper matching and fit, also specify cabinet manufacturer's code letters (usually burned or stamped on back rail of cabinet). Wood parts are supplied only if old part cannot be repaired. When ordering, describe condition of old part in detail.

§ Order these parts using the part number given in Cabinet Hinge Ordering Data, Form No. S379. Otherwise, return old part, or send an outline tracing (exact size) of part and note finish (brass, bronze, etc.).

Description	321DX15 321DX15A	321DX16 321DX16A	321DX17 321DX17A	321DX26
Door Support Arm				
right side	....	....	....	37A 80-1
left side	....	....	....	37A 80-2
Grille Cloth	36C 3-133	36C 3-133	36C 3-134	36C 3-106
§Hinge, Cabinet (pair)	See § footnote below.			
Knobs, Tuning	See "Tuning Knobs and Associated Parts" on page 15.			
Line Cord and Interlock Socket	89A 22-1	89A 22-1	89A 22-1	89A 22-1
Molding, Removable (for pic. window)	35E 224-56	35E 224-57	35E 224-58	35E 227-51
Ornament, Wood, Grille	....	35E 245-60	35E 245-61	....
Plastic Trim (fits around edge of window mask)	33A 85-3	33A 85-3	33A 85-3	33A 85-3
Rubber Strip, Adhesive (1/16x¼x2½")	12B 5-27	12B 5-27	12B 5-27	12B 5-27
Screw, Mtg. Control Panel				
#4x⅜" R.H.W.S.P.H.	1A 7-9-57	1A 7-9-57	1A 7-9-57	1A 7-9-57
#4x⅝" R.H.W.S.P.H.	1A 7-11-57	1A 7-11-57	1A 7-11-57	1A 7-11-57
Screw, Mtg. Window Molding				
#6x1" O.H.W.S.P.H.	1A 15-28-59	1A 15-28-59	1A 15-28-59	1A 15-28-59
Slide, Phonograph Drawer	37B 32-8	37B 32-8	37B 32-8	37B 32-8
Speaker, 6" PM	....	....	....	78B 76-1
Speaker, 12" PM	78B 56-1	78B 56-1	78B 56-1	....
Speaker, 12" PM (includes output transformer)	78B 77-1	78B 77-1	78B 77-1	....
Spring, Phono Lead Retaining	....	....	....	19C 1-21
Swivel Caster				
Set of 4 Casters, less sockets	94A 27-120	94A 27-120	94A 27-120	94A 27-120
Single Casters, less socket	37A 77-1	37A 77-1	37A 77-1	37A 77-1
Tubing, Plastic (1⅜" long, used over 19A70 door spring)	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0
Window, Picture, Glass	21B 62-7	21B 62-7	21B 62-7	21B 62-7
Window Mask, Metal	23D 128	23D 128	23D 128	23D 128
Window Mask Grounding Spring	18A 64	18A 64	18A 64	18A 64

* To insure proper matching and fit, also specify cabinet manufacturer's code letters (usually burned or stamped on back rail of cabinet). Wood parts are supplied only if old part cannot be repaired. When ordering, describe condition of old part in detail.

§ Order these parts using the part number given in Cabinet Hinge Ordering Data, Form No. S379. Otherwise, return old part, or send an outline tracing (exact size) of part and note finish (brass, bronze, etc.).

Description	222DX15	321DX25A 321DX25B	321DX26A 321DX26B	321DX27A 321DX27B
Back, Cabinet	A3848	A3764	A3764	A3764
Baffle Board, Speaker	....	A3767	A3767	A3767
Bell, Cabinet Back	32B 148-17	32B 148-16	32B 148-16	32B 148-16
Bracket, Mask Retainer	....	15A 848	15A 848	15A 848
Bracket (for mtg. picture window)	....	15B 903	15B 903	15B 903
*Cabinet, Wood	*35E 225-1	*35E 237-1	*35E 237-2	*35E 237-3
Carton and Fillers	44B 260	44C 278	44C 278	44C 278
Control Panel (less door)	23D 133-1	23D 129-1	23D 129-1	23D 129-1
Control Panel Door	23D 133-5	23D 129-5	23D 129-5	23D 129-5
Control Panel Door Spring	19A 70	19A 70	19A 70	19A 70
*Door, Cabinet	....	*35E 237-53	*35E 237-54	*35E 237-55
§Door Catch and Strike Plate		See § footnote below.		
Door Handle	....	37A 69-1	37A 69-1	37A 69-1

Description	222DX15	321DX25A 321DX25B	321DX26A 321DX26B	321DX27A 321DX27B
Door Support Arm				
right side	....	37A 80-1	37A 80-1	37A 80-3
left side	....	37A 80-2	37A 80-2	37A 80-4
Grille Cloth	36C 3-135	36C 3-106	36C 3-106	36C 3-157
Grille, Metal	36C 39	....	....	....
§Hinge, Cabinet (pair)	See § footnote below.			
Knobs, Tuning	See "Tuning Knobs and Associated Parts" on page 15.			
Line Cord and Interlock Socket	89A 22-1	89A 22-1	89A 22-1	89A 22-1
Molding, Removable (for pic. window)	35E 225-50	35E 227-50	35E 227-51	35E 227-52
Plastic Trim (fits around edge of window mask)	....	33A 85-3	33A 85-3	33A 85-3
Rubber Strip, Adhesive (1/16x¼x2½")	12B 5-27	12B 5-27	12B 5-27	12B 5-27
Screw, Mtg. Control Panel				
#4x⅜" R.H.W.S.P.H.	1A 7-9-57	1A 7-9-57	1A 7-9-57	1A 7-9-57
#4x⅝" R.H.W.S.P.H.	1A 7-11-57	1A 7-11-57	1A 7-11-57	1A 7-11-57
Screw, Mtg. Window Molding				
#6x1" O.H.W.S.P.H.	1A 15-28-59	1A 15-28-59	1A 15-28-59	1A 15-28-59
Slide, Phonograph Drawer	....	37B 32-8	37B 32-8	37B 32-8
Speaker, 6" PM	....	78B 76-1	78B 76-1	78B 76-1
Speaker, 10" EM	78B 75-1	....	....	....
Swivel Caster				
Set of 4 casters, less sockets	94A 27-120	94A 27-120	94A 27-120	94A 27-120
Single Caster, less socket	37A 77-1	37A 77-1	37A 77-1	37A 77-1
Tubing, Plastic (1⅜" long, used over 19A70 door spring)	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0
Window, Picture, Glass	21B 64-2	21B 62-7	21B 62-7	21B 62-7
Window Mask, Plastic	23E 132	....	....	....
Window Mask, Metal	....	23D 128	23D 128	23D 128
Window Mask Grounding Spring	....	18A 64	18A 64	18A 64

Description	321DX15L Walnut	321DX16L Mahog.	321DX17L Blond
Back, Cabinet (complete)	A3891	A3891	A3891
Bell, Cabinet Back	32B 192-3	32B 192-3	32B 192-3
Bracket, Mask Retainer	15A 848	15A 848	15A 848
Bracket, (for mtg. pic. window)	15B 903	15B 903	15B 903
*Cabinet, Wood	*35E 245-1	*35E 245-2	*35E 245-3
Carton and Fillers	44C 281	44C 281	44C 281
Control Panel (less door)	23D 129-1	23D 129-1	23D 129-1
Control Panel Door	23D 129-5	23D 129-5	23D 129-5
Control Panel Door Spring	19A 70	19A 70	19A 70
*Doors (matched set of 2 front doors)	*35E 245-50	35E 245-51	35E 245-52
§Door, Catch and Strike Plate	See § footnote below.		
Door Handle	37A 79-1	37A 79-1	37A 79-1
Grille Cloth	36C 3-154	36C 3-154	36C 3-154
§Hinge, Cabinet (pair)	See § footnote below.		

* To insure proper matching and fit, also specify cabinet manufacturer's code letters (usually burned or stamped on back rail of cabinet). Wood parts are supplied only if old part cannot be repaired. When ordering, describe condition of old part in detail.

§ Order these parts using the part number given in Cabinet Hinge Ordering Data, Form No. S379. Otherwise, return old part, or send an outline tracing (exact size) of part and note finish (brass, bronze, etc.).

CABINET PARTS

Description	321DX15L	321DX16L	321DX17L
Knobs, Tuning	See "Tuning Knobs and Associated Parts" on Page 15.		
Line Cord and Interlock Socket	89A 22-1	89A 22-1	89A 22-1
Molding, Removable (for pic. window)	35E 245-56	35E 245-57	35E 245-58
Ornament, Wood, Grille	35E 245-59	35E 245-60	35E 245-61
Plastic Trim (fits around edge of window mask)	33A 85-4	33A 85-4	33A 85-4
Rubber, Strip, Adhesive (1/16x1/4x2 1/2")	12B 5-27	12B 5-27	12B 5-27
Screw, Mtg. Control Panel			
#4x3/8" PRH WS	1A 7-9-57	1A 7-9-57	1A 7-9-57
#4x5/8" PRH WS	1A 7-11-57	1A 7-11-57	1A 7-11-57
Screw, Mtg. Window Molding			
#6x1" POH WS	1A 15-28-59	1A 15-28-59	1A 15-28-59
Slide, Phonograph Drawer	37B 32-8	37B 32-8	37B 32-8
Speaker			
12" PM (includes output transformer)	78B 77-1	78B 77-1	78B 77-1
Swivel Caster			
Set of 4 casters, less sockets	94A 27-120	94A 27-120	94A 27-120
Single Caster, less socket	37A 77-1	37A 77-1	37A 77-1
Tubing, Plastic (1 3/8" long, used over 19A70 door spring)	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0
Window, Picture, Glass	21B 65-4	21B 65-4	21B 65-4
Window Mask, Metal	23D 145	23D 145	23D 145

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

Numerical symbols ①, ②, ③, etc. indicate run numbers for all 19 series chassis.

A1, A2,.....Y, Z, etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions below.

WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with PICTURE control set fully to the right, all other controls set for normal picture (in sync). DG Range Finder control set fully to the left (at "0" position). WARNING: Incorrect adjustment of the DX Range Finder control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

Waveform at pins 1 and 4 of V403 and terminal "C" (2) of T404 taken with a 10 mmfd. condenser connected in series with the oscilloscope high side.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

CAUTION

Pulsed high voltage is present on the caps of V404 and V405 and at pin 3 of V406. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage at pin 3 of V406 taken, using an oscilloscope with a capacitive voltage divider probe. Waveform at V406 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the lead connecting to pin 3. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

TV VOLTAGE DATA
(Voltages given on schematic)

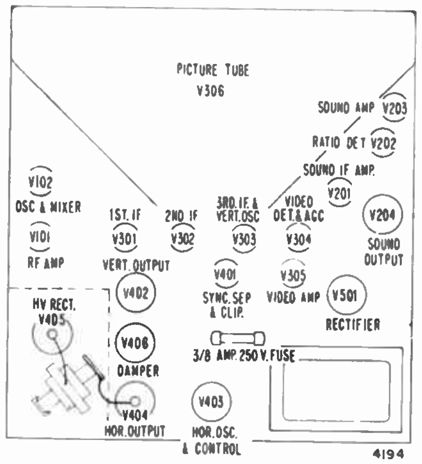
- PICTURE control turned fully clockwise. CHANNEL control set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation. DX Range Finder control set fully to the left (at "0" position).
- Antenna disconnected from set with terminals shorted.
- Voltages marked with an asterisk * will vary widely with control setting.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (TV Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins.

  In tuners using a 6BZ7 tube, voltages taken at pins 1 and 8 must be taken as described above or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.

CAUTION

Pulsed high voltages are present on the cap of V404, pin 3 of V406 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter. 2nd anode voltage is approximately 15 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.



Top View of Chassis.

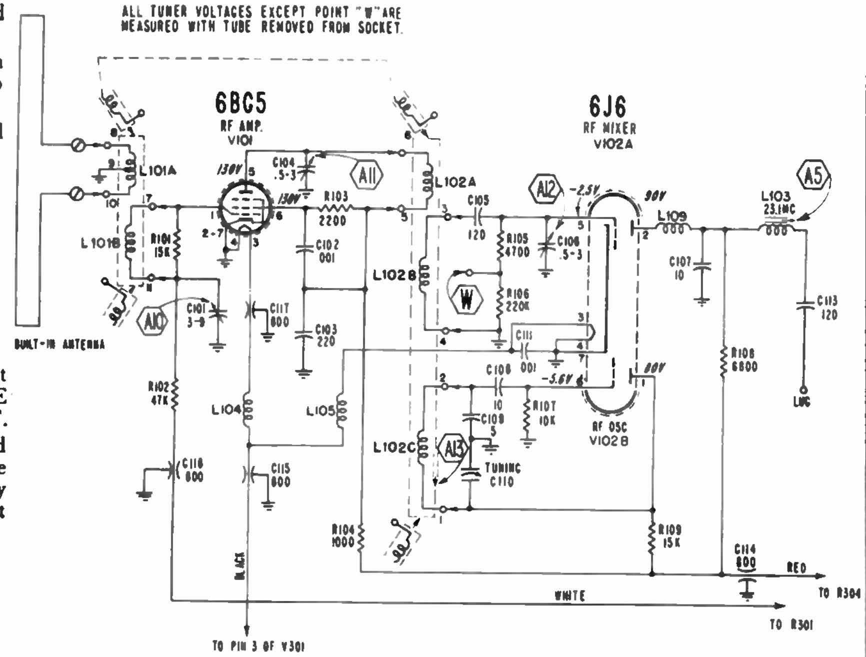
94D46-2 TUNER USED IN 19C1, 19H1, 19F1A CHASSIS.

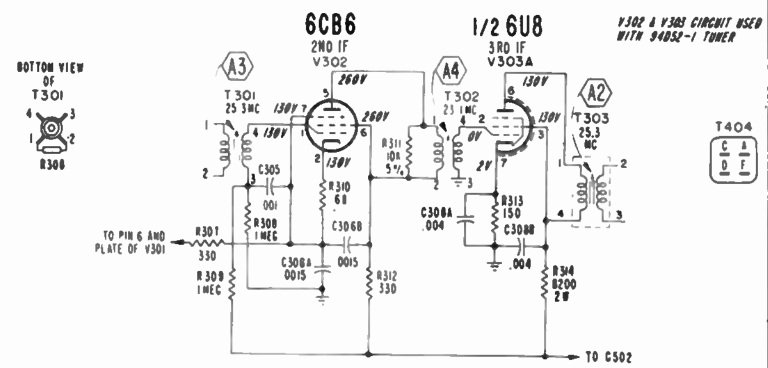
94D52-1 TUNER USED IN 19B1 CHASSIS.

V302 & V303 CIRCUIT SHOWN BELOW USED ONLY WITH 94D52-1 TUNER.

TV TUNER 94D52-1

ALL TUNER VOLTAGES EXCEPT POINT "W" ARE MEASURED WITH TUBE REMOVED FROM SOCKET.





99E122AA

Note: Tone control not used in 19B1 and 19F1A chassis.

Figure 30. Schematic for 19B1, 19C1, 19F1, 19F1A, 19H1 and 19K1 Television Chassis.

Note: This schematic applies only to chassis stamped Run 2 or lower.
See figure 32 for chassis stamped Run 3 and figure 34 for chassis stamped Run 4 and higher.

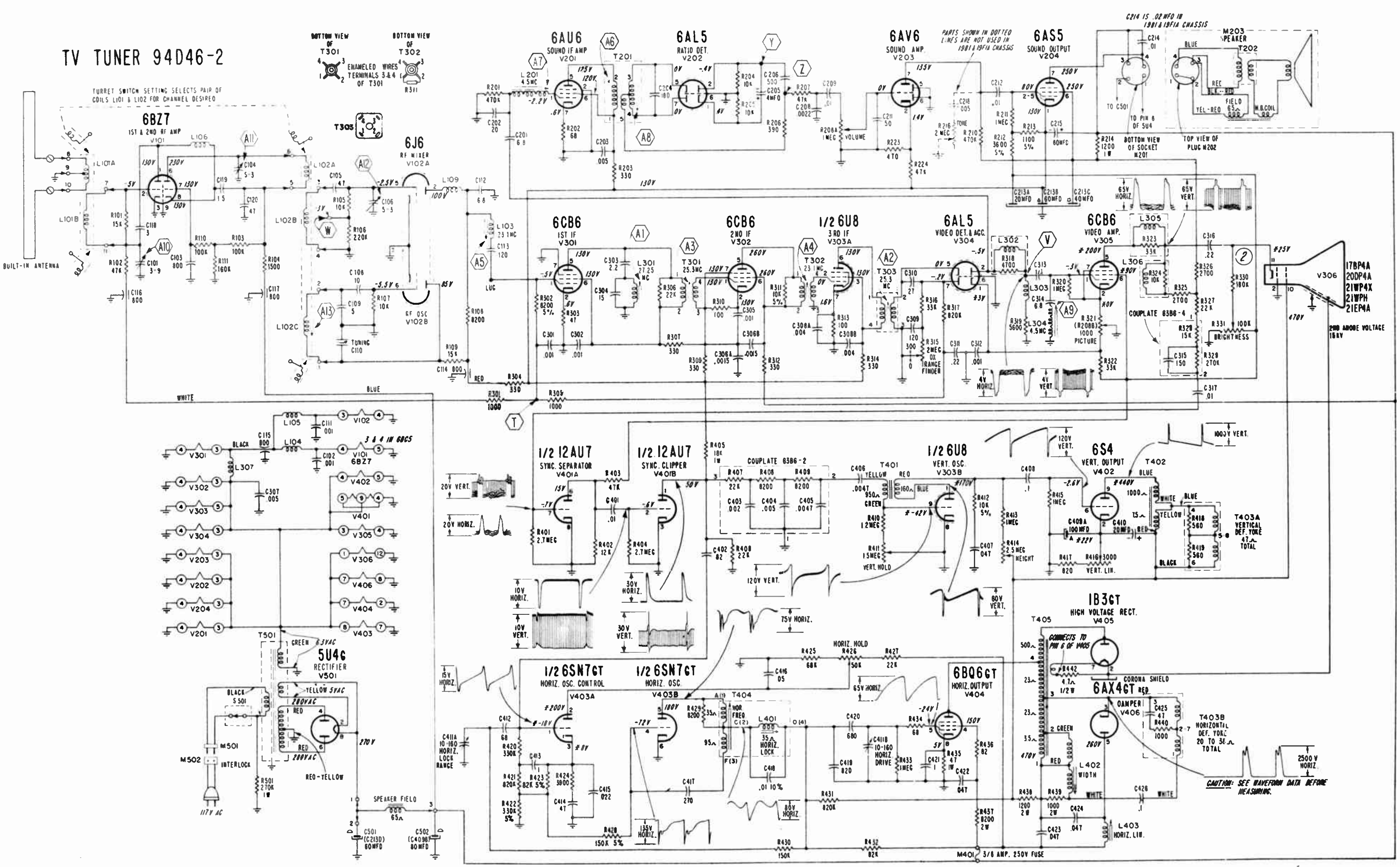
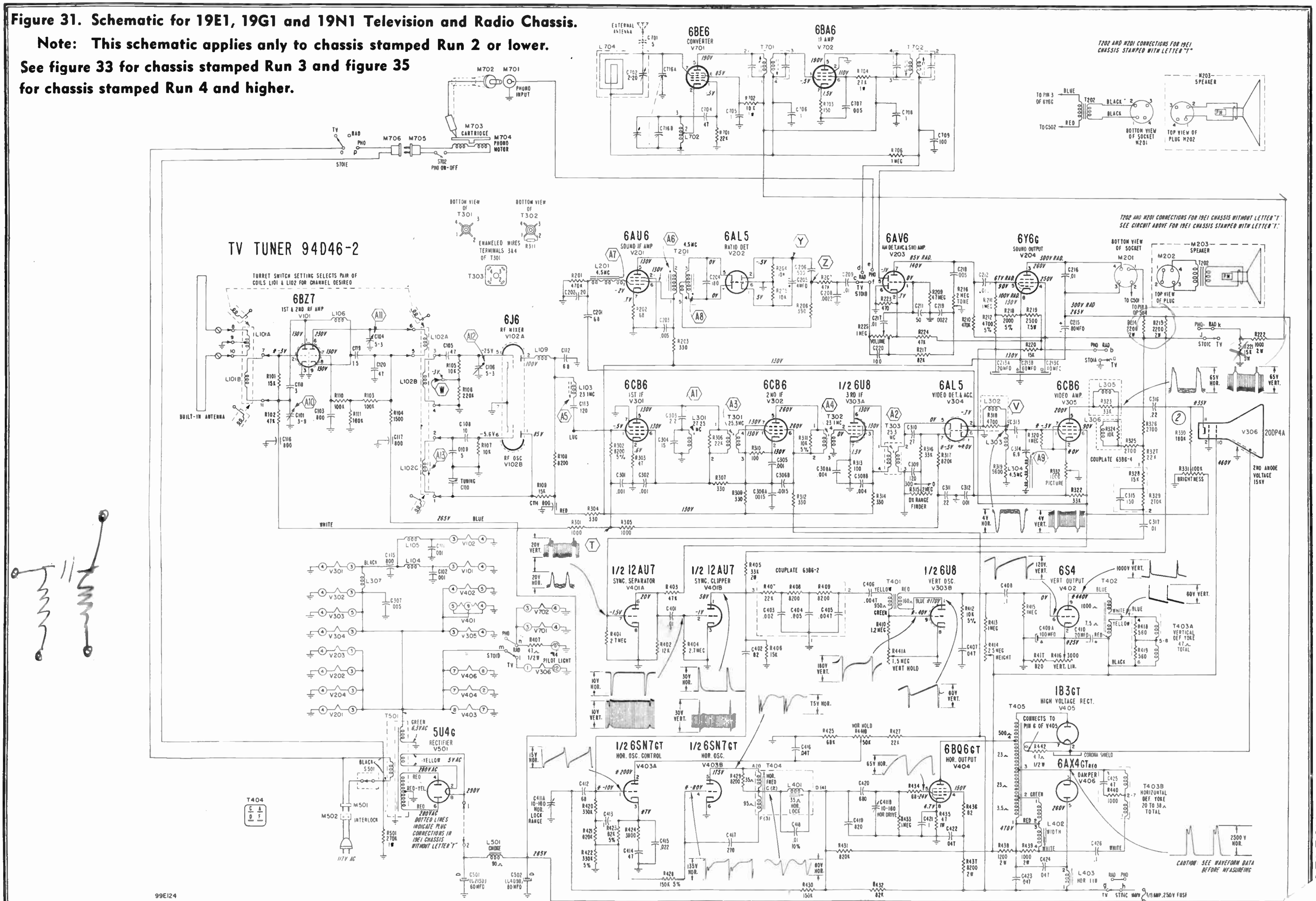


Figure 31. Schematic for 19E1, 19G1 and 19N1 Television and Radio Chassis.

Note: This schematic applies only to chassis stamped Run 2 or lower. See figure 33 for chassis stamped Run 3 and figure 35 for chassis stamped Run 4 and higher.



ADMIRAL TV PAGE 12-

19E1, 19G1, 19N1

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.
Numerical symbols ①, ②, ③, etc. indicate run numbers for all 19 series chassis.

(A1), (A2),.....(Y), (Z), etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions below.

WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with PICTURE control set fully to the right, all other controls set for normal picture (in sync). DX Range Finder control set fully to the left (at "0" position). WARNING: Incorrect adjustment of the DX Range Finder control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

Waveform at pins 1 and 4 of V403 and terminal "C" (2) of T404 taken with a 10 mmfd. condenser connected in series with the oscilloscope high side.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

CAUTION

Pulsed high voltage is present on the caps of V404 and V405 and at pin 3 of V406. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage at pin 3 of V406 taken, using an oscilloscope with a capacitive voltage divider probe. Waveform at V406 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the lead connecting to pin 3. When taking the waveform this way, the shape of the waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

VOLTAGE DATA
(Voltages given on schematic)

- PICTURE control turned fully clockwise. CHANNEL control set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation. DX Range Finder control set fully to the left (at "O" position).
- Antenna disconnected from set with terminals shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (TV Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins.

  In tuners using a 6BZ7 tube, voltages taken at pins 1 and 8 must be taken as described above or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.
- Voltages marked with an asterisk * will vary widely with control setting. In combination models, B+ voltages in TV chassis will be slightly higher when set is switched to radio position. Alternate voltage readings for radio and TV are shown for sound output tube V204 (6Y6G).

CAUTION

Pulsed high voltages are present on the cap of V404, pin 3 of V406 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter. 2nd anode voltage is approximately 15 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

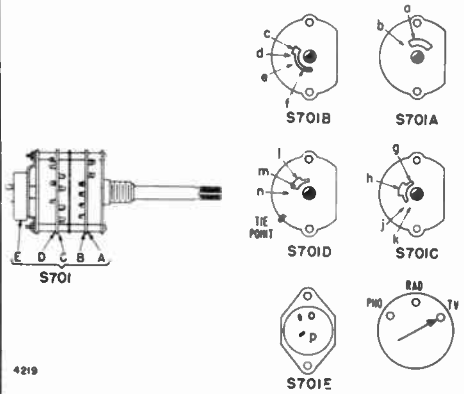
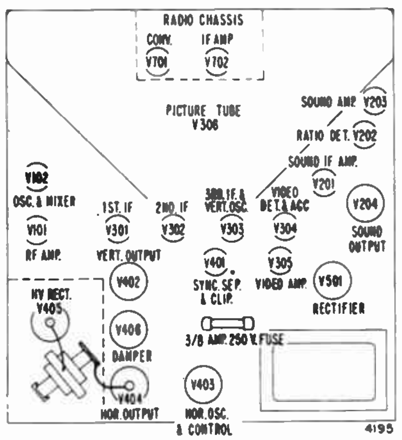


Illustration of TV-RAD-PHO switch S701



**Top View of Chassis.
(V701 and V702 are accessible from underside of chassis).**

Ch. 19B1, 19C1, 19F1, 19F1A, 19H1, 19K1

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.
Numerical symbols ①, ②, ③, etc. indicate run numbers for all 19 series chassis.
by a run number.

(A1), (A2),.....(Y), (Z), etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions below.

WAVEFORM DATA
(Waveforms given on schematic)

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The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

CAUTION

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TV VOLTAGE DATA
(Voltages given on schematic)

- PICTURE control turned fully clockwise. CHANNEL control set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation DX Range Finder control set fully to the left (at "0" position).
- Antenna disconnected from set with Terminals shorted.
- Voltages marked with an asterisk * will vary widely with control setting.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (TV Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins.

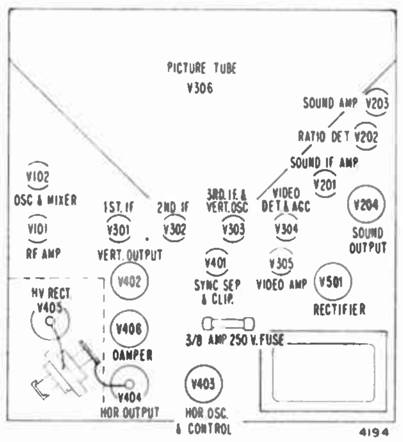
  In tuners using a 6BZ7 tube, voltages taken at pins 1 and 8 must be taken as described above or no voltage reading will be obtained.

  Voltages at V306 measured from top of socket with tube removed.

CAUTION

Pulsed high voltages are present on the cap of V404, pin 3 of V406 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

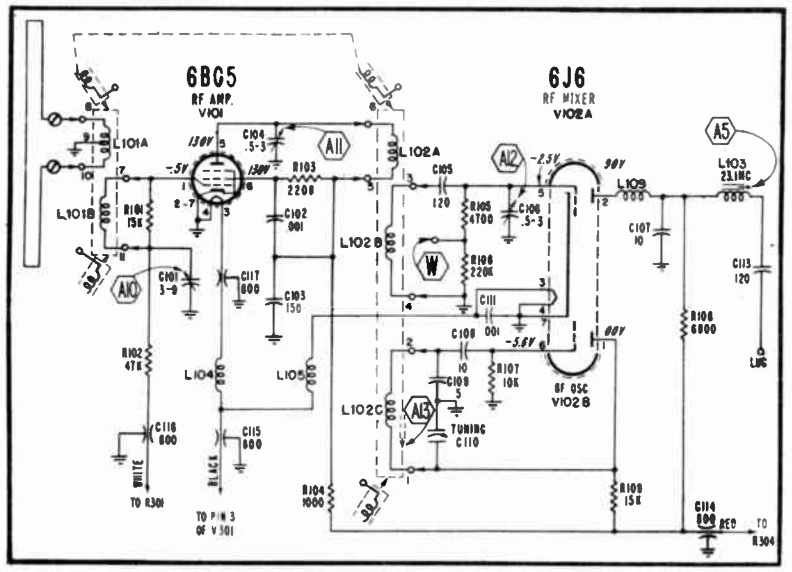
Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 15 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.



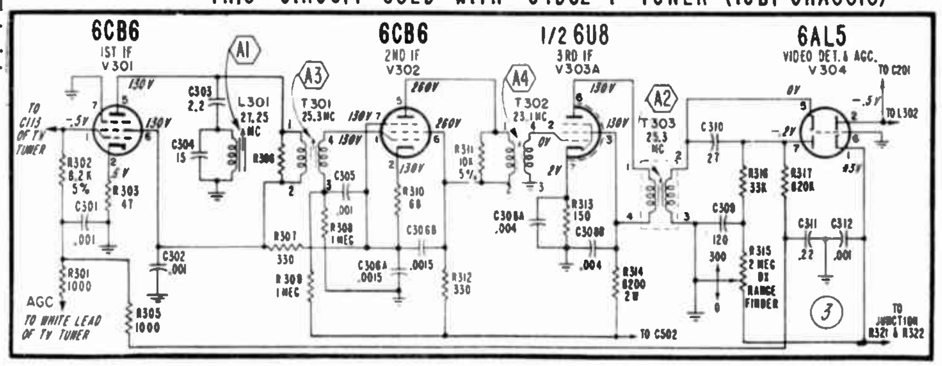
Top View of Chassis.

TV TUNER 94D52-1
USED IN 19B1 CHASSIS ONLY

THE CIRCUITS SHOWN BELOW ARE USED ONLY WITH 94D52-1 TUNER (19B1 CHASSIS)



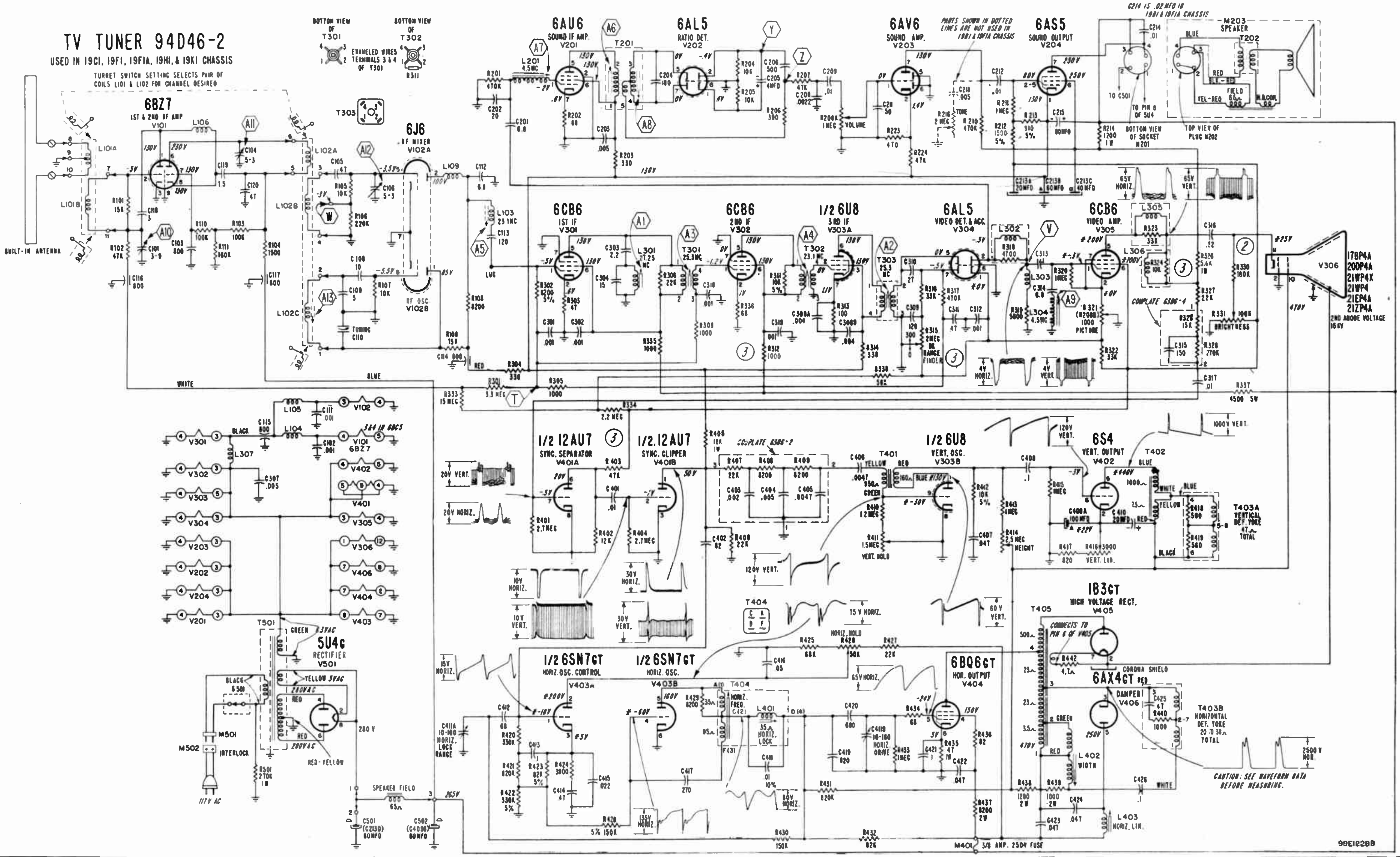
THIS CIRCUIT USED WITH 94D52-1 TUNER (19B1 CHASSIS)



Note: Tone control not used in 19B1 and 19F1A chassis.

Figure 32. Schematic for 19B1, 19C1, 19F1, 19F1A, 19H1 and 19K1 Television Chassis.

Note: This schematic applies only to chassis stamped Run 3. See figure 30 for chassis stamped Run 2 or lower and figure 34 for chassis stamped Run 4 and higher.



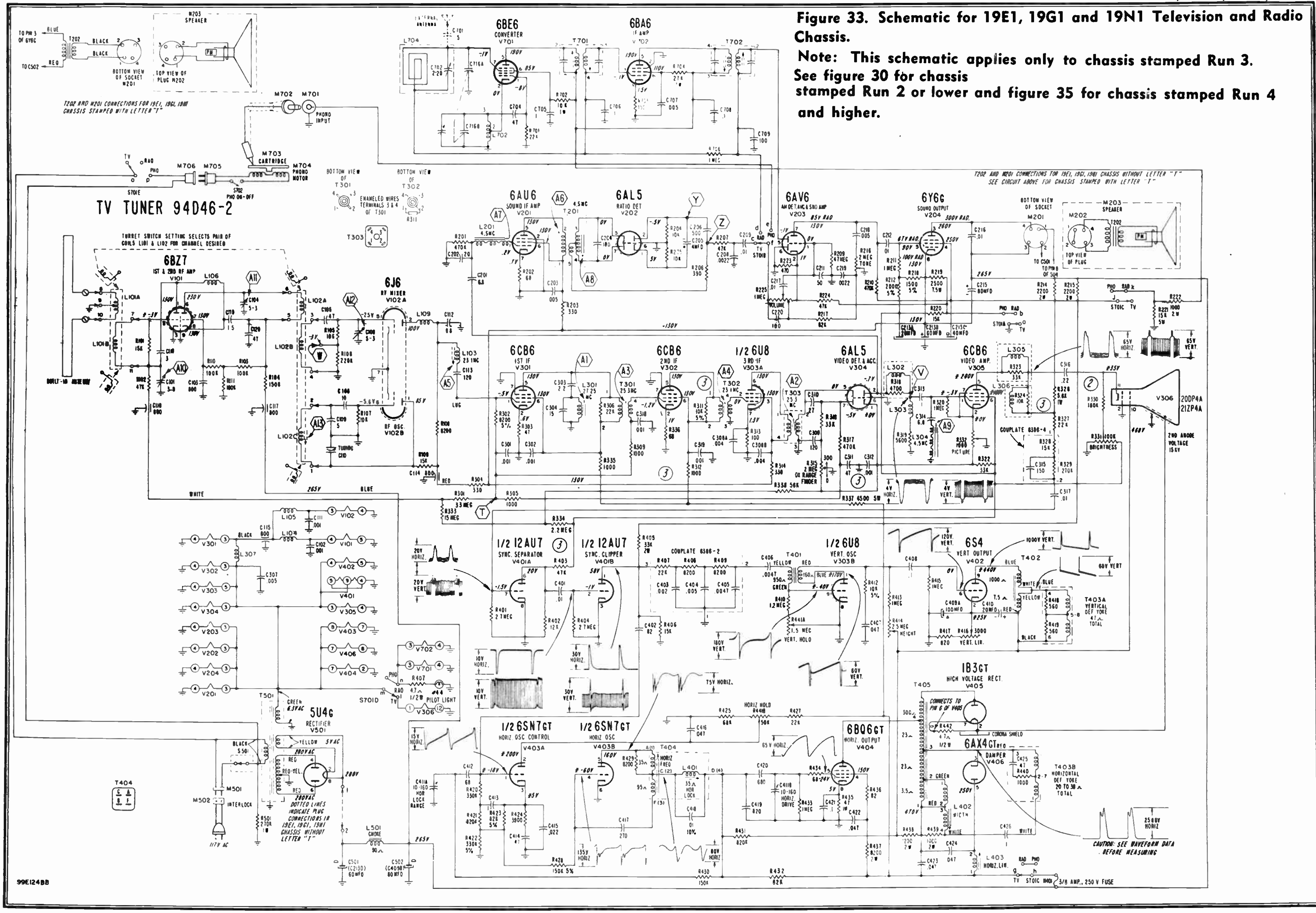


Figure 33. Schematic for 19E1, 19G1 and 19N1 Television and Radio Chassis.

Note: This schematic applies only to chassis stamped Run 3. See figure 30 for chassis stamped Run 2 or lower and figure 35 for chassis stamped Run 4 and higher.

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

Numerical symbols ①, ②, ③, etc. on schematic indicate a production change covered by a run number.

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions below.

WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with PICTURE control set fully to the right, all other controls set for normal picture (in sync). DX Range Finder control set fully to the left (at "0" position). Warning: Incorrect adjustment of the DX Range Finder control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

Waveform at pins 1 and 4 of V403 and terminal "C" (2) of T404 taken with a 10 mmfd. condenser connected in series with the oscilloscope high side.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

CAUTION

Pulsed high voltage is present on the caps of V404 and V405 and at pin 3 of V406. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage at pin 3 of V406 taken, using an oscilloscope with a capacitive voltage divider probe. Waveform at V406 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the lead connecting to pin 3. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

TV VOLTAGE DATA
(Voltages given on schematic)

- PICTURE control turned fully clockwise. CHANNEL control set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation DX Range Finder control set fully to the left (at "0" position).
- Antenna disconnected from set with Terminals shorted.
- Voltages marked with an asterisk * will vary widely with control setting.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (TV Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins.
  In tuners using a 6BZ7 tube, voltages taken at pins 1 and 8 must be taken as described above or no voltage reading will be obtained.
  Voltages at V306 measured from top of socket with tube removed.
- Voltages marked with an asterisk * will vary widely with control setting. In combination models, B+ voltages in TV chassis will be slightly higher when set is switched to radio position. Alternate voltage readings for radio and TV are shown for sound output tube V204 (6Y6G).

CAUTION

Pulsed high voltages are present on the cap of V404, pin 3 of V406 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 15 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

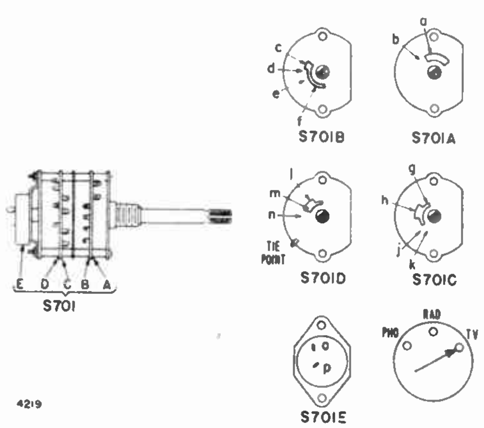
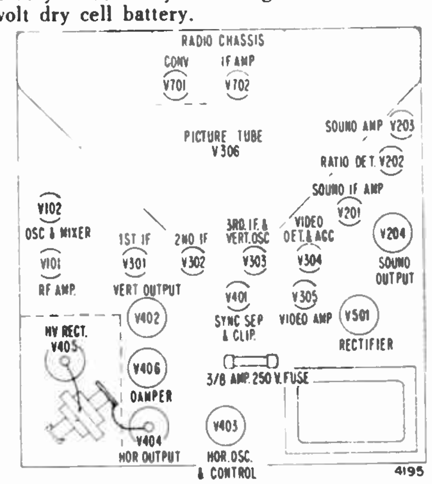


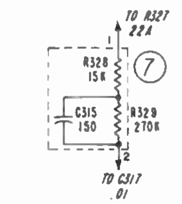
Illustration of TV-RAD-PHO switch S701



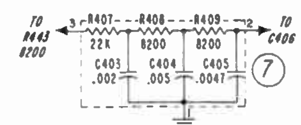
Top View of Chassis. (V701 and V702 are accessible from underside of chassis).

Ch. 19E1, 19G1, 19N1

SEE PRODUCTION CHANGES FOR DIFFERENT COUPLATES USED



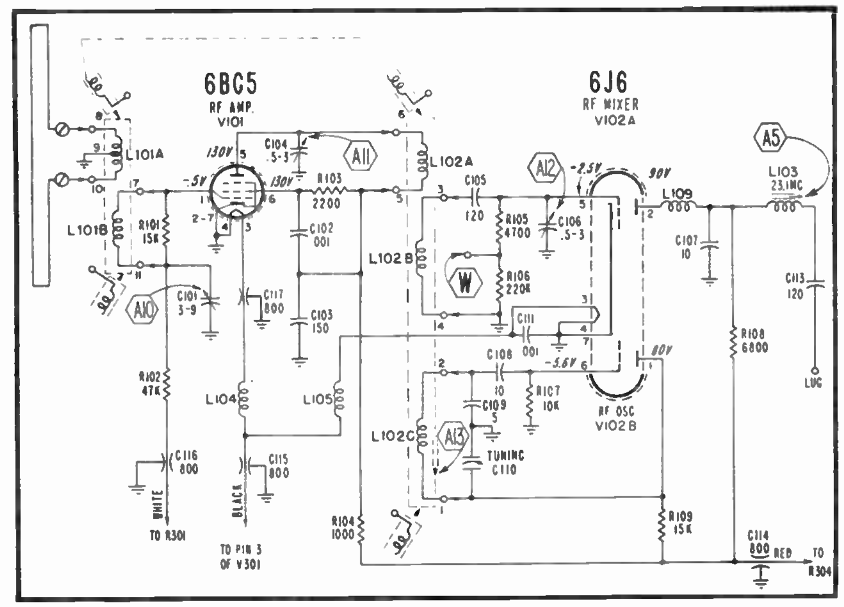
COUPLATE 6386-4



COUPLATE 6386-2

⑥ TV TUNER 94D52-1&-2 USED IN 19B1 CHASSIS ONLY

CIRCUITS SHOWN BELOW USED ONLY WITH 94D52-1&-2 TUNERS (19B1 CHASSIS)



THIS CIRCUIT USED WITH 94D52-1&-2 TUNERS (19B1 CHASSIS)

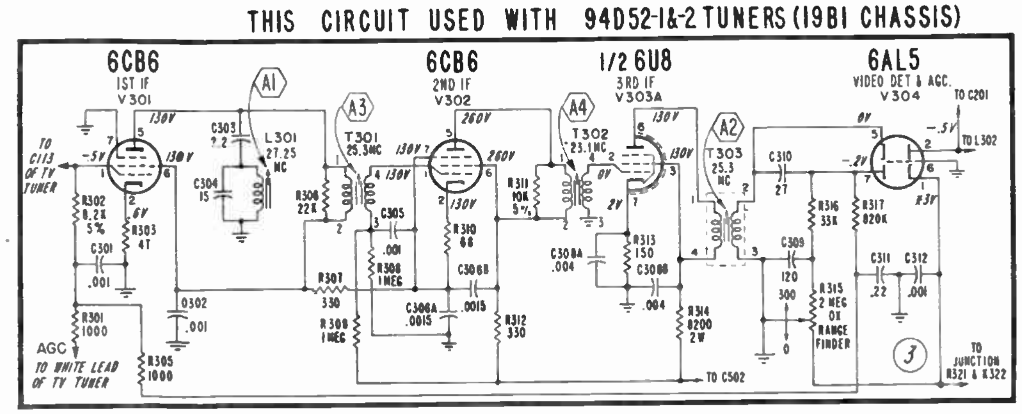
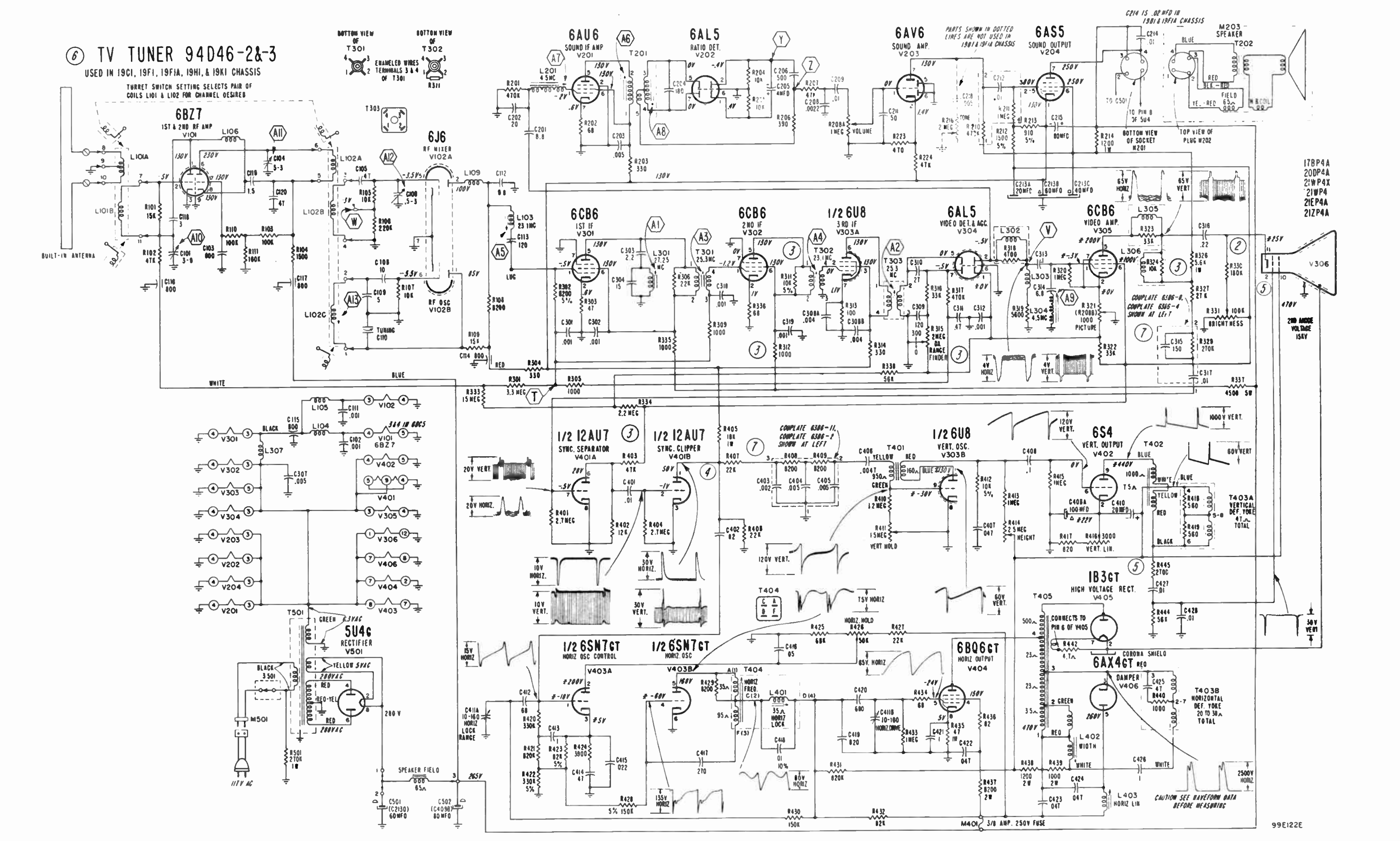


Figure 34. Schematic for 19B1, 19C1, 19F1, 19F1A, 19H1 and 19K1 Television Chassis.

Note: This schematic applies only to chassis stamped Run 4 and higher. See figure 32 for chassis stamped Run 3 and figure 30 for chassis stamped Run 2 or lower.

Note: Tone control not used in 19B1 and 19F1A chassis.



SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

Numerical symbols ①, ②, ③, etc. on schematic indicate a production change covered by a run number.

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IMPORTANT: Before making waveform and voltage measurements, see instructions below.

WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with PICTURE control set fully to the right, all other controls set for normal picture (in sync). DX Range Finder control set fully to the left (at "0" position). WARNING: Incorrect adjustment of the DX Range Finder control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

Waveform at pins 1 and 4 of V403 and terminal "C" (2) of T404 taken with a 10 mmfd. condenser connected in series with the oscilloscope high side.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

CAUTION

Pulsed high voltage is present on the caps of V404 and V405 and at pin 3 of V406. Do not make direct connection to these points with ordinary test equipment. Waveform and peak-to-peak voltage at pin 3 of V406 taken, using an oscilloscope with a capacitive voltage divider probe. Waveform at V406 can also be taken by clipping or twisting the lead from the oscilloscope high side over the insulation on the lead connecting to pin 3. When taking the waveform this way, the shape of waveform will be the same but the peak-to-peak voltage will be much lower, depending upon the degree of coupling.

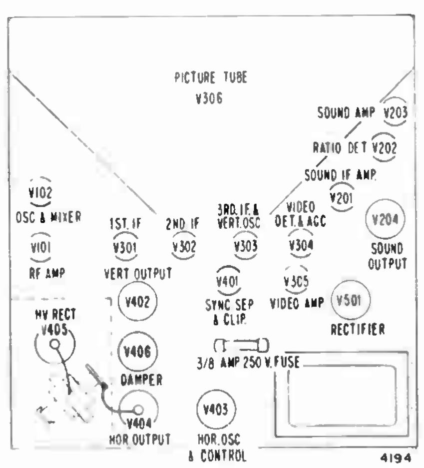
TV VOLTAGE DATA
(Voltages given on schematic)

- PICTURE control turned fully clockwise. CHANNEL control set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation. DX Range Finder control set fully to the left (at "0" position).
- Antenna disconnected from set with terminals shorted.
- Voltages marked with an asterisk * will vary widely with control setting.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 (TV Tuner) are measured with tube in socket. Use an adapter or lift tube out of socket just high enough to allow a needle point probe to contact tube pins.
  In tuners using a 6BZ7 tube, voltages taken at pins 1 and 8 must be taken as described above or no voltage reading will be obtained.
- Voltages at V306 measured from top of socket with tube removed.

CAUTION

Pulsed high voltages are present on the cap of V404, pin 3 of V406 and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 15 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.



19B1, 19C1, 19F1, 19F1A, 19H1, 19K1

Top View of Chassis.

SCHEMATIC NOTES

Run numbers are rubber stamped at the rear of the chassis.

Numerical symbols ①, ②, ③, etc. on schematic indicate a production change covered by a run number.

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(Voltages given on schematic)

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- Antenna disconnected from set with terminals shorted.
- Line voltage 117 volts AC.
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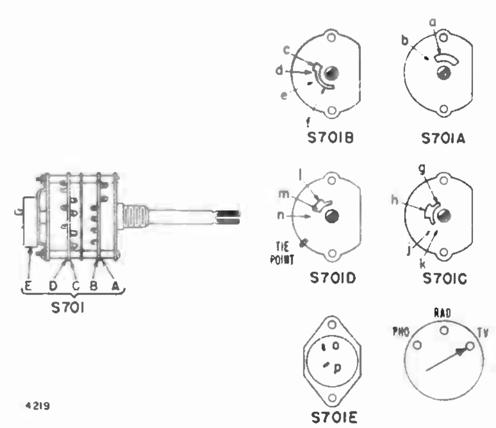
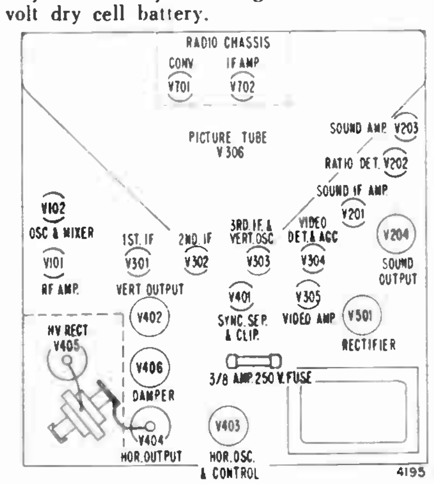


19E1, 19G1, 19N1

Illustration of TV-RAD-PHO switch S701



Top View of Chassis. V701 and V702 are accessible from underside of chassis).

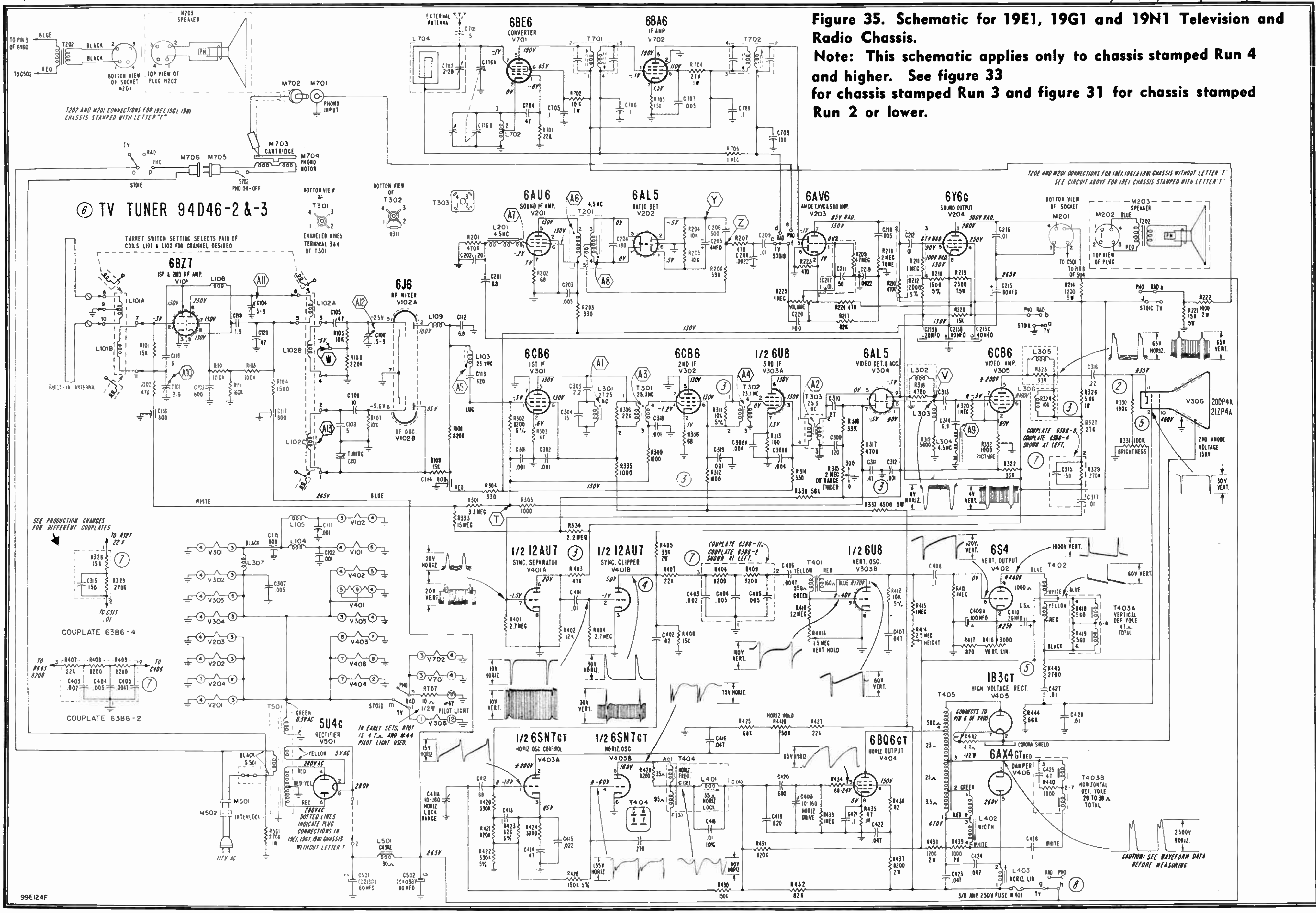


Figure 35. Schematic for 19E1, 19G1 and 19N1 Television and Radio Chassis.

Note: This schematic applies only to chassis stamped Run 4 and higher. See figure 33 for chassis stamped Run 3 and figure 31 for chassis stamped Run 2 or lower.

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MODEL NUMBERS Model numbers may have suffix letter "N"	TV Chassis	Picture Tube	TV Tuner	Record Changer	Radio	Tone Control
222DX15S, 222DX16, 222DX17	22C2	21EP4A	94D47-2	......	......	Yes
222DX26, 222DX27	22C2	21EP4A	94D47-2	......	......	Yes
222DX48, 222DX49	22C2	21EP4A	94D47-2	......	......	Yes
322DX16	22E2	21EP4A	94D47-2	RC600	Built-in AM	Yes

SPECIFICATIONS

Picture Tube

Direct View Electromagnetic. See Model Identification Chart for different picture tubes used.

Operating Voltage

110-120 volts. 60 cycles, AC.

Wattage

200 watts for all models.

Input Impedance and Transmission Line

300-ohm balanced (between antenna terminals).

Note that 72 ohm coaxial cable may be used by connecting the outer conductor to the chassis and the inner conductor to either antenna terminal. In weak signal areas, the use of coaxial cable should be avoided.

Antenna

All models equipped with a built-in TV antenna. TV-Radio models equipped with a built-in radio antenna.

Intermediate Frequencies

Video 25.75 MC. Sound 21.25 MC.

Intercarrier Sound 4.5 MC.

Radio 455 KC. (TV-Radio models).

Fuse Location

The horizontal output circuit is fused with a ¼ amp., 250 volt fuse, part number 84A4-2. The fuse is located at the rear of the high voltage compartment.

Record Changer

The model RC600 record changer is used in combination models. The changer model number is on the top rear of the changer pan and also on the changer model label on the underside of the changer.

TELEVISION CHASSIS NOTES

The 22C2 and the 22E2 chassis employ the same basic television circuitry. The 22C2 chassis is a 22 tube television only set. The 22E2 chassis is a 24 tube television and radio set used in combination models. Both the 22C2 and 22E2 chassis use a 21EP4A (cylindrical faced) picture tube which mounts directly on the chassis.

NEW FEATURES IN 22C2 AND 22E2 CHASSIS

New TV Tuner (part number 94D47-2): This tuner uses the same basic cascode RF amplifier and oscillator mixer circuit as used in earlier cascode TV tuners. The principal differences in the 94D47-2 tuner over earlier cascode TV tuners are confined mainly to the RF amplifier circuit and coupling between the RF mixer and the IF amplifier circuit. An overall HF oscillator adjustment is omitted from the tuner since it is not required.

Some of the principal features of this new improved TV tuner are high sensitivity, high signal to noise ratio and built-in adjacent channel sound and picture traps (19.75MC and 27.25MC). Design of the cascode RF amplifier circuit has been optimized for use of the 6BZ7 tube.

Improved IF Amplifier: Increased gain, greater bandwidth, higher and more uniform sound level and greater elimination of 4.5MC beat interference are some of the features of this new IF amplifier.

A 12AT7 tube is used as the video detector and 1st sound IF amplifier. Some early production sets used a 12AU7 as video detector and 1st sound IF amplifier.

DX Range Finder Control: A DX Range Finder control (AGC delay circuit) is used. This control is a potentiometer located at the rear of the chassis to enable precision adjustment of the receiver sensitivity to suit the signal conditions of any local or fringe area. Use of this control has greatly improved reception in high noise level and weak signal areas.

Tone Control: A Tone control is used in all 22C2 and 22E2 chassis.

Picture Tube Mounted on Chassis: The picture tube is mounted directly on the chassis for servicing convenience. Mounting the picture tube on the chassis has also eliminated possibility of trouble due to poor plug connection.

TUBE COMPLEMENT

V101	6BZ7	RF Amplifier
V102	6J6	Oscillator and Mixer
V201	6AU6	Sound IF
V202	6AL5	Ratio Detector
V203	6AV6	AM Detector, AVC / Sound Amplifier
V204	6V6GT	Sound Output
V301	6CB6	1st IF
V302	6CB6	2nd IF
V303	6AG5	3rd IF
V304	*12AU7 or 12AT7	Video Detector / 1st Sound IF
V305	6AC7	Video Amplifier
V306	21EP4A	Picture Tube
V307	6AU6	Gated AGC
V401A / V401B	6SN7GT	Vertical Oscillator / Sync Inverter
V402	6S4	Vertical Output
V403	12AU7	Sync Separator and Clipper
V404	6AL5	Sync Discriminator
V405	6SN7GT	Horizontal Oscillator
V406	6CD6G	Horizontal Output
V407	1B3GT	2nd Anode Rectifier
V408	6W4GT	Damper
V501	5U4G	Rectifier
V701	6BE6	Converter (AM Radio)
V702	6BA6	IF Amplifier (AM Radio)

* Tubes not directly interchangeable. See schematic.

INSTALLATION AND SERVICE ADJUSTMENTS

Instructions for making installation and service adjustments are given on the following pages.

When installing, adjust the DX Range Finder control, check picture for centering, tilt, shaded corners, proper size, linearity, etc., to insure best performance. It is especially important that the ion trap be checked, and that the channel slugs be adjusted upon installation or servicing of every set to insure ease of tuning. Procedure for making "Individual Channel Slug Adjustment Using A Television Signal" is given at right.

In sets using the 21EP4A (21" cylindrical faced) picture tube, check for excessive curvature (pin cushion effect) at the sides of the picture. Information on correcting curvature is given on page 30.

DX RANGE FINDER ADJUSTMENT

Incorrect adjustment of this control in a strong signal area may result in bending of the picture, excessive contrast and poor sync.

In normal signal strength areas, the DX Range Finder Control will generally be set at the "0" position. In intermediate areas, where the TV signal strength is lower and the noise level is higher, the DX Range Finder control will generally be set within the 10 to 150 position. In fringe areas or areas where long distance "DX" reception is possible, the DX Range Finder control will generally be set within the 150 to 300 position. In weak signal and high noise level areas, adjust the DX Range Finder for minimum noise (snow) and flashing in the picture.

Adjust the DX Range Finder as follows:

a. Rotate the DX Range Finder control fully to the left (to the "0" setting).

b. Tune in a picture, preferably on the strongest TV channel.

c. Set the Picture (contrast) control fully to the right (clockwise).

d. While observing a test pattern or picture, slowly rotate the DX Range Finder control to the right for best contrast with a minimum of snow and flashing in the picture.

Check for bending of vertical objects (overloading) in the picture. Also check to see that the picture locks in sync properly when switching off and on channel. If necessary, rotate the DX Range Finder control to the left or to the right until the operation is satisfactory.

In some fringe areas where long range reception is possible, TV signals may be subject to excessive fading. This may vary with season and time of day. If the signal in the area concerned is subject to excessive fading and the Range Finder is adjusted during the time the signal is weakest, overloading (picture bending) will take place when the signal is stronger. For this reason be sure that the customer is instructed on the adjustment of this control for periodic variations in signal strength.

INDIVIDUAL CHANNEL SLUG ADJUSTMENT USING A TELEVISION SIGNAL

Individual channel oscillator adjustment of every receiver should be checked upon installation or servicing. If this adjustment is properly made, it is possible to tune from one station to another by merely turning the CHANNEL control. With correct oscillator channel adjustment, best picture will be located at the approximate center of the range of the TUNING control. However, this may not necessarily be maximum sound output.

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.

b. Set the CHANNEL knob for a station in operation. Set all other controls for a normal picture.

c. Set TUNING control at center of its range by rotating it approximately half-way.

d. Remove the CHANNEL and TUNING knobs.

e. Insert a 1/8" blade, NON-METALLIC screwdriver (kit consisting of one metallic and one non-metallic screwdriver is available under part number 98A30-3) in the 1/4" hole adjacent to the channel tuning shaft. For each channel in operation, carefully adjust the channel slug for best picture with clear detail. Be sure that the Tuning control is set at the center of its range before adjusting each channel slug. Only slight rotation of the slug will be required; turning the slug in too far will cause it to fall into the coil. (If the slug falls into the coil, remove the coil, move the retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace slug and reset retaining spring.)

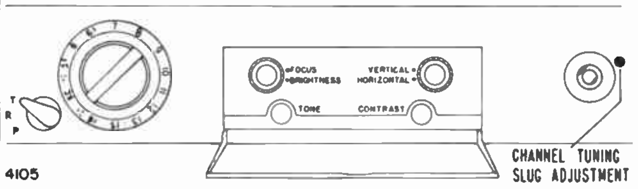


Figure 1. Control Panel in 22E2 Sets. Channel and Tuning Knobs Removed.

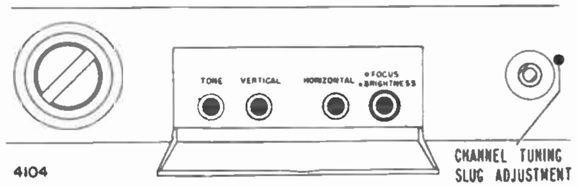


Figure 2. Control Panel in 22C2 Sets. Channel and Tuning Knobs Removed.

TOUCH-UP OF RATIO DETECTOR SECONDARY USING TELEVISION SIGNAL (A12, BOTTOM SLUG OF T201)

*This adjustment is accessible through the 1/4" hole (just below T201) in bottom of the cabinet or the chassis mounting shelf, located toward the left side facing the rear of the set. Removal of the chassis is therefore not required. ***Adjustment need be made on one channel only.*** Proceed as follows:

a. Turn set on and allow about 15 minutes for warm up.

b. Tune set for normal picture and sound.

c. Carefully insert a non-metallic alignment tool through the opening in cabinet bottom below T201. An alignment tool with a screwdriver blade or hexagonal end is required depending on the transformer used, see * note below. When the alignment tool engages the bottom tuning slug A12, adjust the slug for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about 1/4 to 1/2 turn.

d. If necessary, repeat individual channel slug adjustment and conclude with retouching the ratio detector secondary. Note: If oscillator adjustment is required for other channels, it will ***not*** be necessary to repeat the ratio detector secondary adjustment after ***once*** correctly adjusting it.

ALIGNMENT OF 4.5 MC TRAP A13, USING A TELEVISION SIGNAL

Beat interference (4.5 MC) appears in picture as very fine vertical or diagonal lines, very close together, having a "gauze-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

The trap can be tuned by watching the picture and adjusting the slug for minimum 4.5 MC interference. If greater accuracy is required, the trap should be adjusted as shown on page 32 under "4.5 MC Sound IF and Trap Alignment".

ADJUSTING CURVATURE CORRECTING MAGNETS FOR SETS USING A 21EP4 (21") PICTURE TUBE

If either side of the picture has excessive curvature (pin cushion effect) or if corners of the picture are bent inwardly, this can be minimized by adjustment of the correcting magnets located on the yoke bracket. Either side of the picture can be adjusted individually by using the magnet on that side of the picture tube. A picture or test pattern having straight vertical lines near the sides can be used for making adjustment; the pattern from a cross-hatch generator is preferable. IMPORTANT: A cross-hatch generator which is not capable of locking the picture in both horizontal and vertical sync is not suitable. Adjust as follows:

a. Set the receiver control for normal picture. Be sure that the picture is centered properly and vertical linearity adjustment is made.

b. Check the radial position of the magnet brackets. The magnet brackets are generally set so that the mounting screw is centered in the curved slot. It should only be necessary to change from this setting if the curvature at the side of the picture is not centered with respect to the side of the picture tube.

c. Move the correcting magnet against the deflection yoke bracket. While observing the vertical lines on the same side of the picture that the magnet is located, slowly move the magnet forward until curvature of vertical lines near the side is minimized. If the magnets are moved too far forward, the corners of the picture will bend inwardly or become shaded.

SERVICING RADIO TUBES AND DIAL LIGHT IN 22E2 SETS

The radio tubes can be serviced without removing the TV chassis from the cabinet. The radio tubes can be reached through the opening in the underside of the chassis shelf.

The dial light can be serviced by removing the tuning knobs and plastic control panel.

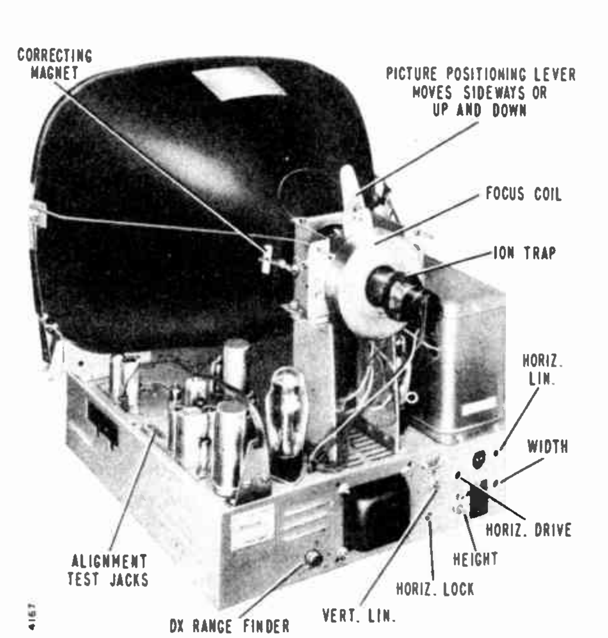


Figure 3. Chassis View Showing Adjustment Locations.

* If ratio detector transformer (T201) has hollow hexagonal core slugs, bottom slug adjustment A12 can be made from top of chassis, if you use alignment tool (part number 98A30-7; available at Admiral Distributor). Bottom slug A12 can be reached through the hole in the core of the upper slug (A11).

SERVICE HINTS

Also see Production Change

TROUBLE SHOOTING

The 22C2 and 22E2 chassis described in this manual are similar to other chassis in the 22 series with respect to the sync, sweep and power supply circuit. The basic differences in the 22C2 and 22E2 chassis over other 22 series are outlined under "New Features in 22C2 and 22E2 Chassis".

In general, the trouble shooting of the 22C2 and 22E2 chassis will be similar to that of other chassis in the 22 series which use a cascode TV tuner.

It is important, however, to remember the following trouble shooting hints which apply to the 22C2 and 22E2 chassis.

No picture or sound: Raster OK. Incorrect adjustment of the DX Range Finder control in a weak signal area may result in complete loss of picture and sound. In strong signal areas, incorrect adjustment may also result in picture bending, excessive contrast and poor sync. See instructions for adjustment.

No sound and no raster. In the 22C2 chassis, no sound and no raster or distorted sound and no raster can be due to a blown fuse M401. See paragraph on "Replacing Fuse M401".

Excessive curvature at the sides of the picture (pin cushion effect) or bending of corners. Excessive curvature at the sides of the picture (pin cushion effect) or bending of corners can be due to misadjustment of the curvature correcting magnets. See "Adjusting Curvature Correcting Magnets Used With 21EP4A (21") Picture Tube".

Picture bending, excessive contrast or poor sync. Incorrect adjustment of the DX Range Finder control in a strong signal area, may result in picture bending, excessive contrast and poor sync. Incorrect adjustment in a weak signal area may also result in complete loss of picture and sound. Instructions for adjustment is given.

MISCELLANEOUS TROUBLES DUE TO FAULTY TUBES

Faulty tubes cause the majority of receiver troubles. The list below contains most common troubles which are generally due to faulty tubes.

a. Poor fringe area reception due to low B plus voltage. Check the 5U4G tube.

b. Poor fringe area reception due to low sensitivity. Check the 6CB6, 6AG5 and 6BZ7 tubes.

c. Picture and sound separated due to IF oscillation. Check the 6CB6 and 6AG5 tubes.

d. Picture bending caused by leakage between tube elements. Check the 6CB6 tubes.

e. Poor sync stability, usually more noticeable in vertical circuit. Check 12AU7 tube.

f. Washed out picture due to negative grid current. Check 6AC7 tube.

EXCESSIVE SNOW IN PICTURE

Excessive snow in the picture can be caused by faulty tubes in the receiver. Check receiver as follows:

Short circuit the antenna terminals and turn the picture control (contrast) fully clockwise.

Connect a vacuum tube voltmeter from test point "V" to chassis. Set the channel selector on an unassigned channel. If the voltmeter reading exceeds .6 volt negative, excessive receiver (tube) noise is indicated. This condition can usually be corrected by tube substitution. Substitute tubes in the following order: Video detector tube V304, RF oscillator tube V102, RF amplifier tube V101 and IF amplifier tube V301, V302 and V303.

Corona or arcing in the second anode supply can also cause a high noise reading at the video detector resulting in excessive snow in weak signal areas.

DISTORTED SOUND

Distorted sound can be caused by misalignment of the ratio detector transformer T201. This misalignment is sometimes due to frequency drift of the ratio detector transformer. If realignment of the ratio detector transformer does not correct this trouble permanently, a permanent remedy for this trouble is to connect a 20 mmfd, —750 temperature coefficient, ceramic condenser (part number 65C6-26) in parallel with condenser C204 (180 mmfd, ceramic, connected across the secondary of the ratio detector transformer T201). Realign ratio detector after adding the 20 mmfd. condenser.

IMPORTANT NOTE ON 27.25 MC AND 19.75 MC TRAP ALIGNMENT

If difficulty is experienced in aligning the 27.25 MC and 19.75 MC traps (A7 and A8), using the method outlined in the alignment procedure on page 8, make trap alignment as follows:

1. Connect an oscilloscope between pin 8 (plate) of video amplifier V305 (6AC7) and chassis.
2. Make all connections and receiver control settings as instructed in steps 5 and 6 of the alignment procedure on page 32.
3. Operate the signal generator with AM (audio) modulation turned on. Full generator output may be required.

   Note: If a termination resistor is used in the generator output cable, increased generator output can be obtained by disconnecting the terminating resistor. Connect a condenser (.002 mfd. or larger) in series with the generator high side.
4. Adjust A7 (27.25 MC trap) and A8 (19.75 MC trap) for minimum amplitude of the waveform on the oscilloscope.

REPLACING FUSE M401

The horizontal output circuit of these receivers is protected by fuse M401 (.25 amp., 250 volts). This fuse is located in the rear of the high voltage compartment. To replace the fuse, remove the two screws at the base of the high voltage compartment and lift the cover away from the base; see figure 3. Carefully remove or insert the fuse so as to avoid damage to the horizontal output transformer.

REMOVABLE PICTURE WINDOW

All models using the 22C2 or 22E2 television chassis have picture windows which can be easily removed from the front of the cabinet for cleaning the inside of the window, picture tube and picture tube mask. A removable picture window molding is used in wood cabinet models. Instructions for removing and cleaning the picture window, picture tube and picture tube mask are given below.

REMOVING PICTURE WINDOW FOR CLEANING

If the picture window has a removable molding (at the top), remove the window by first removing the Phillips head screws and molding at the top of the picture window. Pull the top of the window away from the cabinet slightly and lift it up out of the channel at the bottom.

After cleaning the window, picture tube and picture tube mask as instructed below, install the window by placing the bottom edge in the channel and replace the molding. Use care when tightening screws on molding to prevent stripping.

CLEANING GLASS PICTURE WINDOW

Clean the picture mask using a soft cloth, dampened in mild soapy water. Clean the picture window and the face of the picture tube using a soft cloth, dampened with your favorite window cleaner. Wipe dry using a chamois or soft, lint free cloth. Only use cloths which are just dampened as presence of moisture or water inside the set may cause damage. Install the window as instructed above.

PICTURE TUBE REPLACEMENT

Picture tube replacement for the 22 series receivers is similar to that of other chassis using a rectangular glass picture tube. Instructions for adjusting curvature correcting magnets used with 21EP4A (21" cylindrical faced) picture tube is given on page 30.

PRODUCTION CHANGES

The production changes given below appear in later production sets.

At the start of production, chassis were not stamped with a run number, therefore some chassis will not have a run number stamp.

Production changes are coded RUN 1, RUN 2, etc., as given in the headings below. Run number (stamped on chassis) indicates that this chassis has the change(s) incorporated which are explained under that particular run number heading below, as well as all changes (lower run numbers) made prior to that time.

CHANGE FOR INCREASED SOUND LEVEL

Run 1 in 22C2 and 22E2 chassis

Early production sets used a 12AU7 tube for video detector and first sound IF amplifier V304. Later production sets stamped Run 1 or higher used a 12AT7 tube for V304. The schematic figure 16 shows a partial circuit of the first IF amplifier in sets using the 12AU7 tube. Important: The 12AU7 and 12AT7 tubes are not directly interchangeable. Replace with same type tube used in receiver.

MECHANICAL CHANGE IN RADIO TUNER USED IN 22E2 CHASSIS

Mechanical changes were made to the later production radio tuner sub-chassis used in 22E2 combination models. The dimensions of the radio chassis were altered slightly and the mounting position of the gang condenser was changed.

Early production radio tuners used gang condenser (part number 68B53) which mounts in a vertical position. Later production radio tuners use gang condenser (part number 68B53-1) which mounts in a horizontal position.

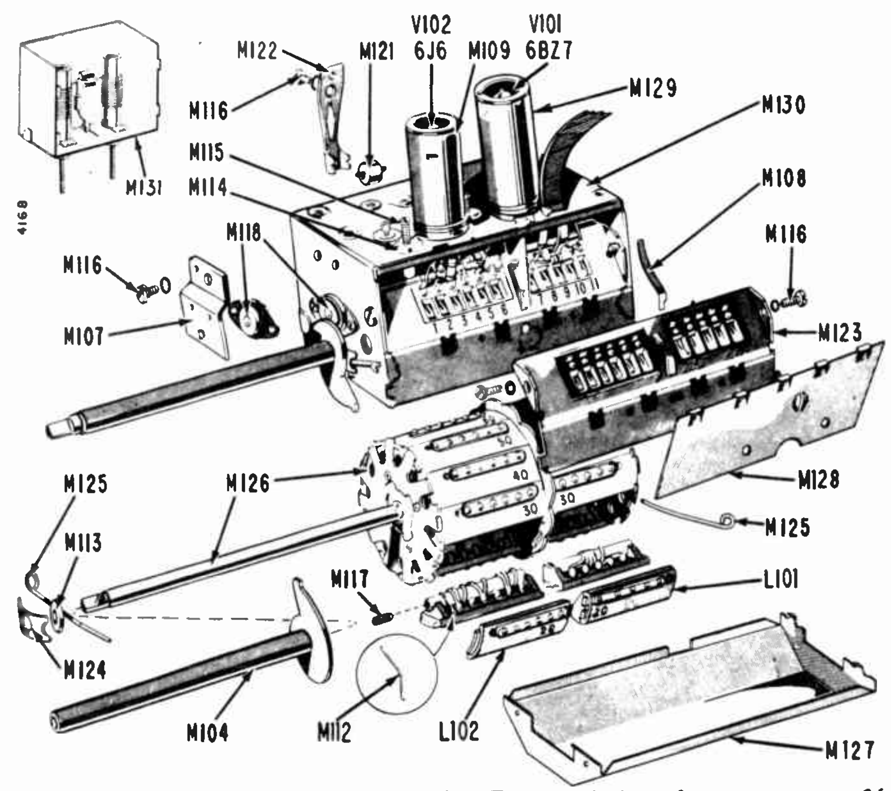


Figure 4. Exploded View, TV Tuner 94D47-2. (For description of parts, see page 36.)

TELEVISION ALIGNMENT PROCEDURE

GENERAL

Complete alignment consists of the following individual procedures and should be performed in this sequence.

a. IF Amplifier and Trap Alignment.
b. IF Response Curve Check.
c. 4.5 MC Sound IF and Trap Alignment.
d. RF and Mixer Alignment.
e. Over-all RF and IF Response Curve Check.
f. HF Oscillator Adjustment.

TEST EQUIPMENT

To properly service this receiver, it is recommended that the following test equipment be available.

IMPORTANT: Many service instruments do not meet the requirements given below. A list of recommended equipment is available from Admiral Distributor.

Oscilloscope

Standard oscilloscope, preferably one with a wide band vertical deflection, vertical sensitivity at least .5 volt (RMS) per inch.

Signal (Marker) Generator

4.5 MC frequency.
18 to 30 MC frequency range.
50 to 90 MC frequency range.
170 to 225 MC frequency range.

Must have a built-in calibration crystal for checking dial accuracy.

Sweep Generator

Sweep generator must provide sweep frequencies from

18 to 30 MC range:
50 to 90 MC range:
170 to 225 MC range:
} with at least 10 MC sweep width.

Output: adjustable; at least one-tenth volt maximum.

Output impedance: 300 ohms balanced to ground.

A sweep generator not having constant output voltage over the swept range and linear sweep, will produce curves which are widely different from the ideal curves shown in the following pages. If repeated difficulty is encountered in obtaining these curves, the sweep generator should be checked. A simple check is to observe the response curve for a set that is in alignment.

Before suspecting the generator, be sure the alignment instructions in this manual have been followed carefully.

Vacuum Tube Voltmeter

Preferably with low range (3 volt) DC zero center scale and a high voltage probe (30,000 volt range).

ALIGNMENT TOOLS

An alignment tool kit consisting of one metallic and one non-metallic screwdriver is available under part number 98A30-3. A non-metallic alignment tool with a screwdriver point at one end and hexagonal wrench (for hollow hexagonal core slugs) at the other is available under part number 98A30-7.

IF AMPLIFIER AND TRAP ALIGNMENT

- Connect bias battery; negative to test point "T", see figure 7, positive to chassis. A 3 volt battery is required for steps 1, 2, 3, 4 and 7. A 1½ volt bias battery is required for steps 5 and 6.
- Disconnect antenna. Connect a jumper wire across the antenna terminals.
- Set Channel selector to channel 12 or other unassigned high channel, to prevent interference during alignment.
- Set the Picture control fully to the left (counterclockwise).
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use lowest DC scale on VTVM.

Step	Signal Gen. Freq.	VTVM and Signal Generator Connections	Instructions	Adjust
1	25.3 MC	VTVM high side to test point "V", common to chassis. Generator high side to 6J6 (V102) tube shield; insulate shield from chassis. Connect low side to chassis near 6J6 tube base.	Use 3 volt bias battery. Use lowest DC scale on VTVM. When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less. Set channel switch to channel 12 or other unassigned high channel.	A1, A2 and A3 for maximum.
2	22.3 MC			A4 for maximum.
3	23.5 MC			A5 for maximum.
4	21.25 MC			A6 for minimum.
5	*27.25 MC	Connect Generator and VTVM same as in step 1.	Use 1½ volt bias battery. Set channel switch between channels to break channel coil contact: VTVM reading will change when coil contact is broken.	A7 for minimum.
6	*19.75 MC			A8 for minimum.
7	25.3 MC	Connect Generator and VTVM same as in step 1.	Use 3 volt bias battery. Set channel switch same as in step 1.	Readjust A1 and A2 for maximum.
8	To insure correct IF alignment, make the "IF Response Curve Check" given			

IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope)

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Set Channel selector on channel 12 or an unassigned high channel. Picture control fully to the left. Connect negative of 3 volt bias battery to test point "T"; positive to chassis.	Connect high side to 6J6 mixer-osc. tube shield. Insulate tube shield from chassis, low side to chassis ground. Set sweep frequency to 23MC, and sweep width approximately 7MC.	If an external marker generator is used, loosely couple high side to sweep generator lead on tube shield, low side to chassis. Marker frequencies indicated on IF Response Curve.	Connect to test point "V". See figures 7 and 8. Marker pips on scope will be more distinct if a condenser from 100 mmfd to 1000 mmfd is connected across the oscilloscope input.	Check curve obtained against ideal response curve in fig. 5. Note tolerances on curve. Keep marker and sweep outputs at very minimum to prevent overloading. A reduction in sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touch-up with IF slugs as instructed below.

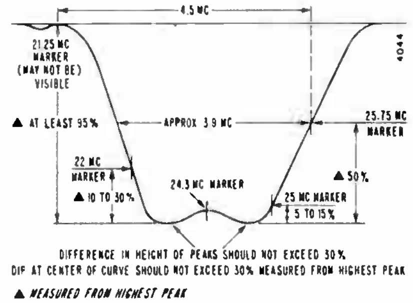


Figure 5. Ideal IF Response Curve.

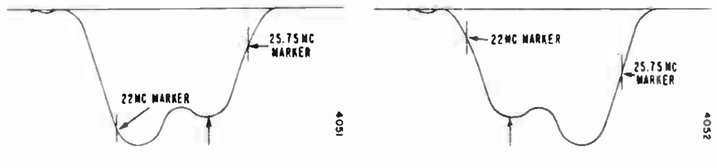


Figure 6. IF Response Curves, Incorrect Shape.

If it is necessary to adjust for approximate equal peaks, carefully adjust slug A5 (23.5 MC). It should not be necessary to turn slug A5 more than one turn in either direction.

If the curve cannot be made to resemble the response curve shown at left, repeat all steps under "IF Amplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carefully made. If a satisfactory curve cannot be obtained after repeating these steps, it may be necessary to change IF amplifier tubes or check for a defective circuit component to be sure that each stage is operating properly.

* Before proceeding, be sure to check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation. Also see "Important Note On 27.25 MC and 19.75 MC Trap Alignment" on page 31.

4.5 MC SOUND IF AND TRAP ALIGNMENT

See page 30 for touch-up of ratio detector using television signal without test equipment.

a. Connect signal generator high side to Pin 1 of V304 (12AU7 or 12AT7) through a .01 mfd. condenser, connect low side to chassis.
b. Allow about 15 minutes for receiver and test equipment to warm up.
c. Set Picture control fully to the left (counterclockwise).
d. Use a NON-METALLIC alignment tool. If Ratio Det. Transformer (T201) has hollow core slugs, bottom slug adjustment A11 can be made from top of chassis, if you use alignment tool #98A30-7 obtainable from Admiral Distributor.

Step	Signal Gen. Freq. (MC)	VTVM Connections	Instructions	Adjust
	When using a signal generator, be sure to check it against a crystal calibrator or other frequency standard for accurate frequency calibration at 4.5 MC. Accuracy required is within one kilocycle. IMPORTANT: If a signal generator and frequency standard are not available, alignment can be made using a TV station signal. Tune in a station and follow steps 1, 2 and 3 below. If necessary use a higher scale on the VTVM.			
1	Set to exactly 4.5 MC	High side to test point "Y"; common to chassis.	Use lowest DC scale on VTVM.	A9, A10 and A11 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt).
2		High side to test point "Z"; common to chassis.	Use zero center scale on VTVM, if available.	A12 for zero on VTVM (the correct zero point is located between a positive and a negative maximum). If A12 was far off, repeat step 1.
3		High side to test point "Y"; common to chassis.	Connect a 10 mmfd. condenser from pin 8 of V305 (6AC7) to pin 8 of V304 (12AU7 or 12AT7). Use lowest DC scale on VTVM.	A13 for minimum.

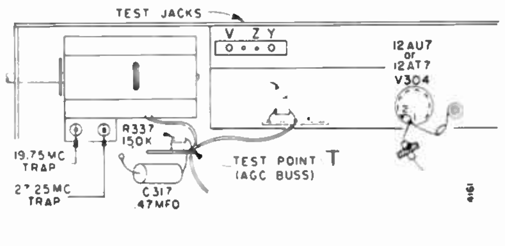


Figure 7. Bottom View Showing Test Point Connections.

ALIGNMENT HINT

After becoming familiar with alignment procedure, some servicemen simplify subsequent alignment of sets by merely using the essential alignment data given in figures 7 and 8.

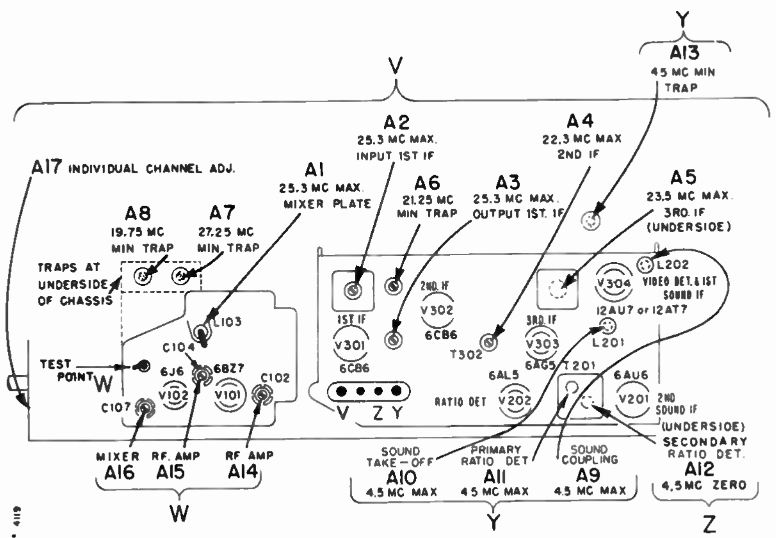
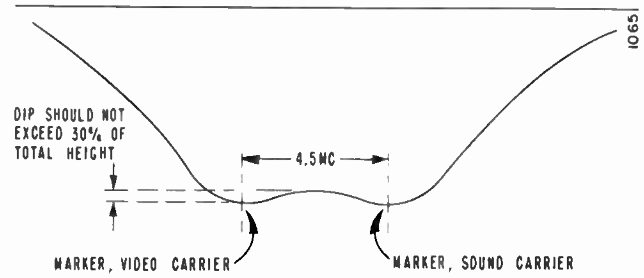


Figure 8. Top View of Chassis Showing Alignment Data.



Full skirt of curve will not be visible unless generator sweep width extends beyond 10 MC.

Figure 9. RF Response Curve.

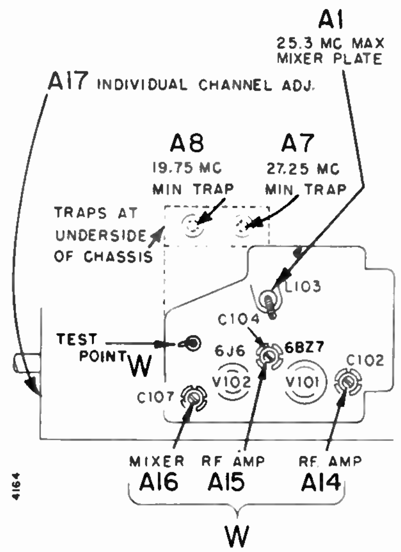


Figure 10. Top of TV Tuner, Showing Adjustment Location.

FREQUENCY TABLE

Channel Number	Channel Freq., MC	Video Carrier, MC	Sound Carrier, MC	HF Osc., MC
2	54- 60	55.25	59.75	81
3	60- 66	61.25	65.75	87
4	66- 72	67.25	71.75	93
5	76- 82	77.25	81.75	103
6	82- 88	83.25	87.75	109
7	174-180	175.25	179.75	201
8	180-186	181.25	185.75	207
9	186-192	187.25	191.75	213
10	192-198	193.25	197.75	219
11	198-204	199.25	203.75	225
12	204-210	205.25	209.75	231
13	210-216	211.25	215.75	237

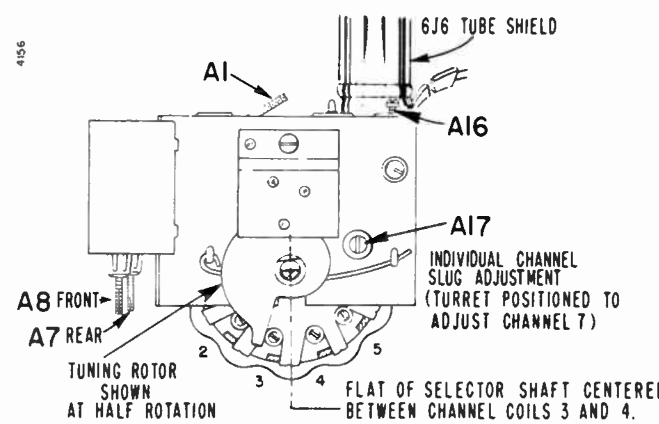


Figure 11. Front View of TV Tuner.

RF AND MIXER ALIGNMENT

a. Connect negative of 3 volt bias battery to AGC buss (test point "T"), positive to chassis. If it is difficult to obtain a curve of sufficient amplitude, remove battery and connect a wire jumper from test point "T" to chassis.

b. Connect sweep generator to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.

c. Connect oscilloscope through a 10,000 ohm resistor to test point "W" on tuner (figure 10). Keep scope leads away from chassis.

d. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	193.25 MC (Video Carrier) 197.75 MC (Sound Carrier)	Sweeping Channel 10. See frequency table below.	Check for RF response curve below. Alternately adjust A15 and A16 (figure 10) as required to obtain equal peak amplitudes and symmetry consistent with proper bandwidth and correct marker location.
2	83.25 MC (Video Carrier) 87.75 MC (Sound Carrier)	Sweeping Channel 6. See frequency table below.	Check for RF response curve below. Adjust A14 as required to obtain curve having maximum amplitude and flat top appearance consistent with proper bandwidth and correct marker location. After completing adjustment, recheck adjustment of step 1.
3	Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve shown below. In general, the adjustment performed in steps 1 and 2 are sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for a weak high channel as a compromise adjustment to favor the particular channel. Repeat step 2 for the weak low channel to favor the particular channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.

OVER-ALL RF AND IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope)

Receiver Controls and Bias Battery	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Picture control fully to the left. Channel selector on channel 12 or other unassigned high channel. Connect negative of 3 volt bias battery to test point "T", positive to chassis.	Connect to antenna terminals. Set generator to sweep channel selected. Keep generator output as low as possible, to prevent overloading. See frequency table on opposite page.	If an external marker generator is used, loosely couple high side to sweep generator lead. Marker frequencies are shown in frequency table on opposite page.	Connect to point "V". See figure 8.	Compare the response curve obtained against the ideal curve shown in figure 12. If the curve is not within tolerance, touch up the IF slug as instructed below. It should never be necessary to turn slugs more than one turn in either direction. If the curve is satisfactory on the channel checked, all other channels should also be satisfactory. IMPORTANT: When sweep output is reduced, response curve amplitude on scope should also decrease, but curve shape should remain the same. If curve shape changes, reduce sweep output and/or the scope gain until the shape does not change.

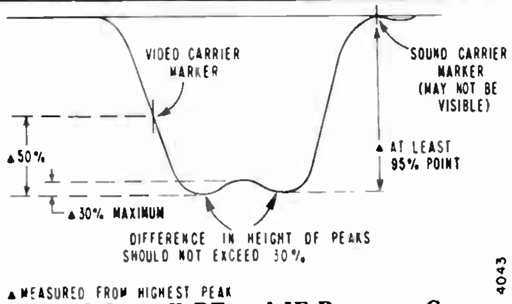


Figure 12. Ideal Over-all RF and IF Response Curve.

Note that video carrier (marker) on the "Over-all RF-IF Response Curve" will appear on the opposite side of the curve as compared to the "IF Response Curve" figure 5. This is due to action of the mixer tube.

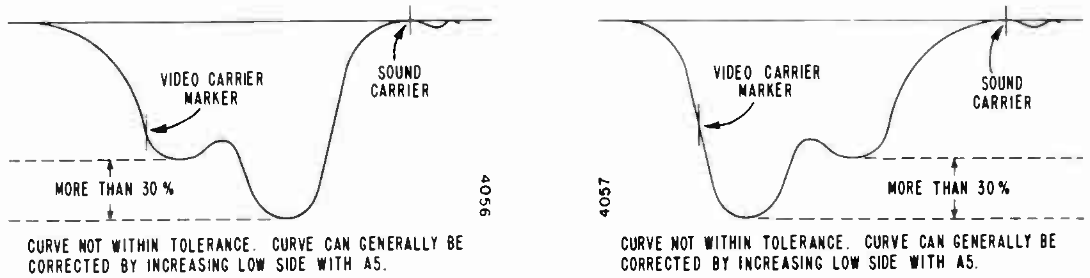


Figure 13. Over-all RF and IF Response Curves, Incorrect Shape.

HF OSCILLATOR ADJUSTMENT

(Using a signal generator)

It is always advisable to make HF oscillator adjustments using a Television Signal as instructed on page 30. If a Television Signal is not available, HF oscillator adjustment can be made using a crystal calibrated signal generator. Make adjustments as follows:

Receiver Control Settings	Signal Generator	Instructions
Set channel selector for each channel to be adjusted. Set "Tuning" control at half rotation. Turn volume control fully to the right (clockwise).	Connect to antenna terminals. Set generator to exact frequency of HF oscillator. See frequency table on opposite page. *Set generator for maximum output.*	Connect a wire jumper from test point "W" on the tuner to test jack "Z". See figure 8. Remove the ratio detector tube V202 (6AL5). Carefully adjust the individual oscillator slug A17 until a whistle (beat) is heard in the speaker of the receiver.

SERVICING RADIO TUNER IN 22E2 MODELS

SERVICING RADIO TUBES AND DIAL LIGHT

The radio tubes and radio dial light can be serviced without removing the TV chassis from the cabinet. The radio tubes can be reached through the opening cut in the underside of the chassis shelf.

The dial light (in models with wood cabinet only) can be serviced by removing the tuning knobs and control panel.

REMOVING RADIO TUNER

The radio tuner is mounted at the front apron of the chassis. Alignment, taking voltage readings or an inspection of the underside of the radio tuner can be performed without complete removal of the radio tuner from the TV chassis. To gain access to the underside of the radio tuner, disconnect the tuning drive cord, remove the two self-tapping screws at the chassis front and back and move the tuner as far as the connecting leads permit. The radio tuner can be completely removed from the TV chassis by unsoldering the leads to the main chassis (including the leads from the radio loop antenna).

DIAL STRINGING

Dial stringing for the radio tuning control is shown below.

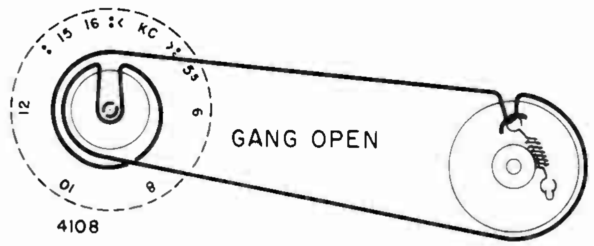


Figure 14. Dial Stringing for the 22E2 Chassis.

ALIGNMENT OF RADIO TUNER

The radio tuner in television and radio chassis should be aligned as instructed under "Radio Alignment Procedure" below.

The radio alignment trimmers are accessible without disassembly of the radio tuner from the TV chassis.

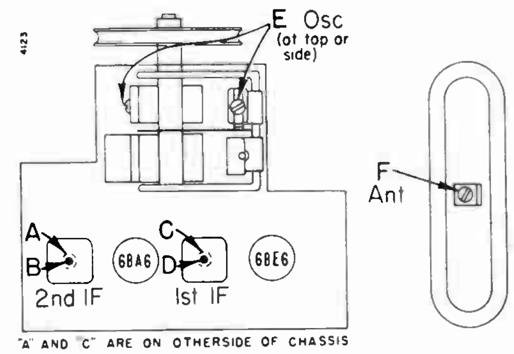


Figure 15. Trimmer Locations for AM Radio Tuner in 22E2 Chassis.

RADIO ALIGNMENT PROCEDURE

- Connect output meter across speaker voice coil.
- Turn receiver Volume control fully on; Tone control fully clockwise.
- Function switch in "Radio" position.
- Use lowest output setting of signal generator that gives a satisfactory reading on meter.
- Use a non-metallic alignment tool for IF adjustments.
- Repeat adjustments to insure good results.

Step	Connect Signal Generator	Dummy Antenna Between Radio and Signal Generator	Signal Generator Frequency	Receiver Dial Setting	Adj. Trimmers in Following Order to Max.
1	Gang condenser antenna stator	.1 MFD	455 KC	Tuning gang wide open	*A-B (2nd IF) *C-D (1st IF)
2	"	"	1620 KC	"	E (oscillator)
3	Place generator lead close to loop of set to obtain adequate signal. No actual connection (signal by radiation).		1400 KC	Tune in signal	§F (antenna)

* Adjustments A and C made from underside of chassis. See figure 15 for trimmer locations.
§ AM antenna trimmer may not peak if antenna leads are not properly routed or separated.

PARTS LIST

Electrical components have symbols in 100 series, 200 series, etc., according to location on schematic. Order parts by number and description from Admiral Distributor.

CHASSIS PARTS

RESISTORS

Sym.	Description	Part No.
R101	15,000 ohms, ½ watt	98A 45-67
R102	47,000 ohms, ½ watt	98A 45-17
R104	1,500 ohms, ½ watt	94D 47-58
R105	10,000 ohms, ½ watt	98A 45-18
R106	220,000 ohms, ½ watt	98A 45-21
R107	10,000 ohms, ½ watt	98A 45-18
R108	15,000 ohms, ½ watt	98A 45-67
R109	15,000 ohms, ½ watt	98A 45-67
R110	100,000 ohms, ½ watt	94C 37-87
R111	160,000 ohms, ½ watt	94D 47-59
R112	100,000 ohms, ½ watt	94C 37-87
R114	8,200 ohms, ½ watt	60B 8-822
R201	470,000 ohms, ½ watt	60B 8-474
R202	120 ohms, ½ watt	60B 8-121
R203	1,000 ohms, ½ watt	60B 8-102
R204	390 ohms, ½ watt	60B 8-391
R205	10,000 ohms, ½ watt	60B 8-103
R206	10,000 ohms, ½ watt	60B 8-103
R207	47,000 ohms, ½ watt	60B 8-473
R208A R208B	1 megohm, Volume 1,000 ohms, Picture (R208 includes switch SW501)	75B 11-22
R209	4.7 megohms, ½ watt	60B 8-475
•R210	150,000 ohms, ½ watt (in 22E1 chassis)	60B 8-154
	470,000 ohms, ½ watt (in 22C2 chassis)	60B 8-474
•R211	47,000 ohms, ½ watt	60B 8-473
•R212	1 megohm, ½ watt	60B 8-105
R213	330 ohms, 1 watt	60B 14-331
R219	1 megohm, ½ watt (when V304 is 12AT7)	Part of L203
	150 ohms, ½ watt (when V304 is 12AU7)	60B 8-151
R220	100,000 ohms, ½ watt	60B 8-104
R221	33,000 ohms, ½ watt (in sets using 12AT7 for V304)	60B 8-333
	47,000 ohms, ½ watt (in sets using 12AU7 for V304)	60B 8-473
R222	100,000 ohms, ½ watt	60B 8-104
R223	2 megohms, Tone control	75B 13-22
R224	1 megohm, Volume control (R224 includes switch SW501)	75C 2-16
R225	82,000 ohms, ½ watt	60B 8-823
R301	8,200 ohms, ½ watt, 5%	60B 7-822
R302	1,000 ohms, ½ watt	60B 8-102
R303	470 ohms, ½ watt	60B 8-471
R304	1,000 ohms, ½ watt	60B 8-102
R305	47 ohms, ½ watt, carbon resistor only	60B 28-45
R306	15,000 ohms, ½ watt	60B 8-153
R307	330 ohms, ½ watt	60B 8-331
R308	68 ohms, ½ watt, carbon resistor only	60B 28-44
R309	10,000 ohms, ½ watt, 5%	60B 7-103
R310	330 ohms, ½ watt	60B 8-331
R311	150 ohms, ½ watt	60B 8-151
R312	1,000 ohms, ½ watt	60B 8-102
R315	4,700 ohms, ½ watt, 5%	60B 7-472
R316	Picture control	See R208B
R319	3,000 ohms, 15 watt, candohm	61A 3-14
R320	18,000 ohms, ½ watt	Part of L303
R321	10,000 ohms, ½ watt	Part of L304
R322	4,700 ohms, 2 watt	60B 20-472
‡R323	15,000 ohms, ½ watt	60B 8-153
R324	470,000 ohms, ½ watt	60B 8-474
R325	560,000 ohms, ½ watt	60B 8-564
R326	100,000 ohms, ½ watt	60B 8-104
‡R329	270,000 ohms, ½ watt	60B 8-274
R331	220,000 ohms, ½ watt	60B 8-224
R332	6,800 ohms, ½ watt	60B 8-682
R333	150,000 ohms, ½ watt	60B 8-154
R334	100,000 ohms, ½ watt	60B 8-104
R335	270 ohms, ½ watt	60B 8-271
R337	150,000 ohms, ½ watt	60B 8-154
R338	7,500 ohms, 5 watt	61A 1-18
R339	15,000 ohms, 1 watt	60B 14-153
R341	4,700 ohms, ½ watt	Part of L301
R342	5 megohms, DX Range Finder	75B 1-54
R343A R343B	100,000 ohms, Brightness 750 ohms, Focus	75B 17-1
R344	1,000 ohms, Picture control	75B 13-21
R345	27,000 ohms, ½ watt	60B 8-273
R346	6,200 ohms, ½ watt, 5%	60B 7-622
§R401	22,000 ohms, ½ watt	60B 8-223
§R402	8,200 ohms, ½ watt	60B 8-822
§R403	8,200 ohms, ½ watt	60B 8-822
R404	1.2 megohms, ½ watt	60B 8-125
R405	1 megohm, Vertical Hold	75B 13-14
R406	1 megohm, ½ watt	60B 8-105
R407	10,000 ohms, ½ watt, 5%	60B 7-103
R408	2.5 megohms, Height	75B 13-3
R409	1 megohm, ½ watt	60B 8-105
R410	3,000 ohms, Vert. Lin.	75B 13-7
R411	820 ohms, ½ watt	60B 8-821
R412	560 ohms, ½ watt	60B 8-561
R413	560 ohms, ½ watt	60B 8-561
R414	2.2 megohms, ½ watt	60B 8-225
R415	820 ohms, 2 watt	60B 20-821
R416	2.2 megohms, ½ watt	60B 8-225
R417	18,000 ohms, 1 watt	60B 14-183
R418	33,000 ohms, 2 watt	60B 20-333
R419	2,200 ohms, ½ watt	60B 8-222
R420	27,000 ohms, 2 watt	60B 20-273
R421	8.2 megohms, ½ watt	60B 8-825
R423	1,000 ohms, ½ watt	60B 8-102
R424	2,200 ohms, ½ watt	60B 8-222
R426	100,000 ohms, ½ watt, 5%	60B 7-104
R427	100,000 ohms, ½ watt, 5%	60B 7-104
R428	470,000 ohms, ½ watt	60B 8-474
R429	4.7 megohms, ½ watt	60B 8-475
R430	12,000 ohms, 2 watt	60B 20-123
R431	5,600 ohms, ½ watt	60B 8-562
R432	1,500 ohms, ½ watt	60B 8-152
R433	120,000 ohms, ½ watt	60B 8-124
R434	25,000 ohms, Hor. Hold	75B 13-13
R435	8,200 ohms, 1 watt	60B 14-822
R436	150,000 ohms, ½ watt	60B 8-154
R437	1 megohm, ½ watt	60B 8-105
R438	8,200 ohms, ½ watt	60B 8-822
R439	68 ohms, ½ watt, carbon resistor only	60B 28-44
R440	47 ohms, 1 watt	60B 14-470
R441	82 ohms, ½ watt, carbon resistor only	60B 28-31
R442	3,300 ohms, 2 watt	60B 20-332
R443	2.7 ohms, ½ watt, carbon only	60B 28-47
R444	470,000 ohms, 1 watt, carbon only	60B 28-43
R445	1,000 ohms, ½ watt	60B 8-102
R448	150,000 ohms, ½ watt	60B 8-154
R450	680 ohms, 2 watt	60B 20-681
R451	3,300 ohms, 2 watt	60B 20-332
R452	Focus Control	See R343B
R453A R453B	1.5 megohms, Vert. Hold 25,000 ohms, Horiz. Hold	75B 17-2
R501	270,000 ohms, 1 watt	60B 14-274
R701	22,000 ohms, ½ watt	60B 8-223
R702	10,000 ohms, 2 watt	60B 20-103
R703	150 ohms, ½ watt	60B 8-151
R704	27,000 ohms, 1 watt	60B 14-273
R706	1 megohm, ½ watt	60B 8-105
R707	4.7 ohms, 1 watt, carbon only	60B 28-49
R715	5,300 ohms, 5 watt, candohm	61A 3-16

* Component may be part of couplate, part number 63B6-3 or 63B6-5. Part number 63B6-3 used in 22E2 chassis, part number 63B6-5 used in 22C2 chassis. Order exact duplicate or individual components.
‡ Component may be part of couplate, part number 63B6-4. Order exact duplicate or individual components.
§ Component may be part of couplate, part number 63B6-2. Order exact duplicate or individual components.

CONDENSERS

Sym.	Description	Part No.
C102	3 to 9 mmfd, Cer. Trim.	98A 45-96
C103	.001 mfd. min., ceramic	98A 45-24
C104	.5 to 3 mmfd, Cer. Trim.	98A 45-23
C105	47 mmfd, ceramic, —1400 temp. coeff.	94D 47-50
C106	47 mmfd, ceramic, —1400 temp. coeff.	94D 47-50
C107	.5 to 3 mmfd, Cer. Trim.	98A 45-23
C108	10 mmfd, 3%, Cer, —80 temp. coeff.	94D 47-51
C109	5 mmfd, 5%, Cer, —750 temp. coeff.	94D 47-52
C111	Tuning Rotor	98A 45-92
C112	6.8 mmfd, 3%, Cer, NPOK temp. coeff.	94D 47-53
C114	.001 mfd. min. ceramic	98A 45-24
C115	800 mmfd. min, cer, feed-thru	94C 37-90
C116	800 mmfd. min, cer, disc	94C 37-91
C117	800 mmfd. min, cer, feed-thru	94C 37-90
C118	800 mmfd. min, cer, feed-thru	94C 37-90
C119	800 mmfd. min, cer, feed-thru	94C 37-90
C120	3 mmfd, 3%, ceramic	94D 47-54
C121	51 mmfd, 3%, Cer, —80 temp. coeff.	94D 45-52
C122	24 mmfd, 3%, Cer, —80 temp. coeff.	94D 47-55
C123	6 mmfd, 3%, Cer, NPOK temp. coeff.	94D 47-57
C124	.001 mfd. min, ceramic	98A 45-24
C125	1.5 mmfd, ceramic	94D 46-84
C126	6.8 mmfd, 3%, Cer, NPO temp. coeff.	94D 47-53
C201	6.8 mmfd, —.00033 temp. coeff.	65C 6-71
C202	20 mmfd, 5%, ceramic (in sets using 12AU7 for V304)	65C 6-51
	39 mmfd, ceramic (in sets using 12AT7 for V304)	65C 6-88
C203	.005 mfd, min, ceramic	65C 10-1
C204	180 mmfd, 5%, —.00003 temp. coeff.	65C 6-59
C205	500 mmfd, ceramic	65C 6-6
C206	4 mfd, 50 volts, electrolytic	67A 4-9
C207	.002 mfd, 400 volts, paper	64B 9-17
C208	.047 mfd, 200 volts, paper	64B 9-9
C209	.005 mfd, min, ceramic	65C 10-1
C210	50 mmfd, ceramic	65C 6-4
•C212	.01 mfd, 400 volts, paper	64B 5-10
C213A C213B C213C	20 mfd, 25 V. 10 mfd, 450 V. electrolytic 10 mfd, 25 V.	67C 15-19
C214	.0047 mfd, 600 volts, paper	64B 9-15
C215	100 mmfd, ceramic	65C 6-3
C216	.0047 mfd, 400 volts, paper	64B 9-15
C217	.0022 mfd, 400 volts, paper	64B 9-17
C218	56 mmfd, cer, —.00075 temp. coeff. (in sets using 12AU7 for V304)	65C 6-34
	.001 mfd, min, ceramic (in sets using 12AT7 for V304)	65C 6-41
C219	39 mmfd, ceramic, NPO temp. coeff.	65C 6-88
C301	.001 mfd, min, ceramic	65C 6-41
C302A C302B	.0015 mfd. .0015 mfd. dual ceramic	65A 17-2
C303A C303B	.004 mfd. .004 mfd. dual ceramic	65A 17-1
C304	.005 mfd. min, ceramic	65C 10-1
C305	6.8 mmfd, ceramic, —.00033 temp. coeff.	65C 6-71
C307A C307B C307C	20 mfd, 350 V. 40 mfd, 350 V. electrolytic 60 mfd, 400 V.	67C 15-21
C308	.047 mfd, 400 volts, paper	64B 9-9
C309	.1 mfd, 400 volts, paper	64B 5-5
C310	.047 mfd, 400 volts, paper	64B 9-9
C311	.005 mfd, min, ceramic	65C 10-1
C312A C312B	.004 mfd. .004 mfd. dual ceramic	65A 17-1
C314	120 mmfd, 3%, mica	65B 1-10
‡C315	150 mmfd, mica	65B 21-151
C316	.001 mfd, 600 volts, paper	64B 9-19
C317	.47 mfd, 100 volts, paper	64B 9-53
C318	.005 mfd, min, ceramic	65C 10-1
C320	.005 mfd, min, ceramic	65C 10-1
C322	6.8 mmfd, —.00033 temp. coeff.	65C 6-71
C323	.47 mfd, 100 volts, paper	64A 10-1
C324	22 mmfd, 5%, cer, Zero temp. coeff.	65C 6-47
C325	120 mmfd, ceramic	65C 6-66
C326	6.8 mmfd. cer, —.00033 temp. coeff.	65C 6-71
C327	3.3 mmfd, cer. NPO temp. coeff.	65C 6-89
§C401	.002 mfd, 600 volts, paper	64B 5-14
§C402	.005 mfd, 600 volts, paper	64B 5-12
§C403	.0047 mfd, mica	65B 21-472
C404	.0047 mfd, mica	65B 21-472
C405	.1 mfd, 600 volts, paper	64B 5-5
C406	.047 mfd, 600 volts, paper	64A 2-14
C407A C407B C407C	100 mfd, 50 V. 20 mfd, 450 V. electrolytic 80 mfd, 350 V.	67C 15-18
C409	.02 mfd, 400 volts, paper	64B 9-11
C410	.01 mfd, 400 volts, paper	64B 9-13
C412	.001 mfd, mica	65B 21-102
C413	.001 mfd, mica	65B 21-102
C415	.005 mfd, 600 volts, paper	64B 9-15
C416	.047 mfd, 400 volts, paper	64B 9-9
C417	.01 mfd, 400 volts, paper	64B 9-13
C418	.0039 mfd, 5%, silver mica	65B 1-63
C419	330 mmfd, mica	65B 21-331
C420	330 mmfd, mica	65B 21-331
C421	680 mmfd, mica	65B 21-681
C422	Electrolytic	See C213B
C423	20 to 280 mmfd, trimmer, Hor. Drive	66A 30-1
C424	Electrolytic	See C213C
C425	.047 mfd, 600 volts, paper	64B 8-9
C426	.25 mfd, 600 volts, paper	64B 5-3
C427	.02 mfd, 400 volts, paper	64A 2-9
C428	.047 mfd, 200 volts, paper	64A 2-14
C429	500 mmfd, 20,000 volts, ceramic	65B 18-5
C430	47 mmfd, 5%, 1,500 volts, mica	65B 1-64
C431	.1 mfd, 400 volts, paper	64A 2-6
C432	Electrolytic	See C307C
C434	.0068 mfd, 600 volts, paper	64A 2-15
C701	5 mmfd, mica (C701 not supplied with set)	65B 1-62

* Component may be part of couplate, part number 63B6-3 or 63B6-5. Part number 63B6-3 used in 22E2 chassis, part number 63B6-5 used in 22C2 chassis. Order exact duplicate or individual components.
‡ Component may be part of couplate, part number 63B6-4. Order exact duplicate or individual components.
§ Component may be part of couplate, part number 63B6-2. Order exact duplicate or individual components.

Sym.	Description	Part No.
C702	2 to 20 mmfd. trimmer	66B 8-5
C704	47 mmfd. ceramic	65C 6-79
C705	.1 mfd. 400 volts, paper	64A 3-15
C706	.1 mfd, 400 volts, paper (C706 was .1 mfd, 200 volts in early sets)	64A 3-15
C707	.005 mfd, min, ceramic	65C 10-1
C708	.1 mfd, 400 volts, paper	64A 3-15
C709	100 mmfd, min, ceramic	65C 6-3
C716A / C716B	420 mmfd, max. / 105 mmfd, max. } gang (mounts horiz.)	68B 53-1
C716A / C716B	420 mmfd. max. / 105 mmfd, max. } gang (mounts vert.) (Note: Dial drum spot welded to gang.)	68B 53

COILS, TRANSFORMERS

Sym.	Description	Part No.
L101	Antenna Coil (Stamped 2Q, 3Q, etc.)	
	for Channel #2	94D 46-52
	for Channel #3	94D 46-53
	for Channel #4	94D 46-54
	for Channel #5	94D 46-55
	for Channel #6	94D 46-56
	for Channel #7	94D 46-57
	for Channel #8	94D 46-58
	for Channel #9	94D 46-59
	for Channel #10	94D 46-60
	for Channel #11	94D 46-61
	for Channel #12	94D 46-62
	for Channel #13	94D 46-63
L102	Mixer—Osc. Coil (Stamped 2Q, 3Q, etc.)	
	for Channel #2	94D 46-72
	for Channel #3	94D 46-73
	for Channel #4	94D 46-74
	for Channel #5	94D 46-75
	for Channel #6	94D 46-76
	for Channel #7	94D 46-77
	for Channel #8	94D 46-78
	for Channel #9	94D 46-79
	for Channel #10	94D 46-80
	for Channel #11	94D 46-81
	for Channel #12	94D 46-82
	for Channel #13	94D 46-83

For 94D 47-2 TV Tuner only

Sym.	Description	Part No.
L103	Mixer Plate Coil	98A 45-77
L104	Heater RF Choke	98A 45-13
L105	Heater RF Choke	98A 45-14
L106	Peaking Coil	94C 37-89
L107	Coil, 27.25 MC Trap } Part of trap assem.	94D 47-56
L108	Coil, 19.75 MC Trap } Part of trap assem.	94D 47-56
L109	Mixer Plate Choke	94D 46-86
L110	Coil, Bandpass Coupling — Part of trap assem.	94D 47-56
L201	Sound Take-off Coil	72B 99-4
L202	Sound Coupling Coil	72B 99-4
L203	Peaking Coil (wound on R219)	73A 5-2
L301	Video Peaking Coil (wound on R341)	73A 5-15
L302	Video Peaking Coil	73A 5-7
L303	Video Peaking Coil (wound on R320)	73A 5-14
L304	Video Peaking Coil (wound on R321)	73A 11-1
L305	Heater RF Choke	73A 2-5
L306	Heater RF Choke	73A 2-5
L308	Trap Coil (includes C322)	72B 99-3
L309	Coil, 1st IF Input	72B 106
L310	Coil, 21.25 MC Trap (includes C327, C324 and R345)	72C 96-24
L401	Horizontal Lock Coil (includes C418, R431)	94A 17
L402	Width Control Coil	94A 39-1
L403	Horizontal Linearity Coil	94A 28
L404	Focus Coil	69C 117-3
L406	Choke Coil	73B 8-2
L702	Oscillator Coil	69A 52-4
L704	AM Antenna	69C 155-2

Sym.	Description	Part No.
T201	Ratio Detector Transformer	72B 68-2
T202	Audio Output Transformer	
	for 22C2	79C 33-3
	for 22E2	79C 33-4
T301	1st IF Transformer	72C 96-14
T302	2nd IF Transformer (includes R309)	72C 96-16
T303	3rd IF Transformer (includes C305 and C325)	72B 105-1
T401	Blocking Oscil. Transformer	79A 18-4
T402	Vertical Output Transformer	79B 40-1
T403	Deflection Yoke (includes R412, R413, R445, C430)	94C 30-1
T404	Horizontal Output Transformer	79C 38-1
T501	Power Transformer	80C 26-1
T701	1st IF Transformer	72B 28-7
T702	2nd IF Transformer	72B 28-7

MISC. PARTS for 94D47-2 TV TUNER

See page 31 for parts illustration.

Sym.	Description	Part No.
M104	Shaft Shell & Rotor Assy. (Sharp Tuning) (with 4 1/16" long brass shaft shell)	98A 45-92
M107	Bracket, Sharp Tuning Rotor Retaining	98A 45-95
M108	Spring, Detent Plate Grounding	98A 45-94
M109	Shield, Tube (Slotted) for 6J6	98A 45-73
M112	Spring, Slug Retaining (Osc. coil)	98A 45-52
M113	Washer, Fibre Spacer (¼" IDx½" OD)	98A 45-63
M114	Nut, Locking Spring (for trimmers)	98A 45-31
M115	Screw, Trimmer (4-36x⅝")	98A 45-33
M116	Screw, Bracket Mtg. (6-32x¼")	98A 45-62
M117	Slug, Brass Tuning	98A 45-88
M118	Stator Plate (ungrounded); Silver with Ceramic Insulator, for Sharp Tuning C111 (includes mtg. bracket)	98A 45-86
M121	Roller, Detent (⅜" dia., 3/32" dia. bearing)	98A 45-82
M122	Spring, Detent (2 5/16" long)	98A 45-81
M123	Contact Plate and Bracket Assembly (uses Wiping Contacts)	98A 45-84
M124	Spring, Sharp Tuning Rotor Contact (flat bronze 1 7/16"x½")	98A 45-83
M125	Spring, Front and Rear Turret Shaft (wire 2¾" long, 3/64" dia.)	98A 45-85
M126	Turret, and Shaft Assembly (less coils) (5⅜" shaft and 3/16" rounded detent depression)	98A 45-91
M127	Shield, Bottom	94C 37-92
M128	Shield, Side	94C 37-93
	Socket, Tube (mica filled)	
	miniature, 7 pin	94C 37-95
	miniature, 9 pin	94C 37-96
M129	Shield, Tube (plain; for 6BZ7)	94C 37-94
M130	Tuner, Television (complete)	94D 47-2
M131	Adjacent Channel Trap Assembly (Trap assem. includes C121, C122, C124, L107, L108 and L110.)	94D 47-56

MISCELLANEOUS CHASSIS PARTS

For picture tube mtg. parts, see separate headings.

Sym.	Description	Part No.
M201	Speaker Socket	88A 5-6
M202	Speaker Plug	88A 5-5
M203	Speaker	See Cabinet Parts List
M401	Horiz. Output Fuse, ¼ amp, 250 volts	84A 4-2
M401	Fuse Holder	84A 5-1
M501	Interlock Socket (Male)	89A 22-2
M502	Line Cord, with interlock socket	89A 22-1
M701	Socket, Phono Input	88A 1
SW501	Switch, On-Off Power (S.P.S.T.)	Part of R208 or R224
SW703	Switch, Tel-Radio-Phono	77C 42

Description	Part No.
Bracket, Tuner Shaft (Bakelite)	32A 111-1
Clip, Tube Cap	
for 6CD6G tube	88A 16-6
for 1B3GT tube	19A 54
Connector Lead, 2nd Anode	88A 16-12
Cover, IF Strip	15B 640
Fuse, ¼ amp, 250 volts	84A 4-2
Fuse Holder	84A 5-1
Ion Trap	94A 15-2
Insulating Plate (for 2nd anode filter condenser mtg.)	32A 135-3
Knob, DX Range Finder	33A 23-4
Lock, 1B3GT Mounting Shell Disc	15A 589
Pilot Light (#44)	81A 1-5
Pilot Light Socket	82A 11-59
Plastic Tubing (for 2nd anode lead)	96B 18-2-16-0
Shield, Tube	
for 7 pin miniature tube	
plain type	87A 7-7
slotted type	98A 45-73
for 9 pin miniature tube	87A 7-10
Shield, HV Compartment	15D 815-2
Shield Cover, HV Compartment	15D 815-1
Socket, Shell (cover for 1B3GT tube socket)	88A 27-1
Socket, Test (4 terminal)	10A 28
Socket, Tube	
miniature bakelite (7 pin)	87A 24-5
octal, plain	87A 5-1
octal, ringmount (mica filled)	87A 20-2
miniature (9 pin)	87A 25-4
picture tube	87B 31-8
Tuner, Television (complete)	94D 47-2
Washer, Spring (for mounting picture positioning lever)	4A 5-10

MISC. RADIO PARTS for 22E2 CHASSIS

Sym.	Description	Part No.
M701	Socket, Phono Input	88A 1
M706	Socket, Phono Motor	88A 8-7
SW703	Switch, Function (complete)	77C 42
	Clip, IF Transformer Mounting	72B 28-10
	Dial Cord (30" length needed)	50A 1-3
	Drum, Gang	A3797
	Grommet, Gang Mounting	12B 1-2
	Lock Washer, Osc. Coil & Gang (#6 I.T.)	3B 1-25-24
	Pilot Light (#44 Mazda)	81A 1-5
	Pilot Light Shield	82A 5-3
	Screw, Drum Set (#6-32x¼ Allen Hd.)	1A 43-14
	Sleeve, Tuning (includes drum)	AA231
	Socket, Pilot Light	82A 18-1
	Socket, Tube, 7 pin miniature	87A 3-7
	Spacer Sleeve (for gang mounting)	29A 2-1-24
	Spring, Dial Cord Tension	19C 1-3
	Spring, Tube Retaining	19A 56-4
	Washer, Vellutex (oscillator coil mtg.)	5A 1-21

PARTS for MOUNTING 21EP4A (21") PICTURE TUBE on CHASSIS

Description	Part No.
Brace, Tie Rod Mtg.	15A 778
Bracket, Picture Tube Mounting (supports front of picture tube)	
right side (facing front)	A3788
left side (facing front)	A3789
Bracket, Strap (supports yoke coil)	15A 572
Bracket, Top and Bottom (for mounting picture tube and focus coil)	
top	15C 613-1
bottom (tube mtg. housing)	43B 183
Bracket	
tube front stop	
for right side facing front	15A 807-1
for left side facing front	15A 807-2
Connector Lead, 2nd Anode	88A 16-12
Insulator Strip, Fibre	
support for 2nd anode lead	32A 143
for deflection yoke	32A 75-1
Ion Trap	94A 15-2
Lever, Picture Positioning	15B 574
Magnet, Correcting (with mtg. bracket)	A3614
Nut, for threaded end of tie rod (#8-32)	2A 1-15-24
Nut, for clamping tube support band (¼-20x7/16)	2A 1-23-24
Plastic Tubing, eliminates corona between 2nd anode lead and HV housing	96B 18-2-16-0
Rubber Channel (used under metal strap), 26" length	12A 47-2
Rubber Collar (supports flare of picture tube)	12B 40
Rubber Insert	
1" dia. (for tube support bracket)	12A 16-4
1 3/16" wide (for tube support bracket)	12A 46-1
Rubber Strip, Adhesive (3/16"x1¼"x3")	12B 5-36
Rubber Strip, Adhesive (1/16"x½"x1¾")	12B 5-35
Screw	
for mounting upper to lower bracket (#10-24x½ H.H.M.S.)	1A 109-31-24
for supporting deflection yoke (8-32x¾ wing head)	1A 101-1-24
Spacer Sleeve (⅛" in length)	29A 2-3-24
Spring, Tube Grounding	19A 23-2
Strap, Bracket and Spade Bolt Assembly	A3617
Tie Rod (#8-32 thread, 20" long, supports sides of tube mtg.)	28B 52-4
Tie Rod (#8-32 thread, 10½" long)	28A 51-1
Washer, Spring	
for mtg. picture positioning lever	4A 5-10
for mtg. correcting magnet	4A 5-18
Washer, Steel (for mtg. correcting magnet)	4B 1-29-24

TUNING KNOBS and ASSOCIATED PARTS

Description	Part No.
Knob, Radio Tuning	
"Tuning"	33D 88-19
"Tel-Rad-Pho"	33B 90-4
Knob, Television Tuning	
black, "DX Range Finder"	33A 23-4
maroon, "Channel" (with gold inserts)	33C 53-23
maroon, "Off-Volume" (with gold inserts)	33C 53-24
maroon, "Off-Volume" (with gold inserts, 22E2 only)	33C 53-25
maroon, "Picture"	33D 88-20
maroon, "Tuning"	33D 88-21
maroon, "Vertical-Focus"	33A 92-3
Washer, Fibre used behind Volume and Picture knob	5A 1-36

CABINET PARTS for MODELS 222DX48 and 222DX49

Description	222DX48 (Maple)	222DX49 (Silver Fox)
Back, Cabinet	A3773	A3773
*Cabinet, Wood	*35E 236-1	*35E 236-2
Carton and Fillers	44B 273	44B 273
Control Panel Door	23B 130	23B 130
Control Panel Door Spring (mtd. on inside of cabinet)	18A 62	18A 62
Control Panel Plate	15B 866-1	15B 866-1
*Doors (matched set of 2 front doors)	*35E 236-50	*35E 236-51
§Door Catch and Strike Plate	See § footnote below.	
Door Handle	37A 85-1	37A 53-1
Grille Cloth	36C 3-144	36C 3-145
§Hinge, Cabinet (pair)	See § footnote below.	
Knobs, Tuning (See "Tuning Knobs and Associated Parts" on page 36.)		
Line Cord and Interlock Socket	89A 22-1	89A 22-1
Molding, Removable (for pic. window)	35E 236-55	35E 236-55
Rubber Strip, Adhesive (1/16"x¼"x2½")	12A 5-27	12A 5-27
Screw, Mtg. control Panel Plate (#4x¼" RHWS PH)	1A 7-8-59	1A 7-8-59
Screw, Mtg. Window Molding (#6x1" OHWS PH)	1A 15-28-59	1A 15-28-59
Speaker, 10" PM	78B 47-2	78B 47-2
Speed Nut (for mtg. speaker)	2B 10-8-59	2B 10-8-59
Swivel Caster	37A 77-1	37A 77-1
Window, Picture, Glass	21B 64-2	21B 64-2
Window Mask, Plastic	23E 132	23E 132

CABINET PARTS for MODEL 322DX16

Description	Part No.
Back, TV (complete)	A3810
*Cabinet, Wood	*35E 233-2
Carton and Fillers	44B 272
Control Panel (less door)	23D 129-4
Control Panel Door	23D 129-5
Control Panel Door Spring	19A 70
*Doors (matched set of front doors)	*35E 233-51
§Door Catch and Strike Plate	See § footnote below.
Door Handle	37A 82
Escutcheon, Plastic (changer front)	23D 123-1
Grille Cloth	36C 3-142
§Hinge, Butt, Door (three)	See § footnote below.
§Hinge, Cabinet (pair)	See § footnote below.
Jewel, Pilot Light	82A 10-8
Knobs, Tuning (See "Tuning Knobs and Associated Parts" on page 36.)	
Line Cord and Interlock Socket	89A 22-1
Molding, Removable (for pic. window)	35E 233-50
Phonograph Parts	See page
Rubber Strip, Adhesive (1/16"x¼"x2½")	12B 5-27
Screw, Mtg. Control Panel (#4x¾" RHWS PH)	1A 7-9-57
Screw, Mtg. Control Panel (#4x⅝" RHWS PH)	1A 7-11-57
Screw, Mtg. Window Molding (#6x1" OHWS PH)	1A 15-28-59
Slide, Phonograph Drawer	37B 32-8
Speaker 12" PM	78B 56-1
Speed Nut (for mtg. speaker)	2B 10-8-59
Swivel Caster	37A 77-1
Tubing, Plastic (1⅜" long, used over 19A70 door spring)	96B 19-3-20-0
Window, Picture, Glass	21B 64-2
Window Mask, Plastic	23E 132

CABINET PARTS FOR MODELS 222DX15S, 222DX16, 222DX17, 222DX26 and 222DX27

Description	222DX15S (Walnut)	222DX16 (Mahogany)	222DX17 (Blond)	222DX26 (Mahogany)	222DX27 (Blond)
Back, Cabinet (complete)	A3773	A3773	A3773	A3773	A3773
*Cabinet, Wood	*35E 225-1	*35E 225-2	*35E 225-3	*35E 226-2	*35E 226-3
Carton and Fillers	44B 260	44B 260	44B 260	44B 269	44B 269
Control Panel (less door)	23D 133-1	23D 133-1	23D 133-1	23D 133-1	23D 133-1
Control Panel Door	23D 133-5	23D 133-5	23D 133-5	23D 133-5	23D 133-5
Control Panel Door Spring	19A 70	19A 70	19A 70	19A 70	19A 70
*Doors (matched set of front doors)	....	....	....	*35E 226-50	*35E 226-51
§Door Catch and Strike Plate	....	....	....	See § footnote below.	
Door Handle	....	....	....	37A 72	37B 81
Grille, Metal	....	36C 39	36C 39	36B 41	....
Grille Cloth	36C 3-135	36C 3-135	36C 3-139	36C 3-137	36C 3-138
§Hinge, Cabinet (pair)	....	....	....	See § footnote below.	
Knobs, Tuning	See "Tuning Knobs and Associated Parts" on page 36.				
Line Cord and Interlock Socket	89A 22-1	89A 22-1	89A 22-1	89A 22-1	89A 22-1
Molding, Removable (for pic. window)	35E 225-50	35E 225-51	35E 225-52	35E 226-54	35E 226-55
Rubber Strip, Adhesive (1/16"x¼"x2½")	12B 5-27	12B 5-27	12B 5-27	12B 5-27	12B 5-27
Screw, Mtg. Control Panel (#4x¾" RHWS PH)	1A 7-9-57	1A 7-9-57	1A 7-9-57	1A 7-9-57	1A 7-9-57
Screw, Mtg. Control Panel (#4x⅝" RHWS PH)	1A 7-11-57	1A 7-11-57	1A 7-11-57	1A 7-11-57	1A 7-11-57
Screw, Mtg. Window Molding (#6x1" OHWS PH)	1A 15-28-59	1A 15-28-59	1A 15-28-59	1A 15-28-59	1A 15-28-59
Speaker, 10" PM	78B 47-2	78B 47-2	78B 47-2	78B 47-2	78B 47-2
Speed Nut (for mtg. speaker)	2B 10-8-59	2B 10-8-59	2B 10-8-59	2B 10-8-59	2B 10-8-59
Swivel Caster	37A 77-1	37A 77-1	37A 77-1	37A 77-1	37A 77-1
Tubing, Plastic (1⅜" long, used over 19A70 door spring)	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0	96B 19-3-20-0
Window, Picture, Glass	21B 64-2	21B 64-2	21B 64-2	21B 64-2	21B 64-2
Window Mask, Plastic	23E 132	23E 132	23E 132	23E 132	23E 132

* To insure proper matching and fit, also specify cabinet manufacturer's code letters (usually burned or stamped on back rail of cabinet). Wood parts are supplied only if old part cannot be repaired; when ordering, describe condition of old part in detail.

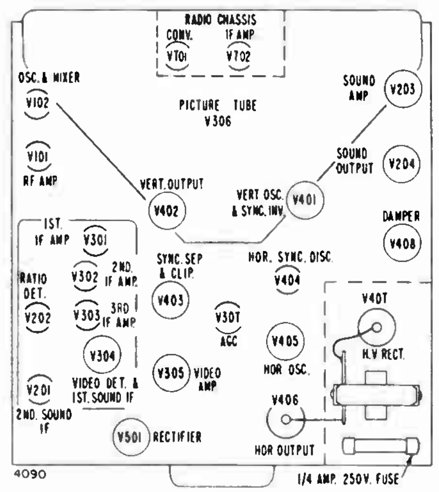
§ Order these parts using the part number given in Cabinet Hinge Ordering Data, Form No. S379. Otherwise, return old part, or send an outline tracing (exact size) of part and note finish (brass, bronze, etc.).

PHONOGRAPH PARTS

Model RC600 record changer is used. The changer model number is on the top rear of the changer pan and also on the changer model label on the underside of the changer.

Sym.	Description	Part No.
M702	Cable, Shielded (includes plug)	413A 11-1
M703	Cartridge, Phono Pickup (includes needle)	409A 13
M704	Motor (3 speed)	407C 20
M705	Plug, Motor (Male)	88A 8-1
	Adapter, 45 RPM Record (envelope of 12)	48A 8-2
	Base, Changer (wood, gold finish)	35E 209-3
	Belt, Rubber Drive	406A 20
	Cable, Audio Extension (66" long)	89A 27-4
	Centerpost Assembly	G400B 601
	Escutcheon, Plastic (changer front)	23D 123-1

Sym.	Description	Part No.
	Idler Wheel Assembly (includes tire)	G400A 279
	Manual, Record Changer Service	S454
	Needle, Phonograph for 409A13 cartridge	98A 15-19
	for 409A13-1 cartridge	98A 15-18
	Needle Retaining Nut (for 409A13 cartridge)	98A 54-2
	Plug Button	13A 2-8-57
	Pull, Drawer	37A 31
	Slide, Drawer	37A 32-8
	Spring, Changer Float	405A 139
	Touch-up Paint (Gold Hammertone)	98A 54-12



Top View of 22E2 Chassis. (V701 and V702 are accessible from underside of chassis).

WAVEFORM DATA
(Waveforms given on schematic)

Waveforms taken with PICTURE control set fully to the right, all other controls set for normal picture (in sync). Warning: Incorrect adjustment of the DX Range Finder control will cause waveform distortion.

Waveforms at video and sync stages obtained with transmitted signal input to receiver.

The oscilloscope sweep is adjusted for 30 cycles (which is one-half of the vertical frequency), or for 7875 cycles (which is one-half of the horizontal frequency) so that two pulses appear on the screen.

The peak-to-peak voltage readings shown are subject to some variations due to response of the oscilloscope and parts tolerances.

VOLTAGE DATA
(Voltages given on schematic)

- TV voltages taken with function switch on "TV" position. PICTURE control turned fully clockwise. CHANNEL control set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation. DX Range Finder control set fully to the left (at "O" position). TV antenna disconnected from set with terminals shorted.
- Radio voltages V701 and V702 taken with function switch on "Rad" position; voltages measured from underside of tube sockets. When measured from top of tube sockets (with tube removed), B plus voltage at pins 5 and 6 of V701 and V702 will be approximately 275 volts.
- B plus voltages at V203 and V204, will be slightly higher when set is switched to "Rad" position. Voltages marked with an asterisk * will vary widely with control setting.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.
  Voltages at V306 measured from top of socket with tube removed.

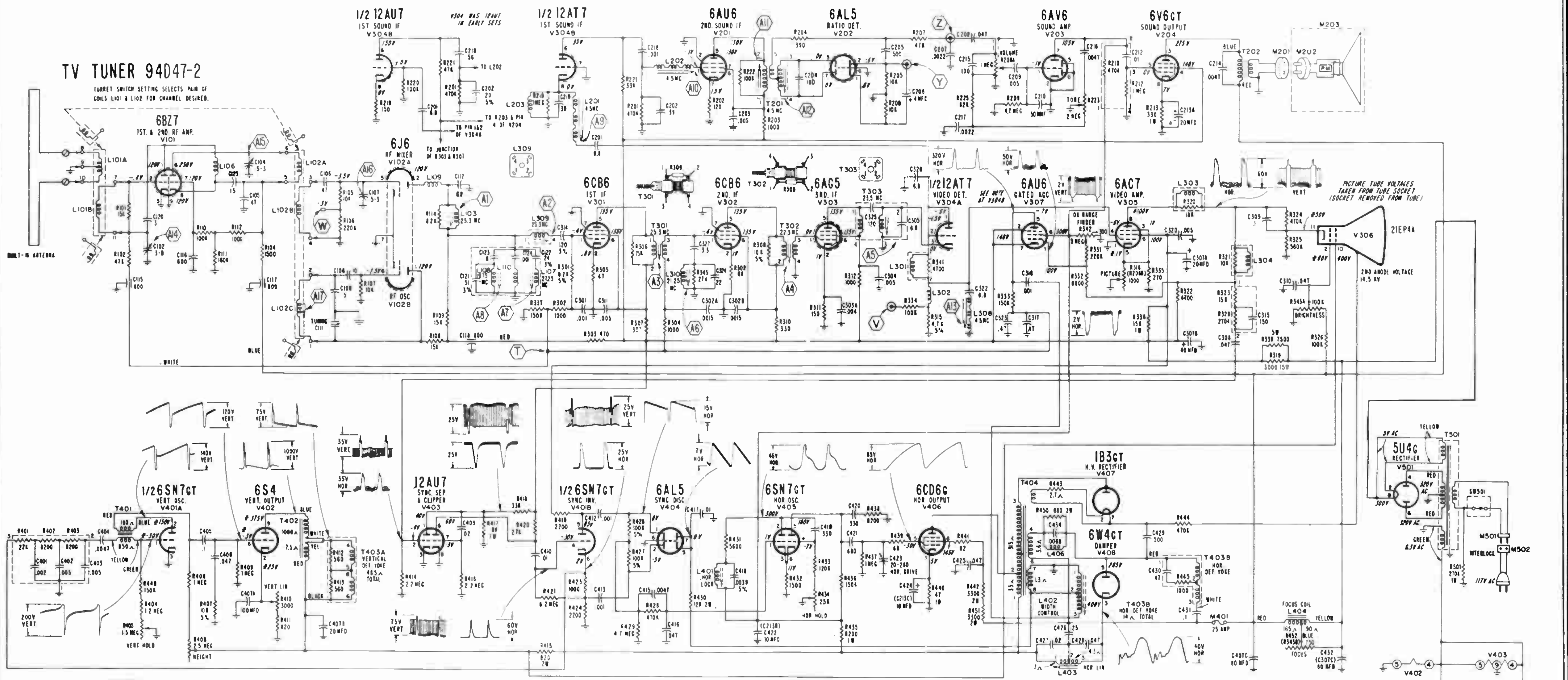
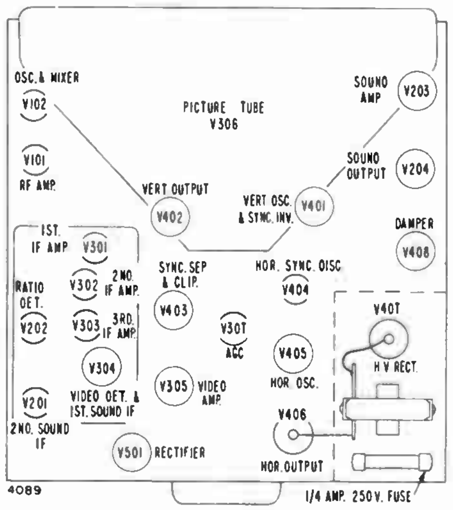


Figure 16. Schematic for 22C2 Television Chassis.



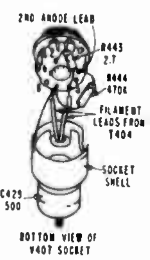
Top View of 22C2 Chassis.

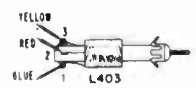
TV VOLTAGE DATA

(Voltages given on schematic)

- PICTURE control turned fully clockwise. CHANNEL control set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation. DX Range Finder control set fully to the left (at "O" position).
- Antenna disconnected from set with terminals shorted.
- Voltages marked with an asterisk * will vary widely with control setting.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum tube voltmeter between tube socket terminals and chassis, unless otherwise indicated.

Voltages at V306 measured from top of socket with tube removed.





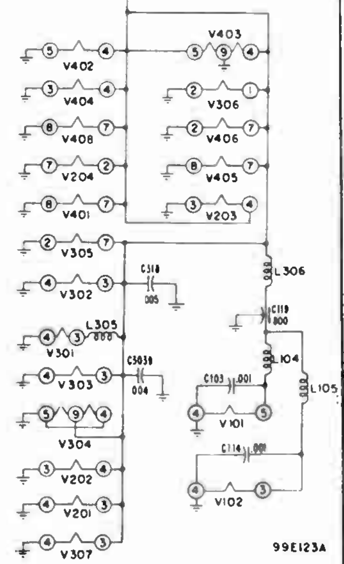
SCHEMATIC NOTES

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections.

CAUTION

Pulsed high voltages are present on the cap of V406, and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter. 2nd anode voltage is approximately 14.5 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.



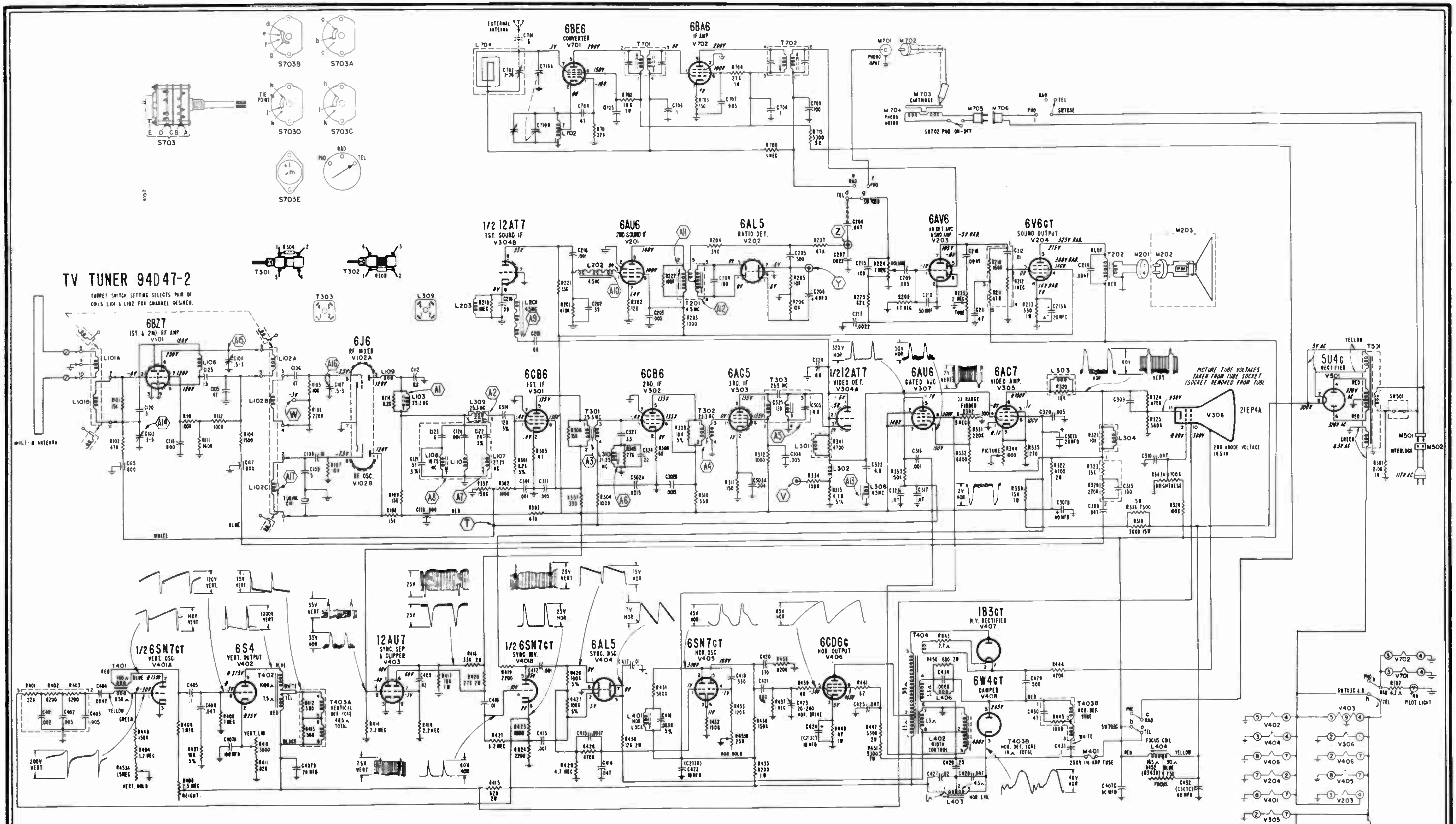
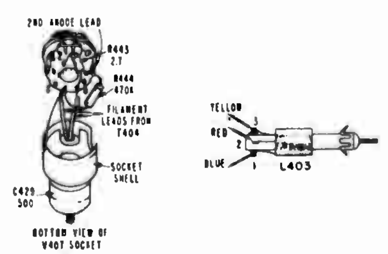
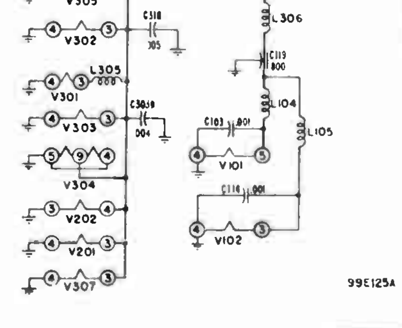


Figure 17. Schematic for 22E2 Television and Radio Chassis.





SCHEMATIC NOTES

(A1), (A2),......(Y), (Z), etc. indicate alignment points and alignment connections.

CAUTION

Pulsed high voltages are present on the cap of V406, and on the filament terminals and cap of the 1B3GT tube. NO ATTEMPT SHOULD BE MADE TO TAKE MEASUREMENTS FROM THESE POINTS WITHOUT SUITABLE TEST EQUIPMENT.

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter. 2nd anode voltage is approximately 14.5 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

99E125A

MODEL NUMBERS Model numbers may have suffix letter "N"	TV Chassis	Picture Tube	TV Tuner	Record Changer	Radio	Tone Control
228DX16, 228DX17	23A1	27EP4	94D47-2	......	......	Yes

SPECIFICATIONS FOR 23A1 CHASSIS

Picture Tube
Type 27EP4 (27") rectangular picture tube with aluminum coated screen. Magnetic deflection and focus.

Operating Voltage
110-120 volts, 60 cycles, AC.

Wattage
265 watts for all models.

Input Impedance and Transmission Line
300-ohm balanced (between antenna terminals).
Note that 72-ohm coaxial cable may be used by connecting the outer conductor to the chassis and the inner conductor to either antenna terminal. In weak signal areas, the use of coaxial cable should be avoided.

Antenna
All models equipped with a built-in TV antenna.

Intermediate Frequencies
Video 25.75 MC. Sound 21.25 MC.
Intercarrier Sound 4.5 MC.

Fuse Location
The horizontal output circuit is fused with a 3/8 amp., 250-volt fuse, part number 84A4-3. The fuse is located at the rear of the high voltage compartment.

TUBE COMPLEMENT FOR 23A1 CHASSIS

V101	6BZ7	RF Amplifier
V102	6J6	Oscillator and Mixer
V201	6AU6	2nd Sound IF
V202	6AL5	Ratio Detector
V203	6AV6	Sound Amplifier
V204	6V6GT	Sound Output
V301	6CB6	1st IF
V302	6CB6	2nd IF
V303	6AG5	3rd IF
V304A / V304B	12AT7	Video Detector / 1st Sound IF
V305	6CL6	Video Amplifier
V306	27EP4	Picture Tube
V307	6AU6	Gated AGC
V401A / V401B	6SN7GT	Vertical Oscillator / Sync Inverter
V402	6AV5GT	Vertical Output
V403	12AU7	Sync Separator and Clipper
V404	6AL5	Sync Discriminator
V405	6SN7GT	Horizontal Oscillator
V406	6CD6G	Horizontal Output
V407	1B3GT	2nd Anode Rectifier
V408	6V3	Damper
V501	5U4G	Low Voltage Rectifier
V502	5U4G	High Voltage Rectifier

23A1 CHASSIS NOTES

The 23A1 chassis is a 23 tube television receiver using a 27 inch (27EP4) rectangular picture tube. The picture tube is mounted separately from the chassis. Circuitry of the 23A1 chassis is similar to that of the 22 series chassis with the exception of the video amplifier, vertical output, horizontal output, damper and power supply circuits. See paragraphs below on "New Features In 23A1 Chassis."

NEW FEATURES IN 23A1 CHASSIS

New Video Amplifier: A 6CL6 tube (9-pin miniature pentode) is used as a video amplifier. This tube is capable of higher output, thereby providing greater peak-to-peak output voltage with high efficiency and low amplitude distortion.

New 27" Picture Tube: A 27EP4 (27" rectangular) picture tube is used. This picture tube features a high quality neutral density face plate which produces increased picture contrast and detail under high ambient light conditions. A reflective metal back (aluminized screen backing) increases the light output and contrast.

Vertical Retrace Blanking Circuit: A vertical retrace blanking circuit is used to eliminate vertical retrace lines. Vertical retrace blanking is achieved by applying the pulse voltage appearing at the secondary of the output transformer to the grid of the picture tube.

New Vertical Output Tube: A 6AV5GT beam power amplifier is used as the vertical output tube. This tube is capable of greater output currents at low plate and screen voltages. Use of the 6AV5GT tube and other circuit improvements made to the vertical output stage has resulted in increased vertical output and improved interlace.

Improved Horizontal Output Circuit: A new high efficiency auto-transformer with a ferrite core is coupled directly to a high efficiency 90 degree deflection yoke. A potentiometer type Horizontal Drive control is used for the drive adjustment. A new Width control (having two windings) permits more effective and increased range of width adjustment.

Circuit improvements made to the horizontal output stage have resulted in increased output, capable of producing full 90 degrees deflection and increased 2nd anode voltage (approximately 19,000 volts).

New Damper Tube: A 6V3 tube (9-pin miniature) is used as the damper tube. This tube features a higher heater to cathode breakdown voltage rating, higher peak inverse plate voltage rating and greater ability to handle high peak currents. Use of this new damper tube minimizes possibility of tube failure in the damper circuit.

Improved Deflection Yoke: A newly designed deflection yoke, provides the 90 degree deflection angle required for the 27 inch picture tube.

Use of this new deflection yoke eliminates the need for pin cushion correction magnets as used with some 21 inch picture tubes.

Improved Focusing Circuit: The focus coil in this receiver is of the shunt type, being connected across the filtered output of the low voltage power supply. This new circuit provides better range of focus, minimizing defocusing effects due to loading of other circuits and variation in power line voltage.

Improved Power Supply: Two 5U4G rectifier tubes are used. One 5U4G (V502) tube is used as the high voltage B+ rectifier, the other 5U4G (V501) tube is used as the low voltage B+ rectifier. Use of two rectifier tubes and other changes in the B+ circuits have provided more efficient B+ distribution with better voltage regulation.

Twin 10" Speakers: Two high qaulity 10" PM speakers are used to provide increased audio frequency response (higher fidelity). The response of the speakers is staggered to produce widest possible range of audio response.

INSTALLATION and SERVICE ADJUSTMENTS

NOTE: Except for DX Range Finder adjustments, all adjustments described on this page and those which follow are for the 23A1 chassis only. For general service information, alignment, etc., see 22C2 and 22E2 chassis.

When installing, each set should be checked for DX Range Finder adjustment (generally set on zero), picture centering, picture tilt, shaded corners, proper size, linearity, etc., to insure best performance. It is especially important that Ion Trap adjustment be checked, and that the Channel Slugs be adjusted upon installation or servicing of every set to insure ease of tuning. Make all checks and adjustments as instructed on the following pages.

For best results, all checks or adjustments should be made using a transmitted television test pattern. A mirror placed in front of the picture tube screen will be of help in observing the picture while making adjustments at the rear of the chassis. Removing the TV back disconnects the interlocking line cord; use a separate line cord (part number 89A22-1) when servicing. See "High Voltage Warning"

INDIVIDUAL CHANNEL SLUG ADJUSTMENT USING A TELEVISION SIGNAL

Individual channel slug adjustment of every receiver should be checked upon installation or servicing. If this adjustment is properly made, it is possible to tune from one station to another by merely turning the CHANNEL control. With correct channel slug adjustment, best picture and satisfactory sound will be located at the approximate center (half rotation) of the range of the Tuning control.

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.
b. Set the CHANNEL knob for a station; set other controls for normal picture and sound.
c. Remove the CHANNEL knob.
d. Set TUNING control at center of its range by rotating it approximately half-way. At this setting, the hole in the TUNING knob will coincide with the hole in the control panel.
e. Insert a 1/8" blade, NON-METALLIC tool in the hole through the TUNING knob (see illustration). For each channel in operation, carefully adjust the channel slug for best picture with clear detail. (Note that this may not be the point at which the sound is loudest.) Be sure that the Tuning control is set at the center of its range before adjusting each channel slug. Generally, only slight rotation of the slug will be required; turning the slug in too far will cause it to fall into the coil. (If the slug falls into the coil, remove the chassis from the cabinet and remove the coil. Move the retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace slug and reset retaining spring.)

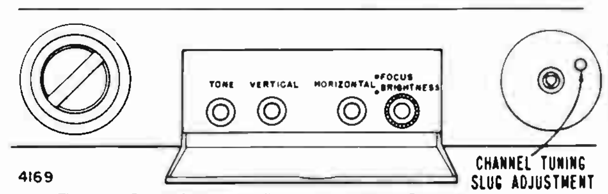


Figure 18. Control Panel for 23A1 Chassis. CHANNEL Knob Removed.

ION TRAP ADJUSTMENT

To prolong the life of the picture tube, it is important that this adjustment be made upon installation, after adjusting the picture positioning lever, or after repositioning the focus coil.

Set the BRIGHTNESS control (at front of set) for normal brightness.

Position the ion trap on the picture tube close to the base. Starting from this point, very carefully move the

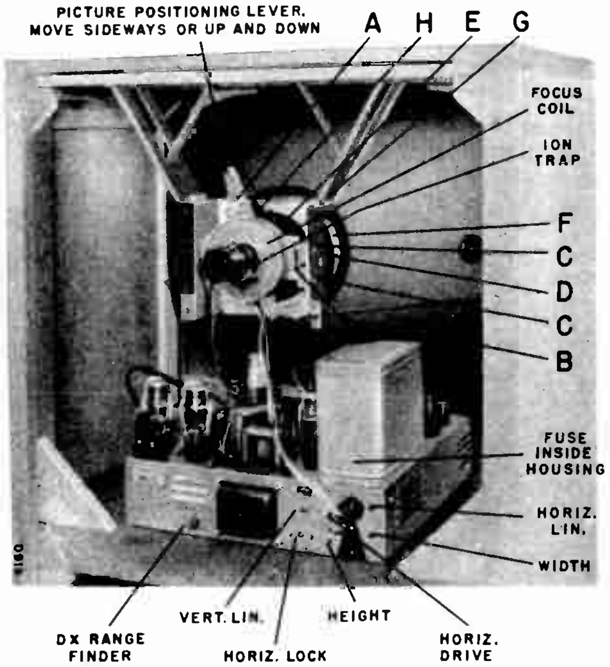


Figure 19. Rear View of 23A1 Chassis Showing Adjustment Locations.

ion trap forward or backward and at the same time, rotate it slightly in either direction until maximum brightness is produced.

Reset the BRIGHTNESS control for normal brightness. Adjust the FOCUS control (at front of set) for good focus. Readjust the ion trap for maximum brightness.

Note that there may be two locations where the brightest picture can be produced. The second ion trap location, which is further away from the tube base, should not be used or tube damage will result.

Important: If the corners of the picture are shaded, be sure the ion trap has been properly adjusted. Do not sacrifice picture brightness when adjusting the ion trap to remove shaded corners. To eliminate shaded corners, see the discussion under "Check Picture Centering". Be sure to readjust the ion trap each time after adjusting picture positioning lever or repositioning the focus coil. Tighten the ion trap mounting screw after adjustment.

LATEST DX RANGE FINDER ADJUSTMENT INFORMATION FOR 22C2, 22E2 AND 23A1 CHASSIS

(Supersedes adjustment information given on page 21.)

This control is at the rear of the set, near the left side.

This control is used to improve TV reception in fringe areas and in areas where there is interference.

The DX RANGE FINDER should be at the "0" position, if satisfactory pictures can be obtained by using the operating controls on the front of the set.

Where the TV signal strength is weak, the picture can often be improved by turning the DX RANGE FINDER part way to the right or, if necessary, all the way to "300".

White flashes across the picture can sometimes be minimized by careful adjustment of the DX RANGE FINDER.

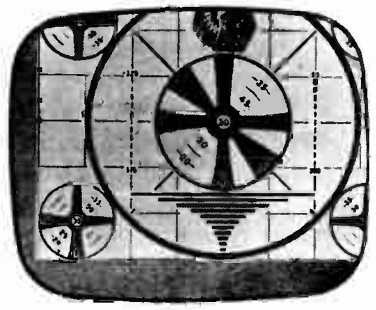
Caution: If the DX RANGE FINDER is turned too far to the right for a strong signal, the picture may disappear completely.

If the signal strength changes, it may be desirable to change the setting of the DX RANGE FINDER; however, it is generally possible to set it at a single compromise position which gives reasonable reception for the different signal strengths.

It is important to keep the DX RANGE FINDER setting as low as possible consistent with satisfactory pictures.

PICTURE CENTERING ADJUSTMENT

If picture is off center, it can be centered by using the picture positioning lever, and when necessary, repositioning the focus coil around picture tube neck. ***Note picture positioning lever can be moved sideways, or up and down.***



Picture Not Centered; Adjust Picture Positioning Lever.

Centering the Picture

a. Adjust ion trap as instructed on preceding page.
b. Slightly loosen the screw "A" which locks the picture positioning lever to the focus coil, and adjust the lever (sideways, or up and down) for correct picture centering. If centering is not done with a test pattern, it may be necessary to reduce picture height and width to determine correct centering.
c. Readjust the ion trap.

Difficulty in Centering the Picture

a. Adjust ion trap as instructed on preceding page.
b. Slightly loosen the two screws "B" which hold the focus coil to the yoke bracket. Center focus coil around the tube neck; tighten screws.
c. Loosen the screw "A" and center the picture with the picture positioning lever. If the picture cannot be centered with the lever, it may be necessary to locate the focus coil slightly off center and then center the picture with picture positioning lever.
d. Readjust the ion trap.

Difficulty in Eliminating Shaded Corners

a. Loosen screws "G", then move the yoke support housing forward until rubber grommet "F" is firmly against the flare of the picture tube.
b. Move the deflection yoke coil "E" as far forward as possible. If the deflection yoke coil cannot be moved forward far enough, it may be necessary to loosen the two screws "D", move the bracket up or down, and then move the deflection yoke coil forward.
c. Adjust ion trap as instructed on preceding page.
d. Shaded corners may also result from use of the wrong ion trap. These picture tubes use iron trap 94A15-2. The part number is stamped on the magnet.

REPOSITIONING FOCUS COIL

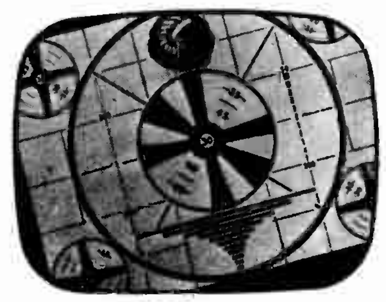
Adjustment of focus coil location in the deflection yoke support housing is made at the factory. Readjustment should not generally be required except when making picture replacement or if difficulty in focusing is encountered.

To adjust the position of the focus coil, proceed as follows:

a. Check to see that the deflection yoke housing and deflection yoke coil are moved forward as far as possible. See paragraph on "Difficulty In Eliminating Shaded Corners".
b. Loosen screws "C" at the sides of the yoke housing. Move the focus coil forward or backward as required. The spacing between the focus coil and the windings of the deflection yoke coil (not the fibre insulator disc) should be about 3/8 of an inch minimum. Moving the focus coil too far away from the deflection yoke coil may cause difficulty in focusing. Moving the focus coil too close to the deflection yoke coil will cause a reduction in picture width and make it impossible to properly focus the picture with the focus control.

PICTURE TILT ADJUSTMENT

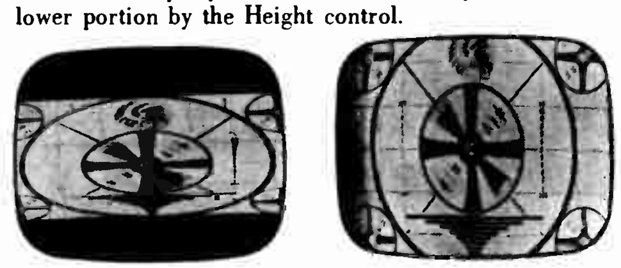
If picture is tilted, loosen wing screw "H" on deflection yoke coil "E" and slightly rotate yoke until the picture is straight. Before tightening the wing screw, be sure yoke is as far forward as possible, otherwise corners of picture may become shaded.



Picture Tilted; Adjust Deflection Yoke Coil.

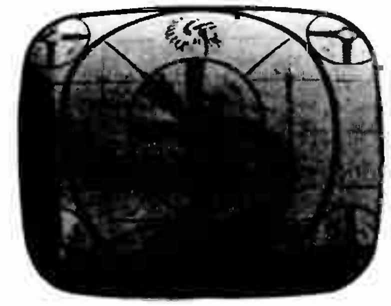
HEIGHT AND VERTICAL LINEARITY ADJUSTMENT

If the picture is of incorrect height (vertical size), adjust the HEIGHT control with BRIGHTNESS control set for normal brightness. This adjustment may affect the vertical linearity of the picture. If necessary, alternately adjust the VERT. LIN. control and HEIGHT control. Note that the upper portion of the picture is affected mostly by the Vertical Linearity control; the lower portion by the Height control.



Incorrect Height; Alternately Adjust HEIGHT and VERT. LIN. Controls.

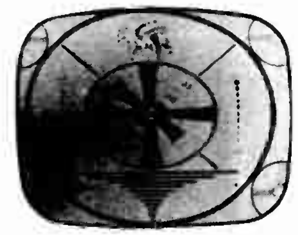
If the large circle in the test pattern appears cramped or flattened at top or bottom (non-linear vertically), correct by alternately adjusting the VERT. LIN. control and the HEIGHT control.



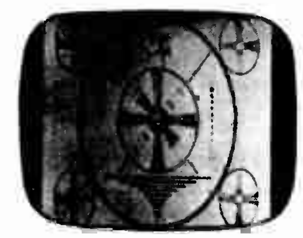
Top or Bottom of Picture Cramped or Flattened; Adjust VERT. LIN. and HEIGHT.

WIDTH ADJUSTMENT

If the picture is too wide or too narrow, adjust the WIDTH adjustment screw until the picture just fills the picture tube screen. Make this adjustment with the BRIGHTNESS control set for normal brightness.



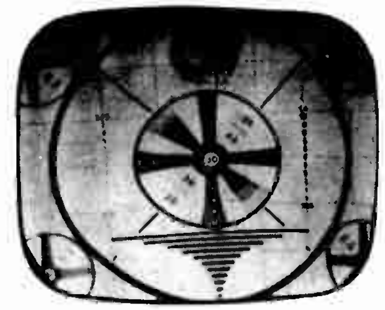
Too Much Width; Adjust WIDTH.



Not Enough Width; Adjust WIDTH.

HORIZONTAL LINEARITY ADJUSTMENT

If the large circle in the center of the test pattern has a cramped or flattened appearance at either side (non-linear horizontally), adjust the HORIZ. LIN. adjustment screw by turning it out (fully to the left). Then slowly turn it in (to the right) until linearity is best. Note that there are two settings of the HORIZ. LIN. adjustment that appear to give good linearity. The correct adjustment setting is the one with the adjustment screw further out (to the left). Note also, that the Horizontal Drive and the Width adjustments also affect linearity. Be sure that these adjustments are set correctly if difficulty is encountered when making the horizontal linearity adjustment.

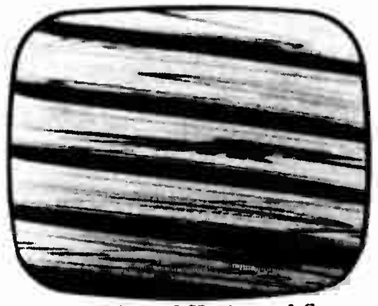


Side of Picture Cramped or Flattened; Adjust HORIZ. LIN.

HORIZONTAL OSCILLATOR and HORIZONTAL DRIVE ADJUSTMENT

A receiver which requires horizontal oscillator or horizontal drive adjustment can be corrected only by following in exact detail the step-by-step procedure given here.

NOTE: *If HORIZ. DRIVE adjustment is not properly made, it may be difficult to obtain sufficient picture width and brightness.*



Picture Out of Horizontal Sync.

Check to see if the HORIZONTAL control (on front panel) keeps the picture in "horizontal sync" through half of its range so that the picture does not "break up" when switching channels. Note: Since there is some interaction between the HORIZ. LOCK adjustment and the HORIZ. DRIVE control, adjustment of these controls are combined in one procedure.

If the picture will not stay in "horizontal sync" through half of the range of the HORIZONTAL control (on front panel), it will be necessary to make HORIZ. LOCK and HORIZ. DRIVE adjustments. However, before making these adjustments, be sure that the picture can be made to remain stationary up and down (sync vertically) as lack of both vertical and horizontal sync is an indication of trouble in the sync circuits such as a defective tube or other component.

Make the HORIZ. LOCK and HORIZ. DRIVE adjustments exactly as follows:

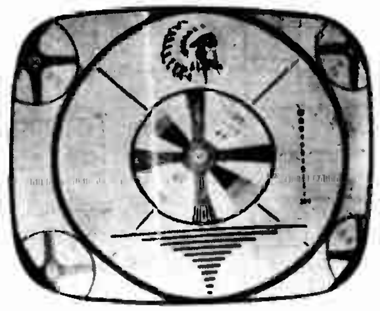
a. Allow the receiver to warm up for a few minutes. Tune in the station, set the BRIGHTNESS control at a lower than average setting. Turn PICTURE control fully to the left. Important: Before proceeding, be sure that the DX Range Finder control (AGC) is adjusted according to the instructions given in this manual.

b. Turn the HORIZONTAL control (front panel) completely to the left. Turn the HORIZ. DRIVE control fully to the right.

c. Turn the HORIZ. LOCK adjustment to the right until the picture falls out of sync. If the picture cannot be made to fall out of sync, momentarily interrupt the signal by switching the CHANNEL control off channel and then back on.

d. With the picture out of sync, turn the HORIZ. LOCK adjustment slowly to the left until the picture just falls in sync.

e. Turn the CHANNEL control to an unused channel. If a white vertical line(s) appears near the center of the screen, slowly turn the HORIZ. DRIVE control to the left until the line(s) just disappears.



Vertical Line;
Adjust HORIZ. DRIVE.

f. If, in step "e", the HORIZ. DRIVE control required readjustment, tune in a station and repeat steps "c" and "d" to be sure of proper Horizontal Oscillator adjustment.

g. Adjustment should now be satisfactory. However, check adjustment by slowly rotating the HORIZONTAL control in either direction while interrupting the television signal by switching the CHANNEL control off channel and then back on. The picture should automatically fall in sync through at least half of the range of the HORIZONTAL control. If necessary, repeat the above step.

h. Do not use the HORIZ. DRIVE control to obtain correct width or linearity. If necessary, make Width and Horizontal Linearity adjustments.

SERVICE HINTS

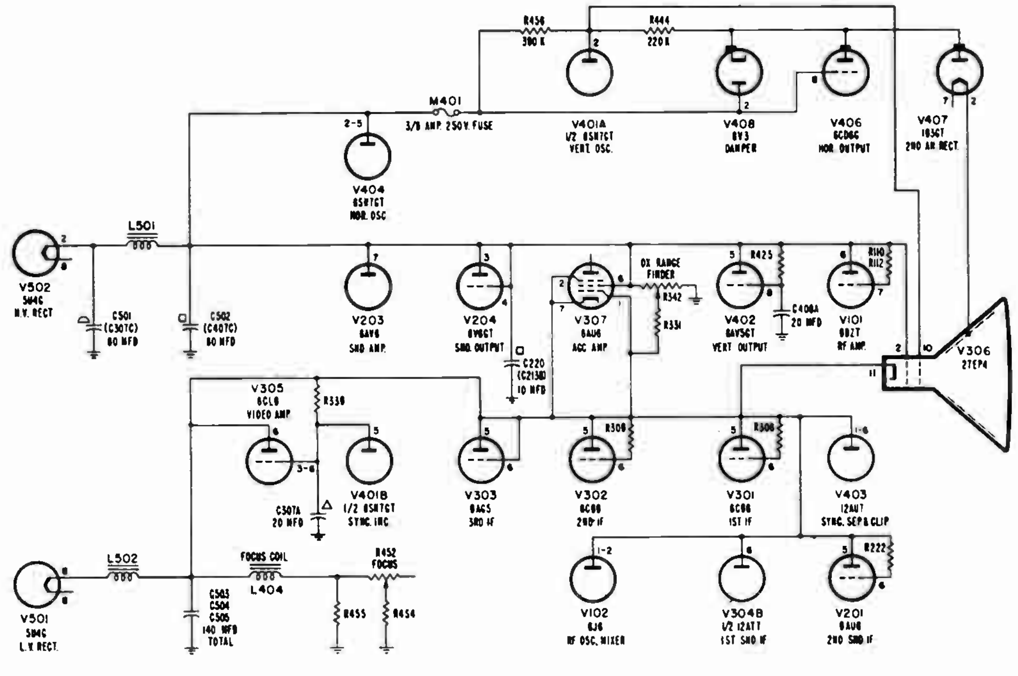
TELEVISION ALIGNMENT

Alignment for the 23A1 chassis is the same as for the 22C2 and 22E2 chassis. For alignment information, see page 32 and page 33

Important: The focus coil and the deflection yoke coil must be connected to chassis during alignment.

TROUBLE SHOOTING

The 23A1 chassis described in this manual is similar to the 22 series chassis with the exception of the video amplifier, picture tube, vertical output, horizontal output, damper and power supply circuits. The basic differences in the 23A1 chassis over the 22 series is outlined under "New Features In 23A1 Chassis".



NOTE: This diagram applies only to chassis which are not stamped with a run number.

Figure 20. Simplified Diagram Showing B+ Distribution in 23A1 Chassis.

In general, the trouble shooting of the 23A1 chassis will be similar to that of the 22 series chassis

It is important, however, to remember the following trouble shooting hints which apply to the 23A1 chassis. Note: Some hints also apply to the 22C2 and 22E2 chassis.

Improper Focus (control focuses at extreme end of rotation, 23A1 chassis): This may be caused by a weak 5U4G rectifier tube V501. Try another rectifier tube.

It may also be impossible to obtain good focus with FOCUS control if the focus coil is spaced too far away from the deflection yoke coil. Spacing between the focus coil and the deflection yoke coil should be 3/8 of an inch minimum. The deflection yoke coil should be as far forward on the neck of the tube as possible. See paragraph "Repositioning Focus Coil" on page 25.

Insufficient Picture Width (23A1 chassis). This may be caused by a weak rectifier tube V502, a weak horizontal output tube V406 or a weak damper tube V408.

Insufficient picture width may also be caused by incorrect adjustment of the Horizontal Drive control R447, or improper positioning of the focus coil on the deflection yoke housing. Moving the focus coil too close to the deflection yoke coil will result in reduction of picture width. The spacing between the focus coil and the deflection yoke coil should be 3/8 of an inch minimum.

White Flashes Across Picture (22C2, 22E2 and 23A1 chassis): In weak signal, high noise level areas, white flashes across the picture can sometimes be minimized by careful adjustment of the DX Range Finder control. Caution: Turning the DX Range Finder control too far to the right for a strong signal may cause the picture to disappear completely. See instructions for DX Range Finder Adjustment on page 41.

No Picture; Sound Normal (22C2, 22E2 and 23A1 chassis): If the DX Range Finder control is turned too far to the right for a strong signal, the picture may disappear completely. Advancing the DX Range Finder control too far to the right for a strong signal area will cause excessive delay in AGC bias thereby blocking the video amplifier. See instructions for DX Range Finder Adjustment on page 41.

TROUBLE SHOOTING B+ CIRCUITS

The power supply and B+ distribution circuits of the 23A1 chassis are different from previous model television receivers. A simplified diagram, showing the B+ distribution in the 23A1 chassis, is shown in figure 20.

REDUCING SNOW IN INTERMEDIATE FRINGE AREAS

(Applies to 22C2, 22E2 Chassis Below Run 2 and 23A1 Chassis without a Run Number)

To reduce snow (front end noise) in intermediate fringe areas, it is recommended that the tuner AGC voltage be reduced to 1½ or 2 volts. This reduction in AGC voltage can be accomplished by removing resistor R337 (150,000 ohms) and replacing it with a 100,000 ohm resistor and a 47,000 ohm resistor connected in series. Connect the 47,000 ohm resistor to chassis ground and the 100,000 ohm resistor to resistor R302, 1,000 ohms (test point "T"). Remove the tuner AGC lead (usually white) from test point "T" and connect it to the junction of the 100,000 ohm resistor and 47,000 ohm resistor. To reduce the possibility of unstable operation, it is recommended that the tuner AGC lead be by-passed to chassis by a .005 mfd. ceramic condenser.

CHANGE IN SIZE OF FUSE M401

To prevent possibility of fuse burn-out, due to momentary overload, the horizontal output fuse was changed from a ¼ ampere, 250-volt fuse to a ⅜ ampere, 250-volt fuse, part number 84A4-3. Fuse replacement should be made only with a ⅜ ampere, 250-volt fuse, part number 84A4-3.

REPLACING FUSE M401

The horizontal output circuit of these receivers is protected by fuse M401 (⅜ amp., 250 volts, part number 84A4-3). This fuse is located in the rear of the high voltage compartment. To replace the fuse, remove the two screws at the base of the high voltage compartment and lift the cover away from the base; see figure 19. Carefully remove or insert the fuse so as to avoid damage to the horizontal output transformer.

CLEANING GLASS PICTURE WINDOW

The picture window and the picture tube should be cleaned whenever the television chassis is removed from the cabinet.

Clean the picture window and the face of the picture tube with a soft cloth dampened with clear water or window cleaner. Dry the glass with a chamois or a lint-free cotton cloth.

The plastic tube mask is held in place with the picture window in a channel along the top and by brackets at the sides and the bottom edge. The tube mask may be removed when it requires cleaning. Mild soap and water applied with a soft cloth will safely remove any dirt on the plastic tube mask.

HIGH VOLTAGE WARNING

High voltages are present throughout the horizontal output, damper and second anode supply circuits. No attempt should be made to make measurements from high voltage points in these circuits with ordinary test equipment.

Caution: Operation of the set outside of the cabinet or with cabinet back removed involves shock hazard. Exercise normal high voltage precautions.

27EP4 PICTURE TUBE REPLACEMENT

Important: Make all deflection adjustments — Repositioning Focus Coil, Picture Centering, Picture Tilt and Ion Trap — whenever replacing the picturing tube. These adjustments are described on pages 41 to 42.

Warning: Before removing or replacing the picture tube, note the following precautions:

- Before handling the picture tube, remove any residual charge on the second anode connector and the second anode socket on the tube.
- Due to the high vacuum and large surface area of the picture tube, great care must be exercised when handling. Do not pick up the picture tube by the neck. Do not scratch or subject the picture tube to excessive pressure as fracture of the glass will result in an explosion of considerable violence which may cause serious personal injury. Shatterproof goggles and heavy gloves should be worn while handling or installing a picture tube.

The picture tube, deflection yoke and focus coil mounting assembly are mounted on a removable board which slides in place along the rails under the cabinet top. Mounting for the 27" picture tube is shown in figure 19.

To remove the picture tube, proceed as follows:

1. Disconnect the ground strap and all plugs which connect between the picture tube assembly, the chassis and the cabinet.
2. Remove the television chassis.
3. Remove the Phillips head screws at the sides and back which fasten the mounting board to the top of the cabinet. Slide the picture tube assembly out of the cabinet.
4. Remove the ion trap.
5. Remove the tube stops on the front tube support brackets. Loosen the tie rod nut and disconnect the tie rods at each side of the picture tube. Remove the nuts on the spade bolts at each end of the picture tube strap and carefully remove the strap assembly.
6. Carefully move the tube straight out from the deflection yoke and focus coil to avoid any damage to either the picture tube neck or the deflection coil. Use care so the fibre insulating disc, which is between the focus coil and the deflection yoke, does not slip down and catch on the tube socket. To facilitate picture tube removal and installation, the fibre insulating disc may be taped to the focus coil.

To install a new picture tube, proceed as follows:

a. Loosen the four hexagonal head screws "G" and slide the deflection yoke housing as far back as it will move; see figure 19. Carefully insert the picture tube, fitting the fibre insulating disc (between deflection yoke and focus coil) over the tube base. Move the picture tube in until it is positioned properly on the front support brackets.
b. Install the tube stops on the front support brackets and move the picture tube forward and snug against these stops.
c. Loosen deflection yoke wing nut "H" and move yoke coil back.
d. Slide the deflection yoke housing forward until the tube ring is snug against the flare of tube and tighten screws.
e. Move deflection coil forward as far as it will go and tighten wing nut "H".
f. Install the strap assembly and tighten the nuts on the spade bolts. Install each tie rod and tighten the tie rod nuts. Be sure that the strap is fitted squarely over the top of the picture tube, that the picture tube rests squarely and snug in the front tube support brackets.
g. Dampen a soft cotton cloth with water and wipe away any finger marks. Polish the tube surface with a dry cotton cloth.
h. Install the ion trap.
i. Install picture tube assembly and chassis in cabinet.
j. Make all picture tube adjustments described on pages 41 to 42.

SUPPLEMENTARY PARTS LIST FOR 23A1 CHASSIS

This parts list includes parts used in the 23A1 chassis which are not used in the 22C2 or 22E2 chassis. Parts which have the same symbol number but have different values in either the 22C2, 22E2 or the 23A1 chassis are also listed. For parts used in the 23A1 chassis, use this parts list FIRST; then refer to the parts list for the 22C2 and 22E2.

RESISTORS

Sym.	Description	Part No.
*R210	150,000 ohms, ½ watt (22E2 chassis)	60B 8-154
	470,000 ohms, ½ watt (22C2, 23A1 chassis)	60B 8-474
R215	560 ohms, 2 watt	60B 20-561
R331	220,000 ohms, ½ watt (22C2, 22E2 chassis)	60B 8-224
	180,000 ohms, ½ watt (23A1 chassis)	60B 8-184
R343A	100,000 ohms, Brightness	75B 17-1
R343B	750 ohms, Focus (22C2, 22E2 chassis)	
R343A	100,000 ohms, Brightness	75B 17-4
R343B	3,300 ohms, Focus (23A1 chassis)	
R404	1.2 megohms, ½ watt (22C2, 22E2 chassis)	60B 8-125
	750,000 ohms, ½ watt, 5% (23A1 chassis)	60B 7-754
R405	1.5 megohms, Vert. Hold (22C2, 22E2 chassis)	75B 13-14
	1.5 megohms, Vert. Hold (23A1 chassis)	75B 13-26
R406	1 megohm, ½ watt (22C2, 22E2 chassis)	60B 8-105
	1.8 megohms, ½ watt (23A1 chassis)	60B 8-185
R409	1 megohm, ½ watt (22C2, 22E2 chassis)	60B 8-105
	3.3 megohms, ½ watt (23A1 chassis)	60B 8-335
R411	820 ohms, ½ watt (22C2, 22E2 chassis)	60B 8-821
	220 ohms, 1 watt (23A1 chassis)	60B 14-221
R415	820 ohms, 2 watt (22C2, 22E2 chassis)	60B 20-821
	470 ohms, 2 watt (23A1 chassis)	60B 20-471
R422	91,000 ohms, 1 watt, 5%	60B 13-913
R425	91,000 ohms, 1 watt, 5%	60B 13-913
R430	12,000 ohms, 2 watt (22C2, 22E2 chassis)	60B 20-123
	100,000 ohms, 2 watt (23A1 chassis)	60B 20-104
R435	8,200 ohms, ½ watt (22C2, 22E2 chassis)	60B 8-822
	3,300 ohms, 2 watt (23A1 chassis)	60B 20-332
R436	150,000 ohms, ½ watt (22C2, 22E2 chassis)	60B 8-154
	100,000 ohms, ½ watt (23A1 chassis)	60B 8-104
R437	1 megohm, ½ watt (22C2, 22E2 chassis)	60B 8-105
	470,000 ohms, ½ watt (23A1 chassis)	60B 8-474
R438	8,200 ohms, ½ watt (22C2, 22E2 chassis)	60B 8-822
	5,600 ohms, ½ watt (23A1 chassis)	60B 8-562
R440	47 ohms, 1 watt (22C2, 22E2 chassis)	60B 14-470
	120 ohms, 2 watt (23A1 chassis)	60B 20-121
R442	3,300 ohms, 2 watt (22C2, 22E2 chassis)	60B 20-332
	4,700 ohms, 2 watt (23A1 chassis)	60B 20-472
R444	470,000 ohms, 1 watt, carbon only (22C2, 22E2 chassis)	60B 28-43
	220,000 ohms, ½ watt (23A1 chassis)	60B 8-224
R447	150,000 ohms, Horiz. Drive	75B 13-29
R449	1,200 ohms, 2 watt	60B 20-122
R451	3,300 ohms, 2 watt (22C2, 22E2 chassis)	60B 20-332
	4,700 ohms, 2 watt (23A1 chassis)	60B 20-472
R452	Focus control	See R343B
R454	470 ohms, 2 watt	60B 20-471
R455	4,700 ohms, 2 watt	60B 20-472
R456	390,000 ohms, ½ watt	60B 8-394
R457	1.8 megohms, ½ watt	60B 8-185
R715	5,300 ohms, 5 watt, candohm	61A 3-16

CONDENSERS

Sym.	Description	Part No.
C114	.001 mfd, min, ceramic	98A 45-24
C207	.0022 mfd, 400 volts, paper	64B 9-17
C213A	20 mfd, 25 V. electrolytic	67C 15-19
C213B	10 mfd, 450 V. electrolytic	
C213C	10 mfd, 25 V. electrolytic	
C214	.0047 mfd, 600 volts, paper	64B 9-15
C219	39 mmfd, ceramic	65C 6-88
C220	Electrolytic	See C213B
C307A	20 mfd, 350 V. electrolytic	67C 15-21
C307B	40 mfd, 350 V. electrolytic	
C307C	60 mfd, 400 V. electrolytic	
C318	.005 mfd, min, cer. (22C2, 22E2 chassis)	65C 10-1
	.1 mfd, 600 volts, paper (23A1 chassis)	64B 5-5
C319	.1 mfd, 600 volts, paper	64B 5-5
C326	6.8 mmfd, cer, —.00033 temp. coeff.	65C 6-71
§C403	.005 mfd, 600 volts, paper	64B 5-12
C407A	100 mfd, 50 V. electrolytic	67C 15-18
C407B	20 mfd, 450 V. electrolytic	
C407C	80 mfd, 350 V. electrolytic	
C408A	20 mfd, 350 V. electrolytic	67C 15-21
C408B	40 mfd, 350 V. electrolytic	
C408C	60 mfd, 400 V. electrolytic	
C409	.022 mfd, 400 volts, paper	64B 9-30
C411	330 mmfd, mica	65B 21-331
C414	.1 mfd, 600 volts, paper	64B 5-5
C415	.0047 mfd, 600 volts, paper	64B 9-15
C417	.01 mfd, 400 V, paper (22C2, 22E2 chassis)	64B 9-13
	.0022 mfd, 600 V, paper (23A1 chassis)	64B 9-17
C420	330 mmfd, mica (22C2, 22E2 chassis)	65B 21-331
	270 mmfd, mica (23A1 chassis)	65B 21-271
C421	680 mmfd, mica (22C2, 22E2 chassis)	65B 21-681
	.01 mfd, 400 volts, paper (23A1 chassis)	64B 9-13
C424	Electrolytic	See C213C
C426	.25 mfd, 600 volts, paper (22C2, 22E2 chassis)	64B 5-3
	.01 mfd, 400 volts, paper (23A1)	64B 9-13
C427	.02 mfd, 400 volts, paper (22C2, 22E2 chassis)	64A 2-9
	.047 mfd, 400 V, paper (23A1 chassis)	64A 2-14
C429	500 mmfd, 20,000 volts, ceramic (22C2, 22E2 chassis)	65B 18-5
	500 mmfd, 30,000 volts, ceramic (23A1 chassis)	65B 18-8
C430	47 mmfd, 5%, 1,500 volts, mica (22C2, 22E2 chassis)	65B 1-64
	140 mmfd, 5%, 1,500 volts, mica (23A1 chassis)	65B 1-74
C435	Electrolytic	See C407B
C436	150 mmfd, min, ceramic	65C 10-10
C501	Electrolytic	See C307C
C502	Electrolytic	See C407C
C503	Electrolytic	See C408C
C504	Electrolytic	See C408B
C505	Electrolytic	See C307B

* Component may be part of couplate, part number 63B6-3. Order exact duplicate in individual components.
§ Component may be part of couplate, part number 63B6-2. Order exact duplicate in individual components.

COILS, TRANSFORMERS

Sym.	Description	Part No.
L401	Horizontal Lock Coil (includes C418, R431)	
	for 22C2 and 22E2 chassis	94A 17
	for 23A1 chassis	94B 48-1
L402	Width Control Coil	
	for 22C2 and 22E2 chassis	94A 39-1
	for 23A1 chassis	94A 56-1
L403	Horizontal Linearity Coil	
	for 22C2 and 22E2 chassis	94A 28
	for 23A1 chassis	94A 55-1
L404	Focus Coil	
	for 22C2 and 22E2 chassis	69D 117-3
	for 23A1 chassis (includes plug M404)	69D 117-10
L501	Filter Choke (2 Henry)	74B 18-6
L502	Filter Choke (6 Henry)	74B 18-5
T202	Audio Output Transformer	
	for 22C2 chassis	79C 33-3
	for 22E2 chassis	79C 33-4
	for 23A1 chassis	79C 33-5
T402	Vertical Output Transformer	
	for 22C2 and 22E2 chassis	79B 40-1
	for 23A1 chassis	79B 43-1
T403	Deflection Yoke	
	for 22C2 and 22E2 chassis (includes R412, R413, R445 and C430)	94C 30-1
	for 23A1 chassis (includes R412, R413, R445, C430 and plug M406)	94D 54-1
T404	Horizontal Output Transformer	
	for 22C2 and 22E2 chassis	79C 38-1
	for 23A1 chassis	79D 44-1
T501	Power Transformer	
	for 22C2 and 22E2 chassis	80C 26-1
	for 23A1 chassis	80C 36-1

MISCELLANEOUS CHASSIS PARTS

Sym.	Description	Part No.
M201	Speaker Socket	88A 5-6
M202	Speaker Plug	88A 5-5
M203	Speaker	See Cabinet Parts List
M204	Speaker	See Cabinet Parts List
M205	Speaker Plug	88A 5-5
M206	Speaker Socket	Part of M203
M401	Horiz. Output Fuse	
	¼ Amp. 250 V. (in 22C2, 22E2)	84A 4-2
	⅜ Amp. 250 V. (in 23A1)	84A 4-3
M403	Socket, Focus Coil	87A 4-4
M404	Plug, Focus Coil	88A 3-5
	Cover & Insulator (for 88A3-5 plug)	88A 3-4
M405	Socket, Deflection Yoke	87A 2-7
M406	Plug, Deflection Yoke	88B 23-3
M503	Pilot Light Socket (includes leads)	82A 11-59
	Clip, Tube Cap	
	for 6CD6G tube	88A 16-20
	for 6V3 tube	88A 16-21
	Connector Lead, 2nd Anode, 17" long	88A 16-15
	Pilot Light (#44)	81A 1-5
	Socket, Picture tube	87A 32-8

PARTS for 27EP4 (27") PICTURE TUBE ASSEMBLY

Sym.	Description	Part No.
M403	Socket, Focus Coil	87A 4-4
M404	Plug, Focus Coil	88A 3-5
	Cover and Insulator (for 88A3-5 plug)	88A 3-4
M405	Socket, Deflection Yoke	87A 2-7
M406	Plug, Deflection Yoke	88B 23-3
	Board, Deflection Assembly and Tube Mtg.	46D 37
	Bracket	
	Deflection Yoke Adjustment	15B 871
	Deflection Yoke Support (includes rear tube support bracket)	A3878
	Focus Coil Mounting	15A 872
	Front Tube Stop	15A 807
	Front Tube Support	
	for right side (facing front)	A3788
	for left side (facing front)	A3789
	Rear Base	15C 868
	Cable Assembly, Grounding	A3883
	Connector Lead, 2nd Anode, 17" long	88A 16-15
	Insulating Disc, Fibre (between focus coil and deflection yoke)	32A 181
	Insulator Strip, Fibre (support for 2nd anode lead)	32A 143
	Ion Trap	94A 15-2
	Lever, Picture Positioning	15B 574
	Nut, for mounting focus coil (#8-32)	2A 8-18-24
	Nut, for threaded end of tie rod (#8-32)	2A 1-15-24
	Nut, for tube support strap (¼-20)	2A 1-23-24
	Rubber Bumper	
	for tube stop (⅝" dia. x ½" high)	12A 16-3
	for tube support (1" dia. x 3/16" high)	12A 16-4
	Rubber Channel (for strap assembly)	
	9" long	12A 47-5
	31" long	12A 47-6
	Rubber Pad	
	for tie rod bracket (1¼" wide x 3½" long)	12B 5-37
	for tube support (1¾" wide x 1⅝" long)	12A 46-1
	Rubber Strip (for pict. wind. mtg. bracket)	12B 5-22
	Rubber Support (for flare of picture tube)	
	Rubber Strip Adhesive (¼"x1¼"x3½") 8 req.	15B 5-37
	Rubber Collar	12B 50
	Screw	
	for deflection yoke (#8-32x⅜ wing)	1A 101-1-24
	for mounting deflection yoke adjustment bracket and focus coil (#8-½ B.H.M.S.)	85-500-C2-24
	for mounting deflection yoke support bracket (#10-24x½ H.H.M.S. with lockwasher)	1A 109-31-24
	for mounting focus coil bracket (#6x⅜ B.H.M.S.)	85-375-C2-24
	for mounting front tube stop (#6-32x¼ H.H.S.T.)	1A 51-2-24
	for mounting picture positioning lever (#6-⅜ B.H.M.S.)	65-375-C2-24
	Spacer Sleeve (for picture positioning lever)	29A 2-3-24
	Strap Assembly (includes tie rod brackets and ¼x20x1" spade bolt at each end)	A3879
	Tie Rod (#8-32 threaded end)	28B 65-1
	Washer, Spring (for mtg. picture positioning lever)	4A 5-10

TUNING KNOBS and ASSOCIATED PARTS

Description	Part No.
Knob, Television Tuning	
black, "DX Range Finder"	33A 23-4
maroon, "Channel" (with gold inserts)	33C 53-23
maroon, "Off-Volume" (with gold inserts)	33C 53-24
maroon, "Picture"	33D 88-20
maroon, "Tuning"	33D 88-21
maroon, "Focus"	33A 92-3
Spring, TV Knob Tension	
for "Off-Volume" knob	18A 43-2
for "Tuning" knob	18A 43-1
for "Channel" knob	18A 43-3
Washer, Fibre	
between Volume and Picture knob	5A 1-36

CABINET PARTS for MODELS 228DX16, 228DX17

These model numbers may have the suffix letter "N".

Description	228DX16 Mohog.	228DX17 Blond
Back, TV (complete)	A3882	A3882
Bracket, for mtg. picture window		
1 3/16" wide (used at sides)	15A 763-1	15A 763-1
1 1/16" wide (used at bottom)	15A 763-2	15A 763-2
*Cabinet, Wood	*35E 234-2	*35E 234-3
*Cabinet Doors (matched set of 2 front doors)	*35E 234-50	*35E 234-51
Carton and Fillers	44B 267	44B 267
Caster, Swivel	37A 77-1	37A 77-1
Control Panel (less door)	23D 133-1	23D 133-1
Control Panel Door	23D 133-5	23D 133-5
Control Panel Door Spring	19A 70	19A 70

CABINET PARTS (Continued)

Description	228DX16 Mohog.	228DX17 Blond
§Door Catch and Strike Plate	See § footnote below.	
Door Handle	37A 84	37A 84
†Gasket, Sponge Rubber for pic. window)	12A 32-13	12A 32-13
Grille Cloth	36C 3-140	36C 3-141
Grille, Metal	36C 43	36C 43
§Hinge, Cabinet Door (pair)	See § footnote below.	
Jewel, Pilot Light	82A 10-8	82A 10-8
Knobs, Tuning	See "Tuning Knobs and Associated Parts".	
Light, Pilot #44	81A 1-5	81A 1-5
Line Cord and Interlock Socket	89A 22-1	89A 22-1
Rubber Strip, Adhesive (1/16"x¼"x4")	12B 5-22	12B 5-22
Screw, for mounting control panel (#4x¼" R.H.W.S. P.H.)	1A 7-9-57	1A 7-9-57
Screw, for mounting TV chassis (¼-20x1¼ M.S.)	1A 67-44-24	1A 67-44-24
Speaker, 10" PM (M204; includes 12" leads and plug M205)	78C 78-1	78C 78-1
Speaker, 10" PM (M203; includes 38" leads, plug M202 and socket M206)	78C 78-2	78C 78-2
Speed Nut (for mtg. speaker)	2B 10-8-59	2B 10-8-59
Tubing, Plastic (1⅜" long, used over 19A70 door spring)	96B 19-3-20-0	96B 19-3-20-0
Washer (for mtg. speaker)	4B 1-56-24	4B 1-56-24
Window, Picture, Glass	21B 49-25	21B 49-25
Window Mask, Plastic	23E 134	23E 134

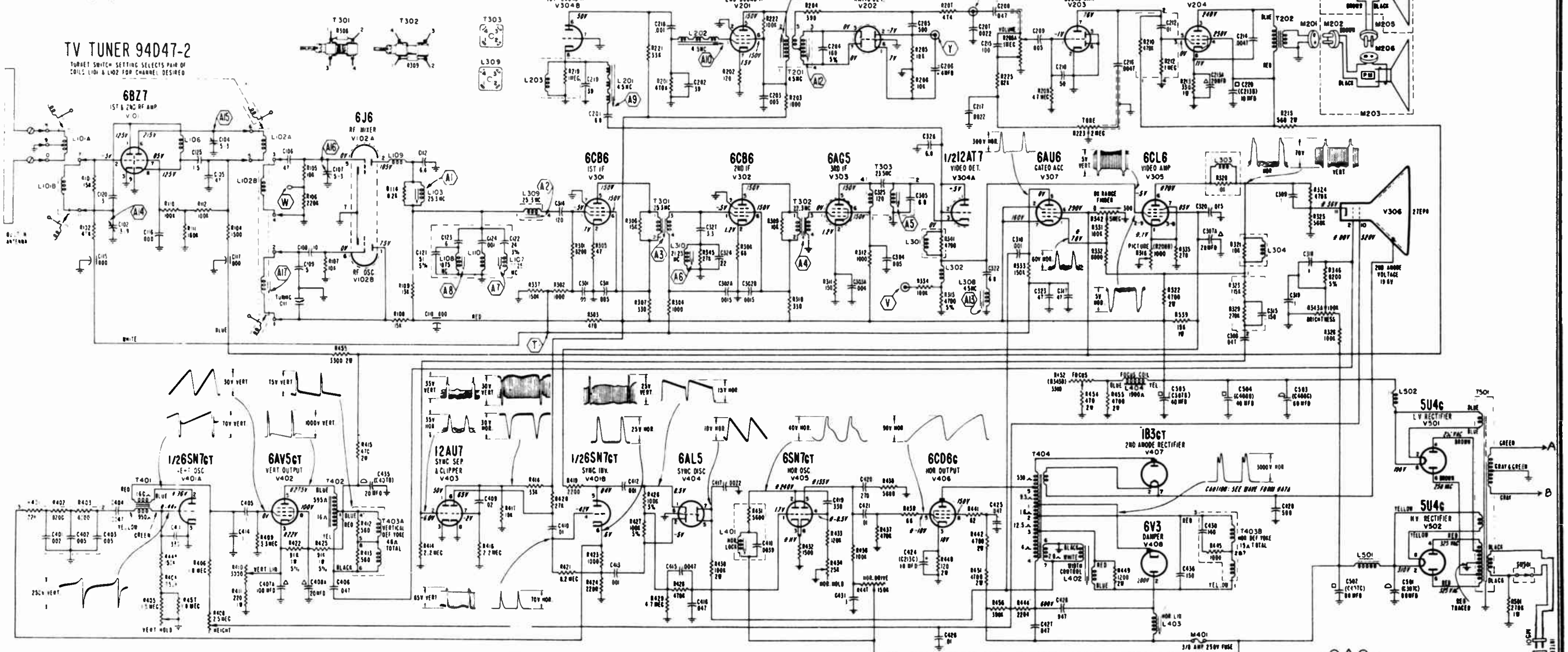
* To insure proper matching and fit, also specify cabinet manufacturer's code letters (usually burned or stamped on back rail of cabinet). Wood parts are supplied only if old part cannot be repaired; when ordering, describe condition of old part in detail.

§ Order these parts using the part number given in Cabinet Hinge Ordering Data, Form No. S379. Otherwise, return old part, or send an outline tracing (exact size) of part and note finish (brass, bronze, etc.).

† Use only rubber cement when mounting sponge rubber gasket.

SCHEMATIC NOTES

(A1), (A2), ... (Y), (Z), etc. indicate alignment points and alignment connections.



CAUTION

Picture tube 2nd anode voltage can be measured from the 2nd anode connector and should be taken only with a high voltage instrument such as a kilovoltmeter or a vacuum-tube voltmeter with a high voltage probe. 2nd anode voltage is approximately 19 KV. Proper filament voltage check of the 1B3GT tube may be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

Figure 22. Schematic for 23A1 Television Chassis.

NOTE: This schematic applies only to chassis which are not stamped with a run number.

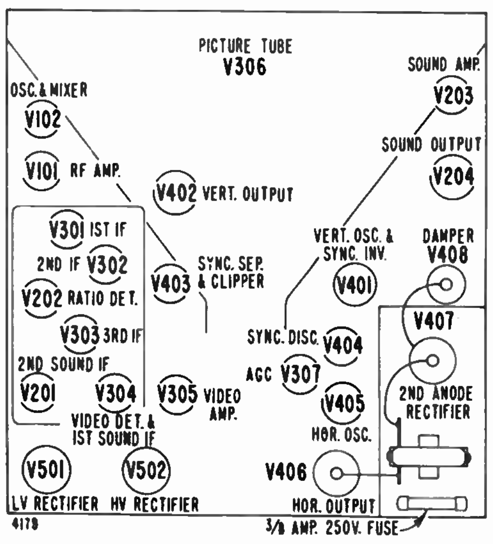


Figure 21. Top View of 23A1 Chassis.

TV VOLTAGE DATA

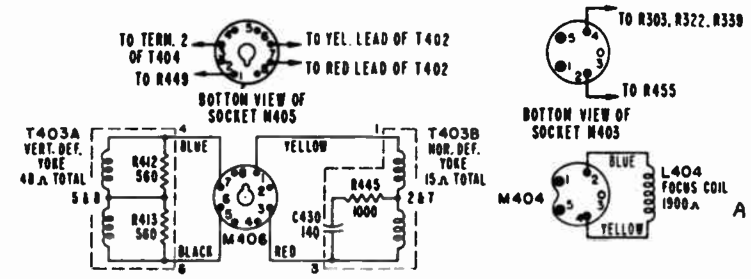
(Voltages given on schematic)

- Picture control turned fully clockwise. Channel control set on an unused channel. Other front controls set at approximately half rotation. Vert. Lin. and Height set at approximately half rotation. DX Range Finder control set fully to the left (at "0" position).
- Antenna disconnected from set with terminals shorted.
- Line voltage 117 volts AC.
- Voltages measured with a vacuum-tube voltmeter between tube socket terminals and chassis, unless otherwise indicated. Voltages at V306 measured from top of socket with tube removed.
- Voltages marked with an asterisk * will vary widely with control setting.

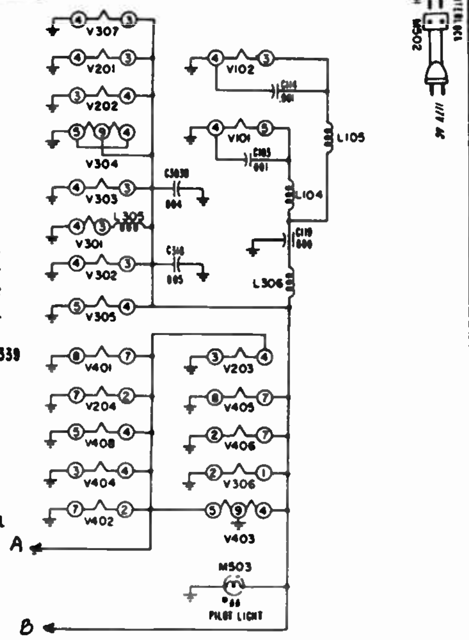
WAVEFORM DATA

(Waveforms given on schematic)

Waveforms taken with Picture control set fully to the right, all other controls set for normal picture (in sync). Important: Incorrect adjustment of the DX Range Finder control will cause waveform distortion. DX Range Finder should be at zero setting.



DEFLECTION YOKE AND FOCUS COIL CONNECTORS FOR 23A1 CHASSIS.



NOTE: Both 16" and 17" rectangular glass picture tubes are used. They require different mechanical mountings and mask and therefore are not interchangeable. When replacing tubes in service use identical tube sizes.

Electrical and Mechanical Specifications

Radio Frequency Ranges

Channel Number	Channel Freq. MC	Picture Carrier Freq. MC	Sound Carrier Freq. MC	Receiver RF Osc. Freq. MC
2	54-60	55.25	59.75	81
3	60-66	61.25	65.75	87
4	66-72	67.25	71.75	93
5	76-82	77.25	81.75	103
6	82-88	83.25	87.75	109
7	174-180	175.25	179.75	201
8	180-186	181.25	185.75	207
9	186-192	187.25	191.75	213
10	192-198	193.25	197.75	219
11	198-204	199.25	203.75	225
12	204-210	205.25	209.75	231
13	210-216	211.25	215.75	237

Power Supply - - - - - - - - - - - - - - - - - - - 105-125 volts 60 cycles 240 watts
Speaker - 5" PM 1.0 oz. Alnico 5
Speaker - 10" PM 3.16 oz. Alnico 5
Speaker - 12" PM 4.64 oz. Alnico 5
Voice Coil Impedance - - - - - - - - - - - - - - 3.2 ohms at 400 cycles
Receiver Antenna Input Impedance - - - - - - - 300 ohms balanced

Tube Complement		Function
1) 6AG5 or 6BC5	(V1)	RF Amplifier
2) 6J6	(V2)	RF Oscillator and Converter
3) 6AU6 or 6BA6**	(V3)	1st Sound IF Amplifier
4) 6AU6	(V4)	2nd Sound IF Amplifier and Driver
5) 6AL5	(V5)	Sound Discriminator
6) 6AV6	(V6)	1st Audio Amplifier
7) 6V6GT	(V7)	Audio Output
8) 6AG5 or 6BC5	(V8)	1st Pix and Sound IF
9) 6AG5 or 6BC5	(V9)	2nd Pix IF Amplifier
10) 6AG5 or 6BC5	(V10)	3rd Pix IF Amplifier
11) 6AL5	(V11)	Video Detector, Automatic Gain Control and Sync Limiter
12) 12AU7	(V12)	1st and 2nd Video Amplifier
13)*16KP4/16RP4	(V13)	Kinescope (Picture Tube)
14) 6SN7GT	(V14)	Sync Amplifier and Separator
15) 12BH7	(V15)	Vertical Oscillator and Vertical Output

* On 17" Models use 17BP4/17BP4A

** When a 6BA6 is used in V3 position R1 (cathode bias resistor) is bypassed with a 1500 mmf condenser.

Tube Complement (Continued)		Function
16) 6SN7GT	(V16)	Horizontal Oscillator and AFC
17) 6BQ6GT	(V17)	Horizontal Output
18) 1B3GT	(V18)	High Voltage Rectifier
19) 6W4GT	(V19)	Damper
20) 5U4G	(V20)	Power Supply Rectifier

Picture Intermediate Frequencies

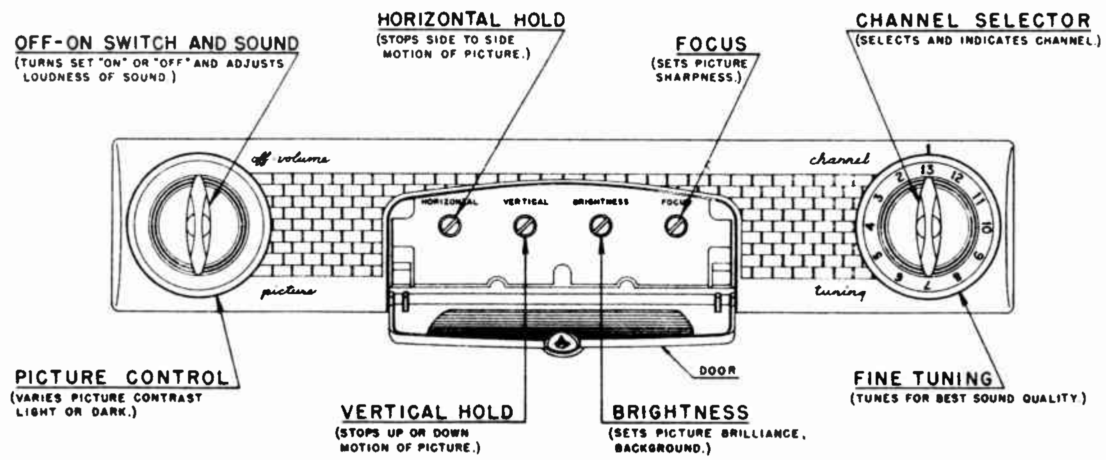
Picture Carrier Frequency - - - - - - - - - - - - - 25.75 MC
Accompanying Sound Traps - - - - - - - - - - - - - 21.25 MC

Sound Intermediate Frequencies

Sound Carrier Frequency - - - - - - - - - - - - - - 21.25 MC
Sound discriminator band width (between peaks) - - - 350 KC

Operating Controls (front panel)

Channel Selector / Fine Tuning — Dual Control Knobs
Power Switch and Volume / Contrast (Picture) Control — Dual Control Knobs
Horizontal Hold - - - - - - - - - - - - - - - - - - - Single Control
Vertical Hold - Single Control
Brightness - Single Control
Focus - Single Control



Non-Operating Controls

Width - - - - - - - - - - - - - - - - - Rear screwdriver adjustment.
Height - - - - - - - - - - - - - - - - Front chassis screwdriver adjustment.
Horizontal Linearity - - - - - - - - - Rear chassis screwdriver adjustment.
Vertical Linearity - - - - - - - - - - Front chassis screwdriver adjustment.
Horizontal Drive - - - - - - - - - - - Rear chassis screwdriver adjustment.
Horizontal Oscillator Frequency
(Fine) - - - - - - - - - - - Rear chassis screwdriver adjustment (L16).
Horizontal Oscillator Frequency
(Wave Shape) - - - - - - - - Bottom chassis screwdriver adjustment (L17)

Horizontal Locking Range - - - - Rear Chassis screwdriver adjustment.
Focus Coil - - - - - - - - - - - - - (Top chassis) lever adjustment for centering of raster.
Ion Trap Magnet - - - - - - - - - On neck of picture tube.
Deflection Coil - - - - - - - - - - - Top chassis wing screw adjustment.

ALIGNMENT

Equipment Required

1) RF signal generator to provide the following accurate frequencies. If the accuracy of the generator frequencies is not known, some type of crystal calibrator should be utilized to check the correct settings of the RF generator for each particular frequency.

(a) 4.5 MC Video Amplifier Trap

(b) IF Frequencies

21.25 MC	Sound IF, Sound Discriminator and Sound Traps
22.25 MC	Converter Coil
22.5 MC	Marker Frequency
23.0 MC	First Pix IF Coil
26.5 MC	Second Pix IF Coil
25.0 MC	Third Pix IF Coil
25.75 MC	Picture Carrier Marker

(c) RF Frequencies

Channel Number	Picture Carrier Freq. MC	Sound Carrier Freq. MC
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

(d) Output on these ranges should be adjustable and capable of providing at least .1 volt.

2) Electronic Voltmeter
3) Cathode Ray Oscilloscope, 3" minimum screen
4) RF Sweep Generator, meeting the following requirements:

(a) Frequency Ranges
18 to 30 MC., 1 MC. sweep width
40 to 90 MC., 10 MC. sweep width
170 to225 MC., 10 MC. sweep width

(b) Output adjustable to .1 volt.

The chassis may be removed from the cabinet with the kinescope tube in place and servicing and alignment work can be accomplished without removing the kinescope tube. This work is most conveniently performed by placing the chassis on its left side (power supply cage resting on work bench) and the controls facing the operator.

To remove chassis from cabinet remove
(1) Line cord from power outlet
(2) Masonite back
(3) Antenna Lead-in from terminal posts
(4) Speaker plug from rear of chassis
(5) Knobs from front of cabinet
(6) Four mounting screws and washers from bottom of cabinet

In sliding chassis out of cabinet be careful that the kinescope tube does not strike against cabinet or any other obstruction.

Order of Alignment

When complete receiver alignment is necessary it should be performed in the following sequence.

(1) Pix IF Traps
(2) Sound IF Transformers
(3) Sound Discriminator
(4) Pix IF Coils
(5) Retouch Pix IF Transformers
(6) 4.5 MC Trap

After removing chassis from cabinet, connect power and speaker plugs.

If a local station is not operating on channel #9 set the tuner to this channel, turn on power switch and proceed as follows: (If #9 is a local station channel use channel #8 or #10).

Picture I-F Trap Adjustment

Insert 100,000 ohm resistor in series with hot lead of electronic voltmeter and connect to Pin #7 of V11 with meter range switch set to lowest scale and observing polarity for negative readings.

Couple hot lead of RF SignalGenerator to converter tube V2 by means of a loop consisting of two turns of insulated hook-up wire. Connect ground lead of RF Signal Generator to chassis.

Note: If the converter tube V2 is shielded - remove shield.

Set the generator frequency accurately to 21.25 MC, and adjust L7 cathode sound trap (see tube and trimmer layout drawing) for minimum reading on voltmeter.

By means of a clip lead, short circuit condenser C26 on cathode trap.

Increase generator output to maximum (recheck 21.25 MC generator setting) and adjust L5 for minimum reading of voltmeter.

Sound IF Transformer Adjustment

Change hot lead connection of electronic voltmeter (with 100,000 ohm resistor connected in series) to terminal marked "C" of sound discriminator transformer. Reduce output of the signal generator to give approximately 2 volts reading on voltmeter scale.

Adjust L1 and L2 for maximum reading.

Sound Discriminator Adjustment

Change hot lead connection of voltmeter to pin #1 of V5 and adjust L3 for zero reading on voltmeter. This zero setting is very critical and the adjustment must be made with extreme care.

Repeat adjustments for L2 and L3 in the same manner indicated above.

Pix IF Coil Adjustment

Connect hot lead of voltmeter to pin #7 of V11 and adjust the following slugs for maximum output at frequencies indicated:

L301 - - - - - - - - - - - - -22.25 MC
L4 (Bottom of can) - - -23.0 MC
L6 - - - - - - - - - - - - -26.5 MC
L8 - - - - - - - - - - - - -25.0 MC

If oscillation occurs during alignment, temporarily lower frequency of L8 by turning screw clockwise until screw projects approximately $\frac{1}{4}$". After properly adjusting L301, L4 & L6 then set L8 to proper frequency. Oscillation is evidenced by high reading on voltmeter (-10v to -20v) with signal generator OFF and no signal coming in through the antenna terminals.

Retouch Pix IF Transformer Adjustment

Disconnect RF signal generator leads and connect hot lead of sweep generator to coupling loop on converter tube and ground lead to chassis.

Connect vertical input terminal of oscilloscope to pin #7 of V11 (Pix Dectector) and connect ground lead of scope to chassis.

Connect $1\frac{1}{2}$ V flashlight battery with positive terminal to chassis and negative terminal to #2 pin of V11.

Set tuner to channel 9 unless local station is operating on this frequency, in which case an adjacent channel should be used.

Set sweep generator frequency to IF sweep on the 20 to 30 MC range.

Adjust sweep generator output to produce a curve on the scope which is approximately 2/3 of the screen diameter.

Loosely couple output of RF signal generator to hot lead of sweep generator and set frequency of RF signal generator to 25.75 MC (marker).

Curve shown on scope should be similar to the standard response curve shown below. For proper setting of the pix carrier the 25.75 MC marker should appear on the curve at a point approximately 50% to 60% of the vertical height of the curve.

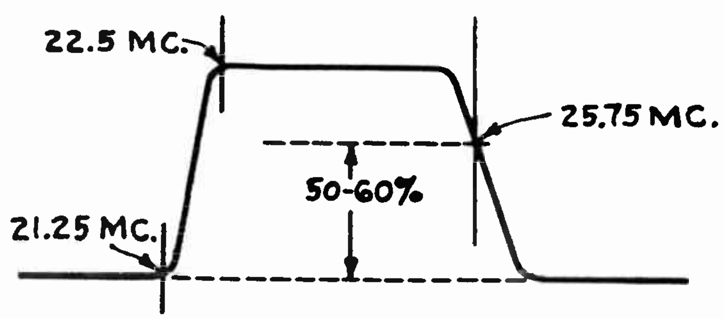
To obtain this setting retouch L6 and L8.

Reset RF signal generator frequency to 22.5 MC and retouch L301 and L4 for correct positioning of marker on shoulder of curve.

The curve may now be flat topped by retouching L8 & L4.

Recheck setting of 25.75 MC marker to make sure that position has not shifted on curve.

Disconnect bias battery.



Note: If the curve cannot be made to appear as above due to a local station or other interference, or multiple markers appear, remove (V1) 6BC5 RF tube from tuner.

Tuner Adjustments for Models using Tuner Part #CL-2262

Note: Before making a complete tuner adjustment it is essential that the Sound I.F. and discriminator circuits be aligned at their proper frequencies as described above. WHEN CHANGING THE CONVERTER TUBE IT IS NECESSARY TO REALIGN THE OSCILLATOR ADJUSTMENT ON ALL CHANNELS WITH THE V2 TUBE SHIELD IN PLACE.

RF and Converter Alignment

1) Set channel selector switch to #12
2) Connect oscilloscope through 10,000 ohms to test point on tuner (bare tinned copper loop wire located between V1 and V2)
3) Set fine tuning control at approximate mid-point of its tuning range. Temporarily connect jumper wire from pin #7 of V11 to chassis.
4) Feed Sweep generator into antenna terminals, sweeping channel 12.
5) Adjust C301, C302, and C304 for flat top response curve. Check picture and sound carrier markers corresponding to frequencies shown on Page 2 for all respective channels.
6) Remove jumper from pin #7 of V11 to chassis.

Oscillator Alignment

1) Set channel selector switch to #12
2) Connect signal generator to one antenna terminal and ground. Set to sound carrier frequency 209.75 MC.
3) Connect electronic voltmeter to pin #1 of V5 (6AL5) sound discriminator.
4) Adjust C303 for zero reading on electronic voltmeter between a positive and negative peak.
5) Check all channels for zero reading on voltmeter. It is usually not necessary to make any further adjustments. If it is found necessary to touch up the oscillator coils, the following procedure should be observed.

Oscillator Coil Touch-up

(a) Center fine tuning control, as described in Note A below.
(b) Place a non-metallic screwdriver through opening, and adjust oscillator coil on channel 12 (L312)
(c) Turn channel selector switch to channel 13 and adjust L313.
(d) This adjustment can be repeated for all channels or if necessary on any single channel.

ADJUSTMENTS

Ion Trap Magnet Adjustment

Turn the brightness control fully clockwise and the contrast control fully counter-clockwise. Adjust the ion trap magnet by moving it forward or backward and at the same time rotating it slightly around the neck of the kinescope until the raster on the screen is brightest. Reduce the brightness control setting until the raster is slightly above average brilliance. Adjust focus control until the line structure of the raster is clearly visible (sharp). Readjust the ion trap magnet again for maximum raster brilliance. The final touches on this adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained

Focus Coil Adjustments:

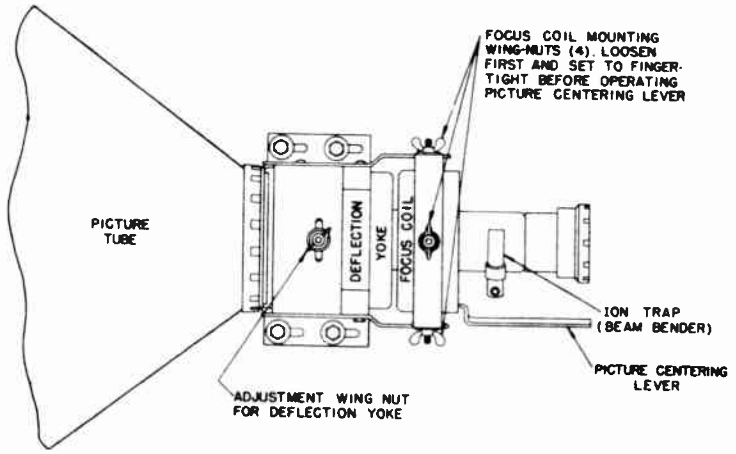
The focus coil is mounted within a frame to permit movement about its horizontal and vertical axis. The four wing nuts holding the focus coil to the frame are tightened at the factory to prevent movement during shipment. Upon installation of the receiver these wing nuts should be loosened and then adjusted finger tight. Centering of the picture within the mask is accomplished by gently moving the lever welded to the focus coil up and down or from left to right until the entire raster or picture is visible on the screen.

Deflection Yoke Adjustment:

If the lines of the raster are not horizontal or squared with the picture mask, loosen the deflection yoke adjustment screw and rotate the deflection yoke until this condition is obtained, and retighten the yoke adjustment screw.

If neck shadow is evident or the corners of the raster are dark, the deflection yoke must be moved forward as far as possible and the wing screw retightened. After observing that the picture tube is brought forward as far as possible to rest against the two tube stop brackets, loosen the four screws holding the rear tube support bracket to the chassis and move the entire bracket forward so that the rubber cup presses firmly against the cone of the picture tube. Where an additional reinforcing bracket is used to hold the rear tube support to the high voltage power supply cage it will be necessary to remove the power supply cover and remove the mounting screws in the bracket prior to making the above adjustment. After the rear tube support bracket has been properly adjusted and the screws retightened the reinforcing bracket can be reassembled using another set of mounting holes on the side of the power supply cage which will maintain a firm pressure of the rubber cup against the cone of the picture tube.

Note A - The mid-point of the fine tuning range is attained when the point of the bakelite cam (which is attached to the fine tuning control) faces directly downward.)



Check of Horizontal Oscillator Alignment

(Any adjustments or check of horizontal oscillator alignment should be made after a fifteen to thirty minute chassis warm-up period.)

Obtain a test pattern and turn the horizontal hold control to the extreme clockwise position. The picture should remain in synchronization or shift slightly to the right with the blanking bar becoming visible. The blanking bar may be unstable and move from side to side. Turn hold control counter-clockwise and the picture should remain in synchronization unless the signal is weak and in which case 3 or 4 bars may be seen sloping downward to the left.

If the receiver behaves in this manner and the test pattern is normal and stable, the horizontal oscillator is properly adjusted. Skip the "Adjustment of Horizontal Oscillator" and proceed with Height and Vertical Linearity adjustments.

Horizontal Oscillator

The horizontal oscillator is adjusted at the factory to provide the wave shape shown on the following page and normally can be adjusted by means of the horizontal frequency threaded brass screw (L16) at rear of chassis, and by means of the horizontal lock trimmer (C57).

(a) Turning the horizontal lock trimmer (C57) clockwise decreases the range of the horizontal hold control, and turning the trimmer counter-clockwise increases the range of the hold control. Normal setting is about one turn counter-clockwise from the tight position. In "Fringe" or weak signal areas the trimmer may be set two turns counter-clockwise from the tight position resulting in somewhat better range on the hold control.

(b) Turning the horizontal frequency screw (L16) clockwise lowers the frequency, (bars sloping downward to left). Turning the screw counter-clockwise increases frequency (bars sloping downward to right).

Adjustment of Horizontal Oscillator (with the use of an oscilloscope)

1) Allow set to warm up to operating temperature. Select station operating normally.
2) Connect vertical input lead of oscilloscope to terminal "C" of horizontal oscillator transformer (TR-2294) and ground oscilloscope to chassis. Set frequency of scope to approximately 5 KC.
3) Set horizontal lock trimmer (C57) one turn from tight.
4) Short terminals "C" & "D" on TR-2294 by means of clip lead.
5) **Set horizontal hold control at maximum clockwise rotation.**
6) **Adjust horizontal frequency screw (L16) until picture falls into sync. Then turn screw slightly counter-clockwise until blanking bar shows, or three or four bars show sloping downward to right.**
7) **Remove short from terminals "C" & "D" of TR-2294 and adjust screw (L17) at terminal end of TR-2294 (under chassis) until wave shape as observed on scope is like that shown in sketch.**

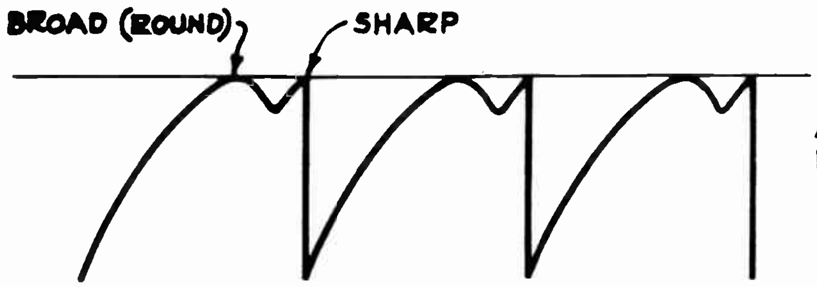
NOTE: Due to variations in oscilloscope input characteristics it may be necessary to insert a 50,000 ohm resistor in the vertical input lead. This will prevent the loading of the scope from affecting the frequency of the horizontal circuit.

8) **Some further adjustment of horizontal frequency screw (L16) may be necessary to keep picture in sync while L17 is being adjusted for proper wave shape.**
9) **Remove scope from terminal "C".**
10) **Turn horizontal hold control through entire range. Picture should remain in sync except in clockwise position when "blanking bar" will appear, or two or three bars will show sloping downward to the right.**
11) **If picture falls out at left or condition described in "10" is not obtained, adjust horizontal frequency screw (L16) slightly. Observe paragraphs "a" & "b" under "Horizontal Oscillator"**

NOTE: Some manufacturers types of 6SN7GT may perform better than others in the horizontal oscillator socket and excessive drift of the horizontal oscillator circuit may be caused by a weak or defective 6SN7GT tube.

After the horizontal oscillator circuit has been adjusted in the manner outlined above, any subsequent touch-up may be made with the horizontal frequency screw L16.

Caution: It is important that the picture be centered in the mask properly with the horizontal hold control in the mid-position, otherwise the set user may attempt to center the picture by means of the hold control. Under this condition the control may be on "edge" and impulse noise or change of camera will cause the picture to fall out of synchronization.



ADJUST L17 FOR EQUAL HEIGHTS OF ROUND AND SHARP PORTIONS OF PULSE.

Height and Vertical Linearity Adjustments:

Adjust the height control until the picture fills the mask vertically. Adjust vertical linearity until the test pattern is symmetrical from top to bottom.

Adjustment of one control will require readjustment of the other. Then adjust focus coil lever to align the picture within the mask.

Width, Drive and Horizontal Linearity:

Turn the width control L19 (accessible through a hole in the rear of chassis) clockwise until the picture fills the entire width of the tube. Adjust the trimmer "horizontal drive" C67 (rear of chassis) to give the best degree of brightness and linearity. Adjust the horizontal linearity control L18 (rear of chassis) for best linearity of the right half of the picture. Readjust the width control until the picture fills the mask and again adjust the focus coil lever to align the picture within the mask.

NOTE: It is advisable to adjust both the height and width of the picture to a size slightly larger than the mask opening so that during periods of low line voltage or subsequent aging of tubes adequate deflection to fill the mask opening is obtained.

IMPORTANT:

The horizontal oscillator frequency must be checked for proper range of horizontal hold control after any adjustment of horizontal drive (C67) and horizontal lock (C57) trimmers. Some interaction is present between these trimmers and any adjustment of either one will usually require resetting of the horizontal frequency adjustment screw (L16).

FOCUS:

Adjust the focus control for maximum definition of the vertical wedge of the test pattern and uniform focus over face of picture tube.

Sensitivity Switch

A two-position switch is provided at the rear of the chassis for increasing the gain of the receiver which may be required for proper operation in fringe areas. Where sound and picture reception is weak with the sensitivity switch set in LOCAL position, switching to "FRINGE" position will improve the performance of the receiver.

Phono-Television Switch

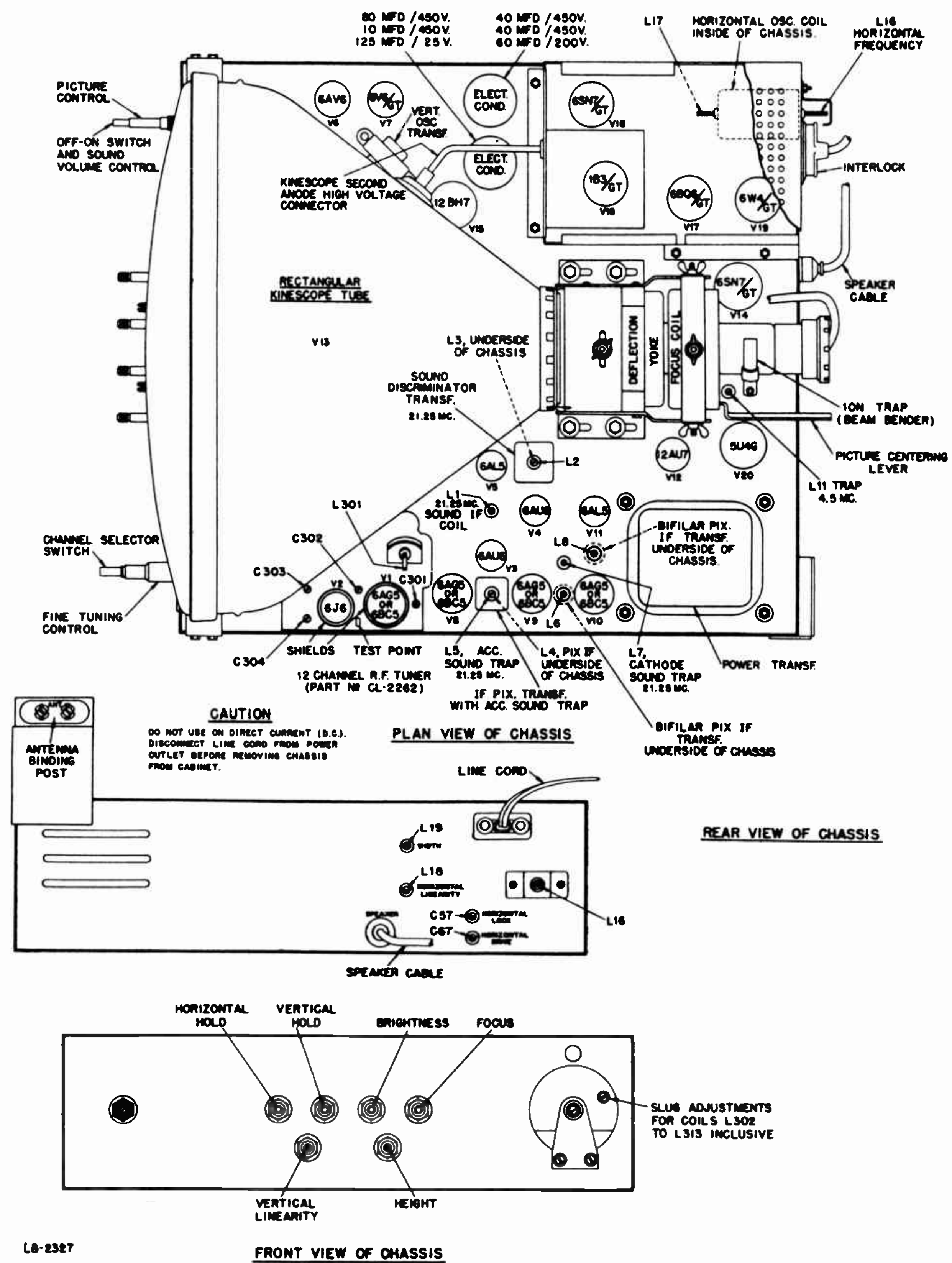
A two-position slide switch is provided at the rear of the chassis together with a pick-up socket for plug-in of an external record changer.

Built-In Antenna

All models are equipped with a built-in antenna which will provide satisfactory ...eption in many locations. In areas of weak reception an outside antenna will substan... improve the performance of the receiver. An antenna post is provided at the rear of ...is and is accessible through the opening in the masonite back to permit the con... ...n outside aerial. The built-in antenna is normally connected to the antenna ...ust be disconnected when attaching the outside aerial. To prevent the lead-in ...e built-in antenna from contacting chassis parts and tubes it is recommended that the lead-in wire be folded and held in place by tape or a rubber band. In some cases reception can be improved by changing the location of the receiver in the room.

Note: The text in this manual applies to television receivers wired in accordance with enclosed schematic diagram DG-2346-1.

TUBE AND TRIMMER LAYOUT



rouble: Fuse blows on line voltage surge, etc. resulting in small picture, fold over on both sides and damping bars.
Remedy: Remove fuse from present circuit and then remove green lead from terminal #1 on TR-2293 horizontal output transformer and connect to #8. Connect fuse between #8 and #1. Remove yellow wire from #8 and connect to #7. Dress fuse away from high voltage terminals.

Trouble: Insufficient width.
Remedy: Connect an .05-400 volt condenser across width control (terminals #5 and #6 on transformer). In severe cases of low line voltage, etc. a .1-400 condenser may be used. Change 6BQ6GT.

Trouble: Vertical retrace lines visible at low contrast. May be due to low transmitter sync level, or variations in picture tube characteristics.
Remedy: Connect .05-600 volt condenser from green lead of vertical output transformer (TR-2189) to yellow lead (pin #11 V13 Kinescope). These leads run to adjacent tie points on terminal strip near vertical output transformer.

Trouble: Beat interference, hash in picture or sound, or separation of sound and picture on high band. Oscillation in sound I.F.
Remedy: Ground cathode resistor (R1 150 ohms) directly to center shield of V3 socket 1st sound IF amplifier, instead of terminal strip ground. Connect 1500 mmf ceramic condenser between pin #7 cathode and socket center shield. Check alignment of sound IF, sound traps, and distriminator.

1. Tube Changes
Due to the critical shortage of 12AU7 tubes, the first and second video amplifier V12 will at times be replaced by a 6SN7GT tube. Due to inability to obtain adequate supplies of 12BH7 tubes, the vertical oscillator tube V15 is now being replaced by a 6SN7GT and all further production will use the latter type of tube.

2. Circuit Change
Condenser No. C18 .01/600 volts is being returned to the 6V6 screen, pin #4 instead of ground to reduce possibility of voltage breakdown.
Resistor No. R50, 6.8 Meg. going to the vertical hold control is not being used in all sets. It is often eliminated for better range of the vertical hold control.

3. Horizontal Tearing (Defective Parts)
If tearing occurs, especially in fringe areas resulting in a distorted picture, when contrast control is advanced, check for a short, leaky or open .05 condenser (C37) and low capacity in 220 MMF mica condenser (C38).

4. Color Converter
A color converter socket is now being wired in on the rear of the chassis for use with color converters -- when available.

5. Underwriters' Changes
In accordance with U/L requirements, a 120,000 ohm 1 watt resistor is being placed across condenser C48 in the primary of the power transformer -- connecting one side of the A.C. line to ground.

6. Picture Width
To increase picture width for low line voltage areas, a .05/600 W.V. paper condenser is now used on all models across terminals 5 and 6 of the flyback transformer TR-2293.

7. Vertical Height
To improve vertical height, try replacing the vertical output tube V15 which may be either a 6SN7GT or a 12BH7. As noted in paragraph one, both 6SN7GT and 12BH7 have been used in V15 socket.
Due to resistor shortages, R55 and R56, 3300 ohms each respectively in series have been replaced on some receivers by one 6500 ohm 5 watt wire wound resistor. To obtain increased height where R55 and R56 are used, short out either one of them. Where a 6500 ohm resistor is used, shunt another 6500 ohm 2 to 5 watt resistor across the present one or replace it by a 3300 ohm 2 watt resistor.

8. Width Control
Due to the scarcity of power transformers, Olympic Part No. TR-1966, it has been necessary to substitute another specification TR-1688 giving slightly lower B+ voltages. On all models where TR-1688 have been substituted and to secure sufficient width, the width control has been removed from the circuit by connecting both width control leads to terminal #1 of the 6BQ6GT tube. (V17 socket).
If it is necessary to reduce the width of the picture, restore connections of the width control by re-wiring to terminals 5 and 6 of the flyback transformer.

9. Vacuum Tubes
It appears that component parts manufacturers standards have been appreciably lowered lately. Therefore -- always check tubes first in case of performance and operation troubles. Some manufacturers types are better than others especially in 6BQ6 and 6SN7 types.

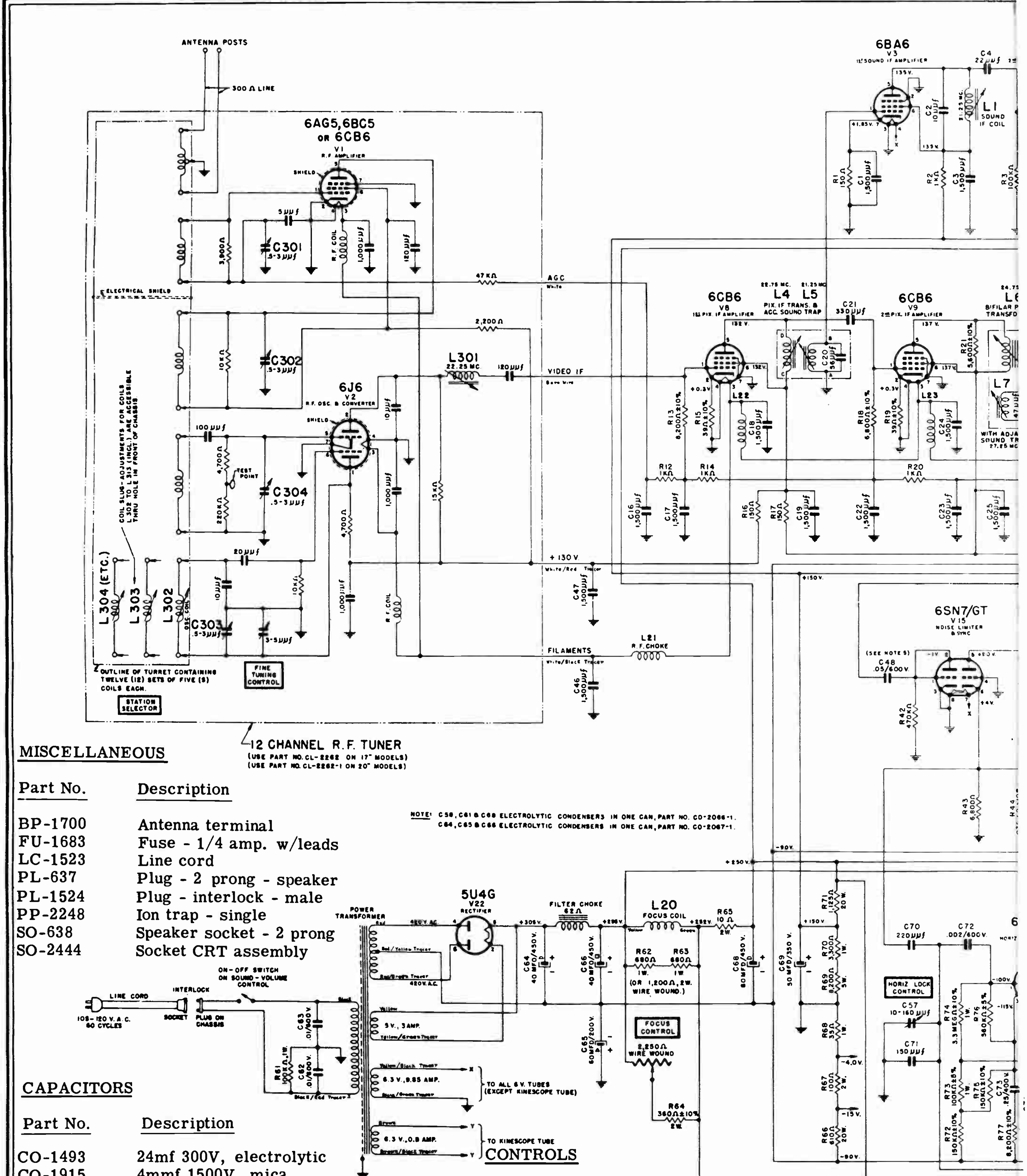
10. Resistors
Because of the critical shortage of this item, we and other manufacturers are compelled to develop new sources of supply even using resistors of foreign manufacture. While foreign resistors are properly rated as to wattage and resistance, the majority of them are of the un-insulated type. In production, these resistors are dressed away from contact with other parts. Transportation shock may cause them to shift, causing shorts. In case of trouble, check for short circuits and re-dress resistors so that they do not touch adjacent parts or components.

11. Horizontal Tearing (Modification)
When tearing of picture occurs at high or medium contrast control setting, R36 1000 ohm should be reduced to 700 or 800 ohms. When tearing or distortion occurs at low contrast setting R36 is too low and should be increased to 1200 ohms.

Production Changes

Pix Width: R76 56,000 ohm 1 watt resistor changed to 22,000 ohm ±20% 1 watt.

Pix Height: R55 and R56 3,300 ohm 2 watt, (actually 6500 ohm 10 watt in production) replaced by one 3300 ohm 2 watt. A parallel resistor combination may be used as an equivalent of a 3300 ohm 2 watt resistor.



MISCELLANEOUS

Part No.	Description
BP-1700	Antenna terminal
FU-1683	Fuse - 1/4 amp. w/leads
LC-1523	Line cord
PL-637	Plug - 2 prong - speaker
PL-1524	Plug - interlock - male
PP-2248	Ion trap - single
SO-638	Speaker socket - 2 prong
SO-2444	Socket CRT assembly

CAPACITORS

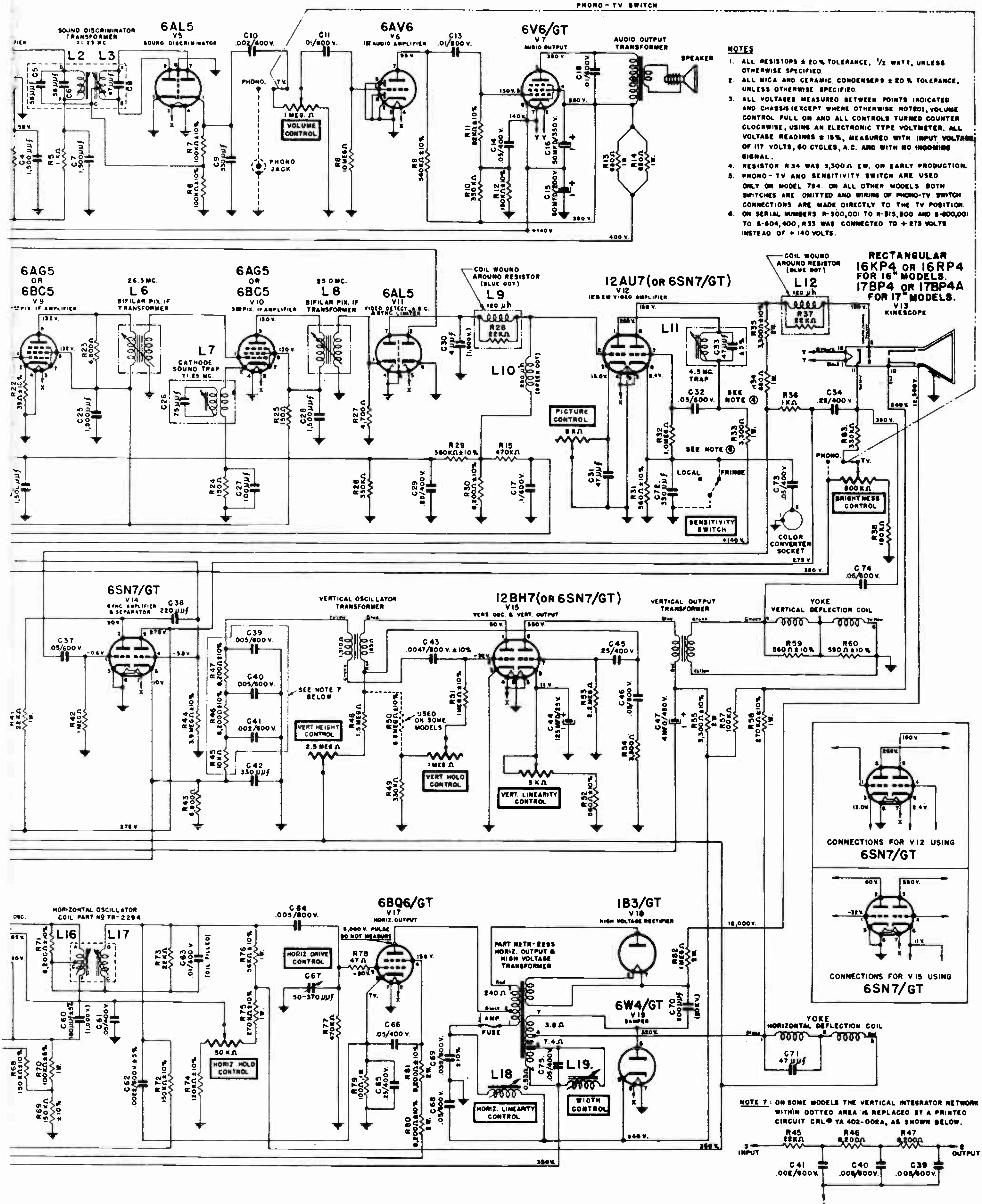
Part No.	Description
CO-1493	24mf 300V, electrolytic
CO-1915	4mmf 1500V, mica
CO-2066-1	80/450V, 10/450V, 125/25V, elect. w/cardboard shield
CO-2067-1	40/450V, 40/450V, 60/200V, elect. w/cardboard shield
CO-2266	500mmf 20KV
CO-2344	50/350V, electrolytic
CT-2261	10-160mmf, 50-370mmf, trimmer
PC-2435	Vertical inter. network

CONTROLS

Part No.	Description
PT-2267	Control - volume (5000), contrast (1 meg)
PT-2268	Control - horiz. hold (50K)
PT-2269	Control - vertical hold (1 meg)
PT-2270	Control - brilliance (1/2 meg)
PT-2271	Control - vertical linearity (5000Ω)
PT-2272	Control - height (2 1/2 meg)
PT-2273	Control - focus(2250Ω)

RESIST

Part No
RE-150
RE-150

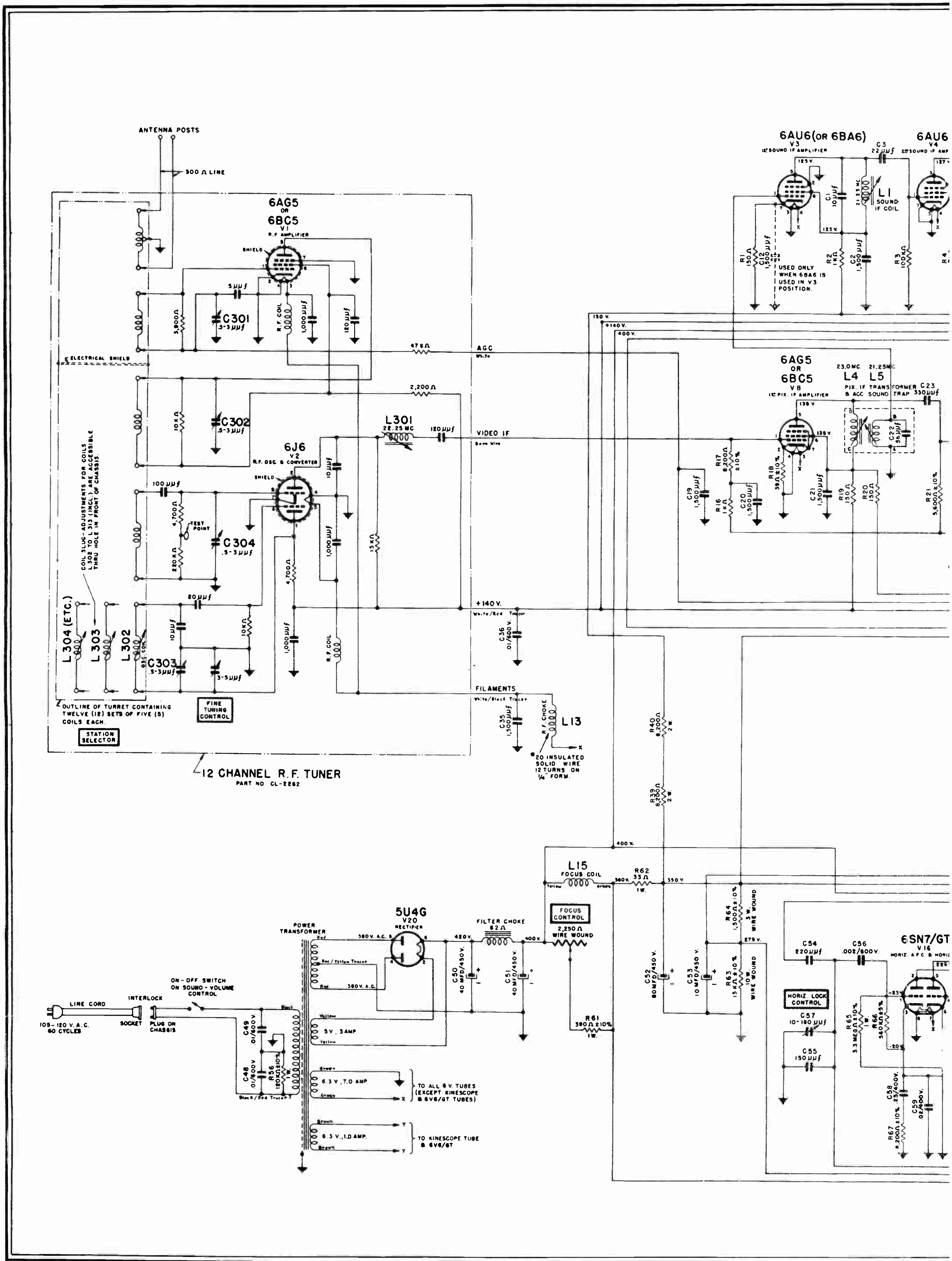


NOTES

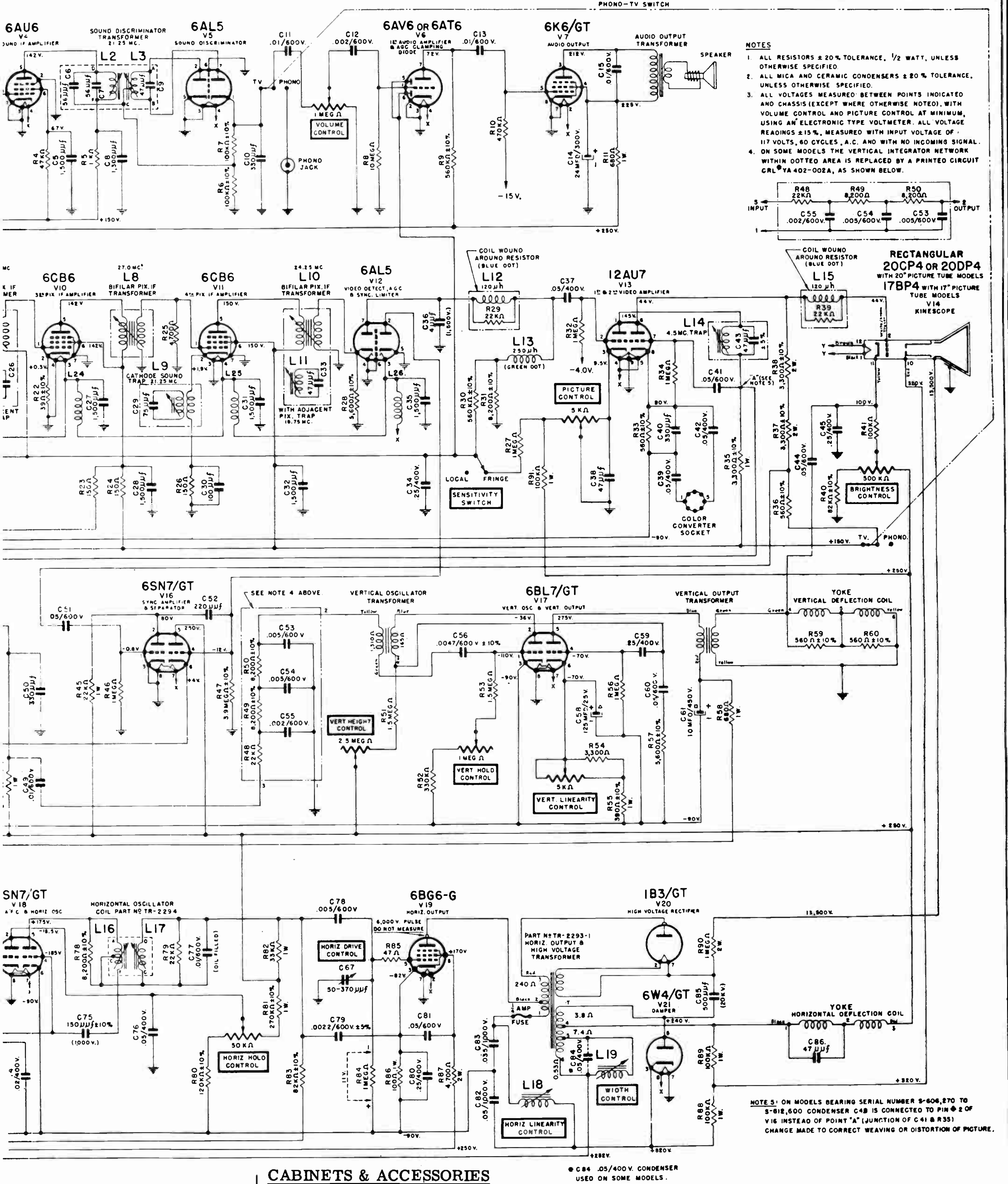
1. ALL RESISTORS ± 20% TOLERANCE, 1/2 WATT, UNLESS OTHERWISE SPECIFIED.
2. ALL MICA AND CERAMIC CONDENSERS ± 20% TOLERANCE, UNLESS OTHERWISE SPECIFIED.
3. ALL VOLTAGES MEASURED BETWEEN POINTS INDICATED AND CHASSIS (EXCEPT WHERE OTHERWISE NOTED), VOLUME CONTROL FULL ON AND ALL CONTROLS TURNED COUNTER CLOCKWISE, USING AN ELECTRONIC TYPE VOLTMETER. ALL VOLTAGE READINGS ± 15%, MEASURED WITH INPUT VOLTAGE OF 117 VOLTS, 60 CYCLES, A.C. AND WITH NO INCOMING SIGNAL.
4. RESISTOR R34 WAS 3,300Ω 2W. ON EARLY PRODUCTION.
5. PHONO-TV AND SENSITIVITY SWITCH ARE USED ONLY ON MODEL 784. ON ALL OTHER MODELS BOTH SWITCHES ARE OMITTED AND WIRING OF PHONO-TV SWITCH CONNECTIONS ARE MADE DIRECTLY TO THE TV POSITION.
6. ON SERIAL NUMBERS R-500,001 TO R-515,800 AND S-600,001 TO S-604,400, R33 WAS CONNECTED TO + 275 VOLTS INSTEAD OF + 140 VOLTS.

NOTE 7: ON SOME MODELS THE VERTICAL INTEGRATOR NETWORK WITHIN DOTTED AREA IS REPLACED BY A PRINTED CIRCUIT CRL® TA 402-002A, AS SHOWN BELOW.

DG-2346-2



ANTENNA POSTS
300 Ω LINE
6AG5 OR 6BC5 V1 R.F. AMPLIFIER
6J6 V2 R.F. OSC. & CONVERTER
C301
C302
C303
C304
L301
L302
L303
L304 (ETC.)
AGC
VIDEO IF
+140 V.
FILAMENTS
L13
12 CHANNEL R.F. TUNER
PART NO. CL-2262
STATION SELECTOR
FINE TUNING CONTROL
OUTLINE OF TURRET CONTAINING TWELVE (12) SETS OF FIVE (5) COILS EACH.
COIL SLUG-ADJUSTMENTS FOR COILS L302 TO L313 (INCL.) ARE ACCESSIBLE THRU HOLE IN FRONT OF CHASSIS.
*20 INSULATED SOLID WIRE 12 TURNS ON 1/4" FORM.
6AU6 (OR 6BA6) V3 1ST SOUND IF AMPLIFIER
6AU6 V4
L1 SOUND IF COIL
USED ONLY WHEN 6BA6 IS USED IN V3 POSITION.
6AG5 OR 6BC5 V8 1ST PIX. IF AMPLIFIER
L4 L5
PIX. IF TRANSFORMER & ACC SOUND TRAP
L15 FOCUS COIL
FOCUS CONTROL
5U4G V20 RECTIFIER
POWER TRANSFORMER
FILTER CHOKE
6SN7/GT V16
HORIZ. LOCK CONTROL
LINE CORD
INTERLOCK
SOCKET
PLUG ON CHASSIS
105-120 V.A.C. 60 CYCLES
ON-OFF SWITCH ON SOUND-VOLUME CONTROL
5V., 3 AMP.
6.3 V., 7.0 AMP.
TO ALL 6V. TUBES (EXCEPT KINESCOPE & 6V6/GT TUBES)
6.3 V., 1.0 AMP.
TO KINESCOPE TUBE & 6V6/GT



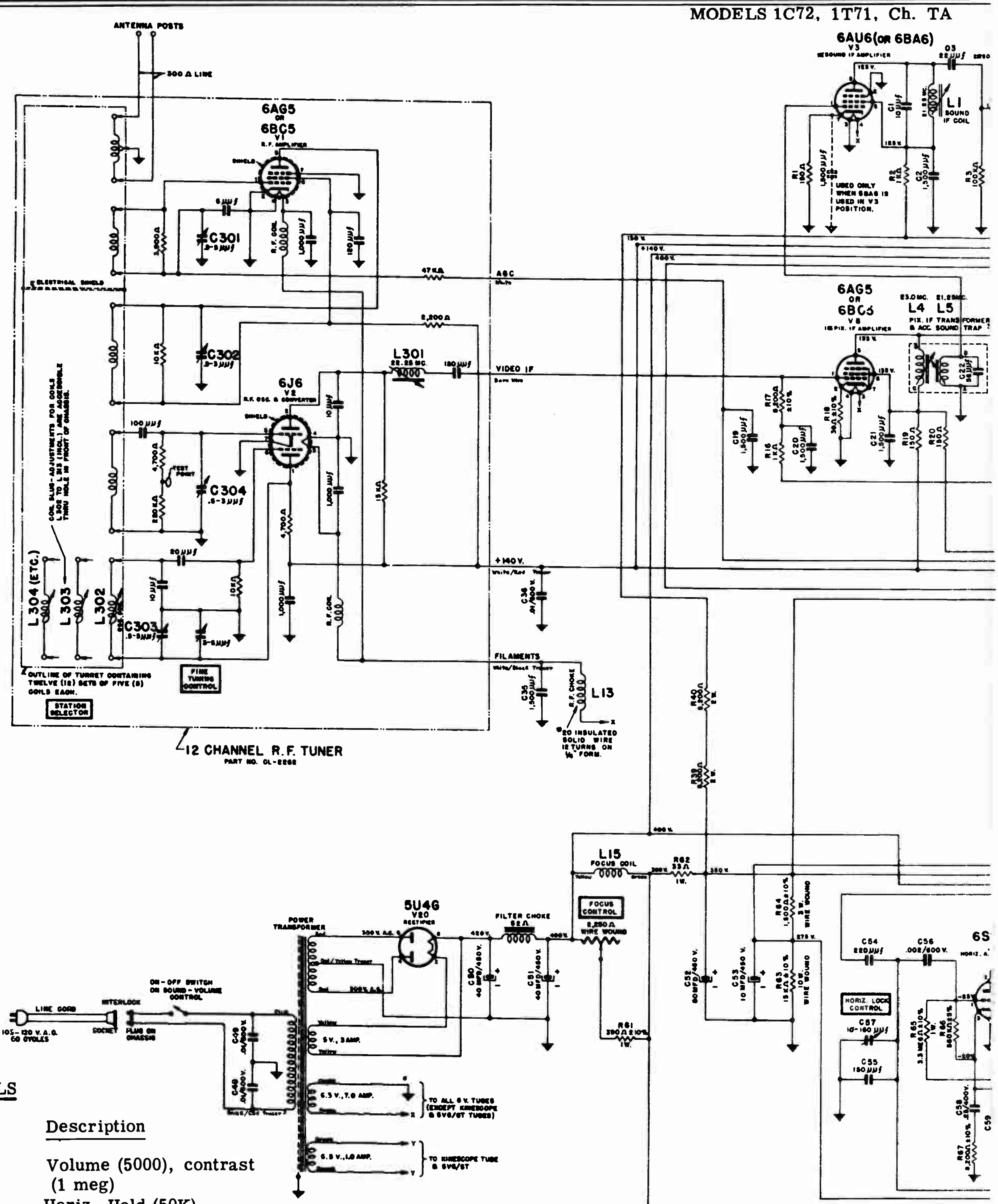
...ORS

...	Description
4	8200/35/100Ω, vol. div.
5	1125/610Ω, vol. div.

CABINETS & ACCESSORIES

Part No.	Description
CA-2422	Cabinet - console w/full doors
KN-2545	Knob - blonde chan. selec.
KN-2546	Knob - blonde fine tuning
KN-2547	Knob - blonde volume
KN-2548	Knob - blonde contrast cont.
LP-2353	TV antenna loop
PP-2414	Safety glass - decorated 20"
PP-2421	Mask
SK-1789-1	Speaker - 10" PM

DG-2522



CONTROLS

Part No.	Description
PT-2267	Volume (5000), contrast (1 meg)
PT-2268	Horiz. Hold (50K)
PT-2269	Vertical Hold (1 meg)
PT-2270	Brilliance (1/2 meg)
PT-2271	Vertical linearity (5000 ohms)
PT-2272	Height (2 1/2 meg)
PT-2273	Focus (2250 ohms)

RESISTORS

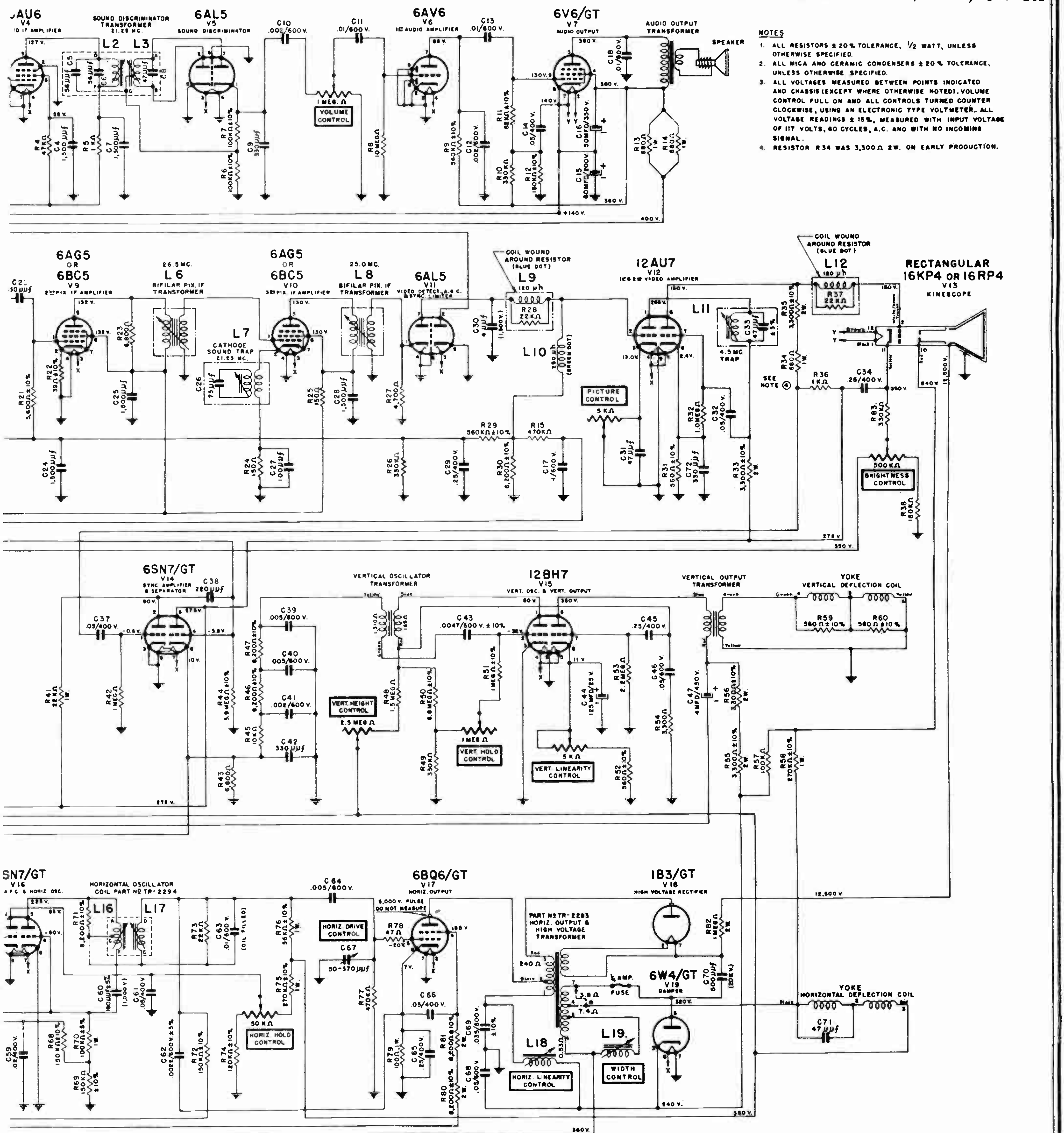
Part No.	Description
RE-2084	Vol. div. 15000/1500 ohms
RE-2627	3300 ohms 10w

CABINETS AND ACCESSORIES

Part No.	Description
CA-2236	Cabinet - table
CA-2240	Cabinet - table
GL-2030	Grille
KN-2295-1	Knob - mohog. channel selector
KN-2296	Knob - mahog. fine tuning
KN-2297-1	Knob - mahog. volume control
KN-2298	Knob - mahog. contrast control
KN-2545	Knob - blonde chan. selector

KN-2546
KN-2547
KN-2548
LP-2353
MP-2303-1
MP-2304-1
PP-2242
PP-2244
PP-2245
SK-1788-1
ST-2223
ST-2235-1

MODELS 1C72, 1T71, Ch. TA



NOTES

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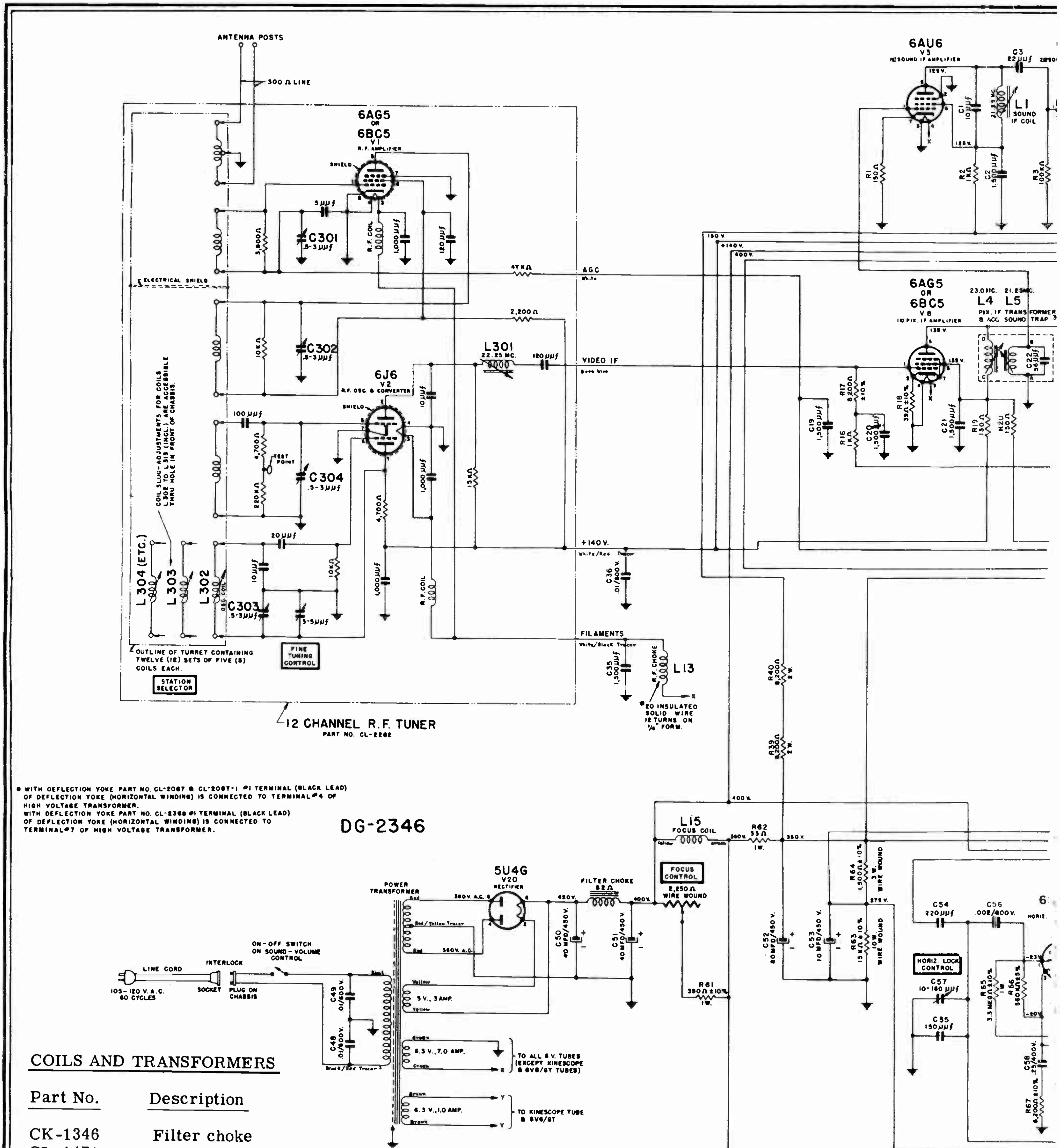
4. RESISTOR R34 WAS 3,300Ω 2W. ON EARLY PRODUCTION.

VHF antenna strips for
Standard Coil Tuners
VHF oscillator strips for
Standard Coil Tuners

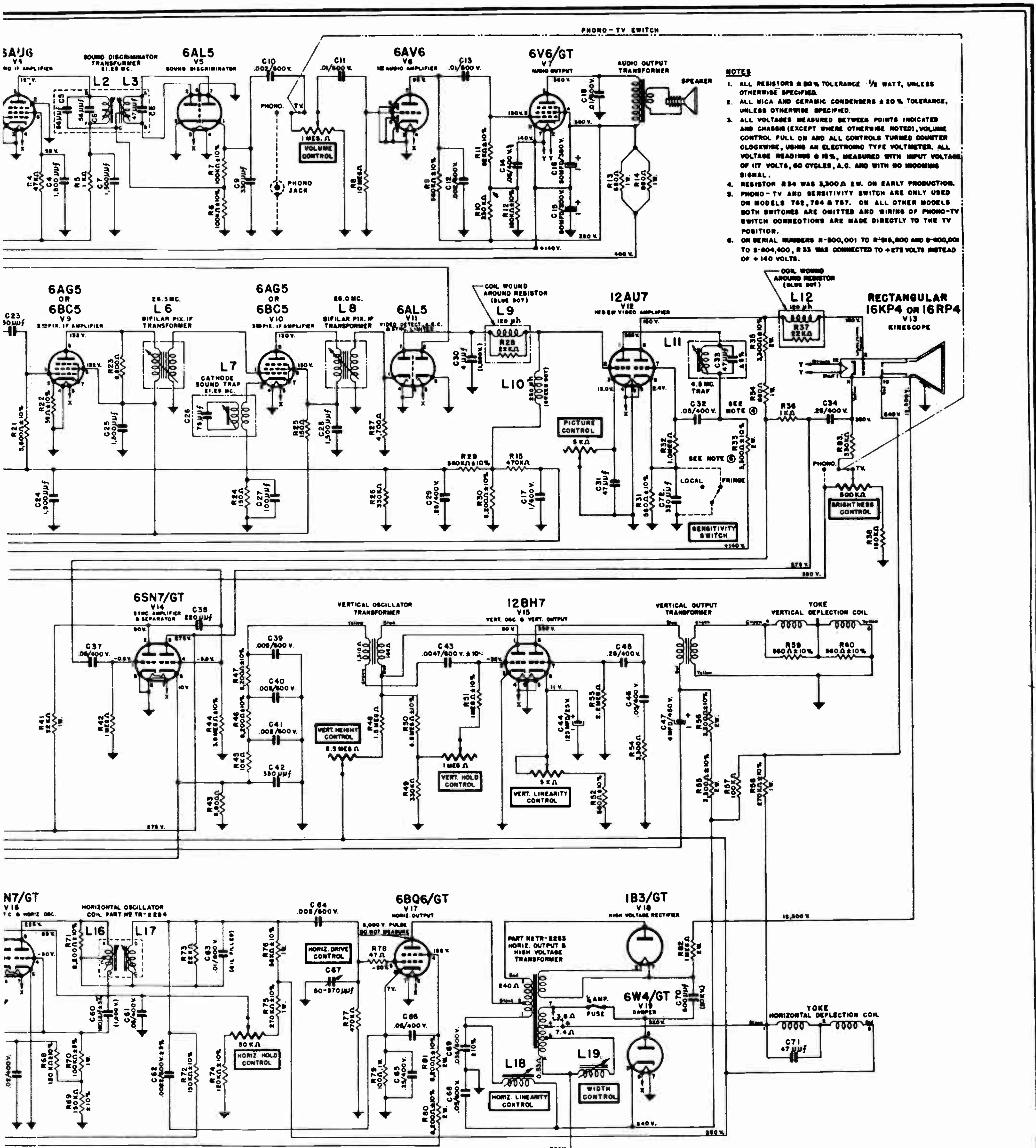
CAPACITORS

Part No.	Description
CO-1056	4mf, 450V, electrolytic
CO-1915	4mmf 1500V, mica
CO-2066	80/450V, 10/450V, 125/25V, elec.
CO-2067	40/450V, 40/450V, 60/200V, elec.
CO-2266	500mmf 20KV
CO-2344	50/350V, electrolytic
CO-2560	20/450V, electrolytic
CT-2261	10-160mmf & 50-370mmf, trimmer
PC-2435	Vertical inter. network



COILS AND TRANSFORMERS

Part No.	Description
CK-1346	Filter choke
CL-1471	Sound IF coil
CL-1472	Cathode sound trap w/75mmf cond.
CL-1502	Width control
CL-1503	Horiz. lin. control
CL-1535	Peaking coil 36μh (black dot)
CL-1536	Peaking coil 120μh (blue dot)
CL-2073	Peaking coil 250μh (green dot)
CL-2087-1	Deflection yoke 70^{o}
CL-2262	Tuner - standard coil
CL-2300	Focus coil
CL-2309	Pix IF transformer
CL-2331	Sound coil 4.5 mc trap
CL-2427	Filament choke (RF)
TR-1469	Transformer - disc.
TR-1473	Transformer - vert osc.
TR-1506	Transformer - audio output
TR-1966	Transformer - power
TR-2117	Transformer - pix IF w/adj. sound trap
TR-2189	Transformer - vert. output
TR-2293	Transformer - flyback
TR-2294	Transformer - horiz. osc.
	UHF osc./ant. strips (pair) for Standard Coil Tuners



* WITH DEFLECTION YOKE PART NO. CL-2087 & CL-2087-1 #1 TERMINAL (BLACK LEAD) OF DEFLECTION YOKE (HORIZONTAL WINDING) IS CONNECTED TO TERMINAL #4 OF HIGH VOLTAGE TRANSFORMER.
WITH DEFLECTION YOKE PART NO. CL-2366 #1 TERMINAL (BLACK LEAD) OF DEFLECTION YOKE (HORIZONTAL WINDING) IS CONNECTED TO TERMINAL #7 OF HIGH VOLTAGE TRANSFORMER.

DG-2346-1

Knob - blonde fine tuning
Knob - blonde volume
Knob - blonde contrast cont.
TV antenna loop
Escutcheon - plastic
Door - plastic
Safety glass
Mask - 16"
Mask - 17"
Speaker - 5" PM
Back
Back

MISCELLANEOUS

Part No.	Description
BP-1700	Antenna terminal
FU-1683	Fuse - 1/4 amp. w/leads
LC-1529	Line cord
PL-637	Plug - 2 prong - speaker
PL-1524	Plug - Interlock - male
PP-2248	Ion trap - single
PP-2352	Sec. anode conn.
SO-638	Speaker socket - 2 prong

All chassis are provided with a sensitivity switch and a phono-TV switch with phonojack.

NOTE: Both 17" and 20" rectangular glass picture tubes are used. They require different mechanical mountings and mask and therefore are not interchangeable. When replacing tubes in service use identical tube sizes.

Electrical and Mechanical Specifications

Radio Frequency Ranges

Channel Number	Channel Freq. MC	Picture Carrier Freq. MC	Sound Carrier Freq. MC	Receiver RF Osc. Freq. MC
2	54-60	55.25	59.75	81
3	60-66	61.25	65.75	87
4	66-72	67.25	71.75	93
5	76-82	77.25	81.75	103
6	82-88	83.25	87.75	109
7	174-180	175.25	179.75	201
8	180-186	181.25	185.75	207
9	186-192	187.25	191.75	213
10	192-198	193.25	197.75	219
11	198-204	199.25	203.75	225
12	204-210	205.25	209.75	231
13	210-216	211.25	215.75	237

Power Supply ---------------------------- 105-125 volts 60 cycles 230 watts
Speaker ---------------------------- 5" PM 1.0 oz. Alnico 5
Speaker ---------------------------- 8" PM 2.15 oz. Alnico 5
Speaker ---------------------------- 10" PM 3.16 oz. Alnico 5
Voice Coil Impedance -------------------- 3.2 ohms at 400 cycles
Receiver Antenna Input Impedance ---------- 300 ohms balanced

Tube Complement		Function
1) 6AG5, 6BC5 or 6CB6	(V1)	RF Amplifier
2) 6J6	(V2)	RF Oscillator and Converter
3) 6BA6	(V3)	1st Sound IF Amplifier
4) 6AU6	(V4)	2nd Sound IF Amplifier and Driver
5) 6AL5	(V5)	Sound Discriminator
6) 6AV6 or 6AT6	(V6)	1st Audio Amplifier & AGC Clamping Diode
7) 6K6GT	(V7)	Audio Output
8) 6CB6	(V8)	1st Pix and Sound IF
9) 6CB6	(V9)	2nd Pix IF Amplifier
10) 6CB6	(V10)	3rd Pix IF Amplifier
11) 6CB6	(V11)	4th Pix IF Amplifier
12) 6AL5	(V12)	Video Detector, Automatic Gain Control and Sync Limiter
13) 12AU7	(V13)	1st and 2nd Video Amplifier
14) 17BP4/17BP4A 20CP4/20DP4	(V14)	Kinescope (Picture Tube)
15) 6SN7GT	(V15)	Noise Limiter & Vertical Sync Amplifier
16) 6SN7GT	(V16)	Sync Amplifier and Separator
17) 6BL7GT	(V17)	Vertical Oscillator and Vertical Output
18) 6SN7GT	(V18)	Horizontal Oscillator and AFC
19) 6BG6G	(V19)	Horizontal Output
20) 1B3GT	(V20)	High Voltage Rectifier
21) 6W4GT	(V21)	Damper
22) 5U4G	(V22)	Power Supply Rectifier

Picture Intermediate Frequencies

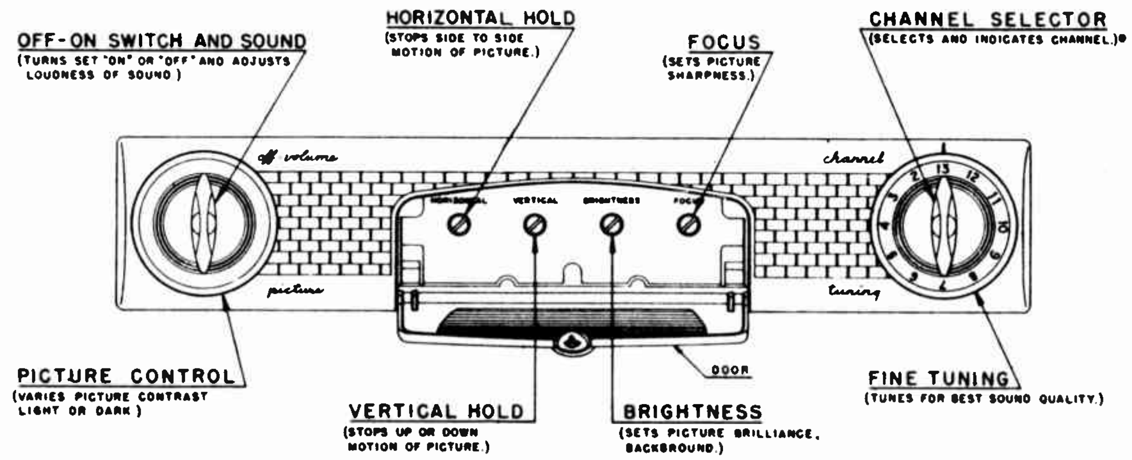
Picture Carrier Frequency ------------- 25.75 MC
Accompanying Sound Traps ------------- 21.25 MC

Sound Intermediate Frequencies

Sound Carrier Frequency --------------- 21.25 MC
Sound discriminator band width (between peaks) --- 350 KC

Operating Controls (front panel)

Channel Selector } Dual Control Knobs
Fine Tuning
Power Switch and Volume } Dual Control Knobs
Contrast (Picture) Control
Horizontal Hold -------------------- Single Control
Vertical Hold -------------------- Single Control
Brightness -------------------- Single Control
Focus -------------------- Single Control



Non-Operating Controls

Width ---------------- Rear screwdriver adjustment.
Height ---------------- Front chassis screwdriver adjustment.
Horizontal Linearity ------- Rear chassis screwdriver adjustment.
Vertical Linearity ------- Front chassis screwdriver adjustment.
Horizontal Drive --------- Rear chassis screwdriver adjustment.
Horizontal Oscillator Frequency
(Fine) ----------- Rear chassis screwdriver adjustment (L16).

Horizontal Oscillator Frequency (Wave Shape) - - - - - - - Bottom chassis screwdriver adjustment (L17).
Horizontal Locking Range - - - - Rear Chassis screwdriver adjustment.
Focus Coil - - - - - - - - - - - - - (Top chassis) lever adjustment for centering of raster.
Ion Trap Magnet - - - - - - - - - On neck of picture tube.
Deflection Coil - - - - - - - - - - - Top chassis wing screw adjustment.

ALIGNMENT

Equipment Required

1) RF signal generator to provide the following accurate frequencies. If the accuracy of the generator frequencies is not known, some type of crystal calibrator should be utilized to check the correct settings of the RF generator for each particular frequency.

(a) 4.5 MC Video Amplifier Trap

(b) IF Frequencies

19.75 MC	Adjacent Pix Trap
21.25 MC	Sound IF, Sound Discriminator and Sound Traps
22.25 MC	Converter Coil
22.5 MC	Marker Frequency
22.75 MC	First Pix IF Coil
24.25 MC	Fourth Pix IF Coil
24.75 MC	Second Pix IF Coil
25.75 MC	Picture Carrier Marker
27.0 MC	Third Pix IF Coil
27.25 MC	Adjacent Sound Trap

(c) RF Frequencies

Channel Number	Picture Carrier Freq. MC	Sound Carrier Freq. MC
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

(d) Output on these ranges should be adjustable and capable of providing at least .1 volt.

2) Electronic Voltmeter
3) Cathode Ray Oscilloscope, 3" minimum screen
4) RF Sweep Generator, meeting the following requirements:

(a) Frequency Ranges

18 to 30 MC.,	10 MC. sweep width
40 to 90 MC.,	10 MC. sweep width
170 to 225 MC.,	10 MC. sweep width

(b) Output adjustable to .1 volt.

The chassis may be removed from the cabinet with the kinescope tube in place and servicing and alignment work can be accomplished without removing the kinescope tube. This work is most conveniently performed by placing the chassis on its left side (power supply cage resting on work bench) and the controls facing the operator.

To remove chassis from cabinet remove
(1) Line cord from power outlet
(2) Masonite back
(3) Antenna Lead-in from terminal posts
(4) Speaker plug from rear of chassis
(5) Knobs from front of cabinet
(6) Four mounting screws and washers from bottom of cabinet

In sliding chassis out of cabinet be careful that the kinescope tube does not strike against cabinet or any other obstruction.

Order of Alignment

When complete receiver alignment is necessary it should be performed in the following sequence.

(1) Adjacent Channel Traps
(2) Accompanying Sound Traps
(3) Sound IF Transformers
(4) Sound Discriminator
(5) Pix IF Coils
(6) Retouch Pix IF Transformers
(7) 4.5 MC Trap

After removing chassis from cabinet, connect power and speaker plugs.

If a local station is not operating on channel #9 set the tuner to this channel, turn on power switch and proceed as follows: (If #9 is a local station channel use channel #8 or #10).

NOTE: Before proceeding with alignment set sensitivity switch in LOCAL position.

Picture IF Trap Adjustment

Insert 100,000 ohm resistor in series with hot lead of electronic voltmeter and connect to junction of peaking coils L12 & L13, with meter range switch set to lowest scale and observing polarity for negative readings.

Couple hot lead of RF Signal Generator to converter tube V2 by means of a loop consisting of two turns of insulated hook-up wire. Connect ground lead of RF Signal Generator to chassis.

NOTE: If the converter tube V2 is shielded - remove shield.

Refer to tube and trimmer layout drawing. Set the generator frequency accurately to 27.25 MC and adjust L7 adjacent sound trap for minimum reading on voltmeter. Set generator to 19.75 MC and adjust L11 adjacent pix trap for minimum reading on voltmeter.

Set the generator frequency accurately to 21.25 MC, and adjust L9 cathode sound trap (see tube and trimmer layout drawing) for minimum reading on voltmeter.

By means of a clip lead, short circuit condenser C29 on cathode trap.

Increase generator output to maximum (recheck 21.25 MC generator setting) and adjust L5 for minimum reading of voltmeter.

Sound IF Transformer Adjustment

Change hot lead connection of electronic voltmeter (with 100,000 ohm resistor connected in series) to terminal marked "C" of sound discriminator transformer. Reduce output of the signal generator to give approximately 2 volts reading on voltmeter scale.

Adjust L1 and L2 for maximum reading.

Sound Discriminator Adjustment

Change hot lead connection of voltmeter to pin #1 of V5 and adjust L3 for zero reading on voltmeter. This zero setting is very critical and the adjustment must be made with extreme care.

Repeat adjustments for L2 and L3 in the same manner indicated above.

Pix IF Coil Adjustment

Connect hot lead of voltmeter to pin #7 of V12 and adjust the following slugs for maximum output at frequencies and sequence indicated:

L301	22.25 MC
L4 (Bottom of Can)	22.75 MC
L6	24.75 MC
L8	27.0 MC
L10	24.25 MC

If oscillation occurs during alignment, temporarily raise frequency of L8 by turning screw counterclockwise until screw projects approximately 3/4". After properly adjusting L301, L4, L6 & L10 then set L8 to proper frequency. Oscillation is evidenced by high reading on voltmeter (-10v to -20v) with signal generator OFF and no signal coming in through the antenna terminals.

Retouch Pix IF Transformer Adjustment

Disconnect RF signal generator leads, replace V2 tube shield, connect hot lead of sweep generator through a 330 mmf condenser to test point on tuner and ground lead to chassis.

Connect vertical input terminal of oscilloscope to junction of peaking coils L12 and L13, and connect ground lead of scope to chassis.

Connect 3v. flashlight battery with positive terminal to chassis and negative terminal to junction of C34 (.25-400v) and R30 (560k). This point is origin of AGC bias voltage.

Set tuner to channel 9 unless local station is operating on this frequency, in which case an adjacent channel should be used.

Set sweep generator frequency to IF sweep on the 20 to 30 MC range.

Adjust sweep generator output to produce a curve on the scope which is approximately 2/3 of the screen diameter.

Loosely couple output of RF signal generator to hot lead of sweep generator and set frequency of RF signal generator to 25.75 MC (marker).

Curve shown on scope should be similar to the standard response curve shown on following page. (See note below). For proper setting of the pix carrier the 25.75 MC marker should appear on the curve at a point approximately 50% of the vertical height of the curve.

To obtain this setting retouch L6 and L8.

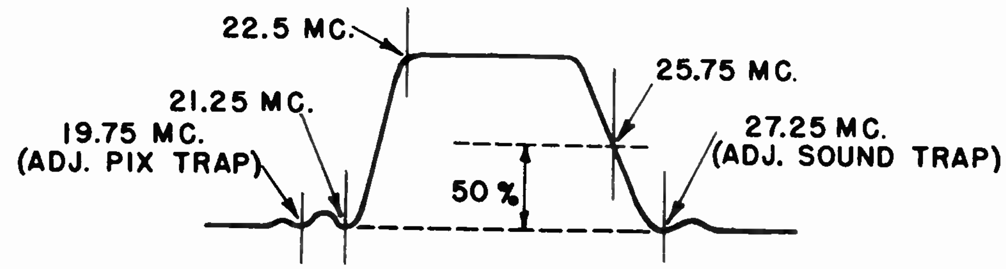
Reset RF signal generator frequency to 22.5 MC and retouch L301 and L4 for correct positioning of marker on shoulder of curve.

The curve may now be flat topped by first retouching L10 and then L6.

Recheck setting of 25.75 MC marker to make sure that position has not shifted on curve.

NOTE: To obtain increased sensitivity for fringe reception the response curve should be modified as shown on page 11.

Disconnect bias battery.



STANDARD RESPONSE CURVE

Note: If the curve cannot be made to appear as above due to a local station or other interference, or multiple markers appear, remove (V1)* 6BC5 RF tube from tuner.

4.5 MC TRAP ADJUSTMENT

Connect hot lead of 4.5 MC generator to pin #7 of V12 (6AL5) video detector tube, and ground lead to chassis.

Connect voltmeter lead to pin #7 of V13 (12AU7) video amplifier, and ground lead to chassis. Turn Picture Control full "ON" (clockwise).

Adjust L14 4.5 MC trap for minimum reading on voltmeter.

NOTE: If generator does not have sufficient output (1 volt at 4.5 MC), to provide indication on electronic voltmeter, adjust L14 by observing raster on screen of picture tube as follows:

Turn L14 "out" (counterclockwise) so that the 4.5 MC "beat" is observed on screen which will appear as if a fine meshed screen was superimposed on the raster. Turn L14 "in" clockwise until the beat disappears. Adjust Brightness and Focus controls for sharpest line definition. Do not turn trap further "clockwise" than is necessary to remove "beat" or picture quality will suffer.

Tuner Adjustments for Models using Tuner Part #CL-2262 and CL-2262-1

Note: Before making a complete tuner adjustment it is essential that the Sound I.F. and discriminator circuits be aligned at their proper frequencies as described above. WHEN CHANGING THE CONVERTER TUBE IT IS NECESSARY TO REALIGN THE OSCILLATOR ADJUSTMENT ON ALL CHANNELS WITH THE V2 TUBE SHIELD IN PLACE.

RF and Converter Alignment

1) Set channel selector switch to #12
2) Connect oscilloscope through 10,000 ohms to test point on tuner (bare tinned copper loop wire located between V1 and V2)
3) Set fine tuning control at approximate mid-point of its tuning range. Temporarily connect jumper wire from pin #7 of V12 to chassis.
4) Feed Sweep generator into antenna terminals, sweeping channel 12.
5) Adjust C301, C302, and C304 for flat top response curve. Check picture and sound carrier markers corresponding to frequencies shown on Page 2 for all respective channels.
6) Remove jumper from pin #7 of V12 to chassis.

* This may also be a 6AG5 or 6CB6

Oscillator Alignment

1) Set channel selector switch to #12
2) Connect signal generator to one antenna terminal and ground. Set to sound carrier frequency 209.75 MC.
3) Connect electronic voltmeter to pin #1 of V5 (6AL5) sound discriminator.
4) Adjust C303 for zero reading on electronic voltmeter between a positive and negative peak.
5) Check all channels for zero reading on voltmeter. It is usually not necessary to make any further adjustments. If it is found necessary to touch up the oscillator coils, the following procedure should be observed.

Oscillator Coil Touch-up

(a) Center fine tuning control, as described in Note A below.
(b) Place a non-metallic screwdriver through opening, and adjust oscillator coil on channel 12 (L312)
(c) Turn channel selector switch to channel 13 and adjust L313.
(d) This adjustment can be repeated for all channels or if necessary on any single channel.

ADJUSTMENTS

Ion Trap Magnet Adjustment

Turn the brightness control fully clockwise and the contrast control fully counter-clockwise. Adjust the ion trap magnet by moving it forward or backward and at the same time rotating it slightly around the neck of the kinescope until the raster on the screen is brightest. Reduce the brightness control setting until the raster is slightly above average brilliance. Adjust focus control until the line structure of the raster is clearly visible (sharp). Readjust the ion trap magnet again for maximum raster brilliance. The final touches on this adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained.

Focus Coil Adjustments:

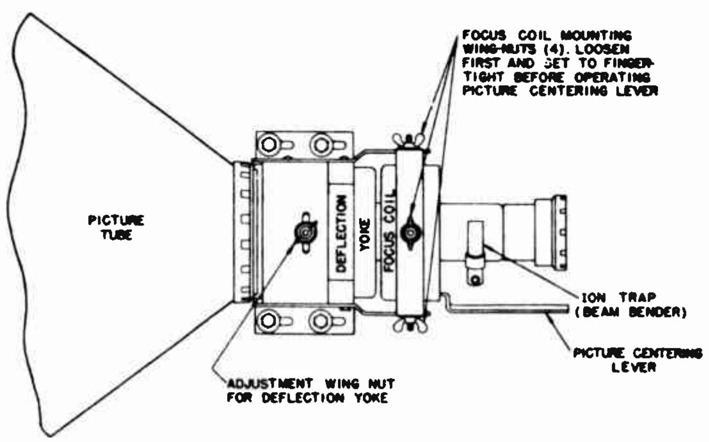
The focus coil is mounted within a frame to permit movement about its horizontal and vertical axis. The four wing nuts holding the focus coil to the frame are tightened at the factory to prevent movement during shipment. Upon installation of the receiver these wing nuts should be loosened and then adjusted finger tight. Centering of the picture within the mask is accomplished by gently moving the lever welded to the focus coil up and down or from left to right until the entire raster or picture is visible on the screen.

Deflection Yoke Adjustment:

If the lines of the raster are not horizontal or squared with the picture mask, loosen the deflection yoke adjustment screw and rotate the deflection yoke until this condition is obtained, and retighten the yoke adjustment screw.

If neck shadow is evident or the corners of the raster are dark, the deflection yoke must be moved forward as far as possible and the wing screw retightened. After observing that the picture tube is brought forward as far as possible to rest against the two tube stop brackets, loosen the four screws holding the rear tube support bracket to the chassis and move the entire bracket forward so that the rubber cup presses firmly against the cone of the picture tube. Where an additional reinforcing bracket is used to hold the rear tube support to the high voltage power supply cage it will be necessary to remove the power supply cover and remove the mounting screws in the bracket prior to making the above adjustment. After the rear tube support bracket has been properly adjusted and the screws retightened the reinforcing bracket can be reassembled using another set of mounting holes on the side of the power supply cage which will maintain a firm pressure of the rubber cup against the cone of the picture tube.

Note A - The mid-point of the fine tuning range is attained when the point of the bakelite cam (which is attached to the fine tuning control) faces directly downward.)



Check of Horizontal Oscillator Alignment

(Any adjustments or check of horizontal oscillator alignment should be made after a fifteen to thirty minute chassis warm-up period.)

Obtain a test pattern and turn the horizontal hold control to the extreme clockwise position. The picture should remain in synchronization or shift slightly to the right with the blanking bar becoming visible. The blanking bar may be unstable and move from side to side. Turn hold control counter-clockwise and the picture should remain in synchronization unless the signal is weak and in which case 3 or 4 bars may be seen sloping downward to the left.

If the receiver behaves in this manner and the test pattern is normal and stable, the horizontal oscillator is properly adjusted. Skip the "Adjustment of Horizontal Oscillator" and proceed with Height and Vertical Linearity adjustments.

Horizontal Oscillator

The horizontal oscillator is adjusted at the factory to provide the wave shape shown on the following page and normally can be adjusted by means of the horizontal frequency threaded brass screw (L16) at rear of chassis, and by means of the horizontal lock trimmer (C57).

(a) Turning the horizontal lock trimmer (C57) clockwise decreases the range of the horizontal hold control, and turning the trimmer counter-clockwise increases the range of the hold control. Normal setting is about one turn counter-clockwise from the tight position. In "Fringe" or weak signal areas the trimmer may be set two turns counter-clockwise from the tight position resulting in somewhat better range on the hold control.

(b) Turning the horizontal frequency screw (L16) clockwise lowers the frequency, (bars sloping downward to left). Turning the screw counter-clockwise increases frequency (bars sloping downward to right).

Adjustment of Horizontal Oscillator (with the use of an oscilloscope)

1) Allow set to warm up to operating temperature. Select station operating normally.
2) Connect vertical input lead of oscilloscope to terminal "C" of horizontal oscillator transformer (TR-2294) and ground oscilloscope to chassis. Set frequency of scope to approximately 5 KC.
3) Set horizontal lock trimmer (C57) one turn from tight.
4) Short terminals "C" and "D" on TR-2294 by means of clip lead.
5) Set horizontal hold control at maximum clockwise rotation.
6) Adjust horizontal frequency screw (L16) until picture falls into sync. Then turn screw slightly counter-clockwise until blanking bar shows, or three or four bars show sloping downward to right.
7) Remove short from terminals "C" & "D" of TR-2294 and adjust screw (L17) at terminal end of TR-2294 (under chassis) until wave shape as observed on scope is like that shown in sketch.

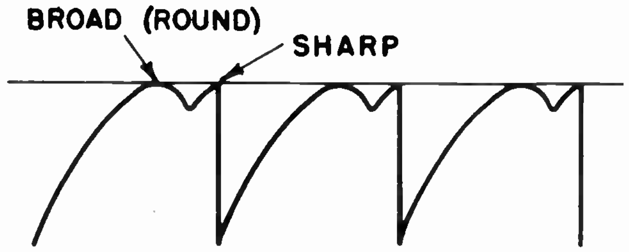
NOTE: Due to variations in oscilloscope input characteristics it may be necessary to insert a 50,000 ohm resistor in the vertical input lead. This will prevent the loading of the scope from affecting the frequency of the horizontal circuit.

8) Some further adjustment of horizontal frequency screw (L16) may be necessary to keep picture in sync while L17 is being adjusted for proper wave shape.
9) Remove scope from terminal "C".
10) Turn horizontal hold control through entire range. Picture should remain in sync except in clockwise position when "blanking bar" will appear, or two or three bars will show sloping downward to the right.
11) If picture falls out at left or condition described in "10" is not obtained, adjust horizontal frequency screw (L16) slightly. Observe paragraphs "a" & "b" under "Horizontal Oscillator"

NOTE: Some manufacturers types of 6SN7GT may perform better than others in the horizontal oscillator socket and excessive drift of the horizontal oscillator circuit may be caused by a weak or defective 6SN7GT tube.

After the horizontal oscillator circuit has been adjusted in the manner outlined above, any subsequent touch-up may be made with the horizontal frequency screw L16.

Caution: It is important that the picture be centered in the mask properly with the horizontal hold control in the mid-position, otherwise the set user may attempt to center the picture by means of the hold control. Under this condition the control may be on "edge" and impulse noise or change of camera will cause the picture to fall out of synchronization.



Height and Vertical Linearity Adjustments:

Adjust the height control until the picture fills the mask vertically. Adjust vertical linearity until the test pattern is symmetrical from top to bottom.

Adjustment of one control will require readjustment of the other. Then adjust focus coil lever to align the picture within the mask.

Width, Drive and Horizontal Linearity:

Turn the width control L19 (accessible through a hole in the rear of chassis) clockwise until the picture fills the entire width of the tube. Adjust the trimmer "horizontal drive" C67 (rear of chassis) to give the best degree of brightness and linearity. Adjust the horizontal linearity control L18 (rear of chassis) for best linearity of the right half of the picture. Readjust the width control until the picture fills the mask and again adjust the focus coil lever to align the picture within the mask.

NOTE: It is advisable to adjust both the height and width of the picture to a size slightly larger than the mask opening so that during periods of low line voltage or subsequent aging of tubes adequate deflection to fill the mask opening is obtained.

IMPORTANT:

The horizontal oscillator frequency must be checked for proper range of horizontal hold control after any adjustment of horizontal drive (C67) and horizontal lock (C57) trimmers. Some interaction is present between these trimmers and any adjustment of either one will usually require resetting of the horizontal frequency adjustment screw (L16).

FOCUS:

Adjust the focus control for maximum definition of the vertical wedge of the test pattern and uniform focus over face of picture tube.

Sensitivity Switch

A two-position switch is provided at the rear of the chassis for increasing the gain of the receiver which may be required for proper operation in fringe areas. Where sound and picture reception is weak with the sensitivity switch set in LOCAL position, switching to "FRINGE" position will improve the performance of the receiver.

Phono-Television Switch

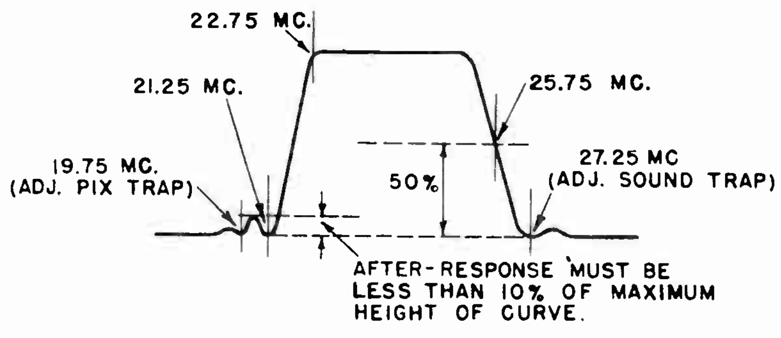
A two-position slide switch is provided at the rear of the chassis together with a pick-up socket for plug-in of an external record changer.

Built-In Antenna

All models are equipped with a built-in antenna which will provide satisfactory reception in many locations. In areas of weak reception an outside antenna will substantially improve the performance of the receiver. An antenna post is provided at the rear of the chassis and is accessible through the opening in the masonite back to permit the connection of an outside aerial. The built-in antenna is normally connected to the antenna posts and must be disconnected when attaching the outside aerial. To prevent the lead-in wires of the built-in antenna from contacting chassis parts and tubes it is recommended that the lead-in wire be folded and held in place by tape or a rubber band. In some cases reception can be improved by changing the location of the receiver in the room.

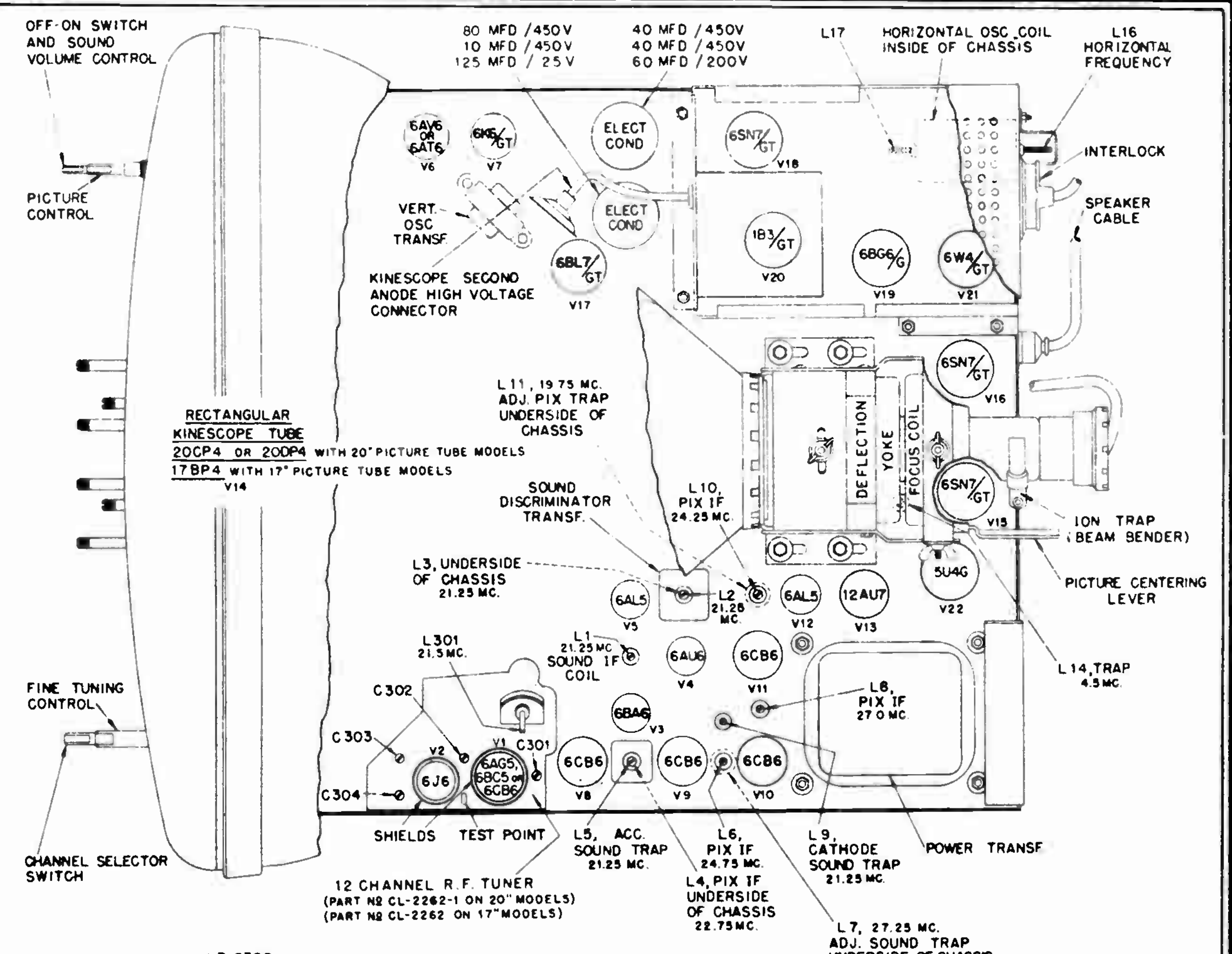
Special Alignment Procedure for Fringe Reception

All adjustments are the same as for standard alignment except that the curve and marker frequency 22.75 MC (instead of 22.5 MC) are as shown below during "Retouch Pix IF Transformer Adjustment" and a $1\frac{1}{2}$v bias battery is used instead of a 3v bias battery.



FRINGE RESPONSE CURVE

The "after response" shown on the curve should not exceed 10% of the maximum curve to prevent adjacent channel interference in areas where a weak signal is on the low frequency side of a powerful local station. The adjustment of L301 and L4 will have the greatest effect on "after response". However L301 and L4 must not be set to a higher frequency (counterclockwise) than is necessary to reduce "after response" otherwise the sound sensitivity will suffer.



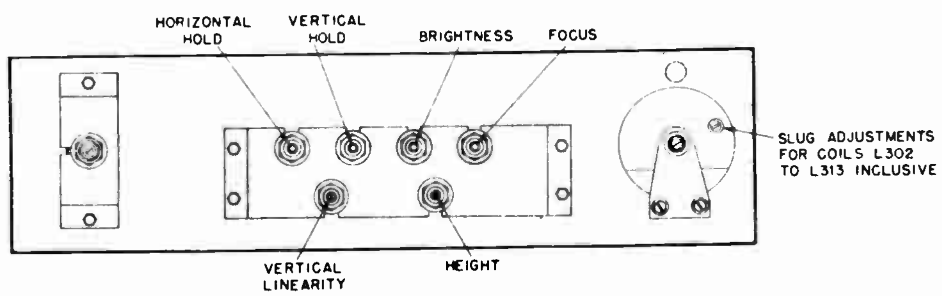
LB-2328

PLAN VIEW OF CHASSIS

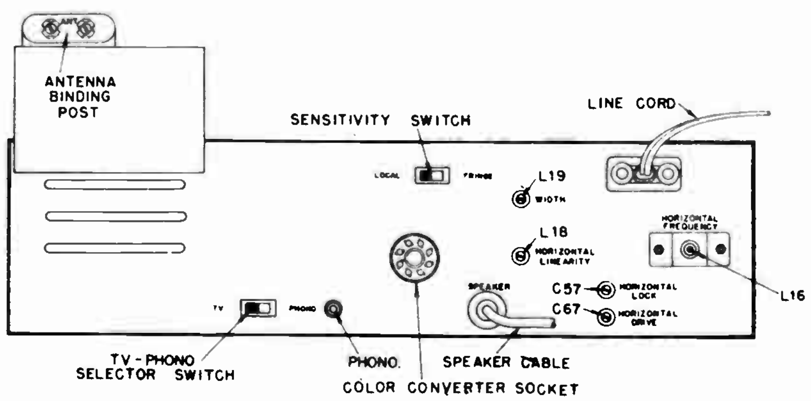
THIS APPARATUS USES INVENTIONS OF UNITED STATES PATENTS LICENSED BY RADIO CORPORATION OF AMERICA PATENT NUMBERS SUPPLIED UPON REQUEST

CAUTION

DO NOT USE ON DIRECT CURRENT (DC) DISCONNECT LINE CORD FROM POWER OUTLET BEFORE REMOVING CHASSIS FROM CABINET.



FRONT VIEW OF CHASSIS



REAR VIEW OF CHASSIS

COILS AND TRANSFORMERS

Part No.	Description
CK-1346	Filter choke
CL-1471	Sound IF coil
CL-1472	Cathode sound trap w/75mmf cond.
CL-1502	Width control
CL-1503	Horiz. lin. control
CL-1536	Peaking coil 120μh (blue dot)
CL-2073	Peaking coil 250 μh (green dot)
CL-2087-1	Deflection yoke 70°
CL-2262-1	Tuner - Standard Coil
CL-2300	Focus coil
CL-2309	Pix IF transformer
CL-2331	Sound coil 4.5 mc trap
CL-2364	Bifilar pix IF coil w/adj. pix trap
CL-2365	Bifilar pix IF coil w/adj. sound trap
CL-2427	Filament choke (RF)
TR-1469	Transformer - disc.
TR-1473	Transformer - vert. osc.
TR-1506	Transformer - audio output
TR-2117	Transformer - pix IF w/adj. sound trap
TR-2189	Transformer - vert. output
TR-2470	Transformer - power
TR-2293-1	Transformer - flyback
TR-2294	Transformer - horiz. osc.
	UHF Osc./Ant. Strips (pair) for Standard Coil Tuners
	VHF Antenna Strips for Standard Coil Tuners
	VHF Oscillator Strips for Standard Coil Tuners

GENERAL DESCRIPTION

The model 630FA-2 chassis is a 31 tube receiver including picture and three rectifiers. Features include: full 12 channel coverage: latest Standard Coil Cascode circuit RF tuner, with a high signal to noise ratio. Adaptable to UHF by just changing a channel strip. Limiter-discriminator FM sound system, automatic frequency control of the horizontal oscillator (Syncroloc), full 4Mc band width, noise saturation circuits, fast action keyed AGC, threshold control, Hi-fidelity push pull audio output, Phonograph connection and switch, color connection, front focus control, all molded plastic condensers.

Line Voltage	117VAC, 60 Cycle
Power Consumption	320 Watts
Tuner input impedence	300 Ohms
Video IF carrier Freq.	26.4MC
Sound IF carrier Freq.	21.9MC
Band width of Video IF.	4MC
Band width of Sound Discriminator	350KC
Adjacent channel trap (picture)	20.4MC
Adjacent channel trap (sound)	27.9MC
Video sensitivity	4 Microvolts
Video IF amplifier	4 stages
Video amplifier	2 stages
Sound IF amplifier	3 stages
Audio amplifier	2 stages
Overall gain of Video Amplifier	40 times
Audio Output undistorted	5 watts
Audio Output maximum	10 watts

TUBE COMPLEMENT

Circuit Symbol	Tube Type	Function
V-1	5U4	Low voltage rectifier
V-2	5U4	Low voltage rectifier
V-3	6CB6	1st Sync Amplifier
V-4	6CB6	Sync Separator
V-5a	6SN7	2nd Sync Amplifier
V-5b	6SN7	Horizontal discharge
V-6	6AL5	Horiz. Sync. Discr.
V-7	6AC7	Horiz. Oscillator control
V-8	6K6	Horizontal Oscillator
V-9	6CD6	Horizontal Output
V-10	1B3	High Voltage Rectifier
V-11	6W4	Horizontal Damper
V-12	6J5	Vert. Osc. & Discharge
V-13	6S4	Vertical Output
V-14 to 17	6CB6	1st, 2nd, 3rd, 4th Video IF
V-18a	6AL5	2nd Video Detector
V-18b	6AL5	DC Restorer
V-19	6AU6	1st Video Amplifier
V-20	6V6	2nd Video Amplifier
V-21	6AU6	AGC Control
V-22	6BA6	1st Sound IF
V-23	6BA6	2nd Sound IF
V-24	6AU6	3rd Sound IF & Liminator
V-25	6AL5	Sound Disc. Detector
V-26a	6SL7	1st Audio Amplifier
V-26b	6SL7	Phase Inverter
V-27&28	6AQ5	Audio Output

VIDEO I.F. ALIGNMENT

1. Connect the common lead of the VTVM to chassis ground. Set the meter on -volts setting and connect the DC probe to the junction of PC-2 and R28. This is the load resistor of the 2nd pix detector.

2. Remove the 6AU6 AGC control tube VT-21.

3. Apply a bias of -3 volts to the AGC line. This is the junction of C-35, R22B and R-22. For fringe areas -1.5V should be used.

4. Turn the tuner channel selector to a station that does not have a local signal.

5. Apply the IF signal with an accurate generator to the 6J6 tube in the tuner. This may be done by placing an ungrounded shield cover over the tube and applying the signal to the shield. The ground connection for the generator should be as short as possible.

6. Set the generator to 24.05MC with high output and adjust L2 for maximum reading on the VTVM. Keep the meter on the lowest scale. Always keep the generator output low enough to prevent the VTVM from reading over 1.5 volts during all alignment steps.

7. Set signal generator to 25.85MC and adjust L1 for maximum reading.

8. Set signal generator to 21.9MC and adjust T7 for minimum reading.

9. Set signal generator to 22.95MC and adjust T2 bottom for maximum.

10. Set signal generator to 21.9MC and adjust T2 top for minimum.

11. Repeat steps 9 and 10.

12. Set signal generator to 27.9MC and adjust T1 top for minimum.

13. Set signal generator to 25.95MC and adjust T1 bottom for maximum.

14. Set signal generator to 22.45MC and adjust converter on tuner for maximum reading.

SOUND I.F ALIGNMENT

1. Connect the signal generator to pin 1 of VT-24 and set it on 21.9MC. This setting should not be touched during the entire alignment. Reduce output of generator where necessary to keep meter reading within the specified scale.

2. Connect the VTVM common lead to ground and the other lead in series with a 1 megohm resistor to the junction of the diode resistors R-110 and R-111. Do not remove the discriminator shield to make these connections as they can be made by making a hook on the resistor and making connection to the transformer lug C through the hole provided for the adjusting tool. Set the meter on the +10 scale and the top of T-10 should be adjusted for maximum reading.

3. Connect the meter common lead to ground and the other lead to the junction of R-113 and C-111. The VTVM should be set to plus 3 or 5 volt scale. Adjust T-10 bottom for zero reading on the meter.

4. Connect the probe of the VTVM to terminal A of T-9. Set the meter on -3 or 5 volt scale and adjust both the top and bottom of T-9 for maximum reading.

5. Apply a 21.9MC signal to the 6J6 tube in the same manner as that done in step 5 of the Video IF Alignment Section. Adjust T-8 top and bottom for maximum reading on VTVM.

RF OSCILLATOR ALIGNMENT

The RF unit or tuner is factory pre-aligned and the alignment screws on the top of the tuner should not be touched. Only the converter coil on the tuner should be adjusted as in step number 14 of the Video IF Alignment.

The only adjustment that you can make on the tuner is the oscillator adjustment for the channel slugs.

1. Connect an antenna to the tuner and turn the set on.

2. Select the channels that are on the air. Set the fine tuning control to its midway position and do not touch again. A 1/4 inch hole to the right of the control shaft will be exposed.

3. Insert a fiber or plastic screwdriver not larger than 3/16" through the oscillator adjustment hole and slightly turn the slug in or out until maximum volume without distortion is obtained. Do not screw the slug more than a couple of turns or it will fall into the coil and you will have to remove the coil and reset the slug.

4. Turn the channel selector to the stations that you can receive and repeat step 3 for each channel.

OVERALL ALIGNMENT

While it is generally unnecessary to use a sweep generator, it may be desirable to view the overall response curve. This curve is similar to that drawn below. To obtain it a 50-216 MC sweep generator is used together with a standard signal generator and an oscilloscope.

1. In a normal area the -3V bias should be applied to the IF strip as in steps 2 and 3 of the Video Alignment section. For fringe area the -1.5 volt bias should be used.

2. Connect the IF sweep generator to the antenna terminals and set to channel 12 or 13. Set the receiver channel selector to the same channel.

3. Connect the common lead of the VTVM to ground and the DC probe to the junction of PC-2 and R-28. Set the meter to the -3 or -5V scale.

4. Set the sweep generator output to high output and adjust the fine tuning control on the receiver until a response curve appears on the scope screen. Reduce the generator output until a reading of .3 volts is obtained on the VTVM. Readjust the oscilloscope gain if necessary to get an adequate size pattern.

5. Connect the signal generator to the antenna terminals through a small capacitor and feed in a 26.4MC IF picture carrier marker.

6. Observe and analyze the response curve obtained. If necessary the IF adjustments should be slightly retouched in order to obtain a curve similar to the one illustrated.

7. If T-2 bottom requires any adjustment it may be necessary to readjust T-2 top. When all the final adjustments are made the picture carrier marker 26.40MC should be at approximately 50% response. The curve must be approximately flat top with a 22.95MC marker at approximately 100% response, a 22.95MC marker may be obtained by readjusting the signal generator as in step 5.

Throughout the video IF alignment care should be taken to see that no two transformers are tuned to the same frequency. Replace 6AU6 tube, VT-21 and remove bias batteries.

INSTALLATION NOTES

If the set is to be used in a custom cabinet, mounting brackets are always supplied with the cabinet for the mounting of the picture tube. If the set is to be used in a wall installation then metal mounting brackets are available for this purpose.

After mounting the picture tube, the deflection yoke should be placed all the way up on the neck of the tube as far as it will go. Mount the focus coil with the gap forward. The focus coil should be about 1/4" behind the yoke. It is understood that the brackets that hold the yoke and focus coil are already fastened to the board or brackets.

Mount the ion trap on the neck of the tube near the cap. Make sure that you are using the correct ion trap with the particular tube you are using. Most tubes today use single magnet ion traps and that is what is supplied with the set.

Connect the high voltage lead to the picture tube. Turn on the set. Adjust the brightness control to about 3/4 of the way and slowly bring the ion trap forward and back slowly rotating at the same time until maximum brightness can be obtained on the picture tube. There might be two positions where maximum brightness can be obtained. The correct position is nearest the cap of the picture tube.

Connect the antenna to the set. Turn the AGC level control 3/4 clockwise. Turn up the contrast until a picture is on the screen. If the picture tears or has a venetian blind effect, adjust the synchroloc T-5 until the picture becomes steady. If it is rolling up or down, adjust the vertical hold control on the front of the chassis.

Adjust the width and horizontal drive control until the picture fills the tube. Then adjust the vertical height and linearity control to fill the tube vertically. If shadows are on the corners of the picture tube, tilt the focus coil slightly. This will remove the shadows and readjust the ion trap slightly. If the picture tube is centered in the yoke and focus coil there should be very little adjusting to be done.

If the picture is tilted, loosen the wing nut on top of the yoke and move it to the left or right. This will level the picture. Tighten up the wing nut after this setting.

SERVICE HINTS

POOR BRIGHTNESS
1. Width coil
2. Ion trap adjustment
3. VT-5, 8, 9, 10, 11
4. Deflection yoke
5. Picture tube
6. R-81 too high in value
7. Setting of Horiz. drive
8. HV arcing or corona

SOUND BUT NO RASTER
1. Deflection yoke
2. No high voltage
3. Picture tube
4. R-88
5. High voltage fuse
6. Ion trap adjustment
7. Coil LL-1
8. Flyback transformer
9. VT-5, 8, 9, 10, 11

NO RASTER OR SOUND
1. VT-1, 2
2. Supply voltages
3. AC input

INSUFFICIENT WIDTH
1. Deflection yoke
2. Low line voltage
3. VT-5, 8, 9, 10, 11
4. R-88
5. Horiz. drive control

NO SOUND
1. Speaker or leads
2. Output transformer
3. Volume control
4. VT-22, 23, 24, 25, 26A, 26B, 27, 28

VERTICAL LINE, NO RASTER
1. Deflection yoke
2. VT-11
3. Flyback transformer

HORIZONTAL LINE, NO RASTER
1. Deflection yoke
2. T-4 Vertical output transformer
3. VT-12, 13

RASTER BUT NO PICTURE
1. Picture tube socket connections
2. Continuity of width & AGC coils
3. VT-14, 15, 16, 17, 18, 19, 20, 21
4. Bias of AGC lines, should be -.6 to -4 volts depending on signal
5. Contrast control
6. PC-1, 2, 3, 4, 5, 6 in video circuit

INSUFFICIENT HEIGHT
1. Deflection yoke
2. VT-12, 13
3. Vert lin & height control

NO SYNC
1. VT-18A, 3, 4, 5

NO HORIZONTAL SYNC
1. Horizontal hold control
2. VT-6, 7
3. C-45, C-66
4. Sync discr. transformer T-5

NO VERTICAL SYNC
1. C-51, C-52, C-53, C-54
2. R-51, R-52, R-53, R-54, R-58
3. VT-12
4. T-3
5. Vertical hold control

IMPROPER FOCUS
1. Adjustment of focus control
2. Defective picture tube
3. Low high voltage
4. Focus coil should be 470 ohms
5. R-7 and focus control
6. Improper adjustment of ion trap

HORIZONTAL JITTER
1. Yoke leads too close to kine. grid lead
2. Minus 2 volts supply line
3. T-5
4. VT-7

POOR VERTICAL LINEARITY
1. Deflection yoke
2. VT-12, 13
3. Height, Vertical Lin & vertical hold

BURN OUT SPOT ON SCREEN
1. Picture tube

DARK LINES ON LEFT SIDE OF PICTURE
1. 6CD6 tube VT-9
2. Yoke wires too close to picture grid lead
3. C-82 in yoke

SOUND BARS IN PICTURE
1. Sound IF Alignment

LIGHT LINE LEFT SIDE OF PICTURE
1. Horizontal drive control
2. VT-5
3. Value of R-81 to be increased to 560K or 680K

ONE HALF OF RASTER DARKER
1. VT-14, 15, 16, 17, 18, 19, 20
2. All low voltage electrolytics

VERTICAL JITTER
1. VT-12
2. Increase value of C-3B to 1mfd.
3. C-54 or R-58
4. T-3

RASTER OFF CENTER
1. Focus coil & vertical centering control
2. Reverse focus coil leads
3. Incorrect setting of ion trap

TILTED RASTER
1. Adjustment of deflection yoke
2. Reverse leads of focus coil

CORNERS OF RASTER CUT OFF
1. Defective picture tube
2. Focus coil too far back
3. Deflection yoke too far back
4. Improper ion trap or ion trap adjustment

POOR PICTURE DETAIL
1. VT-18A, 19, 20
2. PC-1, PC-2, PC-3, PC-4, PC-5, PC-6
3. IF alignment

TRAPEZOIDAL RASTER-KEYSTONE
1. Defective deflection yoke
2. C-82 in yoke defective

POOR HORIZONTAL LINEARITY
1. VT-8, 5, 9, 10, 11
2. Deflection yoke
3. C-80, C-83
4. Improper ion trap for picture tube

RESISTORS

All resistors are 1/2 watt plus or minus 10% unless otherwise stated

Part	Value	Circuit
R1	1360 17W	Bleeder Network
R2	12K 2W	Bleeder Network
R3	12 2W	Bleeder Network
R4	100 4W	Bleeder Network
R5	230 10W	Bleeder Network
R6	1800 2W	Bleeder Network
R7	270 2W	Bleeder Network
R8		
R9		
R10	10K	1st Vid IF grid
R11	47	1st Vid IF Cath
R12	1K	1st Vid IF Decoup
R13	47	2nd Vid IF grid
R14	150	Decoupling
R15	1K	AGC decoupling
R16	47	2nd Vid IF Cath
R17	1K	2nd Vid IF Decoup
R18	150	Deoupling
R19	1K	AGC decoupling
R20	4.7K	3rd Vid IF grid
R21	47	3rd Vid IF Cath
R22	47K	AGC
R22A	18K	AGC
R22B	100K	AGC
R23	1K	3rd Vid IF decoup
R24	150	Decoupling
R25	2.7K	4th Vid IF Plate
R26	1K	4th Vid IF decoup
R27	516K	4th Vid IF plate
R28	3.9K	Vid Det diode load
R29		
R30	10K	4.5MC trap damper
R31		
R32	3.3K	1st Vid Amp Plate load
R33	1.2meg.	Bias network
R34	820K	2nd Vid Amp Grid
R35	12K 2W	2nd Vid Bias Network
R36	3.3K 2W	2nd Vid Amp plate load
R37	100	2nd Vid Amp Cath limit
R38	150K 1W	AGC Cathode resistor
R39	18K	AGC screen dropping
R40	27K	Missing from schematic AGC isolating resistor from pin 1 of AGC tube VT-21 to junction of PC-4 and R-32
R40	18K 1W	AGC peaking
R41	4.7K	1st sync amp plate
R42	4.7meg.	Bias network
R43	1meg.	1st sync amp grid
R44	6.8K	Sync sep plate
R45	1meg.	2nd sync amp grid
R46	4.7K	2nd sync amp plate
R47	1K	2nd sync amp decoup
R51	22K	Integrating network
R52	8.2K	Integrating network
R53	8.2K	Integrating network
R54	22K	Integrating network
R55	82K	Vert Osc Grid
R56	2.2meg.	Vert output
R57	2.2meg.	Vert output grid
R58	1.5meg.	Vert osc. grid
R59	560	Vert deflect coil damp
R60	560	Vert deflect coil damp
R61	10K	Vertical peaking

Part	Value	Wattage	Circuit
R62	680		Vert output cathode
R64	1K		Vert retrace blanking
R66	470K		Hor sync disc load
R67	470K		Hor sync disc load
R68	1meg		Hor sync disc load
R69	470K		Hor AFC Filter Network
R70	560		Hor AFC Grid
R71	10		Hor AFC Cathode
R72	47K		Hor AFC Plate
R73	39K		Hor AFC Plate
R74	39K		Hor AFC Screen
R75	27K		Hor AFC Screen
R76	27K		Hor Osc. Grid
R77	10K		Hor Osc. Screen
R78	5K	10	Hor Osc. Plate
R79	6.8K		Differentiator
R80	220K		Hor Disc. grid
R81	330K		Hor Disc. plate
R82	4.7K		Hor. peaking
R83	330K		Hor. output grid
R84	100		Hor. Out grid decoup
R85	280	4	Hor output cathode
R86	25K	4	Hor output screen
R87	3.3		HV Rect fil limiter
R88	470K		HV Filter
R89	600-600	12	Sweep control for max width & HV only one used, for smaller tubes 2 in series are used.
R96	150K		Anode dropping
R97	150K		Anti-blooming
R98	10K		Picture tube grid
R99	1meg.		DC restorer diode load
R100			
R101	1meg.		1st sound IF grid
R102	100		1st sound IF cathode
R103	1K		1st sound IF decoupling
R104	470K		2nd sound IF grid
R105	100		2nd sound IF cathode
R106	1K		2nd sound IF decoupling
R107	22K		3rd sound IF grid
R108	39K	2	3rd sound IF decoupling
R109	10K		Voltage divider
R110	100K		Sound Disc diode load
R111	100K		Sound Disc diode load
R112	27K		De-emphasis
R113	22K		De-emphasis
R114	10meg.		1st Audio Amp grid
R115	330K		1st Audio Amp plate
R116	470K		Phase inverter grid
R117	3300		Phase inverter cathode
R118	100K		Phase inverter cathode
R119	100K		Phase inverter plate
R120	150K		VT-27 grid
R121	150K		VT-28 grid
R122	270	2	PP Audio output cath.
R123	1K	5	Audio output screens

CONDENSERS

Part	Value	Voltage	Circuit
C1	.01mfd	600	line filter
C2	.01mfd	600	line filter
C3A	30mfd	450	filter
C3B	80mfd	150	bias filter
C4A	40mfd	450	filter
C4B	40mfd	450	filter
C4C	10mfd	475	Vert Out filter
C5A	60mfd	450	filter
C5B	50mfd	50	cathode vert out
C6A	40mfd	350	LV filter
C6B	10mfd	350	Sync filter
C7A	20mfd	400	Audio filter
C7B	80mfd	350	filter
C8	1000mfd	6	Vert cent filter
C10	1500mmf		1st Vid IF filt bypass
C11	1500mmfd		1st Vid decoupling
C12	1500mmfd		AGC bypass
C13	1500mmfd		1st Vid IF screen bypass
C14	270mmfd	500	Video IF coupling
C15	1500mmfd		2nd Vid fil bypass
C16	1500mmfd		2nd Vid IF screen bypass
C17	1500mmfd		2nd Vid IF AGC bypass
C18	1500mmfd		2nd Vid IF decoupling
C19	270mmfd	500	Video IF coupling
C20	1500mmfd		3rd Vid IF fil bypass
C22	1500mmfd		3rd Vid IF screen bypass
C23	1500mmfd		3rd Vid IF decoupling
C24	270mmfd	500	video IF coupling
C25	1500mmfd		4th video IF decoupling
C26	1500mmfd		4th Vid IF fil bypass
C27	1500mmfd		4th Vid IF screen bypass
C28	270mmfd	500	Video IF coupling
C29	10mmfd	500	Video diode filter
C30	1500mmfd		Vid diode fil bypass
C31	.05mfd	600	Video coupling
C32	4700mmfd	600	2nd vid amp cath decoup
C33A	82mmfd	500	3rd video IF cathode dec
C33	.005mfd	600	AGC cathode decoupling
C34	.0018mfd	600	AGC coupling
C35A	.5mfd	400	AGC
C35	.05mfd	600	Video coupling
C36	.5mfd	200	AGC
C41	270mmfd	500	1st sync amp decoup
C42	270mmfd	500	1st sync amp plate coup
C43	.05mfd	600	Sync separator coupler
C44	.01mfd	600	Vert sync coupler
C45	82mmfd	500	Hor sync coupler
C51	.002mfd	400	integrator
C52	.005mfd	400	integrator
C53	.005mfd	400	integrator
C54	.006mfd	500	Vert osc. grid
C55	.1mfd	400	Vert sweep coupling
C56	.05mfd	600	Vert discharge
C66	.015mfd	400	Fixed trimmer
C67	.004mfd	600	Hor osc. grid
C68	.015mfd	400	Phase shifter
C69	1200mmfd		Phase shifter (Temp comp cer)
C70	.004mfd	600	AFC coupling
C71	.05mfd	400	AFC filter
C72	.05mfd	600	Hor Osc Cont screen
C73	.05mfd	600	Hor osc screen
C74	390mmfd	500	Differentiator net
C75	.01mfd	400	Hor. sweep coupling
C76	.001mfd	1000	Hor. sweep coupling
C77	680mmfd	500	Horizontal discharge
C78	.22mfd	400	Horiz. out screen
C79	.5mfd	400	Horiz. out cathode
C80	.047mfd	400	Horiz. out damper filter

Part	Value	Voltage	Circuit
C81	500mmfd	20KV	HV filter
C82	47mmfd		Horiz. deflect filter
C83	.1mfd	600	Yoke coupler
C84	.22mfd	400	Damper filter
C85	.033mfd	600	Damper filter
C98	.1mfd	400	Kine cathode
C101	3.3mmfd	500	sound IF coupling
C102	1500mmfd		1st Sound IF cath
C103	1500mmfd		1st Sound IF screen
C104	.01mfd	600	2nd Sound IF grid
C105	1500mmfd		2nd Sound IF cathode
C106	1500mmfd		2nd Sound IF screen
C107	51mmfd	500	3rd Sound IF grid
C108	6800mmfd	500	3rd Sound IF screen
C109	.01mfd	400	De-emphasis
C110	270mmfd	500	Sound diode filter
C111	.0025mfd	400	Sound coupling
C112	.01mfd	400	Sound coupling
C113	.05mfd	400	Sound coupling
C114	.1mfd	400	Sound coupling
C115	.1mfd	400	Sound coupling
C116	.005mfd	600	Audio out plate bypass

TRANSFORMERS

Part		Description
T-3	Vert Osc.	Trans Turns Ratio 1:4.2 Approx res at 25C Pri 165 ohms Sec 1310 ohms
T-4	Vert Out	Turns Ratio 13:1 Pri imp. 19,000 ohms Approx res at 25C Pri 6.9 ohms Sec 590 ohms
T-5	Syncroloc	Pri 37 ohms CT Sec 35 ohms tapped at 9.5 ohms
T-6	Horiz Out	D.C. Resistance between terminals 1-3 3.7 ohms 3-5 30 ohms 5-7 3.6 ohms 8-9 22 ohms 9-HV 414 ohms operating temp 100C maximum. RCA type 225T1
T-12	Focus Coil	470 ohms
T-13	Filter Choke	3henrys 300Ma 45 ohms
DC-2	Deflection yoke	With harness Vert 68 ohms total. Horizontal 20 ohms

R.F. & I.F. COILS

Part	Ohms	Description
PC-1	5	Wound on 22K resistor, 120mmh
PC-2	8	250mmh
PC-3	5	Wound on 22K resistor, 120mmh
PC-4	4	93mmh
PC-5	5	Wound on 22K resistor, 120mmh
PC-6	4	93mmh
PC-7	8	250mmh
T-8		1st sound IF Pri .2 Sec 0
T-9		2nd sound IF Pri .2 Sec 0
T-10		Sound Disc. Pri 0 Sec 0
CH-1	0	Filament choke
CH-2		Filament choke
CH-3		Filament choke
CH-4		Filament choke
CH-5		Filament choke
T-1		1st Picture IF & trap
T-2		2nd Picture IF & sound takeoff
L-1		3rd picture IF
L-2		4th picture IF
T-7		Cathode sound trap
LL-1		Horiz lin coil A-B 4.5 B-C 1.5
LW-1		Horiz width coil 11 ohms

CONTROLS

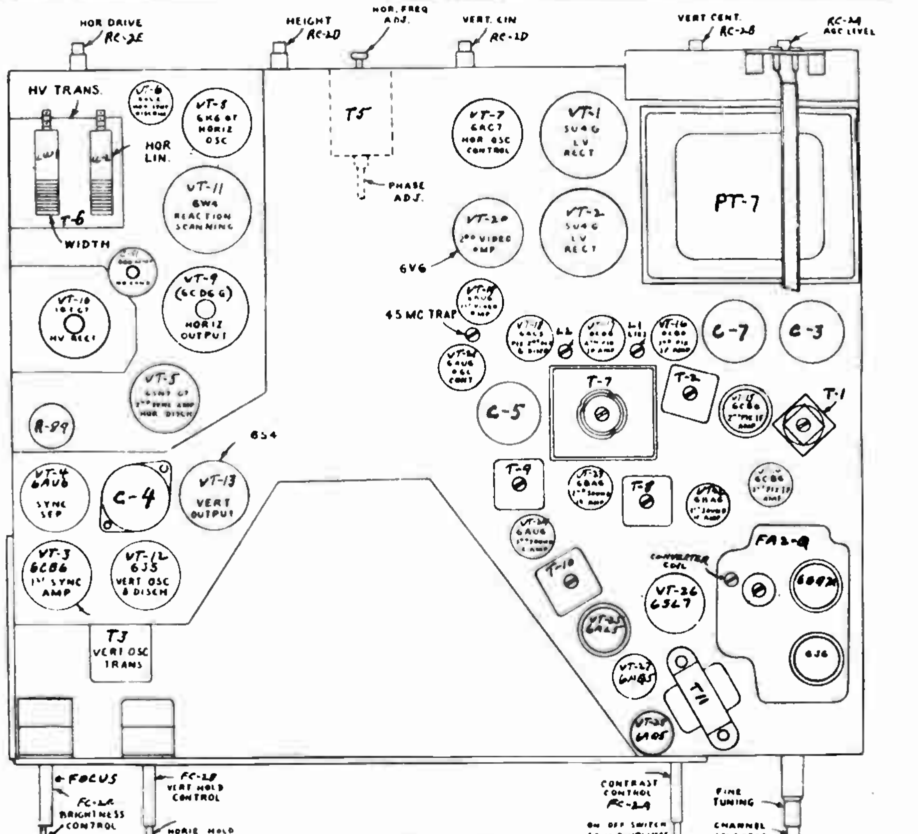
Airex #	Res.	Watts	Description
FC-2A	1meg 10K	.5 .5	Vol, control tapped at 200K rear. Contrast front On-off SW1 on vol cont.
FC-2B	50K 1meg	.5 .5	Horiz Hold rear Vert hold front
FC-2C	50K 1500	.5 5.0	Brightness control rear Focus control front Phono SW2 attach to rear
RC-2A	25K	.5	Threshold control
RC-2B	20	2	Vert cent tapped at 10
RC-2C	5K	.5	Vertical linearity
RC-2D	2.5meg	.5	Height control
RC-2E	20K	.5	Horizontal drive

SPEAKER

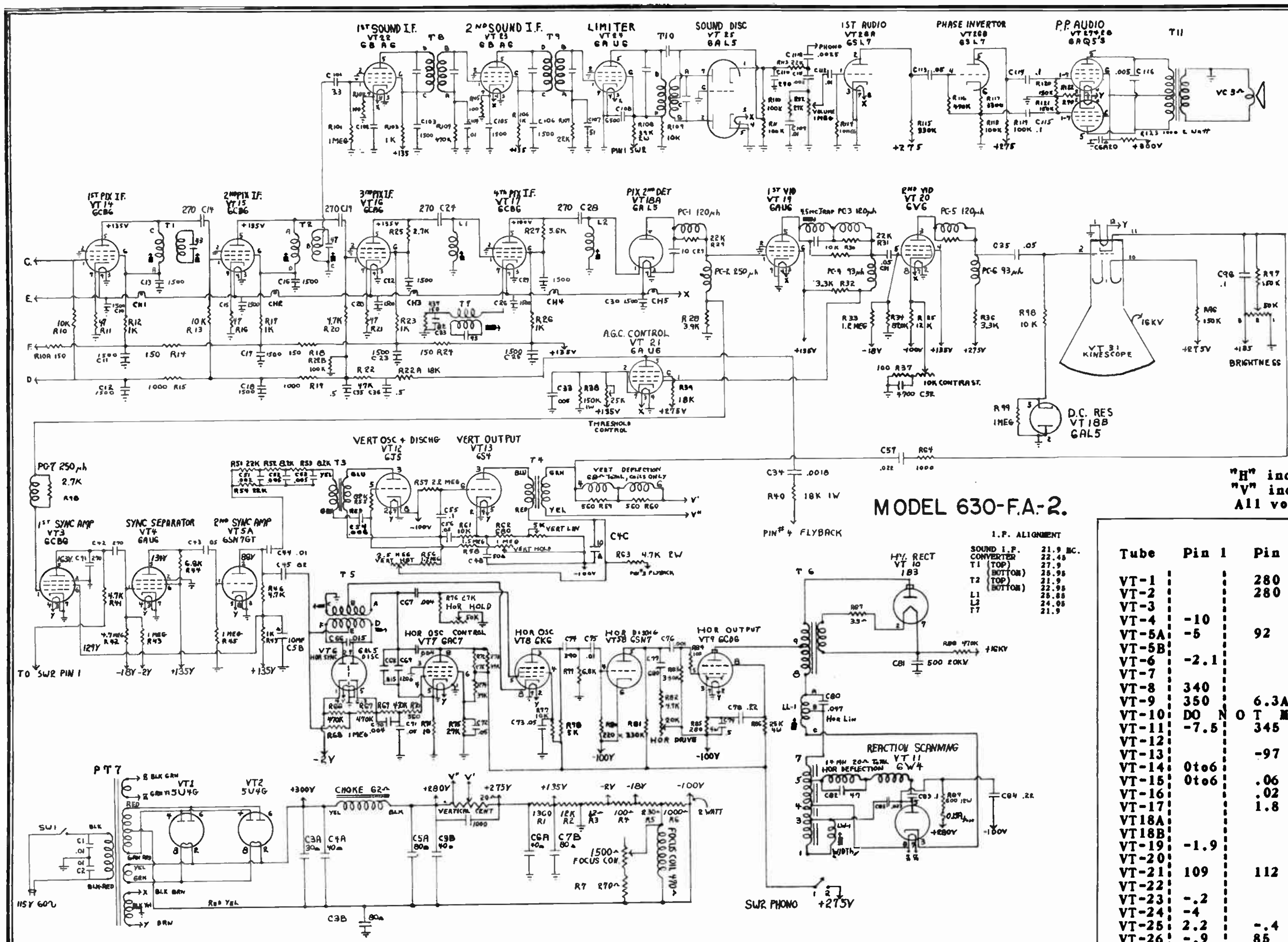
SPFA-2	12" P.M. 3.2 VC Audio output trans. mounted on frame with 36" leads
T-11	10,000 ohms 6AQ5 PP to 3.2 ohm V.C.

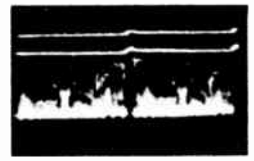
POWER TRANSFORMER

PT-7	Top Mount	Pri 1	117VAC 2.75A 320Watts Black, black & yellow
		Sec	360-0-360 Red, Red yellow, Red
		Fi 1	6.3V 10A X&Y tied Green, Green
		Fi 1	6.3V 1.2A Brown, Brown
		Fi 1	5V 6A Yellow, Yellow



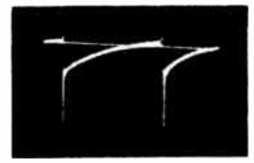
TOP VIEW OF CHASSIS





INPUT TO 2ND VIDEO AMP. - 18 V. "V"

INPUT TO VERT. DEFL. YOKE-100V."V"



GRID OF VERT. OSC.- 280V. "V"

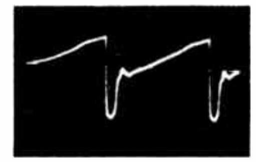
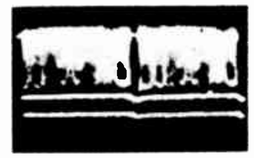


PLATE OF HOR. DISCH.-125V. "H"



INPUT TO 1ST VIDEO AMP.-2V. "V"

INPUT TO VERT. OUTPUT-120V."V"

"H" indicates Oscilloscope sync'd to 1/2 of Horizontal Sweep Rate
"V" indicates Oscilloscope sync'd to 1/2 of Vertical Sweep Rate
All voltages shown are peak to peak values.

VOLTAGE READINGS

Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
VT-1		280		360AC		360AC		288	
VT-2		280		360AC		360AC		288	
VT-3				6.3AC	170	130			
VT-4	-10			6.3AC	130	135			
VT-5A	-5	92							
VT-5B				-150		-120	6.3AC		
VT-6	-2.1			6.3AC	-2.5		-20		
VT-7				-2.2DC	.2	100	6.3AC	195	
VT-8	340		165	185	-20		6.3AC	.26	
VT-9	350	6.3AC	-95	-120	-120	200		-5.8	
VT-10	DO NOT MEASURE HIGH VOLTAGE								
VT-11	-7.5	345	350	260	150	345	340	340	
VT-12			6	-120	-125	-117	6.3AC	-117	
VT-13		-97				-110	-109		270
VT-14	0to6			6.3AC	130	130			
VT-15	0to6	.06	6.3AC		128	130			
VT-16		.02	6.3AC		130	130			
VT-17		1.8	6.3AC		86	124			
VT18A			6.3				-1.8		
VT18B					0to25				
VT-19	-1.9			6.3AC	116	134			
VT-20			22	135	-9		6.3AC	0to-1.1	
VT-21	109	112		6.3AC	AGC	260	108		
VT-22				6.3AC	120	124	.35		
VT-23	-.2			6.3AC	120	124	.4		
VT-24	-4			6.3AC	40	42			
VT-25	2.2	-.4	4.9AC				-.7		
VT-26	-.9	85	32	215	53	53	6.3AC		
VT-27		1.5		6.3AC	230	235			
VT-28		1.5		6.3AC	230	235			

All voltages above are DC unless otherwise specified. DC voltage readings are at 20,000 ohms per volt. AC voltage readings are at 1000 ohms per volt.

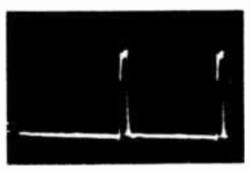
Pin numbers are from the bottom view of the chassis and are measured to ground.

Readings taken with line voltage at 117VAC.

Front and rear controls set for good picture quality and linearity.

Where readings may vary according to the setting of the service controls, both minimum and maximum readings are given.

WAVE-SHAPES



OUTPUT OF 2ND SYNC. AMP.-23V. "H"

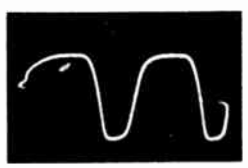
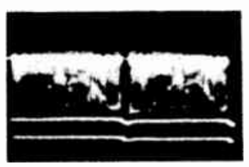


PLATE OF HOR. OSC.-200V. "H"

OUTPUT OF 1ST SYNC. AMP. >35V. "H"



INPUT TO KINE. GRID-90 TO 110V. "V"

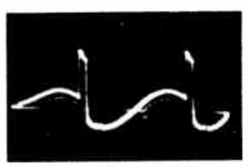


PLATE OF HOR. SYNC. DCR. (PIN 7 OF VT-6-17V. "H"

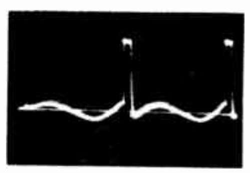
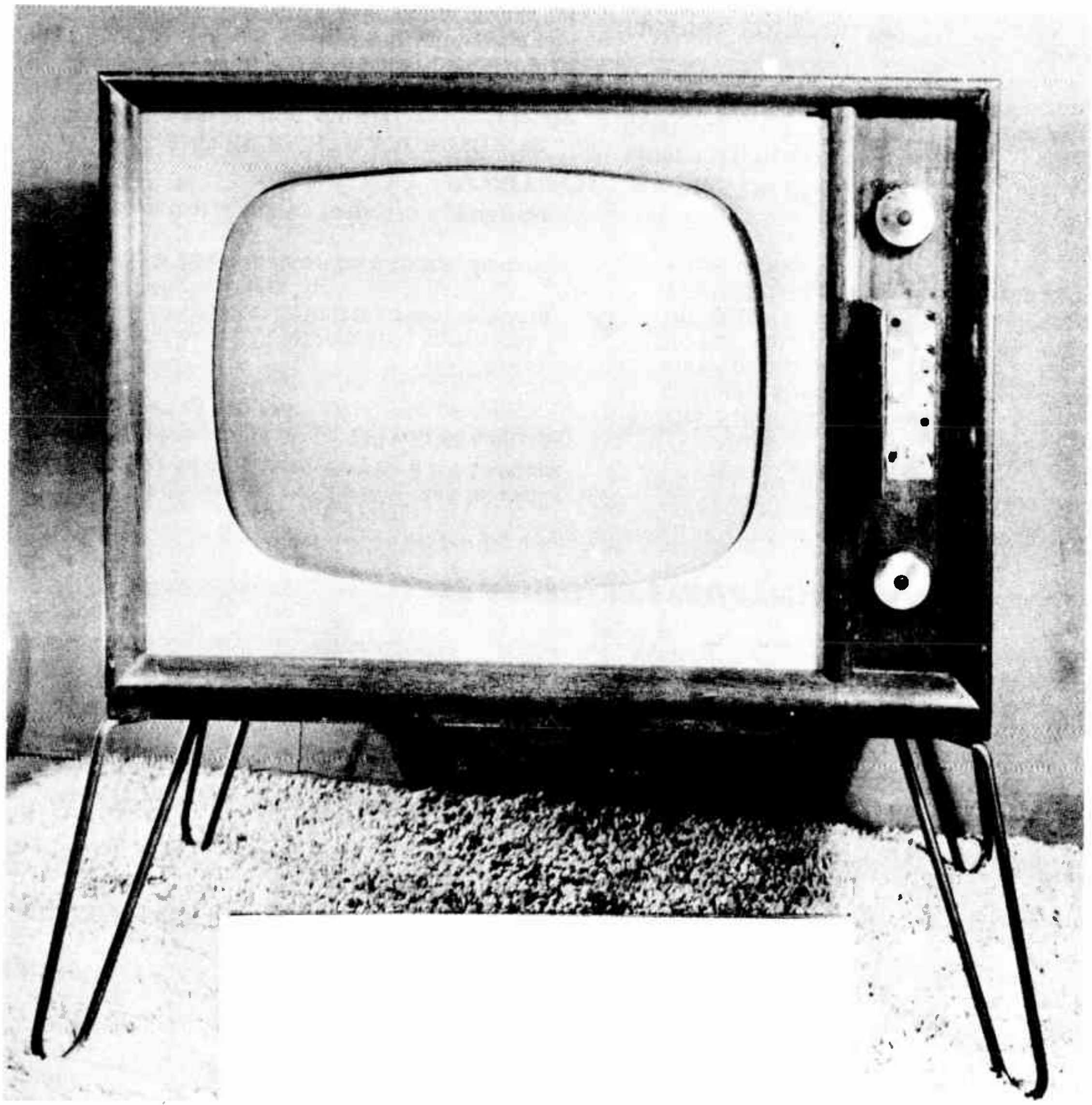


PLATE OF HOR. SYNC. DCR. (PIN 2 OF VT-6-17V. "H"



CHASSIS CODE NUMBER

The first code group indicates the picture tube type and size.
The second code group indicates the cabinet model.
The third code group indicates the chassis model.

Example:

27A 28 D
1st 2nd 3rd

TUBE COMPLIMENT

SYMBOL	TUBE	FUNCTION
V1	6BQ7A	R.F. Amplifier
V2	6J6	Osc. and Mixer
V3, V4, V5	6CB6	1st, 2nd and 3rd I.F.
V6	6AG7	Video Amplifier
V7	27NP4	Picture Tube
V8	6AU6	Sound I.F.
V9A	1/2-6T8	Ratio Detector
V9B	1/2-6T8	Sound Amplifier
V10	6Y6	Sound Output
V11	5U4	Low Voltage Rectifier
V12A	1/2-6U8	Sync Separator
V12B	1/2-6U8	Sync Clipper Amplifier
V13	6C4	Vertical Blocking Oscillator
V14	6AH4	Vertical Output
V15A	1/2-6SN7	Horizontal Osc. Control
V15B	1/2-6SN7	Horizontal Oscillator
V16	6CD6	Horizontal Output
V17	6V3	Damper
V18	1B3	High Voltage Rectifier
Xtal	1N60 or 1N64	Video Detector

GENERAL INFORMATION

SPECIFICATIONS

OPERATING VOLTAGE
105-125 volts, 60 cycles.

POWER CONSUMPTION
215 watts.

FUSE
Located at rear of chassis.
(5 amp. 3AG)

RECEIVER INPUT IMPEDANCE
300 OHM balanced (between terminals). If 72 OHM coaxial cable is used, connect outer conductor to chassis and inner conductor to either antenna terminal.

INTERMEDIATE FREQUENCIES
Video Carrier - - - - - - - 24.75 MC.
Sound Carrier - - - - - - - 20.25 MC.
Intercarrier Sound- - - - - 4.5 MC.

SPEAKER
10" P.M. (all models except 21" T.M.)
Voice Coil Impedance - - 3.2 ohms.
Audio Power Output - - - 2.5 watts. (Undistorted)

DEFLECTION
Electromagnetic

FOCUS
Electrostatic or Magnetic.

CAUTION NOTICE

HIGH VOLTAGE; (18,000 VOLTS) EXISTS AT THE HIGH VOLTAGE LEAD TO THE PICTURE TUBE, AND GREAT CARE MUST BE TAKEN WHEN REMOVING THE CHASSIS FOR SERVICING.

PICTURE TUBE HANDLING; GOGGLES AND HEAVY GLOVES SHOULD BE WORN WHEN HANDLING THE PICTURE TUBE. NEVER LIFT THE PICTURE TUBE BY ITS NECK OR STRIKE THE NECK IN ANY WAY.

BACK COVER; THIS SHOULD ONLY BE REMOVED BY A QUALIFIED SERVICE TECHNICIAN.

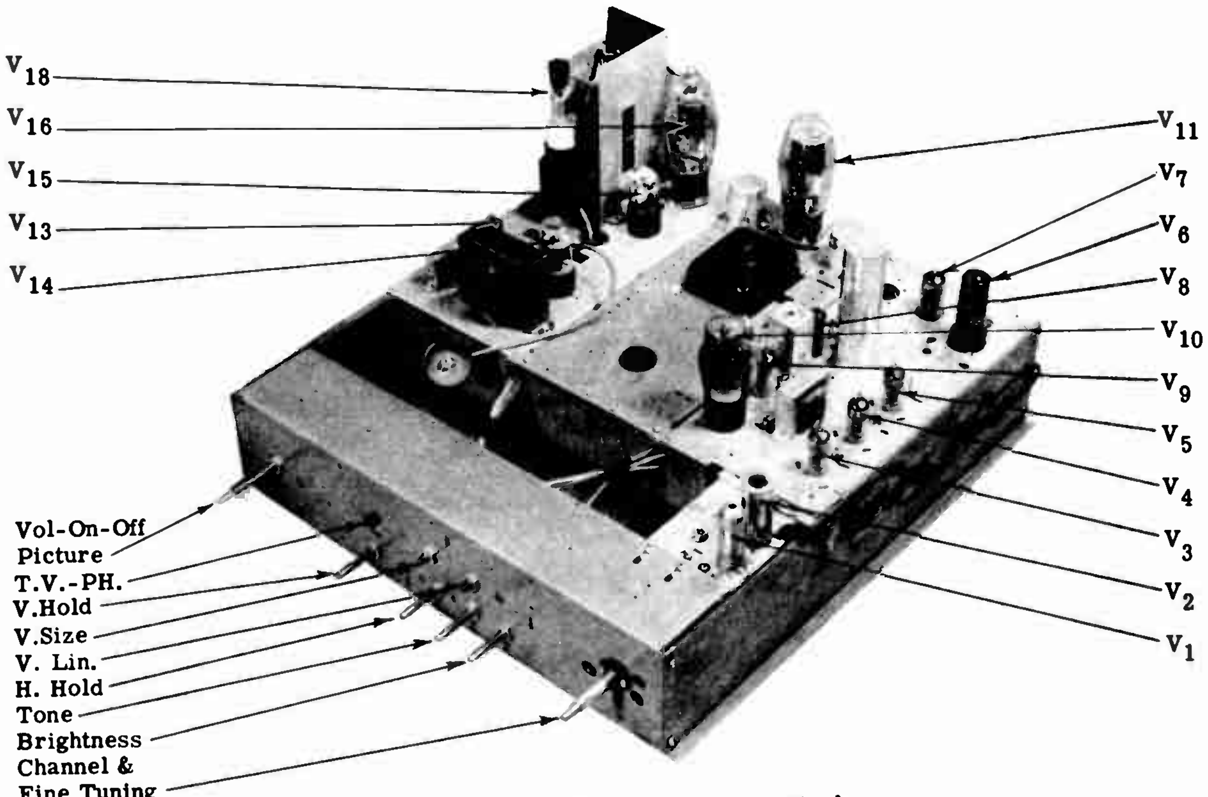


Fig. 2. Tubes and Front Controls.

INSTALLATION INSTRUCTIONS

This receiver is normally shipped ready for operation. After unpacking and removing wooden shipping base the following operational checks should be performed; Connect either an Indoor or Outside Antenna to the Receiver Antenna Terminals and plug in the line cord. The OPERATING INSTRUCTIONS given below should now be followed.

Controls for customer adjustment are located on the front panel behind the small control door. Controls at the rear of receiver should be adjusted (if necessary) only by the installation technician.

OPERATING INSTRUCTIONS

The receiver is adjusted at the factory and is ready for operation after installation. To place the receiver in operation attach the cord to any 117 volt 60 cycle AC outlet and proceed as follows:

1. Turn the OFF-ON, VOLUME control knob clockwise about one half turn and wait for tubes to warm to operating temperature.
2. Turn the CHANNEL selector knob to the desired channel.
3. The picture control should be turned to a point near half way rotation.
4. The FINE TUNING control located behind the channel selector knob is then adjusted for the clearest picture.
   NOTE: This may also require readjustment of the PICTURE control for maximum picture quality.
5. The VOLUME control is then adjusted for desired sound level.

PRE-SET CONTROL ADJUSTMENTS

VERTICAL SIZE AND LINEARITY ADJUSTMENTS
Adjust the SIZE control until the picture completely fills the mask. Adjust the VERTICAL LINEARITY control until the picture is symetrical from top to bottom. Adjustment of one control will effect the adjustment of the other, therefore, readjustment may be required for correct setting.

VERTICAL HOLD CONTROL
Rotate the VERTICAL HOLD control until the picture moves slowly downward. Turn the control back until the picture moves upward and locks in.

PICTURE CONTROL
Adjust this control for best contrast with a test pattern or good picture.

BRIGHTNESS CONTROL
This control must be operated in conjunction with the PICTURE control for best picture contrast.

HORIZONTAL HOLD
Adjust this control to mid position.

PHONO TV SWITCH
Place switch in downward position for T.V. operation.

TONE CONTROL
Adjust control for desired sound range.

LOCAL FRINGE SWITCH
Place switch in upward position for local stations.

SERVICE INFORMATION

PICTURE TUBE ADJUSTMENTS

- IMPORTANT -
"Read (caution notice) on page 1.".

These adjustments to be made by Qualified Service Technicians only.

ION TRAP ADJUSTMENT
It is important that this adjustment be made upon installation and repeated after "Focus" or "Positioning" adjustments.

When adjusting the ION TRAP have the BRIGHTNESS control set for normal brightness. Start with the ION TRAP close to the picture tube socket and move it slowly in the direction of the yoke while rotating it to find the position which gives maximum raster brilliance.

Reset BRIGHTNESS control for normal brilliance. There may exist two positions of the trap where maximum brightness occurs. The ION TRAP should always be placed at the position closest to the picture tube base.

CAUTION: Never set the ION TRAP to the forward position.

If shadows now appear in the corner of the raster do not attempt to eliminate them by adjusting the ION TRAP and sacrificing raster brilliance. Remove shadows by adjusting the CENTERING DEVICE and DEFLECTION YOKE. The ION TRAP should always be readjusted after the CENTERING, FOCUS or YOKE adjustments.

FOCUS ADJUSTMENT
For receivers using electrostatically focused picture tubes a fixed 300 volts (positive) DC is applied to the focusing anode and no focusing provision is provided. With ion trap and centering adjustments correctly made, proper focus will result.

For receivers using magnetically focused picture tubes a combination permanent magnet focusing device and centering assembly is provided. The magnetic field is varied by placing a non-magnetic screw driver in slot provided as a screw driver adjustment on the PM focalizer unit. This unit is located behind the deflection yoke on the neck of the picture tube. Focus adjustment is made at the factory, but if necessary, this adjustment should be made while viewing the raster with normal picture brilliance. Optimum focus results when the horizontal lines are clearly defined.

PIN CUSHION CORRECTOR MAGNET ADJUSTMENT
Two CORRECTOR MAGNETS are used to eliminate curvature of the top and bottom edges of the raster. These magnets are mounted on the deflection coil mounting bracket and can be moved in an out or up and

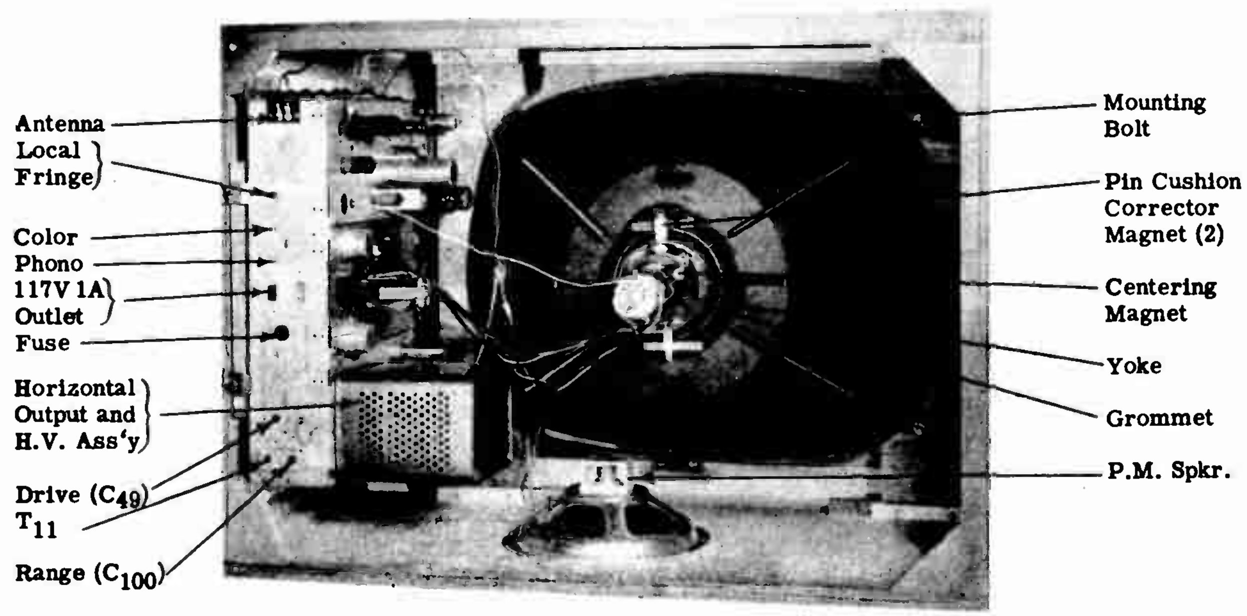


Fig. 3. View Showing Rear of Cabinet.

down by moving the holding arm.

To make adjustment;

1. Turn the VERTICAL SIZE control until both the top and bottom edges of the raster are visable.
2. Loosen the screw that holds the magnet arm in place and adjust the magnet position by moving the arm forward and/or rotate it around the screw until the top and bottom edges are straight and parallel to each other.

NOTE: Mis-adjustment of the CORRECTOR MAGNETS may cause keystoning, poor linearity, etc.

CENTERING ADJUSTMENTS

Two types of centering assemblies have been used in production.

One assembly utilizes a small bar type magnet which can be turned by means of a knurled shaft. This assembly is adjusted by turning the knurled shaft and by rotating the entire unit until the picture is centered on the screen.

One assembly consists of two magnetic rings mounted as two movable washers. The washers are provided with tabs to enable rotating the magnets independently of each other to vary the magnetic field. This unit is installed about 3/4 inch behind the yoke to prevent the yoke from demagnetizing the ring magnets. Adjustment is made by gradually rotating them with respect to each other and by rotating the entire unit until the picture is centered.

TO REMOVE AND REPLACE PICTURE TUBE

REMOVING THE PICTURE TUBE

1. The vertical wooden bar (located at right of the screen) is secured by a holding screw inserted from inside the cabinet. After the holding screw has been removed, grasp the vertical wooden bar and force upward until the bottom of the bar is clear of the framework. Bar can now be removed by pulling at the bottom with an outward and downward motion.
2. Remove the safety glass front by placing palms of hands on the glass and forcing it to the right and then upward until the glass edge is clear of the bottom and left side of the cabinet. Hold the glass carefully and remove by bringing the bottom edge forward.
3. Using the same general rule as in step 2 remove the mask.
4. Remove the cathode ray tube socket and the yoke plug, ion trap, centering device, the second anode wire and cathode lead.
5. Remove the yoke and rubber grommet by first removing the yoke retaining springs from the eye bolts on the cabinet. The springs should be removed in this order; top left, bottom right, top right and bottom left. The yoke and grommet may now be taken from the neck of the CRT.
6. Return to the front of cabinet and remove the nuts and washers from the bottom CRT retaining bolts. Remove the nuts and washers from the top CRT retaining bolts and the CRT can be removed while taking great care not to drop or jar it.
7. Remove the metal strap around the CRT by loosening the bolts on each side of the screen until the strap will slide off the picture tube.

REPLACING THE PICTURE TUBE

1. Place the metal strap around the picture tube and tighten the side bolts, being sure that bolts are midway along the side of picture and then tighten for equal spacing. The picture tube should fit against the four small curved retaining brackets. Tighten the strap securely.
2. Replace the springs and washers as shown:

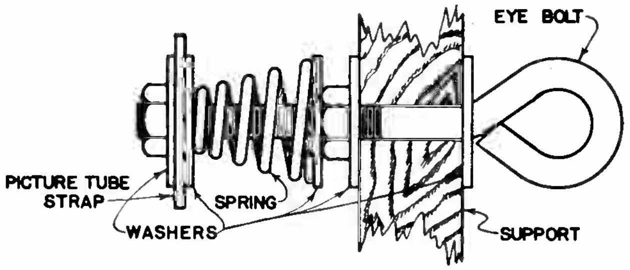


Fig. 4. Picture Tube Mounting Bolt.

and place picture tube in position with the two top nuts and washers being replaced before the two bottom nuts and washers.

3. Tighten the mounting nuts to bring the picture screen just against the picture mask. Check position by putting picture mask in place by first fitting it in the top groove, lowering it in place and then sliding it to the left. If the picture tube is too far back remove the mask and loosen proper mounting nuts. If the picture tube is too far forward mask will not fit and the mounting nuts must be tightened.
4. Replace the rubber grommet and then the yoke. Replace the four springs on the yoke with the short end toward the neck of the picture tube and the hook toward the tube base. Then attach the springs of the eye-bolts on the tube mount in this order; top left, bottom right, top right and bottom left.
5. Replace centering device, ion trap (see ion trap adjustments), yoke plug, picture tube socket, cathode lead and second anode lead.
6. Replace the safety glass by placing it in the upper groove first then lowering it in the bottom groove and then sliding it to the left as was done with the mask.
7. Replace wooden bar by moving top end up into the hole provided and pushing it down into the bottom hole. Insert the holding screw from inside the cabinet.

SEMI-REMOVAL OF CHASSIS

The receiver chassis may be partially removed from cabinet for minor service and adjustments. The chassis may be moved out from cabinet approximately one foot after removing the two rear retaining brackets.

LIMIT OF CHASSIS REMOVAL DEPENDS UPON SLACK IN LEAD WIRES FROM THE CHASSIS TO PICTURE TUBE.

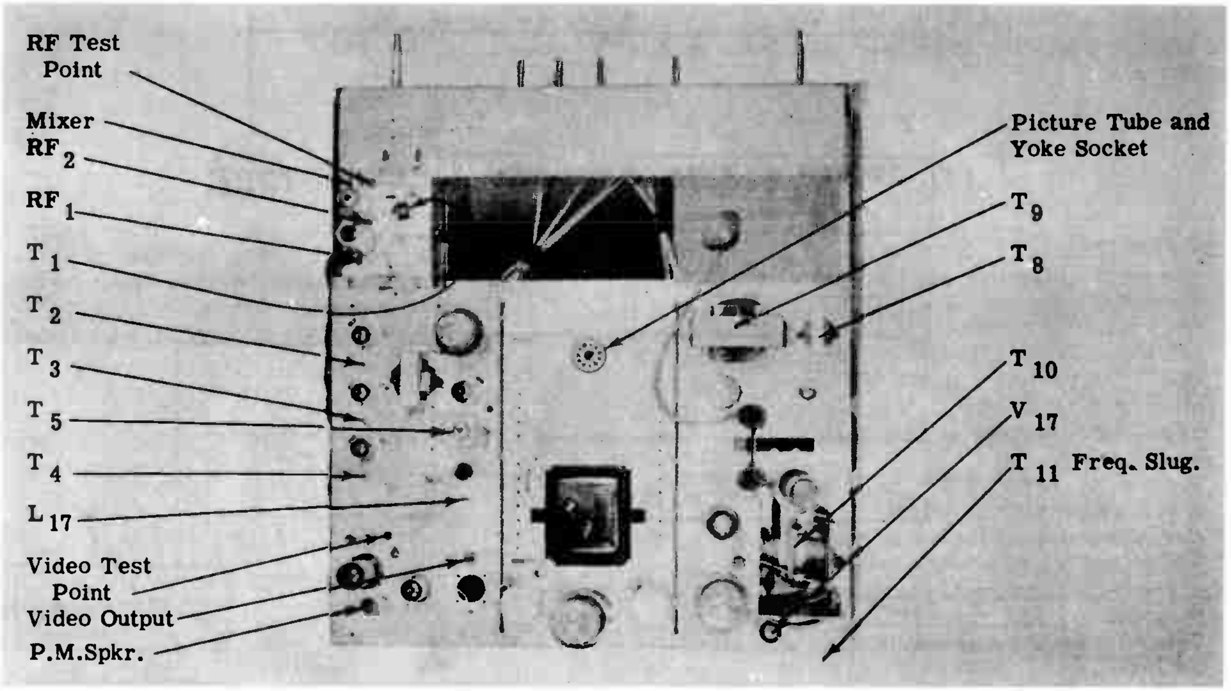


Fig. 5. Top View of Chassis.

HORIZONTAL OSCILLATOR ADJUSTMENTS

A) "HORIZONTAL FREQUENCY ADJUSTMENT"

1. Short circuit terminals "C" and "D" of the horizontal oscillator transformer "T_{11}". Tune in a station and sync in the picture if possible. Set PICTURE control to mid position. Set RANGE control "C_{100}" to approximately one turn from full in position.
2. Turn the HORIZONTAL HOLD control R_{65} to the extreme clockwise position. If picture is out of sync adjust frequency slug on "T_{11}" (back of chassis). NOTE; There may be two settings at which picture syncs, so use the one with screw farthest out of the coil. After this position has been correctly located readjust the frequency adjustment slug counter clockwise until picture is just out of sync.
3. Turn the HOLD control approximately 1/4 turn from the extreme clockwise position, to just sync picture horizontally.(It may be necessary to slightly readjust "T_{11}" back of chassis). Adjust the HORIZONTAL DRIVE control "C_{49}" (back of chassis) counter clockwise, to point where vertical drive line appears near center of raster. If this throws picture out of sync readjust "T_{11}" (back of chassis) and then turn "C_{49}" so that line just disappears. This is the proper adjustment of "C_{49}". Now, turn the HORIZONTAL HOLD control "R_{65}" to the extreme clockwise position and if picture loses sync readjust "T_{11}".

(B) "HORIZONTAL STABILIZER ADJUSTMENT"

1. Remove the short circuit from "C" and "D" of

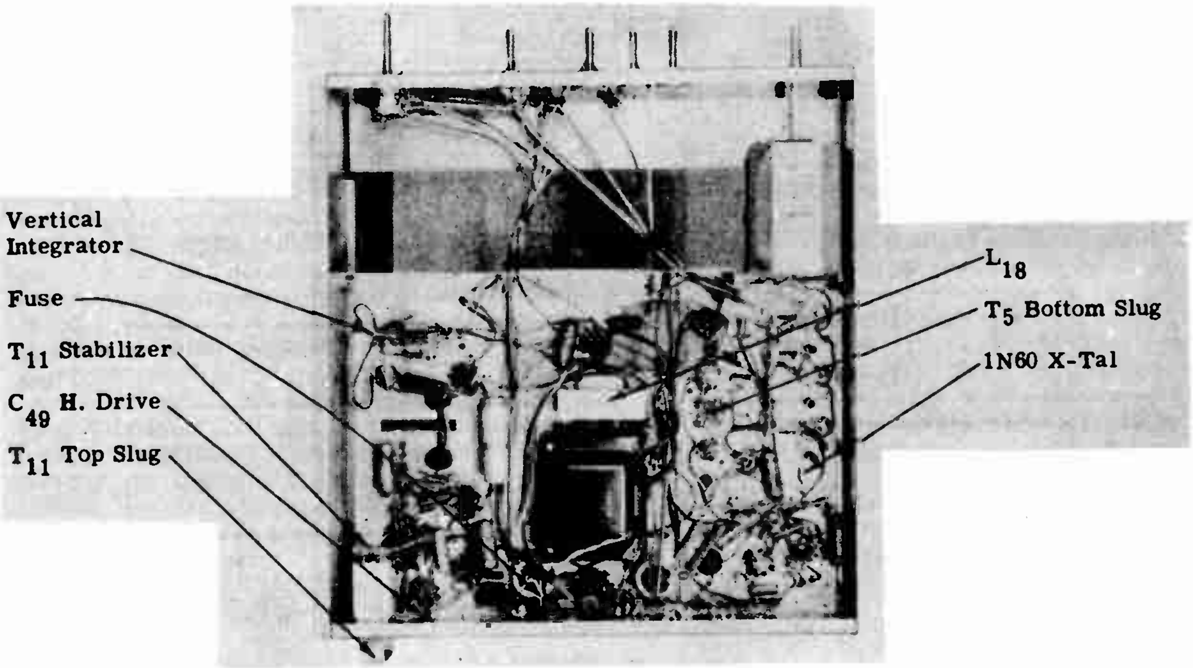


Fig. 6. Bottom View of Chassis.

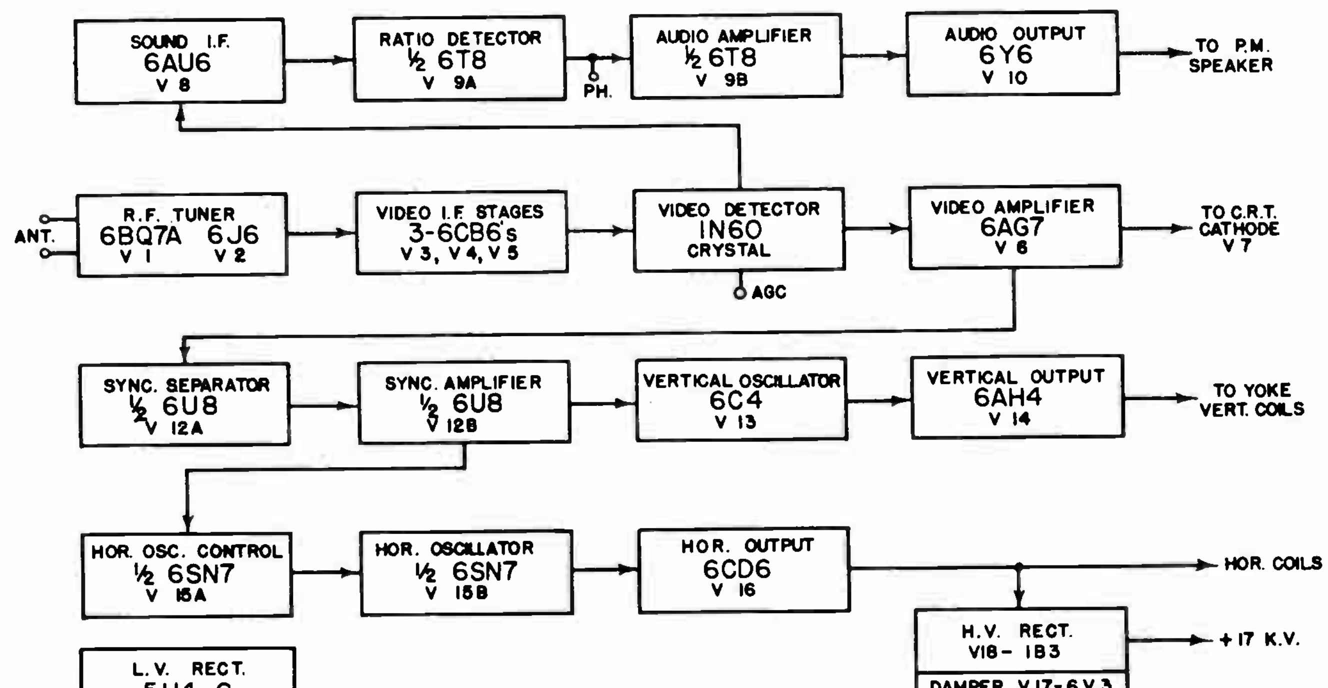


Fig. 8. Block Diagram.

"T_{11}". If picture loses sync slightly adjust the stabilizer adjustment of "T_{11}" (under chassis). NOTE; There may be two settings that sync picture, use the one which is obtained with the screw farther out of the coil.

2. Connect the low capacity probe of an oscilloscope to terminal "C" of "T_{11}". If scope upsets sync adjustment readjust frequency adjustment of "T_{11}" (back of chassis). The pattern on the scope should be as shown in Figure (7).

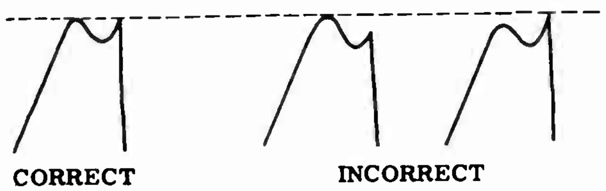


Fig. 7. Horizontal Stabilizer Waveforms.

3. Adjust the stabilizer adjustment "T_{11}" (under chassis) for above waveforms. The correct adjustment of this slug is when the two peaks are of equal height. During this adjustment the picture must be kept in sync by readjusting the HOLD control or "T_{11}" frequency adjustment (back of chassis). This adjustment is very important for correct operation of the circuit from the stand-point of oscillator drift and noise immunity.
4. Remove scope.

(C) "HORIZONTAL LOCKING - RANGE - ADJUSTMENT"

1. Set the horizontal HOLD control fully counter clockwise. The picture may remain in sync. If so turn "T_{11}" frequency adjust (back of chassis) slightly and momentarily switch channel until picture falls out of sync with diagonal lines sloping down to the left. Momentarily remove the signal by switching CHANNEL selector to next channel and back again. Slowly turn the HORIZONTAL HOLD control clockwise and note the least number of diagonal bars obtained as the picture pulls into sync.
2. If more than 7 bars are present as the picture pulls into sync, adjust the horizontal LOCKING RANGE trimmer "C_{100}" (back of chassis) slightly clockwise. If less than 3 bars are present, adjust "C_{100}" (range control) slightly counter clockwise; momentarily remove the signal, and then, again rotate the HOLD control clockwise noting the least number of horizontal bars obtained as the picture pulls into sync, repeating this procedure until 3 to 5 bars are present.
3. Replace scope and readjust "T_{11}" stabilizer control for the waveforms of Figure (7).
4. Remove scope and set HOLD control to the extreme clockwise position. Adjust frequency slug "T_{11}" (back of chassis) counter-clockwise so that the vertical blanking bar just appears on the screen and then turn slug clockwise until blanking bar just disappears. The HOLD control can now be rotated either way without loss of sync.

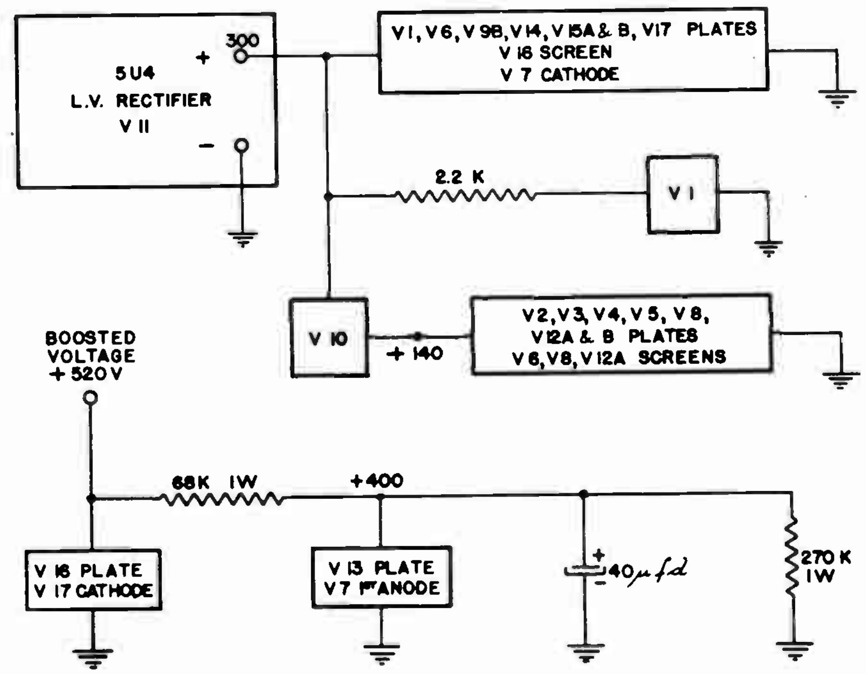


Fig. 9. D.C. Distribution Diagram.

The distribution of the D.C. plate and screen voltages is shown in Figure 9. This diagram will serve as an aid in servicing the D.C. circuits. It will be noted that V10 serves the dual function of an Audio Power Amplifier and a voltage divider. In this manner 140 volts is obtained at the cathode of V10.

ALIGNMENT PROCEDURES

I.F. AMPLIFIER ALIGNMENT

PREALIGNMENT INSTRUCTIONS

1. Connect negative side of bias battery (4V) to white lead entering R.F. tuner sub chassis and positive lead to chassis. IMPORTANT; Be sure local-fringe switch is in local position. A method of obtaining 4V DC for AGC bias is shown in Figure (10).

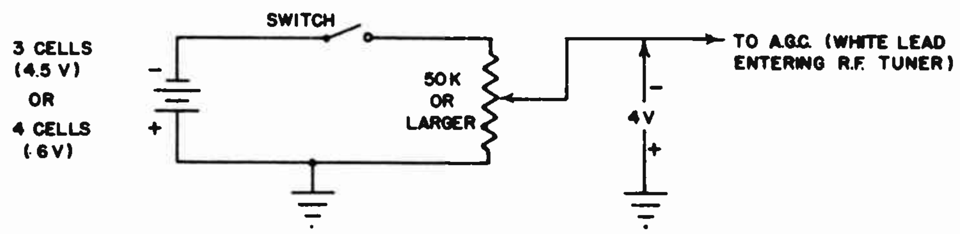


Fig. 10. Suggested Circuit for Adjusting AGC Bias.

2. Disconnect antenna and short antenna terminals.
3. Set channel selector to unused channel.
4. Set picture control at mid position.
5. Allow reasonable warming period for receiver and test equipment.
6. Connect V.T.V.M. (5V.D.C. scale or less) to video "test point" at video detector, near V-6 (positive side of V.T.V.M. to chassis).
7. Connect RF signal generator high side to 6J6 shield. (Be sure to raise shield on the 6J6 to insulate it from chassis). Connect low side of generator to chassis at 6J6 base.

PROCEDURE

IMPORTANT:
The following adjustments are made keeping the R.F. generator output low enough to give a V.T.V.M. reading of less than one volt at the video "test point".

1. Set the signal generator to 23.9 M.C. and adjust T_4 for maximum on the V.T.V.M.
2. Set the signal generator to 24.7 M.C. and adjust T_3 for maximum on the V.T.V.M.
3. Set the signal generator to 21.9 M.C. and adjust T_2 for maximum on the V.T.V.M.
4. Set the signal generator to 22.7 M.C. and adjust T_1 for maximum on the V.T.V.M.
5. Repeat procedure.

IF RESPONSE CURVE (Visual Check)
The preceeding procedure should result in a reasonable IF response characteristic. However, a visual check of the IF response curve will insure correct alignment. The response curve should appear as in Figure (11).

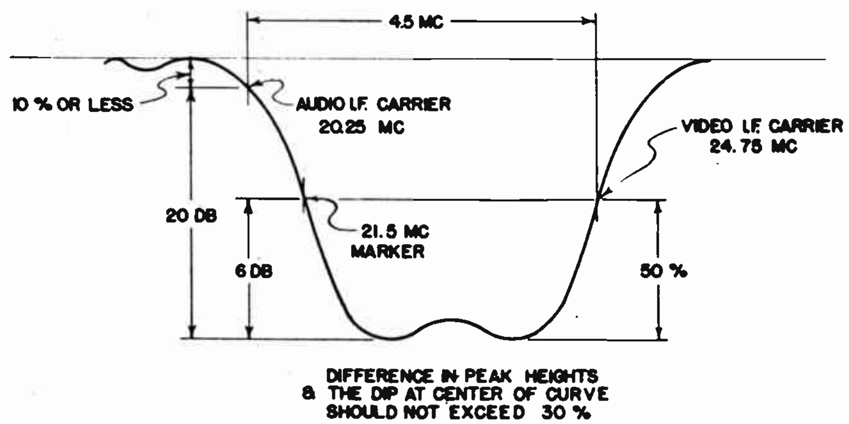


Fig. 11. Ideal I.F. Response Curve.

PROCEDURE:

1. Follow prealignment instructions, steps 1 thru 6.
2. Connect sweep generator high side to the 6J6 tube shield. Raise shield on 6J6 tube to prevent it from shorting the generator signal to ground.
3. If a separate marker generator is used, loosely couple high side to sweep generator lead on tube shield, low side to chassis. Marker frequencies are indicated on IF response curve Figure (11).
4. Connect oscilloscope to "Video test point". Marker pips on scope will be more distinct if a condenser between 100 MMFD and 1000 MMFD is connected across the oscilloscope input.
5. Check curve obtained against response curve of Figure (11). Note tolerance on curve. To prevent overloading keep sweep and marker outputs at very minimum. If response varies from tolerance given, or the markers are not in the proper location on the curve, improve the response by making the following adjustments:
   a. If peaks are not equal, carefully adjust T4 (23.9mc). It should not be necessary to adjust more than one turn in either direction.
   b. If the curve cannot be made to resemble the ideal response curve of Figure (11), repeat all steps under "IF" amplifier alignment. Be sure that generator frequencies are accurate and adjustments carefully made. If a satisfactory curve cannot be obtained after the steps have been repeated, stages may not be operating properly due to defective tube or other circuit component.

R.F. AMPLIFIER AND MIXER ALIGNMENT

TEST EQUIPMENT: Oscilloscope, RF Marker Generator, and RF Sweep Generator.

1. Allow receiver and test equipment to warm up for approximately 15 minutes.
2. Repeat step 1 of IF prealignment instructions (pertaining to bias battery).
3. Connect sweep generator to antenna terminals on the receiver. If sweep generator does not have an internal marker generator, loosely couple an external marker generator through a 2 or 3 MMFD capacitor to the antenna terminals as shown in Figure (12).
4. Connect the oscilloscope vertical input to the RF test point on the RF tuner through a 10K resistor. A .002 MFD condenser placed across scope vertical input will remove stray pickup.
5. Connect the "scope output" on the sweep generator to the horizontal input of the scope.

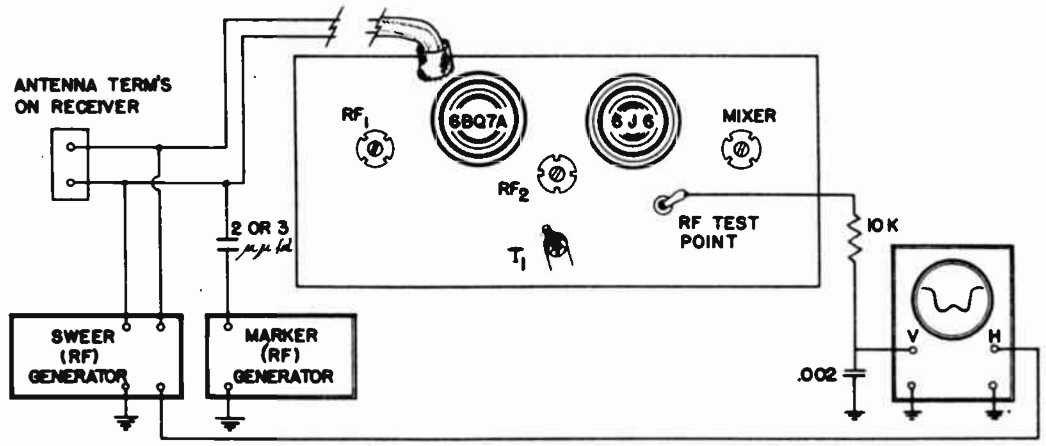


Fig. 12. Connections for R.F. Tuner Alignment.

PROCEDURE

IMPORTANT:
The following adjustments are made while keeping the sweep generator output at a minimum and the marker pips are just barely visible on the oscilloscope. The alignment of the standard RF tuner used in American Television receivers can be simplified by the alignment of one HIGH and one LOW frequency channel. This is possible because the same trimmer condensers are used on all channels.

ALIGNMENT CHART

CHANNEL SELECTOR	SWEEP GENERATOR	MARKER FREQ.		ADJUSTMENTS	
		Sound (MC)	Picture (MC)	(Step 1) Mixer & RF_2	(Step 2) RF_1
5	79MC (15 MC sweep)	81.75	77.25	Adjust for equal peak amplitudes. Peaks should occur at proper marker points as shown in Figure (13).	no adjustment
10	195 MC (20 MC sweep)	197.75	193.25	no adjustment	Adjust maximum amplitude and maximum flatness while keeping markers properly located as in Fig. (13).

With the above procedure the alignment of all channels will now be sufficiently correct.

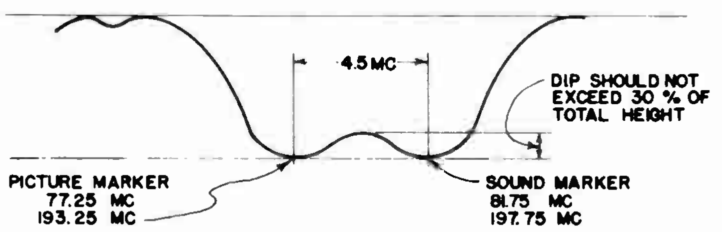


Fig. 13. R.F. Response Curve.

As a final check of tuner alignment, turn channel selector to each of the channels in the area where the receiver will operate. Use the above alignment chart in conjunction with the frequencies given in Figure (14) on the following page. The adjustments being, step 1 for channels 2 to 6, and step 2 for channels 7 to 13. If a compromise adjustment must be made, favor the weaker channels.

Channel		Sweep Gen. M.C.	Marker Gen.		OSC M.C.
			Sound M.C.	Picture M.C.	
L	2	57	59.75	55.25	81
	3	63	65.75	61.25	87
O	4	69	71.75	67.25	93
	5	79	81.75	77.25	103
W	6	85	87.75	83.25	109
	7	177	179.75	175.25	201
H	8	183	185.75	181.25	207
I	9	189	191.75	187.25	213
G	10	195	197.75	193.25	219
H	11	201	203.75	199.25	225
	12	207	209.75	205.25	231
	13	213	215.75	211.25	237

Fig. 14. Alignment Frequencies.

OVER-ALL ALIGNMENT

RF and IF section)

1. Use the same setup as shown in Figure (12) except that the oscilloscope is connected to "video test point" instead of the "RF test point". (The 10K resistor and .002 cap. are not necessary).
2. Set the CHANNEL selector to an unassigned HIGH channel and set the sweep generator to sweep this channel. See sweep generator frequency Figure (14).
3. Set marker to proper sound and picture carriers for unassigned HIGH channel chosen. See Figure (14).
4. If the response curve obtained does not compare with that shown in Figure (15), adjust T_4 for proper response curve. An adjustment of more than one turn in either direction should not be necessary.

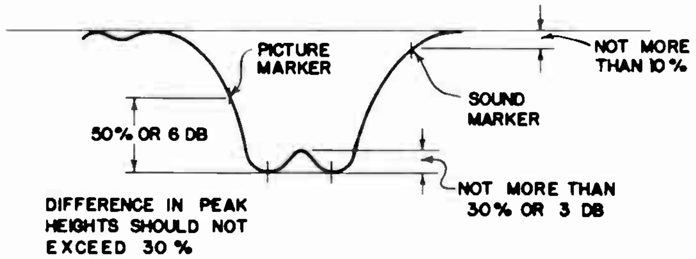


Fig. 15. Overall Response Curve.

R.F. OSCILLATOR ADJUSTMENT

(Using Television Station)

It is suggested, that RF oscillator adjustments be made using an "on the air television station".

1. Allow at least 15 minutes warm up time.
2. Set the "FINE TUNING" control at the center of rotation.
3. Set the CHANNEL selector to the channel whose oscillator frequency you wish to adjust.
4. Remove the CHANNEL selector and TUNING control knobs.
5. Using a non-metalic screw driver of (1/8) inch diameter, adjust the oscillator slug in the hole provided near the CHANNEL selector shaft.

6. Proper adjustment of this slug is for best picture clarity and detail.
NOTE: The proper adjustment of the oscillator slug will not be where maximum sound level occurs.

IMPORTANT: The oscillator slug need not be rotated very much. Turning the slug in too far will cause it to drop into the coil form. In the event that this occurs move the retaining spring aside, remove the coil, and lightly tap the open end of the coil until the slug slips out. Replace the slug and coil, reset the retaining spring, and repeat adjustment as above.

(Using a Signal Generator)

It is suggested that the RF oscillator adjustments be made using an on-the-air television station. However, if a television station signal is not available, the following procedure may be used.

1. Set CHANNEL selector to channel to be adjusted.
2. Set "FINE TUNING" at mid position.
3. Set VOLUME control fully clockwise.
4. Connect a crystal calibrated signal generator to the antenna terminals. Adjust the signal generator for maximum output.
5. Set crystal calibrated signal generator to exact frequency that the receiver oscillator should be in the channel being adjusted. See Figure (14).
6. With a clip lead and a .01 MFD capacitor connect the "RF test point" on the tuner to the center lug on the VOLUME control, or pin 8 of V_9.
7. Adjust the RF oscillator slug on the tuner until a whistle or beat note is heard in the speaker.
8. Repeat for all channels to be adjusted.

SOUND I.F. ALIGNMENT

IMPORTANT:

The following adjustments are made using a non-metalic screw driver with a 1/8 inch blade.

1. Connect two 100K OHM resistors in series from pin 2 of V9 to chassis ground. See Figure (16).
2. Connect a V.T.V.M. (50v scale) to points A and B as in Figure (16). Note polarity of Connections.

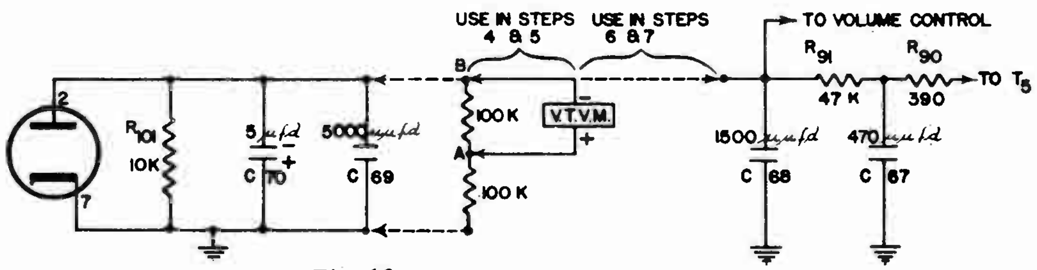


Fig. 16. Ratio Detector Alignment.

3. Tune in a T.V. station, adjust the receiver front controls for a good picture. (Set volume control fully counter clockwise.)
4. Adjust T5 primary (bottom slug) for maximum deflection of the V.T.V.M.
5. Adjust L_{17} for maximum deflection of the V.T.V.M. and repeat step 4 then readjust L_{17} for maximum deflection.
6. Remove negative lead of the V.T.V.M. from point B in Figure (16) and connect it to the junction of R_{91} (47K) and C_{68} (1500 MMF). The positive lead remains at point A in Figure (16).
7. Adjust the quardrature slug (top slug) on T5 for a null on the V.T.V.M.

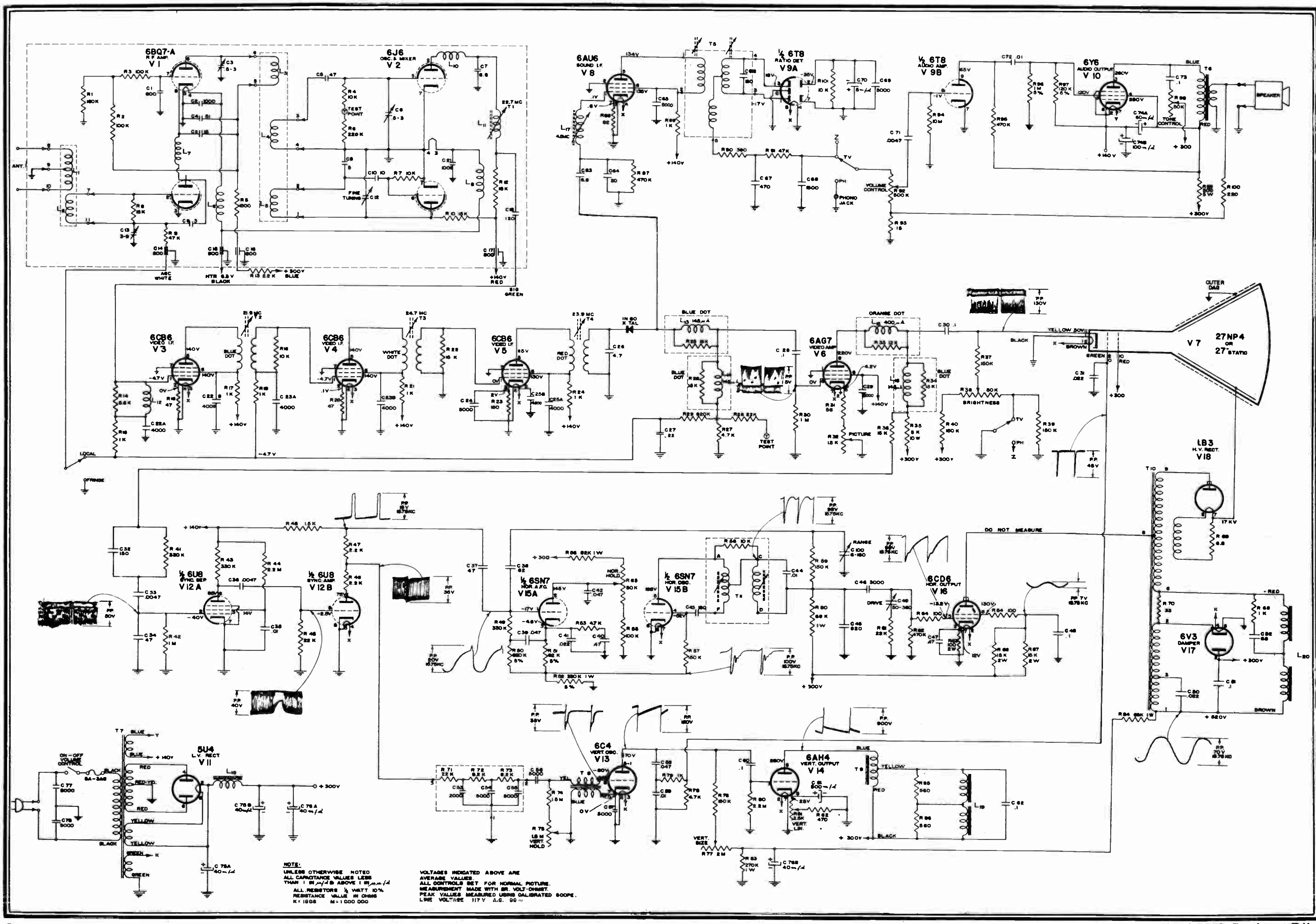
NOTE: Misalignment of T_5 (top slug) may make reading either negative or positive depending on direction T_5 is turned. T_5 (top slug) should be adjusted for zero. Adjustment should be made using the 50V range of the V.T.V.M. and then succeedingly lower ranges to obtain the most sensitive null.

PARTS LIST

List of Resistors, Condensers, Coils, and Transformers

Reference No.	Description	Part No.	Comments
R_1 thru R_{12}	Loacted in Standard Coil Tuner		Supplied by Manufacturer of Tuner
R_{13}, R_{46}, R_{47}	2.2K 1/2W 10%	R-8203	
R_{14}	5.6K 1/2W 10%	R-8198	
R_{15}, R_{17}, R_{19}, R_{21} R_{24}, R_{79}, R_{89}	1K 1/2W 10%	R-8200	
R_{16}, R_{20}	47 ohms 1/2W 10%	R-8154	
R_{18}, R_{58}, R_{101}	10K 1/2W 10%	R-8199	
R_{22}, R_{36}	15K 1/2W 10%	R-8166	
R_{23}	180 ohms 1/2W 10%	R-8218	
R_{25}, R_{26}, R_{34}	15K 1/2W 10%	L-6109	Part of Blue Dot Peaking Circuit
R_{27}, R_{53}, R_{78}	4.7K 1/2W 10%	R-8163	
R_{28}, R_{45}, R_{61}	22K 1/2W 10%	R-8167	
R_{29}	820K 1/2W 10%	R-8175	
R_{30}, R_{42}	1Meg. 1/2W 10%	R-8176	
R_{31}	56 ohms 1/2W 10%	R-8219	
R_{33}	12K 1/2W 10%	L-6120	Part of Orange Dot Peaking Coil
R_{35}	5K 10W 10%	R-8204	
R_{37}, R_{39}, R_{40} R_{57}, R_{59}, R_{76}	150K 1/2W 10%	R-8212	
R_{41}, R_{43}, R_{49}	330K 1/2W 10%	R-8172	
R_{44}, R_{80}	2.2Meg. 1/2W 10%	R-8177	
R_{48}	1.5K 1/2W 10%	R-8214	
R_{50}	820K 1/2W 5%	R-8196	
R_{51}	82K 1/2W 5%	R-8223	
R_{52}	330K 1W 5%	R-8173A	
R_{54}, R_{64}	100 ohms 1/2W 10%	R-8156	
R_{55}	100K 1/2W 10%	R-8171	
R_{56}	82K 1W 10%	R-8220	
R_{60}, R_{84}	68K 1W 10%	R-8224	
R_{62}, R_{95}	470K 1/2W 10%	R-8174	
R_{63}	100 ohms 2W 10%	R-8157	
R_{66}, R_{67}	15K 2W 10%	R-8225	
R_{68}	1K 1/2W 10%	R-8187	Part of L-6116
R_{69}	6.8 ohms 1/2W 10%	R-8153	
R_{70}	33 ohms 1W 10%	R-8215	
R_{71}, R_{72}, R_{73}	CRL - PC - 100	M-0017	Part of Vertical Integrator
R_{74}	1.5Meg. 1/2W 10%	R-8229	
R_{75}	1.5Meg. Pot.	R-8216	Vertical Hold
R_{77}	2Meg. Pot.	R-8183	Vertical Size
R_{81}	2.5K Pot.	R-8180	Vertical Linearity
R_{82}	470 ohms 1W 10%	R-8160	
R_{83}	270K 1W 10%	R-8226	
R_{85}, R_{86}	560 ohms 1/2W 10%	R-8186	Part of L-6116
R_{87}	470K 1/2W 10%	R-8185	Part of L-6101

Reference No.	Description	Part No.	Comments
R_{88}	82 ohms 1/2W 10%	R-8155	
R_{90}	390 ohms 1/2W 10%	R-8201	
R_{91}	47K 1/2W 10%	R-8619	
R_{92}, R_{32}	Dual Pots. - Switch	R-8179	1.5K Picture 500K Volume
R_{93}	15 ohms 1/2W 10%	R-8228	
R_{94}	10Meg. 1/2W 10%	R-8211	
R_{96}	1Meg. 1/2W 5%	R-8202	
R_{97}	120K 1/2W 5%	R-8221	
R_{98}, R_{65}, R_{38}	50K Triple Ganged Potentiometers.	R-6030	Tone, Brightness, Horizontal Hold
R_{99}	500 ohms 5W 10%	R-8161	
R_{100}	220 ohms 1/2W 10%	R-8159	
C_1 thru C_{21}	Located in Standard Coil Tuner.		Supplied by Manufacturer of Tuner
C_{22A}, C_{22B}, C_{23A}, C_{23B}, C_{25A}, C_{25B}	2x4000mmf 500V 10%	K-9110	Dual Ceramic Disc
C_{24}, C_{29}, C_{56}, C_{57}, C_{65}, C_{69}, C_{77}, C_{78}	5000mmf 600V 10%	K-9128A	Mica
C_{26}	4.7mmf 500V 10%	K-9101	B.C. Hi-Cap
C_{27}	.22mfd 200V 10%	K-9136	Wax Paper Tubular
C_{28}, C_{30}, C_{48}, C_{51}, C_{60}, C_{62}, C_{73}	.1mfd 400V 10%	K-9114	Molded Paper Tubular
C_{31}, C_{41}, C_{50}	.022mfd 400V 10%	K-9127	Molded Paper Tubular
C_{32}	150mmf 500V 10%	K-9103	B.C. Hi-Cap
C_{33}, C_{36}, C_{71}	.0047mmf 400V 10%	K-9111	Molded Paper Tubular
C_{34}, C_{37}	47mmf 500V 10%	K-9102	B.C. Hi-Cap
C_{35}, C_{44}, C_{59}, C_{72}	.01mfd 400V 10%	K-9112	Molded Paper Tubular
C_{38}	82mmf 500V 10%	K-9141	Mica
C_{39}, C_{42}, C_{58}	.047mfd 400V 10%	K-9113	Molded Paper Tubular
C_{40}, C_{47}	.47mfd 200V 10%	K-9116	Molded Paper Tubular
C_{43}, C_{66}	180mmf 500V 10%	K-9130	TCN - 330 B.C. Hi-Cap
C_{45}	820mmf 500V 5%	K-9129	Silver Mica
C_{46}	3000mmf 500V 10%	K-9140	Mica
C_{49}	50-380mmf Trimmer	K-9106	Horizontal Drive
C_{52}	68mmf 3KV	K-9137	Part of L-6116 in Yoke
C_{61}	500mfd 50V	K-9139	Electrolytic, Tubular
C_{67}	470mmf 500V 10%	K-9135	B.C. Hi-Cap
C_{68}	1500mmf 500V 10%	K-9134	B.C. Hi-Cap
C_{70}	5mfd 50V	K-9117	Electrolytic, Tubular
C_{74A}, C_{74B}	60mfd @ 350V and 100mfd @ 250V	K-9006B	Dual Electrolytic, Tubular Twist Lock Can
C_{75A}, C_{75B}, C_{76A}, C_{76B}	2x40mfd 450V 10%	K-9118A	Dual Electrolytic, Tubular Twist Lock Can
C_{100}	6-160mmf Trimmer	K-9142	Horizontal Range
C_{53}, C_{54}, C_{55}	CRL-PC-100	M-0017	Part of Vertical Integrator
C_{63}	6.8mmf B.C. Hi-Cap.	K-9122	Part of L-6109 Audio Takeoff
C_{64}	20mmf Ceramic Disc.	K-9123	Part of L-6109 Audio Takeoff
L_1 thru L_{11}	Located in Standard Coil Tuner.		Supplied by Manufacturer of Tuner
L_{12}	40uh (Choke)	L-6114	
L_{13}, L_{14}, L_{16}	145uh Peaking Coil.	L-6109	Durez Coated Blue Dot & 15K
L_{15}	400uh Peaking Coil.	L-6120	Durez Coated Orange Dot & 12K
L_{17}	4.5MC I.F.	L-6101	Audio Takeoff
L_{18}	Filter Choke.	L-6005	2.5h @ 250 ma
L_{19}, L_{20}	90^{o} Deflection Yoke.	L-6116	46uh Vertical 12.5uh Horizontal
T_1	Located on Standard Coil Tuner.		Supplied by Manufacturer of Tuner
T_2	21.9MC 1st I.F.	X-5107A	Blue Dot I.F. Transformer
T_3	24.7MC 2nd I.F.	X-5109A	White Dot I.F. Transformer
T_4	23.9MC 3rd I.F.	X-5108A	Red Dot I.F. Transformer
T_5	Ratio Detector Transformer.	X-5105	
T_6	Sound Output Transformer.	X-5006	
T_7	Power Transformer.	X-5117	
T_8	Vertical Oscillator Transformer.	X-5110	
T_9	Vertical Output Transformer.	X-5116	
T_{10}	Horizontal Output & H.V. Transformer.	X-5113	
T_{11}	Syncro-Guide Transformer.	L-6112	



AMERICAN TELEVISION TV PAGE 12-9

CHASSIS Series "D"

MODEL 1127

MODEL 621CM

MODEL 721CDM

GENERAL DESCRIPTION

30 tube receivers (including picture tube and three rectifiers). Features include: full 12 channel coverage; latest Standard Coil Cascode Circuit RF tuner, with high signal to noise ratio, UHF adaptable; limiter-discriminator FM sound system; high second anode potential for full picture brilliance and definition; automatic frequency control of the horizontal oscillator (Syncrolok); full 4 mc. bandwidth of the picture channel; noise saturation circuits; keyed A.G.C.; and a phonograph input connector by means of which the sound section may be used as an audio amplifier. Reference is made to the overall *Circuit Diagram*

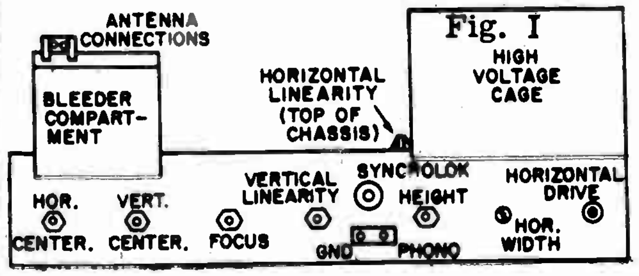


Fig. I

ELECTRICAL SPECIFICATIONS

RF Frequency Range: Channels 2 to 13 in 12 steps.

Power Supply Rating: 117 Volts, 60 Cycles, 275 Watts.

Audio Power Rating: Undistorted—2.5 Watts.
Maximum—4 Watts.

Antenna Input Impedance: 300 Ohms.

RF amplifier and RF oscillator-Mixer tubes are also supplied. These are the 6J6, oscillator and mixer, and 6BK7 or 6BQ7, RF amplifier in the tuner.

TUBE COMPLEMENT

Circuit Symbol	Tube Type	Function
V101	6BA6	1st Sound IF Amplifier
V102	6BA6	2nd Sound IF Amplifier
V103	6AU6	3rd Sound IF Amplifier (Limiter)
V104	6AL5	Sound Discriminator
V105	6AT6	1st Sound Amplifier and Syncrolok Damper
V106	6K6	Audio Output Tube
V107	6AG5	1st pix IF Amplifier
V108	6AG5	2nd pix IF Amplifier
V109	6AG5	3rd pix IF Amplifier
V110	6AG5	4th pix IF Amplifier
V111	6AL5	Pix 2nd Det. and D.C. Restorer
V112	6AU6	1st Video Amplifier
V113	6K6	2nd Video Amplifier
V114	6AU6	AGC Keying Tube
V115	6J5-GT	High Frequency Sync Clipper
V116	6J5-GT	Low Frequency Sync Clipper
V117	6SN7-GT	2nd Sync Amplifier and Horizontal Discharge
V118	6J5-GT	Vertical Oscillator and Discharge Tube
V119	6K6	Vertical Output Tube
V120	6AL5	Horizontal Sync Discriminator
V121	6K6-GT	Horizontal Oscillator
V122	6BG6-G	Horizontal Output—
V123	6AC7	Horizontal Oscillator Control
V124	1B3-GT/8016	High Voltage Rectifier
V125	6W4-GT	Damper
V126	5U4-G	Rectifier
V127	5U4-G	Rectifier

INSTALLATION NOTES

Adjust the Ion Trap

In order to prolong the life of the picture tube, it is important that the following adjustment be made on every receiver upon installation and every time the receiver is serviced:

Very carefully move the ion trap forward or backward, and at the same time, rotate it in either direction; adjust for the brightest picture possible with the brightness control set for average brightness.

Note that there may be two locations where the brightest picture can be produced. The ion trap location that is further forward on the picture tube neck should *not* be used; use the location nearer the rear.

IMPORTANT:—If the corners of the picture are shaded, be sure the ion trap has been properly adjusted. Do not sacrifice picture brightness when adjusting the ion trap to remove shaded corners. To eliminate shaded corners, see the discussion under "Check Picture Centering". Be sure to re-adjust the ion trap *each time after adjusting the focus coil.*

If the picture or raster is off-center with respect to the mask, to the right or left, or too high or too low, it may readily be repositioned by adjustment of the Horizontal and Vertical centering controls located on the rear apron of the chassis. (See Fig. I).

If the picture has a slightly blurred or fuzzy appearance, this may be cleared up by adjustment of the FOCUS control on the rear panel. The focus control should be adjusted for sharpest and clearest picture while viewing the face of the picture tube at close range, using a mirror if necessary. A good indication can be gotten by closely observing the scanning lines of the picture and adjusting for the sharpest and thinnest lines across the entire face of the picture tube.

When the height of the picture is not sufficient to fill the mask, or if vertical non-linearity is present (evidenced by unequal heights of the vertical wedges in the test pattern, or heads and bodies being out of proportion in a picture), the VERTICAL LINEARITY AND HEIGHT controls must be adjusted. These two controls affect each other, and when one is adjusted, it is usually necessary to readjust the other to obtain a satisfactory picture. The HEIGHT CONTROL has its greatest effect on the bottom half of the picture, while the LINEARITY CONTROL mostly affects the top half. If the picture width is not right, or if horizontal non-linearity is present, (i.e., one side of the picture expanded and the other side squeezed in), adjustment of the HORIZONTAL WIDTH, HORIZONTAL LINEARITY and/or HORIZONTAL DRIVE controls will be necessary. (See Fig. I).

Check Picture Tilt

If the picture is tilted, loosen the wing screw on the deflection yoke coil and slightly rotate the yoke until the picture is straight. Before tightening the wing screw, be sure that the yoke is moved as far forward as possible, otherwise corners of the picture may become shaded.

If the picture does not hold in sync throughout the range of the HORIZONTAL HOLD control, it may be possible to make it do so by adjusting the SYNCROLOK control on the rear panel. If this cannot be done, a detailed adjustment of the sync system, must be made.

9. Using a Record Player

Provision is made on the chassis for playing a record player throughout the receiver. The record player may be placed at a remote point, or near the set. The means of connecting the record player to the receiver is as follows:

A terminal link board at the central rear chassis apron is the external means for connecting the record player through the audio amplifier of the television receiver. This is so labeled on the rear chassis apron. Also, see Fig. I. Use a *shielded* phono lead between the player and the television chassis. This is to minimize extraneous pickup into the sensitive audio system of the chassis. Connect the shield end of the phono lead to the link board Terminal No. 1, which is at ground. Connect the phono *output* lead to Terminal No. 3.

Operation: The procedure for using the record player through the television receiver after the preceding connections are installed is as follows:

A phono switch is provided on the Brightness Control. When the Brightness Control is turned to its extreme *counter-clockwise* position, a click will be heard at this point, as the phono switch is thus turned on. With this simple motion all reception and light are entirely extinguished from the picture tube, and the phono circuit is put into operation. Reference may be made to the Schematic Circuit Diagram for the simple circuit involved.

The record player is now ready to be used. To adjust the phono volume, use the regular volume control on the television receiver.

When resumption of television reception is desired, simply turn and reset the Brightness Control clockwise in the normal manner.

ALIGNMENT PROCEDURE

Equipment Needed

Signal generator (or sweep signal generator with internal Sweep signal generator) marker generator.

Cathode Ray Oscilloscope.

Plastic aligning tool having a recessed metal blade.

Adjustable low voltage source (0-6V).

Pre-Alignment—Fixed Frequency

1. Connect the RF output leads of the signal generator between the shield of the 6J6 in the tuner and ground. Raise the shield slightly so that it no longer contacts the chassis. Switch to modulated RF.
2. Attach the vertical amplifier leads of the Cathode Ray Oscilloscope to the picture 2nd detector load resistor (R139—3900 Ohms). Use high vertical amplifier gain.
3. Disable the AGC system by connecting the low voltage supply across the AGC condenser C134 (0.47 Mfd). (Positive side to ground) and removing the AGC tube in the H.V. cage.
4. Adjust the signal generator to produce each of the listed frequencies using *barely sufficient* RF output to produce a usable 400 cycle sine wave pattern on the screen of the oscilloscope in each case. Make sure that there is no over-loading by raising and lowering the RF output and observing that the sine-wave pattern varies in amplitude accordingly. Use sufficient AGC voltage to prevent over-loading.
5. At each listed setting of the signal generator, adjust the specified screw for maximum or minimum amplitude of the sine-wave pattern as indicated.

Adjustment	Frequency	Coil	Location	Amplitude
A	25.7 MC.	Converter Coil (Tuner)	Top	Max.
B	22.3 MC.	1st Pix IF (T103)	Bottom	Max.
C	22.8 MC.	2nd Pix IF (T104)	Bottom	Max.
D	25.7 MC.	3rd Pix IF (L183)	Top	Max.
E	23.9 MC.	4th Pix IF (T105)	Top	Max.
F	21.75 MC.	1st Pix IF (T103)	Bottom	Min.
G	21.75 MC.	4th Pix IF (T105)	Bottom	Min.
H	20.25 MC.	2nd Pix IF (T104)	Top	Min.
I	27.75 MC.	3rd Pix IF (L183)	Bottom	Min.

6. It is advisable to repeat step 5 if the adjustments required resetting by more than a few turns from their original position.
7. Now connect the oscilloscope leads to Terminal A of the 2nd sound IF transformer T112 and ground.
8. Set the signal generator to 21.75 mc. and adjust the top and bottom screws of the 1st and 2nd sound IF transformers T111 and T112 for maximum amplitude of the sine wave pattern.
9. Connect the oscilloscope leads to the junction of R111 (22 K ohm resistor emerging from shield over sound discriminator socket) C116 at the output of the sound discriminator. The junction is at the end lug of a terminal strip mounted on the inner side apron of the chassis.
10. Still using 21.75 mc. adjust the primary of the sound discriminator transformer T113 (Top) for maximum amplitude and then adjust the bottom for zero amplitude. This zero should be quite critical with a sharp rise of amplitude to either side of the zero amplitude position.

Sweep Alignment

1. Connect RF output of the sweep signal generator to the antenna terminals. Set the frequency to 85 mc. and the sweep width to 10 mc. Switch tuner to Channel 6. Set AGC voltage to −2 volts.

NOTE: — Steps 1 and 3 apply if separate sweep and signal generators are available. This is the preferable method. If a sweep generator with internal marker generator is the available instrument, connect as per step 1 of the pre-alignment instructions. Use a sweep frequency of about 24 mc. and disable the local oscillator of the tuner by using a 6J6 with Pin No. 1 broken off or carefully balancing the Standard Coil Tuner switching mechanism between channels. With the Dumont tuner only the former method can be used.

Be careful not to use excessive sweep signal output or marker injection as mis-shaping of the response curve will result.

2. Attach the oscilloscope leads to the terminals of the pix 2nd detector load resistor (R139-3900). Connect the Hor. amplifier input of the oscilloscope to the horiz. sweep output of the sweep signal generator. Switch off the internal sweep of the oscilloscope.

NOTE: — Excessive marker injection will alter the shape of the response curve. Use as little RF output as is necessary to produce a "birdie".

3. Clip the signal generator output lead to the "body" (no electrical connection) of the grid resistor of the 1st pix IF amplifier (R119-22 K ohms) near the AGC end. This serves to inject a weak signal capacitively into the pix IF amplifier. If this method of coupling doesn't produce a "birdie" or marker on the response curve, try clipping the signal generator leads between various points of the tuner chassis.
4. Use sufficient RF output of the sweep generator to produce a sweep pattern on the oscilloscope screen. Be very careful not to use excessive RF output or overloading will result. This will flatten the bottom of the response curve as viewed on the scope.
5. If 85 mc. input is being used, rotate the fine tuning control of the television chassis until the entire response curve comes into view. Use that portion of the fine tuning range where the response curve remains uniform. If some portion of the response curve is still off the horizontal trace, try changing the sweep generator or using greater sweep width.
6. The various adjustments should be touched up as follows to produce a response curve to conform with figure 2.

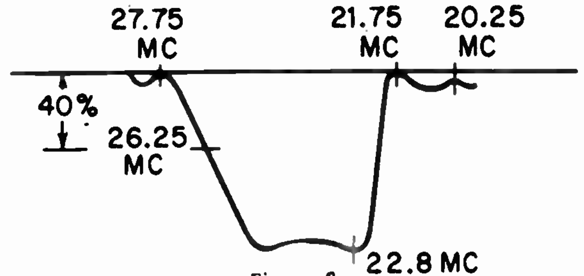
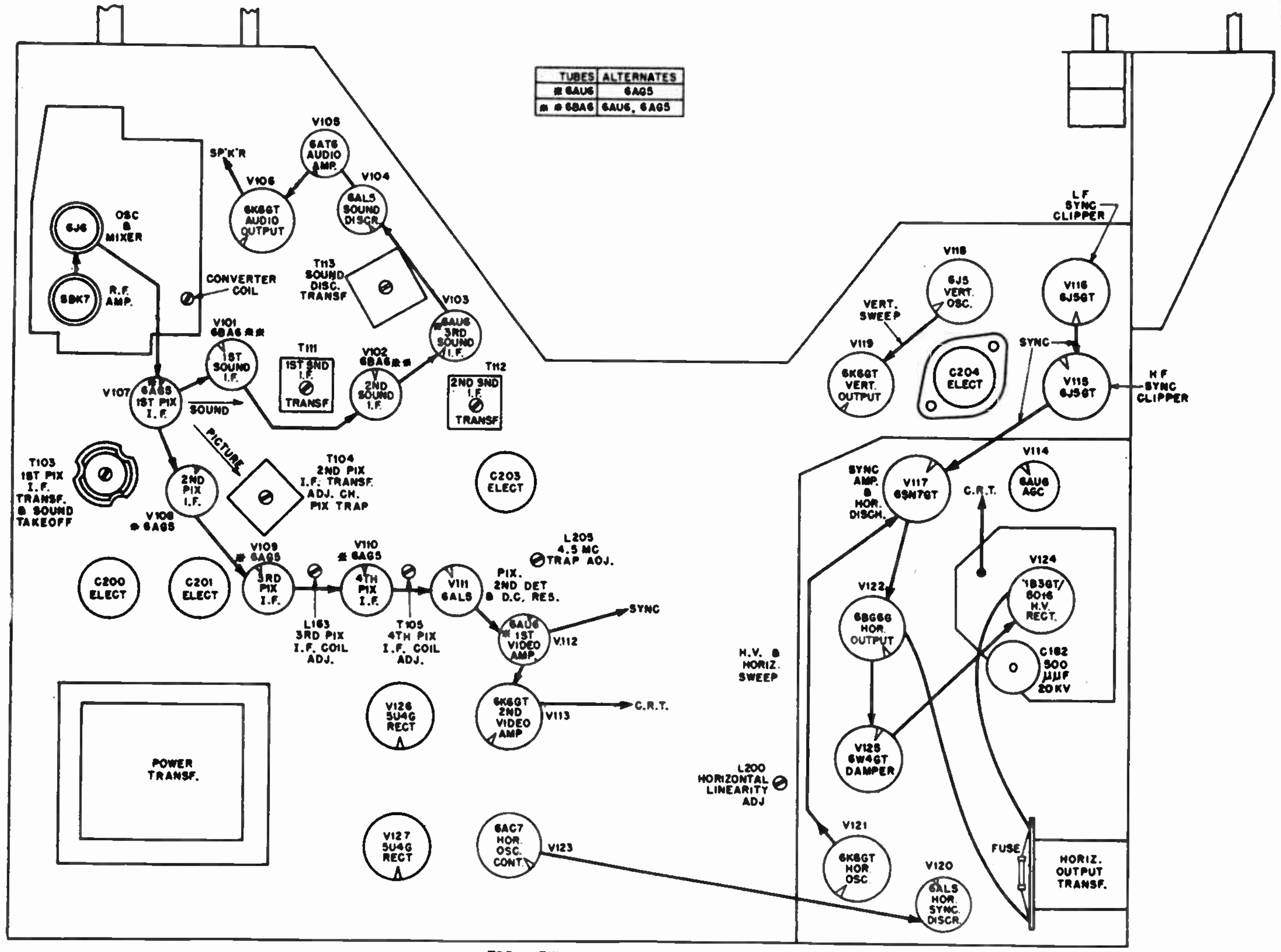


Figure 2
I.F. Alignment Curve

7. If any of the adjustments were changed substantially from their pre-alignment position, repeat adjustments F-I of step 5, pre-alignment instructions.
8. Remove oscilloscope leads and connect to the 2nd sound IF transformer, lug A. Set the sweep and signal generators to 21.75 mc. and reduce the sweep width to about 1 mc.
9. Readjust the 1st and 2nd sound IF coils (Top and Bottom) for a symmetrical response curve to either side of 21.75 mc.



Marker	Frequency	Coils	Location	Function
A	22.8 MC.	1st Pix IF (T103)	Bottom	Max. response at 22.8 MC.
		2nd Pix IF (T104)	Bottom	Min. response between 21.75 MC. and 20.75 MC. traps. Low frequency shaper.
B	26.25 MC. (Pix carrier)	Converter (Tuner)	Top	Marker (26.25 MC.) Adjustment at 30-40% of max. amplitude.
		3rd Pix IF (L183)	Top	High frequency shaper.
C	26.25 MC.	4th Pix IF (T105)	Top	Balance response curve.

10. Now attach the oscilloscope leads to the end of the 22K Ohm resistor emerging from the shield over the socket of the sound discriminator tube. The "S" curve should now appear. Adjust the primary of the sound discriminator transformer (T113) for equal upper and lower peaks without excessive loss of amplitude.

Tuner Channel Slug Adjustment

Individual channel tuner oscillator adjustments of the television receiver should be checked, upon its installation or servicing. If such adjustments are properly made, it is possible to tune from one station to another by merely turning the CHANNEL Selector and, if necessary, slightly readjusting the fine TUNING control. With correct oscillator channel adjustment, best picture and satisfactory sound will be located at the approximate center (half rotation) of the range of the FINE TUNING control.

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.

b. Set the CHANNEL SELECTOR knob for a station; set other controls for normal picture and sound.

c. Set FINE TUNING control at center of its range by rotating it approximately half way.

d. Remove the CHANNEL Selector and FINE TUNING knobs.

e. Insert a 1/8" blade, non-metallic screwdriver in the 1/4" hole (to the right of the channel tuning shaft). For each channel in operation, carefully adjust the channel slug for best picture with clear detail and best sound. Be sure that the FINE TUNING control is set at the center of its range before adjusting each channel slug. Generally, only a slight rotation of the slug will be required, turning the slug in too far will cause it to fall into its coil. (If the slug falls into the coil, remove the coil strip from the tuner, move the retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace slug and re-set retaining spring.)

GENERAL TROUBLE-SHOOTING NOTES

The lay-out diagram shows the various "strings" or chains of vacuum tubes that control the pix, sound, "sync" signals, vertical and horizontal sweeps. In the event of failure of any portion of the chassis, trouble-shooting should be undertaken in the following order:

1. Replace the tubes in the involved "string" in sequence.
2. Check the voltage readings against those listed on the schematic diagram for the involved "string".
3. Compare the wave-forms against those shown. An approximate method for measuring the peak voltages as listed is to use the 6.3 volt heater supply as a reference. The method consists of observing the desired pattern on the oscilloscope screen and then comparing the amplitude with that obtained by connecting to the heater voltage without altering the vertical amplifier gain sitting. The overall amplitude, (top to bottom of the observed heater voltage) represents approximately 18 volts.

AGC System

The AGC system keeps the voltage across the 2nd detector load resistor (R139-3900 Ohms) at a reasonably constant level (−1.8) volts for all signals of reasonable signal strength. Defects in the system can cause this voltage to rise or fall excessively.

The AGC voltage as measured across the AGC condenser (C134-47 Mfd) ranges from a fraction of a volt (−) to a little over −4 volts.

As a rough check of the system, if trouble is suspected, remove the 6AU6, 1st video amplifier. The AGC voltage should rise to well over −40 volts and the sound should disappear as the tuner and 1st pix IF amplifier are cut-off.

Sympton of AGC Defects

(a) *Picture appears on weak signal or without antenna but strong signal produces black white raster. Sound normal* — this is due to lack of AGC voltage and may be due to a defective AGC tube (6AU6) in the high voltage cage or a defective width control (mounted above flyback transformer on rear of cage).

(b) *Absence of picture and sound, raster normal*— Replace the tubes that are common to the picture and sound "strings". If this doesn't help try replacing the 1st video amplifier and the AGC tube (6AU6). If the trouble lies in the AGC system, there will be an excessively high AGC voltage across C134, and the AGC condenser (.47 Mfd).

Barkhausen Oscillations

Under certain operating conditions, the horizontal output circuit may produce spurious signals of a type known as "Barkhausen oscillations". These signals cause one or more dark vertical stripes to appear in the picture on some channels usually on the left-hand side.

In order to eliminate them, take the following steps in order:

1. Reduce the horizontal drive (turn the horizontal drive trimmer screw clockwise).
2. Dress the antenna lead-in away from the H.V. cage and power line-cord.
3. Replace the 6BG6-G horizontal output tube.
4. Replace the deflection yoke.
5. Replace the horizontal output (Flyback) transformer.

Insufficient Height Consistent with Good Linearity

1. Replace tubes in the vertical sweep "string".
2. Replace the vertical output transformer T107.
3. Check voltages and waveforms.

Picture Twists Horizontally

1. Replace tubes in the sync "string".
2. Replace the 6AC7, hor. osc. control and the hor. sync discriminator, 6AL5.
3. Check the cathode resistors and condensers of the 6J5 sync clippers, V115, V116 according to the schematic diagram.
4. Check the voltages and waveforms.

Buzz in Sound which Disappears when Contrast Control is Rotated Fully Clock-wise

1. Redress white wire to center arm of the contrast control away from other leads and up against side apron of chassis.

Picture Over-loads (Picture excessively black and white with almost no grays)

This sometimes occurs in a very strong signal area due to the very high signal strength over-loading the tuner beyond the limits of the AGC system. In that case, it is necesary to reduce the signal strength by the insertion of a suitable pad in series with the antenna terminals. A sketch of a recommended type is shown below constructed from small carbon resistors. In the event that the over-loading occurs in a weak or normal signal area, trouble in the AGC system should be suspected.

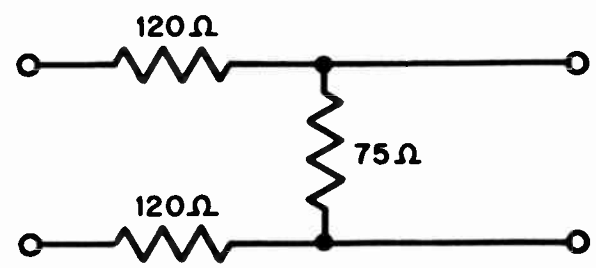


Fig. 5

Several Vertical White Stripes in the Left Side of the Picture (disappears when the width switch is snapped to wide position)

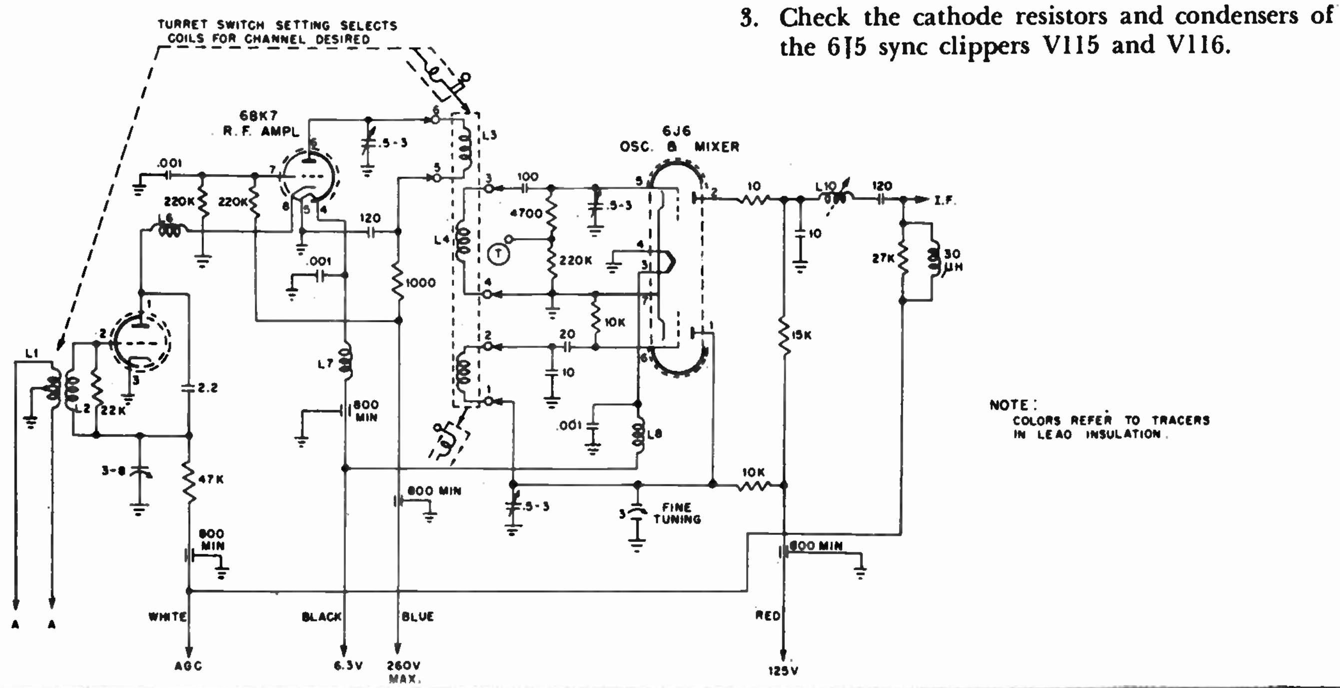
Replace R219, 470 resistor across width control. Use a 5 Watt resistor.

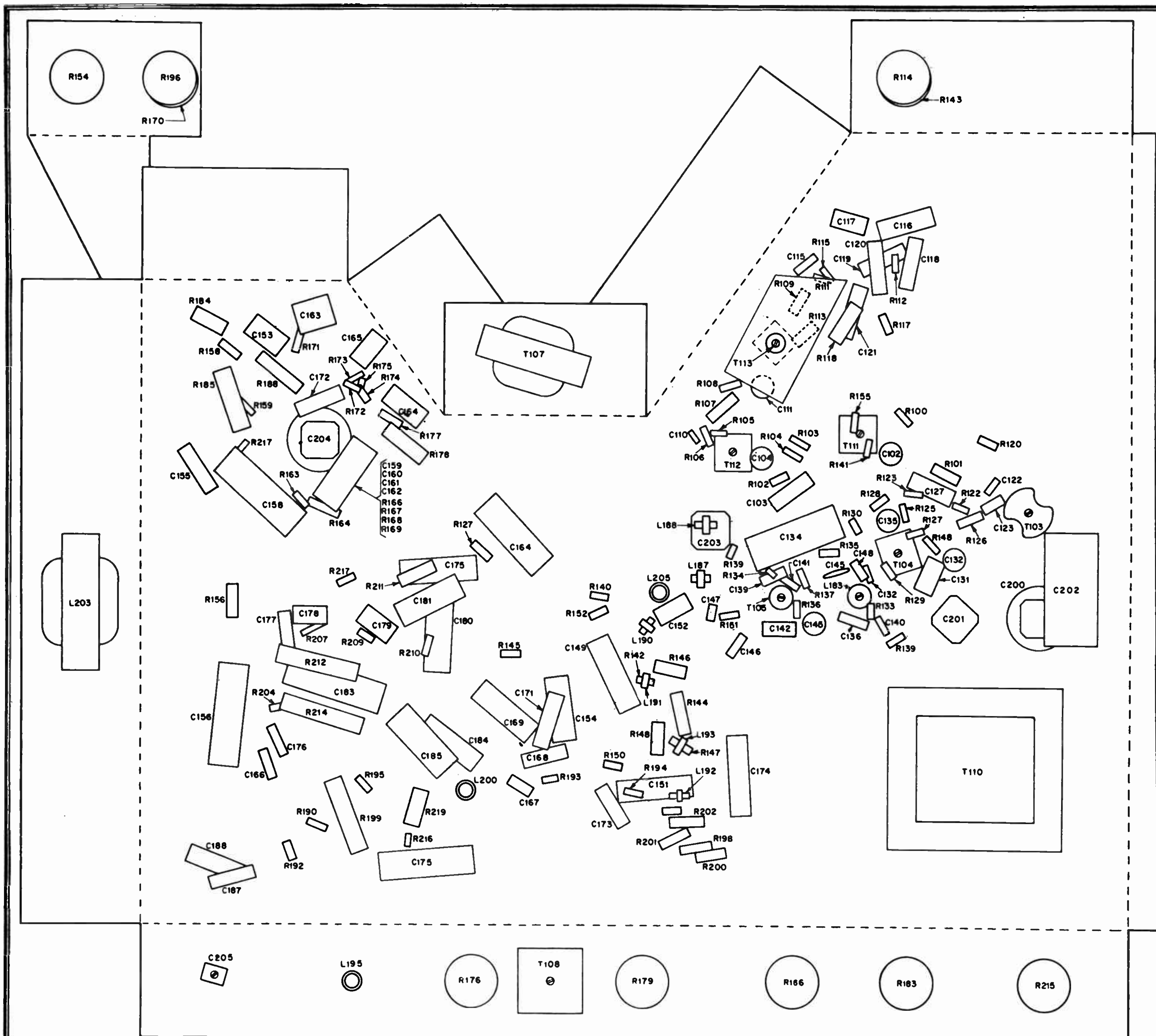
Incorrect Vertical Frequency

1. Replace 6J5 vertical oscillator.
2. Check all the resistors and condensers of the vertical oscillator and discharge circuit.
3. Check the integrating network (R167, 168, 169, C160, 161, 162, etc. contained in a printed circuit wafer).
4. Check the vertical blocking oscillator transformer—T106.

Lack of Vertical Hold

1. Replace the tubes of the sync "string".
2. Check the integrating network (R167, 168, 169, C160, 161, 162, etc. contained in a printed circuit wafer).
3. Check the cathode resistors and condensers of the 6J5 sync clippers V115 and V116.





BOTTOM VIEW
PARTS LAYOUT

RESISTANCE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V 101	0	0	0	0	18K	18K	100	--
V 102	600K	0	0	0	18K	20K	100	--
V 103	22K	O	0	0	8.2K	8.2K	0	--
V 104	190K	94K	0	0	0	0	94K	--
V 105	12.5 meg	0	0	0	20K	20K	430K	--
V 106	100	0	16K	16K	270K	330K	0	0
V 107	230K	39	0	0	16K	16K	39	--
V 108	96K	40	0.15	0	16K	16K	40	--
V 109	92K	37	0.15	0	18K	15.5K	37	--
V 110	0.4	130	0	0	21K	15.5K	130	--
V 111	0.4	13.5	0	0	930K	0	3.9K	--
V 112	3.9	0	0	0	18K	14K	0.3	--
V 113	NC	0	18.5K	14.5K	1.1 meg	3.9K	0	4.2K
V 114	44K	14 K	0	0	87K	28K	14K	--
V 115	0	0	62K	NC	27K	14.5K	0	2. meg
V 116	0	0	62K	NC	27K	15K	0	2.2 meg
V 117	310K	24K	0	230K	275K	580	0	0
V 118	0	0	0.48 meg	86K	1.6 meg	56K	0	580
V 119	55K	0	16K	16K	2.2 meg	0.75K	0	2.6K
V 120	1.4 meg	700K	0	0	12	0	700K	--
V 121	NC	0	20K	24 K	30K	28K	0	9
6BG6G V 122	NC	0	10K	1NF	450K	NC	0	15 K
6BQ6GT V 122	NC	0	1NF	20K	550K	NC	0	800
V 123	0	0	0	1.8 meg	9	19 K	0	40K
V 124	NC	1NF	NC	NC	NC	NC	1NF	NC
V 125	--	NC	28K	14.5K	14.5K	15K	28K	28K
V 126	NC	15K	NC	570	NC	570	NC	15K
V 127	NC	15K	NC	570	NC	570	NC	15K

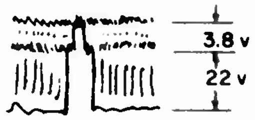
VOLTAGE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V 101	0	0	0	6.2AC	100	100	0.8	--
V102	0	0	6.3AC	0	100	98	0.9	--
V103	-0.25	0	0	6AC	39	39	0	--
V104	.02	-0.46	6AC	0	0	0	-0.5	--
V105	-0.84	0	6AC	0	-0.3	-0.3	66	--
V106	-14.8	6AC	210	215	-14.5	0	0	0
V107	-2.7	0.38	0	6AC	80	80	0.38	--
V108	-0.27	0.47	6AC	0	84	84	0.47	--
V109	-0.27	0.4	6AC	0	62	84	0.4	--
V110	0	1.1	6AC	0	58	94	1.1	--
V111	0	0	6AC	0	17	0	-1.2	--
V112	-1.2	0	0	6AC	88	102	0	--
V113	NC	0	75	102	2.1	0	6AC	5.4
V114	90	98	6AC	0	450	245	98	--
V115	0	6AC	235	NC	82	250	0	92
V116	0	6AC	235	NC	80	250	0	90
V117	1.35	34	0	-170	-35	-140	6AC	0
V118	0	0	270	-125	-250	-142	6AC	-140
V119	-140	6AC	220	220	-155	-142	0	-110
V120	-2	-15	0	6AC	-1.9	0	-15	--
V121	NC	0	165	180	-21	500	6AC	.25
6BG6G V122	NC	6AC		-9	-135	NC	0	120
V					-160			-140

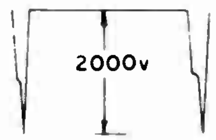
WAVE-FORMS

THESE WAVE-FORMS ARE SKETCHED FROM AN R.C.A. CATHODE RAY OSCILLOSCOPE WITH VERTICAL AMPLIFIERS OF EXTENDED HIGH FREQUENCY RESPONSE.

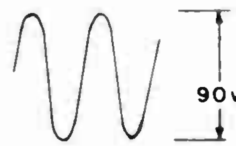
VIDEO SIGNAL OUTPUT OF PIX 2nd DETECTOR AT JUNCTION OF L188 AND R139 (60~)



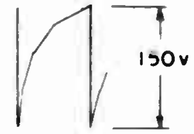
VIDEO SIGNAL OUTPUT OF 1st VIDEO AMPLIFIER AT JUNCTION OF L190 AND C149 (60~)



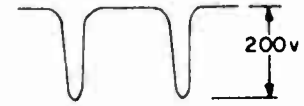
HORIZONTAL PULSE VOLTAGE TO YOKE AT TERMINAL 7 OF HORIZONTAL OUTPUT TRANSFORMER (15,750~)



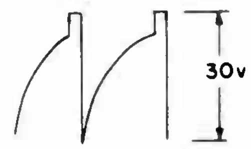
SINE WAVE AT TERMINAL A OF T108, SYNC DISCRIMINATOR TRANSFORMER (15,750~)



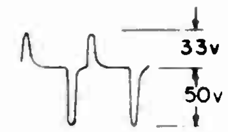
HORIZONTAL SAW TOOTH AT PIN 5 OF V122 6BG6 HORIZONTAL OUTPUT (15,750~)



OUTPUT OF PLATE CIRCUIT OF HORIZONTAL OSCILLATOR AT PIN 3 OF V121 6K6 (15,750~)

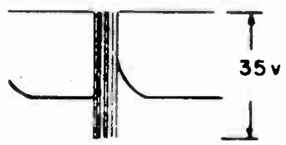


SINE WAVE PLUS HORIZONTAL SYNC PULSE AT TERMINAL F OF T108 SYNC DISCRIMINATOR TRANSFORMER (15,750~)

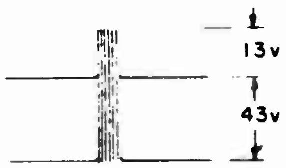


DIFFERENTIATED OUTPUT OF HORIZONTAL OSCILLATOR AT JUNCTION OF C176 AND C177 (15,750~)

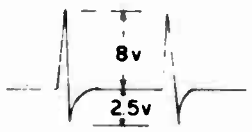
VIDEO SIGNAL OUTPUT TO GRID OF KINESCOPE AT JUNCTION OF L192 AND C151 (60~)



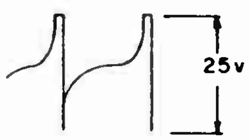
OUTPUT OF SYNC CLIPPERS V115 AND V116 AT PIN 3 OF EITHER TUBE (60~)



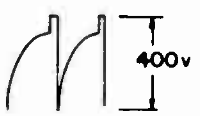
OUTPUT OF 2nd SYNC AMPLIFIER AT PIN 2 OF V117 (6SN7) (60~)



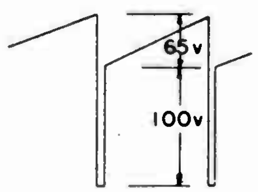
VERTICAL SYNC PULSE AT JUNCTION OF TERMINAL 3 OF THE VERTICAL INTEGRATING NETWORK AND THE YELLOW WIRE OF VERTICAL OSCILLATOR TRANSFORMER (6J5 VERT. OSC (V118) REMOVED FROM SOCKET) (60~)



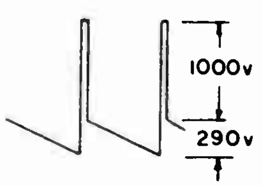
SINE WAVE PLUS HORIZONAL SYNC PULSE AT TERMINAL D OF T108, SYNC DISCRIMINTOR TRANSFORMER (15,750~)



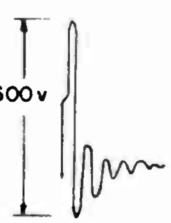
VERTICAL OSCILLATOR GRID PULSE (60 cycles) AT PIN 5 OF V118 6J5 (60~)



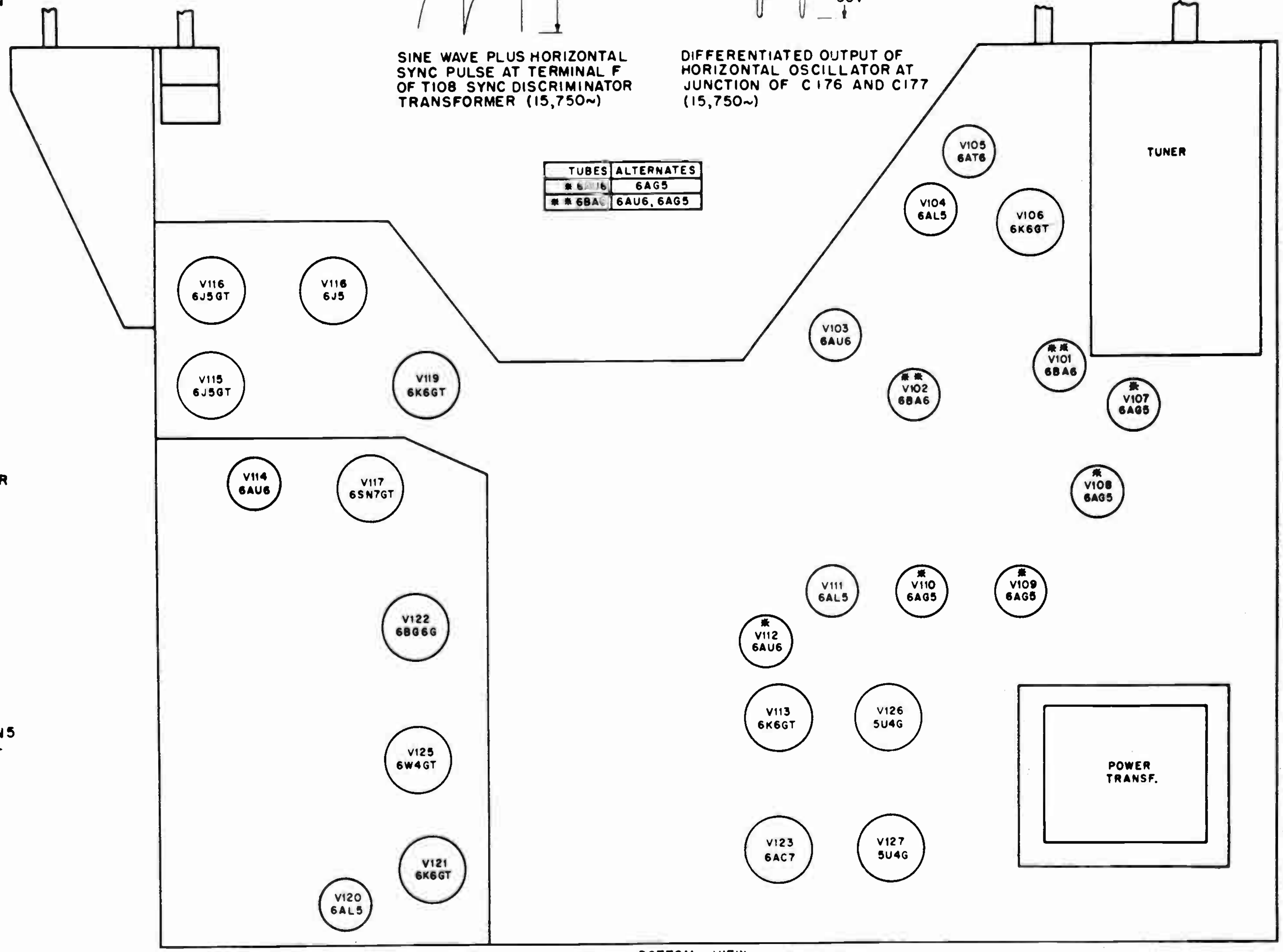
VERTICAL SAW-TOOTH AT PIN5 OF V119 6K6 VERTICAL OUTPUT (60~)



AMPLIFIED VERTICAL SAW-TOOTH AT PIN 3 OR 4 OF V119 6K6 VERTICAL OUTPUT (60~)



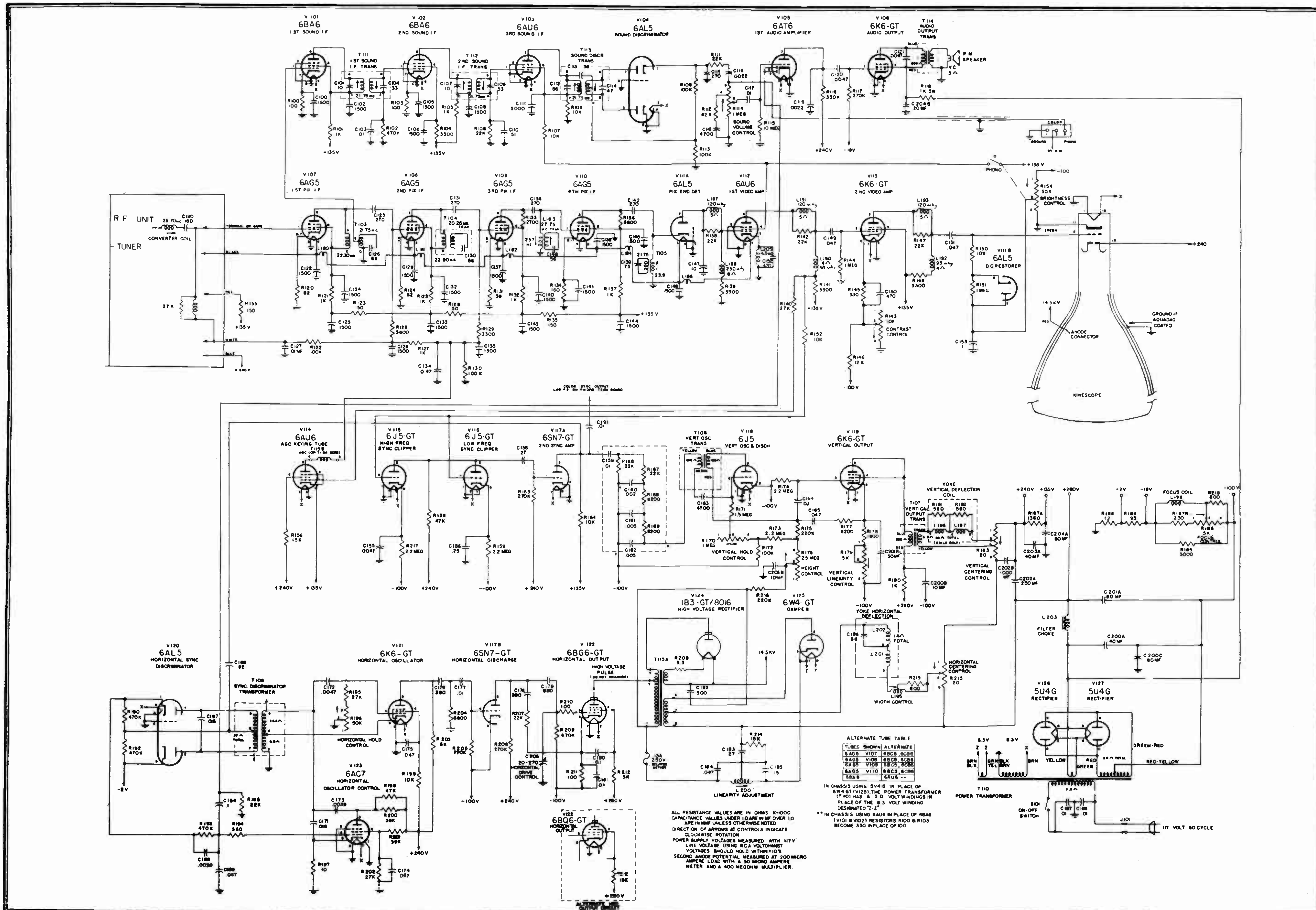
AGC KEYING PULSE AT PIN 5 OF V114 6AU6 AGC KEYING TUBE (15,750~)



BOTTOM VIEW

PARTS LIST

Ref. No.	Description	Part Number
	Resistors — Fixed — Carbon — ½ Watt	
R-208	3.3 ohms ± 10%	ERA-33G1
R-197	10 ohms ± 10%	ERA-1001
R-131	39 ohms ± 10%	ERA-3901
R-120, R-124	82 ohms ± 10%	ERA-8201
R-100, R-103, R-210	100 ohms ± 10%	ERA-1011
R-123, R-128, R-134, R-135, R-155	150 ohms ± 10%	ERA-1511
R-145	330 ohms ± 10%	ERA-3311
R-181, R-182, R-189, R-194	560 ohms ± 10%	ERA-5611
R-101, R-105, R-121, R-125, R-127 R-132, R-137	1000 ohms ± 10%	ERA-1021
R-178	1.8K ohms ± 10%	ERA-1821
R-191	2.2K ohms ± 10%	ERA-2221
R-133	2.7K ohms ± 5%	ERA-2725
R-129	3.3K ohms ± 5%	ERA-3325
R-104, R-141	3.3K ohms ± 10%	ERA-3321
R-139	3.9K ohms ± 5%	ERA-3925
R-126, R-136	5.6K ohms ± 5%	ERA-5625
R-204	6.8K ohms ± 10%	ERA-6821
R-177	8.2K ohms ± 10%	ERA-8221
R-108, R-150, R-152	10K ohms ± 10%	ERA-1031
R-156	15K ohms ± 10%	ERA-1531
R-106, R-111, R-165, R-207	22K ohms ± 10%	ERA-2231
R-140, R-195	27K ohms ± 10%	ERA-2731
R-158	47K ohms ± 10%	ERA-4731
R-112	82K ohms ± 10%	ERA-8231
R-109, R-113, R-122, R-130, R-172	100K ohms ± 10%	ERA-1041
R-175, R-205, R-216	220K ohms ± 10%	ERA-2241
R-117, R-163, R-206	270K ohms ± 10%	ERA-2741
R-116	330K ohms ± 10%	ERA-3341
R-102, R-190, R-192, R-193, R-209	470K ohms ± 10%	ERA-4741
R-144, R-151	1 megohm ± 10%	ERA-1051
R-171	1.5 megohm ± 5%	ERA-1555
R-159, R-173, R-174, R-217	2.2 megohm ± 10%	ERA-2251
R-115	10 megohm ± 10%	ERA-1061
	Resistors — Fixed — Carbon — 1 Watt	
R-188	12 ohms ± 10%	ERB-1201
R-180	1000 ohms ± 10%	ERB-1021
R-148	3.3K ohms ± 10%	ERB-3321
R-107, R-164, R-199	10K ohm ± 10%	ERB-1031
R-202	27K ohm ± 10%	ERB-2731
R-200, R-201	39K ohm ± 10%	ERB-3931
R-198	47K ohm ± 10%	ERB-4731
		ERB-4741
	Resistors — Fixed — Carbon — 2 Watt	
R-211	100 ohms, ± 10%	ERC-1011
R-146	12K ohms, ± 10%	ERC-1231
	Resistors — Fixed — Wire Wound — High Wattage	
R-184	100 ohms ± 10%, 5 Watts	ERD-115
R-218, R-219	600 ohms ± 10%, 10 Watts	ERD-104
R-185	3K ohms ± 10%, 10 Watts	ERD-110
R-212	5K ohms ± 10%, 10 Watts,	ERD-112
R-214	15K ohms ± 10%, 10 Watts	ERD-107
		ERD-109
R-187A, R-187B	Bleeder assy. — round — 1960 ohms and 230 ohms, 27 Watts	ERD-102
	Controls — Variable — Resistor	
R-176	Height — control — carbon — 2.5 megohms	EP-101
R-170, R-196	Vertical and Horizontal hold—dual control—50K ohms—1 meg carbon	EP-105
R-154	Brightness Control — 50 K ohms Carbon with SPST Switch	EP-106
R-114, R-143	Power on-off—sound—contrast—dual control—1 meg—10K carbon	EP-107
R-186	Focus control — wire wound — 5K ohms — 5 Watts	EP-108
R-179	Vertical Linearity Control — wire wound — 5K ohms — 2 Watts —	EP-111
R-183, R-215	Vertical and Horizontal Centering Controls — 20 ohms — 2 Watt —	EP-104
	Condensers — Fixed — Ceramic	
C-147	10 mmfd. ± 10%, 500 V.D.C.	EGC-100
C-110	51 mmfd. ± 10%, 500 V.D.C.	EGC-101
C-186	56 mmfd. ± 10%, 1000 V.D.C.	ECC-114
C-100, C-102, C-105, C-106, C-108, C-122, C-125, C-128, C-129, C-132, C-133, C-135, C-137, C-138, C-140, C-143, C-144, C-145	1500 mmfd. due GMV, 500 V.D.C.	ECC-111
C-124, C-141, C-146	1500 mmfd. single GMV, 500 V.D.C.	ECC-108
C-111	5000 mmfd. single GMV 500 V.D.C.	ECC-110
	Condensers — High Voltage — Ceramic	
C-182	500 mmfd. 20KV	ECC-105-B
	Condensers — Fixed — Mica	
C-166	82 mmfd. ± 10%, 600 V.D.C.	ECM-100-A
C-115, C-123, C-136,. C-142, C-131	270 mmfd. ± 10%, 600 V.D.C.	ECM-101
C-178, C-176	390 mmfd. ± 10%, 600 V.D.C.	ECM-113
C-150, C-152	470 mmfd. ± 10%, 600 V.D.C.	ECM-114
C-179	680 mmfd. ± 10%, 600 V.D.C.	ECM-115
C-163	4700 mmfd. ± 10%, 600 V.D.C.	ECM-102
	Condensers —.Variable	
C-205	20-270 mmfd., mica padder	ECM-112
	Condensers — Fixed — Moulded Paper	
C-116	.0022 mfd., 600 V.D.C.	ECP-102
C-119	.0022 mfd., 400 V.D.C.	ECP-116
C-168, C-173	.0039 mfd., 400 V.D.C.	ECP-103
C-118, C-120, C-121, C-155, C-172	.0047 mfd., 400 V.D.C.	ECP-105
C-103, C-117, C-127, C-187, C-188, C-177, C-191	.01 mfd., 400 V.D.C.	ECP-107
C-167, C-171	.015 mfd. ± 10%, 400 V.D.C.	ECP-123
C-165, C-184	.047 mfd., 600 V.D.C.	ECP-111
C-149, C-151, C-174, C-169, C-194, C-175	.047 mfd., 400 V.D.C.	ECP-110
C-153, C-154, C-181	.1 mfd., 400 V.D.C.	ECP-113
C-164, C-180	.1 mfd., 600 V.D.C.	ECP-114
C-185	.15 mfd., 600 V.D.C.	ECP-117
C-156, C-158, C-193, C-192	.27 mfd., 400 V.D.C.	ECP-115
C-183	.27 mfd., 600 V.D.C.	ECP-124
C-134	.47 mfd., 200 V.D.C.	ECP-121
	Condensers — High Electralytic	
204A, C-204B, C-204C	20 mfd./450 V.D.C., 80 mfd./350 V.D.C.	ECE-100
C-200A, C-200B, C-200C	40 mfd./450 V.D.C., 80 mfd./150 V.D.C., 10 mfd./450 V.D.C.	ECE-102
C-201A, C-201B	80 mfd./450 V.D.C., 50 mfd./50 V.D.C.	ECE-104
C-203A, C-203B, C-203C	40 mfd./450 V.D.C., 10 mfd./450 V.D.C., 10 mfd./350 V.D.C.	ECE-101
C202B, C202A	1000 mfd./6V, 250 mfd./12V dual condenser	ECE-109
	Coils and Transformers	
L-180, L-181, L-182, L-184 L-186	Choke, filament	EL-111
L-203	Choke, filter	EL-113
T-103	Coil, 1st video I.F. (21.75 mc sound take off)	EL-120
T-104	Coil, 2nd Video I.F. (20.25 mc trap)	EL-101
L-183	Coil, 3rd Video I.F. (27.75 mc trap)	EL-121
T-105	Coil, 4th Video I.F. (21.75 mc trap)	EL-122
L-187, L-191, L-193	Coil, Peaking—Blue (120 microh. and 22K)	EL-107
L-190, L-192	Coil, Peaking—Red (93 microh.)	EL-108
L-188	Coil, Peaking—Green (250 microh.)	EL-106
L-198	Coil, Focus	EL-114C
	Coils and Transformers	
L-200	Coil, Linearity	EL-126
L-205	Coil, 4.5 m.c. Trap	EL-102
L-195	Coil, width	EL-127
T-111, T-112	Transformer, Sound IF	EL-104
T-113	Transformer, Sound Discriminator	EL-105
	Yoke, Deflection	EL-112D
	Yoke, Deflection, Cosine Corrected	EL-138
T-110	Transformer, Power	ET-101-B
T-114	Transformer, Audio Output	ET-105
T-106	Transformer, Vertical Blocking Oscillator	ET-102
T-107	Transformer, Vertical Output	ET-103
T-108	Transformer, Syncrolok	ET-100
T-115A	Transformer, Horizontal Output, High Voltage with A.G.C. Winding	ET-106
	Electrical Components	
	Fuse, Pig Tail, Delayed Action—.15 amp.	EF-101
	Network, Integrating	ENW-100
	Tuner, Cascode, with Tubes and Shields	EFE-105



ALTERNATE TUBE TABLE

TUBES	SHOWN	ALTERNATE
6AG5	V107	6BC5, 6CB6
6AG5	V108	6BC5, 6CB6
6AG5	V109	6BC5, 6CB6
6AG5	V110	6BC5, 6CB6
6BA6		6AU6 **

IN CHASSIS USING 5V4G IN PLACE OF 6W4GT (V125) THE POWER TRANSFORMER (T110) HAS A 5.0 VOLT WINDINGS IN PLACE OF THE 6.3 VOLT WINDING DESIGNATED "Z-Z"

** IN CHASSIS USING 6AU6 IN PLACE OF 6BA6 (V101 & V102) RESISTORS R100 & R103 BECOME 330 IN PLACE OF 100

ALL RESISTANCE VALUES ARE IN OHMS K=1000
CAPACITANCE VALUES UNDER 1.0 ARE IN MF OVER 1.0 ARE IN MMF UNLESS OTHERWISE NOTED
DIRECTION OF ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION
POWER SUPPLY VOLTAGES MEASURED WITH 117V LINE VOLTAGE USING RCA VOLTOHMYST VOLTAGES SHOULD HOLD WITHIN ±10%
SECOND ANODE POTENTIAL MEASURED AT 200 MICRO AMPERE LOAD WITH A 50 MICRO AMPERE METER AND A 400 MEGOHM MULTIPLIER.

MODEL TV-5020

TV-5120

OPERATION

This television receiver is designed to operate on a 105-125 Volt AC, 60 cycle power line.

The receiver should not be installed near a radiator or any other area where it will be exposed to excessive heat. The position in a room will depend on the seating and lighting arrangements available. Best performance can be realized in a dim or moderately lit room.

The receiver is equipped with a built-in antenna which will afford excellent reception in most areas. A simple folded dipole antenna with reflectors used with a 300 ohm transmission line can be used in weak signal areas.

CONTROLS

VOLUME CONTROL AND ON-OFF SWITCH

The outer knob on the left side of the cabinet puts the receiver on or off and controls the sound. It has no affect on the picture quality.

CONTRAST CONTROL

The inner knob on the left side of the cabinet controls the picture contrast. Turning this control too far to the right will result in stark pictures with extreme black and white images. Turning it back too far will make the picture appear weak and washed out. The control should be adjusted until the picture appears natural with good black and white definitions.

CHANNEL SELECTOR

The bar knob on the right side of the receiver is used to select the required channel as indicated by the numbers on the channel selector escutcheon. The fine tuning inner knob should then be adjusted for the best picture and sound.

INSTALLATION

The deflection yoke, "Focalizer", and ion trap settings may have shifted during transit. These components and all other controls should be re-adjusted at the time of installation. Make all the following adjustments.

DEFLECTION YOKE

Loosen the two screws securing the yoke mounting bracket. Push yoke to the closest possible position on the "bell" of the cathode ray tube. Tighten screws. Loosen the screw on the bottom of the deflection yoke. With a test pattern visible on the screen, rotate yoke so that top of picture runs parallel with the cabinet top. Tighten screw.

ION TRAP

Turn the back panel brilliance control to the almost full position. Move the ion trap backwards and forwards carefully rotating it at the same time for the best possible brilliance on the screen.

FOCUS AND POSITIONING

This receiver is equipped with a newly designed device known as a "focalizer". It provides for all magnetic means of focusing and positioning.

POSITIONING

Loosen the two nuts securing the "focalizer" to the mounting bracket. Slide the "focalizer" up or down and from one side to the other until a position is located that centers the test pattern on the picture tube. In some cases it may be necessary to re-adjust ion trap if neck shadowing occurs.

NOTE "A"

Some models are manufactured with a "Focalizer" equipped with a "shutter" assembly. This shutter assembly is actuated by a rod extending out near the Cathode Ray Tube neck. Rotating this rod will also rotate the picture on the picture tube screen, thereby adding to the ease of picture centering.

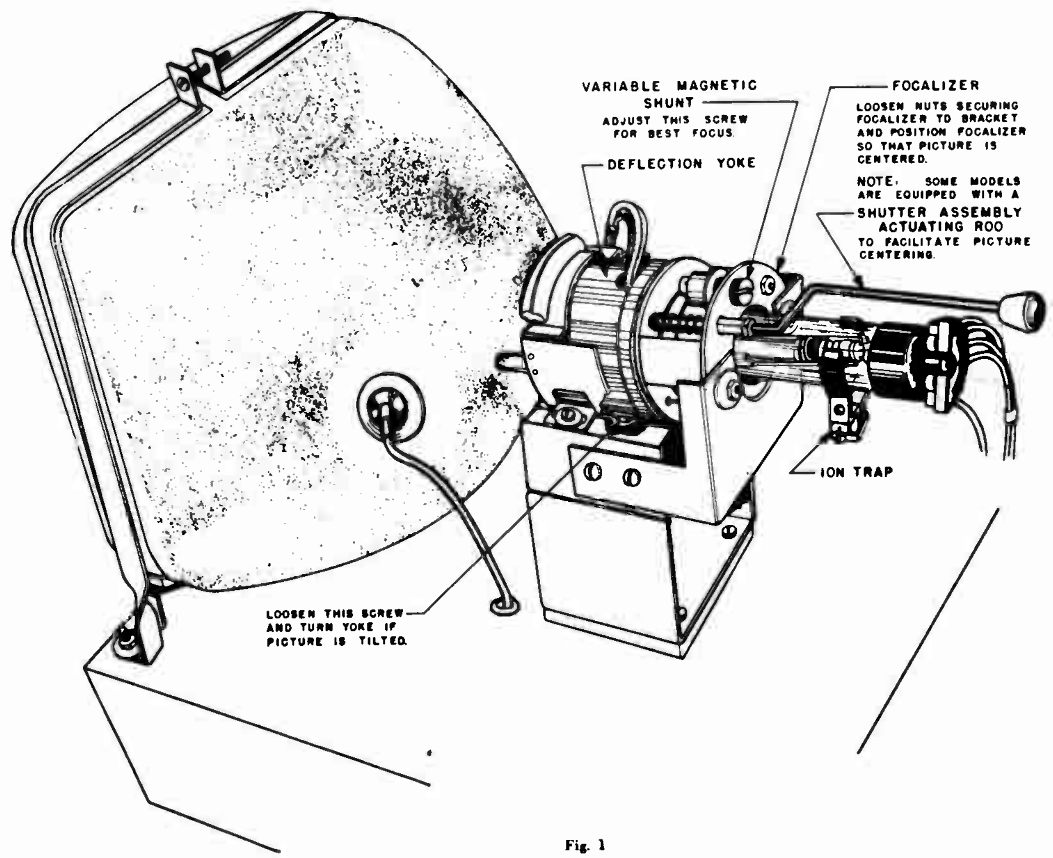
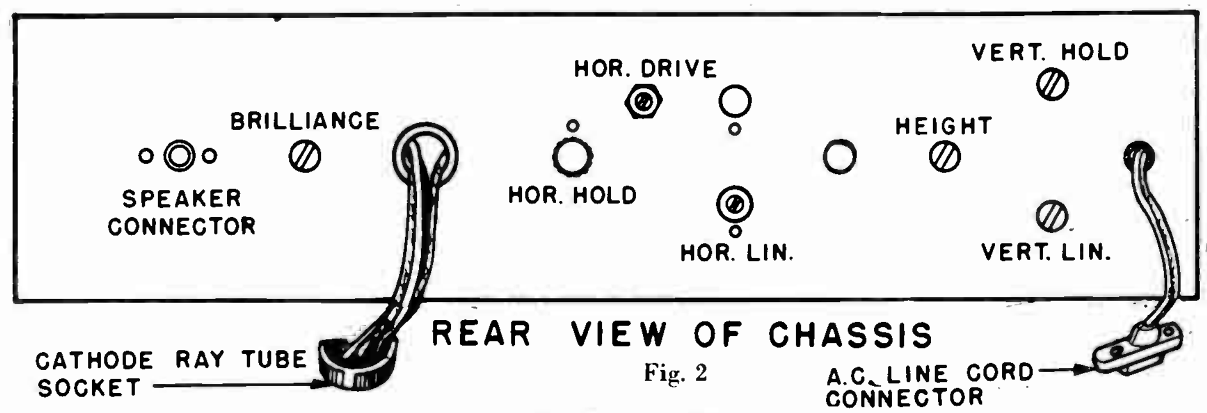


Fig. 1



REAR VIEW OF CHASSIS

Fig. 2

FOCUS

Turn the channel selector to an inoperative channel. Turn brilliance control up until the raster is visible. Adjust variable magnetic shunt by turning large screw on top of "Focalizer" until raster lines are in focus. Re-adjust ion trap and repeat variable magnetic shunt adjustment.

REAR CHASSIS CONTROLS

VERTICAL LINEARITY AND HEIGHT CONTROLS

Adjust these controls so that the entire picture screen is filled vertically, and that the test pattern measures the same from center to top and from center to bottom. There is normally some interaction between these controls and the adjustments should be repeated several times.

HORIZONTAL DRIVE

This control should be adjusted to obtain additional horizontal size. Improper adjustment of this control may result in two bright lines showing on the left hand side of the picture screen. Re-adjust this control until the lines disappear.

HORIZONTAL LINEARITY

Proper adjustment of this control will fill out the left side of the test pattern so that the pattern will be round and not flattened on one side.

VERTICAL HOLD

This control should be adjusted so that picture does not roll vertically. Re-adjust control if picture rolls when channel selector is turned on or off an active channel.

HORIZONTAL HOLD

Adjust this control so picture does not roll horizontally. Check this adjustment by putting channel selector on or off channel. If picture rolls horizontally, re-set control.

BRILLIANCE

Adjust the brilliance control so that picture appears natural with good black and white contrast. Turning up this control too far may result in diagonal white re-trace lines showing on the picture screen. The control should be turned back until these lines disappear. It may also be necessary to re-adjust the contrast control on the front panel while this adjustment is made.

GENERAL DATA

TUBE COMPLIMENT

V1.	6AG5	RF Amplifier
V2.	6J6	RF Oscillator and mixer
V3.	6AU6	1st Video IF Amplifier
V4.	6AU6	2nd Video IF Amplifier
V5.	6AU6	3rd Video IF Amplifier
V6.	6AL5	Video detector
V7.	12AU7	1st and 2nd Video Amplifier
V8.	6SH7	Ratio Detector driver
V9.	6AL5	Ratio detector
V10.	6SH7	1st Audio
V11.	6V6	Audio output
V12.	6SN7	Horizontal sweep oscillator
V13.	6BG6-G	Horizontal sweep output
V14.	1B3	High voltage rectifier
V15.	6W4	Horizontal damper
V16.	6AL5	Horizontal phase detector
V17.	12AU7	Sync. amplifier, Phase splitter and DC restorer
V18.	6J5	Vertical sweep oscillator
V19.	6BL7	Vertical sweep output
V20.	5U4	Low voltage rectifier
V21.	17BP4A 17RP4 16KP4 16RP4 or 16TP4 20CP4 20DP4-A	Cathode Ray Picture Tube

R.F. TUNER

This receiver is equipped with a tuner designed to operate satisfactorily in any local or fringe areas. The tuner has rugged turret style construction and features very high sensitivity and a high signal to noise ratio. All oscillator and RF coils are snapped into position on a drum and can be readily replaced if necessary. Oscillator adjustments are accessible from the receiver front and adjustment can be made without removing the receiver from the cabinet.

VIDEO I. F.

The video IF amplifier consists of 3 6AU6 stages with four IF transformers. A powdered iron slug adjustment for each coil is available on the top of the chassis. The IF transformers are stagger tuned to two frequencies. The fourth and second IFs are tuned to 25.6 MC and the third and first IFs are tuned to 23.4 MC.

SYNC. CIRCUIT

This receiver employs a new and improved "Sync. Amplifier, Phase Splitter, and DC Restorer" circuit. The AFC circuit in conjunction with this new circuit minimizes picture disturbances caused by ignition and similar types of interference. The improved sync. circuit also prevents vertical rolling in high interference or fringe areas.

VIDEO AMPLIFIER

The video amplifier in the receiver consists of a 12AU7 dual triode. The output of the video detector is fed into the first section of the video amplifier. The output stage of the 12AU7 is connected to the sound take-off coil where the sound is sent to the ratio detector driver, ratio detector, audio amplifier and finally to the speaker. Picture information is fed to the picture tube grid. Sync. pulses are also separated at the end of this stage and sent to their respective circuits.

SOUND SYSTEM

This receiver uses the Inter-Carrier Sound System. The difference between this system and other systems is that the sound and picture information are both carried through a single I. F. amplifier channel. The sound carrier is taken off the video amplifier by a 4.5 megacycle sound "take-off" coil and fed through a 4.5 MC amplifier to the Ratio Detector, and the audio amplifier. The advantage of this system is that the necessity of two IF amplifiers is avoided and that drift in the local oscillator does not distort or cut off "sound" reception.

VIDEO I. F. ALIGNMENT

(Refer to Fig. 3 and Fig. 8 for reference points)

1. A fixed battery bias should be applied to the AGC circuit for proper IF alignment. Connect negative terminal of 3-volt battery to reference point "B" the junction of 2.2 meg resistor (R31), 330 ohm resistor (R27), and 11,000 ohm resistor (R28).
2. Connect positive terminal of 3-volt battery to chassis ground.
3. Connect hot terminal of VTVM (set for negative voltage reading) to reference point "A", the junction of the video detector 700 MH peaking coil and 4.7 K resistor (R37).
4. Connect ground terminal of VTVM to chassis ground.
5. Lift 6J6 tube shield above ground and connect AM signal generator (unmodulated) to tube shield. Connect signal generator ground to nearest chassis ground. Keep signal generator leads short to avoid regeneration.
6. Align IF-24 and IF-22 at 25.6 MC for maximum output as indicated by the VTVM.
7. Align IF-23 and IF-21 at 23.4 MC for maximum output.

The over all IF response may be observed on a Cathode Ray oscilloscope in the following manner:

1. Connect the synchronizing sweep voltage from a sweep Generator to the horizontal input of an oscilloscope for horizontal deflection.
2. Loosely couple sweep generator by connecting to ungrounded tube shield floating over 6J6 tube and nearby ground. (Keep all leads short to avoid re-generation due to stray coupling.)
3. Set sweep generator to 24.5 MC frequency and 10 MC sweep width.
4. Connect vertical amplifier of scope to same point as VTVM, reference point "A", remove VTVM.
5. Set marker to 21.25 MC and 25.75 MC.

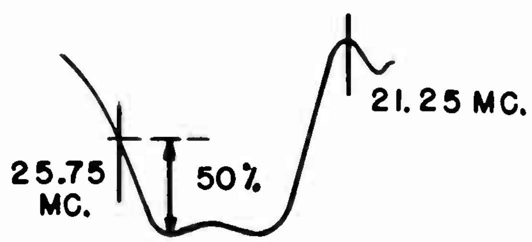


Fig. 4

Response curve should be similar to curve shown in Fig. 4.

Response curve may be flattened out and improved by re-adjusting IF 21 on front end.

OSCILLATOR ADJUSTMENT

The oscillators may be adjusted without removing the chassis from the cabinet by the following procedure:

1. Remove channel selector knobs.
2. Remove channel selector escutcheon.
3. Turn channel selector to desired station.
4. Set fine tuning control to the middle of its range.
5. Adjust oscillator screw through a hole located just to the right of the channel selector shaft. This adjustment should be made with a fibre or bakelite screwdriver. Set oscillator for best compromise between picture and sound.

The oscillators may all be adjusted by using an All Channel Television sweep generator, a Marker Generator and a Cathode Ray Oscilloscope.

The output of the sweep generator should be connected to the antenna terminals. Loosely couple marker generator to antenna terminals also.

Connect high side of oscilloscope to same point "A" as VTVM connection and ground side of scope to nearest chassis ground.

Frequency settings for each channel can be determined from the chart below.

SOUND IF FREQUENCY 21.25 MC.
PICTURE IF FREQUENCY 25.75 MC.

Frequency Chart

Channel	*Frequency*	*Picture Marker Frequency*	*Sound Marker Frequency*
2	54-60	55.25	59.75
3	60-66	61.25	65.75
4	66-72	67.25	71.75
5	76-82	77.25	81.75
6	82-88	83.25	87.75
7	174-180	175.25	179.75
8	180-186	181.25	185.75
9	186-192	187.25	191.75
10	192-198	193.25	197.75
11	198-204	199.25	203.75
12	204-210	205.25	209.75
13	210-216	211.25	215.75

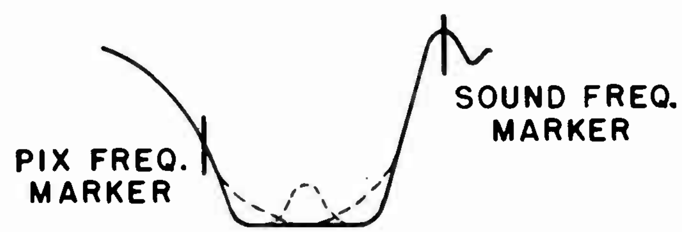


Fig. 5

Set Sweep Generator to approximately mid-frequency of each channel and tune until response curve is centered on oscilloscope screen. Adjust picture and sound markers to the exact frequency as indicated on the Frequency Chart.

Adjust oscillator screw so that sound carrier falls in notch as shown in Fig. 5. This adjustment should place the picture carrier at a point approximately 50% up on the opposite side of the response curve. Some variations in location of picture carrier and wave shapes are permissable. The position of the picture carrier may vary from 45% to 60% up on the slope. A 15% valley is also acceptable in the overall wave shape response.

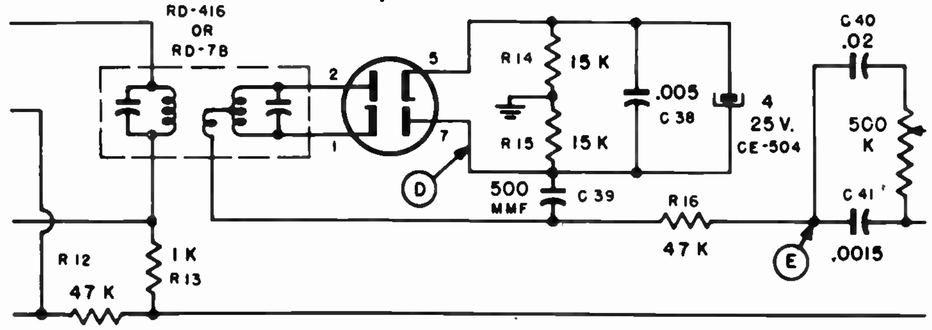
SOUND ALIGNMENT

(See Fig. 3, Fig. 6 and Fig. 8 for reference points)

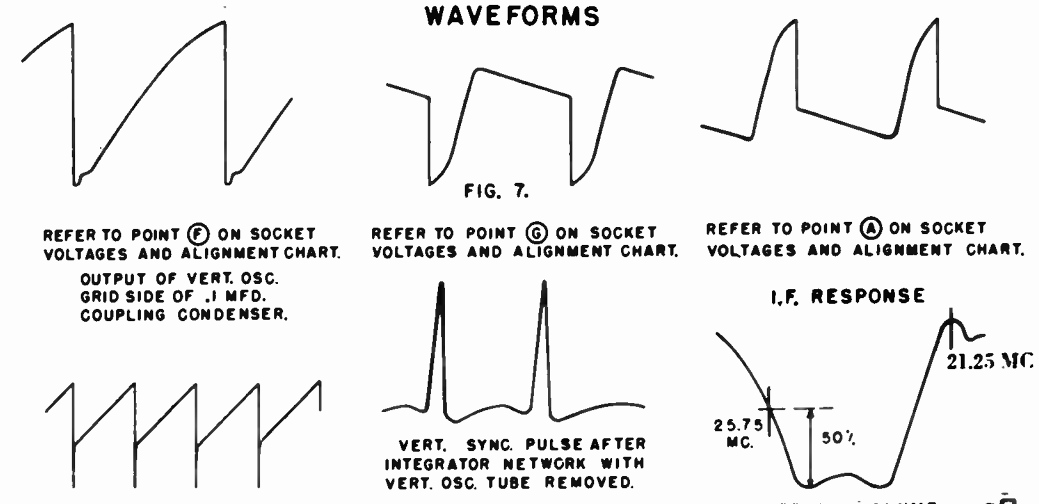
1. Connect AM signal generator (unmodulated) to reference point "C", pin 7 of 12AU7 (V 7) video amplifier.
2. Connect hot terminal of VTVM, set for negative voltage reading, to reference point "D", pin 7 of 6AL5 (V9) ratio detector.
3. Connect ground terminal of VTVM to chassis ground.
4. Set signal generator to 4.5 MC and adjust top and bottom of sound take-off coil (ST-10) and bottom of ratio detector coil (RD-416 or RD-7B) for maximum output.
5. Connect VTVM to reference point "E", junction of 47,000 ohm resistor (R16) and .0015 MFD condenser (C41).
6. Adjust top of ratio detector coil for zero reading.

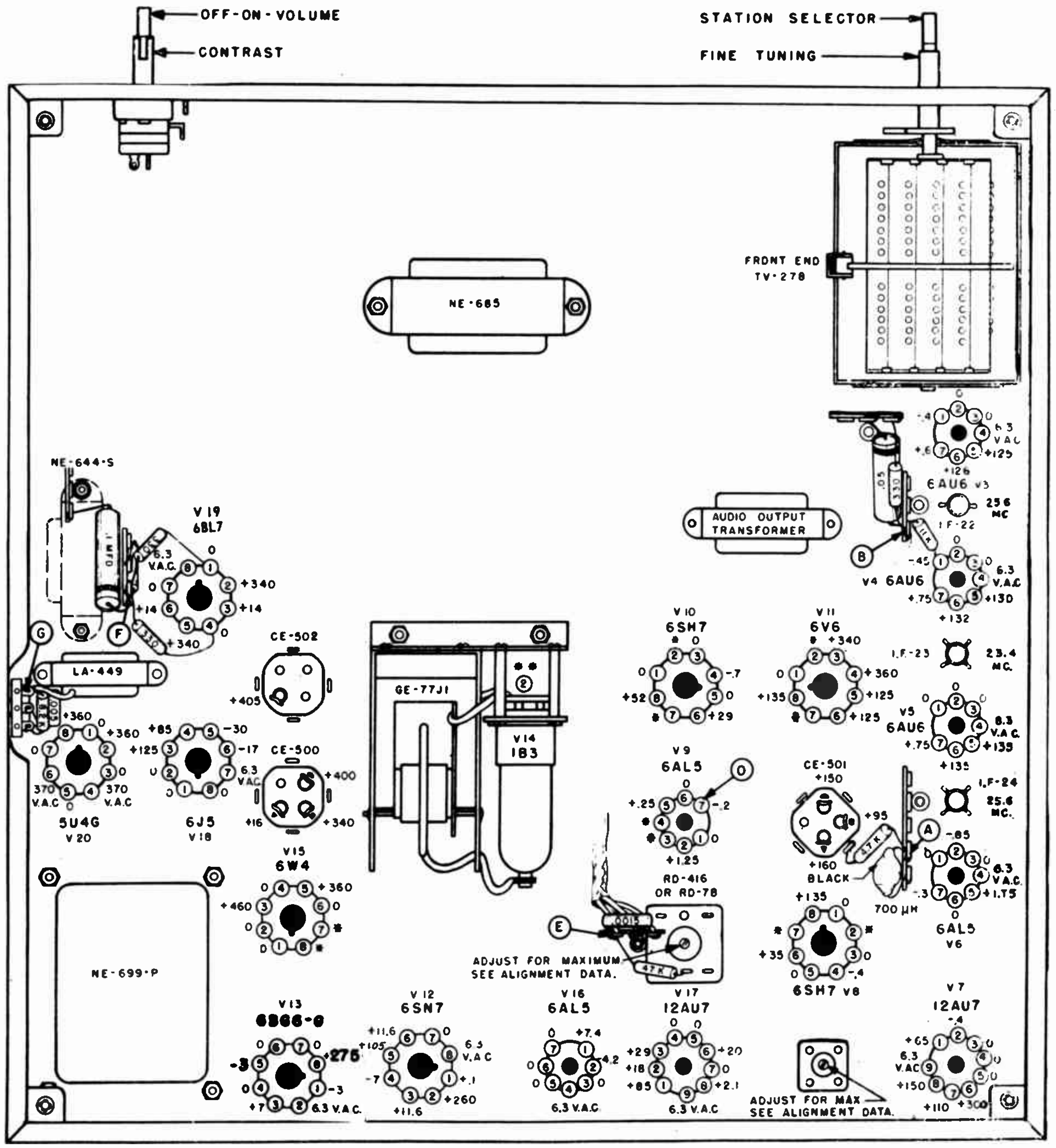
NOTE: Top of ratio detector may be re-adjusted for minimum "buzz" while a channel is in operation and a test pattern tone signal is being received.

RATIO DETECTOR 6AL5 V9 FIG. 6.



WAVEFORMS





KINESCOPE SOCKET

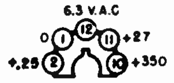


Fig. 8

BOTTOM VIEW OF CHASSIS

SOCKET VOLTAGES AND ALIGNMENT CHART

* DO NOT MEASURE.
** 11 KV-13 KV. USE VTVM WITH HIGH VOLTAGE PROBE.

TOP VIEW OF CHASSIS

TUBE PLACEMENT AND ALIGNMENT CHART

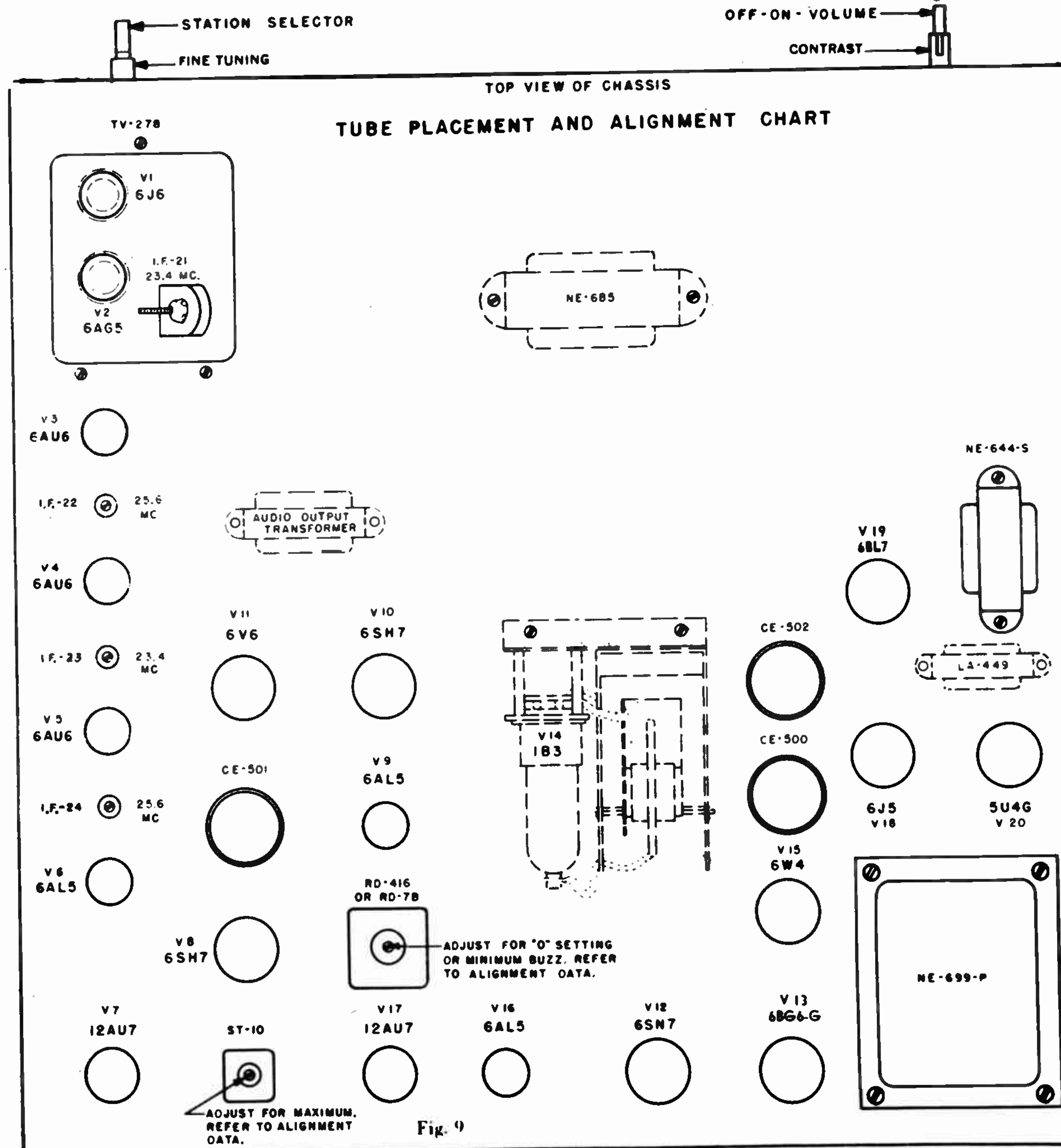


Fig. 9

SYMBOL	DESCRIPTION
R10	47KΩ, 1/2w, 10%
R11	27KΩ, 1/2w, 10%
R12	47KΩ, 1/2w, 10%
R13	1KΩ, 1/2w, 10%
R14	15KΩ, 1/2W, 10%
R15	15KΩ, 1/2w, 10%
R16	47KΩ, 1/2w, 10%
R17	10MΩ, 1/2w, 10%
R18	1MΩ, 1/2w, 10%
R19	250KΩ, 1/2w, 10%
R20	100KΩ, 1/2w, 10%
R21	200KΩ, 1/2w, 10%
R22	100KΩ, 1/2w, 10%
R23	10KΩ, 1/2w, 10%
R24	82K, 1/2w, 10%
R25	150Ω, 1/2w 10%
R26	330Ω, 1/2w, 10%
R27	330Ω, 1/2w, 10%
R28	11KΩ, 1/2w, 10%
R29	82Ω, 1/2w, 10%
R30	150Ω, 1/2w, 10%
R31	2.2MΩ, 1/2w, 10%
R32	22KΩ, 1/2w, 10%
R33	82Ω, 1/2w, 10%
R34	150Ω, 1/2w, 10%
R35	470KΩ, 1/2w, 10%
R36	100KΩ, 1/2w, 10%
R37	4.7KΩ, 1/2w, 10%
R38	15KΩ, 1/2w, 10%
R39	1.2MΩ, 1/2w, 10%
R40	10KΩ, 1w, 10%
R41	3.3KΩ, 1w, 10%
R42	11KΩ, 1/2w, 10%
R43	1.2MΩ, 1/2w, 10%
R44	150Ω, 1/2w, 10%
R45	1.2KΩ, 2w
R46	680KΩ, 1/2w, 10%
R47	4.7KΩ, 1w, 10%
R48	2.2KΩ, 1/2w, 10%
R49	5.6KΩ, 1w, 10%
R50	1.5KΩ, 1/2w, 10%
R51	150KΩ, 1/2w, 10%
R52	220KΩ, 1/2w, 10%
R53	8.2KΩ, 2w
R54	470KΩ, 1/2w, 10%
R55	330Ω, 1/2w, 10%
R56	82Ω, 1w, 10%
R57	27KΩ, 2w
R58	470KΩ, 1w
R59	470Ω, 1/2w, 10%
R60	100KΩ, 1/2w, 10%
R61	100KΩ, 1/2w, 10%
R62	470KΩ, 1/2w, 10%
R63	4.7MΩ, 1/2w, 10%
R64	27KΩ, 1/2w, 10%

SYMBOL	DESCRIPTION
R65	5.6KΩ, 1/2w, 10%
R66	3.3MΩ, 1/2w, 10%
R67	3.9KΩ, 1/2w, 10%
R68	22KΩ, 1w, 10%
R69	270KΩ, 1/2w, 10%
R70	5.6KΩ, 1w, 10%
R71	8.2KΩ, 1/2w, 10%
R72	8.2KΩ, 1/2w, 10%
R73	500KΩ, 1/2w, 10%
R74	100KΩ, 1/2w, 10%
R75	3.3KΩ, 1/2w, 10%
R76	6.8MΩ, 1/2w, 10%
R77	330Ω, 1/2w, 10%
R78	330Ω, 1/2w, 10%
R79	3.3MΩ, 1/2w, 10%
R80	5.6KΩ, 1/2w, 10%
R81	470Ω, 1/2w, 10%
R82	470KΩ, 1/2w, 10%
R83	560Ω, 1/2w, 10%
R84	560Ω, 1/2w, 10%
CE500	Electrolytic 40mf 450V 40mf 350V 100mf 25V
CE501	Electrolytic 40mf 350V 40mf 250V 10mf 350V
CE502	Electrolytic 80mf 450V
CE503	Electrolytic 40mf 350V
CE504	Electrolytic 4mf 25V
C18	0.005mf Ceramic Disk 500V
C19	0.005mf Ceramic Disk 500V
C20	0.005mf Ceramic Disk 500V
C21	0.005mf Ceramic Disk 500V
C22	0.05mf Paper Tubular 400V
C23	0.05mf Paper Tubular 400V
C24	0.005mf Ceramic Disk 500V
C25	0.005mf Ceramic Disk 500V
C26	0.005mf Ceramic Disk 500V
C27	0.005mf Ceramic Disk 500V
C28	100mmf Ceramic Tubular 500V 10%
C29	0.005mf Ceramic Disk 500V
C30	4.7mmf Ceramic Tubular 500V 10%
C31	0.05mf Paper Tubular 400V
C32	0.05mf Paper Tubular 400V
C33	0.05mf Paper Tubular 400V
C34	0.1mf Paper Tubular 600V
C35	39mmf Ceramic Tubular 500V 10%
C36	0.005mf Ceramic Disk 500V
C37	0.02mf Paper Tubular 600V
C38	0.005mf Ceramic Disk 500V
C39	500mmf Ceramic Tubular 500V 10%
C40	0.02mf Paper Tubular 600V
C41	0.0015mf Ceramic 500V
C42	0.02mf Paper Tubular 600V
C43	0.02mf Paper Tubular 600V

SYMBOL	DESCRIPTION
C44	0.02mf Paper Tubular 600V
C45	0.02mf Paper Tubular 600V
C46	250mmf Silver Mica 500V 10%
C47	0.004mf Ceramic Tubular 500V 10%
C48	0.1mf Paper Tubular 600V
C49	500mmf Silver Mica 500V 10%
C50	25-250mmf Trimmer
C51	250mmf Silver Mica 500V 10%
C52	0.5mf Paper Tubular 200V
C53	0.05mf Paper Tubular 400V
C54	0.5mf Paper Tubular 400V
C55	500mmf HV 20KV
C56	0.05mf Paper Tubular 400V
C57	0.05mf Paper Tubular 400V
C58	0.005mf Paper Tubular 600V
C59	1000mmf Ceramic Tubular 500V 10%
C60	1000mmf Ceramic Tubular 500V 10%
C61	0.005mf Paper Tubular 600V
C62	0.1mf Paper Tubular 600V
C63	0.002mf Mica 500V 10%
C64	0.005mf Mica 500V 10%
C65	0.005mf Mica 500V 10%
C66	0.005mf Mica 500V 10%
C67	0.1mf Paper Tubular 600V
C68	0.1mf Paper Tubular 600V
C69	.05mf Paper Tubular 400V
C70	50mmf Molded Mica 500V 10%
O-10	Horizontal Oscillator coil
HL-10	Horizontal Linearity coil
ST-10	Sound Trap
RD-7B or RD-416	Ratio Detector coil
IF-22	1st IF Transformer 25.6MC
IF-23	2nd IF Transformer 23.4MC
IF-24	3rd IF Transformer 25.6MC
280 Orange	Peaking Coil 235mh
281 Blue	Peaking Coil 160mh
282 Pink	Peaking Coil
284 Red	Peaking Coil 230mh
285 White	Peaking Coil 290mh
286 Black	Peaking Coil 700mh
NE 699P	Power Transformer
LA 449	Vertical Blocking Oscillator Transformer
GE 77J1	Horizontal Output Transformer
NE 664-S	Vertical Output Transformer
J-70-14	Deflection Yoke
NE 685	Filter Choke
TRV-90	Height Control 2 MegΩ
TRV-91	Vertical Linearity 5000Ω
TRV-120	Vertical Hold Control 1 MegΩ
TRV-121	Dual Volume and Contrast and Switch (On & Off) 1/2 MegΩ 1000Ω
TRV-122	Brightness Control 25000Ω
TO-908	Audio Output Transformer
PM-908	Speaker

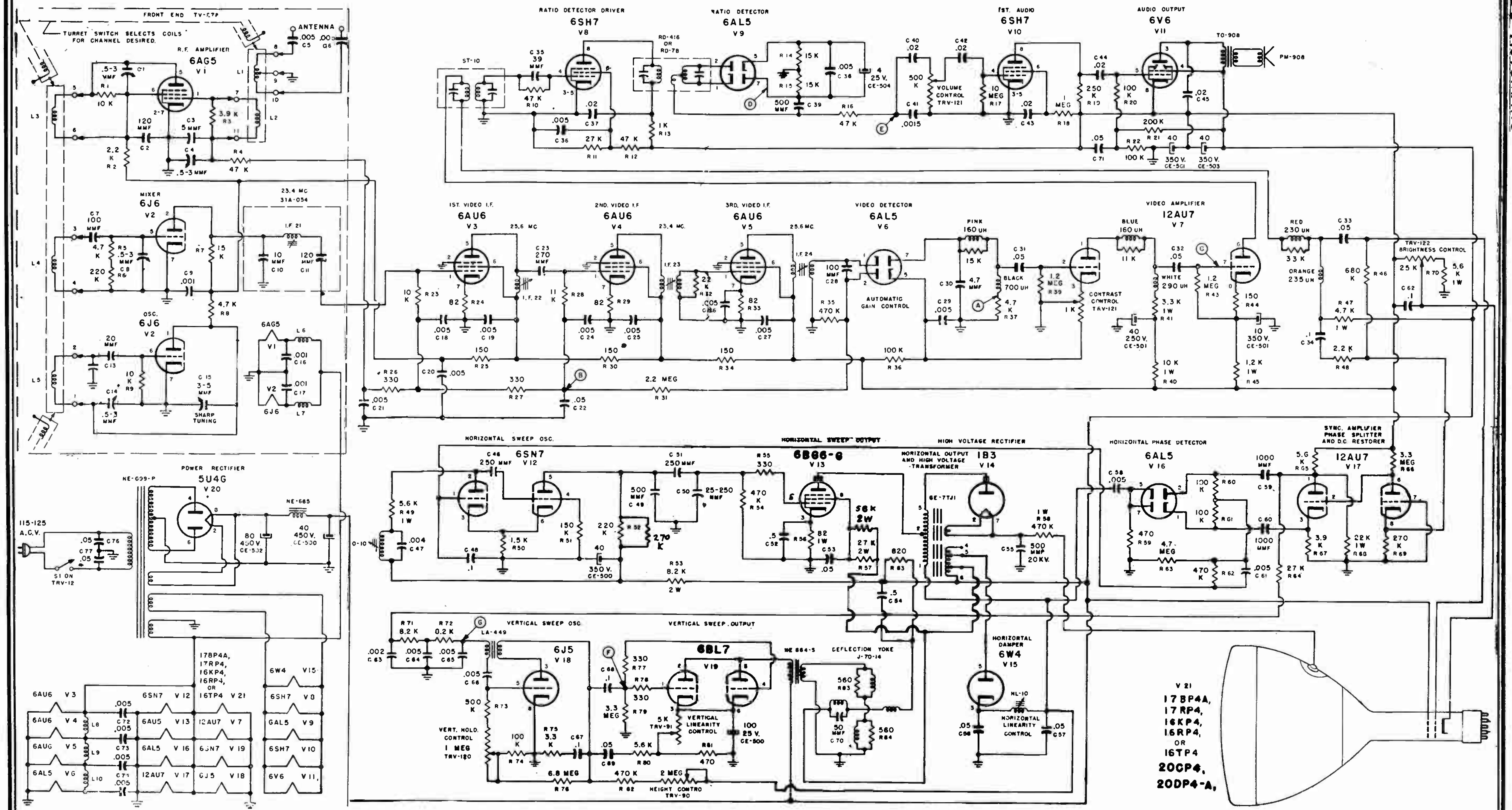

FRONT END TV-C7P
TURRET SWITCH SELECTS COILS FOR CHANNEL DESIRED.
ANTENNA
R.F. AMPLIFIER
6AG5
V1
MIXER
6J6
V2
OSC.
6J6
V2
SHARP TUNING
RATIO DETECTOR DRIVER
6SH7
V8
RATIO DETECTOR
6AL5
V9
1ST. AUDIO
6SH7
V10
AUDIO OUTPUT
6V6
V11
VOLUME CONTROL TRV-121
1ST. VIDEO I.F.
6AU6
V3
2ND. VIDEO I.F.
6AU6
V4
3RD. VIDEO I.F.
6AU6
V5
VIDEO DETECTOR
6AL5
V6
VIDEO AMPLIFIER
12AU7
V7
AUTOMATIC GAIN CONTROL
CONTRAST CONTROL TRV-121
TRV-122 BRIGHTNESS CONTROL
HORIZONTAL SWEEP OSC.
6SN7
V12
HORIZONTAL SWEEP OUTPUT
6BG6-G
V13
HIGH VOLTAGE RECTIFIER
1B3
V14
HORIZONTAL OUTPUT AND HIGH VOLTAGE TRANSFORMER
HORIZONTAL PHASE DETECTOR
6AL5
V16
SYNC. AMPLIFIER PHASE SPLITTER AND D.C. RESTORER
12AU7
V17
POWER RECTIFIER
5U4G
V20
115-125 A.C.V.
S1 ON TRV-12
VERTICAL SWEEP OSC.
6J5
V18
VERTICAL SWEEP OUTPUT
6BL7
V19
VERT. HOLD. CONTROL 1 MEG TRV-120
VERTICAL LINEARITY CONTROL
HEIGHT CONTROL TRV-90
DEFLECTION YOKE
HORIZONTAL DAMPER
6W4
V15
HORIZONTAL LINEARITY CONTROL
V 21
17BP4A,
17RP4,
16KP4,
16RP4,
OR
16TP4
20CP4,
20DP4-A,

Fig. 3

INDEX

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CHASSIS SPECIFICATIONS

Power Requirements

117 volts, 60 cycles AC

Power Consumption

250 Watts

Fine Tuning

Plus & minus 1 MC on Channel 2
Plus & minus 1.6 MC on Channel 13

Audio Power Output

2.8 watts

Band Width

Video amplifier 3.8 MC within 3 db
IF Amplifiers 4 MC within 6 db
Antenna input to picture tube 3.5 MC at 6 db
Ratio detector, peak to peak 200 KC

Deflection

Horizontal & Vertical	Magnetic
Focus	Electro Magnetic
Scanning	Interlaced, 525 Lines
Horiz. Freq.	15750 CPS
Vert. Freq.	60 CPS
Frame Freq.	30 CPS

MODEL IDENTIFICATION TABLE

MODELS FM27C, HB27C

Model Number	Chassis	Picture Tube	Focus	VHF Tuner	UHF Tuner	Speaker
FM27C, HB27C	T14-3	27EP4	Electro-Magnetic	258051-2	258052-1	10″ PM
TM24DS, TB24DS	T14-10	24CP4	Electro-Magnetic	258051-2	–	6″ PM
TM24DU, TB24DU	T14-11	24CP4	Electro-Magnetic	258051-2	258052-1	6″ PM

The T14-10 Chassis has all of the necessary mechanical provisions for accommodating the 258052-1 UHF Tuner. Please order by type No. CT-14.

TUBE COMPLEMENT

Tube	Type	Function	Tube	Type	Function
V1	6BZ7	Cascode RF Amplifier	V16	27EP4 or 24CP4	Picture Tube
V2	6X8	Mixer & Oscillator			
V3	6BA6	1st IF Amplifier	V17	5U4G	Low Voltage Rectifier
V4	6CB6	2nd IF Amplifier	V18A	1/2 6SN7GT	Sync Clipper
V5	6CB6	3rd IF Amplifier	V18B	1/2 6SN7GT	Vertical Oscillator
V6	6CB6	4th IF Amplifier	V19	6AH4GT	Vertical Output
V7	6AU6	4.5 MC Amplifier	V20	6AL5	Phase Detector
V8	6AU6	Ratio Detector Driver	V21	6SN7GT	Horizontal Oscillator
V9	6AL5	Ratio Detector	V22	6CD6G	Horizontal Output
V10	6AU6	Audio Amplifier	V23	6AX4GT	Horizontal Damper
V11	6W6GT	Audio Output	V24	1X2-A	Hi-Voltage Rectifier
V12	6AU6	Keyed AGC Amplifier	V25	6AF4	UHF Oscillator
V13	6AH6	Video Amplifier	V26	6AN4	UHF Mixer
V14	12AT7	Noise Inverter	V27	5U4G	Low Voltage Rectifier
V15	6AU6	Sync Separator	V28	1X2-A	Hi-Voltage Rectifier

VHF FREQUENCY CHART

Chan. No.	Chan. Freq.	Picture Carrier	Sound Carrier	RF Osc. Freq.
2	54-60	55.25	59.75	101MC
3	60-66	61.25	65.75	107MC
4	66-72	67.25	71.75	113MC
5	76-82	77.25	81.75	123MC
6	82-88	83.25	87.75	129MC
7	174-180	175.25	179.75	221MC
8	180-186	181.25	185.75	227MC
9	186-192	187.25	191.75	233MC
10	192-198	193.25	197.75	239MC
11	198-204	199.25	203.75	245MC
12	204-210	205.25	209.75	251MC
13	210-216	211.25	215.75	257MC

The UHF band of frequencies has been placed between 470MC and 890MC. Each channel from 14 to 83 has been alloted, in succession, a band 6MC wide within this spectrum.

IF Frequencies: Picture Carrier – 45.75 MC
Sound Carrier – 41.25 MC

ALIGNMENT PROCEDURE

VISUAL ALIGNMENT OF THE RF AND MIXER STAGES

CAUTION: Always determine by suitable tests, the causes of unsatisfactory operation before attempting to align portions of this receiver. Necessity for realignment will, in all cases, be rare.

PROCEDURE:

1. Connect an RF sweep generator with at least a 10MC sweep width to the antenna terminals through the test circuit shown in Figure 1.

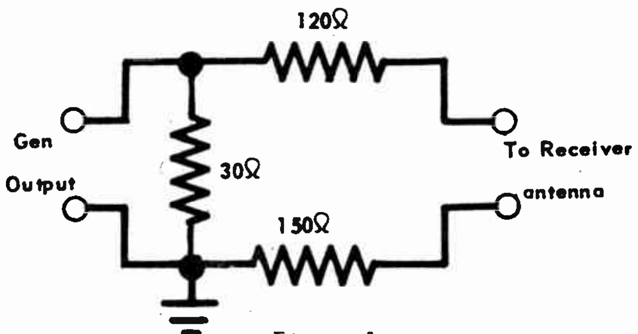
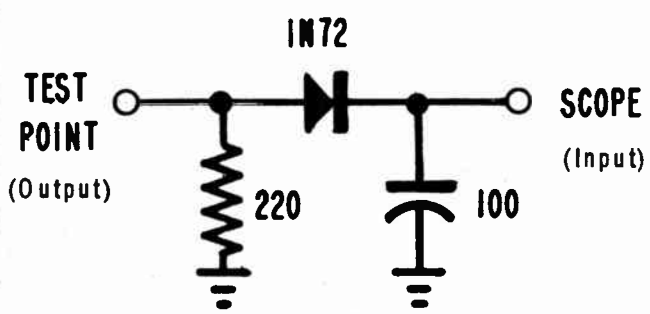


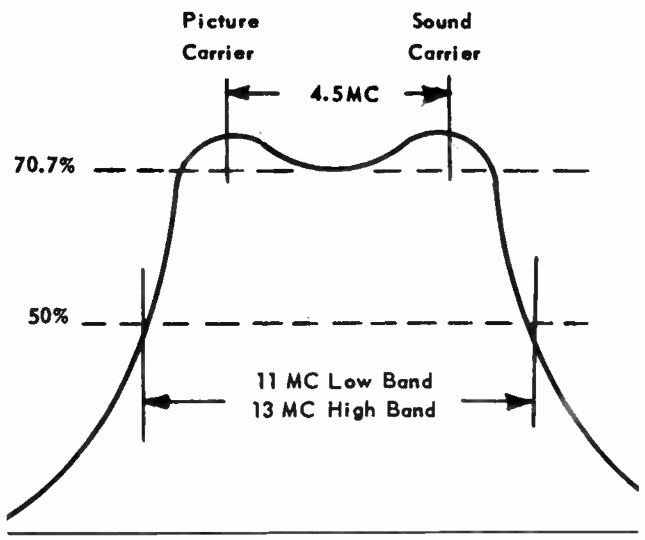
Figure 1

2. Remove the keyed AGC Amplifier tube V12. (This is necessary in order to eliminate AGC action which would interfere with RF alignment.)
3. Connect the positive terminal of a 3 volt dry cell supply to chassis ground and the negative terminal to the RF AGC test point.
4. Attach the high side of the vertical input of an oscilloscope to the input of the detector test circuit shown in Figure 2, and the output to the test point located on the tuner – see Figure (4). In order to synchronize the sweep of the oscilloscope with the RF sweep, connect the horizontal amplifier terminals on the RF sweep generator labeled "oscilloscope sweep voltage."



Test Circuit for Oscilloscope Observation of Tuner Response
Figure 2

5. Turn the station selector to Channel 13 and adjust the sweep generator until it sweeps from 208MC to 218MC. (NOTE: If the sweep generator does not supply marker signals at picture and sound carrier frequencies, an external source, such as a CW signal generator should be used to supply them. For method of marker injection, refer to instructions supplied by the manufacturer of sweep generator being used.
6. Adjust L913, L929, L930 until the viewed response curve is similar to that shown in Figure 3. Check all other channels readjusting L913, L929 and L930 as necessary to obtain optimum response on all twelve channels.



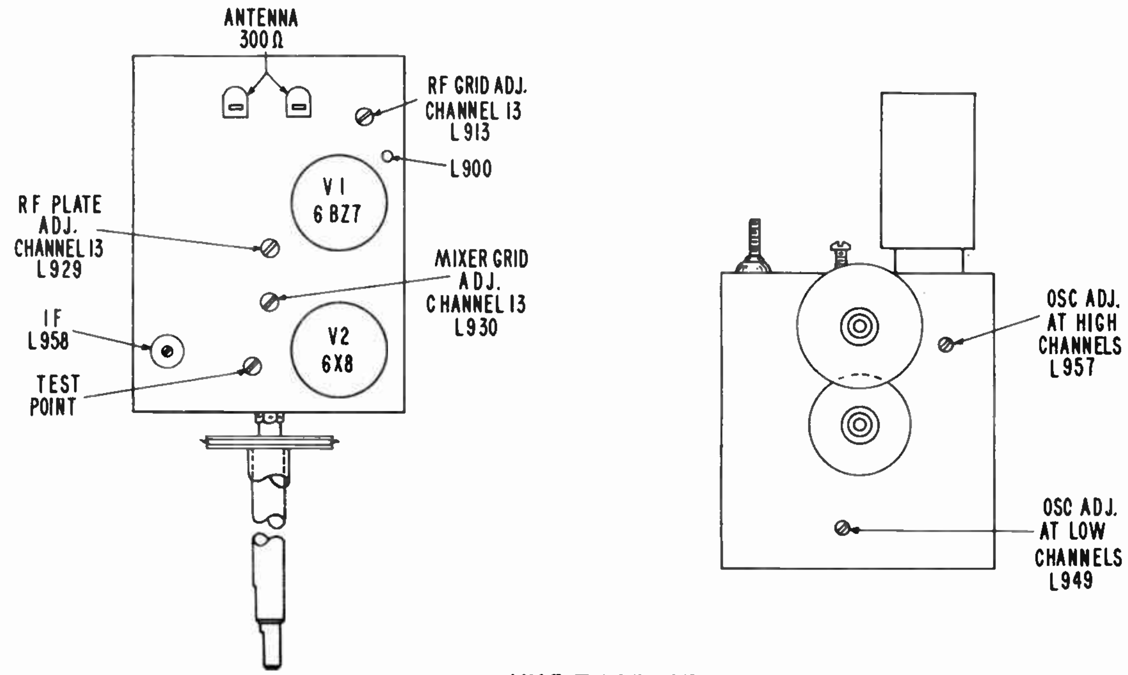
RF Response Curve
Figure 3

The dip in the curve between picture and sound carriers should not fall below 70.7% of the response peak and the bandwidth at 50% down should not exceed 11MC on the low band and 13MC on the high band.

RF OSCILLATOR ALIGNMENT

CW METHOD

1. Remove V12 from its socket and connect the negative terminal of a 3 volt dry cell bias supply to the RF and IF AGC test points. (This can best be accomplished by tieing the two points together.)
2. Apply the CW signal to the antenna terminals through the pad shown in Figure 1.
3. Connect the DC probe of a vacuum tube voltmeter to test point C.



VHF TUNER VIEWS

Figure 4

4. Turn the fine tuning control to approximately the center of its rotating range, and proceed as follows:

For low band alignment

– Turn channel selector to Channel No. 6.
– Tune signal generator to the sound carrier frequency of Channel 6 – see frequency chart on page 2.
– Adjust the lowband oscillator slug (see Figure 4) until a sharp dip in the voltage reading on the VTVM is reached.

For high band alignment

– Turn channel selector to Channel No. 13.
– Tune signal generator to the sound carrier frequency of Channel 13 – see frequency chart on page 2.
– Adjust the high band oscillator slug (see Figure 4) until a sharp dip in the voltage reading on the VTVM is reached.

IF ALIGNMENT

Remove the AGC Amplifier (V12) from its socket. Connect the negative terminal of a 3 volt dry cell supply to the IF AGC test point and the positive terminal to chassis ground. Raise the tube shield of V2 so that it is not grounded and apply the signal to it.

Generator Frequency	VTVM Connections	Adjustment	Remarks
45 MC	To Test Point (C) and Ground	T3-T2-L958*	Adjust for Max.
42 MC	To Test Point (C) and Ground	L5-T1-L2*	Adjust for Max.
41.25 MC	To Test Point (C) and Ground	L1-L3	Adjust for Min. with output of Signal Gen. at Max.
39.75 MC	To Test Point (C) and Ground	L4	Adjust for Min. with output of Signal Gen. at Max.

NOTE: To insure correct IF Alignment follow the procedure outlined under Visual Check of IF Alignment.

* The designated frequencies for L958 and L2 are to be used for preliminary alighment only. Since these two coils compromise a band pass circuit, final alignment should be made with a sweep generator.

VISUAL CHECK OF IF ALIGNMENT

1. Lift the shield of the oscillator mixer tube V2 until it becomes ungrounded. Connect the high side of a sweep generator to the ungrounded tube shield and the ground lead to chassis ground. Connect a lead from the sweep synchronizing terminal on the sweep generator to the external sweep terminal on the oscilloscope.
2. Connect high side of oscilloscope to pin 7 of V13 video amplifier tube and ground lead to chassis ground. (Set contrast control at minimum.)
3. Remove the keyed AGC amplifier tube V12.
4. Connect the negative terminal of a 3 volt dry cell to the IF AGC test lead and the positive terminal to chassis ground.
5. Adjust sweep generator to sweep from 40 to 50MC.
6. Connect a vacuum tube voltmeter between pin #1 of V13 and ground and adjust the sweep generator output until a reading of −2 volts is obtained.
7. Adjust the oscilloscope until the IF response curve is centered.
8. Place a lead from an AM signal generator near the IF strip and adjust it to cover from 40 to 50MC.
9. Observe the response curve and the position of the markers (see nominal response curve Figure 5). A slight deviation from this response curve is permissible; however, complete realignment of the IF will be necessary if a great deviation is noted. Some improvement in the shape of the response curve may be accomplished by slightly readjusting L2 on the main chassis and L958 on the tuner.

For best performance the difference in height of peaks should not exceed 30% nor should the dip drop more than 30% below the peak of the response curve.

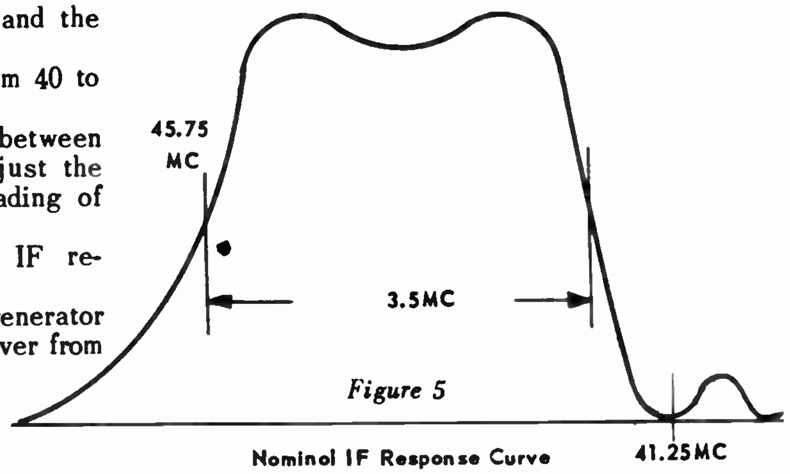


Figure 5

Nominal IF Response Curve

SOUND ALIGNMENT

Connect the Negative Terminal of a 9 volt dry cell supply to the IF AGC test point and the Positive Terminal to Chassis ground.

Signal Generator Coupling	*Frequency*	*Connect*	*Adjust*	*Remarks*
High side to Pin 1 of V13 (Video Amp)	4.5 MC	DC probe of VTVM to "PT.E." Common lead to chassis.	L9 T10 (top & bottom)	Adjust for Max. reading keeping output of Generator high enough to produce about 4V at "PT.E."
SAME	4.5 MC	Parallel R38 with two 100K resistors which are within 1% of each other. DC probe of VTVM of "PT.A." Common lead to chassis.	L11	Adjust for Max. reading.
SAME	4.5 MC	DC probe of VTVM to "PT.B." Common lead to "PT.A."	L13	Adjust for zero reading at cross-over.

NOISE INVERTER ADJUSTMENT

NOTE: The noise inverter control is adjusted at the factory to give optimum performance under varied conditions, therefore, only upon rare occasions would any adjustment be necessary. If the receiver is to be operated in an extremely weak signal area having a high noise level, or this control becomes maladjusted by one means or another, it can be satisfactorily set by the following procedure:

Select and properly tune in the strongest station in the area.

Turn the contrast control to its maximum position (full clockwise).

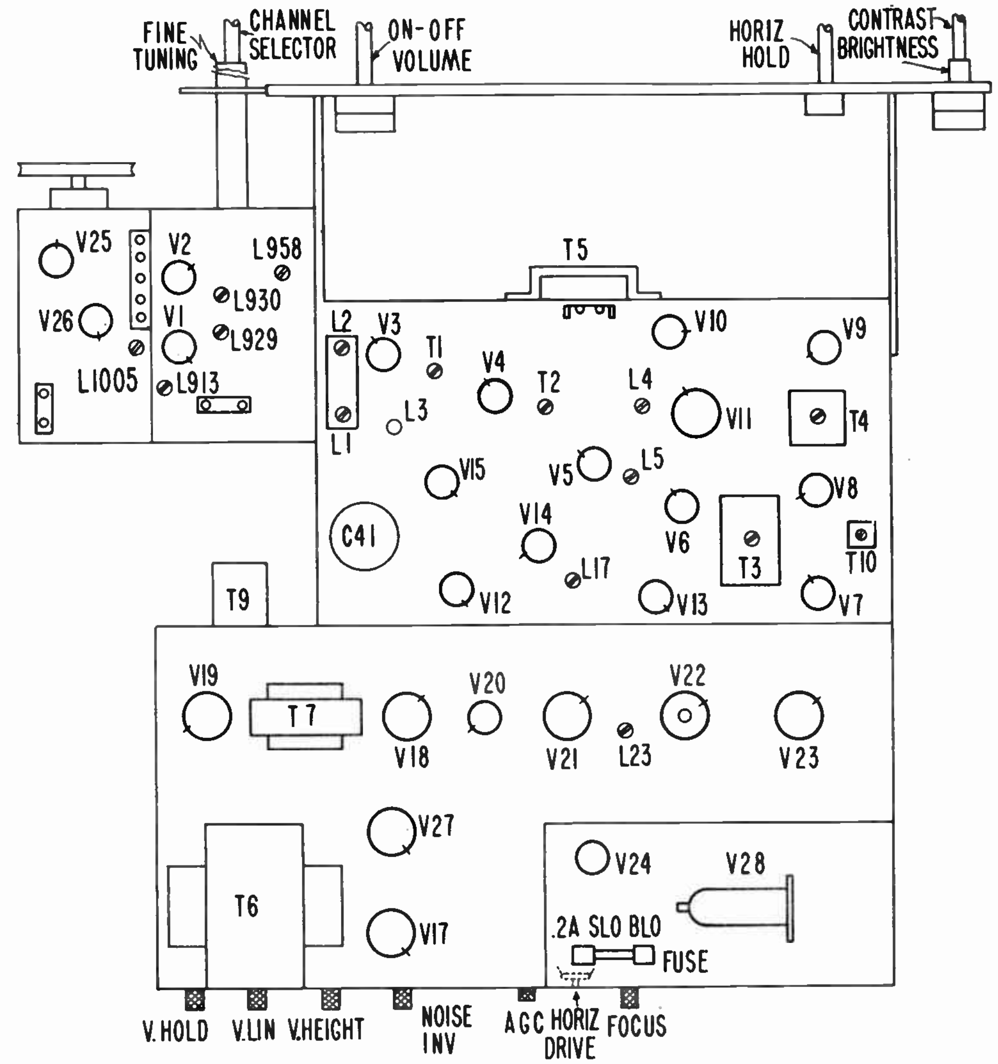


Figure 6

With the noise inverter control set at minimum, slowly turn it in the clockwise direction until a slight shifting of the picture in the horizontal plane is observed, then back off (counterclockwise) 1/8 of a turn.

CAUTION: If this control is set too far in the clockwise position an erratic jumping of the picture will be encountered when switching channels.

HORIZONTAL OSCILLATOR ADJUSTMENT

This adjustment may be satisfactorily performed with any received program signal.

Set the Horizontal Hold control, R115, at approximately mid-position.

Set the Contrast control to the normal operating position.

Adjust the Horizontal Oscillator control, L23, until the diagonal streaks on the screen decrease in number and become erect (picture locks in sync).

The setting obtained by the preceding steps may not give optimum range on the Horizontal front panel hold control, therefore, further adjustment by the trial and error method should be performed. When L23 is properly adjusted, the H. Hold control can be slowly rotated to its stops in either direction without losing picture sync.

HORIZONTAL DRIVE ADJUSTMENT

Allow the receiver to warm up for at least five minutes.

Adjust the contrast and brightness for a normal picture.

Adjust the horizontal drive trimmer until there is no indication of horizontal foldover in the picture.

ANTI-PIN CUSHIONING MAGNETS

Pin cushioning is an effect caused by the use

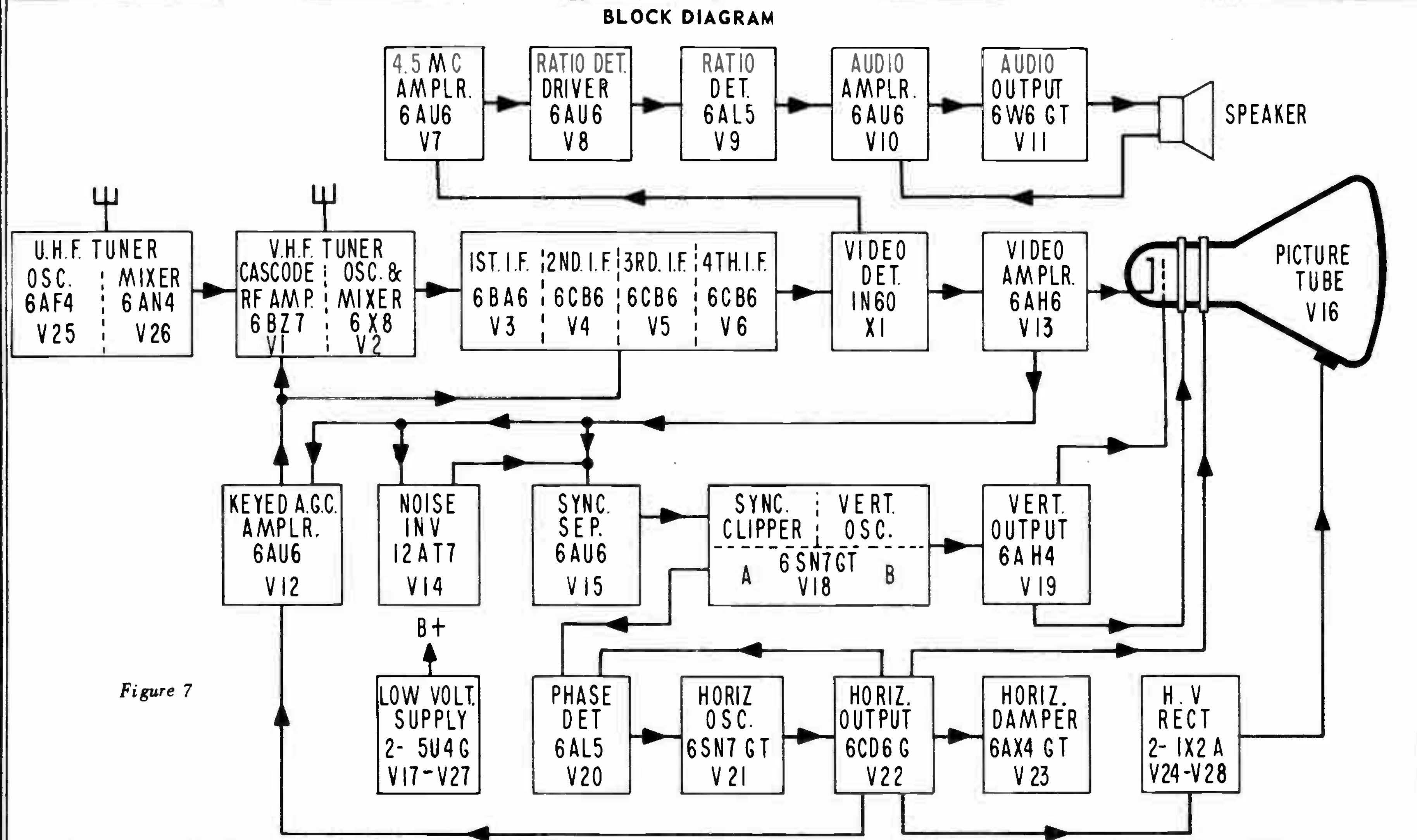


Figure 7

of the cosine-deflection yoke and is apparent by the *"bowing in"* along the edges of the raster. In order to compensate for this condition two anti-pin cushioning magnets have been mounted to the picture tube mounting brackets. For ease of adjustment these magnet brackets are hinged in two places; thus allowing the magnet to be moved either forward or backward at various distances from the picture tube surface. The proper adjustment of each magnet may be observed by moving the raster off center far enough to see the side of the picture that is being straightened.

NOTE: These magnets are properly set at the factory and should require no further adjusting unless a new picture tube is installed.

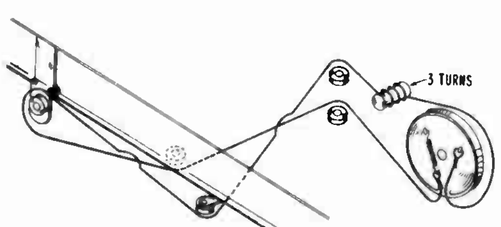


Figure 8

UHF DIAL CORD STRINGING

ION TRAP ADJUSTMENT

Reduce the *contrast* and raise the *brightness* to a point where a blank raster is just visible on the picture tube. Rotate the ion trap while moving it either forward or backward until the *brightest* raster is obtained.

WARNING: It is extremely important that the ion trap be adjusted properly as soon as the set is turned on. A trap even slightly maladjusted can cause severe damage to the CR tube, and this type of damage is not covered by the factory warranty. *NEVER ADJUST THE ION TRAP TO REMOVE SHADOW.*

LOW VOLTAGE POWER SUPPLY

A straight AC power supply utilizing two 5U4G rectifier tubes is used. The input voltage is stepped up in the secondary of the power transformer (T6) and fed to the plates of the rectifier tubes, (V17) and (V27). The output of the rectifiers is fed to the filter section consisting of C55A, L26, L18, and C42B. Tubes V11 and V12 are in series with V5 and 8, V2, V4, V7, V14, V15, V25 and V26 serving as voltage regulators for these tubes. When the current through these amplifiers change due to changes in signal strength the cathode voltage of V11 and V12 vary accordingly. This causes the impedance of V11 and V12 to change maintaining a constant voltage of +165 volts at the cathode of V11.

NOTE: No DC voltage from the low voltage rectifiers is supplied to V9, V20 or the plate of V12.

REMOVAL AND INSTALLATION OF PICTURE TUBE

CAUTION: Be sure the power is off. Wear goggles whenever a picture tube is being handled.

1. Place the cabinet face down taking all precautions necessary to keep from marring the finish.
2. Remove the high voltage lead from its socket.
3. Remove the tube socket from the base of the tube.
4. Remove the ion trap from the neck of the tube.
5. Loosen and remove the two 1/4″ bolts that hold the yoke and hood assembly to the mounting straps.
6. Remove this assembly from the neck of the tube.
7. Bend the two straps away from the tube as far as possible.
8. Grasp the rim of the picture tube face and gently lift the tube out of its harness. Do not allow the tube to rest on its neck or base, and do not under any circumstances carry or handle the tube by its neck alone.
9. To replace the tube, reverse the above procedure paying particular attention to the fact that the two 1/4″ bolts which hold the yoke and hood assembly should be tightened with equal pressure.

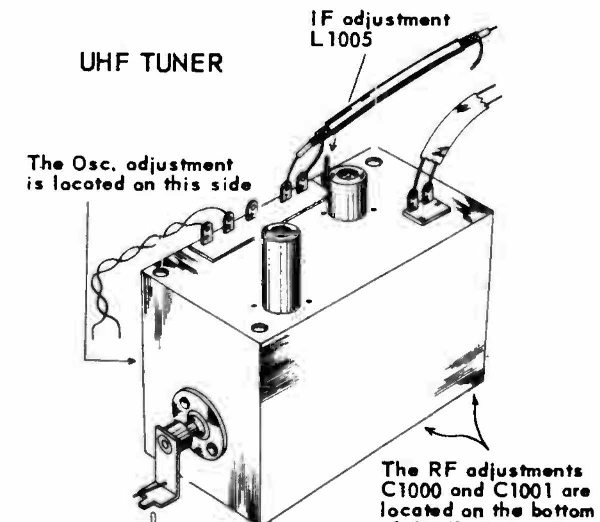


Figure 9

NOTE: No attempt should be made to align this UHF Tuner without the aid of a UHF Generator.

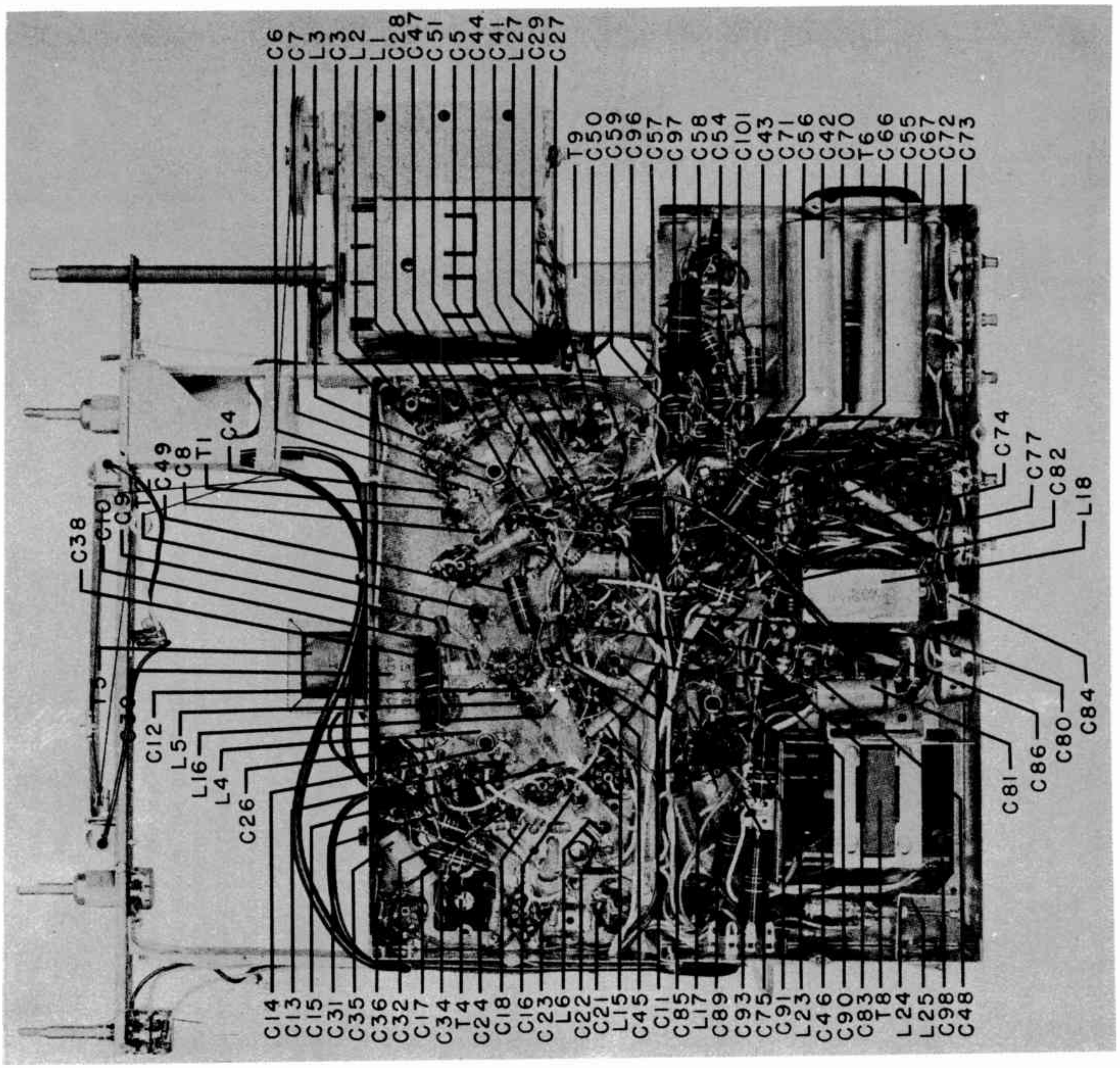
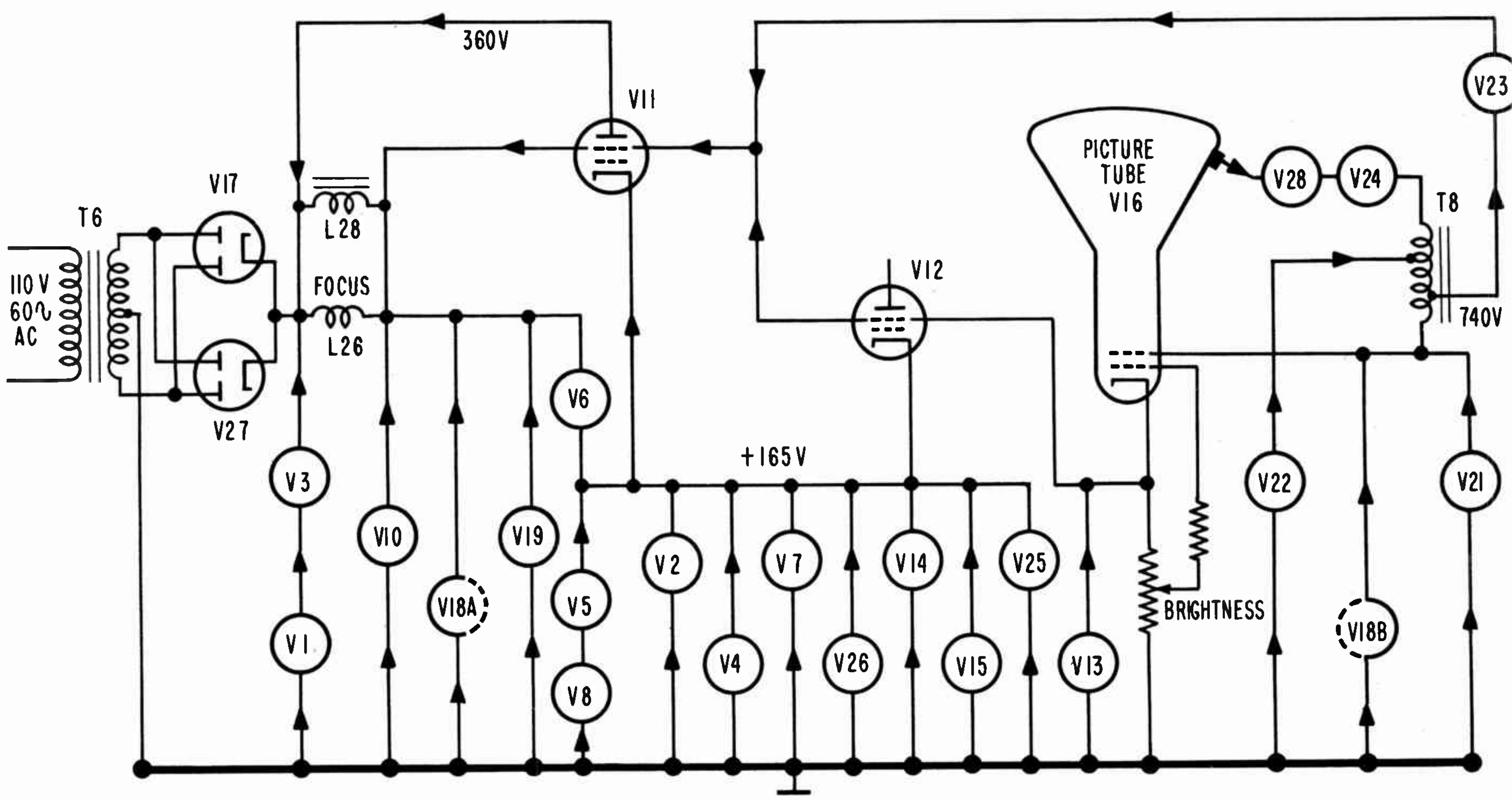


Figure 11

CURRENT DISTRIBUTION DIAGRAM



NOTE: There is no DC voltage applied to V9, V20 or to the plate of V12.

Figure 10

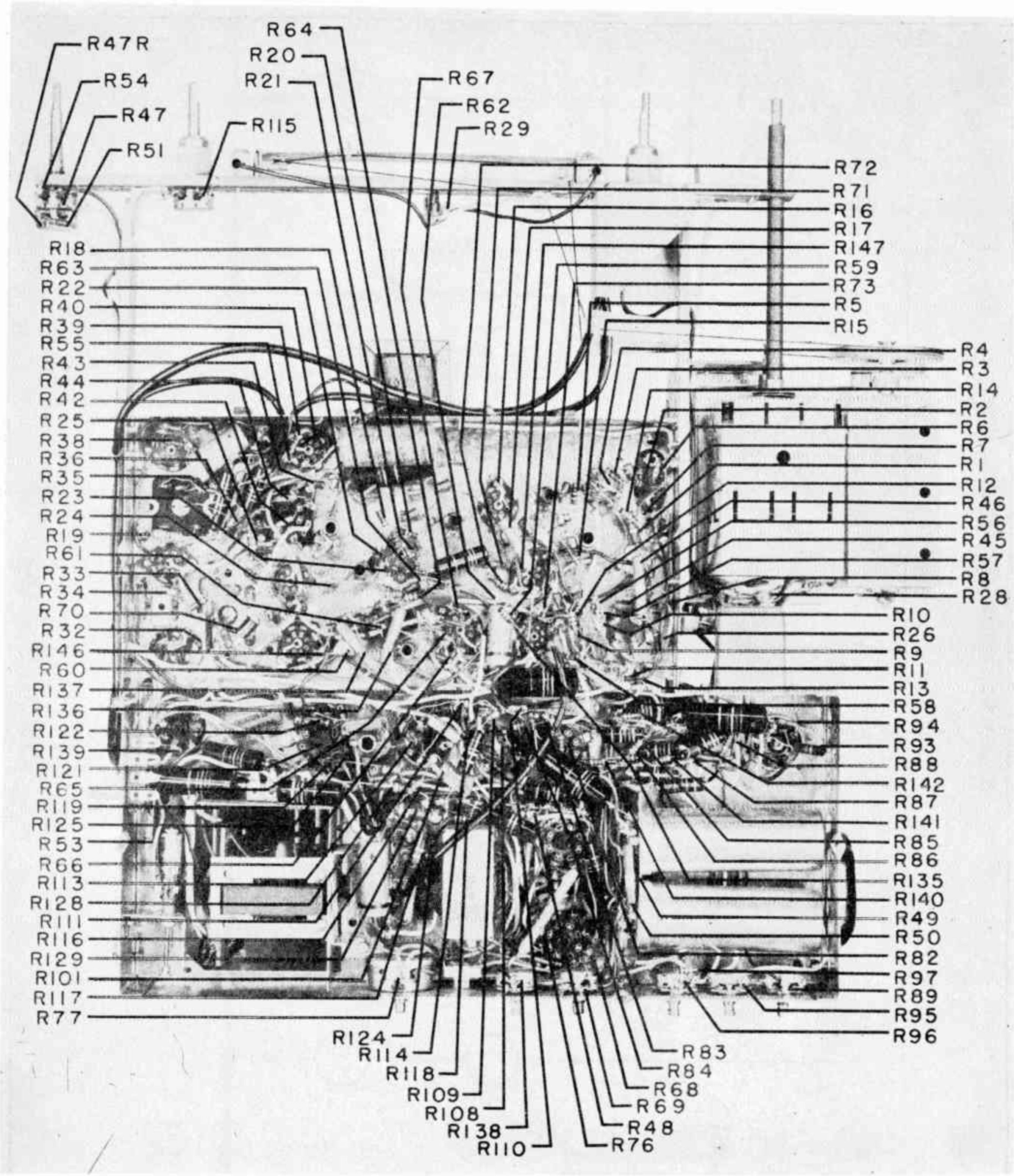


Figure 12

CIRCUIT DESCRIPTION

UHF TUNER

This tuner covers the entire UHF range of 470 to 890MC continuously by means of a three section tuning element. Two of these elements are used for tuning the band-pass or preselector input circuits while the other is for oscillator tuning. A bandwidth of approximately 10MC is realized in this band-pass circuit. The received signal from this point is fed into a grounded-grid mixer stage V26 a 6AN4 where it beats with the local oscillator signal. Injection of the oscillator voltage is through C1012 to the filament of V26. V25 a 6AF4 is the UHF local oscillator, the frequency of which, is maintained and tracked at a difference of 41MC from the incoming signal by the tuning element. Since the IF system of the TV receiver is tuned to 41MC, single conversion is accomplished within this tuner. The 41MC output is applied through L960 and L900 to the VHF tuner circuits which have been altered to operate as 41MC IF amplifiers by the switching arrangement. When the channel selector is in the UHF position the VHF local oscillator is inoperative allowing both the cascode amplifier and mixer stage to act as IF amplifiers thereby increasing the overall sensitivity during UHF reception.

VHF – RF SYSTEM

The tuner is of the rotary switch type, made up of a series of coils in cascade, bridging the contacts of the channel selector switch. The selector switch has 16 positions. Two positions of this switch are utilized to switch the necessary B+ and bias circuits to operate the accompanying UHF tuner, and alter the VHF tuner to provide additional amplification in the IF range. All of the step-tuned coils are preadjusted with the final overall tuning adjustments made in the Bendix factory with the use of a sweep generator. Adjustment of the tuner in the field should not be attempted unless a sweep generator is used; and the instructions that are included under *Alignment Procedure* followed very carefully.

The antenna input circuit is designed to give optimum performance with 300 ohms balanced impedance. The signal is inductively coupled through T900 to the input grid of the RF amplifier. This grid also has applied to it the AGC voltage which controls the gain through both sections of the RF amplifier and 1st IF stage.

The RF amplifier, V1, is a 6BZ7, twin triode type of tube connected in what is known as a series "cascode" circuit. In using a circuit of this design the noise figure which accompanies a conventional pentode amplifier has been greatly reduced and yet equivalent gain has been maintained. The input section of the RF stage is connected as a grounded cathode type amplifier. Its output is fed through L914 to the cathode of a grounded grid amplifier – the output section of the RF stage. All of the preselector coils are preadjusted and matched to a standard, therefore the only adjustments made available for overall RF alignment are L913, L929 and L930. The amplified RF signal is capacitively coupled through C908 to a pentode mixer stage – 1/2 of a 6X8 (V2). Tuning of the mixer grid is accomplished by the same step-tuning method that is utilized throughout the preselector stages. Grid leak bias for this stage is developed across R905 a 220K resistor. A test point for checking the tuner response curve has been made available at the top of the tuner. This point is coupled to the mixer plate by C915 making it necessary to detect the signal before applying it to the oscilloscope.

The other half of V2 a triode is used in a Colpitts type oscillator circuit. There are two oscillator adjustments accessible from the front of the tuner, L957 for the high band of frequencies and L949 for the low band. The fine tuning capacitor has sufficient range to compensate for any further tuning which is required for the individual channels. Capacitive coupling (C913) is used to inject the oscillator output into the grid of the mixer stage.

The output of the mixer is fed to the first IF amplifier through a series double tuned band pass circuit consisting of L958, C28 and L2. This type of circuit accomplishes two purposes – a high degree of oscillator frequency isolation plus optimum transfer of energy. The tunable tank circuit L1 and C2 is used as a sound trap capacitively coupled to the grid of the first IF amplifier. This IF trap along with the one located in the plate circuit of the first IF amplifier reduces the IF gain at the sound carrier frequency approximately 32db, providing satisfactory sound attenuation.

IF SYSTEM

Five stagger-tuned circuits employing one 6BA6 and three 6CB6 tubes along with a crystal detector comprises the interstage IF amplifier system.

Three of the IF transformers used in this system are of the Bifilar wound type – two windings interwound on a single form. A winding of this type approximates unity coupling and gives the effect of a single tuned coil. The following advantages are derived from such an arrangement. Improved filtering of all plate and grid returns can be achieved because the bypass condensers are returned to the same ground as their associated cathode thus eliminating circulating ground currents. It is also possible to keep the time constant in the grid circuit of each amplifier to a very low value therefore minimizing the possibility of a charge building up on the grid of these stages during heavy noise pick up. This latter advantage permits the IF system to operate at optimum performance at all times. Unbypassed cathode resistors are used in the first two stages to reduce the variations of input capacity with AGC voltage changes. Within this IF strip there are two cases of voltage cascading which means that two or more tubes are connected in what can be termed as "plate current series" with one another. The first case involves the first IF (V3) and the RF amplifier V1, while a similar hook-up encases V6, V5 and V8. In each case the tube at the top of the line-up has applied to its plate approximately the maximum voltage available and is so biased that the voltage drop across it is sufficient to reduce the voltage at its cathode to a value that is proper for operating the next stage. This continues to happen right on down the line until the tube at the bottom of the string has its cathode D.C. connected to the ground. A hook-up of this kind consumes less power due to the fact that the tubes at the top of the string are effectively used as the plate load resistor for the pursuing stage, therefore the dissipation that normally takes place across a load resistor is utilized for amplification. This IF system has been designed to provide an overall response curve which is flat topped with a nominal bandwidth of 4MC 6db down from peak response. The IF output is fed into the video detector can T3 which encases the third IF amplifier plate transformer, sound take off coil, the crystal video detector IN60, and its associated peaking coils necessary to extend the frequency response to the desired bandwidth.

Various test points have been indicated on the schematic diagram in order to facilitate the making of checks on the operation of the IF system. One is located in the AGC string at the junction of R56 and R57 while another is located at the junction of R10 and R12. These two points have been made available from the top of the chassis for checking developed AGC voltage and for applying bias potentials when making sweep tests on the RF or IF systems. Another test point "C" has been designated at Pin 7 of V14, the noise inverter, for connecting a VTVM when measuring the voltage developed by the crystal detector during alignment with a CW signal.

SOUND SECTION

Intercarrier sound reproduction is used. By this method both the picture and sound carriers are amplified by the same IF amplifiers and beat together in the Video Detector, giving a 4.5MC FM carrier that is fed to the sound amplifier V7. The 4.5 megacycle beat is constant since it is always the fixed difference between the Video and Sound coming from the TV Station. Therefore, the Sound will not be affected by any normal oscillator drift, since both the Video and Sound carriers will drift equal amounts and the difference will always be 4.5MC. The 4.5MC signal is taken off at L9 and amplified by V7, which in turn is transformer coupled to the ratio detector driver V8. This tube has low DC voltages on the plate and screen and, while there is some amplification, its chief function is that of limiting. The Ratio Detector (V9) is of the conventional type. The 33 ohm (R35) resistor in series with the coupling line of the detector transformer (T4) stabilizes the impedance presented by the diodes. If this resistor was deleted, the variation in impedance between individual tubes would cause the AM rejection to vary between receivers.

The output of the Detector is amplified in the 1st Audio stage (V10) and then directly coupled to the grid of the output tube (V11). This DC coupling is possible since V11 is part of the voltage regulating system. (See Current Distribution Diagram.)

About 10db of negative feedback is provided by R55 which is connected between the secondary of the Audio output transformer and the cathode of the 1st Audio amplifier (V10) to reduce output distortion.

VIDEO AMPLIFIER

The Video amplifier is a 6AH6, with the associated wide band, low pass filters. The output of the crystal detector is DC connected to the grid of the Video amplifier through a filter circuit comprising a series (L7) and a shunt (L8) peaking coils. L16 is a shunt plate peaking coil used to extend the frequency response of the Video amplifier to its desired value and compensate for any incurred phase shift. The response of the Video system is flat to 1MC and down 3db at 3.8MC.

The contrast is controlled by changing the amount of degeneration in the Video amplifier. This is accomplished by varying the control R47 in the cathode circuit.

No DC restoration is necessary at the output of the Video amplifier because the entire Video amplifier is direct coupled from the output of the crystal detector to the cathode of the picture tube. Therefore, the rectified video signal does not vary about an AC axis.

Notice that the polarity of the detector is such that a negative signal is applied to the grid of the Video amplifier, resulting in a positive video signal at the plate which is applied directly to the cathode of the picture tube.

KEYED AGC

V12 is the AGC amplifier whose function is to keep the sensitivity automatically adjusted in accordance with the strength of the received signal. This is accomplished by the negative voltage which is developed at the plate of the AGC amplifier V12 tube and applied to the grids of the RF and IF amplifiers. The plate voltage for V12 is in the form of a positive pulse taken from terminal #5 on the horizontal output Transformer T8.

This pulse is developed by the collapsing of the field in the horizontal deflection coils and its duration is about 5% of the horizontal period. Plate current can flow only during the application of this pulse and the amount of current flow is controlled by the amplitude of the sync pulse on the grid, pin #1 of V12, and the setting of R138, the AGC control which serves as a variable grid resistor. The grid is DC connected to the video amplifier output at the junction of R62 and R63, the plate load resistors for the video amplifier. The bias level for V12 is a function of the video amplifier plate current. The AGC cathode potential is +165 volts, taken from the source which also supplies the plate of V13. The screen potential is approximately +340 volts, thus maintaining the required potential difference with respect to the cathode. The screen and plate voltages are approximately the same at the time the pulse occurs.

When current flows in the plate circuit of V12 it will develop a negative voltage across resistors R56, R57 and R58. This voltage is filtered by the RC network R56, R57 and C43 to rid it of the horizontal frequency component (15,750cps). Therefore, the time constant required to filter frequencies of this kind can be made very short as compared to the time constant used in conventional AGC systems, which had to filter out a 60 cycle component. The control voltage for the IF stages is taken from the junction of the dividing network, R56 and R57. The control voltage for the RF amplifier is taken from the junction of R57 and R58 and fed through R9 with a delay voltage being applied by means of a voltage dividing network from the +165 supply. The circuit constants are such that the IF bias reaches a value of approximately −4.5 volts before the RF delay is overcome.

The keyed AGC system has good noise immunity because its duty cycle is only about 5% of the total time, and any noise pulses occurring during the other 95% of the time do not affect its operation. The developed AGC voltage is a function of sync pulse amplitude only and is not affected by picture content. Hence, the AGC action can be made fast, practically eliminating the flutter caused by airplanes.

NOISE INVERTER

The noise inverter, V14, provides a major improvement in signal-noise ratio for both horizontal and vertical synchronization.

This new circuit requires the use of a Hi-Mu twin triode tube. Its purpose is to prevent the noise that is normally present in the sync region of the composite video signal from appearing at the input of the sync limiter, V15. In this chassis the circuit has been designed around a 12AT7. The way this circuit accomplishes its purpose is by amplifying and inverting the noise that appears at the screen of the video amplifier and superimposing its negative output upon the positive noise pulses that are normally prevalent in the composite signal at this point. This out-of-phase component will cancel out and eliminate any noise at the input of the sync separator that would ordinarily appear in the sync region of the composite video signal.

The first section of this twin triode is connected in parallel with R65, the screen resistor for the video amplifier, V13. It is so biased by the voltage divider network, R66, R68 and R69 that it will conduct at varying degrees corresponding to the signal level applied to its cathode from the screen of V13. This variation causes the tube to act as a variable low impedance shunt across R65 holding the voltage on the screen of V13 fairly constant until the desired moment – *the arrival of a noise pulse*. The same video signal that is being applied to the cathode of Unit #1 is also being coupled through C47 to the grid of Unit #2, but its amplitude is insufficient to overcome the bias of that section which is set by R69 the noise inverter control. It is important that the bias be set high enough to keep this section from conducting on sync peaks because that would cancel out the sync signal entirely allowing both vertical and horizontal to fall out of step. The next step is to follow the chain of reactions that is set up by a noise pulse which has great enough amplitude to ride well above the sync peaks. A noise pulse of this amplitude will, due to design, drive the grid of the video amplifier into cutoff thus allowing the voltage on both the plate and screen of that stage to rise rapidly. This pulse being of a positive polarity on the screen will also cutoff unit #1 of V14, doing away with its affect as a low impedance shunt across R65 allowing the voltage at its cathode to rise rapidly to the potential of the supply source. This wave front has been increased sufficiently, due to this chain of reactions, to overcome the bias of Unit #2 when applied to its grid through C47. The overcoming of this bias allows Unit #2 of V14 to conduct and amplify this noise pulse, superimposing it at the junction of R64 and R67 exactly upon the same noise pulse that created it within the composite video signal. Since the output of the noise inverter is negative in polarity the noise peak is cancelled to the point where it is placed well below the sync pulse region before the composite video signal reaches the sync separator.

ANTI-LOCKOUT MEASURES

When using the noise inverter circuit in a receiver employing keyed AGC, there is an important problem of "lockout" to be taken into consideration. The term "lockout" refers to a condition which may take place in the receiver upon the loss of horizontal synchronism. When the receiver loses horizontal sync, the keyed AGC will not function properly removing the bias from the IF amplifiers, thus permitting an excessive signal to be applied to the video amplifier V13. This increased signal is sufficient to drive the grid of V13 into cutoff causing the noise inverter to function continuously inverting the sync pulses, thereby preventing the receiver from pulling back into horizontal or vertical sync. Therefore anti-lockout measures have been designed with this circuit. C48 and R67 located in the plate circuit of Unit #2 of V14 plays an important part in this function. When the receiver is out of sync, the vertical sync pulse causes C48 to charge sufficiently to reduce the effective plate voltage on the second half of V14 enough that the noise inverter approaches an inoperative condition. Another measure which aids the one just mentioned consists of placing an RC time constant, C47 and R70 in the grid circuit of Unit #2 of V14. C47 becomes negatively charged due to the grid current that will flow during the vertical sync pulse while the receiver is out of sync. Here again this charge reaches proportions that approach grid cutoff of this section of the tube. The charges that build up on both C47 and C48 will remain only long enough to enable the receiver to regain synchronism due to the value of their respective resistors. Still another anti-lockout measure has been employed. This one consists of connecting the video detector output to the grid of Unit #2 of V14 through R70 a 2.2 meg resistor. Since the negative output of the video detector reaches several volts in amplitude, without the application of AGC voltage to the IF amplifiers, this connection aids to further the negative bias on the grid of the output section of V14. In view of the fact that each measure tends to place this stage in an inoperative condition, their combined effects completely eliminate any tendency of the receiver to lockout during the loss of horizontal sync.

SYNC LIMITER

Video signals are applied to the grid of the Sync Limiter tube (V15) from the plate of the Video amplifier (V13) through an isolating resistor R64 and capacitor C49. This isolation is required to avoid adding excessive capacity to the Video plate circuit, which would reduce the bandwidth. Limiting is accomplished in the grid of V15. The signal is amplified and then clipped again in the plate of V15. The grid develops its own bias and the plate is operated at a low DC potential. The output is fed to the Sync Clipper (V18A). From the plate of V18A, the positive vertical pulse is fed through an integrating network to the Vertical Oscillator and Output, V18B and V19. Both a positive and a negative horizontal sync pulse are taken from V18A, the positive pulse is coupled through C71 to pin 7 of V20 and the negative one through C70 to pin 5 of V20.

THE VERTICAL DEFLECTION SYSTEM

The vertical deflection system consists of a blocking oscillator (V18B) and vertical output (V19) which is locked into synchronism by the vertical integrated sync pulse. The output of V19 is coupled to the vertical deflection coils (L19 and L20) by the vertical output transformer (T7).

For a discussion of the circuit operation it will be assumed that no triggering pulses are present. Following this, the triggering pulses will be added and their effect upon the operation discussed.

For any linear magnetic deflection system, the waveform of voltage which must be present across the deflection coils (L19 and L20) is as shown in Figure 13, where A is the trace time and B is the retrace time.

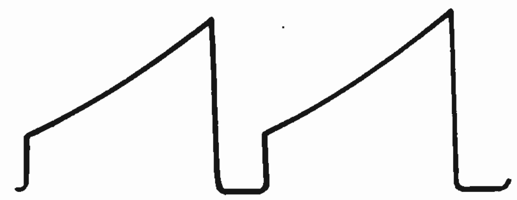


Figure 13

The procedure for obtaining this waveform is as follows:

In common with all oscillators, feedback of energy from plate to grid must occur. A transformer (T9) is employed for this purpose. Any change in plate current will induce a voltage in the grid circuit which will act to aid this change. For instance, an increase in plate current will induce a positive voltage in the grid circuit through the blocking oscillator transformer T9 (See Schematic Diagram). As the grid becomes more positive, more plate current will flow, resulting in the grid becoming rapidly very positive. This will cause electrons to flow in the circuit, charging (C58). The electrons reaching the grid, pile-up on the negative side of condenser (C58). The resistances in this circuit are made large enough so that in combination with condenser (C58) they create a sufficient time constant for the oscillator to block out at a frequency slightly lower than 60 CPS. The electrons stored on C58 discharge slowly to ground.

Because of the slow discharge of (C58) caused by the high value of resistance in the circuit, electrons which have accumulated on the grid remain there in sufficient numbers to give it a large negative bias, sufficient to block or stop the plate current flow. Gradually the charge built up on (C58) passes through the resistance in the circuit back to the positive plate of (C58). The negative bias on the grid then becomes less. When (C58) is almost completely discharged, electrons again begin to flow from the cathode to the plate, the tube begins to draw plate current very fast, and reaches its high value, which drives the grid positive and the whole process is repeated. From the above explanation we can see that during every cycle there is a sharp pulse of plate current, followed by a period during which the tube blocks itself until the accumulated negative charge built up on the grid leaks off again. The frequency of these pulses is determined by C58 and the associated resistance in the circuit.

Figure 14 shows the voltage waveform across the resistance in the circuit. Figure 15 shows the plate current waveform which occurs once in every cycle.

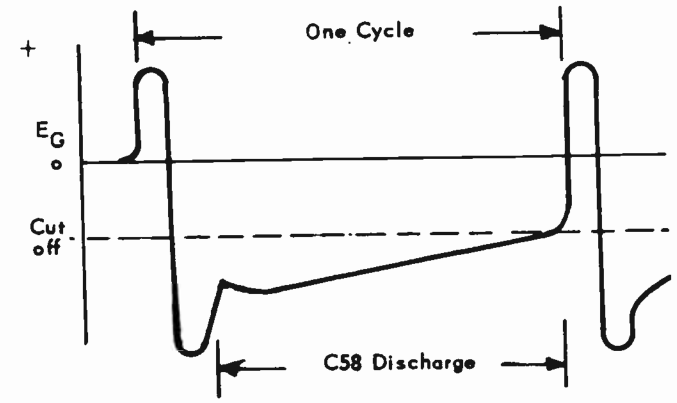


Figure 14

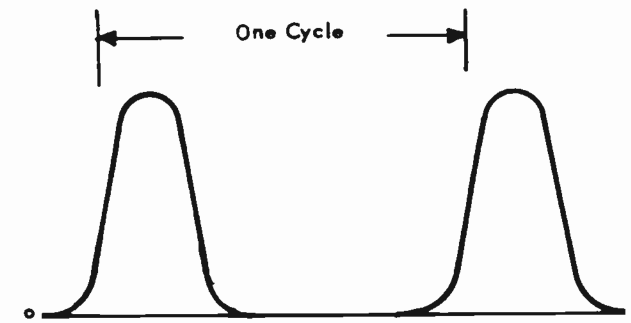


Figure 15

The combination of resistor R142 and capacitor C59 forms the sawtooth waveform needed to drive the vertical output tube (V19). This sawtooth waveform is amplified in V19 and coupled to the deflection coils (L19 and L20) through the vertical output transformer (T7).

A pulse is taken from the junction of C59 and R142 and fed to the suppressor grid (Pin 2 of V15) sync separator. This pulse arrives at the suppressor grid immediately after the blocking oscillator is fired by the leading edge of the integrated vertical sync pulse.

The pulse fed to the suppressor grid is of sufficient amplitude (approximately 100 volts) to cut off the tube. This pulse is formed by the vertical blocking oscillator fly-back and is negative in polarity. This negative pulse cuts the tube off for the remainder of the vertical sync and post equalizing pulse interval and the tube starts to conduct when the preparatory horizontal pulses arrive. Gating off the sync separator tube during most of the vertical and all of the post equalizing pulse interval prevents these pulses from being coupled to the vertical circuit which would impair interlace.

HORIZONTAL SWEEP SYSTEM

The horizontal sweep system consists of a free running multivibrator (V21) coupled to a horizontal output tube (V22) which drives the horizontal deflection coils (L21, L22). The phase detector tube (V20) is used to synchronize the multivibrator. The horizontal generator employs a 6SN7GT tube as a multivibrator, whose frequency is controlled by the L, R and C in the circuit. The amount of charge placed on C80 will determine the multivibrator frequency. The synchronizing system used to lock the oscillator in step with the synchronizing pulses employs a 6AL5 (V20) as a balanced phase detector.

The operation of the multivibrator and associated circuits will be discussed first of all in the completely unsynchronized state. This condition would exist if V20 was removed from the circuit. The operation will then be discussed in the synchronized state.

UNSYNCHRONIZED STATE

The multivibrator used in the horizontal sweep system is of the cathode coupled type. Feedback between unit 1 and unit 2 is accomplished through coupling condenser C80 and the unbypassed cathode resistor R112 which is common to both sections. Now let us apply power to this circuit and follow the chain of reactions as they take place. Any disturbance within the circuit would very likely cause an increase in the plate current of V21B, which in turn will increase the voltage at the top of the common cathode resistor R112. In an unsynchronized condition the bias on V21A can be thought of as being fixed, therefore a substantial increase in cathode voltage will drive the unit into plate current cutoff. Since both units commence conducting upon the application of voltage, this cutoff point of V21A is reached very rapidly. When the cathode voltage cuts-off this unit, the plate voltage immediately approaches the potential of the supply voltage, thereby forming a very steep wave front. C80 couples this positive wave front to the grid of V21B causing the plate current to flow freely offering a very low impedance discharge path for the voltage which has built up on C82. The grid of Unit #2, due to the positive pulse coupled through C80, is driven sufficiently positive to make it draw current. This grid current is being drawn through R114 and R115 consequently building up a negative charge on the grid side of C80 to proportions that will cut off conduction within V21B. With V21B cut-off, the voltage at the top of R112 will drop to a level that will allow V21A to start drawing current. Its plate voltage will then drop sharply applying the developed negative wave front through C80 to the grid of Unit #2, pushing it even more negative than it was when first cutting-off. V21 remains in this condition, that is – Unit #1 drawing current and Unit #2 cut-off, until the negative charge on C80 drains off through R114 and R115. The time required for this negative charge to become small enough to allow V21B to conduct again is determined by the RC time constant of the circuit and has been designed to be approximately 15750 cycles per second. Consequently when this point is reached the first cycle will be completed only to be repeated.

The frequency of this multivibrator is controlled by two separate circuits. One is an RC circuit consisting of R114, R115 (Hor. Hold Control) and C80 while the other is a LC circuit made up of L23 (Hor. Osc. Adjustment) and C75. The latter one is a tank circuit which should be tuned to be resonant at approximately 15750 CPS in order to aid in keeping the multivibrator oscillating at the correct frequency. The function of the RC circuit was discussed in the previous paragraph.

In order to produce the necessary current flow in the horizontal deflection yoke a sawtooth voltage must be applied to the grid of the horizontal output tube. An RC circuit comprised of R118, a 18K resistor and C82, a 330 mmf condenser is used to properly shape the voltage to produce a linear sweep. This sawtooth voltage is amplified by V22 (6CD6G) and since the high voltage transformer is its plate load, produces a sawtooth current which is fed to the horizontal deflection coils, L21 and L22.

OPERATION WITH SYNCHRONIZATION

The Phase Detector (V20) provides automatic frequency control for the horizontal oscillator (V21). This is accomplished by comparing the phase of two different waveforms: both polarities of the incoming horizontal sync pulse and a sawtooth waveform taken from the horizontal output transformer. The positive and negative polarities of the incoming sync pulse kept approximately equal in amplitude, are taken from the plate and cathode of V18A. See Figure 16 (a and b). They are coupled through C70 and C71 to pins 5 and 7 respectively of V20. The second waveform consists of a sawtooth voltage obtained from terminal 5 of the horizontal output transformer. The integrating network C72 and R124 correctly shapes the desired sawtooth waveform revolving about an AC axis. The sawtooth voltage thus developed is both positive and negative, and is applied to pins 1 and 2 of the phase detector tube (V20). See Figure 16 (c).

The sync pulses and the sawtooth waveform are superimposed on each other in the phase

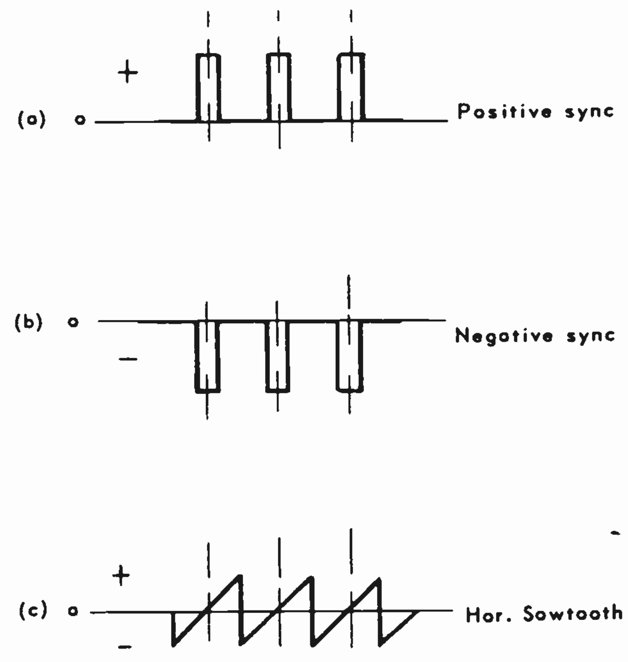


Figure 16

detector. The amplitude of each sync pulse and the sawtooth wave remain the same, but any phase shift between the two will cause a variation in the DC voltage developed at the junction of R108 and R109.

When both the horizontal oscillator and incoming sync are at the same frequency, they are properly phased and the amplitudes of the waveforms in each section of the phase detector are equal. See Figure 17 (a). Each diode, therefore, conducts equally and the DC voltages across the two load resistors, R108 and R109, are equal but opposite in polarity. The voltage developed at the junction of these resistors is therefore zero. Since the output is zero, no change in grid bias takes place and there is no change in the oscillator frequency.

If the horizontal oscillator is ***higher*** in frequency than the incoming sync pulse, the sawtooth voltage being applied to pins 1 and 2 of V20 will be in the positive portion of its cycle by the time the sync pulses arrive on pins 5 and 7. See Figure 17 (b). This places a negative sync pulse on pin 5, equal amounts of positive sawtooth voltage on pins 1 and 2 and a positive sync pulse on pin 7, allowing more current to flow through the pin 2 and 5 section of V20. The result of this is a ***positive*** voltage at the junction of R108 and R109, [see Figure 18 (a)] which makes the grid (pin 1 of V21) more positive and ***slows down*** the oscillator frequency.

If the horizontal oscillator is lower in frequency than the incoming sync pulse, the sawtooth voltage being applied to pins 1 and 2 of V20 will now be in the negative portion of its cycle at the time the sync pulses arrive on pins 5 and 7. See Figure 17 (c). This places a negative voltage on pins 1 and 2, instead of the positive potential that was there in the previous example, and more current will flow through the

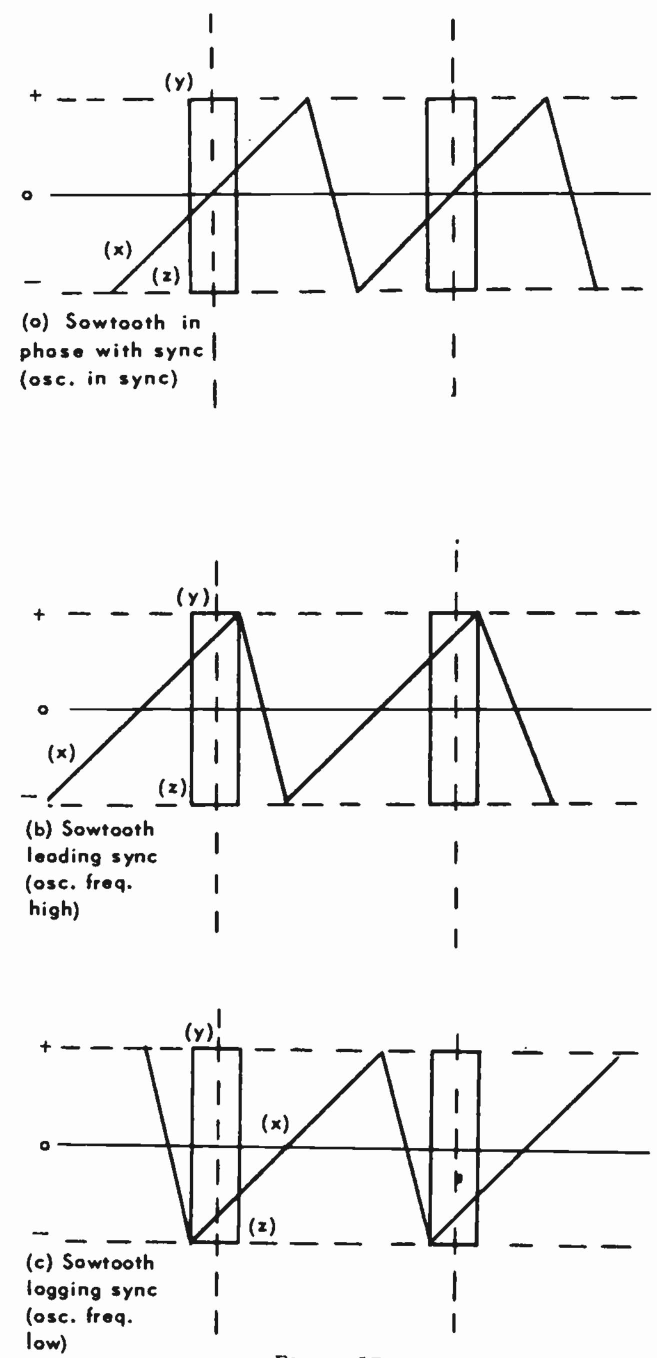


Figure 17

pin 1 and 7 section of the diode. The voltage developed at the junction of R108 and R109 will now be at a negative potential, [see Figure 18 (b)], making the grid (pin 1 of V21) more negative and ***speeding up*** the oscillator frequency. R110 provides a DC return for the grid of V21 in the event V20 should fail or be removed from the socket.

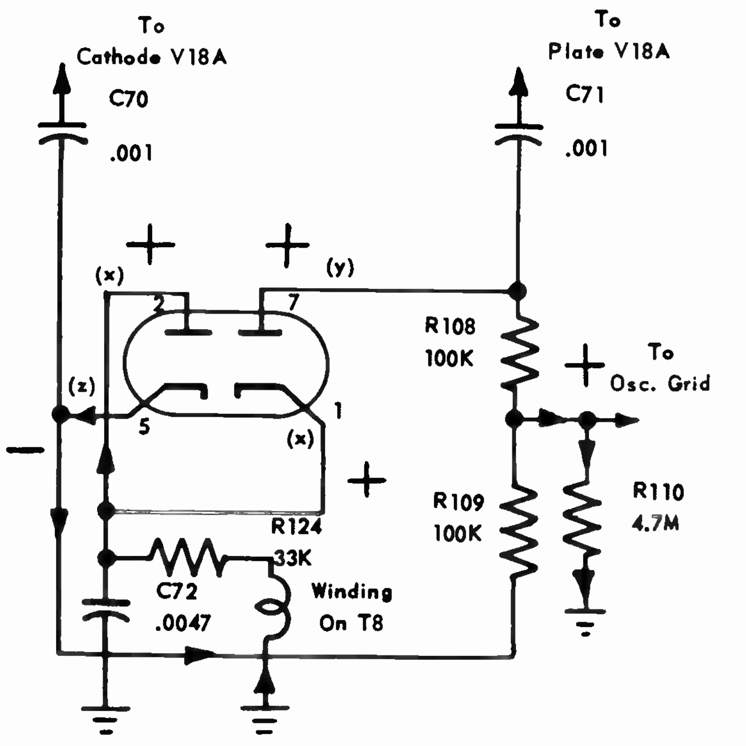


Figure 18 (a)

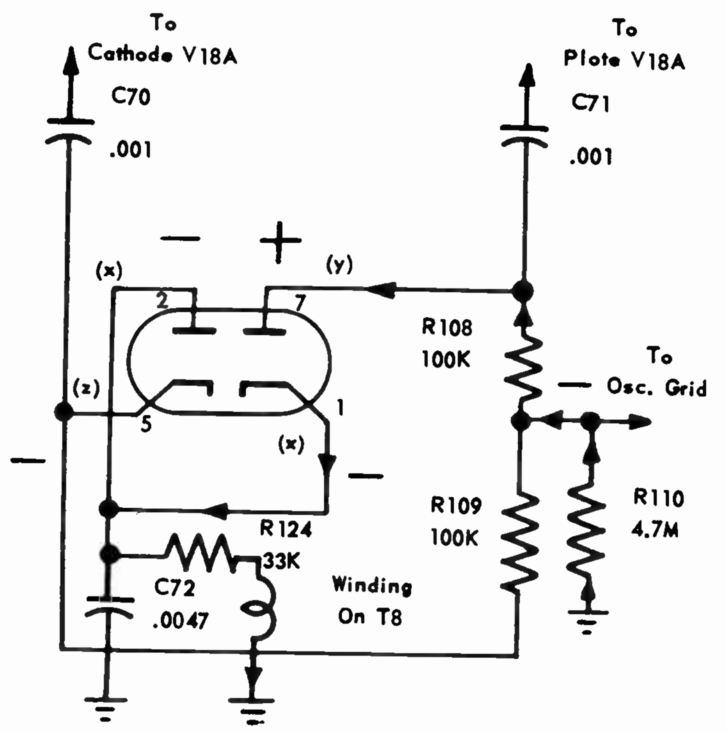


Figure 18 (b)

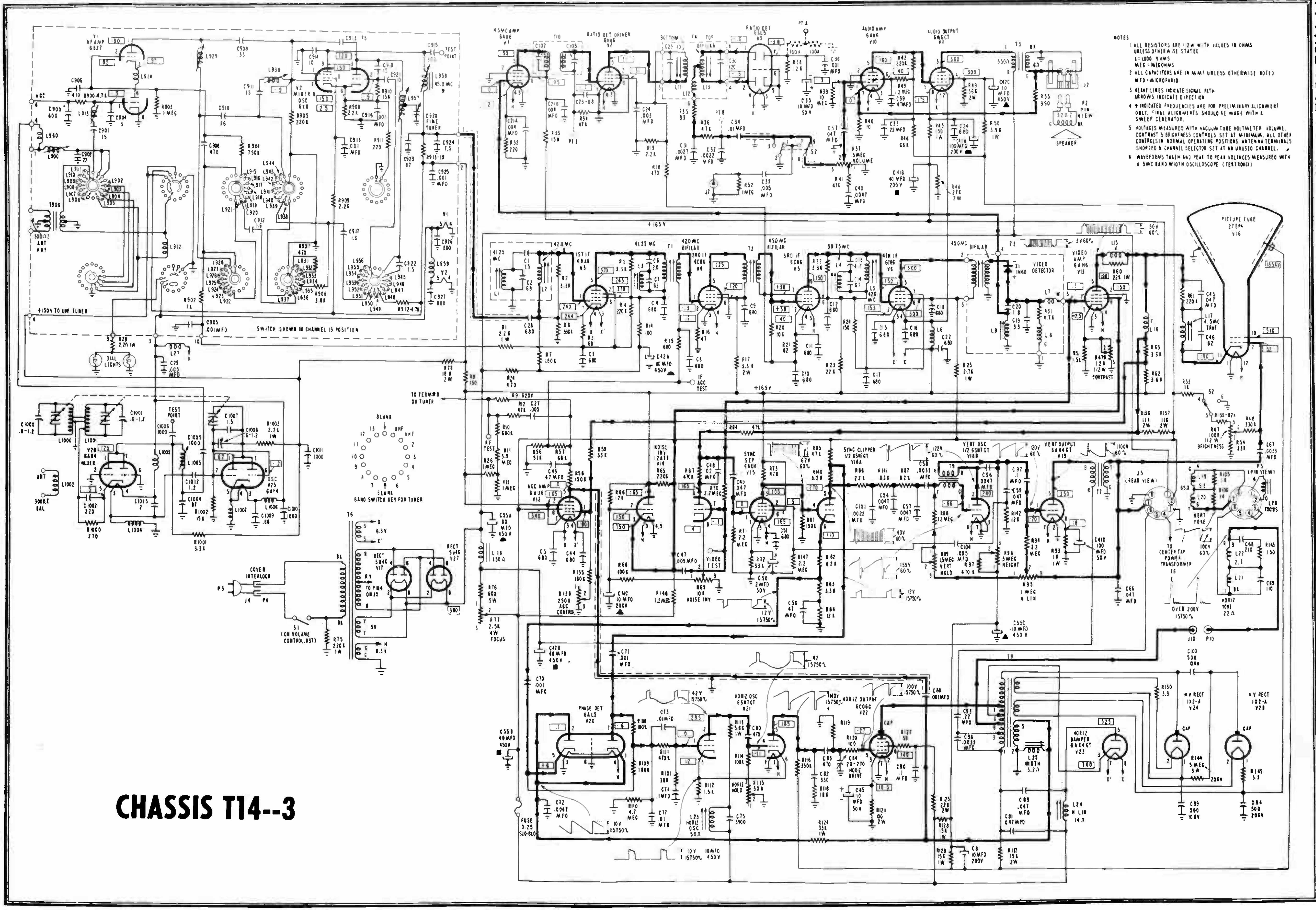
PART NUMBER	SYMBOL NUMBER	DESCRIPTION	LIST PRICE
		ELECTRICAL COMPONENTS	
258051-2		VHF TUNER	48.80
258052-1		UHF TUNER	30.00
267032-9	C3, 4, 5, 8, 9, 10, 11, 12, 16, 17, 18, 22, 26, 44, 51, 15	CAPACITOR–Ceramic 680 mmf ±20% 500V	.20
267052-402	C21a, b	CAPACITOR–Dual Ceramic .004 mfd Min. 500V	.27
267032-37	C23	CAPACITOR–Ceramic 68 mmf ±10% 500V	.21
267064-302	C24	CAPACITOR–Disc Ceramic .003 mfd ±20% 500V	.25
267037-502	C27, 29, 33, 47, 104	CAPACITOR–Disc Ceramic .005 mfd Min. 500V	.24
267059-272	C31	CAPACITOR–Molded Tub., .0027 mfd ±10% 400V	.28
267036-222	C32	CAPACITOR–Molded Tub., .0022 mfd ±20% 400V	.26
267036-103	C34	CAPACITOR–Molded Tub., .01 mfd ±20% 400V	.26
267024-16	C35, 85	CAPACITOR–Elect. 10 mfd +250% –10% 50V	.80
267032-17	C36	CAPACITOR–Ceramic 1000 mmf Min. 500V	.24
267056-473	C37, 45, 49	CAPACITOR–Molded Tub., .047 mfd ±20% 200V	.25
267036-224	C38	CAPACITOR–Molded Tub., .22 mfd ±20% 400V	.26
267036-474	C39, 43, 56	CAPACITOR–Molded Tub., .47 mfd ±20% 400V	.39
267059-472	C40, 72	CAPACITOR–Molded Tub., .0047 mfd ±10% 400V	.28
267005-10	C41a, b, c	CAPACITOR–Elect. (100-200, 40-200, 10-200)	2.73
267005-8	C42a, b, c, 55a, b, c	CAPACITOR–Elect. (80-450, 40-450, 10-450)	3.10
267037-203	C48	CAPACITOR–Disc Ceramic .02 mfd Min. 500V	.41
267024-17	C50	CAPACITOR–Elect. 2 mfd +150% –10% 50V	.74
267060-472	C54, 57, 96	CAPACITOR–Molded Tub., .0047 ±10% 600V	.26
267060-332	C58, 98	CAPACITOR–Molded Tub., .0033 mfd ±10% 600V	.26
267055-473	C59, 64, 89, 91	CAPACITOR–Molded Tub., .047 mfd ±20% 600V	.25
267058-104	C66, 74	CAPACITOR–Molded Tub., .1 mfd ±10% 200V	.25
267036-332	C67	CAPACITOR–Molded Tub., .0033 mfd ±20% 400V	.26
267036-102	C70, 71	CAPACITOR–Molded Tub., .001 mfd ±20% 400V	.26
267059-103	C73, 77	CAPACITOR–Molded Tub., .01 mfd ±10% 400V	.25
CM24J392K	C75	CAPACITOR–Silvered Mica 3900 mmf ±10% 500V	.80
CM22A471K	C80	CAPACITOR–Mica 470 mmf ±10% 500V	.29
267024-14	C81	CAPACITOR–Elect. 10 mfd +100% –10% 200V	1.19
CM22A331K	C82	CAPACITOR–Mica 330 mmf ±10% 500V	.26
267032-39	C83	CAPACITOR–Ceramic 470 mmf±20% 500V	.24
260009-10	C84	CAPACITOR–Trimmer Mica 20-270 mmf	.49
CM24A102K	C86	CAPACITOR–Mica 1000 mmf ±10% 500V	.36
267055-104	C90, 97	CAPACITOR–Molded Tub., .1 mfd 10% 600V	.40
267059-224	C93	CAPACITOR–Molded Tub., .22 mfd 10% 400V	.46
267063-1	C94	CAPACITOR–Ceramic 500 mmf 20KV	1.20
267061-1	C99, 100	CAPACITOR–Ceramic 500 mmf 10KV	1.25
267060-222	C101	CAPACITOR–Molded Tub., .0022 mfd ±10% 600V	.26
RC24A102K	R1	RESISTOR–Comp. 1000 ohms 1W ±10%	.18
RC23A332J	R2, 5, 22, 83	RESISTOR–Comp. 3.3K ohms 1/2W ±5%	.15
RC23A680J	R3	RESISTOR–Comp. 68 ohms 1/2W ±5%	.15
RC23A224K	R4, 61, 65	RESISTOR–Comp. 220K ohms 1/2W ±10%	.13
RC23A334J	R6	RESISTOR–Comp. 330K ohms 1/2W ±10%	.15
RC23A184K	R7, 135	RESISTOR–Comp. 180K ohms 1/2W ±10%	.10
RC23A151K	R8, 24	RESISTOR–Comp. 150 ohms 1/2W ±10%	.10
RC23A624J	R9	RESISTOR–Comp. 620K ohms 1/2W ±5%	.15
RC23A684K	R10, 99	RESISTOR–Comp. 680K ohms 1/2W ±10%	.10
RC23A395J	R11	RESISTOR–Comp. 3.9 meg 1/2W ±5%	.15
RC23A473K	R12, 34, 36, 41, 64, 73	RESISTOR–Comp. 47K ohms 1/2W ±10%	.10
RC23A105J	R13, 26	RESISTOR–Comp. 1 meg 1/2W ±5%	.15
RC23A101K	R14, 120	RESISTOR–Comp. 100 ohms 1/2W ±10%	.10
RC23A681K	R15	RESISTOR–Comp. 680 ohms 1/2W ±10%	.10
RC23A470K	R16	RESISTOR–Comp. 47 ohms 1/2W ±10%	.10
RC25A332K	R17	RESISTOR–Comp. 3.3K ohms 2W ±10%	.25
RC23A471K	R18, 74	RESISTOR–Comp. 470 ohms 1/2W ±10%	.10
RC23A222K	R19	RESISTOR–Comp. 2.2K ohms 1/2W ±10%	.10
RC23A103J	R20	RESISTOR–Comp. 10K ohms 1/2W ±5%	.15
RC23A820K	R21	RESISTOR–Comp. 82 ohms 1/2W ±10%	.13
RC23A223K	R23, 86	RESISTOR–Comp. 22K ohms 1/2W ±10%	.10

RC24A272K	R25	RESISTOR–Comp. 2.7K ohms 1W ±10%	.15
RC25A183K	R28	RESISTOR–Comp. 18K ohms 2W ±10%	.20
268001-022	R29	RESISTOR–Wirewound 2.2 ohms 1W ±10%	.20
RC23A221K	R32	RESISTOR–Comp. 220 ohms 1/2W ±10%	.13
RC23A153K	R33	RESISTOR–Comp. 15K ohms 1/2W ±10%	.10
RC23A330K	R35	RESISTOR–Comp. 33 ohms 1/2W ±10%	.13
262041-2	R37	POTENTIOMETER–.5 meg 1/4W ±30% (volume with switch)	1.31
RC23A123K	R38, 66	RESISTOR–Comp. 12K ohms 1/2W ±10%	.13
RC23A106K	R39	RESISTOR–Comp. 10 meg 1/2W ±10%	.10
RC23A100K	R40	RESISTOR–Comp. 10 ohms 1/2W ±10%	.10
RC23A224J	R42	RESISTOR–Comp. 220K ohms 1/2W ±5%	.15
RC23A125K	R43, 88, 146	RESISTOR–Comp. 1.2 meg 1/2W ±10%	.13
RC23A683K	R44	RESISTOR–Comp. 68K ohms 1/2W ±10%	.13
RC24A151M	R45	RESISTOR–Comp. 150 ohms 1W ±20%	.15
RC25A273K	R46	RESISTOR–Comp. 27K ohms 2W ±10%	.25
262045-1	R47	POTENTIOMETER–Tandem 100K ohms 1/2W ±30% (Bright) 1.2K ohms 1/2W ±30% (Contrast)	1.82
RC23A304J	R48	RESISTOR–Comp. 300K ohms 1/2W ±5%	.15
RC25A563K	R49	RESISTOR–Comp. 56K ohms 2W ±10%	.23
RC24A392K	R50	RESISTOR–Comp. 3.9K ohms 1W ±10%	.15
RC23A152K	R51	RESISTOR–Comp. 1.5K ohms 1/2W ±10%	.10
RC23A105M	R52	RESISTOR–Comp. 1 meg 1/2W ±20%	.10
RC23A102M	R53	RESISTOR–Comp. 1000 ohms 1/2W ±20%	.10
RC23A333K	R54, 59, 72	RESISTOR–Comp. 33K ohms 1/2W ±10%	.13
RC23A391K	R55	RESISTOR–Comp. 390 ohms 1/2W ±10%	.10
RC23A513J	R56	RESISTOR–Comp. 51K ohms 1/2W ±5%	.15
RC23A683J	R57	RESISTOR–Comp. 68K ohms 1/2W ±5%	.15
RC23A154K	R58	RESISTOR–Comp. 150K ohms 1/2W ±20%	.10
RC23A362J	R62, 63	RESISTOR–Comp. 3.6K ohms 1/2W ±5%	.15
RC23A474K	R67, 97, 98, 111, 119	RESISTOR–Comp. 470K ohms 1/2W ±10%	.13
RC23A104K	R68, 81, 114	RESISTOR–Comp. 100K ohms 1/2W ±10%	.10
262025-15	R69	POTENTIOMETER–10K ohms 1/4W ±20% (Noise Inverter)	.72
RC23A225K	R70, 71, 94, 147	RESISTOR–Comp. 2.2 meg 1/2W ±10%	.13
268016-4	R80	RESISTOR–Wirewound 175 ohms 7-1/2W ±10%	.45
268016-5	R76	RESISTOR–Wirewound 600 ohms 5W ±10%	.35
RC24A224K	R75	RESISTOR–Comp. 220K ohms 1W ±10%	.15
262023-9	R77	POTENTIOMETER–2500 ohms 4W ±10% (Focus)	1.28
RC23A822K	R82, 87, 140, 141	RESISTOR–Comp. 8.2K ohms 1/2W ±10%	.10
RC23A123K	R84	RESISTOR–Comp. 12K ohms 1/2W ±10%	.13
RC23A472K	R85	RESISTOR–Comp. 4.7K ohms 1/2W ±10%	.10
262025-14	R89	POTENTIOMETER–1.5 meg 1/4W ±20% (V. Hold)	1.03
RC23A102K	R93	RESISTOR–Comp. 1000 ohms 1/2W ±10%	.13
262025-19	R95	POTENTIOMETER–1 meg 1/4W ±20% (V. Lin.)	.73
262025-12	R96	POTENTIOMETER–3 meg 1/4W ±30% (Height)	.70
RC23A393K	R101	RESISTOR–Comp. 39K ohms 1/2W ±10%	.18
RC23A184K	R108, 109	RESISTOR–Comp. 180K ohms 1/2W ±10%	.10
RC23A475M	R110	RESISTOR–Comp. 4.7 meg 1/2W ±10%	.10
RC23A152K	R112	RESISTOR–Comp. 1.5K ohms 1/2W ±10%	.10
RC24A562K	R113	RESISTOR–Comp. 5.6K ohms 1W ±10%	.15
262022-4	R115	POTENTIOMETER–30K 1/4W ±20% (H. Hold)	.73
RC23A334K	R116	RESISTOR–Comp. 330K ohms 1/2W ±10%	.10
RC25A153K	R117	RESISTOR–Comp. 15K ohms 2W ±10%	.20
RC23A183K	R118	RESISTOR–Comp. 18K ohms 1/2W ±10%	.10
RC23A105M	R119	RESISTOR–Comp. 1 meg 1/2W ±20%	.10
RC25A101M	R121	RESISTOR–Comp. 100 ohms 2W ±20%	.20
RC23A560K	R122	RESISTOR–Comp. 56 ohms 1/2W ±10%	.13
RC25A223K	R125	RESISTOR–Comp. 22K ohms 2W ±10%	.20
RC24A333K	R124	RESISTOR–Comp. 33K ohms 1W ±10%	.15
RC24A153K	R128, 129	RESISTOR–Comp. 15K ohms 1W ±10%	.15
RC23A103K	R127	RESISTOR–Comp. 10K ohms 1/2W ±10%	.13

PART NUMBER	SYMBOL NUMBER	DESCRIPTION	LIST PRICE
		ELECTRICAL COMPONENTS - Continued	
268000-033	R130, R145	RESISTOR–Comp. 3.3 ohms 1/2W ±10%	.20
RC25A113J	R136, 137	RESISTOR–Comp. 11K ohms 2W ±5%	.50
262025-16	R138	POTENTIOMETER–250K ohms 1/4W ±20% AGC	.73
RC23A813K	R139	RESISTOR–Comp. 81K ohms 1/2W ±10%	.13
RC23A123J	R142	RESISTOR–Comp. 12K ohms 1/2W ±5%	.15
268514-1	R144	RESISTOR–Comp. 5 meg 3W ±20% 20KV	1.82
259138-1	L1, 2, C1, 2,	ASSEMBLY–1st I.F. Grid & Sound I.F. Trap	2.53
259146-1	L3, C6, 7	COIL ASSEMBLY–Sound I.F. Trap	1.11
259147-1	L4, C13, 14	COIL ASSEMBLY–Adj. Ch. Picture I.F. Trap	1.13
259148-1	L5	COIL ASSEMBLY–4th I.F. Grid	.70
259149-1	L6	CHOKE–Filament	.23
259105-7	L15, R60	COIL–Video Peaking	.48
259105-4	L16	COIL–Video Peaking	.43
259108-1	L17, C46	COIL ASSEMBLY–4.5 Mc Trap	.92
265047-3	L18	CHOKE–Filter	3.60
265074-1	L19, 20, 21, 22, C68, R105, 106, P5, C69, R143	YOKE–Deflection	12.12
259121-1	L23	COIL–Horz. Oscillator	.83
259082-6	L24	COIL–Horz. Linearity	1.20
259114-3	L25	COIL–Width Control	.99
265045-9	L26	COIL–Focus	9.28
259144-1	T1	TRANSFORMER–2nd I.F. Grid	.64
259145-1	T2	TRANSFORMER–3rd I.F. Grid	.68
259142-2	T3, L7, 8, 9, C19, 20, R31, X1	TRANS. ASSY.–Output & 1st Sound I.F. & Video Detector	5.76
259115-2	T4, L11, 12, 13, C25, 30	TRANS.–Ratio Detector	2.70
265071-12	T5	TRANS.–Audio Output	2.05
265048-2	T6	TRANS.–Power	15.97
265089-1	T7	TRANS.–Vertical Output	4.76
265075-1	T8	TRANS.–HO & HV	10.40
265054-2	T9	TRANS.–Vert. Osc.	3.08
259154-1	T10, C102, 103	TRANS.–2nd Sound I.F.	1.50
1N60	X1	DETECTOR–Crystal	1.17
266164-5201	FUSE	FUSE–"Slo-Blo" Type 3AG .2 Amp.	.31
274197-5		ION TRAP	.50

CABINET REPLACEMENT PARTS LIST

PART NUMBER	FM27C	HB27C	DESCRIPTION	LIST PRICE
251317-1	X	X	Access Door Assy.	3.45
251212-7	X	X	Back Cover Assy.	4.20
255136-1		X	CABINET–Half Door Console (Blond)	213.90
255135-1	X		CABINET–Full Door Console (Mahog.)	196.26
257640	X	X	DIAL–Glass – UHF	.26
269076-1	X	X	KNOB–Brightness	.16
269087-2	X	X	KNOB–Channel Indicator	.85
269077-3	X	X	KNOB–Contrast	.73
269078-1	X	X	KNOB–Fine Tuning	.16
269080-1	X	X	KNOB–{Horz. Hold / Off-On-Vol.	.42
269088-1	X	X	MASK–27" (Plastic)	6.45
257530-19	X	X	SAFETY GLASS–Laminated	17.50
256012-4	X	X	SPEAKER–10" PM	7.83
270833	X	X	STRIP–Decorative	.96


NOTES
1 ALL RESISTORS ARE 1/2 W WITH VALUES IN OHMS UNLESS OTHERWISE STATED
K = 1000 OHMS
MEG = MEGOHMS
2 ALL CAPACITORS ARE IN MMF UNLESS OTHERWISE NOTED
MFD = MICROFARID
3 HEAVY LINES INDICATE SIGNAL PATH
ARROWS INDICATE DIRECTION
4 * INDICATED FREQUENCIES ARE FOR PRELIMINARY ALIGNMENT ONLY. FINAL ALIGNMENTS SHOULD BE MADE WITH A SWEEP GENERATOR.
5 VOLTAGES MEASURED WITH VACUUM TUBE VOLTMETER. VOLUME, CONTRAST & BRIGHTNESS CONTROLS SET AT MINIMUM. ALL OTHER CONTROLS IN NORMAL OPERATING POSITIONS. ANTENNA TERMINALS SHORTED & CHANNEL SELECTOR SET AT AN UNUSED CHANNEL.
6 WAVEFORMS TAKEN AND PEAK TO PEAK VOLTAGES MEASURED WITH A 5MC BAND WIDTH OSCILLOSCOPE (TEKTRONIX)
SWITCH SHOWN IN CHANNEL 13 POSITION
BAND SWITCH KEY FOR TUNER
PICTURE TUBE
SPEAKER
CHASSIS T14--3

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CHASSIS SPECIFICATIONS

Power Requirements
117 volts, 60 cycles AC

Power Consumption
240 watts

Fine Tuning
Plus & minus 600 KC on Channel 2
Plus & minus 1 MC on Channel 13

Audio Power Output
2.8 watts

Band Width
Video amplifier 3.8 MC within 3 db
IF Amplifiers 3.5 MC within 6 db
Antenna input to picture tube 3.25 MC at 6 db
Ratio Detector, peak to peak 200 KC

Deflection
Horizontal & Vertical — Magnetic

Focus — Magnetic (PM)

Scanning — Interlaced, 525 lines
Horiz. Freq. — 15750 CPS
Vert. Freq. — 60 CPS
Frame Freq. — 30 CPS

MODEL IDENTIFICATION TABLE

Model Numbers	Chassis	Picture Tubes	Focus	Tuner	Speaker
KM17CD, SKM17C	T17-1	17QP4A	PM	258050-1	10″ PM
TM17CD, STM17C TS17C	T17-1	17QP4A	PM	258050-1	6″ PM
KS21C	T17	21EP4A	PM	258050-1	8″ PM
TS21C	T17	21EP4A	PM	258050-1	6″ PM

These receivers are adaptable to UHF reception by the insertion of Channel Strips. Please order the UHF strips by the basic part number 275105- making the dash number the same as the channel number desired.

TUBE COMPLEMENT

Tube	Type	Function	Tube	Type	Function
V1	6BQ7	Cascode RF Amplifier	V13	17QP4A or 21EP4A	Picture Tube
V2	6J6	Mixer & Oscillator	V14	5U4G	Low Voltage Rectifier
V3	6BA6	1st IF Amplifier	V15A	1/2 6SN7GT	Sync Clipper
V4	6CB6	2nd IF Amplifier	V15B	1/2 6SN7GT	1/2 Vertical Oscillator
V5	6CB6	3rd IF Amplifier	V16	6W6GT	1/2 Vertical Oscillator & Vertical Output
V6	6AU6	Ratio Detector Driver	V17	6AL5	Phase Detector
V7	6AL5	Ratio Detector	V18	6SN7GT	Horizontal Oscillator
V8	6AU6	Audio Amplifier	V19	6BQ6GT	Horizontal Output
V9	6W6GT	Audio Output	V20	6W4GT	Horizontal Damper
V10	6AU6	Keyed AGC Amplifier	V21	1B3GT	Hi-Voltage Rectifier
V11	6AH6	Video Amplifier			
V12	6BE6 or 6CS6	Sync Separator & Noise Gate			

FREQUENCY CHART

Chan. No.	Chan. Freq.	Picture Carrier	Sound Carrier	RF Osc. Freq.
2	54-60	55.25	59.75	101MC
3	60-66	61.25	65.75	107MC
4	66-72	67.25	71.75	113MC
5	76-82	77.25	81.75	123MC
6	82-88	83.25	87.75	129MC
7	174-180	175.25	179.75	221MC
8	180-186	181.25	185.75	227MC
9	186-192	187.25	191.75	233MC
10	192-198	193.25	197.75	239MC
11	198-204	199.25	203.75	245MC
12	204-210	205.25	209.75	251MC
13	210-216	211.25	215.75	257MC

IF Frequencies: Picture Carrier – 45.75 MC
Sound Carrier – 41.25 MC

ALIGNMENT PROCEDURE

VISUAL ALIGNMENT OF THE RF AND MIXER STAGES

NOTE:

CAUTION: Always determine by suitable tests, the causes of unsatisfactory operation before attempting to align portions of this receiver. Necessity for realignment will, in all cases, be rare.

PROCEDURE:

1. Connect an RF sweep generator with at least a 10 MC sweep width to the antenna terminals through the test circuit shown in Figure 1.

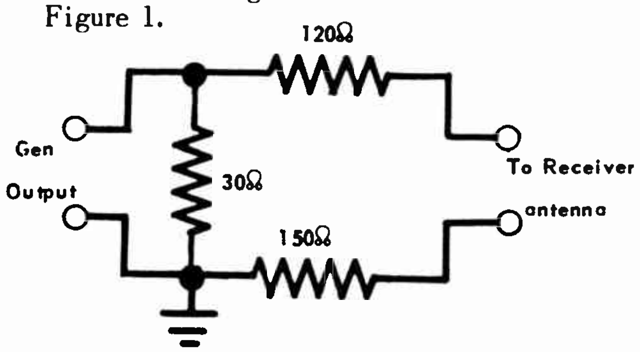
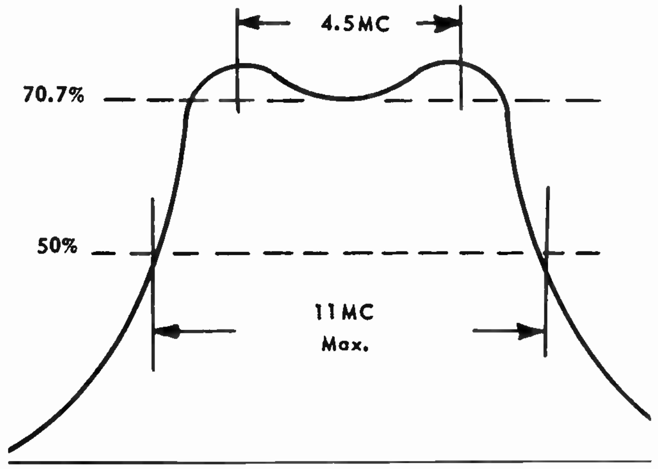


Figure 1

2. Remove the keyed AGC Amplifier tube V10 (This is necessary in order to eliminate AGC action which would interfere with RF alignment).
3. Connect the positive terminal of a 3 volt dry cell supply to chassis ground and the negative terminal to the RF AGC test point.
4. Attach the high side of the vertical input of an oscilloscope through a 10,000 OHM resistor to the test point located at the junction of R806 and R807. In order to synchronize the sweep of the oscilloscope with the RF sweep, connect the horizontal amplifier terminals of the oscilloscope to the terminals on the RF sweep generator labeled "oscilloscope sweep voltage."
5. Turn the station selector to Channel 12 and adjust the sweep generator until it sweeps from 202MC to 212MC. (NOTE: If the sweep generator does not supply marker signals at picture and sound carrier frequencies, an external source, such as a CW signal generator should be used to supply them. For method of marker injection, refer to instructions supplied by the manufacturer of sweep generator being used.
6. Adjust C802, C808 and C811 until the viewed response curve is similar to that shown in Figure 2. Check all other channels readjusting C802, C808 and C811 as necessary to obtain optimum response on all twelve channels as shown.



RF Response Curve

Figure 2

The dip in the curve between picture and sound carriers should not fall below 70.7% of the response peak and the bandwidth at 50% down should not exceed 11MC on any channel.

RF OSCILLATOR ALIGNMENT

CW METHOD

1. Remove V10 from its socket and connect the negative terminal of a 3 volt dry cell bias supply to the RF and IF AGC test points. (This can best be accomplished by tieing the two points together.)
2. Apply the CW signal to the antenna terminals through the pad shown in Figure 1.
3. Connect the DC probe of a vacuum tube voltmeter to test point C.
4. Set the signal generator to the sound carrier frequency of each channel that is to be aligned.
5. Turn the fine tuning control to approximately the center of its rotating range.
6. Adjust the oscillator coil slug that is accessible through a hole in the front panel of the tuner until a sharp dip in the voltage reading on the VTVM is reached. Repeat this procedure for all channels. Precautions should be taken not to turn the oscillator slug into the coil form too far – to do so will allow the slug to pass beyond the clip which acts as a thread guide thus necessitating the removal of the channel strip in order to return the slug to its proper tuning position.

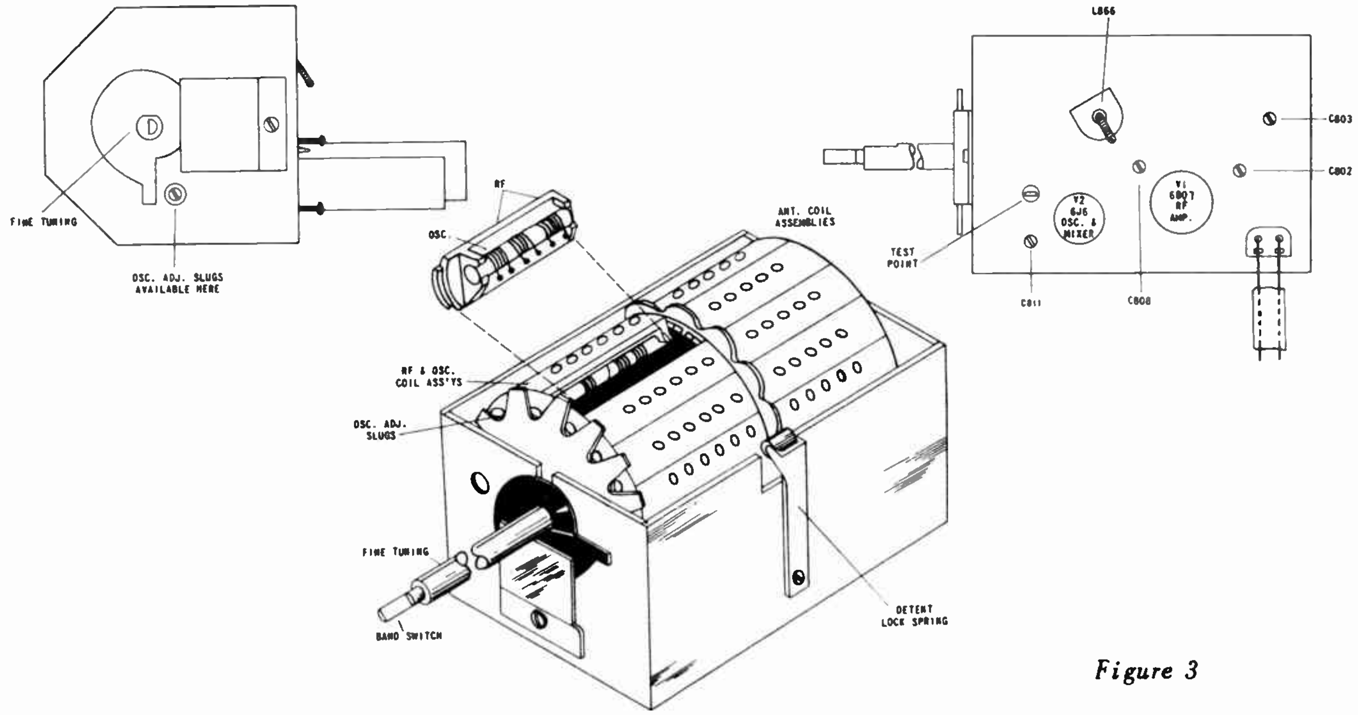


Figure 3

RECEIVED SIGNAL METHOD

There is also another satisfactory method for adjusting the RF oscillator in the turret type tuner. This may be accomplished without removing the chassis from the cabinet by the following procedure:

1. Allow the receiver to warm-up for approximately 10 minutes.
2. Turn the channel selector to a station which is in operation making sure that all other controls are adjusted for normal picture.
3. Set the fine tuning control at the center of its range.
4. Remove both the channel selector and fine tuning knobs.

IF ALIGNMENT

Remove the AGC Amplifier (V10) from its socket.

Connect the negative terminal of a 3 volt dry cell supply to the IF AGC test point and the positive terminal to chassis ground.

Raise the tube shield of V2 so that it is not grounded and apply the signal to it.

Turn channel selector to an unassigned high channel position, to reduce the possibility of interference during alignment.

Generator Frequency	VTVM Connections	Adjustment	Remarks
44.3 MC	To Test Point (C) and Ground	T3	Adjust for Max.
42.7 MC	To Test Point (C) and Ground	T2-L2	Adjust for Max.
45.0 MC	To Test Point (C) and Ground	T1-L866	Adjust for Max.
41.25 MC	To Test Point (C) and Ground	L1	Adjust for Min. with output of Signal Gen. at Max.

NOTE: To insure correct IF Alignment follow the procedure outlined under visual check of IF Alignment.

5. Adjust the brass slug which is accessible through a 1/4″ hole beside the tuning shaft first in a counterclockwise direction for the clearest detailed picture. If best detail is not reached then screw in clockwise direction. Here again caution must be taken not to rotate the slug too far into the coil form. (For best results a non-metallic screwdriver approximately 8 inches long must be used.)
6. Repeat this procedure for each local station making sure that the fine tuning control is in the center of its range.

VISUAL CHECK OF IF ALIGNMENT

1. Lift the shield of the oscillator mixer tube V2 until it becomes ungrounded. Connect the high side of a sweep generator to the ungrounded tube shield and the ground lead to chassis ground. Connect a lead from the sweep synchronizing terminal on the sweep generator to the external sweep terminal on the oscilloscope.
2. Connect high side of oscilloscope to pin 7 of V11 video amplifier tube and ground lead to chassis ground. (Set contrast control at minimum.)
3. Remove the keyed AGC amplifier tube V10.
4. Connect the negative terminal of a 3 volt dry cell to the IF AGC test lead and the positive terminal to chassis ground.
5. Adjust sweep generator to sweep from 40 to 50MC.
6. Connect a vacuum tube voltmeter between pin #1 of V11 and ground and adjust the sweep generator output until a reading of −2 volts is obtained.
7. Adjust the oscilloscope until the IF response curve is centered.
8. Place a lead from an AM signal generator near the IF strip and adjust it to cover from 40 to 50MC.
9. Observe the response curve and the position of the markers (see nominal response curve Figure 4). A slight deviation from this response curve is permissible; however, complete realignment of the IF will be necessary if a great deviation is noted. Some improvement in the shape of the response curve may be accomplished by slightly re-adjusting L2 on the main chassis and L866 on the Standard Coil (strip type) tuner or L958 on the Sarkes-Tarzian (switch type) tuner.

For best performance the difference in height of peaks should not exceed 30% nor should the dip drop more than 30% below the peak of the response curve.

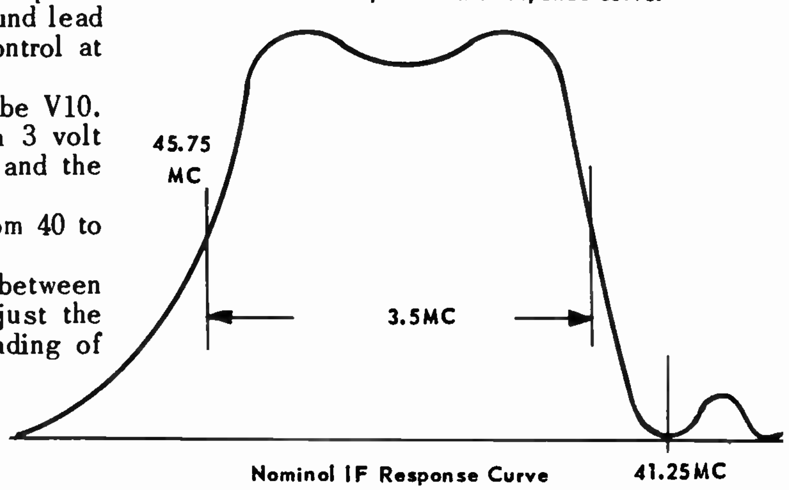


Figure 4

SOUND ALIGNMENT

Connect the negative terminal of a 9 volt dry cell supply to the IF AGC test point and the positive terminal to chassis ground.

Signal Generator Coupling	Frequency	Connect	Adjust	Remarks
High side to Test Point (C). Low Side to Chassis.	4.5MC	Parallel R23 with two 100K resistors which are within 1% of each other. DC probe of VTVM to PT. A. Common lead to chassis.	L5 L6	Adjust for maximum reading in order given, then repeat.
SAME	4.5MC	DC probe of VTVM to PT. B. Common lead to PT. A.	L8	Adjust for zero reading at cross-over.

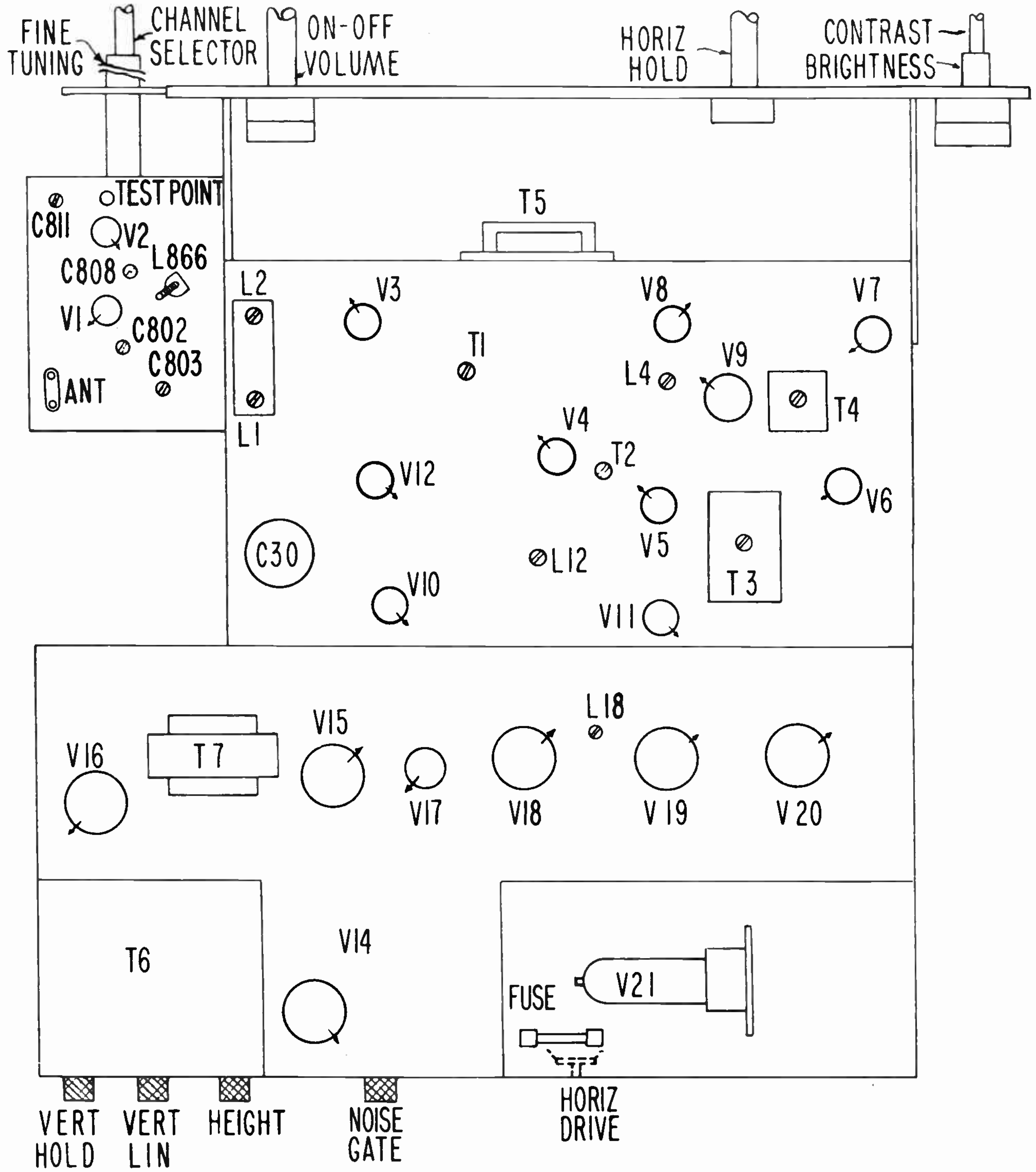


Figure 5

NOISE GATE ADJUSTMENT

NOTE: The noise gate control is adjusted at the factory to give optimum performance under varied conditions. Therefore, only upon rare occasions would any adjustment be necessary. If the receiver is to be operated in an extremely weak signal area where a high noise level is encountered, or this control becomes maladjusted by one means or another it can be satisfactorily set by the following procedure:

– Select and properly tune in the strongest station in the area.

– Turn the contrast control to its maximum position (full clockwise).

– With the noise gate control set at minimum, slowly turn it in the clockwise direction until a slight shifting of the picture in the horizontal plane is observed, then back off (counterclockwise) 1/8 of a turn.

CAUTION: If this control is set too far in the clockwise direction either the receiver will lose sync entirely or an erratic jumping of the picture will be encountered.

HORIZONTAL OSCILLATOR ADJUSTMENT

This adjustment may be satisfactorily performed with any received program signal.

– Set the Horizontal Hold control, R99, at approximately mid-position.

– Set the Contrast control to the normal operating position.

– Adjust the Horizontal Oscillator control, L18, until the diagonal streaks on the screen decrease in number and become erect (picture locks in sync).

The setting obtained by the preceding step may not give optimum range on the Horizontal front panel hold control, therefore, further adjustment by the trial and error method should be performed. When L18 is properly adjusted, the H. Hold control can be slowly rotated to its stops in either direction without losing picture synchronization.

HORIZONTAL DRIVE ADJUSTMENT

CAUTION: Maladjustment of this control may cause unstable Horizontal sync or Horizontal pulling throughout the picture.

– Rotate the selector to an unassigned channel position.

– Turn the contrast control to its extreme counterclockwise position.

– Connect the DC probe of a VTVM to pin #8 of V19 (6BQ6GT).

– Observing the voltmeter reading, turn the horizontal drive control (C70) clockwise not allowing the maximum voltage to exceed 15 volts (on some sets this much voltage may not be obtained).

– The correct setting will be reached by turning the drive control counterclockwise until the rapid voltage drop of approximately 1½ volts suddenly ends. (Further counterclockwise adjusting of the drive control will only cause a slow tapering off in voltage reading).

IMPORTANT: DO NOT adjust for minimum voltage reading. To do so may overdrive the horizontal output stage causing foldover in the picture.

ANTI-PIN CUSHIONING MAGNETS

Pin cushioning is an effect caused by the use of the cosine-deflection yoke and is apparent by the "bowing in" along the edges of the raster. In order to compensate for this condition two anti-pin cushioning magnets have been mounted to the picture tube mounting bracket. For ease of adjustment these magnet brackets are hinged in two places; thus allowing the magnet to be moved either forward or backward at various distances from the picture tube surface. The proper adjustment of each magnet may be observed by moving the raster off center far enough to see the side of the picture that is being straightened.

NOTE: These magnets are properly set at the factory and should require no further adjusting unless a new picture tube is installed.

ION TRAP ADJUSTMENT

Reduce the *contrast* and raise the *brightness* to a point where a blank raster is just visible on the picture tube. Rotate the ion trap while moving it either forward or backward until the *brightest* raster is obtained.

BLOCK DIAGRAM

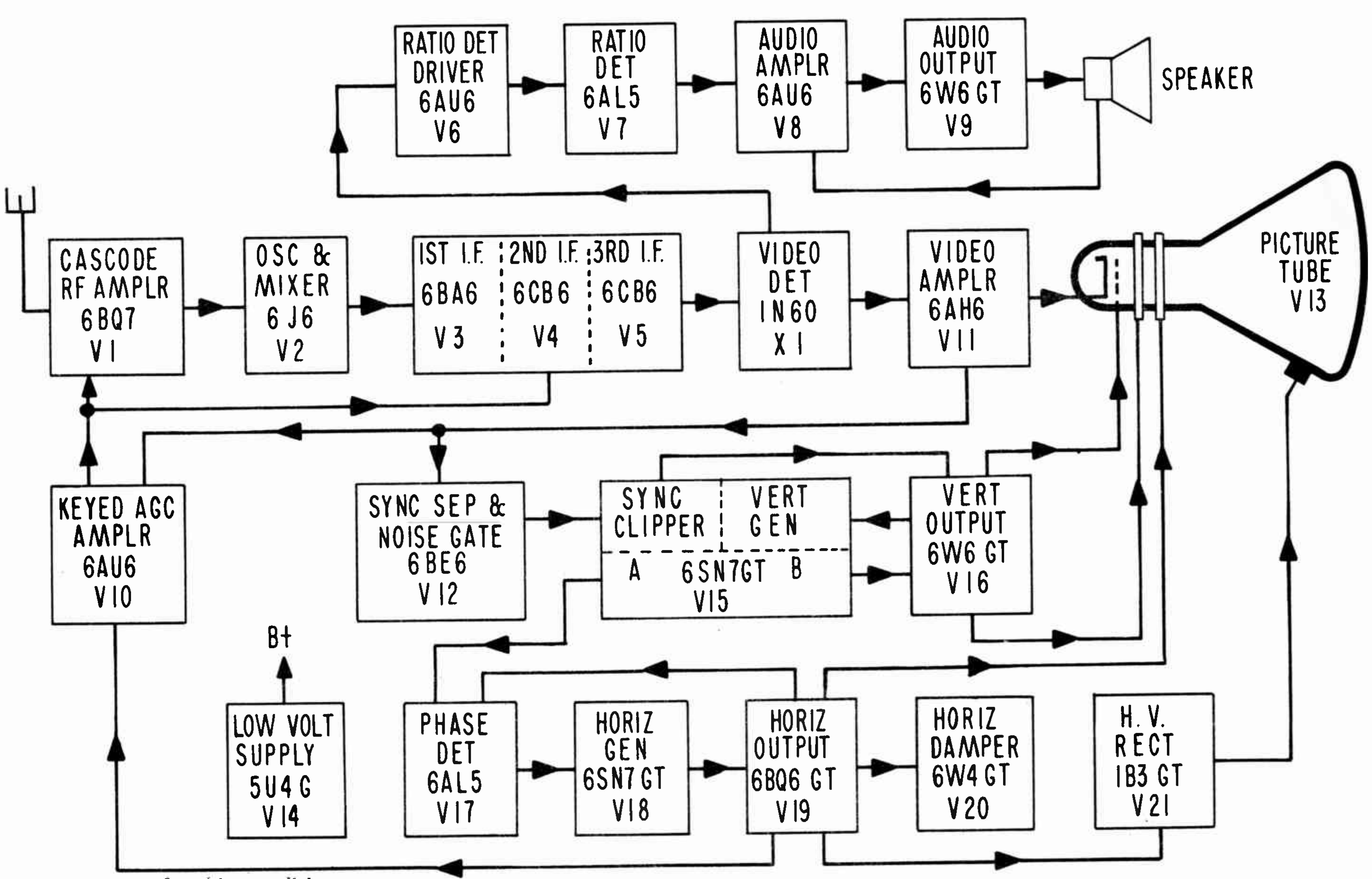


Figure 6

WARNING: It is extremely important that the ion trap be adjusted properly as soon as the set is turned on. A trap even slightly maladjusted can cause severe damage to the CR tube, and this type of damage is not covered by the factory warranty. *NEVER ADJUST THE ION TRAP TO REMOVE SHADOW.*

REMOVAL AND INSTALLATION OF PICTURE TUBE

CAUTION: Be sure the power is off. Wear goggles whenever a picture tube is being handled.

– Place the cabinet face down taking all precautions necessary to keep from marring the finish.

– Remove the high voltage lead from its socket.

– Remove the tube socket from the base of the tube.

– Remove the ion trap from the neck of the tube.

– Loosen and remove the two 1/4″ bolts that hold the yoke and hood assembly to the mounting straps.

– Remove this assembly from the neck of the tube.

– Bend the two straps away from the tube as far as possible.

– Grasp the rim of the picture tube face and gently lift the tube out of its harness. Do not allow the tube to rest on its neck or base, and do not under any circumstances carry or handle the tube by its neck alone.

– To replace the tube, reverse the above procedure paying particular attention to the fact that the two 1/4″ bolts which hold the yoke and hood assembly should be tightened with equal pressure or tightness.

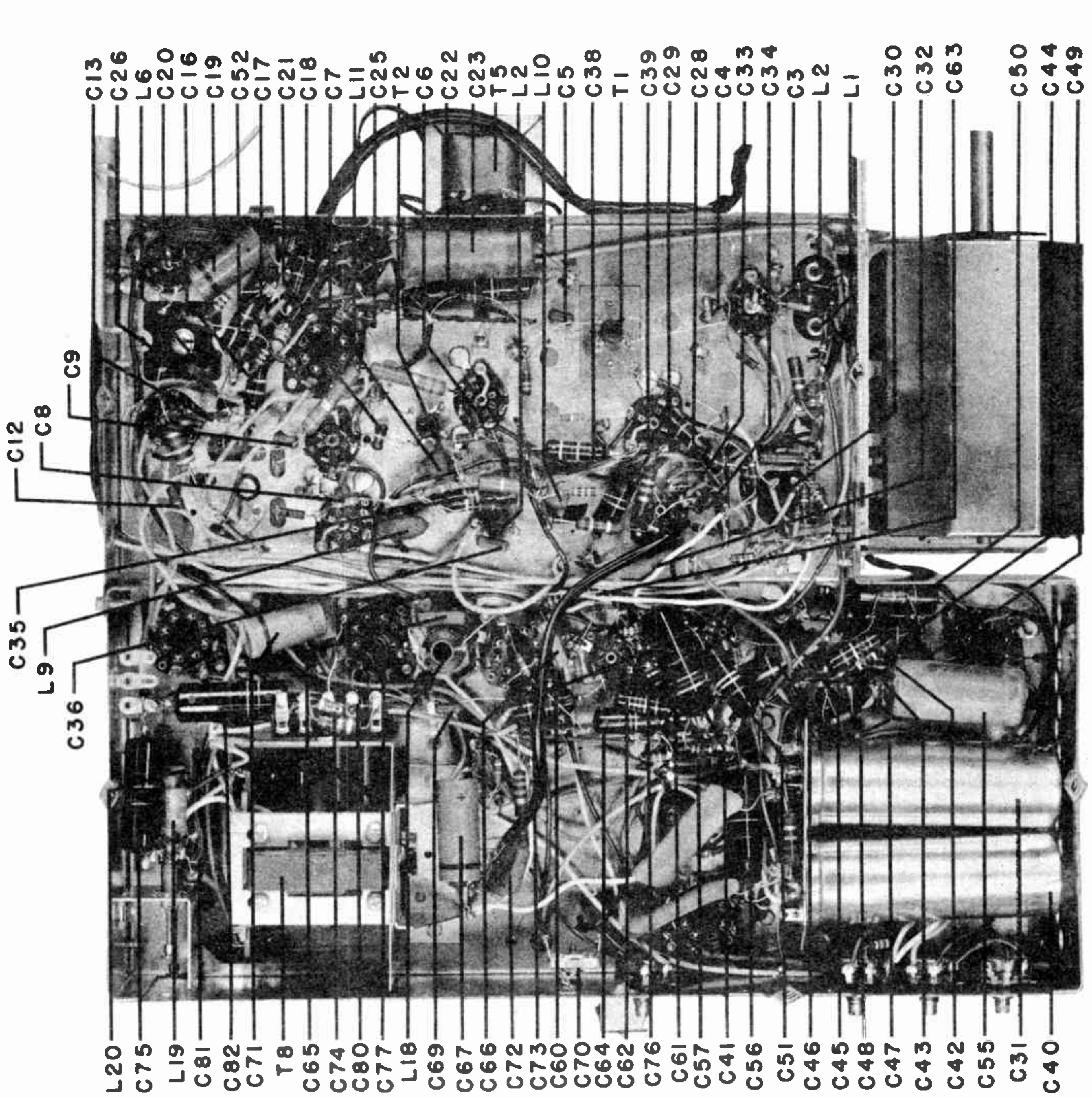
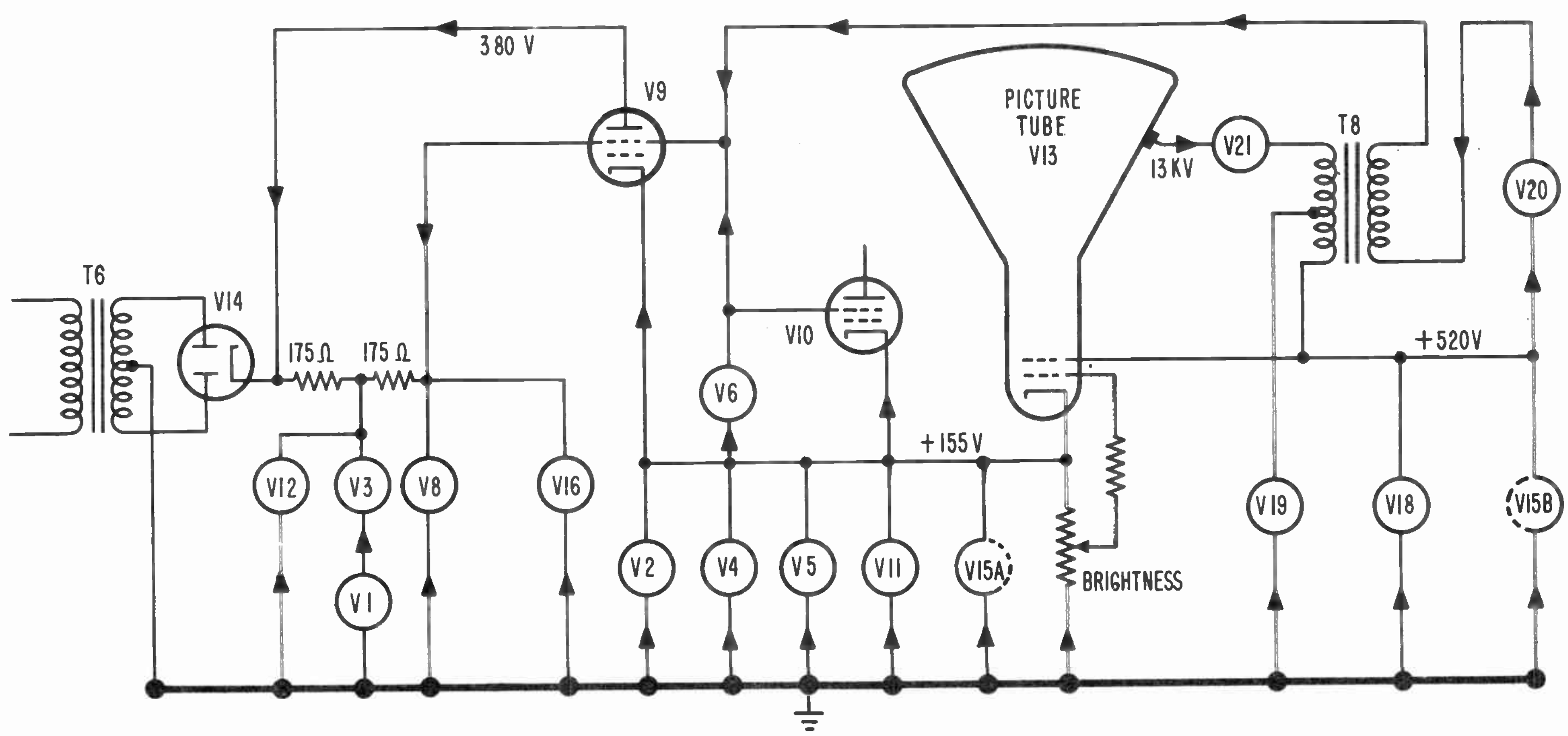


Figure 8

CURRENT DISTRIBUTION DIAGRAM



NOTE: There is no DC voltage applied to V9, V20 or to the plate of V12.

Figure 7

CIRCUIT DESCRIPTION

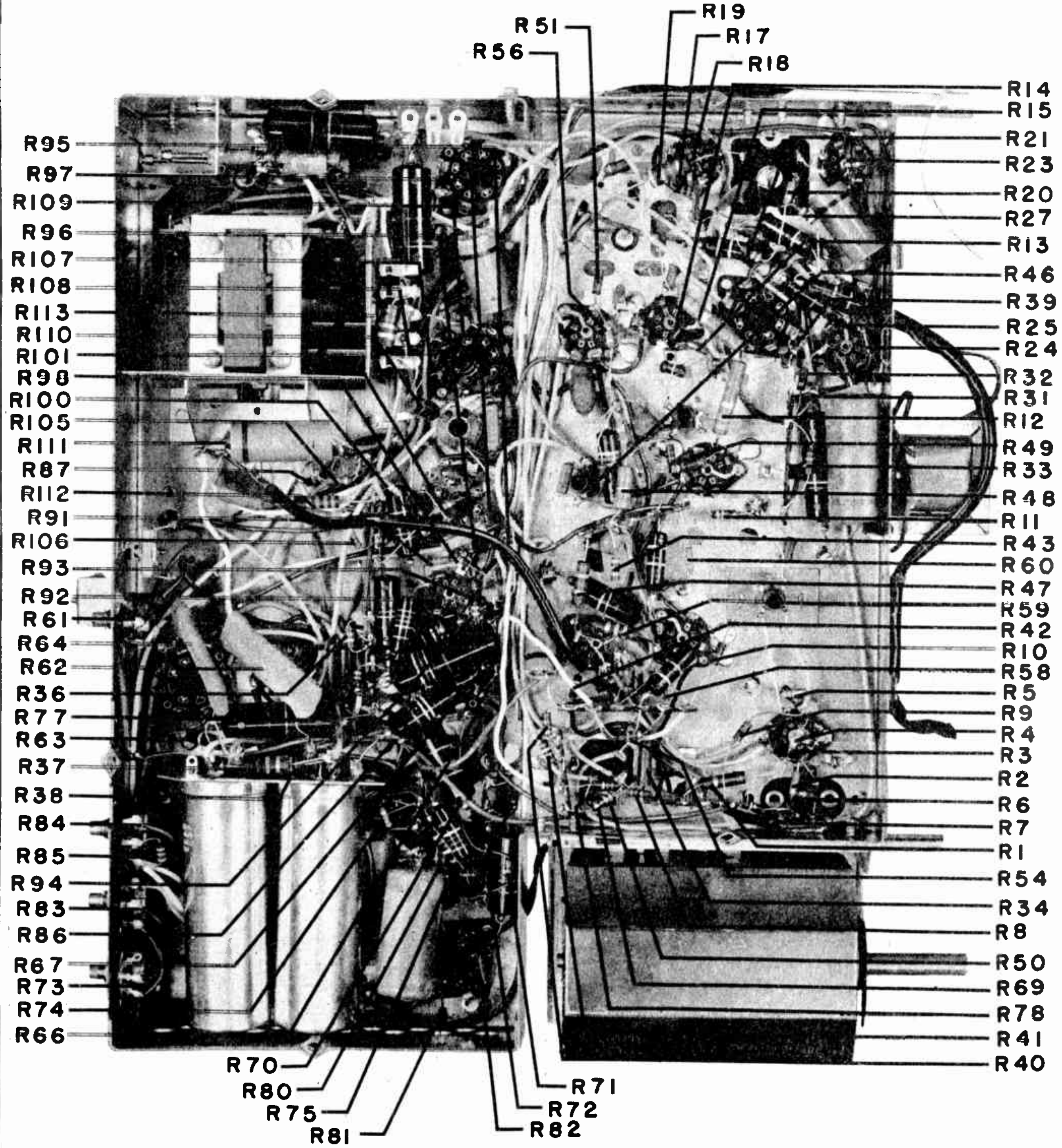


Figure 9

RF SYSTEM

The tuner used in this receiver is a rotary turret type which is made up of separate coil assemblies mounted in a rotating drum. These assemblies are of the snap-in design, therefore can be very readily replaced if and when such a necessity arises. All of the tuning adjustments were made with the aid of a sweep generator in the Bendix factory. Any further adjustment of the tuner in the field is not recommended unless a sweep generator is used and the instructions included under *Alignment Procedure* are followed very carefully. The antenna input circuit is designed to give optimum performance with 300 ohms balanced impedance. The signal is inductively coupled to the input grid of the RF amplifier which is controlled by an AGC voltage.

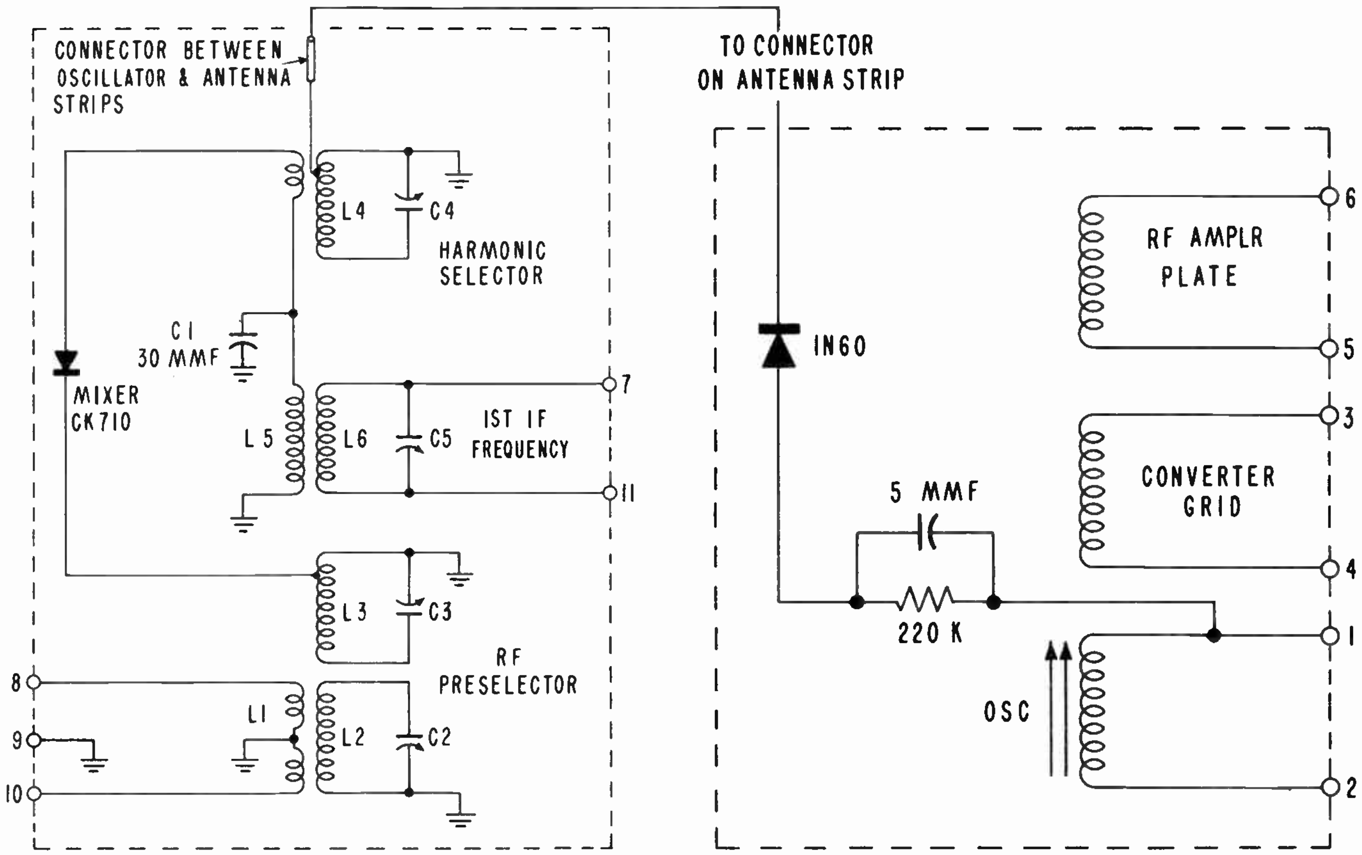
The RF amplifier, V1, is a 6BQ7, twin triode type of tube connected in what is known as a series "Cascode" circuit. In using a circuit of this design the noise figure which accompanies a conventional pentode amplifier has been greatly reduced and yet equivalent gain has been maintained. The input section of the RF stage is connected as a grounded cathode type amplifier. Its output is fed through L827 to the cathode of a grounded grid amplifier – the output section of the RF stage. All of the RF coils are preadjusted and matched to a standard, therefore the only adjustments made available for overall RF alignment are C802, C808 and C811. Two over-coupled tuned circuits couple the plate of the RF amplifier to the grid of the mixer stage, V2, one-half of a 6J6. These circuits are so loaded that the overall response of the RF system is flat over a maximum band width of 11MC, to within 6db of the peak response. R806 connected in series with R807 forms the grid leak resistor for the mixer stage. The test point located at the junction of these two resistors provides a very convenient point for checking a portion of the D.C. voltage developed by the injected oscillator signal and also for connecting an oscilloscope to examine the response characteristic of the RF system with a sweep generator. (A 10,000 ohm resistor should be connected in series with the oscilloscope to avoid adding excessive capacity to the mixer grid circuit.)

The other half of V2 is used in a Colpitts type oscillator circuit. There is an adjustable brass slug assembled in each oscillator coil for ease of correcting its frequency for each channel as it is selected. Inductive coupling is used to inject the oscillator output into the grid of the mixer stage. The DC voltage developed at the test point by the injected oscillator signal should be at least −2.5 volts on all of the channels. C810 and L864 form the neutralizing circuit for the mixer stage. L865 is an RF peaking coil.

The output of the mixer is fed to the first IF amplifier through a band pass double tuned circuit consisting of L866, C822 and L2. This type of circuit accomplishes two purposes – a high degree of oscillator frequency isolation plus optimum transfer of energy. The tunable tank circuit L1 and C2 is used as a sound trap capacitively coupled to the grid of the first IF amplifier. This IF trap reduces the IF gain at the sound carrier frequency approximately 32db, providing satisfactory sound attenuation.

UHF ADAPTION TO THIS SYSTEM

The separate snap-in coil design of this tuner makes it very readily adaptable to UHF reception. The UHF snap-in coils commonly called "strips" are of such design to fit into the turret drum in the same manner as the VHF coils. Therefore an unused VHF position is utilized for UHF reception. The circuitry of these strips is shown in Figure 10. Double conversion is the method used to convert the UHF signal to the 41MC IF frequency of this receiver. The antenna coil L1 is center tapped for a balanced 300 ohms Z input and inductively coupled to the RF preselector circuit. This preselector circuit consists of two separately tuned tank circuits L2, C2 and L3, C3 which are inductively coupled to one another and pretuned to the designated channel frequency. This type of circuit is used to insure a high degree of signal selectivity to the crystal mixer CK710. The signal required for the first conversion of the received UHF is obtained from the VHF local oscillator. In order to insure that the local oscillator's output is rich enough in harmonics to produce the necessary signal, a IN60 is employed as a harmonic generator. This output is fed to the Harmonic Selector Circuit L4 and C4. A predetermined harmonic of the local oscillator selected by this tuned tank circuit is fed to the crystal mixer so as to produce in L5 the signal titled 1st IF frequency. This signal is inductivity coupled into the input section of the 6BQ7 cascode RF amplifier. Since the signal is now in the VHF region, it is amplified and converted in the tuner just as if it were received at the antenna as a VHF station. The circuitry which has just been discussed is mounted on the strip which snaps into this antenna coil section of the removed VHF strips. The oscillator section of the UHF strips appears to be very similar in construction to the VHF strip, with the addition of the harmonic generator circuit.



UHF Antenna Strip

Figure 10

UHF Osc. and Converter Strip

IF SYSTEM

Four stagger-tuned circuits employing one 6BA6 and two 6CB6 tubes along with a crystal detector comprises the interstage IF amplifier system. Three of the IF transformers used in this system are of the Bifilar wound type – two windings interwound on a single form. A winding of this type approximates unity coupling and yet tunes as readily as a single tuned coil. The following advantages are derived from such an assembly. Improved filtering of all plate and grid returns can be achieved because the bypass condensers are returned to the same ground as their associated cathode thus eliminating circulating ground currents. It is also possible to keep the time constant in the grid circuit of each amplifier to a very low value therefore minimizing the possibility of a charge building up on the grids of these stages during heavy noise pick up. This latter advantage permits the IF system to operate at optimum performance at all times. Unbypassed cathode resistors are used in the first two stages to reduce the variations of input capacity with AGC voltage changes. Within this IF strip there is a case of voltage cascading which means that two or more tubes are connected in what may be termed as "plate current series" with one another. This hook-up involves the first IF (V3) and the RF amplifier (V1). In such an arrangement the tube at the top of the line-up has applied to its plate approximately the maximum voltage available and is biased so that the voltage drop across it is sufficient to reduce the voltage at its cathode to a value that is proper for operating the next stage. This continues to happen right on down the line until the tube at the bottom of the string has its cathode D.C. connected to ground. A hook-up of this kind consumes less power due to the fact that the tubes at the top of the string are effectively used as the plate load resistor for the pursuing stage, therefore the dissipation that normally takes place across a load resistor is utilized for amplification. This IF system has been designed to provide an overall response curve which is flat topped with a nominal band width of 3.5MC 6db down from peak response. The IF output is fed into the video detector can T3 which encases the third IF amplifier plate transformer, sound take off coil, the crystal video detector IN60, and its associated peaking coils necessary to extend the frequency response to the desired band width.

Various test points have been indicated on the schematic diagram in order to facilitate the making of checks on the operation of the IF system. One is located in the AGC string at the junction of R40 and R41 while another is located at the junction of R40 and R42. These two points have been made available from the top of the chassis for checking developed AGC voltage and for applying bias potentials when making sweep tests on the RF or IF systems. Another test point "C" has been designated at the grid of the video amplifier V11. This point may be used for connecting a VTVM when measuring the voltage developed by the crystal detector during alignment with a CW signal, and it may also be used for applying a 4.5MC signal with which to align the sound IF's and ratio detector transformer.

SOUND SECTION

Intercarrier sound reproduction is used. By this method both the picture and sound carriers are amplified by the same IF amplifiers and beat together in the Video Detector, giving a 4.5MC frequency modulated signal that is fed to the Ratio Detector Driver V6. The 4.5 megacycle beat is constant since it is always the fixed difference between the video and sound carriers coming from the TV station. Therefore, the sound will not be effected by any normal oscillator drift, since both the video and sound carriers will drift equal amounts making the difference always 4.5MC. This 4.5MC signal is captured by a high impedance tank circuit, L5 and its distributed capacity located inside of the video detector can, and applied to the ratio detector driver V6 through C12. V6 as its name implies amplifies and drives the Ratio Detector hard enough to produce a charge on C19 great enough in amplitude to render V7 inoperative to an amplitude modulated signal of short duration. The Ratio Detector V7 is of conventional design. R20, a 180 ohms resistor, in series with the coupling link of the detector transformer T4 stabilizes the impedance presented by the diodes. If this resistor were omitted, the variation in impedance between individual tubes would cause the AM rejection to vary between receivers.

The output of the Detector is amplified in V8 first audio stage and then directly coupled to the grid of the audio output tube V9. This DC coupling is possible and necessary because V9 plays an intricate part in the voltage regulating system. (See Current Distribution Diagram)

About 10db of negative feedback is provided by R39 which is connected between the secondary of the audio output transformer and the cathode of the first audio amplifier V8 to reduce output distortion.

VIDEO AMPLIFIER

The Video amplifier is a 6AH6, with the associated wide band, low pass filters. The output of the crystal detector is DC connected to the grid of the Video amplifier through a filter circuit comprising a series (L3) and a shunt (L4) peaking coil. L11 is a shunt plate peaking coil used to extend the frequency response of the Video amplifier to its desired band width and compensate for any incurred phase shift. The response of the Video system is flat to 1MC and down 3db at 3.8MC.

The contrast is controlled by changing the amount of degeneration in the Video amplifier. This is accomplished by varying the control R35 in the cathode circuit. The video stage gain is 34db measured at 100KC with the contrast control set at maximum.

No DC restoration is necessary at the output of the Video amplifier because the entire Video amplifier is direct coupled from the output of the crystal detector to the cathode of the picture tube. Therefore, the rectified video signal does not vary about an AC axis.

Notice that the polarity of the detector is such that a negative signal is applied to the grid of the Video amplifier, resulting in a positive video signal at the plate which is applied directly to the cathode of the picture tube.

KEYED AGC

V10 is the AGC amplifier whose function is to keep the sensitivity automatically adjusted in accordance with the strength of the received signal. This is accomplished by the negative voltage which is developed at the plate of V10 and applied to the grids of the RF and IF amplifiers.

The plate voltage for this circuit is a positive pulse taken from terminal 8 of the horizontal output transformer T8. This pulse is developed by the collapsing of the field in the horizontal deflection coils and its duration is about 5% of the horizontal period. Plate current can flow only during this pulse and is controlled by the amplitude of the sync pulse being applied to the grid. The grid is DC connected to the video amplifier output at the junction of R45 and R48. Therefore, the bias level for V10 is a function of the video amplifier plate current. The AGC cathode potential is +150 volts, taken from the source which also supplies the plate and screen of V11. The screen potential is approximately 300 volts, thus maintaining the required potential difference with respect to the cathode. The screen and plate voltages are approximately the same at the time the pulse occurs.

When current flows in the plate circuit of V10 it will develop a negative voltage across resistors R40, R41 and R42. This voltage is filtered by the RC network R40, R41 and C32 to rid it of the horizontal frequency component (15,750cps). Therefore, the time constant required to filter frequencies of this kind can be made very small as compared to the time constant used in conventional AGC systems, which had to filter out a 60 cycle component. The control voltage for the 2nd IF stage is taken from the junc ion of the dividing network, R40 and R41. The control voltage for the RF amplifier and 1st IF stage is taken from the junction of R40 and R42. The reason why bias on V3 can be controlled merely by applying AGC voltage to V1 is because these two tubes are connected in plate current series with one another. In order to increase the effect that this AGC voltage has upon the 1st IF amplifier, it has been shunted by a 470K resistor R4. The manner in which R4 aids this condition is, as the impedance of V3 increases, R4 passes more and more of V1's plate current, therefore effectively reducing the gain in V3 to a much greater extent than in V1.

The keyed AGC system has good noise immunity because its duty cycle is only about 5% of the total time, and any noise pulses occurring during the other 95% of the time do not affect its operation. The developed AGC voltage is a function of sync pulse amplitude only and is not effected by picture content. Hence, the AGC action can be made fast, practically eliminating the flutter caused by airplanes.

SYNC SEPARATOR & NOISE GATE

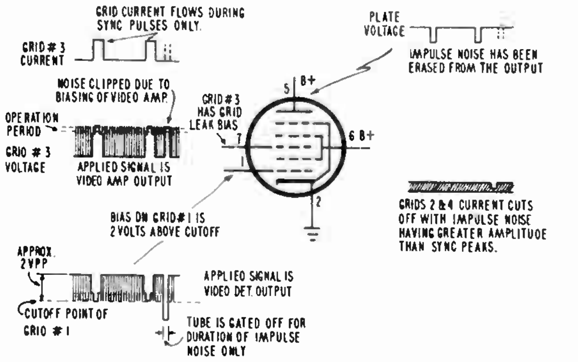
This circuit just as its name implies performs two important functions. It separates the sync pulses from the composite video signal and erases all effects of noise pulses which are greater in amplitude than the incoming sync pulses. The manner in which this pentagrid tube accomplishes its purpose can best be portrayed by following the composite signal accompanied by impulse noise through this stage (see Figure 11). Without a signal the plate current of V12 is cut off due to the negative bias on grid #3, while at the same time a positive bias on grid #1 is allowing grids #2 and #4 which are tied together, to draw maximum current. R61 controls the amount of positive bias being placed on grid #1 which determines at what point the tube will gate off. The negative output of the video detector is being applied to grid #1 as well as to the video amplifier V11. Since V11 has a gain of about 20 the inverted or positive signal which is being coupled through C38 to grid #3 of V12 is of a much greater amplitude than that of the signal being impressed upon grid #1. It can be seen that during normal operation this tube has a negative signal on grid #1 and a positive signal on grid #3. As long as the amplitude of the noise pulses is not greater in amplitude than sync tips, the positive bias on grid #1 is not overcome. Therefore, each sync pulse appearing at grid #3 drives it sufficiently positive to overcome its bias and allow plate current to flow. The presence of noise pulses having greater amplitude than sync peaks drive grid #1 beyond cutoff, preventing the tube from amplifying the noise which would otherwise pass on to the sync circuits. The tube remains in this cutoff condition only for the duration of the impulse noise. This composite characteristic of the noise – immune sync separator shows how the amplitude of the signal at the video detector determines whether or not the pulse is suppressed or amplified.

SYNC SEPARATION

Complete separation of the horizontal and vertical sync pulses from the video composite signal is accomplished in V12 a 6BE6 and V15A 1/2 6SN7 GT.

The manner in which V12 aids in this operation has been presented in the preceding paragraph titled sync separator and noise gate.

The output of V12 consisting entirely of sync pulses wiped clean of all video information, is applied to a triode sync clipper stage V15A. This signal which is now of a negative polarity must be inverted as well as further clipped to insure proper operation of the vertical and horizontal sync circuits. Since the amplitude of these pulses are sufficiently strong to drive V15A into cutoff, the signal is further clipped. The result provides a more constant, flat topped sync pulse with which to control the sweep oscillators.



Detailed Illustration of Noise Gate Operation using either the 6BE6 or 6C56

Figure 11

THE VERTICAL DEFLECTION SYSTEM

The vertical deflection system consists of a free-running multivibrator (V15B and V16) which is locked into synchronism by the vertical integrated sync pulse. The output of the multivibrator (V16) is fed to the vertical output transformer (T7), and then to the vertical deflection coils (L14), (L15) without the use of further amplification. The coupling network consisting of R74, R75, C47 and C48 is used between the two sections of the multivibrator to filter out any 15 KC horizontal pulses that may get through the integrating network, thus improving the interlace.

For a discussion of the circuit operation, it will be assumed that no triggering pulses are present. Following this, the triggering pulses will be added and their effect upon the operation discussed.

For any linear magnetic deflection system, the waveform of voltage which must be present across the deflection coils (L14, L15) is as shown in Figure 12, where A is the trace time and B is the retrace time.

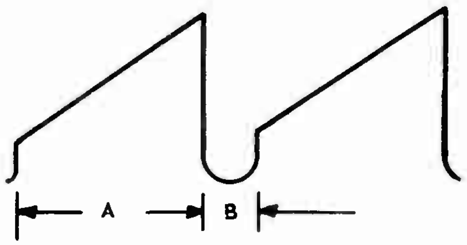


Figure 12

The procedure for obtaining this waveform is as follows:

If the circuit is thought of as starting from a static condition where V15B and V16 are conducting, it can be seen from the schematic diagram, that the circuit is very unstable and will readily break into oscillation. If V16 should have a slight increase in plate current, due to "shot effect," "thermal agitation," or any of many possible reasons, its plate voltage would decrease, driving the grid of V15B in a negative direction. This would, in turn, decrease the plate current of V15B, causing the plate voltage to increase. Under these circumstances the grid of V16 would swing in a positive direction, further increasing the plate current. The process is cumulative and V15B is almost instantaneously driven into cutoff. The period of cutoff for V15B is determined by the time constant of the coupling network. When the charge of C46 decreases sufficiently, V15B starts to conduct and V16 is driven almost instantly to cutoff. The circuit will remain in this condition just long enough for the grid current flowing in V15B to charge C46 sufficiently negative to again cut off this section of the multivibrator. Then V16 begins to conduct and the cycle is repeated. The time constant is so adjusted that the waveform from grid of V15B to ground appears as in Figure 13. During the period of time that V15B is cut off, the waveform at the plate of V15B tries to rise to the B+ voltage, but C45 and R72 form an integrating circuit which causes the plate voltage waveform to appear as shown in Figure 14. The waveform of

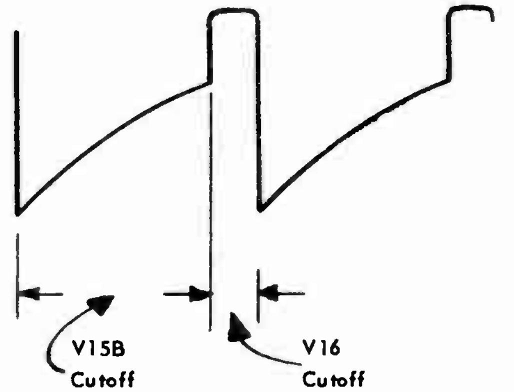


Figure 13

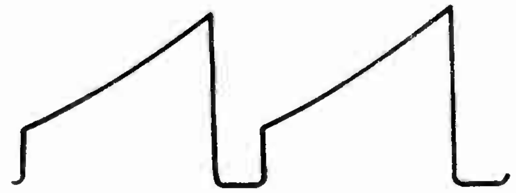


Figure 14

Figure 14 is fed to the grid of V16 which is conducting and capable of amplifying during the trace time. The waveform appearing between the plate of V16 and ground is shown in Figure 15. The waveform appearing between V15B plate and B+ is shown in Figure 16. This is the desired waveform as shown in Figure 12 for the voltage appearing across the deflection coils (L14, L15). The effect of the synchronizing pulses can now be discussed.

The sync pulses appear at the grid of V16

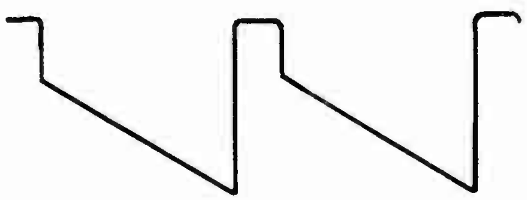


Figure 15

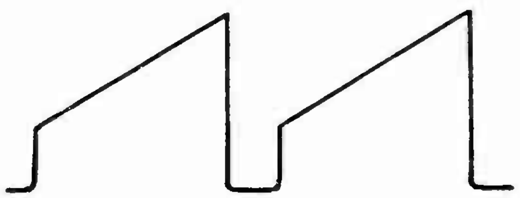


Figure 16

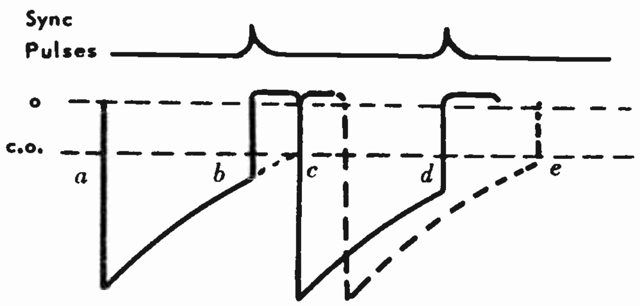


Figure 17

with a negative polarity. They are amplified by V16 and sent to the grid of V15B as positive pulses. The effect is shown in Figure 17 which represents the voltage waveform appearing at the grid of V15B. Without sync pulses V15B would start to conduct at c and e in their respective cycles, but with the sync pulses the grid is driven far enough positive at b and d to cause V15B to conduct and thereby lock the sweep in step with the sync pulses. Vertical hold is obtained by varying R73 which in turn varies the unsynchronized cutoff period of V15B. When R73 is increased the cutoff period is increased and vice-versa. See Figure 18. With the sync pulses as shown in Figure 18, no sync action will occur if R73 is made too large. On the other hand, if R73 is made sufficiently small sync action will take place on every other cycle. This explains why erratic operation is encountered with *too little* "hold," while a double image is sometimes observed with *too much* "hold."

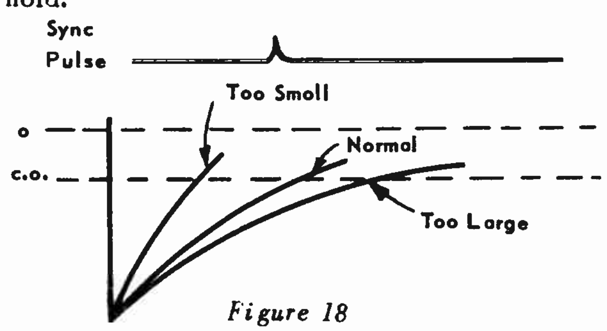


Figure 18

The multivibrator employs a coupling circuit between V15B and V16 consisting of two RC networks in cascade, instead of the usual single RC network. This system makes the vertical sweep circuit much less likely to be triggered by noise and much more smoothly triggered by the sync pulses. The use of cascade coupling causes the grid voltage curve of V15B to cross the cutoff voltage line at a much steeper angle than it would with a single coupling circuit. See Figure 19. It will be observed that R75 and R80 are effectively across the vertical deflection coils (L14, L15) and in conjunction with R89 and R90 provide the dampening action across the deflection coils during the retrace period. Height is controlled by varying the plate load resistance (R84) of V15B, which in turn varies the magnitude of the waveform which is fed to

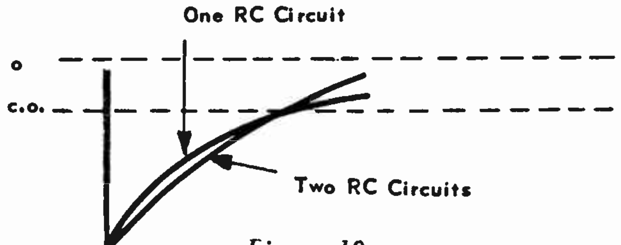


Figure 19

V16. Vertical linearity control, R83, varies the bias of V16, shifting the operating point of the tube up and down its dynamic curve.

NOTE: Vertical height, linearity and hold controls all interact one upon the other. Therefore, it may be necessary to adjust these controls simultaneously for the best test pattern.

HORIZONTAL SWEEP SYSTEM

The horizontal sweep system consists of a multivibrator (V18) coupled to a horizontal output tube (V19) which drives the horizontal deflection coils (L16, L17). The phase detector tube (V17) is used to synchronize the multivibrator. The horizontal generator employs a 6SN7GT tube as a multivibrator, whose frequency is controlled by the L, R and C in the circuit. The amount of charge placed on C66 will determine the multivibrator frequency. The synchronizing system used to lock the oscillator in step with the synchronizing pulses employs a 6AL5 (V17) as a balanced phase detector.

The operation of the multivibrator and associated circuits will be discussed first of all in the completely unsynchronized state. This condition would exist if V17 was removed from the circuit. The operation will then be discussed in a synchronized state.

UNSYNCHRONIZED STATE

The multivibrator used in the horizontal sweep system is of the cathode coupled type. Feedback between unit 1 and unit 2 is accomplished through coupling condenser C66 and the unbypassed cathode resistor R96 which is common to both sections. Now let us apply power to this circuit and follow the chain of reactions as they take place. Any disturbance within the circuit could very likely cause an increase in the plate current of V18B, which in turn will increase the voltage at the top of the common cathode resistor R96. In an unsynchronized condition the bias on V18A can be thought of as being fixed, therefore a substantial increase in cathode voltage will drive the unit into plate current cutoff. Since both units commence conducting upon the application of voltage, this cutoff point of V18A is reached very rapidly. When the cathode voltage cuts-off this unit, the plate voltage immediately climbs toward the voltage level of its source forming a very steep wave front. C66 couples this positive wave front to the grid of V18B causing the plate current to flow freely offering a very low impedance discharge path for the voltage which has built up on C68. In fact, the grid of Unit #2, due to the positive pulse coupled through C66, is driven sufficiently positive to make it draw current. This grid current is being drawn through R98 and R99 consequently building up a negative charge on the grid side of C66 to proportions that will cut off conduction within V18B. With V18B cut off the voltage at the top of R96 will drop to a level that will allow V18A to start drawing current. Its plate voltage will then drop sharply applying the developed negative wave front through C66 to the grid of Unit #2, pushing it even more negative than it was when first cutting-off this section. V18 remains in this condition, that is – Unit #1 drawing current and Unit #2 cutoff, until the negative charge on C66 drains off through R98 and R99. The time required for this negative charge to become small enough to allow V18B to conduct again is determined by the RC time constant of the circuit and has been designed to be approximately 15750 cycles per second. Consequently when this point is reached the first cycle will be completed only to be repeated.

The frequency of this multivibrator is controlled by two separate circuits. One is an RC circuit consisting of R98, R99 (Hor. Hold Control) and C66 while the other is a LC circuit made up of L18 (Hor. Osc. Adjustment) and C65. The latter one is a tank circuit which should be tuned to be resonant at approximately 15750 CPS in order to aid in keeping the multivibrator oscillating at the correct frequency. How the RC circuit fits into the picture was discussed in the previous paragraph.

In order to produce the necessary current flow in the horizontal deflection yoke a sawtooth voltage must be applied to the grid of the horizontal output tube. An RC circuit comprised of R106, a 5600 ohm resistor and C68, a 330 uuf condenser is used to properly shape the voltage in this case. This sawtooth voltage is amplified by V19 (6BQ6) and since the primary of the high voltage transformer is its plate load, produces a sawtooth current which is fed to the horizontal deflection coils, L16 and L17. From pin 7 of the high voltage transformer (T8) a negative pulse is coupled through C80 to the unbypassed screen of V19 driving it down toward its normal B+ voltage, thus allowing the horizontal output tube to draw current much sooner than it normally would. This measure tends to smooth out any oscillation or ringing effect not entirely eliminated by the horizontal damper tube, V20.

OPERATION WITH SYNCHRONIZATION

The Phase Detector (V17) provides automatic frequency control for the horizontal oscillator (V18). This is accomplished by comparing the phase of two different waveforms: the incoming horizontal sync pulse and a pulse taken from the horizontal output transformer. The first waveform is made up of sync pulses, approximately equal in amplitude, taken from the plate and cathode of V15A. See Figure 20 (a and b).

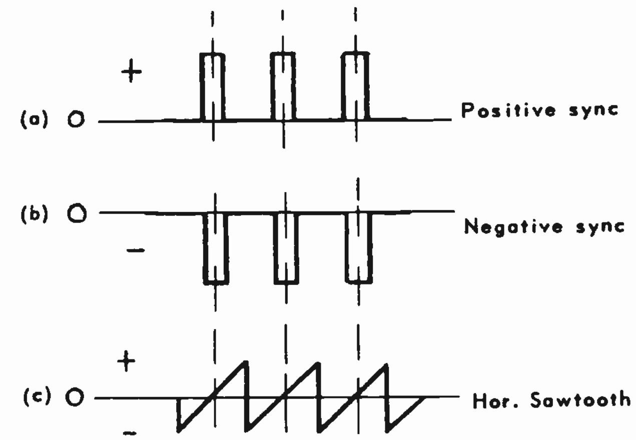


Figure 20

They are coupled through C60 and C61 to pins 5 and 7 respectively of V17. The second waveform consists of a positive component from terminal 8 and a negative component from terminal 7 of the horizontal output transformer. Capacitor C74 along with the network R102 and R77 shifts the phase of these two components to the correct operating point and the integrating network of C62 and R91 gives the correct sawtooth waveform revolving around a zero axis. The sawtooth voltage thus developed is both positive and negative, and is applied to pins 1 and 2 of the phase detector tube (V17). See Figure 20 (c).

The sync pulses and the sawtooth waveform are superimposed on each other in the phase detector. The amplitude of each sync pulse and the sawtooth wave remain the same, but any phase shift between the two will cause a variation in the DC voltage developed at the junction of R92 and R93.

When both the horizontal oscillator and incoming sync are at the same frequency, they are properly phased and the amplitudes of the waveform in each section of the phase detector are equal. See Figure 21 (a). Each diode, therefore, conducts equally and the DC voltages across the two load resistors, R92 and R93, are equal but opposite in polarity. The voltage developed at the junction of these resistors is therefore zero. Since the output is zero, no change in grid bias takes place and there is no change in the oscillator frequency.

If the horizontal oscillator is *higher* in frequency than the incoming sync pulse, the sawtooth voltage being applied to pins 1 and 2 of V17 will be in the positive portion of its cycle by the time the sync pulses arrive on pins 5 and

7. See Figure 21 (b). This places a negative sync pulse on pin 5, equal amounts of positive sawtooth voltage on pins 1 and 2 and a positive sync pulse on pin 7, allowing more current to flow through the pin 2 and 5 section of V17. The result of this is a positive voltage at the junction of R92 and R93, [see Figure 22 (a)] which makes the grid (pin 1 of V18) more positive and slows down the oscillator frequency.

If the horizontal oscillator is lower in frequency than the incoming sync pulse, the sawtooth voltage being applied to pins 1 and 2 of V17 will now be in the negative portion of its cycle at the time the sync pulses arrive on pins 5 and 7. See Figure 21 (c). This places a negative voltage on pins 1 and 2, instead of the positive potential that was there in the previous condition, and more current will flow through the pin 1 and 7 section of the diode. The voltage developed at the junction of R92 and R93 will now be at a negative potential, [see Figure 22 (b)], making the grid (pin 1 of V18) more negative and *speeding up* the oscillator frequency. R94 provides a DC return for the grid of V18 in the event V17 should fail or be removed from the socket.

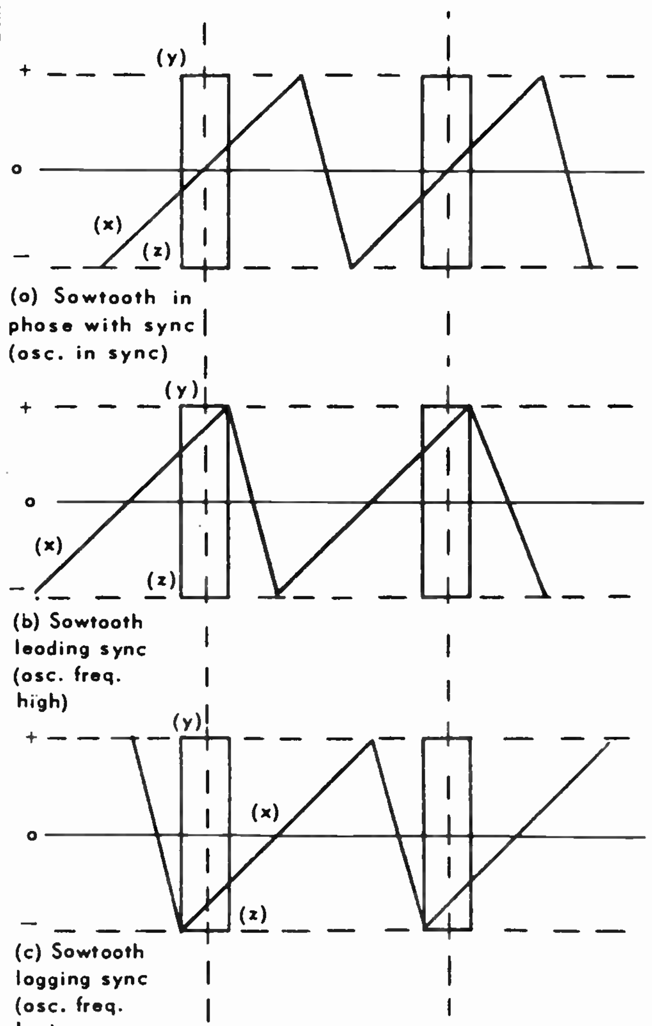


Figure 21

POWER SUPPLY

A transformer power supply is used. The transformer T6 steps up the voltage in its secondary to about 350V AC. This AC voltage is rectified by a 5U4G (V14) and applied to a capacitive input filter network which aids in placing approximately 370V DC on the plate of V9. V9 and V10 are connected in series with several of the other amplifiers serving as voltage regulators. This particular application is carried out in the following manner: when the current through these amplifiers change, the cathode voltage on V9 and V10 varies accordingly. This causes the impedance of these tubes to change, maintaining a fairly constant voltage drop across them at all times.

NOTE: There is no DC voltage applied to V7, V17 or to the plate of V10 from the low voltage power supply.

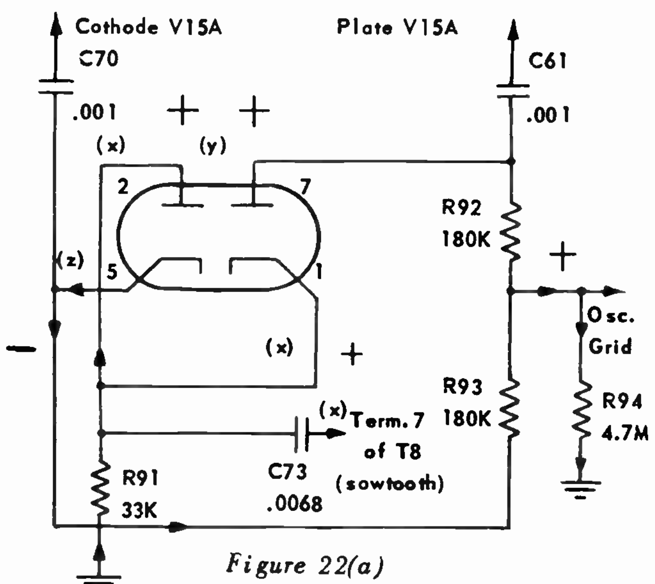


Figure 22(a)

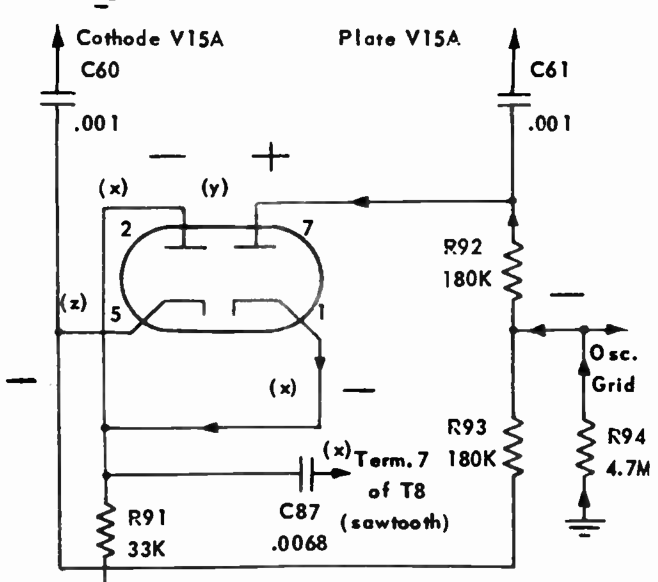


Figure 22(b)

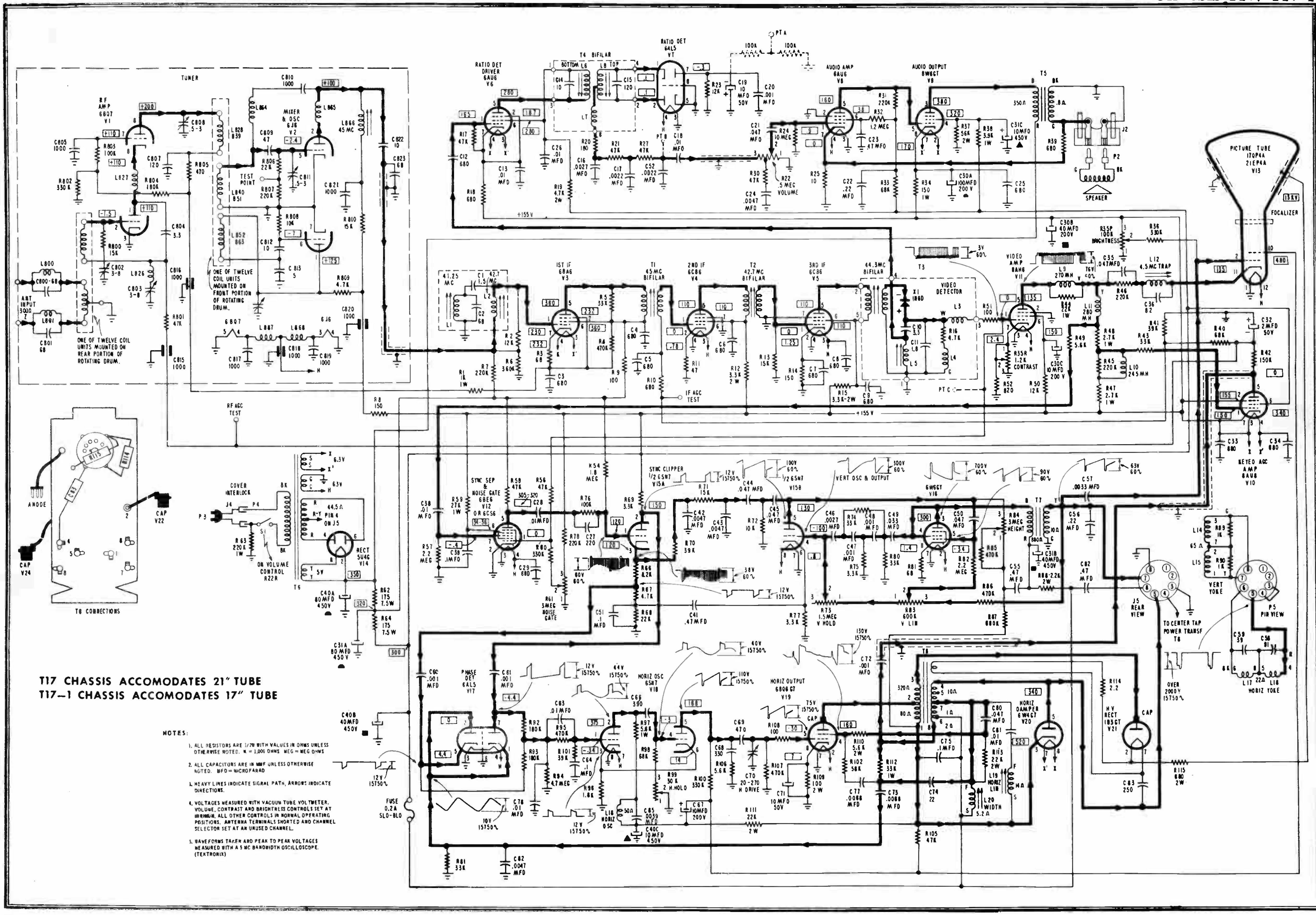
PART NUMBER	SYMBOL NUMBER	DESCRIPTION	LIST PRICE
		TUNER COMPONENTS	
267032-37	C800, 801, 823	CAPACITOR–Ceramic - 68 mmf ±10% 500V	.21
267044-033	C804	CAPACITOR–Ceramic - 3.3 mmf ±10% 500V	.12
267032-17	C805, 810, 821, 817, 819	CAPACITOR–Ceramic - 1000 mmf Min. 500V	.24
276685	C807	CAPACITOR–Ceramic - 120 mmf ±5% 500V	.42
267032-3	C809	CAPACITOR–Ceramic - 47 mmf ±20% 500V	.19
267038-17	C812, 822	CAPACITOR–Ceramic - 10 mmf ±20% 500V	.29
267032-21	C813	CAPACITOR–Ceramic - 5 mmf ±10% 500V	.19
RC23A153K	R800, 810	RESISTOR–Comp. 15K 1/2W ±10%	.10
RC23A473K	R801	RESISTOR–Comp. 47K 1/2W ±10%	.10
RC23A334K	R802	RESISTOR–Comp. 330K 1/2W ±10%	.10
RC23A104K	R803	RESISTOR–Comp. 100K 1/2W ±10%	.10
RC23A184K	R804	RESISTOR–Comp. 180K 1/2W ±10%	.10
RC23A471K	R805	RESISTOR–Comp. 470 ohms 1/2W ±10%	.10
RC23A223K	R806	RESISTOR–Comp. 22K 1/2W ±10%	.10
RC23A224K	R807	RESISTOR–Comp. 220K 1/2W ±10%	.13
RC23A103K	R808	RESISTOR–Comp. 10K 1/2W ±10%	.10
RC23A472K	R809	RESISTOR–Comp. 4.7K 1/2W ±10%	.10
		ELECTRICAL COMPONENTS	
258050-1		TUNER	49.40
267032-9	C3, 4, 5, 6, 7, 8, 9, 12, 25, 29, 33, 34	CAPACITOR–Ceramic 680 mmf ±20% 500V	.20
267037-103	C13, 26	CAPACITOR–Disc. Ceramic .01 mfd Min. 500V	.24
267059-272	C16	CAPACITOR–Molded Tub., .0027 mfd ±10% 400V	.28
267036-222	C17, 52	CAPACITOR–Molded Tub., .0022 mfd ±20% 400V	.26
267036-103	C18, 28, 38	CAPACITOR–Molded Tub., .01 mfd ±20% 400V	.26
267024-16	C19, 71	CAPACITOR–Elect. 10 mfd +250% −10% 50V	.80
267032-17	C20	CAPACITOR–Ceramic 1000 mmf Min. 500V	.24
267056-473	C21, 35	CAPACITOR–Molded Tub., .047 mfd ±20% 200V	.25
267036-224	C22	CAPACITOR–Molded Tub., .22 mfd ±20% 400V	.26
267036-474	C23, 55	CAPACITOR–Molded Tub., .47 mfd ±20% 400V	.39
267059-472	C24, 62	CAPACITOR–Molded Tub., .0047 mfd ±10% 400V	.28
267032-14	C27	CAPACITOR–Ceramic 220 mmf ±20% 500V	.21
267005-10	C30, a, b, c	CAPACITOR–Elect. (100-200, 40-200, 10-200)	2.73
267005-8	C31, a, b, c, C40, a, b, c,	CAPACITOR–Elect. (80-450, 40-450, 10-450) +100%	3.10
267024-17	C32	CAPACITOR–Elect. 2 mfd +150% −10% 50V	.74
267056-104	C39, 51	CAPACITOR–Molded Tub., .1 mfd ±20% 200V	.25
267056-474	C41, 82	CAPACITOR–Molded Tub., .47 mfd ±20% 200V	.60
267060-472	C42, 43	CAPACITOR–Molded Tub., .0047 mfd ±10% 600V	.26
267036-473	C44, 80	CAPACITOR–Molded Tub., .047 mfd ±20% 400V	.30
267055-473	C45, 50	CAPACITOR–Molded Tub., .047 mfd ±20% 600V	.30
CM24A272K	C46	CAPACITOR–Mica 2700 mmf ±10% 500V	.45
CM24A102K	C47, 48, 72	CAPACITOR–Mica 1000 mmf ±10% 500V	.36
267055-333	C49	CAPACITOR–Molded Tub., .033 mfd ±20% 600V	.27
267056-224	C56	CAPACITOR–Molded Tub., .22 mfd ±20% 200V	.43
267036-332	C57	CAPACITOR–Molded Tub., .0033 mfd ±20% 400V	.26
267036-102	C60, 61	CAPACITOR–Molded Tub., .001 mfd ±20% 400V	.26
267059-103	C63, 76	CAPACITOR–Molded Tub., .01 mfd ±10% 400V	.25
267058-104	C64	CAPACITOR–Molded Tub., .1 mfd ±10% 200V	.25
CM24J392K	C65	CAPACITOR–Silvered Mica 3900 mmf ±10% 500V	.80
CM22A391K	C66	CAPACITOR–Mica 390 mmf ±10% 500V	.26
267024-14	C67	CAPACITOR–Elect. (10 mfd +250% −10% 200V)	1.19
CM22A331K	C68	CAPACITOR–Mica 330 mmf ±10% 500V	.26
267032-39	C69	CAPACITOR–Ceramic 470 mmf ±20% 500V	.24
260009-10	C70	CONDENSER–Trimmer - Mica 20-270 mmf	.49
267055-682	C73	CAPACITOR–Molded Tub., .0068 mfd ±20% 600V	.25
267032-40	C74	CAPACITOR–Ceramic 22 mmf ±10% 500V	.28
267055-104	C75	CAPACITOR–Molded Tub., .1 mfd ±20% 600V	.40
267036-682	C77	CAPACITOR–Molded Tub., .0068 mfd ±20% 400V	.30
267055-103	C81	CAPACITOR–Molded Tub., .01 mfd ±20% 600V	.29
267051-2	C83	CAPACITOR–Molded Tub., 250 mmf 12.5 KV.	1.21
RC24A102K	R1	RESISTOR–Comp. 1000 ohms 1W ±10%	.22
RC23A123J	R2	RESISTOR–Comp. 12K ohms 1/2W ±5%	.15
RC23A680J	R3	RESISTOR–Comp. 68 ohms 1/2W ±5%	.15
RC23A474K	R4	RESISTOR–Comp. 470K ohms 1/2W ±10%	.10
RC23A333J	R5	RESISTOR–Comp. 33K ohms 1/2W ±5%	.15
RC23A364J	R6	RESISTOR–Comp. 360K ohms 1/2W ±5%	.15
RC23A224K	R7	RESISTOR–Comp. 220K ohms 1/2W ±10%	.13

RC23A151M	R8	RESISTOR–Comp. 150 ohms 1/2W ±20%	.10
RC23A101M	R9, 51, 108	RESISTOR–Comp. 100 ohms 1/2W ±20%	.10
RC23A681M	R10, 18	RESISTOR–Comp. 680 ohms 1/2W ±20%	.10
RC23A470J	R11	RESISTOR–Comp. 47 ohms 1/2W ±5%	.15
RC25A332K	R12, 15	RESISTOR–Comp. 3300 ohms 2W ±10%	.20
RC23A153J	R13	RESISTOR–Comp. 15K ohms 1/2W ±5%	.15
RC23A820K	R14	RESISTOR–Comp. 82 ohms 1/2W ±10%	.13
RC23A473M	R17, 21, 27, 30, 58, 105	RESISTOR–Comp. 47K ohms 1/2W ±20%	.10
RC25A472K	R19	RESISTOR–Comp. 4700 ohms 2W ±10%	.20
RC23A181K	R20	RESISTOR–Comp. 180 ohms 1/2W ±10%	.10
262041-2	R22, S1	POTENTIOMETER–.5 meg 1/4W ±30% (with switch, volume)	1.31
RC23A123K	R23, 50	RESISTOR–Comp. 12K ohms 1/2W ±10%	.13
RC23A106M	R24	RESISTOR–Comp. 10 meg 1/2W ±20%	.10
RC23A100K	R25	RESISTOR–Comp. 10 ohms 1/2W ±10%	.10
RC23A224J	R31	RESISTOR–Comp. 220K ohms 1/2W ±5%	.20
RC23A125J	R32	RESISTOR–Comp. 1.2 meg 1/2W ±5%	.15
RC23A683M	R33	RESISTOR–Comp. 68K ohms 1/2W ±20%	.10
RC24A151M	R34	RESISTOR–Comp. 150 ohms 1W ±20%	.15
262045-1	R35p, r	POTENTIOMETER–Tandem 100K ohms 1/2W ±30% (Bright) 1200 ohms 1/2W ±30% (Contrast)	1.82
RC23A334M	R36, 60	RESISTOR–Comp. 330K ohms 1/2W ±20%	.10
RC25A563K	R37	RESISTOR–Comp. 56K ohms 2W ±10%	.23
RC24A392K	R38	RESISTOR–Comp. 3900 ohms 1W ±10%	.15
RC23A681K	R39	RESISTOR–Comp. 680 ohms 1/2W ±10%	.10
RC23A683J	R40	RESISTOR–Comp. 68K ohms 1/2W ±5%	.15
RC23A393J	R41	RESISTOR–Comp. 39K ohms 1/2W ±5%	.15
RC23A154M	R42	RESISTOR–Comp. 150K ohms 1/2W ±20%	.10
RC23A333J	R43, 80	RESISTOR–Comp. 33K ohms 1/2W ±5%	.15
RC23A224M	R46, 78	RESISTOR–Comp. 220K ohms 1/2W ±20%	.10
RC24A272K	R47, 48	RESISTOR–Comp. 2700 ohms 1W ±10%	.15
RC23A562K	R49, 106	RESISTOR–Comp. 5600 ohms 1/2W ±10%	.13
RC23A821K	R52	RESISTOR–Comp. 820 ohms 1/2W ±10%	.10
RC23A135K	R54	RESISTOR–Comp. 1.8 meg 1/2W ±10%	.10
RC23A473K	R56	RESISTOR–Comp. 47K ohms 1/2W ±10%	.10
RC23A225M	R57, 82	RESISTOR–Comp. 2.2 meg 1/2W ±20%	.10
RC24A273K	R59	RESISTOR–Comp. 27K ohms 1W ±10%	.15
262025-12	R61, 84	POTENTIOMETER–3 meg 1/4W ±30% (Height–Noise Inverter)	.70
268016-4	R62, 64	RESISTOR–Wirewound 175 ohms 7.5W ±10%	.40
RC24A224M	R63	RESISTOR–Comp. 220K ohms 1W ±10%	.15
RC23A822K	R66	RESISTOR–Comp. 8200 ohms 1/2W ±10%	.10
RC23A472K	R67	RESISTOR–Comp. 4700 ohms 1/2W ±10%	.10
RC23A223K	R68	RESISTOR–Comp. 22K ohms 1/2W ±10%	.10
RC23A332K	R69, 75, 77	RESISTOR–Comp. 3300 ohms 1/2W ±10%	.10
RC23A393K	R70, 101	RESISTOR–Comp. 39K ohms 1/2W ±10%	.18
RC23A153M	R71	RESISTOR–Comp. 15K ohms 1/2W ±20%	.10
RC23A103K	R72	RESISTOR–Comp. 10K ohms 1/2W ±10%	.10
262025-14	R73	POTENTIOMETER–1.5 meg 1/4W ±20% (V. Hold)	1.03
RC23A333K	R74	RESISTOR–Comp. 33K ohms 1/2W ±10%	.13
RC23A104M	R76	RESISTOR–Comp. 100K ohms 1/2W ±20%	.10
RC23A680K	R81	RESISTOR–Comp. 68 ohms 1/2W ±10%	.13
262025-13	R83	POTENTIOMETER–600K ohms 1/4W ±20% (V. Lin.)	.70
RC23A474M	R85, 95, 107	RESISTOR–Comp. 470K ohms 1/2W ±20%	.10
RC23A474K	R86	RESISTOR–Comp. 470K ohms 1/2W ±10%	.13
RC23A684M	R87	RESISTOR–Comp. 680K ohms 1/2W ±20%	.10
RC25A222M	R88	RESISTOR–Comp. 2200 ohms 2W ±20%	.20
RC23A333M	R91	RESISTOR–Comp. 33K ohms 1/2W ±20%	.10
RC23A475M	R92, 93, 94	RESISTOR–Comp. 4.7 meg 1/2W ±20%	.10
RC23A182K	R96	RESISTOR–Comp. 1800 ohms 1/2W ±10%	.10
RC24A562K	R97	RESISTOR–Comp. 5600 ohms 1W ±10%	.15
RC23A683K	R98	RESISTOR–Comp. 68K ohms 1/2W ±10%	.13
262022-4	R99	POTENTIOMETER–30K ohms 1/4W ±20% (H. Hold)	.73
RC23A334K	R100	RESISTOR–Comp. 330K ohms 1/2W ±10%	.10
RC23A563K	R102	RESISTOR–Comp. 56K ohms 1/2W ±10%	.10
RC25A101M	R109	RESISTOR–Comp. 100 ohms 2W ±20%	.20
RC25A562K	R110	RESISTOR–Comp. 5600 ohms 2W ±10%	.20
RC25A223M	R111	RESISTOR–Comp. 22K ohms 2W ±20%	.20
RC24A333K	R112	RESISTOR–Comp. 33K ohms 1W ±10%	.15

PART NUMBER	SYMBOL NUMBER	DESCRIPTION	LIST PRICE
		ELECTRICAL COMPONENTS - Continued	
RC25A223K	R113	RESISTOR–Comp. 22K ohms 2W ±10%	.20
268000-022	R114	RESISTOR–Wirewound 2.2 ohms 1/2W ±20%	.18
RC25A684M	R115	RESISTOR–Comp. 680K ohms 2W ±20%	.20
259138-1	L1, 2, C1, 2	COIL ASSEMBLY–1st I.F. Grid & Sound I.F. Trap	2.53
259105-7	L9, R44	COIL ASSEMBLY–Video Peaking	.48
259120-4	L10, R45	COIL ASSEMBLY–Video Peaking	.38
259105-4	L11	COIL ASSEMBLY–Video Peaking	.43
259108-1	L12, C36	COIL ASSEMBLY–4.5 Mc. Trap	.92
265060-1	L14, 15, 16, 17, C58, 59, R89, 90, P5	DEFLECTION YOKE–Ferrite (with plug)	12.12
259121-1	L18	COIL ASSEMBLY–Horizontal Oscillator	.83
259082-5	L19	COIL ASSEMBLY–Horizontal Linearity	.85
259114-1	L20	COIL ASSEMBLY–Width Control	.99
259144-1	T1	TRANS. ASSY.–2nd I.F. Grid	.64
259145-1	T2	TRANS. ASSY.–3rd I.F. Grid	.68
259142-1	T3, L3, 4, 5, R16, X1, C10, 11	TRANS. ASSY.–Output & 1st Sound I.F. & Video Detector	5.76
259115-2	T4, L6, 7, 8, C14, 15	TRANS.–Ratio Detector	2.70
265071-12	T5	TRANS.–Audio Output	2.20
265048-3	T6	TRANS.–Power	16.60
265072-5	T7	TRANS.–Vert. Output	3.59
265051-2	T8, R114, 115, C83	TRANS.–H.O. & H.V. (2nd Assy.)	11.92
266164-5201	FUSE	FUSE–Type 3AG "Slo Blo" 20/100 Amp.	.31
255122-2		MAGNET ASSY.–Anti Pincushion	1.25
1N60	X1	DETECTOR–Crystal	1.17
274197-11		TRAP–Ion	.50
274261-4		FOCALIZER–17" Picture Tube	7.40
274261-3		FOCALIZER–21" Picture Tube	7.40

CABINET REPLACEMENT PARTS LIST

PART NUMBER	KM17CD	TM17CD	TS17C	KS21C	TS21C	DESCRIPTION	LIST PRICE
251212-2	X					Back Cover Assy. (with line cord)	2.45
251212-3		X				Back Cover Assy. (with line cord)	2.45
251349-1			X			Back Cover Assy. (with line cord)	2.25
251349-2				X	X	Back Cover Assy. (with line cord)	2.48
255128-1	X					CABINET–Open Console (Mahog.)	91.24
255127-1		X				CABINET–Table Model (Mahog.)	54.40
255145-1			X			CABINET–Table Model (Mahog.)	37.50
255144-1				X		CABINET–Open Console (Mahog.)	81.52
255143-1					X	CABINET–Table Model (Mahog.)	50.91
269076-1	X	X	X	X	X	KNOB–Brightness	.16
269079-3	X	X				KNOB–Channel Indicator	.85
269079-4			X	X	X	KNOB–Channel Indicator	.85
269077-3	X	X	X	X	X	KNOB–Contrast	.73
269078-1	X	X	X	X	X	KNOB–Fine Tuning	.16
269080-1	X	X	X	X	X	KNOB–{H. Hold / On-Off-Vol.	.42
269086-1	X	X	X			MASK–17"	4.50
269068-3				X	X	MASK–21"	4.72
269075-1	X	X	X	X	X	NAMEPLATE–Bendix	.60
257530-18	X	X	X			Safety Glass	5.20
257530-17				X	X	Safety Glass	9.28
256012-4	X					SPEAKER–10" PM	7.83
256004-1		X	X		X	SPEAKER–6" PM	6.55
256014-3				X		SPEAKER–8" PM	7.42



T17 CHASSIS ACCOMODATES 21" TUBE
T17–1 CHASSIS ACCOMODATES 17" TUBE

NOTES:

1. ALL RESISTORS ARE 1/2W WITH VALUES IN OHMS UNLESS OTHERWISE NOTED. K = 1,000 OHMS MEG = MEG OHMS
2. ALL CAPACITORS ARE IN MMF UNLESS OTHERWISE NOTED. MFD = MICROFARAD
3. HEAVY LINES INDICATE SIGNAL PATH, ARROWS INDICATE DIRECTIONS.
4. VOLTAGES MEASURED WITH VACUUM TUBE VOLTMETER. VOLUME, CONTRAST AND BRIGHTNESS CONTROLS SET AT MINIMUM, ALL OTHER CONTROLS IN NORMAL OPERATING POSITIONS. ANTENNA TERMINALS SHORTED AND CHANNEL SELECTOR SET AT AN UNUSED CHANNEL.
5. WAVEFORMS TAKEN AND PEAK TO PEAK VOLTAGES MEASURED WITH A 5 MC BANDWIDTH OSCILLOSCOPE. (TEKTRONIX)

The Bogen Broad Band Television Booster Model BB-1A is a double tuned push-pull broad band amplifier designed to increase the signal strength on television channels 2 to 13 by as much as 10 times, without introducing noise or reducing picture quality. Automatic power turn-on is built in, and is controlled by the power switch of the TV receiver.

INSTALLATION:

1. Connect the short length twin lead supplied, between the booster terminals marked "output" and the receiver antenna terminals.

2. Connect the antenna lead-in to the booster terminals marked "input".

3. The rear of the chassis clearly indicates which terminals to use for the 300 or 75 ohm lines.

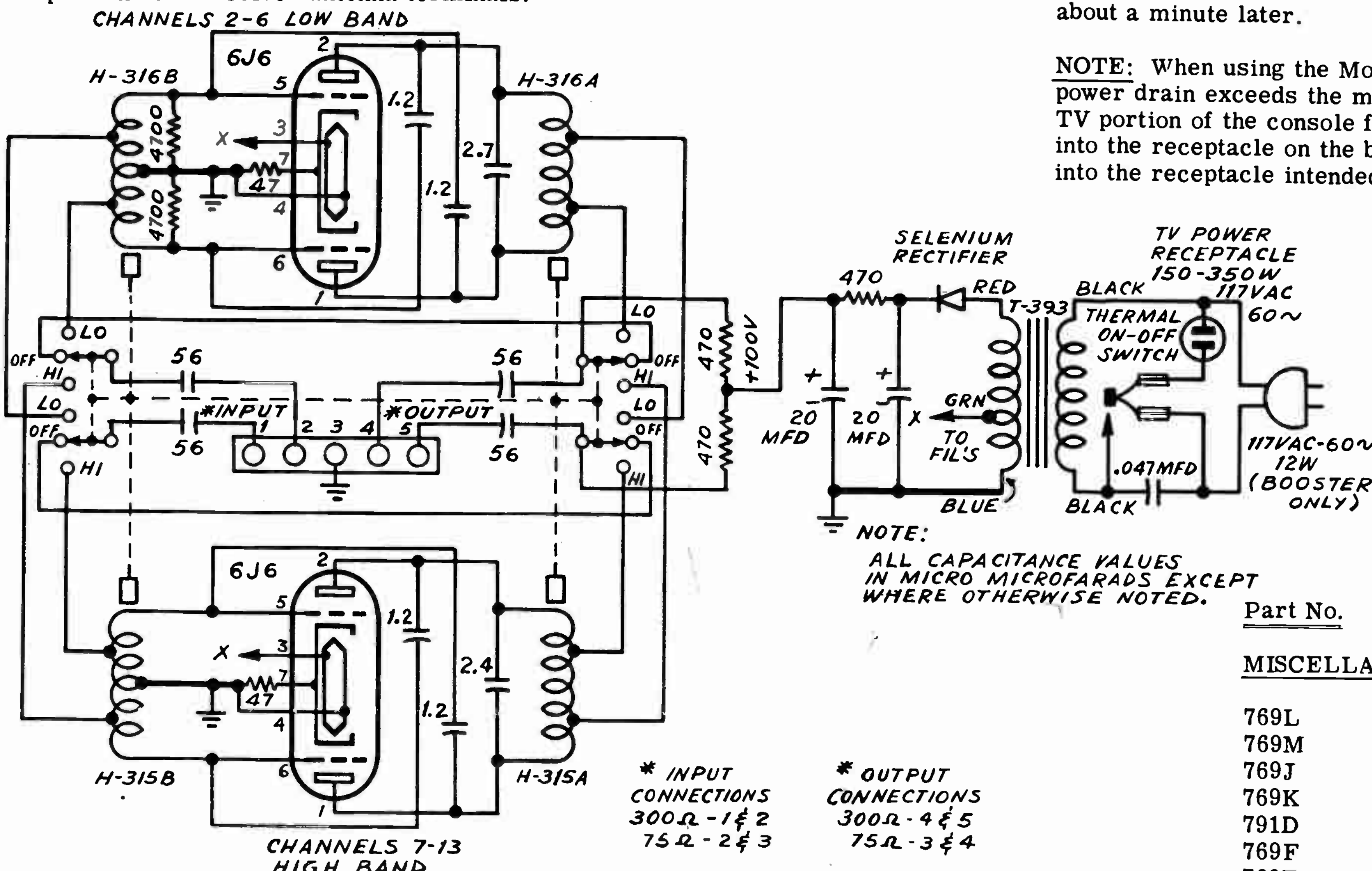
4. Plug the TV set power plug into the receptacle on the rear of the booster and connect the booster to the 117 v cycle A. C. line. (Do not plug into D. C.) The Booster outlet will accomodate TV receivers which draw from 150 to 350 watts.

5. For best results, the input and output twin leads should be straight and short. They should be located so that they neither cross each other, nor run near each other. This may cause oscillation, which will be evidenced either by horizontal black bars appearing on the picture or by complete erasure of the picture.

OPERATION: Turn Booster Dial to "OFF". Turn on the TV power. (Booster power will then turn on automatically in about 30 seconds.) Tune in the desired TV channel number and tune the booster for best results on the TV set. The channel numbers on the booster dial are for reference only and best results frequently may be obtained at settings of the booster tuning dial slightly off the selected channel number.

When the Television Receiver is switched off, the booster will shut off automatically about a minute later.

NOTE: When using the Model BB-1A Booster with a console assembly whose total power drain exceeds the maximum rating of 350 watts, remove the line cord of the TV portion of the console from the receptacle within the console and plug it instead into the receptacle on the booster. The line cord of the booster should be plugged into the receptacle intended for the TV portion of the console.



Part No.	Description
MISCELLANEOUS	
769L	Cabinet
769M	Knob
769J	Drive Cam
769K	Switch Cam
791D	Tuning Plate
769F	Cam Bracket
769E	Drive Shaft
TUBES	
Model 35	Selenium Rectifier
	6J6
TRANSFORMERS	
T-393	Power Transformer
CAPACITORS	
C516	30 x 150, elec.
C317	1.2mmf 10%, ceramic
C318	2.7mmf 10%, ceramic
C321	2.4mmf 5%, ceramic
C319	56mmf 20%, mica
C130	.047mf 20%,400V
RESISTORS	
	47Ω 10% 1/2w, carbon
	470Ω 10% 1/2w, carbon
	4700Ω 10% 1/2w, carbon

MODEL 12F272M

27" C.R.T. TV RECEIVER

SERVICE INFORMATION

TV Chassis CT-74

GENERAL DESCRIPTION

The CT-74 Chassis is the 27 inch CRT Version of the "CX-36" Series. The chassis itself employs 26 tubes, just one more than that employed in the standard "CX-36" Series. The additional tube is used as a second Damper Tube. Basic differences in this chassis are in the sweep circuits which are revised to operate with the larger picture tube. These revisions are as follows:

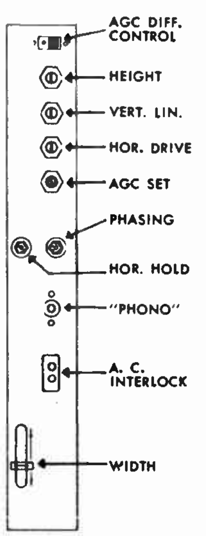
1. A type 6AV5GT tube is used in place of the 6V6 as Vertical Output Tube. Circuit components including the Vertical Output Transformer are also changed in this circuit.
2. A type 6CD6G tube is used in place of the 6BQ6 as Horizontal Output tube.
3. Two 6AX4GT tubes, connected in parallel, are used as Dampers instead of a single 6W4GT.
4. The Horizontal Output Transformer and Width Coil are revised to function with the 90° Deflection Yoke which is required for the 27 inch Rectangular CRT.
5. The video peaking circuits have been revised to provide additional "snap" and "sparkle" in this picture.

The chassis and picture tube are mounted separately in the cabinet. Special Instructions for removal of both the chassis and the CRT are included.

LOCATION OF CONTROLS

There are six (6) primary operating controls accessible from the front of this receiver. These are (from bottom to top) On-Off, Volume (front), Shading (rear), Contrast, Vertical Hold, Fine Tuning (rear) and Channel Selector (front).

Mounted on the rear chassis apron and accessible from the rear of the instrument are the Height, Vertical Linearity, Horizontal Drive and AGC Set. These are all potentiometer controls and with exception of AGC Set are easily adjustable by hand. The AGC Set is a recessed screw-driver adjustment. Also mounted on the rear apron is the Width control which is provided with a sliding adjustment for quick set-up. The Horizontal Oscillator "Frequency" (or "Hold") and "Phasing" slugs are accessible through two small holes in the rear of the chassis apron. The slugs are provided with hex-nuts for adjustment with a ¼" Spintite type wrench.



In addition to these controls a slide type switch referred to as the AGC Differential Control is located on the rear of the chassis. This control provides a variation of the differential bias applied to the R-F and I-F stages, thus permitting the signal circuits to be operated with an optimum signal-to-noise ratio under varying circuit conditions.

TUBE COMPLEMENT

Ref. No.	Type	Function
V101	6BQ7	R. F. Amplifier
V102	6J6	Osc. & Mixer
V201	6CB6	1st I.F. Amplifier
V202	6CB6	2nd I.F. Amplifier
V203	6CB6	3rd I.F. Amplifier
V204	6CB6	4th I.F. Amplifier
V205	6X8	Triode Section, 1st Video Amplifier; Pentode Section, 1st Sound I.F. Amplifier
V206	6AQ5	Video Output
V208	27GP4 or 27EP4	Picture Tube
V301	6AU6	2nd Sound I.F. Amplifier
V302	6AL5	Ratio Detector
V303	6AV6	1st Audio Amp. & AGC Clamp
V304	6AQ5	Audio Output
V401	6AU6	Keyed A.G.C. Amplifier
V402	6BA6	Sync Amplifier
V403	6BE6	Sync Sep. & Noise Clipper
V404	12AT7	1st Triode, Sync Clipper; 2nd Triode, Reactance Tube
V501	6AL5	Horizontal A.F.C.
V502	12AU7	1st Triode, Horizontal Oscillator; 2nd Triode, Horizontal Discharge
V505	1B3	H.V. Rectifier
V506	6C4	Vertical Multibibrator
V508	6CD6	Horizontal Output
V509	6AX4	Damper
V510	6AX4	Damper
V511	6AV5	Vertical Output
V601	5U4	L. V. Rectifier
V602	5U4	L. V. Rectifier
CR201	1N64 (Germanium Diode)	Video Detector

REMOVAL OF SAFETY GLASS ESCUTCHEON

Should it be necessary, the safety glass is removable from the front of this instrument. The glass is fitted into slots in the chassis mounting shelf and the sides of the cabinet. It is held firmly in place at the top by a removable wood strip.

TO REMOVE THE GLASS:

1. Remove the small wood screw from the wood strip at the top of the safety glass and remove the strip.
2. Slide the glass to the right until it is free of the cabinet slot at the left of the cabinet.
3. Slide the glass upward until it is free of the bottom slot and tilt the glass forward at the left. Note: A small rubber suction cup (such as a CRT H.V. anode cup) can be used to assist in removing the glass from the cabinet.

To replace the glass the above procedure should be followed in reverse.

Removing the Picture Tube From the Cabinet

CAUTION — Due to the weight and bulk of the 27" CRT it is recommended that more than normal precautions be exercised in handling. One suggested procedure to facilitate removal of the CRT is to first place the instrument face down on the floor, using a heavy blanket or other padding to protect the cabinet, then proceed with the removal of the CRT as outlined below. Using this method one man can remove the tube without assistance.

To Remove the CRT:

1. Remove the cabinet rear door assembly (held in place by twelve (12) wood screws).
2. Remove the CRT socket from the CRT base.
3. Disconnect the Deflection Yoke Cable.
4. Disconnect the H.V. Anode Connector from the CRT.
5. Remove the rear braces from the deflection yoke support assembly.
6. Remove the four (4) nuts which fasten the front CRT strap assembly to the cabinet. NOTE: Unless the instrument is in the face down position (as described above) the CRT should be supported from the rear while the mounting nuts are being removed.
7. Lift the tube out of the cabinet tilting it slightly to avoid striking the H.V. Section of the TV Chassis.

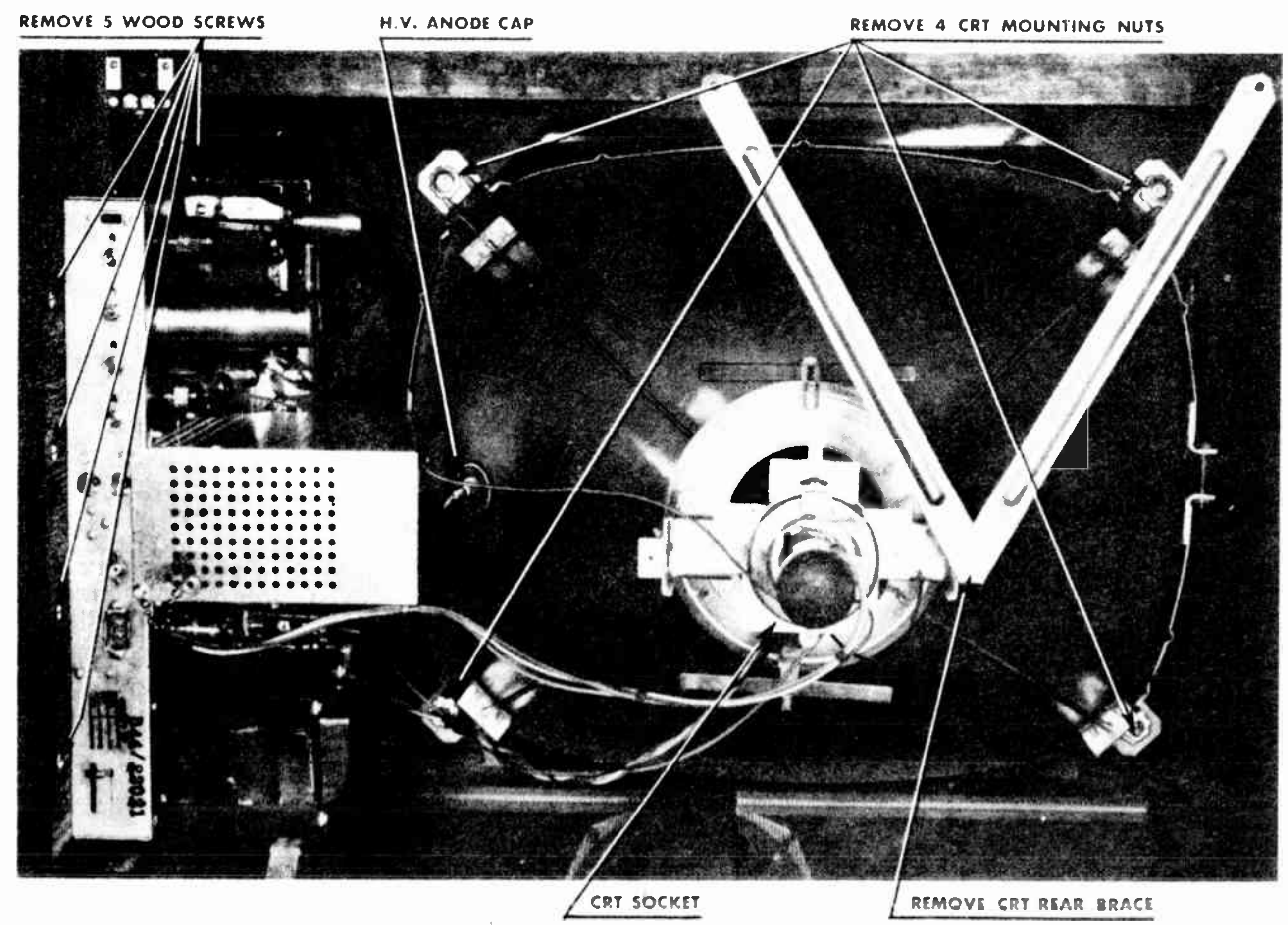
After removing the CRT assembly from the cabinet place it face down on a pad (to protect the CRT face) and remove the Ion Trap, Focus Magnet and Deflection Yoke. When installing a new CRT be certain that the rubber collar, which is used to hold the deflection yoke in place against the bell of the tube, is solidly in place.

Removing the Chassis From the Cabinet

The chassis used in this model is bolted to a sliding skid which fits in grooves provided in the cabinet construction. For maintenance the chassis can be removed from the rear of the instrument as follows:

1. Remove the control knobs from the front of the instrument.
2. Remove the cabinet rear door assembly (held in place by twelve (12) wood screws).
3. Remove the Antenna Terminal strip (fastened to cabinet by two (2) wood screws).
4. Remove the CRT Socket from the CRT base.
5. Disconnect the Deflection Yoke Cable.
6. Disconnect H.V. Anode Connector from the CRT.
7. Remove the Speaker plug from the TV chassis.
8. Remove the wood screws which fasten the chassis mounting skid to the cabinet (four screws at the rear and one at the front near the R-F Unit.)
9. Slide the chassis on the sliding skid from the rear of the instrument.
10. Remove the wooden skid from the chassis to facilitate service.

To replace the chassis in the cabinet, follow this procedure in reverse. Make certain that all interconnecting cables are properly connected and see that the chassis and sliding skid are securely fastened.



SET-UP ADJUSTMENTS

Final adjustment of the various secondary (or set-up) controls should be made at the time of installation of the receiver. The receiver should be given a thorough operating test at the same time, and, of course, the owner should be instructed as to the operation of the various controls on the front panel. The owner should be cautioned that the secondary controls should be adjusted only by an experienced television service man.

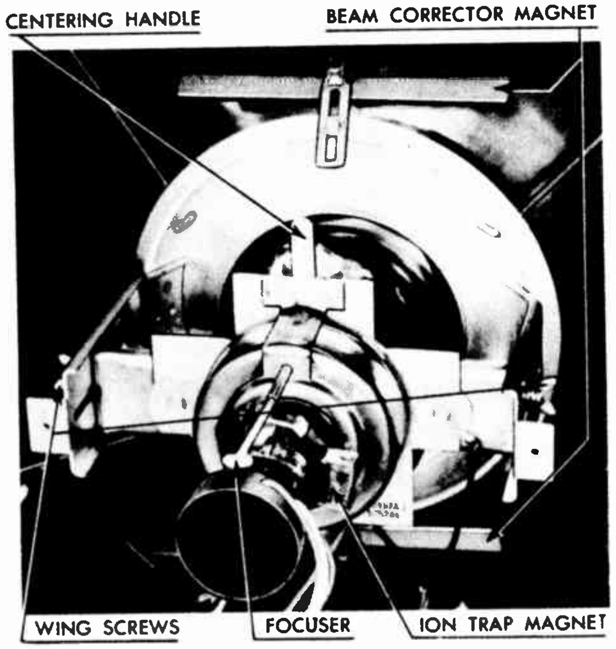
Adjustments of the Horizontal A.F.C. circuits and setting the Local Oscillator of the R.F. Tuner should be made as outlined

Preliminary Checks:

1. Remove the cabinet back and connect the receiver to an AC source, using a "cheater cord" (A line cord that can be plugged into the AC Interlock receptacle on the rear of the chassis).
2. Turn the receiver on and adjust the Shading and Contrast controls to approximately half rotation. If a raster is not seen after allowing time for the tubes to warm up, immediately adjust the Ion Trap Magnet to obtain a raster. Upon obtaining a raster, continue to adjust the magnet (by sliding back and forth and rotating about the neck of the CRT) to obtain maximum brightness.
3. Check to see that the Deflection Yoke is flush against the bell of the CRT. If the raster is tilted, rotate the yoke to correct the tilt.
4. Connect the lead wire from an antenna to the terminals on the rear of the set. Be sure to remove the lead wire from the "built-in" antenna from these terminals when using an outside antenna.
5. Set the Channel knob to a channel on which a program is being transmitted.
6. Adjust the Fine Tuning and Contrast controls to obtain the best reception. Tune for the sharpest detail in the picture, but not necessarily the brightest picture or loudest sound.
7. Adjust the Shading control for the desired brightness and the Volume control for the desired volume. Check the Sound quality.
8. Adjust the Vertical Hold control if the picture rolls vertically.

Picture Centering and Focus:

9. To center the picture on the CRT screen move the centering handle on the Focusing Magnet.



If proper horizontal centering cannot be obtained with this adjustment, check the Horizontal Phasing Adjustment as outlined under "Adjustment of Horizontal A.F.C. Circuit."

10. To provide over all good focus adjust the Focuser adjustment which extends from the rear of the Focusing Magnet. The magnet should be approximately ½ inch from rear of the yoke.

ADJUSTMENT OF HORIZONTAL A.F.C. CIRCUIT

There is no Horizontal Hold front panel control provided on this chassis. The picture should lock in synchronism automatically when switching from channel to channel. In event, however, that adjustment of this circuit is required, because of tube or component replacement, the following procedure should be followed:

1. Remove the Horizontal A.F.C. Detector Tube (6AL5) from its socket and adjust the Horizontal Frequency slug until the picture is syncronized horizontally. When properly adjusted the picture will move slowly back and forth horizontally with one vertical blanking bar.
2. Re-insert the 6AL5 tube, and as soon as the tube reaches its normal operating temperature, the picture should fall in sync.
3. After making the frequency adjustment, check the horizontal phasing. This can best be done by decentering the picture so that the right hand edge of the raster is visible. Adjust the Shading control for maximum brilliance and reduce the Contrast control until the raster edge can be seen. There should be approximately 3/16 inch between the edge of the raster on 17 inch tubes and 1/4 inch on 21 inch tubes. If the picture is out of phase, adjust the Horizontal Phasing "slug" on the rear of the chassis.

If considerable amount of change is required in the phasing adjustment, it may be necessary to re-adjust the horizontal frequency as in Step 1, above.

Picture Size and Linearity:

11. Adjust the Horizontal Drive and Width controls to obtain the proper picture width and horizontal linearity. The Horizontal Drive control should be adjusted first to provide maximum scan and then the Width control should be used to adjust for the proper horizontal size. If a vertical white line (or lines) appears in the picture, back off the Horizontal Drive control slightly.
12. Adjust the Height and Vertical Linearity controls to obtain proper height and vertical linearity. It may be necessary to adjust the Vertical Hold control while making these adjustments, if the picture should roll. (Refer to "Beam Corrector Magnet Adjustment").

Final Check:

13. In sequence, set the Channel knob to all channels on which reception is obtained. Adjust the receiver for operation as outlined in the Owner Operating Instructions. Check the quality of reception, picture and sound on all available TV stations in the area.

NOTE: If a degree of "background noise" is noticed on moderate signals the AGC Differential Control (switch on rear chassis apron) should be placed in the DOWN position. If no background noise is apparent with the switch in the UP position, it should be left in this position.

14. Recheck the focuser adjustment and Ion Trap Magnet setting for good picture focus.
15. Check to see that the best reception is obtained on all channels with the Fine Tuning control set to the approximate center of its range. This can be obtained by making the adjustments outlined under "Oscillator Adjustments Using a TV Signal
16. Remove the "cheater cord" and replace the cabinet back.

OSCILLATOR ADJUSTMENT USING A TELEVISION SIGNAL

1. Turn set on and allow sufficient time for set to reach normal operating temperature.
2. Turn Channel selector to the channel to be adjusted and adjust Shading, Contrast and Volume controls for normal sound and picture. Set the Fine Tuning control to the midpoint of its range.
3. Remove Channel and Fine Tuning knobs and adjust the oscillator slug for that channel, using a small non-metallic screwdriver. When the CHANNEL selector is set for a particular channel, the oscillator "slug" for that channel is accessible through a small hole in the front of the tuner chassis.

Adjust the oscillator slug for the clearest and sharpest detail in the picture. At this point the sound should be best, but not necessarily the loudest.

NOTE: BE CAREFUL NOT TO TURN THE SLUG TOO FAR, AS IT MAY FALL COMPLETELY OUT OF ITS MOUNTING.

Beam Corrector Magnet Adjustment

Adjust the Height Control so that the top and bottom edges of the raster are just visible and check to see if the raster lines near the top and bottom are sufficiently straight. If the lines are bent adjust the two Beam Corrector Magnets (attached to the CRT metal support ring, one above and the other below the bell of the CRT) to remove the bend. These magnets are adjusted at the factory and should not require re-adjustment unless they have been accidently bent out of position.

These magnets can be adjusted by moving them closer to or further from the bell of the CRT or by moving them from side to side. As the magnet is moved closer to the tube, the raster lines will be pulled toward the magnet. Likewise as the magnet is moved away from the tube, it will have less effect on the raster lines. If the magnets have been shifted either to the left or right, an irregular bend may appear in the raster lines near the top or bottom.

ALIGNMENT INSTRUCTIONS

General Information

Before attempting either complete or partial alignment of the receiver circuits it is recommended that all of the alignment data included here be read thoroughly. After becoming familiar with the procedure it will probably be necessary to refer to the alignment charts only. Note that there are two methods given for alignment of the I-F Stages. The method to be used will depend upon the type of equipment available. If a Sweep Generator having a 40 - 50 MC range is not available, the I-F Stages (with exception of the over-coupled transformer) can be accurately aligned with a Signal Generator having a 40-50 MC range and a VTVM. In this case the over-coupled stage can be aligned while observing the over-all R-F, I-F curve on a channel which is known to have a fairly flat response.

A suggested list of Test Equipment needed for proper alignment of the receiver is listed here. Under no circumstances should alignment be attempted without the proper equipment. When connecting the test equipment to the various points in the receiver, be certain that a good connection is made and that the leads are as short as possible.

In alignment of the R-F Amplifier in particular the Sweep Generator must be properly terminated in order to prevent distortion of the response curve caused by reflections and losses on the lines. All equipment used must be adequately grounded on the receiver chassis. Always allow sufficient time for both test equipment and receiver to warm up before starting the alignment.

Test Equipment Specifications

1. R-F Sweep Generator
   a. Frequency Ranges
      4.5 Mc with .5 and 2 MC Sweep Width, 40 - 50 MC with approximately 10 MC Sweep Width 50 - 90 MC, 170 - 220 MC with at least 10 MC Sweep Width.
   b. Constant Output within the sweep range.
   c. Signal Output not less than 0.1 volt maximum.
2. Marker Generator
   a. Frequency Ranges
      41.25 - 47.25MC — I-F Markers
      55.25 - 215.75MC — Picture Sound Carrier Markers
      4.5 MC — Sound I-F and 4.5 MC Trap
   b. Modulated Signal over I-F Range (optional)

R-F AMPLIFIER ALIGNMENT

1. Connect the sweep generator output cable to the receiver antenna input terminals through the proper terminating network. If the sweep generator used has a 300 ohm balanced output use the matching pad shown in Figure 1A. For other generators use the proper values of R_o and R_i for the output cable impedance of the particular generator. Adjust the generator to sweep Channel 10.
2. Couple an accurately calibrated marker generator into the antenna input to provide picture and sound carrier markers. In most cases the marker generator can be connected across the sweep generator terminals. A 10K isolating resistor should be used in series with the marker output cable. Maintain the output of the marker generator at a low level to prevent distortion of the response curve.
3. Connect the oscilloscope (high side) through a 10K isolating resistor to the test point (small wire loop) on top of R-F Tuner Chassis. If necessary to provide a clean trace on the scope, connect a 270 uuf. (approx. value) capacitor across the vertical input terminals of the scope.
4. Remove the AGC Amplifier tube (V401, 6AU6) and connect a bias source (see note 2 of Video I-F Alignment) from terminal 2 of the R-F, I-F Chassis Power Cable Plug to chassis. Set the bias on terminal 2 at −3 volts.
5. Remove the 1st I-F Amplifier tube (V201) and detune the mixer plate transformer, T101.
6. Set the receiver Channel Selector for Channel 10. A trace should appear on the scope similar to that shown in Figure 2. Adjust the trimmers C117, C107 and C111 on top of the R-F Tuner Chassis for maximum amplitude and to locate the sound and picture carrier markers within the limit shown in Figure 2.
7. Adjust the sweep and marker generators progressively for each channel. Check the response curve obtained on each channel. The curve should be within the following limits: neither side of the curve should be down more than 30% and the valley of the curve should not be down more than 30% of the total amplitude. If the response of a particular channel does not come within these limits, check to see that the correct coils for that channel are being used and try replacing the antenna coil for that channel. As a final step, a compromise can be made by adjusting the trimmer C117, C107 and C111 to improve the response of the channel that is off. The response on all other channels should then be rechecked to determine the extent to which they were affected by the compromise.

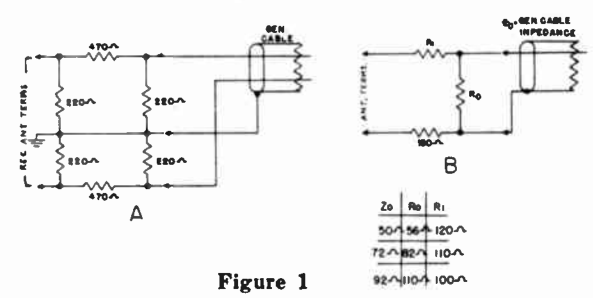


Figure 1

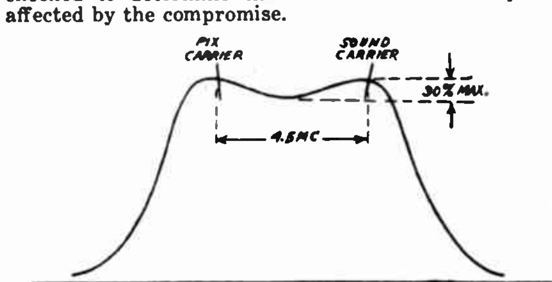


Figure 2

R-F AMPLIFIER ALIGNMENT CHART

Step No.:	Set Sweep Generator to:	Set Marker Generator to:	Connect Generator Output Cable to:	Connect Oscilloscope to:	Set Channel Selector to:	Adjust	Refer to Note/s:
1	Sweep Channel 10	193.25MC 197.75MC	Receiver Antenna Input Terminals	Test Point on R-F Tuner through 10K Resistor	Channel 10	C117, C107 & C111 for Maximum Amplitude & location in Fig. 2.	1, 2, 3, 4, 5
2	Sweep Channel 13	211.25MC, 215.75MC			Channel 13	Check Response Curve on all Channels	7
3	Sweep Channel 12	205.25MC 209.75MC			Channel 12		
4	Sweep Channel 11	199.25 MC 203.75MC			Channel 11		
5	Sweep Channel 9	187.25MC, 191.75MC			Channel 9		
6	Sweep Channel 8	181.25MC, 185.75MC			Channel 8		
7	Sweep Channel 7	175.25MC, 179.75MC			Channel 7		
8	Sweep Channel 6	83.25MC, 87.75MC			Channel 6		
9	Sweep Channel 5	77.25MC, 81.75MC			Channel 5		
10	Sweep Channel 4	67.25MC, 71.25MC			Channel 4		
11	Sweep Channel 3	61.25MC, 65.75MC			Channel 3		
12	Sweep Channel 2	55.25MC, 59.75MC			Channel 2		

LOCAL OSCILLATOR ALIGNMENT CHART

Step No.	Set Sweep Generator to:	Set Marker Generator to:	Connect Generator Output Cable to:	Connect Oscilloscipe to:	Set Channel Selector to:	Adjust	Refer to Note/s:
1	Sweep Channel 13	211.25MC, 215.75MC	Receiver Antenna Input Terminals	Junction of R219 and pin 2 of V205A through 10K Resistor	Channel 13	Channel 13 Oscillator Slug	1, 2, 3 4, 5, 6 7
2	Sweep Channel 12	205.25MC, 209.75MC			Channel 12	Channel 12 Oscillator Slug	
3	Sweep Channel 11	199.25MC, 203.75MC			Channel 11	Channel 11 Osc. Slug	
4	Sweep Channel 10	193.25MC, 197.75MC			Channel 10	Channel 10 Osc. Slug	
5	Sweep Channel 9	187.25MC, 191.75MC			Channel 9	Channel 9 Osc. Slug	
6	Sweep Channel 8	181.25MC, 185.75MC			Channel 8	Channel 8 Osc. Slug	
7	Sweep Channel 7	175.25MC, 179.75MC			Channel 7	Channel 7 Osc. Slug	
8	Sweep Channel 6	83.25MC, 87.75MC			Channel 6	Channel 6 Osc. Slug	
9	Sweep Channel 5	77.25MC, 81.75MC			Channel 5	Channel 5 Osc. Slug	
10	Sweep Channel 4	67.25MC, 71.75MC			Channel 4	Channel 4 Osc. Slug	
11	Sweep Channel 3	61.25MC, 65.75MC			Channel 3	Channel 3 Osc. Slug	
12	Sweep Channel 2	55.25MC, 59.75MC			Channel 2	Channel 2 Osc. Slug	

NOTE: The individual oscillator slugs are accessible from the front of the cabinet, therefore, if the R-F and I-F circuit are properly aligned, "touch up" of the oscillator alignment on any channel can be accomplished without removing the chassis from the cabinet. For further information, refer to "Oscillator Alignment Using a TV Signal" on Page 3.

LOCAL OSCILLATOR ALIGNMENT

1. Connect the sweep generator output cable to the receiver antenna input terminals through the proper terminating network. If the sweep generator used has a 300 ohm balanced output use the matching pad shown in Figure 1A. For other generators use the proper values of R_o and R_i for the output cable impedance of the particular generator. Adjust the generator to sweep Channel 13.
2. Couple an accurately calibrated marker generator into the antenna input to provide picture and sound carrier markers for Channel 13.
3. Connect the oscilloscope (high side) through a 10K isolating resistor to the junction of R219 and pin 2 of V205A.
4. Remove the AGC Amplifier tube (V401, 6AU6) and connect a short test lead from pin 2 of the R-F, I-F Chassis Power Cable plug to chassis. This places the R-F Amplifier bias at zero. Also, connect a bias battery (a 4.5 Volt battery with a 1K pot connected across its terminals can be used), negative side to terminal 3 of the same plug and positive side to chassis. Adjust the pot to provide −3 volts bias at terminal 3 of the R-F, I-F Chassis Power Cable plug.
5. Set the Channel Selector to Channel 13 and check the response curve obtained against the ideal curve shown in Figure 4. If the shape of the curve is not within these limits, it will be necessary to repeat the R-F and I-F Amplifier Alignments. The R-F and I-F Amplifiers must be properly aligned before the oscillator adjustments can be correctly made.
6. Set the Fine Tuning control to the approximate center of its mechanical range and leave it set in this position for the entire alignment.
7. Adjust the individual oscillator "slug" for Channel 13 to properly position the markers on the curve. This adjustment should be made with a non-metallic screwdriver having an ⅛ inch blade approximately. If one of the slugs should "fall into" the coil form, first remove the metal shield which covers the lower portion of the turret (to remove the shield pull down at the front and slide it out of its hinges at the rear) and then remove the particular oscillator coil from the turret. To reposition the slug, move the slug retaining spring aside and tap the coil until the slug slides forward, then replace the spring so that the slug is held in place. Replace the coil in the turret and proceed with its alignment.
8. Set the sweep and marker generators, progressively for each channel and check the position of the markers on the curves. Adjust the individual oscillator "slug" wherever necessary to properly locate the markers.

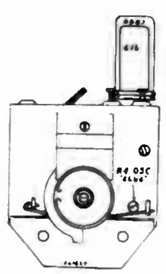


Figure 3

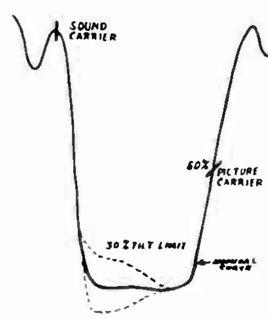


Figure 4

VIDEO I-F ALIGNMENT

1. Connect the sweep generator output cable (properly terminated in its characteristic impedance) to pin 1 of V201 (grid of 1st I-F Amplifier) through a .001 ufd. isolating capacitor and adjust it to sweep from 40 to 50 MC. If a separate marker generator is used it should be coupled to the same point through a 10K resistor.
2. Remove the AGC Amplifier tube (V401, 6AU6) and connect a bias source from terminal 3 of the R-F, I-F Chassis Power Cable plug to chassis. A bias source may be obtained from a 4.5 volt battery with a 1K pot connected across its terminals. Connect the positive end of the battery to chassis ground and connect the arm of the pot to terminal 3 of the R-F, I-F plug. Connect a VTVM to terminal 3 of the plug and adjust the pot for a minus 3 volt reading on the VTVM.
3. Connect the oscilloscope high side to the junction of R219 and pin 2 of V205A through a 10K isolating resistor.
4. Check the response curve for evidence of local oscillator influence by adjusting the fine tuning control. If the shape of the curve changes, switch to another channel where oscillator influence is not present or else adjust the Channel Selector so that it is between channels.
5. Adjust the marker generator to provide a marker at 41.25 MC and adjust the top slug of T202 (Co-Channel Sound I-F Trap) for minimum response at the marker frequency. This adjustment may be made easier by running the sweep generator output high so that the trap "dips" are easily visible.
6. Adjust the marker generator to 47.25 MC and adjust the top slugs of T203 and T204 (Adjacent Channel Sound I-F Traps) for minimum response at the marker frequency.
7. Reduce the sweep generator output so that a normal curve is seen. Adjust the marker generator to 42.65 MC and then adjust the bottom slugs of T202 and T204 to obtain maximum amplitude of the 42.65 MC marker.
8. Adjust the marker generator to 45.3 MC and adjust the bottom slugs of T203 and T205 to obtain maximum amplitude of the 45.3 MC marker. To obtain access to the bottom slug of T205 remove the contrast control from the front panel. Use a thin blade alignment tool for the adjustment.
9. Connect the sweep and marker generators to the test point on the R-F Tuner through a .001 ufd., isolating capacitor. Set Channel Selector to Channel No. 9. If the available equipment allows, markers at both 42.25 MC and 45.75 MC should be provided simultaneously.
10. Adjust the overcoupled I-F circuit, T101 (on top of the R-F Tuner) and the bottom slug of L211 to obtain a curve similar to that shown in Figure 5. With certain types of sweep generators this method is not usable due to the spureous response curves obtained on the scope which are caused by the various harmonic of the generator. Under these conditions the overcoupled stage should be aligned as in step 6 of alternate method of I-F alignment. The 42.25 MC marker must fall within 30% to 70% of maximum amplitude of the curve on one side and the 45.75 MC marker must fall within 40% to 60% of maximum on the other side. The valley of the curve should not exceed 10% and the tilt should not be greater than + or −10%. A 45 MC marker should fall within 5% of maximum amplitude on the high frequency side of the curve.

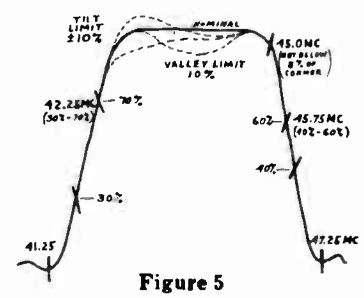


Figure 5

VIDEO I-F ALIGNMENT CHART

Step No.	Set Sweep Generator to:	Set Marker Generator to:	Connect Generator Output Cables to:	Connect Oscilloscope to:	Adjust	Refer
1.	Sweep from 40 to 50MC	41.25MC	pin 1 of V201 (grid of 1st I-F Stage) through a .001 ufd. capacitor	Junction of R219 and pin 2 of V205A through a 10K resistor	Top slug of T202 for min. response at 41.25MC	1, 2, 3, 4
2.		47.25MC			Top slugs of T203 & T204 for min. response at 47.25MC	1, 2, 4, 6
3.		42.65MC			Bottom slugs of T202 & T204 for max. amplitude of marker	1, 2, 4, 7
4.		45.3MC			Bottom slugs of T203 & T205 for max. amplitude of marker	1, 2, 4, 8
5.		Repeat Steps 1 & 2 after completing Steps 3 & 4				
6.		42.25MC 45.0 MC 45.75MC	Test Point on R-F Tuner through a .001 ufd., capacitor		T101 (on top of R-F tuner) and Bottom slug of L211 for curve shown in Fig. 5	2, 4, 9, 10

ALTERNATE METHOD OF VIDEO I-F ALIGNMENT

1. Connect the signal generator output cable to pin 1 of V201 through .001 ufd., isolating capacitor. If an oscilloscope is used for indication, the generator should be AM modulated with a 400 c.p.s. signal.
2. Set the bias at the I-F grids to minus 3 volts (refer to note 2 of Video I-F Alignment).
3. Connect the VTVM to the junction of R219 and pin 2 of V205 through a 10K resistor.
4. Set the signal generator to 41.25 MC and adjust the top slug of T202 for minimum indication on the VTVM.
5. Set the signal generator to 47.25 MC and adjust the top slugs of T203 and T204 for minimum indication on the VTVM.
6. Set the signal generator to 42.65 MC and adjust the bottom slugs of T202 and T204 for maximum indication on the VTVM.
7. Set the signal generator to 45.3 MC and adjust the bottom slugs of T203 and T205 for maximum indication on the VTVM. To obtain access to the bottom slug of T205, remove the Contrast Control from the front panel. Use a thin blade alignment tool for this adjustment.
8. Connect the Sweep Generator output cable to the receiver antenna input terminals through the proper terminating network. (Refer to note 1 of R-F Amplifier Alignment).
9. Connect the marker generator to pin 1 of V201 through a .001 ufd., capacitor.
10. Set the I-F Bias to minus 3 volts (Refer to Note 2 of Video I-F Alignment).
11. Connect the oscilloscope high side to the junction of R219 and pin 2 of V205A through a 10K resistor.
12. Set the receiver Channel Selector to Channel 12 and adjust the sweep generator to sweep Channel 12. A curve should appear on the scope similar to that shown in Figure 6. The marker generator should be adjusted to provide markers at 42.25 MC and 45.75 MC.
13. Adjust T101 (on top of the R-F Tuner) and the bottom slug of L211 for location of the markers as stated in Note 10 of Video I-F Alignment.

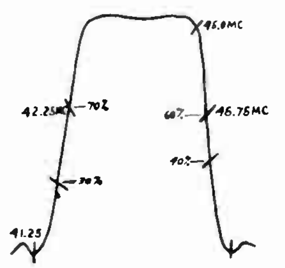
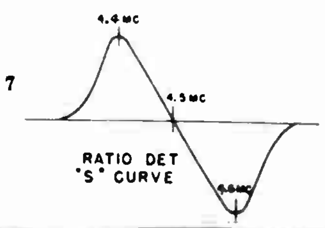


Figure 6

SOUND (4.5MC) I-F ALIGNMENT

1. Connect the sweep generator output cable to the junction of L205 and R218 through a .001 ufd., isolating capacitor and adjust it for 1 MC sweep, with center frequency at 4.5MC.
2. If a separate marker generator is used it may be coupled to the sweep generator cable through a 10K isolating resistor. The marker must be accurately calibrated at 4.5MC.
3. Connect the oscilloscope (high side) to the junction of R306, R307 and C310.
4. Adjust L301 for maximum amplitude of the response curve such as shown in Figure 7.
5. Adjust the secondary (top) of T301 to center the marker on the curve and to provide as straight a slope as possible between the negative and positive peak.
6. Adjust the primary (bottom) of T301 for maximum and equal amplitude of the peaks. Remove the Volume Control from the front panel and insert a long "thin blade" alignment tool through the mounting hole for this adjustment.
7. Recheck the adjustment of L301 for maximum amplitude and also the adjustment of T301 (secondary) to center the marker on the curve.

Figure 7



VIDEO I-F ALIGNMENT CHART (ALTERNATE METHOD)

Step No.	Set Sweep Generator to:	Set Signal Generator to:	Connect Generator Output Cables to:	Connect Oscilloscope or VTVM to:	Adjust	Refer to Note/s
1.		41.25MC	Pin 1 of V201 (grid of 1st I-F Stage) through a .001 ufd., capacitor	Junction of R219 and pin 2 of V205A through 10K resistor	Top slug of T202 for minimum indication.	1, 2
2.		47.25MC			Top slug of T203 & T204 for minimum indication.	1, 2
3.		42.65MC			Bottom slugs of T202 & T204 for Maximum indication.	1, 2
4.		45.3 MC			Bottom slugs of T203 & T205 for Maximum indication.	1, 2, 7
5.	Repeat Steps 1 and 2 after completing Steps 3 and 4.					
6.	Sweep Channel 12	Markers at 42.25MC, 45.0 MC, 45.75MC	See Notes 8 and 9	Junction of R219 & pin 2 of V205A through 10K resistor	T101 (on top of R-F Tuner) and Bottom Slug of L211 for curve shown in Fig. 6.	8, 9, 10, 11, 12

(ALIGNMENT INSTRUCTIONS CONT.)

SOUND (4.5MC) I-F ALIGNMENT CHART

Step No.:	Set Sweep Generator To:	Set Marker Generator To:	Connect Generator Output Cables To:	Connect Oscilloscope Vertical input Cable To:	Adjust:	Refer To Note/s:
1.	4.5 MC 1.0 MC Sweep	4.5MC	Junction of L205 & R218, Ground Side to Chassis	Junction of R306, 307 & C310. Ground Side to Chassis	L301 for Maximum Amplitude of Curve Figure 7.	1, 2
2.					Secondary (top) of T301 to center Marker.	1, 2, 5
3.					Primary (bottom) of T301 for equal amplitude of peaks	1, 2, 6
4.					L301 for Maximum Amplitude and symetry of curve	1, 2
5.					Secondary of T301 to center Marker.	1, 2

4.5MC TRAP (L208) ADJUSTMENT

1. Connect the sweep generator to the junction of L205 and R218 and adjust it for 2MC sweep width at 4.5MC.
2. If a separate marker generator is used, it may be coupled to the sweep generator cable through a 10K resistor. The marker must be accurately calibrated at 4.5MC.
3. Connect the detector network to the CRT grid lead (as shown in Fig. 8), and connect the scope cable to the output of the detector network.
4. Adjust L208 (located near V206) for minimum amplitude at the 4.5MC marker. The curve should be similar to that shown in Figure 9.

4.5MC TRAP (L208) ADJUSTMENT CHART

Step No.:	Set Sweep Generator To:	Set Marker Generator To:	Connect Generator Output Cables To:	Connect Oscilloscope Vertical Input Cable To:	Adjust:	Refer To Note/s:
1.	4.5MC (2MC sweep)	4.5MC	Junction of L205 & R218. Ground side to chassis	To Detector Network as shown in Figure 8	L208 slug for minimum amplitude at 4.5MC Marker	1, 2, 3, 4

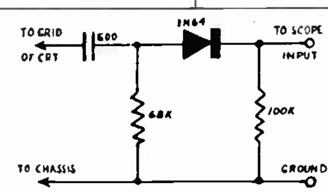


Figure 8

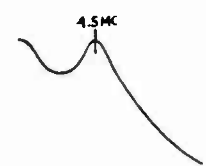
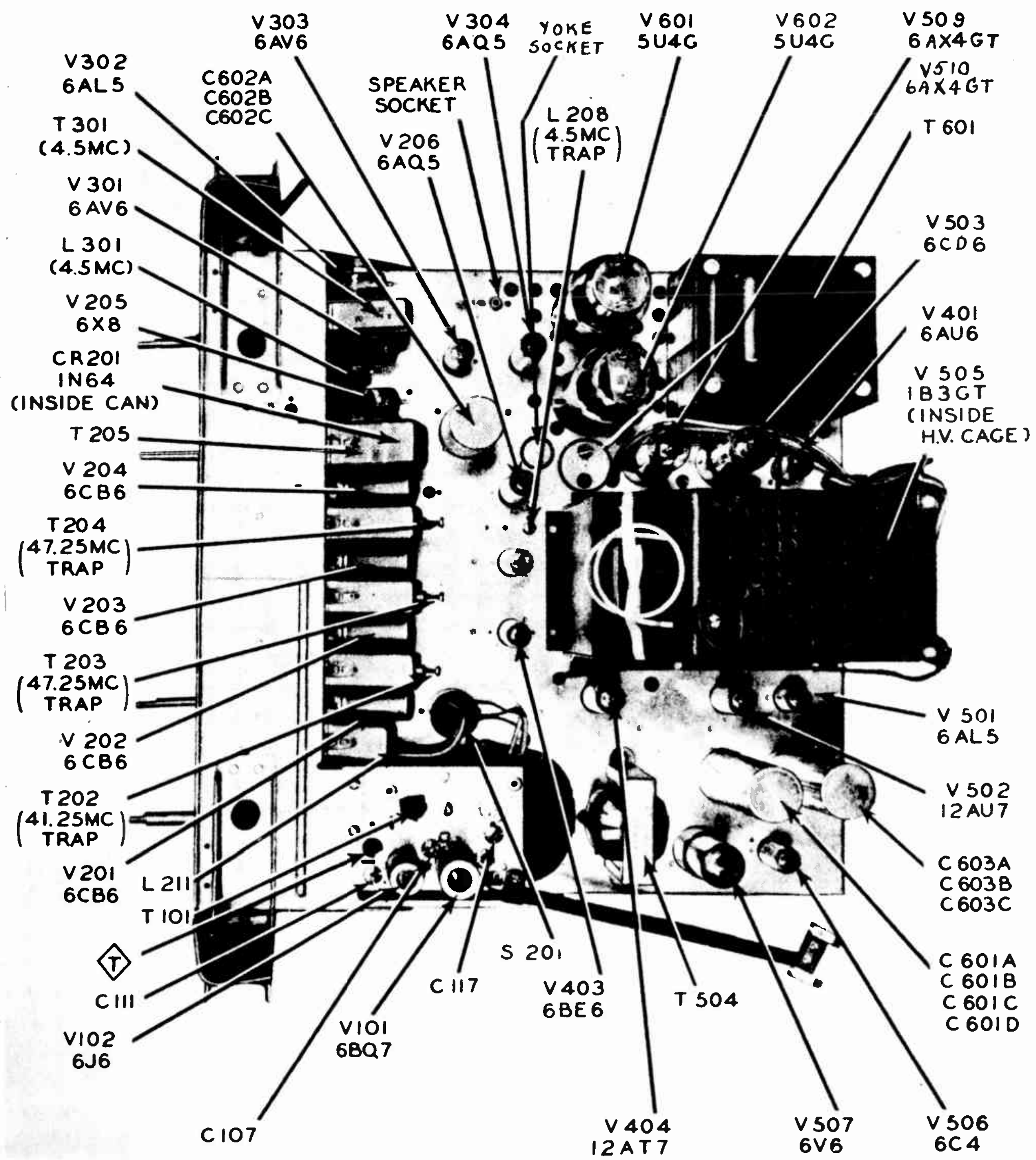


Figure 9

TOP VIEW CHASSIS LAYOUT
CT-74
Location of Components, Tubes and Alignment Adjustments



TUBE SOCKET VOLTAGE CHART
CHASSIS CT-74

TUBE SOCKET TERMINALS									
Tube Type & Ref. No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V101 (6BQ7)	171	.5	.2	6.3AC	0	265	141	141	0
V102 (6J6)	95	105	6.3AC	0	−5.3	−4	0	—	—
V201 (6CB6)	−4.5	1	0	6.3AC	150	125	0	—	—
V202 (6CB6)	−4.5	1	0	6.3AC	145	125	0	—	—
V203 (6CB6)	0	2.0	0	6.3AC	135	138	0	—	—
V204 (6CB6)	0	2.0	0	6.3AC	154	148	0	—	—
V205 (6X8)	0	−1	120	6.3AC	0	0	−.9	130	130
V206 (6AQ5)	9 to 1	20 to 10	0	6.3AC	285 to 260	135	N.C.	—	—
V207 (CRT)	Pin 1 0	Pin 2 −23 to .5	Pin 6 320	Pin 10 370	Pin 11 155 to 26	Pin 12 6.3AC	HV Anode 15KV†		
V301 (6AU6)	−5	0	0	6.3AC	140	140	.2	—	—
V302 (6AL5)	9	−9	6.3AC	0	2	0	1.6	—	—
V303 (6AV6)	−.6	0	0	6.3AC	.5	.5	84	—	—
V304 (6AQ5)	N.C.	16	0	6.3AC	250	260	0	—	—
V401 (6AU6)	27	61 to 115	130 / 0.AC	135 / 6.3AC	2.6 to 2.8	310	61 to 120	—	—
V402 (6BA6)	−.3	0	0	6.3AC	30	91	0	—	—
V403 (6BE6)	−.7/0*	0	0	6.3AC	12	20/12*	−15/−13*	—	—
V404 (12AT7)	275	0	3.4	0	0	150	−.1	0	6.3AC
V501 (6AL5)	9.6	−8.5	6.3AC	0	0	0	−8.5	—	—
V502 (12AU7)	205	−44	0	0	0	260	−22	.2	6.3AC
V503 (6CD6)	N.C.	6.3AC	N.C.	205	−23	19	0	19	CAP HV Pulse Do Not Measure
V504 (6W4)	N.C.	N.C.	540	N.C.	290	N.C.	140 / 6.3AC	140 / 0AC	
V505 (1B3)	N.C.	—	N.C.	N.C.	N.C.	N.C.	—	N.C.	CAP HV Pulse Do Not Measure
V506 (6C4)	5.2 to 140	N.C.	6.3AC	0	5.4 to 140	−2.5 to −38	0	—	—
V507 (6V6)	N.C.	0	310 to 255	315 to 290	0 to −10	N.C.	6.3AC	44 to 20	—
V601 (5U4)	N.C.	330 / 11AC	N.C.	−9 / 305AC	N.C.	−9 / 305AC	N.C.	330 / 8AC	—
V602 (5U4)	N.C.	330 / 11AC	N.C.	−9 / 305AC	N.C.	−9 / 305AC	N.C.	330 / 8AC	—

*Values obtained on chassis coded "D-3" or earlier with the noise limiting switch in the "OFF" position.

†Measured with zero brilliance

MEASUREMENT CONDITIONS

All voltages measured with no signal input on a vacuum tube voltmeter from tube socket pin to chassis unless otherwise indicated. All voltages should be within ± 20% of the above stated values with line voltage of 117 volts, 60 cycle AC. Voltages on V206 vary with setting of Contrast. Voltages on V401 vary with setting of AGC Set. Voltages on V507 and V506 vary with settings of Vert. Hold, Vert. Lin. and Height. Voltages on V207 vary with setting of Shading.

PARTS LIST

RESISTORS

All Resistors are ½ watt 10% unless otherwise noted.

Ref. No.	Description	Part No.	List
R547	6.8 ohm	650101A-22	$ .10
R202, 208, 517	47 ohm	3229-470	.10
R317	68 ohm	3229-680	.10
R306	120 ohm 5%	3228-121	.15
R213, 217	150 ohm	3229-151	.10
R518	180 ohm 4W	650101A-25	.40
R206, 210, 215	220 ohm	3229-221	.10
R508, 526, 528, 527	470 ohm	3229-471	.10
R225, 315	680 ohm 1W	3232-681	.15
R440	820 ohm	3229-821	.10
R303, 305, 507, 441	1000 ohm	3229-102	.10
R221	1200 ohm	3229-122	.10
R602	1750 ohm 14.2W, W.W	750288A-7	.85
R316	2000 ohm 7W, W.W	650101A-23	.45
R605	2200 ohm 2W	3235-222	.25
R204, 209, 405, 425	3300 ohm	3229-332	.10
R226	3300 ohm 2W	3235-332	.25
R603	3500 ohm 7W, W.W	650101A-24	.45
R205, 218	4700 ohm	3229-472	.10
R211 216	5600 ohm	3229-562	.10
R549	1K, 2W	3235-102	.25
R308, 309, 515	6800 ohm	3229-682	.10
R203	8200 ohm	3229-822	.10
R402, 414. 417. 219. 439 . 506. 522. 535, 504, 304	10K	3229-103	.10
R424. 436	10K 1W	3232-103	.15
R521	10K 2W	3235-103	.10
R538, 437, 201. 545, 207, 546	12K	3229-123	.10
R411	15K	3229-153	.10
R604	15K 10W W.W	400106A-6	1.05
R548	18K	3229-183	.10
R511	22K	3229-223	.10
R404	22K 2W	3235-223	10
R416, 442	22K, 2W	3236-223	.25
R412	27K 1W	3232-273	.10
R418	33K	3229-333	.10
R435	47K	3229-473	.10
R307, 539, 313	68K	3229-683	.10
R229, 304 .. 534	100K	3229-104	.10
R537, 514	120K	3229-124	.10
R525	18K, 2W	3235-183	.25
R512	15K, 2W	3235-153	.25
R419	150K 5%	3228-154	.15
R228	220K	3229-224	.10
R420	270K 5%	3228-274	.15
R312, 433, 523, 407	330K	3229-334	.10
R314, 503, 501, 519, 502, 540, 509	470K	3229-474	.10
R536	560K	3229-564	.10
R443, 318	680K	3229-684	.10
R532	470K	3229-474	.10
R220, 223, 227, 319, 438 , 505 , 510, 516, 520, 601	1 Meg.	3229-105	.10
R427	1.5 Meg.	3229-155	.10
R530	2.2 Meg.	3229-225	.10
R421	2.7 Meg. 1W, 5%	3231-275	.25
R421	3.3 Meg	3229-335	.10
R413, R421 , R427	3.9 Meg.	3229-395	.10
R408	4.7 Meg.	3229-475	.10
R311	10 Meg.	3229-106	.10
R533	39K	3229-393	.10
R550	22K, 1W	3232-223	.10
R551	22K	3229-223	.10
R552	33K	3229-333	.10
R553	1 meg, 1W	3232-105	.15
R554. R555	10	3229-100	.10
R556	12K, 2W	3235-123	.25
R557	15K	3229-153	.10
R558	150K	3229-154	.10
R561	470, 2W	3235-471	.25
R562	270, 1W	3232-271	.15
R563	68	3229-680	.10

CAPACITORS

Electrolytic

Ref. No.	Description	Part No.	List
C601A	80 ufd., 400V.	750090B-33	4.75
B	40 ufd., 350V.		
C	10ufd., 350V.		
D	10 ufd., 25V.		
C602A	40 ufd., 350V.	750090B-36	3.60
B	10 ufd., 350V.		
C	100 ufd., 25V.		
D	25 ufd., 25V.		
C603A	80 ufd., 400V.	750090B-34	4.75
B	40 ufd., 400V.		
C	100 ufd., 50V.		
C602D*	25 ufd., 25V.	650228A-7	.75
C313	5 ufd., 150V.	650228A-10	1.05
C409	2 ufd., 150V.	650228A-11	1.00

*Used as a separate capacitor in early production only.

Ceramic

—All Ceramic Capacitors 500V. unless otherwise noted—

Ref. No.	Description	Part No.	List
C306	10 uuf., N150	650030A-16	.30
C307	47 uuf., N150	650030A-17	.25
C228	68 uuf., N150	650030A-15	.30
C320	100 uuf.,	650030A-14	.20
C525	500 uuf., 20KV.	650153B-2	1.90
C538, 539	1000 uuf., 600V.	450469A-7	.20
C205, 206, 207, 208, 209, 210, 213, 214, 218, 221, 222, 223, 224, 232, 233	1000 uuf.,	450469A-5	.20
C605, 606	1500 uuf.,	450469A-2	.25
C236, 305, 308, 318 , 607	5000 uuf.,	450469A-1	.25

Mica

—All Mica Capacitors rated 500V unless otherwise noted—

Ref. No.	Description	Part No.	List
C512	22 uuf., Silver Mica	2272-23220	.25
C509	100 uuf., Silver Mica	2272-23101	.25
C410	100 uuf., Silver Mica	2272-21101	.25
C411, 536	390 uuf.,	2272-21391	.25
C542	470 uuf., 1000V.	2272-61471	.50
C517	820 uuf., 5%	2272-41821	.25
C310	1000 uuf., 300V, 5% Silver Mica	650263A-12	.55
C510	1200mmfd. ±5%, Silver Mica	750272A-44	.80

Oil Paper Tubular

—All Tubular Capacitors 600V. unless otherwise noted—

Ref. No.	Description	Part No.	List
C311, 514, 518, 535, 537	.001 ufd.,	2248-1020	.25
C531	.0022 ufd.,	2248-2220	.25
C530	.0033mfd., 1000V	2249-3320	.30
C312. 316, 507	.0047 ufd.	2248-4720	.25
C508	4800mmfd. Total Capacity		
C314, 315, 317, 405 , 412, 516, 522	.01 ufd.,	2248-1030	.20
C511, 529, 541, 543	.022 ufd.,	2248-2230	.25
C533	.033 ufd.,	2248-3339	.30
C506	.047 ufd., 200V.	2246-4730	.20
C407, 515, 520, 521, 540, 405	.047 ufd.,	2248-4730	.30
C534	.068 ufd., 200V.	2246-6839	.30
C231, 235, 237, 406, 419, 519	.1 ufd., 200V.	2246-1040	.30
C229, 230, 532	.1 ufd.,	2248-1040	.35
C505	.22 ufd., 200V.	2246-2240	.35
C523, 524	.22 ufd., 400V.	2247-2240	.30
C544	120mmfd., 4KV	450954A-5	.30
C545	500mmfd., 30KV	453350A-1	4.00
C548	20mfd., 450V	650228A-12	1.75
C549	1mfd., 400V	2247-1050	.95
C550	.01mfd., 600V	2248-1030	.20
C551, C552	1100mmfd. ±10%, Tub. Ceramic (N750)	650261A-18	.65
C508			

Ref. No.	Description	Part No.	List
	Antenna Dipole	650598A-G1	.50
CR201	1N64 Crystal Diode		1.20
	Noise Limiting Switch	453166A-1	.25
	Ion Trap	650276A-6	.85
	Fuse, (0.2 amp)	450183A-2	.45
	Magnetic Focuser	750397A-1	8.70
	Ion Trap	650276A-5	1.20
	Beam Corrector Magnet	650683A-3	.80

CONTROLS

Ref. No.	Description	Part No.	List
R230, 310	Volume & Brilliance (1.5 meg., 200K)	453117C-1	2.10
R224	Contrast (1.5K)	453116B-2	1.25
R542	Vertical Hold (1 meg.)	453115B-1	.80
R531	Vertical Height (2.5 meg.)	452733A-1	.75
R529	V. Lin. 2K, 2W	450893A-2	1.35
R401	A.G.C. (10K)	453137A-1	.80
R513	Horizontal Drive (250K)	453114A-1	.80
R320	AM Rejection Control (200 ohm)	650642A-4	.60

TRANSFORMERS AND INDUCTANCES

Ref. No.	Description	Part No.	List
T602	Power Transformer	750351C-2	32.85
T501	Horizontal Sine Wave Osc.	750352B-1	2.80
T505	Width Transformer	650636A-1	1.75
T502	Horizontal Scan Transformer	850220D-1	12.10
L208	4.5 Mc. Trap	650591A-2	.65
L502	Deflection Yoke	850221B-1	13.25
L209	Peaking Coil ((300 uh)	650220A-5	.45
L210	Peaking Coil (140 uh)	650219A-10	.45
L214	Peaking Coil (115 uh)	650585A-8	.45
L501	Peaking Coil (11 mh)	650221A-1	.80
T302	Audio Output Transformer	650216A-1	2.35
L602	Filter Choke	650587C-2	3.30
T504	Horiz. Scan Transformer	850246A-1	13.25
L503	Defl. Yoke & Plug Assy.	850247B-1	25.65
T202, 203, 204	Video IF. Transformers	750349B-1	1.85
T205	Video Detector Transformer	750350B-1	5.90
T301	Ratio Detector Transformer	650584A-1	2.70
L201, 202	R. F. Choke (0.8 uh)	452667B-1	.10
L207	Choke (5.6 uh)	450338A-3	.20
L203, 204	Choke (2.2 uh)	450338A-4	.20
L205	Peaking Coil (75 uh)	650585A-1	.45
L206	Peaking Coil (250 uh)	650585A-2	.45
L211	Choke, 1st I.F. Grid	650590B-1	1.15
L301	Coil Assy., 4.5 Mc.	650591A-3	.65
L215	4.5 Mc. Trap	453225A-1	.80
T506	Vert. Output Transformer	750398A-1	4.70

MISCELLANEOUS

Ref. No.	Description	Part No.	List
	Socket-Speaker and Phono	450972A-2	.10
	Pilot Lamp	600093A-8	.15
	Width Control Core	453118A-1	.35
	H.V. Anode Cable	650049A-6	.40
	CRT Socket	650596C-2	1.20
PC501	Vertical Integrator (Printed Circuit)	453214A-1	.90
	Centering Ring (Picture Tube)	650471A-2	1.30
	Interlock Receptacle	452580A-2	.20
	R.F. Tuner	850222B-1	54.90
	Pilot Lamp Socket Assy	453120A-1	.25

CABINET PARTS 12F272M

Description	Part No.	List
Antenna Binding Post	450439A-3	.25
Speaker 10" PM	850179A-3	10.50
Safety Glass	850248A-1	35.65
Mask	950189A-1	11.55
Knob (Vertical Hold)	650592A-1	1.10
Knob (Contrast)	650592A-2	1.10
Knob (Fine Tuning)	650593A-1	.40
Knob (Shading)	650593A-2	.40
Knob (Off-On)	650594B-G4	1.50
Knob (Channel)	650594B-G7	1.70

PARTS LIST—R. F. TUNER 850222B-1

RESISTORS

Ref. No.	Description	Part No.	List
R101, 105	220K	3229-224	.10
R102	180K	3229-184	.10
R103	470	3229-471	.10
R104, 107, 110	15K	3229-153	.10
R108	47K	3229-473	.10
R109	4.7K	3229-472	.10
R111	10K	3229-103	.10

CAPACITORS

Ref. No.	Description	Part No.	List
C105	120 uufd.	451064A-1	.30
C103, 106, 112, 114, 115, 118	1000 uufd.	451061A	.25
C109	5 uufd.	451215A-1	.60
C110	10 uufd.	451063A-1	.30

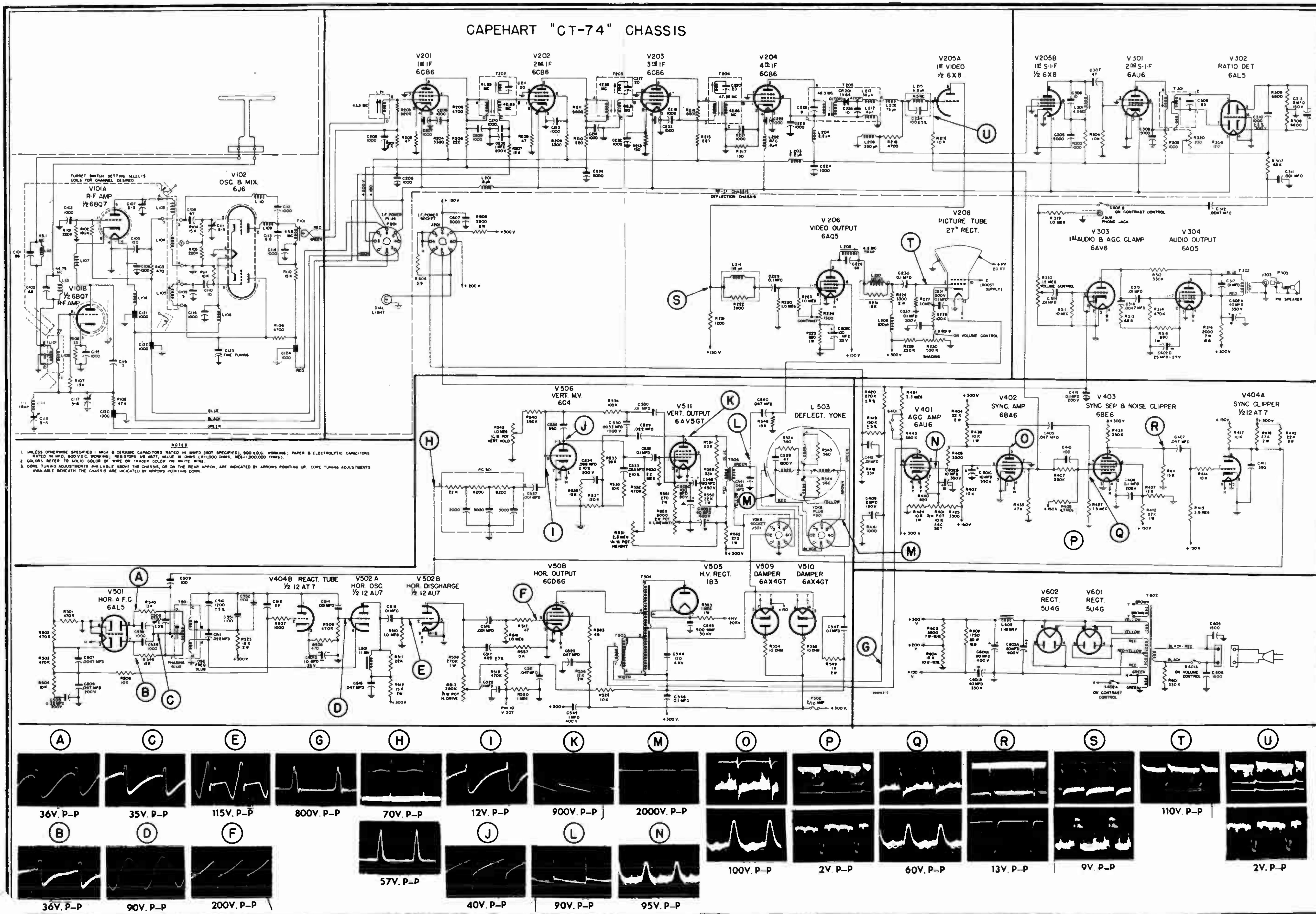
MISCELLANEOUS

Description	Part No.	List
Fine Tuning Assy.	451326A-1	2.15

INDUCTANCES

Ref. No.	Description	Part No.	List
T101	I.F. Transformer	451327A-1	1.30
L106	R.F. Filament Choke	451306A-1	.35
L107	Cathode Coil	451329A-1	.35
L108	Osc. Filament Choke	451307A-1	.35
L110	Neutralizing Coil	451328A-1	.35
	45.1 Mc. Trap Assy.	451330A-1	1.30
	44.75 Mc. Trap Assy.	451331A-1	1.30
	Series Trap Assy.	451332A-1	1.30
	Antenna Coil Assy. Ch. 2	451324A-2	1.30
	Antenna Coil Assy. Ch. 3	451324A-3	1.30
	Antenna Coil Assy. Ch. 4	451324A-4	1.30
	Antenna Coil Assy. Ch. 5	451324A-5	1.30
	Antenna Coil Assy. Ch. 6	451324A-6	1.30
	Antenna Coil Assy. Ch. 7	451324A-7	1.10
	Antenna Coil Assy. Ch. 8	451324A-8	1.10
	Antenna Coil Assy. Ch. 9	451324A-9	1.10
	Antenna Coil Assy. Ch. 10	451324A-10	1.10
	Antenna Coil Assy. Ch. 11	451324A-11	1.10
	Antenna Coil Assy. Ch. 12	451324A-12	1.10
	Antenna Coil Assy. Ch. 13	451324A-13	1.10
	R.F. & Osc. Coil Assy. Ch. 2	451325A-2	1.70
	R.F. & Osc. Coil Assy. Ch. 3	451325A-3	1.70
	R.F. & Osc. Coil Assy. Ch. 4	451325A-4	1.70
	R.F. & Osc. Coil Assy. Ch. 5	451325A-5	1.70
	R.F. & Osc. Coil Assy. Ch. 6	451325A-6	1.70
	R.F. & Osc. Coil Assy. Ch. 7	451325A-7	1.60
	R.F. & Osc. Coil Assy. Ch. 8	451325A-8	1.60
	R.F. & Osc. Coil Assy. Ch. 9	451325A-9	1.60
	R.F. & Osc. Coil Assy. Ch. 10	451325A-10	1.60
	R.F. & Osc. Coil Assy. Ch. 11	451325A-11	1.60
	R.F. & Osc. Coil Assy. Ch. 12	451325A-12	1.60
	R.F. & Osc. Coil Assy.	451325A-13	1.60

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE



CAPEHART-FARNSWORTH TV PAGE 12-7

SPECIFICATIONS

Power Source Rating:

Frequency .... 60 cycles
Voltage .... 117 volts
Wattage (TV Operation) .... 210 watts

R-F Tuning Range:

VHF TV Channels .... Nos. 2 through 13
UHF TV Channels .... (Refer to "Adaptability to UHF")

Intermediate Frequencies:

Picture I-F Carrier .... 45.75 MC
Sound I-F Carrier .... 41.25 MC
Intercarrier Sound I-F .... 4.5 MC

Antenna Input:

Impedance .... Balanced 300 ohms

Audio System:

Type Speaker .... PM Dynamic
Voice Coil Impedance .... 3.2 ohms
Power Output (Max. Undistorted) .... 2.0 watts

Tube Complement:

REF NO.	TYPE	FUNCTION
V101	6BQ7	R-F Amplifier
V102	6J6	Mixer-Oscillator
V201	6CB6	1st I-F Amplifier
V202	6CB6	2nd I-F Amplifier
V203	6CB6	3rd I-F Amplifier
V204	6CB6	4th I-F Amplifier
V205	6X8	Triode Unit, 1st Sound I-F Amplifier Pentode Unit, 1st Video Amplifier
V206	6AQ5	2nd Video Amplifier
V301	6BN6	Audio Detector
V302†	6BK5	Audio Power Output
V401	6AU6	Keyed AGC Amplifier
V402	6BE6	Sync Separator & Noise Clipper
V403	12AU7	1st Triode, Phase Splitter 2nd Triode, Hor. Phase Det.
V501	6BF6	Vertical Osc. & AGC Clamp
V502	6V6	Vertical Output
V503	12AU7	Horiz. Oscillator
V504	6BQ6	Horizontal Output
V505	1B3-GT	H. V. Rectifier
V506	6W4	Horizontal Damper
V601	5U4G	L. V. Rectifier
V207*	17LP4 or 21FP4	Picture Tube
CR201	1N64 (Germanium Diode)	Video Detector

*The 17LP4 is used in Chassis No. CT-75 and the 21FP4 is used in Chassis No. CT-77 & CT-81.
†Not included in Chassis No. CT-81.

GENERAL INFORMATION

CHASSIS PRODUCTION RUN CODING

To facilitate and coordinate the handling of production changes both in the factory and in the field a production run coding system has been established for these chassis. The initial production is coded as follows:

The R.F-I.F. chassis will be stamped just forward of the R.F. Tuner with either R-1 or CR-1. Both designations will indicate the first production run.

The Deflection Chassis will be stamped on the rear apron above the width control with a D-1.

Minor circuit changes will not affect this coding, however, when a major change is made, for example in the Deflection Chassis, the code will be changed to D-2.

REMOVING CHASSIS FROM CABINET

To gain access to the chassis the cabinet back must first be removed. The back is held in place by several small wood screws. When shipped from the factory, the chassis is bolted to the cabinet shelf by six mounting bolts. These are ⅜" head, hex-head machine bolts. The two bolts near the center of the chassis are shipping bolts and it is not necessary that these be replaced after servicing the chassis. After removing the chassis mounting bolts, the control knobs and the speaker cable, the chassis may be slid out of the rear of the cabinet. On some table model sets it will be necessary to remove the speaker from the cabinet before removing the chassis.

For servicing, it is suggested that the chassis be placed on the bench on its left side.

CAUTION — The normal safety precautions should be taken when handling this chassis since the picture tube is highly evacuated. Any weakening of the picture tube glass caused by chipping, scratching or abnormal pressure may cause implosion.

Installation Instructions

After the instrument has been unpacked the following inspection checks and adjustments should be made before placing the instrument in operation.

1. General appearance and condition of cabinet.
2. All tubes in place in their respective sockets.
3. Mechanical operation of all front panel controls.
4. Inter-connections, speaker cable, picture tube H.V. Anode cap and socket connector.

POWER SOURCE

This instrument is designed to operate from an alternating current (AC) power source of 117 volts, 60 cycles. It is suggested that in all cases it be determined in advance that the power source available will meet these requirements.

ANTENNA CONNECTIONS

These instruments incorporate a "built-in" television antenna which will provide good reception on all VHF television channels in areas where signal strength is sufficient. When installing an external antenna, either indoor or outdoor type, the lead from the "built-in" TV antenna must be disconnected from the antenna terminal at the rear of the cabinet and the lead-in from the antenna in use must be connected in its place.

For information concerning antenna installation for UHF reception refer to page 17.

REMOVAL OF SAFETY GLASS ESCUTCHEON

Should it be necessary, the safety glass is removable from the front of this instrument. The glass is fitted into slots in the sides of the cabinet and held solidly in place by a strip of felt which is inserted in the right hand slot between the glass and the cabinet.

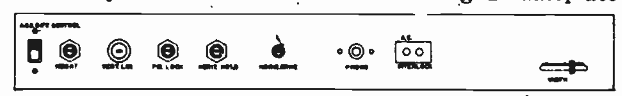
TO REMOVE THE GLASS:

1. Slide back the small catch, located at the right front of the cabinet (facing front of the cabinet) on the underside of the chassis shelf. It will be necessary to loosen the screw which holds the catch in place before it can be slid back. Note: On table model sets a metal plug button is used instead of the catch, on these sets the plug can be pried loose with a screwdriver.
2. From the exposed hole (formerly covered by the catch) pull out the strip of felt.
3. After removing the felt, slide the glass to the right until it is free of the cabinet slot at the left.
4. Tilt the glass forward at the left and remove from the cabinet. With the glass removed the CRT mask can also be removed.

NOTE: A small rubber suction cup (such as a CRT H.V. Anode cup) can be used to assist in removing the glass from the cabinet.

LOCATION OF SECONDARY CONTROLS AND ADJUSTMENTS

There are four primary operating controls and four secondary controls (concealed by the hinged nameplate) accessible to the owner from the front of the instrument. The primary controls on the left are: Off-On Volume (front) and Contrast (rear) and on the right: Channel Selector (front) and Fine Tuning (rear). The secondary controls located behind the hinged nameplate



are: TV-Phono Tone control, Shading, Vertical Hold and Horizontal Hold (top). On sets not having a TV-Phono Tone Control the secondary controls are from left to right Shading, Horizontal Hold and Vertical Hold.

Mounted on the rear chassis apron and accessible from the rear of the instrument are the Height, Vertical Linearity, Picture Lock and Rear Horiz. Hold. These are all potentiometer controls and with exception of Vert. Lin. are easily adjustable by hand. The Vert. Lin. is a recessed screwdriver adjustment. Also mounted on the rear apron is the Width control which is provided with a sliding adjustment for quick set-up. The Horizontal Drive is a trimmer which is accessible through a small hole in the rear of the chassis apron. In addition to these controls a Switch referred to as the AGC Differential Control is located on the rear apron.

SET-UP ADJUSTMENTS

Final adjustment of the various "set-up" controls should be made at the time of installation of the receiver. The receiver should be given a thorough operating test at the same time, and, of course, the owner should be instructed as to the operation of the various controls on the front panel. The owner should be cautioned that the "set-up" controls should be adjusted only by an experienced television serviceman.

Preliminary Checks:

1. Remove the cabinet back and connect the receiver to an AC source, using a "cheater cord" (A line cord that can be plugged into the AC Interlock receptacle on the rear of the chassis).
2. Turn the receiver on and adjust the TV-Phono-Tone switch to either the TV Bass or TV Treble position. The Shading and Contrast controls should be adjusted to approximately one half of full rotation. If a raster is not seen after allowing time for the tubes to warm up, immediately adjust the Ion Trap Magnet to obtain a raster. Upon obtaining a raster, continue to adjust the magnet (by sliding back and forth and rotating about the neck of the CRT) to obtain maximum brightness and good focus.
3. Check to see the Deflection Yoke is flush against the bell of the CRT. If the raster is tilted, loosen the wing screw on top of the yoke and rotate the yoke to correct the tilt.
4. Connect the lead wire from an antenna to the terminals on the rear of the set. Be sure to remove the lead wire from the "built-in" antenna from these terminals when using an outside antenna.
5. Set the Channel knob to a channel on which a program is being transmitted.
6. Adjust the Fine Tuning and Contrast controls to obtain the best reception. Tune for the sharpest detail in the picture.
7. Adjust the Shading control for the desired brightness and the Volume control for the desired volume. Check the Sound quality.
8. Adjust the Vertical Hold control if the picture rolls vertically.
9. Adjust the (Front) Horizontal Hold control from one extreme to the other and note the amount of picture shift. The picture should be properly phased when the front Horizontal Hold control is in the center of its mechanical range. When adjusted to both extremes the control should vary the picture phasing by an equal amount. If these conditions do not exist, follow the procedure listed under "Adjustment of Horizontal Oscillator".

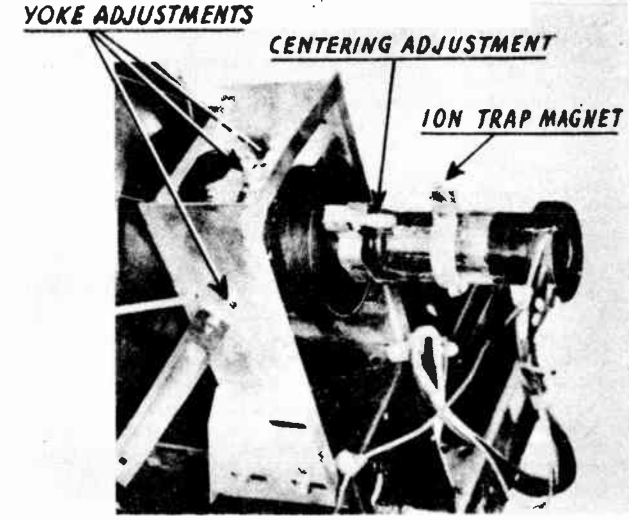
Picture Lock Adjustment:

10. Rotate the PIX. LOCK control to the extreme clockwise position and then back it off slowly while observing the picture. As the control is backed off the picture will shift slightly to the left. The control should be set to the position immediately prior to the point where it causes the picture to shift.
In extreme noisy and weak signal areas the Pix Lock control should be adjusted in conjunction with the sync controls to provide the most stable operation.

Picture Centering:

11. To center the picture on the CRT screen, adjust the knurled knob on the centering magnet, and, if necessary, rotate the centering magnet on the CRT neck.

YOKE ADJUSTMENTS



If the picture cannot be centered, loosen the wing screw on the centering magnet and reset its location on the CRT neck until centering can be achieved with the centering adjustment.
The centering magnet should be located as close to the yoke as possible. If corner cutting is experienced, loosen the two adjustment screws on either side of the deflection yoke and push the yoke as far up on the bell of the CRT as possible. Also center the yoke on the tube neck and tighten the adjustment screws.

Picture Size and Linearity:

12. Adjust the Horizontal Drive Trimmer and Width control to obtain the proper picture width and horizontal linearity. The Horizontal Drive should be adjusted first to provide maximum scan and then the Width control should be used to adjust for the proper horizontal size. If a vertical white line (or lines) appears in the picture, turn the Horizontal Drive Trimmer in slightly.

13. Adjust the Height and Vertical Linearity controls to obtain proper height and vertical linearity. It may be necessary to adjust the Vertical Hold control while making these adjustments, if the picture should roll. (On sets employingBeam Corrector Magnets refer to instructions for adjustment on page 18.

Final Check:

14. In sequence, set the Channel knob to all channels on which reception is obtained. Adjust the receiver for operation as outlined in the Owner Operating Instructions. Check the quality of reception, picture and sound on all available TV stations in the area.
    NOTE: If a degree of "background noise" is noticed on moderate signals the AGC Differential Control should be placed in the DOWN position. If no background noise is apparent with the control in the UP position, it should be left in this position.
15. Recheck the Ion Trap Magnet setting for good picture focus.
16. On receivers using the turret type R-F unit check to see that best reception is obtained on all channels with the Fine Tuning control set to the approximate center of its range. This can be obtained by making the adjustments outlined under "Oscillator Adjustments Using a TV Signal."
17. Remove the "cheater cord" and replace the cabinet back.

ADJUSTMENT OF HORIZONTAL OSCILLATOR

The procedure outlined here should be followed if the adjustment described in Step 9 cannot be properly made:

1. Remove the cover from the rear of the H.V. compartment and connect a shorting jumper between the two terminals which are provided on a lug strip just inside the H. V. compartment. This jumper is used to short out L501, the Horiz. Ringing Coil during the following adjustment.
2. Remove the 6BE6 tube (V402) and adjust the Rear Horizontal Hold control so that when the front Horizontal Hold control is set to the center of its range there is approximately 1/4" between the edge of the picture and the right edge of the raster.
3. Remove the short from across L501. Adjust the slug of the ringing coil (L501) so that with the Front Horizontal Hold control set to the center of its range the picture is properly phased as outlined in step 2.
4. Replace the 6BE6 tube and check the pull-in range of the circuit by setting the Front Horizontal Hold control to extreme clockwise position and switching off channel momentarily to interrupt the signal. If the picture breaks sync horizontally, slowly rotate the Front Horizontal Control and observe the least number of diagonal blanking bars visible before the picture synchronizes. Pull-in should occur at 1½ to 2½ bars. Repeat this adjustment with the Front Horizontal Hold control in the opposite extreme position.

OSCILLATOR ADJUSTMENT USING A TELEVISION SIGNAL

1. Turn set on and allow sufficient time for set to reach normal operating temperature.
2. Turn Channel selector to the channel to be adjusted and adjust Shading, Contrast and Volume controls for normal sound and picture. Set the Fine Tuning control to the midpoint of its range.
3. Remove Channel and Fine Tuning knobs and adjust the oscillator slug for that channel, using a small non-metallic screwdriver. When the CHANNEL selector is set for a particular channel, the oscillator "slug" for that channel is accessible through a small hole in the front of the tuner chassis.

Adjust the oscillator slug for the clearest and sharpest detail in the picture. At this point the sound should be best, but not necessarily the loudest.

NOTE: BE CAREFUL NOT TO TURN THE SLUG TOO FAR, AS IT MAY FALL COMPLETELY OUT OF ITS MOUNTING.

ADJUSTMENT OF QUADRATURE COIL AND NOISE REJECTION CONTROL

Adjustment of the Quadrature Coil (L302) and Noise Rejection Control (R307) should be made at the time the instrument is installed to insure the best sound reproduction. Access to these adjustments has been provided from the front of the instrument. With a station properly tuned in remove the Volume and Contrast Knobs.

Adjustment of the Quadrature Coil can be made by inserting an alignment tool through the bottom hole that is located behind the Volume and Contrast Knobs. Adjustment of this control should be made for the strongest and clearest sound.

The Noise Rejection Control can best be set with the signal attenuated until background noise is apparent in the sound. With the signal attenuated adjust the control for minimum background hiss and noise. This control is located behind the top hole that is exposed by removing the Volume and Contrast Knobs.

General Description

The Capehart "CX-37" TV Chassis is a two-piece chassis containing 21 tubes, including the Picture Tube and two Rectifiers. The front section of the chassis, the R-F - I-F Unit, bolts to the rear section of the chassis which is the Sync Deflection Unit. The chassis features a tilted I-F strip for ease in adjustment and replacing tubes. Complete isolation is obtained between the R-F - I-F Stages and the Deflection circuits.

The front portion of the R-F - I-F Unit forms a solid mount for the picture tube while the H.V. Section serves as a rear mount for the CRT and Deflection Yoke. The H.V. Section is a separate unit which is easily removable from the chassis for servicing.

The chassis is designed for use with the new low-voltage electrostatic focus picture tubes which employ the new cylindrical face for reduced reflection. Mounting arrangement of the CRT allows removal from the front of the cabinet without removing the chassis.

There are three versions of the "CX-37" TV Chassis. These are the basic units, Chassis No. CT-75 and CT-77 (using 17" and 21" rectangular picture tubes, respectively), and Chassis No. CT-81 (similar to CT-77 except for the deletion of the audio circuits. This chassis is designed for use in conjunction with a separate radio chassis). The following circuit descriptions refer to the basic units, the CT-75 and CT-77.

The R-F Tuning Unit

The R-F Tuner used in this chassis is the "Cascode" Tuner employing two tubes; a type 6BQ7 tube and a type 6J6 tube. The 6BQ7 tube is used as a driven-grounded grid (Cascode) R-F Amplifier. Effectively this is a two-stage amplifier which combines the equivalent gain of a pentode with the low-noise factor of a triode. This combination results in a greatly improved signal-to-nosie ratio which means less "snow" in weak and low signal areas.

There are two traps connected in series with the antenna input. These are parallel-resonant traps formed by L112 & C101 (fixed tuned to 45.1 MC) and L113 & C102 (fixed tuned to 44.75 MC) which provide the desired amount of attenuation of signals within the I-F pass band at the input to the R-F Amplifier. In addition to these traps, a series-resonant adjustable trap (formed by L111 and C116) is provided in the input grid circuit of the R-F Amplifier. The capacitor, C116 (the variable portion of the trap) can be adjusted to provide maximum rejection of any interfering signal within the I-F pass band. Thus, the R-F circuits are highly selective and provide maximum rejection of unwanted signals. In addition to this, the tuner is completely shielded to prevent radiation from the local oscillator and also, to prevent pickup of unwanted signals in the various tuned circuits.

The 6J6 tube is used as a mixer and oscillator in circuits very similar to those used in the earlier Standard Coil Tuners. The mechanical arrangement and switching on this tuner is also the same as the earlier tuner.

Common I-F Amplifier Stages

The Capehart CX-37 chassis employs four stages (4 type 6CB6 tubes) of common I-F amplification. In accord with present RTMA Recommendations, the frequency of the I-F stages is in the 40 MC region. The use of the higher intermediate frequency eliminates the problem of local oscillator radiation in the existing television channels. The principles of intercarrier sound are employed wherein both the picture and sound information are amplified simultaneously throughout the I-F stages and are then separated after heterodyning in the Video Detector.

Using the intercarrier sound principle, the sound I-F carrier must be kept at a considerably low level with reference to the picture carrier level. In order to maintain the proper difference in amplitude between the two carriers, a 41.25 MC trap is included in the coupling transformer (T202) between the 1st and 2nd I-F stages.

Coupling between the mixer and the 1st I-F stage is by means of a low impedance overcoupled circuit. The coil in the grid circuit of the 1st stage and the mixer plate transformer form a tuned overcoupled circuit centered at 43.5 MC. The 2nd, 3rd and 4th stages and the Video Detector are coupled by means of Bifilar I-F coils. The "Staggered-Pairs" system of tuning is used wherein the 2nd and 4th coils are tuned to the low-frequency side of the I-F bandpass (42.65 MC) and the 3rd and 5th coils are tuned to the high side (45.3 MC) while the 1st coil in the grid of the 1st stage is tuned near the center of the pass band.

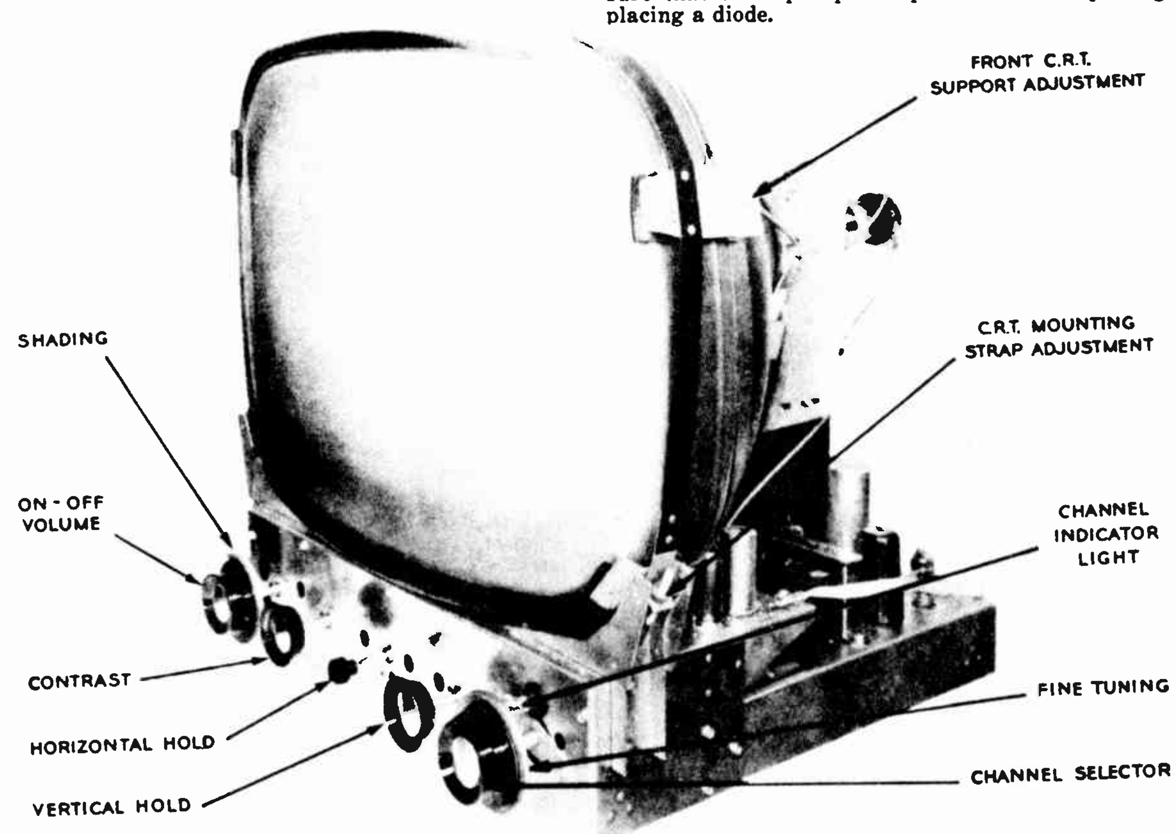
The use of bifilar-wound transformers allows a coefficient of coupling to be achieved which approaches unity. The coupling capacitor such as used with impedance coupling is not necessary with this type of transformer. The bifilar coils provide improved noise immunity due to the low resistance presented in the grid circuits by the secondary winding. Noise pulses of sufficient amplitude would develop a charge on a coupling capacitor, if used, which in turn would cause a momentary increase in bias and subsequent reduction in stage gain. The noise pulse itself, which modulates the carrier toward the black level, is not objectionable; however, each pulse is followed by a white tail (or streak) which has an undesirable effect both on picture and sync.

Each bifilar coil is tuned by a threaded powdered-iron core which is adjustable from the underside of the chassis. All trap adjustments are available from the top of the chassis and are provided with hex-nuts for easy adjustment by hand. The 1st trap is tuned to the Co-Channel Sound I-F and the 2nd and 3rd traps are both tuned to the Adjacent Channel Sound I-F.

The 1st and 2nd I.F. stages are actually connected in series DC-wise as can be seen from the current distributor diagram on the schematic diagram; the stages are, therefore, referred to as being "stacked". B plus for all of the I.F. tubes is taken from the +300 volt source. The cathodes of the 3rd and 4th stages are returned to +135 volts while the 2nd stage is returned through the 1st to chassis ground. AGC voltage is applied to the grid of the 1st stage and due to its series DC connection, the 2nd stage is also AGC controlled.

Video Detector

The Video Detector is a germanium crystal diode, type 1N64. The diode is mounted on the top terminals of the last I-F transformer (T205). The diode is readily accessible by removing (pull-off) the top cap of the I-F shield can. By enclosing the diode within the shield can harmonic radiation from the crystal is prevented. The Detector Circuit is filtered to eliminate harmonic feedback also. Because of its accessibility, the diode can be replaced, if need be, with the chassis in the cabinet. When replacing a crystal diode, care should be taken not to apply excess heat which may possibly damage the crystal. Always be sure that the top cap is replaced after inspecting or replacing a diode.



Video Amplifier

Two stages of video amplification are employed in this chassis; the pentode section of a 6X8 and a pentode 6AQ5 tube. The rectified output of the Video Detector developed across the video detector load resistor is coupled directly into the grid of the 1st Video Amplifier (V205A). The amplified output of this tube is then coupled through a peeking network into the grid of the 2nd Amplifier, a 6AQ5 tube (V206).

Variation of contrast is provided by a potentiometer in the cathode circuit of the 2nd amplifier. The output of this tube is coupled through a series peaking coil and a coupling capacitor into the grid of the picture tube.

By providing a 2 volt signal at the output of the video detector a signal of 125 volts peak-to-peak or more is available at the CRT grid through the use of two video amplifier stages. The method of selective peaking employed in these stages is designed to provide emphasis of certain portions of the video response. This emphasis assures reception of sharp, clear pictures even though the transmitted signal may not contain high definition video.

A slug tuned 4.5 MC trap is included in the plate circuit of the 2nd Video Amplifier to prevent the beat signal, developed in the detector, from reaching the CRT grid.

The new cylindrical face Electrostatic Focus picture tube is used with this chassis. The CRT is the low voltage focus type which requires a voltage of approximately 550 volts at the focus anode. Focus is completely automatic—no focus control is needed. Variation of brightness is accomplished by a potentiometer (Shading control) in the cathode circuit of the CRT.

Sound I-F Circuits

The Sound I.F. Circuits are of the 4.5 Mc. intercarrier type. The 4.5 Mc. beat between the picture and sound carriers that is produced in the video detector is amplified with the video information by the pentode section of the 6X8 (V205). The 4.5 Mc. signal is removed from the video amplifier by a 4.5 Mc. Trap consisting of L301 and C306. This trap effectively couples the 4.5 Mc. information from the video amplifier plate circuit to the grid of the sound I.F. amplifier (V205B) for additional amplification.

Detection of the 4.5 Mc. FM signal takes place in the 6BN6 Gated Beam Detector (V301). The 6BN6 provides FM detection through an unusual constructional feature. The tube is so constructed that a beam of electrons flowing from cathode to plate can be cut off with a small amount of signal applied to either the first (limiter) grid or the third (quadrature) grid. By connecting the quadrature grid to a 4.5 Mc. resonant circuit the signal is coupled to the quadrature grid through the electron stream of the tube with a phase shift of 90°. As the frequency of the applied signal is varied around 4.5 Mc. (as with FM) the phase shift between the limiter grid and quadrature grid will vary. As the phase shift varies the electron stream will be allowed to flow to the plate for a longer or shorter length of time. The length of time that plate current flows is exactly in step with the phase shift variations and thus follows the frequency shift of the incoming signal. The audio signal appears across R309 as a result of the plate current flow of V301. Limiting to reject any AM signal is achieved in the tube when the signal exceeds an amplitude of bias set by the Noise Rejection Control (R307).

Audio Amplifier

The audio signal that is present across R309 is coupled through the TV-Phono switch mounted on the Contrast Control, coupling capacitor C312 and the Volume control R311 to the grid of the audio output tube (V302). Through the large audio signal that is supplied by the detector and the high sensitivity of the 6BK5 output tube no first audio amplifier stage is required. The output of the audio amplifier is supplied to a speaker connector on the chassis through the output transformer T301.

A phono input jack is mounted on the rear panel so that a record changer can be connected and used if desired. The phono input is connected to the amplifier when switch S301 is actuated by turning the contrast control to its maximum counter-clockwise position.

Keyed Automatic Gain Control

A type 6AU6 Tube (V401) is employed as a Keyed AGC Amplifier. The grid of this tube is DC coupled to the plate of the 1st Video Amplifier tube (V205A). The signal appearing at this point is a sync-positive composite video signal. The white portions of the signal may be crushed, but this does not affect the AGC action because of direct coupling from the second detector to the AGC amplifier).

The screen voltage of the first video amplifier (V205A) is supplied from +300V through a 33K resistor (R241) and the AGC control (R238). By varying the screen voltage on the video amplifier the amplification of that stage and thus the amount of signal that is aplied to the grid of the AGC amplifier is set.

The plate of the AGC amplifier is pulsed with a 700 volt positive pulse, derived from a secondary winding on the horizontal width coil. The duration of this pulse is only for the retrace time of the horizontal deflection system. This coincides with the received sync pulse applied to the grid of the AGC amplifier tube, provided the horizontal oscillator is in sync, and properly phased. Thus the AGC amplifier tube operates as a keyed rectifier tube.

During the time of conduction of this tube, the capacitor C403 is charged negatively. When the tube stops conducting (during the interval between horizontal pulses) C403 discharges through R406 and R407 developing a voltage across these resistors which is divided and applied to the controlled stages as bias.

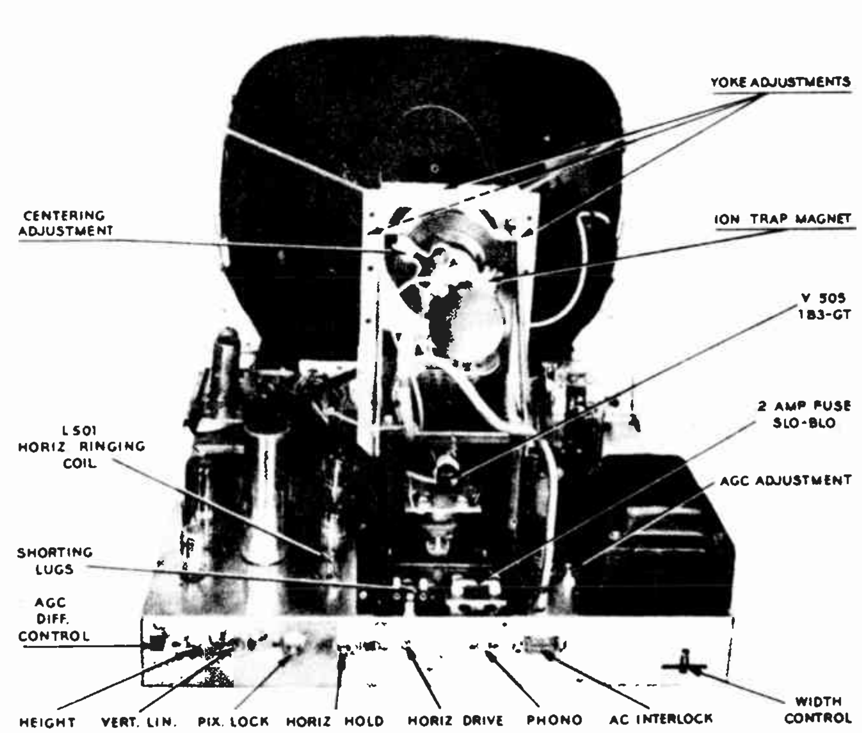
As the strength of the received signal increases, the peak sync voltage developed at the plate of the video amplifier tube (V205A) increases and thus increases the current output of the AGC amplifier tube. This results in a more negative AGC voltage being developed, which reduces the gain of the controlled stages.

Bias for the R.F. Amplifier is taken off across both R406 and R407, while bias for the I.F. stage is taken off at their junction. The diode section of V501, 6BF6 tube is used as an AGC clamp. The plate of this diode is connected to the R.F. bias point. The plate of this tube is also connected, through R409 & R410 (in series) to +300 volts. With a weak signal input, this diode holds the R.F. bias at zero or just above. If the signal were to be increased gradually the voltage developed across R406 and R407 would eventually become sufficiently negative to cause the diode plate to go negative. With the diode negative it no longer controls the R-F bias and hence the bias is allowed to increase rapidly. The circuit is so designed that the diode will hold the R.F. bias to zero until the signal becomes strong enough to provide a snow-free picture without maximum R-F Amplifier gain. The switch, S401 is used to vary the point at which the diode loses its control and in this manner affords a compensation for circuit variables.

SYNC SEPARATION AND NOISE CANCELLATION

The amplification and shaping of the horizontal and vertical sync pulses plus the removal of noise bursts that would be harmful to the stability of the scanning circuits is accomplished by the 6BE6 Sync Separator (V402) and one section of a 12AU7 (V403A) used as a Phase Splitter.

The composite video signal is applied to the signal grid (pin 7) of the 6BE6 through a .01 mfd. coupling capacitor (C406). Through a combination of no fixed bias, low plate voltage and a positive going sync pulse, grid current flows charging C406 to the amplitude of the sync pulses. Capacitor C406 partially discharges through 1.5 megohm grid resistor (R417) during the interval between pulses, setting a bias on the grid that is equal to the amplitude of the pulse. This bias effectively clamps the tip of the sync pulses to ground potential. Since the video information is negative with respect to the sync pulses, this portion of the applied signal cuts the tube off permitting no plate current to flow at the intervals between pulses. Thus the sync pulses are effectively stripped from the composite signal.



To eliminate positive going noise pulses that could be passed through the sync separator and cause unstable sync a noise cancellation circuit is used. A small amount of the video information is coupled from the video detector load through a 47K isolation resistor (R221) to the first grid of the 6BE6 (pin 1). This signal is 180° out of phase with the signal applied to the signal grid (pin 7). The bias on the first grid is set so that with a normal signal, plate current is allowed to flow all of the time. If a noise pulse arrives at this grid that is of the same polarity and of greater amplitude than the sync pulses then the plate current is cutoff for the period of time that the noise pulse is actually present. During this time no sync information is passed to the control circuits of the oscillators but the stability of the oscillators is such that they will remain in sync during this short time interval.

The sync information that is present at the 6BE6 plate load (R419) is coupled to one-half of a 12AU7 (V403A). The vertical control pulses are amplified and passed on to the vertical integrating circuit (PC501). The horizontal pulses are removed from both the cathode and plate circuit of the tube in a phase splitting action. By removing the horizontal pulses across balanced load resistors (R422 and R423) pulses are supplied to the Horizontal Phase Detector (V403B) that are of equal amplitude and opposite in phase.

Vertical Multivibrator & Output

The vertical scanning pulses are developed in a conventional two-tube multivibrator and discharge circuit using a 6V6 (V502) and a 6BF6 (V501) height necessitating readjustment of the Height control. This circuit provides the sharp pulse which is required to develop a sawtooth of current in the vertical winding of the deflection yoke.

Vertical sync pulses are coupled into the vertical MV circuit from the output of the Phase Splitter through the vertical integrator network and injected at the grid of the 6BF6 (V501).

The free-running frequency of the MV is controlled by the setting of the Vertical Hold control which is connected in the grid circuit of the 6BF6 tube. The Vertical Hold is provided as an owner operating control on the front panel.

The Height control (R531) varies the amplitude of the sawtooth wave on the plate of the 6BF6 by controlling the rate of charge of the capacitor C533.

The Vertical Linearity control (R529) varies the cathode bias on the output tube (V502). The grid voltage-plate current curve of this tube is not a straight line over its entire range; therefore, the effect of varying R529 produces variations in the shape of the sawtooth wave by shifting the operating point of the tube to different points along its characteristic. The effective gain of this tube will be varied as the operating point is shifted: therefore, adjustment of the Linearity control will affect picture height necessitating readjustment of the height control.

Horizontal Oscillator and AFC Circuit

Automatic control of the Horizontal Oscillator is accomplished by the Horizontal Phase Detector circuit which employs one-half of a type 12AU7 tube. The plate of this tube (V403B) is pulsed by a 15750 cycle pulse which is coupled from the plate of the AGC Amplifier tube (V401). Before application to the plate of V403B the pulse is integrated and reduced in amplitude by the combination of R507, R502, C510 and C509 and, therefore, appears as a sawtooth pulse of approx. 20 volts peak-to-peak amplitude. In the grid-cathode of V403B is a balanced resistor circuit composed of two 82K resistors (R503 & R504). A positive going sync pulse is applied through C506 to the grid of this tube. The positive pulse on the grid causes the tube to draw grid current which in turn develops a potential across the two 82K resistors. Circuit values are chosen such that when the sync pulse applied to the grid and the sawtooth (derived from the Horiz. Oscillator) applied to the plate are in step, the resultant voltage at the center of the two 82K resistors will be approximately zero (position of Hor. Hold Control will affect this voltage due to AFC action). If the oscillator should shift slightly, an out-of-phase condition will result. As a result of the difference in phase between the plate and grid, the potential on the plate at the instant of arrival of the sync pulse at the grid will be either more or less positive depending on the direction of the shift. The change in plate potential will cause a corresponding change in plate current and as a result cause the potential at the center of the two 82K resistors to shift in either a positive or negative direction from zero. The voltage obtained at the center of these two resistors is fed through a filtering network to the Horizontal Oscillator and is used to control the oscillator frequency.

R506 is used as the DC plate return for V403B. The capacitor C505 feeds a negative going sync pulse into the cathode of V403B. This negative pulse serves to cancel the positive pulse, at the center of the two 82K resistors, which otherwise would be coupled through to the oscillator. In addition to the noise immunity afforded by the Noise Cancellation circuit employed in the sync circuit a certain amount of immunity to noise is provided by this arrangement. A further advantage is provided by this circuit design in that should the sync pulses be interrupted for a period of time, there will be no grid current drawn in the tube and hence the point of take-off of the control voltage will be zero. This leaves the oscillator free-running and it is sufficiently stable to maintain its frequency until control is re-established.

The Horizontal Oscillator V503, a 12AU7 type tube is connected as a cathode-coupled multivibrator, with an L-C circuit (L501 and C515) in series with the plate-load resistor R509 of the first triode section. This type of oscillator combines the pull-in sensitivity of the multivibrator with the stability of a sinusoidal circuit.

The operating frequency is set at 15,750 cycles with the L-C circuit shorted out. With the Front Horizontal Hold control (R511) set to the center of its range, the rear Horizontal Hold control (R512) is adjusted so that a picture or test pattern is properly synchronized horizontally. After removing the short from the L-C circuit, the Ringing Coil (L501) is adjusted to a natural resonant frequency of 15,750 cycles to stabilize the frequency of the circuit beyond that of a conventional multivibrator. R511, the front Horizontal Hold control, is actually a fine horizontal frequency adjustment that is provided for use by the owner.

The DC control voltage that is developed in the AFC Detector circuit (previously described) is applied to the grid of the first triode section of the oscillator. This control voltage either adds to or subtracts from the normal bias on the grid of this tube causing it to remain cut-off either a longer or shorter period of time. By changing the time interval of conduction, naturally, the frequency of the multivibrator will be changed.

The operation of the multivibrator may be briefly summed up as follows: As a point to start from assume that the plate current of the second triode section is rising rapidly. This current flow will develop a voltage across the common cathode resistor R510 which is sufficient to cut-off the first section. The second section does not cut-off, however, because of the feedback capacitor C516 which maintains the grid of this tube sufficiently positive to counteract the negative cathode bias. During this time when the second section is conducting heavily the discharge capacitor, C517 discharges through this tube. During this instant of heavy current flow the grid of this tube will start to draw current. This immediately biases the grid to cut-off and allows the first section to conduct again and C517 to charge again. At this point the cycle commences again where the second section, no longer biased by grid current, is allowed to start conducting.

The modified sawtooth appearing across the output of the multivibrator is coupled to the grid of the Horizontal Output tube from a capacitor voltage divider circuit. The lower portion of this divider is the Horizontal Drive trimmer C519. Adjustment of this trimmer will vary the amplitude of the pulse applied to the Horizontal Output tube and hence the drive.

Horizontal Output & High Voltage

The Horizontal Output stage employs a type 6BQ6-GT beam power amplifier. This tube produces the horizontal deflection current and is the source of the high voltage supply for the CRT second anode. The amplitude of the pulse applied to the 6BQ6 tube is varied by a trimmer (C519, the Horizontal Drive Control) connected in the grid circuit of V504.

When the plate current in the 6BQ6 tube is suddenly cut-off by the sharp negative pulse applied to its control grid, the magnetic field which is created in the primary of the Horizontal Output transformer collapses, developing a very high voltage pulse. This voltage tends to oscillate in the 6BQ6 plate circuit, but it is rapidly damped out by the Damper tube, a 6W4-GT (V506). The B+ "Boost" is a combination of the +300 volt supply voltage plus the charge that is developed across C524 during the retrace time (duration of the high voltage pluse developed in the 6BQ6 plate circuit). This "Boost" voltage is used as plate supply for the Horizontal Output tube and also for the CRT first anode and focus voltage.

A high-efficiency ferrite core transformer is used to couple the output of the 6BQ6 to the horizontal winding of the deflection yoke and also to step up the high voltage pulse for rectification by the 1B3-GT H.V. Rectifier (V505). The deflection yoke is coupled off across two intermediate points on the horizontal output transformer secondary. This method of coupling provides an optimum impedance match and tends to reduce the effect of high frequency "ringing" which would show up in the raster as light and dark vertical bars.

The 1B3-GT tube rectifies the high voltage pulses which are applied to its plate during the horizontal retrace time. The 15,750 cycle ripple is filtered out by C525 in the 1B3 filament circuit and R523 (330K) in conjunction with the capacitance provided by the external coating on the CRT.

Variation of picture width is provided by a slug tuned inductance (T503) connected across a portion of the horizontal output transformer secondary. The Width Coil is provided with a "speed-slide" adjustment which allows for quick set-up.

Low Voltage Power Supply

A transformer-type power supply is employed using a 5U4G Rectifier (V601). Adequate filtering is provided by an inductance-capacitance type filter circuit. The B+ supplies 300 volts and a tap is provided for 135 volts. All circuits are returned to chassis ground.

The power transformer (T601) is equipped with a copper shield passing completely around the winding and core. This shield eliminates "snaking" in the picture which may result from a difference between the transmitted vertical sync frequency and the local power source frequency.

General Information

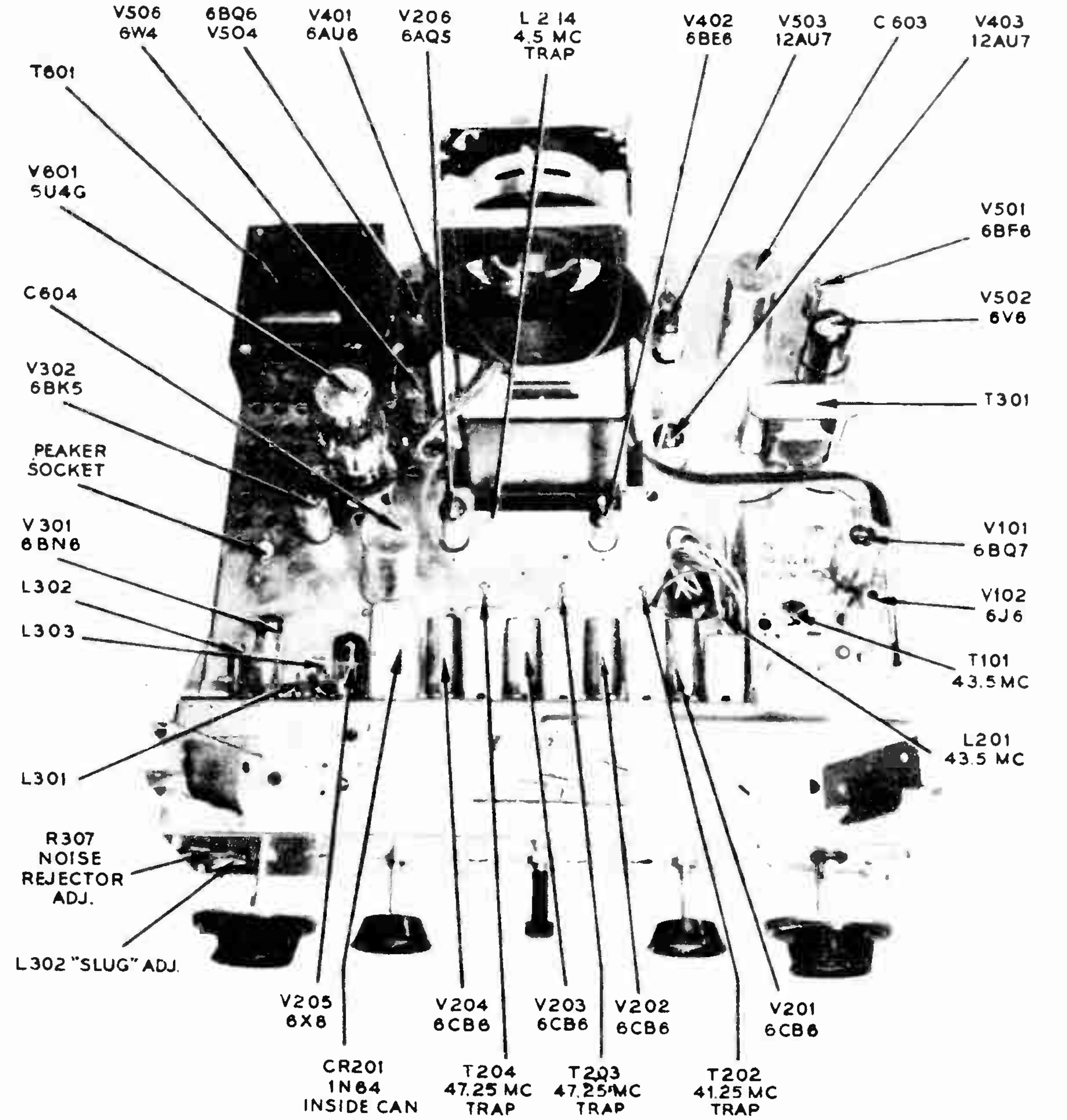
Before attempting either complete or partial alignment of the receiver circuits it is recommended that all of the alignment data included here be read thoroughly. After becoming familiar with the procedure it will probably be necessary to refer to the alignment charts only. Note that there are two methods given for alignment of the I-F Stages. The method to be used will depend upon the type of equipment available. If a Sweep Generator having a 40 - 50 MC range is not available, the I-F Stages (with exception of the over-coupled transformer) can be accurately aligned with a Signal Generator having a 40-50 MC range and a VTVM. In this case the over-coupled stage can be aligned while observing the over-all R-F, I-F curve on a channel which is known to have a fairly flat response.

A suggested list of Test Equipment needed for proper alignment of the receiver is listed here. Under no circumstances should alignment be attempted without the proper equipment. When connecting the test equipment to the various points in the receiver, be certain that a good connection is made and that the leads are as short as possible.

In alignment of the R-F Amplifier in particular the Sweep Generator must be properly terminated in order to prevent distortion of the response curve caused by reflections and losses on the lines. All equipment used must be adequately grounded on the receiver chassis. Always allow sufficient time for both test equipment and receiver to warm up before starting the alignment.

Test Equipment Specifications

1. R-F Sweep Generator
   a. Frequency Ranges
      4.5 MC with 25 KC Sweep Width, 40 - 50 MC with approximately 10 MC Sweep Width 50 - 90 MC, 170 - 220 MC with at least 10 MC Sweep Width.
   b. Constant Output within the sweep range.
   c. Signal Output not less than 0.1 volt maximum.
2. Marker Generator
   a. Frequency Ranges
      41.25 - 47.25MC — I-F Markers
      55.25 - 215.75MC — Picture-Sound Carrier Markers
      4.5 MC — Sound I-F and 4.5 MC Trap
   b. Modulated Signal over I-F Range (optional)
   c. 50% AM modulation at 4.5 MC.



3. Oscilloscope
   a. Good sensitivity in Vertical Amplifier
   b. Preferably a 5 inch screen or larger
4. Vacuum Tube Voltmeter
   a. High input resistance
   b. Accurate low voltage range
5. Crystal Detector Network
   a. Refer to construction detail in figure 7.

R-F AMPLIFIER ALIGNMENT

Note:

1. Connect the sweep generator output cable to the receiver antenna input terminals through the proper terminating network. If the sweep generator used has a 300 ohm balanced output use the matching pad shown in Figure 1A. For other generators use the proper values of R_t and R_1 for the output cable impedance of the particular generator. Adjust the generator to sweep Channel 10.
2. Couple an accurately calibrated marker generator into the antenna input to provide picture and sound carrier markers. In most cases the marker generator can be connected across the sweep generator terminals. A 10K isolating resistor should be used in series with the marker output cable. Maintain the output of the marker generator at a low level to prevent distortion of the response curve.
3. Connect the oscilloscope (high side) through a 10K isolating resistor to the test point (small wire loop) on top of R-F Tuner Chassis. If necessary to provide a clean trace on the scope, connect a 270 uuf. (approx. value) capacitor across the vertical input terminals of the scope.
4. Remove the AGC Amplifier tube (V401, 6AU6) and connect a bias source (see note 2 of Video I-F Alignment) from terminal 2 of the R-F, I-F Chassis Power Cable Plug to chassis. Set the bias on terminal 2 at 3 volts.
5. Remove the 1st I-F Amplifier tube (V201) and detune the mixer plate transformer, T101.

R-F AMPLIFIER ALIGNMENT CHART

Step No.:	Set Sweep Generator to:	Set Marker Generator to:	Connect Generator Output Cable to:	Connect Oscilloscope to:	Set Channel Selector to:	Adjust	Refer to Note/s:
1	Sweep Channel 10	193.25MC 197.75MC	Receiver Antenna Input Terminals	Test Point on R-F Tuner through 10K Resistor	Channel 10	C117, C107 & C111 for response curve shown in Fig. 2.	1, 2, 3, 4, 5, 6
2	Sweep Channel 13	211.25MC, 215.75MC			Channel 13	Check Response Curve on all Channels	7
3	Sweep Channel 12	205.25MC 209.75MC			Channel 12		
4	Sweep Channel 11	199.25 MC 203.75MC			Channel 11		
5	Sweep Channel 9	187.25MC, 191.75MC			Channel 9		
6	Sweep Channel 8	181.25MC, 185.75MC			Channel 8		
7	Sweep Channel 7	175.25MC, 179.75MC			Channel 7		
8	Sweep Channel 6	83.25MC, 87.75MC			Channel 6		
9	Sweep Channel 5	77.25MC, 81.75MC			Channel 5		
10	Sweep Channel 4	67.25MC, 71.25MC			Channel 4		
11	Sweep Channel 3	61.25MC, 65.75MC			Channel 3		
12	Sweep Channel 2	55.25MC, 59.75MC			Channel 2		

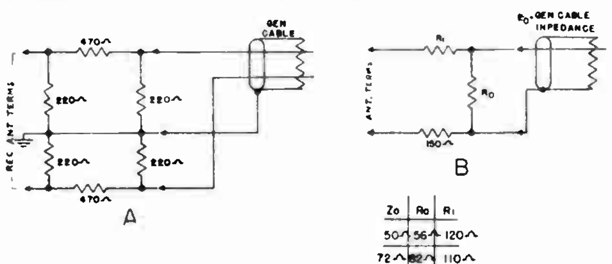


Figure 1

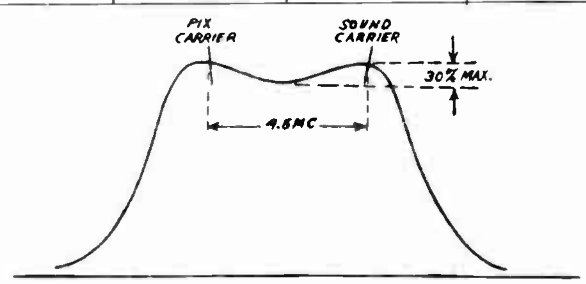


Figure 2

6. Set the receiver Channel Selector for Channel 10. A trace should appear on the scope similar to that shown in Figure 2. Adjust the trimmers C117, C107 and C111 on top of the R-F Tuner Chassis for maximum amplitude and to locate the sound and picture carrier markers within the limit shown in Figure 2.
7. Adjust the sweep and marker generators progressively for each channel. Check the response curve obtained on each channel. The curve should be within the following limits: neither side of the curve should be down more than 30% and the valley of the curve should not be down more than 30% of the total amplitude. If the response of a particular channel does not come within these limits, check to see that the correct coils for that channel are being used and try replacing the antenna coil for that channel. As a final step, a compromise can be made by adjusting the trimmer C117, C107 and C111 to improve the response of the channel that is off. The response on all other channels should then be rechecked to determine the extent to which they were affected by the compromise.

LOCAL OSCILLATOR ALIGNMENT

Note:
1. Connect the sweep generator output cable to the receiver antenna input terminals through the proper terminating network. If the sweep generator used has a 300 ohm balanced output use the matching pad shown in Figure 1A. For other generators use the proper values of R_o and R_i for the output cable impedance of the particular generator. Adjust the generator to sweep Channel 13.
2. Couple an accurately calibrated marker generator into the antenna input to provide picture and sound carrier markers for Channel 13.
3. Connect the oscilloscope (high side) through a 10K isolating resistor to the junction of R219 and pin 7 of V205A.
4. Remove the AGC Amplifier tube (V401, 6AU6) and connect a short test lead from pin 2 of the R-F, I-F Chassis Power Cable plug to chassis. This places the R-F Amplifier bias at zero. Also, connect a bias battery (a 4.5 Volt battery with a 1K pot connected across its terminals can be used), negative side to terminal 3 of the same plug and positive side to chassis. Adjust the pot to provide −3 volts bias at terminal 3 of the R-F, I-F Chassis Power Cable plug.
5. Set the Channel Selector to Channel 13 and check the response curve obtained against the ideal curve shown in Figure 4. If the shape of the curve is not within these limits, it will be necessary to repeat the R-F and I-F Amplifier Alignments. The R-F and I-F Amplifiers must be properly aligned before the oscillator adjustments can be correctly made.
6. Set the Fine Tuning control to the approximate center of its mechanical range and leave it set in this position for the entire alignment.
7. Adjust the individual oscillator "slug" for Channel 13 to properly position the markers on the curve. This adjustment should be made with a non-metallic screwdriver having an ⅛ inch blade approximately. If one of the slugs should "fall into" the coil form, first remove the metal shield which covers the lower portion of the turret (to remove the shield pull down at the front and slide it out of its hinges at the rear) and then remove the particular oscillator coil from the turret. To reposition the slug, move the slug retaining spring aside and tap the coil until the slug slides forward, then replace the spring so that the slug is held in place. Replace the coil in the turret and proceed with its alignment.
8. Set the sweep and marker generators, progressively for each channel and check the position of the markers on the curves. Adjust the individual oscillator "slug" wherever necessary to properly locate the markers.

VIDEO I-F ALIGNMENT

Note:
1. Connect the sweep generator output cable (properly terminated in its characteristic impedance) to pin 1 of V201 (grid of 1st I-F Amplifier) through a .001 ufd. isolating capacitor and adjust it to sweep from 40 to 50 MC. If a separate marker generator is used it should be coupled to the same point through a 10K resistor.
2. Remove the AGC Amplifier tube (V401, 6AU6) and connect a bias source from terminal 3 of the R-F, I-F Chassis Power Cable plug to chassis. A bias source may be obtained from a 4.5 volt battery with a 1K pot connected across its terminals. Connect the positive end of the battery to chassis ground and connect the arm of the pot to terminal 3 of the R-F, I-F plug. Connect a VTVM to terminal 3 of the plug and adjust the pot for a minus 3.8 volt reading on the VTVM.
3. Connect the oscilloscope high side to the junction of R219 and pin 7 of V205A through a 10K isolating resistor.
4. Check the response curve for evidence of local oscillator influence by adjusting the fine tuning control If the shape of the curve changes, switch to another channel where oscillator influence is not present or else adjust the Channel Selector so that it is between channels.

LOCAL OSCILLATOR ALIGNMENT CHART

Step No.	Set Sweep Generator to:	Set Marker Generator to:	Connect Generator Output Cable to:	Connect Oscilloscipe to:	Set Channel Selector to:	Adjust	Refer to Note/s:
1	Sweep Channel 13	211.25MC, 215.75MC	Receiver Antenna Input Terminals	Junction of R219 and pin 7 of V205A through 10K Resistor	Channel 13	Channei 13 Oscillator Slug	1, 2, 3 4, 5, 6 7
2	Sweep Channel 12	205.25MC, 209.75MC			Channel 12	Channel 12 Oscillator Slug	
3	Sweep Channel 11	199.25MC, 203.75MC			Channel 11	Channel 11 Osc. Slug	
4	Sweep Channel 10	193.25MC, 197.75MC			Channel 10	Channel 10 Osc. Slug	
5	Sweep Channel 9	187.25MC, 191.75MC			Channel 9	Channel 9 Osc. Slug	
6	Sweep Channel 8	181.25MC, 185.75MC			Channel 8	Channel 8 Osc. Slug	
7	Sweep Channel 7	175.25MC, 179.75MC			Channel 7	Channel 7 Osc. Slug	
8	Sweep Channel 6	83.25MC, 87.75MC			Channel 6	Channel 6 Osc. Slug	
9	Sweep Channel 5	77.25MC, 81.75MC			Channel 5	Channel 5 Osc. Slug	
10	Sweep Channel 4	67.25MC, 71.75MC			Channel 4	Channel 4 Osc. Slug	
11	Sweep Channel 3	61.25MC, 65.75MC			Channel 3	Channel 3 Osc. Slug	
12	Sweep Channel 2	55.25MC, 59.75MC			Channel 2	Channel 2 Osc. Slug	

NOTE: The individual oscillator slugs are accessible from the front of the cabinet, therefore, if the R-F and I-F circuit are properly aligned, "touch up" of the oscillator alignment on any channel can be accomplished without removing the chassis from the cabinet. For further information, refer to "Oscillator Alignment Using a TV Signal" as outlined in the Installation Instructions.

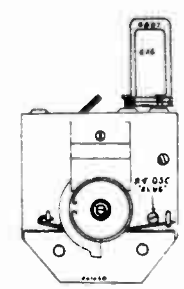


Figure 3

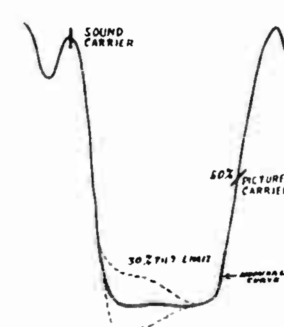


Figure 4

5. Adjust the marker generator to provide a marker at 41.25 MC and adjust the top slug of T202 (Co-Channel Sound I-F Trap) for minimum response at the marker frequency. This adjustment may be made easier by running the sweep generator output high so that the trap "dips" are easily visible.
6. Adjust the marker generator to 47.25 MC and adjust the top slugs of T203 and T204 (Adjacent Channel Sound I-F Traps) for minimum response at the marker frequency.
7. Reduce the sweep generator output so that a normal curve is seen. Adjust the marker generator to 42.65 MC and then adjust the bottom slugs of T202 and T204 to obtain maximum amplitude of the 42.65 MC marker.
8. Adjust the marker generator to 45.3 MC and adjust the bottom slugs of T203 and T205 to obtain maximum amplitude of the 45.3 MC marker. To obtain access to the bottom slug of T205 remove the contrast control from the front panel. Use a thin blade alignment tool for the adjustment.
9. Connect the sweep and marker generators to the test point on the R-F Tuner through a .001 ufd., isolating capacitor. Set Channel Selector to Channel No. 9. If the available equipment allows, markers at both 42.25 MC and 45.75 MC should be provided simultaneously.
10. Adjust the overcoupled I-F circuit, T101 (on top of the R-F Tuner) and the slug of L201 to obtain a curve similar to that shown in Figure 5. With certain types of sweep generators this method is not usable due to the spureous response curves obtained on the scope which are caused by the various harmonics of the generator. Under these conditions the overcoupled stage should be aligned as in step 6 of alternate method of I-F alignment. The 42.25 MC marker must fall within 30% to 70% of maximum amplitude of the curve on one side and the 45.75 MC marker must fall within 40% to 60% of maximum on the other side. The valley of the curve should not exceed 10% and the tilt should not be greater than + or −10%. A 45 MC marker should fall within 5% of maximum amplitude on the high frequency side of the curve.

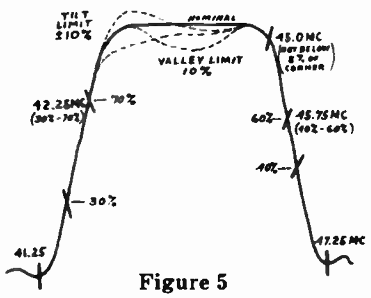


Figure 5

ALTERNATE METHOD OF VIDEO I-F ALIGNMENT

Note:

1. Connect the signal generator output cable to pin 1 of V201 through .001 ufd., isolating capacitor. If an oscilloscope is used for indication, the generator should be AM modulated with a 400 c.p.s. signal.
2. Set the bias at the I-F grids to minus 3.8 volts (refer to note 2 of Video I-F Alignment).
3. Connect the VTVM to the junction of R219 and pin 7 of V205A through a 10K resistor.
4. Set the signal generator to 41.25 MC and adjust the top slug of T202 for minimum indication on the VTVM.
5. Set the signal generator to 47.25 MC and adjust the top slugs of T203 and T204 for minimum indication on the VTVM.
6. Set the signal generator to 42.65 MC and adjust the bottom slugs of T202 and T204 for maximum indication on the VTVM.
7. Set the signal generator to 45.3 MC and adjust the bottom slugs of T203 and T205 for maximum indication on the VTVM. To obtain access to the bottom slug of T205, remove the Contrast Control from the front panel. Use a thin blade alignment tool for this adjustment.
8. Connect the Sweep Generator output cable to the receiver antenna input terminals through the proper terminating network. (Refer to note 1 of R-F Amplifier Alignment).
9. Connect the marker generator to pin 1 of V201 through a .01 ufd., capacitor.
10. Set the I-F Bias to minus 3 volts (Refer to Note 2 of Video I-F Alignment).
11. Connect the oscilloscope high side to the junction of R219 and pin 7 of V205A through a 10K resistor.
12. Set the receiver Channel Selector to Channel 12 and adjust the sweep generator to sweep Channel 12. A curve should appear on the scope similar to that shown in Figure 6. The marker generator should be adjusted to provide markers at 42.25 MC and 45.75 MC.
13. Adjust T101 (on top of the R-F Tuner) and the slug of L201 for location of the markers as stated in Note 10 of Video I-F Alignment.

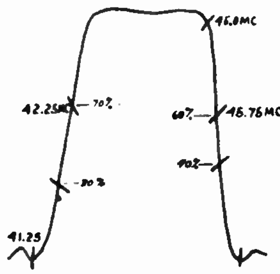


Figure 6

4.5 MC. SOUND I-F ALIGNMENT

Note:

1. Connect generator output cables to junction of L206 and R219 (pin 2 of V205A).
2. Connect vertical input leads of oscilloscope to detector network shown in fig. 7. Clip the alligator clip of the detector input over the insulated wire between pin 2 of the 6BN6 and L303 so that there is no direct electrical connection between the input to the detector network and the circuit under test. The ground connection of the detector circuit, however, should be connected to the chassis.
3. Short pin 1 to pin 2 of tube V202.
4. Inject 4.5 Mc. Signal with 50% AM modulation and adjust L301 for maximum. Use full vertical amplifier oscilloscope gain so that the signal level from the generator is kept as low as possible.
5. Adjust L303 for maximum indication and then recheck the adjustment of L301.
6. Remove crystal detector network and connect the oscilloscope directly to the junction of R308 and R309.
7. Inject 4.5 Mc. FM signal with 25 kc. deviation and using full generator output to insure limiting in the 6BN6, adjust L302 (quadrature coil — accessible through bottom hole in back of Shading Control) for maximum output.
8. Remove short from V202 and connect receiver to antenna through a signal attenuator (Centralab PCH-4, IRC QJ-3 or Equivalent). Adjust set for reception of a local TV signal. By attenuating the incoming signal so that background noise is just noticeable at all times a more exact setting can be obtained. Adjust Noise Rejection Control (R307 — accessible through top hole in back of Shading Control) for minimum background noise and hiss.
9. Remove attenuator and with full signal adjust L302 for clearest sound.

VIDEO I-F ALIGNMENT CHART

Step No.	Set Sweep Generator to:	Set Marker Generator to:	Connect Generator Output Cables to:	Connect Oscilloscope to:	Adjust	Refer to Note/s:
1.		41.25MC			Top slug of T202 for min. response at 41.25MC	1, 2, 3, 4
2.	Sweep from 40 to 50MC	47.25MC	pin 1 of V201 (grid of 1st I-F Stage) through a .001 ufd. capacitor	Junction of R219 and pin 7 of V205A through a 10K resistor	Top slugs of T203 & T204 for min. response at 47.25MC	1, 2, 4, 6
3.		42.65MC			Bottom slugs of T202 & T204 for max. amplitude of marker	1, 2, 4, 7
4.		45.3MC			Bottom slugs of T203 & T205 for max. amplitude of marker	1, 2, 4, 8
5.	Repeat Steps 1 & 2 after completing Steps 3 & 4					
6.		42.25MC 45.0 MC 45.75MC	Test Point on R-F Tuner through a .001 ufd., capacitor		T101 (on top of R-F tuner) and Top slug of L201 for curve shown in Fig. 5	2, 4, 9, 10

VIDEO I-F ALIGNMENT CHART (ALTERNATE METHOD)

Step No.	Set Sweep Generator to:	Set Signal Generator to:	Connect Generator Output Cables to:	Connect Oscilloscope or VTVM to:	Adjust	Refer to Note/s
1.		41.25MC			Top slug of T202 for minimum indication.	1, 2
2.		47.25MC	Pin 1 of V201 (grid of 1st I-F Stage) through a .001 ufd., capacitor	Junction of R219 and pin 7 of V205A through 10K resistor	Top slug of T203 & T204 for minimum indication.	1, 2
3.		42.65MC			Bottom slugs of T202 & T204 for Maximum indication.	1, 2
4.		45.3 MC			Bottom slugs of T203 & T205 for Maximum indication.	1, 2, 7
5.	Repeat Steps 1 and 2 after completing Steps 3 and 4.					
6.	Sweep Channel 12	Markers at 42.25MC, 45.0 MC, 45.75MC	See Notes 8 and 9	Junction of R219 & pin 7 of V205A through 10K resistor	T101 (on top of R-F Tuner) and Top Slug of L201 for curve shown in Fig. 6.	8, 9, 10, 11, 12

4.5MC. TRAP L214 ADJUSTMENT CHART

Step No.	Set Marker Generator To:	Connect Generator Output Cables To:	Connect Oscilloscope Vertical Input Cable to:	Adjust:
1.	4.5 MC A.M. Modulation	Junction of L205 & R219 Ground side to chassis	Junction of C234, R235, R232 thru detector network Fig. 7	L214 slug for minimum amplitude of modulation.

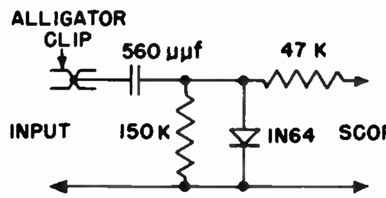


Figure 7

4.5 MC. SOUND I-F ALIGNMENT CHART

Step No.	Set Generator to:	Connect Generator Output Cable to:	Connect Scope Vertical Input Cable to:	Adjust	To Obtain	Refer to: Note/s
1.	4.5 Mc. 50% AM Modulation		Pin 2, V301 through detector net-work fig. 7	L301 and L303	Maximum Indication	1, 2, 4, 5
2.	4.5 Mc. FM 25 kc Deviation (maximum signal output)	Junction L206, R219	Junction R308 and R309	L302	Maximum Indication	7
3.	Remove short on V202 and connect set to antenna. Tune in station and attenuate signal so that background hiss is apparent.			R307	Minimum background Hiss and Noise	8
4.	Set connected to antenna with full signal input.			L302	Clearest Sound	

CX-37 TV CHASSIS
TUBE SOCKET RESISTANCE CHART
CHASSIS CT-75 OR CT-77

TUBE SOCKET TERMINALS

Tube Type & Ref. No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V101 (6BQ7)	Inf.	500K	24	.2	0	100K	130K	Inf.	0
V102 (6J6)	120K	130K	.1	0	220K	9.5K	0	—	—
V201 (6CB6)	50K	47	0	0	Inf.	Inf.	0	—	—
V202 (6CB6)	125K	Inf.	100K	100K	80K	90K	Inf.	—	—
V203 (6CB6)	100K	100K	100K	100K	80K	100K	100K	—	—
V204 (6CB6)	90K	80K	90K	100K	80K	80K	100K	—	—
V205 (6X8)	0	60K	300K	0	0	68	90	90K	100K
V206 (6AQ5)	500K	600 to 2K	0	0	100K	100K	N.C.	—	—
V207 (CRT)	140K	1.2 meg.	(Pin 6) 140K	(Pin 10) Inf.	(Pin 11) 140K	(Pin 12) 140K			
V301 (6BN6)	150 to 650	3	0	0	100K	3.5	400K	—	—
V302 (6BK5)	100K	N.C.	0 to 500K	0	0	220	0 to 500K	80K	N.C.
V401 (6AU6)	100K	100K	100K	100K	200K	80K	100K	—	—
V402 (6BE6)	50K	0	0	0	80K	100K	1.5 meg.	—	—
V403 (12AU7)	22K	250K	100K	0	0	100K	2.2 meg.	3900	—
V501 (6BF6)	500K to 1.2 meg.	0	0	0	450K	450K	1.4 meg.	—	—
V502 (6V6)	N.C.	0	80K	80K	2.2 meg.	80K	0	700 to 3000	—
V503 (12AU7)	180K	50K to 300K	1.2K	0	0	100K	5 meg.	1.2K	0
V504 (6BQ6)	N.C.	0	N.C.	80K	1 meg.	300K	0	0	—
V506 (6W4)	N.C.	N.C.	Inf.	N.C.	100K	N.C.	100K	100K	—
V601 (5U4)	N.C.	80K	N.C.	15	N.C.	15	N.C.	80K	—

All measurement are made from the tube socket pin to chassis. All readings may vary ±20%. The resistance readings on tubes V206, V301, V302, V501, V502 and V503 will vary with control settings.

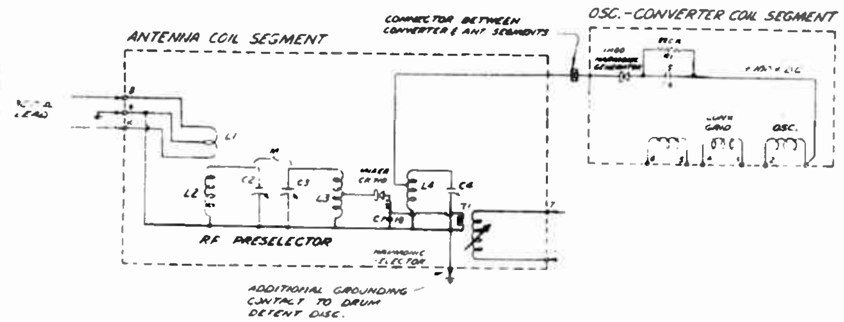
ADAPTABILITY TO UHF

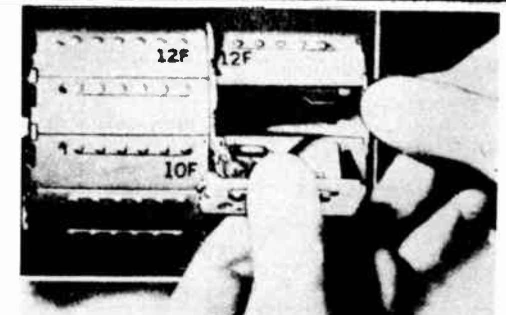
Conversion of the tuner incorporated in the CX37 chassis to reception of UHF stations can be accomplished by merely removing coil strips from the tuner (for channels that are not locally received) and inserting a set of UHF strips for each UHF channel that is locally available. Due to the physical dimensions of the UHF strips it is not possible to place them adjacent to each other. If strips for more than one UHF channel are to be installed, there should be the space of at least one channel strip between them. The UHF strips are in two sections (as is the VHF strip) and contain all of the required components to complete the conversion.

One section of the UHF strip includes the antenna input circuit, a crystal mixer and its tuned circuit and a 1st I-F grid coil. The second section consists of the coils for the 1st I-F plate, converter grid and the Oscillator.

In operation, the UHF signal is fed into the balanced antenna input coil and is then coupled into the mixer circuit where it is mixed with an oscillator frequency (a harmonic of the fundamental oscillator frequency) to produce an I-F frequency which falls in the spectrum between the two present VHF television bands. This I-F frequency is then coupled into the grid of the R-F Amplifier which in this case acts as a 1st I-F Amplifier. The amplified I-F signal is then coupled into the mixer circuit where the fundamental oscillator frequency mixes with it to produce the regular I-F frequency of the receiver. The functions of the receiver from this point on then are the same as for VHF reception.

Channel strips to convert this tuner to UHF reception are available through your local Capehart parts distributor. At the time of ordering it is essential that the exact UHF channel number desired and the exact tuner that the strips are to fit, be specified.





ELIMINATION OF TELEVISION INTERFERENCE

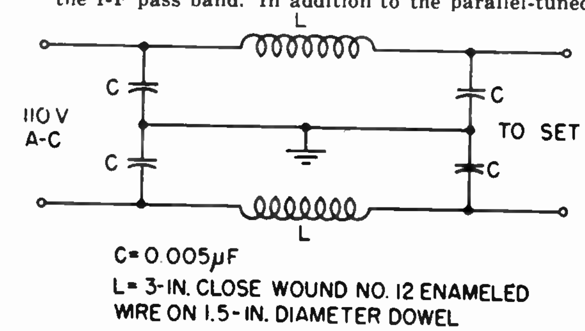
Everyone is familiar with the types of interference that have continually plagued the radio listener—it has merely been accepted as "static." Unfortunately for television viewers, the eyes are much more critical with respect to interference than the ears. In addition to this, there are other factors which add to the interference problem. Television, having a relatively wide band width, provides a greater range over which interference can be received. Also, the problem of weak signals in many areas permits types of interferences which otherwise would not be noticeable.

Many types of television interference are beyond the scope of elimination within the receiver especially in weak signal areas. The design of the CX-37 series chassis takes into consideration, wherever possible, the elimination or minimization of TVI. Use of the 40MC I-F itself eliminates a sizeable amount of interference resulting from images, oscillator radiation from other TV sets and, of course, signals in the 21 to 27MC range. High selectivity in the R-F amplifier is supplemented with the incorporation of parallel-tuned wave traps in the antenna input circuit. These traps are tuned to provide rejection of signals within the I-F pass band. In addition to the parallel-tuned traps, a series-tuned trap is provided in the input grid circuit of the R-F Amplifier. This trap can be adjusted to provide maximum rejection at any frequency within the I-F pass band.

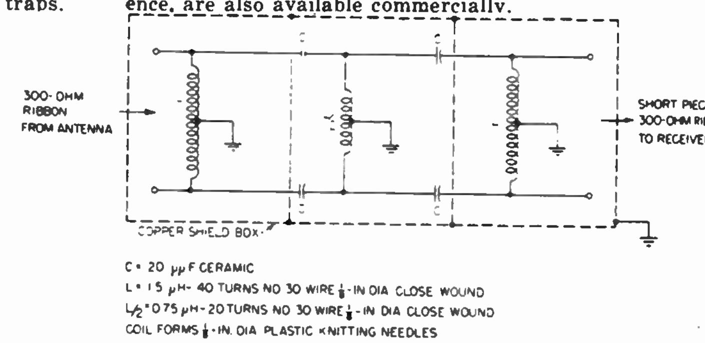
In addition to the rejection built into these instruments, additional rejection of certain types of TVI can be obtained through the use of external devices such as the High-Pass Filter, which is shown below. This high-pass filter provides additional attentuation of all frequencies below the television band. The device can be constructed as shown in the diagram; however, similar devices are available commercially for such use.

In the case of interference from household electrical appliances entering the receiver through the AC line, a power-line filter such as shown below may be of some help. Interference of this type is best eliminated at the source, however it is not always possible to do so. Some difficulty may be encountered in locating the source and also in obtaining the cooperation of the owner of the interfering appliance.

Powerline filters, for eliminating this type of interference, are also available commercially.



Power-line filter for appliance interference



Typical high-pass filter to attenuate interference below television frequencies

CX-37 TV CHASSIS
TUBE SOCKET VOLTAGE CHART
CHASSIS CT-75 OR CT-77

TUBE SOCKET TERMINALS

Tube Type & Ref. No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V101 (6BQ7)	123	−0.3	0.7	0	6.3 A.C.	240	120	123	
V102 (6J6)	94	88	6.3 A.C.	0	−1.8	−6.7	0	—	—
V201 (6CB6)	−1.3 to −1.6	0.5	0	6.3 A.C.	130	115	0	—	—
V202 (6CB6)	140	140	6.3 A.C. (135 D.C.)	0 A.C. (135 D.C.)	290	275	140	—	—
V203 (6CB6)	130	135	6.3 A.C. (135 D.C.)	0 A.C. (135 D.C.)	275	250	130	—	—
V204 6CB6)	130	135	6.3 A.C. (135 D.C.)	0 A.C. (135 D.C.)	280	280	130	—	—
V205 (6X8)	0	−1.2	30	6.3 A.C.	0	0.7	−1.2	130	90
V206 (6AQ5)	1 to 9	10 to 18	0	6.3 A.C.	221 to 242	130	N.C.	—	—
V207 (CRT)	0 A.C. (135 D.C.)	125	Pin 6 160 to 300	Pin 10 550	Pin 11 160 to 300	Pin 12 6.3 A.C. (135 D.C.)	H. V. Anode 13KV†		

V301 (6BN6)	2.7	0	0	6.3 A.C.	54	0	130	—	—
V302 (6BK5)	270	N.C.	0	0	6.3 A.C.	6.8	N.C.	280	N.C.
V401 (6AU6)	125	—	0 A.C. (135 D.C.)	6.3 A.C. (135 D.C.)	130	300	130	—	—
V402 (6BE6)	0	0	0	6. 3 A.C.	24	17	−18	—	—
V403 (12AU7)	−.4	−3.2	2.3	0	0	70	22	22	6.3 A.C.
V501 (6BF6)	−.6 to −12	0	0	6.3 A.C.	0.3	0.3	−.5 to 100	—	—
V502 (6V6)	N.C.	0	280	295	0	295	6.3 A.C.	26	—
V503 (12AU7)	150	−6.4 to −20	9	0	0	250	−.4	9	6.3 A.C.
V504 (6BQ6)	N.C.	6.3 AC	N.C.	149 to 162	−37	8 to 10	0	0	(cap) 452 to 541
V506 (6W4)	N.C.	N.C.	550	N.C.	285	N.C.	6.3 A.C. (135 D.C.)	0 A.C. (135 D.C.)	—
V601 (5U4)	N.C.	320 D.C. (5 A.C.)	N.C.	320 A.C.	N.C.	320 A. C.	N.C.	320 D.C. (5 A.C.)	—

†Measured with zero brilliance.

MEASUREMENT CONDITIONS

All voltages measured with no signal input on a vacuum tube voltmeter from tube socket pin to chassis unless otherwise indicated. All voltages should be with ± 20% of the above stated values with line voltage of 117 volts, 60 cycle AC. Voltages on V206 vary with setting of Contrast. Voltages on V401 vary with setting of AGC Set. Voltages on V501 and V502 vary with settings of Vert. Hold, Vert. Lin. and Height. Voltages on V207 vary with setting of shading.

A. G. C. Adjustment

Adjustment of the AGC control (R238) should only be made with the aid of a calibrated oscilloscope. Connect the vertical input of the scope to pin 1 of the 2nd Video Amplifier (V206). With the set connected to an antenna and adjusted for normal reception adjust the AGC control (on top of chassis between power transformer and high voltage cage) for an indication of 12 volts peak-to-peak.

The AGC control is properly adjusted at the factory and the setting is marked with colored cement across the shaft and bushing of the control. If the control should become misadjusted and a calibrated oscilloscope is not available, the control can be set approximately by resetting to its original position, as indicated by the cement.

Production Changes

Early production chassis may vary from the schematic shown in the following ways:

C209, C239, C240, C241 were not used.
R225, R242, R306 were not used.
R315 was 470K instead of 100K.
R226 was 1800 instead of 820.
R238 was 250K instead of 100K and was connected between pin No. 1 and pin No. 7 with a 4.7K in series. C526 (.047 mfd 400V) was connected from junction of C524-R519 to +300V and H. V. fuse was .15 amp.
C525 was grounded instead of connected to pin No. 8 of V502.

PARTS PRICE LIST

RESISTORS

All Resistors are ½ watt 10% unless otherwise noted.

Ref. No.	Description	Part No.	List
R524	6.8	650101A-22	.10
R517, 202, 208 213	47	3229-470	.10
R220	68	3229-680	.10
R217, 303	150	3229-151	.10
R312	220	3229-221	.10
R522, 527	470	3229-471	.10
R313	470 1W.	3232-471	.15
R230	680 1W.	3232-681	.15
R215	820 1W.	3232-821	.15
R405, 308	1000	3229-102	.10
R510, 515 206	1200	3229-122	.10
R210	1500	3229-152	.10
R226	1800	3229-182	.10
R236	2200 2W.	3235-222	.25
R231	3300 2W.	3235-332	.25
R422, 423	3900	3229-392	.10
R224	3900 1W.	3232-392	.15
R225, 204, 205 219	4700	3229-472	.10
R211, 216	5600	3229-562	.10
R203, 218	8200	3229-822	.10
R509	8200 1W.	3232-822	.15
R424, 222, 535 209	10K	3229-103	.10
R413, 538 201	12K	3229-123	.10
R519	12K 2W.	3235-123	.25
R506, 310	22K	3229-223	.10
R233, 407	33K	3229-333	.10
R602	33K 2W.	3235-333	.20
R223, 502... R507	39K	3229-393	.10
R418	39K 1W.	3232-393	.15
R221	47K	3229-473	.10
R513, 533.... R304	56K	3229-563	.10
R525	56K 1W.	3232-563	.10
R503, 504	82K	3229-823	.10
R420, 505 534	100K	3229-104	.10
R514, 537	120K	3229-124	.10
R239	150K	3229-154	.10
R406	150K 5%	3228-154	.15
R305	220K	3229-224	.10
R207, 212	220K 5%	3228-224	.15
R408	270K 5%	3228-274	.15
R309, 523	330K	3229-334	.10
R419	390K	3229-394	.10
R415, 540	470K	3229-474	.10
R410	680K	3229-684	.10
R532	820K	3229-824	.10
R227, 228, 235, 516, 601	1 Meg	3229-105	.10
R232, 417	1.5 Meg	3229-155	.10
R421, 530	2.2 Meg	3229-225	.10
R409	2.7 Meg	3229-275	.10
R508	4.7 Meg	3229-475	.10

CAPACITORS

Ref. No.	Description	Part No.	List
Electrolytic			
C238	25 mfd 25V	650228A-7	.75
C603A	50 mfd 400V	750090B-38	4.75
C603B	40 mfd 400V		
C603C	100 mfd 50V		
C603D	100 mfd 25V		
C604A	50 mfd 400V	750090B-39	4.25
C604B	20 mfd 400V		
C604C	20 mfd 350V		
C604D	25 mfd 25V		
C403	2 mfd 150V	650228A-11	1.00
Ceramic			
C525	500 mmfd 20KV	650153B-2	1.90
C402, 231	5000 mmfd Disc	450469A-1	.25
C204, 205, 207, 210, 214, 220, 222, 223, 218 315	1000 mmfd Disc	450469A-5	.20
C307	5.5 mmfd 500V	650501A-26	.70
C237, 306, 309	10 mmfd N150	650030A-16	.30
C304	47 mmfd N150	650030A-17	.25
C311	1000 mmfd Disc 20%	450469A-7	.20
C305	3.3 mmfd 500V	650030A-5	.10
C208A-B, 212A-B, 219A-B, 225A-B, 226A-B	2 x 1000 mmfd Dual Disc.	600881A-9	.30
C308, 310, 314	10,000 mmfd Disc.	600881A-8	.25
C236	68 mmfd	650030A-15	.30
C601, 602	1500 mmfd Disc.	450469A-2	.25
Mica			
C516	390 mmfd Silver mica	2272-23391	.30
C515	4700 mmfd Silver mica	2272-43472	1.55
C507	47 mmfd	2272-21470	.20
C508	270 mmfd	2272-21271	.25
C517	330 mmfd	2272-21331	.25
C505, 506, 511, 518	470 mmfd	2272-21471	.30
C232, 512	100 mmfd	2272-21101	.25
C536	390 mmfd	2272-21391	.25
Oil Paper Tubular			
C234, 408, 520 203	.047 mfd 600V	2248-4730	.30
C510, 587	.001 mfd 600V	2248-1020	.25
C509	.0022 mfd 600V	2248-2220	.20
C312, 313, 404, 406, 514 535	.01 mfd 600V	2248-1030	.20
C529, 540 541	.022 mfd 600V	2248-2230	.25
C533	.033 mfd 600V 10%	2248-3339	.30
C233, 407, 532	.1 mfd 600V	2248-1040	.35
C513	.0033 mfd 600V	2248-3320	.20
C523, 524	.22 mfd 400V	2247-2240	.30
C534	.068 mfd 200V 10%	2246-6839	.30
C235, 405	.1 mfd 200V	2246-1040	.30
C521	.01 mfd 200V	2246-1030	.20
C530	.0022 mfd 1000V	2249-2220	.25

CONTROLS

Ref. No.	Description	Part No.	List
R234, 311	Volume & Brilliance	453337A-1	2.10
R229	Contrast	650641B-1	2.50
R542	Vertical Hold	453115B-1	.80
R531	Vertical Height	452733A-1	.75
R529	Vertical Linearity	650642A-3	.45
R238	A.G.C.	650653A-1	.75
R416	Pix Lock	453333A-1	.75
R511	Horizontal Hold	650639B-1	.75
R512	Horizontal Hold (Rear Panel)	453332C-1	.80
R307	Noise Rejection Control	650642A-2	.40
C519	Horiz. Drive (Trimmer)	450527B-1	.50

TRANSFORMERS AND INDUCTANCES

Ref. No.	Description	Part No.	List
T202, 203 204	I.F. Transformer	750349B-1	1.85
T205	Video Detector	750350B-1	5.90
T301	Audio Output	650216A-1	2.35
T501	Vertical Output	750354B-1	4.20
T502	Horizontal Output	850220D-1	12.10
T503	Width Transformer	650589B-1	1.25
T601	Power Transformer	750395B-1	23.35
L201	I.F. Grid Choke 43.5 mc	650590B-1	1.15
L202, 203, 204	Choke 2.2 uh	450338A-4	.20
L209	Peaking Coil, 140 uh	650219A-10	.45
L206	Peaking Coil, 75 uh	650585A-1	.45
L208	Peaking Coil, 200 uh	650219A-8	.50
L210	Peaking Coil, 300 uh	650220A-5	.45
L211	Filament Choke	452667B-1	.10
L213	Peaking Coil, 220 uh	650219A-9	.50
L214	4.5 mc Trap. Assy.	650591A-2	.65
L301	4.5 mc Coil Assy.	650591A-3	.65
L302	Quadrature Coil	650640A-1	.80
L303	Limiter Grid Coil	650638B-1	1.15
L304	Filament Choke	452667B-1	.10
L501	Horiz. Osc. Ringing Coil	650637B-1	1.00
L502	Deflection Yoke	850221B-1	13.25
L601	Filter Choke	650215A-2	2.20

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

MISCELLANEOUS

Ref. No.	Description	Part No.	List
	CRT Strap Assy. 17"	453154A-G1	.75
	CRT Strap Assy. 21"	453161A-G1	.90
	Ion Trap	650276A-6	.85
	Centering Magnet	650471A-2	1.30
	Anode Connector Assy.	650049A-5	.50
	RF Tuner	850222D-1	54.90
	Width Transformer	453118B-1	.35
	Tuning Core	450317A-13	.40
	Fuse 200 MA (slo-blo)	453214A-1	.90
PC501	Vertical Integrator Ckt	650596C-1	1.30
	CRT socket	453120A-1	.25
	Pilot Lamp Socket Assy.	600093A-8	.15
	Speaker & Phono	450972A-2	.10
	AGC Differential Switch	453166A-1	.25
	Interlock Receptacle	452580A-2	.20
	Fuse Holder	453330A-1	.20

PARTS LIST—R. F. TUNER 850222B-1

RESISTORS

Ref. No.	Description	Part No.	List
R101, 105	220K	3229-224	.10
R102	180K	3229-184	.10
R103	470	3229-471	.10
R104, 107.... 110	15K	3229-153	.10
R108	47K	3229-473	.10
R109	4.7K	3229-472	.10
R111	10K	3229-103	.10

CAPACITORS

Ref. No.	Description	Part No.	List
C105	120 uufd.	451064A-1	.30
C103, 106, 112, 114, 115, 118	1000 uufd.	451061A-1	.25
C109	5 uufd.	451215A-1	.60
C110	10 uufd.	451063A-1	.30

MISCELLANEOUS

Ref. No.	Description	Part No.	List
	Fine Tuning Assy.	451326A-1	2.15

INDUCTANCES

Ref. No.	Description	Part No.	List
T101	I.F. Transformer	451327A-1	1.30
L106	R.F. Filament Choke	451306A-1	.10
L107	Cathode Coil	451329A-1	.30
L108	Osc. Filament Choke	451307A-1	.10
L110	Neutralizing Coil	451328A-1	.10
	45.1 Mc. Trap Assy.	451330A-1	1.30
	44.75 Mc. Trap Assy.	451331A-1	1.30
	Series Trap Assy.	451332A-1	1.30
	Antenna Coil Assy. Ch. 2	451324A-2	1.30
	Antenna Coil Assy. Ch. 3	451324A-3	1.30
	Antenna Coil Assy. Ch. 4	451324A-4	1.30
	Antenna Coil Assy. Ch. 5	451324A-5	1.30
	Antenna Coil Assy. Ch. 6	451324A-6	1.30
	Antenna Coil Assy. Ch. 7	451324A-7	1.10
	Antenna Coil Assy. Ch. 8	451324A-8	1.10
	Antenna Coil Assy. Ch. 9	451324A-9	1.10
	Antenna Coil Assy. Ch. 10	451324A-10	1.10
	Antenna Coil Assy. Ch. 11	451324A-11	1.10
	Antenna Coil Assy. Ch. 12	451324A-12	1.10
	Antenna Coil Assy. Ch. 13	451324A-13	1.10
	R.F. & Osc. Coil Assy. Ch. 2	451325A-2	1.70
	R.F. & Osc. Coil Assy. Ch. 3	451325A-3	1.70
	R.F. & Osc. Coil Assy. Ch. 4	451325A-4	1.70
	R.F. & Osc. Coil Assy. Ch. 5	451325A-5	1.70
	R.F. & Osc. Coil Assy. Ch. 6	451325A-6	1.70
	R.F. & Osc. Coil Assy. Ch. 7	451325A-7	1.60
	R.F. & Osc. Coil Assy. Ch. 8	451325A-8	1.60
	R.F. & Osc. Coil Assy. Ch. 9	451325A-9	1.60
	R.F. & Osc. Coil Assy. Ch. 10	451325A-10	1.60
	R.F. & Osc. Coil Assy. Ch. 11	451325A-11	1.60
	R.F. & Osc. Coil Assy. Ch. 12	451325A-12	1.60
	R.F. & Osc. Coil Assy. Ch. 13	451325A-13	1.60

Special Instructions for UHF Installation

These receivers are manufactured with two types of R-F Units. The standard models employ a chassis using the turret type tuner (Part No. 850222) which can be adapted to UHF by addition of UHF Channel Strips. The second version incorporates a chassis which employs a UHF/VHF Tuner assembly.

Models Employing the UHF/VHF Tuner Assembly

These models can be identified by the marking "CX-37-1" on the chassis rear apron, also the model number as appears on the model number label on the cabinet back will contain the suffix "-1". Separate antenna input terminals are provided on the rear of the cabinet on these models for UHF and VHF antennas. These are properly marked, VHF and UHF. If separate UHF and VHF antennas are used in the installation with individual transmission lines for each, the individual lines should be attached to the corresponding input terminals. If a single transmission line is used for both UHF and VHF as would be the case if a combination antenna is employed a UHF/VHF antenna coupler (such as the Vee DX Mighty Match MM-30) can be used to separate the signals at the receiver. In this case the common transmission line from the antenna should be connected to the center terminals of the coupler, the UHF terminals on the receiver should be connected to the UHF terminals on the coupler and the VHF terminals on the receiver should be connected to the VHF terminals on the coupler. The UHF/VHF tuner is completely pre-adjusted at the factory and should require no adjustments upon installation of the receiver.

Models Employing the Turret Type Tuner

The chassis used in these models will be marked "CX-37R" on the chassis rear apron. (Note: Early CX-37 Series Chassis were not marked as such). These models have a single antenna input terminal on the rear of the cabinet which is used for both VHF and UHF. It is advisable to use a common transmission line, however, if separate lines are employed an antenna coupler can be used to feed the two lines into the common input terminals.

Installation of UHF Channel Strips

To install UHF Channel Strips it is not necessary to remove the chassis from the cabinet. The installation can be made from the bottom of the instrument, as follows:

(1) Turn the instrument over on its top, placing it on a suitable protective pad or cloth. Remove a few staples and fold back a portion of the ventilating screen on the tuner side of the chassis mounting shelf. This provides easy access to the tuner in most instruments. On the smaller table models it may be necessary to loosen the chassis mounting bolts and allow the chassis to slip down a fraction of an inch.

(2) Remove the anti-radiation shield, prying up with a screw driver.

(3) Remove a set of unused VHF strips (either adjacent or preferably, one channel away from a locally received VHF station).

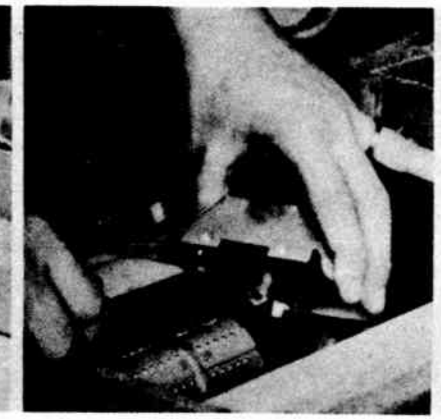
(4) Insert the UHF Strips as follows:
- (A) UHF Antenna segment first.
- (B) Oscillator segment last. Make certain that a good connection is made at the inter-connector wire between segments.
- (C) Make sure that the spring clips hold the segments securely in place.

(5) Replace the anti-radiation shield and tack down the ventilating screen.

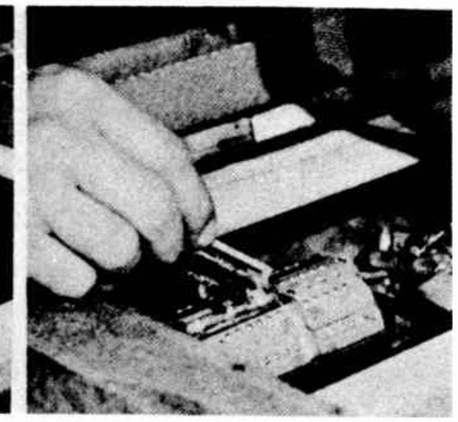
(6) Return the instrument to the upright position and proceed with the set-up adjustments as outlined on page 1 of this folder. The local oscillator adjustment for the UHF strip is similar to that for VHF. As a final check set the channel selector to the channel position in which the UHF strip has been installed and set the fine tuning control to the center of its range. Insert an insulated alignment screw driver through the oscillator adjustment hole in the front of the chassis and adjust the oscillator slug slowly (either in or out) until the picture begins to distort (sound in picture). Rotate the slug just slightly from this position to the point of best picture definition.

Caution: Do not make any other adjustments to the UHF strips. When more than one set of strips are installed they must be spaced on the turret at least one VHF strip apart. Due to the physical size of the strips, they cannot be installed adjacent to each other in the turret. After the installation is completed, the proper UHF channel indicator tab should be cemented in place on the Channel Selector to identify the position (or positions) in which UHF strips have been inserted. Sets of UHF and VHF channel tabs are available from your Capehart Distributor. The set contains VHF tabs which can be cemented in place also on the Channel Selector to present a symetrical appearance.

Raising Screen From Chassis Mtg. Shelf

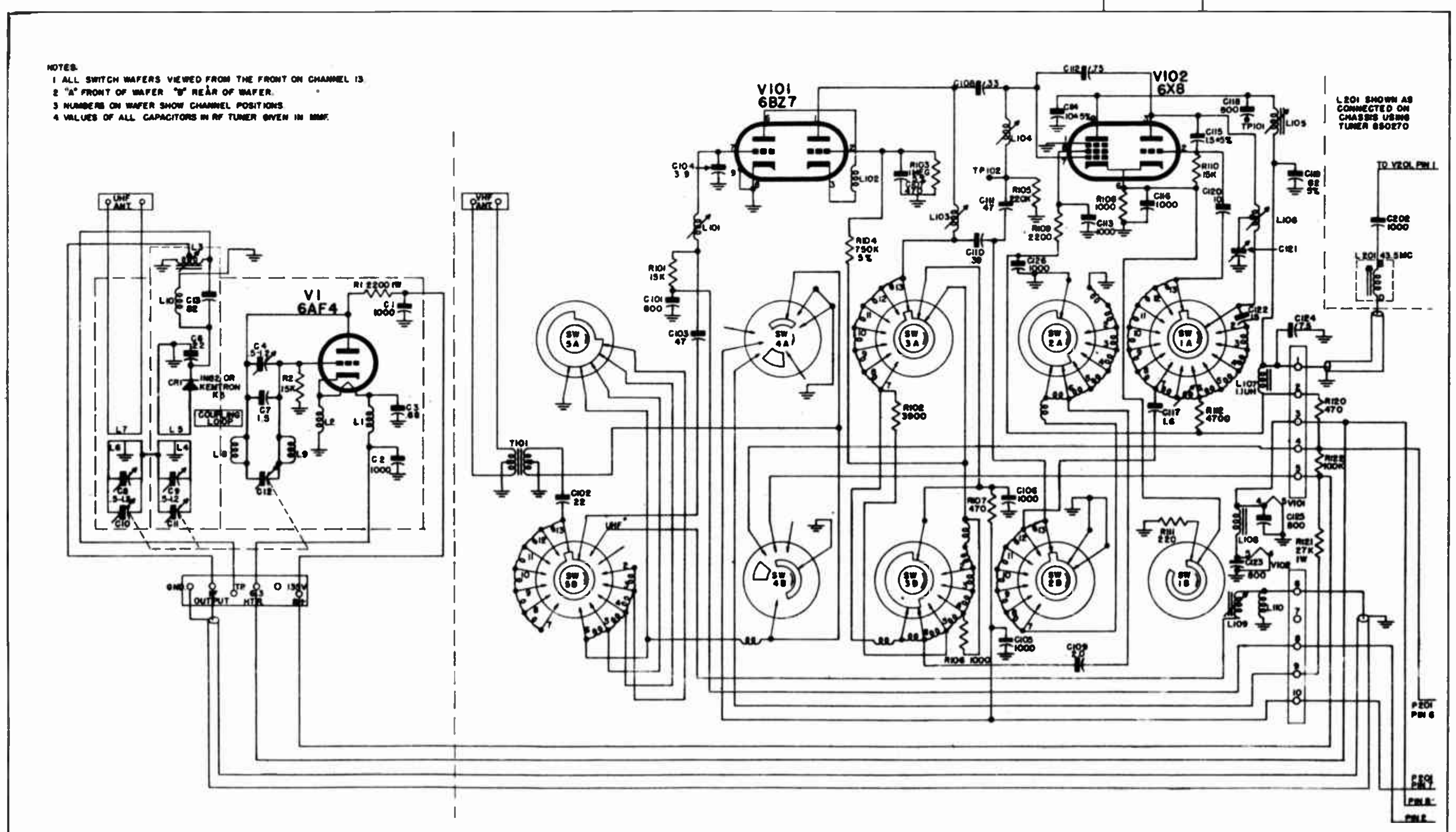


Removing Shield from Tuner



Inserting UHF Strips

COMBINED UHF/VHF TUNER UNITS

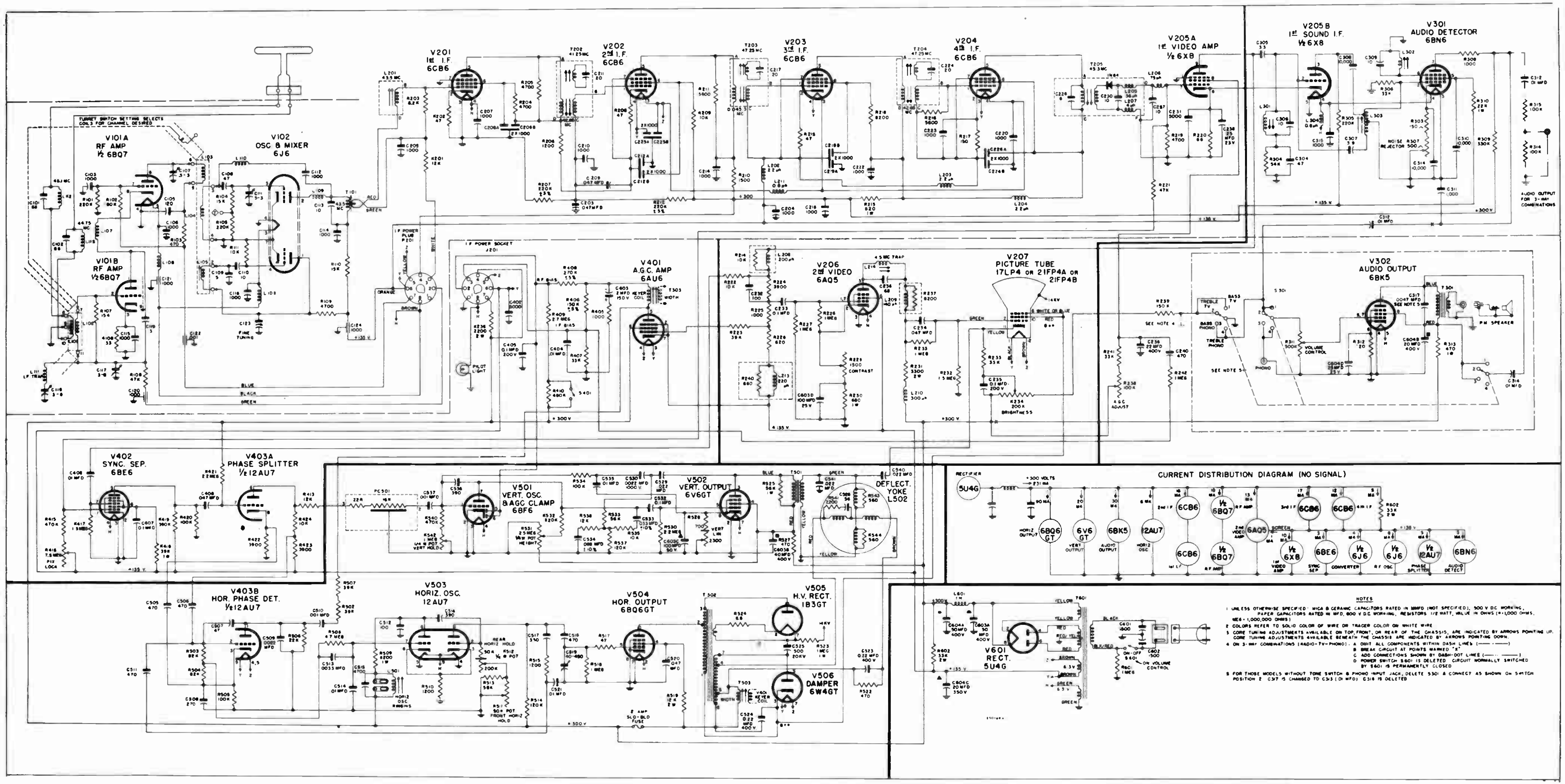


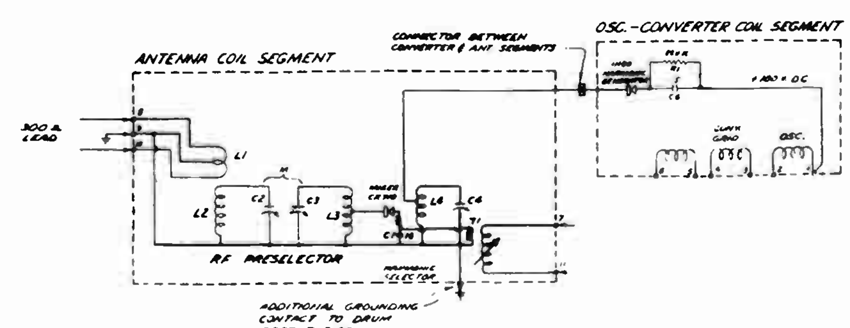
UHF TUNER PART NO. 750445

VHF TUNER PART NO. 850270

CAPEHART "CX-37" SERIES TV CHASSIS

WITH R-F UNIT PART NO. 850222

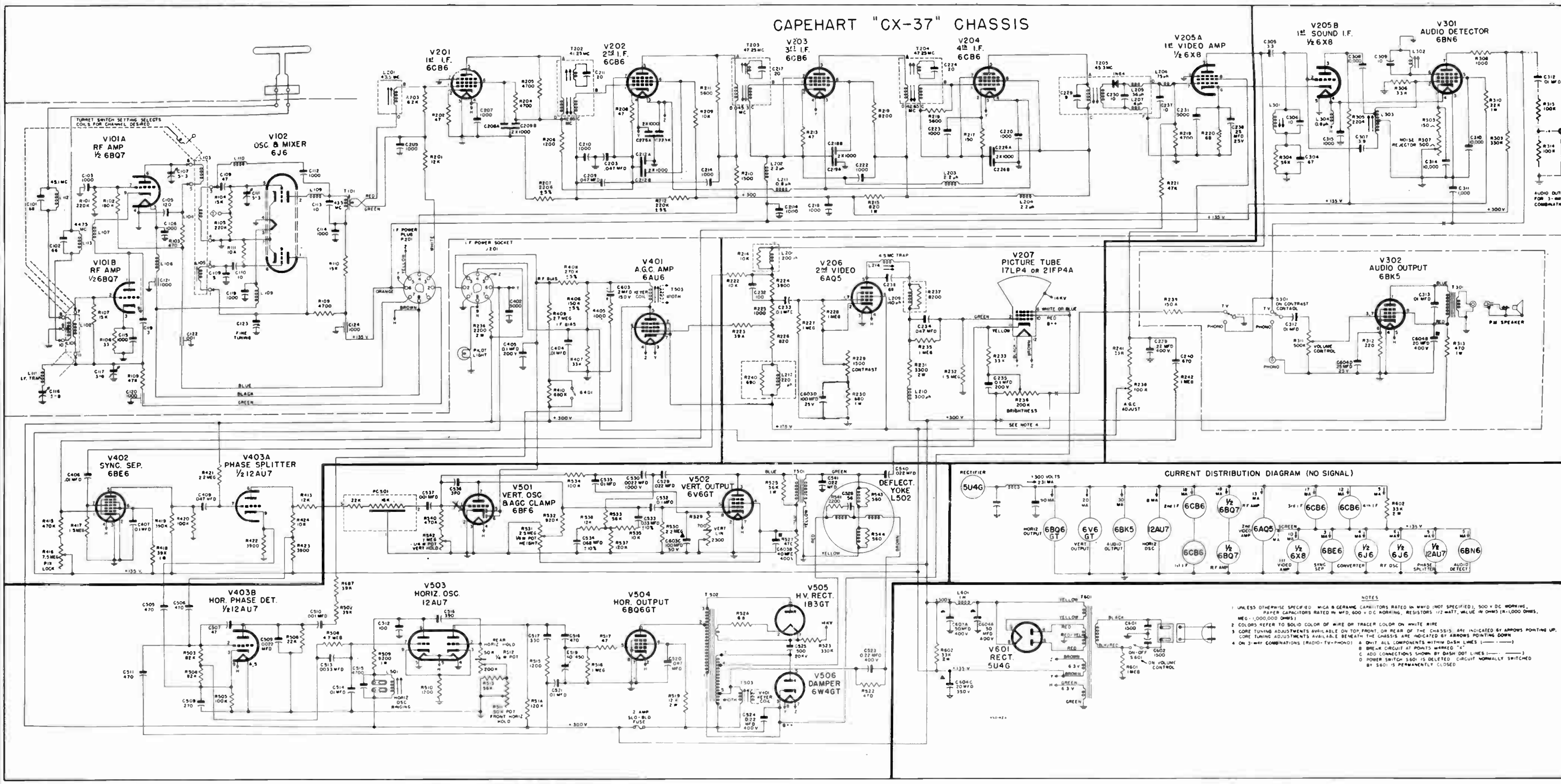




Beam Corrector Magnet Adjustment

Adjust the Height Control so that the top and bottom edges of the raster are just visible and check to see if the raster lines near the top and bottom are sufficiently straight. If the lines are bent adjust the two Beam Corrector Magnets (attached to the yoke support bracket, one on each side of the CRT) to remove the bend. These magnets are adjusted at the factory and should not require re-adjustment unless they have been accidentally bent out of position.

These magnets can be adjusted by moving them closer to or further from the bell of the CRT or by moving them from side to side. As the magnet is moved closer to the tube, the raster lines will be pulled toward the magnet. Likewise as the magnet is moved away from the tube, it will have less effect on the raster lines. If the magnets have been shifted considerbly from their correct adjustment an irregular bend may appear in the raster at the sides.


CAPEHART "CX-37" CHASSIS
V101A RF AMP 1/2 6BQ7
V101B RF AMP 1/2 6BQ7
V102 OSC & MIXER 6J6
V201 1st I.F. 6CB6
V202 2nd I.F. 6CB6
V203 3rd I.F. 6CB6
V204 4th I.F. 6CB6
V205A IE VIDEO AMP 1/2 6X8
V205B 1st SOUND I.F. 1/2 6X8
V301 AUDIO DETECTOR 6BN6
V401 A.G.C. AMP 6AU6
V206 2nd VIDEO 6AQ5
V207 PICTURE TUBE 17LP4 or 21FP4A
V302 AUDIO OUTPUT 6BK5
V402 SYNC. SEP. 6BE6
V403A PHASE SPLITTER 1/2 12AU7
V501 VERT. OSC & AGC CLAMP 6BF6
V502 VERT. OUTPUT 6V6GT
DEFLECT. YOKE L502
CURRENT DISTRIBUTION DIAGRAM (NO SIGNAL)
V403B HOR. PHASE DET. 1/2 12AU7
V503 HORIZ. OSC. 12AU7
V504 HOR. OUTPUT 6BQ6GT
V505 H.V. RECT. 1B3GT
V506 DAMPER 6W4GT
V601 RECT. 5U4G
NOTES

THE FLEETWOOD MODEL 600 REMOTE TUNING TELEVISION SYSTEM

The FLEETWOOD Remote Receiver is designed for custom installation in a special cabinet, in the wall of a room, or into a recess or nook which may exist in the television viewing area. Its flexibility frees it from the usual requirement that the entire set be accessible for tuning. With the FLEETWOOD Remote system, it is quite practicable to place the viewing screen over a stairway, or over a buffet. The tuner, measuring only 7 x 11 1/2 inches, may be built into an end table, into a magazine rack, or placed wherever it may be of service with a minimum of effort on the part of the viewer. It may be mounted in any position, and its beautifully edgelit dial, in perfect taste, will add warmth and color to any room.

The system employs 27 tubes, and will accommodate any of the standard 21" or 24" magnetic focus picture tubes. The high voltage system employed will supply 18,000 volts nominally, resulting in extremely good spot focus and high brilliance. A cosine squared yoke insures uniform focus over the entire screen.

The picture chassis, when fitted with a 21" tube, can be mounted in a space 21" wide and 21" high. The 21AP4 picture tube is only 22 3/4" long, from the faceplate to the outside of the tube socket. This tube is recommended wherever space is at a premium; for installation in an existing cabinet, or an enclosure of limited size. When fitted with a 24" tube, the chassis can be mounted in a space 26" wide and 30" high. The 24" tube is 24" long from faceplate to the outside of the socket.

The following Kits are available as accessories to your Fleetwood Receiver:

601 A Kit for mounting a type 21AP4 Metal rectangular tube. This Kit includes:

1 - Plastic ring for the front of the picture tube.
1 - Plastic sleeve for the picture tube, with anode connector.
1 - Rubber band for the plastic ring.
1 - Tie down cable for the picture tube, 49" long.
1 - Set of blocks for the front of the picture tube.
4 - 8-32 x 3/4" self-threading screws for the blocks.
2 - Nuts for the tie down cable.

601 B Kit for mounting a 21" glass tube, either cylindrical or spherical faced. This Kit includes:

1 - Pair of support blocks for the front of the picture tube.
1 - Tie down strap for the front of the picture tube.
1 - Anode connector for the picture tube.
4 - 8-32 x 3/4" self-threading screws for the support blocks.
2 - Pieces of cork for the face of the support blocks.
2 - Phosphor Bronze Strips 1/4" x 2".
2 - #6-32 Self-threading screws.

604 A Kit for mounting a 24AP4 round metal tube. This Kit contains:

1 - Pair of side panels to support the yoke and focus coil.
1 - Pair of front tube support assemblies.
2 - 6-32 x 1/4" self-threading screws for the front support assemblies.
2 - 8-32 x 1/4" self-threading screws for the front support assemblies.
1 - Tie down cable for the front of the tube - 64" long.
1 - Plastic ring for the front of the tube
1 - Insulating sleeve for the tube, with anode connector.
1 - Rubber band for the plastic ring.

621 A Kit for framing a 21" metal picture tube. This Kit is assembled at the factory and is composed of the following items:

1 - Picture frame of Pacific Coast Birch, unfinished, sanded smooth, approximately 18 1/2" x 24 1/2" outside dimensions.
1 - Safety glass, 16" x 22" x 7/32", laminated.
1 - Mask for a 21AP4 type tube, gray-green in color.
4 - Clips for holding the assembled frame to the wall.

621 B Kit for framing a 21" Cylindrical Faced glass tube. This kit is assembled at the factory, and is identical with the 621 A Kit except for the mask, which will fit a Cylindrical Faced glass tube instead of the metal tube.

624 Kit for framing a 24" Round Metal Tube. This kit is assembled at the factory, and is composed of the following items:

1 - Picture Frame of Pacific Coast Birch, unfinished, sanded smooth, approximately 22" x 28" outside dimensions.
1 - Safety Glass, 20" x 26" x 7/32", laminated.
1 - Mask for a 24AP4 tube, gray-green in color.
4 - Clips for holding the assembled frame to the wall.

ELECTRICAL SPECIFICATIONS

PICTURE TUBE:	21AP4 Metal Rectangular or 24AP4 Metal Round
REMOTE PANEL CONTROLS:	Station Selector Fine Tuning Contrast Off-On-Volume

PICTURE CHASSIS CONTROLS: FRONT:	Height Vertical Linearity Brightness Focus Horizontal Hold Vertical Hold	
REAR:	Width Horizontal Drive Horizontal Linearity	
I. F. FREQUENCIES:	Video 25.75 mc Audio 21.25 mc	
BANDWIDTH:	4 mc	
AUDIO OUTPUT:	1. 4.5 watts at terminals on Picture Chassis with volume control on remote tuner; 2. Ratio detector output; no volume control.	
POWER:	117 Volts, 60 Cycle Picture tube chassis: 180 watts Remote tuner chassis: 55 watts	
PICTURE TUBE ANODE VOLTAGE:	18 kv, design center	

TUBE COMPLEMENT:
(Remote Tuner)

1 - 6BQ7/6BK7	Cascode R.F. Amplifier
1 - 6J6	First Detector and Local Oscillator
1 - 6CB6	First I. F. Amplifier
3 - 6AU6	2nd, 3rd, and 4th I. F. Amplifiers
1 - 12AU7	Video Detector, AGC Rectifier, and 1st sound I. F. Amplifier
1 - 6AU6	2nd sound I. F. Amplifier
1 - 6AL5	Sound Ratio Detector
1 - 6AB4	Sound Cathode Follower
1 - 12AT7	Video Cathode Follower
1 - 6X4	Rectifier

TUBE COMPLEMENT:
(Picture Chassis)

1 - 6AB4	Grounded Grid Video Input Stage
1 - 6AC7	Video Output Stage
1 - 6BE6	Sync Stripper and Noise Inverter
1 - 6SN7	Sync Phase Inverter and D.C. Restorer
1 - 6AL5	Horizontal Discriminator
1 - 6SN7	Vertical Oscillator
1 - 6S4	Vertical Output Amplifier
1 - 6SN7	Horizontal Oscillator
1 - 6CD6	Horizontal Amplifier
1 - 6W4	Horizontal Damper
1 - 1B3	High Voltage Rectifier
1 - 6AV6	Audio Input Amplifier
1 - 6V6	Audio Power Amplifier
1 - 5U4	Plate Supply Rectifier

WARNING — HIGH VOLTAGE

Extremely high voltages are used in the operation of this set. To avoid personal injury, extreme care should be exercised so that no contact is made with any components connected to the high voltage circuits. Do not operate the receiver with the high voltage compartment shield removed.

WARNING — PICTURE TUBE HANDLING

Particular care must be exercised when handling picture tubes due to their high vacuum and large surface area. The picture tube must not be struck, scratched, or subjected to more than moderate pressure at any time as fracture of the glass will result in an implosion of considerable violence capable of damaging both property and person.

DIMENSIONS

	Width	Height	Depth
PICTURE CHASSIS			
21" Chassis:	20 1/4	14 1/2	20 1/4
21" Chassis, tube mounted:	20 3/4	21	23 1/4
24" Chassis:	20 1/4	19	22 1/2
24" Chassis, tube mounted:	26	30	25 1/4
TUNER CHASSIS	11 1/2	7	8 1/2

INSTALLING A 21" METAL PICTURE TUBE (21AP4) USING 601 A KIT

1. Mount the front support blocks on the chassis, ridges forward, screwing the 8-32 x 3/4" self-threading screws through the blocks and into the holes found 1/2" from the front of the chassis.

2. Unpack the type 21AP4 picture tube and place it face down on a soft pad to protect it from being scratched. Place plastic sleeve over the tube away from the socket key. Bend the clip around the front edge of the rim of the picture tube.

3. With the plastic sleeve snug against the tube, wrap the plastic ring around the front rim of the tube, over the sleeve. Work the ring tightly around the tube. Secure the ring with the rubber band, which must lie flat in the groove.

4. Loosen the screws which hold the yoke mounting hood on top of the mounting panels, allowing the yoke to slip toward the rear of the chassis.

5. Set the picture tube, complete with its ring and plastic cover, in place on the chassis, using extreme caution not to damage the deflection yoke windings with the prongs of the picture tube as the base of the tube is guided through the yoke. The high voltage clip should be on your left as you face the tube. The ridges on the front mounting blocks should fit into the groove in the mounting ring.

6. Place the tie down cable in the groove in the plastic ring and pass the ends through the holes in the front corners of the chassis. Screw the nuts on the ends and tighten MODERATELY. These nuts need be only "finger tight" to secure the tube.

7. Solder anode connector to the end of the white wire extending through the front of the high voltage box. Snap this connector into the terminal in the plastic sleeve.

8. Loosen the wing screw protruding from the top of deflection yoke. Push the yoke mounting hood forward until the rubber rims engage the flare of the picture tube firmly. While holding the hood forward under moderate tension, tighten the two screws which fasten the hood to the top of the upright panels.

9. Push the deflection yoke forward until it also engages the flare of the picture tube, and tighten the wing screw in the top of the deflection yoke.

10. Clamp the Ion Trap Magnet around the neck of the picture tube, about 1/2" forward of the tube base.

11. Place the picture tube socket on the base of the picture tube. Dress the leads away from the tubes on the chassis, and also away from the picture tube.

INSTALLING A 21" GLASS TUBE USING A 601 B KIT

1. Mount the front support blocks on the chassis, screwing the 8-32 x 3/4" screws through the blocks and into the holes found 1/2" from the front of the chassis.

2. Remove the four screws which hold the yoke mounting panels to the chassis. Move the entire assembly (yoke, focus coil and panels) back 1 1/4", by putting the screws into the front set of holes in the panels.

3. Fasten the 2" x 1/4" grounding strips to front of yoke mounting panels, using 6-32 x 1/4" self-threading screws.

4. Place the pieces of cork on the faces of the front blocks. If desired, the cork may be cemented to the blocks.

5. Loosen the screws which hold the yoke mounting hood on top of the mounting panels, allowing the yoke to slide toward the rear of the chassis.

6. Set the picture tube in place on the blocks, using extreme caution not to damage the deflection yoke windings with the prongs of the picture tube as the base of the tube is guided through the yoke. The anode connection on the side of the picture tube should be on your left as you face the tube. The grounding strips must make connection with the coating on the outside of the tube.

7. Place the tie down strap over the top of the picture tube and pass the ends through the holes in the front corners of the chassis Screw the nuts onto the ends of the strap MODERATELY. These nuts need be only "finger tight" to properly secure the tube.

8. Loosen the wing screw protruding from the top of the deflection yoke. Push the yoke mounting hood forward until the rubber rim engages the flare of the picture tube firmly. While holding the hood forward under moderate tension, tighten the two screws which fasten the hood to the top of the upright panels.

9. Push the deflection yoke forward until it also engages the flare of the picture tube, and tighten the wing screw on top of the deflection yoke.

10. Clamp the ION TRAP MAGNET around the neck of the tube, about 1/2" forward of the base.

11. Place the picture tube socket on the base of the picture tube.

12. Dress the leads away from the tubes on the chassis, and also away from the picture tube.

13. Solder the anode connector onto the end of the white wire extending through the front wall of the high voltage box, and press connector into place on the picture tube.

INSTALLING A 24" TUBE USING A 604 A KIT

1. Mount the front support brackets on the chassis. Each front support bracket is mounted (wood side forward) with one 8-32 and one 6-32 self-threading screws. The screws are driven upward from beneath the chassis. The 8-32 screw goes through the hole in the corner of the chassis and engages the center hole in the bracket.

2. Remove the deflection yoke hood and the focus magnet assembly from the upright panels at the rear of the chassis. Remove the panels, and replace them with the taller panels supplied with the 24" mounting kit. Replace the deflection yoke and hood, leaving it loose and free to slip toward the rear of the chassis. Remount the focus magnet on the new panels.

3. Unpack the type 24AP4 tube and place it face down on a soft pad to protect it from being scratched. Place the plastic sleeve over the tube, with high voltage clip on the side of the tube away from the socket key. Bend the high voltage clip around the front edge of the rim of the tube.

4. With the plastic sleeve snug against the tube, wrap the plastic ring around the front of the tube, over the sleeve. Secure the ring with the rubber band, which must lie flat in the groove.

5. Set the picture tube, complete with its ring and sleeve on the chassis, using extreme caution not to damage the deflection yoke windings with the prongs of the picture tube as the base of the tube is guided through the yoke. The high voltage clip should be on your left as you face the tube. The front mounting pieces should fit into the groove in the mounting ring.

6. Place the tie down cable in the groove in the plastic ring, and pass the ends through the holes in the outside ends of the front mounting assemblies. Screw the nuts on the ends of the rod and tighten moderately.

7. Solder anode connector to the end of the white wire extending through the front of the high voltage box. Snap this connector into the terminal in the plastic sleeve.

8. Loosen the wing screw which holds the deflection yoke in the yoke mounting hood. Push the yoke mounting hood forward until the rubber rims engage the flare of the picture tube firmly. While holding the hood forward under moderate tension, tighten the two screws which fasten the hood to the top of the upright panels.

9. Push the deflection yoke forward until it also engages the flare of the picture tube, and tighten the wing screw which holds it in the yoke mounting hood.

10. Clamp the Ion Trap Magnet around the neck of the picture tube about 1/2" forward of the tube base.

11. Place the picture tube socket on the base of the picture tube. Dress leads away from the tubes on the chassis, and away from the picture tube.

ELECTRICAL CONNECTIONS

Connect the tuner chassis with the picture chassis, using the 40-foot cable provided. Connect a P.M. Type speaker to the speaker terminals on the picture tube chassis. Plug each unit into a 117 volt, 60 cycle source of power. Turn the system "ON" by clockwise rotation of the center control on the tuner chassis. The tubes in both chassis should now be lighted.

Set the brightness control on the picture chassis to maximum. Adjust the Ion Trap Magnet until the screen of the picture tube lights up. The Ion Trap may be rotated completely, and moved back and forth along the neck of the picture tube. Proper adjustment has been attained when the light on the face of the picture tube is at its maximum.

Connect an antenna to the antenna terminals on the tuner chassis, using 300 ohm twin lead. It should now be possible to tune in a station.

CENTERING THE PICTURE

Each FLEETWOOD system is operated at the factory with a standard picture tube and is properly adjusted. However, picture tubes vary slightly and, when first set up, the picture on your set may not be properly centered. Around the neck of the picture tube, to the rear of the deflection yoke, will be found a focus magnet. It is mounted on a shelf with a single wing nut and is adjustable laterally on the shelf. The shelf in turn is mounted with two wing nuts and is adjustable vertically. These adjustments permit centering the picture. If the picture must be raised, the focus coil must be raised. Similarly, if the picture must be moved to one side in order to be centered, the focus magnet must be moved in the same direction as it is necessary to move the picture.

After the picture has been centered, it will be necessary to readjust the Ion Trap. The Ion Trap MUST BE ADJUSTED FOR MAXIMUM SCREEN BRIGHTNESS ONLY, OR THE PICTURE TUBE WILL BE DAMAGED, OVER A PERIOD OF TIME. MAKE ALL CENTERING ADJUSTMENTS WITH THE FOCUS COIL.

To level the picture, loosen the wing screw above the deflection yoke and turn the yoke slightly. Keep the yoke pushed forward against the flare of the picture tube when tightening the wing screw.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS: These adjustments should be made only if a reliable test pattern is available from a station. During some parts of the day several stations may be transmitting test patterns, and their individual differences may be "averaged." Generally speaking, the "Vertical Linearity" controls the top portion of the picture, and can make the test pattern "flat headed" or "egg headed." After changing the Vertical Linearity, the height will probably have to be reset.

HORIZONTAL HOLD: If the stations should come in as a series of black and white bars running diagonally across the screen, adjust the Horizontal Hold. Do not center the picture with this control.

VERTICAL HOLD: Proper adjustment of this control will prevent the picture from "rolling" either up or down. When the Horizontal and Vertical Hold controls have been adjusted, they should not require re-setting for many months.

BRIGHTNESS: With no station tuned in, adjust this control so that the screen is nearly dark.

NORMAL OPERATION OF THE SYSTEM:

Select a station desired with the Station Selector Knob. Behind this knob is a FINE TUNING CONTROL. Turn this control counter-clockwise until the picture appears to be covered with a fine mesh pattern, or has "sound" in it. Turn the fine tuning control clockwise until this effect just disappears. This will be the point at which the picture will have a maximum of fine detail.

Adjust the CONTRAST control for the most pleasing picture. Too much contrast will give the picture a coarse appearance, while too little contrast will give the picture a "washed out" appearance.

OPERATION OF THE SYSTEM WITH A SEPARATE AUDIO SYSTEM:

On the rear of the tuner chassis is a jack marked DETECTOR OUTPUT, which may be used to supply audio to an external amplifier. In this case, the volume control in the tuner will not function, and the loudness or volume control in the external system must be used. It is important that the speaker terminals on the picture tube chassis be shorted with a wire at all times if there is no speaker connected to these terminals. Failure to do so may result in damage to the audio output transformer in the picture tube chassis.

CABINET CONSIDERATIONS

The FLEETWOOD picture chassis should always be mounted in a cabinet, or in an enclosure behind a wall. In either case, the face of the picture tube should be protected by a safety glass window. Suitable laminated safety glass, together with a Royalite Picture Mask and a mounting frame are available in the FLEETWOOD 621 Accessory Kit (for 21" tube); and the FLEETWOOD 624 Accessory Kit (for 24" tube). This safety glass should be mounted on a plywood panel not less than 1/4" thick. Panel layout drawings will be found in the back of this manual.

A piece of the plywood 2-1/2" x 10-1/2" should be salvaged from the panel cutout to make a matching cover for the secondary controls. Two spring clips are provided to hold the cover in place. This cover will rarely have to be opened after the set has been properly adjusted. If the set is housed in a cabinet, the back of the cabinet should be masonite. Ventilation should be provided by piercing the masonite with holes not larger than 1/4" in diameter, on centers not greater than 1/2".

In order that the longest possible life may be expected from the tubes and other components in the system, it is imperative that both chassis be installed in a manner that will provide adequate ventilation. The shelf on which the picture chassis is mounted should have an opening approximately ten inches square, near the center of the chassis. This opening should be covered with hardware cloth, or heavy screen.

MOUNTING THE TUNER

If the tuner is to be installed in a piece of furniture, check the thickness of the panel behind which it is to be installed. If the panel is not over 1/2" thick, the front panel and the bottom of the tuner may be removed and the dial bezel may be mounted directly on the panel.

An opening approximately 4" x 6" should be made in the shelf beneath the chassis for ventilation, and the opening should be covered with hardware cloth or heavy screen. Provision must also be made for ventilating the top of the chassis. At least 30 square inches of opening is recommended, at either the top, back, or sides of the tuner.

SERVICE NOTES

OSCILLATOR ADJUSTMENT

If the fine tuning control knob does not turn far enough to properly bring in a particular station, set the fine tuning control at the middle of its range. Turn the oscillator adjusting slug clockwise until the picture has "sound interference" in it. Turn slug counter-clockwise until this interference just disappears. This slug can be adjusted through the hole located one inch to the right of, and 1/4 inch above the station selector shaft. As the station selector is turned to a different station, a different slug will appear in the hole. Use a non-metallic screw driver. A fraction of a turn should be sufficient.

Should the slug "fall into" the coil form, remove the bottom tuner cover by pulling downward on its forward end, and remove the forward channel coil cartridge of the station concerned. Move the slug retaining spring out of its slot, and tap the coil assembly until slug slips forward. Set the retaining spring in place so that it rests firmly against the slug, and reassemble the tuner.

If the fine tuning is off in the same direction on all stations, due to replacing V2 (6J6), set the station selector on a station in the "high group" (11-13), set the fine tuning knob in the middle of its range. Turn C15 counter-clockwise until the picture has "sound interference" in it, then turn it clockwise until this interference just disappears.

I. F. ALIGNMENT — VIDEO

1. Connect the negative terminal of a 3-volt battery to the junction of C118 and R105; positive grounded.

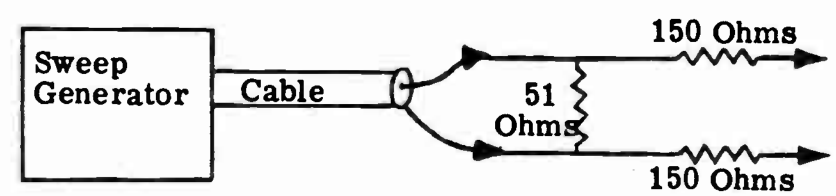
2. Connect the negative probe of a VTVM to point "A" at the "high" end of the contrast potentiometer; positive meter terminal to ground.

3. Connect signal generator having a 21-28 mc range, to pin #1 of V101 (6CB6) through a D.C. blocking condenser.

Adjust the following:

Coil	Frequency	Indication
T105 - Bottom Slug	27.25	Null
T101 - Bottom Slug	21.1	Null
T102	21.25	Null
T105 - Top Slug	25.5	Maximum
T101 - Top Slug	22	Maximum
L104	23	Maximum
L105	24.5	Maximum

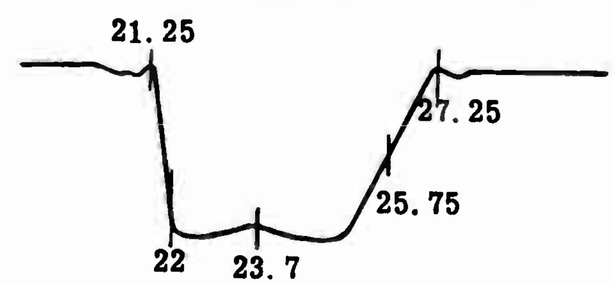
Replace the VTVM with an oscilloscope, and the signal generator with a sweep generator, adjusted to sweep 20-28 M.C. If necessary, re-adjust T101 (top), T105 (top), L104 and L105 to produce a curve approximately as shown:



Set marker generator to 23.7 and adjust L9 so that the dip produced by it is at 23.7 mc. Move the sweep generator lead to the output terminal of the tuner and adjust L101 for maximum response at 23.7 m.c.

TUNER ADJUSTMENT

Set sweep generator on channel 12 and feed the antenna terminals through a balancing network as shown:



Set station selector on channel 12 and adjust C6, C2 and C7 for maximum output and minimum tilt on top of curve.

I. F. ALIGNMENT – SOUND CHANNEL

1. Connect a voltmeter from the junction of R125 and R126 (point D) to ground. Tune in a station. Adjust T103, top and bottom, and T104 bottom for maximum reading. Connect the voltmeter between points C and D and adjust T104 top for zero voltage.

4 1/2 M.C. VIDEO TRAP ADJUSTMENT

With a station tuned in, turn the fine tuning control knob counter-clockwise until "sound interference" can be seen in the picture. Adjust L107 for a minimum of this interference.

HORIZONTAL OSCILLATOR ADJUSTMENTS:

1. Horizontal Linearity, L604:

   Connect a voltmeter across the cathode resistor of the 6CD6, R609, and adjust the Horizontal Linearity Coil, L604 for minimum voltage, while watching a standard test pattern. Proper adjustment will be attained when the two halves of the pattern are similar, and will be close to the point of minimum cathode voltage.

2. Horizontal Frequency, L603:

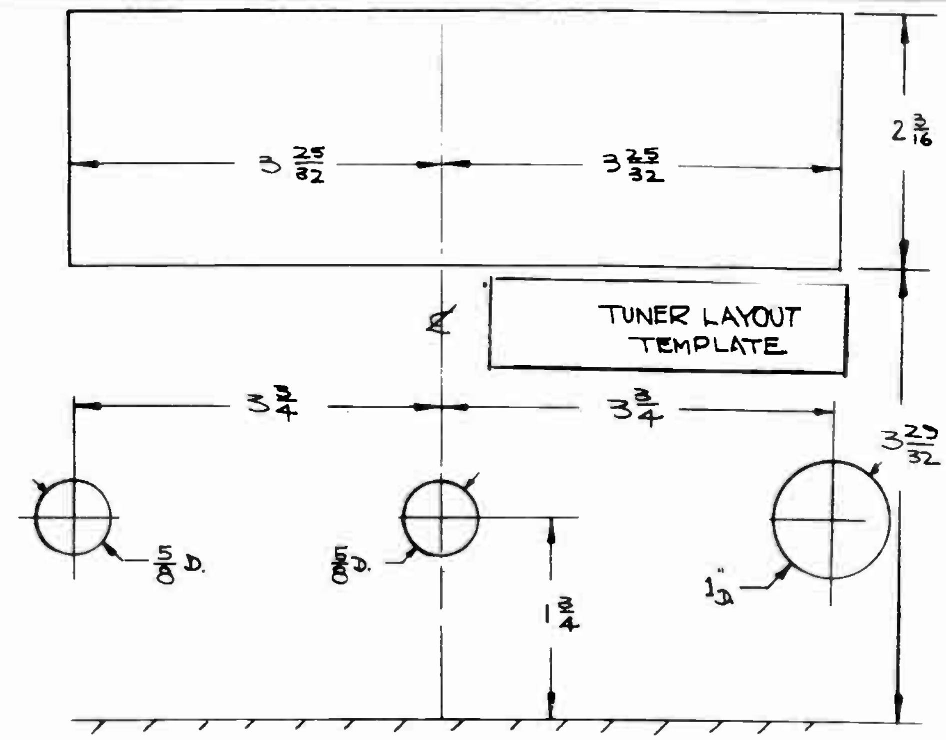
   With a station tuned in, temporarily ground the grid, pin #1, of V601, the horizontal oscillator. Set the horizontal hold in the middle of its range, and adjust L603 until the picture is nearly stopped. Remove temporary ground from pin #1, V601.

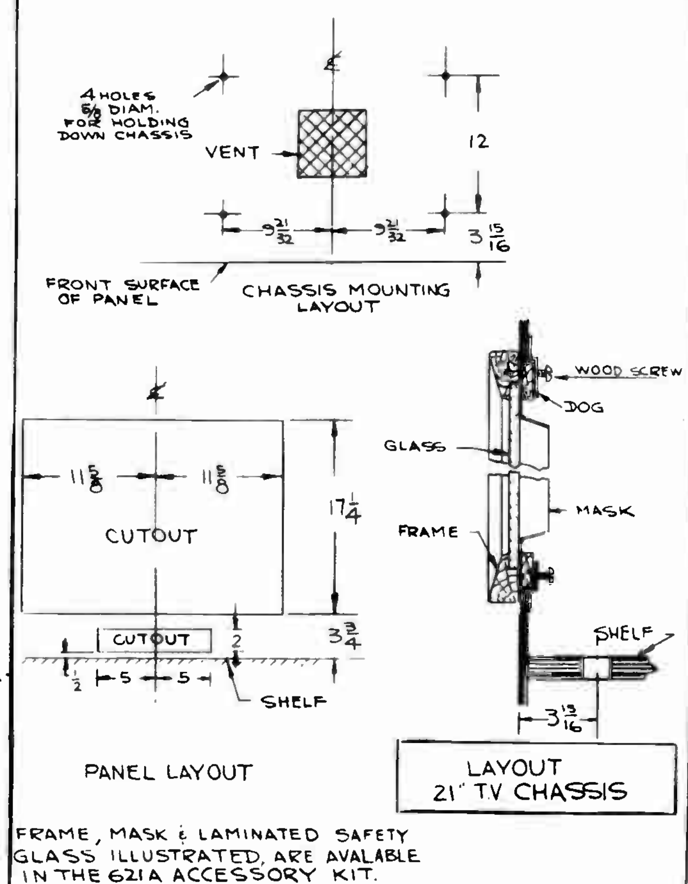
3. Horizontal Drive, C609:

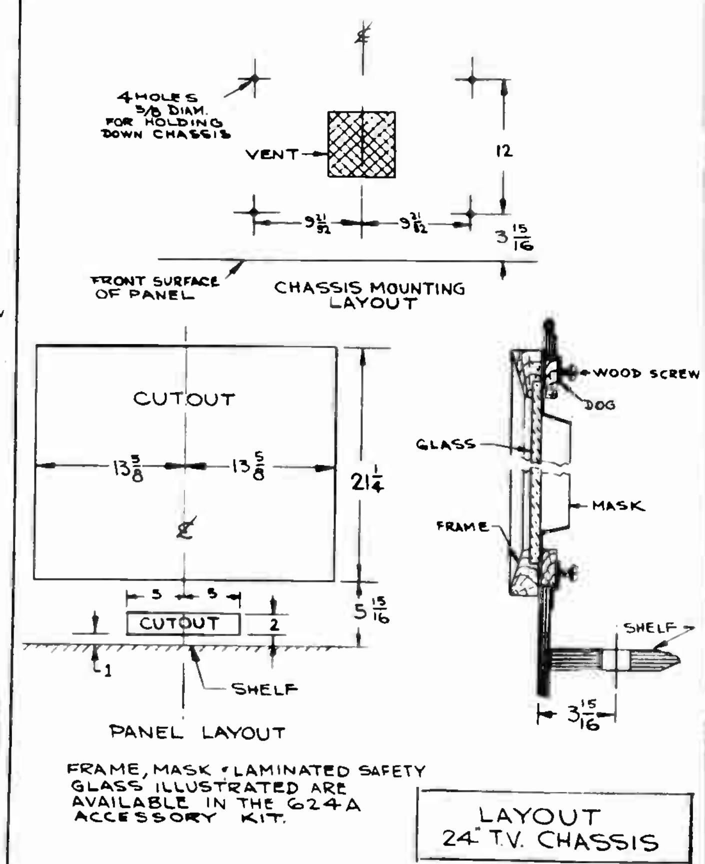
   With a station tuned in, set contrast at its minimum, and brightness so that the screen is lighted. Turn C609 clockwise from the rear of the chassis (loosen) until a white vertical bar appears near the middle of the screen. Tighten (counter-clockwise) until the bar just disappears.

4. Width:

   Adjust so that 1/8" to 1/4" of the picture is off the screen on each side.







All resistors are 1/2 watt, 10% composition except as noted.

RESISTORS

Symbol No.	Description
R-615	3.9Ω, w.w.
R-302	10Ω, w.w.
R-431	51Ω 5%
R-430	100Ω
R-434	120Ω
R-608	150Ω
R-435	220Ω
R-207	270Ω
R-304	470Ω 1w
R-619, R-620	560Ω
R-609	300Ω 10w, w.w.
R-208	1000Ω 20% 2w
R-618	1000Ω
R-602	1500Ω 5%
R-512	2000Ω 1w
R-506	1800Ω
R-617	2200Ω 2w 20%
R-422	2700Ω
R-432	2700Ω 5%
R-421	3900Ω
R-309	3900Ω 2w
R-405	4700Ω 2w 5%
R-601, R-606	4700Ω 5%
R-310	5600Ω 2w
R-423	4700Ω
R-308	7500Ω 10w, w.w.
R-610	18KΩ 3w
R-433	10KΩ
R-611	10KΩ 1w
R-514	15KΩ
R-406, R-429, R-612	22KΩ
R-418	39KΩ
R-613, R-614	47KΩ
R-515	82KΩ
R-616, R-621	82KΩ 1w
R-301, R-410, R-424, R-425, R-416	100KΩ
R-203, R-507	220KΩ
R-603, R-604	180KΩ
R-409	330KΩ
R-415	390KΩ
R-205, R-427, R-408, R-426, R-607, R-419, R-436	470KΩ
R-505	250KΩ 1w
R-513, R-428	1 meg
R-509	1.2 meg
R-414, R-417	2.2 meg
R-202	10 meg

POTENTIOMETERS

Symbol No.	Description
R-511	3000Ω (Vert. Lin.)
R-305	3000Ω (Focus)
R-412	500K (Brightness)
R-605	100KΩ (Horiz. Hold)
R-508	250KΩ (Vert. Hold)
R-510	2 meg (Height)

VACUUM TUBES

Symbol No.	Description
V-404	6AL5
V-602	6CD6G
V-201	6AV6
V-202	6V6GT
V-301	5U4G
V-401	6AC7
V-501, V-601, V-403	6SN7GT
V-502	6S4
V-603	6W4GT
V-604	1B3GT
V-402	6BE6
V-406	6AB4
V-405	Kinescope

CAPACITORS

Symbol No.	Description
C-603	47mmf 10% 500V, mica
C-613	47mmf 10% 1KV, mica
C-409	220mmf 20%, mica
C-602	270mmf 5%, mica
C-410, C-411	500mmf 10%
C-611	500mmf 20KV
C-416	.0015mf 10%, mica
C-203	.004mf 600V, tubular paper molded
C-612, C-614	.01mf 600V, molded paper
C-201, C-412	.005mf 500V, ceramic disc
C-506, C-615, C-407	.006mf 600V, paper
C-601	.006mf 500V 10%, mica
C-505	.015mf 600V, paper
C-604	.01mf 600V, paper
C-414	.01, ceramic disc
C-609	700mmf, trimmer
C-202, C-510	.02mf 600V, paper
C-302, C-305	.022mf 600V
C-403, C-408, C-413, C-507, C-607, C-608	.05mf 600V, paper 20%
C-415	.22mf 600V, molded paper
C-404, C-606, C-509, C-616	.1mf 600V, paper
C-511	.25mf 600V, paper
C-605	.5mf 200V, paper
C-618	20mf 450V
C-508	50mf 50V, electrolytic
C-303A, C-303B/C406, C-303C, C-303D/C617	20x20x20x20mf 450V, electrolytic
C-304A/C204, C-304B/C205, C-304C/C610, C-304D	20x20x20mf 450V + 20mf 25V, elec.
C-301A, B	40x40mf 475V

COILS AND TRANSFORMERS

Symbol No.	Description
L-301	Filter choke
L-302	Focus coil, 1400Ω
L-404	Series peaking coil, 93μh
L-402	Shunt peaking coil, 450μh
L-403	Series peaking coil, 215μh on 22K res.
L-602	Width coil, 3-16μh
L-603	Ringing coil, 5.5-20μh
L-601	Deflection yoke, 18 1/2μh
L-604	Linearity coil, 1.5-8.3μh
T-201	Audio output
T-301	Power
T-501	Vertical output
T-601	Horizontal output

All resistors are 1/2 watt, 10% Composition except as noted.

RESISTORS

Symbol No.	Description
R-141	1.5Ω 1w, w.w.
R-102	51Ω 5%
R-104, R-110	68Ω 5%
R-106, R-112, R-113, R-115, R-117, R-120	150Ω
R-137	150Ω 10w, w.w.
R-123	270Ω
R-139	800Ω 10w, w.w.
R-105, R-107, R-114, R-122, R-135, R-133	1000Ω
R-140	2000Ω 10w, w.w.
R-138	3900Ω 1w
R-101	3300Ω 5%
R-108, R-111	4700Ω 5%
R-116	5600Ω 5% 1w
R-132	6800Ω 1w
R-103, R-109	10KΩ 5%
R-125, R-126	10KΩ
R-127	15KΩ 1w
R-124, R-128, R-136	22KΩ
R-121	100KΩ
R-118, R-119, R-129	470KΩ

POTENTIOMETERS

Symbol No.	Description
R-201	500KΩ (Volume) with switch
R-142	5000Ω (Contrast)

VACUUM TUBES

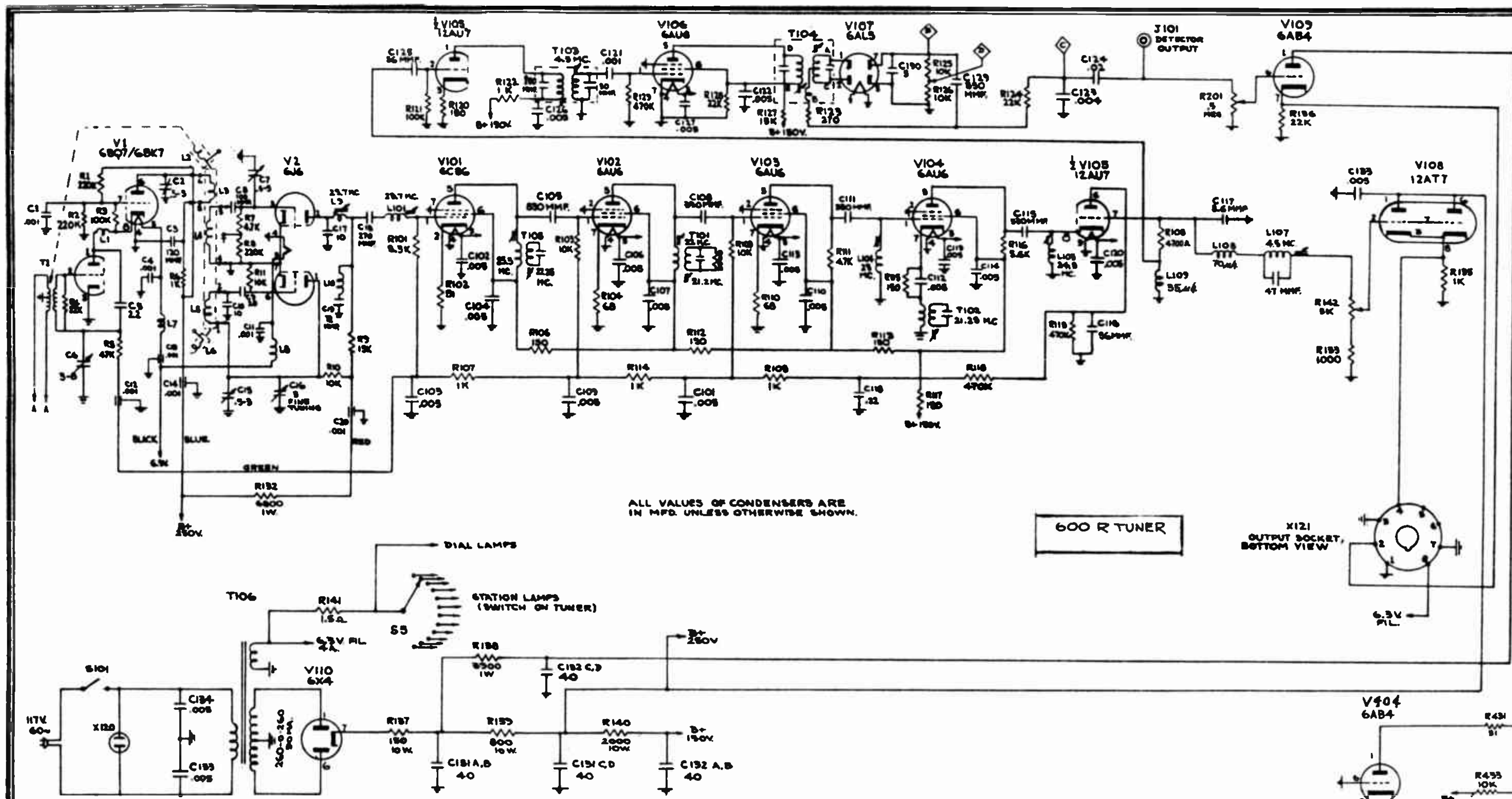
V-107	6AL5
V-102, V-103, V-104, V-106	6AU6
V-101	6CB6
V-105	12AU7
V-109	6AB4
V-108	12AT7
V-110	6X4

CAPACITORS

Symbol No.	Description
C-117	5.6mmf, ceramic tubular
C-116, C-125	56mmf, ceramic tubular
C-129	330mmf 10% mica
C-105, C-108, C-111, C-115	330mmf, ceramic tubular
C-121	1000mmf, ceramic tubular
C-123	.004mf 600V, tubular paper molded
C-101, C-102, C-103, C-104, C-106, C-107, C-109, C-110, C-113, C-114, C-119, C-120, C-122, C-126, C-127, C-112, C-133, C-134, C-135	.005mf, 500V, ceramic disc
C-124	.022mf 600V
C-118	.22mf 400V, paper molded
C-130	5mf 50V, electrolytic
C-131, C-132	20x20x20x20mf 450V, electrolytic

COILS AND TRANSFORMERS

Symbol No.	Description
L-104, L-105, L-101	I. F. Coil
L-107	Video trap coils 4.5 mc
T-105	#2 I. F. Coil with 27.25 mc trap
T-101	#3 I. F. Coil
T-102	Cathode Trap 21.25 mc
T-104	Ratio Det. Coil 4.5 mc
T-103	I. F. Transf. 4.5 mc
L-108	Series Peaking Coil 70 μh
L-109	35 μh Peaking Coil



MODEL 600 CHASSIS
VOLTAGE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V406	235	-	0	F	-	0	3.8	-	-
V401	0	0	0	0	2	140	F	240	-
V402	0	0	F	0	7	15	1.8	-	-
V403	82	82	82	0	380	14	F	0	
V404	±2	±2	F	0	0	-	0		
V501	0	75	3	-16	100	3	F	0	
V502	-	40	0	0	F	0	40	-	600
V601	1	265	11	-11	125	11	F	0	
V602	-	0	30	-	-3	-	F	160	
V603	-	-	Do not measure	360	-		650	650	
V201	-.9	0	F	0	0	0	100		
V202	0	0	225	260	0	-	F	12.5	
V301	-	380	-	357AC	-	357AC	-	380	

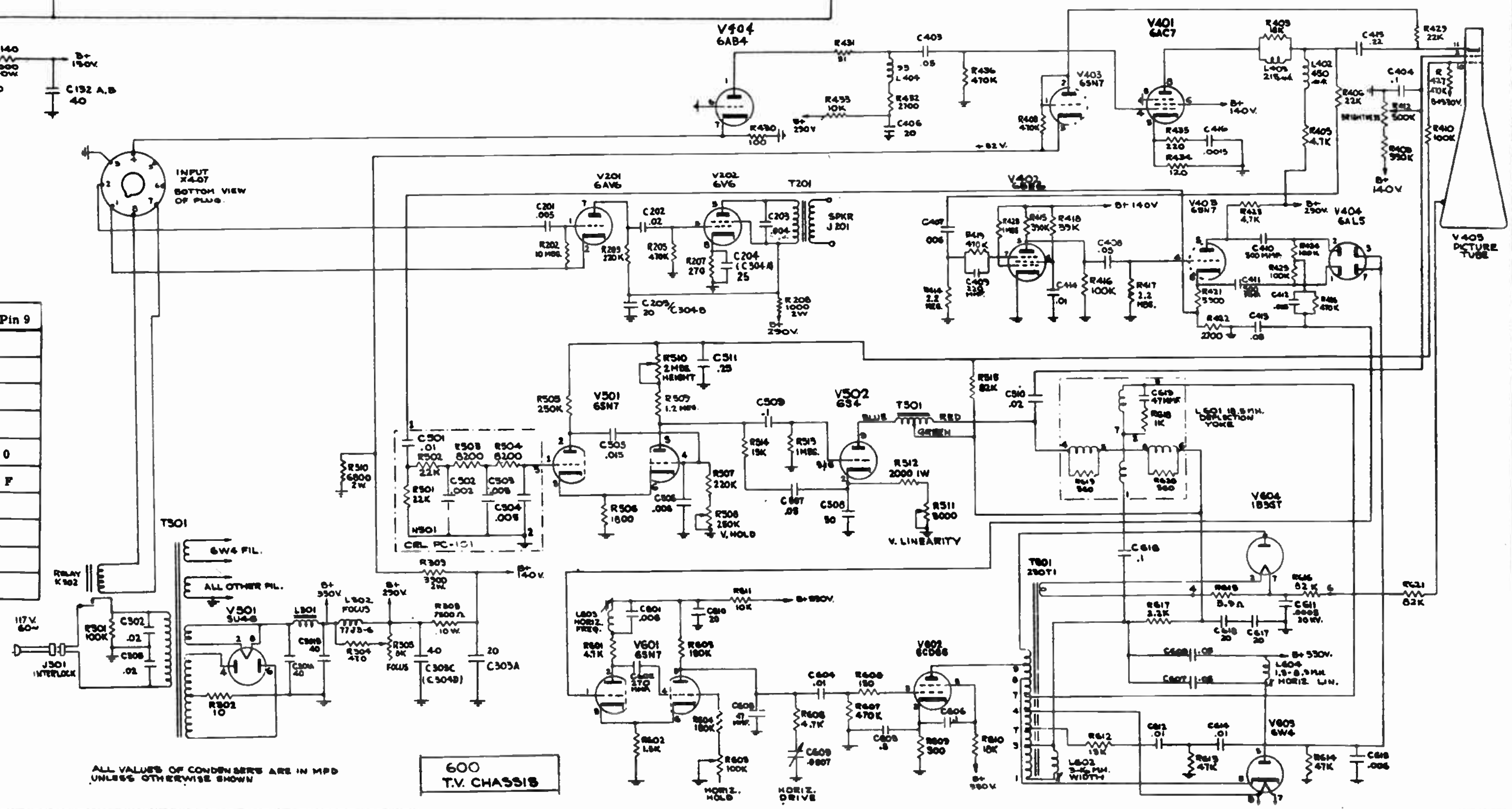
Kinescope Pin #1 - F Pin #2 - 45 Pin #10 - 420 Pin #11 - 82 Pin #12 - 0

Readings taken with RCA Voltohmist or equivalent VTVM

TUNER 600R
VOLTAGE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V101	-2	.3	F	0	125	125	0		
V102	-2	0	F	0	125	125	.3		
V103	-2	0	F	-	105	125	.3		
V104	0	0	F	0	95	125	1.1		
V105	125	0	.8	F	F	-2	-.8	0	0
V108	200	-.8	2.8	0	0	200	-.8	2.8	F
V106	-.8	0	0	F	60	60	0		
V107	-.6	-.6	0	F	0	0	-1.1		
V109	270	-	F	0	-	0	6		
V110	260AC	-	F	0	-	260AC	280		

Readings taken with RCA Voltohmist or equivalent VTVM, with no station tuned in.



CONRAC TV PAGE 12-9

FLEETWOOD MODEL 610 TELEVISION RECEIVER

The Fleetwood Model 610 Television Receiver is a Custom Quality chassis designed for installation into a wall, or for use in a special cabinet. It is especially suited for installations which include high fidelity sound systems and record players. Two types of audio output are provided, making it possible to connect the receiver into almost any sound system without circuit changes, or to operate a loud-speaker from the amplifier which is included in the 610 Receiver.

The Fleetwood 610 Receiver will accommodate a 21" or a 24" picture tube, either metal or glass. Kits are available, which will mount any of the standard types of tubes. When the Receiver has been fitted with the desired type of picture tube, it makes a complete package, with everything except the loud-speaker firmly mounted onto a single chassis The chassis may be mounted in any position. A set of knobs is supplied with the Fleetwood 610.

UHF Tuner strips are available which will enable the FLEETWOOD to receive any of the new Ultra High Frequency stations. A set of these strips replaces a set of coils which are not used in a particular locality. The Super Cascode turret type tuner with which your Fleetwood is equipped insures maximum sensitivity on any channel, in both the VHF and UHF bands. When properly fitted with the strips for the UHF stations in your locality, these channels can be tuned in as easily as the regular VHF channels. An extra position on the dial is provided to show UHF when such a station is tuned in. The panel light associated with the replaced coils can easily be moved to this UHF position behind the dial panel.

ELECTRICAL SPECIFICATIONS

PICTURE TUBE: (Not Supplied)	21AP4 21EP4 24AP4
CONTROLS:	Off-Volume Contrast Brightness Station Selector-fine tuning
SECONDARY CONTROLS:	Vertical Hold Horizontal Hold Height Vertical Linearity
SECONDARY CONTROLS: (Rear of Chassis)	Width Horizontal Drive Horizontal Linearity Focus
I. F. FREQUENCIES:	Video 25.75 Mc. Audio 4.5 Mc.
BANDWIDTH:	Video 4 Mc.
AUDIO OUTPUT:	1. Ratio detector output; no volume control. 2. 6V6 Power Amplifier with inverse feedback.
POWER:	117 Volts, 60 Cycles 210 Watts
PICTURE TUBE ANODE VOLTAGE:	18 kv, design center, 20.5 kv max.

TUBE COMPLEMENT:

1 - 6BQ7	Cascode RF Amplifier
1 - 6J6	First Detector & Local Oscillator
1 - 6CB6	First I. F. Amplifier
3 - 6AU6	2nd, 3rd, and 4th I. F. Amplifiers
1 - 12AU7	Video Detector, AGC Rectifier and 1st I. F. Amplifier
1 - 6AU6	2nd Sound I. F. Amplifier
1 - 6AL5	Ratio Detector
1 - 6AV6	1st Audio Amplifier
1 - 6V6	Audio Power Amplifier
1 - 6AC7	Video Amplifier
1 - 6BE6	Sync Stripper and Noise Inverter
1 - 6SN7	Sync Phase Inverter
1 - 6AL5	Horizontal Phase Discriminator
1 - 6SN7	Horizontal Oscillator
1 - 6CD6	Horizontal Amplifier
1 - 6W4	Horizontal Damper
1 - 1B3	High Voltage Rectifier
1 - 6SN7	Vertical Oscillator
1 - 6S4	Vertical Output Amplifier
1 - 5U4	Plate Supply Rectifier

WARNING - HIGH VOLTAGE

Extremely high voltages are used in the operation of this set. To avoid personal injury, extreme care should be exercised so that no contact is made with any components connected to the high voltage circuits. Do Not Operate the receiver with the high voltage compartment shield removed.

WARNING - PICTURE TUBE HANDLING

Particular care must be exercised when handling picture tubes due to their high vacuum and large surface area. The picture tube must not be struck, scratched, or subjected to more than moderate pressure at any time as fracture of the glass will result in an implosion of considerable violence capable of damaging both property and person.

DIMENSIONS

	Width	Height	Depth
Chassis:	20 1/4	14 1/2	20 1/4
Chassis, 21" tube mounted:	20 3/4	21	23 1/4
Chassis, 24" tube mounted:	26	30	25 1/4

UNPACKING

Remove the chassis from the shipping carton. A small package will be found in the carton, which contains a set of knobs, the Ion Trap for the neck of the picture tube, a pair of clips for holding a trap door in position over the secondary controls, and some small wood screws for mounting the clips onto the back side of the trap door. As soon as the receiver has been unpacked, examine it for any apparent damage which may have occurred in shipment. Should any damage be found, file a claim immediately with the carrier, stating the extent of the damage.

INSTALLING A 21" METAL PICTURE TUBE (21AP4) USING 601 A KIT

1. Mount the front support blocks on the chassis, ridges forward, screwing the 8-32 x 3/4" self-threading screws through the blocks and into the holes found 1/2" from the front of the chassis.

2. Unpack the type 21AP4 picture tube and place it face down on a soft pad to protect it from being scratched. Place plastic sleeve over the tube away from the socket key. Bend the clip around the front edge of the rim of the picture tube.

3. With the plastic sleeve snug against the tube, wrap the plastic ring around the front rim of the tube, over the sleeve. Work the ring tightly around the tube. Secure the ring with the rubber band, which must lie flat in the groove.

4. Loosen the screws which hold the yoke mounting hood on top of the mounting panels, allowing the yoke to slip toward the rear of the chassis.

5. Set the picture tube, complete with its ring and plastic cover, in place on the chassis, using extreme caution not to damage the deflection yoke windings with the prongs of the picture tube as the base of the tube is guided through the yoke. The high voltage clip should be on your left as you face the tube. The ridges on the front mounting blocks should fit into the groove in the mounting ring.

6. Place the tie down cable in the groove in the plastic ring and pass the ends through the holes in the front corners of the chassis. Screw the nuts on the ends and tighten MODERATELY. These nuts need be only "finger tight" to secure the tube.

7. Solder anode connector to the end of the white wire extending through the front of the high voltage box. Snap this connector into the terminal in the plastic sleeve.

8. Loosen the wing screw protruding from the top of deflection yoke. Push the yoke mounting hood forward until the rubber rims engage the flare of the picture tube firmly. While holding the hood forward under moderate tension, tighten the two screws which fasten the hood to the top of the upright panels.

9. Push the deflection yoke forward until it also engages the flare of the picture tube, and tighten the wing screw in the top of the deflection yoke.

10. Clamp the Ion Trap Magnet around the neck of the picture tube, about 1/2" forward of the tube base.

11. Place the picture tube socket on the base of the picture tube. Dress the leads away from the tubes on the chassis, and also away from the picture tube.

INSTALLING A 21" GLASS TUBE USING A 601 B KIT

1. Mount the front support blocks on the chassis, screwing the 8-32 x 3/4" screws through the blocks and into the holes found 1/2" from the front of the chassis.

2. Remove the four screws which hold the yoke mounting panels to the chassis. Move the entire assembly (yoke, focus coil and panels) back 1 1/4", by putting the screws into the front set of holes in the panels.

3. Fasten the 2" x 1/4" grounding strips to front of yoke mounting panels, using 6-32 x 1/4" self-threading screws.

4. Place the pieces of cork on the faces of the front blocks If desired, the cork may be cemented to the blocks.

5. Loosen the screws which hold the yoke mounting hood on top of the mounting panels, allowing the yoke to slide toward the rear of the chassis.

6. Set the picture tube in place on the blocks, using extreme caution not to damage the deflection yoke windings with the prongs of the picture tube as the base of the tube is guided through the yoke. The anode connection on the side of the picture tube should be on your left as you face the tube. The grounding strips must make connection with the coating on the outside of the tube.

7. Place the tie down strap over the top of the picture tube and pass the ends through the holes in the front corners of the chassis. Screw the nuts onto the ends of the strap MODERATELY. These nuts need be only "finger tight" to properly secure the tube.

8. Loosen the wing screw protruding from the top of the deflection yoke. Push the yoke mounting hood forward until the rubber rim engages the flare of the picture tube firmly. While holding the hood forward under moderate tension, tighten the two screws which fasten the hood to the top of the upright panels.

9. Push the deflection yoke forward until it also engages the flare of the picture tube, and tighten the wing screw on top of the deflection yoke.

10. Clamp the ION TRAP MAGNET around the neck of the tube, about 1/2" forward of the base.

11. Place the picture tube socket on the base of the picture tube.

12. Dress the leads away from the tubes on the chassis, and also away from the picture tube.

13. Solder the anode connector onto the end of the white wire extending through the front wall of the high voltage box, and press connector into place on the picture tube.

INSTALLING A 24" TUBE USING A 604 A KIT

1. Mount the front support brackets on the chassis. Each front support bracket is mounted (wood side forward) with one 8-32 and one 6-32 self-threading screws. The screws are driven upward from beneath the chassis. The 8-32 screw goes through the hole in the corner of the chassis and engages the center hole in the bracket.

2. Remove the deflection yoke hood and the focus magnet assembly from the upright panels at the rear of the chassis. Remove the panels, and replace them with the taller panels supplied with the 24" mounting kit. Replace the deflection yoke and hood, leaving it loose and free to slip toward the rear of the chassis. Remount the focus magnet on the new panels.

3. Unpack the type 24AP4 tube and place it face down on a soft pad to protect it from being scratched. Place the plastic sleeve over the tube, with high voltage clip on the side of the tube away from the socket key. Bend the high voltage clip around the front edge of the rim of the tube.

4. With the plastic sleeve snug against the tube, wrap the plastic ring around the front of the tube, over the sleeve. Secure the ring with the rubber band, which must lie flat in the groove.

5. Set the picture tube, complete with its ring and sleeve on the chassis, using extreme caution not to damage the deflection yoke windings with the prongs of the picture tube as the base of the tube is guided through the yoke. The high voltage clip should be on your left as you face the tube. The front mounting pieces should fit into the groove in the mounting ring.

6. Place the tie down cable in the groove in the plastic ring, and pass the ends through the holes in the outside ends of the front mounting assemblies. Screw the nuts on the ends of the rod and tighten moderately.

7. Solder anode connector to the end of the white wire extending through the front of the high voltage box. Snap this connector into the terminal in the plastic sleeve.

8. Loosen the wing screw which holds the deflection yoke in the yoke mounting hood. Push the yoke mounting hood forward until the rubber rims engage the flare of the picture tube firmly. While holding the hood forward under moderate tension, tighten the two screws which fasten the hood to the top of the upright panels.

9. Push the deflection yoke forward until it also engages the flare of the picture tube, and tighten the wing screw which holds it in the yoke mounting hood.

10. Clamp the Ion Trap Magnet around the neck of the picture tube about 1/2" forward of the tube base.

11. Place the picture tube socket on the base of the picture tube. Dress leads away from the tubes on the chassis, and away from the picture tube.

ELECTRICAL CONNECTIONS

Connect a PM type speaker to the speaker terminals on the chassis Connect an antenna to the antenna terminals, using 300 ohm twin lead. Plug the unit into a 117 volt, 60 cycle source. Turn the receiver on by clockwise rotation of the "off-volume" control. The tubes in the receiver should now be lighted. Set the brightness control to maximum (clockwise rotation). Adjust the Ion Trap Magnet until the screen of the picture tube lights up. The Ion Trap may be rotated completely, and moved back and forth along the neck of the picture tube. Proper adjustment has been attained when light of the face of the tube is at its maximum. It should now be possible to tune in a station.

CENTERING THE PICTURE

Each FLEETWOOD system is operated at the factory with a standard picture tube and is properly adjusted. However, picture tubes vary slightly and, when first set up, the picture on your set may not be properly centered. Around the neck of the picture tube, to the rear of the deflection yoke, will be found a focus magnet. It is mounted on a shelf with a single wing nut and is adjustable laterally on the shelf. The shelf in turn is mounted with two wing nuts and is adjustable vertically. These adjustments permit centering the picture. If the picture must be raised, the focus coil must be raised. Similarly, if the picture must be moved to one side in order to be centered, the focus magnet must be moved in the same direction as it is necessary to move the picture.

After the picture has been centered, it will be necessary to readjust the Ion Trap. The Ion Trap MUST BE ADJUSTED FOR MAXIMUM SCREEN BRIGHTNESS ONLY, OR THE PICTURE TUBE WILL BE DAMAGED, OVER A PERIOD OF TIME. MAKE ALL CENTERING ADJUSTMENTS WITH THE FOCUS COIL.

To level the picture, loosen the wing screw above the deflection yoke and turn the yoke slightly. Keep the yoke pushed forward against the flare of the picture tube when tightening the wing screw.

HEIGHT AND VERTICAL LINERARITY ADJUSTMENTS: These adjustments should be made only if a reliable test pattern is available from a station. During some parts of the day several stations may be transmitting test patterns, and their individual differences may be "averaged." Generally speaking, the "Vertical Linearity" controls the top portion of the picture, and can make the test pattern "flat headed" or "egg headed." After changing the Vertical Linearity, the height will probably have to be reset.

HORIZONTAL HOLD: If the stations should come in as a series of black and white bars running diagonally across the screen, adjust the Horizontal Hold. Do not center the picture with this control.

VERTICAL HOLD: Proper adjustment of this control will prevent the picture from "rolling" either up or down. When the Horizontal and Vertical Hold controls have been adjusted, they should not require re-setting for many months.

NORMAL OPERATION OF THE SYSTEM: Select a station desired with the Station Selector Knob. Behind this knob is a FINE TUNING CONTROL. Turn this control counter-clockwise until the picture appears to be covered with a fine mesh pattern, or has "sound" in it. Turn the fine tuning control clock-wise until this effect just disappears. This will be the point at which the picture will have a maximum of fine detail.

Adjust the CONTRAST CONTROL for the most pleasing picture. Too much contrast will give the picture a coarse appearance, while too little contrast will give the picture a "washed out" appearance.

Adjust the BRIGHTNESS for the amount of light desired.

OPERATION OF THE SYSTEM WITH A SEPARATE AUDIO SYSTEM: On the rear of the chassis is a jack marked DETECTOR OUTPUT, which may be used to supply audio to an external amplifier. In this case, the volume control on the receiver will not function, and the loudness or volume control in the external system must be used. It is important that the speaker terminals on the picture tube chassis be shorted with a wire at all times if there is no speaker connected to these terminals. Failure to do so may result in damage to the audio output transformer in the picture tube chassis.

CABINET CONSIDERATIONS

The FLEETWOOD picture chassis should always be mounted in a cabinet, or in an enclosure behind a wall. In either case, the face of the picture tube should be protected by a safety glass window. Suitable laminated safety glass, together with a Royalite Picture Mask and a mounting frame are available in the FLEETWOOD 621 Accessory Kit (for 21" tube); and the FLEETWOOD 624 Accessory Kit (for 24" tube). This safety glass should be mounted on a plywood panel not less than 1/4" thick. Panel layout drawings will be found in the back of this manual.

A piece of the plywood 2 1/2" x 10 1/2" should be salvaged from the panel cutout to make a matching cover for the secondary controls. Two spring clips are provided to hold the cover in place. This cover will rarely have to be opened after the set has been properly adjusted. If the set is housed in a cabinet, the back of the cabinet should be masonite. Ventilation should be provided by piercing the masonite with holes not larger than 1/4" in diameter, on centers not greater than 1/2".

In order that the longest possible life may be expected from the tubes and other components in the system, it is imperative that both chassis be installed in a manner that will provide adequate ventilation. The shelf on which the picture chassis is mounted should have an opening approximately ten inches square, near the center of the chassis. This opening should be covered with hardware cloth, or heavy screen.

SERVICE NOTES

OSCILLATOR ADJUSTMENT

If the fine tuning control knob does not turn far enough to properly bring in a particular station, set the fine tuning control at the middle of its range. Turn the oscillator adjusting slug clockwise until the picture has "sound interference" in it. Turn slug counter-clockwise until this interference just disappears. This slug can be adjusted through the hole located one inch to the right of, and 1/4 inch above the station selector shaft. As the station selector is turned to a different station, a different slug will appear in the hole. Use a non-metallic screw driver. A fraction of a turn should be sufficient.

Should the slug "fall into" the coil form, remove the bottom tuner cover by pulling downward on its forward end, and remove the forward channel coil cartridge of the station concerned. Move the slug retaining spring out of its slot, and tap the coil assembly until slug slips forward. Set the retaining spring in place so that it rests firmly against the slug, and reassemble the tuner.

If the fine tuning is off in the same direction on all stations, due to replacing V2 (6J6), set the station selector on a station in the "high group" (11-13), set the fine tuning knob in the middle of its range. Turn C15 counter-clockwise until the picture has "sound interference" in it, then turn it clockwise until this interference just disappears.

I. F. ALIGNMENT - VIDEO

1. Connect the negative terminal of a 3-volt battery to the junction of C118 and R105; positive grounded.

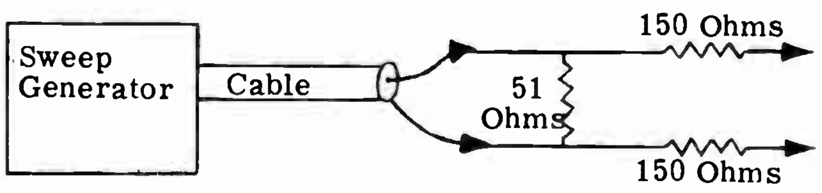
2. Connect the negative probe of a VTVM to pin #4 of the 6AC7 tube; positive meter terminal to ground.

3. Connect signal generator having a 21-28 mc range, to pin #1 of V101 (6CB6) through a D.C. blocking condenser.

Adjust the following:

Coil	Frequency	Indication
T105 - Bottom Slug	27.25	Null
T101 - Bottom slug	21.1	Null
T102	21.25	Null
T105 - Top Slug	25.5	Maximum
T101 - Top Slug	22	Maximum
L104	23	Maximum
L105	24.5	Maximum

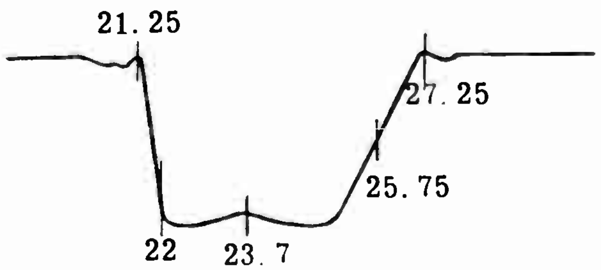
Replace the VTVM with an oscilloscope, and the signal generator with a sweep generator, adjusted to sweep 20-28 M.C. If necessary, re-adjust T101 (top), T105 (top), L104 and L105 to produce a curve approximately as shown:



Set marker generator to 23.7 and adjust L9 so that the dip produced by it is at 23.7 mc. Move the sweep generator lead to the output terminal of the tuner and adjust L101 for maximum response at 23.7 m.c.

TUNER ADJUSTMENT

Set sweep generator on channel 12 and feed the antenna terminals through a balancing network as shown:



Set station selector on channel 12 and adjust C6, C2 and C7 for maximum output and minimum tilt on top of curve.

I. F. ALIGNMENT - SOUND CHANNEL

1. Connect a voltmeter from the junction of R125 and R126 (point D) to ground. Tune in a station. Adjust T103, top and bottom, and T104 bottom for maximum reading. Connect the voltmeter between points C and D and adjust T104 top for zero voltage.

4 1/2 M.C. VIDEO TRAP ADJUSTMENT

With a station tuned in, turn the fine tuning control knob counter-clockwise until "sound interference" can be seen in the picture. Adjust L107 for a minimum of this interference.

HORIZONTAL OSCILLATOR ADJUSTMENTS:

1. Horizontal Linearity, L604:

Connect a voltmeter across the cathode resistor of the 6CD6, R609, and adjust the Horizontal Linearity Coil, L604 for minimum voltage, while watching a standard test pattern. Proper adjustment will be attained when the two halves of the pattern are similar, and will be close to the point of minimum cathode voltage.

2. Horizontal Frequency, L603:

With a station tuned in, temporarily ground the grid, pin #1, of V601, the horizontal oscillator. Set the horizontal hold in the middle of its range, and adjust L603 until the picture is nearly stopped. Remove temporary ground from pin #1, V601.

3. Horizontal Drive, C609:

With a station tuned in, set contrast at its minimum, and brightness so that the screen is lighted. Turn C609 clockwise from the rear of the chassis (loosen) until a white vertical bar appears near the middle of the screen. Tighten (counter-clockwise) until the bar just disappears.

4. Width:

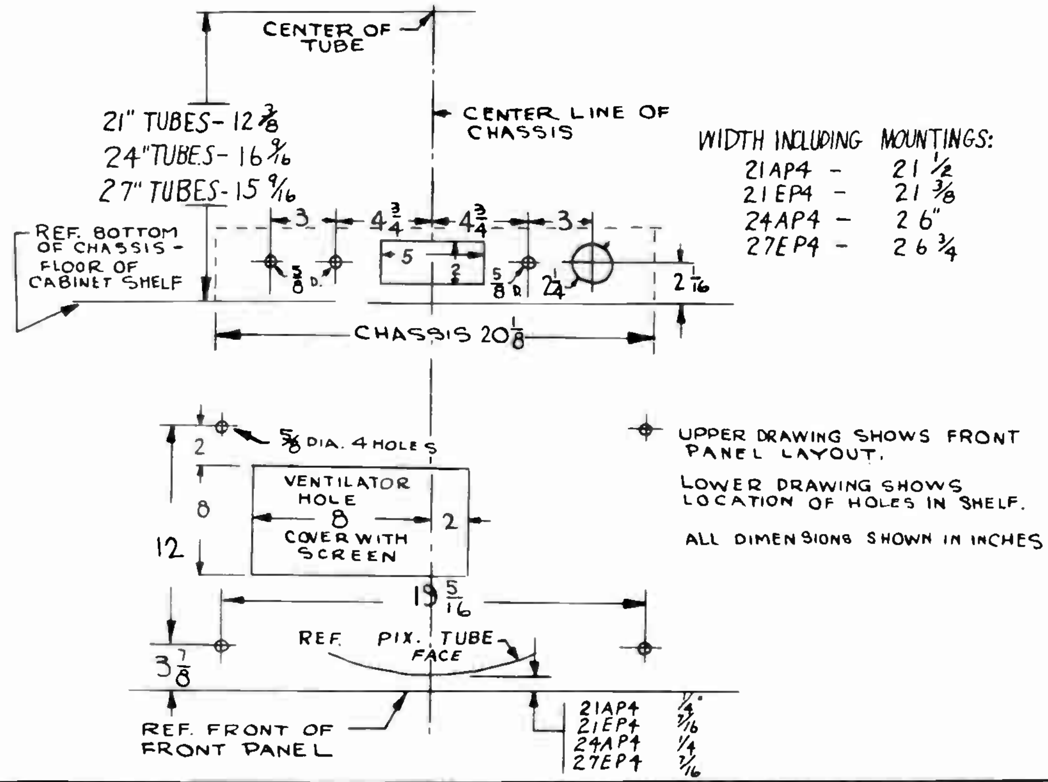
Adjust so that 1/8" to 1/4" of the picture is off the screen on each side.

VOLTAGE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V101	-2	.3	F	0	125	125	0		
V102	-2	0	F	0	125	125	.3		
V103	-2	0	F	-	105	130	.3		
V104	0	0	F	0	95	133	1.1		
V105	125	0	1.6	F	F	-2	-.8	0	0
V106	-.8	0	0	F	60	60	0		
V107	-.6	-.6	0	F	0	0	-1.1		
V401	0	0	0	-.6	0/9	110/190	F	140/200	-
V402	-2	0	F	0	12	15	-1	-	-
V403	0	0	0	0	220	10	F	0	
V404	2.7	-4	F	0	0	-	0		
V501	0	75	3	-18	100	3	F	0	
V502	-	40	0	0	F	0	40	-	600
V601	±2	265	11	-11	135	11	F	0	
V602	-	0	30	-	-3	-	F	160	
V603	-	-	Do not measure	340	-		650	650	
V201	-.9	0	F	0	0	0	100		
V202	0	0	170	190	0	-	F	9	
V301	-	360	-	357AC	-	357AC	-	360	

Kinescope Pin #1 - F Pin #2 - 65 Pin #10 - 420 Pin #11 - 110 Pin #12 - 0

Readings taken with RCA Voltohmist or equivalent VTVM.



RESISTORS

Symbol No.	Description
R615	3.9Ω 10% 1/2w, w.w.
R302	10Ω 10% 1/2w, w.w. Special
R102	51Ω 5% 1/2w
R104, R110	68Ω 5% 1/2w
R106, R112, R113, R115, R117, R120, R608	150Ω 10% 1/2w
R207	270Ω 10% 1/2w
R123	270Ω 10% 1/2w
R609	300Ω 10% 10w, w.w.
R304	470Ω 1w
R619, R620	560Ω 10% 1/2w
R402	820Ω 10% 1/2w
R105, R107, R114, R122, R131, R618	1000Ω 10% 1/2w
R208	1000Ω 2w
R602	1500Ω 5% 1/2w
R303, R306	1500Ω 10% 10w, w.w.
R512	2000Ω 10% 1w
R506	1800Ω 10% 1/2w
R617	2200Ω 2w
R422	2700Ω 10% 1/2w
R421	3900Ω 10% 1/2w
R101	3300Ω 5% 1/2w
R405	4700Ω 10% 2w
R108, R111, R601, R606	4700Ω 5% 1/2w
R116	5600Ω 5% 1w
R423	4700Ω 10% 1/2w
R610	18KΩ 10% 3w
R103, R109	10KΩ 5% 1/2w
R125, R126	10KΩ 10% 1/2w
R611	10KΩ 10% 1w
R514, R612	15KΩ 10% 1/2w
R127	15KΩ 10% 1w
R124, R128, R406	22KΩ 10% 1/2w
R404	22KΩ 10% 1w
R307	33KΩ 10% 1w
R418	39KΩ 10% 1/2w
R613, R614, R420	47KΩ 10% 1/2w
R515	82KΩ 10% 1/2w
R616, R621	82KΩ 10% 1w
R121, R301, R410, R424, R425, R416	100KΩ 10% 1/2w
R203, R507	220KΩ 10% 1/2w
R603, R604	180KΩ 10% 1/2w
R407, R409	330KΩ 10% 1/2w
R415	390KΩ 10% 1/2w
R118, R119, R129, R205, R427, R408, R426, R607, R419	470KΩ 10% 1/2w
R505	250KΩ 10% 1w
R513, R428	1megΩ 10% 1/2w
R509	1.2megΩ 10% 1/2w
R414, R417	2.2megΩ 10% 1/2w
R202	10megΩ 10% 1/2w

CONTROLS

Symbol No.	Description
R511	3000Ω Vert. Lin.
R305	3000Ω Focus, w.w. 4w
R412	500K Brightness
R605	100KΩ Horiz. Hold (Height)
R508	250KΩ Vert. Hold
R401	1KΩ Contrast
R201	500KΩ Volume w/switch
R510	2megΩ Height

CAPACITORS

Symbol No.	Description
C117	5.6mmf 10%, ceramic tubular
C603	47mmf 10% 500V, mica
C613	47mmf 10% 1KV, mica
C116, C125, C401	56mmf, ceramic tubular GP
C409	220mmf, mica
C602	270mmf 5%, mica
C129	330mmf 10%, mica
C105, C108, C111, C115	330mmf, ceramic tubular GP
C128	500mmf 10%, mica
C410, C411	500mmf 10%
C611	500mmf 20KV
C121	1000mmf, ceramic tubular GP
C123, C203	.004mf 600V, tubular paper molded
C612, C614	.002mf 600V, molded paper
C101, C102, C103, C104, C106, C107, C109, C110, C113, C114, C119, C120, C122, C126, C127, C201, C412, C112	.005mf 500V, ceramic disc
C506, C615, C407	.006mf 600V, paper
C601	.006mf 500V 10% Zero Temp.
C505, C604	.01mf 600V, paper
C414	.01mf ceramic disc
C609	700mmf, trimmer
C202, C510	.02mf 600V, paper
C124, C302, C305	.022mf 600V, molded
C403, C408, C413, C507, C607, C608	.05mf 600V, paper
C118	.22mf 400V, molded paper
C404, C606, C509, C616	.1mf 600V, paper
C511	.25mf 600V, paper
C605	.5mf 200V, molded paper
C130	5mf 50V, electrolytic
C618	20mf 450V
C508	50mf 50V, electrolytic
C303A, C303B/C406, C303C, C303D/C617	20x20x20x20mf 450V, electrolytic
C304A/C204, C304B/C205, C304C/C610, C C304D	20x20x20mf 450V plus 20mf 25V, electrolytic can
C301A, C301B	40x40mf 475V

COILS

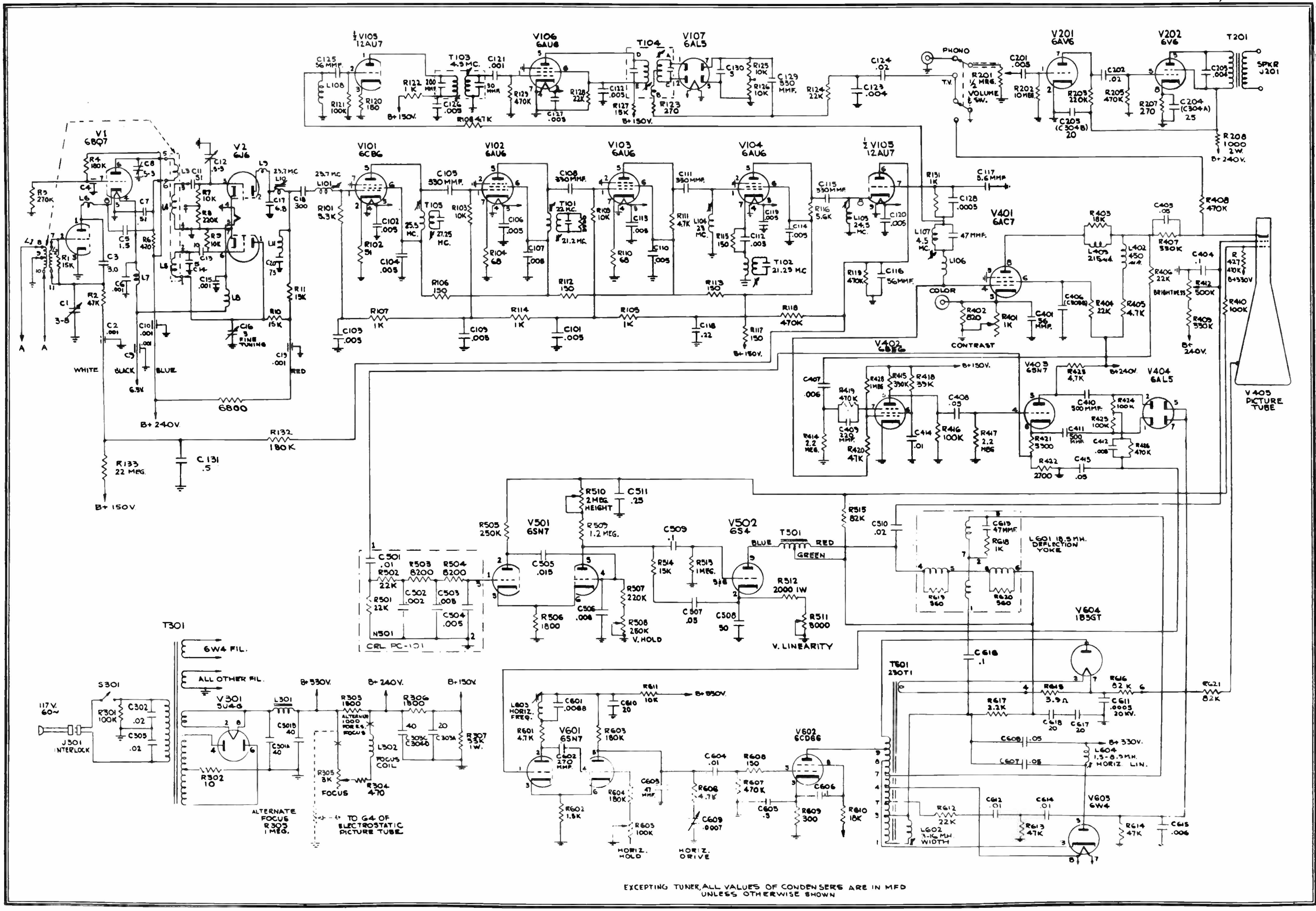
Symbol No.	Description
L104, L105, L101	I. F. Coil
L107	Video Trap Coils 4.5 mc
T105	#2 I. F. Coil with 27.25 mc Trap
T101	#3 I. F. Coil
T102	Cathode Trap 21.25 mc
T104	Ratio Det. Coil 4.5 mc
T103	Sound I. F. Transf. 4.5 mc
L301	Filter Choke
L302	Focus Coil
L106	Peaking Coil 150mh on 10K res.
L402	Shunt Peaking Coil 450mh
L403	Series Peaking Coil 215mh on 18K res.
L602	Width Coil 3-16mh
L603	Ringing Coil 5.5-20mh
L601	Deflection Yoke
L108	Peaking Coil 250mh
L604	Linearity Coil 1.5-8.3mh

TRANSFORMERS

Symbol No.	Description
T201	Audio Output - Single 6V6 to 3.2Ω voice coil
T301	Power
T501	Vertical Output 18:1 Ratio
T601	Horizontal Output

NETWORKS

Symbol No.	Description
N501	Vertical Integrator


EXCEPTING TUNER, ALL VALUES OF CONDENSERS ARE IN MFD UNLESS OTHERWISE SHOWN

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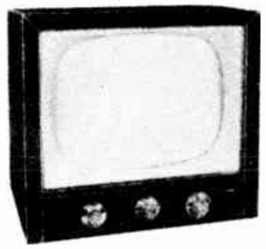
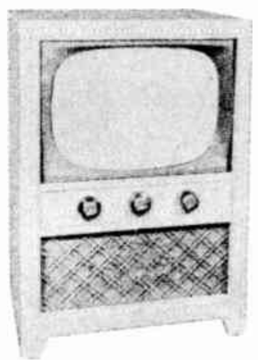
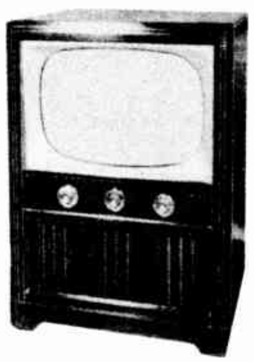


EU-21TOLU
(Mahogany)
EU-21TOLBU
(Blond)



EU-21COLU
(Mahogany)
EU-21COLBU
(Blond)

EU-21CDLU
(Mahogany)
EU-21CDLBU
(Blond)



EU-21COSU
(Mohogany)
EU-21COSBU
(Blond)

These receivers are equipped with twenty (20) tubes including a picture tube, and two (2) selenium rectifiers.

They have a switch type tuner which tunes the twelve V.H.F. television channels (2 to 13), also a U.H.F. converter which covers the seventy (70) U.H.F. television channels (14 to 83).

TUBE COMPLEMENT (VHF Chassis 393,394)

Symbol	Tube	Function	Symbol	Tube	Function
V1	6BC5	R-F Amplifier	V109	6SN7GT	Sync. Clipper & Sync. Output
V2	6J6	VHF Oscillator & Mixer	V110	6AL5	Horizontal A.F.C.
V101	6CB6	1st I-F Amplifier	V111	6W6GT	Audio Output
V102	6CB6	2nd I-F Amplifier	V112	6AX4	Horizontal Damper
V103	6CB6	3rd I-F Amplifier	V113	6SN7GT	Horizontal Oscillator
V104	6C4	1st Audio Amplifier	V114	6BQ6GT	Horizontal Output
V105	12BH7	Vertical Oscillator & Output	V115	1B3GT	H.V. Rectifier
V106	6AL5	Ratio Detector (Sound)	V116	21MP4	Picture Tube (chassis 393)
V107	6AU6	Sound Detector Driver	V116	21FP4A	Picture Tube (chassis 394)
V108	6AH6	Video Amplifier			

TUBE COMPLEMENT (UHF Converter)

Symbol	Tube	Function
V1	6AF4	U.H.F. Oscillator
V2	6BQ7, 6BQ7A or 6BZ7	IF Amplifier

POWER SUPPLY: 117 volts, 60 cycle, a.c.

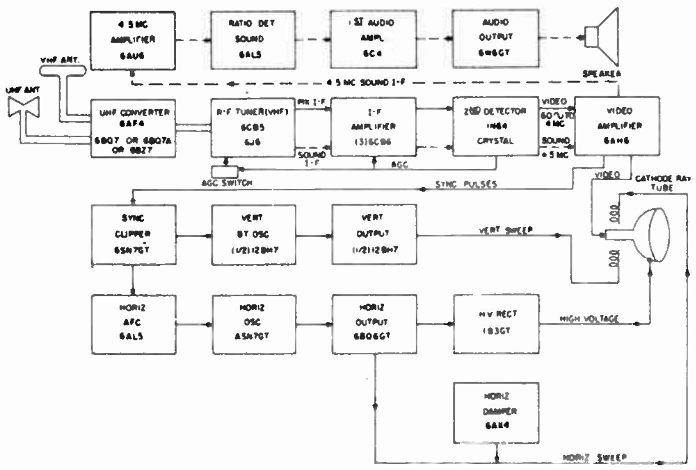
POWER CONSUMPTION: 140 watts.

AUDIO POWER OUTPUT: 2 watts maximum.

ANTENNA INPUT IMPEDANCE:
300 ohms balanced.

INTERMEDIATE FREQUENCY:
Video Carrier — 26.4 mc.
Sound Carrier — 21.9 mc.
Intercarrier Sound — 4.5 mc.
U.H.F. Output — Channels 5 or 6.

BLOCK DIAGRAM:



DEFLECTION: Electromagnetic.

FOCUS: Electrostatic.

ION TRAP: Single Permanent Magnet.

HORIZONTAL SCANNING FREQ.: 15,750 c.p.s.

VERTICAL SCANNING FREQ.: 60 c.p.s.

FRAME FREQUENCY: 30 c.p.s.

SCANNING: Interlaced, 525 lines.

SPEAKER:
21" Console Models 10" P.M.
21" Table Models 5¼" P.M.

VOICE COIL IMPEDANCE: 3.2 ohms at 400 cycles.

CAUTION

HIGH VOLTAGE--Operation of a television receiver with the back open involves a shock hazard. When making adjustments other than adjusting the controls at the front panel, all precautions for working near high voltage should be exercised.

HIGH TEMPERATURE OF TUBES--Some tubes in the receiver operate at extremely high temperatures. To avoid serious burns, do not touch these tubes while the receiver is operating, or until the tubes have cooled after the set is shut off.

HANDLING OF PICTURE TUBES--Breakage of the picture tube, which contains a high vacuum, may result in injury from flying glass. Do not scratch tube face or subject to more than moderate pressure. DO NOT REMOVE OR HANDLE THE PICTURE TUBE IN ANY MANNER UNLESS HEAVY GLOVES AND PROTECTIVE GOGGLES ARE WORN. Persons not so equipped should be kept away while handling the tube. NEVER GRASP THE TUBE BY THE NECK OR ALLOW PRESSURE TO BE EXERTED ON THE NECK. In installation, if the tube sticks or fails to slip smoothly through the deflection yoke, investigate and remove the cause of the trouble. DO NOT FORCE TUBE.

ANTENNAS

BUILT-IN ANTENNAS--The receiver is equipped with two antennas; one for VHF reception is enclosed in the cabinet and one for UHF reception is attached to the UHF antenna terminal board at the rear of the cabinet. These antennas will eliminate the need of an external antenna in some areas where the signal strength is sufficient. If you are in a location where the signal strength is not sufficient and it is impossible to obtain satisfactory results with the built-in antennas due to the above effect, or if the receiver is too far from the television station, it will be necessary to install an external antenna which is designed for both VHF and UHF, or two separate antennas - one designed for VHF and the other for UHF. Sometimes it is possible for VHF reception to be satisfactory on the built-in VHF antenna, but the reception of UHF on the built-in UHF antenna may be unsatisfactory; of vice versa. In these cases it is only necessary to install one external antenna designed for VHF or for UHF, depending on which built-in antenna is not providing satisfactory reception.

EXTERNAL ANTENNA--The choice of the proper type of antenna and its location are very important. Of equal importance is the installation of the antenna. In some localities where there are a number of stations operating, it may be impossible to eliminate all reflections.

CONNECTING EXTERNAL VHF ANTENNA--The antenna terminal board for the VHF antenna is located on a metal plate at the rear of the cabinet. Remove the wires of the built-in antenna that are fastened under the screws of the terminal board. Fasten the lead-in wires of the external VHF antenna under these two screws. Cover bare ends of the wires from the built-in antenna with tape.

CONNECTING EXTERNAL UHF ANTENNA--The antenna terminal board for the UHF antenna is also located on the metal plate at the rear of the cabinet. Remove the UHF dipole antenna (wire loop) leads that are fastened under the two screws and attach the lead-in from the external UHF antenna. Do not drape or coil the lead-in wire and keep it away from the power cord (and also the speaker cable on console models).

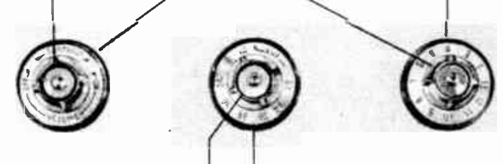
FRONT PANEL CONTROLS

CONTRAST CONTROL- Varies the picture output (increases or decreases the variations between light and dark areas of the picture) similar to the manner in which sound output is varied by the volume control.

OFF-ON-VOLUME- Turns the power off or on and varies the output of sound.

CHANNEL SELECTOR (VHF)- Selects the channel number of the desired VHF station. When tuning for VHF stations be sure the COURSE TUNING (UHF) is set to the VHF position (rotated completely counterclockwise).

FINE TUNING (VHF)- Tunes in the best picture, at which point sound is also received.



COURSE TUNING (UHF)-* Selects the channel number of the desired UHF station. To tune in a UHF station set the CHANNEL SELECTOR (VHF) to channel 5 or 6 as determined by the setting of the slide switch (see note below). Then set the COURSE TUNING (UHF) to the channel number of the desired UHF station.

FINE TUNING (UHF)-Tunes in the best picture, at which point sound is also received. Sometimes a slight adjustment of the Fine Tuning (VHF) will improve reception of a station.

*NOTE - The slide switch operated by a wire looped around the Contrast control shaft should be set, at the time of installation, to its forward position if a VHF station is not assigned to channel 5 in the area in which the receiver is being installed. To set the switch in it forward position, pull the Contrast and Off-On Volume knobs from their shafts. Then pull the wires loop forward on the Contrast control shaft. If a VHF station is assigned to channel 5, set the switch toward the rear by pushing back on the wire loop. In this position the UHF stations can be tuned-in with the COURSE TUNING (UHF) and FINE TUNING (UHF) control knobs, when the CHANNEL SELECTOR (VHF) is set to channel 6. If no VHF station is assigned to channel 5 or to channel 6, set the switch for operation on either channel, whichever may provide the best reception. Be sure to inform the customer as to which channel (5 or 6) the switch has been set to operate on.

ADJUSTMENTS (Chassis 393)

Off Center and Neck Shadow

CENTERING MAGNET ADJUSTMENT — If the picture is off center and/or has neck shadow as shown in the illustration at the left, rotate either or both centering magnet levers to the right or left until the picture is centered on the screen and the picture is free of all neck shadow.

ION TRAP ADJUSTMENT — With the brightness control advanced just enough to dimly light up the face of the picture tube, slide the ion trap backward or forward and at the same time rotate it to the right or left until maximum brightness is obtained. If a neck shadow appears at any of the corners, refer to "Centering Magnet Adjustment" above.

Misadjusted Height

HEIGHT CONTROL—This control increases the overall height of the picture. When making this adjustment it is sometimes necessary to also adjust the VERTICAL LINEARITY to obtain a picture that is correctly proportioned.

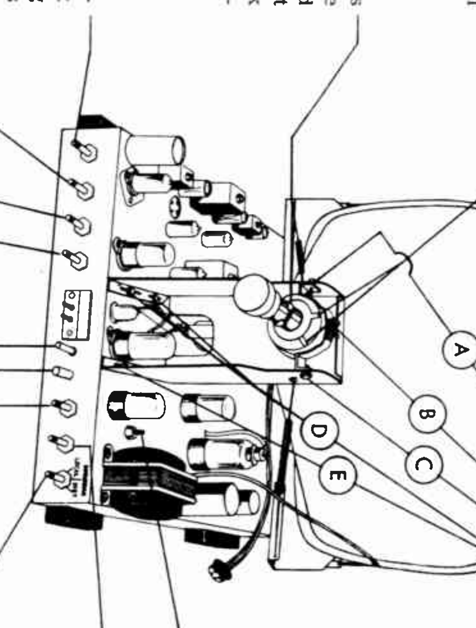
Misadjusted Vertical Linearity

VERTICAL LINEARITY CONTROL — This control increases or decreases the height of the upper portion of the picture.

FOCUS CONTROL — Rotate to the right or left until the sharpest picture, or sharpest horizontal lines, are obtained.

BRIGHTNESS CONTROL — Turn clockwise to increase brightness. To decrease brightness, turn counter-clockwise.

CONNECTING EXTERNAL ANTENNAS — Refer to User's Instruction Booklet furnished with the receiver.



DEFLECTION YOKE ADJUSTMENTS — The deflection yoke must be positioned as far forward as possible on the neck of the picture tube. To make this adjustment, loosen screws "D" and "E" enough to permit the yoke bracket to be pushed forward. While holding the bracket in the forward position, tighten screws "D" and "E". Screws "A" and "C" are for shifting the yoke up or down to center it around the picture tube neck. If the picture is tilted as illustrated at right, loosen wing nut "B". Then, rotate the yoke to left or right as required to make the picture parallel with respect to top and bottom of window frame. Be sure to hold the yoke in position while tightening the wing nut.

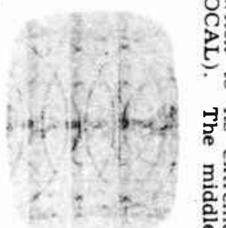
Picture Tilted

HORIZONTAL STABILIZER ADJUSTMENT — See "HORIZONTAL HOLD CONTROL".

Misadjusted Vertical Hold

HORIZONTAL HOLD CONTROL — If the picture appears as shown in the illustration, adjust the horizontal hold control to right or left as required to lock in a single stationary picture. If the range of the control is not sufficient to lock in picture, set the control to its midway position and then adjust the horizontal stabilizer adjustment until the picture locks in.

LOCAL - SUBURBAN - DISTANCE SWITCH — In strong signal areas set this switch to its extreme counter-clockwise position (LOCAL). The middle position (SUBURBAN), and extreme clockwise position (DISTANCE) are used in areas where the signal is weak or medium strength. Set the switch in the position which provides the most satisfactory picture with minimum overloading when the contrast control is advanced.



Misadjusted Horizontal Hold

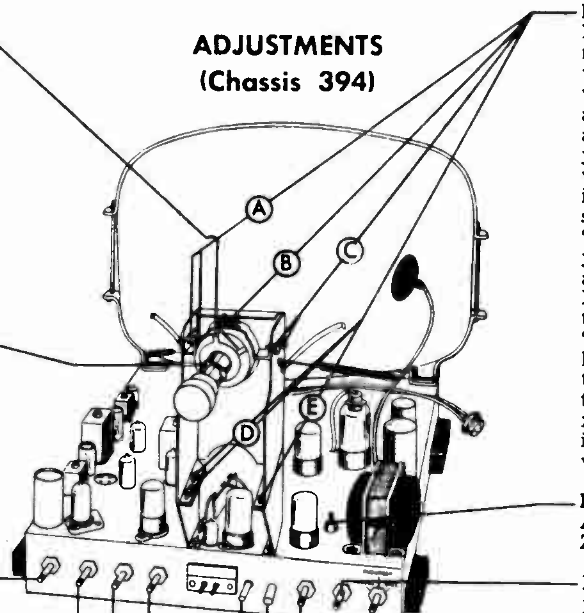
VERTICAL HOLD CONTROL — If the picture is moving up or down as illustrated at right, adjust the vertical hold control until a single stationary picture is obtained.

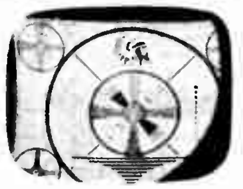
HORIZONTAL CENTERING CONTROL — If the picture is off center to the right or left, rotate this control in either direction as required to center the picture. The picture should become centered when this control is approximately at the middle of its range of adjustment. If not, then set the control at the middle of its range. Then center the picture on the screen by adjusting the centering magnet levers as explained under "CENTERING MAGNET ADJUSTMENT"

WIDTH CONTROL — If the picture is too narrow as illustrated, or too wide, turn the width control clockwise or counter-clockwise as required to adjust the picture to the proper width of the viewing area on the screen.

Picture Too Narrow

ADJUSTMENTS (Chassis 394)



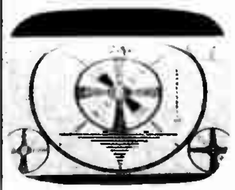

Off Center and Neck Shadow

CENTERING MAGNET ADJUSTMENT — If the picture is off center and/or has neck shadow as shown in the illustration at the left, rotate either or both centering magnet levers to the right or left until the picture is centered on the screen and the picture is free of all neck shadow.

ION TRAP ADJUSTMENT — With the brightness control advanced just enough to dimly light up the face of the picture tube, slide the ion trap backward or forward and at the same time rotate it to the right or left until maximum brightness is obtained. If a neck shadow appears at any of the corners, refer to "Centering Magnet Adjustment" above.


Misadjusted Height

HEIGHT CONTROL—This control increases the overall height of the picture. When making this adjustment it is sometimes necessary to also adjust the VERTICAL LINEARITY to obtain a picture that is correctly proportioned.

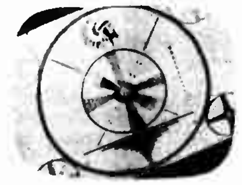

Misadjusted Vertical Linearity

VERTICAL LINEARITY CONTROL — This control increases or decreases the height of the upper portion of the picture.

FOCUS CONTROL — Rotate to the right or left until the sharpest picture, or sharpest horizontal lines, are obtained.

BRIGHTNESS CONTROL — Turn clockwise to increase brightness. To decrease brightness, turn counter-clockwise.

DEFLECTION YOKE ADJUSTMENTS — The deflection yoke must be positioned as far forward as possible on the neck of the picture tube. To make this adjustment, loosen screws "D" and "E" enough to permit the yoke bracket to be pushed forward. While holding the bracket in the forward position, tighten screws "D" and "E". Screws "A" and "C" are for shifting the yoke up or down to center it around the picture tube neck. If the picture is tilted as illustrated at right, loosen wing nut "B". Then, rotate the yoke to left or right as required to make the picture parallel with respect to top and bottom of window frame. Be sure to hold the yoke in position while tightening the wing nut.

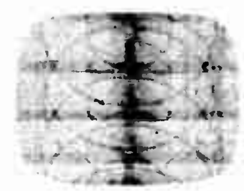

Picture Tilted


Misadjusted Horizontal Hold

HORIZONTAL STABILIZER ADJUSTMENT — See "HORIZONTAL HOLD CONTROL".

HORIZONTAL HOLD CONTROL — If the picture appears as shown in the illustration, adjust the horizontal hold control to right or left as required to lock in a single stationary picture. If the range of the control is not sufficient to lock in picture, set the control to its midway position and then adjust the horizontal stabilizer adjustment until the picture locks in.

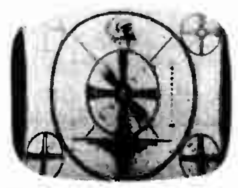
LOCAL - SUBURBAN - DISTANCE SWITCH — In strong signal areas set this switch to its extreme counter-clockwise position (LOCAL). The middle position (SUBURBAN), and extreme clockwise position (DISTANCE) are used in areas where the signal is weak or medium strength. Set the switch in the position which provides the most satisfactory picture with minimum overloading when the contrast control is advanced.


Misadjusted Vertical Hold

VERTICAL HOLD CONTROL — If the picture is moving up or down as illustrated at right, adjust the vertical hold control until a single stationary picture is obtained.

HORIZONTAL CENTERING CONTROL — If the picture is off center to the right or left, rotate this control in either direction as required to center the picture. The picture should become centered when this control is approximately at the middle of its range of adjustment. If not, then set the control at the middle of its range. Then center the picture on the screen by adjusting the centering magnet levers as explained under "CENTERING MAGNET ADJUSTMENT".

WIDTH CONTROL — If the picture is too narrow as illustrated, or too wide, turn the width control clockwise or counter-clockwise as required to adjust the picture to the proper width of the viewing area on the screen.


Picture Too Narrow

ADJUSTMENTS

1. ION TRAP ADJUSTMENT:

Adjust the BRIGHTNESS control for normal brightness. With the ION TRAP positioned close to the base of the picture tube, move the trap forward or backward and at the same time rotate in either direction until maximum brightness of the raster is obtained. Readjust the BRIGHTNESS control until the raster is slightly above average brilliance. Adjust the FOCUS CONTROL until the line structure of the raster is clearly visible. Readjust the ION TRAP again for maximum brightness.

There may be two locations on the tube neck where the ION TRAP will produce maximum brightness. Never set the trap to the forward position, always use the position closest to the tube base.

If there is a shadow in the corners of the raster, be sure the ION TRAP is properly adjusted. Do not sacrifice picture brilliance when adjusting the ION TRAP to overcome shadows in corner of picture. If corner shadows are present, be sure the DEFLECTION YOKE and CENTERING MAGNET are properly adjusted.

2. DEFLECTION YOKE AND BRACKET:

The DEFLECTION YOKE should be positioned as far forward as possible on the picture tube neck and rotated to the left or right as required to make the picture parallel with respect to the top and bottom of window frame.

3. CENTERING RASTER:

If the picture is off center and/or has neck shadow, rotate either or both CENTERING MAGNET levers to the left or right until the picture is centered on the screen and is free of neck shadow. The CENTERING MAGNET is located on the back cover of the DEFLECTION YOKE. To determine the correct picture centering, it may be necessary to reduce the size of the picture with the HEIGHT and WIDTH adjustments. After making adjustment of CENTERING MAGNET, readjust ION TRAP.

4. HEIGHT AND WIDTH ADJUSTMENTS:

The linearity and corresponding size controls will have to be adjusted together and with care to maintain picture symmetry. For this reason it is best to use a test pattern when making these adjustments. Adjust size of picture to fill the screen by means of the HEIGHT, WIDTH, VERTICAL LINEARITY.

5. VERTICAL LINEARITY ADJUSTMENTS:

The VERTICAL LINEARITY control has the effect of expanding the picture at an increasing rate from the bottom to the top of the picture. Adjustment of this control has the greatest effect on the top portion of the picture, some effect on the middle and very little effect on the bottom of the picture. The HEIGHT and FOCUS controls may need readjustment as a result of the change in position of the VERTICAL LINEARITY control.

6. HORIZONTAL HOLD CONTROL:

The HORIZONTAL HOLD CONTROL is adjusted with a weak picture to the center of its pull-in range. If the pull-in range is insufficient or the horizontal sync is unstable, see Horizontal Hold Adjustment" under "Alignment".

7. VERTICAL HOLD CONTROL:

The VERTICAL HOLD CONTROL is also adjusted to the center of its pull-in range with the contrast control set to obtain a weak picture.

8. FOCUS CONTROL:

Adjust the FOCUS CONTROL for best focus of the vertical and horizontal wedges at the center of the test pattern. If corner focus is poor, check position of DEFLECTION YOKE and ION TRAP. While observing the test pattern (or picture), make a slight readjustment of the VERTICAL HOLD control until the horizontal lines are least noticeable. This adjustment is very critical and will require only a very slight movement of the control shaft to obtain proper adjustment.

9. BRIGHTNESS CONTROL:

BRIGHTNESS CONTROL and CONTRAST control should be set to obtain as much shading in the picture as possible. If the Brightness control is set too low, the black and grays of the picture are black and if set too high, the black and grays of the picture will appear light and faded.

10. LOCAL-DISTANCE (AGC) SWITCH:

The LOCAL-DISTANCE SWITCH can be set to prevent the receiver from overloading in strong signal areas or to reduce "snow" in the picture in weak signal areas. In strong signal areas, the "LOCAL" (counter-clockwise) position of the switch must be used. The second and third positions "SUBURBAN" and "DISTANCE" are to be used in medium to weak signal areas. Use the position with which the best picture is obtained with a minimum of overloading of the receiver when the CONTRAST control is advanced.

11. OSCILLATOR ADJUSTMENT USING A TELEVISON SIGNAL:

Do not make any adjustments on the two oscillator adjusting screws unless the FINE TUNING control range is insufficient to properly tune-in the station. The adjusting screws are accessible through holes in the front of the chassis after the chassis is removed from the cabinet.

To make the adjustment, proceed as follows:

(a) Turn the receiver on and allow a warm-up period of approximately five minutes.

(b) For stations from channel 13 to channel 7, set the Station Selector Switch to the highest channel received and adjust the Contrast and Volume control for normal sound and picture. Set the Fine Tuning Control in the center of its range.

(c) Using a small non-metallic screwdriver, adjust the slotted head brass screw located to the left of shaft and above the fiber disc for the clearest and sharpest detail in the picture. This adjustment will be effective on all channels between 13 and 7. If other stations are operating in this range, it may be necessary to compromise slightly on the high channel adjustment so the other channels may be properly tuned-in.

(d) For Stations on channel 6 and below, set the station Selector Switch to the channel received closest to channel 6 and adjust the Contrast and Volume control for normal sound and picture. Set the Fine Tuning control in the center of its range.

(e) Using a small non-metallic screwdriver, adjust the slotted head brass screw located to the right of the shaft for the clearest and sharpest detail in the picture. This adjustment will effect all channels between 6 and 2.

I. F. ALIGNMENT

All lead connections from the signal generator and wobbulator must be shielded. Keep the exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The wobbulator, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

1. To Check I. F. Alignment on Oscilloscope:

(a) Lift the shield of the Oscillator - Mixer tube V2 sufficiently to clear the socket ground clips. Connect sweep signal generator "hot" lead to the underground tube shield and generator ground lead to the tuner chassis.

(b) Connect high side of oscilloscope to high side of contrast control (pin 2 and 7 of V108), and the low side to chassis.

(c) Apply - 3.0 volts D.C. bias to lug 4 of S103 (See sketch "Variable Bias Control"). Contrast control should be set in the maximum counter-clockwise position.

(d) With the generator sweep set at zero, connect an electronic voltmeter between lug 2 of S103 and chassis. Adjust the output of the generator to obtain a reading of 2 volts D.C. on the meter.

(e) Set generator to sweep from 20 mc. to 30 mc.

(f) Connect marker generator to sweep generator output leads and adjust to provide markers that appear in the curve on page 5.

(g) Observe curve and position of markers (see nominal response curve). Slight deviation in shape from the nominal response curve is permissible, but if any great deviation is noted, it will be necessary to realign the I-F Amplifier.

2. Alignment, I. F. & Tuner Assembly (with electronic voltmeter):

(1) Connect - 3.5 Volts D.C. bias supply to lug 4 of S103 or to junction of C115 and R144.

(2) Connect signal generator "hot" lead through a 1000 mmf. capacitor to TP-1 (wire protruding from tuner directly adjacent to the oscillator mixer tube V2) and ground lead to the R. F. tuner case.

(3) Connect high side of Electronic Voltmeter to lug 2 of S103 and low side to chassis.

(4) Set signal generator to 25.0 mc. and adjust bottom of T103 for maximum meter deflection, limiting meter deflection to 2 volts D.C. by adjusting input attenuator.

(5) Set signal generator to 23.3 mc. and adjust bottom to T102 for maximum D.C. meter indication. Adjust signal generator amplitude to make this peak indication approximately 2 volts D.C.

(6) Reset signal generator to 21.9 mc. and adjust the top of T102 for minimum D.C. meter deflection. Signal generator amplitude must be sufficiently high to produce a definite null. Meter must read at least 0.5 volts at null.

(7) Repeat steps (5) and (6).

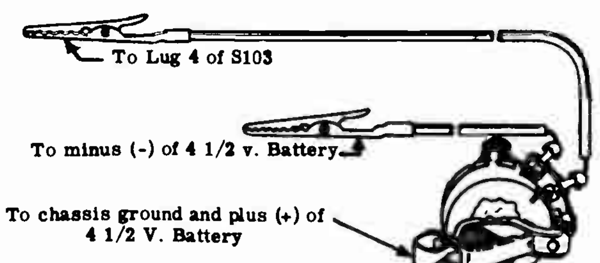
(8) Next set signal generator to 25.2 mc. and adjust bottom of T101 for maximum meter indication, limiting output of generator so peak reading will not exceed 2 volts D.C.

(9) Reset signal generator to 23.3 mc. Connect a 100 ohm resistor in series with a 100 mmf. capacitor from TP-2 (wire protruding from the tuner through the insulated eyelet between the brass adjusting screws) on the R-F Tuner to the Tuner case. Adjust L101 for maximum meter deflection, but limit output of generator so this reading does not exceed 2 volts D.C. Remove the 100 ohm resistor and the 100 mmf. capacitor.

(10) Set signal generator to 24.65 mc. Connect the 100 ohm resistor and the 100 mmf. series capacitor across L101 and adjust mixer output (L9) on R-F Tuner for maximum meter indication. Adjusting amplitude of signal generator to make this maximum indication approximately 2 volts D.C. Remove the 100 ohm resistor and the 100 mmf. capacitor.

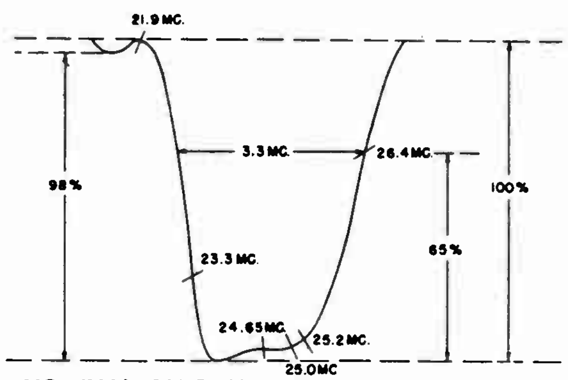
(11) Check sensitivity. The input for 2 volts D.C. output and zero bias should not exceed 150 microvolts at 24.65 mc. with a generator internal resistance of 1.5 ohms or less, and the local oscillator set to properly tune in channel 5.

(12) Remove the signal generator and electronic voltmeter.



5000 Ohm Control only, Part No. 144260

VARIABLE BIAS CONTROL ASSEMBLY



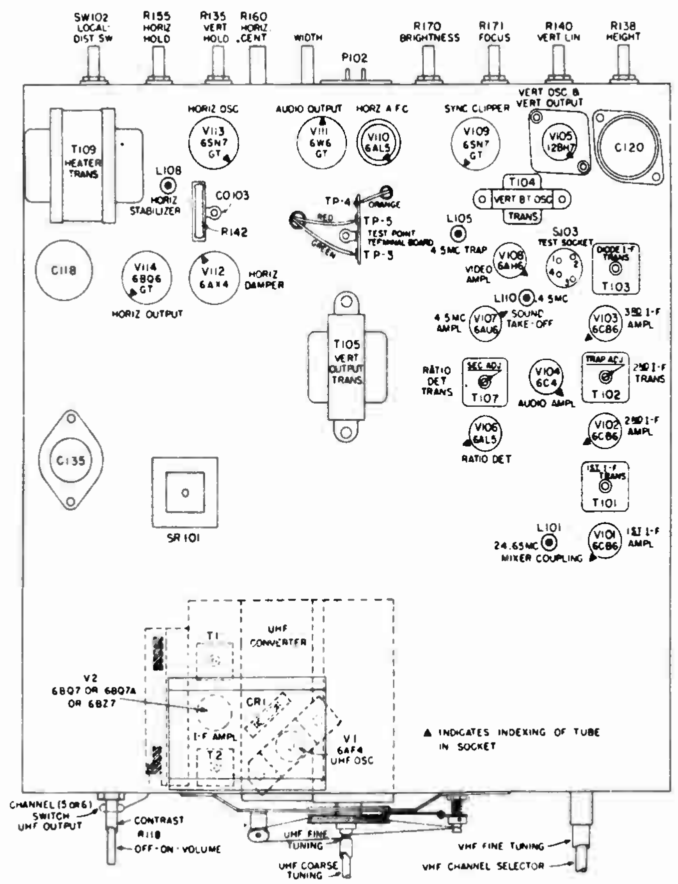
NOMINAL OVERALL I. F. RESPONSE CURVE
NOTE: Response as Seen by Means of Sweep Generator

SOUND ALIGNMENT

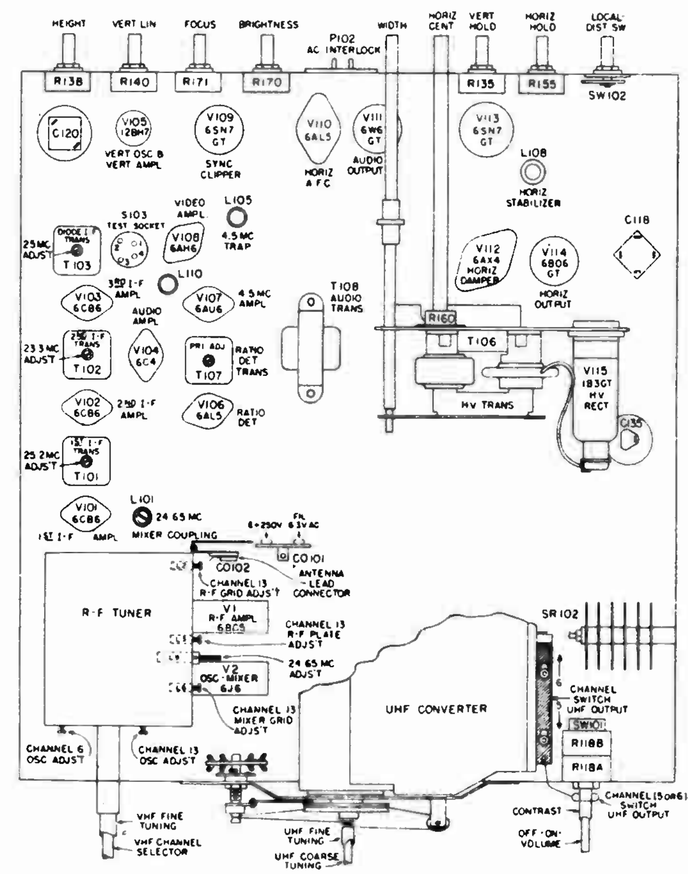
1. Connect crystal controlled 4.5 mc. 400 cycle amplitude modulated signal, modulated 30% or greater, to lug 2 of S103 and chassis.
2. Connect high side of scope through detector probe to the picture tube cathode (pin 11). Connect low side of scope to chassis. Adjust 4.5 mc. trap, L105 for minimum 400 cycle deflection on scope.
3. Connect electronic voltmeter to lug 2 of ratio detector, V106, and adjust 4.5 mc. sound take-off (L110) and bottom of ratio transformer (T107) for peak reading on voltmeter. Adjust input to make this peak reading 4 volts.
4. Adjust input to obtain 12 volts output. Transfer electronic voltmeter to junction of R167 and C153 (refer to Schematic Wiring Diagram). Adjust top of T107 for zero balance of electronic voltmeter.
5. Recheck steps 2, 3 and 4 above.
6. Remove input signal, scope and electronic voltmeter.

HORIZONTAL HOLD ADJUSTMENT

1. Tune in a local television signal and adjust contrast control for normal picture.
2. Connect electronic voltmeter between TP-3 (green lead) and chassis.
3. Short TP-4 (orange lead) to chassis and adjust electronic voltmeter to zero.
4. Remove short from TP-4. Do not change zero on electronic voltmeter.
5. Connect a 0.1 mfd., 20%, 600 volt capacitor between TP-5 (red lead) and chassis.
6. Adjust Horizontal Hold control for zero reading on the meter.
7. Remove the 0.1 mfd. capacitor from TP-5 and chassis. Do not disturb setting of horizontal hold control.
8. Adjust Horizontal Stabilizer coil (L108) for zero reading on the meter.
9. Remove electronic voltmeter from TP-3.
10. Check horizontal pull-in range. The pull-in range should be approximately 50° of the controls rotation.



TV CHASSIS TOP VIEW
(Tube and Alignment Locations)



TV CHASSIS BOTTOM VIEW
(Tube Socket and Alignment Locations)

UHF ALIGNMENT

NOTES:

1. Remove the UHF Converter from the VHF receiver chassis.
2. Disengage the toggle coupling from the switch throw arm on the front of the UHF chassis.

   To accomplish this: -

   a. Turn the UHF tuning control clockwise until the pin located on the rear of the drive pulley is free from the toggle coupling.

   b. Turn the switch throw arm to a vertical position to disengage fork of toggle coupling.

   c. Turn the toggle coupling counter-clockwise to a vertical position so that it does not interfere with the movement of the drive pulley.

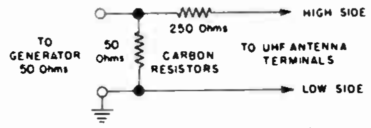
   d. Turn the switch throw arm counter-clockwise to the UHF position; top contact blade on switch rotor must contact and center on the two top switch fingers with the red wires attached. Leave switch in this position while aligning.
3. Connect the output leads of the UHF converter to the R-F input terminals of the VHF Tuner.
4. Connect the B- and filament leads of the tuner to the VHF receiver. Connect UHF Converter chassis to B- (VHF receiver chassis).
5. Set VHF Tuner to Channel 6.
6. Keep all leads as short as possible.
7. Alignment should be followed in the order shown.

I.F. ALIGNMENT:

1. Set I-F slide switch on the UHF Converter to Channel 6 (pushed toward the rear of chassis position).
2. Connect an electronic voltmeter or oscilloscope across the second detector load resistor, R114 on the VHF chassis.
3. Turn on the power.
4. Apply an 82.5 mc. (amplitude modulated if a scope is used) signal to the junction of C2 and C9.
5. Adjust I-F input coil (T2) for peak reading on meter (or maximum indication on scope).
6. Change signal generator frequency to 88.5 mc. and adjust I-F output coil (T1) for maximum reading or indication.
7. Repeat steps 4 through 6 until maximum readings are obtained.
8. Remove the generator connections from the junction of C2 and C9.

OSCILLATOR ALIGNMENT:

1. Connect an electronic voltmeter or scope across the second detector load resistor, R114.
2. Apply a 460 mc. (amplitude modulated when scope is used) signal to the UHF antenna terminals through the antenna matching network. (See Antenna Matching Network sketch.)
3. With the tuner shaft at maximum counter-clockwise position, adjust the oscillator trimmer, C13 for peak reading on the electronic voltmeter (or maximum indication on scope).



Antenna Matching Network

4. Set the signal generator to 904 mc.
5. Rotate the tuner shaft to maximum clockwise position and adjust the oscillator end inductor, L13 for maximum reading on the voltmeter (or scope).
6. Repeat steps 2 through 5 until maximum reading is obtained.

R-F CIRCUIT ALIGNMENT:

1. With the signal generator and electronic voltmeter or scope connected as for the Oscillator Alignment above, set the R-F coupling trimmer, C1 and C2 to minimum capacity by turning the screw counter-clockwise.
2. Set the signal generator to 460 mc. (amplitude modulated when scope is used).
3. With the tuner shaft at maximum counter-clockwise position, adjust the antenna and mixer trimmers, C8 and C11 for maximum meter reading (or scope indication).
4. Reset signal generator to 904 mc.
5. Rotate the tuner shaft to maximum clockwise position and adjust the antenna and mixer end inductors, L1 and L2 for maximum reading on meter (or scope).
6. Repeat steps 2 through 5 until maximum reading is obtained.
7. Reset signal generator to 460 mc.
8. Turn the tuner shaft to maximum counter-clockwise position and adjust the coupling trimmer, C1 and C2 for peak reading.
9. Turn the power switch to the "OFF" position.
10. Disconnect the generator and electronic voltmeter, or scope.
11. Re-engage the toggle coupling in the pin on the switch throw arm and the pin on the drive pulley as follows:

    a. Rotate the tuning control shaft clockwise until the pin on the rear of the drive pulley is toward the base of the chassis.

    b. Turn the switch throw arm to a vertical position.

    c. Turn the toggle coupling approximate 45° clockwise from a vertical position.

    d. Turn the switch throw arm counter-clockwise until pin engages the upper fork on the toggle coupling.

    e. Turn the tuning shaft counter-clockwise and guide the pin on the rear of drive pulley into the lower fork of the coupling. The coupling is now in the proper operating position and when the tuning shaft is turned completely counter-clockwise, the switch will be thrown to the VHF position.
12. Replace the UHF Converter on the VHF receiver chassis.

CRITICAL LEAD AND COMPONENT DRESS VHF RECEIVER CHASSIS

R-F TUNER:

The brown AGC lead from the terminal board to the tuner should be dressed flat down to chassis.

I-F SECTION:

The component leads and wires in the video I-F section must be kept as short as possible.

CRITICAL LEAD AND COMPONENT DRESS VHF RECEIVER CHASSIS (Continued)

R-F CHOKE:

The end of the R-F choke L113 which is wired to T103 lug 6, shall be as short as possible.

LEADS:

The black wire from T103, lug 4 to chassis must be as short as possible. All leads must be kept away from the plates of the selenium rectifiers, SR101 and SR102. Dress the red and blue leads of Audio Output Transformer, T108 away from the high voltage shield so they will not be pinched under it.

COMPONENTS:

Keep all components, particularly peaking coils, away from R121 which is wired between the terminal boards adjacent to V110.

RESISTORS:

Dress the fuse resistor R142 attached to the terminal board, up away from the chassis. On the 396 chassis, dress the two 150K ohm resistors, R151 and R152, in such a manner as not to short against the high voltage shield.

CAPACITORS:

The .006 mfd. capacitor, C138, wired from V114, pin 6, to ground lug of C118, should be dressed down close to the chassis. The .005 mfd. capacitor, C162, which is wired from the case of R118 thru the center lug of R118A to chassis, must have a very short lead on the end wired to the case of R118 so the body of the capacitor prevents any shorting to the shield wired to R118.

CONTROLS:

All controls and the local-distance switch must be kept from shorting to the chassis. Make sure the control does not turn when the nut is tightened.

HIGH VOLTAGE SECTION:

The plate cap of the 1B3GT, V115, should be put on so the lead comes away from it in a vertical direction. The vinyl tape that is applied to the corona ring should cover the entire outside edge of the ring and as much of the socket area as possible.

YOKE COUPLING NETWORK:

The yoke coupling newtwork, L109, wired from T106 lug 3 to V112, lug 1, should be kept away from lug 4 of T106.

CRITICAL LEAD AND COMPONENT DRESS UHF CONVERTER

As the UHF Converter used in this receiver operates over a range (470 mc. to 890 mc.) of frequencies that are from approximately two to four times higher than the highest frequencies encountered in VHF tuners, placement of parts and component lead lengths in the circuit have considerable effect upon the performance of the unit. When replacing components or wiring, special note should be taken of the position of the part or wire to be replaced, before removal. New parts or wires should be located in the same position as those removed. Extremely critical points that require special attention are listed below.

Capacitors:

C3, C6, C7 — The capacitors C3, C6 and C7 in the antenna circuit must be placed with their leads as short and direct as possible.

C9, C10 — The capacitors C9 and C10, 3.3 mmf., must be placed with their leads as short and direct as possible.

C12 — The capacitor C12, 12 mmf., must be placed with only the silvered surface in contact with the lug to which it is soldered. They must be at right angles to the inductor. In order to avoid burning off the silver plating of the unit, the tip temperature of the iron used for soldering should not exceed 500°F. (260°C).

C13 — When the oscillator trimmer assembly, C13 is soldered to the socket contacts, base of trimmer must be firmly held flat against ribs in socket body while socket contacts are firmly seated in the socket body so that this construction is mechanically rigid. Failure to maintain mechanical rigitity in this assembly will result in difficult alignment and poor oscillator frequency stability.

C14 — Capacitor C14, 2.2 mmf., must be placed away from the chassis.

C19, C20 — Capacitors C19 and C20, should be dressed up and away from the function switch.

C21 — Capacitor C21, 27 mmf. must be connected with shortest possible leads.

C22 — Capacitor C22, 1000 mmf. must be oriented so that the flat side of lug is toward pin 2 on the V2 tube socket, in order that the lug may be bent over to the socket contact. If capacitor is not turned quite far enough when threads first begin to tighten, it may be rotated up to about a 1/2 turn further by application of greater torque to wrench. Care should be exercised to prevent stripping threads by turning too far.

RESISTOR:

R5 — The resistor R5, 10,000 ohms, must be placed away from the chassis.

CHOKES:

L4, L6 — The chokes L4 and L6 must be placed away from the chassis.

LEADS:

a. The B+ and heater leads leaving the oscillator radiation shield should be dressed down flat against the R-F chassis.

b. The short red lead joining slide switch terminal and terminal on I-F output transformer should be dressed in form of loop, up and away from chassis.

c. The red lead joining the crystal holder terminal and slide switch terminal should be as short and direct as possible, and dressed down against the chassis. There should be no excess lengths to be looped or doubled up.

R-F COUPLING TRIMMER:

Plates forming the R-F coupling trimmer (C1 and C2) must be placed so that the plates are parallel in both planes when trimmer screw is adjusted so that the plates are 1/32 inch apart. Plates should overlap 1/8 inch minimum. In order to accomplish this overlap, it may be necessary to decenter the parts on the UHF tuner tabs. If so, such decentering should be equally divided between the two parts.

OSCILLATOR:

a. The oscillator plate strap A-154740 (C02) must be assembled with its bottom edge (as viewed from bottom of chassis) resting on the tube socket ribs and with the plane of part of the piece joining the two socket contacts perpendicular to chassis. In order to realize this condition, socket contacts must be firmly seated down against body of socket and "ears" on this piece must be inserted their full length into holes in socket contacts. Solder should be flown between socket contact and the piece for full length of socket contact, in order to avoid possibility of intermittent contact between socket contact and edge of this piece extending beyond "ears". Tab should be soldered flat against and of C12.

b. A dummy plug with hardened steel pins should be inserted in the oscillator socket before components are placed and soldered to socket lugs, to insure alignment of contacts.

CRYSTAL HOLDER:

When soldering connections to the crystal holder terminals, al-

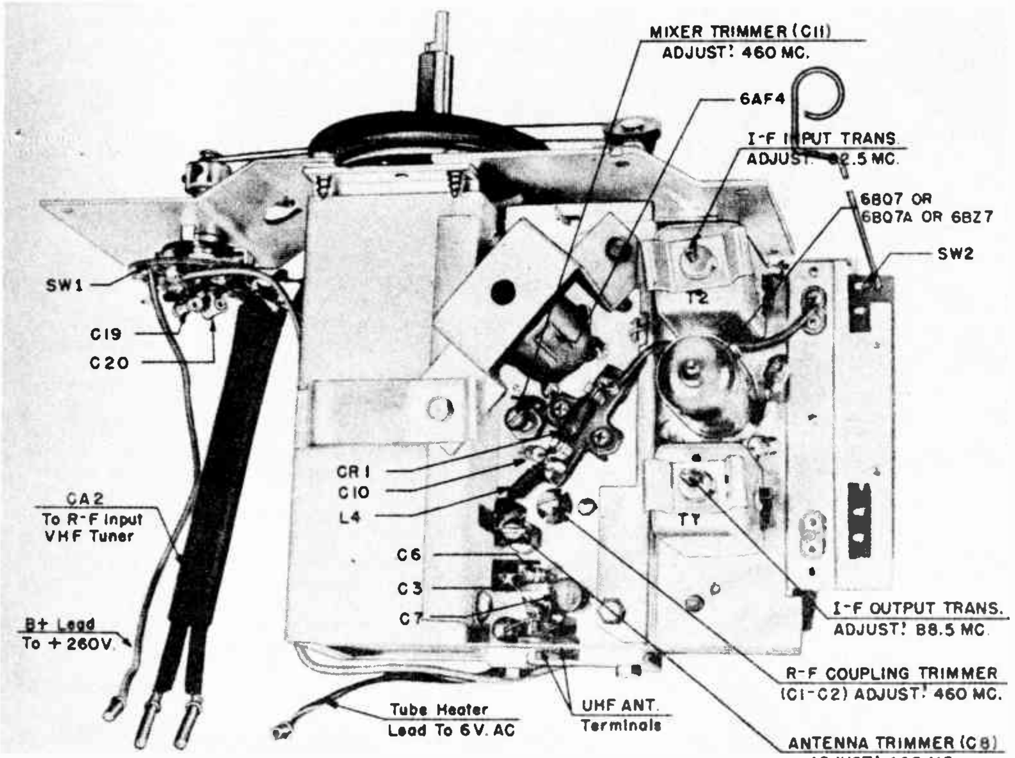
CRITICAL LEAD AND COMPONENT DRESS (Continued)

UHF CONVERTER

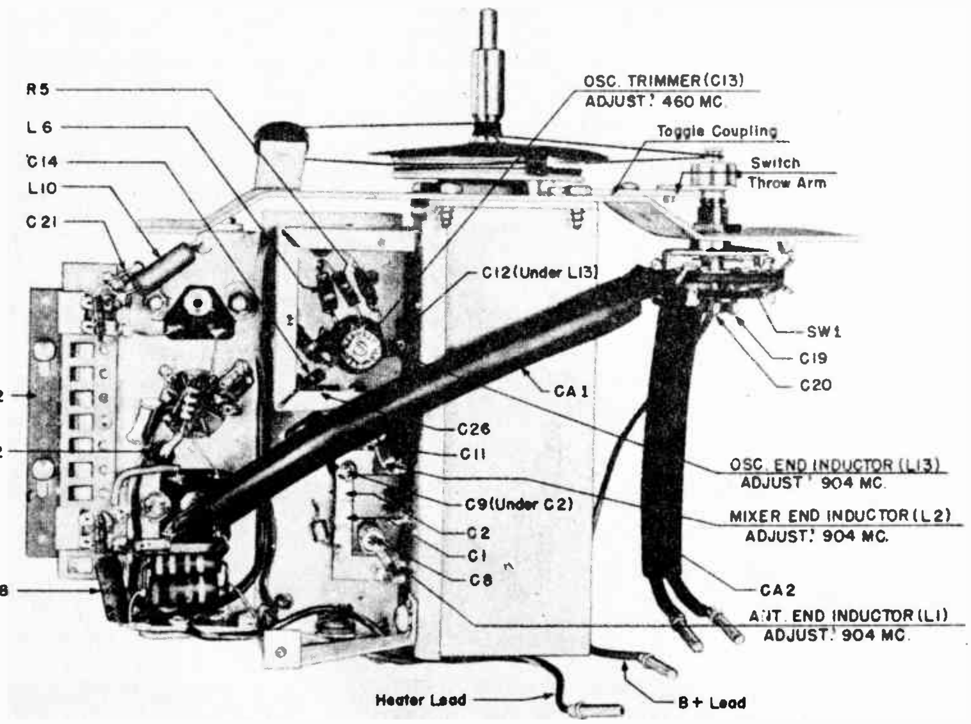
low solder to flow between eyelet and terminal proper to insure a consistent electrical connection.

FUNCTION SWITCH:

The function switch must have all VHF position contacts fully and firmly made and all UHF position contacts fully broken when the UHF tuner shaft is at full counter-clockwise rotation. All VHF position contacts must be fully broken and all UHF position contacts must be fully and firmly made at 7-1/2° or more from full counter-clockwise rotation as tuner shaft is rotated in a clockwise direction.



Top View, UHF Converter



Bottom View, UHF Converter

PARTS LIST

TV CHASSIS 393-394 (Schematic Parts)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
C101	137727-129	Capacitor, 330 mmf., 500 v., ceramic	R101	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
C102	39001-17	Capacitor, .05 mfd., 600 v., paper	R102	39375-63	Resistor, 3900 ohm, 5%, 1/2 w.
C103	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic	R103	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
C104	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic	R104	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
C105	144675-14	Capacitor, .001 mfd., 500 v., disc ceramic	R105	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
C107	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic	R106	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
C108	144675-14	Capacitor, .001 mfd., 500 v., disc ceramic	R107	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
C109	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic	R108	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
C110	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic	R109	39375-75	Resistor, 12,000 ohm, 5%, 1/2 w.
C111	144675-14	Capacitor, .001 mfd., 500 v., disc ceramic	R110	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
C112	137727-135	Capacitor, 10 mmf., 10%, 500 v., ceramic	R111	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
C113	137727-103	Capacitor, 5 mmf., 10%, 500 v., ceramic	R112	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
C114	39001-19	Capacitor, .1 mfd., 600 v., paper	R113	39374-67	Resistor, 1.8 megohm, 10%, 1/2 w.
C115	154157	Capacitor, .5 mfd., 25 v., paper	R114	39375-67	Resistor, 5600 ohm, 5%, 1/2 w.
C116	154100-4	Capacitor, 2.2 mmf., 500 v., ceramic	R115	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
C117	137727-126	Capacitor, 3.3 mmf., 10%, 500 v., ceramic	R116	39374-65	Resistor, 1.5 megohm, 10%, 1/2 w.
C118A	154099	Capacitor, 100 mfd., 300 v.	R117	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
C118B		Capacitor, 10 mfd., 300 v. Electrolytic	R118A	154085	Control (Contrast), 2500 ohm Assembly
C118C		Capacitor, 200 mfd., 200 v.	R118B		Control (Volume), 1 megohm
C118D		Capacitor, 30 mfd., 150 v.	R119	Part of L104	Resistor, 8200 ohm, 10%, 1/2 w.
C119	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic	R120	39374-131	Resistor, 33,000 ohm, 10%, 1 w.
C120A	154098	Capacitor, 200 mfd., 150 v. Electrolytic	R121	39375-361	Resistor, 4700 ohm, 5%, 2 w.
C120B		Capacitor, 5 mfd., 150 v.	R122	Part of L106	Resistor, 6800 ohm, 10%, 1/2 w.
C121	39001-19	Capacitor, .1 mfd., 600 v., paper	R123	Part of L107	Resistor, 3300 ohm, 10%, 1/2 w.
C122	137727-131	Capacitor, 220 mmf., 10%, 500 v., ceramic	R124	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
C123	39477-39	Capacitor, .0047 mfd., 600 v., molded paper	R125	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
C124	137727-26	Capacitor, 22 mmf., 10%, 500 v., ceramic	R126	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
C125	39001-17	Capacitor, .05 mfd., 600 v., paper	R127	39374-59	Resistor, 680,000 ohm, 10%, 1/2 w.
C126	39477-39	Capacitor, .0047 mfd., 600 v., molded paper	R128	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
C127	39477-39	Capacitor, .0047 mfd., 600 v., molded paper	R129	39374-146	Resistor, 560,000 ohm, 10%, 1 w.
C128	39477-41	Capacitor, .01 mfd., 600 v., molded paper	R130	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
C129	39001-11	Capacitor, .005 mfd., 600 v., paper	R131	39374-35	Resistor, 6800 ohm, 10%, 1/2 w.
C130	39477-45	Capacitor, .047 mfd., 600 v., molded paper	R132	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
C131	39477-45	Capacitor, .047 mfd., 600 v., molded paper	R133	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
C132	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic	R134	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
C133	154097	Capacitor, 20 mfd., 450 v., Electrolytic	R134	154087	Control, Vertical Hold (850,000 ohm)
C135	154096	Capacitor, 140 mfd., 150 v., Electrolytic	R136	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
C136	137727-132	Capacitor, 1000 mmf., 10%, 500 v., ceramic	R137	39374-28	Resistor, 1800 ohm, 10%, 1/2 w.
C137	137727-132	Capacitor, 1000 mmf., 10%, 500 v., ceramic	R138	154086	Control, Height (5 megohm)
C138	39001-78	Capacitor, .006 mfd., 600 v., paper	R139	39374-14	Resistor, 120 ohm, 10%, 1/2 w.
C139	39001-76	Capacitor, .003 mfd., 600 v., paper	R140	154088	Control, Vertical Linearity (750 ohm)
C140	39477-52	Capacitor, .001 mfd., 1000 v., molded paper	R141	154084	Resistor, 8700 ohm, 5%, 5 W. Wire Wound
C141	39001-13	Capacitor, .01 mfd., 600 v., paper	R142	154089	Resistor, 7.5 ohm, 10%, 5 W. Wire Wound
C142	137727-134	Capacitor, .75 mmf., 10%, 500 v., ceramic			(Fuse type)
C143	137499-30	Capacitor, 3900 mmf., 10%, 500 v., mica	R143	39374-17	Resistor, 220 ohm, 10%, 1/2 w.
C144	137499-31	Capacitor, 390 mmf., 10%, 500 v., mica	R144	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
C145	137499-34	Capacitor, 560 mmf., 10%, 500 v., mica	R146	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
C146	137499-34	Capacitor, 560 mmf., 10%, 500 v., mica	R147	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
C147	154988	Capacitor, 120 mmf., 10%, 3000 v., ceramic	R148	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
C148	Part of L109	Capacitor, .1 mfd., 200 v., paper	R149	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
C149	137727-133	Capacitor, 68 mmf., 10%, 500 v., ceramic	R150	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
C150	144675-6	Capacitor, .004 mfd., 500 v. disc ceramic	R151	39374-131	Resistor, 33,000 ohm, 10%, 1 w.
C150		Capacitor, .004 mfd., 500 v.	R152	39374-133	Resistor, 47,000 ohm, 10%, 1 w.
C151	154103	Capacitor, 5 mfd., 50 v., Electrolytic	R153	39374-26	Resistor, 1200 ohm, 10%, 1/2 w.
C152	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic	R154	39374-34	Resistor, 5600 ohm, 10%, 1/2 w.
C153	144674-14	Capacitor, .001 mfd., 500 v., disc ceramic	R155	154093	Control, Horizontal Hold (120,000 ohm)
C154	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic	R156	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
C155	154104	Capacitor, 10 mfd., 50 v., Electrolytic	R157	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
C156	39001-13	Capacitor, .01 mfd., 600 v., paper	R158	39374-55	Resistor, 330,000 ohm, 10%, 1/2 w.
C157	39001-80	Capacitor, .02 mfd., 600 v., paper	R159	39374-121	Resistor, 4700 ohm, 10%, 1 w.
C158	Part of L112	Capacitor, 47 mmf., mica	R160	154083	Control, Horizontal Centering (50 ohm)
C159	Part of T102	Capacitor, 68 mmf., 10%, 500 v.	R161	39303-12	Resistor, 2.2 ohm, 10%, 1/2 w. Wire Wound
C160	Part of T107	Capacitor, 10 mmf.	R162	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
C161	Part of T107	Capacitor, 100 mmf.	R163	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
C162	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic	R164	39374-18	Resistor, 270 ohm, 10%, 1/2 w.
C163	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic	R165	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
C164	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic	R166	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
C165	154394	Capacitor, 500 mmf., 20 k.v., ceramic (393 only)	R167	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
C166	39001-17	Capacitor, .05 mfd., 600 v., paper	R168	39374-27	Resistor, 1500 ohm, 10%, 1/2 w.
C167	39001-19	Capacitor, .1 mfd., 600 v., paper	R169	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
C168	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic			

TV CHASSIS 393-394 (Schematic Parts)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
R170	154095	Control, Brightness (5 megohm)	T105	154106	Transformer, Vertical Output
R171	154094	Control, Focus (1.5 megohm)	T106	154990	Transformer, Horizontal Output
R172	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.	T107	154108	Transformer, Ratio Detector
R173	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.	T108	154109-1	Transformer, Audio Output
R174	39374-213	Resistor, 10,000 ohm, 10%, 2 w.	T109	154290	Transformer, Filament
L101	155178	Coil, Converter I. F.	CA101	154177	Antenna Lead
L102	154171	Coil, Video Peaking (168 microhenry, 5%)	CA102	132300-6	Cable & Plug Assy., Power
L103	154184	Coil, Video Peaking (335 microhenry, 5%)	SW101	Part of R118B	Switch, ON-OFF (Power)
L104	154194	Coil, Video Peaking (412 microhenry, 5%)	SW102	154115	Switch, A.G.C. Control
L105	154158	Trap (4.5 megacycle)	SP101	138762-7	Speaker, P.M. (5-1/4")
L106	154206	Coil, Video Peaking (106 microhenry, 5%)	SP102	138762-5	Speaker, P.M. (10")
L107	154176	Coil, Video Peaking (840 microhenry, 5%)	S101	154178	Speaker, Cable & Connector
L108	154220	Coil, Horizontal Osc.	S102	154113	Socket, Test (Connector)
L109	154156	Network, Yoke Decoupling	P101	154243	Plug, Speaker Cable
L110	154183	Coil, Sound Take Off	P102	154125	Plug, Interlock
L111	154442	Choke, Filter (used on SP 101)	SR101	154112	Selenium Rectifier
L112	154221-6	Yoke, Deflection	SR102	154112	Selenium Rectifier
L113	154276	Coil, R. F. Choke	CR101	154111	Crystal (1N64)
L114	154442	Choke, Filter (used on SP102)	CO101	155049	Terminal Boards & Bracket Assy., Antenna (VHF, UHF)
T101	155174	Transformer, 1st. I. F.			
T102	155173	Transformer, 2nd. I.F.	CO102	154114	Connector
T103	155179	Transformer, Diode I. F.	CO103	154114	Connector
T104	154105-1	Transformer, Vertical Blocking Osc.	CO104	154114	Connector

TV CHASSIS 393

Symbol No.	Part No.	Description
	154794	Barrier, Volume Control
	154275-5	Bracket (Frame), Deflection Yoke Mtg.
	154273	Bracket, Deflection Yoke Mtg.
	154368-2	Bracket,(L.H.), Picture Tube Support
	154368-1	Bracket (R.H.), Picture Tube Support
	154190	Bracket, Tuner Mtg.
	154318	Cable, Shielded (18" long) Twin Lead
	154349-1	Cable, Shielded (9" long)
	154349-2	Cable, Shielded (6-1/2" long)
	154180	Coil (High Voltage), Horizontal Deflection Assy.
	154989	Coil (Primary), Horizontal Deflection Assy.
	154276-2	Channel (Rubber 10-5/16"), Deflection Yoke Assy.
	154363	Clip, Picture Tube Anode
	154124	Coupling, Shaft Width Control
	154353	Cushion (Rubber), Picture Tube Support
	154122-1	Grid Cap (V114)
	154134	Grommet (4 used), Tube Mtg. (V105, V113)
	154259	Insulator, Antenna Lead
	154260	Insulator (1-3/16" x 1-7/32" Phenolic), Controls
	154264	Insulator, Interlock
	154268	Insulator (1-13/16" x 19/32 x 1/6" Armite), R. F. Tuner Shaft
	154025	Insulator (Ring), Picture Tube
	154730	Insulator, Volume Control
	154109-2	Ion Trap
	39012-102	Iron Core
	39012-95	Iron Core
	39012-96	Iron Core
	154073	Iron Core, Horizontal Deflection Assy.
	39012-115	Iron Core
	154274	Key & Centering Control Shaft Assy.
	154314	Plate (Bearing), R. F. Tuner Shaft
	154075	Plate, Horizontal Width Control
	154129	Plate, Tube Mtg. (V105, V113)
	154079-1	Ring (Retaining, 3 used), Width Control Shaft Assy.
	154119	Ring (Retaining), Centering Control Shaft Key
	144957	Screw (Wing), Deflection Yoke
	155027	Shaft, RF Pentode Assy.
	154267	Shaft, Width Control
	154077	Shaft, Width Control (Horizontal Deflection Assy.)
	154152	Shield, Corona
	154195	Shield, High Voltage
	39008-37	Shield (Spiral), R. F. Tuner Assy.
	149572	Sleeving (36" lengths), Plate Lead V113, 6-1/2" long
	149572	Sleeving (36" lengths), Anode Lead 4" Long
	154148-2	Socket & Cable Assy., Picture Tube
	154203	Socket, Tube (V113)
	154192	Socket, Tube (V105)
	154092	Socket, Tube (V115)
	154117	Socket, Tube (V110)
	154146	Socket, Tube (V101, V102, V103, C107)
	154131	Socket, Tube (V109, V111, V114)
	154130	Socket, Tube (V112)
	154127	Socket, Tube (V104, V106, V108)
	154381	Spring, Capacitor Mtg. (C165)
	154072	Spring (Clip), Horizontal Deflection Assy.
	154071	Spring (Strap), Horizontal Deflection Assy.
	154120	Spring, Horizontal Centering Control Shaft
	153972-2	Strap, Picture Tube
	154991	Terminal Board, Horizontal Deflection Assy.
	154116	Tuner, R. F. Pentode Assy.
	91595-1	Washer (Flat), Width Control Shaft
	154140	Washer (Protruded) Controls
	149180	Washer (Spring), Width Control Shaft

TV CHASSIS 394

Symbol No.	Part No.	Description
	154794	Barrier, Volume Control
	154275-1	Bracket (Frame), Deflection Yoke Mtg.
	154253	Bracket, Deflection Yoke Mtg.
	154514	Bracket (Lower), Deflection Yoke Mtg.
	154190	Bracket, R. F. Tuner Mtg.
	154358	Bracket (2 used), Picture Support
	154359	Bracket, Picture Tube Stop
	154318	Cable, Shielded (18" long) Twin Lead
	154349-1	Cable, Shielded (9" long)
	154349-2	Cable, Shielded (6-1/2" long)
	154276-2	Channel (Rubber 10-5/16" long), Deflection Yoke Assy.
	154180	Coil (High Voltage), Horizontal Deflection Assy.
	154989	Coil (Primary), Horizontal Deflection Assy.
	155102-2	Connector, Picture Tube Anode
	154124	Coupling, Width Control Shaft
	153424-1	Cushion (Rubber), Picture Tube Strap
	153424-4	Cushion (Rubber), Picture Tube Stop
	154122-1	Grid Cap (V114)
	154134	Grommet (Rubber 4 used), Tube Mtg. (V105, V113)
	154259	Insulator, Antenna Lead
	154260	Insulator (1-13/16" x 17/32", Phenolic), Controls
	154264	Insulator, Interlock
	154268	Insulator, (1-13/16" x 9/32" x 1/6" Armite), R. F. Tuner Shaft
	154730	Insulator, Volume Control
	153109-2	Ion Trap
	39012-102	Iron Core
	39012-114	Iron Core
	154073	Iron Core, Horizontal Deflection Assy.
	39012-115	Iron Core
	155298	Key, Centering Control Shaft
	154314	Plate (Bearing), R. F. Tuner Shaft
	154075	Plate, Horizontal Width Control
	154079-1	Ring (Retaining, 3 used), Width Control Shaft Assy.
	154119	Ring (Retaining), Centering Control Shaft Key
	153423	Rod (2 used), Picture Tube Tie Down
	144957	Screw (Wing), Deflection Yoke
	155299	Shaft, Centering Control
	155027	Shaft, R F Pentode Assy.
	154267	Shaft, Width Control
	154077	Shaft, Width Control (Horizontal Deflection Assy.)
	154152	Shield, Corona
	154197	Shield, High Voltage
	39008-37	Shield (Spiral), R. F. Tuner Assy.
	149572	Sleevings (36" lengths), Plate Lead V113, 6-1/2" long
	154148-2	Socket & Cable Assy., Picture Tube
	154203	Socket, Shock Mtg. Tube (V113)
	154192	Socket, Shock Mtg. Tube (V105)
	154092	Socket, Tube (V115)
	154117	Socket, Tube (V110)
	154146	Socket, Tube (V101, V102, V103, V107)
	154131	Socket, Tube (V109, V111, V114)
	154130	Socket, Tube (V112)
	154127	Socket, Tube (V104, V106, V108)
	154072	Spring (Clip), Horizontal Deflection Assy.
	154414	Spring (2 used), Picture Tube Mtg.
	149671-1	Spring, (Grounding)
	154071	Spring (Strap), Horizontal Deflection Assy.
	154120	Spring, Horizontal Centering Control Shaft
	153422	Strap, Picture Tube
	149322	Support, Picture Tube Anode
	154991	Terminal Board, Horizontal Deflection Assy
	154116	Tuner, R. F. Pentode Assy.
	91595-1	Washer (Flat), Width Control Shaft
	154140	Washer (Protruded), Controls
	149180	Washer (Spring), Width Control Shaft

UHF CONVERTER

Symbol No.	Part No.	Description
C1	153835	Stator, R. F. Coupling Trimmer
C2	151890	Rotor, R. F. Coupling Trimmer
C3	152997-1	Capacitor, 2.2 mmf., 10%, 500 v., ceramic
C5	152997-6	Capacitor, .68 mmf., 10%, 500 v., ceramic
C6	152997-3	Capacitor, 1.5 mmf., 10%, 500 v., ceramic
C7	144675-27	Capacitor, 100 mmf., 500 v., disc ceramic
C8	151880-2	Capacitor, .8-6.5 mmf.
C9	152997-4	Capacitor, 3.3 mmf., 10%, 500 v., ceramic
C10	152997-4	Capacitor, 3.3 mmf., 10%, 500 v., ceramic
C11	151880-2	Capacitor, .8-6.5 mmf.
C12	155077-1	Capacitor, 12 mmf., 5%, 500 v., ceramic
C13	154777-1	Capacitor, 2-7 mmf.
C14	152997-1	Capacitor, 2.2 mmf., 10%, 500 v., ceramic
C15	152997-8	Capacitor, 68 mmf., 10%, 500 v., ceramic
C16	152997-8	Capacitor, 68 mmf., 10%, 500 v., ceramic
C17	137727-66	Capacitor, 18 mmf., 10%, 500 v., ceramic
C18	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic
C19	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic
C20	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic
C21	137727-136	Capacitor, 27 mmf., 10%, 500 v., ceramic
C22	154808	Capacitor, 1000 mmf., 500 v.
C23	144675-27	Capacitor, 100 mmf., 500 v., ceramic
C24	137727-104	Capacitor, 470 mmf., 10%, 500 v., ceramic
C25	137727-113	Capacitor, 1500 mmf., 10%, 500 v., ceramic
C26	152997-2	Capacitor, 1 mmf., 10%, 500 v., ceramic
R1	Part of L12	Resistor, 22 ohm, 10%, 1/2 w.
R2	Part of L12	Resistor, 22 ohm, 10%, 1/2 w.
R3	Part of L12	Resistor, 390 ohm, 10%, 1/2 w.
R4	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R5	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R6	39374-24	Resistor, 820 ohm, 10%, 1/2 w.
R7	39374-217	Resistor, 22,000 ohm, 10%, 2 w.
R8	39374-19	Resistor, 330 ohm, 10%, 1/2 w.
R9	39374-11	Resistor, 68 ohm, 10%, 1/2 w.
R10	39374-133	Resistor, 47,000 ohm, 10%, 1 w.
R11	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R12	39374-12	Resistor, 82 ohm, 10%, 1/2 w.
L1	Part of C8	Inductance
L2	Part of C11	Inductance
L3	148936-2	Choke (.82 microhenry)
L4	154847	Choke (.143 microhenry)
L5	154788	Choke, Oscillator Plate (.182 microhenry)
L6	153286	Choke, Oscillator cathode (.512 microhenry)
L7	151912	Choke & Resistor Assembly
L8	148936-4	Choke (1.2 microhenry)
L9	154788	Choke (.182 microhenry)
L10	148936-4	Choke (1.2 microhenry)
L11	154789	Coil (.105 microhenry)
L12	154711	Inductuner
L13	Part of C13	Inductance
T1	154760	Transformer, I.F. Output
T2	154759	Transformer, I. F. Input
SW1	154721	Switch, Function
SW2	154728	Switch, Slide
SW2	154727	Switch, Body
CA1		Transmission Line (300 ohm), 6-3/4" long
CA2		Transmission Line (300 ohm), 5-7/8" long
CO1	154781	Terminal Board, UHF Antenna
CO2	154740	Strap, Oscillator Plate
CR1	151871	Crystal, Germanium
	154758	Arm & Hub Assembly, Function Switch
	154803	Cotter Pin (External)
	39012-111	Iron Core
	137939-1	Pulley, Drive Cord Idler
	137940-1	Rivet, Drive Cord Idler Pulley
	151883	Screw (6-32 Nylon)
	39311-2	Screw (Set), Arm & Hub Assembly
	153806	Shield, Inductuner
	154677	Shield, Tube (V1)
	51752	Spring, Dial Drive Cord
	152053	Socket, Tube (V1)
	152078	Socket, Tube (V2)
	154848	UHF Converter, Complete

Final Assembly and Cabinet - Model EU-21TOLU (Chassis 393)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377-2	Antenna Assy., VHF		154841-1	Knob (Small), Tuning, UHF
	154965	Antenna Assy., UHF		154217-1	Knob, Volume
	154973	Back & Power Cable Assy.		154265	Knob, Local-Suburban-Distance
	154256	Block, Chassis Mtg. (4 used)		154270	Knob, Controls (Vertical-
	154312-3	Cabinet			Horizontal, Holds)
	132300-6	Cable & Plug Assy., Power		154333-1	Mask, Window
	153550	Clip, Window & Mask Assy.		154313	Nail, Channel Indicator
	144600	Grille Cloth		154347-2	Name Plate, Crosley
	154216-1	Knob, Contrast		145211-22	Nut (Wing), Speaker Mtg.
	154214-1	Knob (Large), Tuning, VHF, UHF		154344-1	Screw, Chassis Mtg.
	154215-1	Knob (Small), Tuning		154382-1	Window, Tempered Glass

Final Assembly and Cabinet - Model EU-21TOLBU (Chassis 393)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377-2	Antenna Assy., VHF		154841-2	Knob (Small), Tuning, UHF
	154965	Antenna Assy., UHF		154217-2	Knob, Volume
	154973	Back & Power Cable Assy.		154265	Knob, Local-Suburban-Distance
	154256	Block, Chassis Mtg. (4 used)		154270	Knob, Controls (Vertical-
	154312-4	Cabinet			Horizontal, Holds)
	132300-6	Cable & Plug Assy., Power		154333-1	Mask, Window
	153550	Clip, Window & Mask Assy.		154313	Nail, Channel Indicator
	145472	Grille Cloth		154347-2	Name Plate, Crosley
	154216-2	Knob, Contrast		145211-22	Nut (Wing), Speaker Mtg.
	154214-2	Knob (Large), Tuning, VHF, UHF		154344-1	Screw, Chassis Mtg.
	154215-2	Knob (Small), Tuning		154382-1	Window, Tempered Glass

Final Assembly and Cabinet - Model EU-21COLU (Chassis 394)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377-2	Antenna Assy., VHF		154841-1	Knob (Small), Tuning, UHF
	154965	Antenna Assy., UHF		154217-1	Knob, Volume
	154975	Back & Power, Cable Assy.		154265	Knob, Local-Suburban-Distance
	155113	Bracket, Chassis Mtg. (4 used)		154270	Knob, Controls (Vertical-
	154332-1	Cabinet			Horizontal, Holds)
	132300-6	Cable, Power		154351-1	Mask, Window
	153550	Clip (Retainer 4 used), Window		154313	Nail, Channel Indicator
		& Mask Assembly		145211-22	Nut (Wing), Speaker Mtg. (4 used)
	154451	Grille Cloth		154504	Plate, Chassis Mtg. (4 used)
	154217-1	Knob, Contrast		154347-1	Plate, Name (Crosley)
	154214-1	Knob (Large), Tuning, VHF, UHF		154334-1	Screw, Chassis Mtg. (4 used)
	154215-1	Knob (Small), Tuning		154382-2	Window, Tempered Glass

Final Assembly and Cabinet - Model EU-21COLBU (Chassis 394)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377-2	Antenna Assy., VHF		154841-2	Knob (Small), Tuning, UHF
	154965	Antenna Assy., UHF		154217-2	Knob, Volume
	154974	Back & Power, Cable Assy.		154265	Knob, Local-Suburban-Distance
	155163	Bracket, Chassis Mtg. (4 used)		154270	Knob, Controls (Vertical-
	154332-2	Cabinet			Horizontal, Holds)
	132300-6	Cable, Power		154351-1	Mask, Window
	153550	Clip (Retainer 2 used), Window		154313	Nail, Channel Indicator
		& Mask Assembly		145211-22	Nut (Wing), Speaker Mtg. (2 used)
	154452	Grille Cloth		154504	Plate, Chassis Mtg. (4 used)
	154216-2	Knob, Contrast		154347-1	Plate, Name (Crosley)
	154214-2	Knob (Large). Tuning, VHF, UHF		154334-1	Screw, Chassis Mtg. (4 used)
	154215-2	Knob (Small), Tuning		154382-2	Window, Tempered Glass

Final Assembly and Cabinet - Model EU-21CDLU (Chassis 394)

Part No.	Description	Part No.	Description
154965	Antenna, Assembly UHF	154216-1	Knob, Contrast
154377-2	Antenna, Assembly VHF	154217-1	Knob, Volume
154975	Back & Power Cable Assembly	154265	Knob, Local - Suburban - Distance
155163	Bracket, Chassis Mtg. (4 Used)	154270	Knob, Controls (Vertical & Horizontal, Holds)
155366-1	Cabinet	154841-1	Knob, Tuning (Channel Indicator), UHF
139319-2	Catch, Doors (4 Used)	154351-2	Mask, Window
153550	Clip, Retainer (2 Used), Window & Mask	154313	Nail, Channel Indicator
	Assembly	145211-21	Nut (Wing), Speaker Mtg. (4 Used)
153817	Doors, One Pair	154803	Pin, External Cotter
155164	Insulation, Chassis Mtg. Bracket (4 Used)	154347-1	Plate, Name (Crosley)
153779	Grille Cloth	154373	Pull (2 Used), Doors
146786	Hinge, Upper Left & Lower Right	154334-3	Screw, Chassis, Mtg. (4 Used)
146787	Hinge, Lower Left & Upper Right	51752	Spring, Dial Cord
154214-1	Knob, Tuning (Fine Tuning), UHF & VHF	139319-1	Strike, Door (4 Used)
154215-1	Knob, Tuning (Channel Indicator), VHF	154382-3	Window, Tempered Glass

Final Assembly and Cabinet - Model EU-21CDLBU (Chassis 394)

Part No.	Description	Part No.	Description
154965	Antenna, Assembly UHF	154216-2	Knob, Contrast
154377-2	Antenna, Assembly VHF	154217-2	Knob, Volume
154975	Back & Power Cable Assembly	154265	Knob, Local - Suburban - Distance
155163	Bracket, Chassis Mtg. (4 Used)	154270	Knob, Controls (Vertical - Horizontal, Holds)
155366-2	Cabinet	154841-2	Knob, Tuning (Channel Indicator) UHF
149941-2	Catch, Doors (4 Used)	154351-2	Mask, Window
153550	Clip, Retainer (2 Used), Window & Mask	154313	Nail, Channel Indicator
	Assembly	145211-21	Nut (Wing), Speaker Mtg. (4 Used)
154023	Doors, One Pair	154803	Pin, External Cotter
155164	Insulation, Chassis Mtg. Bracket (4 Used)	154347-1	Plate, Name (Crosley)
153781	Grille Cloth	149733-1	Pull (2 Used), Doors
149942	Hinge, Upper Left & Lower Right	154334-3	Screw, Chassis, Mtg. (4 Used)
149943	Hinge, Upper Right & Lower Left	51752	Spring, Dial Cord
154214-2	Knob, Tuning (Fine Tuning), UHF & VHF	149941-1	Strike, Doors (4 Used)
154215-2	Knob, Tuning (Channel Indicator), VHF	154382-3	Window, Tempered Glass

Final Assembly and Cabinet - Model EU-21COSU (Chassis 394)

Part No.	Description	Part No.	Description
154965	Antenna, Assembly UHF	154214-1	Knob, Tuning (Fine Tuning) VHF & UHF
154377-2	Antenna, Assembly VHF	154216-1	Knob, Contrast
154975	Back & Power Cable Assembly	154265	Knob, Local - Suburban - Distance
155163	Bracket, Chassis Mtg. (4 Used)	154270	Knob, Controls (Vertical - Horizontal, Holds)
155993-1	Cabinet	154351-7	Mask, Window
153550	Clip, Retainer (2 Used), Window & Mask	154313	Nail, Channel Indicator
	Assembly	154211-21	Nut (Wing), Speaker Mtg. (4 Used)
155164	Insulation, Chassis Mtg. Bracket (4 Used)	154803	Pin, External Cotter
154451	Grille Cloth	154347-1	Plate, Name (Crosley)
156002-1	Knob, Tuning (Channel Indicator) VHF	154334-3	Screw, Chassis Mtg. (4 Used)
156002-3	Knob, Volume	51752	Spring, Dial Cord
156002-5	Knob, Tuning (Channel Indicator) UHF	154382-2	Window, Tempered Glass

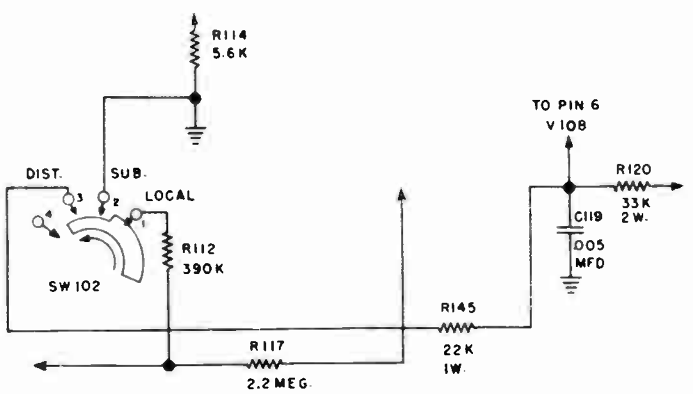
Final Assembly and Cabinet - Model EU-21COSBU (Chassis 394)

Part No.	Description	Part No.	Description
154965	Antenna, Assembly UHF	154214-2	Knob, Tuning (Fine Tuning) VHF & UHF
154377-2	Antenna, Assembly VHF	154216-2	Knob, Contrast
154975	Back & Power Cable Assembly	154265	Knob, Local - Suburban - Distance
155163	Bracket, Chassis Mtg. (4 Used)	154270	Knob, Controls (Vertical - Horizontal, Holds)
155993-2	Cabinet	154351-7	Mask, Window
153550	Clip, Retainer (2 Used) Window & Mask	154313	Nail, Channel Indicator
	Assembly	154211-21	Nut (Wing), Speaker Mtg. (4 Used)
155164	Insulation, Chassis Mtg. Bracket (4 Used)	154803	Pin, External Cotter
154452	Grille Cloth	154347-1	Plate, Name (Crosley)
156002-2	Knob, Tuning (Channel Indicator) VHF	154334-3	Screw, Chassis Mtg. (4 Used)
156002-4	Knob, Volume	51752	Spring, Dial Cord
156002-6	Knob, Tuning (Channel Indicator) UHF	154382-2	Window, Tempered Glass

SUBJECT: TO SHOW VARIOUS CHANGES IN CIRCUITRY AND ASSOCIATED CHASSIS CODE LETTERS.

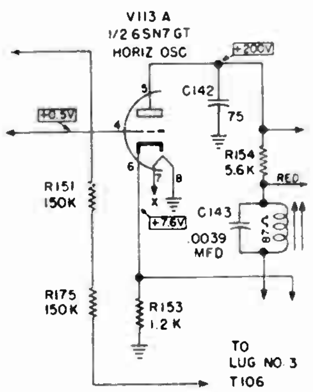
CODE LETTER B

To Increase Vertical Sync. Stability



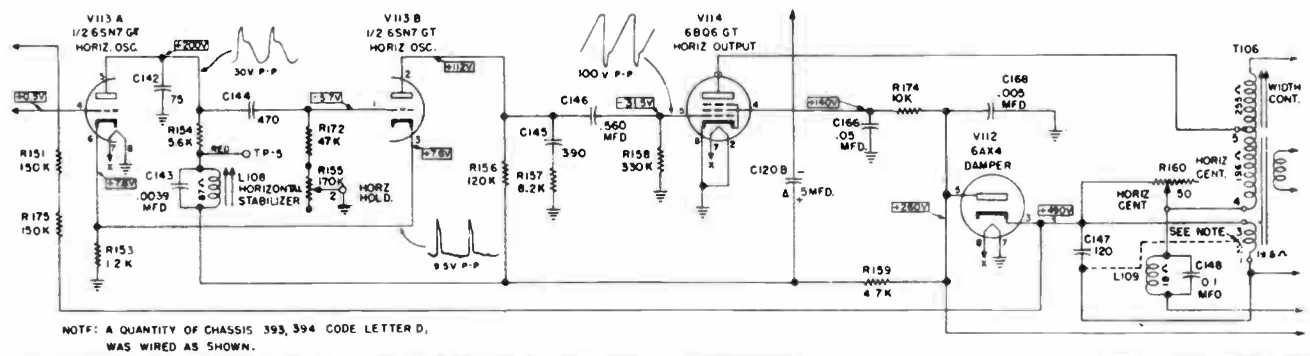
CODE LETTER C

To Reduce Horizontal Fold Over



CODE LETTER E

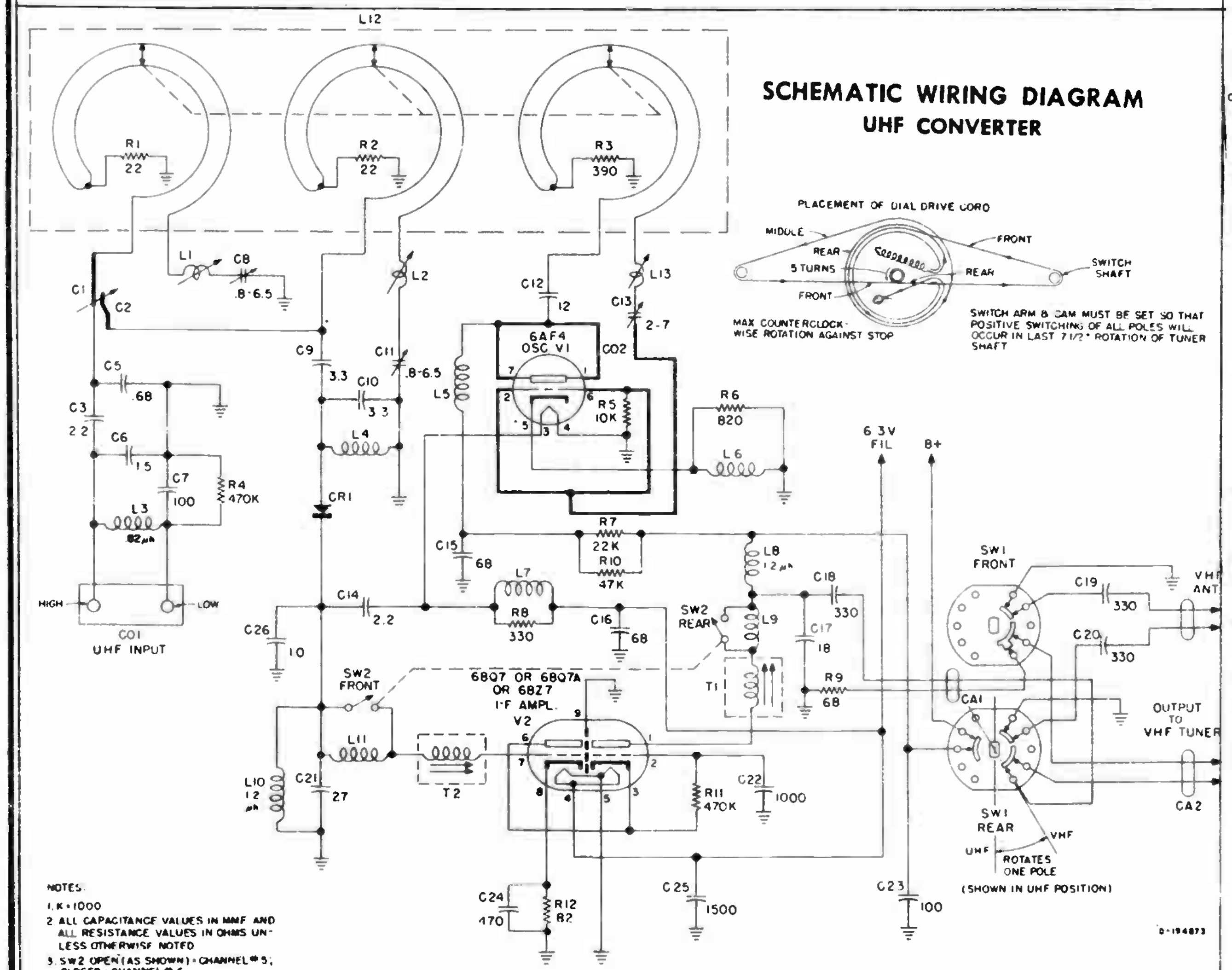
To Simplify Horizontal Alignment and Reduce Overdrive



New Part Numbers for Chassis Code Letters D & E

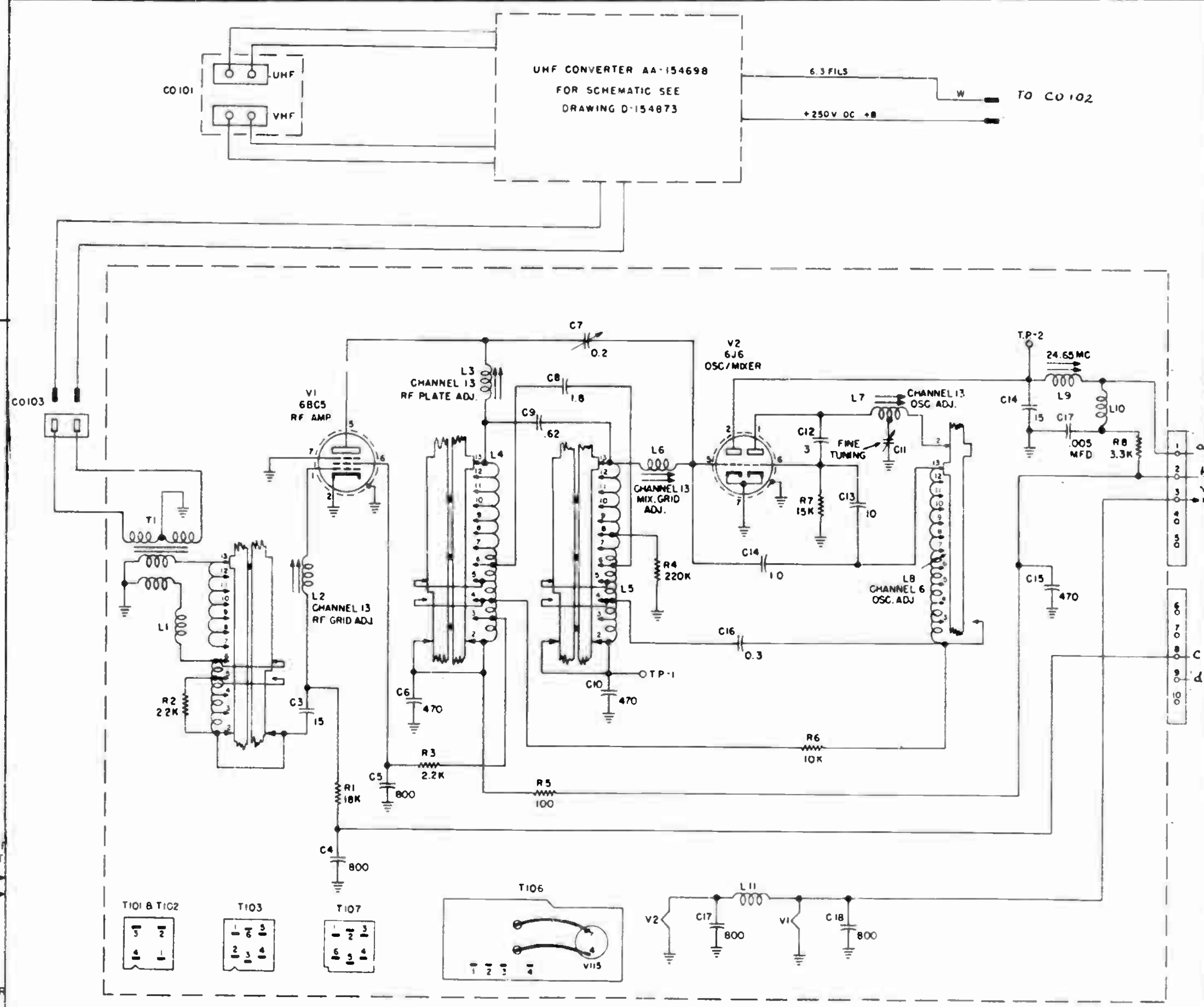
Symbol No.	Part No.	Description
C144	137499-36	Capacitor, 470 mmf., 10%, 500 v., mica
R155	155511	Control, Horizontal Hold (170,000 ohm)

SCHEMATIC WIRING DIAGRAM UHF CONVERTER



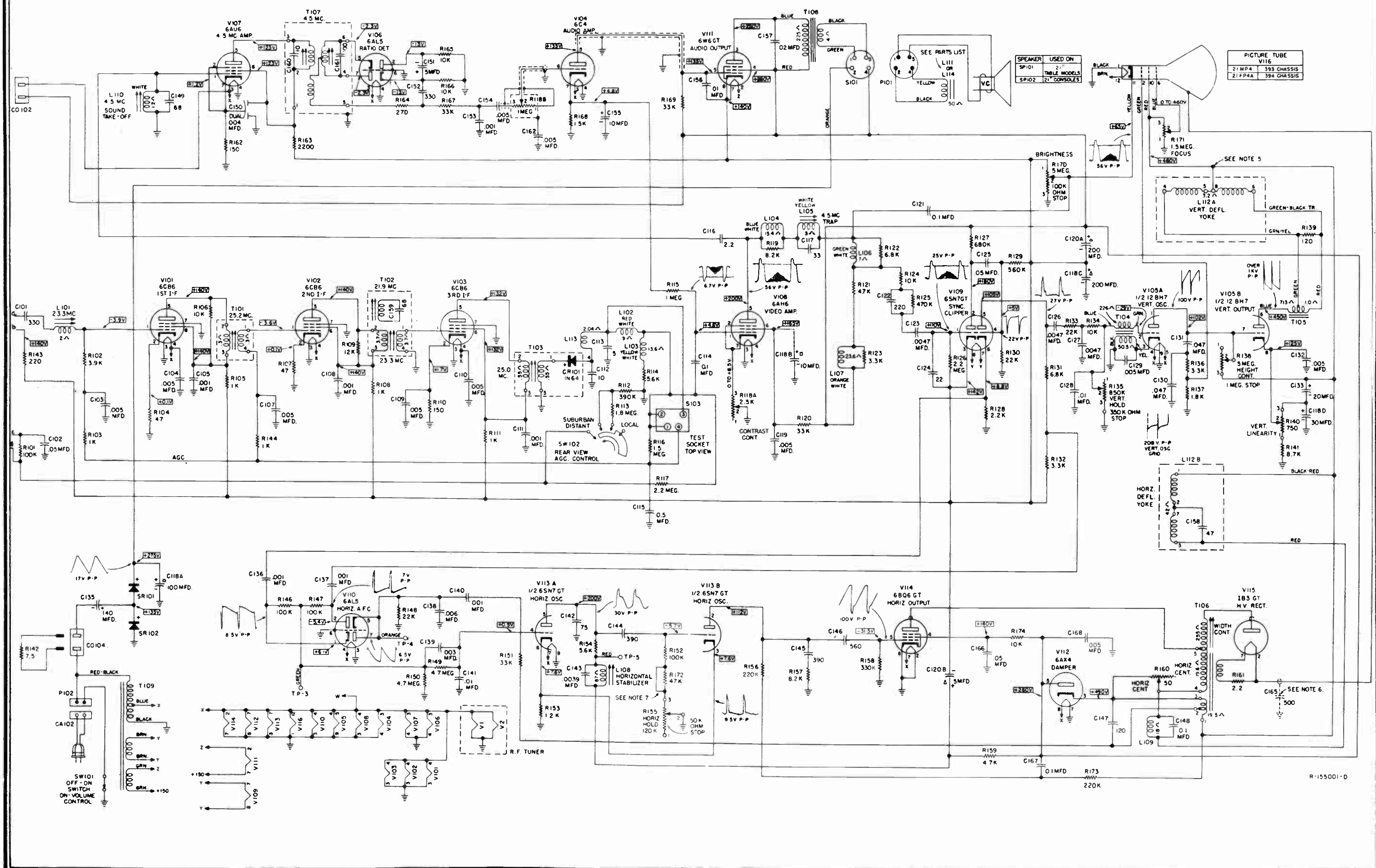
NOTES:
1. K=1000
2. ALL CAPACITANCE VALUES IN MMF AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED
3. SW2 OPEN (AS SHOWN) = CHANNEL # 5; CLOSED = CHANNEL # 6

D-154873



NOTES:
1. ALL VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS.
2. SUPPLY VOLTAGE 117V. 60 CYCLE AC.
3. K = 1000
4. ALL CAPACITANCE VALUES IN MMF. AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
5. TERMINAL 8 TIED TO TERMINAL 1 ON INSIDE OF YOKE.
6. CAPACITOR USED ON 393 CHASSIS ONLY.
7. JUMPER MAY BE CONNECTED OR OPEN DEPENDING ON REQUIREMENTS FOR OSCILLATOR ALIGNMENT.

SCHEMATIC WIRING DIAGRAM - CHASSIS 393 - 394



SUBJECT: TO ADD ALIGNMENT PROCEDURE AND PARTS LIST FOR ONE TUBE CONVERTER PART NO. (155499)

Chassis 393 and 394 Code letter E, incorporate the one tube converter, Part No. 155499. Chassis 393 and 394 coded prior to Code letter E use converter, Part No. 154848.

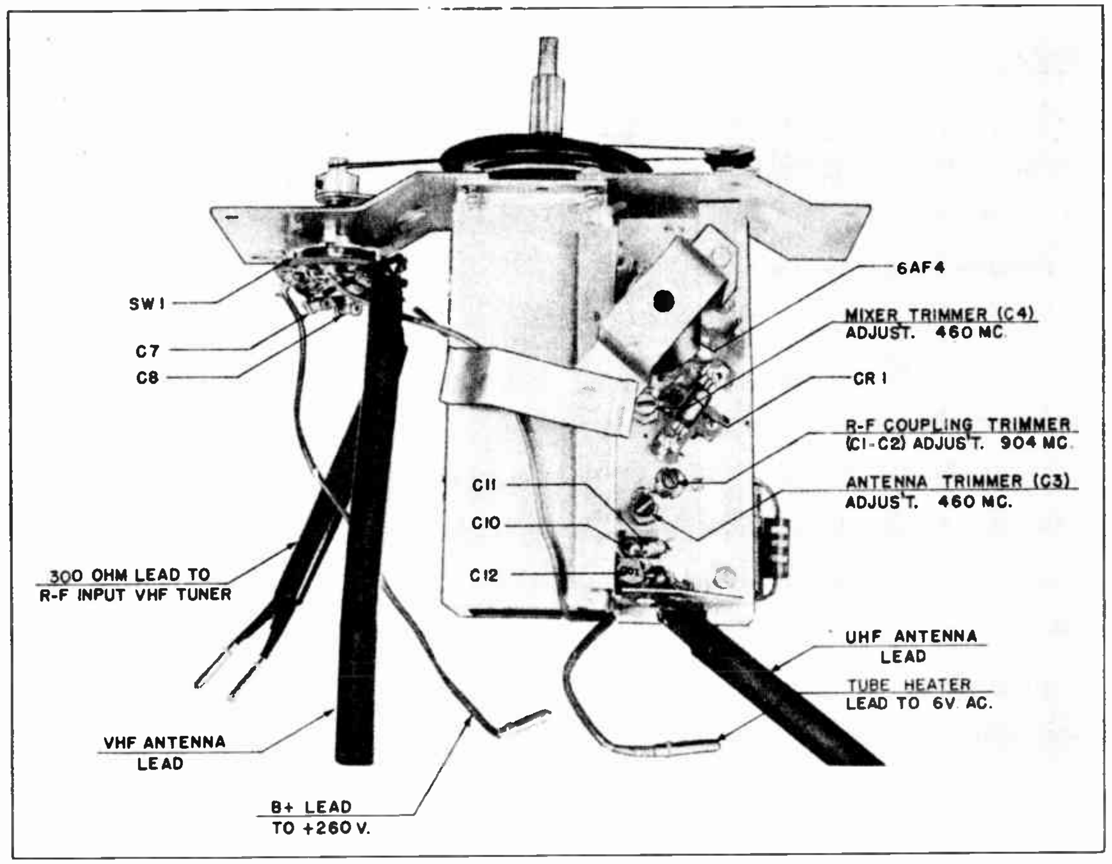
ALIGNMENT PROCEDURE

Oscillator Alignment:

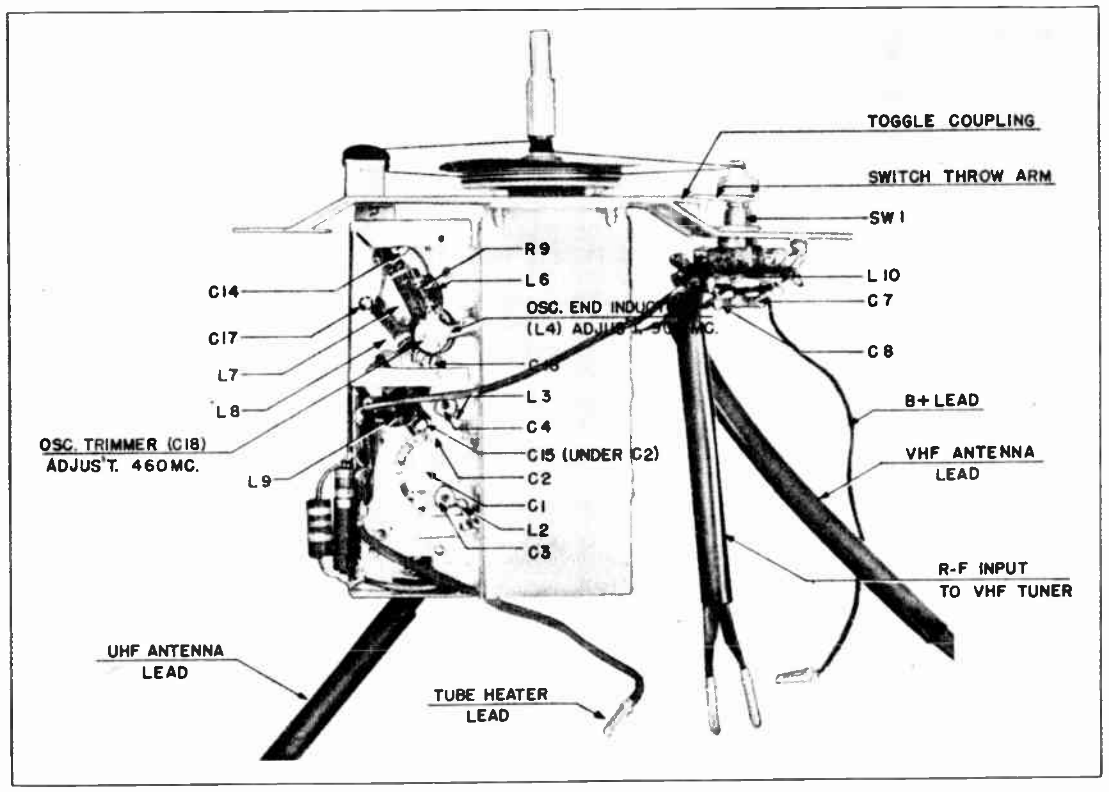
1. Connect an electronic voltmeter or scope across the second detector load resistor, R114.
2. Turn on the power.
3. Apply a 460 mc. (amplitude modulated when scope is used) signal to the UHF antenna terminals through the antenna matching network (Fig. 3).
4. Turn out the adjusting screw of the mixer circuit trimmer C4 so that the flat side of the head is 5/8" above the chassis before aligning oscillator.
5. With the tuner shaft at maximum CCW position, adjust the oscillator trimmer, C18 for peak reading on the electronic voltmeter (or maximum indication on scope).
6. Set the signal generator to 904 mc.
7. Rotate the tuner shaft to maximum CW position and adjust the oscillator end inductor, L4 for maximum reading on the voltmeter (or scope).
8. Repeat steps 3 through 6 until maximum reading is obtained.

R. F. Circuit Alignment:

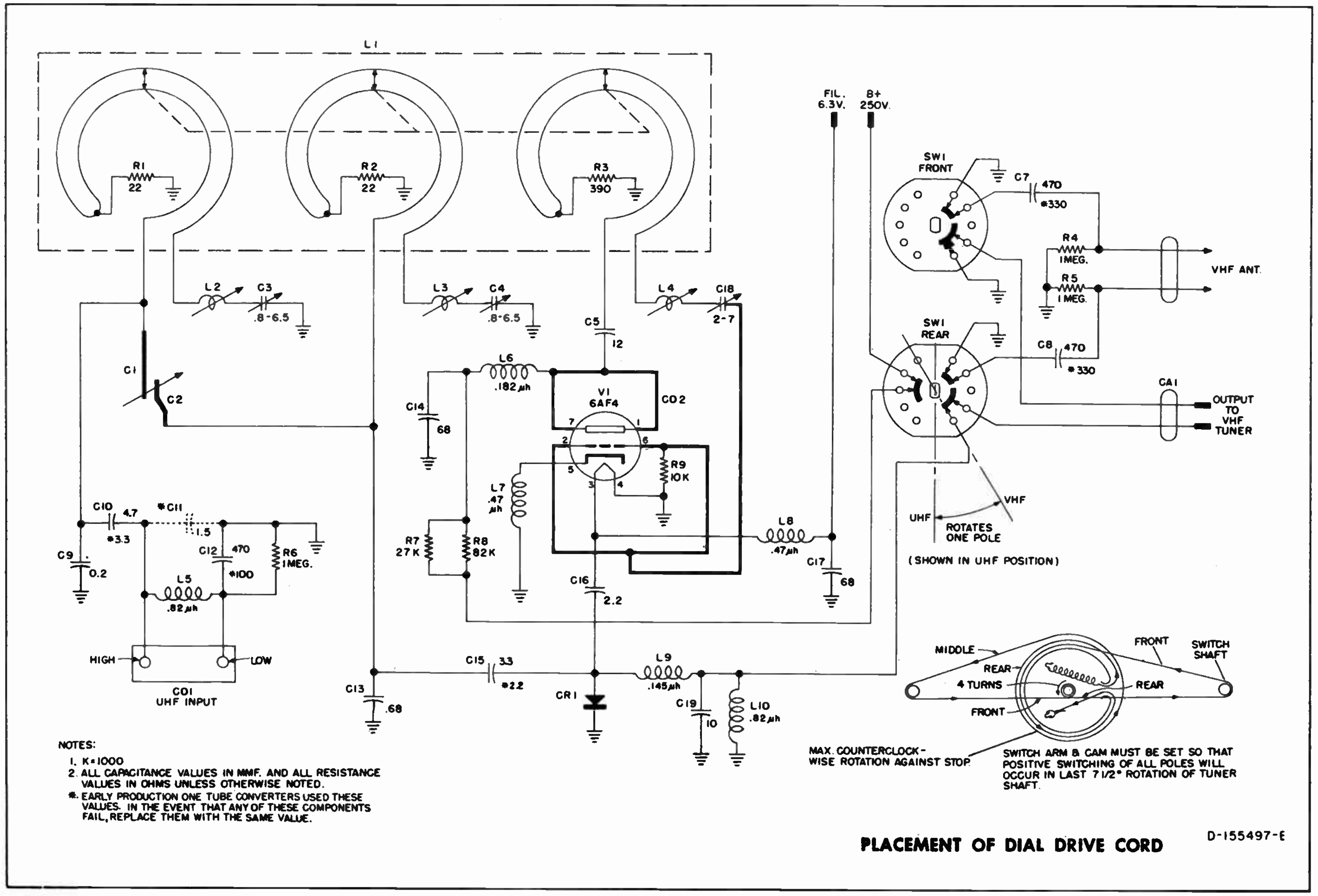
1. With the signal generator and electronic voltmeter or scope connected as for the Oscillator Alignment above, set the R-F coupling trimmer, C1 and C2 to minimum capacity by turning the screw CCW.
2. Set the signal generator to 460 mc. (amplitude modulated when scope is used).
3. With the tuner shaft at maximum CCW position, adjust the antenna and mixer trimmers, C3 and C4 for maximum meter reading (or scope indication).
4. Reset signal generator to 904 mc.
5. Rotate the tuner shaft to maximum CW position and adjust the antenna and mixer end inductors, L2 and L3 for maximum reading on meter (or scope).
6. Repeat steps 2 through 5 until maximum reading is obtained.
7. Turn the tuner shaft to maximum CW position and adjust the coupling trimmer, C1 and C2 for peak reading at 904 MC.
8. Turn the power switch to the "OFF" position.
9. Disconnect the generator and electronic voltmeter, or scope.
10. Re-engage the toggle coupling in the pin on the switch throw arm and the pin on the drive pulley as follows.
    a. Rotate the tuning control shaft clockwise until the pin on the rear of the drive pulley is toward the base of the chassis.
    b. Turn the switch throw arm to a vertical position.
    c. Turn the toggle coupling approximate 45° CW from a vertical position.
    d. Turn the switch throw arm CCW until pin engages the upper fork on the toggle coupling.
    e. Turn the tuning shaft CCW and guide the pin on the rear of drive pulley into the lower fork of the coupling. The coupling is now in the proper operating position and when the tuning shaft is turned completely CCW, the switch will be thrown to the VHF position.
11. Replace the UHF Converter on the VHF receiver chassis.



TOP VIEW UHF CONVERTER



BOTTOM VIEW UHF CONVERTER



SCHEMATIC DIAGRAM

PARTS LIST

Symbol No.	Part No.	Description
C1	155424	Stator, RF Trimmer
C2	155508	Rotor, RF Coupling Trimmer
C3	151880-2	Capacitor, .8-6.5 mmf., Trimmer
C4	151880-2	Capacitor, .8-6.5 mmf., Trimmer
C5	155439-1	Capacitor, 12 mmf., 5% disc ceramic
C7	156201-1	Capacitor, 470 mmf., 2 KV., disc ceramic
C8	156201-1	Capacitor, 470 mmf., 2 KV., disc ceramic
C9	152997-9	Capacitor, .2 mmf., 500V.
C10	152997-10	Capacitor, 4.7 mmf., 10%, 500V.
C12	156201-1	Capacitor, 470 mmf., 2 KV., disc ceramic
C13	152997-6	Capacitor, .68 mmf., 10%, 500V.
C14	152997-8	Capacitor, 68 mmf., 500V.
C15	152997-4	Capacitor, 3.3 mmf., 10%, 500V.
C16	152997-1	Capacitor, 2.2 mmf., 10%, 500V.
C17	152997-8	Capacitor, 68 mmf., 500V.
C18	155713-1	Capacitor, 2-7 mmf., Trimmer
C19	152997-11	Capacitor, 10 mmf., 10%, 500V.
R1	Part of L1	Resistor, 22 ohm, 10%, 1/2 W.
R2	Part of L1	Resistor, 22 ohm, 10%, 1/2 W.
R3	Part of L1	Resistor, 390 ohm, 10%, 1/2 W.
R4	39374-61	Resistor, 1 megohm, 10%, 1/2 W.
R5	39374-61	Resistor, 1 megohm, 10%, 1/2 W.
R6	39374-61	Resistor, 1 megohm, 10%, 1/2 W.
R7	39374-218	Resistor, 27,000 ohm, 10%, 2 W.
R8	39374-136	Resistor, 82,000 ohm, 10%, 1 W.
R9	39374-37	Resistor, 10,000 ohm, 10%, 1/2 W.
L1	154711	Inductuner
L2	Part of C3	Inductance
L3	Part of C4	Inductance
L4	Part of C18	Inductance
L5	148936-2	Choke, RF (.82 microhenries)
L6	156167	Choke, RF (.182 microhenries)
L7	148936-1	Choke, RF (.47 microhenries)
L8	148936-1	Choke, RF (.47 microhenries)
L9	155510	Choke, RF (.145 microhenries)
L10	148936-2	Choke, RF (.82 microhenries)
CA1		Antenna Transmission Line (300 ohm)
C01	154781	Terminal Board. UHF Antenna
C02	155431	Strap, Oscillator Plate
CR1	151871	Crystal, Germanium (1N72)
SW1	154721	Switch, Function
	154758	Arm & Hub Assembly, Function Switch
	154735	Arm, Toggle
	154736	Bracket, Idler Pulley
	154682	Bracket, Tube Lock
	155427	Clip & Board Assembly, Crystal
	155893	Eyelet (3 used to hold Rotors to Shaft)
	156207	Fisher Hub, Small Knob Shaft, Groove Pin & Outer Shaft Assembly
	137939-1	Idler Pulley
	154738	Plate, Tuner Mounting
	155894	Rotor (3used)
	39311-2	Screw (2used), Set
	151883	Screw (6-32), Nylon
	155898	Shaft & Stop Assembly, Inductuner
	153804	Shield (Lid), Oscillator
	153806	Shield, Oscillator
	154677	Shield, Tube (6AF4)
	152053	Socket, Tube (V1)
	155499	UHF Converter Complete
	155895	Washer (1used), Shaft & Stop Assembly

INDEX

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These receivers are equipped with seventeen (17) tubes, two (2) selenium rectifiers, and a picture tube.

They have a switch type tuner which tunes the twelve V.H.F. television channels (2 to 13). The receivers may be converted to receive both V.H.F. and U.H.F. stations with the use of an external converter.

TUBE COMPLEMENT

Symbol	Tube	Function	Symbol	Tube	Function
V1	6BC5	R-F Amplifier	V109	6SN7GT	Sync. Clipper & Sync. Output
V2	6J6	VHF Oscillator & Mixer	V110	6AL5	Horizontal A.F.C.
V101	6CB6	1st I-F Amplifier	V111	6W6GT	Audio Output
V102	6CB6	2nd I-F Amplifier	V112	6AX4	Horizontal Damper
V103	6CB6	3rd I-F Amplifier	V113	6SN7GT	Horizontal Oscillator
V104	6C4	1st Audio Amplifier	V114	6BQ6GT	Horizontal Output
V105	12BH7	Vertical Oscillator & Output	V115	1B3GT	H.V. Rectifier
V106	6AL5	Ratio Detector (Sound)	V116	21MP4	Picture Tube (chassis 386)
V107	6AU6	Sound Detector Driver	V116	21FP4A	Picture Tube (chassis 387)
V108	6AH6	Video Amplifier			

POWER SUPPLY: 117 volts, 60 cycle, a.c.

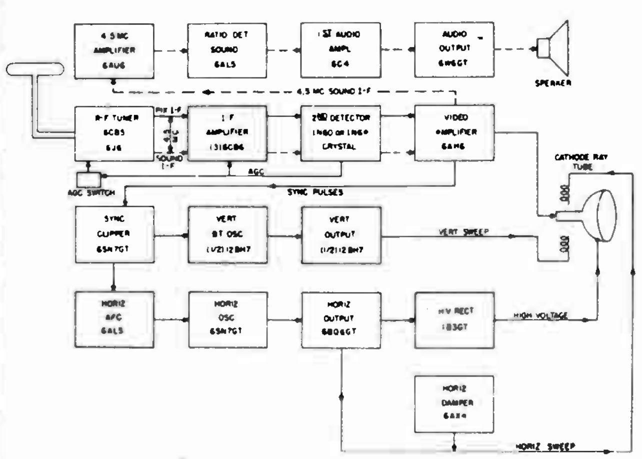
POWER CONSUMPTION: 130 watts.

AUDIO POWER OUTPUT: 2 watts maximum.

ANTENNA INPUT IMPEDANCE:
300 ohms balanced.

INTERMEDIATE FREQUENCY:
Video Carrier — 26.4 mc.
Sound Carrier — 21.9 mc.
Intercarrier Sound — 4.5 mc.

BLOCK DIAGRAM:



DEFLECTION: Electromagnetic.

FOCUS: Electrostatic.

ION TRAP: Single Permanent Magnet.

HORIZONTAL SCANNING FREQ.: 15,750 c.p.s.

VERTICAL SCANNING FREQ.: 60 c.p.s.

FRAME FREQUENCY: 30 c.p.s.

SCANNING: Interlaced, 525 lines.

SPEAKER:
21" Console Models 10" P.M.
Table Models 5¼" P.M.

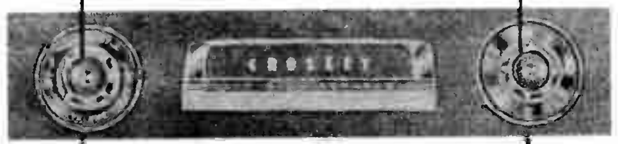
VOICE COIL IMPEDANCE: 3.2 ohms at 400 cycles.

E.M. SPEAKER FIELD COIL, D.C. RESISTANCE:
50 ohms.

FRONT PANEL CONTROLS

OFF-ON VOLUME — Turns the power off or on and varies the output of sound.

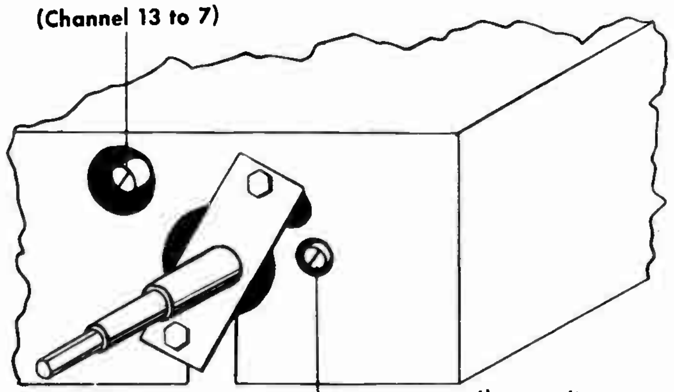
CHANNEL SELECTOR—Selects the channel number of the desired station.



CONTRAST CONTROL — Varies the picture output (increases or decreases the variations between light and dark areas of the picture) similar to the manner in which sound output is varied by a volume control.

FINE TUNING CONTROL — Tunes in the best picture, at which point sound is also received.

R. F. TUNER OSCILLATOR ADJUSTMENT



CHASSIS FRONT VIEW
(OSCILLATOR ADJUSTMENTS)

Generally, the two oscillator adjusting screws do not require adjusting. However, if the range of the FINE TUNING CONTROL is insufficient to permit the station to be tuned in satisfactorily before the control reaches the end of its range (clockwise or counter-clockwise), then it will be necessary to remove the chassis from the cabinet to adjust these oscillator adjusting screws. To remove the chassis, pull the front panel control knobs off their shafts, remove the cabinet back, and the four chassis hold-down bolts.

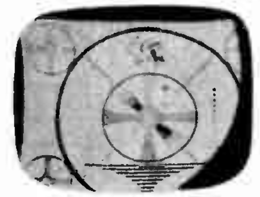
With a service type power cable connected to the inter-lock connector on the rear of the chassis and the antenna connected to its terminals, turn the receiver on, and allow it to operate for at least five minutes before attempting to adjust the oscillator screws.

The upper left screw is used to adjust the oscillator for stations which operate on channels 13 to 7, and the lower right screw adjusts for stations on channels 6 to 2 (See Sketch). When it is necessary to adjust either or both of these screws, proceed as follows:

1. Set the CHANNEL SELECTOR switch to the channel number of the station that is operating on the highest assigned channel number in either the 13 to 7 or the 6 to 2 channel range, depending upon which needs adjusting. (Example: In the 13 to 7 channel range, if stations are operating on channels 11 and 7, set the CHANNEL SELECTOR to channel 11).
2. Adjust the CONTRAST and VOLUME controls for normal sound and picture.
3. Set the FINE TUNING control to the center of its range.
4. With a non-metallic screwdriver adjust the oscillator adjusting screw until the clearest picture is obtained.

NOTE: If other stations are operating in the area in the channel range that is being adjusted (13 to 7 or 6 to 2), it may be necessary to compromise slightly on the oscillator adjustment so as to permit the FINE TUNING to be equally effective on all stations.

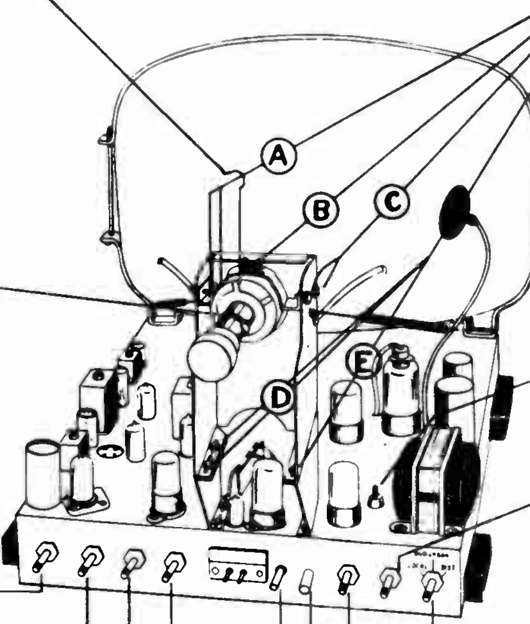
ADJUSTMENTS
Chassis 387

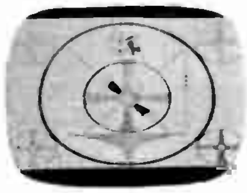


Off Center and Neck Shadow

CENTERING MAGNET ADJUSTMENT — If the picture is off center and/or has neck shadow as shown in the illustration at the left, rotate either or both centering magnet levers to the right or left until the picture is centered on the screen and the picture is free of all neck shadow.

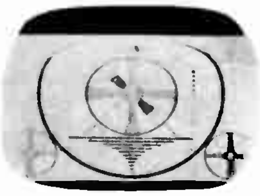
ION TRAP ADJUSTMENT — With the brightness control advanced just enough to dimly light up the face of the picture tube, slide the ion trap backward or forward and at the same time rotate it to the right or left until maximum brightness is obtained. If a neck shadow appears at any of the corners, refer to "Centering Magnet Adjustment" above.





Misadjusted Height

HEIGHT CONTROL — This control increases the overall height of the picture. When making this adjustment it is sometimes necessary to also adjust the VERTICAL LINEARITY to obtain a picture that is correctly proportioned.



Misadjusted Vertical Linearity

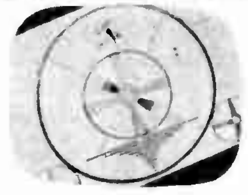
VERTICAL LINEARITY CONTROL — This control increases or decreases the height of the upper portion of the picture.

FOCUS CONTROL — Rotate to the right or left until the sharpest picture, or sharpest horizontal lines, are obtained.

BRIGHTNESS CONTROL — Turn clockwise to increase brightness. To decrease brightness, turn counter-clockwise.

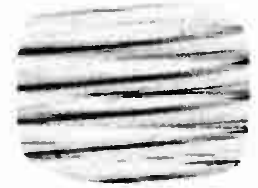
CONNECTING EXTERNAL ANTENNA — Disconnect the built-in antenna wires from the two screw terminals on the back of the receiver, and tape the bare ends of the wires. Fasten the lead-in wires from the external antenna under these screws.

DEFLECTION YOKE ADJUSTMENTS — The deflection yoke must be positioned as far forward as possible on the neck of the picture tube. To make this adjustment, loosen screws "D" and "E" enough to permit the yoke bracket to be pushed forward. While holding the bracket in the forward position, tighten screws "D" and "E". Screws "A" and "C" are for shifting the yoke up or down to center it around the picture tube neck. If the picture is tilted as illustrated at right, loosen wing nut "B". Then, rotate the yoke to left or right as required to make the picture parallel with respect to top and bottom of window frame. Be sure to hold the yoke in position while tightening the wing nut.



Picture Tilted

HORIZONTAL STABILIZER ADJUSTMENT — See "HORIZONTAL HOLD CONTROL".



Misadjusted Horizontal Hold

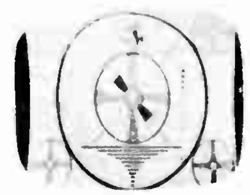
HORIZONTAL HOLD CONTROL — If the picture appears as shown in the illustration, adjust the horizontal hold control to right or left as required to lock in a single stationary picture. If the range of the control is not sufficient to lock in picture, set the control to its midway position and then adjust the horizontal stabilizer adjustment until the picture locks in

LOCAL-SUBURBAN-DISTANCE SWITCH — In strong signal areas set this switch to its extreme counter-clockwise position (LOCAL). The middle position (SUBURBAN), and extreme clockwise position (DISTANCE) are used in areas where the signal is weak or medium strength. Set the switch in the position which provides the most satisfactory picture with minimum over-loading when the contrast control is advanced.

Misadjusted Vertical Hold

VERTICAL HOLD CONTROL — If the picture is moving up or down as illustrated at right, adjust the vertical hold control until a single stationary picture is obtained.

HORIZONTAL CENTERING CONTROL — If the picture is off center to the right or left, rotate this control in either direction as required to center the picture. The picture should become centered when this control is approximately at the middle of its range of adjustment. If not, then set the control at the middle of its range. Then center the picture on the screen by adjusting the centering magnet levers as explained under "CENTERING MAGNET ADJUSTMENT".



Picture Too Narrow

WIDTH CONTROL — If the picture is too narrow as illustrated, or too wide, turn the width control clockwise or counter-clockwise as required to adjust the picture to the proper width of the viewing area on the screen.

1. GENERAL DESCRIPTION

These Crosley television receivers are equipped with seventeen (17) tubes, two (2) selenium rectifiers, and a picture tube. They are designed to operate on 117 volts, 60 cycle alternating current. The chassis 386 is designed for a 21-inch (21MP4) metal picture tube; and chassis 387 is designed to use a 21-inch (21FP4A) glass picture tube.

The receivers will produce high definition pictures with fine detail and excellent brilliance and contrast on all twelve VHF (Very High Frequency) television channels (2 to 13), and may be converted to receive both VHF and UHF (Ultra High Frequency-(channels 14 to 82) stations. However, in no one area are there stations operating on all channels.

Symbol numbers contained in this description are listed on the schematic diagram for the 386 and 387 chassis.

In later production models using the 386 and 387 chassis, some alterations were made in the horizontal deflection circuit that required changing certain components. As the basic operation has not been changed, this description will still apply.

2. Automatic Gain Control reduces interference from flying aircraft and other sources of brightness fluctuations. It also eliminates readjustment of the brightness and contrast controls when tuning from one station to another and minimizes fading in areas of low signal strength.

3. Specially designed built-in antenna that needs no tuning.

4. Tempered safety glass picture tube window.

5. Wide angle viewing and "Procenium Arch" styling of the picture tube window.

6. Electrostatic "Black Face" picture tube provides better contrast, sharper picture and less glare.

7. FM sound system provides true, clear sound.

8. Electronically controlled circuit to erase vertical retrace lines that normally appear during dark scenes, or changes of scenes.

Features Include:

1. Automatic Frequency control, with "Stabilock" circuits, holds picture firm and steady even through electrical disturbances.

1.01 Specifications:

Power Requirements: 117 volts, 60 cycle, a.c.
Power Consumption: 130 watts at 117 volts 60 cycles.
Audio Power Output: 2 watts maximum
Receiver Antenna Input Impedance: 300 ohms balanced.

Picture Area:
Chassis 386; Chassis 387; 239 sq. inches
Picture Size:
Chassis 386; Chassis 387; 19-1/8" x 13-7/8"

Intermediate Frequency:
Video Carrier . . . . 26.4 mc.
Sound Carrier . . . . 21.9 mc.
Intercarrier Sound . . . . 4.5 mc.

Frequency Range:

Channel Number	Channel Frequency (mc)	Video Carrier Freq. (mc)	Audio Carrier Freq. (mc)	Receiver Oscillator Freq. (mc)
2	54-60	55.25	59.75	81.65
3	60-66	61.25	65.75	87.65
4	66-72	67.25	71.75	93.65
5	76-82	77.25	81.75	103.65
6	82-88	83.25	87.75	109.65
7	174-180	175.25	179.75	201.65
8	180-186	181.25	185.75	207.65
9	186-192	187.25	191.75	213.65
10	192-198	193.25	197.75	219.65
11	198-204	199.25	203.75	225.65
12	204-210	205.25	209.75	231.65
13	210-216	211.25	215.75	237.65

Deflection: . . . . Electro Magnetic
Focus: . . . . Electro Static
Ion Trap: . . . . Single P.M.
Horizontal Scanning Frequency: . . . . . 15,750 cps.
Vertical Scanning Frequency: . . . . 60 cps.
Frame Frequency: . . . . 30 cps.
Scanning: . . . . Interlaced, 525 lines.
Speaker: . . . . 21" Console Models 10" P.M.
17" and 21" Table Models 5-1/4" P.M.
17" Console Models 5-1/4" P.M.
Voice Coil Impedance: . . . . 3.2 ohms at 400 cycles.

1.02 Controls:

Operating Controls (Front Panel):

OFF-ON VOLUME
CONTRAST . . . . Dual Control Knob

CHANNEL SELECTOR FINE TUNING	. . . . . . Dual Control Knob		
Auxiliary Controls: (Rear Chassis Apron):		**Adjustments (not including RF and IF):**	
VERTICAL HOLD			
HORIZONTAL HOLD		HORIZ. STABILIZER . . .	L108 -- Screwdriver adjustment.
BRIGHTNESS			
HEIGHT		DEFLECTION COIL	Top of chassis.
VERTICAL LINEARITY			
FOCUS		CENTERING MAGNET	Rear of Deflection Yoke
WIDTH			
HORIZONTAL CENTERING		ION TRAP MAGNET. . . .	Top of chassis, picture tube neck
LOCAL-DISTANCE SWITCH			

PRECAUTIONS

HIGH VOLTAGE WARNING—Operation of this receiver with the interlock by-passed, or the chassis removed from the cabinet involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by anyone not thoroughly familiar with the precautions necessary when working on high voltage equipment. When handling the high voltage lead to the picture tube the receiver power plug should be disconnected from the power receptaclé.

HANDLING PICTURE TUBE—Do not remove or handle the picture tube in any manner unless heavy gloves and protective goggles are worn. Persons not so equipped should be kept away while handling picture tube. Keep the tube away from the body while handling. NEVER GRASP THE TUBE BY ITS NECK OR ALLOW PRESSURE TO BE EXERTED ON THE NECK.

HIGH TEMPERATURE OF TUBES—Some tubes operate at extremely high temperatures. To avoid serious burns, do not touch the tubes while the receiver is operating, or until the tubes have cooled after the receiver is shut off.

2. CIRCUIT DESCRIPTION

2.01 Preliminary:

The "intercarrier" sound system used in this receiver differs from the "conventional" type of television circuit where the video and sound RF carriers are converted to their respective intermediate frequencies in the mixer tube. The video and sound IF are usually divided into two separate IF channels of different frequencies, separated by 4.5 mc. after leaving the plate of the mixer tube or at the plate of the 1st. IF amplifier. As it is important to keep the audio component off the picture tube grid, traps must be inserted in the video IF and/or video amplifier circuits to absorb the sound frequency.

In the "intercarrier" sound system the RF carriers are converted to their respective intermediate frequencies in the same manner as above (in the mixer tube), but the video and sound IF frequencies are not separated after leaving the mixer plate; instead they are amplified together in a common IF channel and both signals appear at the input to the video detector. As the video and sound carriers are always separated by a fixed difference frequency of 4.5 megacycles that must be maintained by the transmitting station in accordance with FCC regulations, both IF signals that appear at the cathode of the video detector are separated exactly 4.5 megacycles. The video detector not only functions as a detector, but also as a mixer for the two IF signals. In the mixing process of the sound IF carrier with the video IF carrier, a 4.5 mc. beat signal is produced. This beat signal is frequency modulated in unison with the sound IF carrier.

The manner in which the 4.5 mc. beat signal is obtained, is comparable to the mixer action in a superheterodyne radio receiver.

In place of a local oscillator, the incoming video IF carrier beats against the incoming sound IF carrier to produce the sum and difference frequencies at the output of the detector. As the sum frequency falls outside the range of the pass-band of the video amplifier, only the difference frequency need be considered.

After being amplified in the video amplifier, the 4.5 mc. signal is trapped or "sucked out" of the video signal and fed to the sound driver stage by means of the sound take-off transformer. The transformer serves a dual purpose of providing a 4.5 mc. trap to reduce sound interference in the picture and providing a sharp pass band for 4.5 mc. injection to the grid of the sound driver stage. The 4.5 mc. signal is amplified and limited in the sound driver which provides sufficient signal to operate the sound detector. FM demodulation of the sound IF signal is accomplished by the two diode sections of V106, that function as an unbalanced ratio detector which converts frequency deviations of the IF carrier to audio frequencies and suppresses amplitude modulation interference. The IF input is applied to the diodes by mutual coupling between the tuned primary and secondary of the ratio detector transformer T107. The applied IF carrier rectified by the diodes, charges the electrolytic capacitor C151. The bias voltage developed across R165 and R166 holds the conduction level of the diodes at a definite value determined by the applied carrier. Any sudden change, such as may be caused by instantaneous noise impulses, cannot change the bias due to the relatively long time constant of R165-R166-C151. The rectified audio frequencies pass through the tertiary winding that is connected to the center tap of the secondary, and through the sound volume control to the grid of the 1st. Audio Amplifier tube V104. The audio amplifier consists of two stages of amplifications, a triode 1st stage V104 coupled to a beam power output stage V111 that drives the speaker.

2.02 RF Unit: (V1,V2)

The RF Unit comprises an RF stage, mixer and oscillator all in one compact unit. Its function is to amplify the received signal and to convert the sound and picture carriers to the correct intermediate frequencies.

The tuner assembly consists of four, twelve position wafer switches mounted on a common shaft. Pretuned coils are mounted between the contacts on each wafer and form a series of coils, tapped at each contact. The channel to which the switch is set, is determined by the amount of inductance (number of coils) in the circuit.

The antenna is matched to the input circuit of the receiver by the transformer T1. As the chassis is at power line potential, isolating capacitors C163 and C164 are inserted between the transformer T1, and the antenna. The antenna circuit is tuned by the first (closest to rear of RF unit) wafer switch connected to the grid of the RF Amplifier V1. The RF coils on the second wafer switch tune the plate circuit of V1. Two variable inductors L2 and L3 are connected in series with the RF coils on the respective wafer switches for alignment of the high channels (7 to 13). To obtain the proper band width, the coils on the antenna switch are tuned to the video carrier and the RF coils in the plate circuit of V1 are tuned to the sound carrier.

The VHF oscillator utilizes one section of the twin triode, V2, in a modified Colpitts oscillator circuit. The feedback voltage from the plate to the grid is obtained by means of the capacitor C12 and the interelectrode capacity of the tube. The oscillator is tuned to frequency by the coils on the front wafer switch and the trimmer capacitor C11, the Fine Tuning control. Two variable inductors are included in this circuit for alignment of the oscillator. Oscillator adjustment at channel 13 is made by L7 and at channel 6 by L8.

The series of coils on the third (from rear) wafer switch, connected to the grid of the mixer through L6, tends to increase the bandwidth of the circuit. The variable inductor L6 is used to align the high channels, the adjustment being made at channel 13.

The incoming signal to which the receiver is tuned, is amplified by V1 and applied to the grid of the mixer section of V2 through the coupling capacitors C8 and C9, while the signal from the local oscillator is injected through the capacitor C14. Feedback voltage from the grid of the mixer is applied to the plate of the RF Amplifier V1, through the capacitor C7. The output of the mixer, contains a wide band of frequencies. It includes both the video and sound intermediate frequencies that are transferred to the grid of the 1st IF amplifier V101, through the mixer plate coil L9, the coupling capacitor C101 and mixer coupling coil L101.

2.03 IF Amplifier: (V101, V102, V103)

The If amplifier consists of three stagger-tuned stages using three sharp-cutoff, high gain pentodes. Stagger-tuning of the IF system provides a simple means of securing adequate gain and a sufficiently broad pass-band that is needed to accept both the video and sound IF carriers.

Each IF coupling network consists of a variable iron core tuned inductance with closely coupled secondary windings over the primary of the coil. The secondaries of the 1st. and 2nd. If coil are coupled directly to the grids of the following tubes and the secondary of the 3rd. IF coil is coupled directly to crystal diode, second detector. An additional winding, tuned with a fixed capacitor, C159, and iron core, on the 2nd. IF transformer coil form, functions as a 21.9 megacycle sound trap.

Decoupling resistors and capacitors are used in the plate, screen and grid circuits to prevent coupling between the stages which might otherwise cause oscillation.

To provide stabilizing degenerative feedback, the cathode resistors R104 and R107 of V101 and V102 are unbypassed.

As an intercarrier sound system is used in this receiver, both the video and sound carriers are amplified together in a common IF channel and both signals appear at the input of the second detector.

2.04 2nd. Detector: (CR101)

The 2nd. detector is a germanium crystal diode and is located in the shield can of T103. The IF carriers are applied to the cathode of the crystal to produce a video signal of the proper polarity. The signal from the anode is applied to the grid of the Video Amplifier V108 through L113, L102 and the coupling capacitor C114.

A low pass filter circuit composed of C112, L113 and C113 in the output of the 2nd. detector, rejects the IF carriers.

To compensate for loss of high frequencies and phase shift, due to the capacity of the circuit, peaking coils, L102 and L103 are inserted in the circuit in series with the detector load resistor R114.

As a fixed difference of 4.5 megacycles always exists between the video and sound carriers, and must be maintained by the transmitting station in accordance with F.C.C. regulations, both IF signals that appear at the input of the detector, are separated exactly 4.5 megacycles.

Besides functioning as a detector, the crystal also functions as a mixer for the two IF signals. In the mixing process of the sound IF carrier with the video IF carrier, a 4.5 megacycle beat signal is produced. This beat signal is frequency modulated in unison with the sound IF carrier.

2.05 A G C Circuit:

The purpose of the AGC circuit is to maintain a constant output at the picture tube as the signal input varies due to different field strengths of the television station or flutter of field strength due to the interference from flying aircraft. As the voltage appearing across the detector load resistor R114 is always negative and varies according to the strength of the incoming signal, this voltage is used for automatic gain control. This potential is applied to the grids of the 1st. and 2nd. IF amplifier tubes V101 and V102 through the resistor R116 and to the grid of the RF amplifier tube V1 through R117.

A three position Local-Distance switch at the rear of the chassis is used to control the gain of the receiver. When the switch is in the "Local" position, the switch is open and the developed AGC voltage is unaffected. When the switch is in the "Suburban" position, a voltage divider network, R112 and R113, is thrown into the circuit. These resistors tend to decrease the applied AGC voltage, thus, increasing the gain. For fringe area reception, the "Distant" position of the switch should be used. This position shorts out a portion (R113) of the voltage divider network so a minimum AGC potential is applied to the tubes.

2.06 Video Amplifier: (V108)

The Video Amplifier V108, functions as an amplifier for the 60 cycle to 4 megacycles video signal. the 4.5 megacycle sound IF signal and the synchronizing pulse signal for control of the deflection circuits.

The video signal is applied to the cathode of the picture tube V116, through L104, L105 and C121. L105 and C117 functioning as a 4.5 megacycle trap prevents sound modulation from reaching the cathode of the picture tube.

L104, L106 and L107 are peaking coils which with their respective damping resistors, R119, R122 and R123 compensate for losses of the higher frequencies. To minimize attenuation of low frequency gain, the screen is bypassed by a large capacitor C118B.

The cathode of V108 is connected to one end of the Contrast Control R118A, with the arm of the control returning to chassis. Connected in this manner, the setting of the control determines the bias on the Video Amplifier and thus, sets the black level of the picture.

The 4.5 mc. sound IF signal is applied to the grid of the 4.5 mc. Amplifier (Sound Driver) tube V107 through the capacitor C116. An absorbtion trap formed by L110 and C149 is tuned to the 4.5 mc. Sound IF frequency and provides a sharp pass-band for 4.5 mc. injection to the grid of V107.

2.07 Sound Channel: (V107, V106, V104, V111)

See last paragraph of "Preliminary Circuit Description" (2.01).

2.08 1st. & 2nd. Sync Clipper: (V109)

A portion of the composit video signal is taken from the plate side of the Video Amplifier plate load resistor R121 and fed to the grid (pin 1) of the 6SN7GT, 1st. Sync Clipper section of V109 through R124, R125 and C123. The signal that appears at the grid is positive in polarity and drives the grid (pin 1) of the 1st. Sync Clipper very positive, the grid current charging C123 negatively.

The tube bias is obtained by grid rectification of the video signal. The voltage developed across R126 biases the tube so that plate conduction occurs only on the peaks of the video signal. Since the maximum amplitude of the video signal is actually the sync pulses, only the sync pulses will appear at the plate (pin 2) of the 1st. Sync Clipper.

The signal from the plate of the 1st. Sync Clipper is applied to the grid (pin 4) of the 2nd. Sync Clipper through C125, and is negative in polarity. Any noise pulses, that would appear as irregularities at the most negative portion of the pulses, would drive the tube beyond cut-off and therefore are limited.

Very little amplification (close to unity) is obtained from the Sync Clipper stage, its primary purpose being to limit the amplitude of the sync pulses, clip the peaks caused by noise pulses, and to couple the sync signals of the proper polarity to the deflection circuits.

2.09 Picture Tube: (V116)

The picture tube is a rectangular electrostatic focus tube. Electromagnetic fields are used for vertical and horizontal deflection.

The high voltage for the anode of the tube is furnished by the high voltage power supply at approximately 12 kilovolts. The Brightness control R170 varies the cathode bias and thus, the tube screen illumination.

The permanent magnet Ion Trap must be properly positioned on the neck of the picture tube for maximum brightness.

2.10 Integrating Network:

To separate the vertical from the horizontal sync pulses, an integrating network composed of R133, R134, C127 and C128, is coupled between the plate of the 2nd. Sync Clipper (through C126) and the grid of the Vertical Oscillator V105A (through T104). This RC network acting as a low pass filter will pass the low frequency of the vertical synchronizing pulse, while the higher frequency of the horizontal sync is attenuated.

2.11 Vertical Oscillator & Amplifier: (V105)

The purpose of these circuits is to provide a sawtooth current of the proper amplitude and frequency to move the scanning beam across the picture tube screen slowly from top to bottom, during the time the image is being placed on the screen, and rapidly from bottom to top during retrace time. A blocking oscillator and discharge circuit is formed by one triode section, V105A, and its associated components. The Vertical Hold Control R135 in series with T104, adjusts the free running frequency of the oscillator.

Cathode to grid feed back induces a current which charges C129 causing bias voltage to be applied momentarily to the tube. When this occurs, plate current begins to flow, and C131 discharges rapidly until plate current saturation is reached. The plate current begins to decay, reversing the direction of the induced cathode voltage which in turn causes C129 to discharge. The grid is then driven negative, cutting off the plate current and slowly charging C131. The cycle is repeated as soon as the voltage across C129 reaches a value that will again cause plate current to flow. This slow charging and rapid discharging of C131 causes a sawtooth voltage to be generated.

The peaking action of R136 and R137 provides a sharp negative pulse to insure that the Vertical Amplifier section (V105B) will remain cut off during retrace time.

A pulse from the junction of R136-R137 is applied to the control grid of the picture tube for the elimination of retrace lines during scene changes.

Although the voltage on the plate of the Vertical Oscillator is of the basic shape to produce a sawtooth current in the vertical deflection yoke, it must be amplified by the Vertical Amplifier (V105B) to obtain sufficient power.

By controlling the plate voltage of the Vertical Oscillator by movement of the arm on the Height Control R138, the amplitude of the sawtooth voltage is varied.

The Vertical Linearity Control R140, varies the cathode bias of the Vertical Amplifier, so that the applied sawtooth voltage is shifted along the operating characteristics of the tube. Impedance match between the plate of the output tube and the deflection yoke is made by the Vertical Output Transformer T105.

2.12 Horizontal AFC: (V110)

The Horizontal AFC tube V110, is connected in a phase discriminator circuit for automatic phase and frequency control of the Horizontal Oscillator and operates in the following manner: A negative pulse from the cathode of the 2nd. Sync Clipper section of V109 is applied to the cathode (pin 1) of the 6AL5 Duo Diode V110, and a positive pulse from the plate of the 2nd. Sync Clipper is fed to the plate (pin 2) of V110.

These pulses are compared, with respect to time, with a wave representative of the Horizontal Oscillator line frequency. This wave is in the form of a sharp pulse and is taken from the Horizontal Deflection Yoke and integrated into a sawtooth by R151, R152, C140 and C138 and applied to the cathode (pin 5) and the plate (pin 7) of V110.

Voltages developed across the diode load resistors, R146 and R147 oppose each other due to the method of connecting the diodes to the output of the 2nd. Sync Clipper.

When the rectified output of the diodes is equal, the voltage developed on the filter network R149-C139, R150 and C141 is zero, and a condition of stable operation exists.

If the oscillator frequency is too fast, the current in the diode section, pins 1 and 7, will increase and the current in the diode section, pins 5 and 2 will decrease. If too slow, the action is reversed.

The difference voltage that is developed at the junction of R146-R147 varies the bias applied to the grid of the Horizontal Oscillator through the filter network R149, C139, R150 and C141, and corrects its frequency.

The long time constant of the filter network retards rapid AC pulses and prevents them from reaching the grid of the Horizontal Oscillator and only D.C. changes will govern the frequency.

2.13 Horizontal Oscillator: (V113)

A cathode coupled multivibrator type of oscillator is employed to generate the sawtooth pulses used for horizontal deflection.

The operation of the circuit is as follows: When V113A starts conducting, the voltage drop across R154 causes the grid of V113B to be driven negative. C144 then discharges through the Horizontal Hold control R155 and holds V113B at cutoff. During this period, C145 charges toward B+ and a voltage is developed across C145 and R157. As the current that is being discharged through R155 starts to diminish, the grid of V113B reaches cutoff, conduction starts, and C145 discharges through R157 and V113B, developing the retrace portion of the sweep voltage.

The sudden pulse of current which occurs in the common cathode resistor R153 when C145 discharges will bias V113A beyond cutoff. The plate current of V113B gradually diminishes until the bias developed across the cathode resistor R153 no longer holds V113A at cutoff, conduction again begins and the cycle is repeated.

As the multivibrator is not very stable, due to its sensitivity to bias changes, a Horizontal Stabilizer (L108-C143) is inserted in the circuit. This tuned circuit resonates at 15,750 c.p.s. and tends to stabilize the oscillator

2.14 Horizontal Output. Damper & High Voltage Rectifier: (V114, V112. V115)

The Horizontal Output tube V114, amplifies the output of the Horizontal Oscillator so that sufficient current of the proper wave shape is available to excite the horizontal deflection yoke for horizontal scanning in the picture tube.

During the return trace of the sweep, the current which was flowing in the horizontal deflection yoke reverses. The induced voltage pulse in the primary winding (lugs 1 and 2) of the Horizontal Output Transformer. T106 appears in the form of a very sharp positive pulse. This pulse is increased by auto transformer action to approximately 12 kilovolts and is applied to the plate of V115, and rectified. When a glass envelope picture tube is used the capacity between the inner and outer coating of the tube is sufficient to store this rectified energy that is used to accelerate the electron beam in the picture tube. When a metal envelope picture tube is used, a capacitor (C165) is added for this purpose. Picture width is increased or decreased by an adjustable iron core that is part of T106, the adjustment being made by the width control on the rear apron of the chassis. This adjustment changes the width of the air gap of the core and permits more or less flux to flow, in this manner, the voltage fed to the plate of V115 is raised or lowered. The Damper tube V112 assists in providing a linear trace by damping out oscillations of the energy stored in the deflection yoke and critically dampens the ringing in the yoke that occurs just at the end of the line retrace period. The plate current of V114 flows through the damper tube for the major portion of the trace.

Capacitor C148 is fully charged during this period and supplies the plate current to V114 during the time the damper tube V112 is not conducting. An average voltage developed across the yoke decoupling network, L109-C148, is used to boost the B+ voltage applied to the plate of the Horizontal Output tube V114 and the Vertical Output tube V105B.

2.15 Low Voltage Power Supply:

The low voltage power supply consists of a voltage doubler circuit using two selenium rectifiers with conventional filtering. Booster voltage from the cathode of the Damper tube V112, supplements the B+ voltage that is delivered to V114, the Horizontal Output tube; the plate of the Vertical Output, V105B and the 1st. anode of the picture tube.

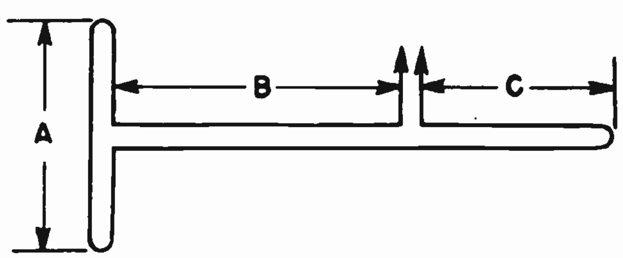
A Filament Transformer, T109 supplies the filament voltage for all the tubes except the H.V. Rectifier V115. Two additional windings on the transformer supply the filament voltage for the Audio Output tube V111 and the Sync Clipper tube V109, as the cathodes of these tubes are at a relatively high positive voltage.

3. ANTENNAS

3.01 Built-in Antenna:

An antenna, that in some localities will eliminate the need of an external TV antenna, is built into the receiver. The built-in antenna serves both the low (channel 2 to 6) and the high (channel 7 to 13) television bands.

For the high band, section "A" of the Built-in Antenna Schematic shown below, is the 1/2 wave folded dipole resonating at 200 mc. Section "B" is the lead-in, and section "C" a 1/2 wave shorted stub resonating at 200 mc. For the low band, A, B, and C resonate at 70 mc.



Schematic of Built-in Antenna

The antenna is mounted, or printed, on a cardboard form fastened in the cabinet. For proper operation of the antenna, do not shorten or lengthen the leads as this will change the resonating frequencies. The results obtained by using the built-in antenna are limited by the distance between the receiver and the transmitter and the location and type of building in which the receiver is used.

Unless the signal transmitted by the television station is of sufficient strength to reach the area where the receiver is located, NO television receiver can reproduce the picture. Due to the high frequencies used for television transmission, the signals reach only to the "line of sight". This is determined by the height of the transmitting and receiving antennas. In addition, steel frame work buildings, mountains, hills etc. reflect the television signals so that even though the television station is only a short distance away, the built-in antenna may not function satisfactorily.

In locations where it is impossible to obtain satisfactory results with the built-in antenna, due to shielding effects of buildings or mountains or if the receiver is located too far from the television station, it will be necessary to install an external indoor or outdoor antenna.

3.02 External Antenna:

A proper antenna installation is the most important factor in avoiding reflections in a picture, or a weak picture, although, in some localities where there are a number of stations operating, it may be impossible to eliminate all reflections. The Service Man should suggest the proper type of antenna to be used in the specific location and install and adjust the antenna for the best picture quality.

This television receiver has been designed to operate from a 300 ohm parallel lead transmission line.

3.03 Connecting External Antenna to Receiver:

Remove the two wires from the built-in antenna fastened to the two screws on the terminal board mounted on the rear of the cabinet and fasten the lead-in from the external antenna under these screws. Tape the loose ends of the wires from the built-in antenna, as noisy reception will result if these wires come in contact with the antenna terminal screws.

4. INSTALLATION

4.01 Unpacking:

The cabinet of this receiver is shipped in first class condition with considerable attention given to protecting the finish. Handle With Care. To remove the cabinet from the shipping container, turn the carton on its side and tear open the carton bottom flaps. Fold the flaps up along the side of the carton and turn the carton back up. Lift the carton up and off the cabinet. Tilt cabinet and carefully knock off the skid that is nailed to the bottom of the cabinet (console models only). Remove the screws in the cabinet back and swing back open. Check to see that all tubes are in place and firmly seated in their sockets. Check high voltage lead to see that it is connected to the CRT second anode connector socket on the bell of the tube. After inspection, close cabinet back and reinsert and tighten the screws.

4.02 Location of the Receiver:

The selection of a proper location for placing the receiver in the room should be given careful consideration. Be guided by the following considerations.

Choose a location:

(1) Where no bright light will fall directly on the picture. (Some ilumination in the room is desirable).

(2) That will provide easy access for operation and comfortable viewing.

(3) Where the built-in antenna will pick up the strongest signal for clearest picture. Due to the variation of the station's signal strength throughout the room, all practical locations should be tried or if an outside antenna is used, choose a location that will permit a convenient connection to the antenna.

(4) Convenient to an electrical outlet of the proper voltage and frequency (117 volts, 60 cycles alternating current).

CAUTION: -- The receiver cabinet is provided with adequate ventilation openings. Do not obstruct the ventilation by placing too close to a wall or placing objects too close to the openings. Do not place close to sources of heat, such as radiators.

5. OPERATING INSTRUCTIONS

The receiver is adjusted at the factory and is ready for operation after being connected to a 117 volt, 60 cycle a.c. outlet. To set the receiver in operation, follow the procedure outlined under "Normal Operation".

5.01 Normal Operation:

1. Turn the Off-On Volume control knob approximately half-way clockwise; this will turn the receiver "on". Wait one minute for the tubes to warm-up to the proper operating temperature.

2. Turn the Channel Selector Knob to the desired station's channel number.

3. Turn the Contrast control knob approximately half-way clockwise.

4. Adjust the Fine Tuning control until a clear picture is obtained; this may require a readjustment of the Contrast control to get the correct picture shading.

5. Turn the Volume control to obtain the desired sound level. On some stations it may be necessary to make a slight readjustment of the Fine tuning control to minimize noise in the sound.

6. To turn the receiver "Off", turn the Off-On-Volume control completely counterclockwise. Normally, only the main controls need be adjusted. At rare intervals it may be necessary to adjust the Auxiliary Controls due to the normal ageing of the tubes and other components.

5.02 Auxiliary Control Adjustment:

1. Turn the receiver "On" as described in paragraph "1" of "Normal Operation".

2. Adjust the Brightness control for moderate brightness, below the point where the raster size increases.

NOTE: If normal brilliance is not obtained at this point it may be necessary to adjust the Ion trap on the neck of the picture tube. For Ion trap adjustment, see "Ion Trap Magnet Adjustment" in section 6.01

3. Turn the Brightness control counter-clockwise until the raster just becomes invisible.

4. Rotate the Channel Selector to the desired channel and move the Fine Tuning Control slowly over this point until the best quality picture is obtained. This may require adjustment of the Contrast control to obtain the proper contrast between the blacks and whites of the picture, or adjustment of the Focus control located on rear of chassis to sharpen the picture. Adjust the focus control for greatest clarity of the lines in the center of the raster.

5. Adjust the Volume control to obtain the desired sound level. On some stations, the readjustment of the Fine Tuning control may be necessary to minimize the noise in the sound.

6. If the picture rolls or jumps vertically, turn Contrast control counter-clockwise to obtain a weak picture and adjust the Vertical Hold control until the picture remains stationary. Then readjust Contrast control.

7. If the picture pulls to the right or tears, adjust the Horizontal Hold control until the picture remains stationary on the screen then set the control in the center of the range in which it makes the picture stationary. This adjustment should also be made with the Contrast control set to obtain a weak picture.

6. SERVICE NOTES

All controls are adjustable without removing the chassis from the cabinet. The back of the cabinet must be opened for the Horizontal Stabilizer adjustment which is on the top of the chassis.

WARNING

An A.C. interlock is provided at the rear of the receiver so that when the back is removed, the power is off. Bypassing the interlock involves a shock hazard from the receiver high voltage power supply and the anode lead to the picture tube. Work on the receiver should not be attempted by anyone not thoroughly familiar with the precautions necessary when working on high voltage equipment.

6.01 Adjustments & Operating Check:

Remove the screws in the cabinet back and swing open the back. Connect an auxiliary power cord with suitable socket to the interlock receptacle on the rear of the receiver chassis.

1. ION TRAP MAGNET ADJUSTMENT - When making this adjustment, do not exert pressure on the neck of the picture tube. Adjust the BRIGHTNESS control for normal brightness. With the ION TRAP positioned close to the base of the picture tube, move the trap forward or backward and at the same time rotate in either direction until maximum brightness of the raster is obtained. Readjust the BRIGHTNESS control until the raster is slightly above average brilliance. Adjust the FOCUS CONTROL until the line structure of the raster is clearly visible. Readjust the ION TRAP again for maximum brightness.

There may be two locations on the tube neck where the ION TRAP will produce maximum brightness. Never set the trap to the forward position, always use the position closest to the tube base.

If there is a shadow in the corners of the raster, be sure the ION TRAP is properly adjusted. Do not sacrifice picture brilliance when adjusting the ION TRAP to overcome shadows in corner of picture. If corner shadows are present, be sure the DEFLECTION YOKE and CENTERING MAGNET are properly adjusted.

2. DEFLECTION YOKE ADJUSTMENT - Position the Deflection Yoke as far forward as possible on the picture tube. If the lines of the raster are not horizontal, rotate the Deflection Yoke so as to make the top of the raster parallel with the top of the chassis, then tighten the yoke adjusting screws.

3. CENTERING RASTER - Center the raster by turning the levers of the CENTERING MAGNET in either direction until the raster is centered. The CENTERING MAGNET is located on the back cover of the deflection yoke. To determine the correct picture centering, it may be necessary to reduce the size of the picture with the HEIGHT and WIDTH adjustments. After making this adjustment, readjust ION TRAP.

4. HEIGHT AND WIDTH ADJUSTMENTS - Height, width and linearity adjustments must be made only when necessary. The linearity and corresponding size controls will have to be adjusted together and with care to maintain picture symmetry. For this reason it is best to use a test pattern when making these adjustments. Adjust size of picture to fill the screen by means of the HEIGHT, WIDTH, VERTICAL LINEARITY and the HORIZONTAL centering control.

5. VERTICAL LINEARITY ADJUSTMENT - The Vertical Linearity control has the effect of expanding the picture at an increasing rate from the bottom to the top of the picture. Adjustment of this control has the greatest effect on the top portion of the picture, some effect on the middle and very little effect on the bottom of the picture. The Height Control and Focus control may need readjustment as a result of the change in position of the Vertical Linearity Control.

6. FOCUS CONTROL - Adjust the FOCUS CONTROL for best focus of the vertical and horizontal wedges at the center of the test pattern. If corner focus is poor, check position of DEFLECTION YOKE and ION TRAP. While observing the test pattern (or picture), make a slight readjustment of the VERTICAL HOLD control until the horizontal lines are least noticeable. This adjustment is very critical and will require only a very slight movement of the control shaft to obtain proper adjustment.

6.02 Oscillator Adjustment Using A Television Signal:

Do not make any adjustments on the two oscillator adjusting screws unless the FINE TUNING control range is insufficient to properly tune-in the station. The adjusting screws are accessible through holes in the front of the chassis after the chassis is removed from the cabinet.

To make the adjustment, proceed as follows:

(a) Turn the receiver on and allow a warm-up period of approximately five minutes.

(b) For stations from channel 13 to channel 7, set the Station Selector Switch to the highest channel received and adjust the Contrast and Volume control for normal sound and picture. Set the Fine Tuning Control in the center of its range.

(c) Using a small non-metallic screwdriver, adjust the slotted head brass screw located to the left of shaft and above the fiber disc for the clearest and sharpest detail in the picture. This adjustment will be effective on all channels between 13 and 7. If other stations are operating in this range, it may be necessary to compromise slightly on the high channel adjustment so the other channels may be properly tuned-in.

(d) For Stations on channel 6 and below, set the station Selector Switch to the channel received closest to channel 6 and adjust the Contrast and Volume control for normal sound and picture. Set the Fine Tuning control in the center of its range.

(e) Using a small non-metallic screwdriver, adjust the slotted head brass screw located to the right of the shaft for the clearest and sharpest detail in the picture. This adjustment will effect all channels between 6 and 2.

6.03 Local-Distance (AGC) Switch:

The Local-Distance Switch can be set to prevent the receiver from overloading in strong signal areas or to reduce "snow" in the picture in weak signal areas. In strong signal areas, the Local (counterclockwise) position of the switch must be used. The second and third positions Suburban and Distance are to be used in medium to weak signal areas. Use the position with which the best picture is obtained with no overloading of the receiver when the Contrast control is advanced.

6.04 Horizontal Lock-in Adjustment:

See "HORIZONTAL HOLD ADJUSTMENT".

6.05 To Clean Picture Tube and Window:

The chassis must be removed from cabinet. (See Section 6.06 Removal of the chassis from the cabinet)

6.06 Removal of the Chassis from the Cabinet:
(Be sure Power is Disconnected)

1. Remove the (slip-on type) knobs from the front panel controls.

2. Remove the screws in the cabinet back and swing open the back.

3. Remove the built-in antenna leads from the antenna terminal board screws.

4. Disconnect the speaker plug from the speaker socket on the rear of the speaker.

5. Remove the hex head machine screws that secure the chassis in the cabinet. These are accessible from the bottom of the chassis shelf on the console models and from the bottom of the cabinet on the table models.

6. Slide the chassis from the cabinet.

7. To reinsert the television chassis in the cabinet, repeat steps 2 to 6 in reverse order, then proceed as follows:

(a) Replace the large and small knobs on the Volume Control and Off-On-Contrast control shafts.

(b) Replace the large and small knobs on the Fine Tuning and Channel Selector control shafts.

6.07 Removal and Replacement of the Picture Tube:

Do not remove or handle the picture tube in any manner unless heavy gloves and protective goggles are worn. KEEP THE TUBE AWAY FROM THE BODY WHILE HANDLING.

1. Disconnect the tube socket and high voltage anode lead from the picture tube. Remove the Ion Trap from the neck of the tube.

2. Remove Picture tube strap.

3. Grasp the picture tube firmly with both hands along the outer edge and gently slide it out of the deflection coils.

CAUTION: NEVER GRASP THE PICTURE TUBE BY ITS NECK OR ALLOW PRESSURE TO BE EXERTED ON THE NECK.

4. Place the picture tube face down, on a flat surface covered by a clean cloth, in a location where it will not be disturbed.

5. When the picture tube is ready to be replaced in the receiver chassis, slide the picture tube gently back into the deflection coils.

6. Bottom of tube should rest on the rubber strip on the bracket fastened to the front of the chassis. Also, see that the neck of the tube is centered in the deflection coil. This centering must be accomplished by adjusting the deflection yoke bracket. DO NOT ALLOW PRESSURE TO BE EXERTED ON THE NECK OF THE TUBE. Fasten the picture tube strap.

7. Slide the deflection coil bracket forward as far as possible until the rubber cushion fits snugly against the flare of the picture tube. Also make sure that the deflection coils are positioned firmly against the flare of the tube.

8. Replace the Ion Trap.

9. Connect the anode (high voltage) lead to tube.

10. Connect the tube socket to base of tube.

6.08 Removal and Replacement of the RF Unit:

1. Unsolder: (a) Black and Yellow lead from lug #3 on rear of Tuner.
(b) R143, 220 ohm resistor from lug #2 on rear of Tuner.
(c) C101, 330 mmf. capacitor from lug #1 on rear of Tuner.
(d) Spiral shield from ground lance on rear of Tuner.
(e) C102, .05 mfd. capacitor and R101, 100,000 ohm resistor from lug #8 on rear of Tuner.
(f) R101, 100,000 ohm resistor and Brown lead from lug #9 on rear of Tuner.

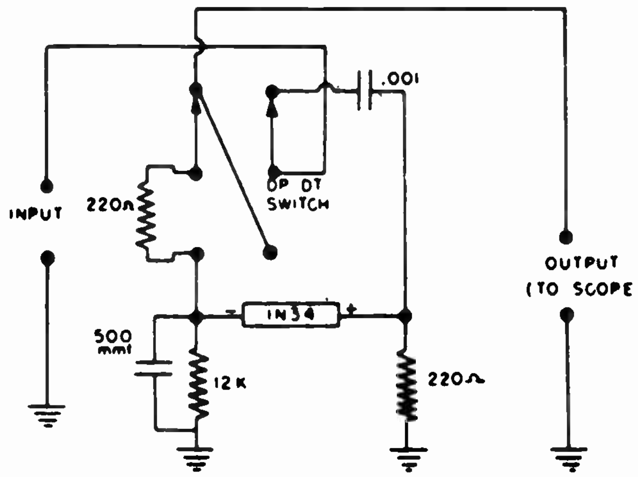
2. Remove CA101 antenna lead from terminal board CO102.

3. Remove two self tapping screws that fasten the tuner shaft support bracket to the front of the chassis. Then remove the two screws that fasten the tuner mounting bracket to the underneath side of the chassis and carefully remove the unit from the bottom of the chassis.

4. To install the new R.F. TUNER UNIT, reverse steps "1" to "3".

6.09 Test Equipment:

Equipment Needed	Required Characteristics
Cathode-Ray Oscilloscope	Very high input impedance. Must readily synchronize with "Y" axis signal. Must have excellent frequency and phase response from 10 cycles to at least two megacycles and should be capable of passing a 60 cycle square wave without appreciable distortion. Must not compress input signal until a reasonably size wave form appears. Wide range input attenuator.
Voltage Calibrator	Suitable for calibrating the amplitude of the wave shapes on the "Y" axis of the oscilloscope.
Electronic Voltmeter	Very high input impedance for d.c. voltage measurements. Having at least one megohm of d.c. resistance on the 3 volt scale.
R. F. Sweep Generator or Wobbulator	Frequency range 20 to 250 megacycles, sweep width 10-12 megacycles (adjustable). Output adjustable with at least .1 volt maximum. Output constant on all ranges. Center frequency variable over the complete television spectrum of channels 2-13. Output impedance 150 ohms unbalanced.
Signal Generator	High frequency signal generator; minimum frequency range 40-250 mc.; frequency calibrations reliable to better than 100 KC. Attenuator should be adjustable and very accurate; modulation up to 30%.
Cathode-Ray Oscilloscope	Same as in "A".
Probe Detector	For connecting scope to circuits ahead of second detector. (Probe Detector Schematic.)
Non-Capacitive Screwdriver	Made of 1/4" fiber rod having screwdriver ends.



Probe Detector Schematic

6.10 Possible Failures:

NOTE: The following failures and possible solutions will aid the serviceman to locate and remedy the trouble.

Tubes should be changed first and if this will not remedy the trouble, check voltages.

1. DEAD RECEIVER:
   a. A.C. interlock not making connection.
   b. Power cord broken, check cord at interlock.
   c. Power switch SW101 contacts open.

2. NO RASTER OR SOUND BUT TUBES LIGHT UP:
   a. Low voltage selenium rectifiers SR101, SR102.
   b. Speaker plug disconnected.
   c. Open choke L111.
   d. Open R142 Fuse type Resistor.

3. PICTURE BUT NO SOUND:
   a. Audio Tubes (V104, V111).
   b. Sound Det. Driver tube (V107).
   c. Defective Speaker voice coil.
   d. Receiver not tuned properly.
   e. T108 or C157 defective.
   f. Sound Detector tube (V106).

4. NO RASTER WITH SOUND PRESENT:
   a. Ion trap magnet not set properly.
   b. No high voltage caused by 1B3 GT rectifier, T106 Horizontal Output transformer, V110, V112, V113, or V114.
   c. Defective Picture tube.

5. NO PICTURE OR SOUND WITH RASTER PRESENT:
   a. I.F. tubes V101, V102, V103.
   b. Crystal detector CR101 or Video amplifier V108; peaking coils open.
   c. R.F. Unit.
   d. Antenna Lead-in.

6. NO VERTICAL DEFLECTION:
   a. Open Vert. Osc. Transformer T104.
   b. Vertical Output Transformer T105 open.
   c. Open deflection coil L112A.
   d. V105 tube defective or burnt out.
   e. C132 shorted.
   f. C131 or C118D shorted or R137 open.

7. NO HORIZONTAL DEFLECTION:
   a. Tubes V112, V113, V114.
   b. Horizontal Stabilizer Coil L108.
   c. Open deflection coil L112B.

8. SOUND BARS OR GRAIN IN PICTURE:
   a. Station not "tuned-in" properly.
   b. Ratio Detector Trans. T107 primary not adjusted properly.
   c. Microphonic tubes. (V2, V101, V102, V103).
   d. Oscillation in I.F. system due to lead dress or open by-pass capacitor.
   e. R.F. or I.F. not aligned properly.

9. SIGNAL BUT NO VERTICAL SYNC:
   a. Defective vertical oscillator Trans. T104.
   b. V105 tube.
   c. Integrator network, C126, open or shorted.
   d. Vertical Hold Control R135 arm not making good contact.

10. SIGNAL BUT NO HORIZONTAL SYNC:
   a. V110
   b. Capcitors C136 and C137 open.
   c. R149 open, or C139 defective.
   d. Horizontal frequency adjustment of L108 not properly adjusted.
   e. Horizontal Hold control R155.

11. SIGNAL BUT NO VERT. OR HORIZ. SYNC:
   a. Tube V109.
   b. C123 or C125 open.
   c. R127 open.

12. SHADOWS IN CORNERS OF PICTURE:
   a. Ion trap magnet adjustment.
   b. Misadjusted centering magnet.

13. "SNOW" IN PICTURE:
   a. Weak signal; check antenna and lead-in.
   b. Noisy tube V2 in R.F. Unit.
   c. Corona discharge from High Voltage power supply due to improper lead dress.

14. SMALL PICTURE:
   a. Low line voltage.
   b. Weak Selenium Rectifiers SR101, SR102.
   c. V112 tube.

15. PICTURE WITH VERTICAL LINES: AND HORIZONTAL NON-LINEARITY:
   a. V112 tube.

6.11 Critical Lead Dress:

CIRCUIT OR LEAD:

R.F. TUNING UNIT:

RF Tuner:

The brown AGC lead from the terminal board to the tuner should be dressed flat down to chassis.

IF Section:

The component leads and wires in the video IF section must be kept as short as possible.

RF Choke:

The end of the RF choke L113 which is wired to T103, lug 6, shall be as short as possible.

LEADS:

The black wire from T103, lug 4 to chassis must be as short as possible. All leads must be kept away from the plates of the selenium rectifiers, SR101 and SR102. Dress the red and blue leads of Audio Output Transformer, T108 away from the high voltage shield so they will not be pinched under it.

Components:

Keep all components, particularly peaking coils, away from R121 which is wired between the terminal boards adjacent to V110.

Resistors:

Dress the fuse resistor R142 attached to the terminal board, up away from the chassis. On the 385 chassis, dress the two 150K ohm resistors, R151 and R152, in such a manner as not to short against the high voltage shield.

Capacitors:

The .006 mfd. capacitor, C138, wired from V114, pin 6, to ground lug of C118, should be dressed down close to the chassis. The .005 mfd. capacitor, C162, which is wired from the case of R118 thru the center lug of R118A to chassis, must have a very short lead on the end wired to the case of R118 so the body of the capacitor prevents any shorting to the shield wired to R118.

Controls:

All controls and the local-distance switch must be kept from shorting to the chassis. Make sure the control does not turn when the nut is tightened.

High Voltage Section:

The plate cap of the 1B3GT, V115, should be put on so the lead comes away from it in a vertical direction. The vinyl tape that is applied to the corona ring should cover the entire outside edge of the ring and as much of the socket area as possible.

Yoke Coupling Network:

The yoke coupling network, L109, wired from T106 lug 3 to V112, lug 1, should be kept away from lug 4 of T106.

6.12 Alignment and Adjustment Notes:

1. The sound I.F. and video I.F. carriers of this receiver are 21.9 megacycles and 26.4 megacycles respectively. Sound I.F. frequency 4.5 mc.

2. When the television receiver is repaired or aligned, always turn the chassis on its side with I.F. strip and R.F. Tuning unit up and block up the deflection coil mounting bracket to prevent the tube from resting on the bench.

3. Never disconnect the speaker while the power is on as the filter choke mounted on the speaker is in the B+ circuit.

4. If the television receiver must be operated with the picture tube removed from the chassis, tape or cover the exposed end of the high voltage anode lead.

5. All lead connections from the signal generator and wobbulator must be shielded. Keep the exposed ends and ground leads as short as possible (about one inch).

6. Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis.

7. The wobbulator, signal generator output, and contrast control must be kept low enough to prevent over loading the television receiver circuits.

CONNECTING EXTERNAL ANTENNA

Remove the two wires from the built-antenna fastened to the two screws on the antenna terminal board mounted at the rear of the receiver. Tape bare ends of wires from the built-in antenna. Keep the lead-in from the external antenna away from the power cord and speaker leads. Fasten the lead-in wires under the two screws on the antenna terminal board.

ADJUSTMENTS

1. ION TRAP ADJUSTMENT:

Adjust the BRIGHTNESS control for normal brightness. With the ION TRAP positioned close to the base of the picture tube, move the trap forward or backward and at the same time rotate in either direction until maximum brightness of the raster is obtained. Readjust the BRIGHTNESS control until the raster is slightly above average brilliance. Adjust the FOCUS CONTROL until the line structure of the raster is clearly visible. Readjust the ION TRAP again for maximum brightness.

There may be two locations on the tube neck where the ION TRAP will produce maximum brightness. Never set the trap to the forward position, always use the position closest to the tube base.

If there is a shadow in the corners of the raster, be sure the ION TRAP is properly adjusted. Do not sacrifice picture brilliance when adjusting the ION TRAP to overcome shadows in corner of picture. If corner shadows are present, be sure the DEFLECTION YOKE and CENTERING MAGNET are properly adjusted.

2. DEFLECTION YOKE AND BRACKET:

The DEFLECTION YOKE should be positioned as far forward as possible on the picture tube neck and rotated to the left or right as required to make the picture parallel with respect to the top and bottom of window frame.

3. CENTERING RASTER:

If the picture is off center and/or has neck shadow, rotate either or both CENTERING MAGNET levers to the left or right until the picture is centered on the screen and is free of neck shadow. The CENTERING MAGNET is located on the back cover of the DEFLECTION YOKE. To determine the correct picture centering, it may be necessary to reduce the size of the picture with the HEIGHT and WIDTH adjustments. After making adjustment of CENTERING MAGNET, readjust ION TRAP.

4. HEIGHT AND WIDTH ADJUSTMENTS:

The linearity and corresponding size controls will have to be adjusted together and with care to maintain picture symmetry. For this reason it is best to use a test pattern when making these adjustments. Adjust size of picture to fill the screen by means of the HEIGHT, WIDTH, VERTICAL LINEARITY.

5. VERTICAL LINEARITY ADJUSTMENTS:

The VERTICAL LINEARITY control has the effect of expanding the picture at an increasing rate from the bottom to the top of the picture. Adjustment of this control has the greatest effect on the top portion of the picture, some effect on the middle and very little effect on the bottom of the picture. The HEIGHT and FOCUS controls may need readjustment as a result of the change in position of the VERTICAL LINEARITY control.

6. HORIZONTAL HOLD CONTROL:

The HORIZONTAL HOLD CONTROL is adjusted with a weak picture to the center of its pull-in range. If the pull-in range is insufficient or the horizontal sync is unstable, see "Horizontal Hold Adjustment" under "Alignment".

7. VERTICAL HOLD CONTROL:

The VERTICAL HOLD CONTROL is also adjusted to the center of its pull-in range with the contrast control set to obtain a weak picture.

8. FOCUS CONTROL:

Adjust the FOCUS CONTROL for best focus of the vertical and horizontal wedges at the center of the test pattern. If corner focus is poor, check position of DEFLECTION YOKE and ION TRAP. While observing the test pattern (or picture), make a slight readjustment of the VERTICAL HOLD control until the horizontal lines are least noticeable. This adjustment is very critical and will require only a very slight movement of the control shaft to obtain proper adjustment.

CAUTION

HIGH VOLTAGE--Operation of a television receiver with the back open involves a shock hazard. When making adjustments other than adjusting the controls at the front panel, all precautions for working near high voltage should be exercised.

HIGH TEMPERATURE OF TUBES--Some tubes in the receiver operate at extremely high temperatures. To avoid serious burns, do not touch these tubes while the receiver is operating, or until the tubes have cooled after the set is shut off.

HANDLING OF PICTURE TUBES--Breakage of the picture tube, which contains a high vacuum, may result in injury from flying glass. Do not scratch tube face or subject to more than moderate pressure. DO NOT REMOVE OR HANDLE THE PICTURE TUBE IN ANY MANNER UNLESS HEAVY GLOVES AND PROTECTIVE GOGGLES ARE WORN. Persons not so equipped should be kept away while handling the tube. NEVER GRASP THE TUBE BY THE NECK OR ALLOW PRESSURE TO BE EXERTED ON THE NECK. In installation, if the tube sticks or fails to slip smoothly through the deflection yoke, investigate and remove the cause of the trouble. DO NOT FORCE TUBE.

ADJUSTMENTS (Continued)

9. BRIGHTNESS CONTROL:

BRIGHTNESS CONTROL and CONTRAST control should be set to obtain as much shading in the picture as possible. If the Brightness control is set too low, the black and grays of the picture are black and if set too high, the black and grays of the picture will appear light and faded.

10. LOCAL-DISTANCE (AGC) SWITCH:

The LOCAL-DISTANCE SWITCH can be set to prevent the receiver from overloading in strong signal areas or to reduce "snow" in the picture in weak signal areas. In strong signal areas, the "LOCAL" (counter-clockwise) position of the switch must be used. The second and third positions "SUBURBAN" and "DISTANCE" are to be used in medium to weak signal areas. Use the position with which the best picture is obtained with a minimum of overloading of the receiver when the CONTRAST control is advanced.

11. OSCILLATOR ADJUSTMENT USING A TELEVISION SIGNAL:

Do not make any adjustments on the two oscillator adjusting screws unless the FINE TUNING control range is insufficient to properly tune-in the station. The adjusting screws are accessible through holes in the front of the chassis after the chassis is removed from the cabinet.

To make the adjustment, proceed as follows:

(a) Turn the receiver on and allow a warm-up period of approximately five minutes.

(b) For stations from channel 13 to channel 7, set the Station Selector Switch to the highest channel received and adjust the Contrast and Volume control for normal sound and picture. Set the Fine Tuning Control in the center of its range.

(c) Using a small non-metallic screwdriver, adjust the slotted head brass screw located to the left of the shaft and above the fiber disc for the clearest and sharpest detail in the picture. This adjustment will be effective on all channels between 13 and 7. If other stations are operating in this range, it may be necessary to compromise slightly on the high channel adjustment so the other channels may be properly tuned-in.

(d) For Stations on channel 6 and below, set the station Selector Switch to the channel received closest to channel 6 and adjust the Contrast and Volume control for normal sound and picture. Set the Fine Tuning control in the center of its range.

(e) Using a small non-metallic screwdriver, adjust the slotted head brass screw located to the right of the shaft for the clearest and sharpest detail in the picture. This adjustment will effect all channels between 6 and 2.

I. F. ALIGNMENT

All lead connections from the signal generator and wobbulator must be shielded. Keep the exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The wobbulator, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

1. To Check I. F. Alignment on Oscilloscope:

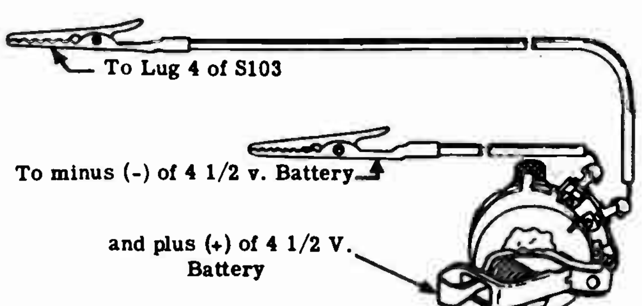
(a) Lift the shield of the Oscillator - Mixer tube V2 sufficiently to clear the socked ground clips. Connect sweep signal generator "hot" lead to the underground tube shield and generator ground lead to the tuner chassis.

(b) Connect high side of oscilloscope to high side of contrast control (pin 2 and 7 of V108), and the low side to chassis.

(c) Apply - 3.0 volts D.C. bias to lug 4 of S103 (See sketch "Variable Bias Control"). Contrast control should be set in the maximum counter-clockwise position.

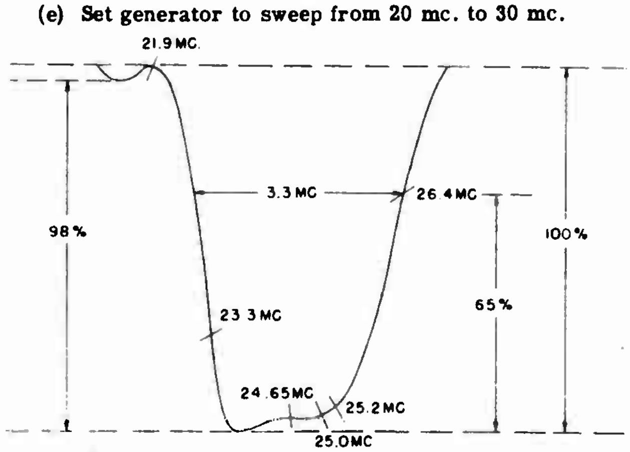
(d) With the generator sweep set at zero, connect an electronic voltmeter between lug 2 of S103 and chassis. Adjust the output of the generator to obtain a reading of 2 volts D.C. on the meter.

(e) Set generator to sweep from 20 mc. to 30 mc.



5000 Ohm Control only, Part No. 144260

VARIABLE BIAS CONTROL ASSEMBLY



NOMINAL OVERALL I. F. RESPONSE CURVE

NOTE: Response as Seen by Means of Sweep Generator

I. F. ALIGNMENT (Continued)

(f) Connect marker generator to sweep generator output leads and adjust to provide markers that appear in the curve.

(g) Observe curve and position of markers (see nominal response curve). Slight deviation in shape from the nominal response curve is permissible, but if any great deviation is noted, it will be necessary to realign the I-F Amplifier.

2. Alignment, I. F. & Tuner Assembly (with electronic voltmeter):

(a) Connect - 3.0 Volts D.C. bias supply to lug 4 of S103.

(b) Connect signal generator "hot" lead through a 1000 mmf. capacitor to TP-1 (wire protruding from tuner directly adjacent to the oscillator mixer tube V2) and ground lead to the R. F. tuner case.

(c) Connect high side of Electronic Voltmeter to lug 2 of S103 and low side to chassis.

(d) Set signal generator to 25.0 mc. and adjust bottom of T103 for maximum meter deflection, limiting meter deflection to 2 volts D.C. by adjusting input attenuator.

(e) Set signal generator to 23.3 mc. and adjust bottom of T102 for maximum D.C. meter indication. Adjust signal generator amplitude to make this peak indication approximately 2 volts D.C.

(f) Reset signal generator to 21.9 mc. and adjust the top of T102 for minimum D.C. meter deflection. Signal generator amplitude must be sufficiently high to produce a definite null. Meter must read at least 0.5 volts at null.

(g) Repeat steps 5 and 6.

(h) Next set signal generator to 25.2 mc. and adjust bottom of T101 for maximum meter indication, limiting output of generator so peak reading will not exceed 2 volts D.C.

(i) Reset signal generator to 24.65 mc. Connect a 500 ohm resistor in series with a 500 mmf. capacitor from TP-2 (wire protruding from the tuner through the insulated eyelet between the brass adjusting screws) on the R-F Tuner to the Tuner side of C101. Adjust L101 for maximum meter deflection, but limit output of generator so this reading does not exceed 2 volts D.C. Remove the 500 ohm resistor and the 500 mmf. capacitor.

(j) Set signal generator to 24.65 mc. Connect the 500 ohm resistor and the 500 mmf. series capacitor across L101 and adjust mixer output (L9) on R-F Tuner for maximum meter indication. Adjusting amplitude of signal generator to make this maximum indication approximately 2 volts D.C. Remove the 500 ohm resistor and the 500 mmf. capacitor.

(k) Check sensitivity. The input for 2 volts D.C. output and zero bias should not exceed 150 microvolts at 24.65 mc. with a generator internal resistance of 1.5 ohms or less, and the local oscillator set to properly tune in channel 5.

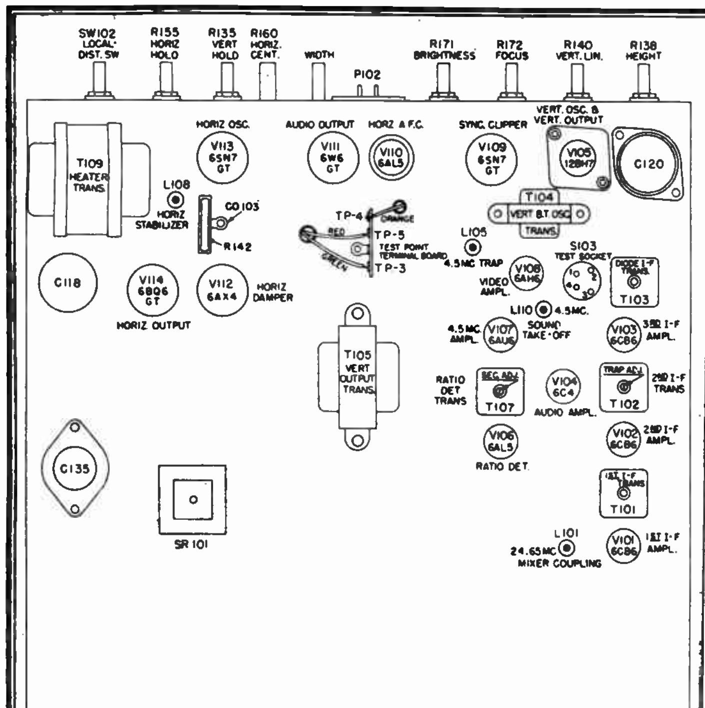
(l) Remove the signal generator and electronic voltmeter.

SOUND ALIGNMENT

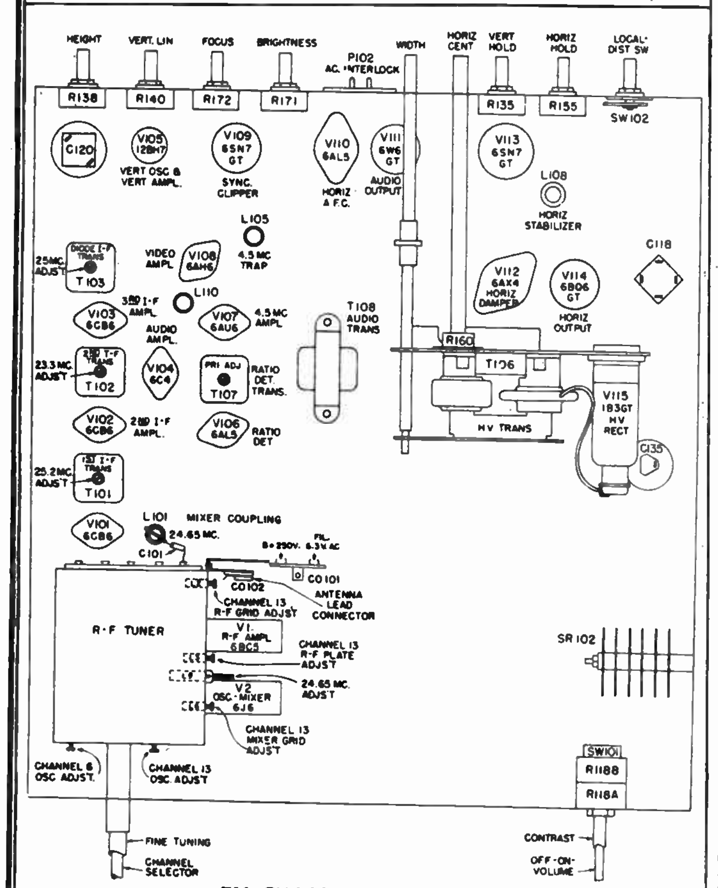
1. Connect crystal controlled 4.5 mc. 400 cycle amplitude modulated signal, modulated 30% or greater, to lug 2 of S103 and chassis.
2. Connect high side of scope through detector probe to the picture tube cathode (pin 11). Connect low side of scope to chassis. Adjust 4.5 mc. trap, L105 for minimum 400 cycle deflection on scope.
3. Connect electronic voltmeter to lug 2 of ratio detector, V106, and adjust 4.5 mc. sound take-off (L110) and bottom of ratio transformer (T107) for peak reading on voltmeter. Adjust input to make this peak reading 4 volts.
4. Adjust input to obtain 12 volts output. Transfer electronic voltmeter to junction of R167 and C153 (refer to Schematic Wiring Diagram). Adjust top of T107 for zero balance on electronic voltmeter.
5. Recheck steps 2, 3 and 4 above.
6. Remove input signal, scope and electronic voltmeter.

HORIZONTAL HOLD ADJUSTMENT

1. Tune in a local television signal and adjust contrast control for normal picture.
2. Connect electronic voltmeter between TP-3 (green lead) and chassis.
3. Short TP-4 (orange lead) to chassis and adjust electronic voltmeter to zero.
4. Remove short from TP-4. Do not change zero on electronic voltmeter.
5. Connect a 0.1 mfd. plus 20%, 600 volt capacitor between TP-5 (red lead) and chassis.
6. Adjust Horizontal Hold control for zero reading on the meter.
7. Remove the 0.1 mfd. capacitor from TP-5 and chassis. Do not disturb setting of horizontal hold control.
8. Adjust Horizontal Stabilizer coil (L108) for zero reading on the meter.
9. Remove electronic voltmeter from TP-3
10. Check horizontal pull-in range. The pull-in range should be approximately 50° of the controls rotation.



TV CHASSIS TOP VIEW
(Tube and Alignment Locations)



TV CHASSIS BOTTOM VIEW
(Tube Socket and Alignment Locations)

TV CHASSIS 386-387 (Schematic Parts)

Symbol No.	Part No.	Description
C101	137727-129	Capacitor, 330 mmf., 500 v., ceramic
C102	39001-17	Capacitor, .05 mfd., 600 v., paper
C103	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C104	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C105	144675-14	Capacitor, .001 mfd., 500 v., disc ceramic
C107	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C108	144675-14	Capacitor, .001 mfd., 500 v., disc ceramic
C109	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C110	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C111	144675-14	Capacitor, .001 mfd., 500 v., disc ceramic
C112	137727-135	Capacitor, 10 mmf., 10%, 500 v., ceramic
C113	137727-103	Capacitor, 5 mmf., 10%, 500 v., ceramic
C114	39001-19	Capacitor, .1 mfd., 600 v., paper
C115	154157	Capacitor, .5 mfd., 25 v., paper
C116	154100-4	Capacitor, 2.2 mmf., 500 v., ceramic
C117	137727-126	Capacitor, 3.3 mmf., 10%, 500 v., ceramic
C118A	154099	Capacitor, 100 mfd., 300 v.
C118B		Capacitor, 10 mfd., 300 v. } Electrolytic
C118C		Capacitor, 200 mfd., 200 v. }
C118D		Capacitor, 30 mfd., 150 v.
C119	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C120A	154098	Capacitor, 200 mfd., 150 v. } Electrolytic
C120B		Capacitor, 5 mfd., 150 v. }
C121	39001-19	Capacitor, .1 mfd., 600 v., paper
C122	137727-131	Capacitor, 220 mmf., 10%, 500 v., ceramic
C123	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C124	137727-26	Capacitor, 22 mmf., 10%, 500 v., ceramic
C125	39001-17	Capacitor, .05 mfd., 600 v., paper
C126	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C127	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C128	39477-41	Capacitor, .01 mfd., 600 v., molded paper
C129	39001-11	Capacitor, .005 mfd., 600 v., paper
C130	39477-45	Capacitor, .047 mfd., 600 v., molded paper
C131	39477-45	Capacitor, .047 mfd., 600 v., molded paper
C132	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C133	154097	Capacitor, 20 mfd., 450 v., Electrolytic
C135	154096	Capacitor, 140 mfd., 150 v., Electrolytic
C136	137727-132	Capacitor, 1000 mmf., 10%, 500 v., ceramic
C137	137727-132	Capacitor, 1000 mmf., 10%, 500 v., ceramic
C138	39001-78	Capacitor, .006 mfd., 600 v., paper
C139	39001-76	Capacitor, .003 mfd., 600 v., paper
C140	39477-52	Capacitor, .001 mfd., 1000 v., molded paper
C141	39001-13	Capacitor, .01 mfd., 600 v., paper
C142	137727-134	Capacitor, 75 mmf., 10%, 500 v., ceramic
C143	137499-30	Capacitor, 3900 mmf., 10%, 500 v., mica
C144	137499-31	Capacitor, 390 mmf., 10%, 500 v., mica
C145	137499-31	Capacitor, 390 mmf., 10%, 500 v., mica
C146	137499-34	Capacitor, 560 mmf., 10%, 500 v., mica
C147	154988	Capacitor, 120 mmf., 10%, 3000 v., ceramic
C148	Part of L109	Capacitor, .1 mfd., 200 v., paper
C149	137727-133	Capacitor, 68 mmf., 10%, 500 v., ceramic
C150	144675-6	Capacitor, .004 mfd., 500 v. } disc ceramic
C150		Capacitor, .004 mfd., 500 v. }
C151	154103	Capacitor, 5 mfd., 50 v., Electrolytic
C152	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic
C153	144674-14	Capacitor, .001 mfd., 500 v., disc ceramic
C154	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C155	154104	Capacitor, 10 mfd., 50 v., Electrolytic
C156	39001-13	Capacitor, .01 mfd., 600 v., paper
C157	39001-80	Capacitor, .02 mfd., 600 v., paper
C158	Part of L112	Capacitor, 47 mmf., mica
C159	Part of T102	Capacitor, 68 mmf., 10%, 500 v.
C160	Part of T107	Capacitor, 10 mmf.
C161	Part of T107	Capacitor, 100 mmf.
C162	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C163	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic
C164	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic
C165	154394	Capacitor, 500 mmf., 20 k.v., ceramic (386 only)
C166	39001-17	Capacitor, .05 mfd., 600 v., paper
C167	39001-19	Capacitor, .1 mfd., 600 v., paper
C168	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
R101	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R102	39375-63	Resistor, 3900 ohm, 5%, 1/2 w.
R103	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R104	39374-9	Resistor, 47 ohm, 10%, 1/2 w.

TV CHASSIS 386-387 (Schematic Parts)

Symbol No.	Part No.	Description
R105	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R106	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R107	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R108	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R109	39375-75	Resistor, 12,000 ohm, 5%, 1/2 w.
R110	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R111	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R112	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R113	39374-67	Resistor, 1.8 megohm, 10%, 1/2 w.
R114	39375-67	Resistor, 5600 ohm, 5%, 1/2 w.
R115	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R116	39374-65	Resistor, 1.5 megohm, 10%, 1/2 w.
R117	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
R118A	154085	Control (Contrast), 2500 ohm } Assembly
R118B		Control (Volume), 1 megohm }
R119	Part of L104	Resistor, 8200 ohm, 10%, 1/2 w.
R120	39374-131	Resistor, 33,000 ohm, 10%, 1 w.
R121	39375-361	Resistor, 4700 ohm, 5%, 2 w.
R122	Part of L106	Resistor, 6800 ohm, 10%, 1/2 w.
R123	Part of L107	Resistor, 3300 ohm, 10%, 1/2 w.
R124	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R125	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R126	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
R127	39374-59	Resistor, 680,000 ohm, 10%, 1/2 w.
R128	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R129	39374-146	Resistor, 560,000 ohm, 10%, 1/2 w.
R130	39374-41	Res'stor, 22,000 ohm, 10%, 1/2 w.
R131	39374-35	Resistor, 6800 ohm, 10%, 1/2 w.
R132	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R133	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R134	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R135	154087	Control, Vertical Hold (850,000 ohm)
R136	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R137	39374-28	Resistor, 1800 ohm, 10%, 1/2 w.
R138	154086	Control, Height (5 megohm)
R139	39374-14	Resistor, 120 ohm, 10%, 1/2 w.
R140	154088	Control, Vertical Linearity (750 ohm)
R141	154084	Resistor, 8700 ohm, 5%, 5 W. Wire Wound
R142	154089	Resistor, 7.5 ohm, 10%, 5 W. Wire Wound (Fuse type)
R143	39374-17	Resistor, 220 ohm, 10%, 1/2 w.
R144	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R146	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R147	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R148	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R149	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R150	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R151	39374-131	Resistor, 33,000 ohm, 10%, 1 w.
R152	39374-133	Resistor, 47,000 ohm, 10%, 1 w.
R153	39374-26	Resistor, 1200 ohm, 10%, 1/2 w.
R154	39374-34	Resistor, 5600 ohm, 10%, 1/2 w.
R155	154093	Control, Horizontal Hold (120,000 ohm)
R156	39374-53	Resistor, 220,000 ohm, 10%, 1/2 w.
R157	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R158	39374-55	Resistor, 330,000 ohm, 10%, 1/2 w.

Symbol No.	Part No.	Description
R159	39374-121	Resistor, 4700 ohm, 10%, 1 w.
R160	154083	Control, Horizontal Centering (50 ohm)
R161	39303-12	Resistor, 2.2 ohm, 10%, 1/2 w. Wire Wound
R162	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R163	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R164	39374-18	Resistor, 270 ohm, 10%, 1/2 w.
R165	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R166	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R167	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R168	39374-27	Resistor, 1500 ohm, 10%, 1/2 w.
R169	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R170	154095	Control, Brightness (5 megohm)
R171	154094	Control, Focus (1.5 megohm)
R172	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R173	39374-50	Resistor, 120,000 ohm, 10%, 1/2 w.
R174	39374-213	Resistor, 10,000 ohm, 10%, 2 w.
L101	154287	Coil, Converter I. F.
L102	154171	Coil, Video Peaking (168 microhenry, 5%)
L103	154184	Coil, Video Peaking (335 microhenry, 5%)
L104	154194	Coil, Video Peaking (412 microhenry, 5%)
L105	154158	Trap (4.5 megacycle)
L106	154206	Coil, Video Peaking (106 microhenry, 5%)
L107	154176	Coil, Video Peaking (840 microhenry, 5%)
L108	154220	Coil, Horizontal Osc.
L109	154156	Network, Yoke Decoupling
L110	154183	Coil, Sound Take Off
L111	154442	Choke, Filter (used on SP 101)
L112	154221-6	Yoke, Deflection
L113	154376	Coil, R. F. Choke
L114	154442	Choke, Filter (used on SP 102)
T101	154307	Transformer, 1st. I. F.
T102	154319	Transformer, 2nd. I. F.
T103	154321	Transformer, Diode I. F.
T104	154105-1	Transformer, Vertical Blocking Osc.
T105	154106	Transformer, Vertical Output
T106	154990	Transformer, Horizontal Output
T107	154108	Transformer, Ratio Detector
T108	154109-1	Transformer, Audio Output
T109	154290	Transformer, Filament
CA101	154177	Antenna Lead
CA102	132300-6	Cable & Plug Assy., Power
SW101	Part of R118B	Switch, ON-OFF (Power)
SW102	154115	Switch, A.G.C. Control
SP101	138762-7	Speaker, P. M. (5-1/4")
SP102	138762-5	Speaker, P. M. (10")
S101	154178	Speaker, Cable & Connector
S102	154113	Socket, Test (Connector)
P101	154243	Plug, Speaker Cable
P102	154125	Plug, Interlock
SR101	154112	Selenium Rectifier
SR102	154112	Selenium Rectifier
CR101	154111	Crystal (1N64)
CO101	154114	Connector
CO102	154114	Connector
CO103	154114	Connector

TV CHASSIS 386

Part No.	Description	Symbol No.	Part No.	Description
154275-5	Bracket (Frame), Deflection Yoke Mtg.		154129	Plate, Tube Mtg. (V105, V113)
154273	Bracket, Deflection Yoke Mtg.		154079-1	Ring (Retaining, 3 used), Width Control Shaft Assy.)
154368-2	Bracket (L.H.), Picture Tube Support		154119	Ring (Retaining), Width Control Shaft Key
154368-1	Bracket (R.H.), Picture Tube Support		144957	Screw (Wing), Deflection Yoke.
154190	Bracket, Tuner Mtg.		154267	Shaft, Width Control
154318	Cable, Shielded (18" long) Twin Lead		154077	Shaft, Width Control (Horizontal Deflection Assy.)
154349-1	Cable, Shielded (9" long)		154152	Shield, Corona
154349-2	Cable, Shielded (6-1/2" long)		154195	Shield, High Voltage
154180	Coil (High Voltage), Horizontal Deflection Assy.		39008-37	Shield (Spiral), R. F. Tuner Assy.
154989	Coil(Primary), Horizontal Deflection Assy.		149572	Sleeving (36" lengths), Plate Lead V113, 6-1/2" long
154276-2	Channel (Rubber 10-5/16"), Deflection Yoke Assy.		149572	Sleeving (36" lenghts), Anode Lead 4" Long
154363	Clip, Picture Tube Anode		154148-2	Socket & Cable Assy., Picture Tube
154124	Coupling, Shaft Width Control		154203	Socket, Tube (V113)
154353	Cushion (Rubber), Picture Tube Support		154192	Socket, Tube (V105)
154122-1	Grid Cap (V114)		154092	Socket, Tube (V115)
154134	Grommet(4 used), Tube Mtg.(V105,V113)		154117	Socket, Tube (V110)
154259	Insulator, Antenna Lead		154146	Socket, Tube (V101, V102, V103, V107)
154260	Insulator (1-3/16" x 1-7/32" Phenolic), Controls		154131	Socket, Tube (V109, V111, V114)
154264	Insulator, Interlock		154130	Socket, Tube (V112)
154268	Insulator(1-13/16" x 19/32 x 1/16" Armite). R. F. Tuner Shaft		154127	Socket, Tube (V104, V106, V108)
154025	Insulator (Ring), Picture Tube		154381	Spring, Capacitor Mtg. (C165)
153109-2	Ion Trap		154072	Spring (Clip), Horizontal Deflection Assy.
39012-102	Iron Core		154071	Spring (Strap), Horizontal Deflection Assy.
39012-95	Iron Core		154120	Spring, Horizontal Width Control Shaft
39012-96	Iron Core		153972-2	Strap, Picture Tube
154073	Iron Core, Horizontal Deflection Assy.		154991	Terminal Board, Horizontal Deflection Assy.
154209-1	Iron Core, Threaded (2 used)		154116	Tuner, R. F. Pentode Assy.
154274	Key, Width Control Shaft		91595-1	Washer (Flat), Width Control Shaft
154314	Plate (Bearing), R. F. Tuner Shaft		154140	Washer (Protruded) Controls
154075	Plate, Horizontal Width Control		149180	Washer (Spring) Width Control Shaft

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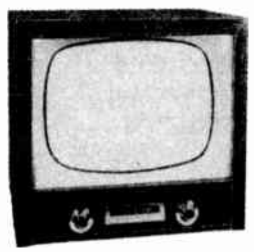
Part No.	Description	Symbol No.	Part No.	Description
154275-1	Bracket (Frame), Deflection Yoke Mtg.		154079-1	Ring (Retaining, 3 used), Width Control Shaft Assy.
154253	Bracket, Deflection Yoke Mtg.		154119	Ring (Retaining), Width Control Shaft Key
154514	Bracket (Lower), Deflection Yoke Mtg.		153423	Rod (2 used), Picture Tube Tie Down
154190	Bracket, R. F. Tuner Mtg.		144957	Screw (Wing), Deflection Yoke
154358	Bracket (2 used), Picture Support		154267	Shaft, Width Control
154359	Bracket, Picture Tube Stop		154077	Shaft, Width Control (Horizontal Deflection Assy.)
154318	Cable, Shielded (18" long) Twin Lead		154152	Shield, Corona
154349-1	Cable, Shielded (9" long)		154197	Shield, High Voltage
154349-2	Cable, Shielded (6-1/2" long)		39008-37	Shield (Spiral), R. F. Tuner Assy.
154276-2	Channel (Rubber 10-5/16" long), Deflection Yoke Assy.		149572	Sleevings (36" lengths), Plate Lead V113, 6-1/2" long
154180	Coil (High Voltage), Horizontal Deflection Assy.		154148-2	Socket & Cable Assy., Picture Tube
154989	Coil (Primary), Horizontal Deflection Assy.		154203	Socket, Shock Mtg. Tube (V113)
154038-3	Connector, Picture Tube Anode		154192	Socket, Shock Mtg. Tube (V105)
154124	Coupling, Width Control Shaft		154092	Socket, Tube (V115)
153424-1	Cushion (Rubber), Picture Tube Strap		154117	Socket, Tube (V110)
153424-4	Cushion (Rubber), Picture Tube Stop		154146	Socket, Tube (V101, V102, V103, V107)
154122-1	Grid Cap (V114)		154131	Socket, Tube (V109, V111, V114)
154134	Grommet (Rubber 4 used), Tube Mtg. (V105, V113)		154130	Socket, Tube (V112)
154259	Insulator, Antenna Lead		154127	Socket, Tube (V104, V106, V108)
154260	Insulator (1-13/16" x 17/32, Phenolic), Controls		154072	Spring(Clip), Horizontal Deflection Assy.
154264	Insulator, Interlock		154414	Spring (2 used), Picture Tube Mtg.
154268	Insulator, (1-13/16" x 9/32" x 1/16" Armite), R. F. Tuner Shaft		149671-1	Spring, (Grounding)
153109-2	Ion Trap		154071	Spring(Strap), Horizontal Deflection Assy.
39012-102	Iron Core		154120	Spring, Horizontal Width Control Shaft
39012-114	Iron Core		153422	Strap, Picture Tube
154073	Iron Core, Horizontal Deflection Assy.		149322	Support, Picture Tube Anode
154209-1	Iron Core, Threaded (5 used)		154991	Terminal Board, Horizontal Deflection Assy.
154274	Key, Width Control Shaft		154116	Tuner, R. F. Pentode Assy.
154314	Plate (Bearing), R. F. Tuner Shaft		91595-1	Washer (Flat), Width Control Shaft
154075	Plate, Horizontal Width Control		154140	Washer (Protruded), Controls
			149180	Washer (Spring), Width Control Shaft

EU 21 COLd (Mahogany)

EU 21 COLBd (Blond)



EU 21 TOL (Mahogany)

EU 21 TOLB (Blond)

Final Assembly and Cabinet - Model EU-21 COLd (Chassis 386)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377-2	Antenna, Assy.		154265	Knob, Local-Suburban-Distance
	154433	Back & Power Cable Assy.		154270	Knob, Controls (Vertical-Horizontal, Holds)
	154503	Block, Chassis Mtg. (4 used)			
	154332-1	Cabinet		154333-2	Mask, Window
	132300-6	Cable & Plug Assy., Power		154313	Nail, Channel Indicator
	153550	Clip, Window & Mask Assy.		154519-1	Name Plate, Crosley
	154451	Grille Cloth		145211-22	Nut (Wing), Speaker Mtg.
	154216-1	Knob, Contrast		154504	Plate, Chassis Mtg. (4 used)
	154214-1	Knob (Large), Tuning		39350-61	Screw, Window & Mask Assy.
	154215-1	Knob (Small), Tuning		154382-2	Window, Tempered Glass
	154217-1	Knob, Volume			

Final Assembly and Cabinet - Model EU-21 COLBd (Chassis 386)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377-2	Antenna Assy.		15427u	Knob, Controls (Vertical-Horizontal, Holds)
	154433	Back & Power Cable Assy.			
	154503	Block, Chassis Mtg. (4 used)		154333-2	Mask, Window
	154332-2	Cabinet		154313	Nail, Channel Indicator
	132300-6	Cable & Plug Assy., Power		154519-2	Name Plate, Crosley
	153550	Clip, Window & Mask Assy.		145211-22	Nut (Wing), Speaker Mtg.
	154452	Grille Cloth		154504	Plate, Chassis Mtg. (4 used)
	154216-2	Knob, Contrast		39350-61	Screw, Window & Mask Assy.
	154214-2	Knob (Large), Tuning		154382-2	Window, Tempered Glass
	154215-2	Knob (Small), Tuning			
	154217-2	Knob, Volume			
	154265	Knob, Local-Suburban-Distance			

Final Assembly and Cabinet - Model EU-21 TOL (Chassis 386)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377-2	Antenna Assy.		154265	Knob, Local-Suburban-Distance
	154419	Back & Power Cable Assy.		154270	Knob, Controls (Vertical-Horizontal, Holds)
	154256	Block, Chassis Mtg. (4 used)			
	154312-1	Cabinet		154333-1	Mask, Window
	132300-6	Cable & Plug Assy., Power		154313	Nail, Channel Indicator
	153550	Clip, Window & Mask Assy.		154519-1	Name Plate, Crosley
	144600	Grille Cloth		145211-22	Nut (Wing), Speaker Mtg.
	154216-1	Knob, Contrast		39350-63	Screw, Window & Mask Assy.
	154214-1	Knob (Large), Tuning		154382-1	Window, Tempered Glass
	154215-1	Knob (Small), Tuning			
	154217-1	Knob, Volume			

Final Assembly and Cabinet - Model EU-21 TOLB (Chassis 386)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377-2	Antenna, Assy.		154265	Knob, Local-Suburban-Distance
	154419	Back & Power Cable Assy.		154270	Knob, Controls (Vertical-Horizontal, Holds)
	154256	Block, Chassis Mtg. (4 used)			
	154312-2	Cabinet		154333-1	Mask, Window
	132300-6	Cable & Plug Assy., Power		154313	Nail, Channel Indicator
	153550	Clip, Window & Mask Assy.		154519-2	Name Plate, Crosley
	145472	Grille Cloth		145211-22	Nut (Wing), Speaker Mtg.
	154216-2	Knob, Contrast		39350-63	Screw, Window & Mask Assy.
	154214-2	Knob (Large), Tuning		154382-1	Window, Tempered Glass
	154215-2	Knob (Small), Tuning			
	154217-2	Knob, Volume			

Final Assemdly and Cabinet - Model EU-21 COLe (Chassis 387)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377-2	Antenna, Assy.		154265	Knob, Local-Suburban-Distance
	154447	Back & Power, Cable Assy.		154270	Knob, Controls (Vertical-Horizontal, Holds)
	154503	Block, Chassis Mtg. (4 used)			
	154332-1	Cabinet		154351-1	Mask, Window
	132300-6	Cable, Power		154313	Nail, Channel Indicator
	153550	Clip (Retainer 4 used), Window & Mask Assembly		145211-22	Nut (Wing), Speaker Mtg. (4 used)
				154504	Plate, Chassis Mtg. (4 used)
	154451	Grille Cloth		154519-1	Plate, Name (Crosley)
	154217-1	Knob, Contrast		154334-1	Screw, Chassis Mtg. (4 used)
	154214-1	Knob (Large), Tuning		39350-61	Screw, Window & Mask Assy. (2 used)
	154215-1	Knob (Small), Tuning			
	154217-1	Knob, Volume		154382-2	Window, Tempered Glass

EU-21 COLe (Mahogany)
EU-21 COLBe (Blond)

Final Assembly and Cabinet - Model EU-21COLBe (Chassis 387)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377-2	Antenna, Assy.		154265	Knob, Local-Suburban-Distance
	154447	Back & Power, Cable Assy.		154270	Knob, Controls (Vertical-Horizontal, Holds)
	154503	Block, Chassis Mtg. (4 used)		154351-1	Mask, Window
	154332-2	Cabinet		154313	Nail, Channel Indicator
	132300-6	Cable, Power		145211-22	Nut (Wing), Speaker Mtg. (2 used)
	153550	Clip (Retainer 2 used), Window & Mask Assembly		154504	Plate, Chassis Mtg. (4 used)
	154452	Grille Cloth		154519-2	Plate, Name (Crosley)
	154216-2	Knob, Contrast		154334-1	Screw, Chassis Mtg. (4 used)
	154214-2	Knob (Large), Tuning		39350-61	Screw, Window & Mask Assy. (2 used)
	154215-2	Knob (Small), Tuning		154382-2	Window, Tempered Glass
	154217-2	Knob, Volume			

Final Assembly and Cabinet - Model EU-21CDL (Chassis 387)

Part No.	Description	Part No.	Description
154377-2	Antenna, Assembly	154215-1	Knob, Tuning (Small)
154447	Back & Power Cable Assembly	154216-1	Knob, Contrast
155163	Bracket, Chassis Mtg. (4 Used)	154217-1	Knob, Volume
155366-1	Cabinet	154265	Knob, Local-Suburban - Distance
139319-2	Catch, Doors (4 Used)	154270	Knob, Controls (Vertical & Horizontal Holds)
153550	Clip, Retainer (2 Used), Window & Mask Assembly	154351-2	Mask, Window
153817	Doors, One Pair	154313	Nail, Channel Indicator
155164	Insulation, Chassis Mtg. Bracket (4 Used)	145211-21	Nut (Wing), Speaker Mtg. (4 Used)
153779	Grille Cloth	154519-1	Plate, Name (Crosley)
146786	Hinge, Upper Left & Lower Right	154373	Pull (2 Used), Doors
146787	Hinge, Lower Left & Upper Right	154334-3	Screw, Chassis Mtg. (4 Used)
154214-1	Knob, Tuning (Large)	139319-1	Strike, Doors (4 Used)
		154382-3	Window, Tempered Glass

EU-21COS (Mahogany)
EU-21COSB (Blond)

Final Assembly and Cabinet - Model EU21COS (Chassis 387)

Part No.	Description	Part No.	Description
154377-2	Antenna, Assembly	154214-1	Knob, Tuning (Fine Tuning)
154447	Back & Power Cable Assembly	154216-1	Knob, Contrast
155163	Bracket, Chassis Mtg. (4 used)	154265	Knob, Local - Suburban - Distance
155993-1	Cabinet	154270	Knob, Controls (Vertical - Horizontal, Holds)
153550	Clip, Retainer (2 used), Window & Mask Assembly	154351-7	Mask, Window
155164	Insulation, Chassis Mtg. Bracket (4 used)	154313	Nail, Channel Indicator
154451	Grille Cloth	154211-21	Nut (Wing), Speaker Mtg. (4 used)
156002-1	Knob, Tuning (Channel Indicator)	154519-3	Plate, Name (Crosley)
156002-3	Knob, Volume	154334-3	Screw - Chassis Mtg. (4 used)
		154382-2	Window, Tempered Glass

Final Assembly and Cabinet - Model EU-21COSB (Chassis 387)

Part No.	Description	Part No.	Description
154377-2	Antenna, Assembly	154214-2	Knob, Tuning (Fine Tuning)
154447	Back & Power Cable Assembly	154216-2	Knob, Contrast
155163	Bracket, Chassis Mtg. (4 used)	154265	Knob, Local - Suburban - Distance
155993-2	Cabinet	154270	Knob, Controls (Vertical - Horizontal, Holds)
153550	Clip, Retainer (2 used) Window & Mask Assembly	154351-7	Mask, Window
155164	Insulation, Chassis Mtg. Bracket (4 used)	154313	Nail, Channel Indicator
154452	Grille Cloth	154211-21	Nut (Wing), Speaker Mtg. (4 used)
156002-2	Knob, Tuning (Channel Indicator)	154519-3	Plate, Name (Crosley)
156002-4	Knob, Volume	154334-3	Screw, Chassis Mtg. (4 used)
		154382-2	Window, Tempered Glass.

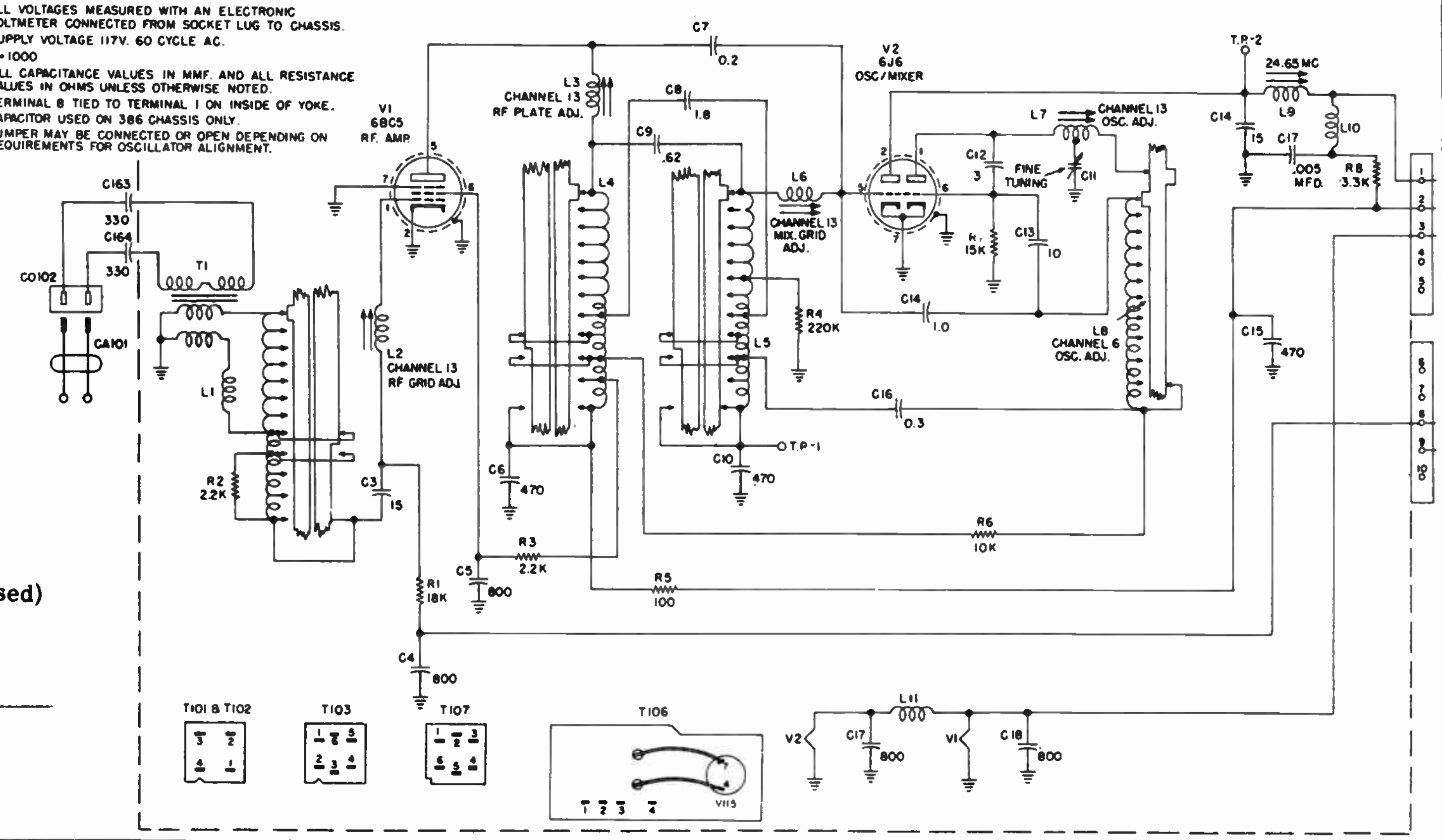
EU-21CDL (Mahogany)
EU-21CDLB (Blond)

Final Assembly and Cabinet - Model EU-21CDLB (Chasis 387)

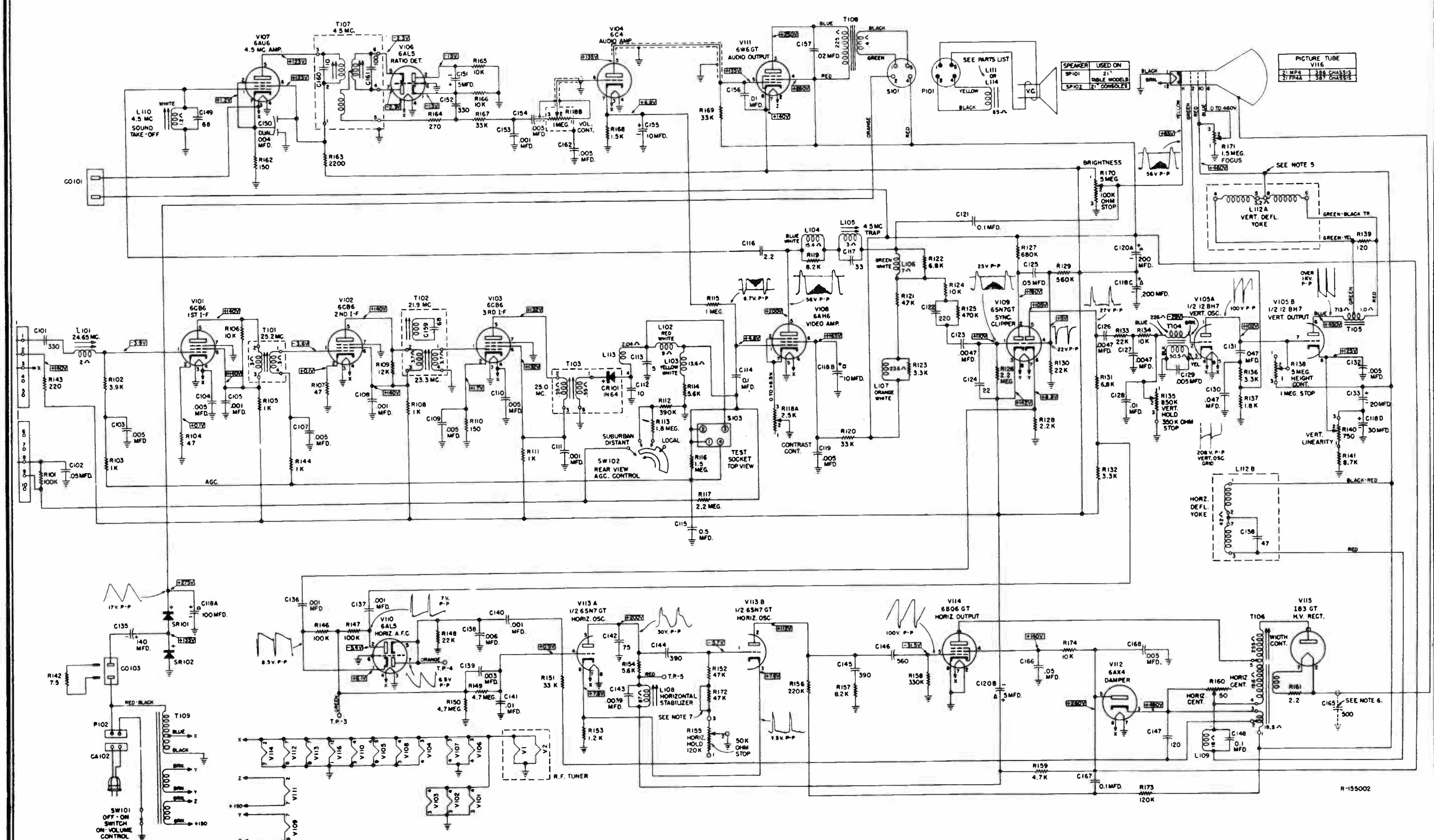
Part No.	Description	Part No.	Description
154377-2	Antenna, Assembly	154215-2	Knob, Tuning (Small)
154447	Back & Power Cable Assembly	154216-2	Knob, Contrast
155163	Bracket, Chassis Mtg. (4 used)	154217-2	Knob, Volume
155366-2	Cabinet	154265	Knob, Local-Suburban - Distance
149941-2	Catch, Doors (4 Used)	154270	Knob, Controls (Vertical - Horizontal Holds)
153550	Clip, Retainer (2 Used), Window & Mask Assembly	154351-2	Mask, Window
154023	Doors, One Pair	154313	Nail, Channel Indicator
155164	Insulation, Chassis Mtg. Bracket (4 Used)	145211-21	Nut (Wing), Speaker Mtg. (4 Used)
153781	Grille Cloth	154519-2	Plate, Name (Crosley)
149942	Hinge, Upper Left & Lower Right	149733-1	Pull (2 Used), Doors
149943	Hinge, Upper Right & Lower Left	154334-3	Screw, Chassis Mtg. (4 Used)
154214-2	Knob, Tuning (Large)	149941-1	Strike, Doors (4 Used)
		154382-3	Window, Tempered Glass

NOTES:

1. ALL VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS.
2. SUPPLY VOLTAGE 117V. 60 CYCLE AC.
3. K=1000
4. ALL CAPACITANCE VALUES IN MMF. AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
5. TERMINAL 8 TIED TO TERMINAL 1 ON INSIDE OF YOKE.
6. CAPACITOR USED ON 386 CHASSIS ONLY.
7. JUMPER MAY BE CONNECTED OR OPEN DEPENDING ON REQUIREMENTS FOR OSCILLATOR ALIGNMENT.



SCHEMATIC WIRING DIAGRAM - REVISED CHASSIS 386-387



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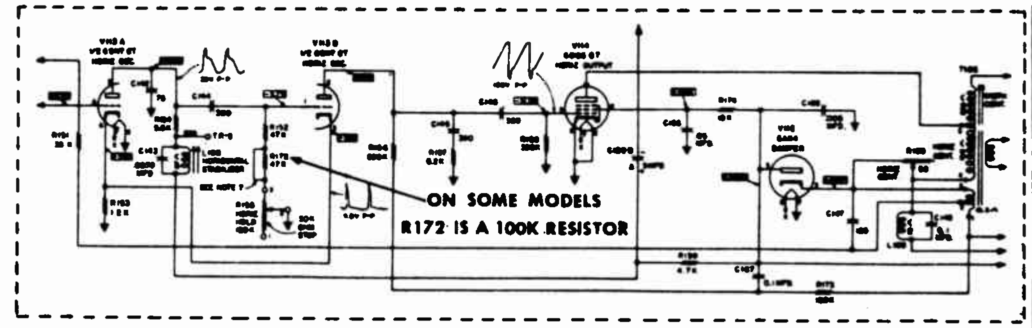
Chassis identified by a code letter later than the letter A also incorporate the changes in the previous coded chassis. For example a chassis identified by code letter D incorporates the changes in codes A, B, C & D.

CHASSIS 386 & 387 HORIZONTAL DEFLECTION TRANSFORMERS AND ASSOCIATED CODE LETTERS

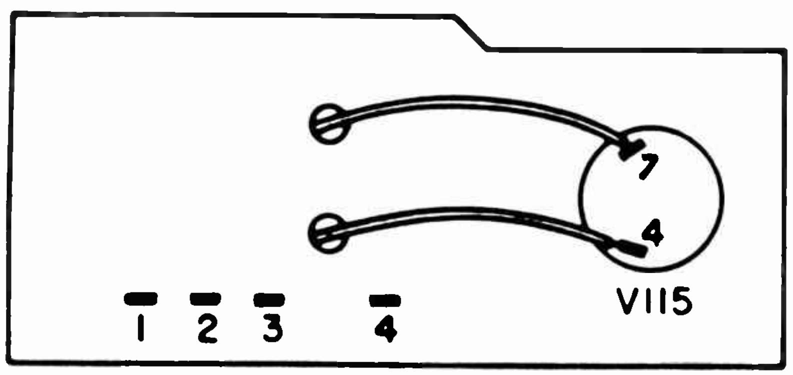
CHASSIS 386 & 387 (CODE LETTER B)
Increase High Voltage and Improve Stability



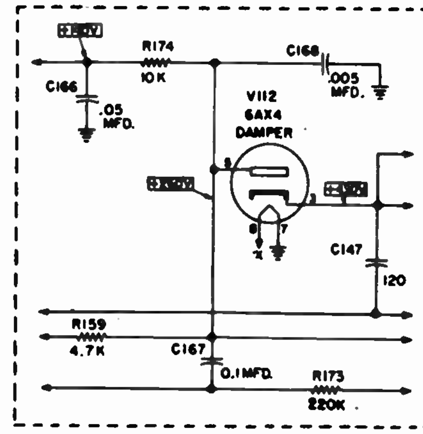
Chassis 386 & 387 (Code Letter A) - For Horizontal Deflection Transformer T106 (Part No. 154069-1), the terminal numbering sequence is as shown in sketch A.

T106

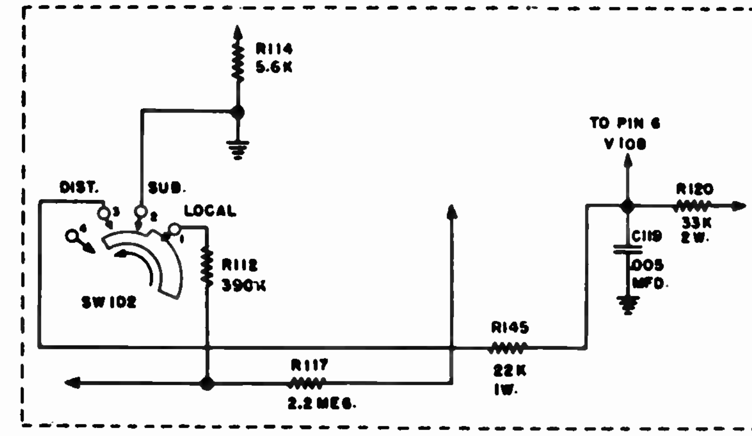
SKETCH A



Chassis 386 & 387 (Code Letter C)
To Reduce Horizontal fold over



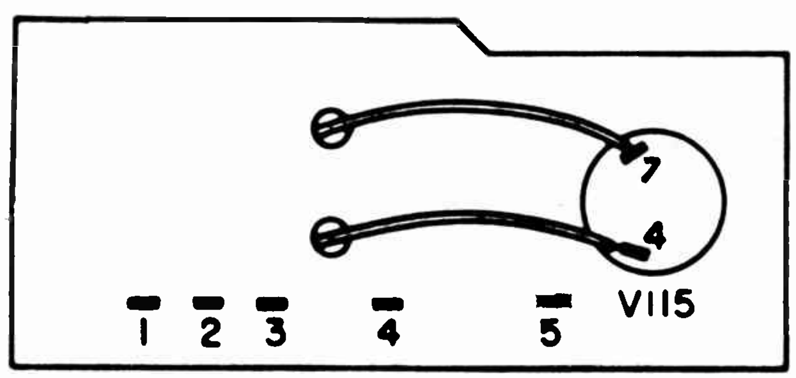
Chassis 386 (Code Letter E), and Chassis 387 (Code Letter D)
To Increase Vertical Sync. Stability



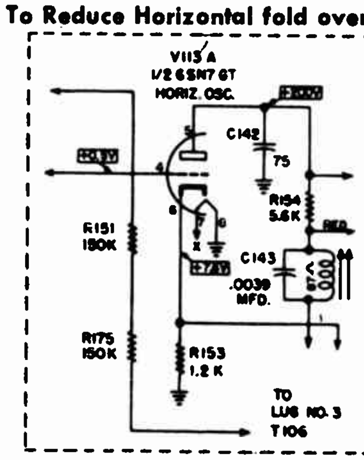
Chassis 386 & 387 (Code Letters B thru E) - For Horizontal Deflection Transformer T106 (Part No. 154990-1), the terminal numbering sequence is as shown in sketch B.

T106

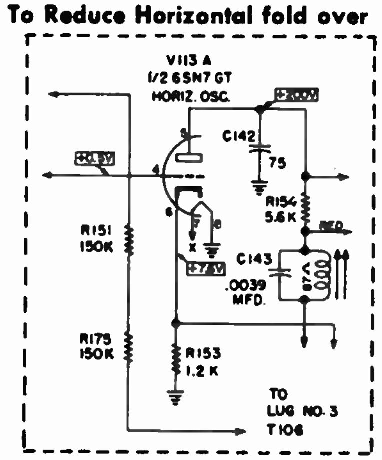
SKETCH B



Chassis 386 (Code Letter D)
To Reduce Horizontal fold over

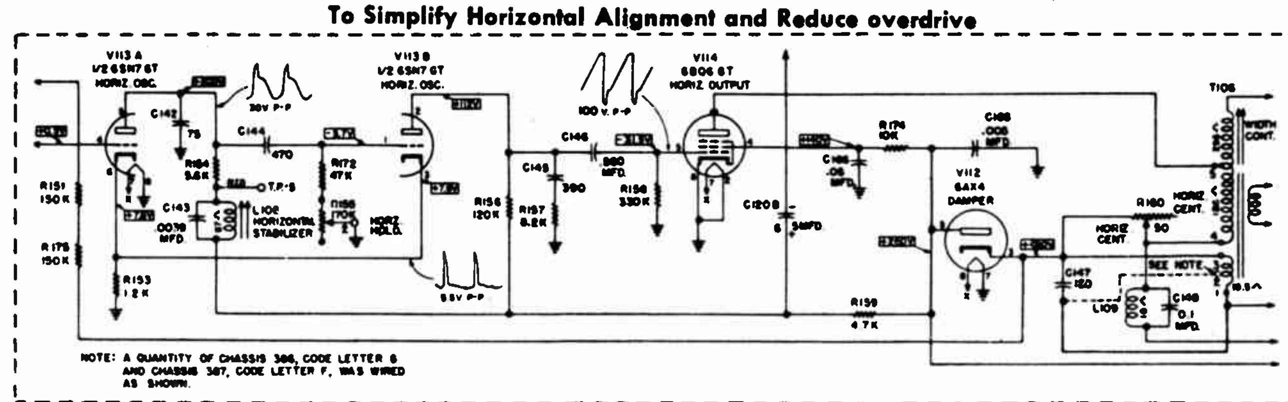


Chassis 386 (Code Letter F), and Chassis 387 (Code Letter E)
To Reduce Horizontal fold over



Chassis 386 (Code Letter H), and Chassis 387 (Code Letter G) - The Horizontal Deflection Transformer (Part No. 154990-1) can be used by omitting lug #2 and by wiring capacitor C147, 120 mmf., between lug #1 and #3.

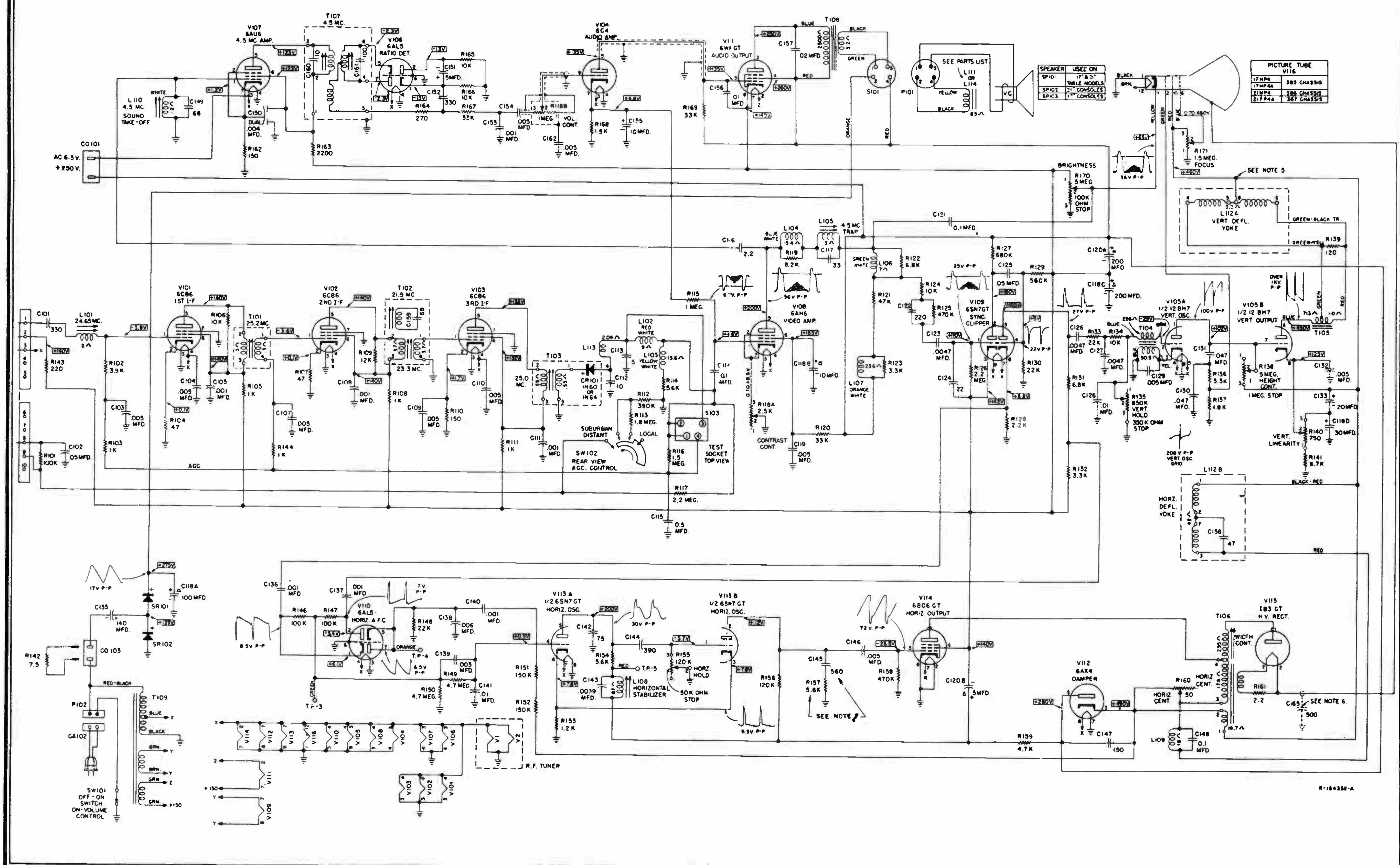
Chassis 386 (Code Letter H), and Chassis 387 (Code Letter G)
To Simplify Horizontal Alignment and Reduce overdrive



New Part Numbers for Chassis Code Letters H&G

Symbol No.	Part No.	Description
C144	137499-46	Capacitor, 470 mmf., 10%, 500 v., mica
R155	155511	Control, Horizontal Hold (170,000 ohm)
T106	154990-2	Transformer, Horizontal Output

SCHEMATIC WIRING DIAGRAM - CHASSIS 386 & 387 (CODE LETTER A)



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SCHEMATIC	35	VOLTAGE MEASUREMENTS . . .	35
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CAUTION

HIGH VOLTAGE--Operation of a television receiver with the back open involves a shock hazard. When making adjustments other than adjusting the controls at the front panel, all precautions for working near high voltage should be exercised.

HIGH TEMPERATURE OF TUBES--Some tubes in the receiver operate at extremely high temperatures. To avoid serious burns, do not touch these tubes while the receiver is operating, or until the tubes have cooled after the set is shut off.

HANDLING OF PICTURE TUBES--Breakage of the picture tube, which contains a high vacuum, may result in injury from flying glass. Do not scratch tube face or subject to more than moderate pressure. DO NOT REMOVE OR HANDLE THE PICTURE TUBE IN ANY MANNER UNLESS HEAVY GLOVES AND PROTECTIVE GOGGLES ARE WORN. Persons not so equipped should be kept away while handling the tube. NEVER GRASP THE TUBE BY THE NECK OR ALLOW PRESSURE TO BE EXERTED ON THE NECK. In installation, if the tube sticks or fails to slip smoothly through the deflection yoke, investigate and remove the cause of the trouble. DO NOT FORCE TUBE.

These receivers are equipped with twenty (20) tubes, two (2) selenium rectifiers, and a picture tube. They have a switch type tuner which tunes the twelve (12) VHF television channels (2 to 13), also a UHF Converter which covers the seventy (70) UHF television channels (14 to 83).

TUBE COMPLEMENT (VHF Chassis 396)

Symbol	Tube	Function	Symbol	Tube	Function
V1	6BC5	R-F Amplifier	V108	6AH6	Video Amplifier
V2	6J6	VHF Oscillator & Mixer	V109	6SN7GT	Sync. Clipper & Sync. Output
V101	6CB6	1st I-F Amplifier	V110	6AL5	Horizontal A.F.C.
V102	6CB6	2nd I-F Amplifier	V111	6W6GT	Audio Output
V103	6CB6	3rd I-F Amplifier	V112	6AX4	Horizontal Damper
V104	6C4	1st Audio Amplifier	V113	6SN7GT	Horizontal Oscillator
V105	12BH7	Vertical Oscillator & Output	V114	6BQ6GT	Horizontal Output
V106	6AL5	Ratio Detector (Sound)	V115	1B3GT	H.V. Rectifier
V107	6AU6	Sound Detector Driver	V116	17HP4 or 17HP4A	Picture Tube

TUBE COMPLEMENT (UHF Converter)

Symbol	Tube	Function
V1	6AF4	UHF Oscillator
V2	6BQ7 or 6BQ7A or 6BZ7	I-F Amplifier

INTERMEDIATE FREQUENCY:
Video Carrier — 26.4 mc.
Sound Carrier — 21.9 mc.
Intercarrier Sound — 4.5 mc.
UHF Output — Channels 5 or 6.

EU-17TOLU (Mahogany)
EU-17TOLBU (Blond)

EU-17COLU (Mahogany)
EU-17COLBU (Blond)

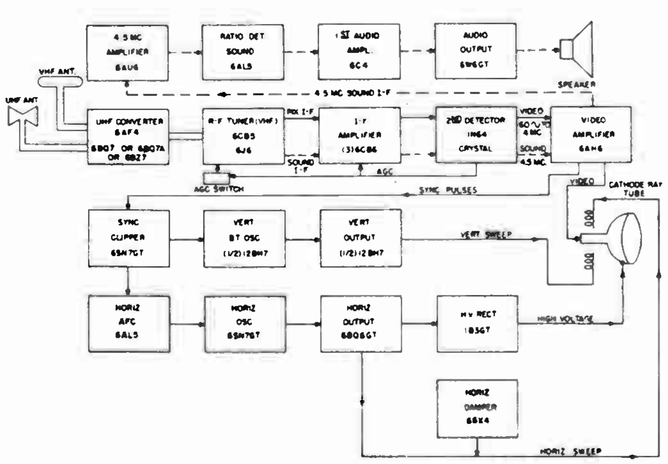
POWER SUPPLY: 117 volts, 60 cycle, a.c.

POWER CONSUMPTION: 140 watts.

AUDIO POWER OUTPUT: 2 watts maximum.

ANTENNA INPUT IMPEDANCE:
300 ohms balanced.

BLOCK DIAGRAM:



DEFLECTION: Electromagnetic.

FOCUS: Electrostatic.

ION TRAP: Single Permanent Magnet.

HORIZONTAL SCANNING FREQ.: 15,750 c.p.s.

VERTICAL SCANNING FREQ.: 60 c.p.s.

FRAME FREQUENCY: 30 c.p.s.

SCANNING: Interlaced, 525 lines.

SPEAKER:
17" Console Models 5¼" P.M.
17" Table Models 5¼" P.M.

VOICE COIL IMPEDANCE: 3.2 ohms at 400 cycles.

ANTENNAS

BUILT-IN ANTENNAS--The receiver is equipped with two antennas; one for VHF reception is enclosed in the cabinet and one for UHF reception is attached to the UHF antenna terminal board at the rear of the cabinet. These antennas will eliminate the need of an external antenna in some areas where the signal strength is sufficient. If you are in a location where the signal strength is not sufficient and it is impossible to obtain satisfactory results with the built-in antennas due to the above effects, or if the receiver is too far from the television station, it will be necessary to install an external antenna which is designed for both VHF and UHF, or two separate antennas--one designed for VHF and the other for UHF. Sometimes it is possible for VHF reception to be satisfactory on the built-in VHF antenna, but the reception of UHF on the built-in UHF antenna may be unsatisfactory; or vice versa. In these cases it is only necessary to install one external antenna designed for VHF or for UHF, depending on which built-in antenna is not providing satisfactory reception.

EXTERNAL ANTENNA--The choice of the proper type of antenna and its location are very important. Of equal importance is the installation of the antenna. In some localities where there are a number of stations operating, it may be impossible to eliminate all reflections.

CONNECTING EXTERNAL VHF ANTENNA--The antenna terminal board for the VHF antenna is located on a metal plate at the rear of the cabinet. Remove the wires of the built-in antenna that are fastened under the screws of the terminal board. Fasten the lead-in wires of the external antenna under these two screws. Cover bare ends of the wires from the built-in antenna with tape.

CONNECTING EXTERNAL UHF ANTENNA--The antenna terminal board for the UHF antenna is also located on the metal plate at the rear of the cabinet. Remove the UHF dipole antenna (wire loop) leads that are fastened under the two screws and attach the lead-in from the external UHF antenna. Do not drape or coil the lead-in wire and keep it away from the power cord (and also the speaker cable on console models).

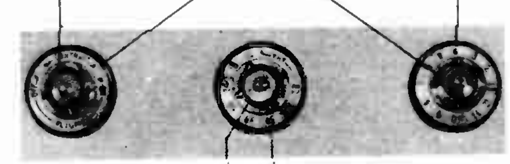
FRONT PANEL CONTROLS

CONTRAST CONTROL- Varies the picture output (increases or decreases the variations between light and dark areas of the picture) similar to the manner in which sound output is varied by the volume control.

OFF-ON-VOLUME- Turns the power off or on and varies the output of sound.

CHANNEL SELECTOR (VHF)- Selects the channel number of the desired VHF station. When tuning for VHF stations be sure the COURSE TUNING (UHF) is set to the VHF position (rotated completely counterclockwise).

FINE TUNING (VHF)- Tunes in the best picture, at which point sound is also received.



COURSE TUNING (UHF)-* Selects the channel number of the desired UHF station. To tune in a UHF station set the CHANNEL SELECTOR (VHF) to channel 5 or 6 as determined by the setting of the slide switch (see note below). Then set the COURSE TUNING (UHF) to the channel number of the desired UHF station.

FINE TUNING (UHF)- Tunes in the best picture, at which point sound is also received. Sometimes a slight adjustment of the Fine Tuning (VHF) will improve reception of a station.

*NOTE - The slide switch operated by a wire looped around the Contrast control shaft should be set, at the time of installation, to its forward position if a VHF station is not assigned to channel 5 in the area in which the receiver is being installed. To set the switch in its forward position, pull the Contrast and Off-On-Volume knobs from their shafts. Then pull the wires loop forward on the Contrast control shaft. If a VHF station is assigned to channel 5, set the switch toward the rear by pushing back on the wire loop. In this position the UHF stations can be tuned-in with the COURSE TUNING (UHF) and FINE TUNING (UHF) control knobs, when the CHANNEL SELECTOR (VHF) is set to channel 6. If no VHF station is assigned to channel 5 or to channel 6, set the switch for operation on either channel, whichever may provide the best reception. Be sure to inform the customer as to which channel (5 or 6) the switch has been set to operate on.

ADJUSTMENTS

1. ION TRAP ADJUSTMENT:

Adjust the BRIGHTNESS control for normal brightness. With the ION TRAP positioned close to the base of the picture tube, move the trap forward or backward and at the same time rotate in either direction until maximum brightness of the raster is obtained. Readjust the BRIGHTNESS control until the raster is slightly above average brilliance. Adjust the FOCUS CONTROL until the line structure of the raster is clearly visible. Readjust the ION TRAP again for maximum brightness.

There may be two locations on the tube neck where the ION TRAP will produce maximum brightness. Never set the trap to the forward position, always use the position closest to the tube base.

If there is a shadow in the corners of the raster, be sure the ION TRAP is properly adjusted. Do not sacrifice picture brilliance when adjusting the ION TRAP to overcome shadows in corner of picture. If corner shadows are present, be sure the DEFLECTION YOKE and CENTERING MAGNET are properly adjusted.

2. DEFLECTION YOKE AND BRACKET:

The DEFLECTION YOKE should be positioned as far forward as possible on the picture tube neck and rotated to the left or right as required to make the picture parallel with respect to the top and bottom of window frame.

3. CENTERING RASTER:

If the picture is off center and/or has neck shadow, rotate either or both CENTERING MAGNET levers to the left or right until the picture is centered on the screen and is free of neck shadow. The CENTERING MAGNET is located on the back cover of the DEFLECTION YOKE. To determine the correct picture centering, it may be necessary to reduce the size of the picture with the HEIGHT and WIDTH adjustments. After making adjustment of CENTERING MAGNET, readjust ION TRAP.

4. HEIGHT AND WIDTH ADJUSTMENTS:

The linearity and corresponding size controls will have to be adjusted together and with care to maintain picture symmetry. For this reason it is best to use a test pattern when making these adjustments. Adjust size of picture to fill the screen by means of the HEIGHT, WIDTH, VERTICAL LINEARITY.

5. VERTICAL LINEARITY ADJUSTMENTS:

The VERTICAL LINEARITY control has the effect of expanding the picture at an increasing rate from the bottom to the top of the picture. Adjustment of this control has the greatest effect on the top portion of the picture, some effect on the middle and very little effect on the bottom of the picture. The HEIGHT and FOCUS controls may need readjustment as a result of the change in position of the VERTICAL LINEARITY control.

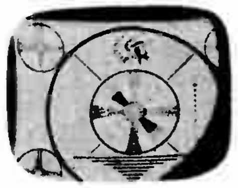
6. HORIZONTAL HOLD CONTROL:

The HORIZONTAL HOLD CONTROL is adjusted with a weak picture to the center of its pull-in range. If the pull-in range is insufficient or the horizontal sync is unstable, see "Horizontal Hold Adjustment" under "Alignment"

7. VERTICAL HOLD CONTROL:

The VERTICAL HOLD CONTROL is also adjusted to the center of its pull-in range with the contrast control set to obtain a weak picture.

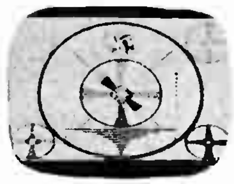
ADJUSTMENTS (Chassis 396)



Off Center and Neck Shadow

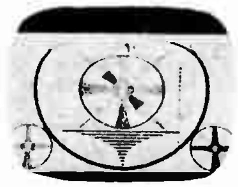
CENTERING MAGNET ADJUSTMENT — If the picture is off center and/or has neck shadow as shown in the illustration at the left, rotate either or both centering magnet levers to the right or left until the picture is centered on the screen and the picture is free of all neck shadow.

ION TRAP ADJUSTMENT — With the brightness control advanced just enough to dimly light up the face of the picture tube, slide the ion trap backward or forward and at the same time rotate it to the right or left until maximum brightness is obtained. If a neck shadow appears at any of the corners, refer to "Centering Magnet Adjustment" above.



Misadjusted Height

HEIGHT CONTROL — This control increases the overall height of the picture. When making this adjustment it is sometimes necessary to also adjust the VERTICAL LINEARITY to obtain a picture that is correctly proportioned.

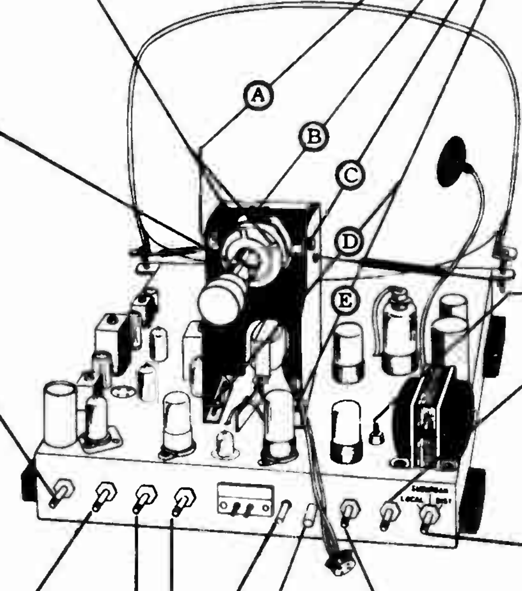


Misadjusted Vertical Linearity

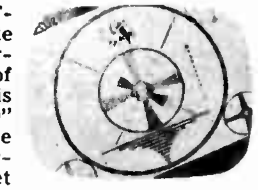
VERTICAL LINEARITY CONTROL — This control increases or decreases the height of the upper portion of the picture.

FOCUS CONTROL — Rotate to the right or left until the sharpest picture, or sharpest horizontal lines, are obtained.

BRIGHTNESS CONTROL — Turn clockwise to increase brightness. To decrease brightness, turn counter-clockwise.



DEFLECTION YOKE ADJUSTMENTS — The deflection yoke must be positioned as far forward as possible on the neck of the picture tube. To make this adjustment, loosen screws "D" and "E" enough to permit the yoke bracket to be pushed forward. While holding the bracket in the forward position, tighten screws "D" and "E". Screws "A" and "C" are for shifting the yoke up or down to center it around the picture tube neck. If the picture is tilted as illustrated at right, loosen wing nut "B". Then, rotate the yoke to left or right as required to make the picture parallel with respect to top and bottom of window frame. Be sure to hold the yoke in position while tightening the wing nut.



Picture Tilted

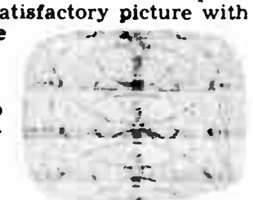
HORIZONTAL STABILIZER ADJUSTMENT — See "HORIZONTAL HOLD CONTROL".

Misadjusted Horizontal Hold

HORIZONTAL HOLD CONTROL — If the picture appears as shown in the illustration, adjust the horizontal hold control to right or left as required to lock in a single stationary picture. If the range of the control is not sufficient to lock in picture, set the control to its midway position and then adjust the horizontal stabilizer adjustment until the picture locks in.

LOCAL - SUBURBAN - DISTANCE SWITCH — In strong signal areas set this switch to its extreme counter-clockwise position (LOCAL). The middle position (SUBURBAN), and extreme clockwise position (DISTANCE) are used in areas where the signal is weak or medium strength. Set the switch in the position which provides the most satisfactory picture with minimum overloading when the contrast control is advanced.

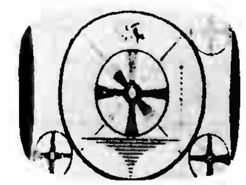
VERTICAL HOLD CONTROL — If the picture is moving up or down as illustrated at right, adjust the vertical hold control until a single stationary picture is obtained.



Misadjusted Vertical Hold

HORIZONTAL CENTERING CONTROL — If the picture is off center to the right or left, rotate this control in either direction as required to center the picture. The picture should become centered when this control is approximately at the middle of its range of adjustment if not, then set the control at the middle of its range. Then center the picture on the screen by adjusting the centering magnet levers as explained under "CENTERING MAGNET ADJUSTMENT"

WIDTH CONTROL — If the picture is too narrow as illustrated, or too wide, turn the width control clockwise or counter-clockwise as required to adjust the picture to the proper width of the viewing area on the screen.



Picture Too Narrow

8. FOCUS CONTROL:

Adjust the FOCUS CONTROL for best focus of the vertical and horizontal wedges at the center of the test pattern. If corner focus is poor, check position of DEFLECTION YOKE and ION TRAP. While observing the test pattern (or picture), make a slight readjustment of the VERTICAL HOLD control until the horizontal lines are least noticeable. This adjustment is very critical and will require only a very slight movement of the control shaft to obtain proper adjustment.

9. BRIGHTNESS CONTROL:

BRIGHTNESS CONTROL and CONTRAST control should be set to obtain as much shading in the picture as possible. If the Brightness control is set too low, the black and grays of the picture are black and if set too high, the black and grays of the picture will appear light and faded.

10. LOCAL-DISTANCE (AGC) SWITCH:

The LOCAL-DISTANCE SWITCH can be set to prevent the receiver from overloading in strong signal areas or to reduce "snow" in the picture in weak signal areas. In strong signal areas, the "LOCAL" (counter-clockwise) position of the switch must be used. The second and third positions "SUBURBAN" and "DISTANCE" are to be used in medium to weak signal areas. Use the position with which the best picture is obtained with a minimum of overloading of the receiver when the CONTRAST control is advanced.

11. OSCILLATOR ADJUSTMENT USING A TELEVISON SIGNAL:

Do not make any adjustments on the two oscillator adjusting screws unless the FINE TUNING control range is insufficient to properly tune-in the station. The adjusting screws are accessible through holes in the front of the chassis after the chassis is removed from the cabinet.

To make the adjustment, proceed as follows:

(a) Turn the receiver on and allow a warm-up period of approximately five minutes.

(b) For stations from channel 13 to channel 7, set the Station Selector Switch to the highest channel received and adjust the Contrast and Volume control for normal sound and picture. Set the Fine Tuning Control in the center of its range.

(c) Using a small non-metallic screwdriver, adjust the slotted head brass screw located to the left of shaft and above the fiber disc for the clearest and sharpest detail in the picture. This adjustment will be effective on all channels between 13 and 7. If other stations are operating in this range, it may be necessary to compromise slightly on the high channel adjustment so the other channels may be properly tuned-in.

(d) For Stations on channel 6 and below, set the station Selector Switch to the channel received closest to channel 6 and adjust the Contrast and Volume control for normal sound and picture. Set the Fine Tuning control in the center of its range.

(e) Using a small non-metallic screwdriver, adjust the slotted head brass screw located to the right of the shaft for the clearest and sharpest detail in the picture. This adjustment will effect all channels between 6 and 2.

ADJUSTMENTS

All lead connections from the signal generator and wobbulator must be shielded. Keep the exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The wobbulator, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

1. To Check I. F. Alignment on Oscilloscope:

(a) Lift the shield of the Oscillator - Mixer tube V2 sufficiently to clear the socket ground clips. Connect sweep signal generator "hot" lead to the underground tube shield and generator ground lead to the tuner chassis.

(b) Connect high side of oscilloscope to high side of contrast control (pin 2 and 7 of V108), and the low side to chassis.

(c) Apply - 3.0 volts D.C. bias to lug 4 of S103 (See sketch "Variable Bias Control"). Contrast control should be set in the maximum counter-clockwise position.

(d) With the generator sweep set at zero, connect an electronic voltmeter between lug 2 of S103 and chassis. Adjust the output of the generator to obtain a reading of 2 volts D.C. on the meter.

(e) Set generator to sweep from 20 mc. to 30 mc.

(f) Connect marker generator to sweep generator output leads and adjust to provide markers that appear in the curve (see nominal overall I. F. response curve).

(g) Observe curve and position of markers (see nominal overall I. F. response curve). Slight deviation in shape from the nominal response curve is permissible, but if any great deviation is noted, it will be necessary to re-align the I. F. Amplifier.

2. Alignment, I. F. & Tuner Assembly (with electronic voltmeter):

(1) Connect - 3.0 Volts D.C. bias supply to lug 4 of S103.

(2) Connect signal generator "hot" lead through a 1000 mmf. capacitor to TP-1 (wire protruding from tuner directly adjacent to the oscillator mixer tube V2) and ground lead to the R. F. tuner case.

(3) Connect high side of Electronic Voltmeter to lug 2 of S103 and low side to chassis.

(4) Set signal generator to 25.0 mc. and adjust bottom of T103 for maximum meter deflection, limiting meter deflection to 2 volts D.C. by adjusting input attenuator.

(5) Set signal generator to 23.3 mc. and adjust bottom of T102 for maximum D.C. meter indication. Adjust signal generator amplitude to make this peak indication approximately 2 volts D.C.

(6) Reset signal generator to 21.9 mc. and adjust the top of T102 for minimum D.C. meter deflection. Signal generator amplitude must be sufficiently high to produce a definite null. Meter must read at least 0.5 volts at null.

(7) Repeat steps 5 and 6.

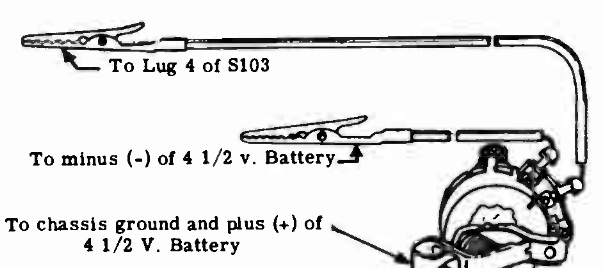
(8) Next set signal generator to 25.2 mc. and adjust bottom of T101 for maximum meter indication, limiting output of generator so peak reading will not exceed 2 volts D.C.

(9) Reset signal generator to 24.65 mc. Connect a 500 ohm resistor in series with a 500 mmf. capacitor from TP-2 (wire protruding from the tuner through the insulated eyelet between the brass adjusting screws) on the R. F. Tuner to the Tuner case. Adjust L101 for maximum meter deflection, but limit output of generator so this reading does not exceed 2 volts D.C. Remove the 500 ohm resistor and the 500 mmf. capacitor.

(10) Set signal generator to 24.65 mc. Connect the 500 ohm resistor and the 500 mmf. series capacitor across L101 and adjust mixer output (L9) on R.F. Tuner for maximum meter indication. Adjusting amplitude of signal generator to make this maximum indication approximately 2 volts D.C. Remove the 500 ohm resistor and the 500 mmf. capacitor.

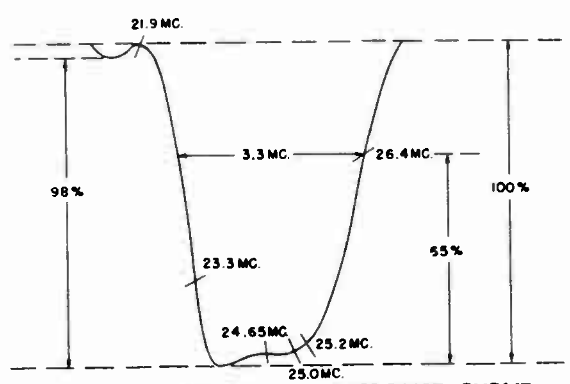
(11) Check sensitivity. The input for 2 volts D.C. output and zero bias should not exceed 150 microvolts at 24.65 mc. with a generator internal resistance of 1.5 ohms or less, and the local oscillator set to properly tune in channel 5.

(12) Remove the signal generator and electronic voltmeter.



5000 Ohm Control only, Part No. 144260

VARIABLE BIAS CONTROL ASSEMBLY



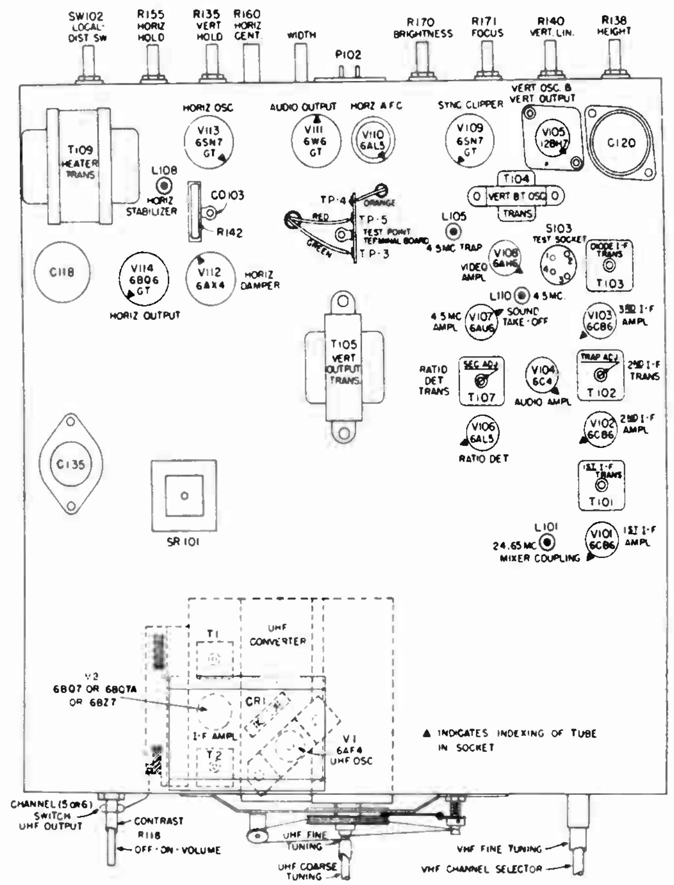
NOMINAL OVERALL I. F. RESPONSE CURVE
NOTE: Response as Seen by Means of Sweep Generator

SOUND ALIGNMENT

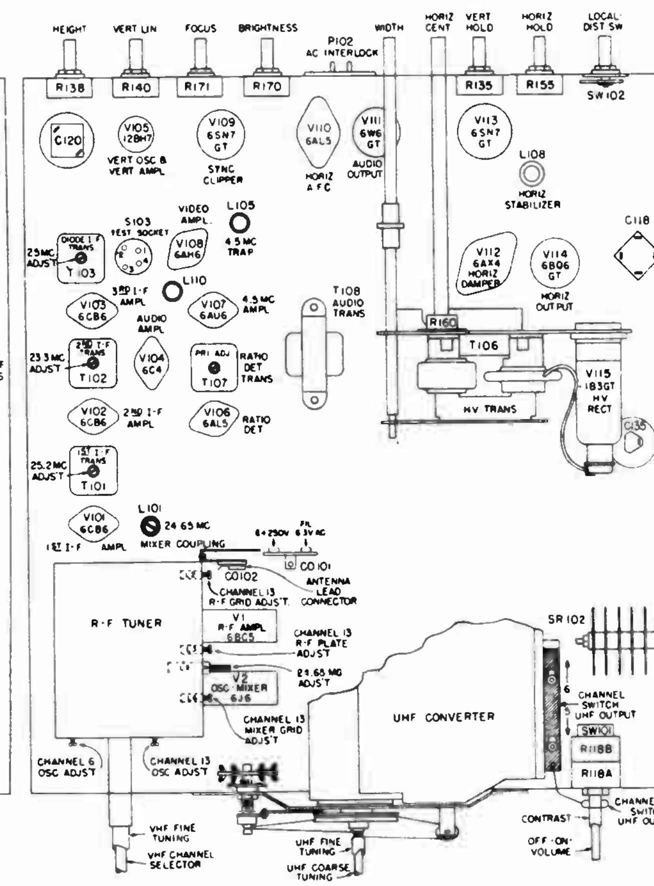
1. Connect crystal controlled 4.5 mc. 400 cycle amplitude modulated signal, modulated 30% or greater, to lug 2 of S103 and chassis.
2. Connect high side of scope through detector probe to the picture tube cathode (pin 11). Connect low side of scope to chassis. Adjust 4.5 mc. trap, L105 for minimum 400 cycle deflection on scope.
3. Connect electronic voltmeter to lug 2 of ratio detector, V106, and adjust 4.5 mc. sound take-off (L110) and bottom of ratio transformer (T107) for peak reading on voltmeter. Adjust input to make this peak reading 4 volts.
4. Adjust input to obtain 12 volts output. Transfer electronic voltmeter to junction of R167 and C153 (refer to Schematic Wiring Diagram). Adjust top of T107 for zero balance on electronic voltmeter.
5. Recheck steps 2, 3 and 4.
6. Remove input signal, scope and electronic voltmeter.

HORIZONTAL HOLD ADJUSTMENT

1. Tune in a local television signal and adjust contrast control for normal picture.
2. Connect electronic voltmeter between TP-3 (green lead) and chassis.
3. Short TP-4 (orange lead) to chassis and adjust electronic voltmeter to zero.
4. Remove short from TP-4. Do not change zero on electronic voltmeter.
5. Connect a 0.1 mfd. plus 20%, 600 volt capacitor between TP-5 (red lead) and chassis.
6. Adjust Horizontal Hold control for zero reading on the meter.
7. Remove the 0.1 mfd. capacitor from TP-5 and chassis. Do not disturb setting of horizontal hold control.
8. Adjust Horizontal Stabilizer coil (L108) for zero reading on the meter.
9. Remove electronic voltmeter from TP-3.
10. Check horizontal pull-in range. The pull-in range should be approximately 50^{0} of the controls rotation.



TV CHASSIS TOP VIEW
(Tube and Alignment Locations)



TV CHASSIS BOTTOM VIEW
(Tube Socket and Alignment Locations)

UHF ALIGNMENT

NOTES:

1. Remove the UHF Converter from the VHF receiver chassis.
2. Disengage the toggle coupling from the switch throw arm on the front of the UHF chassis.

   To accomplish this: -

   a. Turn the UHF tuning control clockwise until the pin located on the rear of the drive pulley is free from the toggle coupling.

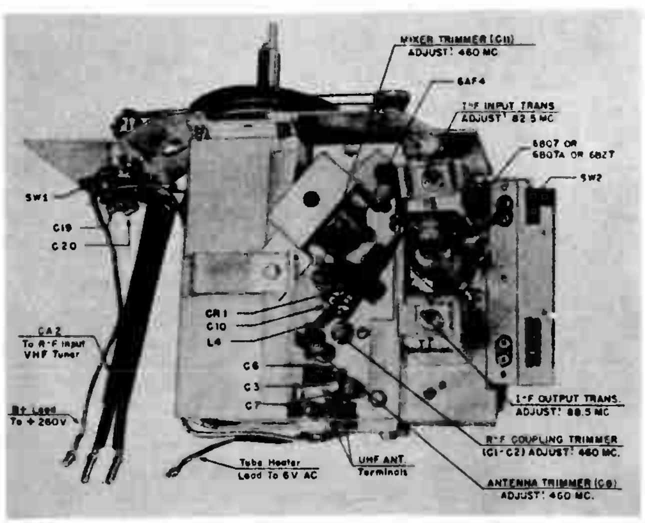
   b. Turn the switch throw arm to a vertical position to disengage fork of toggle coupling.

   c. Turn the toggle coupling counter-clockwise to a vertical position so that it does not interfere with the movement of the drive pulley.

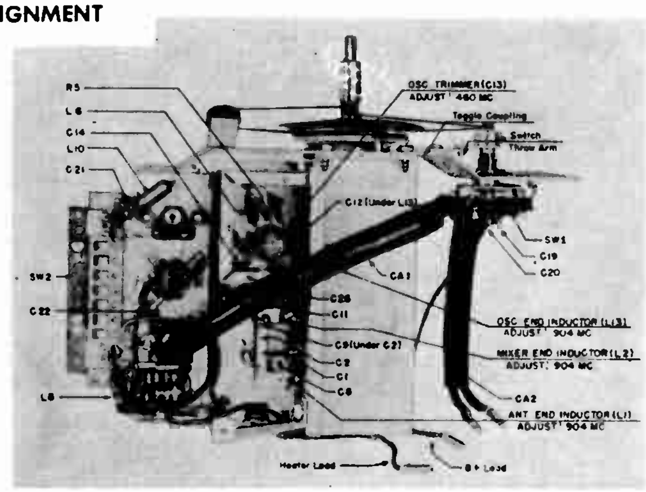
   d. Turn the switch throw arm counter-clockwise to the UHF position; top contact blade on switch rotor must contact and center on the two top switch fingers with the red wires attached. Leave switch in this position while aligning.
3. Connect the output leads of the UHF converter to the R-F input terminals of the VHF Tuner.
4. Connect the B+ and filament leads of the tuner to the VHF receiver. Connect UHF Converter chassis to B- (VHF receiver chassis).
5. Set VHF Tuner to channel 6.
6. Keep all leads as short as possible.
7. Alignment should be followed in the order shown.

I.F. ALIGNMENT:

1. Set I-F slide switch on the UHF Converter to Channel 6 (pushed toward the rear of chassis) position.
2. Connect an electronic voltmeter or oscilloscope across the second detector load resistor, R114 on the VHF chassis.
3. Turn on the power.
4. Apply an 82.5 mc. (amplitude modulated if a scope is used) signal to the junction of C2 and C9.
5. Adjust I-F input coil (T2) for peaking reading on meter (or maximum indication on scope).



Top View, UHF Converter

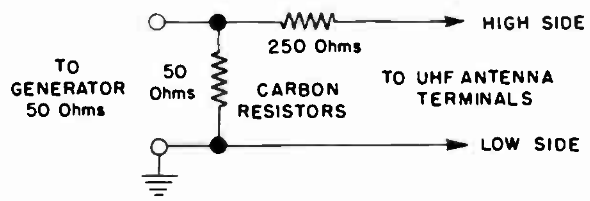


Bottom View, UHF Converter

6. Change signal generator frequency to 88.5 mc. and adjust I-F output coil (T1) for maximum reading or indication.
7. Repeat steps 4 through 6 until maximum readings are obtained.
8. Remove the generator connections from the junction of C2 and C9.

OSCILLATOR ALIGNMENT:

1. Connect an electronic voltmeter or scope across the second detector load resistor, R114.
2. Apply a 460 mc. (amplitude modulated when scope is used) signal to the UHF antenna terminals through the antenna matching network. (See Antenna Matching Network Sketch.)



Antenna Matching Network

3. With the tuner shaft at maximum counter-clockwise position, adjust the oscillator trimmer, C13 for peak reading on the electronic voltmeter (or maximum indication on scope).
4. Set the signal generator to 904 mc.
5. Rotate the tuner shaft to maximum clockwise position and adjust the oscillator end inductor, L13 for maximum reading on the voltmeter (or scope).
6. Repeat steps 2 through 5 until maximum reading is obtained.

R-F CIRCUIT ALIGNMENT:

1. With the signal generator and electronic voltmeter or scope connected as for the Oscillator Alignment above, set the R-F coupling trimmer, C1 and C2 to minimum capacity by turning the screw counter-clockwise.
2. Set the signal generator to 460 mc. (amplitude modulated with scope is used.)
3. With the tuner shaft at maximum counter-clockwise position, adjust the antenna and mixer trimmers, C8 and C11 for maximum meter reading (or scope indication).

UHF ALIGNMENT (Continued)

4. Reset signal generator to 904 mc.
5. Rotate the tuner shaft to maximum clockwise position and adjust the antenna and mixer end inductors, L1 and L2 for maximum reading on meter (or scope).
6. Repeat steps 2 through 5 until maximum reading is obtained.
7. Reset signal generator to 460 mc.
8. Turn the tuner shaft to maximum counter-clockwise position and adjust the coupling trimmer, C1 and C2 for peak reading.
9. Turn the power switch to the "OFF" position.
10. Disconnect the generator and electronic voltmeter, or scope.
11. Re-engage the toggle coupling in the pin on the switch throw arm and the pin on the drive pulley as follows:

    a. Rotate the tuning control shaft clockwise until the pin on the rear of the drive pulley is toward the base of the chassis.

    b. Turn the switch throw arm to a vertical position.

    c. Turn the toggle coupling approximately 45° clockwise from a vertical position.

    d. Turn the switch throw arm counter-clockwise until pin engages the upper fork on the toggle coupling.

    e. Turn the tuning shaft counter-clockwise and guide the pin on the rear of drive pulley into the lower fork of the coupling. The coupling is now in the proper operating position and when the tuning shaft is turned completely counter-clockwise, the switch will be thrown to the VHF position.
12. Replace the UHF Converter on the VHF receiver chassis.

CRITICAL LEAD AND COMPONENT DRESS VHF RECEIVER CHASSIS

R-F TUNER:

The brown AGC lead from the terminal board to the tuner should be dressed flat down to chassis.

I-F SECTION:

The component leads and wires in the video I-F section must be kept as short as possible.

R-F CHOKE:

The end of the R-F choke L113 which is wired to T103 lug 6, shall be as short as possible.

LEADS:

The black wire from T103, lug 4 to chassis must be as short as possible. All leads must be kept away from the plates of the selenium rectifiers, SR101 and SR102. Dress the red and blue leads of Audio Output Transformer, T108 away from the high voltage shield so they will not be pinched under it.

COMPONENTS:

Keep all components, particularly peaking coils, away from R121 which is wired between the terminal boards adjacent to V110.

RESISTORS:

Dress the fuse resistor R142 attached to the terminal board, up away from the chassis. On the 396 chassis, dress the two 150K ohm resistors, R151 and R152, in such a manner as not to short against the high voltage shield.

CAPACITORS:

The .006 mfd. capacitor, C138, wired from V114, pin 6, to ground lug of C118, should be dressed down close to the chassis.

The .005 mfd. capacitor, C162, which is wired from the case of R118 through the center lug of R118A to chassis, must have a very short lead on the end wired to the case of R118 so the body of the capacitor prevents any shorting to the shield wired to R118.

CONTROLS:

All controls and the local-distance switch must be kept from shorting to the chassis. Make sure the control does not turn when the nut is tightened.

HIGH VOLTAGE SECTION:

The plate cap of the 1B3GT, V115, should be put on so the lead comes away from it in a vertical direction. The vinyl tape that is applied to the corona ring should cover the entire outside edge of the ring and as much of the socket area as possible.

YOKE COUPLING NETWORK:

The yoke coupling network, L109, wired from T106 lug 3 to V112, lug 1, should be kept away from lug 4 of T106.

CRITICAL LEAD AND COMPONENT DRESS UHF CONVERTER

As the UHF Converter used in this receiver operates over a range (470 mc. to 890 mc.) of frequencies that are from approximately two to four times higher than the highest frequencies encountered in VHF tuners, placement of parts and component lead lengths in the circuit have considerable effect upon the performance of the unit. When replacing components or wiring, special note should be taken of the position of the part or wire to be replaced, before removal. New parts or wires should be located in the same position as those removed. Extremely critical points that require special attention are listed below.

Capacitors:

C3 C6 C7 — The capacitors C3, C6 and C7 in the antenna circuit must be placed with their leads as short and direct as possible.

C9 C10 — The capacitors C9 and C10, 3.3 mmf., must be placed with their leads as short and direct as possible.

C12 — The capacitor C12, 12 mmf., must be placed with only the silvered surface in contact with the lug to which it is soldered. They must be at right angles to the inductor. In order to avoid burning off the silver plating of the unit, the tip temperature of the iron used for soldering should not exceed 500°F. (260°C).

C13 — When the oscillator trimmer assembly, C13 is soldered to the socket contacts, base of trimmer must be firmly held flat against ribs in socket body while socket contacts are firmly seated in the socket body so that this construction is mechanically rigid. Failure to maintain mechanical rigidity in this assembly will result in difficult alignment and poor oscillator frequency stability.

C14 — Capacitor C14, 2.2 mmf., must be placed away from the chassis.

C19 C20 — Capacitors C19 and C20, should be dressed up and away from the function switch.

CRITICAL LEAD AND COMPONENT DRESS (Continued)
UHF CONVERTER

C21 Capacitor C21, 27 mmf. must be connected with shortest possible leads.

C22 Capacitor C22, 1000 mmf. must be oriented so that the flat side of lug is toward pin 2 on the V2 tube socket, in order that the lug may be bent over to the socket contact. If capacitor is not turned quite far enough when threads first begin to tighten, it may be rotated up to about a 1/2 turn further by application or greater torque to wrench. Care should be exercised to prevent stripping threads by turning too far.

RESISTOR:

R5 The resistor R5, 10,000 ohm, must be placed away from the chassis.

CHOKES:

L4 L6 The chokes L4 and L6 must be placed away from the chassis.

LEADS:

a. The B+ and heater leads leaving the oscillator radiation shield should be dressed down flat against the R-F chassis.

b. The short red lead joining slide switch terminal and terminal on I-F output transformer should be dressed in form of loop, up and away from chassis.

c. The red lead joining the crystal holder terminal and slide switch terminal should be as short and direct as possible, and dressed down against the chassis. There should be no excess lengths to be looped or doubled up.

R-F COUPLING TRIMMER:

Plates forming the R-F coupling trimmer (C1 and C2) must be placed so that the plates are parallel in both planes when trimmer screw is adjusted so that the plates are 1/32 inch apart. Plates should overlap 1/8 inch minimum. In order to accomplish this overlap, it may be necessary to decenter the parts on the UHF tuner tabs. If so, such decentering should be equally divided between the two parts.

OSCILLATOR:

a. The oscillator plate strap A-154740 (CO2) must be assembled with its bottom edge (as viewed from bottom of chassis) resting on the tube socket ribs and with the plane of part of the piece joining the two socket contacts perpendicular to chassis. In order to realize this condition, socket contacts must be firmly seated down against body of socket and "ears" on this piece must be inserted their full length into holes in socket contacts. Solder should be flown between socket contact and the piece for full length of socket contact, in order to avoid possibility of intermittent contact between socket contact and edge of this piece extending beyond "ears". Tab should be soldered flat against end of C12.

b. A dummy plug with hardened steel pins should be inserted in the oscillator socket before components are placed and soldered to socket lugs, to insure alignment of contacts.

CRYSTAL HOLDER:

When soldering connections to the crystal holder terminals, allow solder to flow between eyelet and terminal proper to insure a consistent electrical connection.

FUNCTION SWITCH:

The function switch must have all VHF position contacts fully and firmly made and all UHF position contacts fully broken when the UHF tuner shaft is at full counter-clockwise rotation. All VHF position contacts must be fully broken and all UHF position contacts must be fully and firmly made at 7 1/2° or more from full counter-clockwise rotation as tuner shaft is rotated in a clockwise direction.

PARTS LIST
TV CHASSIS 396 (Schematic Parts)

Symbol No.	Part No.	Description
C101	137727-129	Capacitor, 330 mmf., 500 v., ceramic
C102	39001-17	Capacitor, .05 mfd., 600 v., paper
C103	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C104	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C105	144675-14	Capacitor, .001 mfd., 500 v., disc ceramic
C107	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C108	144675-14	Capacitor, .001 mfd., 500 v., disc ceramic
C109	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C110	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C111	144675-14	Capacitor, .001 mfd., 500 v., disc ceramic
C112	137727-135	Capacitor, 10 mmf., 10%, 500 v., ceramic
C113	137727-103	Capacitor, 5 mmf., 10%, 500 v., ceramic
C114	39001-19	Capacitor, .1 mfd., 600 v., paper
C115	154157	Capacitor, .5 mfd., 25 v., paper
C116	154100-4	Capacitor, 2.2 mmf., 500 v., ceramic
C117	137727-126	Capacitor, 33 mmf., 10%, 500 v., ceramic
C118A	154099	Capacitor, 100 mfd., 300 v. } Electrolytic
C118B		Capacitor, 10 mfd., 300 v. } Electrolytic
C118C		Capacitor, 200 mfd., 200 v. } Electrolytic
C118D		Capacitor, 30 mfd., 150 v. } Electrolytic
C119	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C120A	154098	Capacitor, 200 mfd., 150 v. } Electrolytic
C120B		Capacitor, 5 mfd., 150 v. } Electrolytic
C121	39001-19	Capacitor, .1 mfd., 600 v., paper
C122	137727-131	Capacitor, 220 mmf., 10%, 500 v., ceramic
C123	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C124	137727-26	Capacitor, 22 mmf., 10%, 500 v., ceramic
C125	39001-17	Capacitor, .05 mfd., 600 v., paper
C126	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C127	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C128	39477-41	Capacitor, .01 mfd., 600 v., molded paper
C129	39001-11	Capacitor, .005 mfd., 600 v., paper
C130	39477-45	Capacitor, .047 mfd., 600 v., molded paper
C131	39477-45	Capacitor, .047 mfd., 600 v., molded paper
C132	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C133	154097	Capacitor, 20 mfd., 450 v., Electrolytic
C135	154096	Capacitor, 140 mfd., 150 v., Electrolytic
C136	137727-132	Capacitor, 1000 mmf., 10%, 500 v., ceramic
C137	137727-132	Capacitor, 1000 mmf., 10%, 500 v., ceramic
C138	39001-78	Capacitor, .006 mfd., 600 v., paper
C139	39001-76	Capacitor, .003 mfd., 600 v., paper
C140	39477-52	Capacitor, .001 mfd., 1000 v., molded paper
C141	39001-13	Capacitor, .01 mfd., 600 v., paper
C142	137727-134	Capacitor, 75 mmf., 10%, 500 v., ceramic
C143	137499-30	Capacitor, 3900 mmf., 10%, 500 v., mica
C144	137499-31	Capacitor, 390 mmf., 10%, 500 v., mica
C145	137499-34	Capacitor, 560 mmf., 10%, 500 v., mica

Symbol No.	Part No.	Description
C146	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C147	154102	Capacitor, 150 mmf., 10%, 3000 v., ceramic
C148	Part of L109	Capacitor, .1 mfd., 200 v., paper
C149	137727-133	Capacitor, 68 mmf., 10%, 500 v., ceramic
C150	144675-6	Capacitor, .004 mfd., 500 v. } disc ceramic
C150		Capacitor, .004 mfd., 500 v. } disc ceramic
C151	154103	Capacitor, 5 mfd., 50 v., Electrolytic
C152	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic
C153	144674-14	Capacitor, .001 mfd., 500 v., disc ceramic
C154	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C155	154104	Capacitor, 10 mfd., 50 v., Electrolytic
C156	39001-13	Capacitor, .0' mfd., 600 v., paper
C157	39001-80	Capacitor, .02 mfd., 600 v., paper
C158	Part of L112	Capacitor, 47 mmf., mica
C159	Part of T102	Capacitor, 68 mmf., 10%, 500 v.
C160	Part of T107	Capacitor, 10 mmf.
C161	Part of T107	Capacitor, 100 mmf.
C162	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
R101	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R102	39375-63	Resistor, 3900 ohm, 5%, 1/2 w.
R103	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R104	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R105	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R106	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R107	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R108	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R109	39375-75	Resistor, 12,000 ohm, 5%, 1/2 w.
R110	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R111	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R112	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R113	39374-67	Resistor, 1.8 megohm, 10%, 1/2 w.
R114	39375-67	Resistor, 5600 ohm, 5%, 1/2 w.
R115	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R116	39374-65	Resistor, 1.5 megohm, 10%, 1/2 w.
R117	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
R118A	154085	Control (Contrast), 2500 ohm } Assembly
R118B		Control (Volume), 1 megohm } Assembly
R119	Part of L104	Resistor, 8200 ohm, 10%, 1/2 w.
R120	39374-131	Resistor, 33,000 ohm, 10%, 1 w.
R121	39375-361	Resistor, 4700 ohm, 5%, 2 w.
R122	Part of L106	Resistor, 6800 ohm, 10%, 1/2 w.
R123	Part of L107	Resistor, 3300 ohm, 10%, 1/2 w.
R124	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R125	39374-57	Resistor, 470,000 ohm, 10%. 1/2 w.
R126	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
R127	39374-59	Resistor, 680,000 ohm, 10%, 1/2 w.
R128	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R129	39374-146	Resistor, 560,000 ohm, 10%, 1 w.
R130	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R131	39374-35	Resistor, 6800 ohm, 10%, 1/2 w.
R132	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R133	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R134	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R134	154087	Control, Vertical Hold (850,000 ohm)
R136	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R137	39374-28	Resistor, 1800 ohm, 10%, 1/2 w.
R138	154086	Control, Height (5 megohm)
R139	39374-14	Resistor, 120 ohm, 10%, 1/2 w.
R140	154088	Control, Vertical Linearity (750 ohm)
R141	154084	Resistor, 8700 ohm, 5%, 5 W. Wire Wound
R142	154089	Resistor, 7.5 ohm, 10%, 5 W. Wire Wound (Fuse type)
R143	39374-17	Resistor, 220 ohm, 10%, 1/2 w.
R144	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R146	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R147	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R148	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.

PARTS LIST
TV CHASSIS 396 (Schematic Parts)

Symbol No.	Part No.	Description
R149	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R150	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R151	39374-139	Resistor, 150,000 ohm, 10%, 1 w.
R152	39374-139	Resistor, 150,000 ohm, 10%, 1 w.
R153	39374-26	Resistor, 1200 ohm, 10%, 1/2 w.
R154	39374-34	Resistor, 5600 ohm, 10%, 1/2 w.
R155	154093	Control, Horizontal Hold (120,000 ohm)
R156	39374-50	Resistor, 120,000 ohm, 10%, 1/2 w.
R157	39374-34	Resistor, 5600 ohm, 10%, 1/2 w.
R158	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R159	39374-121	Resistor, 4700 ohm, 10%. 1 w.
R160	154083	Control, Horizontal Centering (50 ohm)
R161	39303-12	Resistor, 2.2 ohm, 10%, 1/2 w. Wire Wound
R162	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R163	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R164	39374-18	Resistor, 270 ohm, 10%, 1/2 w.
R165	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R166	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R167	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R168	39374-27	Resistor, 1500 ohm, 10%, 1/2 w.
R169	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R170	154095	Control, Brightness (5 megohm)
R171	154094	Control, Focus (1.5 megohm)
L101	155178	Coil, Converter I. F.
L102	154171	Coil, Video Peaking (168 microhenry, 5%)
L103	154184	Coil, Video Peaking (335 microhenry, 5%)
L104	154194	Coil, Video Peaking (412 microhenry, 5%)
L105	154158	Trap, (4.5 megacycle)
L106	154206	Coil, Video Peaking (106 microhenry, 5%)
L107	154176	Coil, Video Peaking (840 microhenry, 5%)
L108	154220	Coil, Horizontal Osc.
L109	154156	Network, Yoke Decoupling

Symbol No.	Part No.	Description
L110	154183	Coil, Sound Take Off
L111	154799	Choke, Filter (used on SP 101)
L112	154221-5	Yoke, Deflection
L113	154376	Coil, R. F. Choke
L114	154799	Choke, Filter (used on SP 103)
T101	155174	Transformer, 1st. I. F.
T102	155173	Transformer, 2nd. I. F.
T103	155179	Transformer, Diode I. F.
T104	154105-1	Transformer, Vertical Blocking Osc.
T105	154106	Transformer, Vertical Output
T106	154069-1	Transformer, Horizontal Output
T107	154108	Transformer, Ratio Detector
T108	154109-1	Transformer, Audio Output
T109	154720	Transformer, Filament
CA102	132300-6	Cable & Plug Assy., Power
SW101	Part of R118B	Switch, ON-OFF (Power)
SW102	154115	Switch, A.G.C. Control
SP101	138762-7	Speaker, P. M. (5-1/4")
SP103	138762-7	Speaker, P. M. (5-1/4")
S101	154178	Cable & Connector Assy., (used with SP103)
S102	154113	Socket, Test (Connector)
P101	154243	Plug, Speaker Cable (used with SP103)
P102	154125	Plug, Interlock
SR101	154112	Selenium Rectifier
SR102	154112	Selenium Rectifier
CR101	154111	Crystal (1N64)
CO101	155049	Terminal Boards & Bracket Assy., Antenna (VHF, UHF)
CO102	154114	Connector
CO103	154114	Connector
CO104	154114	Connector

TV CHASSIS 396

Symbol No.	Part No.	Description
	154256	Block, Chassis Mtg.
	154275-1	Bracket (frame), Deflection Yoke Mtg.
	154253	Bracket, Deflection Yoke Mtg.
	154190	Bracket, Tuner Mtg.
	154255-2	Bracket, Picture Tube Stop
	154318	Cable, Shielded (18" long) Twin Lead
	154349-1	Cable, Shielded (9" long)
	154349-2	Cable, Shielded (6-1/2" long)
	154266-1	Channel (Rubber 3"), Picture Tube Strap
	155052	Channel (Rubber 3/4"), Picture Tube Stop Bracket
	154276-2	Channel (Rubber 10 5/16"), Deflection Yoke Assy.
	154180	Coil (High Voltage), Horizontal Deflection Assy.
	154181	Coil,(Primary), Horizontal Deflection Assy.
	155102-1	Connector, Picture Tube Anode
	154124	Coupling Shaft Width Control
	153424-3	Cushion (Rubber, 1/6" x 1-1/4" x 23"), Picture Tube
	154122-1	Grid Cap (V114)
	154134	Grommet (Rubber, 4 used) Tube Mtg. (V105, V113)
	154259	Insulator, Antenna Lead
	154260	Insulator (1-3/16" x 1-7/32" Phenolic), Controls
	154264	Insulator, Interlock
	154268	Insulator (1-13/16" x 19/32" x 1/16" Armite), R. F. Tuner Shaft
	153109-2	Ion Trap
	39012-102	Iron Core
	39012-95	Iron Core
	39012-96	Iron Core
	154073	Iron Core, Horizontal Deflection Assy.
	39012-115	Iron Core
	155298	Key, Centering Control Shaft
	153580	Nut (Wing), Deflection Yoke
	154257-2	Picture Tube Rest (2 used)
	154314	Plate (Bearing), R. F. Tuner Shaft
	154075	Plate, Horizontal Width Control
	154129	Plate, Tube Mtg. (V105, V113)
	154079-1	Ring, (Retaining, 3 used), Width Control Shaft Assy.
	154119	Ring (Retaining), Centering Control Shaft Key
	155299	Shaft, Centering Control
	154267	Shaft, Width Control
	154077	Shaft, Width Control (Horizontal Deflection Assy.)
	155027	Shaft, R. F. Pentode Assy.
	154152	Shielded Corona
	154195	Shield, High Voltage
	39008-37	Shield (Spiral) R. F. Tuner Assy.
	149572	Sleeving (36" Lengths), Plate Lead V113, 6-1/2" long
	149572	Sleeving (36" Lengths), Anode Lead 4" long
	154148-2	Socket & Cable Assy., Picture Tube
	154203	Socket, Tube (V113)
	154192	Socket, Tube (V105)
	154092	Socket, Tube (V115)
	154117	Socket, Tube (V110)
	154146	Socket, Tube (V101, V102, V103, V107)
	154131	Socket, Tube (V109, V111, V114)
	154130	Socket, Tube (V112)
	154127	Socket, Tube (V104, V106, V108)
	149671	Spring (Grounding), Deflection Yoke Assy.
	154072	Spring (Clip), Horizontal Deflection Assy.
	154071	Spring (Strap), Horizontal Deflection Assy.
	154120	Spring, Horizontal Centering Control Shaft
	154205	Strap, Picture Tube
	154170	Terminal Board, Horizontal Deflection Assy.
	154116	Tuner, R. F. Pentode Assy.
	91595-1	Washer (Flat), Width Control Shaft
	154140	Washer (Protruded), Controls
	149180	Washer (Spring), Width Control Shaft

UHF CONVERTER

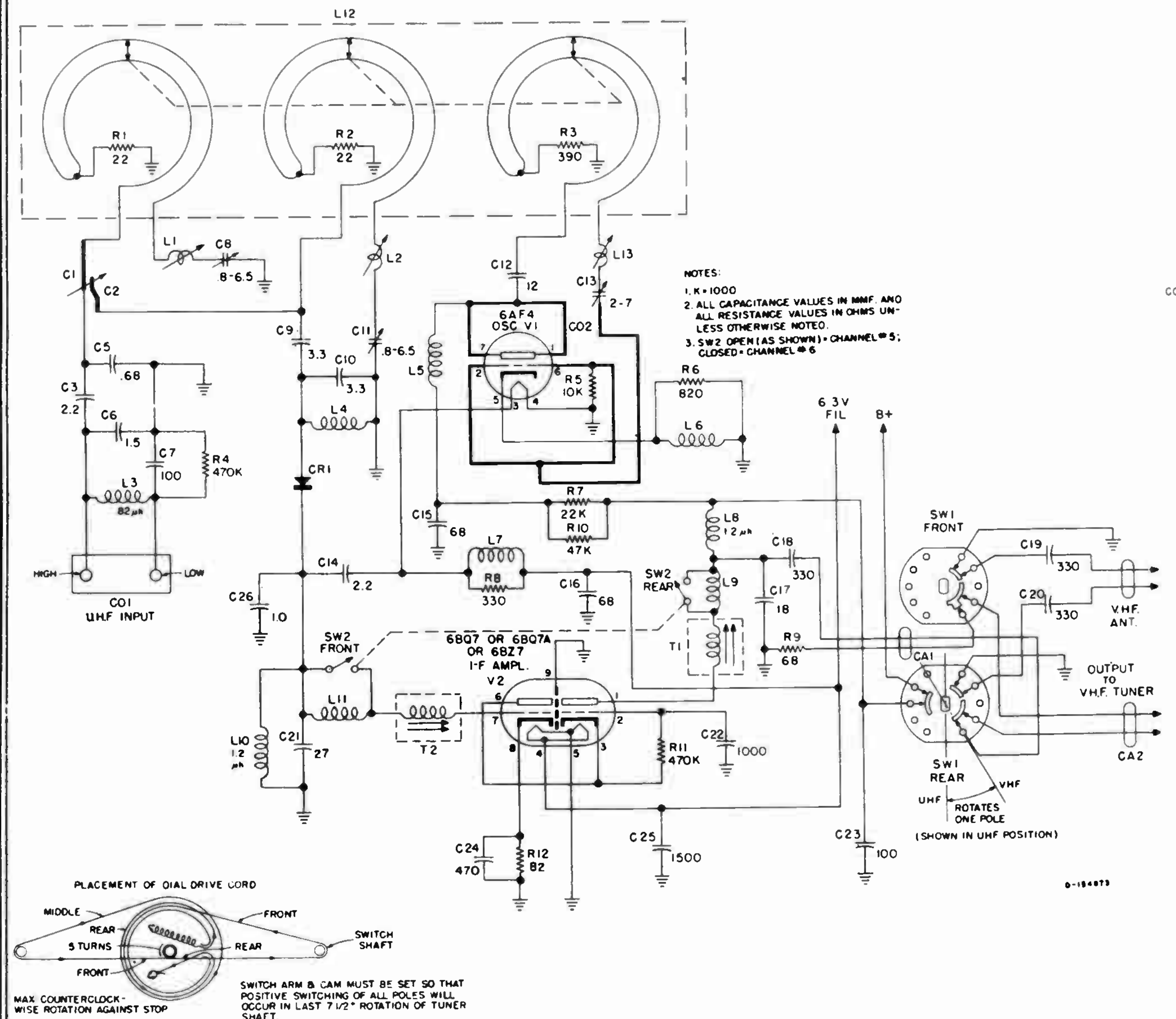
Symbol No.	Part No.	Description
C1	153835	Stator, R. F. Coupling Trimmer
C2	151890	Rotor, R. F. Coupling Trimmer
C3	152997-1	Capacitor, 2.2 mmf., 10%, 500 v., ceramic
C5	152997-6	Capacitor, .68 mmf., 10%, 500 v., ceramic
C6	152997-3	Capacitor, 1.5 mmf., 10%, 500 v., ceramic
C7	144675-27	Capacitor, 100 mmf., 500 v., disc ceramic
C8	151880-2	Capacitor, .8-6.5 mmf.
C9	152997-4	Capacitor, 3.3 mmf., 10%, 500 v., ceramic
C10	152997-4	Capacitor, 3.3 mmf., 10%, 500 v., ceramic
C11	151880-2	Capacitor, .8-6.5 mmf.
C12	155077-1	Capacitor, 12 mmf., 5%, 500 v., ceramic
C13	154777-1	Capacitor, 2-7 mmf.
C14	152997-1	Capacitor, 2.2 mmf., 10%, 500 v., ceramic
C15	152997-8	Capacitor, 68 mmf., 10%, 500 v., ceramic
C16	152997-8	Capacitor, 68 mmf., 10%, 500 v., ceramic
C17	137727-66	Capacitor, 18 mmf., 10%, 500 v., ceramic
C18	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic
C19	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic
C20	137727-129	Capacitor, 330 mmf., 10%, 500 v., ceramic
C21	137727-136	Capacitor, 27 mmf., 10%, 500 v., ceramic
C22	154808	Capacitor, 1000 mmf., 500 v.
C23	144675-27	Capacitor, 100 mmf., 500 v., ceramic
C24	137727-104	Capacitor, 470 mmf., 10%, 500 v., ceramic
C25	137727-113	Capacitor, 1500 mmf., 10%, 500 v., ceramic
C26	152997-2	Capacitor, 1 mmf., 10%, 500 v., ceramic
R1	Part of L12	Resistor, 22 ohm, 10%, 1/2 w.
R2	Part of L12	Resistor, 22 ohm, 10%, 1/2 w.
R3	Part of L12	Resistor, 390 ohm, 10%, 1/2 w.
R4	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R5	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R6	39374-24	Resistor, 820 ohm, 10%, 1/2 w.
R7	39374-217	Resistor, 22,000 ohm, 10%, 2 w.
R8	39374-19	Resistor, 330 ohm, 10%, 1/2 w.
R9	39374-11	Resistor, 68 ohm, 10%, 1/2 w.
R10	39374-133	Resistor, 47,000 ohm, 10%, 1 w.
R11	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R12	39374-12	Resistor, 82 ohm, 10%, 1/2 w.
L1	Part of C8	Inductance
L2	Part of C11	Inductance
L3	148936-2	Choke (.82 microhenry)
L4	154847	Choke (.143 microhenry)
L5	154788	Choke, Oscillator Plate (.182 microhenry)
L6	153286	Choke, Oscillator Cathode (.512 microhenry)
L7	151912	Choke & Resistor Assembly
L8	148936-4	Choke (1.2 microhenry)
L9	154788	Choke (.182 microhenry)
L10	148936-4	Choke (1.2 microhenry)
L11	154789	Coil (.105 microhenry)
L12	154711	Inductuner
L13	Part of C13	Inductance
T1	154760	Transformer, I. F. Output
T2	154759	Transformer, I. F. Input
SW1	154721	Switch, Function
SW2	154728	Switch, Slide
SW2	154727	Switch, Body
CA1		Transmission Line (300 ohm), 6-3/4" long
CA2		Transmission Line (300 ohm), 5-7/8" long
CO1	154781	Terminal Board, UHF Antenna
CO2	154740	Strap, Oscillator Plate
CR1	151871	Crystal, Germanium
	154758	Arm & Hub Assembly, Function Switch
	154803	Cotter Pin (External)
	39012-111	Iron Core
	137939-1	Pulley, DriverCord Idler
	137940-1	Rivet, DriverCord Idler Pulley
	151883	Screw (6-32 Nylon)
	39311-2	Screw (Set), Arm & Hub Assembly
	153806	Shield, Inductuner
	154677	Shield, Tube (V1)
	51752	Spring, Dial Drive Cord
	152053	Socket, Tube (V1)
	152078	Socket, Tube (V2)

Final Assembly and Cabinet-Model EU-17TOLU (Chassis 396)

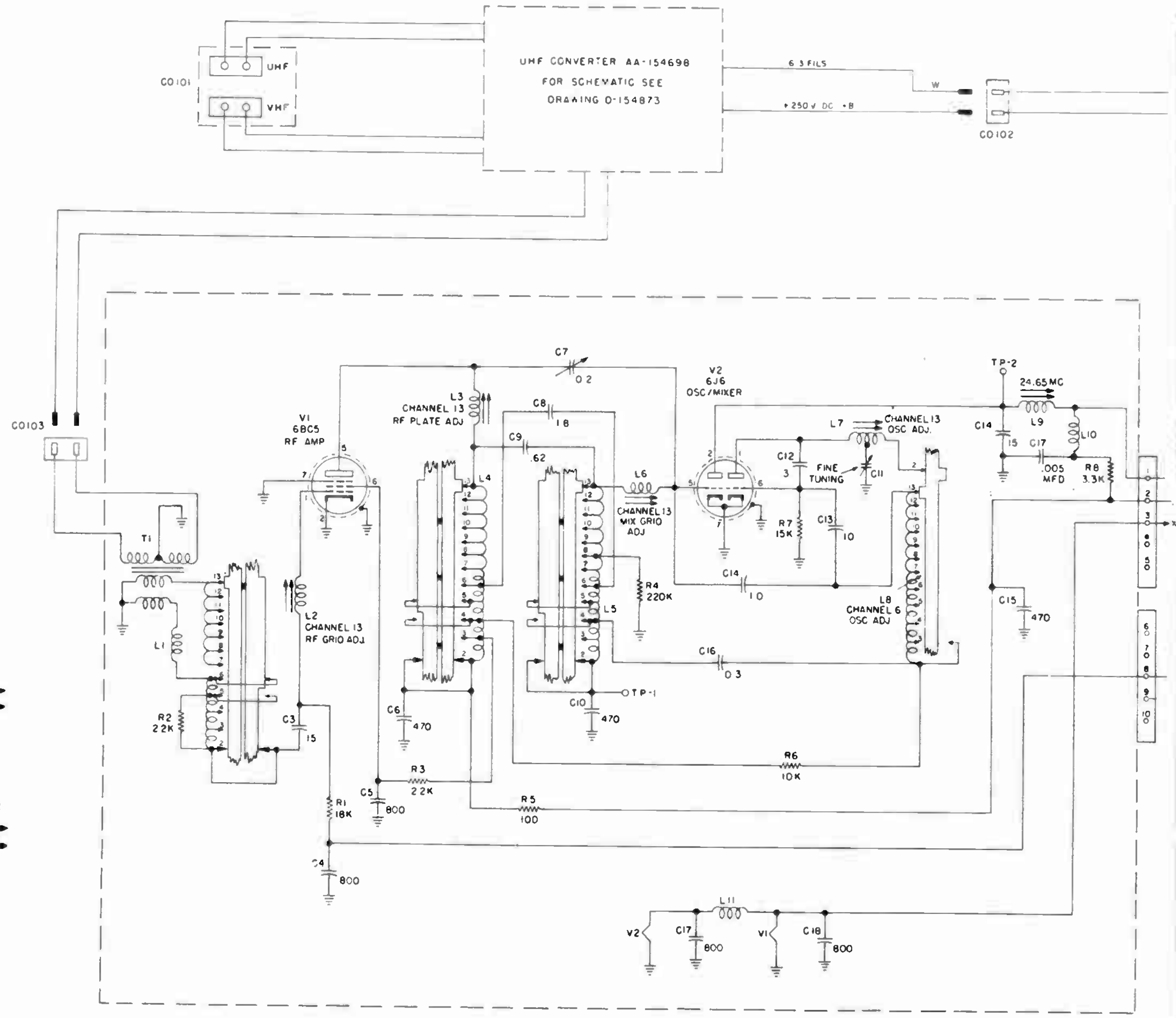
Symbol No.	Part No.	Description
	154377	Antenna Assy., VHF
	154965	Antenna Assy., UHF
	154974	Back & Power Cable Assy.
	154222-3	Cabinet
	132300-6	Cable & Plug Assy., Power
	153751	Clip (4 used), Window Retainer
	144600	Grille Cloth
	154216-1	Knob, Contrast
	154214-1	Knob (Large), Tuning, UHF & VHF
	154215-1	Knob (Small), Tuning, VHF
	154841-1	Knob (Small), Tuning, UHF
	154217-1	Knob, Volume
	154265	Knob, Local-Suburban-Distance
	154270	Knob, Controls (Vertical-Horizontal, Holds)
	154154	Mask, Window
	154313	Nail, Channel Indicator
	154347-1	Name Plate, Crosley
	145211-22	Nut (Wing), Speaker Mtg.
	154334-1	Screw, Chassis Mtg.
	154101	Window, Tempered Glass

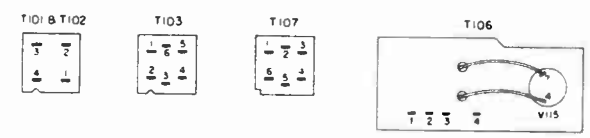
Final Assembly and Cabinet-Model EU-17TOLBU (Chassis 396)

Symbol No.	Part No.	Description
	154377	Antenna Assy., VHF
	154965	Antenna Assy., UHF
	154974	Back & Power Cable Assy.
	154222-4	Cabinet
	132300-6	Cable & Plug Assy., Power
	153751	Clip (4 used), Window Retainer
	145472	Grille Cloth
	154216-2	Knob, Contrast
	154214-2	Knob (Large), Tuning UHF & VHF
	154215-2	Knob (Small), Tuning, VHF
	154841-2	Knob (Small), Tuning, UHF
	154217-2	Knob, Volume
	154265	Knob, Local-Suburban-Distance
	154270	Knob, Controls (Vertical-Horizontal, Holds)
	154154	Mask, Window
	154313	Nail, Channel Indicator
	154347-1	Name Plate, Crosley
	145211-22	Nut (Wing), Speaker Mtg.
	154334-1	Screw, Chassis Mtg.
	154101	Window, Tempered Glass



SCHEMATIC WIRING DIAGRAM
UHF CONVERTER





NOTES:

1 ALL VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS.
2 SUPPLY VOLTAGE 117V 60 CYCLE AC
3 K=1000
4 ALL CAPACITANCE VALUES IN MMF AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED
5 TERMINAL 8 T110 TO TERMINAL 1 ON INSIDE OF YOKE.

PARTS LIST

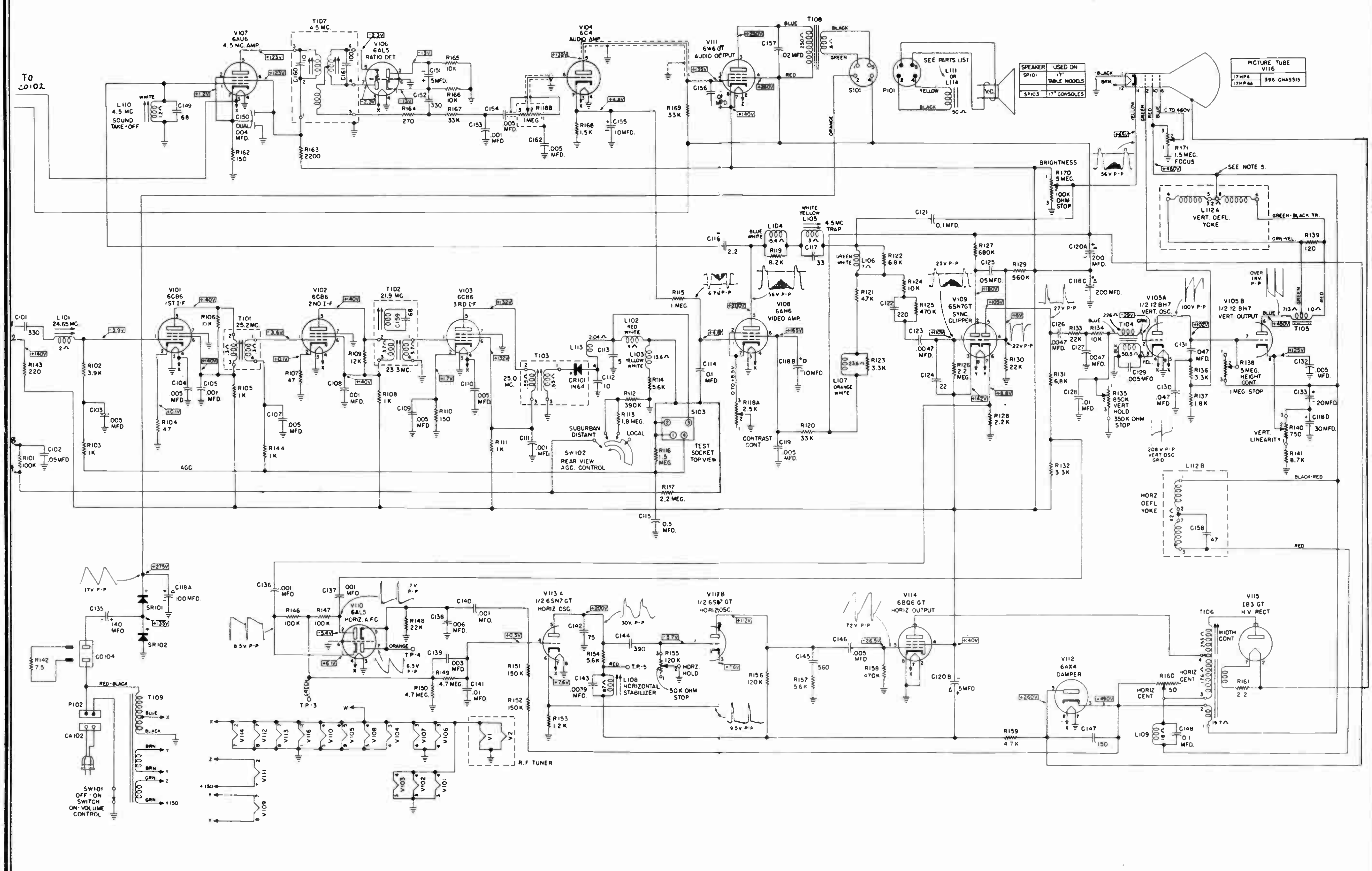
Final Assembly and Cabinet-Model EU-17COLU (Chassis 396)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377	Antenna Assy., VHF		154841-1	Knob (Small), Tuning, UHF
	154965	Antenna Assy., UHF		154217-1	Knob, Volume
	154974	Back & Power Cable Assy.		154265	Knob, Local-Suburban-Distance
	154269-1	Cabinet		154270	Knob, Controls (Vertical-Horizontal Hold)
	132300-6	Cable & Plug Assy., Power			
	153751	Clip (4 used), Window Retainer		154154	Mask, Window
	154451	Grille Cloth		154313	Nail, Channel Indicator
	154216-1	Knob, Contrast		154347-1	Name Plate, Crosley
	154214-1	Knob (Large), Tuning, UHF & VHF		145211-22	Nut (Wing), Speaker Mtg.
				154334-2	Screw, Chassis Mtg.
	154215-1	Knob (Small), Tuning, VHF		154101	Window, Tempered Glass

Final Assembly and Cabinet-Model EU-17COLBU (Chassis 396)

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
	154377	Antenna Assy., VHF		154841-2	Knob (Small), Tuning, UHF
	154965	Antenna Assy., UHF		154217-2	Knob, Volume
	154974	Back & Power Cable Assy.		154265	Knob, Local-Suburban-Distance
	154269-2	Cabinet		154270	Knob, Controls (Vertical-Horizontal, Hold)
	132300-6	Cable & Plug Assy., Power			
	153751	Clip (4 used), Window Retainer		154154	Mask, Window
	154452	Grille Cloth		154313	Nail Channel Indicator
	154216-2	Knob, Contrast		154519-2	Name Plate, Crosley
	154214-2	Knob (Large), Tuning, UHF & VHF		145211-22	Nut (Wing), Speaker Mtg.
				154344-1	Screw, Chassis Mtg.
	154215-2	Knob (Small), Tuning, VHF		154101	Window, Tempered Glass

SCHEMATIC WIRING DIAGRAM-CHASSIS 396



CROSLEY TV PAGE 12-35

SUBJECT: TO ADD ALIGNMENT PROCEDURE AND PARTS LIST FOR ONE TUBE CONVERTER PART NO. (155499)

Chassis 396, Code letter C incorporates the one tube converter, part no. 155499. Chassis 396 coded prior to Code letter C use converter, Part No. 154848.

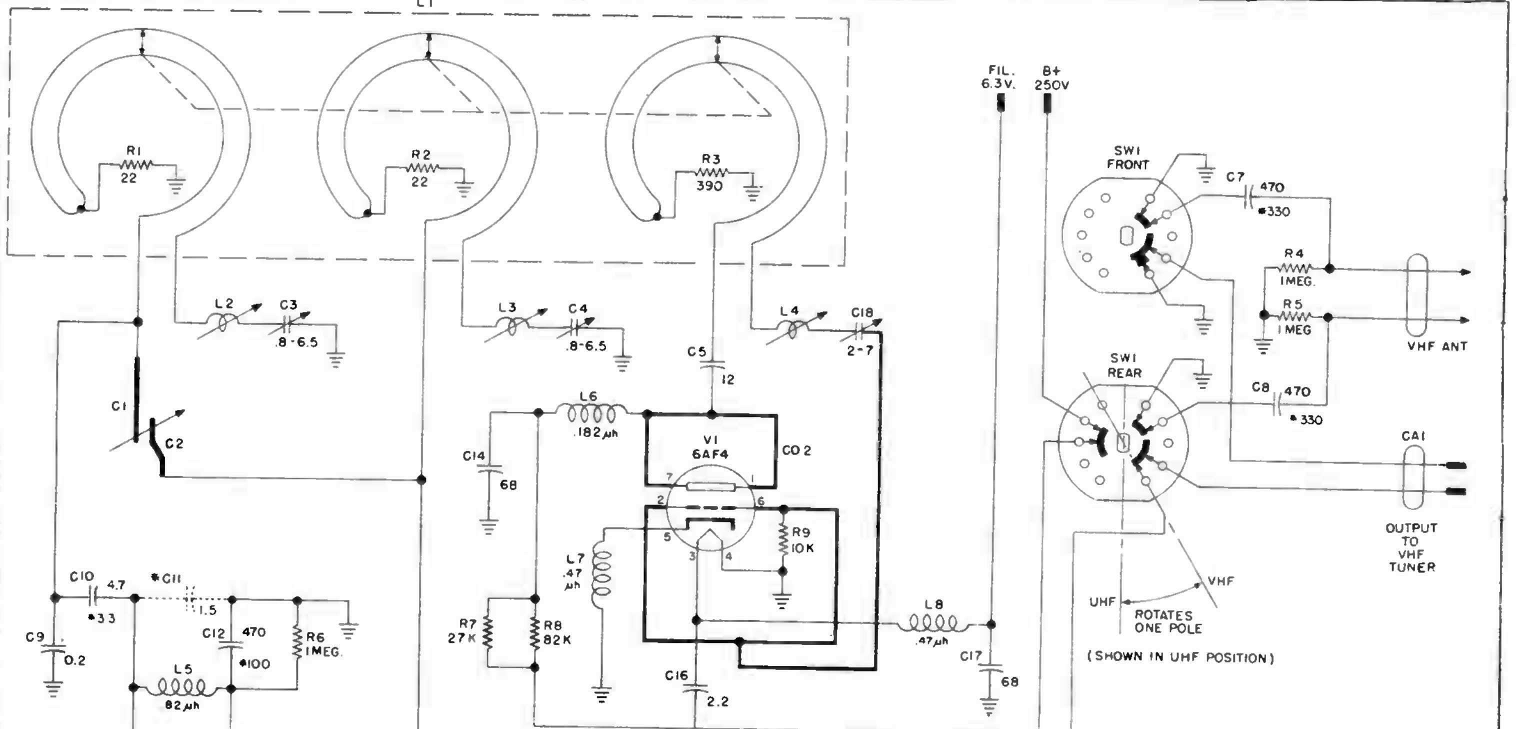
ALIGNMENT PROCEDURE

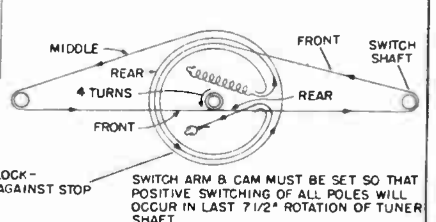
Oscillator Alignment:

1. Connect an electronic voltmeter or scope across the second detector load resistor, R114.
2. Turn on the power.
3. Apply a 460 mc. (amplitude modulated when scope is used) signal to the UHF antenna terminals through the antenna matching network (Fig. 3).
4. Turn out the adjusting screw of the mixer circuit trimmer C4 so that the flat side of the head is 5/8" above the chassis before aligning oscillator.
5. With the tuner shaft at maximum CCW position, adjust the oscillator trimmer, C18 for peak reading on the electronic voltmeter (or maximum indication on scope).
6. Set the signal generator to 904 mc.
7. Rotate the tuner shaft to maximum CW position and adjust the oscillator end inductor, L4 for maximum reading on the voltmeter (or scope).
8. Repeat steps 3 through 6 until maximum reading is obtained.

R. F. Circuit Alignment:

1. With the signal generator and electronic voltmeter or scope connected as for the Oscillator Alignment above, set the R-F coupling trimmer, C1 and C2 to minimum capacity by turning the screw CCW.
2. Set the signal generator to 460 mc. (amplitude modulated when scope is used).
3. With the tuner shaft at maximum CCW position, adjust the antenna and mixer trimmers, C3 and C4 for maximum meter reading (or scope indication).
4. Reset signal generator to 904 mc.
5. Rotate the tuner shaft to maximum CW position and adjust the antenna and mixer end inductors, L2 and L3 for maximum reading on meter (or scope).
6. Repeat steps 2 through 5 until maximum reading is obtained.
7. Turn the tuner shaft to maximum CW position and adjust the coupling trimmer, C1 and C2 for peak reading at 904 MC.
8. Turn the power switch to the "OFF" position.
9. Disconnect the generator and electronic voltmeter, or scope.
10. Re-engage the toggle coupling in the pin on the switch throw arm and the pin on the drive pulley as follows.
    a. Rotate the tuning control shaft clockwise until the pin on the rear of the drive pulley is toward the base of the chassis.
    b. Turn the switch throw arm to a vertical position.
    c. Turn the toggle coupling approximate 45° CW from a vertical position.
    d. Turn the switch throw arm CCW until pin engages the upper fork on the toggle coupling.
    e. Turn the tuning shaft CCW and guide the pin on the rear of drive pulley into the lower fork of the coupling. The coupling is now in the proper operating position and when the tuning shaft is turned completely CCW, the switch will be thrown to the VHF position.
11. Replace the UHF Converter on the VHF receiver chassis.

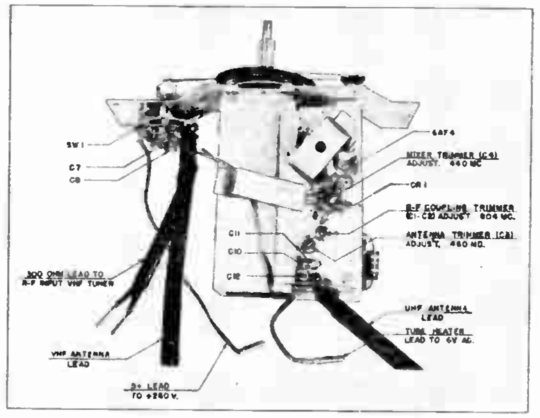


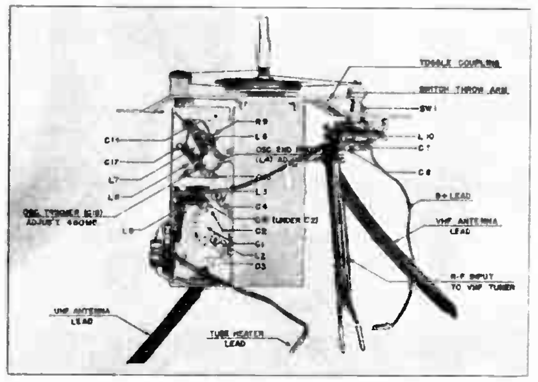


NOTES:
1. K=1000
2. ALL CAPACITANCE VALUES IN MMF AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
* EARLY PRODUCTION ONE TUBE CONVERTERS USED THESE VALUES. IN THE EVENT THAT ANY OF THESE COMPONENTS FAIL, REPLACE THEM WITH THE SAME VALUE.

PLACEMENT OF DIAL DRIVE CORD

D-155497-E



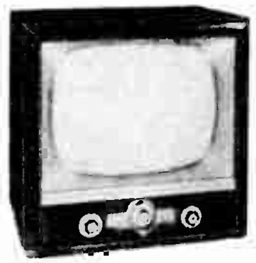


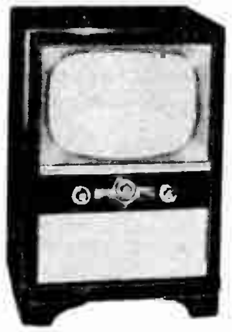
PARTS LIST

Symbol No.	Part No.	Description
C1	155424	Stator, RF Trimmer
C2	155508	Rotor, RF Coupling Trimmer
C3	151880-2	Capacitor, .8-6.5 mmf., Trimmer
C4	151880-2	Capacitor, .8-6.5 mmf., Trimmer
C5	155439-1	Capacitor, 12 mmf., 5% disc ceramic
C7	156201-1	Capacitor, 470 mmf., 2 KV., disc ceramic
C8	156201-1	Capacitor, 470 mmf., 2 KV., disc ceramic
C9	152997-9	Capacitor, .2 mmf., 500V.
C10	152997-10	Capacitor, 4.7 mmf., 10%, 500V.
C12	156201-1	Capacitor, 470 mmf., 2 KV., disc ceramic
C13	152997-6	Capacitor, .68 mmf., 10%, 500V.
C14	152997-8	Capacitor, 68 mmf., 500V.
C15	152997-4	Capacitor, 3.3 mmf., 10%, 500V.
C16	152997-1	Capacitor, 2.2 mmf., 10%, 500V.
C17	152997-8	Capacitor, 68 mmf., 500V.
C18	155713-1	Capacitor, 2-7 mmf., Trimmer
C19	152997-11	Capacitor, 10 mmf., 10%, 500V.
R1	Part of L1	Resistor, 22 ohm, 10%, 1/2 W.
R2	Part of L1	Resistor, 22 ohm, 10%, 1/2 W.
R3	Part of L1	Resistor, 390 ohm, 10%, 1/2 W.
R4	39374-61	Resistor, 1 megohm, 10%, 1/2 W.
R5	39374-61	Resistor, 1 megohm, 10%, 1/2 W.
R6	39374-61	Resistor, 1 megohm, 10%, 1/2 W.
R7	39374-218	Resistor, 27,000 ohm, 10%, 2 W.
R8	39374-136	Resistor, 82,000 ohm, 10%, 1 W.
R9	39374-37	Resistor, 10,000 ohm, 10%, 1/2 W.
L1	154711	Inductuner
L2	Part of C3	Inductance
L3	Part of C4	Inductance
L4	Part of C18	Inductance
L5	148936-2	Choke, RF (.82 microhenries)
L6	156167	Choke, RF (.182 microhenries)
L7	148936-1	Choke, RF (.47 microhenries)
L8	148936-1	Choke, RF (.47 microhenries)
L9	155510	Choke, RF (.145 microhenries)
L10	148936-2	Choke, RF (.82 microhenries)
CA1		Antenna Transmission Line (300 ohm)
CO1	154781	Terminal Board, UHF Antenna
CO2	155431	Strap, Oscillator Plate
CR1	151871	Crystal, Germanium (1N72)
SW1	154721	Switch, Function
	154758	Arm & Hub Assembly, Function Switch
	154735	Arm, Toggle
	154736	Bracket, Idler Pulley
	154682	Bracket, Tube Lock
	155427	Clip & Board Assembly, Crystal
	155893	Eyelet (3 used to hold Rotors to Shaft)
	156207	Fisher Hub, Small Knob Shaft, Groove Pin & Outer Shaft Assembly
	137939-1	Idler Pulley
	154738	Plate, Tuner Mounting
	155894	Rotor (3used)
	39311-2	Screw (2used), Set
	151883	Screw (6-32), Nylon
	155898	Shaft & Stop Assembly, Inductuner
	153804	Shield (Lid), Oscillator
	153806	Shield, Oscillator
	154677	Shield, Tube (6AF4)
	152053	Socket, Tube (V1)
	155499	UHF Converter Complete
	155895	Washer (1used), Shaft & Stop Assembly

F-17TOLU
(Mahogany)
F-17TOLBU
(Blond)

F-21TOLU
(Mahogany)
F-21TOLBU
(Blond)





F-21COLU
(Mahogany)
F-21COLBU
(Blond)

F-21CDLU
(Mahogany)
F-21CDLBU
(Blond)

CHASSIS 402
Models:
F-17TOLH
F-17TOLBH

CHASSIS 403
Models:
F-21TOLH
F-21TOLBH

CHASSIS 404
Models:
F-21COLH F-21CDLH
F-21COLBH F-21CDLBH

CHASSIS 402-1
Models:
F-17TOLU
F-17TOLBU

CHASSIS 403-1
Models:
F-21TOLU
F-21TOLBU

CHASSIS 404-1
Models:
F-21COLU F-21CDLU
F-21COLBU F-21CDLBU

TUBE COMPLEMENT (VHF)

Symbol	Tube	Function	Symbol	Tube	Function
V1	6BC5	R-F Amplifier	V109	6AL5	Horizontal A.F.C.
V2	6J6	VHF Oscillator & Mixer	V110	6C4	1st Audio Amplifier
V101	6CB6	1st I-F Amplifier	V111	6W6GT	Audio Output
V102	6CB6	2nd I-F Amplifier	V112	6AX4	Horizontal Damper
V103	6CB6	3rd I-F Amplifier	V113	6SN7GT	Horizontal Oscillator
V104	12BH7	Vertical Oscillator & Output	V114	6BQ6GT	Horizontal Output
V105	6SN7GT	Sync. Clipper & Sync. Output	V115	1B3GT	H.V. Rectifier
V106	6AL5	Ratio Detector (Sound)	V116	17HP4	Picture Tube (chassis 402-1)
V107	6AU6	Sound Detector Driver (4.5mc.)	V116	21MP4, 21AP4	Picture Tube (chassis 403-1)
V108	6AH6	Video Amplifier	V116	21ZP4A	Picture Tube (chassis 404-1)

TUBE COMPLEMENT (UHF Converter)

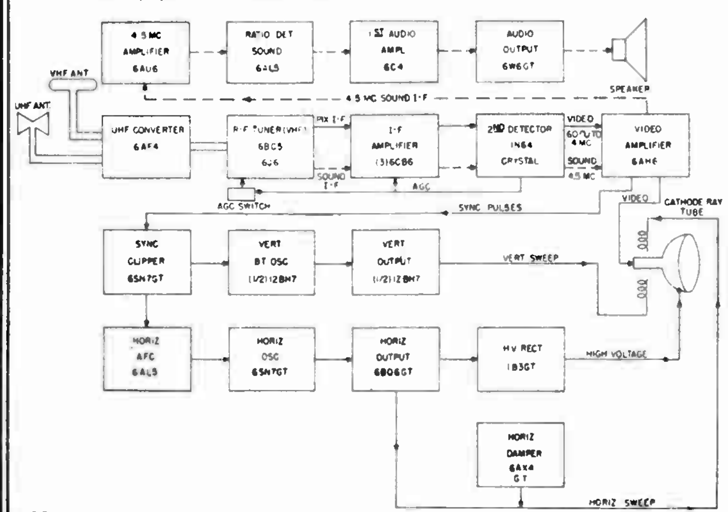
Symbol	Tube	Function
V1	6AF4	UHF Oscillator

POWER SUPPLY: 117 volts, 60 cycle, a.c.

POWER CONSUMPTION: 145 watts. (VHF)
150 watts. (UHF)

AUDIO POWER OUTPUT: 1.4 watts maximum.

BLOCK DIAGRAM:



ANTENNA INPUT IMPEDANCE:
300 ohms balanced.

INTERMEDIATE FREQUENCY:
Video Carrier — 26.4 mc.
Sound Carrier — 21.9 mc.
Intercarrier Sound — 4.5 mc.
UHF Output — Channels 5 or 6.

DEFLECTION: Electromagnetic.

FOCUS: Electrostatic, 402 chassis.
Magnetic, 403 and 404 chassis.

ION TRAP: Single Permanent Magnet

HORIZONTAL SCANNING FREQ.: 15,750 c.p.s.

VERTICAL SCANNING FREQ.: 60 c.p.s.

FRAME FREQUENCY: 30 c.p.s.

SCANNING: Interlaced, 525 lines.

SPEAKER:
21" Console Models 10" P.M.
17" and 21" Table Models 5¼" P.M.

VOICE COIL IMPEDANCE: 3.2 ohms at 400 cycles.

CAUTION

HIGH VOLTAGE--Operation of a television receiver with the back open involves a shock hazard. When making adjustments other than adjusting the controls at the front panel, all precautions for working near high voltage should be exercised.

HIGH TEMPERATURE OF TUBES--Some tubes in the receiver operate at extremely high temperatures. To avoid serious burns, do not touch these tubes while the receiver is operating, or until the tubes have cooled after the set is shut off.

HANDLING OF PICTURE TUBES--Breakage of the picture tube, which contains a high vacuum, may result in injury from flying glass. Do not scratch tube face or subject to more than moderate pressure. DO NOT REMOVE OR HANDLE THE PICTURE TUBE IN ANY MANNER UNLESS HEAVY GLOVES AND PROTECTIVE GOGGLES ARE WORN. Persons not so equipped should be kept away while handling the tube. NEVER GRASP THE TUBE BY THE NECK OR ALLOW PRESSURE TO BE EXERTED ON THE NECK. In installation, if the tube sticks or fails to slip smoothly through the deflection yoke, investigate and remove the cause of the trouble. DO NOT FORCE TUBE.

CONNECTING EXTERNAL ANTENNA

Remove the two wires from the built-in antenna fastened to the two screws on the antenna terminal board mounted at the rear of the receiver. Tape bare ends of wires from the built-in antenna. Keep the lead-in from the external antenna away from the power cord and speaker leads. Fasten the lead-in wires under the two screws on the antenna terminal board.

ADJUSTMENTS

1. ION TRAP ADJUSTMENT:

With the ION TRAP positioned close to the base of the picture tube, and the BRIGHTNESS control at low to medium setting, move the trap forward or backward and at the same time rotate in either direction until maximum brightness of the raster is obtained. Readjust the BRIGHTNESS control until the raster is slightly above average brilliance. Adjust the FOCUS CONTROL until the line structure of the raster is clearly visible. Readjust the ION TRAP again for maximum brightness.

There may be two locations on the tube neck where the ION TRAP will produce maximum brightness. Never set the trap to the forward position, always use the position nearest the tube base.

If there is a shadow in the corners of the raster, be sure the ION TRAP is properly adjusted. Do not sacrifice picture brilliance when adjusting the ION TRAP to overcome shadows in corner of picture. If corner shadows are present, be sure the DEFLECTION YOKE and CENTERING MAGNET are properly adjusted.

2. DEFLECTION YOKE AND BRACKET:

The DEFLECTION YOKE BRACKET should be positioned as far forward as possible so that the rubber cushion on the front of the bracket rests on the flare of the tube.

The DEFLECTION YOKE should be positioned as far forward as possible on the picture tube neck and rotated to the left or right as required to make the picture parallel with respect to the top and bottom of window frame.

3. FOCUSING MAGNET BRACKET ADJUSTMENT:
(403 & 404 chassis)

This bracket should be adjusted so that the magnet is centered around the neck of the picture tube. Do not remove the cardboard spacer between the neck of the tube and the magnet. Adjustment can be made after loosening the two screws in the sloted holes of the bracket on either side of the magnet housing.

4. CENTERING RASTER:

If the picture is off center and/or has neck shadow on receivers using the 402 chassis, rotate either or both CENTERING MAGNET levers to the left or right until the picture is centered on the screen and is free of neck shadow. The CENTERING MAGNET is located on the back cover of the DEFLECTION YOKE. On receivers using the 403 or 404 chassis, move the centering lever (woggle arm) up or down or to the right or left. Some of the Focusing Magnet Brackets have a sloted head screw or a wing screw to lock lever in position. Before adjusting, loosen the screw, retighten screw after adjustment is made. To determine the correct picture centering, it may be necessary to reduce the size of the picture with the HEIGHT and WIDTH adjustments. After making adjustment of CENTERING MAGNET, readjust ION TRAP.

5. HEIGHT AND WIDTH ADJUSTMENTS:

The linearity and corresponding size controls will have to be adjusted together and with care to maintain picture symmetry. For this reason it is best to use a test pattern when making these adjustments. Adjust size of picture to fill the screen by means of the HEIGHT, WIDTH, VERTICAL LINEARITY.

6. VERTICAL LINEARITY ADJUSTMENTS:

The VERTICAL LINEARITY control has the effect of expanding the picture at an increasing rate from the bottom to the top of the picture. Adjustment of this control has the greatest effect on the top portion of the picture, some effect on the middle and very little effect on the bottom of the picture. The HEIGHT and FOCUS controls may need re-adjustments as a result of the change in position of the VERTICAL LINEARITY control.

7. HORIZONTAL HOLD CONTROL:

The HORIZONTAL HOLD CONTROL is adjusted with a weak picture to the center of its lock-in range. If the lock-in range is insufficient or the horizontal sync is unstable, see "Horizontal Hold Adjustment" under "Alignment".

ADJUSTMENTS (Continued)

8. VERTICAL HOLD CONTROL:

The VERTICAL HOLD CONTROL is also adjusted to the center of its lock-in range with the contrast control set to obtain a weak picture.

9. FOCUS CONTROL

Adjust the FOCUS CONTROL for best focus of the vertical and horizontal wedges at the center of the test pattern. If corner focus is poor, check position of DEFLECTION YOKE and ION TRAP.

10. BRIGHTNESS CONTROL:

BRIGHTNESS CONTROL and CONTRAST control should be set to obtain as much shading in the picture as possible. If the Brightness control is set too low, the black and grays of the picture are black and if set too high, the black and grays of the picture will appear light and faded.

11. LOCAL-DISTANCE (AGC) SWITCH:

The LOCAL-DISTANCE SWITCH can be set to prevent the receiver from overloading in strong signal areas or to reduce "snow" in the picture in weak signal areas. In strong signal areas, the "LOCAL" (counter-clockwise) position of the switch must be used. The second and third positions "SUBURBAN" and "DISTANCE" are to be used in medium to weak signal areas. Use the position with which the best picture is obtained with a minimum of overloading of the receiver when the CONTRAST control is advanced.

12. NOISE GATE CONTROL:

This control makes it possible to obtain improved picture stability in the presence of electrical interference (noise), when the Local-Distance switch is in the "Suburban" or "Distance" position. When the control is turned completely counter-clockwise, it is out of the circuit and has no effect. Adjust the control by turning it clockwise until the picture is stable. The limiting factor of this adjustment is the buzz or noise that may be introduced, if the control is turned too far in the clockwise direction.

13. OSCILLATOR ADJUSTMENT USING A TELEVISION SIGNAL:

Do not make any adjustments on the two oscillator adjusting screws unless the FINE TUNING control range is insufficient to properly tune-in the station. The adjusting screws are accessible through holes in the front of the chassis after the tuning knobs are removed.

To make the adjustment, proceed as follows:

(a) Turn the receiver on and allow a warm-up period of approximately five minutes.

(b) For stations from channel 13 to channel 7, set the Station Selector Switch to the highest channel received and adjust the Contrast and Volume control for normal sound and picture. Set the Fine Tuning Control in the center of its range.

(c) Using a small non-metallic screwdriver, adjust the slotted head brass screw located above and to the right of shaft and above the fiber disc for the clearest and sharpest detail in the picture. This adjustment will be effective on all channels between 13 and 7. If other stations are operating in this range, it may be necessary to compromise slightly on the high channel adjustment so the other channels may be properly tuned-in.

(d) For Stations on channel 6 and below, set the station Selector Switch to the channel received closest to channel 6 and adjust the Contrast and Volume control for normal sound and picture. Set the Fine Tuning control in the center of its range.

(e) Using a small non-metallic screwdriver, adjust the slotted head brass screw located below the shaft for the clearest and sharpest detail in the picture. This adjustment will effect all channels between 6 and 2.

I. F. ALIGNMENT

All lead connections from the signal generator and wobbulator must be shielded. Keep the exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The wobbulator, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

1. To Check I. F. Alignment on Oscilloscope:

(a) Lift the shield of the Oscillator-Mixer tube V2 sufficiently to clear the socket ground clips. Connect sweep signal generator "hot" lead to the ungrounded tube shield and generator ground lead to the tuner chassis.

(b) Connect high side of oscilloscope to high side of contrast control (pin 2 and 7 of V108), and the low side to chassis.

(c) Apply -3.0 volts D.C. bias to I-F Bias line (See sketch "Variable Bias Control"). Contrast control should be set in the maximum counter-clockwise position.

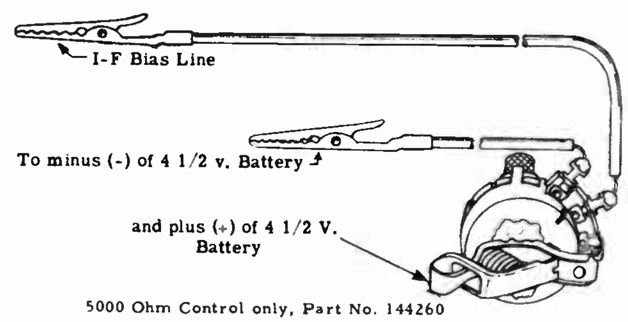
(d) With the generator sweep set at zero, connect an electronic voltmeter between top of detector load resistor, R116 and chassis. Adjust the output of the generator to obtain a reading of 2 volts D.C. on the meter.

(e) Set generator to sweep from 20 mc. to 30 mc.

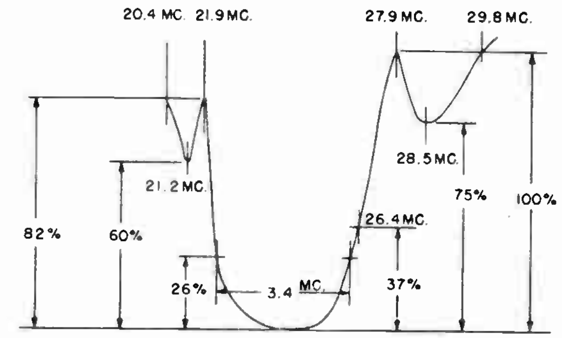
(f) Connect marker generator to sweep generator output leads and adjust to provide markers that appear in the curve.

(g) Observe curve and position of markers (see nominal response curve). Slight deviation in shape from the nominal response curve is permissible, but if any great deviation is noted, it will be necessary to realign the I-F Amplifier.

ADJUSTMENTS (Continued)



VARIABLE BIAS CONTROL ASSEMBLY



NOMINAL OVERALL I. F. RESPONSE CURVE

Note: Response as Seen by Means of Sweep Generator

2. Alignment, I. F. & Turner Assembly (with electronic voltmeter):

(a) Connect -3.0 Volts D.C. bias supply to I-F Bias line.

(b) Connect signal generator "hot" lead through a 1000 mmf. capacitor to TP-1 (wire protruding from tuner directly adjacent to the oscillator mixer tube V2) and ground lead to the R. F. tuner case.

(c) Connect high side of Electronic Voltmeter to top of detector load resistor, R116, and low side to chassis; zero meter.

(d) Set signal generator to 24.4 mc. and adjust top of T101 for maximum D.C. meter indication on voltmeter. Adjust the signal generator amplitude to make this peak indication 2 volts D.C., approximately.

(e) Set signal generator to 22.9 mc. and adjust top of L103 for maximum D.C. meter indication, limiting meter deflection to 2 volts D.C. by adjusting input of attenuator.

(f) Set the signal generator to 21.9 mc. and adjust bottom of L103 for minimum D.C. meter deflection. Input should be high enough to permit a definite null to be observed on the meter.

(g) Repeat steps e and f.

(h) Set signal generator to 25.5 mc. and adjust top of L102 for maximum meter deflection, limiting meter deflection to 2 volts D.C. by adjusting input attenuator.

(i) Reset signal generator to 24.4 mc. Connect a 100 ohm resistor in series with a 1000 mmf. capacitor across L101. Adjust converter output, L11, of R.F. Tuner for maximum meter deflection, but limit output of generator so this reading does not exceed 2 volts D.C. Remove the 100 ohm resistor and the 1000 mmf. capacitor.

(j) Reset signal generator to 27.9 mc. and adjust the bottom of L101 for minimum D.C. meter deflection. Signal generator amplitude must be sufficiently high to produce a definite null.

(k) Set signal generator to 25.5 mc. Connect the 100 ohm resistor and the 1000 mmf. series capacitor from TP-2 (wire protruding from the tuner through the insulated eyelet between the brass adjusting screws) on the R-F Tuner to the tuner case and adjust L101 for maximum D.C. meter indication. Adjusting amplitude of signal generator to make this maximum indication approximately 2 volts D.C. Remove the 100 ohm resistor and the 1000 mmf. capacitor.

(l) Repeat steps j and k.

(m) Check sensitivity. The input for 2 volts D.C. output and zero bias should not exceed 650 microvolts at 24.4 mc. with generator properly terminated, and generator fed into grid of first I-F amplifier.

(n) Remove the signal generator and electronic voltmeter.

(o) Note: When aligning bottom of L103 and bottom of L101 the first null obtained when running the core into the trap winding from the Tinnermann Clip end of the trap winding is the proper alignment null.

SOUND ALIGNMENT

1. Connect crystal controlled 4.5 mc. 400 cycle amplitude modulated signal, modulated 30% or greater, between grid of video amplifier and chassis.

2. Connect high side of scope through detector probe to the picture tube cathode (pin 11). Connect low side of scope to chassis. Adjust 4.5 mc. trap, L109, for minimum 400 cycle deflection on scope.

3. Connect electronic voltmeter to lug 2 of ratio detector, V106, and adjust 4.5 mc. sound take-off (L112) and bottom of ratio transformer (T102) for peak reading on voltmeter. Adjust input to make this peak reading 4 volts.

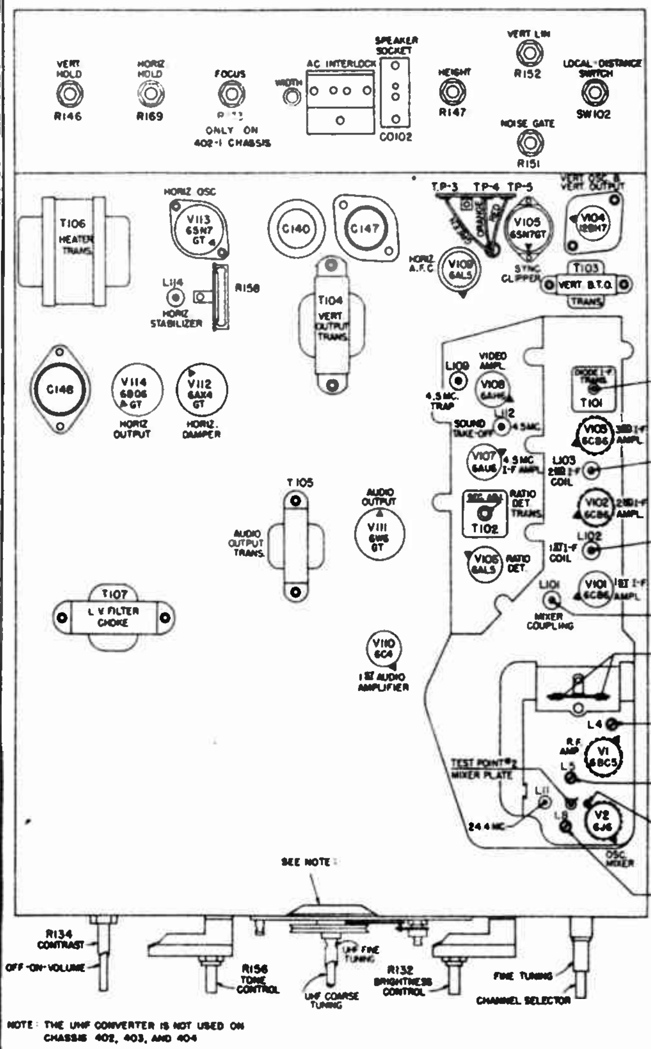
4. Adjust input to obtain 12 volts output. Transfer electronic voltmeter to junction of R129 and C128 (refer to Schematic Wiring Diagram). Adjust top of T102 for zero balance on electronic voltmeter.

5. Recheck steps 2, 3 and 4.

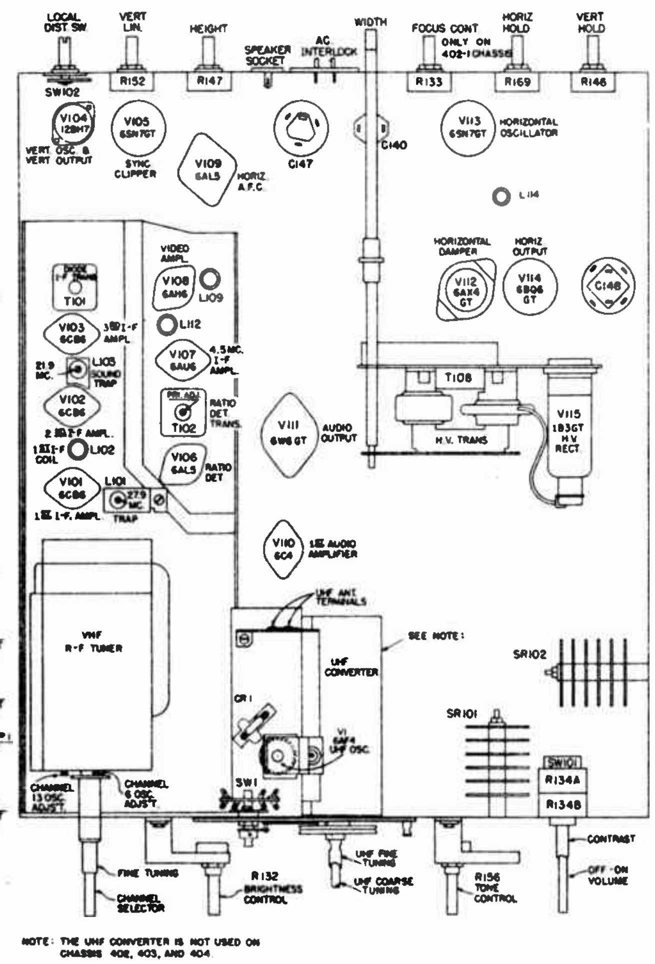
6. Remove input signal, scope and electronic voltmeter.

HORIZONTAL HOLD ADJUSTMENT

1. Tune in a local television signal and adjust contrast control for normal picture.
2. Connect electronic voltmeter between TP-3 (green lead) and chassis.
3. Short TP-4 (orange lead) to chassis and adjust electronic voltmeter to zero.
4. Remove short from TP-4. Do not change zero on electronic voltmeter.
5. Connect a 0.1 mfd., 600 volt capacitor between TP-5 (red lead) and chassis.
6. Adjust Horizontal Hold control for zero reading on the meter.
7. Remove the 0.1 mfd. capacitor from TP-5 and chassis. Do not disturb setting of horizontal hold control.
8. Adjust Horizontal Stabilizer coil (L114) for zero reading on the meter.
9. Remove electronic voltmeter from TP-3.
10. Check horizontal pull-in range. The pull-in range should be approximately 50° of the control's rotation.



TOP VIEW 402-1, 403-1, 404-1 CHASSIS



BOTTOM VIEW 402-1, 403-1, 404-1 CHASSIS

CIRCUIT DESCRIPTION (UHF CONVERTER)

This UHF Converter employs a 1N72 crystal mixer and a 6AF4 UHF oscillator tube. The continuous tuner covers the UHF Commercial Television Band, Channels 14 through 83. The filament and B+ voltages are supplied by the Crosley VHF television receiver with which the converter is used.

The converter is designed to operate from a 300 ohm, balanced or unbalanced line antenna.

Provisions are made for connecting and switching of separate antennas for UHF and VHF. This switching is accomplished by movement of the UHF coarse or fine tuning knob. When the knob is turned completely counter-clockwise (to "VHF") a link coupling throws a switch which in turn connects the VHF antenna to the receiver input. By a slight movement of the knob in a clockwise direction (toward channel "14") the link coupling throws the switch to the UHF position, connecting the UHF antenna to the receiver input and shorting out the VHF antenna. This function is performed before the UHF converter is tuned to any channel in the UHF commercial television band.

The UHF Tuner assembly consists of three variable (tuned line) inductors mounted on a common shaft. The first two inductors tune the UHF antenna preselector circuit. This circuit passes the signal to which the UHF dial is set and attenuates all other signals, thus acting to reduce interference. These inductors in conjunction with the associated capacitors and end inductors, tune to any desired frequency between 465 and 902 megacycles, while the third inductor, used to tune the local UHF oscillator, covers a range of approximately 376 to 820 megacycles.

The antenna preselector circuit is shunted by the choke L5, this provides additional attenuation to unwanted signals and acts as a high-pass radio-frequency filter to suppress broadcast and other low frequency cross modulation interference that may be encountered when the television receiver is located in an extremely intense field of a local AM Broadcast station or other R-F radiators.

The end inductors L2, L3, L4 and the capacitors, C3, C4 and C18, provide a means of aligning the tuner at the high and low end. The UHF oscillator utilizes a 6AF4 tube. Feedback voltage from the plate to the grid is obtained by means of the capacitor C5 and the interelectrode capacity of the tube. The oscillator circuit (and the preselector circuits) is tuned to frequency by movement of a shorting contact on the tuned line inductors. Position of this contact determines the resonant frequency of the inductance.

Both the tuned incoming signal from the antenna and the local oscillator signal are applied to the crystal mixer. The antenna preselector circuit is capacity coupled (through C1, C2 and C15) to the germanium crystal mixer. The local oscillator is coupled to the mixer through capacitor C16. The output of the crystal mixer is coupled through R-F choke L9, to the switch, SW1. When SW1 is in the UHF position, the output of the crystal mixer is fed to the R-F input of the VHF tuner.

Proper operation of the television receiver on the UHF channels require that the VHF Channel Selector be set to either channel 5 or 6, depending upon the locality in which the receiver is used and must be set to the channel not in use by a VHF station in the area. If both channel 5 and 6 are clear, the one with the least interference should be used.

UHF ALIGNMENT

Alignment Notes:

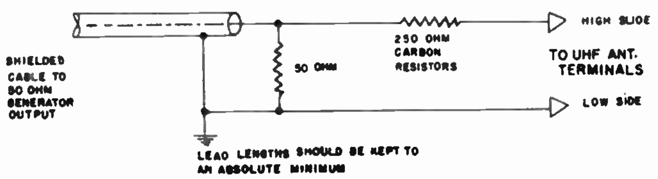
CAUTION: This UHF converter unit is used with a VHF receiver that has one side of the chassis connected to the power line. DO NOT CONNECT TEST EQUIPMENT TO ANY PART OF THE RECEIVER OR GROUND THE CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED BETWEEN THE POWER LINE AND RECEIVER.

1. Remove the UHF Converter from the VHF receiver chassis.
2. Disengage the toggle coupling from the switch throw arm on the front of the UHF chassis.
   To accomplish this: -
   a. Turn the UHF tuning control clockwise until the pin located on the rear of the drive pulley is free from the toggle coupling.
   b. Loosen the two set screws in switch throw arm collar and remove from switch shaft.
   c. Turn the switch clockwise to the UHF position; contact blade on switch rotor must contact and center on the two switch fingers with the red wires attached. Leave switch in this position while aligning.
3. Connect the output leads of the UHF converter to the R-F input terminals of the VHF Tuner.
4. Connect the B+ and filament leads of the tuner to their respective points from which they were removed on the VHF receiver. Connect UHF Converter chassis to B- (VHF receiver chassis).
5. Keep all leads as short as possible, one way to accomplish this is to mount the UHF converter at right angles to the TV chassis with one mounting screw. Most of the leads on the converter will then require no additional length.
6. Set VHF Tuner to Channel 6.
7. Alignment should be followed in the order shown.

UHF ALIGNMENT (Continued)

OSCILLATOR ALIGNMENT

1. Connect an electronic voltmeter or scope across the second detector load resistor.
2. Turn on the power
3. Apply a 460 mc. (amplitude modulated, when scope is used) signal to the UHF antenna terminals through the antenna matching network (See Sketch).

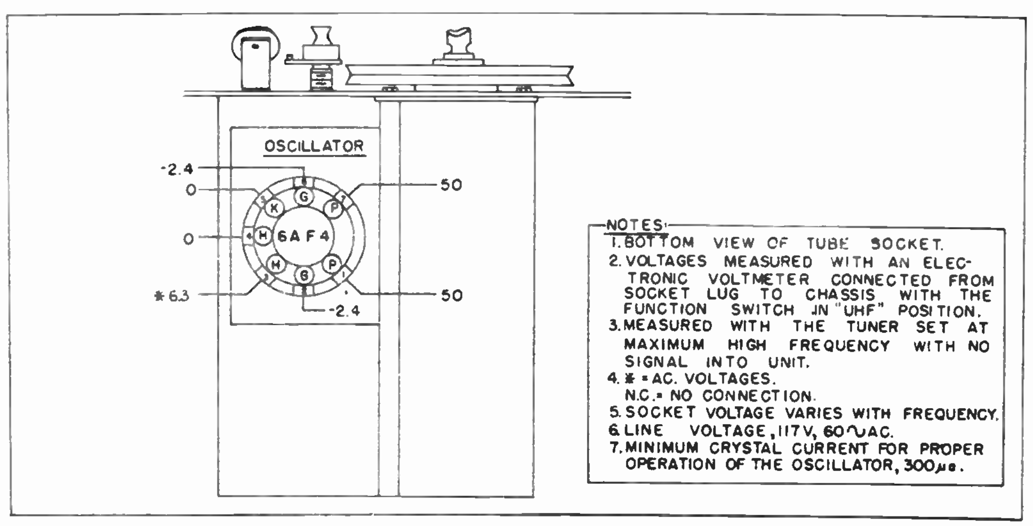


Antenna Matching Network

4. Turn out the adjusting screw of the mixer circuit trimmer C4 so that the flat side of the head is 5/8" above the chassis before aligning oscillator.
5. With the tuner shaft at maximum CCW position, adjust the oscillator trimmer C18 for peak reading on the electronic voltmeter or maximum indication on the scope (oscillator frequency is set to 84 mc below the carrier frequency).
6. Set the signal generator to 904 mc.
7. Rotate the tuner shaft to maximum CW position and adjust the oscillator end inductor, L4 up or down for maximum reading on the voltmeter.
8. Repeat steps 3 through 6 until maximum reading is obtained.

R-F CIRCUIT ALIGNMENT

1. With the signal generator and electronic voltmeter or scope connected as for the Oscillator Alignment above, set the R-F coupling trimmer, C1 and C2 to minimum capacity by turning the screw CCW.
2. Set the signal generator to 460 mc. (Amplitude modulated when scope is used).
3. With the tuner shaft at maximum CCW position, adjust the antenna and mixer trimmers, C3 and C4 for maximum meter reading. (or scope indication)
4. Reset signal generator to 904 mc.
5. Rotate the tuner shaft to maximum CW position and adjust the antenna and mixer end inductors, L2 and L3, for maximum reading on meter or scope, by forming larger or smaller loop
6. Repeat steps 2 through 5 until maximum reading is obtained.
7. Turn the tuner shaft to maximum CW position and adjust the coupling trimmer, C1 and C2 for peak reading at 904 MC.
8. Turn the power switch to the "OFF" position.
9. Disconnect the generator and electronic voltmeter, or scope.
10. Re-engage the toggle coupling in the pin on the switch throw arm and the pin on the drive pulley as follows:
    a. Rotate the tuning control shaft clockwise until the pin on the rear of the drive pulley is toward the base of the chassis.
    b. Turn the tuning shaft CCW and guide the pin on the rear of drive pulley into the fork of the toggle coupling, then continue to turn tuning shaft CCW to stop. The coupling is now in the proper operating position.
    c. With the switch set to the VHF position (CCW) replace the switch throw arm so that the pin on the arm engages the fork of the toggle coupling. In this position it is approximately 30° CW from horizontal. Tighten the two set screws in the switch throw arm collar.
    d. Function switch should be checked for proper operation under conditions of customer use.

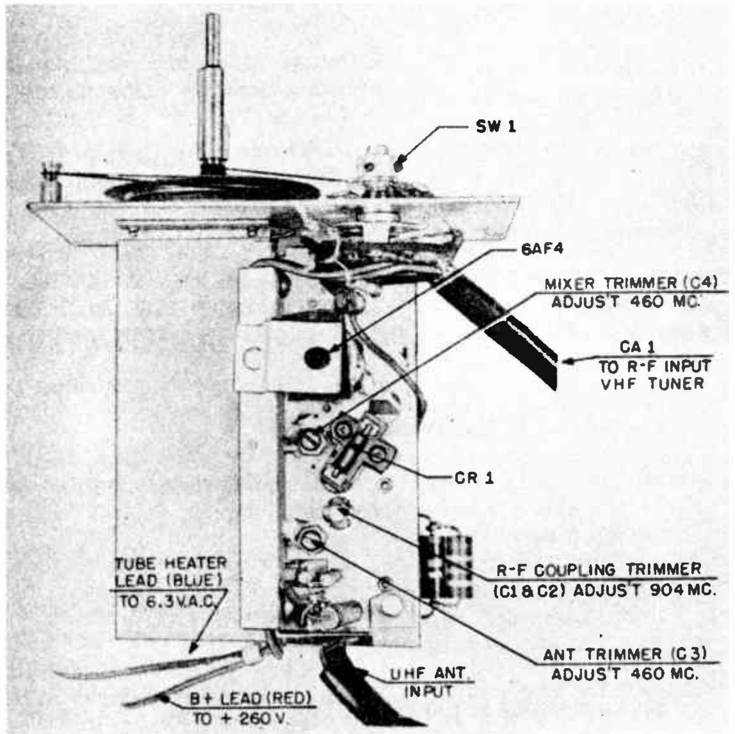


Socket Voltage Chart

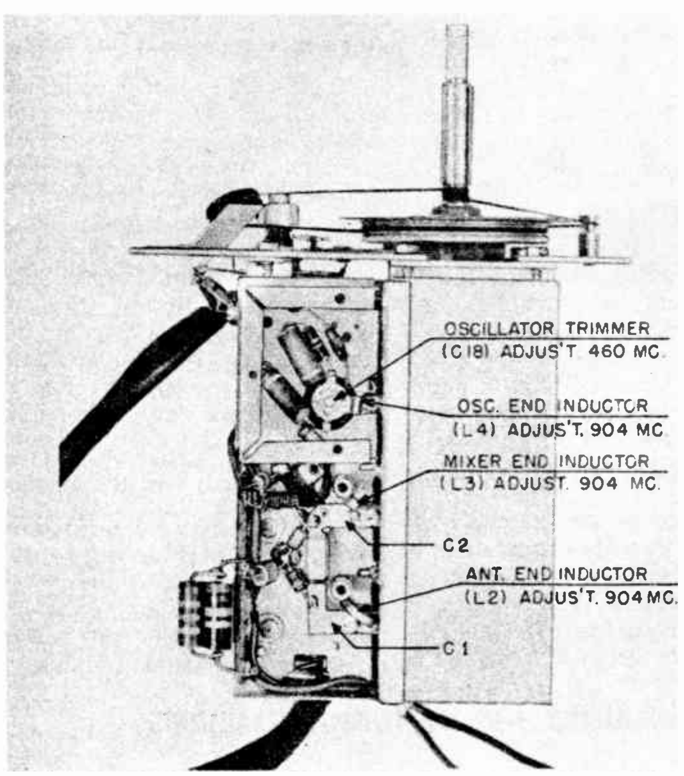
UHF ALIGNMENT (Continued)

At full CCW rotation of tuner shaft, all VHF position contacts must be fully and firmly made and all UHF position contacts must be fully broken. All UHF position contacts must be fully and firmly made and all VHF position contacts must be fully broken, when tuner shaft is 7-1/2° or more from full CCW, as tuner shaft is rotated toward stop from UHF position.

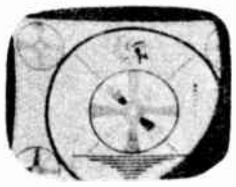
11. Replace the UHF Converter on the VHF receiver chassis.



UHF CONVERTER CHASSIS, (Top View)



UHF CONVERTER CHASSIS, (Bottom View)



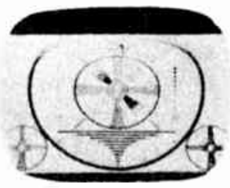
Off Center and Neck Shadow

CENTERING MAGNET ADJUSTMENT — If the picture is off center and/or has neck shadow as shown in the illustration at the left, loosen screw "G" and rotate the centering magnet lever "H" to the right, left, up, down, or a combination of these directions until the picture is centered on the screen and the picture is free of all neck shadow. While holding lever in position tighten screw "G".

ION TRAP ADJUSTMENT — With the ion trap magnet positioned close to the base of the picture tube and the Brightness Control at a low to medium setting, slide the ion trap backward or forward and at the same time rotate it to the right or left until maximum brightness is obtained. Readjust the brightness control until the raster is slightly above average brilliance. Adjust the focus control until the line structure of the raster is clearly visible. Readjust the Ion Trap again for maximum brightness. There may be two locations on the tube neck where the ion trap will produce maximum brightness. Never set the trap to the forward position, always use the position closest to the tube base. If there is a shadow in the corner of the raster, be sure the ion trap is properly adjusted; when adjusting the ion trap, do not sacrifice picture brilliance to overcome shadows in corners. When shadows are present, be sure the deflection yoke and centering magnet are properly adjusted.

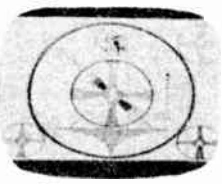
NOISE GATE CONTROL — In areas that have strong electrical interference and the Local-Suburban-Distance Switch can be set to "Suburban" or "Distance" without overloading the receiver, picture stability can be improved by turning the control clockwise to a position where the picture is most stable with no buzz or noise introduced into the sound output.

LOCAL - SUBURBAN - DISTANCE SWITCH — In strong signal areas set this switch to its extreme counter-clockwise position (LOCAL). The middle position (SUBURBAN), and extreme clockwise position (DISTANCE) are used in areas where the signal is weak or medium strength. Set the switch in the position which provides the most satisfactory picture with minimum overloading when the contrast control is advanced.



Misadjusted Vertical Linearity

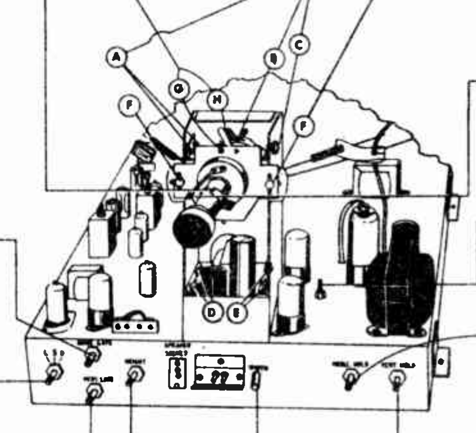
VERTICAL LINEARITY CONTROL — This control increases or decreases the height of the upper portion of the picture.



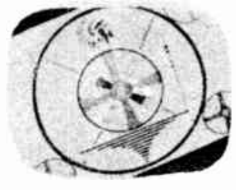
Misadjusted Height

HEIGHT CONTROL — This control increases the overall height of the picture. When making this adjustment it is sometimes necessary to also adjust the VERTICAL LINEARITY to obtain a picture that is correctly proportioned.

REAR VIEW — CHASSIS 404, 404-1 — (Chassis 403, 403-1 are similar to chassis 404, 404-1 except that the 403 and 403-1 chassis are equipped with a metal picture tube and a deflection yoke mounting bracket which is mounted directly to the chassis with the four screws "D" and "E").



CONNECTING EXTERNAL ANTENNA — When connecting an external antenna to the terminals at the rear of the receiver be sure to disconnect the built-in antenna which is being replaced by the external antenna.

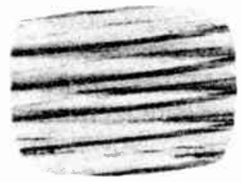


Picture Tilted

DEFLECTION YOKE ADJUSTMENTS — The deflection yoke must be positioned as far forward as possible on the neck of the picture tube. To make this adjustment, loosen screws "D" and "E" enough to permit the yoke bracket to be pushed forward. While holding the bracket in the forward position, tighten screws "D" and "E". Screws "A" and "C" are for shifting the yoke up or down to center it around the picture tube neck. If the picture is tilted as illustrated at right, loosen wing nut "B". Then, rotate the yoke to left or right as required to make the picture parallel with respect to top and bottom of window frame. Be sure to hold the yoke in position while tightening the wing nut.

FOCUS ASSEMBLY — To Center the Focus Assembly around the neck of the picture tube, loosen screws "F" and shift the assembly to right, left, up, or down until paper shim around tube neck can be moved freely. Then tighten screws "F".

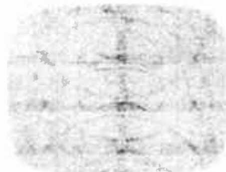
FOCUS CONTROL — Rotate to the right or left until the sharpest picture, or sharpest horizontal lines, are obtained.



Misadjusted Horizontal Hold

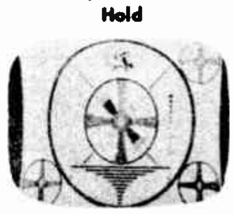
HORIZONTAL STABILIZER ADJUSTMENT — See "HORIZONTAL HOLD CONTROL".

HORIZONTAL HOLD CONTROL — If the picture appears as shown in the illustration, adjust the horizontal hold control to right or left as required to lock in a single stationary picture. If the range of the control is not sufficient to lock in picture, see "Horizontal Hold Control" adjustment.



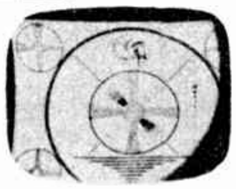
Misadjusted Vertical Hold

VERTICAL HOLD CONTROL — If the picture is moving up or down as illustrated at right, adjust the vertical hold control until a single stationary picture is obtained.



Picture Too Narrow

WIDTH CONTROL — If the picture is too narrow as illustrated, or too wide, turn the width control clockwise or counter-clockwise as required to adjust the picture to the proper width of the viewing area on the screen.



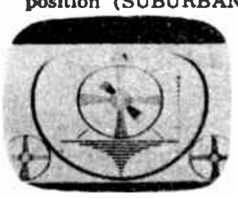
Off Center and Neck Shadow

CENTERING MAGNET ADJUSTMENT — If the picture is off center and/or has neck shadow as shown in the illustration at the left, rotate either or both centering magnet levers to the right or left until the picture is centered on the screen, and the picture is free of all neck shadow.

ION TRAP ADJUSTMENT — With the ion trap magnet positioned close to the base of the picture tube and the brightness control at a low to medium setting, slide the ion trap backward or forward and at the same time rotate it to the right or left until maximum brightness is obtained. Readjust the brightness control until the raster is slightly above average brilliance. Adjust the focus control until the line structure of the raster is clearly visible. Readjust the ion trap again for maximum brightness. There may be two locations on the tube neck where the ion trap will produce maximum brightness. Never set the trap to the forward position, always use the position closest to the tube base. If there is a shadow in the corner of the raster, be sure the ion trap is properly adjusted; when adjusting the ion trap, do not sacrifice picture brilliance to overcome shadows in corners. When shadows are present, be sure the deflection yoke and centering magnet are properly adjusted.

NOISE GATE CONTROL — In areas that have strong electrical interference and the Local-Suburban-Distance Switch can be set to "Suburban" or "Distance" without overloading the receiver, picture stability can be improved by turning the control clockwise to a position where the picture is most stable with no buzz or noise introduced into the sound output.

LOCAL - SUBURBAN - DISTANCE SWITCH — In strong signal areas set this switch to its extreme counter-clockwise position (LOCAL). The middle position (SUBURBAN), and extreme clockwise position (DISTANCE) are used in areas where the signal is weak or medium strength. Set the switch in the position which provides the most satisfactory picture with minimum overloading when the contrast control is advanced.



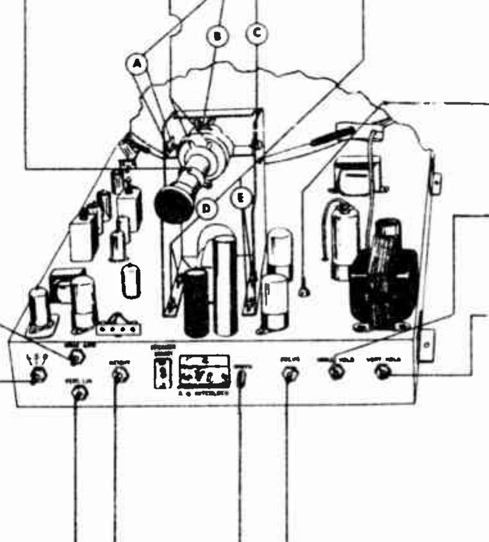
Misadjusted Vertical Linearity

VERTICAL LINEARITY CONTROL — This control increases or decreases the height of the upper portion of the picture.

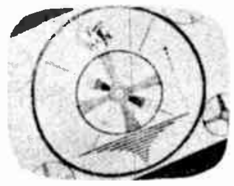
Misadjusted Height

HEIGHT CONTROL — This control increases the overall height of the picture. When making this adjustment it is sometimes necessary to also adjust the VERTICAL LINEARITY to obtain a picture that is correctly proportioned.

REAR VIEW — CHASSIS 402, 402-1



CONNECTING EXTERNAL ANTENNA — When connecting an external antenna, be sure to disconnect the built-in antenna, which is being replaced by the external antenna.



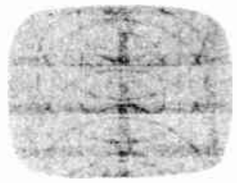
Picture Tilted

DEFLECTION YOKE ADJUSTMENTS — The deflection yoke must be positioned as far forward as possible on the neck of the picture tube. To make this adjustment, loosen screws "D" and "E" enough to permit the yoke bracket to be pushed forward. While holding the bracket in the forward position, tighten screws "D" and "E". Screws "A" and "C" are for shifting the yoke up or down to center it around the picture tube neck. If the picture is tilted as illustrated at right, loosen wing nut "B". Then, rotate the yoke to left or right as required to make the picture parallel with respect to top and bottom of window frame. Be sure to hold the yoke in position while tightening the wing nut.

Misadjusted Horizontal Hold

HORIZONTAL STABILIZER ADJUSTMENT — See "HORIZONTAL HOLD CONTROL".

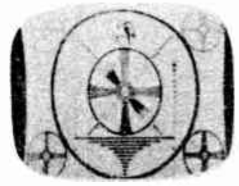
HORIZONTAL HOLD CONTROL — If the picture appears as shown in the illustration, adjust the horizontal hold control to right or left as required to lock in a single stationary picture. If the range of the control is not sufficient to lock in picture, see "Horizontal Hold Control" adjustment.



Misadjusted Vertical Hold

VERTICAL HOLD CONTROL — If the picture is moving up or down as illustrated at right, adjust the vertical hold control until a single stationary picture is obtained.

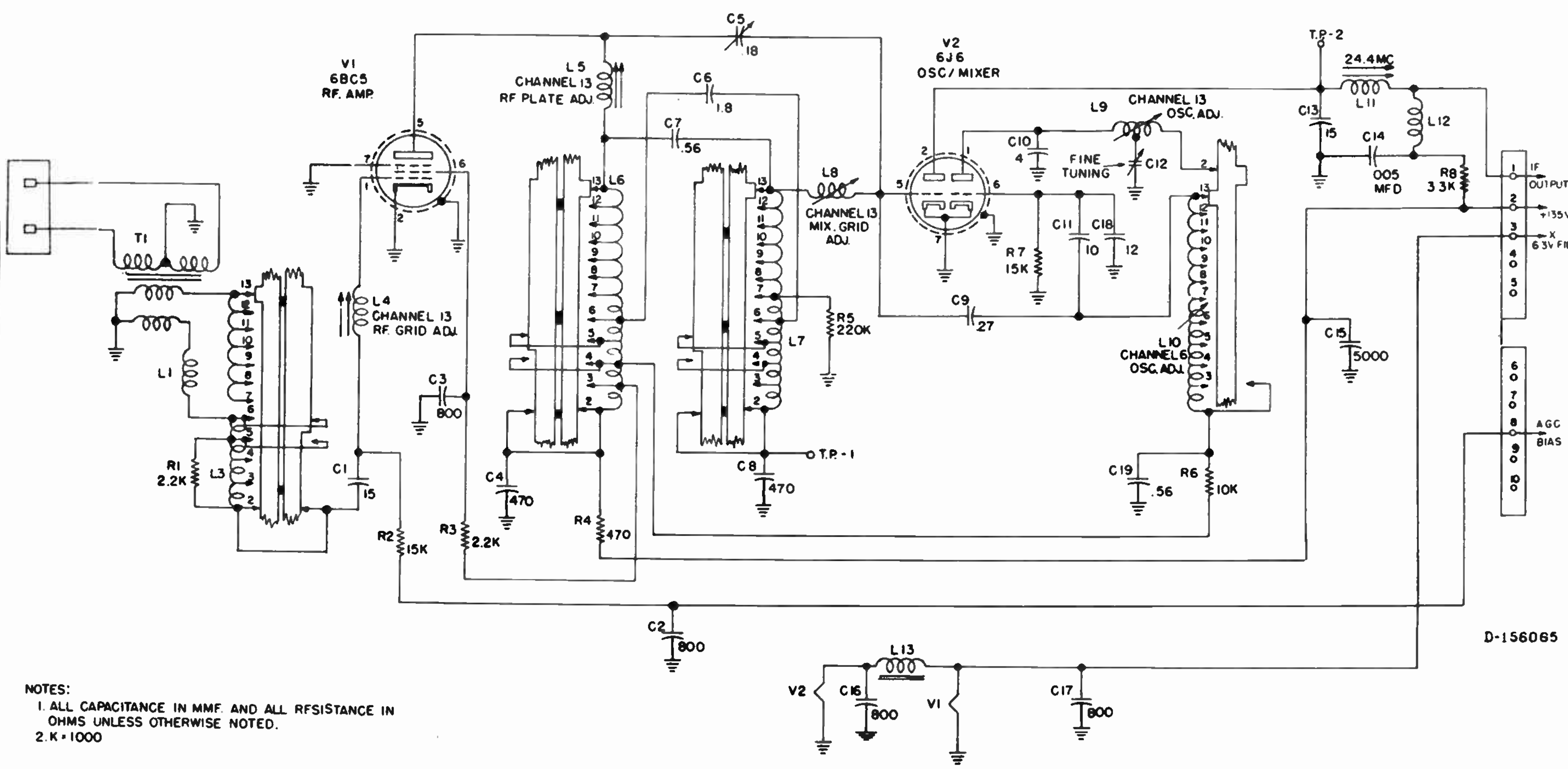
FOCUS CONTROL — Rotate to the right or left until the sharpest picture or sharpest horizontal lines are obtained.



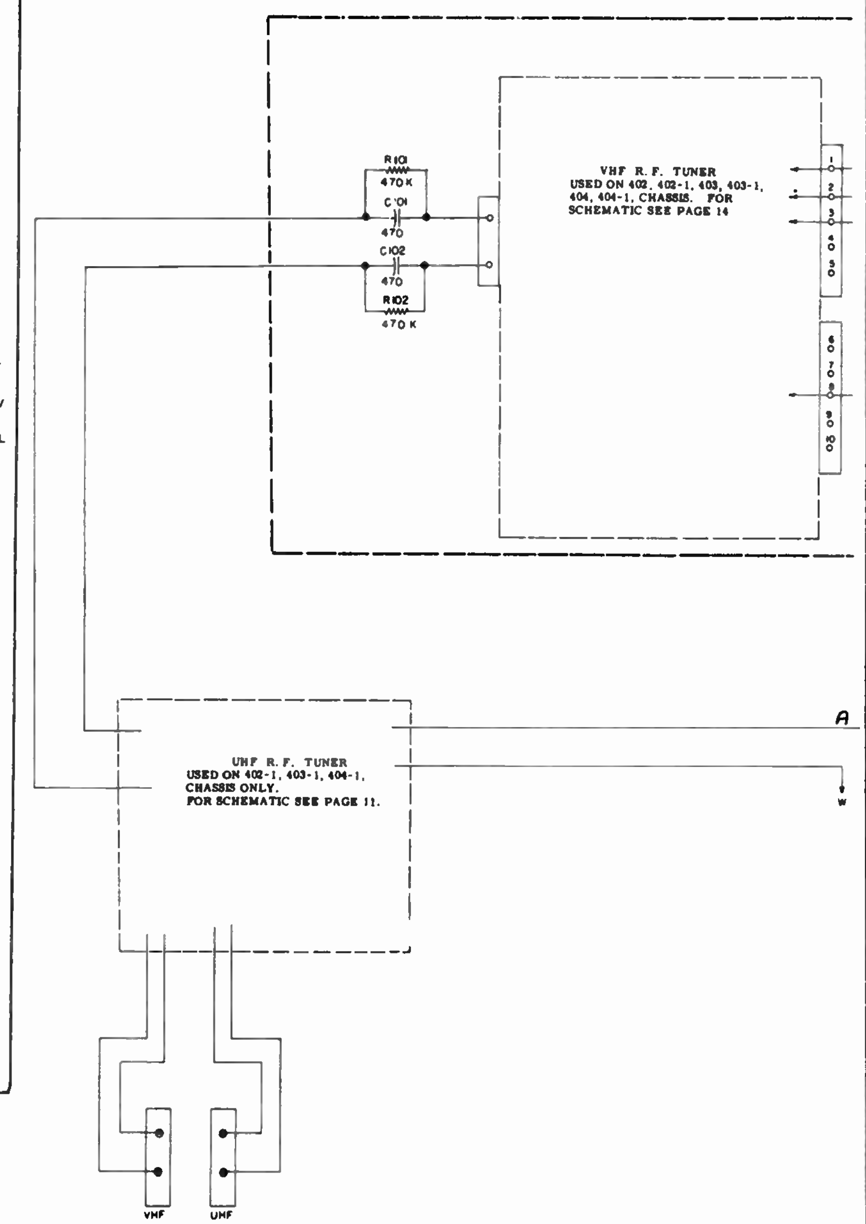
Picture Too Narrow

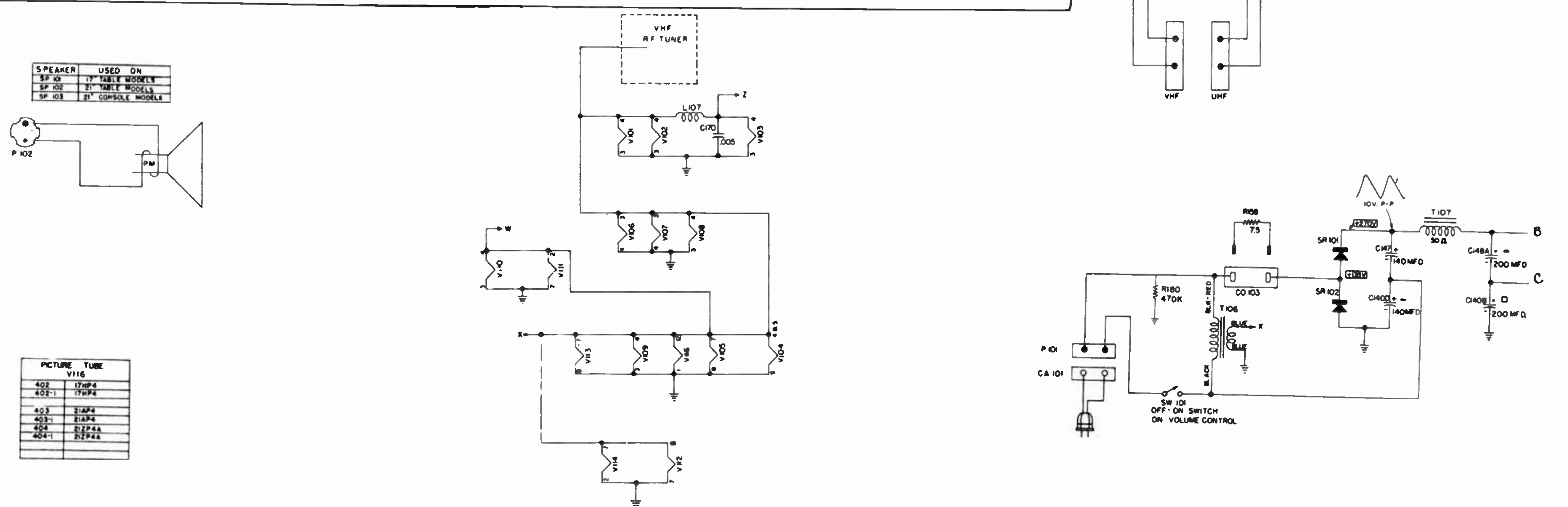
WIDTH CONTROL — If the picture is too narrow as illustrated, or too wide, turn the width control clockwise or counter-clockwise as required to adjust the picture to the proper width of the viewing area on the screen.

VHF TUNER SCHEMATIC



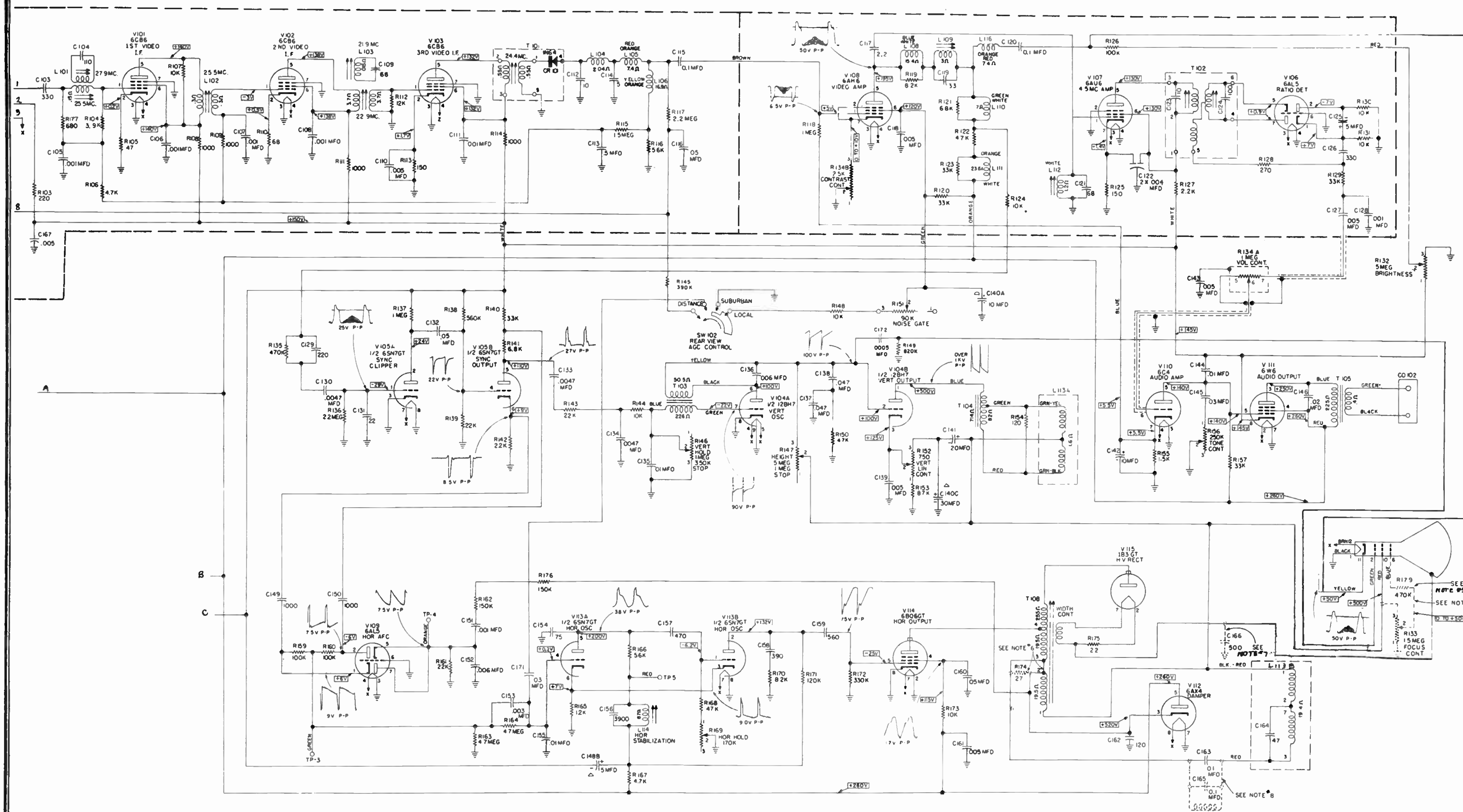
NOTES:
1. ALL CAPACITANCE IN MMF. AND ALL RESISTANCE IN OHMS UNLESS OTHERWISE NOTED.
2. K=1000





SPEAKER	USED ON
SP 101	17" TABLE MODELS
SP 102	21" TABLE MODELS
SP 103	21" CONSOLE MODELS

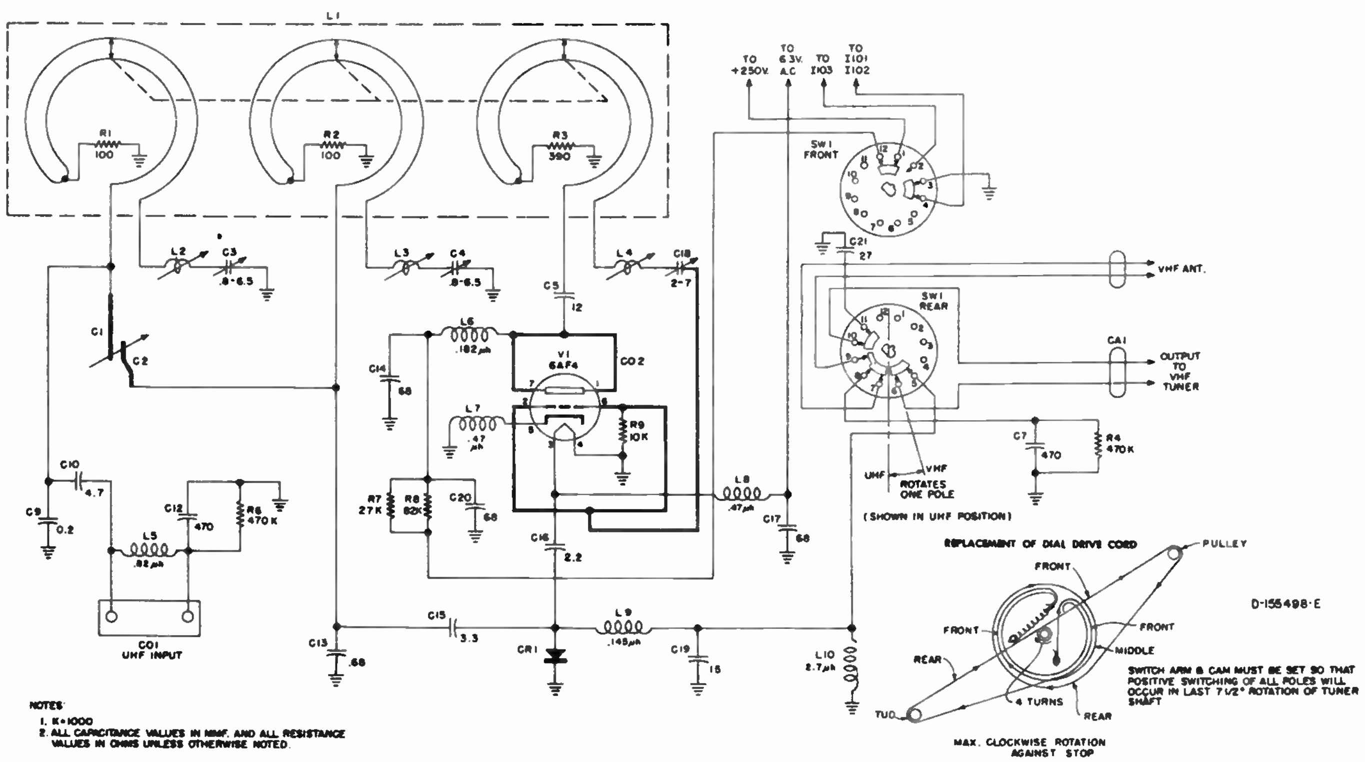
PICTURE TUBE V116	
402	17HP4
402-1	17HP4
403	21AP4
403-1	21AP4
404	21ZP4A
404-1	21ZP4A



NOTES:

1. ALL VOLTAGES MEASURED WITH AN ELECTRONIC VOLTMETER CONNECTED FROM SOCKET LUG TO CHASSIS.
2. SUPPLY VOLTAGE 117 VOLTS 60 CYCLE AC.
3. K=1000
4. ALL CAPACITANCE VALUES IN MMF. AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
5. R-133 FOCUS CONTROL 1.5 MEGOHM - USED ON 402,402-1 CHASSIS.
6. JUMPER IS REMOVED BETWEEN TERMINALS 2 AND 3 ON T108 AND R-174 IS SUBSTITUTED ON 403,403-1,404,404-1 CHASSIS.
7. C-166 IS USED ON 403, 403-1 CHASSIS.
8. C-163 IS REPLACED BY C-165 AND L-115 ON 403, 403-1, 404, 404-1 CHASSIS.
9. R-179 IS USED ONLY ON 402, 402-1 CHASSIS.

UHF CONVERTER SCHEMATIC



PARTS LIST

UHF CONVERTER

Symbol No.	Part No.	Description
C1	155424	Stator, RF Trimmer
C2	155508	Rotor, RF Coupling Trimmer
C3	151880-2	Capacitor, .8-6.5 mmf., Trimmer
C4	151880-2	Capacitor, .8-6.5 mmf., Trimmer
C5	155439-1	Capacitor, 12 mmf., ceramic
C7	156201-1	Capacitor, 470 mmf., 2KV., disc ceramic
C9	152997-9	Capacitor, .2 mmf., 500 V.
C10	152997-12	Capacitor, 4.7 mmf., 500 V.
C12	156201-1	Capacitor, 470 mmf., 2 KV., disc ceramic
C13	152997-6	Capacitor, .68 mmf., 500 V.
C14	152997-8	Capacitor, 68 mmf., 500 V.
C15	152997-4	Capacitor, 3.3 mmf., 500 V.
C16	152997-1	Capacitor, 2.2 mmf., 500 V.
C17	152997-8	Capacitor, 68 mmf., 500 V.
C18	155713-1	Capacitor, 2-7 mmf., Trimmer
C19	152997-13	Capacitor, 15 mmf., 500 V.
C20	152997-8	Capacitor, 68 mmf., 500 V.
C21	152997-14	Capacitor, 27 mmf., 500 V.
R1	Part of L1	Resistor, 100 ohm, 1/2 w.
R2	Part of L1	Resistor, 100 ohm, 1/2 w.
R3	Part of L1	Resistor, 390 ohm, 10%, 1/2 w.
R4	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R6	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R7	39374-42	Resistor, 27,000 ohm, 10%, 1/2 w.
R8	39374-136	Resistor, 82,000 ohm, 10%, 1 w.
R9	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
L1	155158-1	Inductuner, UHF
L2	Part of C3	Inductance
L3	Part of C4	Inductance
L4	Part of C18	Inductance
L5	148936-2	Choke, RF (.82 microhenries)
L6	156167	Choke, RF (.182 microhenries)
L7	148936-1	Choke, RF (.47 microhenries)
L8	148936-1	Choke, RF (.47 microhenries)
L9	155510	Choke, RF (.145 microhenries)
L10	148936-5	Choke, RF (2.7 microhenries)

Symbol No.	Part No.	Description
CA1		Transmission Line, Antenna (300 ohm)
CO1	154781	Terminal Board, UHF Antenna
CO2	155431	Strap, Oscillator Plate
CR1	151871	Crystal, Germanium (1N72)
SW1	156170	Switch, Function
	155495	Arm & Hub Assembly, Function Switch
	155561	Arm, Toggle
	155441	Bracket, Antenna
	154736	Bracket, Idler Pulley
	155488	Bracket, Tube Lock
	155427	Clip & Board Assembly, Crystal
	154803	Cotter Pin (External)
	155893	Eyelet (3 used to hold Rotors to Shaft)
	156788	Fibre Hub, Small Knob Shaft, Groove Pin & Outer Shaft Assembly
	137939-1	Idler Pulley
	155491	Pin, Drive Cord Guide
	156672	Pulley, Drive Cord
	137940-1	Rivet, Idler Pulley
	137940-8	Rivet, Toggle Arm
	155710	Screw, Adjusting (used on capacitor C18)
	151883	Screw, Nylon (used on capacitor C1)
	155484	Screw, Nylon (used to mount C18)
	39311-2	Screw (Set) Arm & Hub Assembly
	155898	Shaft & Stop Assembly, Inductuner
	153804	Shield (Lid), Oscillator
	153806	Shield, Oscillator
	154677	Shield, Tube (V1)
	154743	Shield (Fish Paper Disc), Drive Cord
	152053-1	Socket, Tube (V1)
	51752	Spring, Drive Cord Tension
	156871	UHF Converter Complete
	155895	Washer (1 used), Shaft & Stop Assembly
	155712	Washer (1 used), Used on C18
	148206-1	Washer (Spring Tension), Toggle Arm

PARTS LIST

CHASSIS 402, 403 & 404 (Schematic Parts)
402-1, 403-1 & 404-1

Symbol No.	Part No.	Description
C101	156201-1	Capacitor, 470 mmf., 2 Kv., disc ceramic
C102	156201-1	Capacitor, 470 mmf., 2 Kv., disc ceramic
C103	137727-129	Capacitor, 330 mmf., 500 v., ceramic
C104	Part of L101	Capacitor, 110 mmf., 10%, 500 v., ceramic
C105	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C106	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C107	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C108	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C109	Part of L103	Capacitor, 68 mmf., 10%, 500 v., mica
C110	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C111	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C112	137727-135	Capacitor, 10 mmf.. 500 v., ceramic
C113	154157	Capacitor, .5 mfd., 25 v., papêr
C114	137727-103	Capacitor, 5 mmf., 500 v., ceramic
C115	39001-19	Capacitor, .1 mfd., 600 v., paper
C116	39001-17	Capacitor, .05 mfd., 600 v., paper
C117	154100-4	Capacitor, 2.2 mmf., 500 v., ceramic
C118	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C119	137727-126	Capacitor, 33 mmf., 500 v., ceramic
C120	39001-19	Capacitor, .1 mfd., 600 v., paper
C121	137727-133	Capacitor, 68 mmf., 10%, 500 v., ceramic
C122	144675-6	Capacitor, .004 mfd., 400 v. } Assembly
C122		Capacitor, .004 mfd., 400 v., } Assembly
C123	Part of T102	Capacitor, 10 mmf.
C124	Part of T102	Capacitor, 100 mmf.
C125	154103	Capacitor, 5 mfd., 50 v., Electrolytic
C126	137727-129	Capacitor, 330 mmf., 500 v., ceramic
C127	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C128	144675-28	Capacitor, .001 mfd., 500 v., disc ceramic
C129	137727-131	Capacitor, 220 mmf., 500 v., ceramic
C130	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C131	137727-26	Capacitor, 22 mmf., 500 v., ceramic
C132	39001-17	Capacitor, .05 mfd., 600 v., paper
C133	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C134	39477-39	Capacitor, .0047 mfd., 600 v., molded paper
C135	39478-41	Capacitor, .01 mfd., 600 v., 10% molded paper
C136	39001-78	Capacitor, .006 mfd., 600 v., paper
C137	39477-45	Capacitor, .047 mfd., 600 v., molded paper
C138	39477-45	Capacitor, .047 mfd., 600 v., molded paper
C139	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C140A	155438	Capacitor, 10 mfd., 300 v. } Electrolytic
C140B		Capacitor, 200 mfd., 150 v. } Electrolytic
C140C		Capacitor, 30 mfd., 150 v. } Electrolytic
C140D		Capacitor, 140 mfd., 150 v. } Electrolytic
C141	154097	Capacitor, 20 mfd., 450 v., Electrolytic
C142	154104	Capacitor, 10 mfd., 50 v., Electrolytic
C143	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C144	39001-13	Capacitor, .01 mfd., 600 v., paper
C145	39001-82	Capacitor, .03 mfd., 600 v., paper
C146	39001-80	Capacitor, .02 mfd., 600 v., paper
C147	155684	Capacitor, 140 mfd., 150 v., Electrolytic
C148A	155426	Capacitor, 200 mfd., 150 v. } Electrolytic
C148B		Capacitor, 5 mfd., 150 v. } Electrolytic
C149	137727-132	Capacitor, 1000 mmf., 500 v., ceramic
C150	137727-132	Capacitor, 1000 mmf., 500 v., ceramic
C151	39478-108	Capacitor, .001 mfd., 10%, 1000 v., molded paper
C152	146434-16	Capacitor, .006 mfd., 10%, 600 v., paper

Symbol No.	Part No.	Description
C153	39001-76	Capacitor, .003 mfd., 600 v., paper
C154	137727-134	Capacitor, 75 mmf., 500 v., ceramic
C155	39001-13	Capacitor, .01 mfd., 600 v., paper
C156	137499-30	Capacitor, 3900 mmf., 500 v., mica
C157	137499-36	Capacitor, 470 mmf., 500 v., mica
C158	137499-31	Capacitor, 390 mmf., 500 v., mica
C159	137499-34	Capacitor, 560 mmf., 500 v., mica
C160	39001-17	Capacitor, .05 mfd., 600 v., paper (used on 402 chassis)
C161	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C162	154988	Capacitor, 120 mmf., 10%, 3 KV., disc ceramic
C163	39001-19	Capacitor, .1 mfd., 600 v., paper (used on 402 only)
C164	154211	Capacitor, 47 mmf., 2 KV., mica (Part of L113)
C165	Part of L115	Capacitor, .1 mfd., 200 v., paper
C166	151109	Capacitor, 500 mmf., 20 KV., ceramic (used on 403 chassis only)
C167	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C170	144675-2	Capacitor, .005 mfd., 500 v., disc ceramic
C171	39001-82	Capacitor, .03 mfd., 600 v., paper
C172	39001-5	Capacitor, .0005 mfd., 600 v., paper
R101	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R102	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R103	39374-17	Resistor, 220 ohm, 10%, 1/2 w.
R104	39375-63	Resistor, 3900 ohm, 5%, 1/2 w.
R105	39374-9	Resistor, 47 ohm, 10%, 1/2 w.
R106	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R107	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R108	39374-25	Resistor, 1000 ohm, 10%, 1 2 w.
R109	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R110	39374-11	Resistor, 68 ohm, 10%, 1/2 w.
R111	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R112	39375-75	Resistor, 12,000 ohm, 5%, 1/2 w.
R113	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R114	39374-25	Resistor, 1000 ohm, 10%, 1/2 w.
R115	39374-65	Resistor, 1.5 megohm, 10%, 1/2 w.
R116	39375-67	Resistor, 5600 ohm, 5%, 1/2 w.
R117	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
R118	39374-61	Resistor, 1 megohm, 10%, 1.2 w.
R119	Part of L108	Resistor, 8200 ohm, 10%, 1/2 w.
R120	39374-219	Resistor, 33,000 ohm, 10%, 2 w.
R121	Part of L110	Resistor, 6800 ohm, 10%, 1/2 w.
R122	39375-361	Resistor, 4700 ohm, 5%, 2 w.
R123	Part of L111	Resistor, 3300 ohm, 10%, 1/2 w.
R124	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R125	39374-15	Resistor, 150 ohm, 10%, 1/2 w.
R126	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R127	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R128	39374-18	Resistor, 270 ohm, 10%, 1/2 w.
R129	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R130	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R131	39375-73	Resistor, 10,000 ohm, 5%, 1/2 w.
R132	155352	Control, Brightness (5 megohm)
R133	154094	Control, Focus (1.5 megohm used on 402 chassis only)
R134A	154085	Control, Volume (1 megohm) } Assembly
R134B		Control, Contrast (2500 ohm) } Assembly
R135	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
R136	39374-69	Resistor, 2.2 megohm, 10%, 1/2 w.
R137	39374-61	Resistor, 1 megohm, 10%, 1/2 w.
R138	39374-146	Resistor, 560,000 ohm, 10%, 1 w.
R139	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R140	39374-31	Resistor, 3300 ohm, 10%, 1/2 w.
R141	39374-35	Resistor, 6800 ohm, 10%, 1/2 w.
R142	39374-29	Resistor, 2200 ohm, 10%, 1/2 w.
R143	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R144	39374-37	Resistor, 10,000 ohm, 10%, 1/2 w.
R145	39374-56	Resistor, 390,000 ohm, 10%, 1/2 w.
R146	155610	Control, Vertical Hold
R147	154086	Control, Height
R148	39374-125	Resistor, 10,000 ohm, 10%, 1 w.

PARTS LIST

CHASSIS 402, 403 & 404 (Schematic Parts)

402-1, 403-1 & 404-1

Symbol No.	Part No.	Description
R149	39374-60	Resistor, 820,000 ohm, 10%, 1/2 w.
R150	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R151	155576	Control, Noise Gate (90,000 ohm)
R152	154088	Control, Vertical Linearity
R153	154084	Resistor, 8700 ohm, 5%, 5 w. wire wound
R154	39374-14	Resistor, 120 ohm, 10%, 1/2 w.
R155	39374-27	Resistor, 1500 ohm, 10%, 1/2 w.
R156	155389	Control, Tone (250,000 ohm)
R157	39374-43	Resistor, 33,000 ohm, 10%, 1/2 w.
R158	154089	Resistor, 7.5 ohm, 10%, 5 w. wire wound
R159	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R160	39374-49	Resistor, 100,000 ohm, 10%, 1/2 w.
R161	39374-41	Resistor, 22,000 ohm, 10%, 1/2 w.
R162	39374-139	Resistor, 150,000 ohm, 10%, 1 w.
R163	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R164	39374-77	Resistor, 4.7 megohm, 10%, 1/2 w.
R165	39374-26	Resistor, 1200 ohm, 10%, 1/2 w.
R166	39374-34	Resistor, 5600 ohm, 10%, 1/2 w.
R167	39374-33	Resistor, 4700 ohm, 10%, 1/2 w.
R168	39374-45	Resistor, 47,000 ohm, 10%, 1/2 w.
R169	155511	Control, Horizontal Hold
R170	39374-36	Resistor, 8200 ohm, 10%, 1/2 w.
R171	39374-50	Resistor, 120 ohm, 10%, 1/2 w.
R172	39374-55	Resistor, 330,000 ohm, 10%, 1/2 w.
R173	39374-213	Resistor, 10,000 ohm, 10%, 2 w.
R174	39374-6	Resistor, 27 ohm, 10%, 1/2 w. (used on 403, 404 chassis only)
R175	39303-12	Resistor, 2.2 ohm (Part of T108)
R176	39374-139	Resistor, 150,000 ohm, 10%, 1 w.
R177	39374-23	Resistor, 680 ohm, 10%, 1/2 w.
R179	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w. (used on 402 only)
R180	39374-57	Resistor, 470,000 ohm, 10%, 1/2 w.
L101	155304	Coil, Converter IF (1.98 to 4.5 microhenries)
L102	155319	Coil, 1st IF (1.95 to 4.5 microhenries)
L103	155348	Coil, 2nd IF (2.4 to 4.5 microhenries)
L104	154376	Coil, Diode Choke (15.5 microhenries)

Symbol No.	Part No.	Description
L105	156035	Coil, Video Peaking (117 microhenries)
L106	156036	Coil, Video Peaking (464 microhenries)
L107	155256	Choke, Filament RF (.576 microhenries)
L108	154194	Coil, Video Peaking (414 microhenries)
L109	155446	Coil, 4.5 MC. Trap (27 to 57 microhenries)
L110	154206	Coil, Video Peaking (106 microhenries)
L111	154176	Coil, Video Peaking (840 microhenries)
L112	155442	Coil, Sound Take-Off (12 to 23 microhenries)
L113A	154221-6	Yoke, Deflection } Assembly (used on 402 only)
L113B		Yoke, Deflection
L113A	154221-9	Yoke, Deflection } Assembly (used on 403, 404 chassis)
L113B		Yoke, Deflection
L114	154220	Coil, Horizontal Oscillator (18 to 37 microhenries)
L115	154156	Network, Yoke Coupling (3 microhenries, used on 403, 404 chassis only)
L116	156035	Coil, Video Peaking (117 microhenries)
T101	155594	Transformer, Diode IF
T102	154108	Transformer, Ratio Detector
T103	155255-1	Transformer, Vertical Oscillator
T104	155572	Transformer, Vertical Output
T105	154109-2	Transformer, Audio Output
T106	155390	Transformer, Filament
T107	155529-1	Choke, Filter
T108	155514-1	Transformer, Horizontal Deflection
CO102	138352	Socket, Speaker
CO103	154114	Socket, Terminal Strip
SW101	Part of R134A&B	Switch, ON-OFF Power
SW102	155554	Switch, Rotary (AGC Control)
CR101	154111	Crystal, 1N64
SR101	155575-2	Rectifier, Selenium
SR102	155575-2	Rectifier, Selenium
SP101	138762-7	Speaker, PM (5-1/4")
SP102	138762-7	Speaker, PM (5-1/4")
SP103	138762-5	Speaker, PM (10")
CA101	132300-6	Cable & Plug Assembly, AC Power
P101	154125	Receptacle, AC Power
P102	131983	Plug (Male), 2 Prong

CHASSIS 402 & 402-1

Part No.	Description
154495	Antenna Terminal Board & Bracket Assembly
155462	Barrier, Brightness Control
155375	Barrier, Tone Control
155750-1	Bracket (Frame), Deflection Yoke Assembly
155222	Bracket (Front), VHF Tuner Shaft
154255-2	Bracket, Picture Tube Stop
154238-2	Bracket, Picture Tube Strap Tie Down
154253	Bracket, (Saddle), Deflection Yoke Assembly
155199	Bracket, Tone & Brightness Controls
155558	Cable, Twin Shielded
154276-2	Channel (Rubber), Deflection Yoke Assembly
154266-1	Channel (Rubber), Picture Tube Mounting Foot
156009	Coil (High Voltage), Horizontal Deflection Assembly
154180	Coil (Primary), Horizontal Deflection Assembly
155102-2	Connector, Picture Tube Anode
154124	Coupling, Width Control Shaft
153424-3	Cushion (Rubber), Picture Tube Strap
155194	Disc, Fine Tuning (VHF)
156045	Foot, Picture Tube Mounting (2 used)
154134	Grommet (4 used), Tube Mounting (V104, V113)
155553	Insulator, Antenna Lead
138853	Insulator, Controls (8 used)
154264	Insulator, Interlock
154268	Insulator, VHF Tuner Shaft
153109-3	Ion Trap
39012-102	Iron Core
39012-116	Iron Core (6 used on IF Strip)
154073	Iron Core, Horizontal Deflection Assembly
154122-2	Plate Cap, Tube (V115)
154122-3	Plate Cap, Tube (V114)
155253	Plate (Bearing), VHF Tuner Shaft
154075	Plate, Horizontal Width Control
154079-1	Ring (Retaining), Width Control Shaft (3 used)

Part No.	Description
154079-2	Ring (Retaining), Width Control Shaft Key
153580	Screw (Thumb), Deflection Yoke Assembly
39296-84	Screw (2 used), Picture Tube Strap
155195	Shaft, Width Control
154077	Shaft, Width Control (Horizontal Deflection Assembly)
155027	Shaft, VHF Tuner
155276	Shield, Corona
155241	Shield, High Voltage
154143	Shield, Tube (2 used)
154148-3	Socket & Cable Assembly, Picture Tube
154203	Socket, Tube Shock Mounted (V113)
154192	Socket, Tube Shock Mounted (V104)
154127	Socket, Tube (V106, V107, V108, V110)
39388	Socket, Tube (V111)
154131	Socket, Tube (V105, V114)
154117	Socket, Tube (V109)
154130	Socket, Tube (V112)
154146	Socket, Tube (V101, V102, V103)
149322	Support, Anode Connector
154074	Support, High Voltage Lead (Horizontal Deflection Assembly)
149671-1	Spring (Grounding), Deflection Yoke Assembly
154135	Spring, Picture Tube Mounting (2 used)
154072	Spring (Clip), Horizontal Deflection Assembly
154071	Spring (Strap), Horizontal Deflection Assembly
154205	Strap, Picture Tube
155351	Terminal Board, Horizontal Deflection Assembly
155398	VHF Tuner, Complete
154123	Wafer, Capacitor Mounting (C148)
154126	Wafer, Capacitor Mounting (C140)
155394	Washer (Extruded), Tone & Brightness Controls
138976	Washer (Extruded), Auxillary Controls (8 used)
155339	Washer, Picture Tube Mounting Foot (2 used)
149180	Washer (Spring), Width Control Shaft

NOTE: For Replacement Parts List for Chassis 403, 403-1, 404 & 404-1, see page 20.

PARTS LIST

CHASSIS 403 & 403-1

Part No.	Description
154495	Antenna Terminal Board & Bracket Assembly
155462	Barrier, Brightness Control
155375	Barrier, Tone Control
154722	Barrier, Picture Tube
155750-2	Bracket (Frame), Deflection Yoke Assembly
155222	Bracket (Front), VHF Tuner Shaft
155330-1	Bracket (R.H.), Picture Tube Support
155330-2	Bracket (L.H.), Picture Tube Support
155741	Bracket (2 used), Focuser Mounting
154253	Bracket (Saddle), Deflection Yoke Assembly
155199	Bracket, Tone & Brightness Controls
155558	Cable, Twin Shielded
154276-2	Channel (Rubber), Deflection Yoke Assembly
155579	Clip, Anode Connector
156009	Coil (High Voltage), Horizontal Deflection Assembly
154180	Coil (Primary), Horizontal Deflection Assembly
154124	Coupling, Width Control Shaft
155999-1	Cushion (Rubber), Picture Tube Support (2 used)
155194	Disc, Fine Tuning (V.H.F.)
155788-1	Focuser (P.M.)
154134	Grommet (4 used), Tube Mounting (V104, V113)
155553	Insulator, Antenna Lead
138853	Insulator, Controls (8 used)
154264	Insulator, Interlock
154268	Insulator, VHF Tuner Shaft
154025	Insulator (Ring), Picture Tube
153109-1	Ion Trap
39012-102	Iron Core
39012-116	Iron Core (6 used on IF Strip)
154073	Iron Core, Horizontal Deflection Assembly
154122-2	Plate Cap, Tube (V115)
154122-3	Plate Cap, Tube (V114)
155253	Plate (Bearing), VHF Tuner Shaft
154075	Plate, Horizontal Width Control

Part No.	Description
154079-1	Ring (Retaining), Width Control Shaft (3 used)
154079-2	Ring (Retaining), Width Control Shaft Key
153580	Screw (Thumb), Deflection Yoke Assembly
155195	Shaft, Width Control
154077	Shaft, Width Control (Horizontal Deflection Assembly)
155027	Shaft, VHF Tuner
155851	Shim, used between Focuser & Picture Tube Neck
155276	Shield, Corona
155241	Shield, High Voltage
154143	Shield, Tube (2 used)
155842-1	Socket & Cable Assembly, Picture Tube
154203	Socket, Tube Shock Mounted (V113)
154192	Socket, Tube Shock Mounted (V104)
154127	Socket, Tube (V106, V107, V108, V110)
39388	Socket, Tube (V111)
154131	Socket, Tube (V105, V114)
154117	Socket, Tube (V109)
154130	Socket, Tube (V112)
154146	Socket, Tube (V101, V102, V103)
154074	Support, High Voltage Lead (Horizontal Deflection Assembly)
154381	Spring, Capacitor Mounting (C166)
154414-4	Spring (2 used), Deflection Yoke Assembly to Picture Tube Support
154072	Spring (Clip), Horizontal Deflection Assembly
154071	Spring (Strap), Horizontal Deflection Assembly
153979-2	Strap, Picture Tube
155398	VHF Tuner, Complete
154123	Wafer, Capacitor Mounting (C148)
154126	Wafer, Capacitor Mounting (C140)
155394	Washer (Extruded), Tone & Brightness Controls
138976	Washer (Extruded), Auxillary Controls (8 used)
149180	Washer (Spring), Width Control Shaft

CHASSIS 404 & 404-1

Part No.	Description
154495	Antenna Terminal Board & Bracket Assembly
155462	Barrier, Brightness Control
155375	Barrier, Tone Control
155750-1	Bracket (Upper Frame), Deflection Yoke Assembly
155514	Bracket (Lower Frame), Deflection Yoke Assembly
155199	Bracket, Tone & Brightness Controls
155741	Bracket (2 used), Focuser Mounting
154253	Bracket (Saddle), Deflection Yoke Assembly
155891	Bracket (R.H.), Picture Tube Support
155892	Bracket (L.H.), Picture Tube Support
155558	Cable, Twin Shielded
154276-2	Channel (Rubber), Deflection Yoke Assembly
156009	Coil (High Voltage), Horizontal Deflection Assembly
154180	Coil (Primary), Horizontal Deflection Assembly
155102-3	Connector, Picture Tube Anode
154124	Coupling, Width Control Shaft
153424-1	Cushion, Picture Tube Strap
153424-5	Cushion, Picture Tube Support (2 used)
155194	Disc, Fine Tuning (V.H.F.)
155788-1	Focuser (P.M.)
154134	Grommet (4 used), Tube Mounting (V104, V113)
155553	Insulator, Antenna Lead
138853	Insulator, Controls (7 used)
154264	Insulator, Interlock
154268	Insulator, VHF Tuner Shaft
153109-1	Ion Trap
39012-102	Iron Core
39012-116	Iron Core (6 used on IF Strip)
154073	Iron Core, Horizontal Deflection Assembly
154122-2	Plate Cap, Tube (V115)
154122-3	Plate Cap, Tube (V114)
155253	Plate (Bearing), VHF Tuner Shaft
154075	Plate, Horizontal Width Control
154079-1	Ring (Retaining), Width Control Shaft (3 used)

Part No.	Description
154079-2	Ring (Retaining), Width Control Shaft Key
153580	Screw (Thumb), Deflection Yoke Assembly
155195	Shaft, Width Control
154077	Shaft, Width Control (Horizontal Deflection Assembly)
155027	Shaft, VHF Tuner
155276	Shield, Corona
155241	Shield, High Voltage
154143	Shield, Tube (2 used)
155851	Shim, Used between Focuser & Picture Tube Neck
155842-1	Socket & Cable Assembly, Picture Tube
154203	Socket, Tube Shqck Mounted (V113)
154192	Socket, Tube Shock Mounted (V104)
154127	Socket, Tube (V106, V107, V108, V110)
39388	Socket, Tube (V111)
154131	Socket, Tube (V105, V114)
154117	Socket, Tube (V109)
154130	Socket, Tube (V112)
154146	Socket, Tube (V101, V102, V103)
149322	Support, Anode Connector
154074	Support, High Voltage Lead (Horizontal Deflection Assembly)
149671	Spring (Grounding), Deflection Yoke Assembly
154414-3	Spring, Picture Tube Mounting (2 used)
154072	Spring (Clip), Horizontal Deflection Assembly
154071	Spring (Strap), Horizontal Deflection Assembly
155887	Strap, Picture Tube
155351	Terminal Board, Horizontal Deflection Assembly
155398	VHF Tuner, Complete
154123	Wafer, Capacitor Mounting (C148)
154126	Wafer, Capacitor Mounting (C140)
155394	Washer (Extruded), Tone & Brightness Controls
138976	Washer (Extruded), Auxillary Controls (7 used)
149180	Washer (Spring), Width Control Shaft

PARTS LIST

Final Assembly and Cabinet - Models F-17TOLH & F-17TOLU

Part No.	Description	Part No.	Description
154377-2	Antenna Assembly (VHF)	154216-1	Knob, Contrast Control
154965	Antenna Assembly (UHF)	154265	Knob, Local-Distance-Suburban Switch
155709	Back & Power Cable Assembly (F-17TOLH)	154270	Knob, (2 used), Vertical & Horizontal Hold Controls
155493	Back & Power Cable Assembly (F-17TOLU)		
155163	Bracket (4 used), Chassis Mounting	155513-1	Knob, (2 used), Tone & Brightness Controls
155302-1	Cabinet	156206-1	Knob, Channel Selector (UHF)
153751	Clip (4 used), Window Retaining	156209-1	Knob, Volume Control
156234-1	Escutcheon (F-17TOLH)	156217-1	Knob, Channel Selector (VHF)
156234-2	Escutcheon (F-17TOLU)	154154	Mask, Window
144600	Grille Cloth	145211-22	Nut (Wing), Speaker Mounting
155306	Insulation (4 pieces used), Chassis Mounting Bracket	154210-10	Screw (4 used), Chassis Mounting
		155162	Washer (Extruded), Chassis Mounting Bracket
154214-1	Knob, Fine Tuning (VHF & UHF)	154101	Window, Tempered Glass

Final Assembly and Cabinet - Models F-17TOLBH & F-17TOLBU

Part No.	Description	Part No.	Description
154377-2	Antenna Assembly (VHF)	154216-2	Knob, Contrast Control
154965	Antenna Assembly (UHF)	154265	Knob, Local-Distance-Suburban Switch
155709	Back & Power Cable Assembly (F-17TOLBH)	154270	Knob (2 used), Vertical & Horizontal Hold Controls
155493	Back & Power Cable Assembly (F-17TOLBU)		
155163	Bracket (4 used), Chassis Mounting	155513-2	Knob (2 used), Tone & Brighiness Controls
155302-2	Cabinet	156206-2	Knob Channel Selector (UHF)
153751	Clip (4 used), Window Retaining	156209-2	Knob, Volume Control
156234-1	Escutcheon (F-17TOLBH)	156217-2	Knob, Channel Selector (VHF)
156234-2	Escutcheon (F-17TOLBU)	154154	Mask, Window
145472	Grille Cloth	145211-22	Nut (Wing), Speaker Mounting
155306	Insulation (4 pieces used), Chassis Mounting Bracket	154210-10	Screw (4 used), Chassis Mounting
		155162	Washer (Extruded), Chassis Mounting Bracket
154214-2	Knob, Fine Tuning (VHF & UHF)	154101	Window, Tempered Glass

Final Assembly and Cabinet - Models F-21TOLH & F-21TOLU

Part No.	Description	Part No.	Description
154377-2	Antenna Assembly (VHF)	155513-1	Knob (2 used), Tone & Brightness Controls
154965	Antenna Assembly (UHF)	156206-1	Knob, Channel Selector (UHF)
155995	Back & Power Cable Assembly (F-21TOLH)	156209-1	Knob, Volume Control
155996	Back & Power Cable Assembly (F-21TOLU)	156217-1	Knob, Channel Selector (VHF)
155163	Bracket (4 used), Chassis Mounting	154333-3	Mask, Window
155890	Bracket, Window Reinforcing	155257-1	Moulding (Rubber), Window
155250-1	Cabinet	145211-22	Nut (Wing), Speaker Mounting
156234-1	Escutcheon (F-21TOLH)	156028	Nut (Wing), Trim Strip Mounting
156234-2	Escutcheon (F-21TOLU)	148464-7	Screen, Speaker Baffle
144600	Grille Cloth	154210-10	Screw (4 used), Chassis Mounting
155306	Insulation (4 pieces used), Chassis Mounting Bracket	155886	Spring, Window Retaining
		155860-1	Strip, Window Trim
154214-1	Knob, Fine Tuning (VHF & UHF)	155162	Washer (Extruded), Chassis Mounting Bracket
154216-1	Knob, Contrast Control	155877	Washer (4 used), Window Retaining
154265	Knob, Local-Distance-Suburban Switch	156811-1	Window, Laminated Glass
154270	Knob (2 used), Vertical & Horizontal Hold Controls		

Final Assembly and Cabinet - Models F-21TOLBH & F-21TOLBU

Part No.	Description	Part No.	Description
154377-2	Antenna Assembly (VHF)	155513-2	Knob (2 used), Tone & Brightness Controls
154965	Antenna Assembly (UHF)	156206-2	Knob, Channel Selector (UHF)
155995	Back & Power Cable Assembly (F-21TOLBH)	156209-2	Knob, Volume Control
155996	Back & Power Cable Assembly (F-21TOLBU)	156217-2	Knob, Channel Selector (VHF)
155163	Bracket (4 used), Chassis Mounting	154333-3	Mask, Window
155890	Bracket, Window Reinforcing	155257-1	Moulding (Rubber), Window
155250-2	Cabinet	145211-22	Nut (Wing), Speaker Mounting
156234-1	Escutcheon (F-21TOLBH)	156028	Nut (Wing), Trim Strip Mounting
156234-2	Escutcheon (F-21TOLBU)	148464-7	Screen, Speaker Baffle
145472	Grille Cloth	154210-10	Screw (4 used), Chassis Mounting
155306	Insulation (4 pieces used), Chassis Mounting Bracket	155886	Spring, Window Retaining
		155860-1	Strip, Window Trim
154214-2	Knob, Fine Tuning (VHF & UHF)	155162	Washer (Extruded), Chassis Mounting Bracket
154216-2	Knob, Contrast Control	155877	Washer (4 used), Window Retaining
154265	Knob, Local-Distance-Suburban Switch	156811-1	Window, Laminated Glass
154270	Knob (2 used), Vertical & Horizontal Hold Controls		

PARTS LIST

Final Assembly and Cabinet - Models F-21COLH & F-21COLU)

Part No.	Description	Part No.	Description
154377-2	Antenna Assembly (VHF)	155513-1	Knob (2 used), Tone & Brightness Controls
155822	Antenna Assembly (UHF)	156206-1	Knob, Channel Selector (UHF)
155484	Back & Power Cable Assembly (F-21COLH)	156209-1	Knob, Volume Control
155598	Back & Power Cable Assembly (F-21COLU)	156217-1	Knob, Channel Selector (VHF)
155163	Bracket (4 used), Chassis Mounting	155724-1	Mask, Window
155780-1	Bracket (R.H.), Window Reinforcing	155257-2	Moulding (Rubber), Window
155780-2	Bracket (L.H.), Window Reinforcing	145211-22	Nut (Wing), Speaker Mounting
155244-1	Cabinet	155523-1	Screw (2 used), Trim Strip Mounting
156234-1	Escutcheon (F-21COLH)	154210-10	Screw (4 used), Chassis Mounting
156234-2	Escutheon (F-21COLU)	155885	Spring, Window Retaining
155526	Grille Cloth	155862-1	Strip, Window Trim
155306	Insulation (4 pieces used), Chassis Mounting Bracket	155162	Washer (Extruded), Chassis Mounting Bracket
		155877	Washer (4 used), Window Retaining
154214-1	Knob, Fine Tuning (VHF & UHF)	155464	Wood Anchor
154216-1	Knob, Contrast Control	155350-1	Window, Tempered Glass
154265	Knob, Local-Distance-Suburban Switch		
154270	Knob (2 used), Vertical & Horizontal Hold Controls		

Final Assembly and Cabinet - Models F-21COLBH & F-21COLBU

Part No.	Description	Part No.	Description
154377-2	Antenna Assembly (VHF)	155513-2	Knob (2 used), Tone & Brightness Controls
155822	Antenna Assembly (UHF)	156206-2	Knob, Channel Selector (UHF)
155484	Back & Power Cable Assembly (F-21COLBH)	156209-2	Knob, Volume Control
155598	Back & Power Cable Assembly (F-21COLBU)	156217-2	Knob, Channel Selector (VHF)
155163	Bracket (4 used), Chassis Mounting	155724-1	Mask, Window
155780-1	Bracket (R.H.), Window Retaining	155257-2	Moulding (Rubber), Window
155780-2	Bracket (L.H.), Window Retaining	145211-22	Nut (Wing), Speaker Mounting
155244-2	Cabinet	155523-1	Screw (2 used), Trim Strip Mounting
156234-1	Escutcheon (F-21COLHB)	154210-10	Screw (4 used), Chassis Mounting
156234-2	Escutcheon (F-21COLBU)	155885	Spring, Window Retaining
155528	Grille Cloth	155862-1	Strip, Window Trim
155306	Insulation (4 pieces used), Chassis Mounting Bracket	155162	Washer (Extruded), Chassis Mounting Bracket
		155877	Washer (4 used), Window Retaining
154214-2	Knob, Fine Tuning (VHF & UHF)	155464	Wood Anchor
154216-2	Knob, Contrast Control	155350-1	Window, Tempered Glass
154265	Knob, Local-Distance-Suburban Switch		
154270	Knob, (2 used), Vertical & Horizontal Hold Controls		

Final Assembly and Cabinet - Models F-21CDLH & F-21CDLU

Part No.	Description	Part No.	Description
154377-2	Antenna Assembly (VHF)	154270	Knob (2 used), Vertical & Horizontal Hold Controls
155822	Antenna Assembly (UHF)		
155841	Back & Power Cable Assembly (F-21CDLH)	155513-1	Knob (2 used), Tone & Brightness Controls
155847	Back & Power Cable Assembly (F-21CDLU)	156206-1	Knob, Channel Selector (UHF)
155163	Bracket (4 used), Chassis Mounting	156209-1	Knob, Volume Control
155840-1	Bracket (R.H.), Window Retaining	156217-1	Knob, Channel Selector (VHF)
155840-2	Bracket (L.H.), Window Retaining	155724-2	Mask, Window
155388	Cabinet	155257-4	Moulding (Rubber), Window
139319-2	Catch (4 used), Doors	145211-22	Nut (Wing), Speaker Mounting
155935	Doors (one pair), Matched	156154	Pull (one pair), Doors
156234-1	Escutcheon (F-21CDLH)	155223-1	Screw (2 used), Trim Strip Mounting
156234-2	Escutcheon (F-21CDLU)	154210-10	Screw (4 used), Chassis Mounting
156165	Grille Cloth	155886	Spring, Window Retaining
146786	Hinge, Upper Left & Lower Right	139319-1	Strike (4 used), Doors
146787	Hinge, Lower Left & Upper Right	155862-2	Strip, Window Trim
155306	Insulation (4 pieces used), Chassis Mounting Bracket	155162	Washer (Extruded), Chassis Mounting Bracket
		155877	Washer (4 used), Window Retaining
154214-1	Knob, Fine Tuning (VHF & UHF)	155464	Wood Anchor
154216-1	Knob, Contrast Control	155350-5	Window, Tempered Glass
154265	Knob, Local-Distance-Suburban Switch		

Final Assembly and Cabinet - Models F-21CDLBH & F-21CDLBU

Part No.	Description	Part No.	Description
154377-2	Antenna Assembly (VHF)	154265	Knob, Local-Distance-Suburban Switch
155822	Antenna Assembly (UHF)	154270	Knob, (2 used), Vertical & Horizontal Hold Controls
155841	Back & Power Cable Assembly (F-21CDLHB)		
155847	Back & Power Cable Assembly (F-21CDLBU)	155513-2	Knob (2 used), Tone & Brightness Controls
155163	Bracket (4 used), Chassis Mounting	156206-2	Knob, Channel Selector (UHF)
155840-1	Bracket (R.H.), Window Retaining	156209-2	Knob, Volume Control
155840-2	Bracket (L.H.), Window Retaining	156217-1	Knob, Channel Selector (VHF)
155404	Cabinet	155724-2	Mask, Window
149941-2	Catch (2 used), Doors	155257-4	Moulding (Rubber), Window
155934	Doors (one pair), Matched	145211-22	Nut (Wing), Speaker Mounting
156234-1	Escutcheon (F-21CDLBH)	156153	Pull, Right Hand
156234-2	Escutcheon (F-21CDLBU)	156154	Pull, Left Hand
156155	Grille Cloth	155223-1	Screw (2 used), Trim Strip Mounting
149942	Hinge, Upper Left	154210-10	Screw (4 used), Chassis Mounting
149943	Hinge, Upper Right	155886	Spring, Window Retaining
156587	Hinge, Lower Left	149941-1	Strike (2 used), Doors
156586	Hinge, Lower Right	155862-2	Strip, Window Trim
155306	Insulation (4 pieces used), Chassis Mounting Bracket	155162	Washer (Extruded), Chassis Mounting Bracket
		155877	Washer (4 used), Window Retaining
154214-2	Knob, Fine Tuning	155464	Wood Anchor
154216-2	Knob, Contrast Control	155350-5	Window, Tempered Glass

TURRET TUNERS

Because tuners operate at very high frequencies, considerable care must be taken when working on them. If the following simple precautions are observed no difficulty should be encountered:

1. Don't assume the tuner is at fault until the other circuits of the receiver have been carefully checked.
2. Always use exact replacement parts.
3. When troubleshooting a tuner do not disturb the parts or lead position-ing.
4. When making a replacement, duplicate the positioning and lead dress of the original part.
5. Do not disturb any of the tuner adjustments unless you are familiar with the proper adjustment procedure.

REPLACING TUNER COIL STRIPS. — TU-1, TU-2, TU-3, TU-4, TU-6, TU-8, TU-10

1. Remove the tuner bottom cover by pulling its front end away from the tuner and unhooking its rear edge.
2. Using a screwdriver pry the spring finger, holding the strip, away from the turret end plate and lift out the strip.
3. To install the new strip, insert the two projections into the holes in the detent ring.
4. Pry the spring finger away from the end plate, push the strip in place, and let the spring finger snap over the end of the strip.

TU-5, TU-7, TU-9

1. Remove the four screws holding the tuner bottom cover and remove the cover.
2. Using a screwdriver, push the spring finger holding the strip toward rear of tuner and lift out strip.
3. To install new strip, insert end having smaller projection into the hole in the detent plate.
4. Pry the spring finger away from rear of drum and push the strip into place. Let spring finger snap back into place making sure that projection on end of strip seats correctly in hole in spring finger.

CLEANING THE TUNER CONTACTS. — Remove the tuner bottom cover and several of the coil strips as described in the previous paragraph. Rotate the turret so that the wiping contacts are accessible through the opening made by removing the strips. Clean the coil strip and wiping contacts with a soft cloth moistened with "No Noise".

ADJUSTING THE TENSION OF THE WIPING CONTACTS.—Remove the tuner bottom cover and several of the coil strips. Rotate the turret to permit access to the contacts through the opening thus provided. Using a small screwdriver bend each contact spring until it extends approximately ⅛ inch inward from the surface of the plastic contact-mounting plate.

To check the tension of the spring contacts, place the turret in a position between channels and note the clearance between the contact spring and the surface of the coil strip. The clearance should be approximately 1/64 inch.

REMOVING THE TUNER TURRET DRUM.—

1. Remove the tuner bottom cover.
2. Remove the fine tuning bracket from front of tuner.
3. Remove the front and rear retainer springs by pushing the straight end of each spring toward the top of tuner.
4. Slip the turret drum out of the tuner.

OSCILLATOR TUBE REPLACEMENT. —Due to differences in interelectrode capacitance, replacement of the oscillator tube may result in considerable oscillator frequency shift. This condition can be avoided by trying several tubes and selecting the one which causes the least frequency shift. If it is necessary to use a tube which causes excessive frequency shift the oscillator frequency must be adjusted.

INDIVIDUAL CHANNEL OSCILLATOR ADJUSTMENT.—When the oscillator frequency is correct for some channels but not for others, the individual-channel slugs should be used to correct the oscillator frequency on channels requiring adjustment. Adjust the slugs as follows:

1. Tune the set to the channel requiring adjustment.
2. Remove the Fine-Tuning and Station Selector knobs. If set has a UHF dial, remove the dial.
3. Set the Fine-Tuning control in the center of its mechanical range. If the Fine-Tuning control does not have a stop, turn the control so that the flat on the shaft faces down.
4. Using an insulated alignment tool adjust the slug for best picture and sound. The slug is accessible through the hole just to the right of the tuning shaft.

OVERALL OSCILLATOR ADJUSTMENT.—TU-5, TU-7 and TU-9 are provided with an overall oscillator adjustment. When replacement of the oscillator tube, or components other than a channel strip, causes a change in oscillator frequency, this adjustment may be used to correct the oscillator frequency. The adjustment should be made as follows:

1. Tune the set to the highest channel station available.
2. Set the Fine-Tuning at the center of its mechanical range. If the Fine-Tuning control does not have a stop, turn the control so that the flat on the shaft faces down.
3. Adjust G (figure 2) for best picture and sound.
4. Check the tuning on all available channels and adjust the individual channel slugs if necessary.

TUNER IDENTIFICATION

Chassis	Tuner		Input Impedance	Tubes		Turret Positions	Shaft Lengths, Inches	Output I. F.	Channel Strips	
	Symbol	Part Number		RF Amp.	Mixer-Osc.				Coding	Type
RA-160-162-162B	TU-1	21 009 121	Bal. 300 ohm	6BK7/ 6BQ7	6J6	12	2 13/16—3 5/8	41 mc	Black M	2 section
	TU-2	21 009 122	Bal. 300 ohm	6BQ7	6J6	12	2 13/16—3 5/8	41 mc	Red R	2 section
RA-164-165	TU-3	21 010 781	Bal. 300 ohm	6BQ7	6J6	12	4 13/16—5 9/16	21 mc	Red Q	2 section
	TU-4	21 010 782	Bal. 300 ohm	6BQ7/ 6BQ7A/ 6BZ7	6J6	12	4 13/16—5 9/16	21 mc	Red Q	2 section
	TU-5	89 012 601	Bal. 300 ohm	6BQ7	6J6	12	4 13/16—5 9/16	21 mc	Green Channel No.	1 section
	TU-6	21 010 783	Bal. 300 ohm	6BQ7/ 6BQ7A/ 6BZ7	6J6	12	4 13/16—5 9/16	21 mc	Red Q	2 section
RA-166-167-170	TU-7	89 012 901	Bal. 300 ohm	6BK7	6J6	13	8 —8½	41 mc	Green Channel No. Z to X	1 section
	TU-8	89 012 971	Bal. 300 ohm	6BQ7	6J6	13	8 —8½	41 mc	Green QR	2 section
RA-168-169-171	TU-9	89 012 911	Bal. 300 ohm	6BK7	6J6	13	8 —8½	41 mc	Green Channel No. Z to X	1 section
	TU-10	89 013 021	Bal. 300 ohm	6BQ7	6J6	13	8 —8½	41 mc	Green QR	2 section

TUNER INTERCHANGEABILITY

All tuners that are used on the same chassis are interchangeable. In a few cases special instructions are required. For the technician's convenience an interchangeability chart is shown below which contains these instructions. When a tuner is interchanged the mixer output coil (E in figure 2) of the new tuner should be readjusted. The alignment procedure for the mixer output coil will be found on the service data sheet for the chassis involved.

Chassis	Symbol	Tuner Part Number	Remarks
RA-160-162-162B	TU-1 TU-2	21 009 121 21 009 122	TU-1 and TU-2 are directly interchangeable.
RA-164-165	TU-3 TU-4 TU-5	21 010 781 21 010 782 89 012 601	TU-3, TU-4 and TU-5 are directly interchangeable.
	TU-6	21 010 783	TU-6 may be interchanged with TU-3, TU4 or TU-5 by adding L220 (see production change 6552074 in this issue). TU-3, TU-4 and TU-5 may be interchanged with TU-6 by removing L220.
RA-166-167-170	TU-7 TU-8	89 012 901 89 012 971	TU-7 and TU-8 are directly interchangeable.
RA-168-169-171	TU-9 TU-10	89 012 911 89 013 021	TU-9 and TU-10 are directly interchangeable.

TUNER ALIGNMENT

TEST EQUIPMENT. — To properly align a Du Mont switch turret tuner the following test equipment is required:

Oscillograph

Vertical amplifier must have good 60 cycle response and a vertical deflection sensitivity of at least 0.1 rms volts per inch.

Sweep Signal Generator

Frequency range—54 to 216 mc.
Sweep—At least 10 mc.

Marker Signal Generator

Frequency range—54 to 216 mc.
Should have built-in calibrator crystal.

BENCH SET-UP.— The following precautions should be observed when setting up equipment for tuner alignment purposes:

1. Connect all equipment to a common ground. A metal topped bench is preferred, however heavy bonding straps may be used.
2. The sweep generator output *must* be properly matched to the tuner input. A suitable matching device is shown in figure 1. It consists of a connector plug, which fits the generator output and three half-watt resistors.
3. Before attempting to perform an actual alignment check the bench set-up by connecting the test equipment to a chassis which is operating properly and observe the tuner curves. If the curves are correct it can be assumed that the bench set-up is functioning properly.

FREQUENCY TABLE

Channel Number	Channel Freq., MC	Video Carrier, MC	Sound Carrier, MC	21.25 MC HF Osc., MC	41.25 MC HF Osc., MC
2	54-60	55.25	59.75	81	101
3	60-66	61.25	65.75	87	107
4	66-72	67.25	71.75	93	113
5	76-82	77.25	81.75	103	123
6	82-88	83.25	87.75	109	129
7	174-180	175.25	179.75	201	221
8	180-186	181.25	185.75	207	227
9	186-192	187.25	191.75	213	233
10	192-198	193.25	197.75	219	239
11	198-204	199.25	203.75	225	245
12	204-210	205.25	209.75	231	251
13	210-216	211.25	215.75	237	257

The oscillator frequencies shown in the above table are for reference only. Final oscillator frequency adjustments should always be made with the available TV station signals.

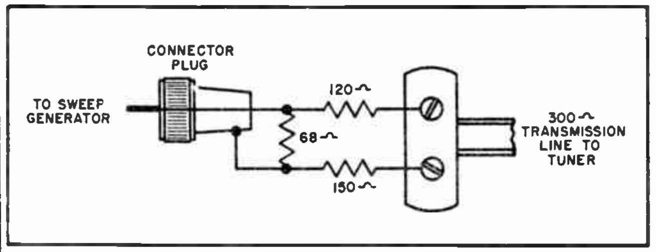


Figure 1. Matching device suitable for tuner alignment work. Keep the lead lengths between the connector plug and the resistor network as short as possible.

Turret Tuner ALIGNMENT PROCEDURE

a. Apply −3 volts to the tuner green a-g-c lead by connecting two small flashlight batteries in series between the tuner a-g-c lead and ground.

b. Connect the tuner antenna transmission line terminal board to the generator matching network.

c. Connect the vertical amplifier terminals of the oscillograph to the tuner look point (D in figure 2) using a short length of coax. Connect a 10K resistor between the look point and the center lead of the coax. Ground the coax outer conductor to the tuner chassis.

d. Disable the horizontal sweep circuits by removing the horizontal oscillator and deflection amplifier tubes.

STEP	SWEEP GEN.	MARKER FREQ.	ADJUST
1	Adjusted to sweep channel 13.	215.75 mc sound 211.25 mc video	Check for curve shown below. If necessary, adjust A and B in figure 2 for proper bandpass, and C in figure 2 for maximum amplitude with equal peaks.
2	Adjust to sweep each channel in turn.	Correct markers for each channel (see frequency table on page 19).	Above adjustment sufficient for all channels. Individual channels may be favored if desired.
3	Tune to each channel on which a TV signal is available.		Set fine tuning control in the center of its mechanical range. If fine tuning control does not have a stop turn control shaft so that flat on shaft faces downward and adjust oscillator slugs. Adjust each oscillator slug for best picture and sound using non-metallic alignment tool.

NOTES

Slug A adjusts low frequency side of curve, slug B the high frequency side and slug C adjusts the r-f stage bandpass.

Some tuners have slug F which adjusts a 40 mc i-f trap. This slug may be reset if additional i-f rejection is required. Its adjustment affects the low channel curves slightly.

Some tuners have slug G which adjusts the oscillator frequency. It should be reset only if a channel strip oscillator slug cannot be properly set for its channel.

Failure to obtain the proper curves can be caused by a misadjusted oscilator slug or mixer output coil E. The adjustment of the mixer output coil is included in the i-f alignment procedure.

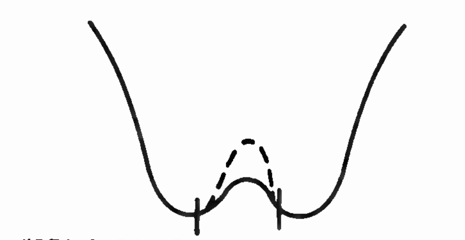


Figure 3—Set video carrier just inside peak. Sound carrier position may vary somewhat. On channel 13 the two peaks may be equal, varying slightly in amplitude on other channels.

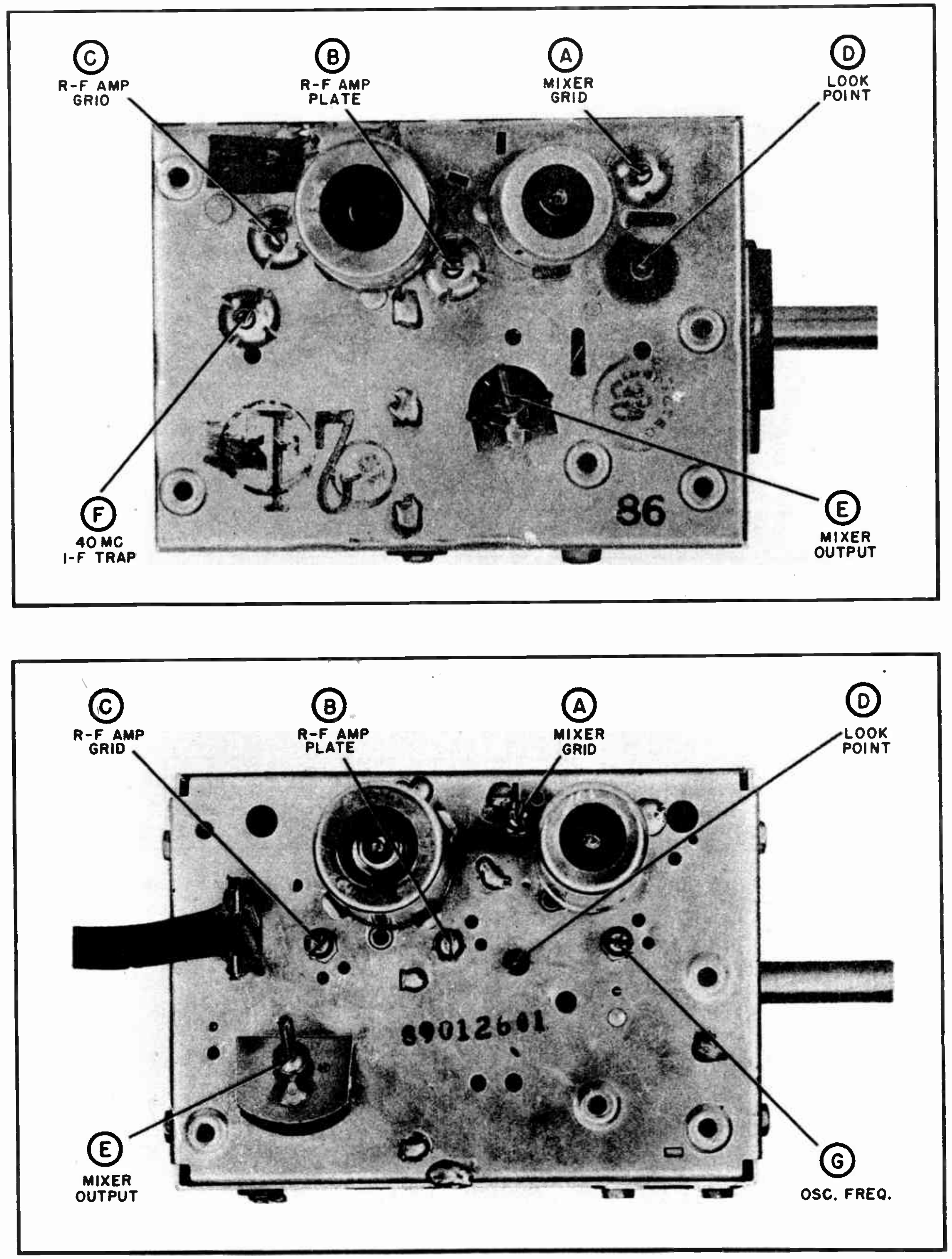


Figure 2. The two basic turret tuners and their adjustment slugs. The upper illustrations is for TU-1, 2, 3, 4, 6, 8 and 10 and the lower is for TU-5, 7 and 9. An explanation of the tuner slug functions will be found on the next page.

SERVICING TURRET TUNERS

PART II

A faulty tuner may produce any of the following symptoms; weak picture and sound, no picture and sound, microphonics, and intermittent noise.

When the picture and sound are weak or completely absent the tuner tubes may be checked by substitution. If the tubes are not at fault return the *original* ones to their sockets and check the video i-f and detector stages of the receiver before troubleshooting the tuner.

After it has been determined that the balance of the receiver is not at fault proceed to check the tuner in the following manner:

1. Measure the voltages at the socket pins. The undersides of the sockets can be reached by removing the tuner side plate. A quick check can be made by removing each tube from its socket and checking the voltages from the top of the socket. Using the latter method the voltages will not agree with those shown in the tables; however a quick check for the presence of the B+ voltages can be made.

2. Measure the resistances at the socket pins.

3. Remove the tuner bottom cover and turret drum and inspect for burnt parts, broken leads, parts touching turret drum, etc.

4. Check resistances of suspected parts.

5. Replace defective parts, clean all contacts, check the tension of the wiping contacts and reassemble the tuner for final check.

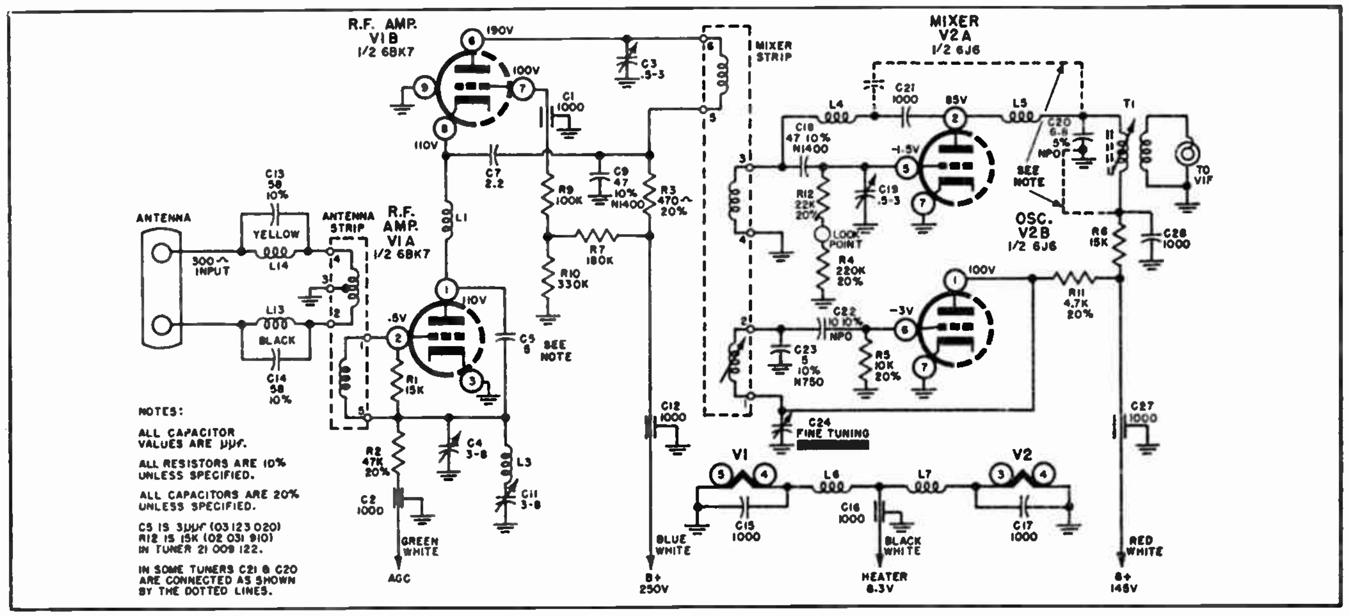
The cause of microphonics or intermittent noise can usually be located by substituting tubes and by careful inspection of all parts and contacts. The chart below outlines the procedures to be followed for various tuner faults.

TROUBLESHOOTING PROCEDURES

Symptom	Procedure
Weak or No Sound and Picture (all channels)	1. Check V1 and V2 by substitution. 2. Check tuner voltage and resistance readings, and associated components. (21 mc Tuners) Check mixer output capacitor and output tab for leakage or shorts.
Weak or No Sound and Picture (one channel)	1. Check incorrect or defective channel strip in tuner drum. 2. Check tension and clean contact springs.
Inoperative-Tubes, Component Check OK	1. Remove coil drum. Inspect for components rubbing against the coil drum, especially at the mixer output coil.
Microphonics	1. Check 6J6 properly seated in its socket. 2. Check 6J6 by substitution. 3. Tighten the 6J6 socket pins.
Oscillator Slugs Do Not Adjust Properly (all channels)	1. Check 6J6 by substitution. 2. Check capacitors in oscillator circuit.
Oscillator Slug Turned Too Far In—Cannot Be Adjusted	1. Remove bottom cover. 2. Rotate the tuner drum and remove the affected coil strip. 3. Loosen slug thread spring. 4. Tap slug back in position and reset its thread spring.
Channel 13 Oscillator Slug Will Not Adjust Properly (21 mc tuner)	1. Check mixer output coil adjustment.
Channel 2 Oscillator Slug Will Not Adjust Properly (21 mc tuner)	1. Check mixer output circuit.
Flashing When Tapped (2-section strip tuners)	1. Check position of fiber washer on drum shaft. The washer should be between the drum retaining spring and the Fine Tuning control spring.
Heavy Picture Beat (all channels)	1. Check adjustment of mixer output coil.

TURRET TUNER SERVICE DATA

TUNERS TU-1 (21 009 121) AND TU-2 (21 009 122)

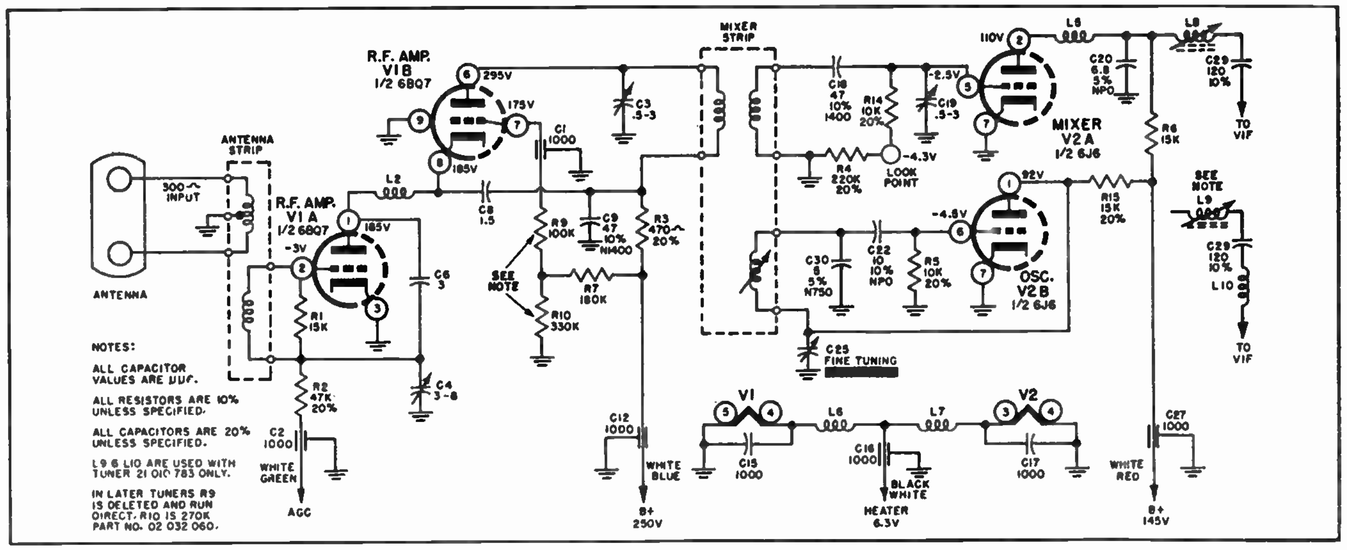


Resistance readings for TU-1 and TU-2 are shown below. All resistance measurements were taken with the tuner wired in the chassis. Voltage readings are shown above in the schematic.

		1	2	3	4	5	6	7	8	9
V1	**6BK7/ 6BQ7**	INF	90K/200K*	0	.1	0	11K	220K	INF	0
V2	**6J6**	18K	28K	.1	0	240K	10K	0		

*Depends upon High-Low Signal Switch position.

TUNERS TU-3 (21 000 781), TU-4 (21 000 782) AND TU-6 (21 000 783)

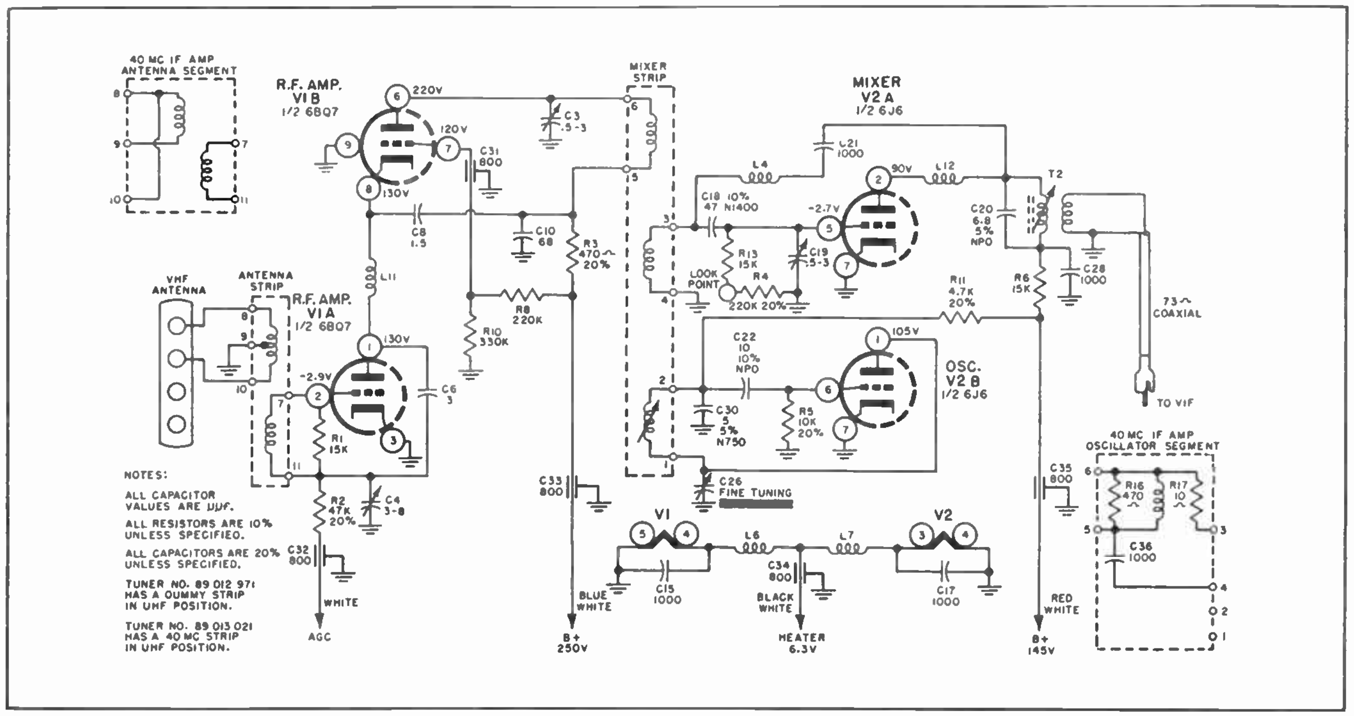


Resistance readings for TU-3, TU-4 and TU-6 are shown below. All resistance measurements were taken with the tuner wired in the chassis. Voltage readings are shown above in the schematic.

		1	2	3	4	5	6	7	8	9
V1	**6BQ7**	90K	85K	.05	0	230K	10K	0		
V2	**6J6**	INF	75K/165K*	0	0	.05	80K	140K	INF	0

*Depends upon Fringe-Block Switch position.

TUNERS TU-8 (89 012 971) AND TU-10 (89 013 021)



Resistance readings for TU-8 and TU-10 are shown below. All resistance measurements were taken with the tuner wired in the chassis. Voltage readings are shown above in the schematic.

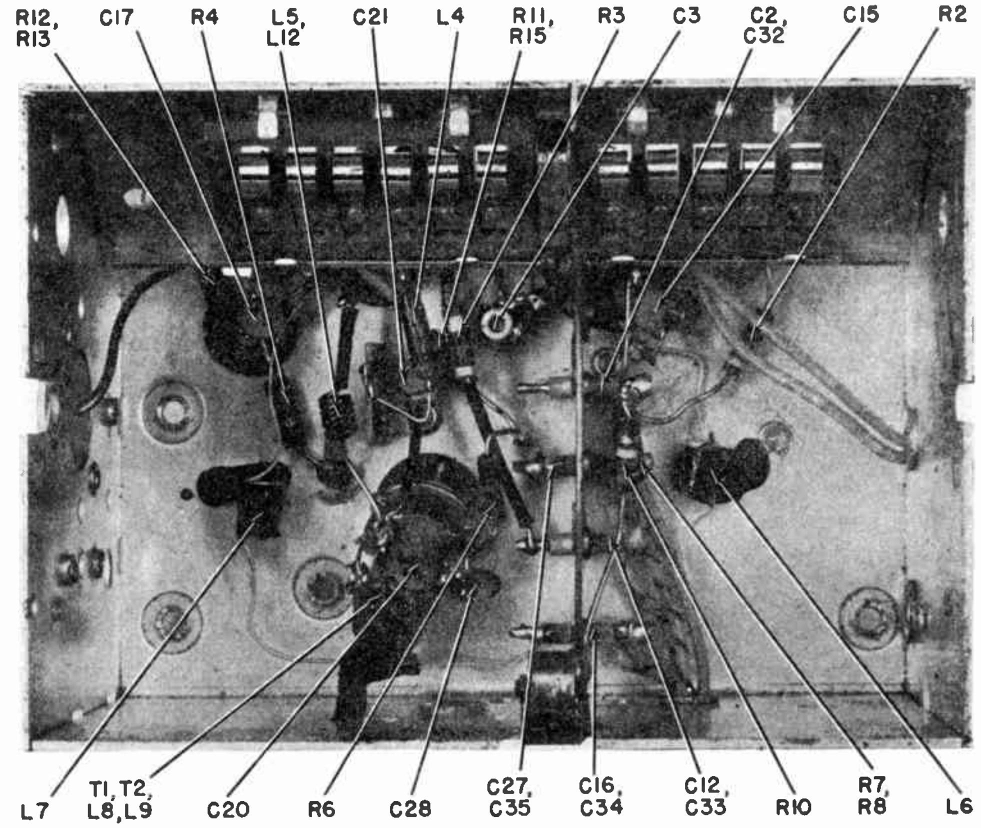
		1	2	3	4	5	6	7	8	9
V1	6BQ7	INF	750K	0	.1	0	30K	150K	INF	0
V2	6J6	15K	28K	.1	0	260K	10K	0		

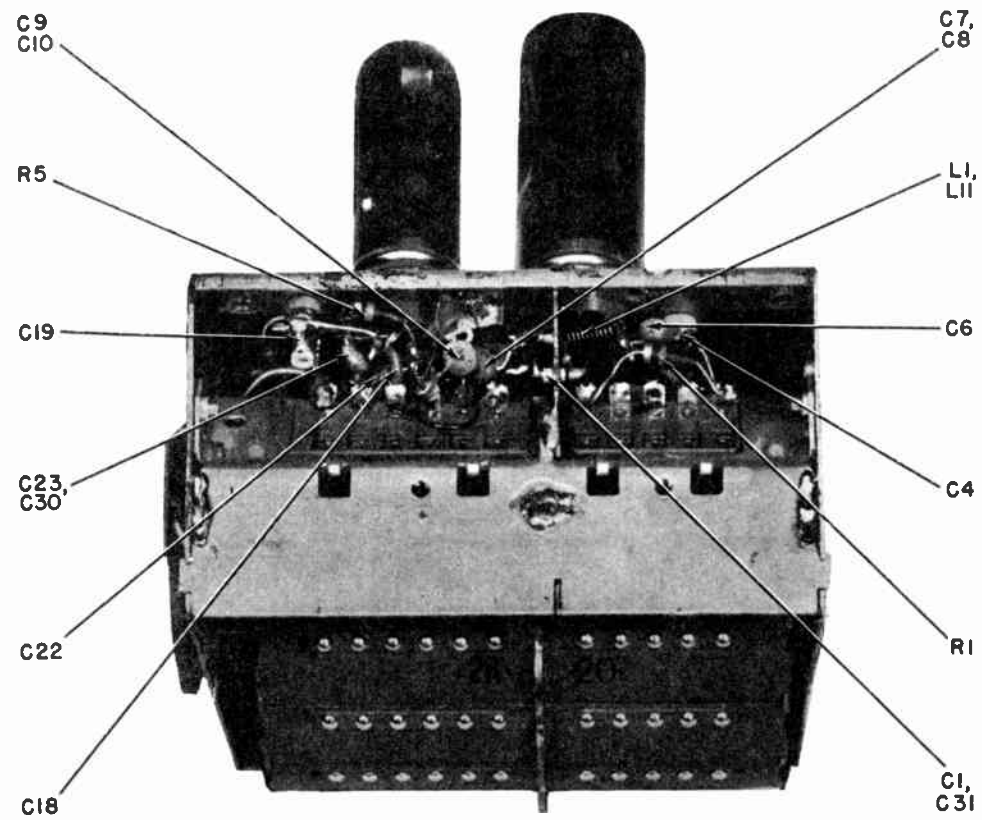
PARTS LIST

TUNERS TU-1, 2, 3, 4, 6, 8 AND 10

Symbol	Part No.	Symbol	Part No.	Symbol	Part No.	Symbol	Part No.	Symbol	Part No.
C1*	42 006 050	C16*	42 006 050	C31	03 124 790	L10	21 011 571	R11	02 032 460
C2*	42 006 050	C17	03 100 490	C32	03 124 790	L11	21 012 041	R12	02 032 500
C3	03 119 150	C18	03 119 170	C33	03 124 790	L12	21 012 051	R13	02 031 910
C4	03 119 160	C19	03 119 150	C34	03 124 790	L13*	21 010 420	R14	02 032 480
C5	03 119 180	C20	03 119 190	C35	02 124 790	L14*	21 010 410	R15	02 032 490
C6	03 123 020	C21	03 100 490	C36	03 100 490	R1	02 031 910	R16	02 031 730
C7	03 119 100	C22	03 119 210	L1	21 010 400	R2	02 032 520	R17	02 031 530
C8	03 123 030	C23	03 119 180	L2	21 011 190	R3	02 032 400	T1	20 007 770
C9	03 119 170	C24	03 119 220	L3	21 010 430	R4	02 032 560	T2	20 008 541
C10	03 119 190	C25	03 123 000	L4	21 010 440	R5	02 032 480	(6BK7)	25 007 341
C11	03 119 160	C26	30 039 231	L5	21 010 450	R6	02 031 910	(6BQ7)	25 007 000
C12*	42 006 050	C27*	42 006 050	L6	21 010 460	R7	02 032 040	V2	25 000 190
C13*	21 010 410	C28	03 100 490	L7	21 010 470	R8	02 032 050		
C14*	21 010 420	C29	03 123 040	L8	21 011 180	R9	02 032 010		
C15	03 100 490	C30	03 123 010	L9	21 011 561	R10	02 032 070		

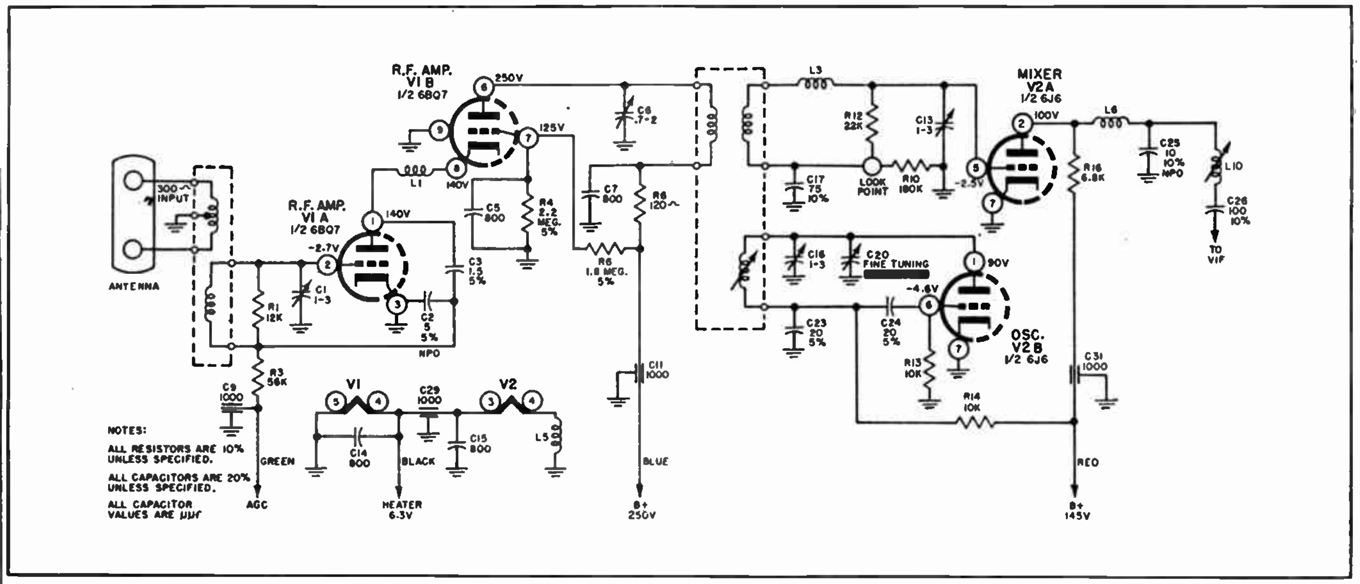
* Denotes an assembled part.





Components location for tuners TU-1, 2, 3, 4, 6, 8 and 10. The upper illustration is the under chassis view with the turret drum removed. The lower illustration is the side view with the side shield removed.

TUNER TU-5 (89 012 601)

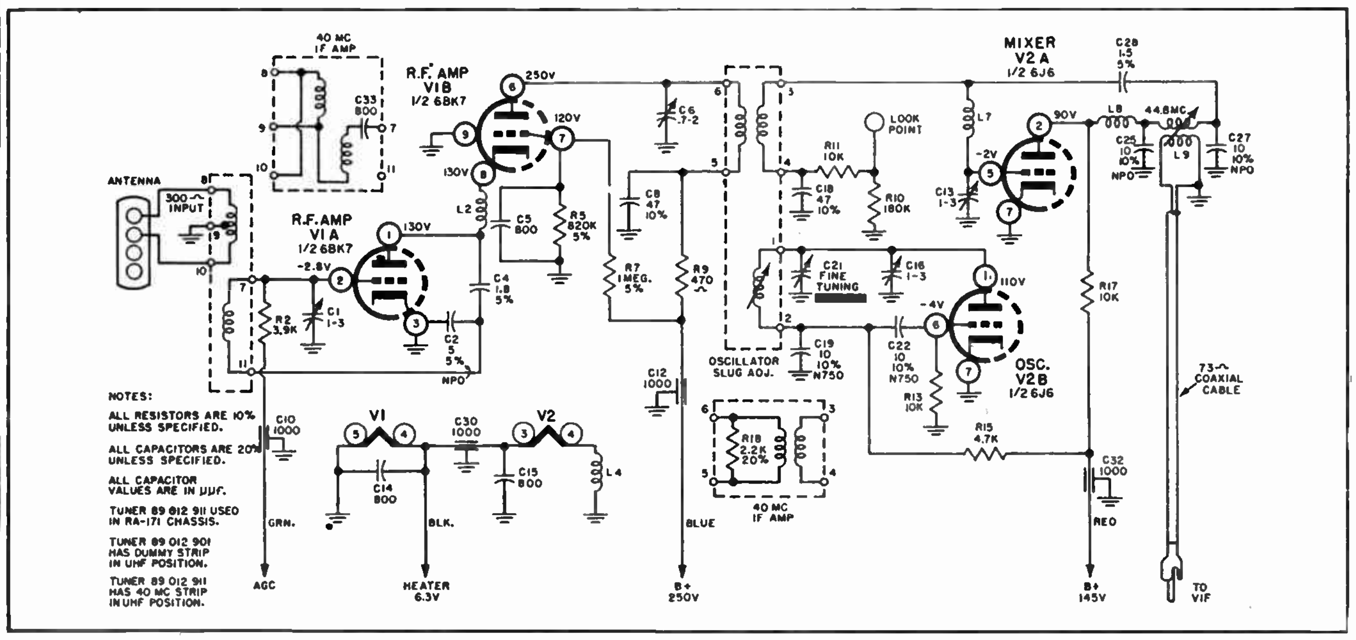


Resistance readings for TU-5 are shown below. All resistance measurements were taken with the tuner wired in the chassis. Voltage readings are shown above in the schematic.

		1	2	3	4	5	6	7	8	9
V1	**6BQ7**	INF	80K/170K*	0	0	.05	70K	1 Meg	INF	0
V2	**6J6**	90K	90K	.05	0	200K	10K	0		

*Depends upon Fringe-Block Switch position.

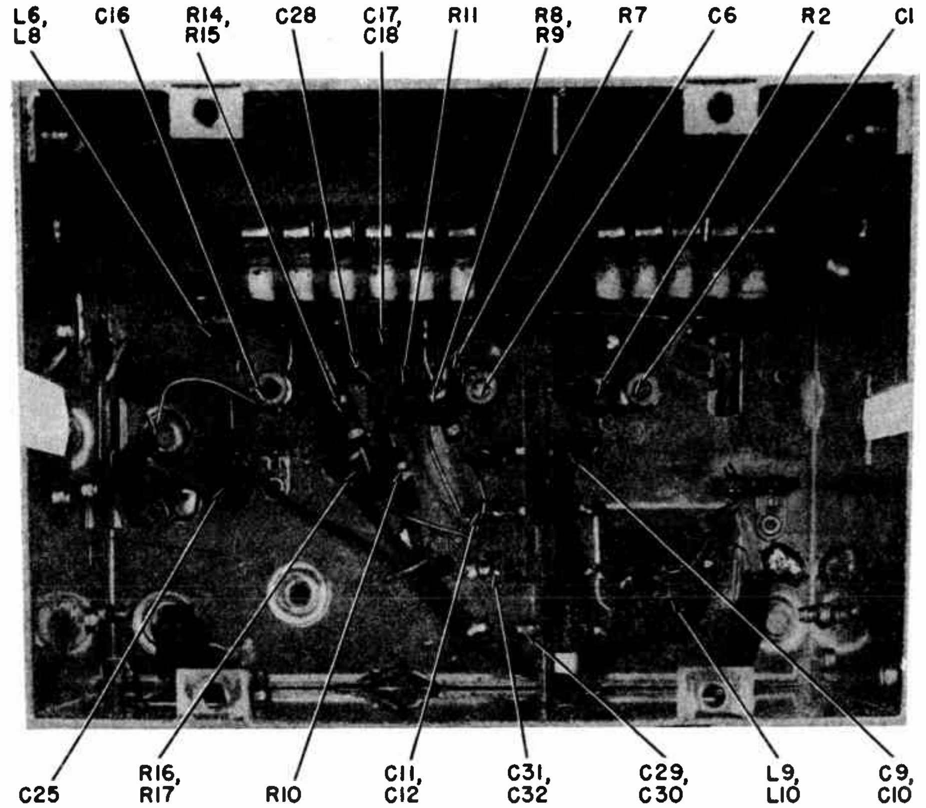
TUNERS TU-7 (89 012 901) AND TU-9 (89 012 911)

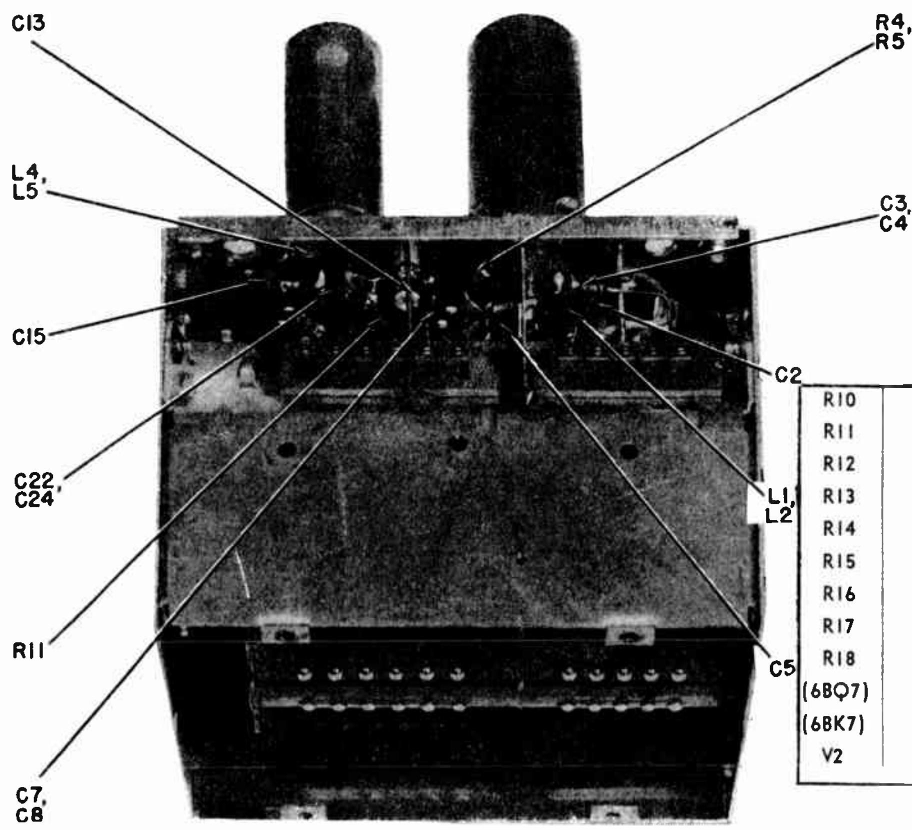


Resistance readings for TU-7 and TU-9 are shown below. All resistance measurements were taken with the tuner wired in the chassis. Voltage readings are shown above in the schematic.

		1	2	3	4	5	6	7	8	9
V1	**6BK7**	INF	700K	0	.1	0	30K	600K	INF	0
V2	**6J6**	80K	90K	.1	0	200K	10K	0		

Components location for tuners TU-5, TU-7 and TU-9. The upper illustration is the underchassis view with the turret drum removed. The lower illustration is the side view with the side shield removed.





PARTS LIST

TUNERS TU-5, TU-7, AND TU-9

Symbol	Part No.
C1	03 019 840
C2	03 124 780
C3	03 125 000
C4	03 125 010
C5	03 124 790
C6	03 124 770
C7	03 124 790
C8	03 119 170
C9	03 125 180
C10	03 125 500
C11	03 125 180
C12	03 125 500
C13	03 019 840
C14	03 124 790
C15	03 124 790
C16	03 019 840
C17	03 125 100
C18	03 119 170
C19	03 126 010
C20	03 125 140
C21	03 126 191
C22	03 126 010
C23	03 125 130
C24	03 125 130
C25	03 125 110
C26	03 125 120
C27	03 125 110
C28	03 125 000
C29	03 125 180
C30	03 125 500
C31	03 125 180
C32	03 125 500
C33	03 124 790
L1	21 011 440
L2	21 011 811
L3	21 011 450
L4	21 011 561
L5	21 011 480
L6	21 011 460
L7	21 011 571
L8	21 011 581
L9	21 011 801
L10	21 011 470
R1	02 031 900
R2	02 031 840
R3	02 031 980
R4	02 031 280
R5	02 031 180
R6	02 031 260
R7	02 031 200
R8	02 031 660
R9	02 031 730
R10	02 032 040
R11	02 031 890
R12	02 031 930
R13	02 031 890
R14	02 031 890
R15	02 031 850
R16	02 031 870
R17	02 031 890
R18	02 031 810
(6BQ7)	25 007 000
(6BK7)	25 007 341
V2	25 000 190

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The new Du Mont RA-166, 167, 170 and 171 chassis are high-performance units designed to provide high-definition pictures and outstanding fringe area reception. RA-166, 167 and 170 chassis are designed to receive all VHF channels and are easily adapted for UHF. The RA-171 chassis is designed to receive all 82 VHF and UHF channels. The circuitry of all chassis is of similar design. The RA-170 and RA-171 are Custom chassis and include a tone control, plus provisions for attachment of a phonograph with a conveniently located Phono-TV switch.

Among the many outstanding features found in these new chassis are:

1. Low-noise cascode 12-channel switch-turret VHF tuner for superior fringe area performance.
2. One dial tuning of all 82 VHF and UHF channels on VHF-UHF models.
3. Non-UHF models easily adapted for UHF by substitution of tuner strips.
4. Du Mont's Selfocus* Teletron*—provides fully automatic focus—eliminates focus control.
5. Four-stage, 41-mc, stagger-tuned, intercarrier video i-f strip for maximum sensitivity and high-definition pictures.
6. Fast acting keyed and delayed AGC, provides instantaneous control of receiver gain and automatically adjusts for both strong and weak signals.
7. Vertical retrace blanking circuit—eliminates retrace lines at all control settings.
8. Conveniently located controls—the most used controls are on the front panel, rear controls are easily accessible.
9. Shipped completely adjusted ready for installation.

* Trade Mark

MODELS

Model	Name	Chassis	CRT	Services	Cabinet
17T350	Chatham	RA-166	17 inch rect.	VHF	Table Model, Mah. and Bl.
21T327	Ridgewood "41"	RA-167	21 inch rect.	VHF	Console W/doors, Mah. and Bl.
21T328	Wakefield "41"	RA-167	21 inch rect.	VHF	Console W/doors, Mah. and Bl.
21T329	Essex	RA-167	21 inch rect.	VHF	Console W/doors, Mah.
21T359	Oxford	RA-167	21 inch rect.	VHF	Table Model, Mah. and Bl.
21T366	Lynwood	RA-167	21 inch rect.	VHF	Console, Mah. and Bl.
21T376	Somerset II	RA-170	21 inch rect.	VHF, Phono provisions	Console W/doors, Mah. and Bl.
21T377	Newbury II	RA-170	21 inch rect.	VHF, Phono provisions	Console W/doors, Mah. and Bl.
21T378	Hanover II	RA-170	21 inch rect.	VHF, Phono provisions	Console W/doors, Mah. and Bl.
21T376U	Somerset II	RA-171	21 inch rect.	UHF-VHF, Phono provisions	Console W/doors, Mah. and Bl.
21T377U	Newbury II	RA-171	21 inch rect.	UHF-VHF, Phono provisions	Console W/doors, Mah. and Bl.
21T378U	Hanover II	RA-171	21 inch rect.	UHF-VHF, Phono provisions	Console W/doors, Mah. and Bl.

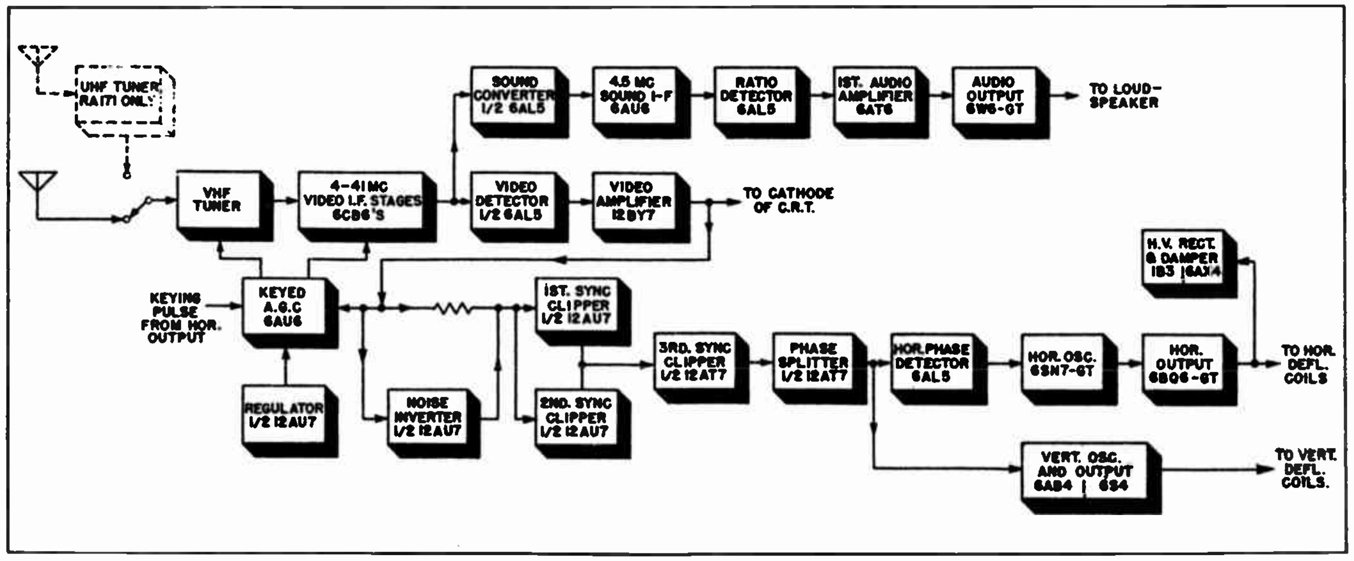


Figure 1. Block diagram of RA-166-167 and RA-170-171 chassis.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

POWER RATING
- Source .... 105-129 volts, 60 cycle a-c
- Consumption
  - RA-166, 167 .... 225 watts
  - RA-170, 171 .... 240 watts (phono included)

NUMBER OF TUBES
- RA-166, 167, 170 .... 22 plus 3 Rectifiers and 1 CRT
- RA-171 .... 23 plus 3 Rectifiers, 2 Crystals and 1 CRT

OPERATING CONTROLS .... Station Selector, Fine Tuning and UHF Tuning, Contrast, Volume and On-Off.

HIDDEN FRONT PANEL CONTROLS
- RA-166, 167
  - Operating .... Brightness, Vertical Hold and Horizontal Hold
  - Service .... Vertical Size and Vertical Linearity
- RA-170, 171
  - Operating .... Brightness, Tone, Vertical Hold, Horizontal Hold and Phono-TV Switch
  - Service .... Vertical Size and Vertical Linearity

ANTENNA INPUT IMPEDANCE
- VHF .... Balanced 300 ohm
- UHF .... Balanced 300 ohm

FREQUENCY RANGE
- RA-166, 167, 170 .... Channels 2 through 13
- RA-171 .... Channels 2 through 83

INTERMEDIATE FREQUENCIES
- Video I-F Carrier .... 45.75 mc
- Sound I-F Carrier .... 41.25 mc
- Sound Intercarrier Frequency ... 4.5 mc
- Adjacent Channel Sound Trap ... 47.25 mc

PICTURE TUBE
- Type RA-166: 17HP4; RA-167, 170, 171: 21FP4A
- Dimensions .... RA-166: 11 x 14¼; RA-167, 170, 171: 13⅞ x 19⅛

CRT HIGH VOLTAGE .... 14.5 kv

SWEEP DEFLECTION .... Magnetic

FOCUS .... Automatic Electrostatic

LOUDSPEAKER
- Size .... Table Model: 5 inch; Console: 10 inch
- Impedance .... 3.2 ohm at 400 cycles

CABINET DIMENSIONS

Name	Model	Height	Width	Depth
Chatham	17T350	20 3/16	21½	19 13/16
Ridgewood "41"	21T327	37⅞	25¼	22 7/16
Wakefield "41"	21T328	37¼	24¾	22 7/16
Essex	21T329	37¼	24¾	22 7/16
Oxford	21T359	23	24	20⅝
Lynwood	21T366	38⅞	24½	20⅞
Somerset II	21T376(U)	37¼	32½	22 3/16
Newbury II	21T377(U)	38¼	31½	22 11/16
Hanover II	21T378(U)	37½	32½	23 3/16

TUBE COMPLEMENT

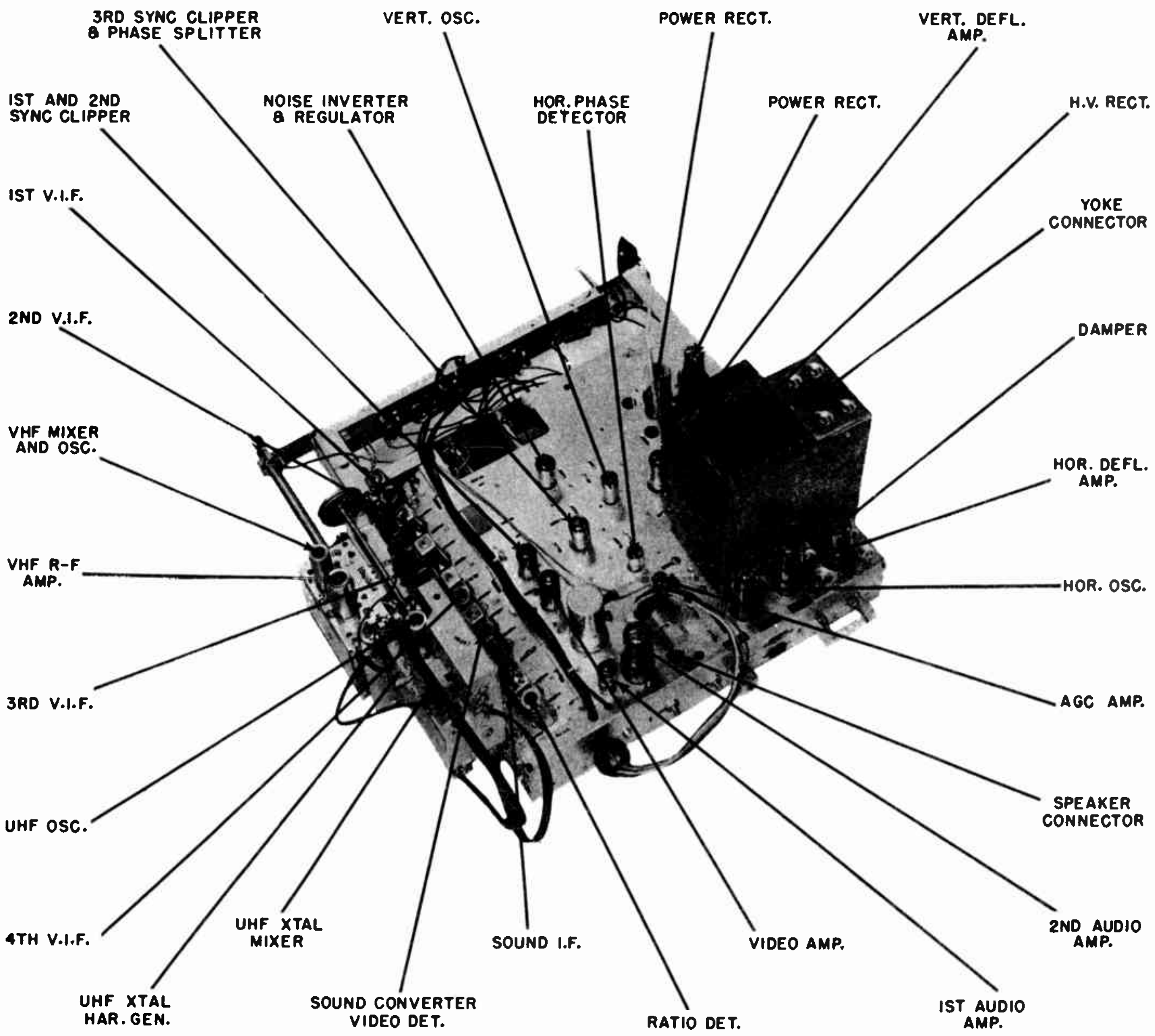
SYMBOL	TYPE	FUNCTION
V101	6BK7	R-F Amplifier
V102	6J6	R-F Oscillator and Mixer
V151	6J6	UHF Oscillator
V201	6CB6	1st Video I-F
V202	6CB6	2nd Video I-F
V203	6CB6	3rd Video I-F
V204	6CB6	4th Video I-F
V205	6AL5	Sound Converter and Video Detector
V206	6AU6	Sound I-F
V207	6AL5	Ratio Detector
V208	12AU7	1st and 2nd Sync Clipper
V209	12AT7	3rd Sync Clipper and Phase Splitter
V210	6AL5	Horiz. Phase Detector
V211	12BY7	Video Amplifier
V212	6AU6	AGC Amplifier
V213	6AB4	Vertical Oscillator
V214	6AT6	1st Audio Amplifier
V215	6W6-GT	2nd Audio Amplifier
V216	6S4	Vertical Deflection Amplifier
V217	5Y3-GT	Power Rectifier
V218	5Y3-GT	Power Rectifier
V219	6SN7-GT	Horizontal Oscillator
V220	6BQ6-GT	Horizontal Deflection Amplifier
V221	6AX4-GT	Damper
V222	1B3-GT	H.V. Rectifier
V223	12AU7	Sync Noise Inverter and Voltage Regulator
V401	17HP4; 21FP4A	CRT

CIRCUIT DESCRIPTION

GENERAL. — A block diagram of the RA-166-167, RA-170-171 chassis is shown in figure 1. The RA-171 is a UHF-VHF receiver equipped with separate UHF and VHF tuners coupled to a single control shaft. In the RA-166, 167 and 170, only the VHF tuner is provided. The VHF tuners in all models are of similar design.

The VHF tuner is of the switch-turret type. 13 switch positions are provided. When the tuner is switched to the thirteenth position, in receivers equipped with UHF tuners, the input of the VHF tuner is switched to the output of the UHF tuner, and the necessary circuits are switched to enable the VHF tuner to operate as a 41 mc i-f amplifier.

The video i-f strip consists of four stagger-tuned 6CB6 amplifier stages. The video i-f is 45.75 mc and the sound i-f is 41.25 mc. Separate video detector and sound



The RA-171 Chassis

converter diodes are provided. This provision increases the amount of signal available at the input of the sound i-f amplifier, as compared to that obtained when a single diode is used. A single high-gain video-amplifier stage is employed.

The sync takeoff is in the plate circuit of the video amplifier. Three sync-clipper stages are used. The output of the third sync clipper is fed to a phase-splitter stage which provides out-of-phase sync signals required for operation of the horizontal phase detector. A multivibrator type horizontal-oscillator circuit is employed. A ringing circuit is provided in the oscillator circuit for improved stability.

A single 6BQ6-GT is used in the horizontal-output stage. A high-efficiency flyback-type high-voltage supply provides 14.5 kv for application to the CRT.

A keyed a-g-c circuit similar to that employed in RA-164-165 chassis is used. The a-g-c system also includes a tuner a-g-c delay circuit to provide a wide range of control for maximum performance in fringe - and strong - signal areas. A voltage regulator tube is provided in the a-g-c amplifier circuit to improve a-g-c stability.

The vertical-sync signal is taken off at the cathode of the phase-splitter stage and applied to a printed-circuit integrator network. A multivibrator circuit performs the combined functions of vertical oscillator and output stage.

As previously mentioned a separate sound-converter diode is provided. The output of the sound converter is applied to the input of a 4.5 mc intercarrier sound i-f stage. A ratio sound detector is employed. To secure optimum sound quality two stages of audio amplification are used.

In the following paragraphs a more detailed description is given of those circuits which are not familiar to the technician.

UHF - VHF TUNERS. — RA-171 chassis are designed to receive all 82 UHF and VHF channels and are equipped with both UHF and VHF tuners. RA-166, RA-167 and RA-170 chassis are designed to receive the 12 VHF channels and are easily converted for UHF reception. The VHF tuners used in all models are of similar design. They are of the conventional switch-turret type, similar to those used in RA-160-162 and RA-164-165 Telesets. Since most technicians are familiar with this type of tuner it will not be described in detail here.

A block diagram of the VHF and UHF tuners, showing the circuit arrangement when receiving the UHF channels, is shown in figure 2. The UHF tuner is of the continuous-tuning type and provides coverage of the complete UHF television band (470-890 mc). 300-ohm balanced input is used. The incoming UHF signal is coupled to a tuned preselector. The preselector consists of two tuned circuits which pass the desired channel and attenuate all other signals. The output of the preselector is applied to a crystal mixer.

The UHF tuner oscillator operates at one half the required frequency and its second harmonic is injected into the mixer circuit. The second-harmonic signal is obtained by applying the oscillator fundamental to a crystal harmonic generator. A tuned circuit is provided to select the proper harmonic.

The oscillator frequency is chosen to provide a second harmonic 41.25 mc higher than the incoming sound carrier, in order to produce a sound i-f of 41.25 mc and a video i-f of 45.75 mc in the output of the mixer. A link-coupling network is provided in the mixer output circuit. The UHF tuner output signals are fed from this coupling circuit to the input of the VHF tuner by means of a short length of 73-ohm coax.

The VHF tuner is provided with 13 switch-turret positions. To receive the UHF channels the tuner is switched to the thirteenth, or UHF position. In this position the tuner oscillator is disabled and the r-f and mixer stages operate as 41-mc i-f amplifiers. Note that the incoming signal is converted only once and that the UHF tuner is a true tuner, not a converter.

When receiving VHF signals the B+ is removed from the UHF tuner and the input of the VHF tuner is connected to the VHF antenna. This is accomplished by a slide switch which is actuated by the Station Selector knob.

PRESELECTOR CIRCUITS. — As previously mentioned the preselector consists of two inductively-coupled tuned circuits. Conventional tuned-circuit construction cannot be used in the UHF tuned circuits, consequently a special type high-Q low-loss circuit referred to as a capacitively-tuned, shorted coaxial line is used as shown in figure 3.

To aid in explanation of the preselector a low-frequency equivalent circuit is shown in figure 4A. The circuit configuration of the preselector is shown at B. The preselector tuned circuits are labeled 1 and 2.

The construction of these circuits is based upon the fact that transmission lines exhibit the same properties as do tuned circuits. For this reason the preselector circuits are referred to as transmission-line tuned circuits. For the benefit of the technician who is not familiar with this property of transmission lines a brief discussion follows.

An ordinary parallel-resonant circuit consists of an inductance and a capacitance as shown in figure 5A. At its resonant frequency this circuit presents a very high impedance. At frequencies above its resonant frequency the inductive reactance, X_L, is greater than the capacitive reactance, X_C. Since the greatest current flows through the smallest reactance, the capacitor current is greater than the inductor current, and the circuit is predominantly capacitive.

At frequencies below the resonant frequency of the circuit the capacitive reactance, X_C, is greater than the inductive reactance, X_L, the current through the inductor

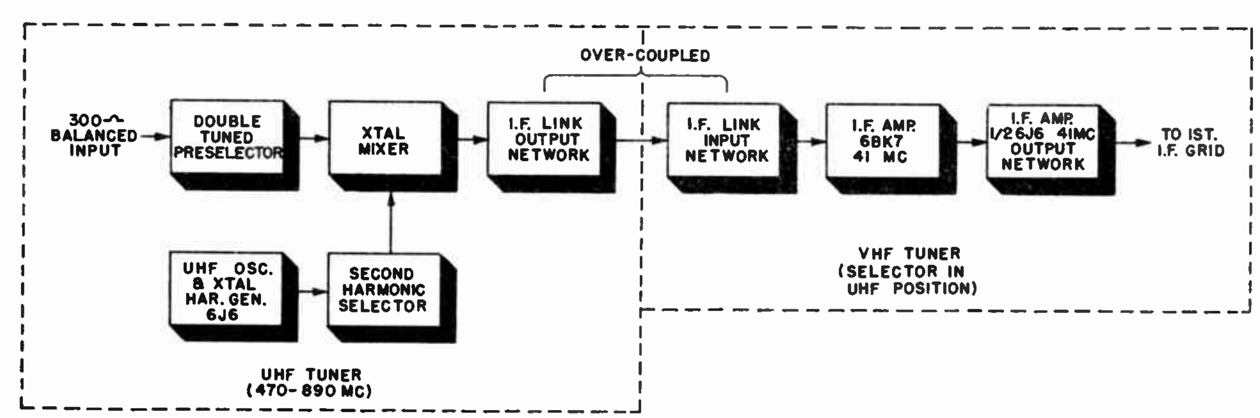


Figure 2. Block diagram of UHF-VHF Tuners.

is greater than that through the capacitor, and the circuit is predominantly inductive.

A section of transmission line an exact electrical quarter-wave length long, shorted at one end, acts just the same as a parallel-resonant circuit. This property of transmission lines is due to the fact that it has both capacitance and inductance, as shown in figure 5B. The line shown is of the coaxial type. When current passes through the inner lead a field is set up around the lead, conseqently the lead has inductance. The capacitance necessary to complete the tuned circuit exists between the inner and outer conductors and is represented by the dotted capacitors in figure 5B. This capacitance is referred to as distributed capacitance and while it is not a "lumped constant" capacitor, as we ordinarily expect to find in a tuned circuit, it performs the same function.

As in the parallel-resonant circuit in figure 5A, the quarter-wave line is a high impedance at its resonant frequency. Above its resonant frequency it is predominantly capacitive, while *below its resonant frequency it is predominantly inductive.* Stating it another way, a transmission line shorter than a quarter wavelength at a given frequency is inductive at that frequency. The fact that a shorted section of transmission line is inductive under certain conditions is important because this characteristic is taken advantage of in the design of the UHF tuner.

A transmission line less than a quarter-wavelength long can therefore be used as the inductor in a parallel-resonant circuit. By adding sufficient capacitance between the inner and outer conductors, as shown in figure 5C, it can be resonated at the desired frequency. If the capacitor is made variable the circuit will be tunable over a band of frequencies.

Comparing figure 5C with the preselector tuned circuits in figure 4B we can see that they are the same. A form of link coupling is used between the preselector tuned circuits. Since the inductance for the circuits is supplied primarily by the inner conductor of the transmission line, the link must be located inside of the line. Partial turns of wire serve as the two links required (3 and 4 in figure 4B). They are brought out through holes in the outer conductors.

The same type of inductive coupling is also used between the input tuned circuit and the antenna. Two coupling loops are used to provide a 300-ohm balanced input (5 in figure 4B).

The output of the second preselector circuit is coupled to the mixer by means of a tap on the inner conductor (6 in figure 4B). This method of coupling is the same as the tapped coil of figure 4A.

The physical construction of the preselector tuned circuits is shown in figure 6. The box in which the tuner is mounted forms parts of the outer conductors of the tuned lines. The inner conductors are hollow U's, as shown in the figure. The inner conductors also serve as the stator plates of the tuning capacitors.

A shield located between the first and second preselector circuits forms one side of the outer conductors of the tuned lines.

The tuning-capacitor rotor plates are of the straight-line frequency type. Four rotor plates are used in each capacitor. The end plates are slotted so that they may be bent in sections to correct tracking and passband characteristics over the tuning range.

Each line section is provided with a metal tab attached to the inner surface of the outer conductor. These tabs are used as trimmer capacitors to correct for normal production variations. They are adjusted by bending them closer to or farther from the inner conductors of the tuned lines, and are adjusted with the tuning-capacitor rotors completely unmeshed, to establish the high end of the tuning range.

As shown in figure 3, two coupling loops are used between the preselector tuned circuits. The upper loop, L162, is effective primarily at the low-frequency end of the band, while the lower loop, L163, is effective primarily at the high-frequency end of the band.

THE UHF OSCILLATOR. — The UHF oscillator uses a push-pull, tuned-plate, tuned-grid circuit. To avoid the need for a special tube type, and permit the use of an existing type of known reliability, the oscillator is operated at one half the required frequency. Operation in this manner also results in greater stability and uniformity in manufacture.

A 6J6 dual triode is used in the oscillator. The plate tank coil is a flat piece of sheet metal shaped as shown in figure 6. This type of construction results in greater uniformity of inductance and lead dress.

Plate-circuit tuning is accomplished by means of split-stator capacitor C4. The rotor of this capacitor is ganged with those of the preselector and harmonic selector circuits. The grid circuit is tuned by L153 which is self resonant at the lower end of the tuning range and maintains the proper oscillator signal amplitude at these frequencies.

C156 and C157 provide the feedback necessary to maintain oscillation. Coil L2 is provided to permit adjustment of the plate circuit inductance. C152 is used to adjust the oscillator tracking at the high end of the tuning range.

In order to produce a 41.25-mc sound i-f and a 45.75-mc video i-f the local-oscillator signal must be tunable from 517 mc to 931 mc. Since the oscillator operates at half the required frequency it tunes from 258.5 mc to 465.5 mc.

The oscillator output is applied to a crystal harmonic generator, CR101, by means of coupling link L164. The crystal distorts the oscillator signal making it rich in harmonics. From the harmonic generator the signal is fed to a harmonic-selector circuit. The harmonic selector is a tuned circuit identical to the preselector circuits, except for frequency range. It is tuned to the second harmonic of the oscillator, the frequency required for mixer injection.

The oscillator second harmonic is applied to the crystal mixer, CR102, by means of a tap on the inner conductor of the harmonic-selector tuned line. L158 is an r-f choke.

The mixer output appears across i-f coil L155. This coil is slug tuned to permit adjustment for proper bandpass. From this point the signal is link coupled (L156) to a short length of 72-ohm coax, through which the signal is fed to the VHF tuner input.

The look point in the mixer-output circuit is used in production to observe the tuner bandpass and check the mixer injection current.

To minimize feedback from the i-f strip to the UHF tuner, the tuner is insulated from the main chassis and

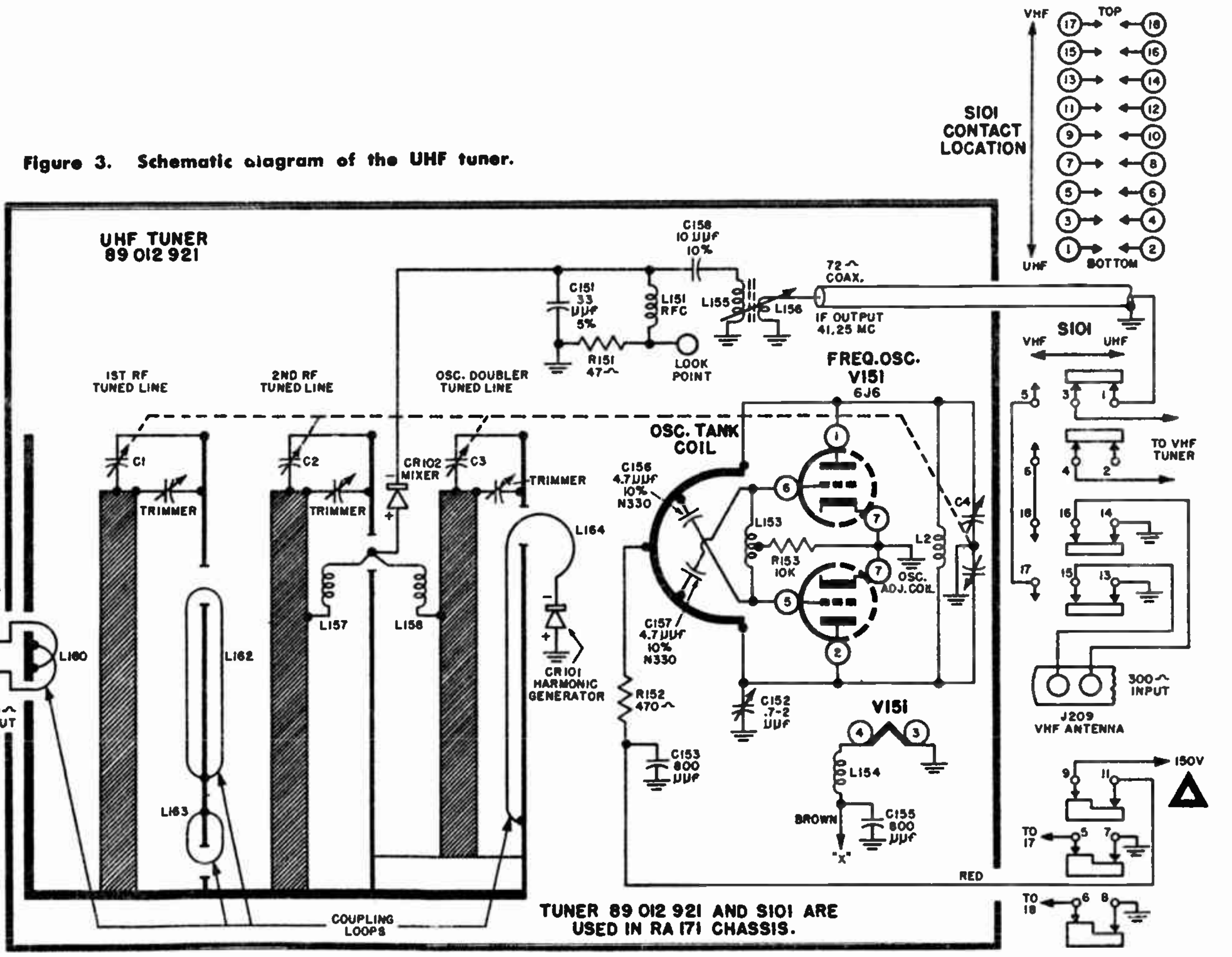


Figure 3. Schematic diagram of the UHF tuner.

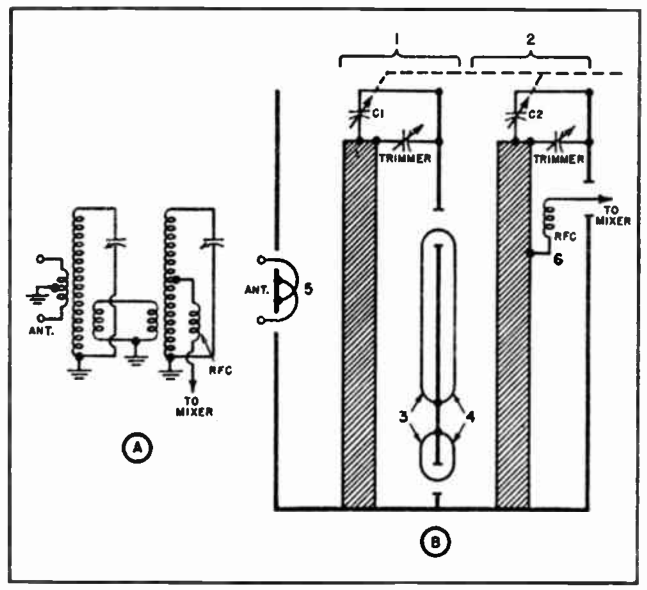


Figure 4. A—Low frequency equivalent of the preselector circuits. B—The actual preselector using tuned coaxial lines.

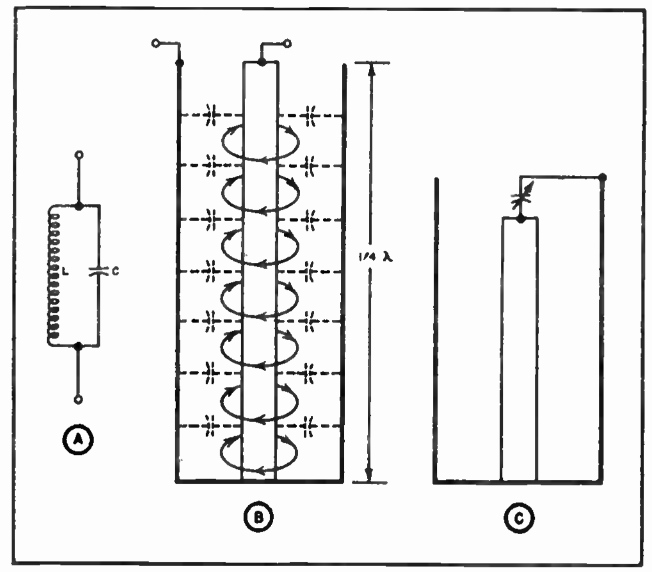


Figure 5. A—Parallel tuned resonant circuit. B—Resonant quarter-wave coaxial line. C—Shorted coax line less than quarter-wave long used as resonant circuit by the addition of capacitance.

grounded at one point by means of a short length of metallic braid. This type of grounding, called "single point grounding," is much more effective than simply mounting the tuner directly on the main chassis.

As pointed out previously the VHF tuner is provided with 13 switch-turret positions. To receive the UHF channels the Station Selector is placed in the thirteenth position. When this is done the VHF oscillator is disabled, and the necessary tuned circuits are switched in the VHF tuner so that the r-f amplifier and the mixer operate as 41 mc i-f stages.

In addition to the above, placing the Station Selector in the thirteenth position actuates a slide switch, S101 in figure 3, which applies B+ to the UHF tuner and connects the VHF tuner input to the UHF tuner output.

VIDEO I-F STRIP. — Four 41-mc stagger-tuned video i-f stages, employing 6CB6 tubes, are used. The grid circuit of the first video i-f stage is double tuned. All other coupling circuits are single tuned. A 47.25 mc adjacent-channel sound trap is provided. This trap is of the absorption type and is located in the plate circuit of the second video i-f stage. A-g-c voltage is applied to the first three stages.

VIDEO DETECTOR AND AMPLIFIER. — One-half of a 6AL5 twin diode serves as the video detector. D-c coupling is used between the detector and the video amplifier, as well as between the video amplifier and the CRT. A single high-gain video-amplifier stage employing a 12BY7 tube, is used.

The contrast control is located in the video-amplifier stage and consists of a potentiometer, connected between the cathode of the tube and ground. This potentiometer varies the bias and hence the gain of the video-amplifier stage.

A-G-C CIRCUITS. — A keyed a-g-c system with provisions to delay application of a-g-c voltage to the tuner r-f amplifier is used. The system posseses the excellent noise immunity and rapidity of action characteristic of keyed systems. In addition the delay provision greatly improves performance in both weak and strong-signal areas.

The tuner a-g-c voltage remains at the minimum permissible value (−.5 volts) on weak signals. This permits the tuner r-f amplifier to operate at full gain, maintaining maximum signal-to-noise ratio and minimizing picture snow. Adequate a-g-c is maintained on weak signals by the voltage applied to the i-f stages.

The tuner a-g-c delay also makes it possible to select component values in the a-g-c circuit which permit the tuner a-g-c voltage to rise rapidly at higher signal levels. As a result maximum performance is obtained over a wider range of input signal levels, with a given a-g-c control setting.

The a-g-c circuit is shown in figure 7. A 6AU6 sharp cut-off pentode is used as a keyed a-g-c amplifier (V212). The composite video signal, at the plate of the video amplifier, is applied to the grid of V212, through R256. Since d-c coupling is used, a portion of the plate voltage of the video amplifier appears at V212's grid, making it positive with respect to ground.

A positive d-c potential is applied to the cathode of V212. This positive voltage is obtained from the cathode of the regulator tube, V223. The positive voltage applied to V212's cathode is greater than the voltage at its grid, consequently the tube is negatively biased.

The composite video signal on the grid of V212 is positive. The grid is biased sufficiently beyond cut off so that only the sync pulses drive the grid out of cut off.

A positive pulse, obtained from terminal 4 of the horizontal output transformer, is applied to the plate of V212 through C238, R239 and R241. This positive horizontal pulse occurs at the same time as the sync pulse at the grid, causing the tube to conduct. As a result a negative voltage is developed at the plate of V212. The a-g-c amplifier is similar to the one used in the RA-164-165 chassis, and the reader is referred to the October, 1952 issue of the Service News for a more detailed description of its operation.

R264 and C245, at the plate of V212, function as a filter which removes most of the horizontal pulse component. The total a-g-c voltage is developed across R245 and R263. This voltage is appplied to the tuner a-g-c delay network, shown in figure 7 within the dotted lines.

To simplify the explanation of the delay network it has been shown in figure 8 with the diodes and capacitors removed. The negative a-g-c voltage produced by V212 appears at point A, causing a current to flow through R245 and R263 in the direction indicated by the dotted arrows. If we assume that this current is 225μa (.000225 amps), point A will be approximately −55 volts with respect to ground. As shown in the figure a bucking voltage of +270 volts is applied to R215, producing a current through the circuit as indicated by the solid arrows. The total resistance of R263, R245, R210 and R215 is 2,667,000 ohms, therefore the current due to the +270 volts is approximately 100 μa. (.0001 amps).

Since the direction of the current due to the bucking voltage is opposite that due to V212, the currents subtract and the resultant current through R263 and R245 is 125 μa (225 μa minus 100 μa), flowing from point A to ground. As a result point A becomes approximately 31 volts negative with respect to ground. The a-g-c voltage for the i-f stages is taken off at the junction of R245 and R263. The voltage at point A divides across these resistors producing approximately −5.9 volts at the i-f a-g-c take off.

Since point A is 31 volts negative and point C is 270 volts positive, the total drop across R210 and R215 is 301 volts. This voltage divides across the resistors producing a drop across R210 of approximately 27 volts. Thus point B is 27 volts positive with respect to point A, making it 4 volts negative with respect to ground. The tuner a-g-c voltage is taken off at point B and is applied to the tuner r-f amplifier through R205.

So far we have explained how the bucking voltage reduces the a-g-c voltage. The delay action of the circuit will be described with reference to figure 9. Referring to figure 9A assume that the same conditions exist as in figure 8. Point A is −31 volts and point B is −4 volts. Now assume that the voltage at point A is gradually made less negative. This will cause the voltage at point B to also gradually become less negative.

When the a-g-c voltage at point A is reduced to approximately −27 volts, the voltage at point B will be zero. A further reduction in the voltage at point A will cause the voltage at point B to become positive. Provisions have been made in the a-g-c circuit to prevent point B from becoming positive. This is accomplished by the addition of diode V214, as shown in figure 9B.

When the voltage at point A is sufficiently negative to produce a negative voltage at point B the plate of the diode is negative and it does not conduct. Therefore it has no effect on the circuit. However, when the voltage at point A is reduced, so that point B tends to become positive, the diode begins to conduct. Under these conditions the diode acts as a very low resistance to ground (practically a short circuit) and point B remains at zero potential.

Now let's examine what occurs as the signal level at the input of the receiver changes. If the signal is very weak the a-g-c voltage at point A is not very negative. Point B tends to become positive but the action of the diode keeps it at zero potential. As the signal strength rises the voltage at point A becomes more negative. However, point B remains at zero until the signal level is great enough to produce approximately −27 volts at point A. The diode now ceases to conduct and as the input signal level continues to increase, making point A more negative, point B also becomes negative and a-g-c voltage is applied to the tuner r-f amplifier.

In this way application of a-g-c voltage to the tuner is delayed until the input signal reaches a pre-determined level. It should be noted that negative a-g-c voltage is being applied to the i-f stages at all times because point A is always negative.

To prevent the plate current of the r-f amplifier from exceeding the maximum tube ratings, a minimum grid bias of −.5 volts must be maintained on the tube. This

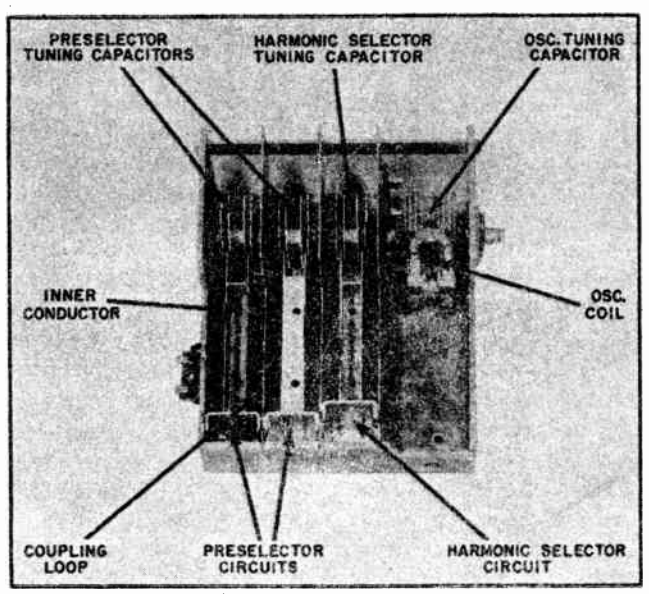


Figure 6. The UHF tuned circuits.

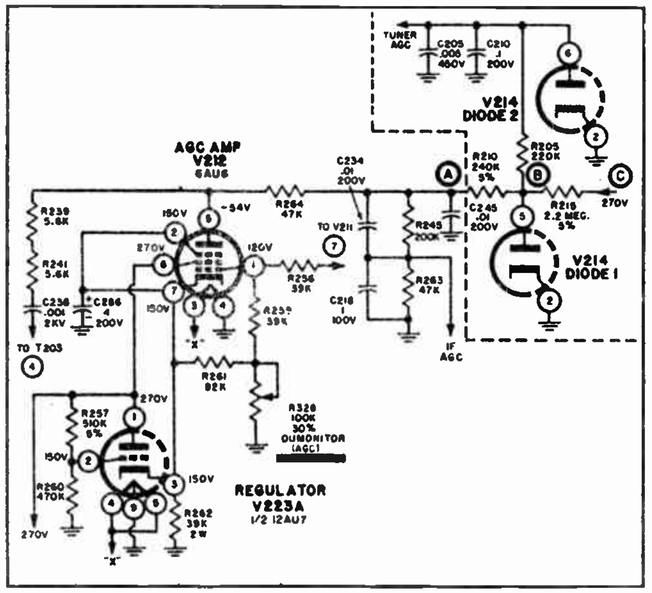


Figure 7. The a-g-c circuit.

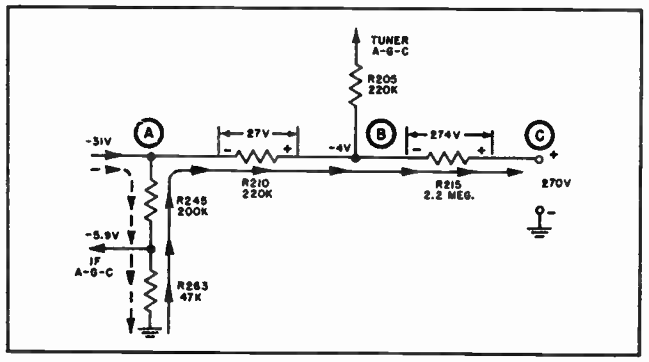


Figure 8. Simplified schematic of a-g-c delay net work showing currents produced by the a-g-c amplifier and the bucking voltage.

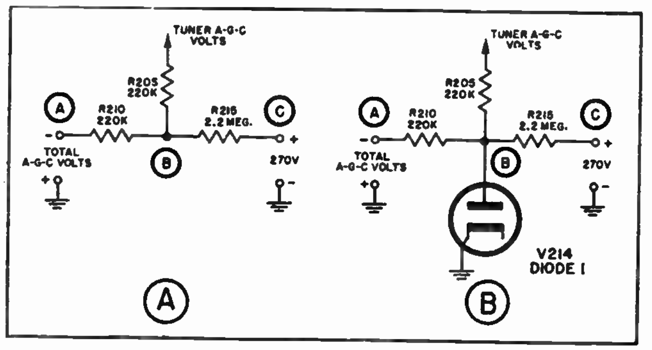


Figure 9. Operation of the delay circuit.

bias is obtained from the plate of diode number 2 in figure 7. When the voltage at point B, in figure 7, is zero the plate of diode 2 assumes a potential of –.5 volts, due to contact potential. This contact potential is produced by random electrons which strike the plate of the diode and create a current flow in R205.

C205 and C210 at the plate of diode 2 are bypass capacitors. C205 prevents r-f signals from the tuner from entering the a-g-c circuits. C210 eliminates the remaining horizontal pulse component from the a-g-c voltage.

As shown in figure 7 a voltage regulator tube (V223A) is provided to stabilize the cathode voltage on the a-g-c amplifier. The addition of this tube prevents line voltage, or power supply load fluctuations from affecting the a-g-c voltage.

When the current through the a-g-c amplifier (V212) increases, the drop across R262 and the bias on V223A also increases. This results in a drop in current through V223A and R262 which tends to compensate for the original change. As a result the bias on V212 is held at a comparatively constant value.

SYNC CIRCUITS. — The sync circuits consist of a noise inverter, three sync-clipper stages and a phase splitter, as shown in the block diagram of figure 10.

The composite-video signal is applied to the grids of the noise inverter and the first and second sync clippers. The noise inverter is biased so that it is normally cut off. When a noise pulse occurs, whose amplitude exceeds that of the sync signal, the noise inverter is driven out of cut off and the noise pulse appears at its plate. The output of the noise inverter is coupled to the grids of the first and second sync clippers. Since a phase reversal occurs in the noise inverter, the noise pulse arrives at the first and second sync clipper grids 180° out-of-phase with the composite-video signal and the noise pulse is cancelled at the grids.

The first sync clipper passes only horizontal sync information and the second sync clipper only vertical sync information. The separated horizontal and vertical sync signals are recombined in the output of the sync clippers and fed to the input of the third sync clipper. The third sync clipper is biased so that it clips near sync tip, to remove noise present on the sync pulse.

The output of the third sync clipper is fed to the grid of the phase splitter. This stage provides additional clipping action and in addition provides out-of-phase sync signals for application to the horizontal phase detector. The vertical sync is taken off at the cathode of the phase splitter.

NOISE INVERTER. — The composite-video signal at the plate of the video amplifier is applied to the upper end of R238 in figure 11. R238, R302 and R303 form a voltage divider. That portion of the signal which appears across R303 is applied to the grid of the noise inverter, V223B. Since d-c coupling is used between the video-amplifier plate and the grid of V223B, part of the video-amplifier plate voltage is applied to the grid, making it positive. A positive potential, obtained from the cathode of V208A, is applied to the cathode of V223B through R305. The positive cathode voltage is sufficiently greater than the positive grid voltage to bias the tube beyond cut off and prevent it from conducting on any part of the composite-video signal, as shown in figure 12. Therefore under normal operating conditions there is no signal at the plate of this stage.

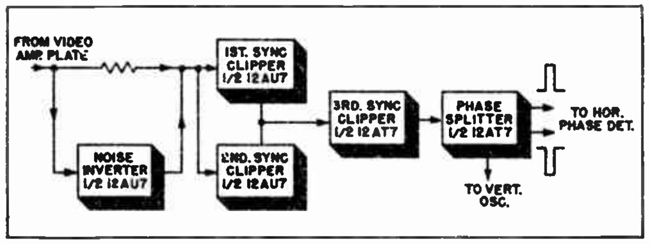


Figure 10. Block diagram of sync circuits.

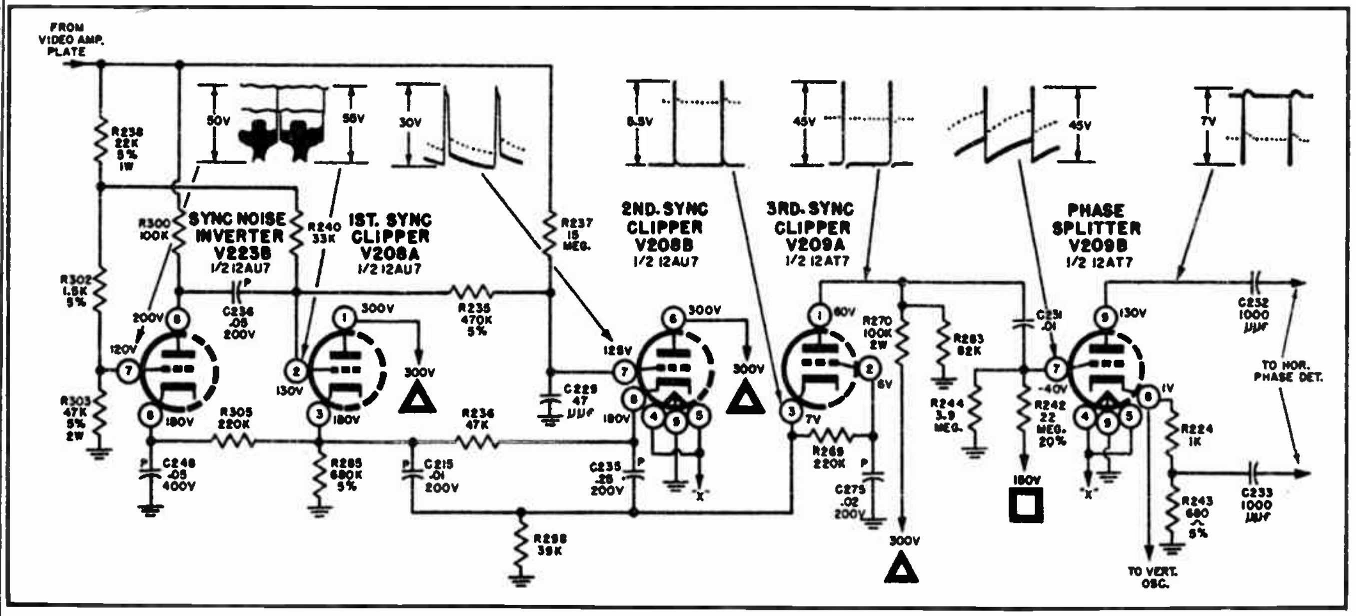


Figure 11. Schematic of sync circuits.

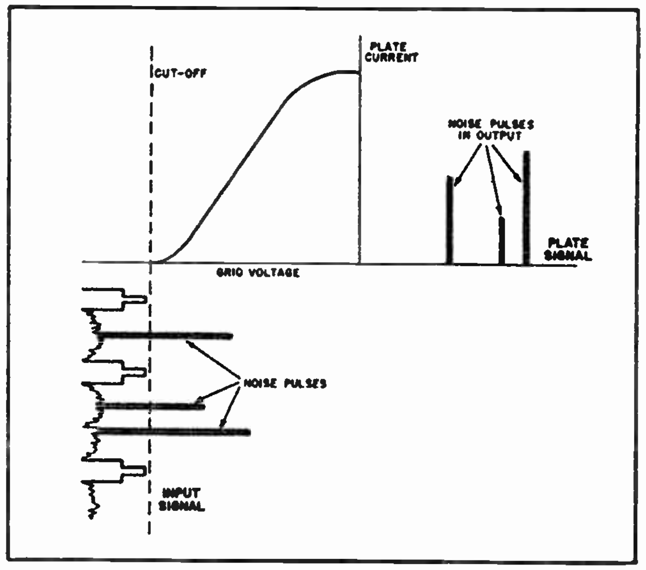


Figure 12. V223B grid-voltage, plate-current waveforms.

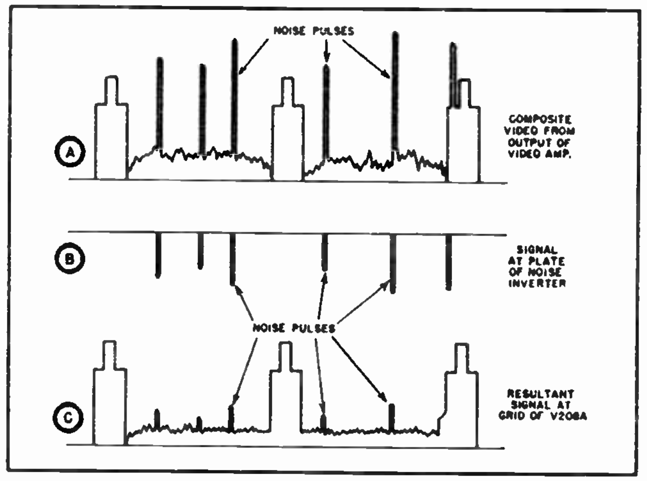


Figure 13. Signal at grid of V208A.

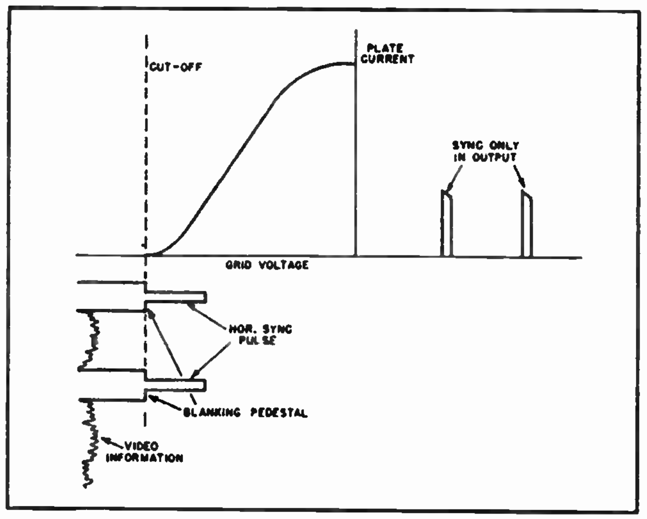


Figure 14. V208A grid-voltage, plate-current waveforms.

When a noise pulse occurs whose amplitude exceeds that of the sync, it drives the tube into conduction and appears in its output, as shown in figure 12. The output of the noise inverter is coupled to the grid of the first sync clipper. The signal at this point is shown in figure 13. A shows the composite-video signal obtained from the junction of R238-R302 and applied to the grid of the first sync clipper (V208A) through R240. B shows the noise pulses which are coupled from the plate of V223B to the grid of V208A, through C236. Note that the polarity of the noise pulses from the plate of V223B is opposite that of those in the composite-video signal. As a result the noise pulses cancel and the resultant signal appears as shown at C. Only a small portion of the noise still remains. In this way a large portion of the noise in the composite video signal is eliminated before application to the sync clippers.

FIRST SYNC CLIPPER. — That portion of the composite-video signal which appears across R302 and R303 is applied to the grid of the first sync clipper in conjunction with the output of the noise inverter. The noise cancellation action previously described takes place at this grid. Since the video-amplifier plate is d-c coupled to V208A, the grid is positive. A positive cathode voltage, exceeding this positive grid voltage, is developed across R285-C215, negatively biasing the tube. The operating conditions of the tube are shown in figure 14. The grid bias point of V208A is well beyond cut off, so that the tube conducts only on the horizontal-sync pulse, and the video and blanking information do not appear in its output.

In addition to eliminating the video and blanking information V208A removes most of the vertical-sync signal. This occurs as a result of the cathode-bias network, R285, C215 and R268. The signal at the grid of V208A is shown in figure 15A. Since the tube does not conduct on the video and blanking portions of the signal they have not been shown.

The horizontal sync pulses have a duration of 5 microseconds. During each horizontal sync pulse the tube conducts, as shown in figure 15C, charging C215 as shown at B. Since the interval between horizontal pulses is 58 microseconds (approximately 12 times the duration of each horizontal pulse), the charge due to each pulse is dissipated before the next pulse occurs, and the bias on V208A is substantially equal to that produced by the static current through the tube. V208A continues to conduct on each horizontal pulse producing current through R268, as shown in figure 15C.

Since the equalizing pulses are only 2.5 microseconds in duration and the interval between them is long (32 microseconds), the charges on C215 due to each pulse is dissipated before the next pulse occurs. Consequently, the equalizing pulses also produce a signal across R268.

As shown in figure 15A the vertical sync pulses are of much longer duration (27 microseconds) and are not as widely separated (4 microseconds) as are the horizontal and equalizing pulses.

As a result the vertical-sync pulses develop a large charge across C215, as shown in figure 15B. This charge is added to the static cathode bias on V208A, causing the tube to remain near cut off for the duration of the vertical-sync interval. Therefore, after the first vertical pulse occurs there is very little current through V208A, and the cathode resistor, R268.

V208A operates as a cathode follower with output taken off across R268. As a result of the operating conditions just described, only the horizontal sync, the equalizing and the leading vertical sync pulses appear in its output.

The advantage of this type of sync-clipper circuit lies in the fact that noise pulses do not affect the bias on the stage. Noise pulses are normally of short duration. As noted in the previous discussion short duration pulses do not develop a significant charge on the cathode capacitor, C215, and therefore do not change the bias on V208A.

In the usual grid-leak biased sync clipper the bias is determined by the peak amplitude of the signal. As a result high-amplitude noise pulses increase the grid bias, changing the clipping level and compressing, or completely eliminating, the sync information.

SECOND SYNC CLIPPER. — As noted in the preceding discussion the first sync clipper, V208A, does not pass the vertical sync signal. As a result other provisions have been made to separate the vertical sync from the composite-video signal. This is accomplished in the second sync clipper, V208B in figure 11.

The composite-video signal at the grid of the first sync clipper is applied to the grid of the second sync clipper through R235. Since noise cancellation takes place at the grid of V208A a large portion of the noise present in the composite-video signal is cancelled before it reaches the grid of V208B.

Bias for V208B is obtained from the cathode of V208A, through resistor R236. R236 and C235 function as a filter to prevent the horizontal and equalizing pulse components, present at the cathode of V208A, from reaching the cathode of V208B. The filter produces a slightly higher positive voltage at the cathode of V208B. Since the grids of V208A and V208B are at approximately the same potential, this causes the negative bias on V208B. to exceed the bias on V208A. To equalize the bias on both tubes R237 has been connected between the video take-off line and the grid of V208B. The addition of the resistor produces a slightly higher voltage at the grid, to compensate for the slightly higher cathode voltage. In this manner V208B is negatively biased beyond cut off. The operating conditions of the tube are shown in figure 16. Cut off corresponds to the blanking-pedestal level.

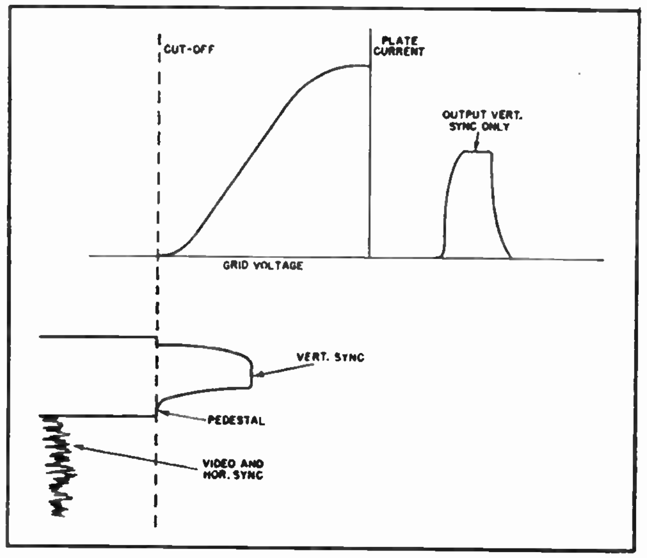


Figure 16. V208B grid-voltage, plate-current waveforms.

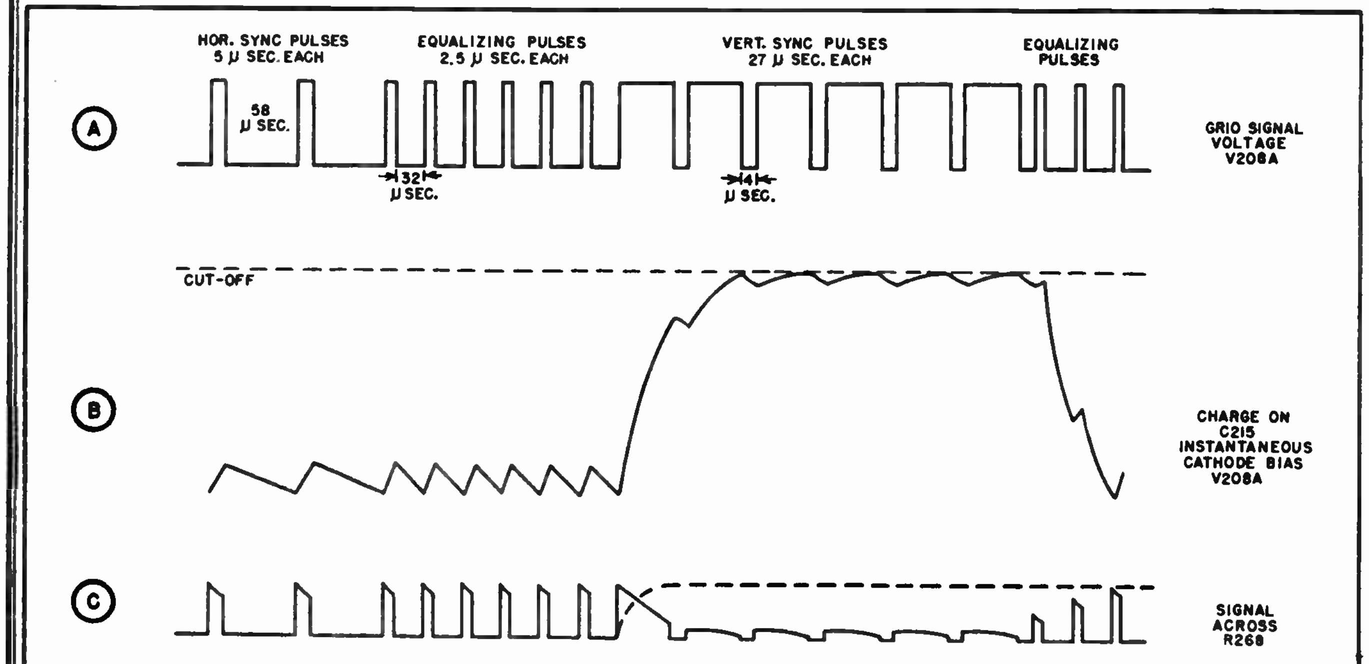


Figure 15. Operation of the first sync clipper, V208A. A—Sync portion of the composite video signal at grid. B—Instantaneous cathode voltage. C—Signal voltage across R-268. The dash line is due to V208B.

As previously mentioned the input signal is applied to the grid of V208B through R235. The time constant of R235-C229 in the grid circuit is approximately 25 microseconds. As a result the 5 microsecond horizontal and the 2.5 microsecond equalizing pulses produce very little voltage at the grid and do not drive the tube into conduction. The 27 microsecond vertical sync pulses, being of much longer duration, are integrated and drive the tube into conduction as shown in figure 16, producing a vertical-sync pulse across cathode resistor R268. This resistor is common to V208A and V208B and both the horizontal and vertical sync signals appear across it.

THIRD SYNC CLIPPER. — The composite-sync signal (horizontal, equalizing and vertical pulses) appearing across R268 is applied to the cathode of the third sync clipper, V209A in figure 11. R269 maintains the grid and cathode at approximately the same d-c potential, while the addition of C275 prevents the input signal from appearing at the grid. The operating conditions of the stage are shown in figure 17. Since the positive input signal is applied to the cathode it has the same effect as a negative signal applied to the grid, therefore the sync pulses drive the tube into cut off. As a result the upper 40% of the sync signal is clipped and does not appear at the plate. This clipping action removes noise superimposed on the sync signal.

PHASE SPLITTER. — The phase splitter, V209B in figure 11, provides additional clipping and out-of-phase sync signals for application to the horizontal a-f-c phase detector.

The sync signal at the plate of V209A is applied to the grid of V209B through coupling capacitor C231. C231 in combination with R244 form a grid-leak bias network which biases the grid negatively. The comparatively long vertical-sync pulse tends to charge C231 and increase the bias on the tube, so that the sync information immediately following the vertical-sync pulse is reduced in amplitude at the output of the stage. To overcome this condition a small positive voltage, obtained from the +150 volt line, is applied to the grid through R242. This permits the charge on C231 to leak off more rapidly so that the amplitude of the horizontal sync information is not reduced.

V209B operates as a conventional triode phase splitter. Output is obtained from both the plate and cathode circuits. The plate and cathode signals are of opposite polarity as required for operation of the horizontal a-f-c phase detector.

The vertical-sync signal is taken off at the cathode of V209B and applied to an integrator network before application to the vertical oscillator.

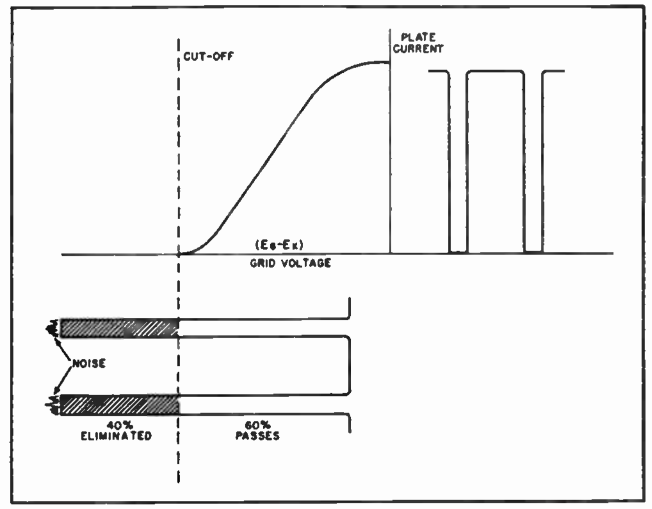


Figure 17. V209A grid-voltage, plate-current waveforms.

SERVICING PROCEDURES

ION-TRAP MAGNET ADJUSTMENT. —

1. Position the ion-trap approximately as shown in figure 18.

NOTE: A small magnetic shunt may have been clipped on the ion-trap magnet at the factory. Do not disturb this shunt.

2. Turn the set on and allow 30 seconds for warm-up. Set the Contrast control at the middle of its range and set the brightness so that a raster is just visible on the screen.

NOTE: Do not operate the Teleset with the ion-trap magnet improperly positioned for any longer than necessary.

3. Slide the magnet slowly back and forth along the neck of the tube, while at the same time rotating it slightly to the left and right. As the raster becomes brighter, turn down the Brightness control until there is just enough brightness to permit the adjustment to be made. When the position giving maximum *brightness* and optimum *focus* has been located, turn up the Brightness control until the raster begins to increase in size. Adjust the ion-trap magnet again, for maximum brightness and optimum focus.

DEFLECTION YOKE ADJUSTMENT. — If the picture is tilted, squeeze the ends of the yoke spring clip (A in Figure 18) together and lift them off the CRT support ring. Rotate the yoke until the picture is horizontal. The deflection yoke retainer (B in Figure 18) may rotate with the yoke. If this occurs the retainer should be held in position while the yoke is rotated, making sure that the yoke end cover rotates with the yoke. When the deflection yoke has been properly adjusted, reset the spring clip to hold the yoke in position.

POSITIONING ADJUSTMENT. — If the picture is not properly positioned, readjust the positioning magnet using the following procedure:

1. Push the positioning magnet assembly forward until it touches the rear of the yoke retainer.
2. Bring the protruding adjustment tabs (C in Figure 18) together.
3. Rotate the entire positioning magnet assembly around the neck of the tube until the picture is properly positioned.
4. If the picture cannot be properly positioned in this manner, separate the tabs slightly and rotate the entire assembly around the tube again. Continue to repeat this step, increasing the separation of the tabs each time, until the picture is properly positioned. When this adjustment has been made, a slight readjustment of the ion-trap magnet may be necessary.

VHF TUNER OSCILLATOR ADJUSTMENT. — Individual oscillator adjustment slugs are provided in the VHF tuner to permit precise adjustments to suit the receiving condition for each channel in your area. These slugs are set at the factory for average conditions and do not require adjustment when the receiver is installed. However, it is often possible to obtain better reception by readjusting the oscillator slugs to suit the particular conditions at the location where the receiver is installed.

The following procedure should be used:

1. Turn the Station Selector to the channel on which the oscillator is to be adjusted.
2. Remove the Fine Tuning and Station Selector knobs (and the RA-171 UHF channel dial).
3. Set the Fine Tuning control so that the flat on the shaft faces downward. The oscillator slug is accessible through the hole just to the right of the tuning shaft.
4. Using an insulated alignment tool. adjust the slug for best picture and sound.

DUMONITOR ADJUSTMENT. — The Dumonitor control is adjusted at the factory and normally does not require readjustment in the field. However, in some cases better reception can be obtained by adjusting the control to suit the conditions in your area.

In weak signal areas the Dumonitor control should be adjusted for best contrast and picture stability.

In strong signal areas the control should be set to prevent overloading on the strongest signal received, using the following procedure:

1. Set the front panel Horizontal Hold control for minimum whip (straight vertical wedge on test pattern) at the top of the picture.
2. Adjust the Dumonitor control until no overload is observed.
3. Switch the Station Selector on and off channel. If this causes overload to occur reset the Dumonitor until the overload does not reappear when switching on and off channel.

In areas where both very strong and very weak signals are received the Dumonitor control should always be adjusted to prevent overloading on the strongest signal.

UHF-VHF ANTENNA CROSSOVER NETWORK. — If a combination UHF-VHF antenna having a single transmission line is used with RA-171 chassis, an antenna crossover network is required to terminate the transmission line at the receiver's UHF and VHF antenna terminals. Crossover network, Du Mont Part No. 88 000 681, should be used. This network is available from your Du Mont distributor.

The UHF-VHF transmission line should be connected to the terminals provided on the crossover network and the separate UHF and VHF output leads should be connected to their respective antenna terminals on the receiver.

REPLACING THE VHF TUNER COIL STRIPS

1. Remove the four screws holding the tuner bottom cover and remove the cover.
2. Using a screw driver, push the spring finger holding the strip toward rear of tuner and lift out strip.
3. To install new strip, insert end having smaller projection into the hole in the detent plate.
4. Pry the spring finger away from rear of drum and push the strip into place. Let spring finger snap back into place making sure that projection on end of strip seats correctly in hole in spring finger.

CLEANING THE TUNER CONTACTS. — Remove the tuner bottom cover and several of the coil strips as described in the previous paragraph. Rotate the turret so that the wiping contacts are accessible through the opening made by removing the strips. Clean the coil strip and wiping contacts with a soft cloth moistened with "No Noise."

ADJUSTING THE TENSION OF THE WIPING CONTACTS. — Remove the tuner bottom cover and several of the coil strips. Rotate the turret to permit access to the contacts through the opening thus provided. Using a small screw driver bend each contact spring until it extends approximately ⅛ inch inward from the surface of the plastic contact-mounting plate.

REMOVING VHF TUNER

1. Unplug the coax lead connection near 1st VIF transformer.
2. Remove the dial cord.
3. Unsolder the four VHF tuner leads from the terminal strip on top of VHF tuner bracket.
4. Unsolder lead from terminal strip at slide switch.
5. Unsolder lead from UHF tuner at slide switch.
6. Unsolder center coax lead from slide switch.

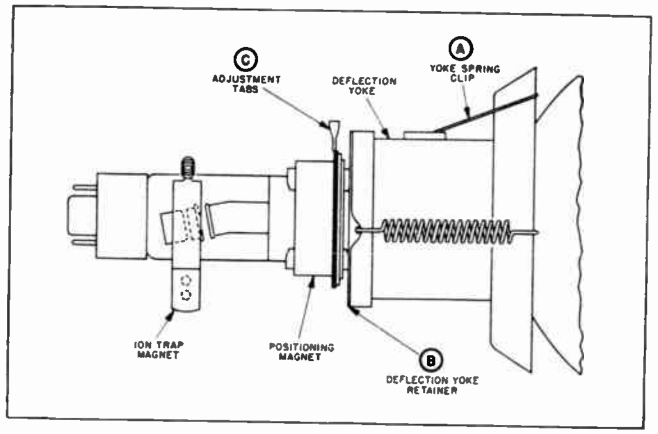


Figure 18.

7. Remove the bracket supporting the front end of the tuning shafts.
8. Remove the three screws mounting the VHF tuner to the support bracket.

REMOVING UHF TUNER

1. Unsolder the center lead of coax from slide switch, and remove ground lug fastening outside lead of coax to bracket.
2. Unsolder red lead from UHF tuner at slide switch.
3. Unsolder brown lead from UHF tuner at terminal strip.
4. Loosen UHF tuner-shaft coupling screw.
5. Remove three screws fastening tuner to mounting bracket.

UHF DIAL CALIBRATION

If a UHF channel is available tune to channel and adjust the UHF dial for proper calibration.

If no UHF channel is available, calibrate the dial so that it tunes below the channel 20 marker and above the channel 80 marker.

DIAL STRINGING PROCEDURE

1. Rotate the UHF pulley shaft fully clockwise.
2. Rotate the UHF tuning control so that the opening of the tuner shaft drum is positioned to the left.
3. Hook end of the dial cord on the pulley drum, marked START in figure 19, and string dial cord as shown.

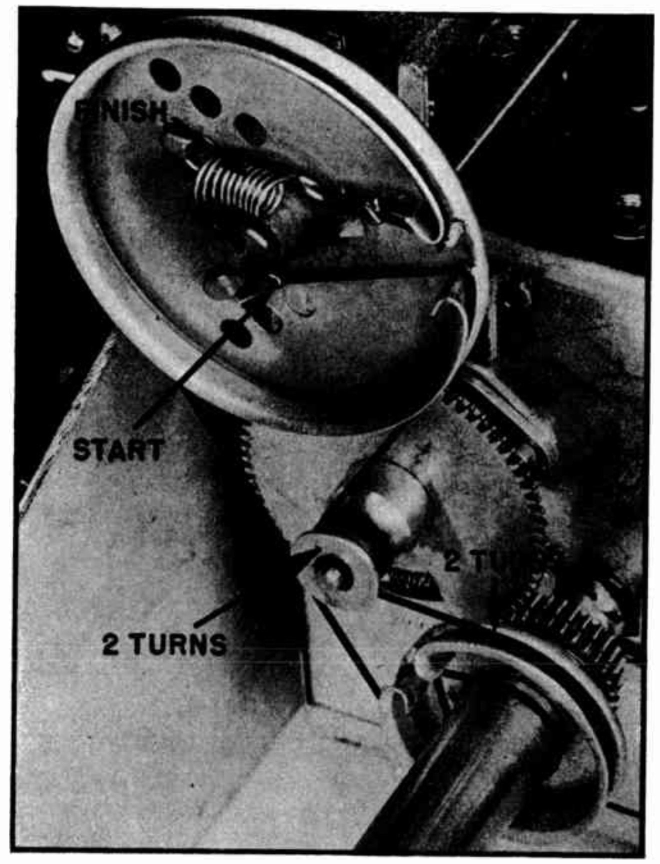


Figure 19.

TROUBLESHOOTING PROCEDURES

PICTURE

Symptom	Procedure
Bright Horizontal Line **Loss of Vertical Size**	1. Substitute V213 and V216 2. Check voltages, waveforms and associated components of V213 and V216 3. Check yoke and vertical output transformer, T201
Critical Vertical Hold	1. Check waveforms in integrator network
Drive Line in Center	1. Check setting of drive control
Insufficient Horizontal Size	1. Check settings of horizontal size and linearity controls 2. Substitute V220, V221 and V219 3. Check boosted B+ and associated components 4. Check C279 and C278
Insufficient Vertical Size	1. Check setting of vertical-size control **Control Has No Effect** 2. Check vertical size pot. R324 **Control Does Not Give Normal Size** 2. Substitute V213 and V216 3. Check voltages, waveforms and associated components of V213 and V216

PICTURE (con't)

Symptom	Procedure
Loss of Horizontal and Vertical Hold Probable Cause: Faulty sync clipper stage	1. Check settings of front panel hold controls 2. Substitute V208 and V209 3. Check voltages, waveforms and associated components of V208 and V209
Loss of Vertical Hold Only	1. Substitute V208 2. Check associated components of V208B
Microphonics - Visual Probable Cause: Mechanical modulation of tube in picture circuits.	1. Check control shafts and knobs for binding against cabinet 2. Substitute V101 and V102 3. Substitute V201, V202, V203, V204 and V211
No Brightness	1. Check for presence of high voltage at CRT connector **High Voltage OK** 2. Check CRT for open filament (look for glow) 3. Check adjustment of ion trap 4. Check voltages and associated components of CRT **No High Voltage** 2. Check the ¼ amp. fuse (F201) in high voltage cage 3. Substitute V222, V221, V220 and V219 4. If a picture of reduced size with heavy horizontal fold-over appears when V221 is removed, replace C278 5. Check voltages, waveforms and associated components of V222, V221, V220 and V219
No Horizontal Hold - or Critical Horizontal Hold Probable Cause: Defective a-f-c circuit	1. Check setting of front panel horizontal hold control 2. Substitute V210 and V219 3. Check setting of L210 horizontal-stabilizer control located on rear of chassis 4. Check voltages, waveforms and associated components of V210 and V219
Picture Oversize - Low Brightness Probable Cause: Insufficient high voltage	1. Substitute V222 2. Check h-v rectifier components
Picture Too Small (Horizontal and Vertical) Probable Cause: B+ low	1. Substitute V217 and V218 2. Check B+ line and associated components
Poor Focus	1. Check setting of ion trap
Poor Horizontal Linearity	1. Check setting of horizontal-linearity control 2. Substitute V220 and V221 3. Check voltages, waveforms and components associated with V220 and V221
Poor Vertical Linearity	1. Check setting of vertical-linearity control 2. Substitute V216 3. Check voltages, waveforms and associated components of V216 and 213
Sound Bars In Picture Probable Cause: Misalignment	1. Check fine tuning adjustment 2. Check video i-f alignment
Vertical Instability Probable Cause: Faulty vertical oscillator	1. Check setting of front panel vertical hold control 2. Substitute V213 and V216 3. Check voltages, waveforms and associated components of V213 and V216
Weak Picture	1. Substitute V211 2. Check voltages and components associated with V211

SOUND

Symptom	Procedure
Buzz Probable Cause: Vertical sync in sound	1. Check fine tuning adjustment 2. Substitute V206 and V207 3. Check sound i-f alignment
Cannot Be Tuned In Properly Probable Cause: H-f oscillator frequency misadjusted	1. Check oscillator slug adjustment 2. Substitute V102
Dead or Weak Probable Cause: Loss of gain in audio or sound i-f stage	1. Substitute, V205, V206, V207, V214 and V215 2. Check speaker plug and speaker audio transformer 3. Check voltages on V205, V206, V207, V214 and V215 4. Check components associated with V205, V206, V207, V214 and V215 5. Check sound i-f alignment
Distorted	1. Check fine tuning adjustment 2. Substitute V206, V207, V214 and V215 3. Check alignment of Z206 4. Check voltages on V214 and V215 5. Check components in 1st and 2nd audio amp.
Microphonics - Audible Probable Cause: Mechanical modulation of h-f oscillator (V102) or audio amplifier tubes.	1. Check for binding knobs or control shafts 2. Substitute V102 3. Substitute V214 and V215
Poor Quieting Probable Cause: Improper operation of ratio detector or sound i-f stage	1. Check fine tuning adjustment 2. Substitute V207 3. Check alignment of Z206 4. Substitute V206 5. Check components of ratio detector, V207

PICTURE AND SOUND

Symptom	Procedure
No Picture, No Sound, Brightness OK	1. Substitute V101, V102, V201, V202, V203, V204, V205, V215 (see note) and V223 2. Check voltages on V101, V102, V201, V202, V203, V204 and V205 and speaker plug connection. NOTE: The 150V source is the cathode of V215, the 2nd audio amp., therefore, a defective tube, speaker plug connection, or output transformer will result in loss of the 150V
No Picture, No Sound, Low Brightness (brightness control set at maximum)	1. Substitute V211 2. Check voltages and components associated with V211
Overload in Picture - Buzz in Sound Probable Cause: Loss of a-g-c voltage	1. Check setting of the a-g-c potentiometer 2. Substitute V212, V201, V202 and V203 3. Check voltages, waveforms and components associated with V212
UHF OK, VHF Inoperative	1. Substitute V102. 2. Check operation of cam and slide switch, S101. 3. Check voltages and components associated with V102.
VHF OK, UHF Inoperative	1. Substitute V151, CR101 and CR102. 2. Check operation of cam and slide switch, S101. 3. Check VHF tuner 40 mc i-f strip.

VIDEO IF ALIGNMENT RA-166/167, 170/171

Place STATION SELECTOR between channels to disable oscillator. Remove fuse, F201. Connect a short length of wire to pin 5 of V101 (see Figure 1). Use the lowest VTVM range for all steps.

Step	Signal Generator Frequency	Signal Generator Connect to	Output Indicator	Connect to	Adjust	Remarks
1	44.5 mc No Sweep	Pin 5 V101 1	VTVM	Pin 2, V211 1VTVM	Z205 for maximum reading	Set signal generator output to maintain reading on lowest range of VTVM.
2	42.5 mc No Sweep	As Above 2	VTVM	As Above 2VTVM	Z204 for maximum reading	Same
3	46.1 mc No Sweep	As Above 3	VTVM	As Above 3VTVM	Z203 (bottom) for maximum reading	Same
4	43.75 mc No Sweep	As Above 4	VTVM	As Above 4VTVM	Z202 for maximum reading	Same
5	47.25 mc	As Above 5	VTVM	As Above 5VTVM	Z203 (top) for minimum reading	Increase signal generator output to obtain reading on VTVM.
6	43.5 mc center freq. 10 mc deviation (min.)	As Above 6	Oscillograph through XTAL	Pin 5 V201 6XTAL	Mixer Plate Coil (L109) and Z201 (top) for 44.8 mc marker on one peak Z201 (bottom) for 42.5 mc marker on other peak.	Adjust for waveform below. 42.5 MC 44.8 MC
7	4.5 mc 400 CPS AM	Pin 2 V211 7	Oscillograph through XTAL	Junction R266, R267, and C239 7XTAL	L207 for minimum reading	

SOUND IF ALIGNMENT

Step	Signal Generator Frequency	Signal Generator Connect to	Output Indicator	Connect to	Adjust	Remarks
8	4.5 mc Approx. 1 MC sweep	Pin 5 V205B 8	Oscillograph through XTAL	Pin 7 V207 8XTAL	L204 and Z206 (bottom)	Adjust for waveform below. 4.5
9	As Above	As Above 9	Oscillograph Direct	Junction R232, C228 9DIR	Z206 top	Adjust for waveform below. 4.5

ALTERNATE SOUND IF ALIGNMENT — USING TV SIGNAL

Step	Signal Source	Output Indicator	Connect to	Adjust	Remarks
8	TV Signal	VTVM	Pin 7, V207 8XTAL	L204 Z206 (bot.) for maximum reading	Teleset must be tuned for best picture.
9	As Above	VTVM	Ratio Det. Test Point P206	Z206 Top for zero reading	As Above

ALIGNMENT TEST POINTS

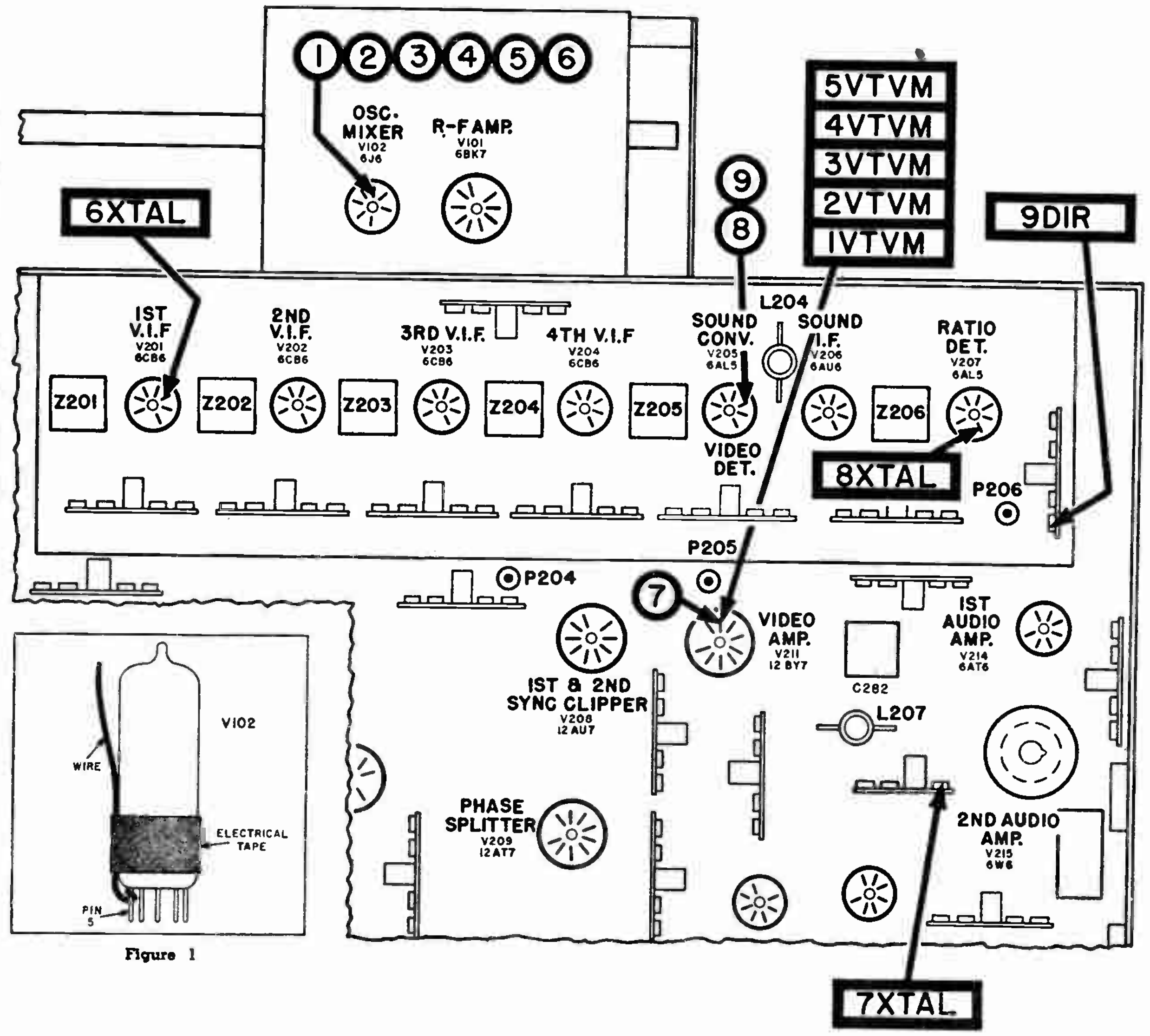


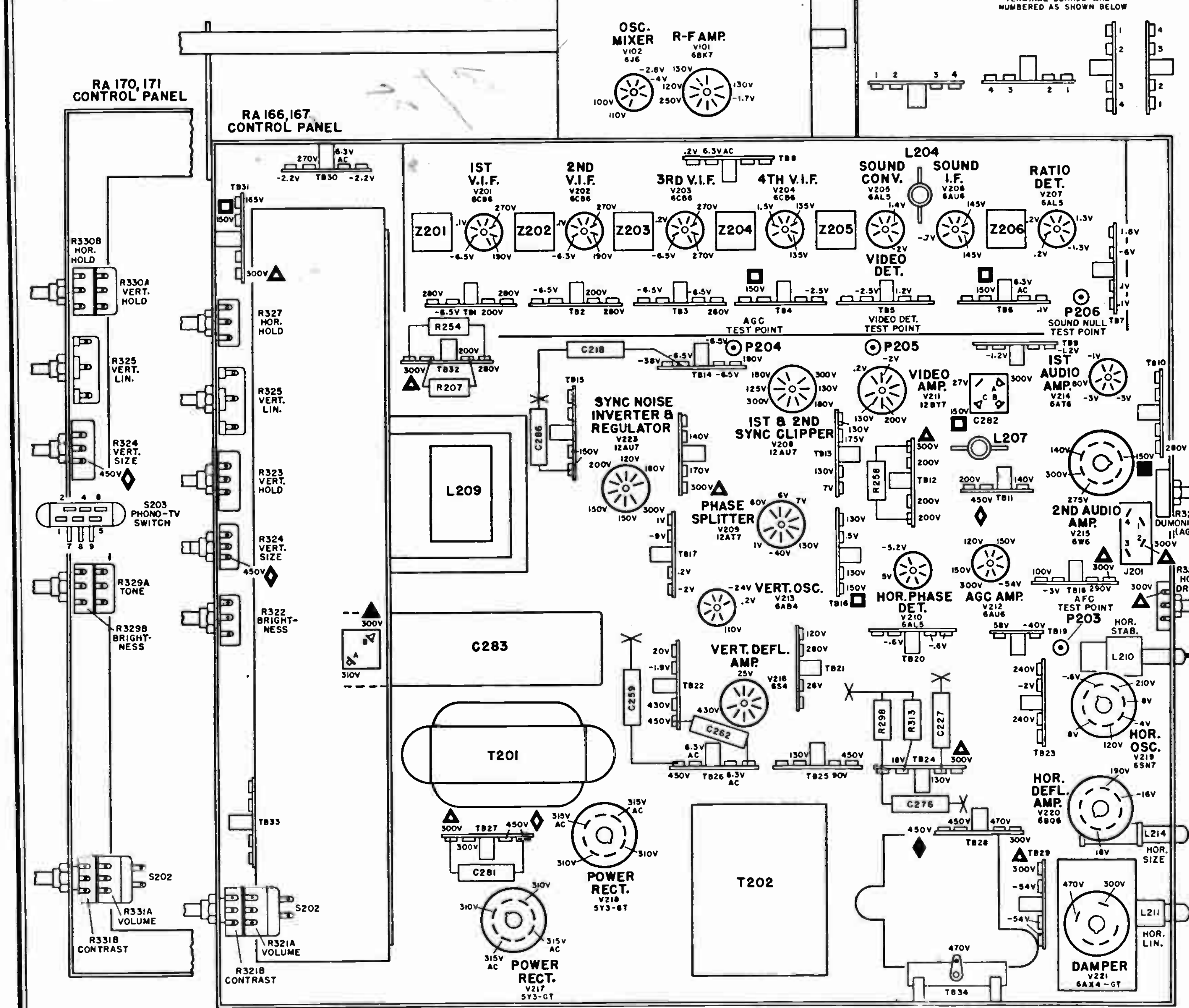
Figure 1

PHASING

When the alignment procedure has been completed, the phasing of the video IF strip should be checked and corrected if required.

1. Tune the receiver to the best signal available, preferably a station transmitting a test pattern.
2. Adjust the Fine Tuning control until the sound in the picture is eliminated.
3. Carefully examine the picture for trailing whites, or the presence of spurious black response (smear) following black elements of the picture.
4. If either of these conditions is encountered, adjust the top slug of Z201 not more than ½ turn to eliminate the condition.

UNDERCHASSIS VOLTAGE POINTS



RESISTANCE MEASUREMENTS
All Readings to Ground

		1	2	3	4	5	6	7	8	9
V201	6BC6	80K	56	.1	0	30K	30K	0		
V202	6CB6	50K	56	.1	0	30K	30K	0		
V203	6CB6	50K	61	.1	0	30K	30K	0		
V204	6CB6	.3	100	.1	0	25M	25M	0		
V205	6AL5	.3	.3	.1	0	1K	0	3.3K		
V206	6AU6	100K	0	0	.1	25M	25M	0		
V207	6AL5	INF	INF	.1	0	15K	0	15K		
V208	12AU7	25K	60K	680K	.1	.1	25K	520K	720K	0
V209	12AT7	50K	220K	3.9K	.1	.1	25M	3.9M	1.6K	
V210	6AL5	12	12	.1	0	4.8M	0	4.8M		
V211	12BY7	0-350	3.3K	0	0	0	.1	25K	25M	0
V212	6AU6	30K-40K	27K-30K	.1	0	280K	25K	27K-30K		
V213	6AB4	INF		.1	0		820K-1.8M	1K		
V214	6AT6	2M	0	0	.1	400K	600K	500K		
V215	6W6GT		.1	25K	25K	270K		0	25M	
V216	6S4		820-5.8K		0	.1	2.2M			INF
V217	5Y3GT		25K		18		18		25K	
V218	5Y3GT		25K		18		18		25K	
V219	6SN7GT	5.3M	30K-50K	1.8K	80K-110K	250K-265K	1.8K	0	.1	
V220	6BQ6GT		0	500K	32K	500K		.1	150	Cap INF
V221	6AX4GT			INF		25K		0	.1	
V222	1B3GT		INF		INF		INF	INF		Cap INF
V223	12AU7	25K	300K	30K	.1	.1	150K	30K	1M	0
V401*	CRT	0	1M-1.5M				25K			

*10	11	12
INF	100K	.1

The above resistance readings were taken with an RCA Model WV97A VTVM. All readings are in ohms, K = 1000, M = million. When the reading is affected by a control two readings are given. These readings indicate the variation produced by the control.

CH. RA-166 - 171, Early

RESISTANCE MEASUREMENTS
All Readings to Ground

		1	2	3	4	5	6	7	8	9
V201	6BC6	80K	56	.1	0	30K	30K	0		
V202	6CB6	50K	56	.1	0	30K	30K	0		
V203	6CB6	50K	61	.1	0	30K	30K	0		
V204	6CB6	.3	100	.1	0	25M	25M	0		
V205	12AU7	1M	3.3K	.8	.1	.1	0	.8	2.7K	0
V206	6AU6	100K	0	0	.1	25M	25M	0		
V207	6AL5	INF	INF	.1	0	15K	0	15K		
V208	12AU7	25K	60K	680K	.1	.1	25K	520K	720K	0
V209	12AT7	50K	220K	3.9K	.1	.1	25M	3.9M	1.6K	
V210	6AL5	12	12	.1	0	4.8M	0	4.8M		
V211	12BY7	0-350	3.3K	0	0	0	.1	25K	25M	0
V212	6AU6	30K-40K	27K-30K	.1	0	280K	25K	27K-30K		
V213	6AB4	INF		.1	0		820K-1.8M	1K		
V214	6AT6	2M	0	0	.1	400K	600K	500K		
V215	6W6GT		.1	25K	25K	350K		0	25M	
V216	6S4		820-5.8K		0	.1	2.2M			INF
V217	5Y3GT		25K		18		18		25K	
V218	5Y3GT		25K		18		18		25K	
V219	6SN7GT	5.3M	30K-50K	1.8K	80K-110K	250K-265K	1.8K	0	.1	
V220	6BQ6GT		0	500K	32K	500K		.1	150	Cap INF
V221	6AX4GT			INF		25K		0	.1	
V222	1B3GT		INF		INF		INF	INF		Cap INF
V223	12AU7	25K	300K	30K	.1	.1	150K	30K	1M	0
V401*	CRT	0	1M-1.5M				25K			

*10	11	12
INF	100K	.1

The above resistance readings were taken with an RCA Model WV97A VTVM. All readings are in ohms, K = 1000, M = million. When the reading is affected by a control two readings are given. These readings indicate the variation produced by the control.

Ch. RA-166/171, Late

PARTS LIST

Symbol	Part No.
C201	03 015 610
C202	03 017 850
C203	03 121 520
C204	03 017 850
C205	03 015 610
C206	03 017 850
C207	03 121 520
C208	03 017 850
C210	03 119 740
C211	03 121 520
C212	03 017 850
C213	03 122 430
C214	03 121 520
C215	03 014 900
C216	03 017 850
C217	03 115 000
C218	03 122 800
C219	03 120 900
C220	03 014 900
C221	03 013 800
C222	03 015 610
C223	03 015 270
C224	03 121 520
C225	03 100 490
C226	03 014 390
C227	03 120 550
C228	03 120 200
C229	03 115 330
C231	03 015 920
C232	03 015 810
C233	03 015 810
C234	03 014 900
C235	03 119 720
C236	03 119 750
C237	03 015 760
C238	03 122 420
C239	03 119 940
C240	03 100 490
C241	03 120 340
C242	03 015 610
C243	03 122 430
C244	03 015 610
C245	03 014 900
C246	03 115 670
C247	03 120 140
C248	03 119 950
C249	03 119 750
C250	03 101 230
C251	03 029 480
C252	03 100 300
C253	03 014 990
C254	03 122 440
C255	03 124 190
C256	03 105 100
C257	03 014 820
C258	03 119 630
C259	03 120 740
C261	03 120 730
C262	03 120 780
C263	03 125 780
C264	03 125 780
C265	03 014 610
C266	03 100 020
C267	03 121 530

Symbol	Part No.
C268	03 021 510
C269	03 030 140
C270	03 115 000
C271	03 120 120
C272	03 021 950
C273	03 120 790
C274	03 120 740
C275	03 119 770
C276	03 119 710
C277	03 015 610
C278	03 121 200
C279	03 104 690
C280	03 121 501
C281	03 250 411
C282	03 124 180
C283	03 121 080
C284	03 120 960
C285	03 122 480
C401	03 122 461
F201	11 000 720
I201	12 001 310
J201	09 022 690
J202	34 003 192
J203	34 003 462
J204	09 031 070
J205	09 031 070
J206	09 015 560
J209	40 015 240
L201	21 011 301
L202	21 006 624
L203	21 006 627
L204	21 011 021
L205	21 011 082
L206	21 006 627
L207	21 010 961
L208	21 006 230
L209	21 010 952
L210	21 010 991
L211	21 011 001
L212	21 006 520
L213	21 006 280
L214	21 011 011
L215	21 008 972
L216	21 008 972
L217	21 008 972
L218	21 008 972
L219	21 006 230
L220	21 006 230
L221	21 011 082
L224	21 011 082
L401	21 011 062
N201	88 000 631
P201	09 036 920
P202	50 093 801
P203	63 018 210
P204	63 018 210
P205	63 018 210
P206	63 018 210
P404	09 015 590
R201	02 037 820
R202	02 032 480
R203	02 041 930
R204	02 031 620

Symbol	Part No.
R205	02 032 050
R206	02 032 420
R207	02 037 890
R208	02 032 420
R209	02 031 850
R210	02 031 050
R211	02 032 420
R212	02 032 420
R213	02 032 420
R214	02 031 620
R215	02 031 280
R216	02 031 890
R217	02 031 570
R218	02 032 420
R219	02 032 420
R220	02 031 830
R221	02 031 650
R222	02 032 420
R223	02 031 600
R224	02 031 770
R225	02 032 520
R226	02 031 860
R227	02 031 830
R228	02 032 010
R229	02 032 410
R230	02 037 970
R231	02 031 720
R232	02 031 930
R233	02 031 910
R234	02 031 910
R235	02 031 120
R236	02 031 970
R237	02 032 270
R238	02 033 800
R239	02 031 860
R240	02 031 950
R241	02 031 860
R242	02 032 680
R243	02 030 440
R244	02 032 200
R245	02 031 030
R246	02 030 440
R247	02 032 010
R248	02 032 010
R249	02 034 540
R250	02 031 900
R251	02 032 210
R252	02 032 130
R253	02 031 850
R254	02 113 050
R255	02 032 410
R256	02 031 960
R257	02 031 130
R258	02 107 960
R259	02 031 960
R260	02 032 090
R261	02 032 000
R262	02 037 960
R263	02 031 970
R264	02 031 970
R265	02 032 420
R266	02 032 020
R267	02 032 060

Symbol	Part No.
R268	02 031 840
R269	02 032 050
R270	02 038 010
R271	02 032 600
R272	02 032 010
R273	02 032 130
R274	02 032 070
R275	02 037 900
R276	02 032 600
R277	02 032 580
R278	02 031 130
R279	02 031 160
R280	02 032 010
R281	02 038 380
R282	02 032 110
R283	02 032 000
R284	02 032 130
R285	02 031 160
R286	02 032 510
R287	02 032 120
R288	02 035 070
R289	02 032 420
R291	02 030 760
R292	02 034 990
R293	02 032 140
R294	02 032 620
R296	02 034 970
R297	02 034 760
R298	02 035 540
R299	02 031 970
R300	02 032 010
R301	02 030 700
R302	02 030 520
R303	02 036 880
R304	02 032 050
R305	02 032 050
R306	02 030 540
R307	02 032 080
R308	02 032 010
R309	02 030 670
R310	02 121 630
R311	02 032 580
R312	02 032 350
R313	02 121 620
R314	02 037 910
R316	02 037 910
R317	02 037 830
R318	02 100 710
R319	02 035 570
R321	01 053 200
R322	01 051 100
R323	01 051 100
R324	01 051 010
R325	01 024 740
R326	01 044 441
R327	01 052 900
R328	01 053 800
R329	01 038 346
R330	01 038 344
R331	01 053 131
R401	02 041 740
R402	02 041 740
S202	01 053 200

Symbol	Part No.
S202	01 053 131
S203	05 005 120
T201	20 008 021
T202	20 008 182
T203	20 008 061
V201	25 002 670
V202	25 002 670
V203	25 002 670
V204	25 002 670
V205	25 000 020
V206	25 000 050
V207	25 000 020
V208	25 000 130
V209	25 001 530
V210	25 000 020
V211	25 007 380
V212	25 000 050
V213	25 001 760
V214	25 000 040
V215	25 002 680
V216	25 003 010
V217	25 000 220
V218	25 000 220
V219	25 000 110
V220	25 001 830
V221	25 007 780
V222	25 000 150
V223	25 000 130
V401 (17")	25 007 710
V401 (21")	25 007 720
Z201	20 008 231
Z202	20 008 241
Z203	20 008 251
Z204	20 008 261
Z205	20 008 303
Z206	20 006 141

TUNER
89 012 901 - 89 012 911

Symbol	Part No.
C101	03 125 500
C102	03 125 010
C103	03 019 840
C104	03 124 780
C105	03 124 770
C106	03 124 790
C107	03 125 500
C108	03 119 170
C109	03 119 170
C110	03 019 840
C111	03 125 110
C113	03 125 110
C114	03 125 500
C115	03 126 010
C116	03 126 010
C117	03 019 840
C118	03 126 191
C119	03 124 790
C120	03 125 500
C121	03 124 790
C123	03 125 000

Symbol	Part No.
L106	21 011 811
L107	21 011 571
L108	21 011 581
L109	21 011 801
L110	21 011 561
P104	09 018 810
R101	02 031 840
R104	02 041 180
R105	02 041 200
R106	02 041 730
R107	02 031 890
R108	02 032 040
R109	02 031 890
R110	02 031 850
R111	02 031 890
V101	25 007 341
V102	25 000 190

89 012 911 Only

Symbol	Part No.
C112	03 124 790
R102	02 212 640
S101	05 007 371

89 012 921

Symbol	Part No.
C151	03 126 130
C152	03 125 180
C153	03 125 500
C154	03 124 790
C155	03 125 500
C156	03 126 140
C157	03 126 140
C158	03 125 460
CR101	26 001 082
CR102	26 001 082
L151	21 011 821
L154	21 011 831
L155	21 011 841
V151	25 000 190

TUNER STRIPS

Channel	Part No.
2	40 014 881
3	40 014 882
4	40 014 883
5	40 014 884
6	40 014 885
7	40 014 886
8	40 014 887
9	40 014 888
10	40 014 889
11	40 014 891
12	40 014 892
13	40 014 893
43 mc IF	40 014 895

MECHANICAL PARTS
Chassis

Part No.	Description
11 000 600	Holder Fuse
12 006 263	Lampholder
12 006 700	Jewel Light
34 001 100	Socket Octal Wafer
34 001 220	Socket 7 Pr. Min. Molded
34 001 300	Socket 7 Pr. Min. Wafer
34 001 670	Socket 9 Pr. Min. Molded
34 001 770	Socket 9 Pr. Min. Wafer
34 002 380	Socket Octal Molded
34 003 193	Socket Octal Wafer V221
34 003 570	Socket Octal, Shock Mtg.
36 003 720	Plate Contact V220
38 001 310	Grommet Rubber
42 002 860	Shield Tube Min.
42 006 611	Shield Corona V222
42 006 710	Base Tube Shield Min.

TUNER
89 012 901 - 89 012 911

Part No.	Description
30 035 020	Detent Roller and Spring
30 035 030	Spring Shaft Support
30 035 040	Snap Ring
35 025 600	Bearing Plate
42 002 900	Tube Shield V101
42 004 580	Tube Shield V102
42 007 930	Bottom Shield
42 007 940	Side Shield
60 408 200	Screw Bottom, Side Shield
60 409 600	Screw Bearing Plate

89 012 911

Part No.	Description
30 033 611	UHF Dial Sleeve
30 033 621	Backlash Gear and Pulley
30 033 641	Shaft, Backlash Gear
30 033 651	Ring Bearing
30 033 661	Bearing Bracket
43 005 011	Spacer, Shaft
60 057 501	Screw Bearing Plate
60 806 101	Set Screw
62 403 221	"C" Washer, Shaft
30 036 621	Cam
30 008 310	Dial Cord
30 035 461	Spring Dial Cord
30 036 631	Gear Turning Shaft
30 035 011	Extension Shaft

Part No.	Description
30 035 262	Coupling
30 035 100	Pulley Dial Cord
61 025 200	Lock Nut Flat
60 408 420	Screw, Coupling

89 012 921

Part No.	Description
42 002 900	Tube Shield V151
45 004 461	Dial UHF

CABINET PARTS
RA-166

Part No.	Description
18 003 521	Speaker Asy 5"
22 001 941	Antenna Loop
28 001 391	L Shunt Ion Trap
29 000 651	Magnet Centering
29 000 661	Magnet Ion Trap
30 014 011	Cup Back Panel
30 027 963	Spring Defl. Coil
30 027 971	Retainer Defl. Coil
32 003 461	Panel Back
35 019 593	Bracket CRT Mtg.
35 022 141	Strap CRT (Sq. Hole)
35 022 142	Strap CRT (Rd. Hole)
35 022 151	Plate CRT Mounting
36 003 761	Clip Bracket Ground
36 003 791	Spring Clip Defl. Coil
38 011 901	Cushion CRT
38 011 921	Door Stop
42 006 662	Cover Control Mah.
42 006 663	Cover Control Bl.
45 004 061	Safety Glass
45 004 431	Knob Selector Mah.
45 004 432	Knob Selector Bl.
45 004 441	Knob Fine Tuning
45 004 442	Knob Contrast
45 004 451	Knob Volume Mah.
45 004 452	Knob Volume Bl.
50 002 900	Power Cable
60 405 070	Screw Chassis Mtg.
62 200 240	Washer Chassis Mtg.
64 006 608	Mask Asy. Brown
64 006 609	Mask Asy. Green
64 007 022	Bezel Front Panel
64 008 691	Support Rear CRT

RA-167-170-171

Part No.	Description
22 001 941	Antenna Loop
28 001 391	L Shunt Ion Trap

Part No.	Description
29 000 651	Magnet Centering
29 000 661	Magnet Ion Trap
30 027 963	Spring Defl. Coil
30 027 971	Retainer Defl. Coil
30 031 282	Cup Back Panel
32 003 471	Panel Back
35 019 592	Bracket CRT Mounting
35 022 121	Strap CRT (Rd. Hole)
35 022 122	Strap CRT (Sq. Hole)
35 022 131	Plate CRT Mounting
35 025 821	Bracket Safety Glass Mtg.
36 003 761	Clip Bracket Ground
36 003 791	Spring Clip Defl. Coil
38 009 841	Side Support Mask Mah.
38 009 842	Side Support Mask Bl.
38 010 141	Cushion Safety Glass
38 011 902	Cushion CRT
38 011 921	Door Stop
38 012 541	Btm. Support Mask Mah.
38 012 542	Btm. Support Mask Bl.
42 006 662	Cover Control Mah.
42 006 663	Cover Control Bl.
45 004 001	Safety Glass
45 004 431	Knob Selector Mah.
45 004 432	Knob Selector Bl.
45 004 441	Knob Fine Tuning
45 004 442	Knob Contrast
45 004 451	Knob Volume Mah.
45 004 452	Knob Volume Bl.
50 002 900	Power Cable
60 405 070	Screw Chassis Mtg.
62 200 240	Washer Chassis Mtg.
64 006 763	Mask Asy. Gold
64 006 764	Mask Asy. Brown
64 008 691	Support Rear CRT

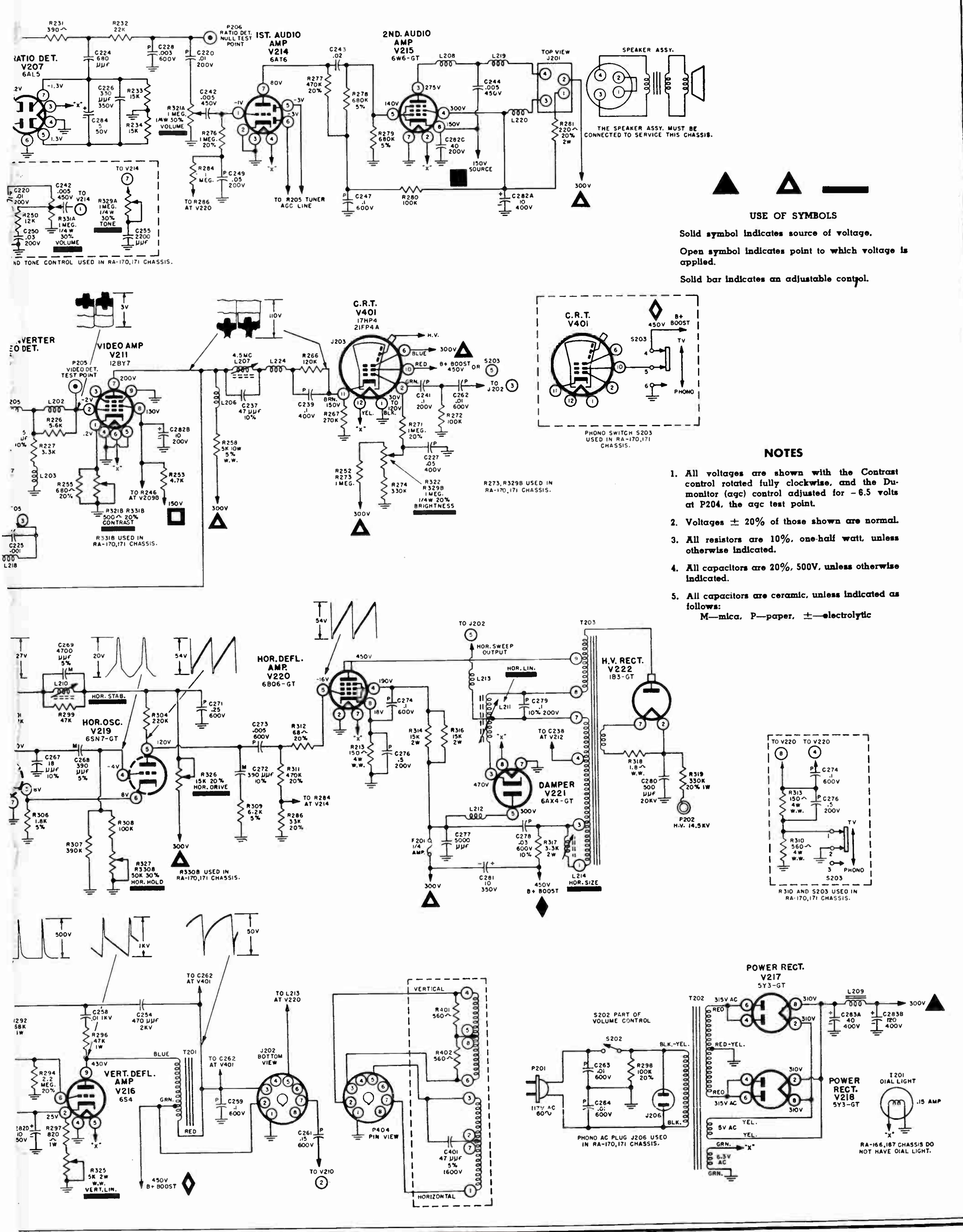
RA-167 Only

Part No.	Description
18 003 521	Speaker Asy 5"
18 003 511	Speaker Asy 10"

RA-170-171 Only

Part No.	Description
18 003 501	Speaker Asy. 10"
32 003 481	Panel Back
45 004 711	Knob Hidden Control Mah.
45 004 712	Knob Hidden Control Bl.

CHASSIS



USE OF SYMBOLS

Solid symbol indicates source of voltage.

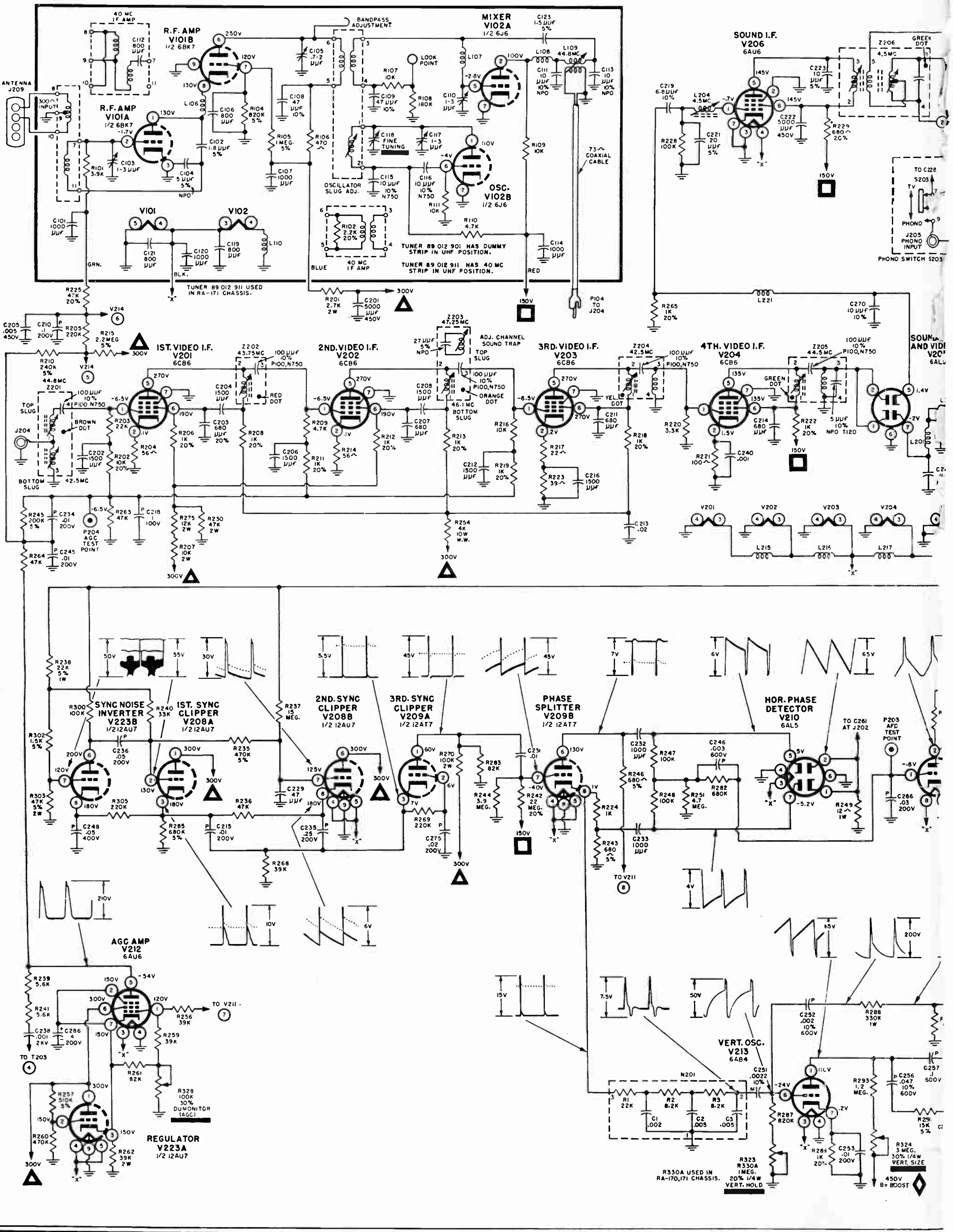
Open symbol indicates point to which voltage is applied.

Solid bar indicates an adjustable control.

NOTES

1. All voltages are shown with the Contrast control rotated fully clockwise, and the Du-monitor (agc) control adjusted for −6.5 volts at P204, the agc test point.
2. Voltages ± 20% of those shown are normal.
3. All resistors are 10%, one-half watt, unless otherwise indicated.
4. All capacitors are 20%, 500V, unless otherwise indicated.
5. All capacitors are ceramic, unless indicated as follows:
   M—mica, P—paper, ±—electrolytic

RA-166/167, 170/171 C



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ALIGNMENT TEST POINTS

NOTE: V205 IS A 6AL5 IN SOME SETS. USE PIN 5 OF THIS TUBE FOR CONNECTIONS 8 AND 9.

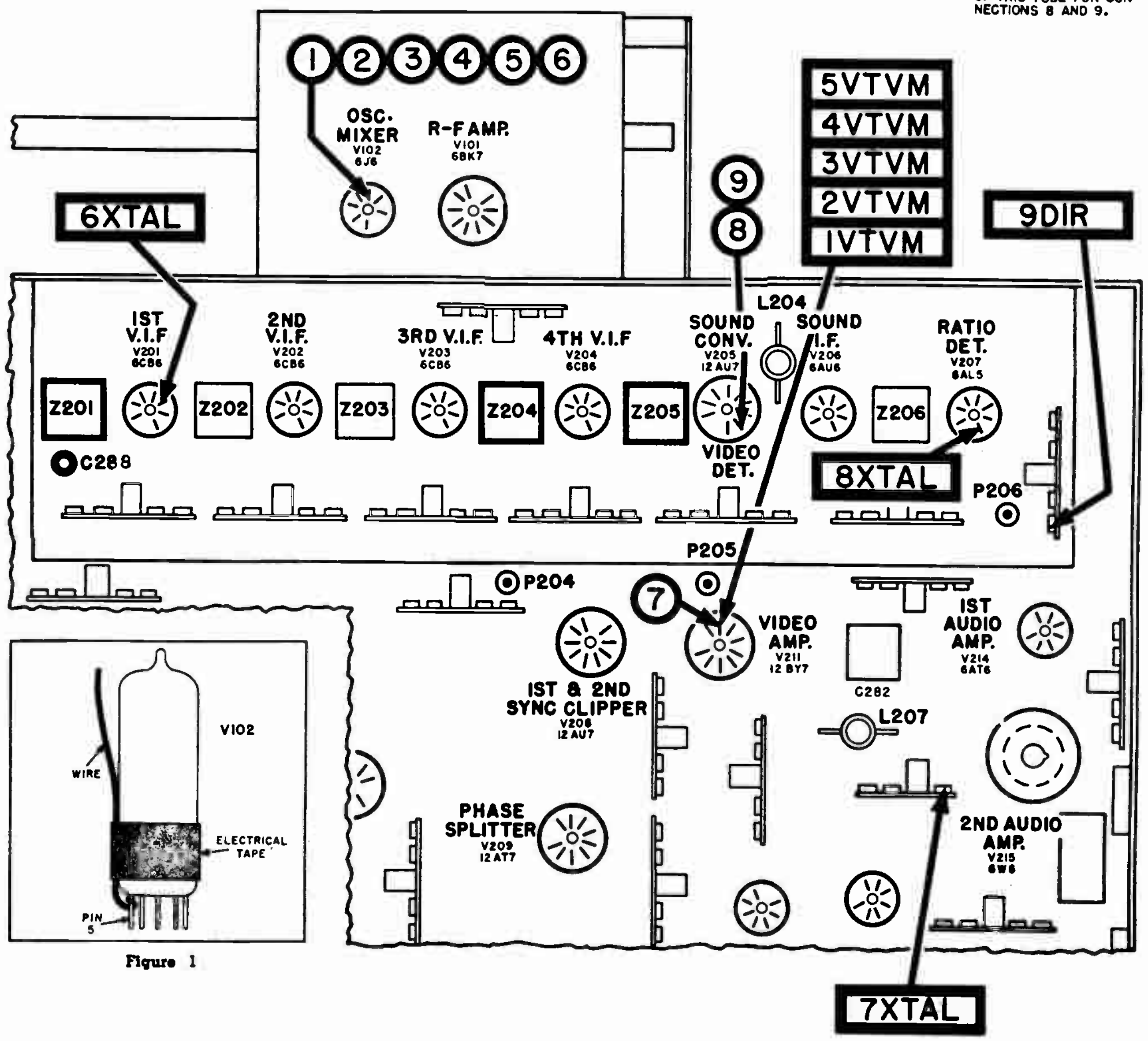


Figure 1

PHASING

When the alignment procedure has been completed, the phasing of the video IF strip should be checked and corrected if required.

1. Tune the receiver to the best signal available, preferably a station transmitting a test pattern.
2. Adjust the Fine Tuning control until the sound in the picture is eliminated.
3. Carefully examine the picture for trailing whites, or the presence of spurious black response (smear) following black elements of the picture.
4. If either of these conditions is encountered, adjust the top slug of Z201 not more than ½ turn to eliminate the condition.

VIDEO IF ALIGNMENT RA-166/171

Place STATION SELECTOR between channels to disable oscillator. Remove fuse, F201. Connect short length of wire to pin 5 of V102, Fig. 1. Use lowest VTVM range.

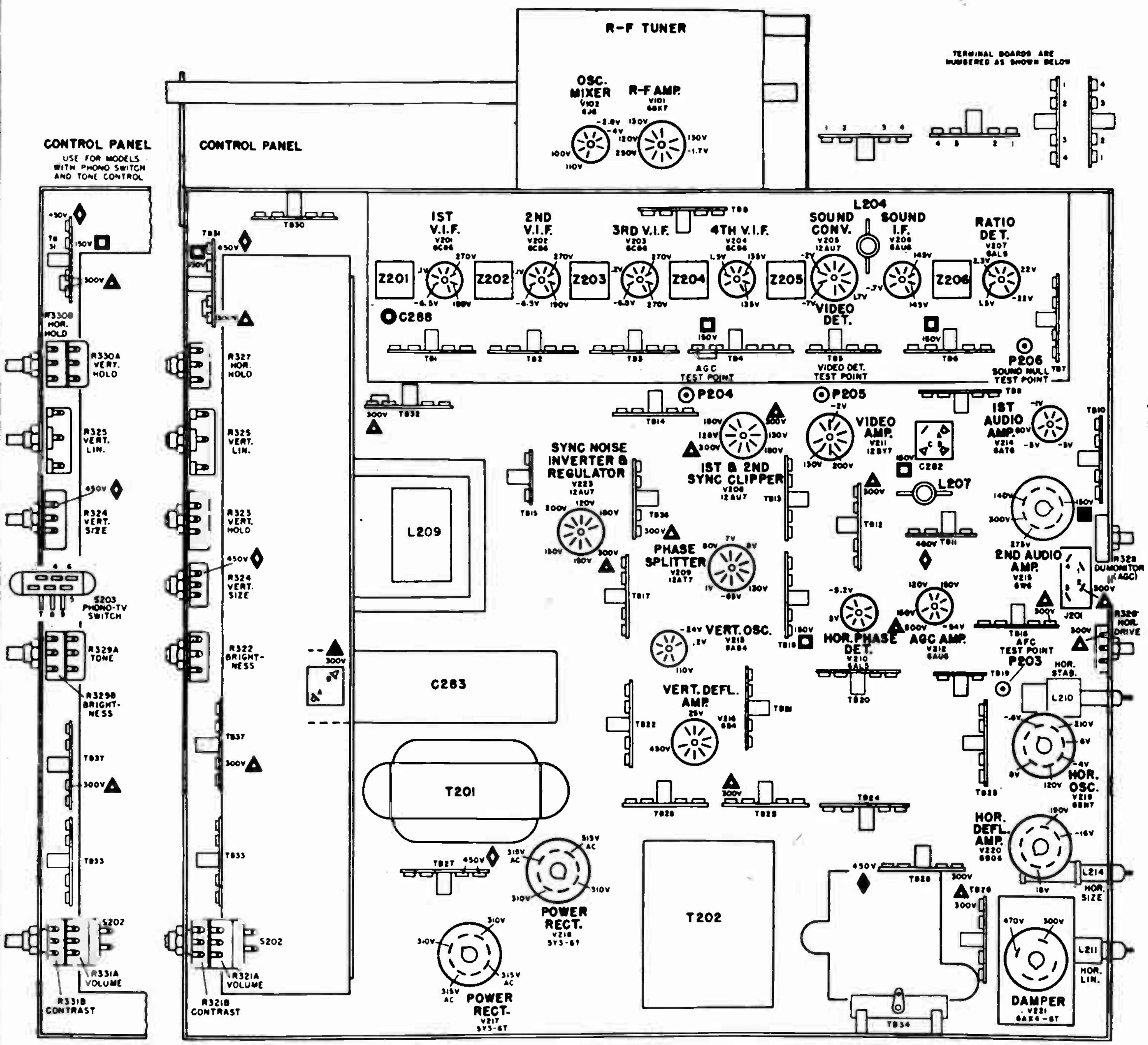
Step	Signal Generator Frequency	Signal Generator Connect to	Output Indicator	Connect to	Adjust
1	44.25 mc No Sweep	Pin 5 V102 ①	VTVM	Pin 2, V211 1VTVM	Z205 for maximum reading. Set signal generator output to maintain reading on lowest range of VTVM.
2	42 mc No Sweep	As Above ②	VTVM	As Above 2VTVM	Z204 for maximum reading
3	46.1 mc No Sweep	As Above ③	VTVM	As Above 3VTVM	Z203 (bottom) for maximum reading
4	44.25 mc No Sweep	As Above ④	VTVM	As Above 4VTVM	Z202 for maximum reading
5	47.25 mc	As Above ⑤	VTVM	As Above 5VTVM	Z203 (top) for minimum reading. Increase signal generator output to obtain reading on VTVM
6	43.5 mc 10 mc deviation	As Above ⑥	Oscillograph through XTAL	Pin 5 V201 6XTAL	Mixer Plate Coil (L109) and Z201 (top) for 44.65 mc marker on one peak Z201 (bottom) for 42.6 mc marker on other peak. C288 for 41.25 mc dip. (Sets not having C288 do not need the 41.25 mc adjustment.) 42.6MC 44.65MC 41.25MC
7	4.5 mc 400 CPS AM	Pin 2 V211 ⑦	Oscillograph through XTAL	Junction R266, R267, & C239 7XTAL	L207 for minimum reading

SOUND IF ALIGNMENT

Step	Signal Generator Frequency	Signal Generator Connect to	Output Indicator	Connect to	Adjust
8	4.5 mc 1 mc Sweep	Pin 8 V205 See Note ⑧	Oscillograph through XTAL	Pin 7 V207 8XTAL	L204 and Z206 (bottom) Adjust for waveform below 4.5
9	As Above	As Above ⑨	Oscillograph Direct	Junction R232, C228 9DIR	Z206 top Adjust for waveform below 4.5

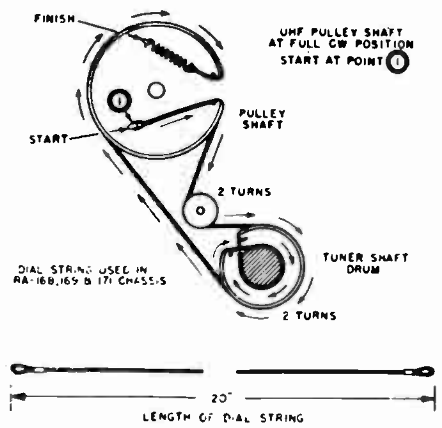
ALTERNATE SOUND IF ALIGNMENT — USING TV SIGNAL

Step	Signal	Output Indicator	Connect to	Adjust
8	TV Signal Teleset must be tuned for best picture.	VTVM	Pin 7, V207 8XTAL	L204 Z206 (bot.) for maximum reading
9	As Above	VTVM	Ratio Det. Test Point P206	Z206 (top) for zero reading

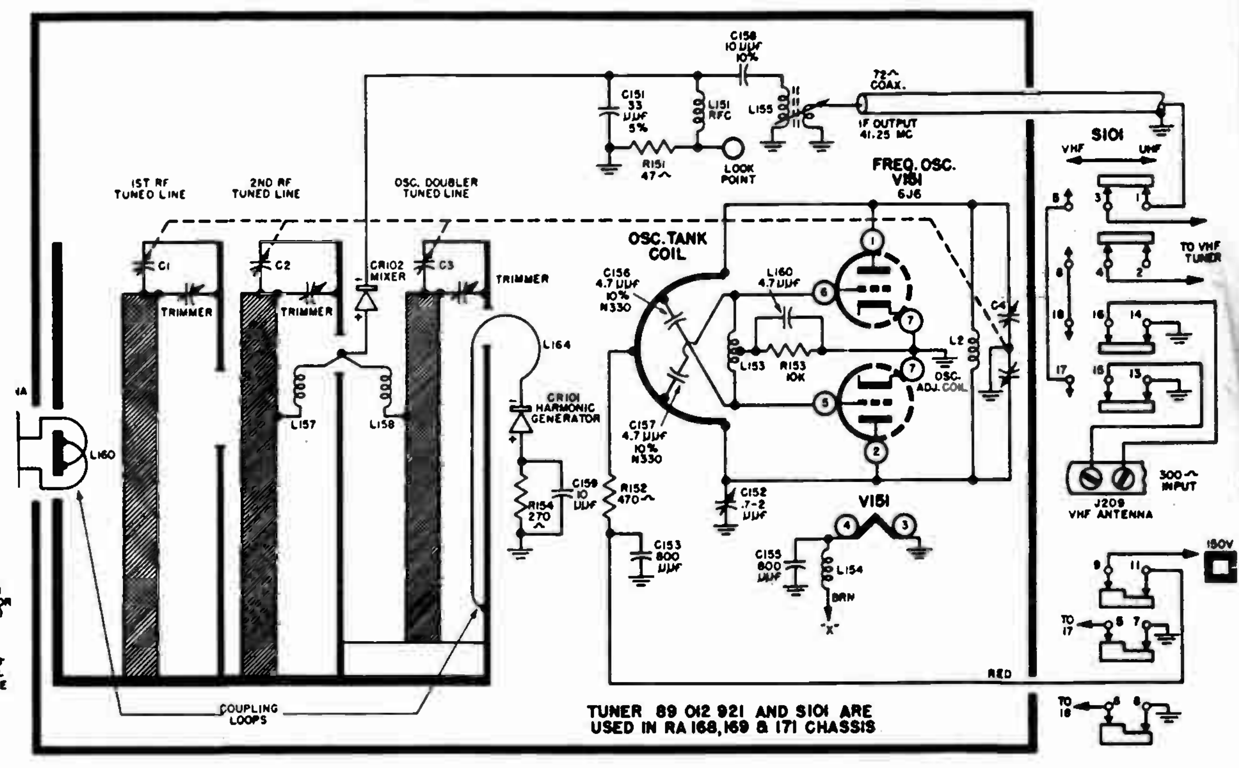


NOTES

1. All voltages are shown with the Contrast control rotated fully clockwise, and the Du-monitor (agc) control adjusted for −6.5 volts at P204, the agc test point.
2. Voltages ± 20% of those shown are normal.
3. All resistors are 10%, one-half watt, unless otherwise indicated.
4. All capacitors are 20%, 500V, unless otherwise indicated.
5. All capacitors are ceramic, unless indicated as follows:
   M—mica, P—paper, ±—electrolytic,
   MP — molded paper
6. Tuner 89 012 901 is used in RA-166, 167 and 170 chassis. Tuner 89 012 911 is used with UHF tuner 89 012 921 in RA-168, 169 and 171 chassis.

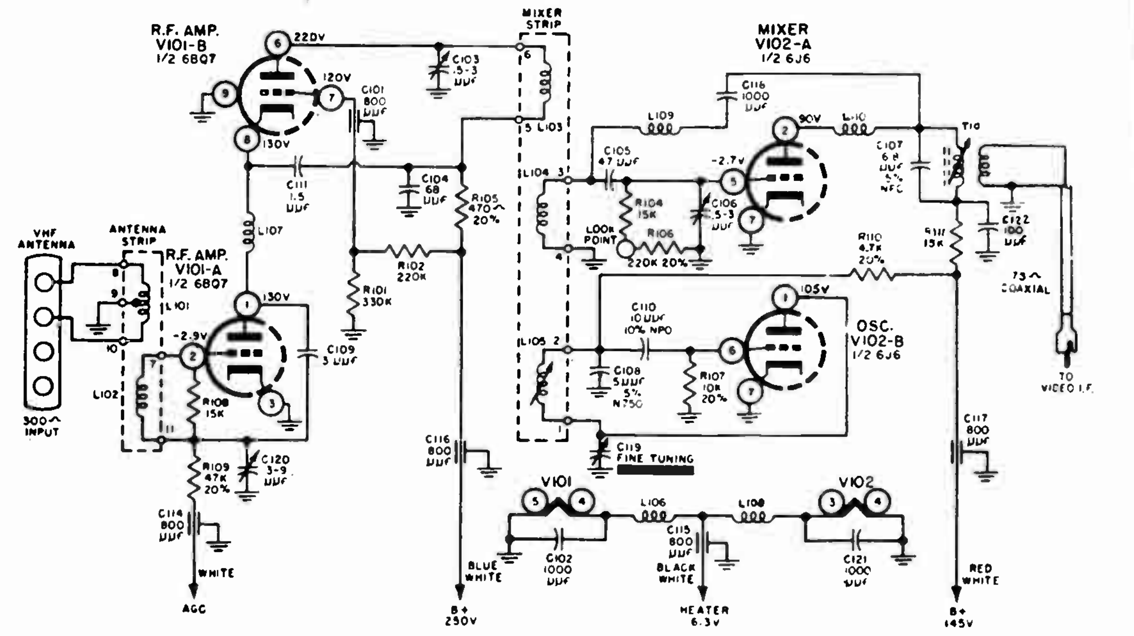


UHF TUNER 89 012 921

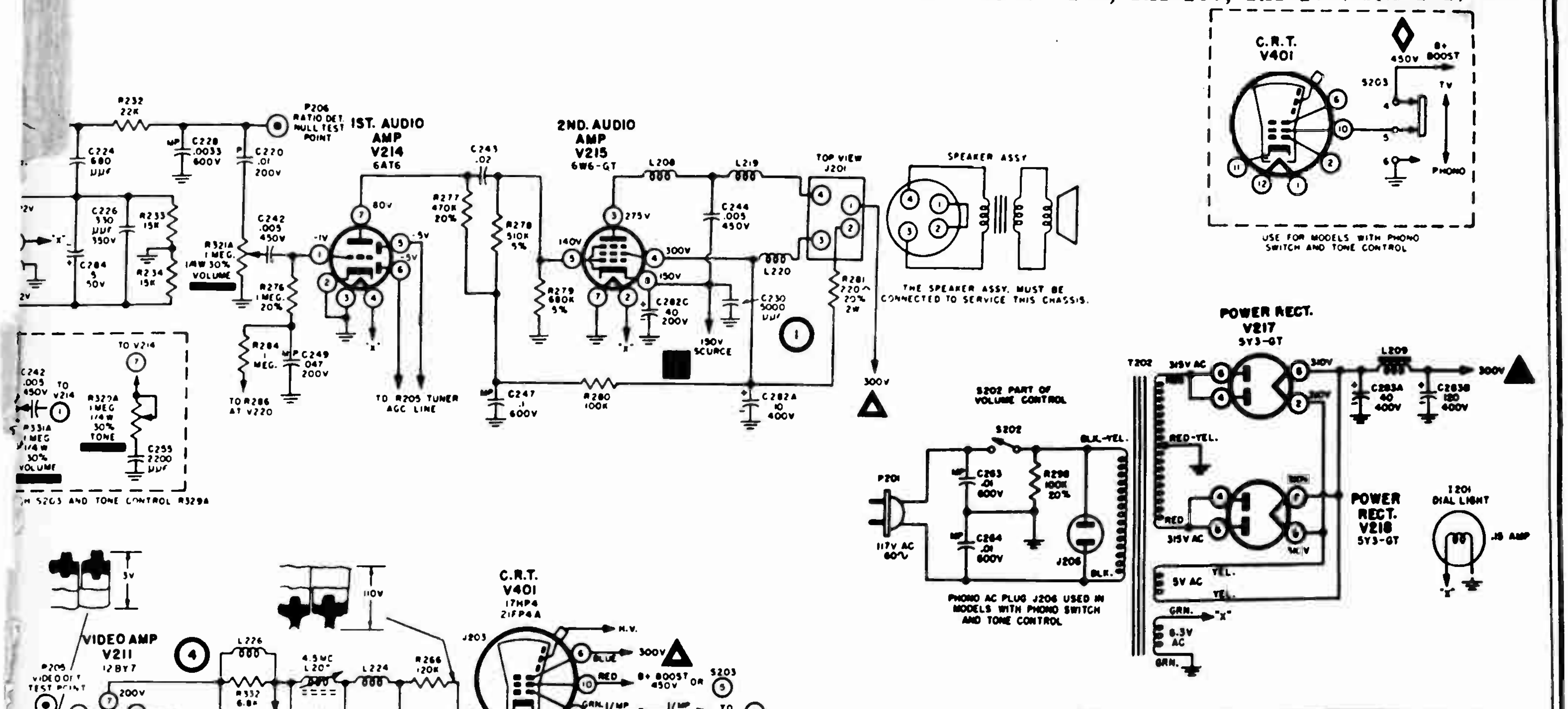


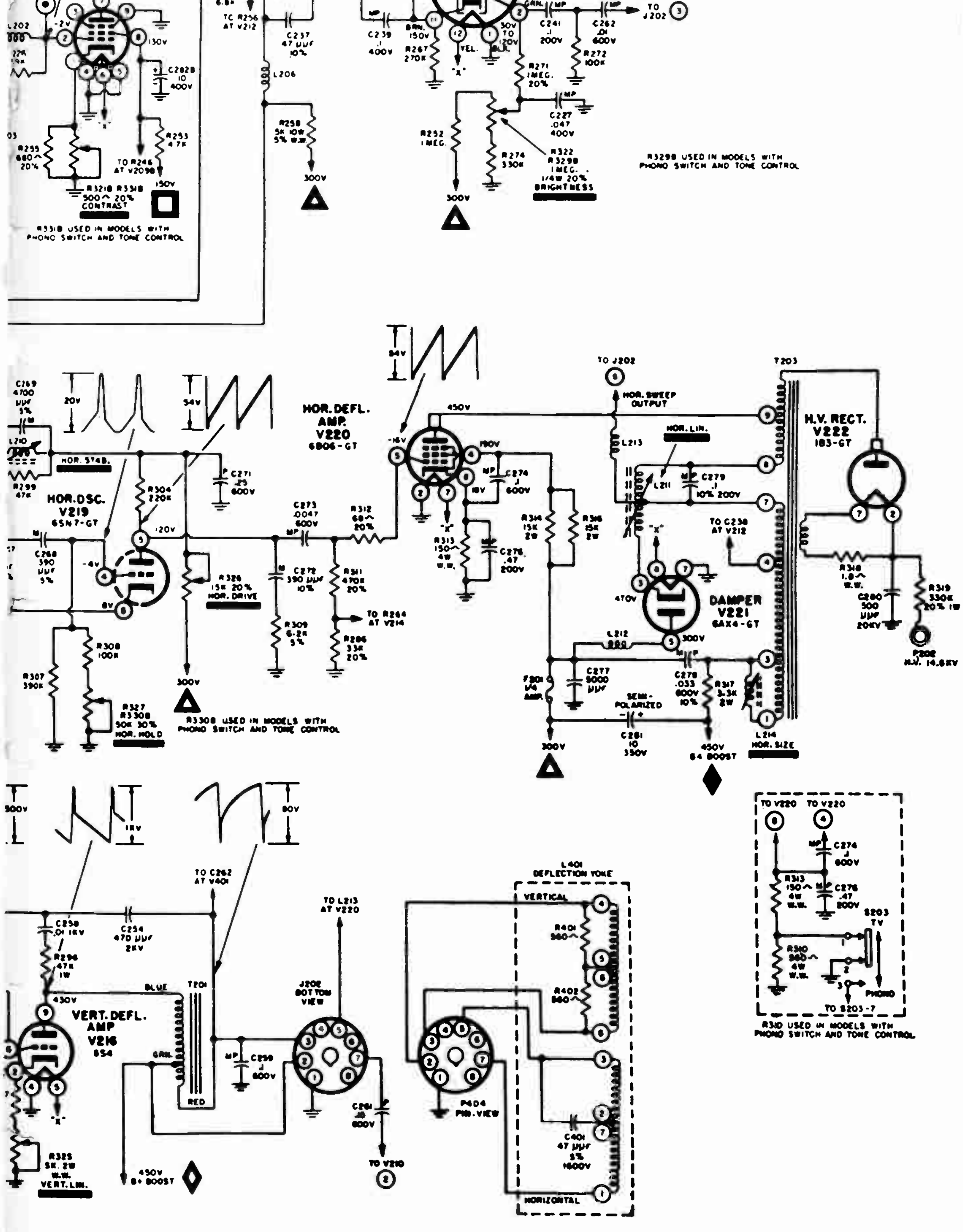
TUNER 89 012 971

USED ALTERNATELY WITH TUNER 89 012 901.



CHASSIS RA-166, RA-167, RA-170, RA-171, Late



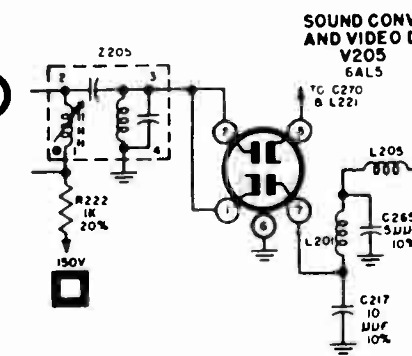


PRODUCTION CHANGES

RA-166/171

(1) C230 is not used in RA-166/171 chassis prior to serial number 666426.

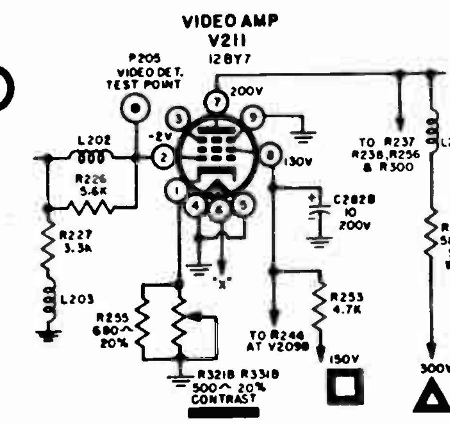
(2)



V205 is a 6AL5 in chassis prior to those coded Run 1. The early circuit is shown above. R265 is 1K and is connected between the junction of C219, L221 and ground.

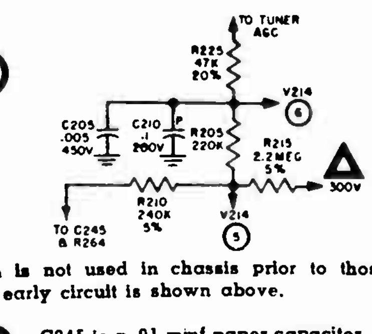
(3) C209, C260, C287 and R320 are not used in RA-166 and RA-167 chassis prior to serial number 668401 or RA-170 chassis prior to serial number 704201.

(4)



In chassis prior to those coded Run 4 the video amplifier circuit shown above is used. In these chassis L225, C288 are not used and R228 is 100K.

(5)

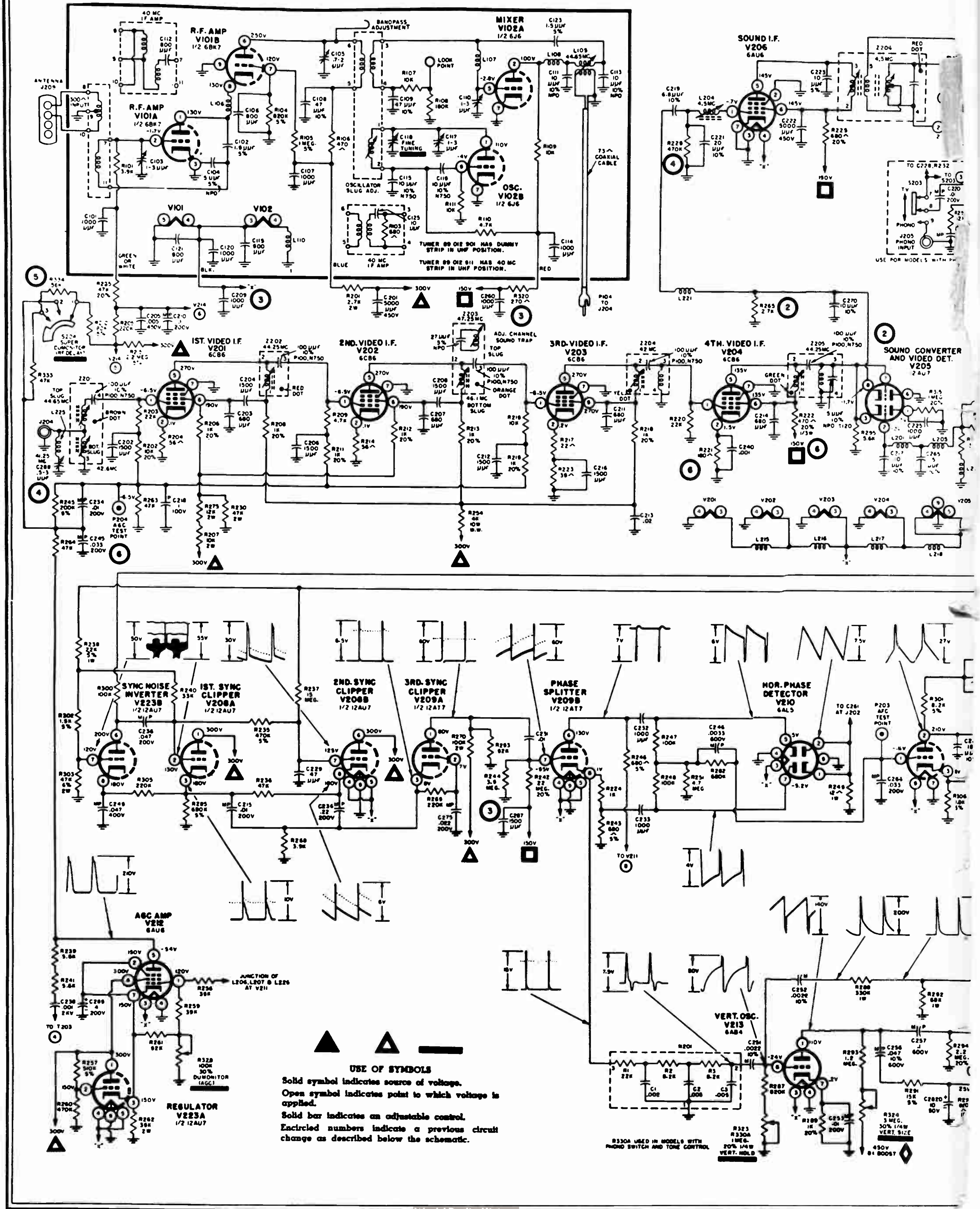


S204 is not used in chassis prior to those coded Run 5. The early circuit is shown above.

(6) C245 is a .01 mmf paper capacitor, R221 is 100 ohms and R222 is 1K in chassis prior to those listed below.

RA-166/167	6619866
RA-168/169	681901
RA-170	7027381
RA-171	719501

RA-166/171 CHASSI



RA-166/171 PRODUCTION CHANGES

Reason:

To eliminate high audio frequency harmonics, present on the 150 volt line. In some cases these harmonics enter other stages of the receiver causing streaks in the picture.

Procedure:

Connect a 5000 mmf ceramic capacitor from pin 8 to pin 7 of the audio output tube, V215.

Parts Required:

SYMBOL	PART NUMBER	DESCRIPTION
C230	03 015 610	Cap. ceramic 5000 mmf.

The first chassis so modified are:

RA-166/167	No. 666426
RA-168/169	No. 681
RA-170	No. 701
RA-171	No. 711

Run 1

Reason:

To reduce radiation of harmonics of the sound and video i-f signals, generated in the video detector and sound converter, V205. Under some conditions these harmonic signals enter the tuner causing interference in the picture. A dual triode is used in place of the 6AL5 dual diode. The triode sections operate as diodes

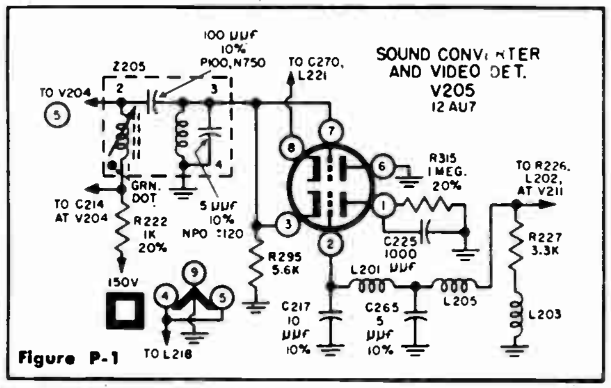


Figure P-1

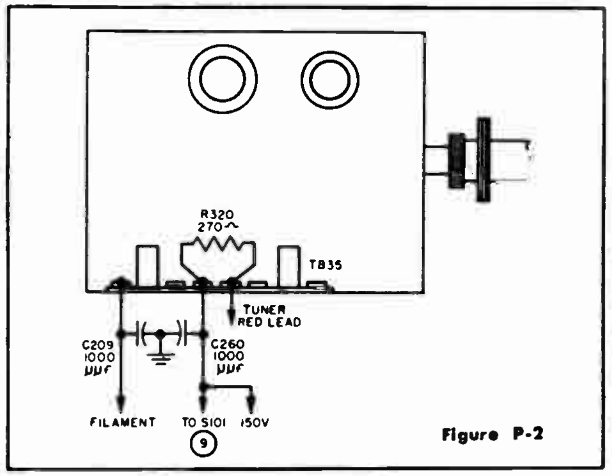


Figure P-2

with the grids acting as the diode plates. The triode plates are used as shields to reduce radiation.

The sound-converter section plate is grounded directly. The video-detector section plate is grounded through a parallel RC network. The network places the plate at ground potential to r-f, while avoiding the loading effect on the video detector which would occur if the plate were grounded directly.

Procedure:

1. Remove the 6AL5 and its socket. Replace the socket with a 9-pin miniature socket. Rewire the circuit as shown in figure P-1.
2. Remove R265, connected between the junction of C219-L221 and ground. Connect R265, 2.7K 10% ½W resistor, from the junction of L221, C270 and pin 8 of V205, to ground.

Parts Required:

SYMBOL	PART NUMBER	DESCRIPTION
R265	02 031 820	Res 2.7K 10% ½W
R295	02 031 860	Res. 5.6K 10% ½W
R315	02 032 600	Res. 1 Meg 20% ½W
V205	25 000 130	Tube, 12AU7
	34 003 590	Socket, 9 prong
	42 009 040	Shield (for 12AU7)
	42 007 110	Base, tube shield

The first chassis so modified are:

RA-166/167	No. 666972
RA-168/169	No. 681
RA-170	No. 70966
RA-171	No. 711

Run 2

Reason:

To reduce the possibility of regeneration in models equipped with a UHF tuner. An RC decoupling network has been added between the +150 volt line and the tuner red lead.

To eliminate r-f components on the tuner filament and +150 volt line two r-f bypass capacitors have been added.

Procedure:

1. Disconnect the yellow lead, and the red lead between S101 and TB-35, from terminal 3 of TB-35 and reconnect them to terminal 4 (see figure P-2).
2. Connect a 270 ohm, ½ watt, resistor between terminals 3 and 4 of TB-35, and connect a 1000 mmf ceramic disc capacitor between terminal 4 of TB-35 and ground. The capacitor ground lead should be soldered to the tuner bracket directly below terminal 4 of TB-35.
3. Connect a 1000 mmf ceramic capacitor between terminal 6 of TB-35 and the ground point in step 2.
4. Connect a 1500 mmf ceramic disc capacitor between terminal 1 of TB-16 and the nearest ground lug.

Parts Required:

SYMBOL	PART NUMBER	DESCRIPTION
C209	03 100 490	Cap. ceramic 1000 mmf
C260	03 100 490	Cap. ceramic 1000 mmf
C287	03 017 850	Cap. ceramic 1500 mmf
R320	02 031 700	Res. 270 ohm 10% ½W

The first chassis so modified are:

RA-166/167	No. 668401
RA-168/169	No. 681
RA-170	No. 704201
RA-171	No. 711

Run 2

Reason:

To increase the long term stability of the vertical oscillator.

Procedure:

Remove C252 and replace it with a 2200 mmf mica capacitor.

Parts Required:

SYMBOL	PART NUMBER	DESCRIPTION
C252	03 029 480	Cap. mica 2200 mmf 10% 500V

The first chassis so modified are:

RA-166/167	No. 6614876
RA-168/169	No. 68795
RA-170	No. 7014100
RA-171	No. 71121

Run 4

Reason:

To provide improved picture quality and very weak signal sound performance. An accompanying sound trap C288-L225 is added, see figure P-3, the video amplifier plate load and sync take off circuits are changed, as shown in figure P-4, and new i-f alignment frequencies are specified.

Procedure:

1. Mount C288 a .5 to 3 mmf capacitor in the rectangular chassis hole located between Z201, the first video i-f transformer and the input jack J204. Solder the capacitor's spring lock nut to the chassis.
   NOTE: A few chassis do not have this hole. In this case drill a ⅛" hole in the chassis midway between Z201-1 and J204, and file the sides to fit C288.
2. Connect L225 between C288 and J204.
3. Remove the black lead connecting pin 7 of V211, the video amplifier, and L207, the 4.5 mc trap.
4. Remove the black lead connected between TB-13-3 (junction of R237, 15 Meg ½W, and R238, 22K 5% 1W) and pin 7 of V211.
5. Connect L226 between pin 7 of V211 and L207. Connect R332, a 6.8K 10% ½W resistor, in parallel with L226.
6. Connect a lead from TB-12-3 (junction of L208 and R258, 5K 5% 10W resistor) to the junction of TB-13-3 noted in step 4.
7. Replace R228 at V206 with a 470K 10% ½W resistor.
8. Replace R220 at V204 with a 22K 10% ½W resistor.
9. Replace R226 at V211 with a 3.9K 10% ½W resistor.
   The frequencies in the alignment procedure should be changed as follows:
   Step 1—44.25 mc (Z205)
   Step 2—42 . mc (Z204)
   Step 4—44.25 mc (Z202)
   Step 6—Adjust mixer plate coil (L109) and Z201 (top) for 44.65 mc marker on one peak and Z201 (bottom) for 42.6 marker on the other peak of waveform shown in figure P-5. Adjust C288 for 41.25 mc dip.

Parts Required:

SYMBOL	PART NUMBER	DESCRIPTION
C288	03 019 871	Cap. cer. var. .5 to 3 mmf
L202	21 006 623	Coil video peaking
L203	21 006 628	Coil video peaking
L225	21 012 011	Inductor, fixed
L226	21 006 623	Coil video peaking
R220	02 031 930	Res. 22K 10% ½W
R226	02 031 840	Res. 3.9K 10% ½W
R228	02 032 090	Res. 470K 10% ½W
R320	02 031 700	Res. 270 ohm 10% ½W
R332	02 031 870	Res. 6.8K 10% ½W

The first chassis so modified are:

RA-166/167	No. 6618456
RA-168/169	No. 681201
RA-170	No. 7023315
RA-171	No. 716174

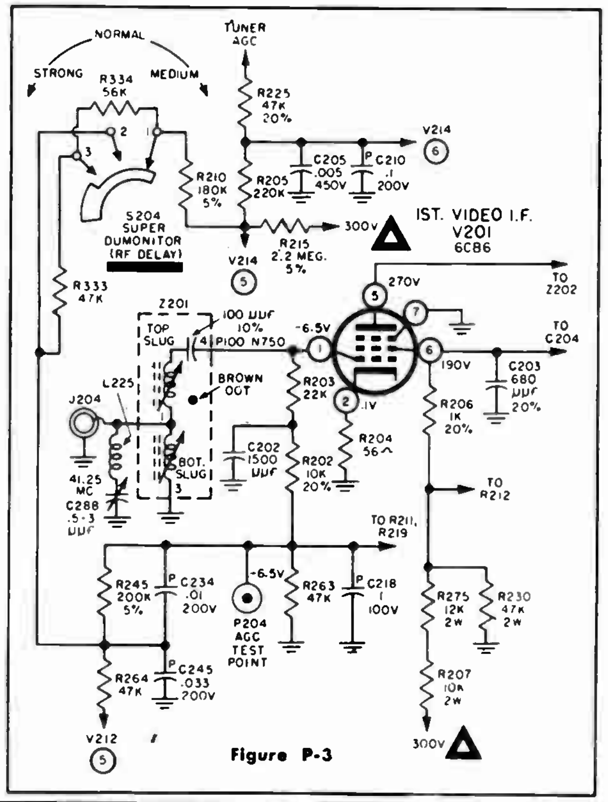


Figure P-3

Run 5

Reason:

To provide a field adjustment of the r-f a-g-c delay in order to obtain improved strong and very weak signal performance. The new control is named the Super Dumonitor.

Procedure:

1. Mount S204, a single-pole three-position rotary switch, on rear of chassis above L210.
2. Remove R210. Connect a 180K ½ watt 5% resistor, between terminal 1 of S204 and terminal 3 of TB-18. Cover the leads of this resistor with spaghetti. The new resistor is shown as R210 in figure P-3.

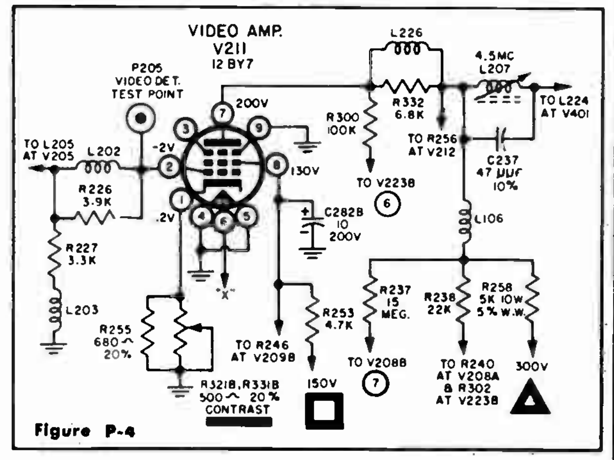


Figure P-4

3. Connect R333, a 47K ½W resistor, between terminals 2 and 3 of S204.
4. Connect R334, a 56K ½ watt resistor, between terminals 1 and 3 of S204.
5. Connect a lead between terminal 2 of S204 and terminal 2 of TB-19.

Parts Required:

SYMBOL	PART NUMBER	DESCRIPTION
R210	02 031 020	Res. 180K 5% ½W
R333	02 031 970	Res. 47K 10% ½W
R334	02 031 980	Res. 56K 10% ½W
S204	05 008 731	Switch 3 position

The first chassis so modified are:

RA-166/167	No. 6619556
RA-168/169	No. 681901
RA-170	No. 7025737
RA-171	No. 719001

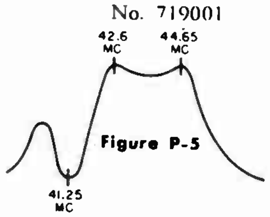


Figure P-5

Run 5

Reason:

To improve the horizontal lock-in range and minimize the possibility of overload in the 4th video i-f stage.

Procedure:

1. Remove C245, the a-g-c filter capacitor (see figure P-3), and replace it with a .033 mf 20% 200V capacitor.
2. Remove R221 in the cathode circuit of V204 and replace it with a 180 ohm 10% ⅓W resistor.
3. Remove R222 in the plate circuit of V204 and replace it with a 470 ohm 10% ⅓W resistor.

Parts Required:

SYMBOL	PART NUMBER	DESCRIPTION
C245	03 126 830	Cap. paper .033 mf 20% 200V
R221	02 031 680	Res. 180 ohm 10% ⅓W
R222	02 201 700	Res. 470 ohm 10% ⅓W

The first chassis so modified are:

RA-166/167	No. 6619866
RA-168/169	No. 681901
RA-170	No. 7027381
RA-171	No. 719501

PARTS LIST

Symbol	Part No.
C201	03 015 610
C202	03 017 850
C203	03 121 520
C204	03 017 850
C205	03 015 610
C206	03 017 850
C207	03 121 520
C208	03 017 850
C209	03 100 490
C210	03 126 860
C211	03 121 520
C212	03 017 850
C213	03 122 430
C214	03 121 520
C215	03 126 800
C216	03 017 850
C217	03 115 000
C218	03 122 800
C219	03 120 900
C220	03 126 800
C221	03 015 790
C222	03 015 610
C223	03 015 270
C224	03 121 520
C225	03 100 490
C226	03 014 390
C227	03 127 600
C228	03 128 130
C229	03 115 330
C231	03 015 920
C232	03 015 810
C233	03 015 810
C234	03 126 800
C235	03 126 880
C236	03 126 840
C237	03 015 760
C238	03 122 420
C239	03 127 620
C240	03 100 490
C241	03 126 860
C242	03 015 610
C243	03 122 430
C244	03 015 610
C245	03 140 330
C246	03 128 130
C247	03 128 220
C248	03 127 600
C249	03 126 840
C250	03 126 830
C251	03 029 480
C252	03 029 480
C253	03 126 800
C254	03 122 440
C255	03 124 190
C256	03 127 900
C257	03 128 220
C258	03 119 630
C259	03 128 220
C260	03 100 490
C261	03 120 730
C262	03 128 160
C263	03 125 780
C264	03 125 780
C265	03 014 610
C266	03 126 830
C267	03 121 530
C268	03 021 510
C269	03 030 140

Symbol	Part No.
C270	03 115 000
C271	03 120 120
C272	03 021 950
C273	03 128 140
C274	03 128 220
C275	03 126 820
C276	03 126 900
C277	03 015 610
C278	03 127 880
C279	03 126 620
C280	03 121 501
C281	03 250 411
C282	03 124 180
C283	03 121 080
C284	03 120 960
C286	03 122 480
C287	03 017 850
C288	03 019 871
C330	03 051 610
C401	03 122 461
F201	11 000 720
I201	12 001 310
J201	09 022 690
J202	34 003 192
J203	34 003 462
J204	09 031 070
J205	09 031 070
J206	09 015 560
J209	40 015 240
L201	21 011 301
L202	21 006 671
L203	21 006 628
L204	21 011 021
L205	21 011 082
L206	21 006 627
L207	21 010 961
L208	21 006 230
L209	21 010 952
L210	21 010 991
L211	21 011 001
L212	21 006 520
L213	21 006 280
L214	21 011 011
L215	21 008 972
L216	21 008 972
L217	21 008 972
L218	21 008 972
L219	21 006 230
L220	21 006 230
L221	21 011 082
L224	21 011 082
L225	21 012 011
L226	21 006 623
L401	21 011 062
N201	88 000 631
P201	09 036 920
P202	50 093 801
P203	63 018 210
P204	63 018 210
P205	63 018 210
P206	63 018 210
P404	09 015 590
R201	02 037 820
R202	02 032 480
R203	02 041 930
R204	02 031 620
R205	02 032 050

Symbol	Part No.
R206	02 032 420
R207	02 037 890
R208	02 032 420
R209	02 031 850
R210	02 031 020
R211	02 032 420
R212	02 032 420
R213	02 032 420
R214	02 031 620
R215	02 031 280
R216	02 031 890
R217	02 031 570
R218	02 032 420
R219	02 032 420
R220	02 031 930
R221	02 041 680
R222	02 052 420
R223	02 031 600
R224	02 031 770
R225	02 032 520
R226	02 031 840
R227	02 031 830
R228	02 032 090
R229	02 032 410
R230	02 037 970
R231	02 031 720
R232	02 031 930
R233	02 031 910
R234	02 031 910
R235	02 031 120
R236	02 031 970
R237	02 032 270
R238	02 033 800
R239	02 031 860
R240	02 031 950
R241	02 031 860
R242	02 032 680
R243	02 030 440
R244	02 032 200
R245	02 031 030
R246	02 030 440
R247	02 032 010
R248	02 032 010
R249	02 034 540
R250	02 031 900
R251	02 032 210
R252	02 032 130
R253	02 031 850
R254	02 113 050
R255	02 032 410
R256	02 031 960
R257	02 031 130
R258	02 107 960
R259	02 031 960
R260	02 032 090
R261	02 032 000
R262	02 037 960
R263	02 031 970
R264	02 031 970
R265	02 031 820
R266	02 032 020
R267	02 032 060
R268	02 031 840
R269	02 032 050
R270	02 038 010
R271	02 032 600
R272	02 032 010
R273	02 032 130

Symbol	Part No.
R274	02 032 070
R275	02 037 900
R276	02 032 600
R277	02 032 580
R278	02 031 130
R279	02 031 160
R280	02 032 010
R281	02 038 380
R282	02 032 110
R283	02 032 000
R284	02 032 130
R285	02 031 160
R286	02 032 510
R287	02 032 120
R288	02 035 070
R289	02 032 420
R291	02 030 760
R292	02 034 990
R293	02 032 140
R294	02 032 620
R295	02 031 860
R296	02 034 970
R297	02 034 760
R298	02 035 540
R299	02 031 970
R300	02 032 010
R301	02 030 700
R302	02 030 520
R303	02 036 880
R304	02 032 050
R305	02 032 050
R306	02 030 540
R307	02 032 080
R308	02 032 010
R309	02 030 670
R310	02 121 630
R311	02 032 580
R312	02 032 350
R313	02 121 620
R314	02 037 910
R315	02 032 600
R316	02 037 910
R317	02 037 830
R318	02 100 710
R319	02 035 570
R320	02 031 700
R321	01 053 200
R322	01 051 100
R323	01 051 100
R324	01 051 010
R325	01 024 740
R326	01 044 441
R327	01 052 900
R328	01 053 800
R329	01 038 346
R330	01 038 344
R331	01 053 131
R332	02 031 870
R333	02 031 970
R334	02 031 940
R401	02 041 740
R402	02 041 740
S202	01 053 200
S202	01 053 131
S203	05 005 120
S204	05 008 731
T201	20 008 021

Symbol	Part No.
T202	20 008 182
T203	20 008 061
V201	25 002 670
V202	25 002 670
V203	25 002 670
V204	25 002 670
V205	25 000 130
V206	25 000 050
V207	25 000 020
V208	25 000 130
V209	25 001 530
V210	25 000 020
V211	25 007 380
V212	25 000 050
V213	25 001 760
V214	25 000 040
V215	25 002 680
V216	25 003 010
V217	25 000 220
V218	25 000 220
V219	25 000 110
V220	25 001 830
V221	25 007 780
V222	25 000 150
V223	25 000 130
V401 (17")	25 007 710
V401 (21")	25 007 720
Z201	20 008 231
Z202	20 008 241
Z203	20 008 251
Z204	20 008 261
Z205	20 008 303
Z206	20 006 141

TUNER
89 012 901 - 89 012 911

Symbol	Part No.
C101	03 125 500
C102	03 125 010
C103	03 019 840
C104	03 124 780
C105	03 124 770
C106	03 124 790
C107	03 125 500
C108	03 119 170
C109	03 119 170
C110	03 019 840
C111	03 125 110
C113	03 125 110
C114	03 125 500
C115	03 126 010
C116	03 126 010
C117	03 019 840
C118	03 126 191
C119	03 124 790
C120	03 125 500
C121	03 124 790
C123	03 125 000
L106	21 011 811
L107	21 011 571
L108	21 011 581
L109	21 011 801
L110	21 011 561
P104	09 018 810
R101	02 031 840
R104	02 041 180
R105	02 041 200
R106	02 041 730
R107	02 031 890
R108	02 032 040
R109	02 031 890
R110	02 031 850
R111	02 031 890
V101	25 007 341
V102	25 000 190

Symbol	Part No.

89 012 911 Only

Symbol	Part No.
C112	03 124 790
C125	03 115 000
R103	02 031 750
S101	05 007 371

TUNER STRIPS
89 012 901-89 012 911

Channel	Part No.
2	40 014 881
3	40 014 882
4	40 014 883
5	40 014 884
6	40 014 885
7	40 014 886
8	40 014 887
9	40 014 888
10	40 014 889
11	40 014 891
12	40 014 892
13	40 014 893
40 mc IF	40 014 896

89 012 921

Symbol	Part No.
C151	03 126 130
C152	03 125 180
C153	03 125 500
C154	03 124 790
C155	03 125 500
C156	03 126 140
C157	03 126 140
C158	03 125 460
C159	03 125 110
C160	03 014 560
CR101	26 001 082
CR102	26 001 082
L151	21 011 821
L154	21 011 831
L155	21 011 841
R151	02 031 610
R152	02 031 730
R153	02 031 890
R154	02 031 700
V151	25 000 190

TUNER
89 012 971

Symbol	Part No.
C101	03 124 790
C102	03 100 490
C103	03 119 150
C104	03 119 190
C105	03 119 170
C106	03 119 150
C107	03 138 130
C108	03 123 010
C109	03 123 020
C110	03 119 210
C111	03 123 030
C114	03 124 790
C115	03 124 790
C116	03 124 790
C117	03 124 790
C118	03 100 490
C119	30 039 231
C120	03 119 160
C121	03 100 490
C122	03 100 490
L106	21 010 460
L107	21 012 041
L108	21 010 470
L109	21 010 440
L110	21 012 051

Symbol	Part No.
R101	02 032 070
R102	02 032 050
R104	02 031 910
R105	02 032 400
R106	02 032 560
R107	02 032 480
R108	02 031 910
R109	02 032 520
R110	02 032 460
R111	02 031 910
T101	20 008 541
V101	25 007 000
V102	25 000 190

TUNER STRIPS ANTENNA
89 012 971

Channel	Part No.
2	40 015 401
3	40 015 402
4	40 015 403
5	40 015 404
6	40 015 405
7	40 015 406
8	40 015 407
9	40 015 408
10	40 015 409
11	40 015 411
12	40 015 412
13	40 015 413

MIXER
89 012 971

2	40 015 381
3	40 015 382
4	40 015 383
5	40 015 384
6	40 015 385
7	40 015 386
8	40 015 387
9	40 015 388
10	40 015 389
11	40 015 391
12	40 015 392
13	40 015 393

MECHANICAL PARTS
Chassis

Part No.	Description
11 000 600	Holder Fuse
12 006 230	Lampholder
12 006 700	Jewel Light
34 001 100	Socket Octal Wafer
34 001 220	Socket 7 Pr. Min. Molded
34 001 300	Socket 7 Pr. Min. Wafer
34 001 670	Socket 9 Pr. Min. Molded
34 001 770	Socket 9 Pr. Min. Wafer
34 002 380	Socket Octal Molded
34 003 193	Socket Octal Wafer V221
34 003 570	Socket Octal, Shock Mtg.
34 003 590	Socket 9 Prong (V205)
34 003 671	Socket, Octal for V222
36 003 720	Plate Contact V220
38 001 310	Grommet Rubber
42 002 860	Shield Tube Min.
42 006 611	Shield Corona V222
42 006 710	Base Tube Shield Min.
42 009 040	Shield for 12AU7 (V205)

TUNER
89 012 901 - 89 012 911

30 035 020	Detent Roller and Spring
30 035 030	Spring Shaft Support
30 035 040	Snap Ring
35 025 600	Bearing Plate
42 002 900	Tube Shield V101
42 004 580	Tube Shield V102
42 007 930	Bottom Shield
42 007 940	Side Shield
60 408 200	Screw Bottom, Side Shield
60 409 600	Screw Bearing Plate

89 012 911

30 008 310	Dial Cord
30 033 611	UHF Dial Sleeve
30 033 621	Backlash Gear and Pulley
30 033 641	Shaft, Backlash Gear
30 033 651	Ring Bearing
30 033 661	Bearing Bracket
30 035 011	Extension Shaft
30 035 100	Pulley Dial Cord
30 035 262	Coupling
30 035 461	Spring Dial Cord
30 036 621	Cam
30 036 631	Gear Tuning Shaft
43 005 011	Spacer, Shaft
60 057 501	Screw Bearing Plate
60 408 420	Screw, Coupling
60 806 101	Set Screw
61 025 200	Lock Nut Flat
62 403 221	"C" Washer, Shaft

89 012 921

42 002 900	Tube Shield V151
45 004 461	Dial UHF

89 012 971

30 029 440	Spring Retainer
30 029 460	Spring Fine Tuning
30 029 470	Spring Detent
30 029 480	Roller Detent
42 003 400	Shield, Tube V102
42 006 210	Shield, Tube V101
60 052 800	Padder Screw
62 005 880	Washer Fiber
62 103 100	Padder Spring Nut

CABINET PARTS
RA-166

18 003 521	Speaker Asy 5"
22 001 941	Antenna Loop
28 001 391	L Shunt Ion Trap
29 000 651	Magnet Centering
29 000 661	Magnet Ion Trap
30 014 011	Cup Back Panel
30 027 963	Spring Defl. Coil
30 027 971	Retainer Defl. Coil
32 003 461	Panel Back
35 019 593	Bracket CRT Mtg.
35 022 141	Strap CRT (Sq. Hole)
35 022 142	Strap CRT (Rd. Hole)
35 022 151	Plate CRT Mounting
36 003 761	Clip Bracket Ground
36 003 791	Spring Clip Defl. Coil

Part No.	Description
38 011 901	Cushion CRT
38 011 921	Door Stop
42 006 662	Cover Control Mah.
42 006 663	Cover Control Bl.
45 004 061	Safety Glass
45 004 431	Knob Selector Mah.
45 004 432	Knob Selector Bl.
45 004 441	Knob Fine Tuning
45 004 442	Knob Contrast
45 004 451	Knob Volume Mah.
45 004 452	Knob Volume Bl.
50 002 900	Power Cable
60 405 070	Screw Chassis Mtg.
62 200 240	Washer Chassis Mtg.
64 006 608	Mask Asy. Brown
64 006 609	Mask Asy. Green
64 007 022	Bezel Front Panel
64 008 691	Support Rear CRT

RA-167-170-171

22 001 941	Antenna Loop
28 001 391	L Shunt Ion Trap
29 000 651	Magnet Centering
29 000 661	Magnet Ion Trap
30 027 963	Spring Defl. Coil
30 027 971	Retainer Defl. Coil
30 031 282	Cup Back Panel
32 003 471	Panel Back
35 019 592	Bracket CRT Mounting
35 022 121	Strap CRT (Rd. Hole)
35 022 122	Strap CRT (Sq. Hole)
35 022 131	Plate CRT Mounting
35 025 821	Bracket Safety Glass Mtg.
36 003 761	Clip Bracket Ground
36 003 791	Spring Clip Defl. Coil
38 009 841	Side Support Mask Mah.
38 009 842	Side Support Mask Bl.
38 010 141	Cushion Safety Glass
38 011 902	Cushion CRT
38 011 921	Door Stop
38 012 541	Btm. Support Mask Mah.
38 012 542	Btm. Support Mask Bl.
42 006 662	Cover Control Mah.
42 006 663	Cover Control Bl.
45 004 001	Safety Glass
45 004 431	Knob Selector Mah.
45 004 432	Knob Selector Bl.
45 004 441	Knob Fine Tuning
45 004 442	Knob Contrast
45 004 451	Knob Volume Mah.
45 004 452	Knob Volume Bl.
50 002 900	Power Cable
60 405 070	Screw Chassis Mtg.
62 200 240	Washer Chassis Mtg.
64 006 763	Mask Asy. Gold
64 006 764	Mask Asy. Brown
64 008 691	Support Rear CRT

RA-167 Only

18 003 521	Speaker Asy 5"
18 003 511	Speaker Asy 10"

RA-170-171 Only

18 003 501	Speaker Asy. 10"
32 003 481	Panel Back
45 004 711	Knob Hidden Control Mah.
45 004 712	Knob Hidden Control Bl.

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Model Numbers	TV Chassis	Tube Size	TV Tuner
711F, 712F, 720D, 732B, 734B	120169-B	21MP4 (metal-rect.)	470689 470696
733F	120169-F T.V. 120152-F RADIO	21MP4 (metal-rect.)	470689 470696

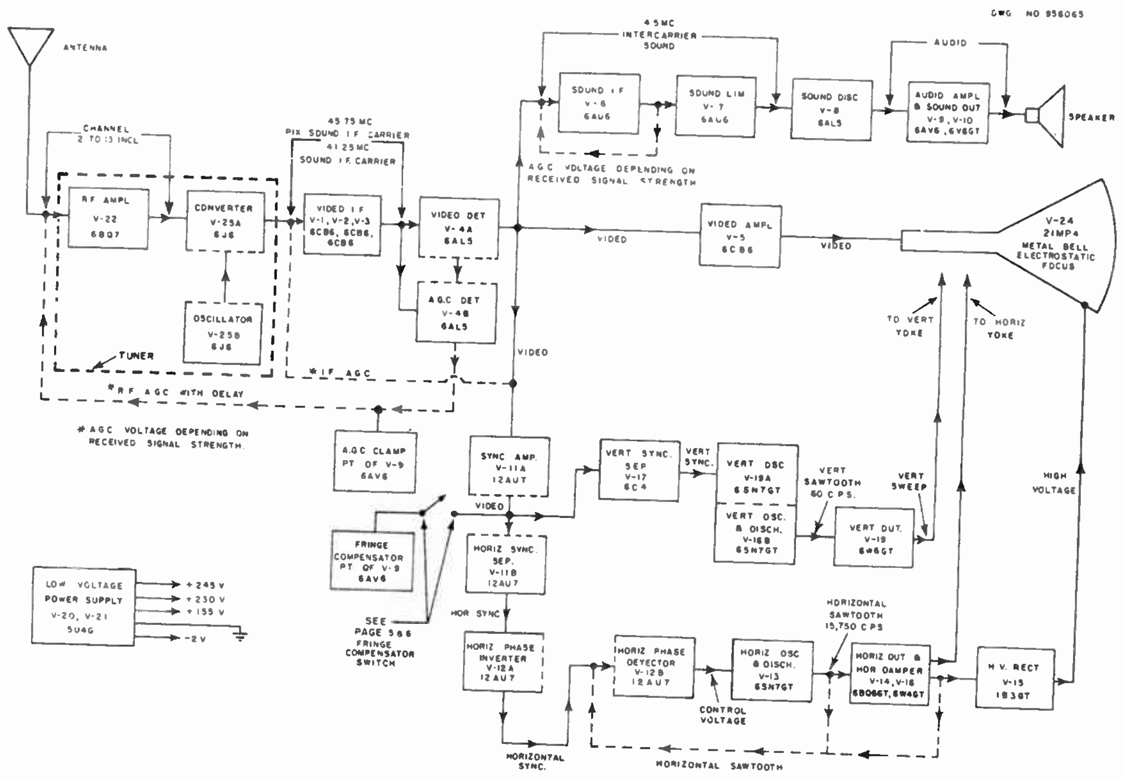


Figure 1 - BLOCK DIAGRAM OF CHASSIS 120169-B, 120169-F

READY FOR U.H.F.

As in all Emerson Television Receivers, this model provides for reception of all V.H.F. Stations as well as new U.H.F. Stations, by means of easily interchanged tuning strips or an external converter.

RECEIVER CHARACTERISTICS

ITEM	DESCRIPTION
Voltage Rating	115V - 60 cycles A.C.
Power Consumption	190 watts
Frequency Range	54-88 mc; 174-216 mc
Intermediate Frequencies	Video - 45.75 mc. Audio - (intercarrier) 4.5 mc
Antenna Input Impedance	300 ohms, balanced
Channel Selection	Twelve position rotary turret

711F

712F

720D

732B

733F

734B

GENERAL DESCRIPTION

Emerson models 711F, 712F, 720D, 732B, 734B and 733F are television receivers providing direct view high definition pictures on a twenty-one inch glare free kinescope. Many advanced circuit designs have been incorporated in these models including built-in antenna, black magic contrast, miracle picture lock, automatic horizontal frequency control, automatic gain control, electrostatic focusing minimum operating controls and many other features.

The 120169-B and 120164-B chassis are similar except for the horizontal frequency control and oscillator circuits which are explained in this note.

Model 733F (chassis 120169-F) in addition to these differences also incorporates a 3-speed phonograph (pt. no. 819069), and an independent 5-tube AM radio (chassis 120152-F). The 120169-F chassis is the same as the 120169-B chassis except where necessary to accommodate this radio and phonograph, which is explained in this note.

HORIZONTAL AUTOMATIC FREQUENCY CONTROL

In modern day receivers it is necessary to use some form of automatic frequency control so that the horizontal sync. pulses do not directly trigger the horizontal oscillator. This is necessary since occasional noise bursts may prematurely trigger the oscillator, causing the picture to either spear or tear out.

By using A.F.C. the average of a group of sync. pulses are used to control the frequency of the oscillator, therefore, if a sync. pulse is distorted or masked by noise little effect will be observed on the screen.

This type of system is especially useful in the fringe areas where the signal to electrical noise interference is very poor.

This particular chassis uses a comparison of phase between the sync. signal and the generated sawtooth as a basis for automatic frequency control (A.F.C.). Such a system is little influenced by changes in sync. amplitude or occasional noise and, therefore, operates extremely well.

A Phase Detector V-12B compares the difference in phase between transmitted horizontal sync. pulse and the horizontal sawtooth voltage which is generated in the receiver. Whenever the frequency of the horizontal multivibrator (V-13) changes, the sawtooth frequency generated by this tube also changes. This effect changes the phase between the sync. and sawtooth voltages which is detected by V-12B (Horizontal Phase Detector).

When the frequency and phase of the sync. and sawtooth is correct the negative grid voltage developed across R-66 (82K) is equal to the positive cathode voltage developed across R-65 (100K), therefore, the net output voltage to the grid of V-13 (Horizontal Oscillator) is zero.

If the oscillator slows up, the phasing is such to cause the grid current to increase more than the plate current with a resultant negative output control voltage.

If the oscillator speeds up the plate current increases more than the grid current and the net output control voltage is positive.

R-77, R-69, C-47, R-64, C-46 are used to couple and shape the negative going pulse to a negatively phased sawtooth.

C-54, C-53 Divide the generated horizontal sawtooth which is further reduced in amplitude by the voltage division of C-48 in series with C-45.

The network of R-68 (2.2 meg) in parallel with C-50 (.001) used in conjunction with C-49 (.015) tends to filter unwanted high frequency pulses, while permitting the low frequency control voltage to pass.

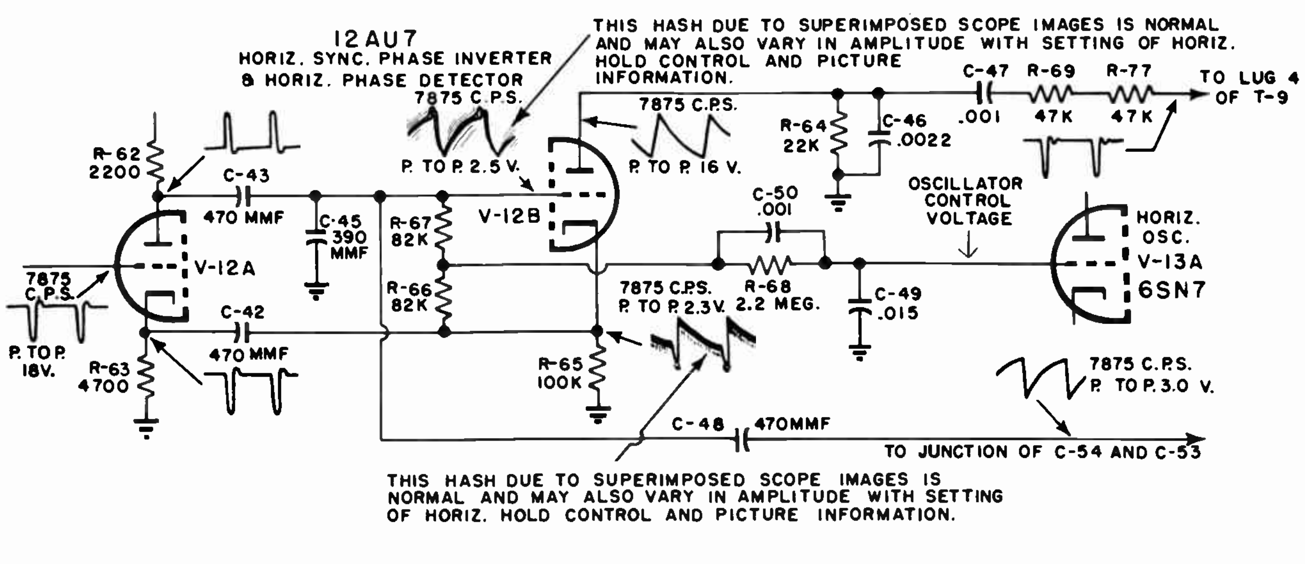


Figure 2 - HORIZONTAL AUTOMATIC FREQUENCY CONTROL NETWORK

HORIZONTAL OSCILLATOR, SWEEP, AND OUTPUT

V-13 6SN7 is a cathode coupled multivibrator whose free running frequency depends upon such factors as setting of R-72 (Horizontal Balance), R74 (Horizontal Hold), adjustment of L-10 (Horizontal Phase Coil) and the applied plate and grid voltages. Since automatic frequency control is to be used in this circuit, one of the above factors will have to be automatically varied. Since the grid of V-13A offers a convenient control point its voltage will be varied automatically to control the oscillation frequency of V-13. The method of control is outlined under "Horizontal Automatic Frequency Control."

The horizontal phase coil (L-10) is adjusted so that its natural resonant frequency is the same as the horizontal sync. rate (15,750 C.P.S.). The abrupt voltage changes in the plate circuit of V-13A shock this circuit into oscillation. Since the frequency of L-10 and C-52 is not effected by voltage changes or other component changes, it greatly stabilizes the operation of the circuit by modulating the plate voltage of V-13A with a 15,750 C.P.S. sine wave. The polarity and phase of this sine wave is such that it maintains the free running frequency at 15,750 C.P.S.

The sweep voltage is developed across C-56, C-54, C-53 which is charged through R-75 (120K) and is then coupled to the grid of the 6BQ6GT horizontal output tube. The 6BQ6GT (V-14) is used as a power amplifier so as to supply the necessary horizontal deflection current to the deflection yoke. The horizontal output transformer (T-9) matches the relatively low impedance of the horizontal deflection yoke winding (L-13) to the plate circuit of the 6BQ6GT (V-14) for maximum efficiency. The damper tube V-16 (6W4GT) is effectively connected across the horizontal deflection yoke to damp out oscillations which occur over part of the horizontal scanning cycle. The resultant energy from these damped oscillations provides the boosted B+ voltage.

PHONO TV SWITCH

In the phono position, the phono-TV switch removes B plus voltages from the screen of the horizontal output tube, plate of the damper tube and removes screen and plate voltages from V-1, V-2 and V-3 (video IF tubes). This renders the TV sweep, H.V. and signal circuits inoperative. At the same time the input to the volume control is disconnected from the discriminator output and connected to the output of the phono crystal.

RADIO CHASSIS 120152F (Model 733F)

This radio is an independent 5 tube superheterodyne A.M. receiver which utilizes the same speaker as the television receiver. This is achieved by means of a relay operated switch which is mounted on the television chassis. This relay also prevents the TV and radio from being operated at the same time. A pilot light incorporated in this chassis indicates when the radio is on. (For service information on Radio see page 7.)

RELAY OPERATED SWITCH (Model 733F Chassis 120169F)

A two pole double throw switch is operated by this relay. When the TV "ON-OFF" switch is in the "OFF" position, the relay is unenergized, (as shown on schematic), thus terminal F is shorted to terminal G and terminal I is shorted to terminal K. Since terminals F and G are connected together, the speaker (SP-1) is connected to the radio's audio output transformer. Since terminals I and K are connected together, power is supplied to the radio outlet (X-9) permitting the radio receiver to be turned on.

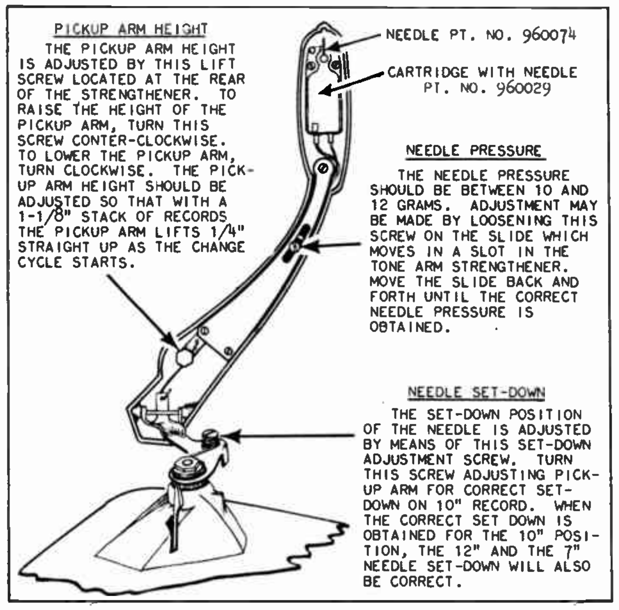
When the TV receiver is turned "ON" the relay is energized, thus shorting terminal E to F and also H to I. This removes the power from the radio outlet (X-9) and connects the speaker (SP-1) to the TV audio output transformer (T-8) instead of the radio's.

3 SPEED (78, 45, 33-1/3 R.P.M.) AUTOMATIC RECORD CHANGER pt#819069 (MODEL 733F)

This changer plays records through the sound portion of the TV chassis when the "Phono-TV switch" is placed in the phono position.

Features of this changer include playing and automatically changing as many as ten – 12", twelve – 10", twelve – 7", or any assortment of intermixed 10" and 12" records of the same R.P.M. (78, 45, 33-1/3 R.P.M.).

This changer shuts off automatically after the last record has been played.



PREPARING FOR OPERATION

1. SHIPPING BOLTS
   Before placing in operation, the changer must be floated freely on the mounting springs. During shipment, the mechanism is secured by means of two shipping bolts. To float the changer, remove the turntable* by lifting it straight up the spindle. Turn the two shipping bolts in a clockwise direction as far as they will go and replace the turntable. Before the turntable can be fully seated, the idler wheel must be gently pushed back out of the way to prevent damage to the rubber tire.

* When shipped turntable is secured to the back of the cabinet.

2. LEVELING RECORD CHANGER
   It is essential to have the record changer absolutely level. Use a torpedo or similar type level on the record changer baseplate. Use adequate shims to level the record changer pan or radio combination cabinet to achieve perfect level.

For additional service information refer to the manual on the 819053 changer which was issued at an earlier date. These changers are the same except 819069 has the addition of an equalizing circuit in series with the pickup arm (2.2 meg ohm in parallel with a 68 mmfd. condenser). See top of page 7.

BEAM BENDER (ION TRAP)

A single magnet type of beam bender is used and should always be adjusted by sliding and rotating the unit for maximum brightness. Do not adjust the trap for removing corner shadows if in so doing the brightness is reduced.

If two positions of maximum brightness are found use the one closer to the picture tube socket.

USE OF THE FRINGE COMPENSATOR

In fringe areas there is generally a higher ratio of electrical impulse noise (ignition, neon signs, electrical motors, etc.) to signal which might tend to effect sync. operation. To reduce this condition this chassis has been equipped with a "Fringe Compensator and Switch". This compensator is located at the rear of the chassis, and can be adjusted to handle the effects of electrical interference in most fringe locations. This compensator is provided with an on-off switch so that it can be disconnected when not required.

NOTE: In most locations this added protection will not be necessary and the fringe compensator should remain in the "off" position.

Improper adjustment or application of the fringe compensator may result in excessive audio buzz and/or picture wiggle. This device is designed to give added performance in fringe areas and will result in satisfactory operation only if instructions are carefully adhered to.

ADJUSTMENT OF THE FRINGE COMPENSATOR

1.) Tune set to a low frequency channel in a normal fashion. If low channels are not available use a higher channel.

2.) Turn fringe compensator switch to the "ON" position and adjust the potentiometer to the center of its mechanical range.

3.) Check all channels normally received in the area and re-adjust compensator if necessary for best performance.

CENTERING PROCEDURE

1. Set the unit, magnets forward, on the tube so that the magnets are about 1/4" behind the yoke. Adjust the clamp so that the unit is a sliding fit on the tube.
2. Set the magnets so that the adjusting arms are approximately 120° apart (figure 3).
3. Adjust the ion trap magnet for maximum brightness.
4. Rotate the whole unit, this will cause the picture to move around a circle. Stop where the picture is most nearly centered.
5. Rotate the magnets separately, in equal distances but in opposite directions to complete the centering.
6. Repeat Steps 3, 4 and 5, if necessary.
7. Tighten clamp.
8. Readjust ion trap magnet to give maximum brightness.

CAUTION: It is important that the centering magnets not be operated too close to the yoke as the A-C field from the yoke may cause the centering magnets to become demagnetized.

NOTE: Some slight improvement in focus may be obtained by adjusting the ion trap magnet within the range of the maximum brightness.

On no account should the trap magnet be adjusted to give good focus at the expense of brightness, as this condition produces ion "burns" on the screen in the course of time.

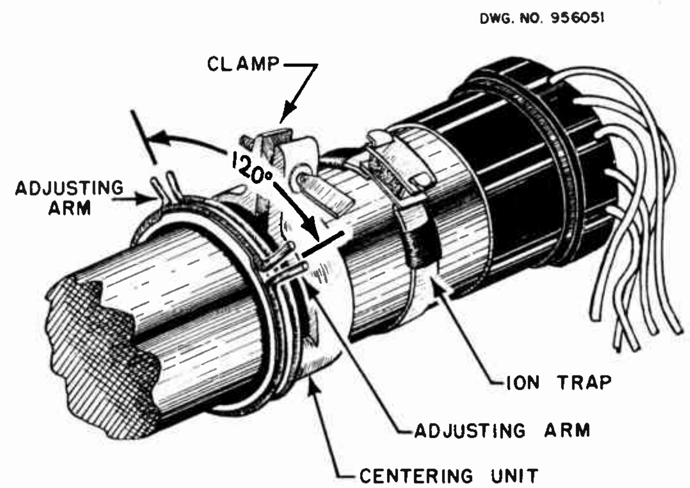


Figure 3 – CENTERING UNIT LOCATION DRAWING

ALIGNMENT

a. Equipment Required - A sweep generator, (10 MC. sweep with center frequency of 44 MC. plus all necessary R.F. sweep frequencies as listed in R.F. Table), accurate marker generator, oscilloscope and V.T.V.M. are required for alignment. The marker generator must supply frequencies of 4.5 MC., 40 to 48 MC. and 50 to 216 MC.

b. Alignment Points - The location of all I.F. transformers, Tuned Circuits, and trimmers shown in Figure 8.

TV R.F. & MIXER ALIGNMENT

Connect 3 volt bias battery to both I.F. and R.F. AGC. circuits, positive terminal to chassis, negative terminal to junction of R-16, C-19, C-18. Add a jumper wire from this junction to junction of R-8, R-14, C-7 so that the bias battery is also applied to I.F. AGC.

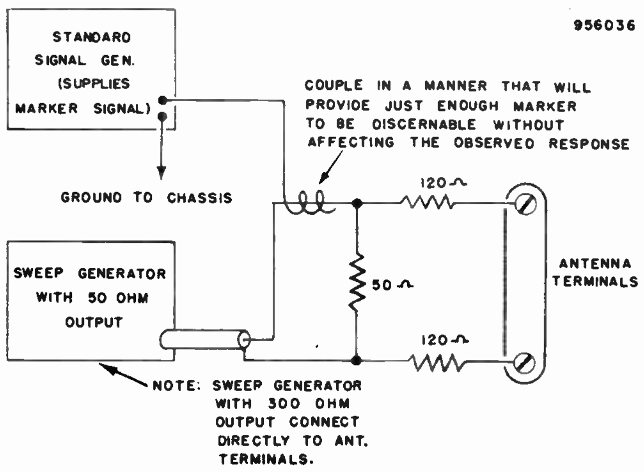


Figure 4. GENERATOR CONNECTIONS FOR TELEVISION R.F. CHANNEL ALIGNMENT.

SWEEP & MARKER GENERATOR		MARKER GEN.	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQ. RANGE	FREQ.				
Connect as shown in Fig. 4 and adjust sweep controls for width so that complete channel response may be observed as shown in Fig. 5	Channel #12 207 MC. Center Freq.	209.75 MC. Sound Carrier 205.25 MC. Pix Carrier	Vert. input of scope through 10K resistor to test point on tuner Fig. 8 Low side to chassis	Set Channel Selector to #12 NOTE Keep output of R.F. Marker Generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	C-2 R.F. Amp Input Trimmer C-1 I.F. Trap C-5 R.F. Plate Trimmer C-6 Mixer Grid Trimmer	Adjust Trimmers C-2, C-5 and C-6 to obtain response shown in Fig. 5 IMPORTANT: When adjusting trimmers C-2, C-5 and C-6 it will be noted that the band pass characteristic can be broadened by sacrificing amplitude. It is undersirable to overly broaden the curve as that would result in a loss of sensitivity. C-1 should normally be set at maximum capacity (screw all the way in) unless interference is encountered. See note below.
Same as Above	#13 213 MC.	*215.75 MC. **211.25 MC.	Same as Above	Set Channel Selector to #13 (See Note Above)		The r-f band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers C-2, C-5 and C-6. Adjust the r-f sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers.
	#11 201 MC.	*203.75 MC. **199.25 MC.		Set Channel Selector to #11 (See Note Above)		
	#10 195 MC.	*197.75 MC. **193.25 MC.		Set Channel Selector to #10 (See Note Above)		
	#9 189 MC.	*191.75 MC. **187.25 MC.		Set Channel Selector to #9 (See Note Above)		
	#8 183 MC.	*185.75 MC. **181.25 MC.		Set Channel Selector to #8 (See Note Above)		
	#7 177 MC.	*179.75 MC. **175.25 MC.		Set Channel Selector to #7 (See Note Above)		
	#6 85 MC.	* 87.75 MC. ** 83.25 MC.		Set Channel Selector to #6 (See Note Above)		
	#5 79 MC.	* 81.75 MC. ** 77.25 MC.		Set Channel Selector to #5 (See Note Above)		
	#4 69 MC.	* 71.75 MC. ** 67.25 MC.		Set Channel Selector to #4 (See Note Above)		
	#3 63 MC.	* 65.75 MC. ** 61.25 MC.		Set Channel Selector to #3 (See Note Above)		
	#2 57 MC.	* 59.75 MC. ** 55.25 MC.		Set Channel Selector to #2 (See Note Above)		

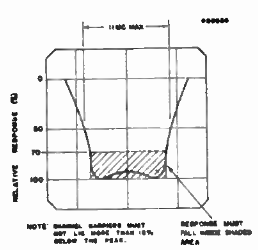


Figure 5 -- TUNER RESPONSE CURVE SHOWING BAND-PASS LIMITS.

The response for all channels should meet with the requirements of Fig. 5. To do so it may be necessary to compromise by slightly changing the initial channel #12 adjustments of C-2, C-5 and C-6 while switched to channel which does not conform.

*Sound Carrier Marker
**Picture Carrier Marker

NOTE: C-1 IS AN I.F. TRAP AND CAN BE ADJUSTED IN THE FIELD TO REDUCE ANY INTERFERENCE WHICH MAY AFFECT CHANNEL #2 FROM A NEARBY TRANSMITTER OPERATING IN THE 40 MC. BAND.

I.F. ALIGNMENT

1) Tune receiver to unused Channel 10 or 12.

2) Connect 3 volt bias battery with negative terminal to I.F. AGC. (Junction R-8, C-7, R-14) positive terminal to chassis.

3) Connect D.C. V.T.V.M. to video test point (see location in Fig. 7 and 8)

4) Connect terminated marker generator to floating shield of converter tube V-23 6J6. (Shield raised slightly so that it does not make contact with chassis). Use unmodulated marker. See Fig. 7.

MARKER GENERATOR	ADJUST	PROCEDURE
45.75 MC. Unmodulated	T-4	Peak for maximum response. Adjust output of signal generator so that maximum response does not produce more than -2V. D.C. on V.T.V.M.
43.2 MC. Unmodulated	T-3	
42.0 MC. Unmodulated	T-2	
45.0 MC. Unmodulated	L-3 T-1	
41.25 MC. Unmodulated	L-2	Adjust trap for minimum response. Increase output from signal generator so that a true minimum position can be found.

5) Connect vertical input of an oscilloscope instead of V.T.V.M. to video test point with vertical scope gain set at, or near, maximum. (Horizontal scope sweep set at 400 cycles).

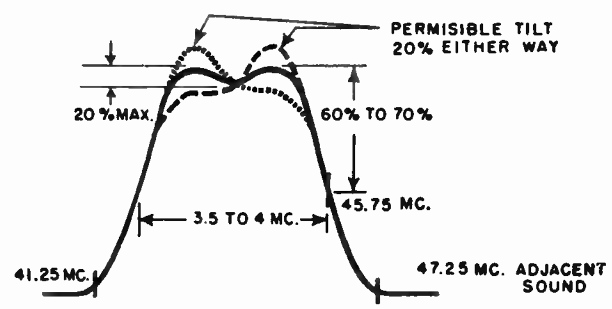
MARKER GENERATOR	ADJUST	PROCEDURE
47.25 MC. 400 Cycles Amp. Mod.	L-1	With signal generator set at maximum output, adjust L-1 for minimum vertical response on scope.

6) Now that all the I.F. coils and transformers have been set, the overall response can be observed and adjusted if necessary.

SIGNAL GENERATOR INPUT			MEASURING INSTRUMENT	ADJUST	PROCEDURE
CONNECTION	FREQUENCY				
	SWEEP	MARKER			
Connect terminated sweep and marker as shown in Fig. 7.	Center frequency 44 MC. 10 MC. Sweep	45.75 MC.	Scope connected to Video Test Point	T-4	If 45.75 MC. doesn't lie from 60 to 70% down adjust T-4 (see fig. 6) for tolerances. *

Providing overall curve is within tolerances as shown below, no further adjustments are needed. If band width or tilt is not as specified, repeat entire alignment procedure. If still out then a slight retouching is permissible. TRAPS L-1 and L-2 MUST BE ADJUSTED AS INDICATED ABOVE. DO NOT RE-ADJUST WHILE OBSERVING OVERALL I.F. RESPONSE CURVE.

*KEEP OUTPUT SIGNAL GENERATOR AS LOW AS POSSIBLE WHEN OBSERVING THE OVERALL I.F. SHAPE SINCE TUBE OVERLOAD MIGHT RESULT AND THE RESPONSE WILL APPEAR INCORRECTLY FLAT AND WIDE.



NOTE: It may be impossible to observe the 47.25 MC. marker with the average service equipment due to the high attenuation of trap L-1 (adjacent sound).

Figure 6. OVERALL I.F. RESPONSE CURVE

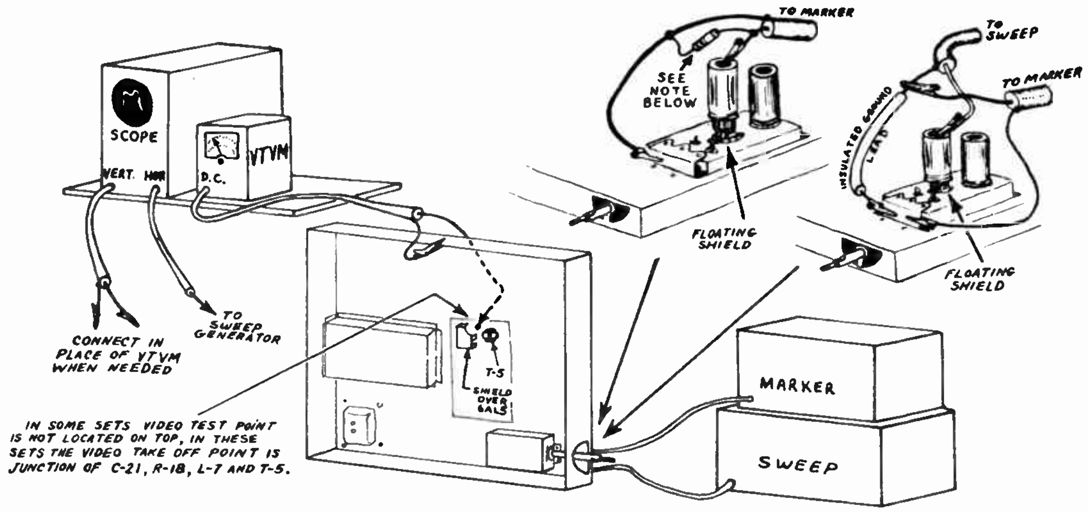


Figure 7. CONNECTIONS FOR I.F. ALIGNMENT.

All instrument leads should be dressed as directed and as short as possible to prevent interaction between input and output leads. Failure to do this may result in an unstable response indication.

NOTE It is important that the output cable of the sweep and marker generator be properly terminated in their characteristic impedance which is usually from 50 to 75 ohms. If this termination has not been built into the end of the cable by the instrument manufacturer * then a resistor of the proper value (characteristic impedance) should be connected across the output of each generator cable as shown above.

* If in doubt check your instruction book which is issued by the test equipment manufacturer.

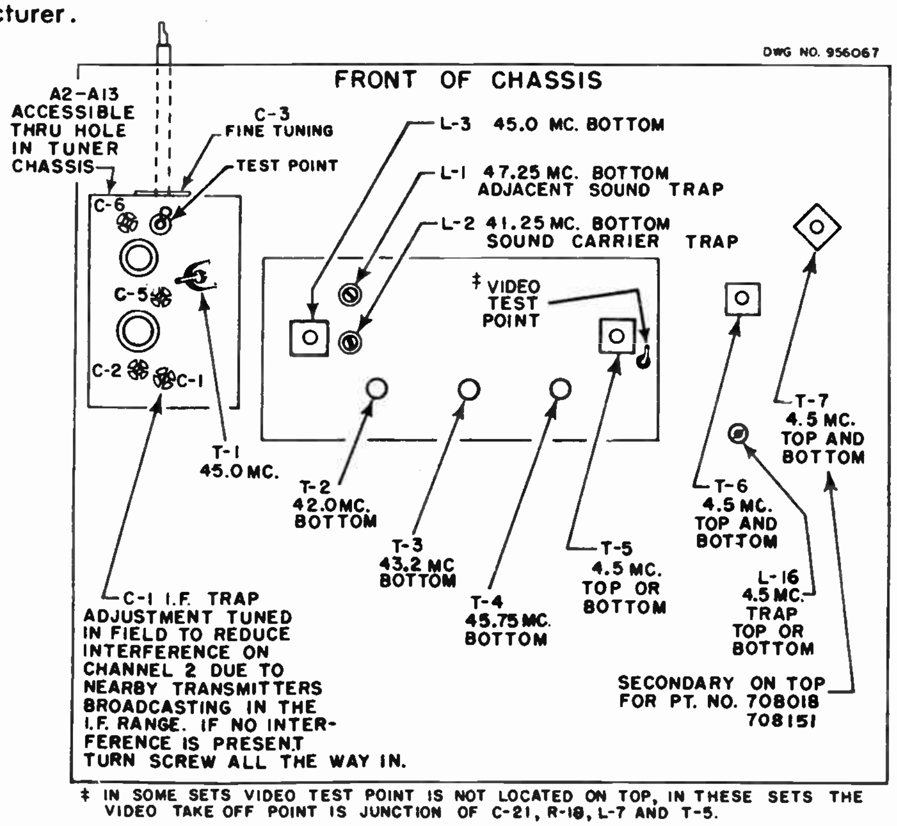
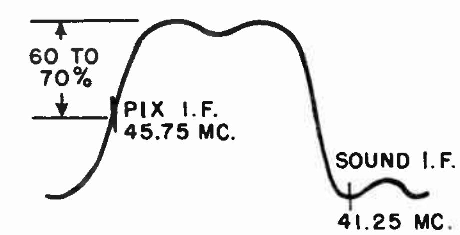


Figure 8 - LOCATION OF ALIGNMENT POINTS (TOP VIEW)

R.F. OSCILLATOR ALIGNMENT

1. Connect marker and sweep generator as shown in Figure 4, low side to chassis.
2. Connect scope to video test point (see location Fig. 7 and 8).
3. Connect 3 volt bias battery as described under R.F. Alignment Page 4.
4. Before undertaking oscillator alignment be sure I.F. circuits are correctly aligned for band pass characteristic and trap settings.
5. During oscillator alignment, it is necessary to set the fine tuning control so that the tooth on the fine turning cam points downword.

MARKER SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR FREQUENCY	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
*209.75 MC. **205.25 MC.	Channel #12 Center Frequency 207 MC. 10 MC. Sweep	Be sure that fine tuning control has been properly positioned (tooth on the cam pointing down) NOTE During this step and thru-out all succeeding steps it is necessary to: 1. Keep output of sweep generator at a level that does not allow the reading on a VTVM to exceed minus 1 volt when connected across video detector load at minimum sweep width. 2. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	Adjust Slug A-12	NOTE: Before making the following adjustment, advance the vertical gain control on the scope in order to magnify the sound trap portion of the response curve. Then, use a non-metallic screwdriver to adjust channel #12 oscillator slug (accessible thru hole on front of r-f tuner unit and shift response curve so that sound carrier marker is located at the position indicated below. Now reduce gain control setting of scope to restore pattern to normal amplitude and observe position of picture carrier marker. This marker should appear on the high frequency side of the characteristic curve. The amplitude of the picture carrier should be between 60 and 70% down from peak response.
*215.75 MC. **211.25 MC.	Channel #13 213 MC.	Set Channel Selector to #13 (See note above)		Adjust the r-f sweep generator and marker generator for operation on other television channels; set marker generator to sound carrier frequency. After setting Channel Selector to corresponding channel, adjust oscillator slug thru hole on front of r-f tuner unit. (A-2 to A-13) This permits response curve to be shifted so that sound carrier marker will appear at the position indicated below.
*203.75 MC. **199.25 MC.	Channel #11 201 MC.	Set Channel Selector to #11 (See note above)		
*197.75 MC. **193.25 MC.	Channel #10 195 MC.	Set Channel Selector to #10 (See note above)		
*191.75 MC. **187.25 MC.	Channel #9 189 MC.	Set Channel Selector to #9 (See note above)		
*185.75 MC. **181.25 MC.	Channel #8 183 MC.	Set Channel Selector to #8 (See note above)		 TYPICAL OVERALL RESPONSE CURVE
*179.75 MC. **175.25 MC.	Channel #7 177 MC.	Set Channel Selector to #7 (See note above)		
* 87.75 MC. ** 83.25 MC.	Channel #6 85 MC.	Set Channel Selector to #6 (See note above)		
* 81.75 MC. ** 77.25 MC.	Channel #5 79 MC.	Set Channel Selector to #5 (See note above)		
* 71.75 MC. ** 67.25 MC.	Channel #4 69 MC.	Set Channel Selector to #4 (See note above)		
* 65.75 MC. ** 61.25 MC.	Channel #3 63 MC.	Set Channel Selector to #3 (See note above)		
* 59.75 MC. ** 55.25 MC.	Channel #2 57 MC.	Set Channel Selector to #2 (See note above)		NOTE: Make sure that cam on fine tuning control shaft remains properly positioned during this step (tooth on the cam pointing downward).

NOTE: If an unsatisfactory overall response is obtained for a particular channel, observe R-F amp. and Mixer response curve for that channel (as described in R-F Amp. and Mixer Alignment Table). If characteristic does not conform reasonably well within the typical curve shown in Figure 5, then do the following things:

1. Check method of connecting scope, voltmeter and generator leads to eliminate possible distortion of observed response, or:
2. Attempt to obtain a better compromise for R.F. response on all channels by realigning R-F Amp. and Mixer circuits, or:
3. Try replacing Antenna, R-F and Oscillator coils for the particular channel.

*Sound Carrier Marker
**Picture Carrier Marker

R.F. OSCILLATOR ALIGNMENT PROCEDURE

SOUND ALIGNMENT

(A) USING 4.5MC UNMODULATED SIGNAL GENERATOR

1) Short pin #1 of V-3 to chassis with short jumper wire.
2) Keep output of signal generator low so as to provide a sharp meter indication with adjustment of transformers.

(B) USING TRANSMITTED TV AIR SIGNAL

1) Connect antenna and tune to a good on the air TV station.
2) Adjust fine tuning control for best picture.
3) Adjust antenna coupling for moderate signal so as to provide a sharp meter indication with adjustment of transformer.
4) Meter reading may pulsate due to changes in signal strength; do not confuse with a peak adjustment.

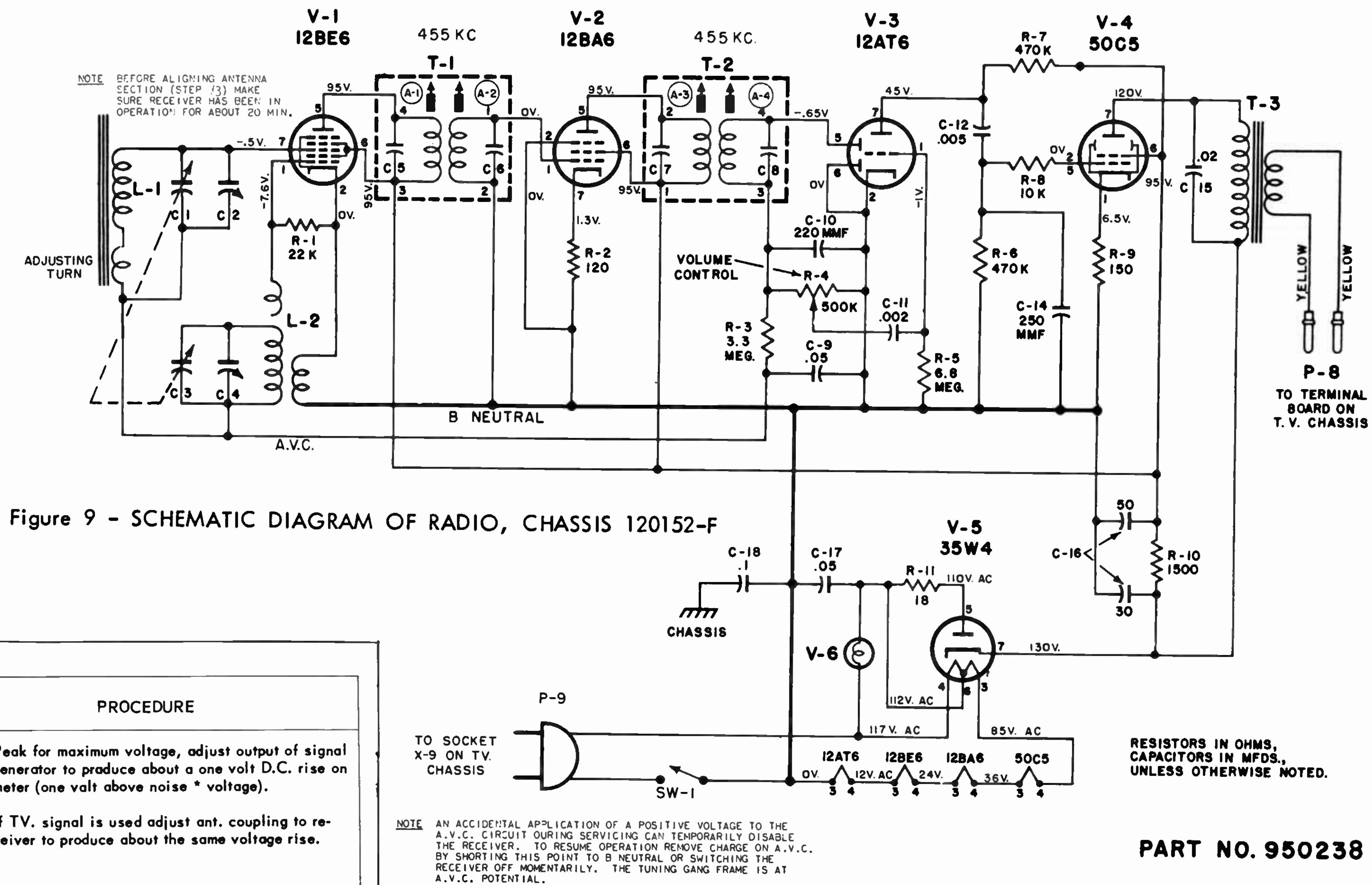


Figure 9 - SCHEMATIC DIAGRAM OF RADIO, CHASSIS 120152-F

PART NO. 950238

STEP	SIGNAL GENERATOR INPUT CONNECTION	SIGNAL GENERATOR INPUT FREQUENCY	MEASURING INSTRUMENT	ADJUST	PROCEDURE
1	Marker gen. through .01 mf. to Pin 7 of V-4 low side to chassis. -or- Connect antenna and tune in a good transmitted TV signal (any channel)	4.5 mc. (unmodulated) -or- a good on the air TV. channel	Connect D.C. V.T.V.M. (negative scale) through 10K resistor to junction of C-29, R-33, R-34 Low side to chassis.	T-5 top or bottom T-6 top and bottom	Peak for maximum voltage, adjust output of signal generator to produce about a one volt D.C. rise on meter (one volt above noise * voltage). If TV. signal is used adjust ant. coupling to receiver to produce about the same voltage rise.
2	Same as above	Same as above	Connect V.T.V.M. through 10K resistor to junction of R-48, C-78 Low side to chassis	T-7 top and bottom discriminator	A) Detune discriminator secondary (T-7 top Pt. #708018, 708151; bottom Pt. #708017) for maximum negative meter reading. B) Adjust primary T-7 for maximum negative meter reading. C) Readjust discriminator secondary (towards original setting) for zero D.C. reading on V.T.V.M. D) Check audio, if distorted repeat steps A to C.

* The noise voltage is measured under no signal conditions (ant. terminals shorted directly at tuner by means of a short jumper wire; or disconnect 4.5 mc. generator if procedure (A) above is followed).

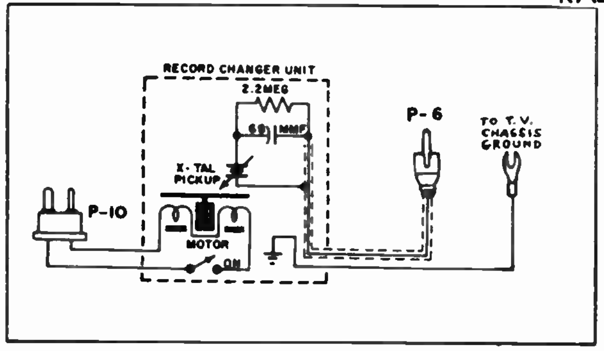
4.5MC. VIDEO TRAP ALIGNMENT (L-16)

1) Short Pin 1 of V-3 to chassis by means of a short jumper wire.
2) Connect a 4.5MC. signal generator (unmodulated and crystal calibrated) through a .01 MF condenser between cathode of V-5 (Pin 2) and chassis.
3) Connect a D.C. V.T.V.M. (neg. scale) between junction of R-33, T-6, C-29 and chassis.
4) With contrast control set at minimum contrast (counter clockwise) adjust L-16 (see Fig. 8) for negative dip on V.T.V.M. (minimum negative reading). Keep output of signal generator low so as to produce a sharp voltage dip on the V.T.V.M.

NOTE Whenever the 4.5MC. Video trap (L-16) is adjusted, repeak the sound take off transformer (T-5) as shown above.

ALIGNMENT OF MIRACLE PICTURE LOCK

1) Tune set to a good channel.
2) Short phase coil (L-10), leads have been brought to top of chassis on a terminal strip near fuse (see tube location diagram figure 11).
3) Short horizontal control grid to chassis. This point has also been brought to top of chassis on same strip as mentioned in step 2.
4) Rotate horizontal hold control (R-74) to center of its mechanical range.
5) Adjust horizontal balance control (R-72) (rear of chassis) until picture pulls into synchronism (in most cases picture will sway from side to side).
6) Remove short from horizontal phase coil (L-10) and adjust L-10 for same synchronous condition as step 5 above.
7) Remove short from horizontal control grid. Horizontal frequency circuits are now properly aligned.
8) When properly adjusted (steps 1-7) the horizontal hold control can be moved slowly over most of its range without throwing the picture out of sync.



CONNECTION OF RECORD CHANGER

RADIO CABINET PARTS LIST-RADIO CHASSIS 120152-F

PART NUMBER MODEL 733F	DESCRIPTION	LIST PRICE
560319	Back - Radio	.30
411400	Dial Plate - Radio	.50
520163	Dial Bezel - Radio	.85
460376	Knob - Radio - Tuning	.20
460377	Knob - Radio - Volume	.20
542280	Spring - Knob	.02
635001	Jewel	.12

Prices subject to change without notice.

ALIGNMENT INSTRUCTIONS

1. Use isolation transformer if available. If not, connect a .1 mfd. condenser in series with low side of signal generator and B neutral.
2. Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated screw driver for adjusting.

STEP	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	.1 mfd.	High side to grid (pin 7) of V1 (12BE6). Low side to B neutral.	455 KC	Variable condenser fully open.	Across voice coil.	T2, T1 (A3, A4, A1, A2)	Adjust for maximum output. If isolation transformer is not used, reduce dummy ant. to .001 mfd. to reduce hum modulation.
2		Form loop of several turns and radiate signal into receiver	1620 KC	"	Across voice coil.	Trimmer C-4 (Osc.)	Adjust for maximum output.
3		"	1400 KC	Tune for maximum output.	Across voice coil.	Trimmer C-2 (Ant.)	Adjust for maximum output.

CONDITIONS FOR VOLTAGE AND RESISTANCE READINGS

1. Voltages indicated are positive d.c., resistances are in ohms, unless otherwise indicated.
2. Measurements made with voltohmyst or equivalent.
3. Line voltage maintained at 117 volts a.c. for voltage measurements.
4. Socket connections are shown as bottom views, with measurements from pin to common negative.
5. Volume control at maximum; no signal applied for voltage measurements.
6. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
7. NC denotes no connection, K is kilohms, MEG is megohms. Resistances marked * are measured to pin 7 of rectifier (B +).

RESISTANT READINGS FOR CHASSIS 120152-F

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
V-1	12BE6	23K	.5	12	24	1500*	1500*	4 MEG
V-2	12BA6	18	0	24	36	1500*	1500*	120
V-3	12AT6	6 MEG	0	0	12	500K	0	470*
V-4	50C5	150	470 K	36	90	470K	1500*	210*
V-5	35W4	N.C.	N.C.	90	120	135	115	0*

VOLTAGE READINGS LOCATED ON THE RADIO SCHEMATIC

DESCRIPTION
RADIO CHASSIS 120152-F

TYPE: Single-band (AM) superheterodyne.

FREQUENCY RANGE: Broadcast 540-1620 kc

TYPES OF TUBES:

- V-1 – 12BE6, converter
- V-2 – 12BA6, i-f amplifier
- V-3 – 12AT6, detector, a.v.c. a-f amplifier
- V-4 – 50C5, power output
- V-5 – 35W4, rectifier

VOLTAGE RATING: 105-125 volts.

POWER SUPPLY: Power from T.V. Outlet X-9

POWER CONSUMPTION: 30 watts.

CURRENT DRAIN: 0.24 amp. at 117 volts a.c.

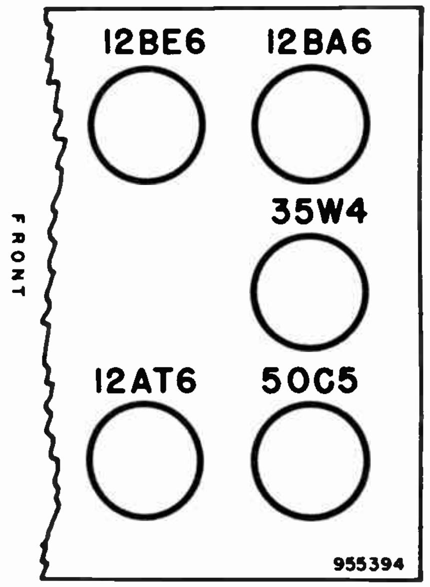


Figure 10 - TUBE LOCATION DIAGRAM
CHASSIS 120152-F

RADIO CHASSIS PARTS LIST - CHASSIS 120152-F

SYMBOL	PART NO.	DESCRIPTION	LIST PRICE
C-1	900091	Variable Capacitor - R.F. Section	3.20
C-2	PT. OF C-1	Trimmer - R.F. Section	
C-3	PT. OF C-1	Variable Capacitor - Oscillator Sectic	
C-4	PT. OF C-1	Trimmer - Oscillator Section	
C-5	PT. OF T-1		
C-6	PT. OF T-1		
C-7	PT. OF T-2		
C-8	PT. OF T-2		
C-9	923554	.05 MF Paper 400V.	.25
C-10	PART OF 923024	220 MMF R.C. Coupling Unit	
C-11	PART OF 923024	.002 MF R.C. Coupling Unit	
C-12	PART OF 923024	.005 MMF R.C. Coupling Unit	1.05
C-14	PART OF 923024	250 MMF R.C. Coupling Unit	
C-15	923524	.02 MF Paper 400V.	.25
C-16	925218	30-50 MF Electrolytic 150V.	1.40
C-17	923554	.05 MF Paper 400V.	.25
C-18	923515	.1 MF Paper 400V.	.30
R-1	PT. OF L-2	22,000 OHM Carbon	
R-2	340272	120 OHM Carbon 1/2 W. ±10%	.10
R-3	351332	3.3 MEGOHM Carbon 1/2 W. ±20%	.14
*R-4	390218	500,000 OHM Volume Control	1.00
R-5	PART OF 923024	6.8 MEGOHM R.C. Coupling Unit	
R-6	PART OF 923024	470,000 OHM R.C. Coupling Unit	
R-7	PART OF 923024	470,000 OHM R.C. Coupling Unit	
R-8	350732	10,000 OHM 1/2 W. ±20%	.05
R-9	340292	150 OHM 1/2 W. ±10%	.10
R-10	380532	1,500 OHM 1 W. ±20%	.16
R-11	340072	18 OHM 1/2 W. ±10%	.14
L-1	700078	Loop Antenna Assembly - Ferrite	
L-2	716071	Oscillator Coil	.95
P-1	583037P	Line Cord	.55
P-8	580236	Lead & Pin Assembly - 2 Req.	
SW-1	PT. OF R-4	ON-OFF Switch	
T-1	720033	1st. I.F. Transformer	1.80
T-2	720033	2nd. I.F. Transformer	1.80
*T-3	734082	Output Transformer	1.35
V-1	800525	Vacuum Tube - 12BE6	
V-2	800524	Vacuum Tube - 12BA6	
V-3	800523	Vacuum Tube - 12AT6	
V-4	800032	Vacuum Tube - 50C5	
V-5	800526	Vacuum Tube - 35W4	
V-6	807000	Pilot Light	

Prices subject to change without notice
*Denotes new part number

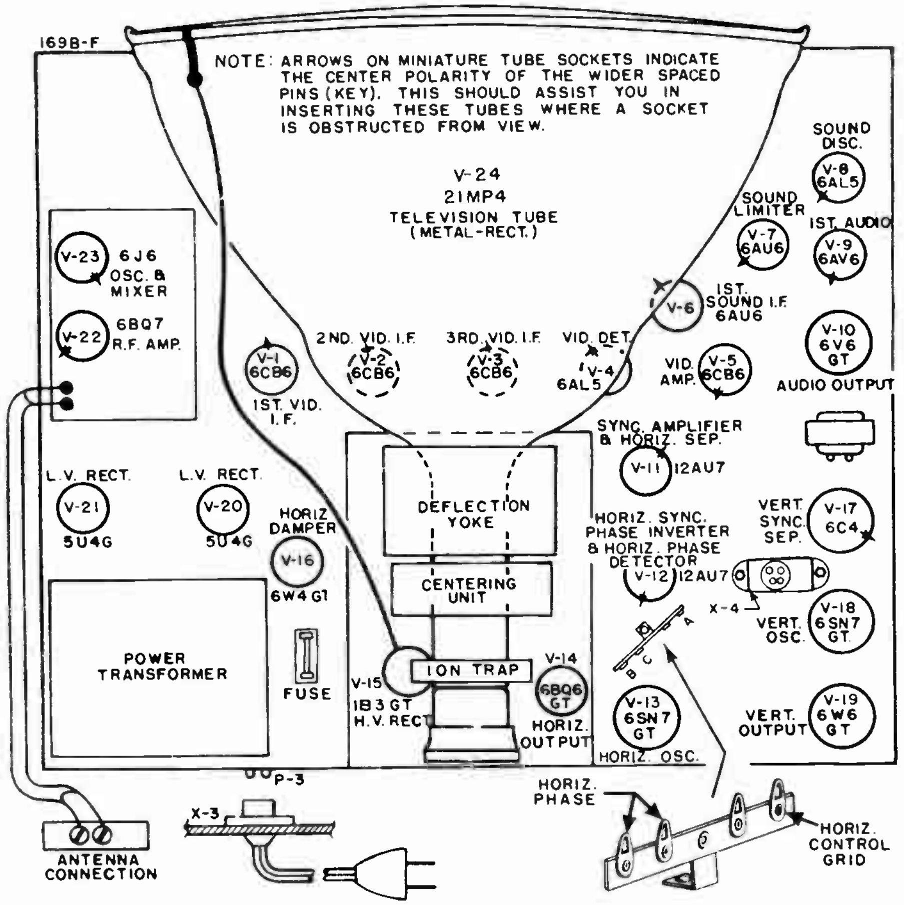


Figure 11 - TUBE LOCATIONS DIAGRAM FOR CHASSIS 120169B and F

TUBE TROUBLE ANALYSIS CHART

SYMPTOM	CHECK
Weak or no sound nor video (picture) raster normal	V-22, V-23, V-1, V-2, V-3, V-4 *
Weak or no sound - Video and raster normal	V-6, V-7, V-8, V-9, V-10
Weak or no video - Sound and raster normal	V-5, V-24
Poor or no horizontal nor vertical sync. Sound and video normal (contrast control makes video darker or lighter)	V-11
Poor or no horizontal nor vertical sync. - video weak or distorted, raster normal - sound may or may not be normal	V-22, V-23, V-1, V-2, V-3, V-4
Poor or no horizontal sync - raster and sound normal (Picture locks in vertically)	V-11, V-12, V-13
Poor or no vertical sync - raster and sound normal. (Picture locks in horizontally)	V-11, V-17, V-18
Horizontal line (no vertical sweep) - sound normal	V-18, V-19
Insufficient horizontal size, sound and video normal	V-14, V-16, V-20, V-21
Insufficient vertical size or white horizontal bar in picture	V-19
No sound, no raster - tubes lit	Fuse, V-20, V-21
No sound, no raster - tubes not lit	Plug connection in wall socket, on-off switch, line cord

* Another very common fault is a shorted or open circuit antenna connection to set. By raster we mean illuminated scanning lines.

TV CHASSIS PARTS LIST - CHASSIS 120169-B, 120169-F

CAPACITORS

SYMBOL	PART NO.	DESCRIPTION	PRICE	SYMBOL	PART NO.	DESCRIPTION	PRICE
C-1	928109	5000 MMF (MIN.) 500V...	.20	C-40	910062	220 MMF ±20% 500V...	.25
C-2	928082	39 MMF ±5% 500V...	.30	*C-41	910064	82 MMF ±20% 500V...	.25
C-3	928084	6.8 MMF ±10% 500V...	.30	C-42	910063	470 MMF ±10% 500V...	.35
C-4	928077	1000 MMF (MIN.) 500V...	.25	C-43	910063	470 MMF ±10% 500V...	.35
C-5	928081	470 MMF ±10% 500V...	.40	C-44	922513	.001 MF ±20% 400V...	.30
C-6	928077	1000 MMF (MIN.) 500V...	.25	C-45	910212	390 MMF ±10% 500V...	.30
C-7	922325	.22 MF ±20% 200V...	.50	C-46	922523	.0022 MF ±20% 400V...	.30
C-8	928077	1000 MMF (MIN.) 500V...	.25	C-47	922713	.001 MF ±20% 600V...	.30
C-9	928081	470 MMF (MIN.) ±10% 500V...	.40	C-48	910063	470 MMF ±10% 500V...	.35
C-10	928109	5000 MMF (MIN.) 500V...	.20	C-49	922320	.015 MF ±20% 200V...	.30
C-11	928076	680 MMF ±10% 500V...	.40	C-50	922513	.001 MF ±20% 400V...	.30
C-12	928077	1000 MMF (MIN.) 500V...	.25	C-51	910063	470 MMF ±10% 500V...	.35
C-13	928076	680 MMF ±10% 500V...	.40	C-52	922653	.0047 MF ±10% 600V...	.35
C-14				*C-53	922220	.015 MF ±10% 200V...	.30
C-15	928012	22 MMF ±20% 500V...	.20	C-54	910028	220 MMF ±10% 500V...	.30
C-16	928077	1000 MMF (MIN.) 500V...	.25	C-55	922325	.22 MF ±20% 200V...	.50
C-17	928017	5 MMF ±10% 500V...	.25	C-56	910218	820 MF ±10% 500V...	.45
C-18	928077	1000 MMF (MIN.) 500V...	.25	C-57	922413	.001 MF ±10% 400V...	.35
C-19	922325	.22 MF ±20% 200V...	.50	C-58	PT. OF C-74	10 MF ELECTROLYTIC 450V...	
C-20	928109	5000 MMF (MIN.) 500V...	.20	C-59	922515	.1 MF ±20% 400V...	.40
C-21	922554	.047 MF ±20% 400V...	.35	C-60	922715	.1 MF ±20% 600V...	.50
C-22	922315	.1 MF ±20% 200V...	.40	C-61	923016	500 MMF 20KV...	2.00
C-23	928077	1000 MMF (MIN.) 500V...	.25	C-62	PART OF YOKE 708162	See top of Page 18	
C-24	922554	.047 MF ±20% 400V...	.35	C-63	910058	47 MMF ±10% 500V...	.25
C-25	922714	.01 MF ±20% 600V...	.35	C-64	922554	.047 MF ±20% 400V...	.35
C-26	928109	5000 MMF (MIN.) 500V...	.20	C-65	922354	.047 MF ±20% 200V...	.30
C-27	928109	5000 MMF (MIN.) 500V...	.20	C-66	922453	.0047 MF ±10% 400V...	.30
C-28	928109	5000 MMF (MIN.) 500V...	.20	C-67	922454	.047 MF ±10% 400V...	.40
C-29	910221	68 MMF ±20% 500V...	.20	C-68	922515	.1 MF ±20% 400V...	.40
C-30	928109	5000 MMF (MIN.) 500V...	.20	C-69	PT. OF C-72	5 MF ELECTROLYTIC 450V...	
C-31	928109	5000 MMF (MIN.) 500V...	.20	C-70	PT. OF C-74	100 MF ELECTROLYTIC 50V...	
C-32	910043	110 MMF ±20% 500V...	.25	C-71	922714	.01 MF ±20% 600V...	.35
C-33	922553	.0047 MF ±20% 400V...	.30	*C-72	925232	80 MF ELECTROLYTIC 300V...	3.40
C-34	922554	.047 MF ±20% 400V...	.35	C-73	PT. OF C-72	40 MF ELECTROLYTIC 300V...	
C-35	922513	.001 MF ±20% 400V...	.30	C-74	925221	40 MF ELECTROLYTIC 250V...	3.85
C-36	922553	.0047 MF ±20% 400V...	.30	C-75	922200	.047 MF 400V...	.35
C-37	PT. OF C-74	80 MF ELECTROLYTIC 300V...		C-76	922200	.047 MF 400V...	.35
C-38	922514	.01 MF ±20% 400V...	.30	C-77	PT. OF L-16	47 MMF 500V...	
C-39	922554	.047 MF ±20% 400V...	.35	C-78	922513	.001 MF ±20% 400V...	.30

RESISTORS

SYMBOL	PART NO.	DESCRIPTION	PRICE	SYMBOL	PART NO.	DESCRIPTION	PRICE
R-1	350412	470 OHM ½W. ±20%...	.14	R-29	351172	680,000 OHM ½W. ±20%...	.14
R-2	340052	15 OHM ½W. ±10%...	.10	R-30	390196	2 MEGOHM FOCUS CONTROL - R	.70
R-3	340172	47 OHM ½W. ±10%...	.10	R-31	340332	220 OHM ½W. ±10%...	.10
R-4	350412	470 OHM ½W. ±20%...	.14	R-32	350412	470 OHM ½W. ±20%...	.14
R-5	350412	470 OHM ½W. ±20%...	.14	R-33	350892	47,000 OHM ½W. ±20%...	.05
R-6	340832	27,000 OHM ½W. ±10%...	.10	R-34	351212	1 MEGOHM ½W. ±20%...	.05
R-7	340172	47 OHM ½W. ±10%...	.10	R-35	370812	22,000 OHM 1W. ±10%...	.15
R-8	350412	470 OHM ½W. ±20%...	.14	R-36	340732	10,000 OHM ½W. ±10%...	.10
R-9	350412	470 OHM ½W. ±20%...	.14	R-37	340692	6,800 OHM ½W. ±10%...	.10
R-10	340712	8,200 OHM ½W. ±10%...	.14	R-38	350412	470 OHM ½W. ±20%...	.14
R-11	340312	180 OHM ½W. ±10%...	.10	R-39	340972	100,000 OHM ½W. ±10%...	.10
R-12	340412	470 OHM ½W. ±20%...	.14	R-40	340972	100,000 OHM ½W. ±10%...	.10
R-13	350972	100,000 OHM ½W. ±20%...	.05	R-41	351452	10 MEGOHM ½W. ±20%...	.14
R-14	351212	1 MEGOHM ½W. ±20%...	.05	R-42	351452	10 MEGOHM ½W. ±20%...	.14
R-15	351212	1 MEGOHM ½W. ±20%...	.05	R-43	390201	1 MEGOHM VOLUME CONTROL - F	2.00
R-16	351212	1 MEGOHM ½W. ±20%...	.05	R-44	351052	220,000 OHM ½W. ±20%...	.05
R-17	340652	4,700 OHM ½W. ±10%...	.10	R-45	351132	470,000 OHM ½W. ±20%...	.06
R-18	340772	15,000 OHM ½W. ±10%...	.10	R-46	370412	470 OHM 1W. ±10%...	.15
R-19	340732	10,000 OHM ½W. ±10%...	.10	R-47	790532	1,500 OHM 2W. ±20%...	.25
R-20	351212	1 MEGOHM ½W. ±20%...	.05	R-48	350932	68,000 OHM ½W. ±20%...	.14
R-21				R-49	350412	470 OHM ½W. ±20%...	.14
R-22	PT. OF R-43	1,500 OHM CONTRAST CONTROL - F		R-50	394122	8.5 OHM WIRE WOUND 5W. ±10%...	.40
R-23	340812	22,000 OHM ½W. ±10%...	.17	R-51	351052	220,000 OHM ½W. ±20%...	.05
R-24	770692	6,800 OHM 2W. ±5%....	.55	R-52	390202	2 MEGOHM FRINGE COMP. - R	1.05
R-25	351132	470,000 OHM ½W. ±20%...	.06	R-53	350972	100,000 OHM ½W. ±20%...	.05
R-26	390181	200,000 OHM BRIGHTNESS CONTROL - F	.70	R-54	380852	33,000 OHM 1W. ±20%...	.10
R-27	351052	220,000 OHM ½W. ±20%...	.05	R-55	350972	100,000 OHM ½W. ±20%...	.05
R-28	351132	470,000 OHM ½W. ±20%...	.06	R-56	350732	10,000 OHM ½W. ±20%...	.05

Prices Subject to Change Without Notice.
* Denotes New Part Number.

TV CHASSIS PARTS LIST - CHASSIS 120169-B, 120169-F continued

RESISTORS (cont'd.)

SYMBOL	PART NO.	DESCRIPTION	PRICE	SYMBOL	PART NO.	DESCRIPTION	PRICE
R-57	351292	2.2 MEGOHM ½W. ±20%...	.06	R-81	790252	100 OHM 2W. ±20%...	.25
R-58	340972	100,000 OHM ½W. ±10%...	.10	R-82	780692	6,800 OHM 2W. ±10%...	.25
R-59	370812	22,000 OHM 1W. ±10%...	.15	R-83	340132	33 OHM ½W. ±10%...	.10
R-60	340692	6,800 OHM ½W. ±10%...	.10	R-84	380972	100,000 OHM 1W. ±20%...	.10
R-61	351092	330,000 OHM ½W. ±20%...	.14	R-85	340392	390 OHM PART OF YOKE 708162	
R-62	340572	2,200 OHM ½W. ±10%...	.10	R-86	351452	10 MEGOHM ½W. ±20%...	.14
R-63	340652	4,700 OHM ½W. ±10%...	.10	R-87	340292	150 OHM ½W. ±10%...	.10
R-64	340812	22,000 OHM ½W. ±10%...	.17	R-88	341012	150,000 OHM ½W. ±10%...	.10
R-65	340972	100,000 OHM ½W. ±10%...	.10	R-89	340572	2,200 OHM ½W. ±10%...	.10
R-66	340952	82,000 OHM ½W. ±10%...	.10	R-90	390156	1 MEGOHM VERT. HOLD CONTROL-F	.65
R-67	340952	82,000 OHM ½W. ±10%...	.10	R-91	341192	820,000 OHM ½W. ±10%...	.10
R-68	351292	2.2 MEGOHM ½W. ±20%...	.06	R-92	340752	12,000 OHM ½W. ±10%...	.10
R-69	370892	47,000 OHM 1W. ±10%...	.15	R-93	351212	1 MEGOHM ½W. ±20%...	.05
R-70	340492	1,000 OHM ½W. ±10%...	.17	R-94	350892	47,000 OHM ½W. ±20%...	.05
*R-71	360672	5,600 OHM 1W. ±5%....	.16	R-95	390196	2 MEGOHM VERT. SIZE CONTROL-R	.70
R-72	390219	200,000 OHM HORIZ. BAL. CONTROL-F	.65	R-96	351292	2.2 MEGOHM ½W. ±20%...	.06
R-73	340972	100,000 OHM ½W. ±10%...	.10	R-97	350852	33,000 OHM ½W. ±20%...	.05
R-74	390183	50,000 OHM HORIZ. HOLD CONTROL-F	.65	R-98	390197	5,000 OHM VERT. LIN. CONTROL-R	1.25
R-75	340992	120,000 OHM ½W. ±10%...	.10	R-99	350412	470 OHM ½W. ±20%...	.14
R-76	340712	8,200 OHM ½W. ±10%...	.14	R-100	340432	560 OHM ½W. ±10%...	.10
R-77	370892	47,000 OHM 1W. ±10%...	.15	R-101	340432	560 OHM ½W. ±10%...	.10
R-78	340572	2,200 OHM ½W. ±10%...	.10	R-102	394116	1,250 OHM WIRE WOUND 10W.±10%...	.45
R-79	341132	470,000 OHM ½W. ±10%...	.06	R-103	380972	100,000 OHM 1W. ±20%...	.10
R-80	350212	68 OHM ½W. ±20%...	.05				

CHOKES & COILS

SYMBOL	PART NO.	DESCRIPTION	PRICE	SYMBOL	PART NO.	DESCRIPTION	PRICE
L-1	720154	VIDEO I.F. TRAP	1.00	L-10	716074	HORIZ. PHASE COIL	1.20
L-2	720149	VIDEO I.F. TRAP	1.00	L-11	708156	HORIZ. SIZE COIL	1.15
L-3	720147	VIDEO I.F. INPUT COIL	1.40	L-12	705021	R.F. CHOKE - 10 UH	.20
L-4	705020	R.F. CHOKE - HEATER - .68 UH ±20%	.20	L-13 L-14	708162	DEFLECTION YOKE ASS'Y	10.50
L-5	705020	R.F. CHOKE - HEATER - .68 UH ±20%	.20			SEE TOP PAGE	
L-6	705020	R.F. CHOKE - HEATER - .68 UH ±20%	.20				
L-7	708114	PEAKING COIL - 440 UH	.30	L-15	737016	FILTER CHOKE	2.25
L-8	708100	PEAKING COIL - 250 UH	.40	L-15 or	737017	FILTER CHOKE	2.25
L-9	708115	PEAKING COIL - 660 UH	.35	L-16	708032	4.5 MC. TRAP	.85

TRANSFORMERS

SYMBOL	PART NO.	DESCRIPTION	PRICE	SYMBOL	PART NO.	DESCRIPTION	PRICE
T-1	PT. OF TUNER	TUNER VIDEO I.F. OUTPUT TRANSFORMER		T-7	708018	SOUND DISCRIMINATOR TRANSFORMER	2.05
T-2	720148	2ND VIDEO I.F. TRANSFORMER	1.30	T-7 OR	708151	SOUND DISCRIMINATOR TRANSFORMER	2.20
T-3	720148	3RD VIDEO I.F. TRANSFORMER	1.30	T-8	734074	AUDIO OUTPUT TRANSFORMER	2.25
T-4	720148	4TH VIDOO I.F. TRANSFORMER	1.30	T-9	738068	HORIZ. OUTPUT TRANSFORMER	9.80
T-5	720146	SOUND TAKE OFF TRANSFORMER	2.10	T-10	738066	VERT. OUTPUT TRANSFORMER	3.40
T-6	720081	SOUND I.F. TRANSFORMER	1.95	T-11	730037	POWER TRANSFORMER	22.70
T-6 OR	720081A	SOUND I.F. TRANSFORMER	1.90				

TUNER

SYMBOL	PART NO.	DESCRIPTION	PRICE	SYMBOL	PART NO.	DESCRIPTION	PRICE
TUNER	470696	T.V. TUNER ASS'Y	50.00	TUNER	470689	T.V. TUNER ASS'Y	50.00

TUBES PARTS LIST

SYMBOL	PART NO.	DESCRIPTION	SYMBOL	PART NO.	DESCRIPTION
V-1	800055	VACUUM TUBE - 6CB6	V-13	800380	VACUUM TUBE - 6SN7GT
V-2	800055	VACUUM TUBE - 6CB6	V-14	800059	VACUUM TUBE - 6BQ6GT
V-3	800055	VACUUM TUBE - 6CB6	V-15	800450	VACUUM TUBE - 1B3GT
V-4	800541	VACUUM TUBE - 6AL5	V-16	800037	VACUUM TUBE - 6W4GT
V-5	800055	VACUUM TUBE - 6CB6	V-17	800068	VACUUM TUBE - 6C4
V-6	800533	VACUUM TUBE - 6AU6	V-18	800380	VACUUM TUBE - 6SN7GT
V-7	800533	VACUUM TUBE - 6AU6	V-19	800061	VACUUM TUBE - 6W6GT
V-8	800541	VACUUM TUBE - 6AL5	V-20	800290	VACUUM TUBE - 5U4G
V-9	800057	VACUUM TUBE - 6AV6	V-21	800290	VACUUM TUBE - 5U4G
V-10	800270	VACUUM TUBE - 6V6GT	V-22	800065	VACUUM TUBE - 6BQ7 T.V. TUNER
V-11	800026	VACUUM TUBE - 12AU7	V-23	800536	VACUUM TUBE - 6J6 T.V. TUNER
V-12	800026	VACUUM TUBE - 12AU7	V-24	810028	TELEVISION TUBE 21 MP4-METAL

MISCELLANEOUS

SYMBOL	PART NO.	DESCRIPTION	PRICE	SYMBOL	PART NO.	DESCRIPTION	PRICE
F-1	808003	FUSE - 1/2 AMP.	.20	P-8	PT. OF RADIO	PLUG - LEAD & PIN ASS'Y - RADIO (2 REQ) 120169-F ONLY	
I-1	708129	ION TRAP - SINGLE	.65	*RELAY	515001	RELAY UNIT 120169-F ONLY	8.05
M-1	708149	CENTERING UNIT	.80	SP-1	180050	SPEAKER - PM - 12" CHASSIS 120169-B ONLY	12.40
*P-2	580235	PLUG - LEAD & PIN ASS'Y - SPEAKER (2 REQ.) CHASSIS 120169-F ONLY		SP-1 OR	180082	SPEAKER - PM - 12" (MOD. 720B & 723B ONLY) CHASSIS 120169-B	9.60
P-2	580128	PLUG - LEAD & PIN ASS'Y - SPEAKER (2 REQ.) CHASSIS 120169-B ONLY	.20	SP-1	180094	SPEAKER - PM - 6" CHASSIS 120169-F ONLY	5.90
P-3	505014	PLUG - INTERLOCK SWITCH	.20				
P-4	505000	PLUG - 4 PIN - DEFLECTION YOKE ASS'Y	.10				
P-6	505016	PLUG - 1 PIN - DEFLECTION YOKE ASS'Y	.05				

TV CHASSIS PARTS LIST - CHASSIS 120169-B & 120169-F (continued)

MISCELLANEOUS (continued)

SYMBOL	PART NO.	DESCRIPTION	PRICE	SYMBOL	PART NO.	DESCRIPTION	PRICE
SW-1	PT. OF R-43	SWITCH - ON-OFF (POWER)		X-6	508004	SOCKET - 1 PRONG - DEFLECTION YOKE ASS'Y 120169-F ONLY	.15 .10
SW-2	PT. OF R-52	SWITCH - ON-OFF (FRINGE COMPENSATOR)		X-7	508010	SOCKET - PHONO INPUT	
SW-3	510091	SWITCH - PHONO - T.V. - FRONT	1.35	X-8	555028	TERMINAL BOARD - SPEAKER - RADIO (CHASSIS 120169-F ONLY)	
X-1	585093	SOCKET - CABLE ASS'Y - KINESCOPE	1.25	*X-9	508034	SOCKET - RADIO RECEPTACLE (CHASSIS 120169-F ONLY)	
X-2	PT. OF T-8	SOCKET - NOT USED		X-10	508005	SOCKET - PHONO MOTOR RECEPTACLE (CHASSIS 120169-F ONLY)	
X-3	583206	SOCKET - & LINE CORD - INTERLOCK SWITCH	.80				
X-4	508050	SOCKET - 4 PRONG - DEFLECTION YOKE ASS'Y	.15				.30

Prices subject to change without notice.
*Denotes new part number

VALUE OF C-62 (120169-B, F CHASSIS NOT BEARING ANY CODE TRIANGLE LETTER)

Each 708162 deflection yoke used in this chassis has been individually balanced at the factory to prevent objectionable yoke ringing (rippling of horizontal raster lines at left third of picture). To accomplish this, a ceramic capacitor, C-62, of 2000 volt rating has been used with each of these yokes. In the unlikely event that C-62 should fail, it must be replaced with one of the same individually identical value, construction and voltage rating. Since the yoke was previously perfectly balanced at the factory, the commercially available 5% tolerance of the first replacement condenser tried may yield a condenser sufficiently different from the original so as to fail to balance perfectly the horizontal windings in this yoke. A cut and try procedure will pay off in performance.

The following yoke balancing condensers may be tried:

VALUE	TOLERANCE + OR −	TYPE	VOLTAGE RATING	PART #	SUGGESTED LIST PRICE
38 mmf	5%	CERAMIC DISCAP	2000 volts	960640	.30
41 mmf	5%	CERAMIC DISCAP	2000 volts	960641	.30
43 mmf	5%	CERAMIC DISCAP	2000 volts	960642	.30
44 mmf	5%	CERAMIC DISCAP	2000 volts	960643	.30
47 mmf	5%	CERAMIC DISCAP	2000 volts	928065	.30
50 mmf	5%	CERAMIC DISCAP	2000 volts	960644	.30
52 mmf	5%	CERAMIC DISCAP	2000 volts	928085	.30
57 mmf	5%	CERAMIC DISCAP	2000 volts	960645	.30
62 mmf	5%	CERAMIC DISCAP	2000 volts	960646	.30

If the deflection yoke itself should fail and a replacement is ordered from your Emerson Distributor, this replacement yoke will have been factory balanced for optimum results, therefore, C-62 and R-85 (390 ohms) are shipped as part of this yoke.

VALUE OF C-62 (120169-B, F CHASSIS CODED TRIANGLE A)

A A circuit change has been incorporated in these chassis which effectively eliminates the necessity to match the value of C-62 for each yoke. See schematic diagram for details of change.

The deflection yoke used may be one of three (3) part numbers, 708137, 708162, 708163. These yokes are all interchangeable when used in a chassis with TRIANGLE A circuit modifications.

Since the value of C-62 is now non-critical, the range of condensers used is from 38 to 62 mmfd. For replacement purposes, however, it is recommended that a value of 47 to 52 mmfd. be used. The part numbers of these condensers are shown above. In some chassis a 390 ohm ½ watt resistor is connected in series with C-62 as indicated on the schematic.

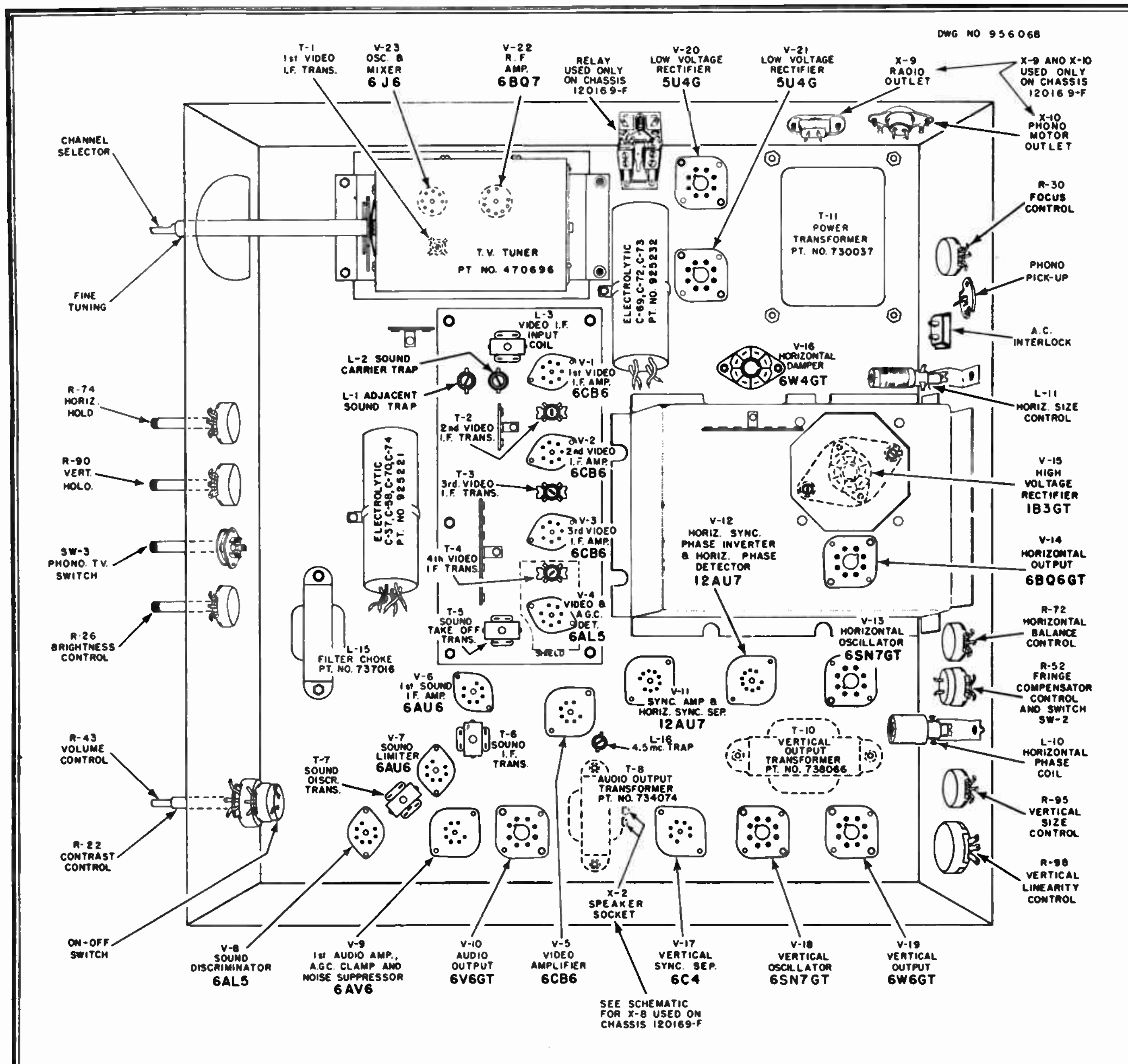


Figure 12 - UNDERSIDE VIEW OF CHASSIS 120169-B & F

VOLTAGE READINGS FOR CHASSIS 120169-B & 120169-F

SYMBOL	TUBE PIN NUMBERS PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PIN 10	PIN 11	PIN 12
V-1	-3V.	.4V.	6.3V.	OV.	148V.	148V.	OV.					
V-2	-3V.	.35V.	6.3V.	OV.	148V.	148V.	OV.					
V-3	OV.	2.7V.	6.3V.	OV.	148V.	148V.	OV.					
V-4	OV.	-1.7V.	6.3V.	OV.	-.45V.	OV.	-.3V.					
V-5	-1.9V.	0 to 2.1V.	6.3V.	OV.	180V. to 225V.	155V.	0 to 2.1V.					
V-6	.48V.	OV.	OV.	6.3V.	148V.	148V.	1.65V.					
V-7	-.5V.	OV.	OV.	6.3V.	148V.	35V.	OV.					
V-8	OV.	*-.9V.	OV.	6.3V.	.05V.	OV.	*-.95V.					
V-9	-.9V.	OV.	OV.	6.3V.	-3V.	-1V.	77V.					
V-10	N.C.	6.3V.	205V.	210V.	OV.		OV.	11.5V.				
V-11	33V.	-1.3V.	OV.	6.3V.	6.3V.	56V.	-.4V	OV.	OV.			
V-12	-.05V.	-.9V.	.25V.	OV.	OV.	150V.	OV.	8.8V.	6.3V.			
V-13	-.25V.	200V.	6.8V.	-11V. to -15.5V.	175V.	6.8V.	OV.	6.3V.				
V-14	N.C.	OV.	N.C.	150V.	-20V.	N.C.	6.3V.	12V.				
V-15	DO NOT MEASURE											
V-16	DO NOT MEASURE				230V.	DO NOT MEASURE						
V-17	N.C.	N.C.	OV.	6.3V.	ϕ9.5V.	-1.3V.	OV.					
V-18	OV.	68V.	3V.	-18.5V. to -25V.	75V. to 115V.	3V.	6.3V.	OV.				
V-19	N.C.	OV.	210V. to 230V.	210V. to 230V.	ϕ-.9V. to +.25V.		6.3V.	20V. to 36V.				
V-20	N.C.	245V.	N.C.	220V. AC.	N.C.	220V. AC.	N.C.	245V.				
V-21	N.C.	245V.	N.C.	220V. AC.	N.C.	220V. AC.	N.C.	245V.				
V-24	OV.					OV. to 465V.				435V.	OV. to 118V.	6.3V.

* Voltage varies with signal.
ϕ Voltage pulsates and varies with noise signal.
N.C. Denotes no connection

CONDITIONS FOR TAKING VOLTAGE AND RESISTANCE READINGS

The resistance measurements listed below are for chassis 120169-B and 120169-F with a triangle code △B.

Due to component variations, voltage and resistance readings may vary slightly from those given here. Slight variations may also be noticed if chassis is not coded as mentioned above.

The picture tube, deflection yoke and high voltage circuits were connected to take the following readings and waveshapes.

1. Antenna disconnected and antenna terminals shorted on tuner and connected to chassis (use short leads).
2. Line voltage 117 volts (Disconnect power for resistance readings).
3. 3 volt bias battery connected to both I.F. and R.F. A.G.C. circuits, positive terminal to chassis, negative terminal to junction of R-16, C-19, C-18. Add a jumper wire from this junction to junction of R-8, C-7, R-14 so that bias battery is also applied to I.F. A.G.C. BIAS BATTERY USED FOR VOLTAGE READINGS ONLY.
4. All controls in position for normal picture. (Varied when it directly effects reading).
5. All measurements taken with a vacuum tube voltmeter and ohmmeter.
6. All readings listed in tables were taken between points shown and chassis.
7. Resistance readings are given in ohms unless otherwise noted.
8. N.C. denotes no connection.

WAVE SHAPE ANALYSIS CHART FOR CHASSIS 120169-B AND 120169-F

For models 711F, 712F, 720D, 732B, 733F and 734B. The information listed was taken from a chassis code marked △B.

Slight peak to peak voltage differences may be noticed if chassis is not triangle code marked as mentioned above.

The wave shapes shown here are arranged so as to give the serviceman an easy method of signal tracing. The peak to peak voltage given may vary slightly depending on signal strength and component variations.

To accurately observe the wave shapes, the relatively high input capacity of an oscilloscope must be reduced so as not to change the operating characteristics of the television set. Failure to do this will result in wrong wave shape readings.

Connect antenna and tune receiver to channel where best reception has been obtained in the past.

Low end of the probe is connected to CHASSIS and the contrast control is set at MAXIMUM CONTRAST.

The 30 and 7875 C.P.S. oscilloscope sweep settings are used so as to permit the serviceman to observe two cycles of the wave shape.

NOTE: A wave shape seen in your oscilloscope may be upside down from same wave shape shown here. This will depend on the number of stages of amplification in the oscilloscope used.

RESISTANCE READINGS FOR CHASSIS 120169-B AND 120169-F

SYMBOL	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PIN 10	PIN 11	PIN 12
V-1	1 meg	45	.2	0	⊕ 15 K	⊕ 15 K	0					
V-2	1 meg	42	.2	0	⊕ 15.5 K	⊕ 15.5 K	0					
V-3	0	170	.15	0	⊕ 15.5 K	⊕ 15.5 K	0					
V-4	0	1 meg	.25	0	95 K	0	5 K					
V-5	1.2 meg	Contrast 2 to 1.6 K	.1	0	⊕ 23 K	⊕ 15 K	Contrast 2 to 1.6 K					
V-6	1 meg	0	0	.05	⊕ 16 K	⊕ 16 K	220					
V-7	55 K	0	0	.05	⊕ 16 K	8.5 K	0					
V-8	0	90 K	0	.05	170 K	0	90 K					
V-9	12 meg	0	0	.05	1.6 meg	fringe comp. 85 K - 2.3 meg	250 K					
V-10	N.C.	05	⊕17 K	⊕17 K	500 K	180 K	0	480				
V-11	⊕6.8 K	2 meg	0	.05	.05	⊕48 K	15 K	0	0			
V-12	22 K	280 K	110 K	0	0	⊕16 K	330 K	5 K	.05			
V-13	2.2 meg	⊕24 K	950	horiz. hold control 105K-150K	⊕180 K	950	0	.05				
V-14	N.C.	0	N.C.	⊕ 22 K	500 K	N.C.	.05	115	Plate Cap of 6BQ6 ⊕105 K			
V-15	PIN 2 AND 7 INFINITE, PLATE ⊕105 K											
V-16	N.C.	N.C.	⊕105 K	N.C.	⊕16 K	N.C.	⊕105 K	⊕105 K				
V-17	N.C.	N.C.	0	.05	12 meg	2.2 meg	0					
V-18	100	160 K	2.3 K	vertical hold 800 K - 1.9 meg	vert.size 1 meg 2.6 meg	2.3 K	.05	0				
V-19	N.C.	0	⊕16K	⊕16 K	2.3 meg	1.9 meg	.05	vert. lin. 430 - 5K				
V-20	N.C.	⊕16 K	N.C.	23	8.5	23	N.C.	⊕16 K				
V-21	N.C.	⊕16 K	N.C.	23	N.C.	23	N.C.	⊕16K				
V-24	0	0	N.C.	N.C.	N.C.	⊕ focus control 0 to 470 K to 95 K	N.C.	N.C.	N.C.	700 K	240 K	.05

⊕ Varying Resistance - Wait Until Meter Settles (about 30 Sec.)

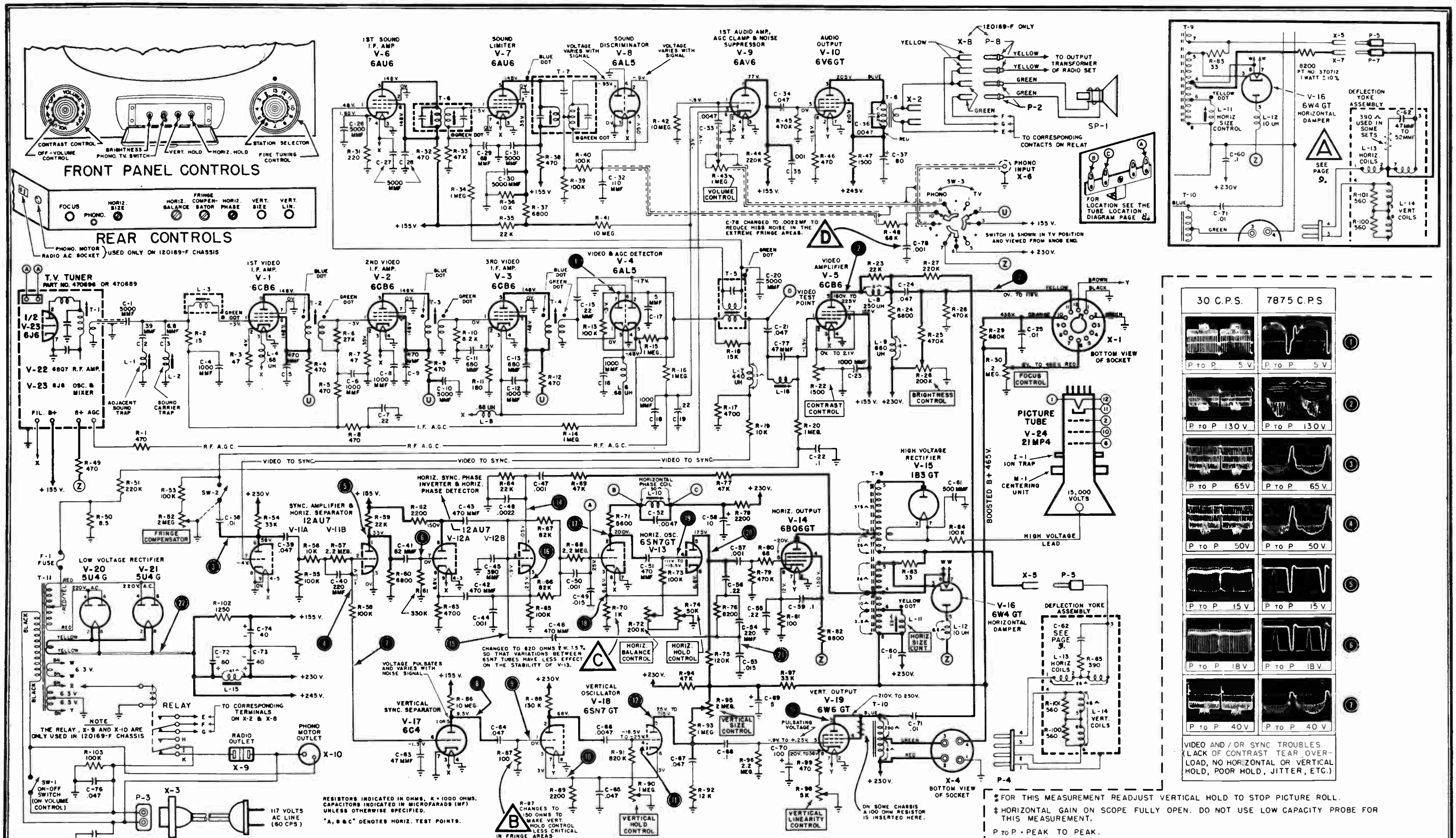
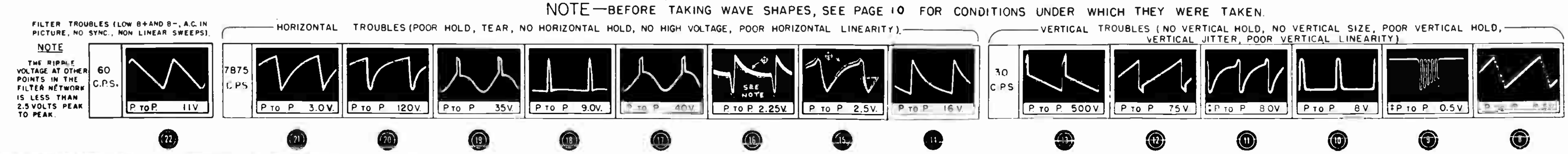
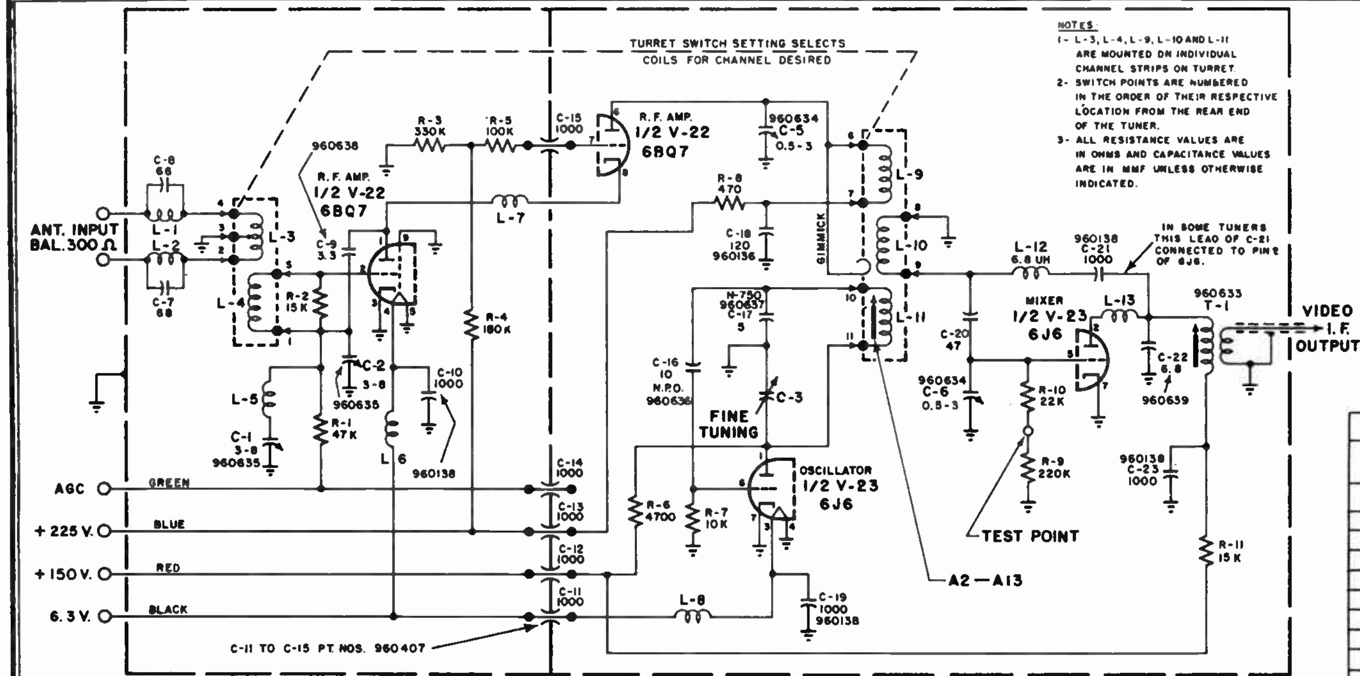


FIGURE-13 SCHEMATIC DIAGRAM CHASSIS 120169-B & 120169-F

NOTE—BEFORE TAKING WAVE SHAPES, SEE PAGE 10 FOR CONDITIONS UNDER WHICH THEY WERE TAKEN.





TUNER PART NO. 470696 or 470689

MECHANICAL PARTS CAN BE ORDERED BY NAMING PARTS FUNCTION AND NOTING THE TUNER PT. NO.

SCHEMATIC PART NO. 950219

Figure 14 - SCHEMATIC DIAGRAM OF TURRET TYPE TUNER USED ON CHASSIS 120169-B & F

REPAIR OF TUNERS

The majority of tuner troubles which are not due to defective tubes can usually be detected by a physical examination of the tuner (turret removed), such as burnt resistors, broken parts, bent or dirty contact fingers, cold solder joints, broken socket pins, etc.

If the tuner checks out physically it should then be checked according to the following trouble shooting chart.

It should always be borne in mind that a burnt tuner resistor is usually the result of a shorted condenser or tube.

The part numbers of items which are not generally commercially available are given on the tuner schematic. When replacing parts, leads should be kept as short as possible and components replaced in the same position as the original parts.

TUNER TROUBLE SHOOTING CHART

Measurements taken under same conditions as listed on top of Page 10. To take measurements from 6BQ7 socket, remove 6BQ7 tube but leave 6J6 tube in its socket, likewise when taking measurements from the 6J6 socket leave 6BQ7 tube in its socket.

	PIN NO.	NORMAL READINGS		POSSIBLE TROUBLES IF READINGS NOT NORMAL
		VOLTAGE	RESISTANCE	
6BQ7	Pin 1	OV.	INF.	(C-9, 3.3 mmf) shorted
	Pin 2	-2.7 V.	2 meg.	(R-2, 15K) or (R-1, 47K) open or shorted
	Pin 3	OV.	0 ^	Cold solder joint
	Pin 6	+215V.	18 K	(C-5) trimmer shorted, (C-18, C-13) shorted, (L-9) open, (R-8, 470 ohm) open or shorted
	Pin 7	+140 V.	260 K	(R-3, 330 K), (R-4, 180 K) or (R-5, 100 K) open or shorted, (C-15, 1000 mmf) shorted
	Pin 8	OV.	INF.	(C-9, 3.3 mmf) shorted
	Pin 9	OV.	9 ^	Cold solder joint

	PIN NO.	NORMAL READINGS		POSSIBLE TROUBLES IF READINGS NOT NORMAL
		VOLTAGE	RESISTANCE	
6J6	Pin 1	170 V.	20 K	(R-6, 4700 ohm) open or shorted, (C-12, 1000 mmf), (C-16, 10 mmf) or (C-17, 5 mmf) shorted
	Pin 2	172 V.	30 K	(L-13) open, (C-21, 1000 mmf), (C-22, 6.8 mmf) or (C-23, 1000 mmf) shorted, (R-11, 15 K) open or shorted
	Pin 5	OV.	240 K	
	Pin 6	OV.	9.5 K	(C-16, 10 MMF) shorted
	Pin 7	OV.	0 ^	Cold solder joint
	Test Point	-1 V. to -5 V.	250 K	Oscillator injection voltage varies between channels (low frequency channels have higher injection voltage about -4 v.)

T.V. CABINET PARTS LIST - CHASSIS 120169-B & 120169-F

PART NUMBERS						DESCRIPTION	LIST PRICE
MODEL 711F	MODEL 712F	MODEL 720D	MODEL 732B	MODEL 734B	MODEL 733F		
140459						Cabinet - Mahogany Table Model	82.00
	140460					Cabinet - Maple Table Model	88.00
		140487				Cabinet - Open Face Console or	109.00
		140487A				Cabinet - Open Face Console - Blonde	109.00
			140486			Cabinet - Console - Full Doors	158.00
				140492		Cabinet - Open Face Console	86.00
					140488	Cabinet - Console - Full Doors	185.00
460249	460249	460249	460249	460249	460249	Mask	5.20
520161	520161	520161	520161	520161	520161	Glass or	9.00
520162	520162			520162	520162	Glass	6.60
445023	445023					Rubber Feet	.10
460252	460252	460252	460252	460252	460252	Control Door	2.45
460318	460318	460318	460318	460318	460318	Control Door Escutcheon	Per
587088	587088	587088	587088	587088	587088	Spring - Door	Set
180041	180041					Speaker - 6"	4.70
					180094	Speaker - 6"	6.50
		180050	180050	180050		Speaker - 12" 3 1/2 oz. Magnet or	12.40
		180082	180082	180082		Speaker - 12" .97 oz. Magnet	9.60
560321	560321	560321	560321	560321	560321	Masonite Back	1.30
583206	583206	583206	583206	583206	583206	Line Cord	.80
460281	460281	460281	460281	460281	460281	Tube Protector Cup	.80
450138	450138	450138	450138	450138	450138	Knob - Contrast	.30
450137	450137	450137	450137	450137	450137	Knob - Fine Tuning	.30
450134	450134	450134	450134	450134	450134	Knob Shank - Off - Volume	.50
460262	460262	460262	460262	460262	460262	Knob Flange - Off - Volume	.35
450133	450133	450133	450133	450133	450133	Knob Shank - Selector	.50
460261	460261	460261	460261	460261	460261	Knob Flange - Selector	.35
275047	275047	275047	275047	275047	275047	Spring Washer - Knobs	.05
587012	587012	587012	587012	587012	587012	Spring Insert	.02
587011	587011	587011	587011	587011	587011	Spring Insert	.01
547516		547516	547516	547516	547516	Indicator Pin	.007
450034	450034	450034	450034	450034	450034	Knob - Phono - T.V.	.25

Prices subject to change without notice

PRODUCTION CHANGES

In the course of production various changes were incorporated in the order shown below. Changes as listed under a particular letter also include changes as listed under all previous letters unless otherwise noted.

Triangle Code Letter	F.S.B. No.	Supp. No.	Purpose
A	Service Note	O	See Schematic and Page 9.
B	Service Note	O	See Schematic
C	Service Note	O	See Schematic
D	Service Note	O	See Schematic

SUPPLEMENT NO. 1
MODEL – 742B
CHASSIS – 120169-B
MODEL – 720F
CHASSIS – 120169-D

Model Numbers	TV Chassis	Tube Size	TV Tuner
742B	120169-B	21MP4 (Metal-Rect.)	470689
720F	120169-D	21FP4A (Glass - Rect.)	470689

The model 720F is the same as the 720D except that it uses a 21 inch glass picture tube (21FP4A, chassis 120169-D) instead of a metal 21 inch picture tube (chassis 120169-B). The 120169-B & D chassis are identical except for the type of picture tube used.

With the exception of the cabinet parts list (below), all technical information pertaining to the models listed above will be found in the service note covering models 711F, 712F, 720D, 732B, 733F and 734B using chassis 120169-B & 120169-F

CABINET PARTS LIST FOR MODEL 742B

PART NO. MODEL 742B	DESCRIPTION	LIST PRICE
140510	Cabinet – Mahogany Open Face Console	120.00
140510A	Cabinet – Blonde Open Face Console	132.00
460249	Mask	5.20
520161	Glass Or	9.50
520179	Glass	9.50
440051	Rubber Channel For Glass	.12
460252	Control Door	2.45
460253	Control Door Escutcheon	per
587088	Spring For Door	set
180120	Speaker – 12"	8.90
560321	Masonite Back	1.30
583206	Line Cord	.80
411445	Tube Protector Cup	.60
450138	Knob – Contrast	.30
450137	Knob – Fine Tuning	.30
450134	Knob Shank –Off – Volume	.50
460262	Knob Flange – Off – Volume	.35
450133	Knob Shank – Selector	.50
460261	Knob Flange – Selector	.35
275047	Spring Washer – Knobs	.05
587012	Spring Insert	.02
587011	Spring Insert – 1/4 Shaft	.01
547516	Indicator Pin	.01

Prices Subject to change without notice.

READY FOR U.H.F.

As in all Emerson Television Receivers, this model provides for reception of all V.H.F. Stations as well as new U.H.F. Stations, by means of easily interchanged tuning strips or an external converter.

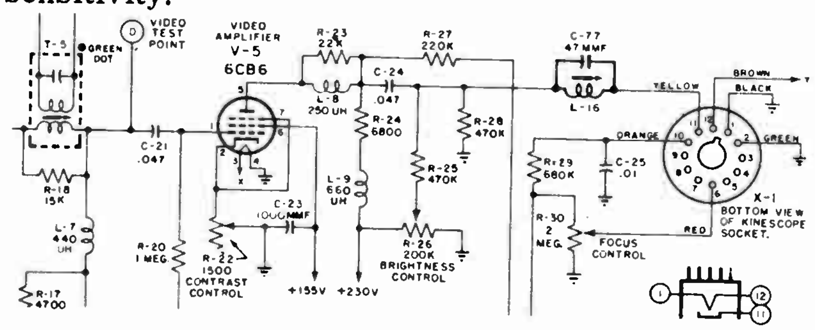
MODEL – 742B
CHASSIS – 120169-B

PRODUCTION CHANGES ON THE 120169-D CHASSIS

The Service Note covers production changes dealing with TRIANGLES A to D so for information concerning these changes, refer to schematic diagram in the Service Note.

△E Sets Coded TRIANGLE E have the 4.5 mc (L-16) trap electrically changed from the grid to the plate circuit of the video amplifier as shown below. The physical mounting of this trap remains the same.

This change has been incorporated to increase the 4.5 mc trap rejection ratio and increase the audio sensitivity.



The procedure for aligning this trap is now different from what is indicated. On all Chassis Coded TRIANGLE E or higher this trap should be aligned in the following manner:

a) Connect a crystal controlled 4.5 mc signal generator through a .01mf. condenser to the grid of the video amplifier tube (pin #1 of V-5 6CB6) low side to chassis.

b) Set contrast control for maximum contrast (fully clockwise).

c) Connect a V.T.V.M. (D.C. scale) through an R.F. probe to the cathode of the picture tube (pin #11 yellow lead) low side to chassis.

d) Adjust the 4.5 mc trap L-16 for minimum reading on the V.T.V.M.

If a crystal controlled generator is not available the video trap can be adjusted in the field by setting the fine tuning control for maximum 4.5 mc in picture and adjusting the 4.5 mc trap (L-16) until this 4.5 mc beat note is reduced. Be sure that video ringing is not introduced from this adjustment since this indicates the trap was aligned at too low a frequency.

SERVICE HINTS ON THE 120169-B, F & D CHASSIS

1) REPEATED FUSE FAILURE IN THESE CHASSIS - REPLACE WITH 1/2 AMP SLOW BLOWING TYPE FUSE. This condition can be caused by momentary arcs in tubes or components which occur intermittantly and soon heal themselves. These causes of fuse failure can be easily overcome by replacing the burnt out fuse with a 1/2 amp slow blowing type fuse.

2) LEAD DRESS TO PREVENT PICTURE WIGGLE ON CHASSIS BEARING NO TRIANGLE CODE.

a) The yellow lead to the cathode of the picture tube should be dressed away from the horizontal oscillator tube to prevent stray pickup of video information by the oscillator tube. This can be done by securing the yellow picture tube lead to the deflection yoke support bracket.

b) The white lead to the fringe compensator ON-OFF switch should be dressed away from the horizontal phase coil and the grid of the horizontal oscillator tube (V-13).

3) USE OF A 6BQ7A or 6BZ7 IN PLACE OF 6BQ7 ON TUNERS. The tuner used with this chassis may now incorporate either a 6BQ7, 6BQ7A or a 6BZ7 tube. These tubes are interchangeable but due to possible variations in interelectrode capacities, several tubes may have to be tried for best results.

GENERAL TUNER INFORMATION

In some tuners R-4 (180K) and R-3 (370K) may be changed to R-4 (150K) and R-3 (270K). Since the ratio of these resistors remain about the same there is no change in performance.

4) IMPROVEMENT OF SOUND IN THE FRINGE AREAS. Under certain conditions of reception or transmission, it may be advisable to touch up the alignment of the sound circuits in the field using an "on the air" TV station as the signal instead of the generator. By doing this, it is possible to improve the audio signal to noise ration.

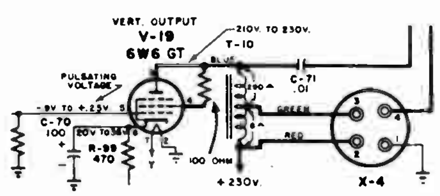
The Service Note shows how this can be done in the field. As a final step the sound transformers should be retouched (while listening to the sound) for best audio and minimum noise.

Chassis Coded TRIANGLES A to D can be further improved if desired, by either shorting out the 4.5 mc trap (jumper wire across L-16) or reconnecting the trap from the grid to the video amplifier plate circuit as shown under TRIANGLE E.

NOTE: If you short out the trap be sure to repeak the sound take-off transformer (T-5).

5) POPPING SOUND IN THE AUDIO WHEN PICTURE STARTS TO ROLL VERTICALLY OR WHEN THE VERTICAL HOLD CONTROL IS ADJUSTED.

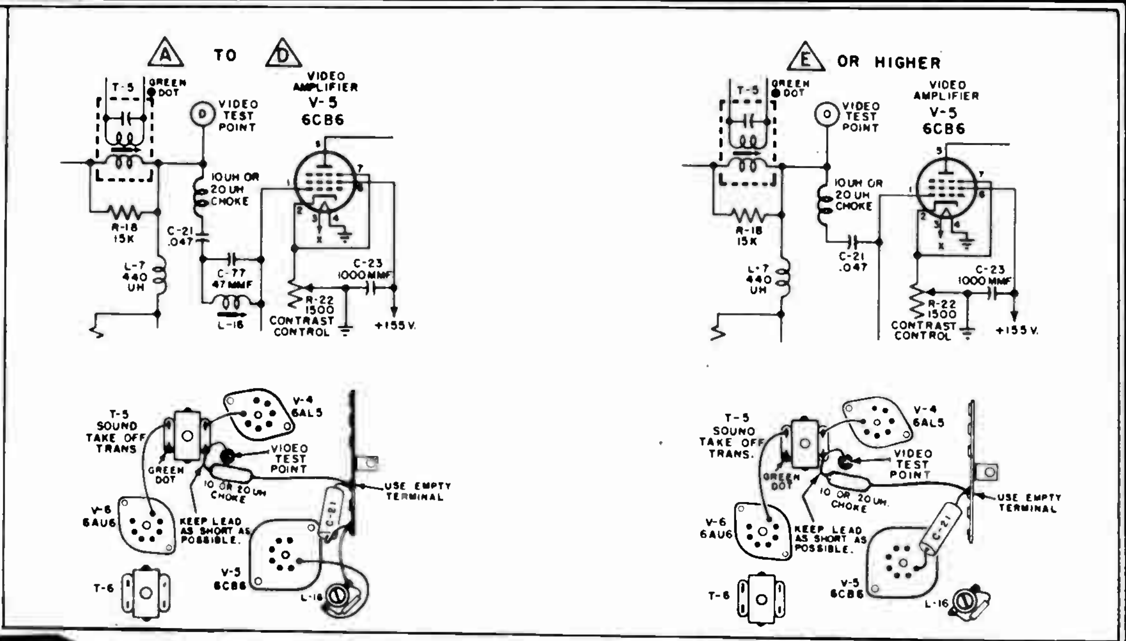
F



This can be eliminated by installing a 100 ohm 1/2 watt resistor between the plate and screen of the vertical output tube (V-19 6W6) as shown here and on schematic in Service Note. Above chassis incorporating this change are coded Triangle F.

6) BLACK HORIZONTAL STREAKS OVER PICTURE WHEN TUNED TO CHANNEL #6. This condition is usually only apparent in the fringe areas and is caused by harmonics of the picture I. F. which is generated in the video detector coupling to the front end, causing regeneration of certain frequencies. This condition is tunable with fine tuning and can sometimes effect Channels 5 or 7.

If this condition exists it can be easily eliminated by connecting a 10 uh R. F. choke part #705021 or a 20 uh R. F. choke part #705014 is series with the condenser (C-21) connected to the grid of the 6CB6 Video Amplifier Tube. This choke should be connected and dressed as shown below:



MODEL 752H

ALL CHANNEL
UHF-VHF RECEIVER

TV Chassis	Tube Size	TV Tuner
120169-H	21MP4 (Metal-Rect.)	470712-VHF 470713-UHF

Model 752H using chassis 120169-H is a 21" direct view television receiver which is designed to receive both V.H.F. channels 2 to 13 and U.H.F. channels 14 to 83.

Combination V.H.F. and U.H.F. tuning is achieved through the use of two tuners which are connected to the same tuning knobs making V.H.F. or U.H.F. channel tuning very simple. The V.H.F. cascode turret tuner has 13 positions (one more than the conventional type), 12 being used for V.H.F. reception, (Channels 2 to 13), while the 13th or U.H.F. position is used to activate the proper U.H.F. circuits and provides additional amplification for the converted 40 mc. U.H.F. signal. In this position, a window is provided to observe the continuous tuning of the U.H.F. channels.

This receiver incorporates a built in U.H.F. - V.H.F. antenna. It has provisions for connecting separate external V.H.F. and U.H.F. antennas, or a combination U.H.F.-V.H.F. antenna which uses a common lead in wire.

Except for the use of a special 13th position V.H.F. turret tuner and a separate U.H.F. continuous tuner and associated circuits, the 120169-H V.H.F.-U.H.F. chassis and the 120169-B V.H.F. chassis are the same. Refer to the Service Note on the 120169-B chassis for all information not included in this addendum service note.

GENERAL DESCRIPTION

The U.H.F. tuner in this chassis utilizes continuous tuning from Channels 14 to 83 and is mounted adjacent to the special V.H.F. cascode turret tuner. This V.H.F. tuner is special in that it is provided with 13 positions (Channels 2 to 13 and a U.H.F. position). The U.H.F. tuner is coupled to the fine tuning control of the V.H.F. tuner by a dial cord. This arrangement allows for simple tuning since both V.H.F. fine tuning and U.H.F. continuous tuning are accomplished by the same knob.

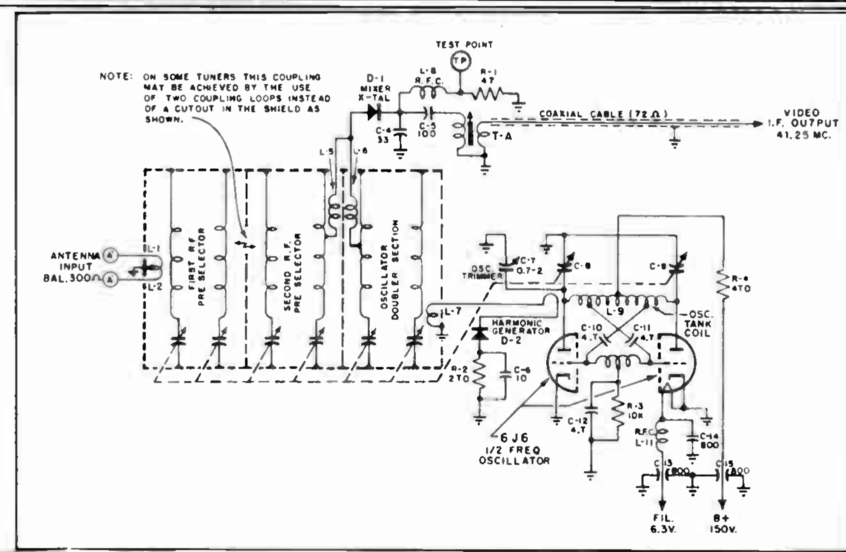
When tuned to V.H.F. (Channels 2 to 13) the U.H.F. tuner is inoperative and, therefore, the set performs as a conventional V.H.F. receiver.

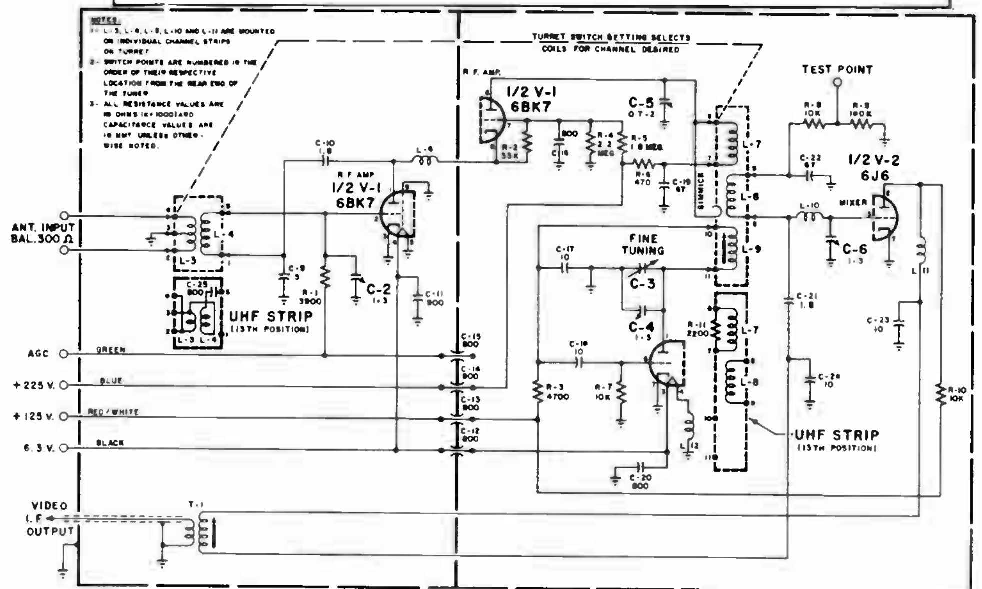
When the channel selector is set to the 13th or U.H.F. position, a window on the channel selector knob displays the U.H.F. channel calibration and a cam located on the V.H.F. turret tuner shaft activates a switch which performs the following functions:

1) Applies B+ to the U.H.F. tuner causing it to function.
2) Connects the V.H.F. or combination of V.H.F.-U.H.F. antenna to the input of the U.H.F. tuner providing one antenna lead in is used.
3) Disconnects the V.H.F. antenna from the V.H.F. tuner.
4) Connects the output of the U.H.F. tuner to the input of the V.H.F. tuner.

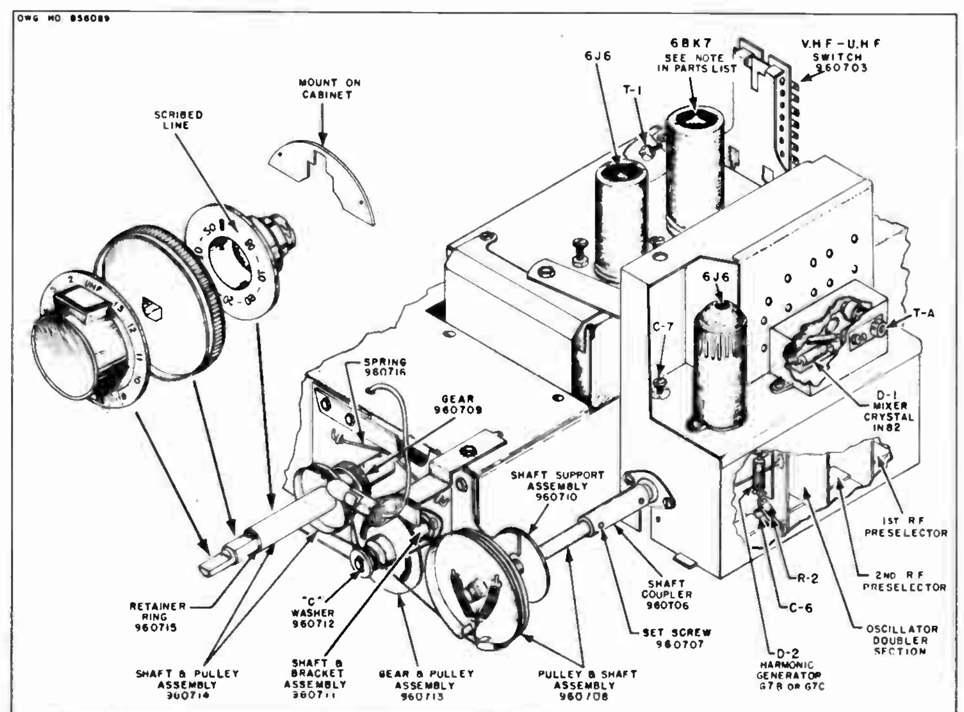
The U.H.F. tuning system is designed for a single conversion, therefore, the I.F. frequencies (40 mc range) are the same from both the V.H.F. and U.H.F. tuners.

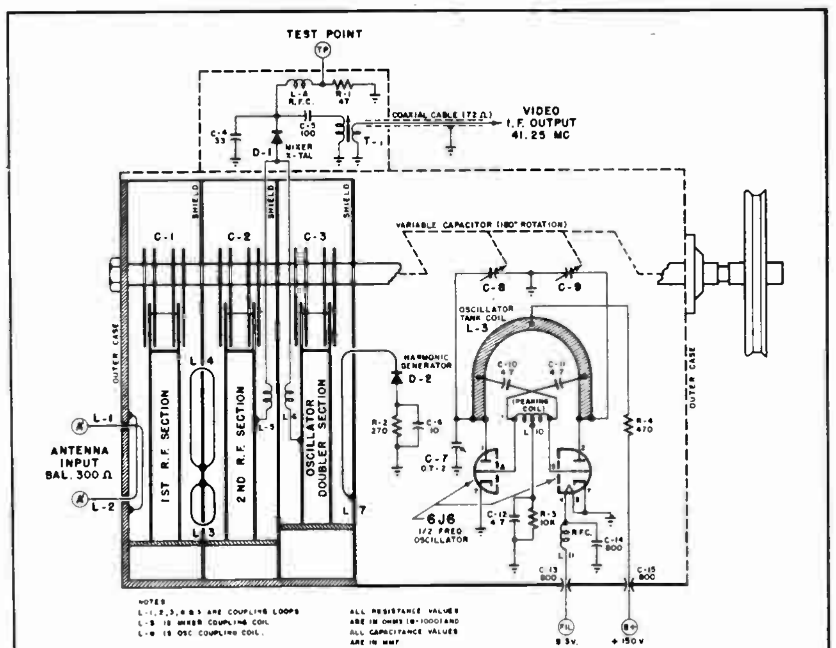
In the 13th or U.H.F. position, the turret tuner strips in the V.H.F. tuner are designed to accept 40 mc signals. This means that the 40 mc I.F. signal from the U.H.F. tuner will be further amplified by the V.H.F. tuner which acts as an additional two stage low noise cascode amplifier preceding the receiver's I.F. system.





TUNER PART NO. 470712 SCHEMATIC PART NO. 950246



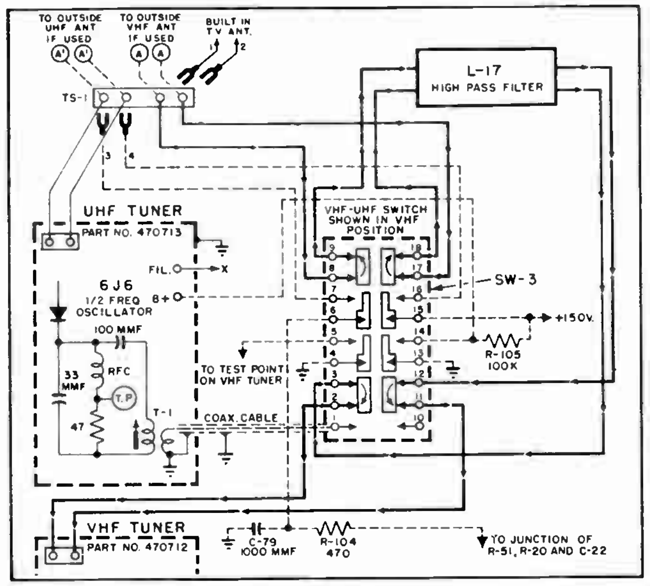


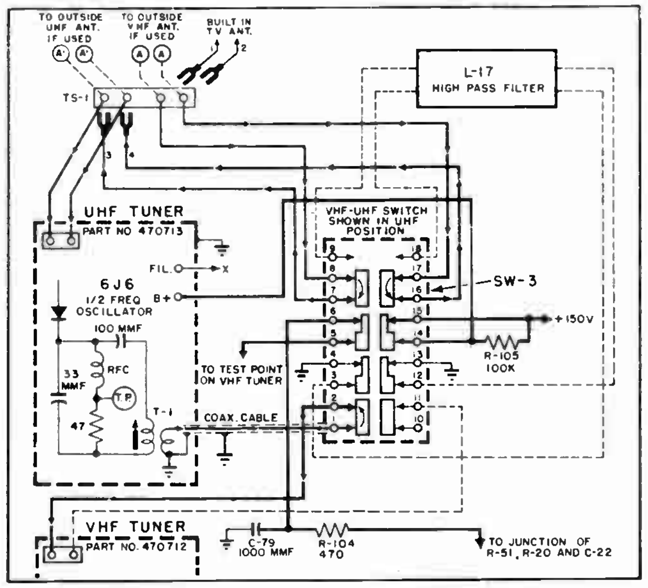
TUNER PART NO. 470713 SCHEMATIC PART NO. 950245

OPERATION OF VHF-UHF SWITCH

This switch is automatically operated by a cam located on the V.H.F. tuner shaft. This cam changes the switch from its V.H.F. position to U.H.F. whenever the V.H.F. tuner is set for U.H.F. operation.

The following diagram and description should make the operation of this switch clear.





VHF POSITION

The V.H.F. antenna is connected through the switch to the input of the high pass filter L-17. The output of this filter is connected to the input of the V.H.F. tuner through this same switch. B+ is supplied to the U.H.F. tuner through a 100K ohm resistor (R-105) preventing it from oscillating but allowing some current to flow through the 6J6 so that its cathode will not be poisoned during long periods of inoperation (V.H.F. reception).

UHF POSITION

The V.H.F. antenna or combination V.H.F.-U.H.F. antenna is disconnected from the V.H.F. tuner and connected to the input of the U.H.F. tuner through the switch and terminals 3 and 4 (providing they are connected. See installation instructions for more information). If a separate lead in is used for U.H.F., then terminals 3 and 4 should not be connected to the U.H.F. antenna terminals.

The single ended output of the U.H.F. tuner is fed through the switch to the input of the V.H.F. tuner.

The 100K resistor R-105 is shorted out by the switch so that full B+ is applied to the U.H.F. tuner.

Since the V.H.F. mixer tube functions as a 40 mc amplifier when tuned to U.H.F., fixed grid bias is applied to it (test point V.H.F. tuner) through the switch.

DESCRIPTION OF UHF TUNER

The tuned elements in this tuner are of the modified coaxial transmission line type. As you can see from the enclosed mechanical schematic, the U.H.F. incoming signal is tuned by means of two R.F. preselectors. These preselectors are quarter wave end tuned coaxial lines. Capacitive tuning is employed at the open ends to electrically adjust the line to 1/4 wave length and, therefore, effect a resonant condition at any frequency within the U.H.F. band. Two identical preselector circuits are coupled together to provide the proper band pass characteristic. The ganged variable capacitors adjust the two preselector lines and are similar to those used in conventional low frequency circuits. Each line is tuned by four rotor plates. Capacitor trimmers are located behind the coaxial line to preset the high frequency end of the R.F. preselectors. The antenna input in this tuner is coupled to the 1st preselector circuit and is designed to match a balanced 300 ohm transmission line. The output from the preselector stages is fed through an R.F. choke (L-5) to the mixer crystal D-1.

The U.H.F. local oscillator uses a 6J6 in a conventional push pull circuit using lumped circuit constants. This oscillator operates at 1/2 the desired frequency which greatly stabilizes the circuit and permits the use of a thoroughly field tested and debugged tube (6J6). The two outer oscillator capacitor plates are slotted to allow for factory corrections of pass band characteristics.

The output from this oscillator is loop coupled to the oscillator doubler section through L-7. A crystal diode (D-2) is employed in series with this coupling loop to provide rectification of the oscillator signal and thus effect more efficient doubling action. The output from this doubler is fed through L-6 to the mixer crystal D-1 where it beats with the preselected incoming U.H.F. signal. A picture I.F. of 45.75 mc and a sound I.F. of 41.25 mc are generated in this fashion. When the receiver is tuned to any V.H.F. channel a 100K ohm resistor is inserted in series with the B+ to the U.H.F. tuner as shown in the switch diagram on page three of this note. This is done to prevent weak operation of the U.H.F. oscillator after long periods of inoperation (set used on V.H.F.).

C-7 is used to set the high end of the oscillator and can be used in the field to compensate for slight variations in 6J6s. The range of this trimmer has been limited so as not to effect tuner tracking. Because of this, several 6J6s may have to be tried if adjustment of C-7 does not produce the desired results. Complete tuner shielding is provided to reduce oscillator radiation and stray pickup to a minimum.

The advantage of using a crystal mixer is its simplicity of design. Since a crystal generally has a higher conversion loss than V.H.F. mixer tubes, it becomes desirable to insert additional I.F. amplification so that the sensitivity of V.H.F. and U.H.F. will be of similar magnitudes.

This is accomplished by feeding the I.F. output from the U.H.F. tuner (T-A) to the input of the V.H.F. tuner. In the 13th or U.H.F. position, the V.H.F. tuner becomes a two stage low noise cascode I.F. amplifier. The tuner input changes from 300 ohm balanced to a 72 ohm unbalanced line to match the I.F. output of the U.H.F. tuner. Since this U.H.F. strip (13th position) does not have any coil section for the V.H.F. oscillator, plate voltage is removed from this section of the 6J6 tube causing it to be inoperative.

ALIGNMENT

The alignment of the tuner is factory set and will usually not require any additional adjustments other than to compensate for differences in 6J6 oscillator tubes. Because of this fact, the only adjustment to be made in the field is trimmer C-7 which is located next to the 6J6 oscillator tube.

This trimmer is normally set at the factory to track the highest U.H.F. Channel (83-). This must be done with a U.H.F. sweep and marker generator. In the field, however, this equipment is not readily available and C-7 should, therefore, be used to track the highest U.H.F. channel received in the area. It is usually best to try a few 6J6 tubes until one is found which more nearly resembles the original, thus requiring only a slight adjustment of C-7.

In the event T-A has been tampered with or replaced, it should be adjusted for best results on all U.H.F. channels received in the area. This I.F. sometimes has only a slight effect on the picture or sound.

Before doing any alignment on this U.H.F. tuner, whether in the field or shop, be sure that the V.H.F. I.F. and R.F. circuits have been properly set up. Information pertaining to this can be found in the Service Note to which this is an addendum.

GENERAL TROUBLE SHOOTING INFORMATION

Since the operation of this tuner is dependent almost entirely on its mechanical configuration, all component parts whether lumped constants or transmission line section, have been manufactured and mounted as rigid as possible. If it is necessary to replace a component, the exact replacement part should be used. Be sure it is mounted in the same position using the same lead lengths as the original. This is very important since at U.H.F. frequencies a small piece of wire has an appreciable inductance. Stray capacitances between components and chassis also tend to affect the circuit's operation to a marked degree.

Due to the simplicity of design and manufacture of this tuner, little trouble is to be expected. In the event that this tuner becomes defective in any way, the trouble shooting chart in this note can be used to good advantage.

If the crystal D-2 is open or shorted, or the oscillator is inoperative, there will be no bias developed across R-2. If replacing D-2 does not rectify this condition, then it can be assumed that the oscillator is not functioning. Be sure that the harmonic generator coupling loop (L-7) is not touching the shield. A voltage and resistance check of the 6J6 oscillator circuit should soon locate the trouble.

If the correct bias is measured across the R-2 and the set still operates poorly on U.H.F., then it can be assumed that the mixer crystal D-1 is defective in some way. This can easily be determined by lifting R-1 off chassis and inserting a D.C. milliammeter between it and chassis. In the event that the current readings are abnormally low or high, a new crystal known to be good should be inserted (see trouble shooting chart). If it is desired to localize the difficulty further, C-4 and, or C-5, can be disconnected. When soldering near crystals, be sure to use a small tipped, low wattage iron, placing the pliers between the crystal and the connection so as to absorb the heat thus protecting the crystal. This is important, since excessive heat can easily damage it.

Do not attempt to repair or adjust this tuner by adjusting any of the coupling loops or by moving various components. The only adjustment that can be made in the field is C-7 to compensate for a change in interelectrode capacities when a new 6J6 is used. The proper procedure for this is shown under alignment.

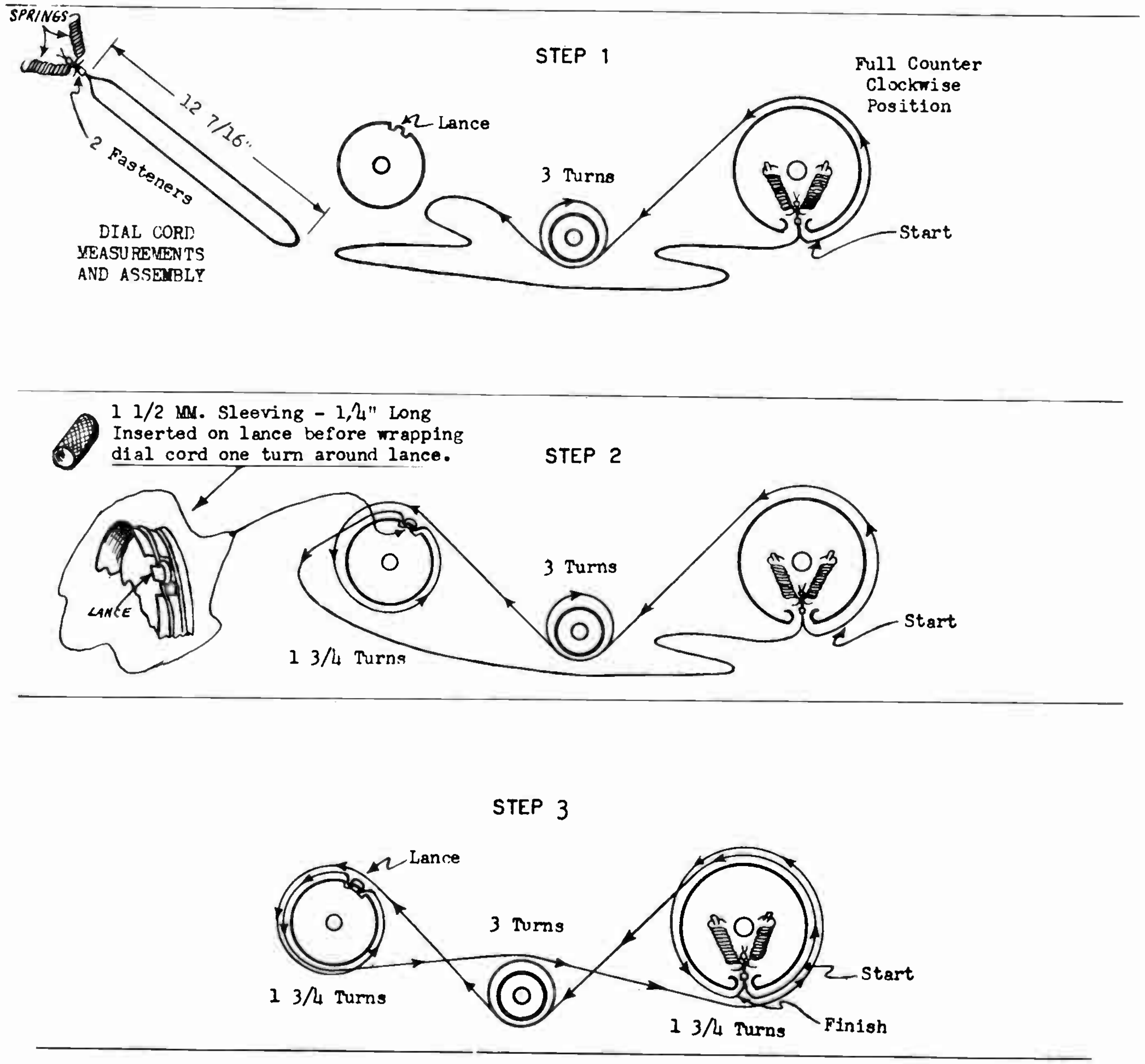
Components which are not a part of the R.F. or oscillator tuned circuits such as feed thru condensers, B+ resistors, T-A, etc., can usually be replaced with little difficulty providing the above precautions are observed.

NOTE: In the event that this tuner needs an over all alignment or service of parts, the defective tuner should be returned for repairs through your Emerson distributor.

TROUBLE SHOOTING CHART

Component		Variations Low to High Frequency	POSSIBLE TROUBLE (If voltage readings not normal)
	B+	+150V.	C-10, C-15, C-11 shorted, the V.H.F.-U.H.F. switch.
6J6	Filament	6.3V. A.C.	L-11 open, C-14, C-13 shorted.
	R-3	-20V. to -3V.	R-3 open, C-12 shorted, L-10 open or shorted.
D-2 Harmonic Gen. Crystal	R-2	±1.5V. to ±2.6V.	Crystal defective, L-7 shorted to chassis, C-7 shorted. Voltage polarity depends upon crystal polarity.
D-1 Mixer Crystal	Current thru R-1 Insert Milliammeter	0.6 thru 3.7 to 1.00 ma. (current)	D-1 defective, C-4 shorted, L-8 open.

DIAL CORD STRINGING



GENERAL V.H.F. INSTALLATION INSTRUCTIONS

(A) ANTENNA

This chassis is designed to operate from either its built in U.H.F.-V.H.F. antenna, an external combination U.H.F.-V.H.F. antenna or separate U.H.F. and V.H.F. antennas using one or two sets of antenna lead in wires.

The set as delivered is ready to operate from its built in U.H.F.-V.H.F. antenna. In most strong signal areas this will suffice.

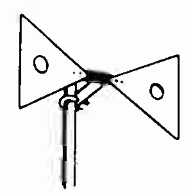
If it is necessary to install an external antenna, disconnect the built in one by removing the spade lugs (1 and 2) from the V.H.F. antenna terminals.

If one antenna lead in is used for both U.H.F. and V.H.F. reception, it should be connected to the V.H.F. input terminals. When the receiver is set for U.H.F. reception, the U.H.F.-V.H.F. switch automatically transfers the single antenna lead in to the input of the U.H.F. tuner removing it from the V.H.F. tuner. This transfer will only take place providing the jumper twin lead, connected to terminals 7 and 16 of the U.H.F.-V.H.F. switch is also connected to the U.H.F. input terminal strip by means of spade lugs 3 and 4.

If separate U.H.F. and, or V.H.F. antenna lead in wires are used, they should be connected to their respective antenna input terminals. Under these conditions, spade lugs 3 and 4 must be removed from the U.H.F. input antenna terminals.

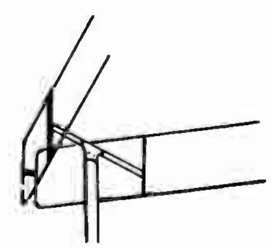
For new installations, it would be desirable and economical to install a combination U.H.F.-V.H.F. antenna providing, of course, that a V.H.F. station has been allocated to that area. In the event that the terrain is hilly or in a metropolitan area, ghosts may present quite a problem and it may be better to install separate U.H.F. and V.H.F. antennas. This may be necessary since combination antennas usually have poor directivity at U.H.F. Separate U.H.F. and V.H.F. antennas can be connected to one lead in if desired through a printed commercially available circuit filter.

U.H.F. ANTENNAS WHICH WILL TAKE CARE OF MOST PRESENT DAY INSTALLATIONS.



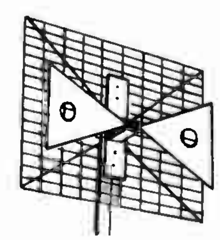
SINGLE BOW TIE

For use in strong signal areas where ghosts do not present a problem.



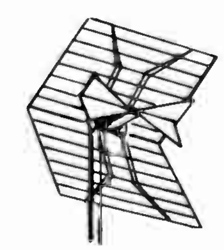
STACKED V

For use in weak signal areas where ghosts do not present much of a problem. Can also be used for strong V.H.F. signals.



BOW TIE SCREEN REFLECTOR

For use in weak signal areas where ghosts present a problem.



FOLDED BOW TIE CORNER REFLECTOR

For use in fringe areas where ghosts present a problem.

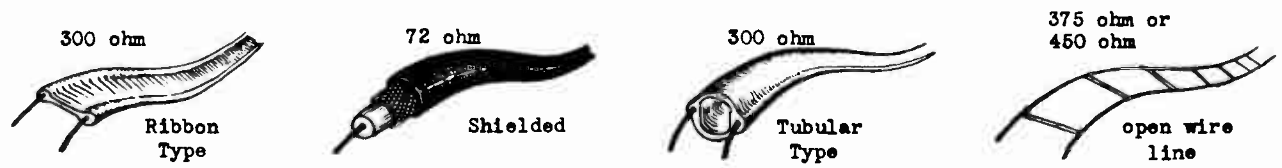
NOTE: All of the above four antennas will operate over all 70 U.H.F. channels.

In U.H.F. the use of free space terminals and rigid construction is an important detail. By free space terminals we mean air insulation between the terminals of each antenna section instead of bakelite or poly. The use of an insulation other than air, tends to collect moisture which creates a signal leakage path thus reducing the signal.

Since U.H.F. frequencies have relatively short wave lengths, rigid elements are very important. The slightest movement could easily become an appreciable part of a wave length which may affect signal pickup.

(B) ANTENNA WIRE

The common type 300 ohm ribbon line will work out satisfactorily only in strong signal areas, since when wet, line losses increase by almost 8 times at the high end of the U.H.F. band. The tubular 300 ohm line is much better in this respect as the leakage path is not as readily affected by moisture and can, therefore, be used in most signal areas. When wet, tubular line losses increase slightly more than two times at the high end of the U.H.F. band. In the extreme fringe areas the use of open wire line may be best, but it is more difficult to work with. Shielded 72 ohm or 300 ohm transmission line is not at all affected by weather conditions but these lines generally have a higher loss to start with and are comparatively expensive.



Transmission lines other than the shielded type should be mounted away (6 to 7 inches) from all nearby metal objects by use of stand-offs, as the closer these lines are to metal, the greater are the losses. In the event that it is impractical to use stand-offs, shielded lines such as RG-59U or RG-11U should be used. Never rest unshielded lines next to metal objects over any appreciable distance as losses will be exceptionally high and depend to a great extent on humidity variations.

If tubular line is used, be sure that the ends are sealed to prevent moisture from entering the line. This is easily done by heating the ends and pressing them together to form a good seal.

(C) HEIGHT AND ORIENTATION OF ANTENNAS AT U.H.F.

Since the wave lengths at U.H.F. are much shorter than at V.H.F., objects which did not appreciably reflect the V.H.F. wave will now reflect U.H.F. waves. Because of this, orientation and the use of directive antennas is much more important to minimize the pickup of reflected or ghost signals.

Another effect of these shorter wave lengths is to cause a more rapid variation of signal pickup with antenna height. Because of this fact, it is important that antenna height be probed for maximum signal pickup. A foot higher or lower may yield a marked increase in the signal pickup.

SETTING OF TUNING KNOBS

1) Make sure chassis has been adjusted in the cabinet so that the tuning shafts are perfectly centered through the cabinet hole.

2) Insert fine tuning knob on shaft and rotate fully counter clockwise (no further rotation of outer U.H.F. dial shaft).

3) Remove fine tuning knob and insert the U.H.F. dial (contains U.H.F. Channel #s) on U.H.F. dial shaft. Set the scribed line at 12 o'clock before placing on shaft. Do not twist or turn when inserting U.H.F. dial. The scribe line is a hair thickness and is located about 3/16" to the right of the heavy black line near 0 of Channel 20.

4) Place fine tuning and selector knobs on their respective shafts.

NOTE: Leave enough space between knobs so that there will not be any binding.

REPLACEMENT OF TUNERS

If it becomes necessary to return a U.H.F. tuner to your distributor for repair or replacement, remove and retain the extension shaft and pulley. When returning the V.H.F. tuner, remove and retain the V.H.F.-U.H.F. switch and the front plate which consists of a pulley and gear combination. This is important since replacement tuners will not come equipped with the above devices.

Under no conditions are both the V.H.F. and U.H.F. tuners to be returned as a unit. Before returning for replacement or repair, an honest effort should be made to repair the unit since all parts will be available through your Emerson distributor.

NEW PARTS

Part #	Description	Part #	Description
587040	Dial Cord Spring	470712	V.H.F. Tuner
541005	Dial Cord Fastener	470713	U.H.F. Tuner
530002	Dial Cord (specify length)	960703	V.H.F.-U.H.F. Switch
460424	Contrast Knob	817026	1N82 U.H.F. Mixer Crystal (D-1)
460423	Fine Tuning Knob	817027	G7B U.H.F. Harmonic
460422	On-Off Volume Knob		Gen. Crystal (D-2) or
460421	Channel Selector Knob	817028	G7C U.H.F. Harmonic
460425	U.H.F. Dial		Gen. Crystal (D-2)
565264	Fish Paper Mask for Dial	960704	T-A I.F. Coil on U.H.F. Tuner
	(mounted to cabinet)	960705	T-1 I.F. Coil on V.H.F. Tuner
547507	Escutcheon Pin for Mask	720173	High Pass Filter L-17

NOTE: The R.F. amplifier tube presently used is a 6BK7. In the future a 6BQ7, 6BQ7A or a 6BZ7 may be used. These three tubes are interchangeable, but due to possible variations in interelectrode capacities, several tubes may have to be tried for best results.

ADDENDUM SERVICE NOTE

NOTE: This information should be considered as part of the Service Note for models 711F, 712F, 720D, 732B, 733F and 734B using chassis 120169-B & 120169-F

G

June 1953

Supplement No. 2

Models - 767C, 771C

Chassis - 120169-B

Model Numbers	TV Chassis	Tube Size	TV Tuner
767C, 771C	120169-B	21MP4 (Metal-Rect.)	470689

With the exception of the cabinet parts list (below), all technical information pertaining to the models listed above will be found in the service note covering models 711F, 712F, 720D, 732B, 733F and 734B using chassis 120169-B & 120169-F

READY FOR U.H.F.

As in all Emerson Television Receivers, this Model provides for reception of all V.H.F. stations as well as new U.H.F. stations, by means of easily inter-changed tuning strips or an external converter.

Model 767C

Model 771C

CABINET PARTS LIST - MODELS 767C and 771C

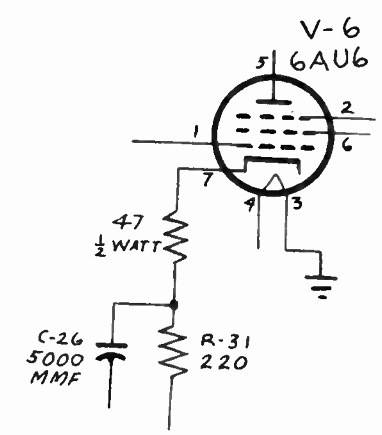
Part Numbers Model 767C	Part Numbers Model 771C	Description		List Price
140536		Cabinet - Open Face Console - Mahogany		
140536A		Cabinet - Open Face Console - Blonde		
	140537	Cabinet - Console with Doors - Mahogany		
	140537A	Cabinet - Console with Doors - Blonde		
520192	520192	Glass		200.00
460491A	460491A	Mask		9.00
411091	411091	Clips for Mask		4.70
411492	411492	Retaining Strip - Glass (side)		.05
411493	411493	Retaining Strip - Glass (top)		1.10
460252	460252	Control Door - Gold		1.10
460253	460253	Control Door Escutcheon - Gold	For 140536 and 140537 Cabinet	2.45 Per Set
587088	587088	Spring for Door		
460252B	460252B	Control Door - Mottled Ivory		
460253D	460253D	Control Door Escutcheon - Mottled Ivory	For 140536A and 140537A Cabinet	1.55 Per Set
587088	587088	Spring for Door		
460284		Emerson Emblem		.45
180120	180120	Speaker - 12"		8.90
560342	560342	Masonite Back		1.30
583206	583206	Line Cord		.80
411445	411445	Tube Protector Cup		.60
450138	450138	Knob - Contrast		.30
450137	450137	Knob - Fine Tuning		.30
450134	450134	Knob Shank - Off - Volume		.50
460262	460262	Knob Flange - Off - Volume		.35
450133	450133	Knob Shank - Selector		.50
460261	460261	Knob Flange - Selector		.35
275047	275047	Spring Washer - Knobs		.05
587012	587012	Spring Insert		.02
587011	587011	Spring Insert - 1/4" shaft		.01

Prices Subject to Change Without Notice

Production Changes on Chassis 120169-B

G 120169-B chassis coded Triangle G have the following change to reduce the detuning effect on the sound takeoff trap T-5 as a result of different signal levels. The advantage of this becomes apparent in "Fringe Areas."

Remove C-26 and R-31 from pin #7 V-6 (6AU6 1st sound I.F.) and insert a 47 ohm 1/2 watt resistor from junction of C-26 R-31 to pin #7



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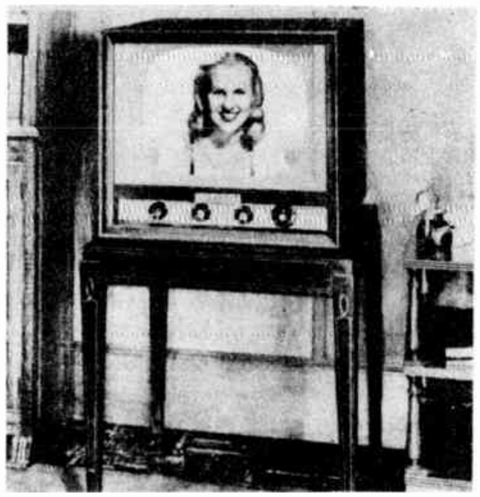
17T6



17T9

17C2

17C4

HIGH VOLTAGE WARNING

Operation of this receiver outside its cabinet or with covers removed involves a shock hazard from the power supplies. No work should be attempted on this receiver by anyone not thoroughly familiar with the precautions necessary when working on high voltage equipment.

CATHODE RAY TUBE HANDLING PRECAUTIONS

Extreme care must be used in handling the picture tube. The tube is highly evacuated and, due to its large size, is subjected to a considerable amount of atmospheric pressure. The handler should wear safety goggles and gloves for protection. Avoid nicking or scratching the glass by rough contact with other objects.

Before removing the picture tube, discharge the capacitor formed by the inner and outer aquadag coatings on the tube by shorting the anode contact on the side of the tube to the outer surface with a well insulated piece of wire.

GENERAL INFORMATION

TUNING RANGE: Channels 2 through 13.

SOUND RATIO DETECTOR AND SOUND I.F. FREQUENCY: 4.5 MC

PICTURE I.F. FREQUENCY: 26.1 MC

Channel Number	Channel Freq. Mc.	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	54-60	55.25	59.75	81.35
3	60-66	61.25	65.75	87.35
4	66-72	67.25	71.75	93.35
5	76-82	77.25	81.75	103.35
6	82-88	83.25	87.75	109.35
7	174-180	175.25	179.75	201.35
8	180-186	181.25	185.75	207.35
9	186-192	187.25	191.75	213.35
10	192-198	193.25	197.75	219.35
11	198-204	199.25	203.75	225.35
12	204-210	205.25	209.75	231.35
13	210-216	211.25	215.75	237.35

ANTENNA: "Built-in-Antenna" with provisions for connection of external antenna where necessary.

EXTERNAL ANTENNA IMPEDANCE: Balanced 300 ohms

POWER SUPPLY: 117 V. 60 cycles A.C.

POWER CONSUMPTION: 250 watts

AUDIO OUTPUT: 3.2 watts

TUBE COMPLEMENT

Symbol	Tube Used	
V1	6BQ7 or 6BK7	Cascode RF Amplifier
V3	6J6	Osc. Mixer
V4	6CB6	1st IF
V5	6CB6	2nd IF
V6	6CB6	3rd IF
V7A	½ 6AL5	Video Detector
V7B	½ 6AL5	A.G.C.
V8	6AG7 or 12BY7	Video Output
V9A	½ 12AU7	Sync. Separator
V9B	½ 12AU7	Sync. Clipper
V10	6AL5	Hor. Phase Detector
V11	6SN7-GT	Hor. Osc. & Discharge
V12	6CD6-G	Hor. Output
V13	6W4-GT	Damper
V14	1B3-GT	High Voltage Rectifier
V15	6S4	Vertical Output
V16	5U4-G	Low Voltage Rectifier
V17	5U4-G	Low Voltage Rectifier
V18A	½ 6SN7	Vertical Osc.
V18B	½ 6SN7	Sync. Inverter
V19	6K6-GT	Audio Output
V20A	½ 6T8	Audio Amplifier
V20B	½ 6T8	Ratio Detector
V21	6AU6	Ratio Det. Driver
V22	17BP4 or 17RP4	Picture Tube

INSTALLATION INSTRUCTIONS

SHIPPING BLOCK

The shipping block and bolt located on the top rear inside portion of the cabinet must be removed when the receiver is installed. Models 17C2, 17C4.

RECEIVER LOCATION

The receiver may be placed anywhere in the room, but for greatest satisfaction it should be located:

1. Away from any bright light that may fall directly on the screen or be reflected from it. This includes windows and lamps. Some illumination in the room, off to one side, is desirable to prevent eye-strain.

2. To provide comfortable viewing and ease in operation.

3. At least one inch away from a wall to allow for cabinet ventilation. This is very important.

ANTENNAS

The choice of a television antenna depends entirely upon the location of the receiver with respect to all television station transmitting antennas in any locality. Maximum pick-up is obtained when the receiving antenna is directly in line of sight with the transmitting antenna.

"BUILT-IN-ANTENNA"

The receiver is normally shipped with the FADA built-in-antenna connected. This antenna is a stationary folded dipole which is used for both the high and low frequency channels. It is fastened to the top underside of the cabinet, and connected to the antenna terminals on the back of the cabinet.

When this antenna is used, the following requirements should be observed for best reception:

1. In order to get maximum performance and satisfactory pictures from the "BUILT-IN-ANTENNA," ample signals from the television station must be present at the location of the receiver. Normally, the strength of the signals will vary throughout the room in which the receiver is located. For this reason, better pictures will be obtained if the receiver is tried in all possible locations in the viewing room and is then placed where the clearest pictures are received from all stations. Avoid large metallic objects, such as radiators, metal panels, etc.

2. Lamps, vases, and metallic objects, when placed on top of the receiver, may affect the efficiency of the "BUILT-IN-ANTENNA."

3. The Fada "BUILT-IN-ANTENNA" will give satisfactory reception in strong signal areas, but if the receiver is located in a fringe or weak signal area, an outdoor antenna is recommended.

OUTDOOR ANTENNA

The "BUILT-IN-ANTENNA" must be disconnected from the antenna terminal strip before connecting the outdoor antenna leads. It is immaterial which lead is connected to which terminal.

OPERATING INSTRUCTIONS

(Refer to Figure 1)

(1) Turn OFF-ON SOUND volume control clockwise about a half turn. This turns the receiver on and sets the sound volume to a reasonable level.

(2) Allow a brief warm-up period.

(3) Set Station Selector to desired channel.

(4) Adjust the Fine Tuning control to where music or speech is heard, assuming that the station is broadcasting.

(5) Turn picture control fully counter clockwise.

(6) Turn the brightness control fully clockwise and then slowly counter clockwise until light is just visible on the screen.

(7) Turn the picture control clockwise until activity or a definite form is just noted on the screen. Do not advance control any further until steps 8, 9, and 10 are completed.

(8) If the pattern is moving up or down adjust Vertical control until pattern is stationary in vertical direction.

(9) If picture appears as black and white diagonal lines or seems to be moving sideways, adjust Horizontal control until a proper picture is obtained.

(10) Readjust Fine Tuning control for best picture.

(11) Adjust Picture control until picture is suitable for brightness and contrast. If the control is advanced to maximum clockwise position, overloading of the picture will occur on strong signals. This will be noted by excessive contrast, bending of picture and raspy noise in the sound output. When this occurs rotate the picture control slowly in a counter clockwise direction until the picture and sound distortion disappears. The brightness and details of a picture are controlled by the Brightness and Picture knobs. Adjust Tone Control for desired quality of sound.

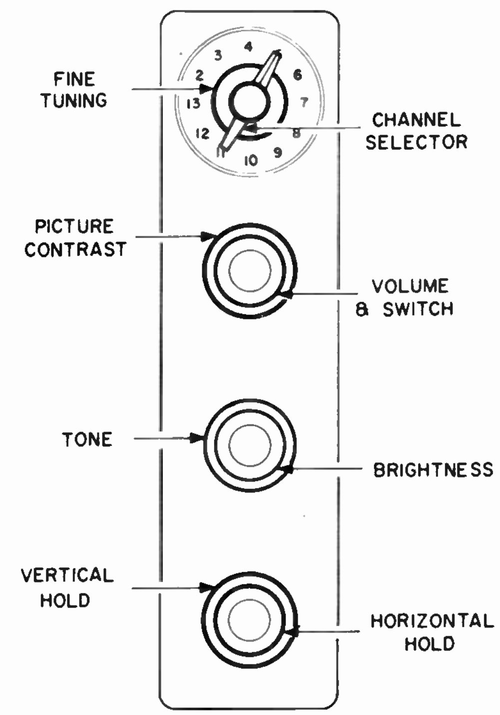
(12) Recheck the Fine Tuning control for best picture.

NOTE: If any difficulty is experienced with steps number 8 or 9, turn the PICTURE control ¼ turn counter clockwise, readjust the Fine Tuning control and then repeat these adjustments.

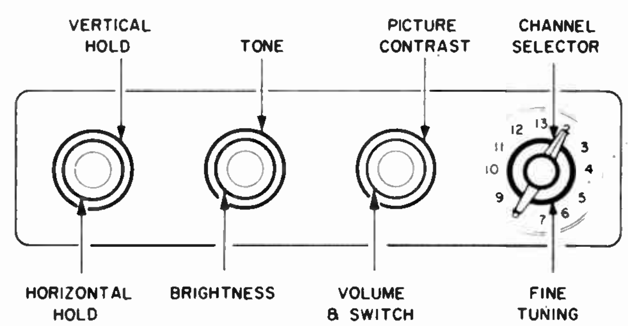
If the receiver has been in previous operation and no controls disturbed except for turning the on-off knob to "off" position, then subsequent operation should require the previous steps 1 through 3 and, if necessary, steps 13 and 14 as follows:

(13) Adjust the FINE TUNING control for best picture quality. Readjust the SOUND volume control to desired level.

(14) Adjust PICTURE and BRIGHTNESS controls to obtain desired level of contrast and brightness.



17C2 - 17C4



17T6 - 17T9

FIG. 1. OPERATING CONTROLS

SERVICE ADJUSTMENTS

The receiver is completely adjusted at the factory, so normally none other than the front panel operating instructions need be followed to put the receiver in operation. However, to provide for any misadjustment of the service controls due to handling, the following instructions are in order.

ION TRAP, FOCUSER AND DEFLECTION YOKE ADJUSTMENTS

Before any adjustments can be made the back of the cabinet will have to be removed. Remove all screws holding back cover to cabinet, and pull cover away from cabinet. Since the power cord circuit is broken by the interlock when the cabinet back is removed, an extra television power cord will be necessary to make a power connection to the receiver. A mirror placed in front of the receiver will help in making the adjustments.

FOR MAGNETIC FOCUS KINESCOPES:

ION TRAP ADJUSTMENTS

Turn on the receiver and switch to one of the television channels not in use in your area. With the brightness control in the maximum clockwise position and the picture control fully counter-clockwise adjust the ion trap by moving it forward or backward at the base of the tube, at the same time rotating it slightly around the neck of the cathode ray tube for the brightest raster on the screen. Reduce the brightness control setting until the raster is just visible on the screen, readjust the ion trap for maximum brilliance. Adjust the focuser adjustment control (shown in Figure 2 or 3) until the line structure of the raster is clearly visible. Readjust the ion trap for maximum raster brilliance. The final touches of the adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained.

FOCUSER MAGNET ADJUSTMENT

The focuser magnet should be adjusted so that there is approximately one-eighth inch of space between the rear shell of the deflection yoke and the front face of the focuser magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the focuser magnet should be parallel with the axis of the cathode ray tube neck. See Figure 2 or 3.

NOTE: The cardboard insert between the focuser magnet and the neck of the cathode ray tube must not be removed.

DEFLECTION YOKE ADJUSTMENT

If the lines of the raster are not horizontal or squared with the picture mask, loosen the yoke centering wing screw (shown in Figure 2, 3) and rotate the yoke until this condition is obtained. Tighten the wing screw making sure the deflection yoke is as far forward on the neck of the cathode ray tube as possible.

CENTERING ADJUSTMENTS

No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet as shown in Fig. 2 or 3. The centering plate has a locking screw which must be loosened before centering. Up and down adjustment of the plate moves the picture side to side and sidewise adjustment moves the picture up and down.

If a corner of the raster is shadowed, check the position of the ion trap. Reposition the ion trap within the range of maximum raster brightness to eliminate the shadow and recenter the picture by adjustment of the focus centering plate. In no case should the ion trap be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the cathode ray tube. In some cases it may be necessary to shift the position of the focuser magnet in order to eliminate a corner shadow.

FOR ELECTROSTATIC FOCUS KINESCOPES:

ION TRAP ADJUSTMENTS

Turn on the receiver and switch to one of the television channels not in use in your area. With the brightness control in the maximum clockwise position and the picture control fully counter-clockwise adjust the ion trap by moving it forwards or backwards at the base of the kinescope, at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen.

DEFLECTION YOKE ADJUSTMENT

If the lines of the raster are not horizontal or squared with the picture mask, loosen the yoke centering wing screw (shown in figure 4) and rotate the yoke until this condition is obtained. Tighten the wing screw making sure that the deflection yoke is as far forward on the neck of the cathode ray tube as possible.

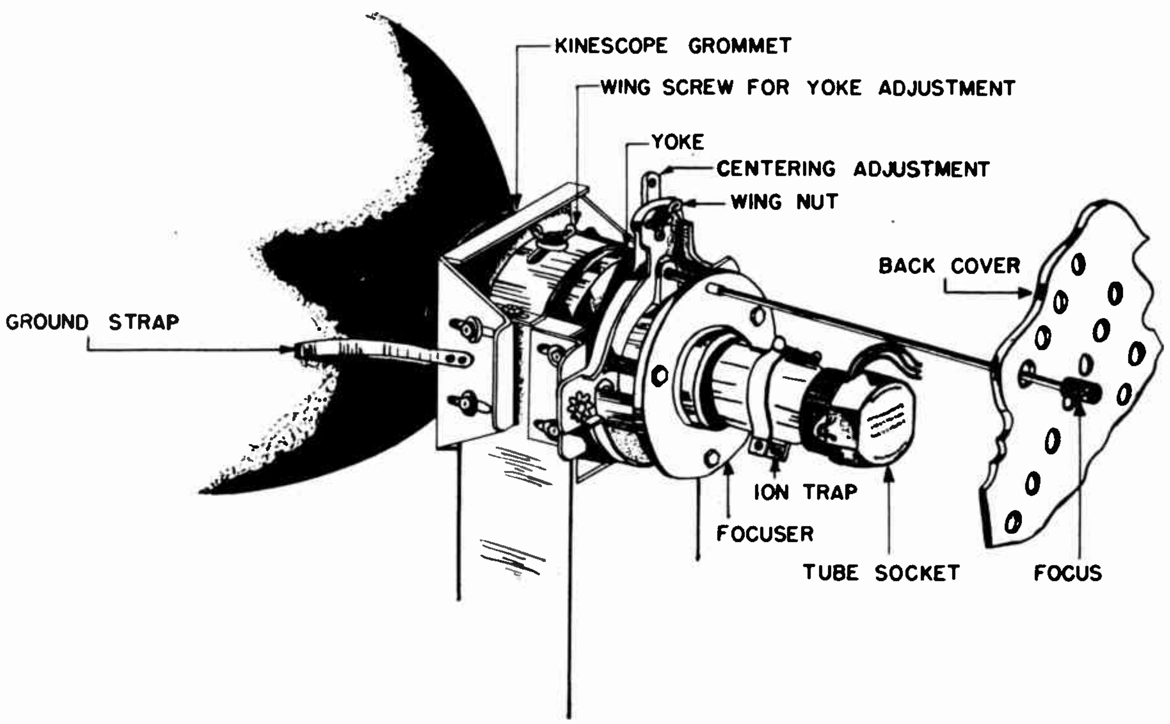


FIG. 2. SERVICE ADJUSTMENT AND CONTROLS
ELECTROMAGNETIC FOCUS KINESCOPES
17T6 — 17T9

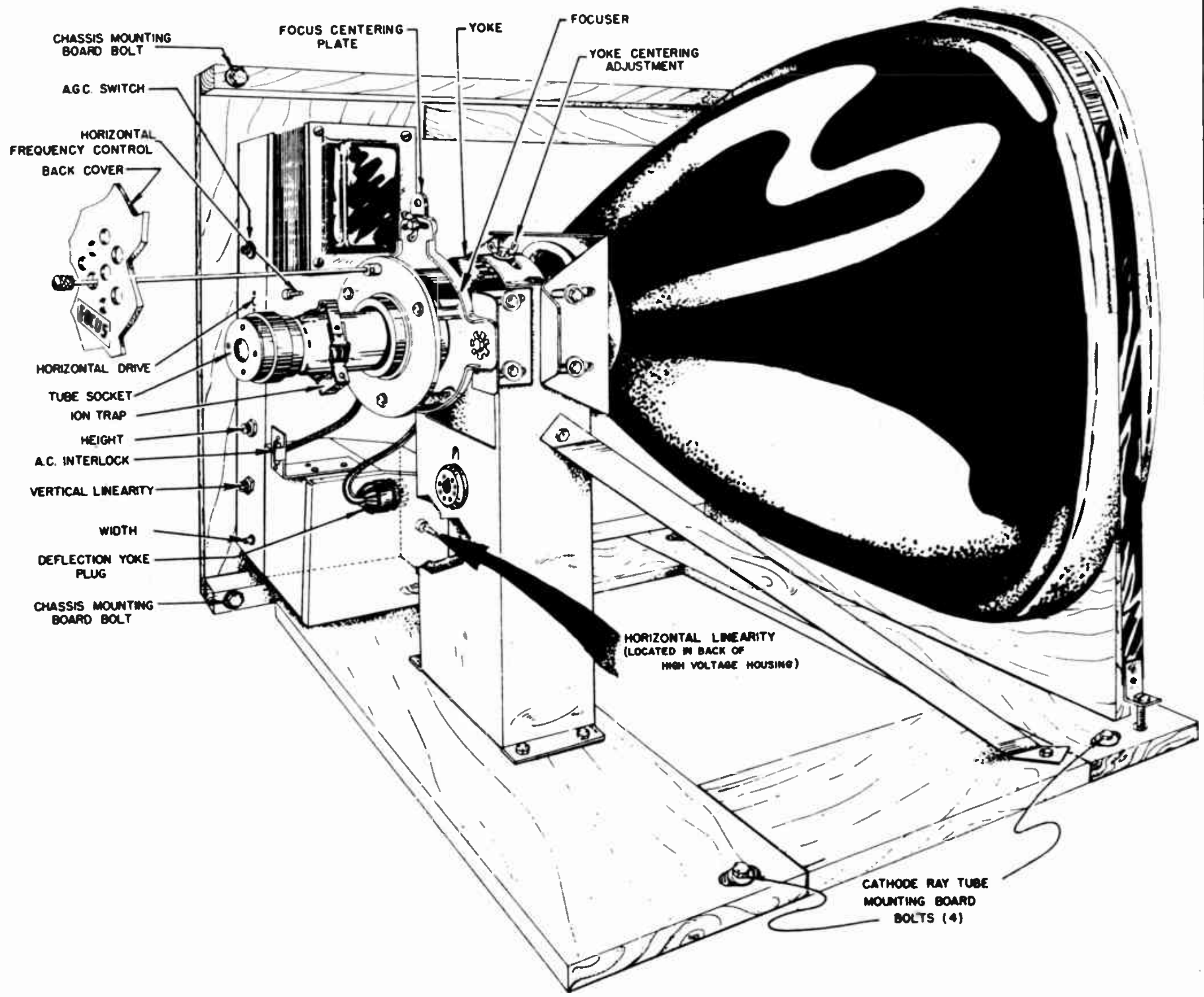


FIG. 3. SERVICE ADJUSTMENTS AND CONTROLS
ELECTROMAGNETIC FOCUS KINESCOPES
17C2 —17C4

CENTERING ADJUSTMENTS:

No electrical centering controls are provided. Centering is accomplished by the adjustment of a P.M. centering device located close to the back of the yoke (see figure 4). Two types of centering magnets are shown. With the rotatable magnet type, centering is achieved by rotating the entire unit as well as the centering control. With the contrarotatable magnet type, centering is achieved by rotating one magnet (or disc) with respect to the other. When the centering is satisfactory, readjust the ion trap for maximum raster brilliance keeping the brightness control at the maximum position with which good line focus can be maintained.

NOTE: As all electrostatic focus kinescopes used are essentially of the self-focus variety, good focusing will automatically be obtained throughout the life of the kinescope. In most receivers utilizing the electrostatic focus kinescope, there is a focus control (see figure 5) for optimizing the focus. See step No. 8 under Service Control Adjustments for adjusting this control.

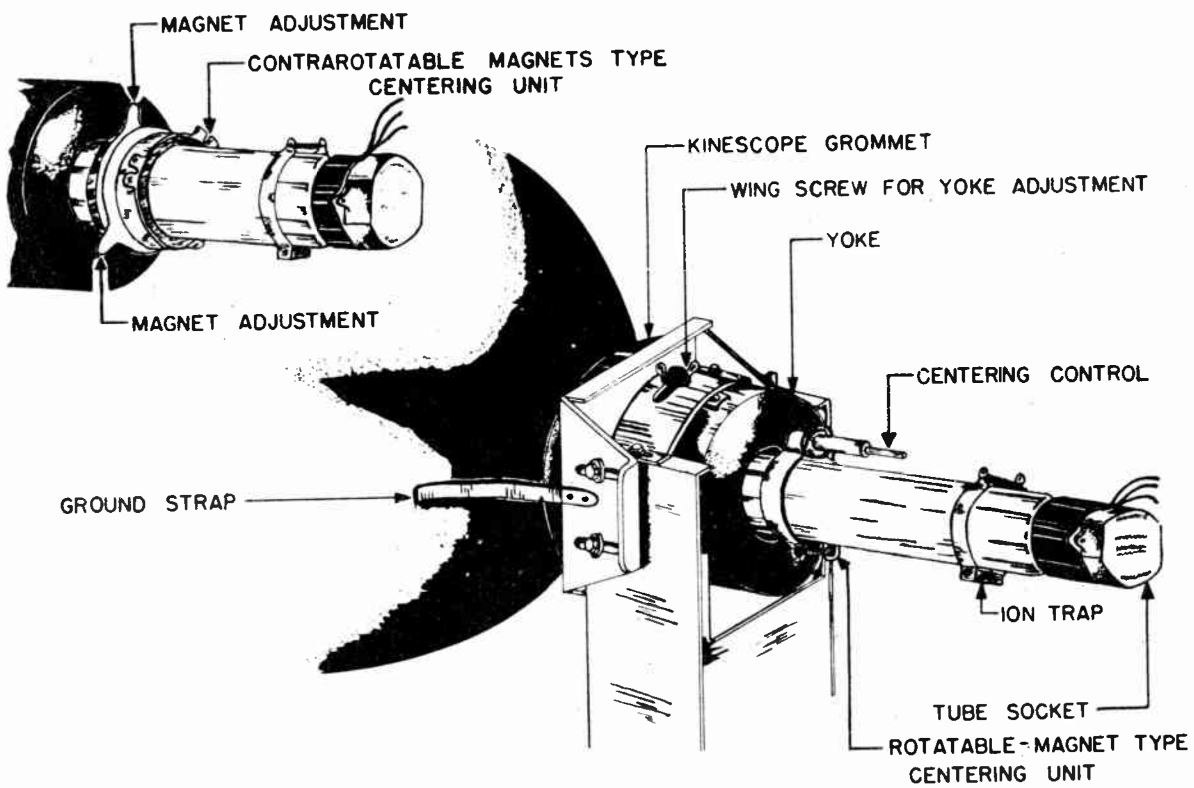


FIG. 4. SERVICE ADJUSTMENTS AND CONTROLS
ELECTROSTATIC FOCUS KINESCOPES
17T6 - 17T9 - 17C2 - 17C4

SERVICE CONTROL ADJUSTMENTS

With the deflection system in proper mechanical alignment, the service controls may be adjusted. The mechanical adjustments ordinarily will not require further attention until the cathode ray tube is replaced. Normal picture contrast and brightness should be maintained during adjustments with the AGC switch in its normal position (max. clockwise position). Using a test pattern from a local television station, make the service control adjustments as follows: (Refer to Figure 3 or 5.)

1. Set the horizontal and vertical hold controls on the front panel for a steady test pattern. If horizontal synchronization cannot be effected within the normal range of the horizontal hold control, set the control in the center of its range and adjust the horizontal frequency coil for a steady picture. This screw driver adjustment is reached from the top rear section of the chassis.

2. Set the picture control on the front panel to minimum, counter-clockwise, and advance the brightness control on the front panel clockwise to maximum. Fully open the horizontal drive trimmer adjustment located on the center rear apron of chassis. If no vertical white line appears in the center of the test pattern, leave it at full drive and proceed to the next step. If a vertical white line does appear in the center of the test pattern, gradually tighten up on the trimmer screw until the white line is eliminated. Insufficient horizontal drive will cause the raster to fall short of filling the mask horizontally or cause the picture to lack the brilliance normally obtained with a correct adjustment.

3. Reset the picture control for the desired picture contrast. If necessary, readjust the brightness control for a most desirable picture.

4. Set the width coil screw-driver adjustment so that the test pattern fills the kinescope mask horizontally. If necessary recenter the pattern.

5. Set the horizontal linearity coil screw-driver adjustment so that the test pattern is symmetrical from left to right. A slight readjustment of the horizontal drive may be necessary after making this adjustment.

6. Set the height control on the rear apron of the chassis so that the test pattern fills the kinescope mask vertically. Recenter the pattern if necessary.

7. Set the veterical linearity control on the rear apron of the chassis for a symmetrical test pattern vertically. A slight readjustment of the height control may be required after making this adjustment.

8. In receivers with electromagnetic focus kinescopes, set the brightness and picture controls for a normal test pattern and adjust the focus adjustment until the line horizontal line structure of the raster is clearly visible over the picture area. The control should be turned through the correct point several times so that optimum focus is obtained.

In receivers with electrostatic focus kinescopes, set the brightness and picture controls for a normal test pattern and adjust the focus control for the clearest horizontal and vertical wedges. Readjust the ion trap for maximum brightness.

TO REMOVE FRONT SAFETY GLASS ON MODEL 17T9 ONLY

The front glass may be removed to allow cleaning of its rear face and of the picture tube face.

The top edge of the glass fits into a groove on the inside surface at the top of the cabinet. The bottom edge rests on a metal bracket attached to the cabinet. The bracket is covered by a snap-on FADA nameplate.

Place fingers over top and bottom of the FADA nameplate and pull. The nameplate will snap off to expose two screws in the bracket. Press bracket in towards cabinet with one hand and remove the two screws with the other hand. After removing screws, hold the bottom edge of the glass with free hand. Remove bracket. While holding glass at bottom allow it to slide down gently, until its top edge comes below cabinet top. With other hand grasp top edge of glass and remove glass from cabinet.

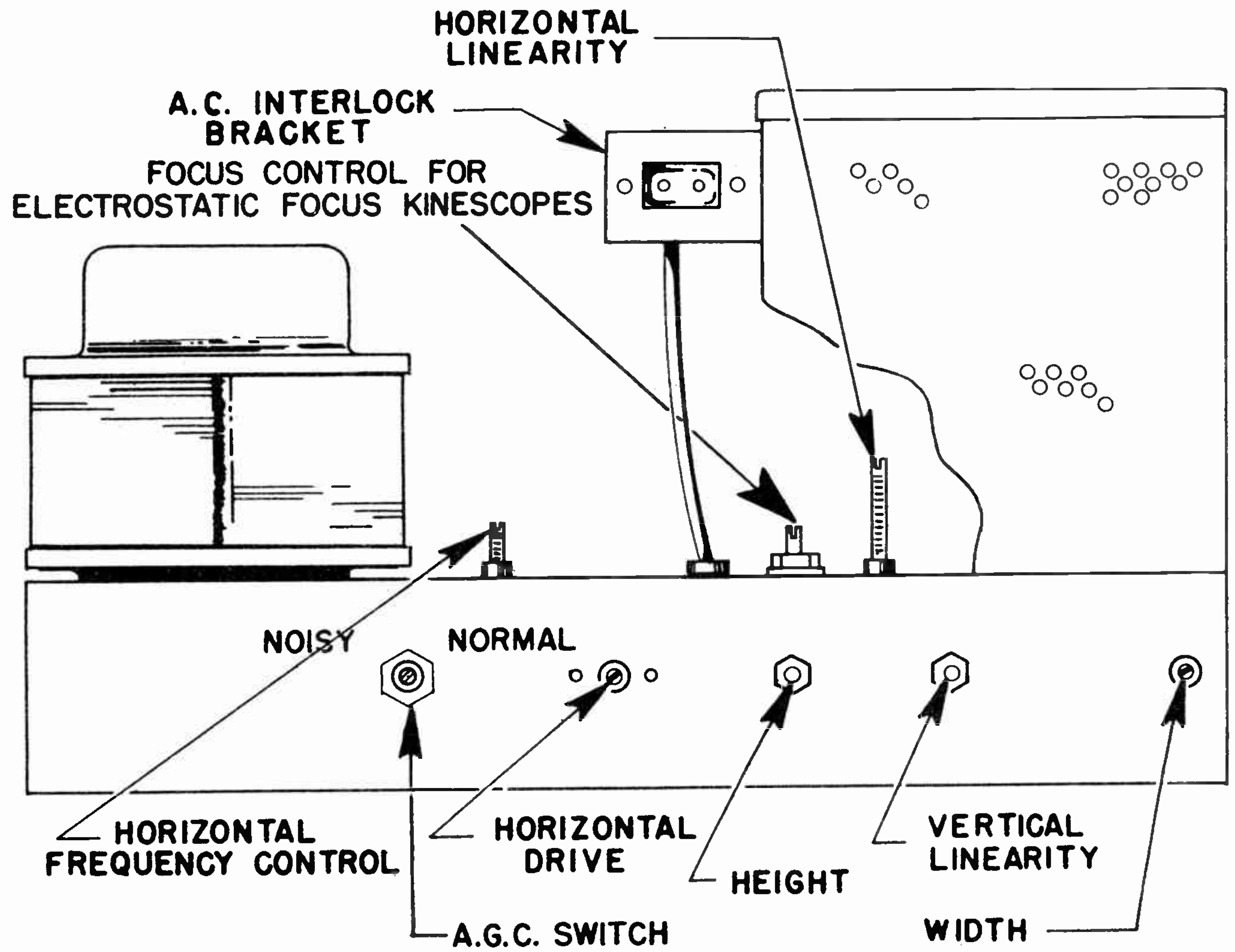


FIG. 5. SERVICE ADJUSTMENTS

ALIGNMENT

GENERAL

If the receiver must be aligned or some portion serviced, the chassis and kinescope must be removed from the cabinet. Remove the knobs from the front panel, remove all screws holding back cover to cabinet, and pull cover away from cabinet to disengage interlock. Remove the two screws holding the antenna terminal strip to cabinet. Remove speaker plug.

For table model receivers the chassis and kinescope must be removed as one unit. Remove the four chassis mounting bolts from the underside of the cabinet. Slide the chassis back out of the cabinet.

For console model receivers the chassis must be removed first and separately from the kinescope (see fig. 3). Disengage the kinescope socket, the kinescope high voltage lead, and the yoke plug. Remove the two bolts on the back top and bottom of the chassis mounting board. Slide the chassis board with chassis out of the cabinet. To remove the kinescope, remove the four bolts holding the tube mounting board to the cabinet and slide the complete assembly out of the cabinet.

EQUIPMENT REQUIRED

RF SWEEP GENERATOR meeting the following requirements:

(a) Frequency Ranges

18 to 30 mc	10 mc sweep width
40 to 90 mc	10 mc sweep width
170 to 225 mc	10 mc sweep width

(b) Output adjustable with at least 1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

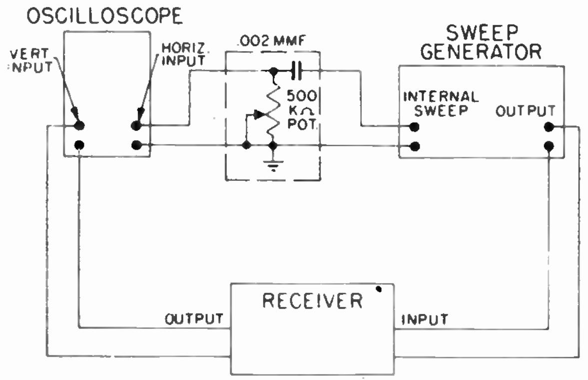


FIG. 6. SWEEP SETUP EXTERNAL PHASING

If the sweep generator does not have an internal blanking control or a phasing control, then it will be necessary to connect a phasing network between the sweep output of the sweep generator and the horizontal input to the oscilloscope. See Fig. 6 SWEEP-SET-UP EXTERNAL PHASING.

CATHODE RAY OSCILLOSCOPE preferably one with a wide band vertical deflection, input calibrating source, and a low capacity probe.

SIGNAL GENERATOR to cover all IF frequencies of from 4.5mc to 28mc and all picture and sound carrier frequencies.

ELECTRONIC VOLTMETER of Junior "Voltohmyst" type and a high voltage multiplier probe for use with this meter to permit measurements up to 20KV.

Bias supply made of batteries to give 4.5 volts.

ORDER OF ALIGNMENT

Sound Ratio Detector.

Sound IF Transformers.

Picture IF Transformers (preliminary and flat topping).

Oscillator and RF sections.

PRECAUTIONS

Before proceeding with IF Alignment, the following precautions should be observed:

Disconnect the antenna. Set picture control for minimum. Remove R.F. unit bottom shield. Remove channel 11 oscillator coil section. This is the coil strip nearest the fine-tuning control. Short the coil nearest the oscillator tuning slug, by soldering a bare wire across the coil terminals. Use extreme care so as not to short the oscillator coil to any other coil and also not to deform any of the coils. Reinsert channel 11 oscillator coil section and set R.F. unit to channel 11. Now the local oscillator is deactivated and you may proceed with the alignment without interference from local television stations.

For all IF Alignment, insert a 47K ohm resistor in series with the VTVM probe; also, a 47K ohm resistor should be inserted between the take-off point and the oscilloscope lead for decoupling.

SOUND RATIO DETECTOR AND IF ALIGNMENT

1. Connect probe of the VTVM to the diode plate of the ratio detector tube V20B (6T8, pin 2). Common to ground. See Figure 8.

2. Connect high side of the signal generator to the grid of the ratio detector driver. V21 (6AU6, pin 1). Common to ground. See Figure 8.

3. Tune the signal generator to exactly 4.5mc and attenuate the generator so it does not exceed 8 volts on the VTVM.

4. Peak L16 bottom core (FIG. 8) for maximum.

5. Peak L17 top core (FIG. 9) for maximum.

6. Adjust attenuator of signal generator to give exactly eight volts on the VTVM.

7. Move probe of VTVM to junction of R35, C28 and C29. (FIG. 8).

8. Adjust L17 top core (FIG. 9) for exactly 4 volts on the VTVM.

9. Move signal generator to video output tube V8 (6AG7, pin 4) (FIG. 8) and repeat steps number 1 and 3.

10. Peak L12 bottom (FIG. 8) and L13 top (FIG. 9) for maximum.

11. Repeat with care steps 1-3-4-5-6-7-8.

ALTERNATIVE PROCEDURE FOR STEPS 6-7-8:

1. Connect common lead of VTVM to junction of R33 and R34. (FIG. 8).

2. Connect probe of VTVM to junction of R35, C28, and C29. (FIG. 8).

3. Adjust L17 top (FIG. 9) for zero reading on the VTVM.

PICTURE I.F. (ROUGH ALIGNMENT)

1. Connect the bias battery as shown in fig. 8. The negative side of the bias battery to the junction of R4, R5, and C80, and the positive side to ground. Disconnect the white wire, that goes to the center terminal of the AGC switch (S2), from the junction of R4, R5, and C80. Connect the output of the signal generator between the test point on the R.F. unit (see fig. 9) and ground.

2. Connect the probe of the VTVM to the junction of L11 and R16 (fig. 8). Common to ground. When 12BY7 is used connect to junction of L11 and R118.

3. Set the signal generator to 21.6 mc. and adjust L25, co-channel sound trap, (fig. 9) for minimum output on V T V M.

4. Reset the signal generator to 23.25 mc. Adjust the output of the signal generator for approximately 2.5 volts on the VTVM.

5. Peak first Picture I.F. coil (located on R.F. Unit) and the third Picture I.F. coil L6 (fig. 9) for maximum. Maintain approximately 2.5 volts on the VTVM by adjusting the generator output.

6. Reset signal generator to 25.7 mc.

7. Peak second Picture I.F. coil L3 and the fourth Picture I.F. coil L9 (fig. 9) for maximum.

PICTURE I.F. (FLAT-TOPPING)

1. Remove signal generator and VTVM.

2. Connect the sweep generator between the R.F. test point and ground.

3. Connect the oscilloscope probe to the junction of L11 and R16 (or L11 and R118 in sets using 12BY7).

4. Connect the hot side of the signal generator to the chassis side apron nearest the first I.F. stage. Leave the ground side disconnected.

5. With most sweep generators, there is enough output to give an I.F. response curve of sufficient height on the oscilloscope. If there is insufficient output use 3 volts bias instead of 4.5 volts. In adjusting the output of the sweep generator, make sure you do not overload the I.F.'s. This can be ascertained by noticing that the relative shape of the I.F. response does not change with small variations in sweep generator output.

6. Set the signal generator to 26.1 mc. and advance the output until a marker pip is visible on the Picture I.F. curve on the oscilloscope. Be careful not to distort the I.F. curve by advancing the generator output too far. Adjust L3 and L9 so that the marker pip is at the 50% point. See Fig. 7 Picture I.F. curves and Markers.

7. Set the signal generator to 22.7 mc. Adjust the first Picture I.F. coil (located on the R.F. Tuner) and L6 so that the marker pip is at the 50% point. See Fig. 7.

8. Repeat steps 6 and 7 until an acceptable curve is achieved.

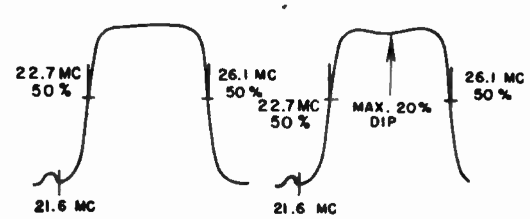


FIG. 7. TYPICAL PICTURE I.F. CURVES AND MARKERS

OSCILLATOR AND R.F. ALIGNMENT

The R.F. Unit is a turret type tuner with separate coil segments for each channel. Normal channel sequence is progressive in a clockwise direction covering channels 2 to 13. The R.F. amplifier is of the cascode type utilizing a 6BQ7 or 6BK7. The converter stage utilizes a 6J6.

OSCILLATOR ALIGNMENT

It should be possible to tune in all channels with the fine tuning control C212 (see figs. 8 and 9) in the middle third of its range. When V3 ages, the oscillator may shift slightly in frequency requiring adjustment. If V3 is defective and must be replaced, several tubes should be tried to find one that requires the least oscillator adjustment.

If an accurately calibrated signal generator that covers all the R.F. frequencies is available then continue with step 1. If not go on to step 10.

1. Remove tube shield on 6J6, V3.

2. Modify a tube shield which will fit snugly over the 6J6 and still remain ungrounded.

3. Remove shorting wire from channel 11 oscillator coil and replace segment and R.F. unit bottom shield.

4. Turn channel selector to channel 12.

5. Set generator to the oscillator frequency which is 231.35 mc. for channel 12.

6. With reference to figure 10 connect the generator to one of the 10 mmf capacitors and connect the other 10 mmf capacitor to the ungrounded tube shield over the 6J6. Connect remaining terminal on probe to vertical input on oscilloscope.

7. Set fine tuning control C212 (fig. 9) to center of its range. Adjust C211 for zero beat pattern on the oscilloscope screen. (The oscillator coil slug which is accessible from the chassis front apron should be in its mechanical mid-position. If the slug should fall in during adjustment, the oscillator coil segment will have to be removed from the turret housing, the little wire spring which normally fits into the slug threads lifted up, and the slug brought forward to its mean position.)

8. Reset the generator for the oscillator frequency of channel 11. Adjust the oscillator coil slug for zero beat on the oscilloscope screen. Use a non-metallic screw-driver in adjusting the oscillator coil slug.

9. Repeat step 8 for the remaining channels, making sure the signal generator is set for the proper frequency on each channel.

When an accurately calibrated generator is not available, then oscillator alignment can only be accomplished when the local T.V. transmitters are on the air.

10. Remove bias battery and replace AGC lead to junction of R4, R5, and C80 (fig. 8).

11. Set fine tuning control C212 (fig. 9) to center of its range.

12. Rotate channel selector control to one of the local T.V. stations and adjust the oscillator coil slug, which is accessible from the front chassis apron (fig. 9), for best picture.

13. Check remaining local stations by rotating the channel selector switch to each channel in turn and adjusting the oscillator slug for best picture.

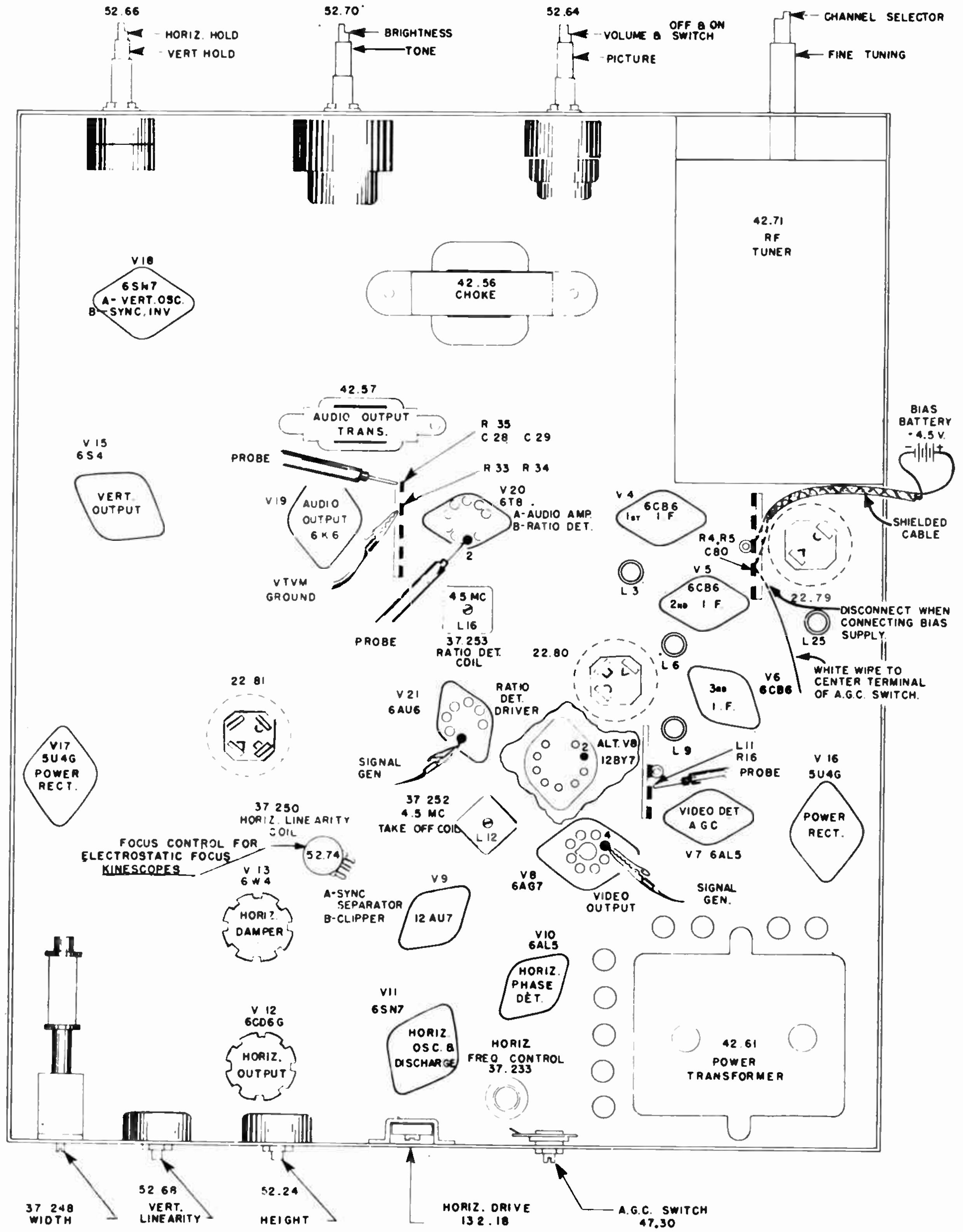


FIG. 8. BOTTOM VIEW OF CHASSIS

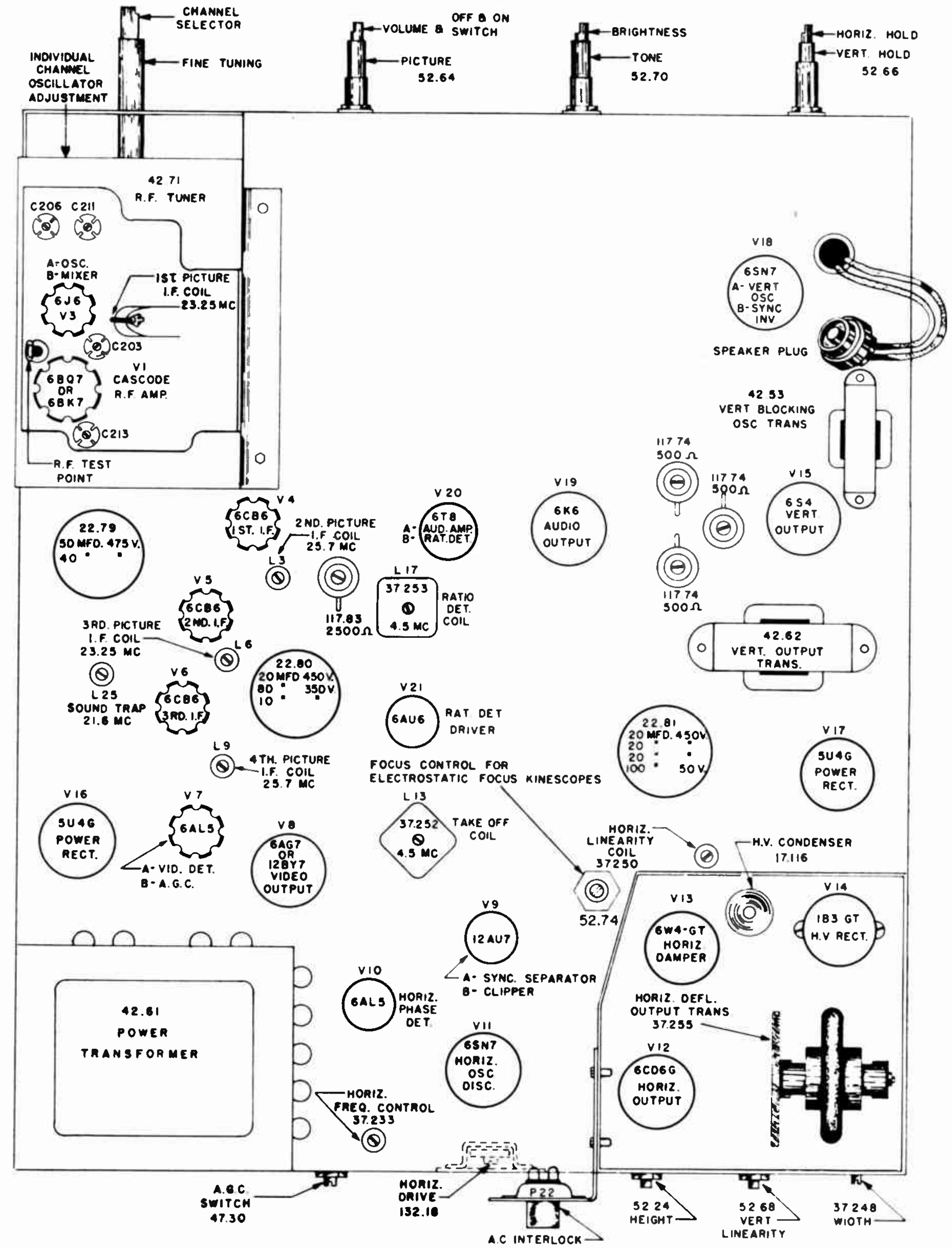


FIG. 9. TOP VIEW OF CHASSIS

14. If on one or two of the channels you do not have enough oscillator range, readjust C211 and repeat steps 12 and 13.

It is possible to adjust the oscillator channel slugs without removing the chassis from the cabinet. The slugs are made accessible by removing the channel selector and fine tuning knobs and by moving the escutcheon plate to one side. Use a long thin fibre or bakelite screwdriver for making adjustments.

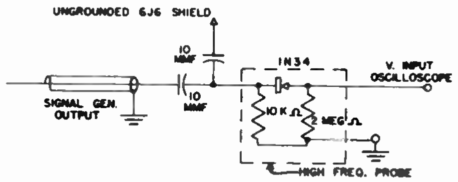


FIG. 10.

R.F. ALIGNMENT

1. Reconnect bias battery as in step 1. Picture I.F. (Rough alignment). Disconnect white AGC wire. Set bias for 3 volts.

2. Connect oscilloscope through 10,000 ohms to test point on R.F. Unit. Connect sweep generator to antenna terminals. If the sweep generator is not terminated for balanced 300 ohms, insert the network shown in fig. 11 below.

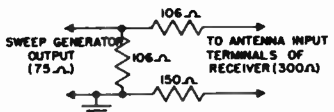


FIG. 11.

3. Set fine tuning control at approximately the midpoint of its tuning range and rotate channel selector to channel 12.

4. Adjust sweep generator to channel 12 and loosely couple signal generator to sweep generator in order to obtain picture carrier and sound carrier markers.

5. Adjust C206, C203, and C213 for flat top response curve. See figure 12 for acceptable R.F. passbands.

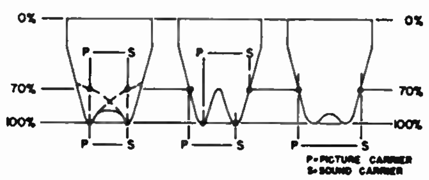
6. Check remaining channels. If the response curves obtained on any channel is not acceptable, it might be necessary to return to channel 12 and make a compromise of its response. If one channel is extremely out, that coil section should be repaired or replaced. It is not necessary to remove the tuner from the chassis in order to repair or replace a coil section.

"POWER PLUS" SWITCH, ITS FUNCTION AND USE

The new Fada television receiver with "Power Plus" control has been designed for optimum performance in all areas. This has been achieved by the utilization of two types of automatic gain control (AGC) circuits. The AGC circuit in use is controlled by the AGC "Power Plus" switch located on the rear apron of the receiver chassis.

In normal or strong signal areas, the AGC switch is rotated to its maximum clockwise position. This introduces a peak detector type of AGC which is fast acting, has good limiting and prevents overloading, all of which are desirable features for superior reception in these areas.

In weak and noisy signal areas, the AGC switch is rotated to its maximum counterclockwise position. This introduces an average detector type of AGC which is completely immune to the impulse type of noises prominent in weak signal areas. Another desirable feature of this type of AGC for weak signal areas is that a lower value of bias is developed for a fixed signal strength, thereby giving better noise factor and superior contrast. These characteristics give a picture which has a minimum of snow, which is free of noise, and which is free of horizontal and vertical jitter.



ACCEPTABLE R.F. PASSBAND
FIG. 12.

SERVICE SUGGESTIONS

No Raster Kinescope
Incorrect adjustment of ion trap magnet.
Defective Kinescope.
No high voltage. Check V11, V12, V13, V14. Check all voltages and waveforms associated with these tubes.
Incorrect setting of horizontal drive control (C51).
Check fuse F1.

Horizontal Deflection Only
Check V15, V18A, T5, T6, L18, L19, R60 and R66.
Check voltage and waveforms on grids and plates of V15, V18A.

Poor Horizontal Linearity
Check V12, V13, L21, L23, L24, C56, C57 and C58.

Small Raster
Low B or low line voltage.
Check V16 and V17.

Raster—No Sound No Picture with Control Over Brightness
Check V4, V5, V6, V7, V8 and their associated circuits.
Check R. F. Unit.

Raster — No Sound No Picture and No Control Over Brightness
Check 130 volts supply and R87.

Raster Picture and No Sound
Check V19, V20 A and B, V21.
Check alignment of L12, L13, L16, and L17.

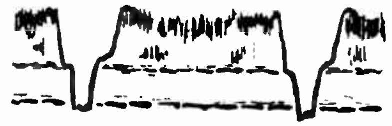
Poor or No Horizontal Sync.
Check for gassy Kinescope.
Check V9, V10, V18B and their associated circuits.

Poor or No Vertical Sync.
Check V9, V18B and their associated circuits.

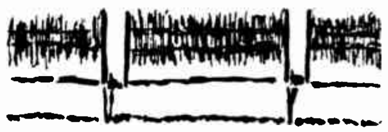
Picture Smear
Check Video peaking coils L10, L11, L14, and L15.
Check V7, V8, and their associated circuits.
Check video I. F. Alignment.

Arcing in High Voltage Supply
When replacing a component in the high voltage supply all soldered connections should be made round so that there are no sharp ends. This will eliminate any possibility of corona.

WAVE FORMS

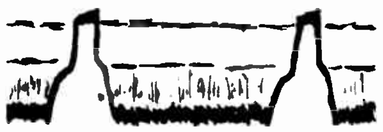


PIN 7 (V7A) 6AL5
VIDEO DETECTOR (HORIZ. SCOPE)
3 VOLTS PP



PIN 7 (V7A) 6AL5
VIDEO DETECTOR (VERT. SCOPE)
3 VOLTS PP

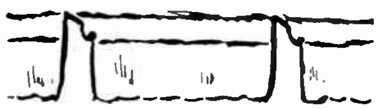
PIN 3 (V18B) 6SN7GT
SYNC. INVERTER (VERT. SCOPE)
25 VOLTS PP



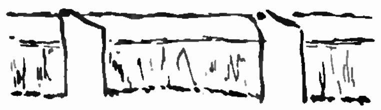
PIN 8 (V8) 6AG7
VIDEO OUTPUT (HORIZ. SCOPE)
65 VOLTS PP

PIN 8 (V8) 6AG7
VIDEO OUTPUT (VERT. SCOPE)
65 VOLTS PP

PIN 6 (V15) 6S4
VERTICAL OUTPUT
48 VOLTS PP

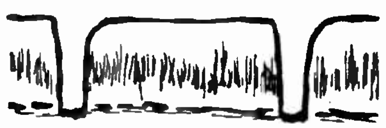


PIN 2 (V9A) 12AU7
SYNC. SEPARATOR (HORIZ. SCOPE)
45 VOLTS PP



PIN 2 (V9A) 12AU7
SYNC. SEPARATOR (VERT. SCOPE)
45 VOLTS PP

PIN 1 (V10) 6AL5
HORIZ. PHASE DETECTOR
20 VOLTS PP

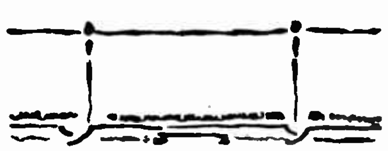


PIN 1 (V9A) 12AU7
SYNC. SEPARATOR (HORIZ. SCOPE)
16 VOLTS PP

PIN 1 (V9A) 12AU7
SYNC. SEPARATOR (VERT. SCOPE)
16 VOLTS PP

PIN 5 & 7 (V10) 6AL5
HORIZ. PHASE DETECTOR
16 VOLTS PP

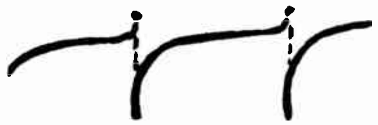
PIN 6 (V9B) 12AU7
SYNC. CLIPPER (HORIZ. SCOPE)
65 VOLTS PP



PIN 6 (V9B) 12AU7
SYNC. CLIPPER (VERT. SCOPE)
65 VOLTS PP

PIN 5 (V12) 6CD6G
HORIZ. OUTPUT
65 VOLTS PP

WAVE FORMS
(continued)



PIN 4 (V18A) 6SN7GT
VERTICAL OSCILLATOR
48 VOLTS PP

PIN 9 (V15) 6S4
VERTICAL OUTPUT
850 VOLTS PP

PIN 2 (V10) 6AL5
HORIZ. PHASE DETECTOR
20 VOLTS PP

PIN 2 (V11) 6SN7GT
HORIZ. OSC. & DISCHARGE
38 VOLTS PP

PIN 5 T4
HORIZ. WIDTH COIL
250 VOLTS PP

LIST OF PARTS

Symbol	Part No.	Description
C1	17.44	.005 mf Disc 500V
C2	17.44	.005 mf Disc 500V
C3	17.45	1500 mmf 20% 500V
C4	17.106	120 mf 20% 500V
C5	17.44	.005 mf Disc 500V
C6	17.44	.005 mf Disc 500V
C7	17.106	120 mmf 20% 500V
C8	17.44	.005 mf Disc 500V
C9	17.44	.005 mf Disc 500V
C10	17.106	120 mmf 20% 500V
C11	17.44	.005 mf Disc 500V
C12	12.49	.1 mf 20% 200V
C13	17.106	120 mmf 20% 500V
C14	17.44	.005 mf Disc 500V
C15	17.79	5 mmf 10% 500V
C16	12.72	.01 mf 20% 400V
C17	12.49	.1 mf 20% 200V
C18	17.107	470 mmf 10% 500V
C19	17.108	680 mmf 20% 500V
C20A	22.80D	20 mf 450V
C20B	22.80D	80 mf 350V
C20C	22.80D	10 mf 350V
C21	17.44	.005 mf Disc 500V
C22	17.131	3 mf 20% 500V
C23	17.105	39 mmf 20% 500V
C24	17.80	.01 mf Disc 500V
C25	17.125	620 mmf 10% 350V
C26	22.70	1 mf 150V
C27	12.68	.0047 mf 20% 400V
C28	12.72	.01 mf 20% 400V
C29	12.71	.0039 mf 20% 400V
C30	12.82	.022 mf 20% 400V
C31	22.66	25 mf 50V
C32	12.83	.0047 mf 20% 600V
C33	17.130	47 mmf 10% 500V
C34	17.127	2 mmf 25% 500V
C35	17.109	1000 mmf 10% 500V
C36	17.109	1000 mmf 10% 500V
C37	12.68	.0047 mf 20% 400V
C38	12.72	.01 mf 20% 400V
*C40	12.86	.002 mf 20% 400V
*C41	12.68	.0047 mf 20% 400V
*C42	12.68	.0047 mf 20% 400V
C43	12.75	.1 mf 20% 400V
C44	12.67	.047 mf 20% 400V
C45A	22.81	20 mf 450V
C45B	22.81	20 mf 450V
C45C	22.81	20 mf 450V
C45D	22.81	100 mf 50V
C46	17.113	.0039 mf 5% 500V
C47	12.67	.047 mf 20% 400V
C48	17.69	330 mmf 10% 500V
C49	17.38	390 mmf 10% 500V
C50	17.123	270 mmf 10% 500V
C51	132.18	25-280 mmf Ceramic Trimmer
C52	12.66	.047 mf 20% 600V
C53	22.56	5 mf 50V
C54	17.124	20 mmf 10% 1500V
C55	17.124	20 mmf 10% 1500V
C56	12.77	.22 mf 20% 400V
C57	12.67	.047 mf 20% 400V
C58	12.94	.033 mf 20% 400V
C59	12.77	.22 mf 20% 400V
C60	17.122	56 mmf 5% 1500V
C61	17.116	500 mmf 20,000V
C62A	22.79	50 mf 475V
C62B	22.79	40 mf 450V
C63	22.82	40 mf 450V
C65	17.136	.01 Dual Disc 500V
C66	17.136	.01 Dual Disc 500V
C69	12.68	.0047 mf 20% 400V
C70	12.75	.1 mf 20% 400V
C71	12.67	.047 mf 20% 400V
C72	12.82	.022 mf 20% 400V
C73	17.80	.01 mf Disc 500V
C74	12.92	.47 mf 20% 200V
C75	17.59	2 mmf 20% 500V
C76	12.60	.1 mf 20% 600V
C80	17.44	.005 mf Disc 350V
C84	12.115	.8 mf ± .05 mf 150V
C85	12.68	.0047 20% 400V
*C40 *C41 *C42	167.1	Vertical Integrator. Three capacitors in one unit, plus R46, R54, R55
R1	32.11	10 K ohms 10% ½ Watt
R2	32.197	47 ohms 10% ½ Watt
R3	32.2	100 ohms 10% ½ Watt
R4	32.67	330 ohms 10% ½ Watt
R5	32.77	8.2 K ohms 10% ½ Watt
R6	32.197	47 ohms 10% ½ Watt
R7	32.2	100 ohms 10% ½ Watt
R8	32.2	100 ohms 10% ½ Watt
R9	32.126	5.6 K ohms 10% ½ Watt
R10	32.118	120 ohms 10% ½ Watt
R11	32.2	100 ohms 10% ½ Watt
R12	32.33	1 megohm 10% ½ Watt
R13	32.35	680 K ohms 10% ½ Watt
R14	32.103	39 K ohms 10% 1 Watt
R15	32.33	1 megohm 10% ½ Watt
R16	32.77	8.2 K ohms 10% ½ Watt
R17	52.64	750 ohms tap at 250 ohms (contrast)
R18	32.125	82 ohms 10% ½ Watt
R19	32.103	39 K ohms 10% 1 Watt
R20	32.660	39 K ohms 10% 2 Watts
R21	117.80	5 K ohms 10% 10 Watts (Wirewound)
R22	32.660	39 K ohms 10% 2 Watts
R23	32.173	470 ohms 20% ½ Watt
R24	32.67	330 ohms 10% ½ Watt
R25	32.11	10 K ohms 10% ½ Watt
R30	32.15	47 K ohms 10% ½ Watt
R31	32.74	4.7 K ohms 10% 1 Watt
R33	32.13	22 K ohms 10% ½ Watt
R34	32.13	22 K ohms 10% ½ Watt
R35	32.12	15 K ohms 10% ½ Watt
R36	52.64	500 K ohms (Volume)
R37	32.99	10 megohms 20% ½ Watt
R38	32.18	220 K ohms 20% ½ Watt
R39	32.92	470 K ohms 10% ½ Watt
R40	32.115	680 ohms 10% 1 Watt
R41	32.399	470 ohms 10% 1 Watt
*R46	32.13	22 K ohms 10% ½ Watt
R49	32.39	100 K ohms 10% ½ Watt
R50	32.39	100 K ohms 10% ½ Watt
R51	32.98	4.7 megohms 10% ½ Watt
R52	32.92	470 K ohms 10% ½ Watt
*R54	32.77	8.2 K ohms 10% ½ Watt
*R55	32.77	8.2 K ohms 10% ½ Watt
R56	32.147	1.5 megohms 10% ½ Watt
R57	52.24	2.5 megohms (Height)
R58	32.33	1 megohm 10% ½ Watt
R59	32.34	2.2 megohms 10% ½ Watt
R60	52.66	1 megohm (Vertical Hold)
R61	32.15	47 K ohms 10% ½ Watt
R62	32.15	47 K ohms 10% ½ Watt
R63	32.77	8.2 K ohms 10% ½ Watt
R64	32.34	2.2 megohms 10% ½ Watt
R65	32.67	330 ohms 10% ½ Watt
R66	52.68	5 K ohms (Vertical Linearity)
R67	117.81	7.5 K ohms 10% 10 Watts (Wirewound)
R68	32.68	560 ohms 10% ½ Watt
R69	32.68	560 ohms 10% ½ Watt
R70	32.126	5.6 K ohms 10% ½ Watt
R71	32.89	100 K ohms 10% ½ Watt
R72	52.66	50 K ohms (Horizontal Hold)
R73	32.15	47 K ohms 10% ½ Watt
R74	32.263	1.2 K ohms 5% ½ Watt
R75	32.90	150 K ohms 10% ½ Watt
R76	32.92	470 K ohms 10% ½ Watt
R77	32.2	100 ohms 10% ½ Watt
R78	32.635	100 ohms 10% 2 Watts
R79	32.655	15 K ohms 10% 2 Watts
R80	117.71	17.5 K ohms 10% 10 Watts (Wirewound)
R81	32.62	3.3 ohms 10% ½ Watt
R82	32.373	100 K ohms 20% 1 Watt
R83	32.8	1 K ohm 10% ½ Watt
R85	117.74	500 ohms 20 Watts (Wirewound)
R86	117.74	500 ohms 20 Watts (Wirewound)
R87	117.83	2500 ohms 10% 25 Watts (Wirewound)
R90	32.10	6.8 K ohms 10% ½ Watt
R93	52.70	50 K ohms (Brightness)
R94	32.183	22 K ohms 20% ½ Watt
R95	32.15	47 K ohms 10% ½ Watt
R96	32.11	10 K ohms 10% ½ Watt
R97	32.103	39 K ohms 10% 1 Watt
R98	32.14	33 K ohms 10% ½ Watt
R99	32.208	1.8 megohms 10% ½ Watt
R100	32.208	1.8 megohms 10% ½ Watt
R101	32.60	2.2 K ohms 10% ½ Watt
R102	32.46	6.8 megohms 10% ½ Watt
R103	32.8	1 K ohm 10% ½ Watt
R104	32.60	2.2 K ohms 10% ½ Watt
R105	32.142	12 K ohms 10% ½ Watt
R106	32.411	68 K ohms 10% 1 Watt
R107	32.92	470 K ohms 10% ½ Watt
R108	32.205	330 K ohms 10% ½ Watt
R112	117.74	500 ohms 20 Watts (Wirewound)
R117	32.412	82 K ohms 10% 1 Watt
R118	32.126	5.6 K ohms 10% ½ Watt
R119	52.74	2.5 megohms 30% ½ Watt (Focus Control)
R120	52.70	500 K ohms (Tone)
*R46 *R54 *R55	167.1	Vertical Integrator. Three resistors in one unit, plus C40, C41, C42
L2	37.89	Filament Choke
L3	37.99	I.F. Coil
L4	37.89	Filament Choke
L5	37.197	I.F. Choke
L6	37.99	I.F. Coil
L7	37.89	Filament Choke
L8	37.197	I.F. Choke
L9	37.99	I.F. Coil
L10	37.234	Video Coil 120 uh
L11	37.235	Video Coil 600 uh
L12	37.252	4.5 Mc take-off Coil
L13	37.252	4.5 Mc take-off Coil
L14	37.236	Video Coil 190 uh + 18 K ohms
L15	37.237	Video Coil 245 uh
L16	37.253	4.5 Mc Ratio Detector
L17	37.253	4.5 Mc Ratio Detector
L18	37.261	Vertical Yoke Coil
L19	37.261	Vertical Yoke Coil
L20	37.233	Horizontal AFC Coil
L21	37.250	Horizontal Linearity Coil
L22	37.248	Horizontal Width Coil
L23	37.261	Horizontal Yoke Coil
L24	37.261	Horizontal Yoke Coil
L25	37.268	I.F. Sound Trap
T1	42.61	Power Transformer
T2	42.56	Choke
T4	37.255	Horizontal Defl. Output Trans.
T5	42.53	Vertical Osc. Transformer
T6	42.62	Vertical Output Transformer
T7	42.57	Audio Output Transformer
	42.71	R.F. Unit & Tubes

R.F. UNIT

CAPACITORS

Symbol	Description
C201	800 mmf. GMV. Disc Ceramic on centershield assembly
C202	1000 mmf GMV Ceramic
C203	0.5-3 mmf Ceramic Trimmer
C204	120 mmf 5% N750 Ceramic
C205	100 mmf 20% N750 Ceramic
C206	0.5-3 mmf Ceramic Trimmer
C207	10 mmf 5% NPO Ceramic
C208	10 mmf 5% N750 Ceramic
C209	2.2 mmf ± .25 mmf N330 ± 500 Ceramic
C210	20 mmf 10% NPO Ceramic
C211	0.5-3 mmf Ceramic Trimmer
C212	Fine Tuning Variable Capacitor
C213	3-9 mmf Ceramic Trimmer
C214, C215, C216, C217	800 mmf GMV Feed Thru Capacitors on Centershield Assembly
C218	120 mmf 10% N750 Ceramic
C219	1000 mmf GMV Ceramic

RESISTORS

Symbol	Description
R201	220 K ohms 20% ½ Watt
R202	180 K ohms 10% ½ Watt
R203	4.7 K ohms 10% ½ Watt
R204	1.0 K ohm 20% ½ Watt
R205	220 K ohms 20% ½ Watt
R206	10 K ohms 10% ½ Watt
R207	22 K ohms 20% ½ Watt
R208	47 K ohms 20% ½ Watt
R209	10 K ohms 10% ½ Watt
R210	10 K ohms 10% ½ Watt
R211	15 K ohms 20% ½ Watt

COILS

Symbol	Description
L201	Antenna Section, separate for each channel
L202	Antenna Section, separate for each channel
L203	R.F. Section, separate for each channel
L204	R.F. Section, separate for each channel
L205	R.F. Section, separate for each channel
L206	Heater Choke
L207	Neutralizing Coil
L208	Heater Choke
L209	Tuned I.F. Coil

MISCELLANEOUS

Description

Tube—6BK7/6BQ7

Tube—6J6

Model 17T9 Part No.	Model 17T6 Part No.	Description
92.544	92.498	Safety Glass
92.367	92.367	Bottom Plate for Cabinet
92.381-1	92.381-1	Escutcheon
92.114	92.114	Escutcheon Mtg. Spring
97.339	97.339	Grille Cloth
97.484	97.454	Cabinet
97.488	97.457	Cabinet Back
97.487	97.456-1	Mask
142.94	142.94	Knob—Outside Shaft
142.93	142.93	Knob—Inside Shaft
142.91	142.91	Knob—Channel Selector
142.92	142.92	Knob—Fine Tuning
107.46	107.46	Speaker
102.700	92.375	Nameplate
62.389		Nameplate Mtg. Bracket

Model 17C2 Part No.	Model 17C4 Part No.	Description
92.517	92.463	Safety Glass
92.518	92.474	Bottom Plate for Cabinet
92.504-1	92.504-1	Escutcheon
92.114	92.114	Escutcheon Mtg Spring
97.468	97.418	Grille Cloth
97.453	97.407	Cabinet
97.466	97.466	Cabinet Back
97.465-2	97.417-1	Mask
142.94	142.94	Knob--Outside Shaft
142.93	142.93	Knob—Inside Shaft
142.91	142.91	Knob—Channel Selector
142.92	142.92	Knob—Fine Tuning
107.47	107.47	Speaker
92.375	92.375	Nameplate

When Electromagnetic Focus Kinescope is Used

ALL MODELS

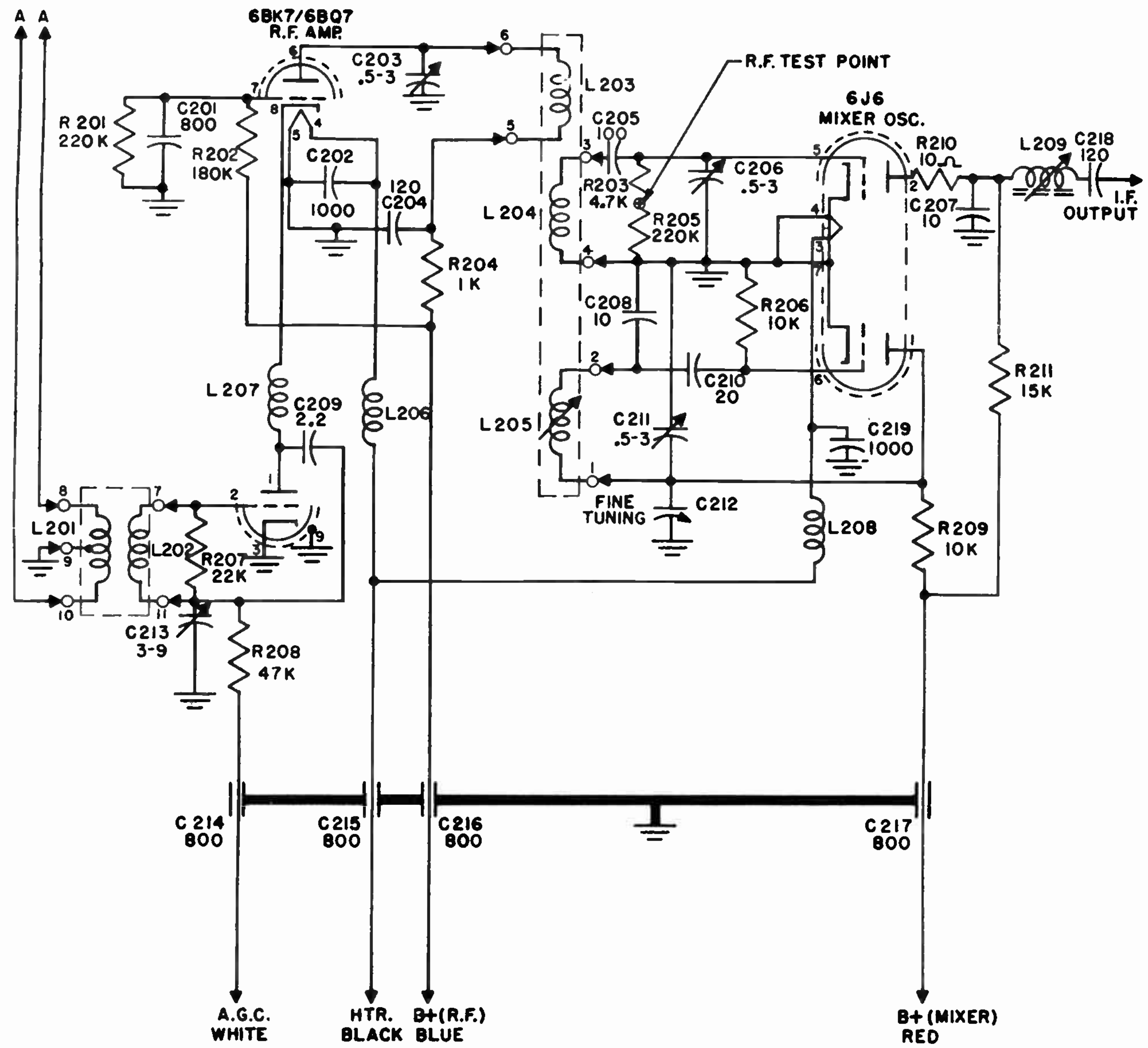
Picture Tube	17BP4
Ion Trap	112.23
Focalizer	112.26

When Electrostatic Focus Kinescope is Used

ALL MODELS

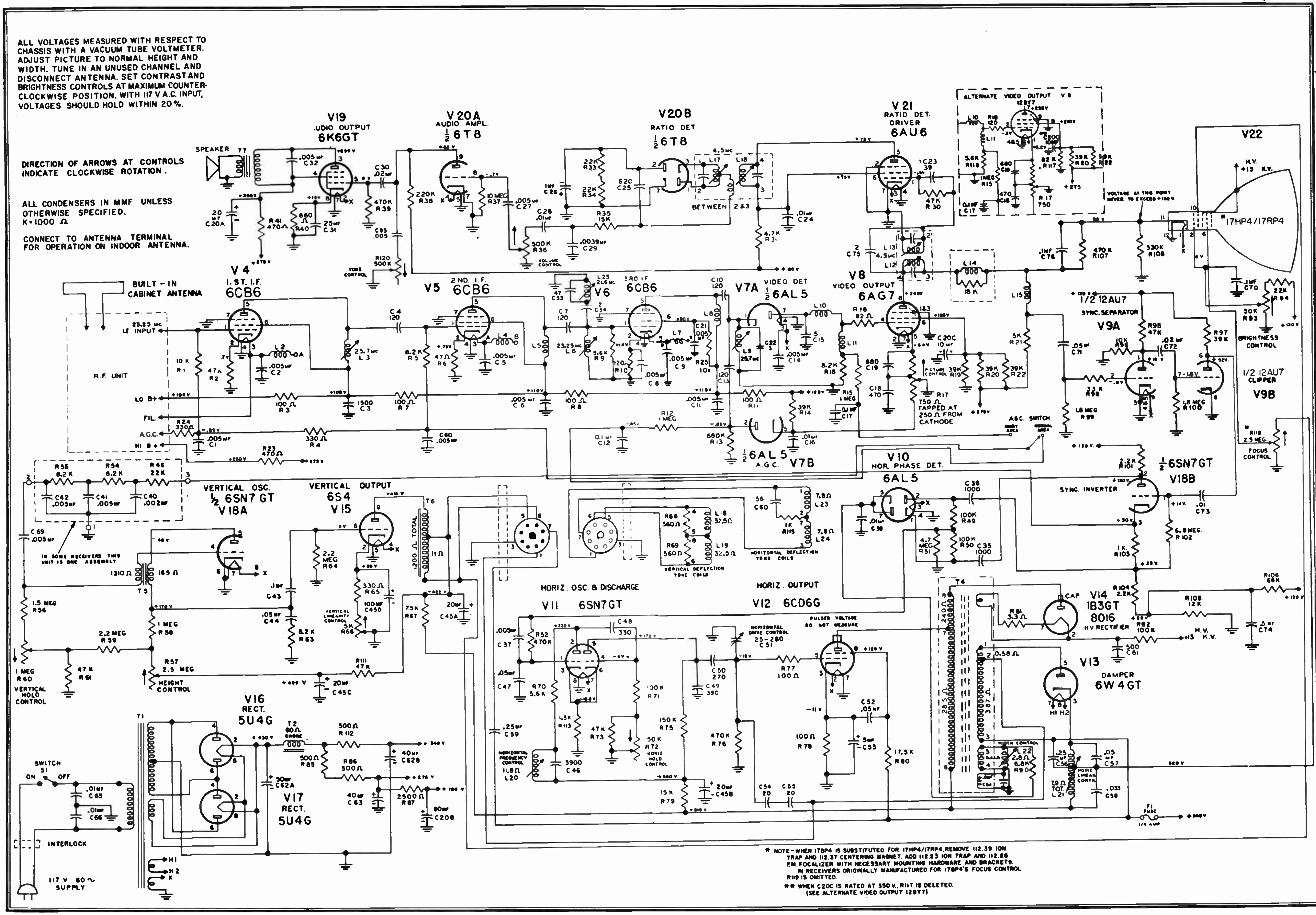
Picture Tube	17HP4/17RP4
Ion Trap	112.39
Centering Magnet	112.37

ALL OTHER PARTS, ORDER ACCORDING TO MODEL NUMBER OF RECEIVER.



1. ALL CAPACITANCE VALUES STATED IN MMF.
2. R201 & R202 MAY BOTH BE CODED 220K, BUT ARE SELECTED.
3. INTERCHANGE OF TUBE TYPE IN R.F. AMPLIFIER REQUIRES REALIGNMENT OF C203, C206, & C213.

SCHEMATIC R.F. UNIT

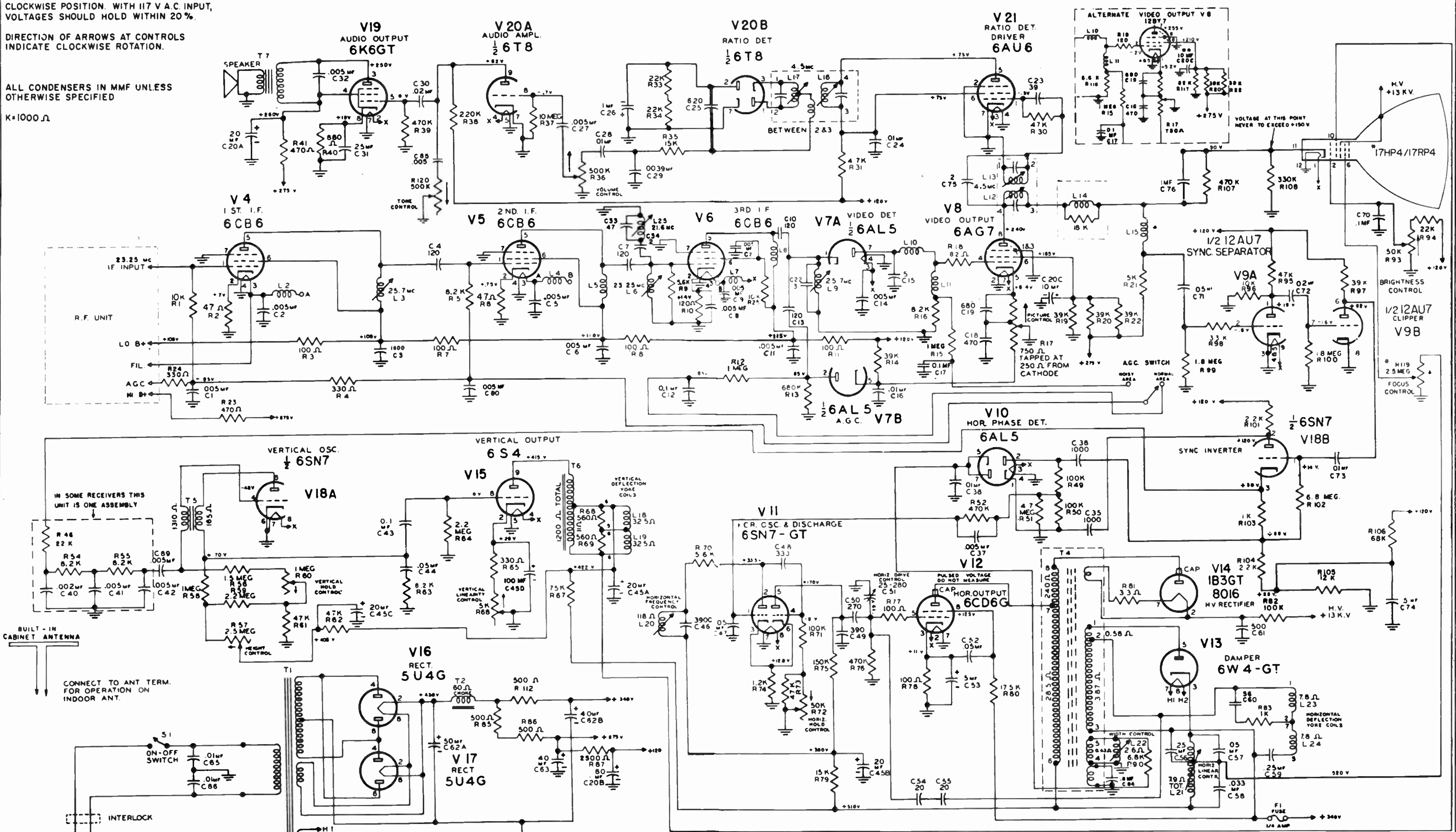

ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS WITH A VACUUM TUBE VOLTMETER. ADJUST PICTURE TO NORMAL HEIGHT AND WIDTH. TUNE IN AN UNUSED CHANNEL AND DISCONNECT ANTENNA. SET CONTRAST AND BRIGHTNESS CONTROLS AT MAXIMUM COUNTER-CLOCKWISE POSITION. WITH 117 V A.C. INPUT, VOLTAGES SHOULD HOLD WITHIN 20%.
DIRECTION OF ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.
ALL CONDENSERS IN MMF UNLESS OTHERWISE SPECIFIED. K=1000 Ω
CONNECT TO ANTENNA TERMINAL FOR OPERATION ON INDOOR ANTENNA.
V19 AUDIO OUTPUT 6K6GT
V20A AUDIO AMPL. 1/2 6T8
V20B RATIO DET 1/2 6T8
V21 RATIO DET. DRIVER 6AU6
ALTERNATE VIDEO OUTPUT V8 12BY7
V22 17HP4/17RP4
V4 1 ST. I.F. 6CB6
V5 2 ND. I.F. 6CB6
V6 3RD I.F. 6CB6
V7A VIDEO DET. 1/2 6AL5
V8 VIDEO OUTPUT 6AG7
1/2 12AU7 SYNC. SEPARATOR V9A
1/2 12AU7 CLIPPER V9B
BUILT-IN CABINET ANTENNA
R.F. UNIT
1/2 6AL5 A.G.C. V7B
V10 HOR. PHASE DET. 6AL5
1/2 6SN7GT V18B SYNC. INVERTER
VERTICAL OSC. 1/2 6SN7 GT V18A
VERTICAL OUTPUT 6S4 V15
IN SOME RECEIVERS THIS UNIT IS ONE ASSEMBLY
HORIZ. OSC. & DISCHARGE V11 6SN7GT
HORIZ. OUTPUT V12 6CD6G
V14 1B3GT 8016 HV RECTIFIER
V13 DAMPER 6W4GT
V16 RECT. 5U4G
V17 RECT. 5U4G
SWITCH S1 ON OFF
INTERLOCK
117 V 60~ SUPPLY
VERTICAL HOLD CONTROL
HEIGHT CONTROL
BRIGHTNESS CONTROL
FOCUS CONTROL
* NOTE - WHEN 17BP4 IS SUBSTITUTED FOR 17HP4/17RP4, REMOVE 112.39 ION TRAP AND 112.37 CENTERING MAGNET. ADD 112.23 ION TRAP AND 112.26 P.M. FOCALIZER WITH NECESSARY MOUNTING HARDWARE AND BRACKETS. IN RECEIVERS ORIGINALLY MANUFACTURED FOR 17BP4'S FOCUS CONTROL R119 IS OMITTED.
** WHEN C20C IS RATED AT 350 V., R117 IS DELETED. (SEE ALTERNATE VIDEO OUTPUT 12BY7)

ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS WITH A VACUUM TUBE VOLTMETER. ADJUST PICTURE TO NORMAL HEIGHT AND WIDTH. TUNE IN AN UNUSED CHANNEL AND DISCONNECT ANTENNA. SET CONTRAST AND BRIGHTNESS CONTROLS AT MAXIMUM COUNTER-CLOCKWISE POSITION. WITH 117 V A.C. INPUT, VOLTAGES SHOULD HOLD WITHIN 20 %.

DIRECTION OF ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.

ALL CONDENSERS IN MMF UNLESS OTHERWISE SPECIFIED

K=1000 Ω



* NOTE: WHEN 17BP4 IS SUBSTITUTED FOR 17HP4/17RP4, REMOVE 112 39 ION TRAP AND 112 37 CENTERING MAGNET ADD 112 23 ION TRAP AND 112 26 PM FOCALIZER WITH NECESSARY MOUNTING HARDWARE AND BRACKETS.
IN RECEIVERS ORIGINALLY MANUFACTURED FOR 17BP4'S FOCUS CONTROL R119 IS OMITTED.

** WHEN C20C IS RATED AT 350 V., R117 IS DELETED. (SEE ALTERNATE VIDEO OUTPUT 12BY7)

FADA TV PAGE 12-11

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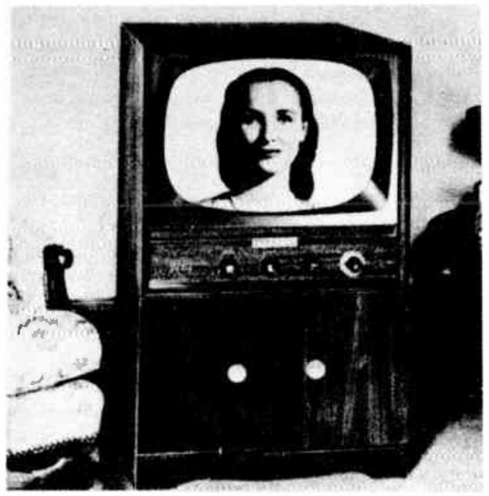
HIGH VOLTAGE WARNING

Operation of this receiver outside its cabinet or with covers removed involves a shock hazard from the power supplies. No work should be attempted on this receiver by anyone not thoroughly familiar with the precautions necessary when working on high voltage equipment.



21T

DL21T

21C2

24T2

CATHODE RAY TUBE HANDLING PRECAUTIONS

Extreme care must be used in handling the picture tube. The tube is highly evacuated and, due to its large size, is subjected to a considerable amount of atmospheric pressure. The handler should wear safety goggles and gloves for protection. Avoid nicking or scratching the glass by rough contact with other objects.

Before removing the picture tube, discharge the capacitor formed by the inner and outer aquadag coatings on the tube by shorting the anode contact on the side of the tube to the outer surface with a well insulated piece of wire.

GENERAL INFORMATION

Channel Number	Channel Freq. Mc.	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	54-60	55.25	59.75	81.35
3	60-66	61.25	65.75	87.35
4	66-72	67.25	71.75	93.35
5	76-82	77.25	81.75	103.35
6	82-88	83.25	87.75	109.35
7	174-180	175.25	179.75	201.35
8	180-186	181.25	185.75	207.35
9	186-192	187.25	191.75	213.35
10	192-198	193.25	197.75	219.35
11	198-204	199.25	203.75	225.35
12	204-210	205.25	209.75	231.35
13	210-216	211.25	215.75	237.35

TUNING RANGE: Channels 2 through 13.

SOUND RATIO DETECTOR FREQUENCY: 4.5MC.

SOUND IF FREQUENCY: 4.5MC.

PICTURE IF FREQUENCY: 26.1MC.

ANTENNA: "Built-in-Antenna" with provisions for connection of external antenna where necessary.

EXTERNAL ANTENNA IMPEDANCE: Balanced 300 ohms.

POWER SUPPLY: 117 volts, 60 cycles A.C.

POWER CONSUMPTION: 250 watts.

AUDIO OUTPUT: 3.2 watts.

INSTALLATION INSTRUCTIONS

SHIPPING BLOCK

The shipping block and bolt located on the top rear inside portion of the cabinet must be removed when the receiver is installed Model 21C2 only

RECEIVER LOCATION

The receiver may be placed anywhere in the room, but for greatest satisfaction it should be located:

1. Away from any bright light that may fall directly on the screen or be reflected from it. This includes windows and lamps. Some illumination in the room, off to one side, is desirable, however, to prevent eye-strain.

2. To provide comfortable viewing and ease in operation.

3. At least one inch away from a wall to allow for cabinet ventilation. This is very important.

ANTENNAS

The choice of a television antenna depends entirely upon the location of the receiver with respect to all television station transmitting antennas in any locality. Maximum pick-up is obtained when the receiving antenna is directly in line of sight with the transmitting antenna.

"BUILT-IN-ANTENNA"

The receiver is normally shipped with the FADA built-in-antenna connected. This antenna is a stationary folded dipole which is used for both the high and low frequency channels. It is fastened to the top underside of the cabinet, and connected to the antenna terminals on the back of the cabinet.

When this antenna is used, the following requirements should be observed for best reception:

1. In order to get maximum performance and satisfactory pictures from the "BUILT-IN-ANTENNA," ample signals from the television station must be present at the location of the receiver. Normally, the strength of the signals will vary throughout the room in which the receiver is located. For this reason, better pictures will be obtained if the receiver is tried in all possible locations in the viewing room and is then placed where the clearest pictures are received from all stations. Avoid large metallic objects, such as radiators, metal panels, etc.

2. Lamps, vases, and metallic objects, when placed on top of the receiver, may effect the efficiency of the "BUILT-IN-ANTENNA."

3. The Fada "BUILT-IN-ANTENNA" will give satisfactory reception in strong signal areas; but if the receiver is located in a fringe or weak signal area, an outdoor antenna is recommended.

OUTDOOR ANTENNA

The "BUILT-IN-ANTENNA" must be disconnected from the antenna terminal strip before connecting the outdoor antenna leads. It is immaterial which lead is connected to which terminal.

TUBE COMPLEMENT

Symbol	Tube Used	
V1	6BQ7 or 6BK7	Cascode RF Amplifier
V3	6J6	Osc. Mixer
V4	6CB6	1st IF
V5	6CB6	2nd IF
V6	6CB6	3rd IF
V7A	½ 6AL5	Video Detector
V7B	½ 6AL5	A.G.C.
V8	6AG7 or 12BY7	Video Output
V9A	½ 12AU7	Sync. Separator
V9B	½ 12AU7	Sync. Clipper
V10	6AL5	Hor. Phase Detector
V11	6SN7-GT	Hor. Osc. & Discharge
V12	6CD6-G	Hor. Output
V13	6W4-GT	Damper
V14	1B3-GT	High Voltage Rectifier
V15	6S4	Vertical Output
V16	5U4-G	Low Voltage Rectifier
V17	5U4-G	Low Voltage Rectifier
V18A	½ 6SN7	Vertical Osc.
V18B	½ 6SN7	Sync Inverter
V19	6K6-GT	Audio Output
V20A	½ 6T8	Audio Amplifier
V20B	½ 6T8	Ratio Detector
V21	6AU6	Ratio Det. Driver
V22	21EP4, 21AP4 or 24AP4	Picture Tube

OPERATING INSTRUCTIONS

(Refer to Figure 1)

(1) Turn OFF-ON SOUND volume control clockwise about a half turn. This turns the receiver on and sets the sound volume to a reasonable level.

(2) Allow a brief warm-up period.

(3) Set Station Selector to desired channel.

(4) Adjust the Fine Tuning control to where music or speech is heard, assuming that the station is broadcasting.

(5) Turn picture control fully counter clockwise.

(6) Turn the brightness control fully clockwise and then slowly counter clockwise until light is just visible on the screen.

(7) Turn the picture control clockwise until activity or a definite form is just noted on the screen. Do not advance control any further until steps 8, 9, and 10 are completed.

(8) If the pattern is moving up or down adjust Vertical control until pattern is stationary in vertical direction.

(9) If picture appears as black and white diagonal lines or seems to be moving sideways, adjust Horizontal control until a proper picture is obtained.

(10) Readjust Fine Tuning control for best picture.

(11) Adjust Picture control until picture is suitable for brightness and contrast. If the control is advanced to maximum clockwise position, overloading of the picture will occur on strong signals. This will be noted by excessive contrast, bending of picture and raspy noise in the sound output. When this occurs rotate the picture control slowly in a counter clockwise direction until the picture and sound distortion disappears. The brightness and details of a picture are controlled by the Brightness and Picture knobs. Adjust Tone Control for desired sound quality.

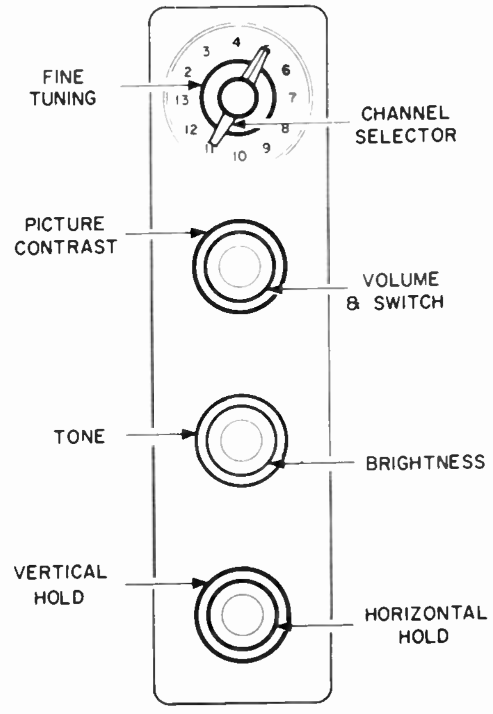
(12) Recheck the Fine Tuning control for best picture.

NOTE: If any difficulty is experienced with steps number 8 or 9, turn the PICTURE control ¼ turn counter clockwise, readjust the Fine Tuning control and then repeat these adjustments.

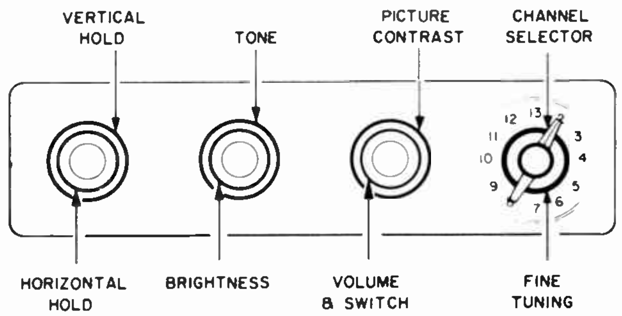
If the receiver has been in previous operation and no controls disturbed except for turning the on-off knob to "off" position, then subsequent operation should require the previous steps 1 through 3 and, if necessary, steps 13 and 14 as follows:

(13) Adjust the FINE TUNING control for best picture quality. Readjust the SOUND volume control to desired level.

(14) Adjust PICTURE and BRIGHTNESS controls to obtain desired level of contrast and brightness.



21C2 - 24T2



21T - DL21T

FIG. 1. OPERATING CONTROLS

SERVICE ADJUSTMENTS

The receiver is completely adjusted at the factory, so normally none other than the front panel operating instructions need be followed to put the receiver in operation. However, to provide for any misadjustment of the service controls due to handling, the following instructions are in order.

ION TRAP, FOCUSER AND DEFLECTION YOKE ADJUSTMENTS

Before any adjustments can be made the back of the cabinet will have to be removed. Remove all screws holding back cover to cabinet, and pull cover away from cabinet. Since the power cord circuit is broken by the interlock when the cabinet back is removed, an extra television power cord will be necessary to make a power connection to the receiver. A mirror placed in front of the receiver will help in making the adjustments.

ION TRAP ADJUSTMENTS

Turn on the receiver and switch to one of the television channels not in use in your area. With the brightness control in the maximum clockwise position and the picture control fully counter-clockwise adjust the ion trap by moving it forward or backward at the base of the tube, at the same time rotating it slightly around the neck of the cathode ray tube for the brightest raster on the screen. Reduce the brightness control setting until the raster is just visible on the screen, readjust the ion trap for maximum brilliance. Adjust the focuser adjustment control (shown in Figure 2, 3 or 4) until the line structure of the raster is clearly visible. Readjust the ion trap for maximum raster brilliance. The final touches of the adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained.

FOCUSER MAGNET ADJUSTMENT

The focuser magnet should be adjusted so that there is approximately one-eighth inch of space between the rear shell of the deflection yoke and the front face of the focuser magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the focuser magnet should be parallel with the axis of the cathode ray tube neck. See Figure 2, 3 or 4.

NOTE: The cardboard insert between the focuser magnet and the neck of the cathode ray tube must not be removed.

DEFLECTION YOKE ADJUSTMENT

If the lines of the raster are not horizontal or squared with the picture mask, loosen the yoke centering wing screw (shown in Figure 2, 3 or 4) and rotate the yoke until this condition is obtained. Tighten the wing screw making sure the deflection yoke is as far forward on the neck of the cathode ray tube as possible.

CENTERING ADJUSTMENTS

No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet as shown in Fig. 2, 3 or 4. The centering plate has a locking screw which must be loosened before centering. Up and down adjustment of the plate moves the picture side to side and sidewise adjustment moves the picture up and down.

If a corner of the raster is shadowed, check the position of the ion trap. Reposition the ion trap within the range of maximum raster brightness to eliminate the shadow and recenter the picture by adjustment of the focus centering plate. In no case should the ion trap be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the cathode ray tube. In some cases it may be necessary to shift the position of the focuser magnet in order to eliminate a corner shadow.

SERVICE CONTROL ADJUSTMENTS

With the deflection system in proper mechanical alignment, the service controls may be adjusted. The mechanical adjustments ordinarily will not require further attention until the cathode ray tube is replaced. Normal picture contrast and brightness should be maintained during adjustments. Using a test pattern from a local television station, make the service control adjustments as follows: (Refer to Figure 2, 3 or 4.)

1. Set the horizontal and vertical hold controls on the front panel for a steady test pattern. If horizontal synchronization cannot be effected within the normal range of the horizontal hold control, set the control in the center of its range and adjust the horizontal frequency coil for a steady picture. This screw driver adjustment is reached from the top rear section of the chassis.

2. Set the picture control on the front panel to minimum, counter-clockwise, and advance the brightness control on the front panel clockwise to maximum. Fully open the horizontal drive trimmer adjustment located on the center rear apron of chassis. If no vertical white line appears in the center of the test pattern, leave it at full drive and proceed to the next step. If a vertical white line does appear in the center of the test pattern, gradually tighten up on the trimmer screw until the white line is eliminated. Insufficient horizontal drive will cause the raster to fall short of filling the mask horizontally or cause the picture to lack the brilliance normally obtained with a correct adjustment.

3. Reset the picture control for the desired picture contrast. If necessary, readjust the brightness control for a most desirable picture.

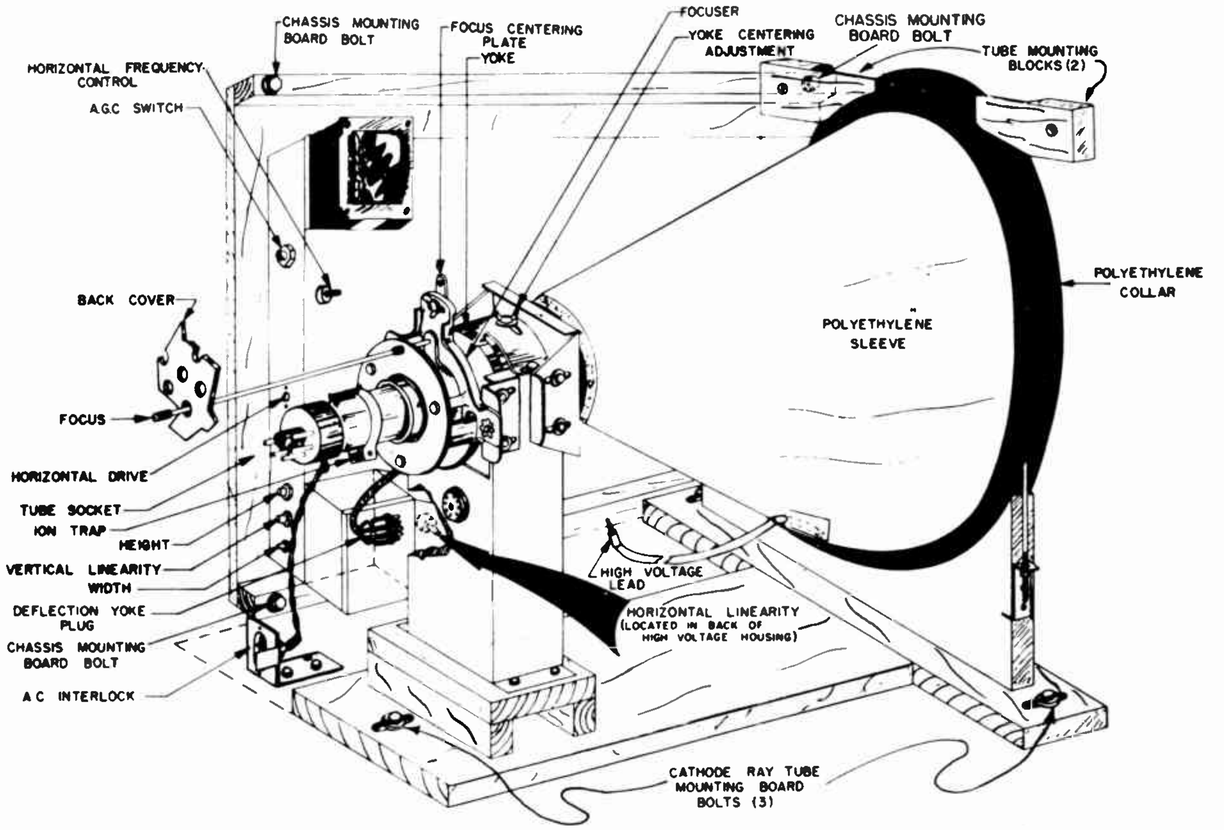
4. Set the width coil screw-driver adjustment so that the test pattern fills the horizontal dimensions of the cathode ray tube mask. A minor adjustment of the focuser centering plate may be necessary to recenter the pattern.

5. Set the horizontal linearity coil screw-driver adjustment so that the test pattern is symmetrical from left to right. A slight readjustment of the horizontal drive may be necessary after making this adjustment.

6. Set the height control on the rear apron of the chassis so that the test patern fills the vertical dimensions of the cathode ray tube mask. A minor adjustment of the focuser centering plate may be required to recenter the pattern.

7. Set the vertical linearity control on the rear apron of the chassis for a symmetrical test pattern in the vertical dimensions. A slight readjustment of the height control may be required after making this adjustment.

8. Set the brightness and picture controls for a normal test pattern and adjust the focus adjustment until the fine horizontal line structure of the raster is clearly visible over the picture area. The control should be turned through the correct point several times so that optimum focus is obtained.



24T2

FIG. 2. SERVICE ADJUSTMENT AND CONTROLS

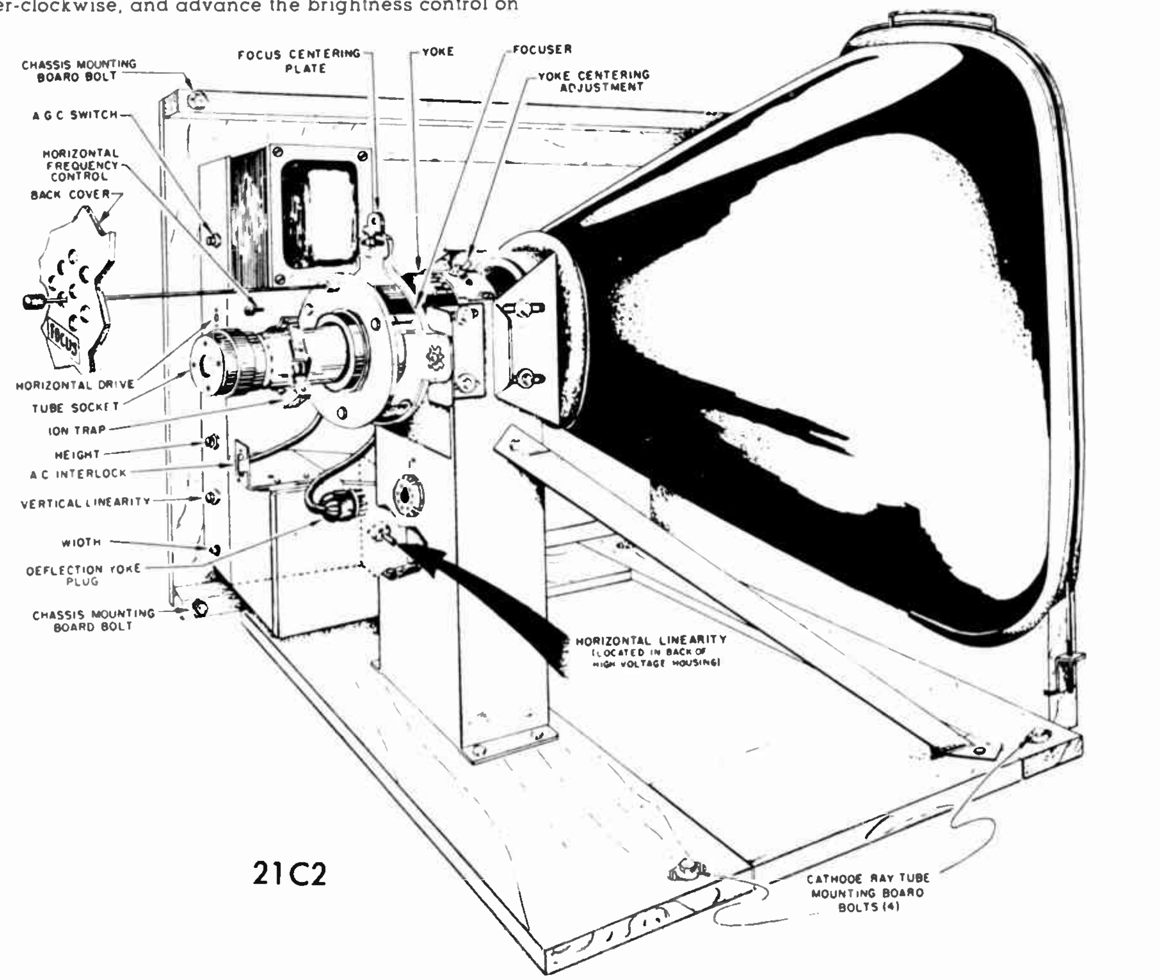


FIG. 3. SERVICE ADJUSTMENTS AND CONTROLS

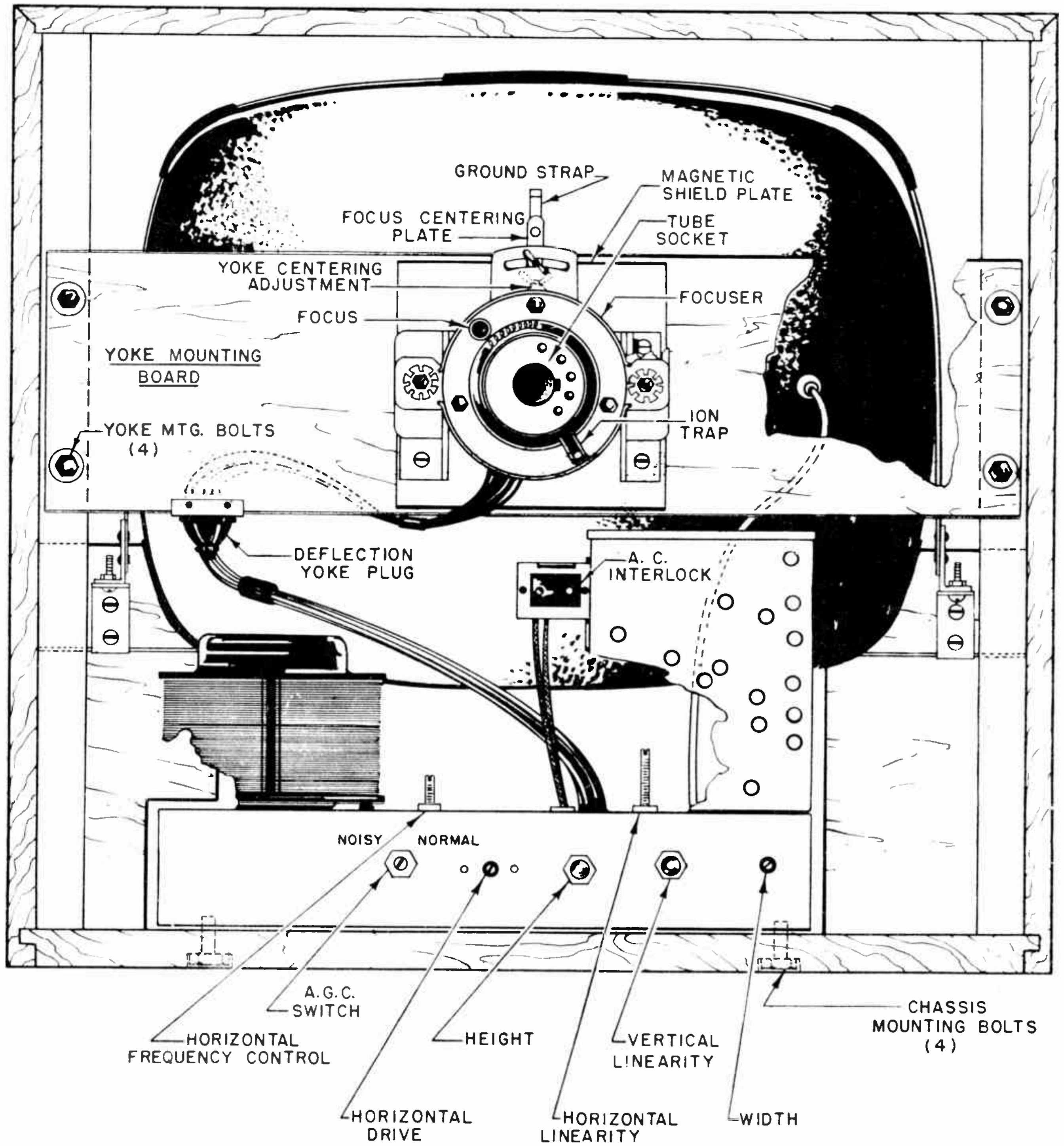


FIG. 4. SERVICE ADJUSTMENTS AND CONTROLS

21T DL21T

TO REMOVE FRONT SAFETY GLASS ON MODEL 21T ONLY

The front glass may be removed to allow cleaning of its rear face and of the picture tube face.

The top edge of the glass fits into a groove on the inside surface at the top of the cabinet. The bottom edge rests on a metal bracket attached to the cabinet. The bracket is covered by a snap-on decorative plate.

Place fingers over top and bottom of the decorative plate and pull. The nameplate will snap off to expose two screws in the bracket. Press bracket in towards cabinet with one hand and remove the two screws with the other hand. After removing screws, hold the bottom edge of the glass with free hand. Remove bracket. While holding glass at bottom allow it to slide down gently, until its top edge comes below cabinet top. With other hand grasp top edge of glass and remove glass from cabinet.

TO REMOVE FRONT SAFETY GLASS ON MODEL DL21T ONLY

The top edge of the glass fits into a groove on the inside surface at the top of the cabinet. The bottom edge of the glass fits into a groove on the inside surface at the bottom of cabinet and rests on a push-up bar which passes through the bottom (near front and center) of the cabinet. A screw holds this push bar to the underside of the cabinet bottom.

Move cabinet forward until the felt feet at the front portion of the cabinet bottom just touch the edge of the table. The front edge of the cabinet will overhang the table. There will now be sufficient room to reach the screw holding the push bar to the bottom of the cabinet.

Place one hand on the top portion of the safety glass. With the free hand remove the screw holding the push bar. Place the free hand on glass next to the other hand. Press gently forward and down on glass which will slide down to expose top edge. Grasp top edge with either hand and bring glass out and then up from bottom groove.

ALIGNMENT

GENERAL

If the receiver must be aligned or some portion serviced, the chassis must be removed first and separately from the kinescope. (See figures 2, 3, or 4.) To remove the chassis, remove the knobs from the front panel, remove all screws holding back cover to cabinet and pull cover away from cabinet to disengage interlock. Disengage the kinescope socket, the kinescope high voltage lead, the yoke plug, and the speaker plug. Remove the two screws holding the antenna terminal strip to the top of the cabinet.

For Models 21T and DL21T, remove the four chassis mounting bolts from the underside of the cabinet, (See Figure 4) and slide the chassis back out of the cabinet.

For Model 21C2 remove the two bolts on the back top and bottom of the chassis mounting board. A third bolt which runs through the bottom board underneath the front of the chassis must be loosened. (This bolt is used to align the control shafts with the holes on the front panel.) Slide chassis board with chassis out of the cabinet. (See Fig. 3). For Model 24T2 remove the two bolts on the back top and bottom and one bolt on the top front of the chassis mounting board, (See Figure 2) and slide the chassis mounting board with the chassis out of the cabinet.

To remove the kinescope on Models 21C2 and 24T2 remove the bolts (four on 21C2 and three on 24T2) holding the tube mounting board to the cabinet. For the 24T2, also remove the kinescope holding blocks. Slide the complete assembly out of the cabinet.

To remove the kinescope on Models 21T and DL21T place the cabinet front down and remove the four bolts holding the yoke mounting board. Lift the yoke mounting board off the tube, being careful not to exert any force on neck of tube, and then loosen the two screws holding the kinescope holding strap to free tube. Kinescope can then be lifted free from cradle. **Warning:** Do not attempt to lift kinescope by grasping neck of tube.

EQUIPMENT REQUIRED

RF SWEEP GENERATOR meeting the following requirements:

(a) Frequency Ranges

18 to 30 mc	10 mc sweep width
40 to 90 mc	10 mc sweep width
170 to 225 mc	10 mc sweep width

(b) Output adjustable with at least 1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

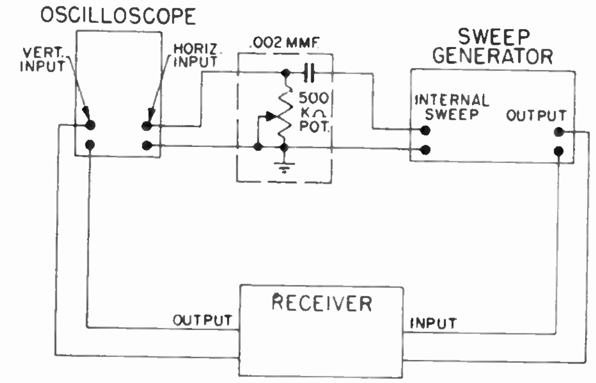


FIG. 5. SWEEP SETUP EXTERNAL PHASING

If the sweep generator does not have an internal blanking control or a phasing control, then it will be necessary to connect a phasing network between the sweep output of the sweep generator and the horizontal input to the oscilloscope. See Fig. 5 SWEEP-SET-UP EXTERNAL PHASING.

CATHODE RAY OSCILLOSCOPE preferably one with a wide band vertical deflection, input calibrating source, and a low capacity probe.

SIGNAL GENERATOR to cover all IF frequencies of from 4.5mc to 28mc and all picture and sound carrier frequencies.

ELECTRONIC VOLTMETER of Junior "Voltohmyst" type and a high voltage multiplier probe for use with this meter to permit measurements up to 20KV.

Bias supply made of batteries to give 4.5 volts.

ORDER OF ALIGNMENT

Sound Ratio Detector.

Sound IF Transformers.

Picture IF Transformers (preliminary and flat topping).

Oscillator and RF sections.

PRECAUTIONS

Before proceeding with IF Alignment, the following precautions should be observed:

Disconnect the antenna. Set picture control for minimum. Remove R.F. unit bottom shield. Remove channel 11 oscillator coil section. This is the coil strip nearest the fine-tuning control. Short the coil nearest the oscillator tuning slug, by soldering a bare wire across the coil terminals. Use extreme care so as not to short the oscillator coil to any other coil and also not to deform any of the coils. Reinsert channel 11 oscillator coil section and set R.F. unit to channel 11. Now the local oscillator is deactivated and you may proceed with the alignment without interference from local television stations.

For all IF Alignment, insert a 47K ohm resistor in series with the VTVM probe; also, a 47K ohm resistor should be inserted between the take-off point and the oscilloscope lead for decoupling.

SOUND RATIO DETECTOR AND IF ALIGNMENT

1. Connect probe of the VTVM to the diode plate of the ratio detector tube V20B (6T8, pin 2). Common to ground. See Figure 11.

2. Connect high side of the signal generator to the grid of the ratio detector driver. V21 (6AU6, pin 1). Common to ground. See Figure 11.

3. Tune the signal generator to exactly 4.5mc and attenuate the generator so it does not exceed 8 volts on the VTVM.

4. Peak L16 bottom core (FIG. 11) for maximum.

5. Peak L17 top core (FIG. 12) for maximum.

6. Adjust attenuator of signal generator to give exactly eight volts on the VTVM.

7. Move probe of VTVM to junction of R28, C31 and C29. (FIG. 11).

8. Adjust L17 top core (FIG. 12) for exactly 4 volts on the VTVM.

9. Move signal generator to video output tube V8 (6AG7, pin 4) (FIG. 11) and repeat steps number 1 and 3.

10. Peak L12 bottom (FIG. 11) and L13 top (FIG. 12) for maximum.

11. Repeat with care steps 1-3-4-5-6-7-8.

ALTERNATIVE PROCEDURE FOR STEPS 6-7-8:

1. Connect common lead of VTVM to junction of R29 and R30 (FIG. 11).

2. Connect probe of VTVM to junction of R28, C31, and C29. (FIG. 11).

3. Adjust L17 top (FIG. 12) for zero reading on the VTVM.

12. Connect detector probe shown in figure 6 between kinescope cathode (junction of R37 and R38) and ground.

13. Rotate the contrast control to its maximum clockwise position. Connect probe of VTVM to detector.

14. Adjust L12 (bottom slug) for minimum output on VTVM.

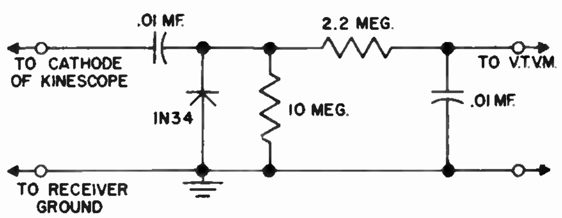


FIG. 6. DETECTOR PROBE

PICTURE I.F. (ROUGH ALIGNMENT)

1. Connect the bias battery as shown in fig. 11. The negative side of the bias battery to the junction of R8, R5, and C81, and the positive side to ground. Disconnect the white wire, that goes to the center terminal of the AGC switch (S2), from the junction of R8, R5, and C81. Connect the output of the signal generator between the test point on the R.F. unit (see fig. 12) and ground.

2. Connect the probe of the VTVM to the junction of L11 and R16 (fig. 11). Common to ground.

3. Set the signal generator to 21.6 mc. and adjust L25, co-channel sound trap, (fig. 12) for minimum output on VTVM.

4. Reset the signal generator to 23.25 mc. Adjust the output of the signal generator for approximately 2.5 volts on the VTVM.

5. Peak first Picture I.F. coil (located on R.F. Unit) and the third Picture I.F. coil L6 (fig. 12) for maximum. Maintain approximately 2.5 volts on the VTVM by adjusting the generator output.

6. Reset signal generator to 25.7 mc.

7. Peak second Picture I.F. coil L3 and the fourth Picture I.F. coil L9 (fig. 12) for maximum.

PICTURE I.F. (FLAT-TOPPING)

1. Remove signal generator and VTVM.

2. Connect the sweep generator between the R.F. test point and ground.

3. Connect the oscilloscope probe to the junction of L11 and R16.

4. Connect the hot side of the signal generator to the chassis side apron nearest the first I.F. stage. Leave the ground side disconnected.

5. With most sweep generators, there is enough output to give an I.F. response curve of sufficient height on the oscilloscope. If there is insufficient output use 3 volts bias instead of 4.5 volts. In adjusting the output of the sweep generator, make sure you do not overload the I.F.'s. This can be ascertained by noticing that the relative shape of the I.F. response does not change with small variations in sweep generator output.

6. Set the signal generator to 26.1 mc. and advance the output until a marker pip is visible on the Picture I.F. curve on the oscilloscope. Be careful not to distort the I.F. curve by advancing the generator output too far. Adjust L3 and L9 so that the marker pip is at the 50% point. See Fig. 7 Picture I.F. curves and Markers.

7. Set the signal generator to 22.7 mc. Adjust the first Picture I.F. coil (located on the R.F. Tuner) and L6 so that the marker pip is at the 50% point. See Fig. 7.

8. Repeat steps 6 and 7 until an acceptable curve is achieved

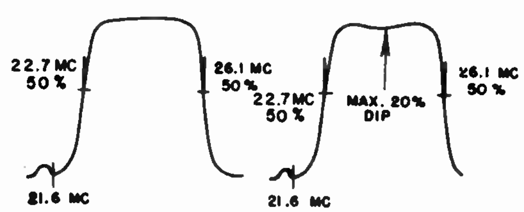


FIG. 7. TYPICAL PICTURE I.F. CURVES AND MARKERS

OSCILLATOR AND R.F. ALIGNMENT

The R.F. Unit is a turret type tuner with separate coil segments for each channel. Normal channel sequence is progressive in a clockwise direction covering channels 2 to 13. The R.F. amplifier is of the cascode type utilizing a 6BQ7 or 6BK7. The converter stage utilizes a 6J6.

OSCILLATOR ALIGNMENT

It should be possible to tune in all channels with the fine tuning control C212 (see figs. 11 and 12) in the middle third of its range. When V3 ages, the oscillator may shift slightly in frequency requiring adjustment If V3 is defective and must be replaced, several tubes should be tried to find one that requires the least oscillator adjustment.

If an accurately calibrated signal generator that covers all the R.F. frequencies is available then continue with step 1. If not go on to step 10.

1. Remove tube shield on 6J6, V3.

2. Modify a tube shield which will fit snugly over the 6J6 and still remain ungrounded.

3. Remove shorting wire from channel 11 oscillator coil and replace segment and R.F. unit bottom shield.

4. Turn channel selector to channel 12.

5. Set generator to the oscillator frequency which is 231.35 mc. for channel 12.

6. With reference to figure 8 connect the generator to one of the 10 mmf capacitors and connect the other 10 mmf capacitor to the ungrounded tube shield over the 6J6. Connect remaining terminal on probe to vertical input on oscilloscope.

7. Set fine tuning control C212 (fig. 12) to center of its range. Adjust C211 for zero beat pattern on the oscilloscope screen. (The oscillator coil slug which is accessible from the chassis front apron should be in its mechanical mid-position. If the slug should fall in during adjustment, the oscillator coil segment will have to be removed from the turret housing, the little wire spring which normally fits into the slug threads lifted up, and the slug brought forward to its mean position.)

8. Reset the generator for the oscillator frequency of channel 11. Adjust the oscillator coil slug for zero beat on the oscilloscope screen. Use a non-metallic screw-driver in adjusting the oscillator coil slug.

9. Repeat step 8 for the remaining channels, making sure the signal generator is set for the proper frequency on each channel.

When an accurately calibrated generator is not available, then oscillator alignment can only be accomplished when the local T.V. transmitters are on the air.

10. Remove bias battery and replace AGC lead to junction of R8, R5, and C81 (fig. 11).

11. Set fine tuning control C212 (fig. 12) to center of its range.

12. Rotate channel selector control to one of the local T.V. stations and adjust the oscillator coil slug, which is accessible from the front chassis apron (fig. 12), for best picture.

13. Check remaining local stations by rotating the channel selector switch to, each channel in turn and adjusting the oscillator slug for best picture.

14. If on one or two of the channels you do not have enough oscillator range, readjust C211 and repeat steps 12 and 13.

It is possible to adjust the oscillator channel slugs without removing the chassis from the cabinet. The slugs are made accessible by removing the channel selector and fine tuning knobs and by moving the escutcheon plate to one side. Use a long thin fibre or bakelite screwdriver for making adjustments.

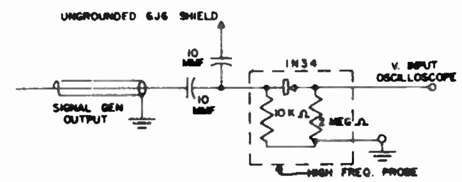


FIG. 8.

R.F. ALIGNMENT

1. Reconnect bias battery as in step 1. Picture I.F. (Rough alignment). Disconnect white AGC wire. Set bias for 3 volts.

2. Connect oscilloscope through 10,000 ohms to test point on R.F. Unit. Connect sweep generator to antenna terminals. If the sweep generator is not terminated for balanced 300 ohms, insert the network shown in fig. 9 below.

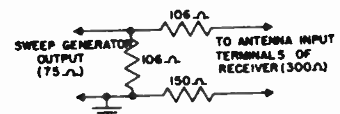


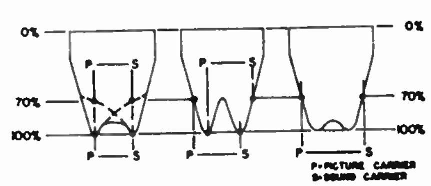
FIG. 9.

3. Set fine tuning control at approximately the midpoint of its tuning range and rotate channel selector to channel 12.

4. Adjust sweep generator to channel 12 and loosely couple signal generator to sweep generator in order to obtain picture carrier and sound carrier markers.

5. Adjust C206, C203, and C213 for flat top response curve. See figure 10 for acceptable R.F. passbands.

6. Check remaining channels. If the response curves obtained on any channel is not acceptable, it might be necessary to return to channel 12 and make a compromise of its response. If one channel is extremely out, that coil section should be repaired or replaced. It is not necessary to remove the tuner from the chassis in order to repair or replace a coil section.



ACCEPTABLE R.F. PASSBAND

FIG. 10.

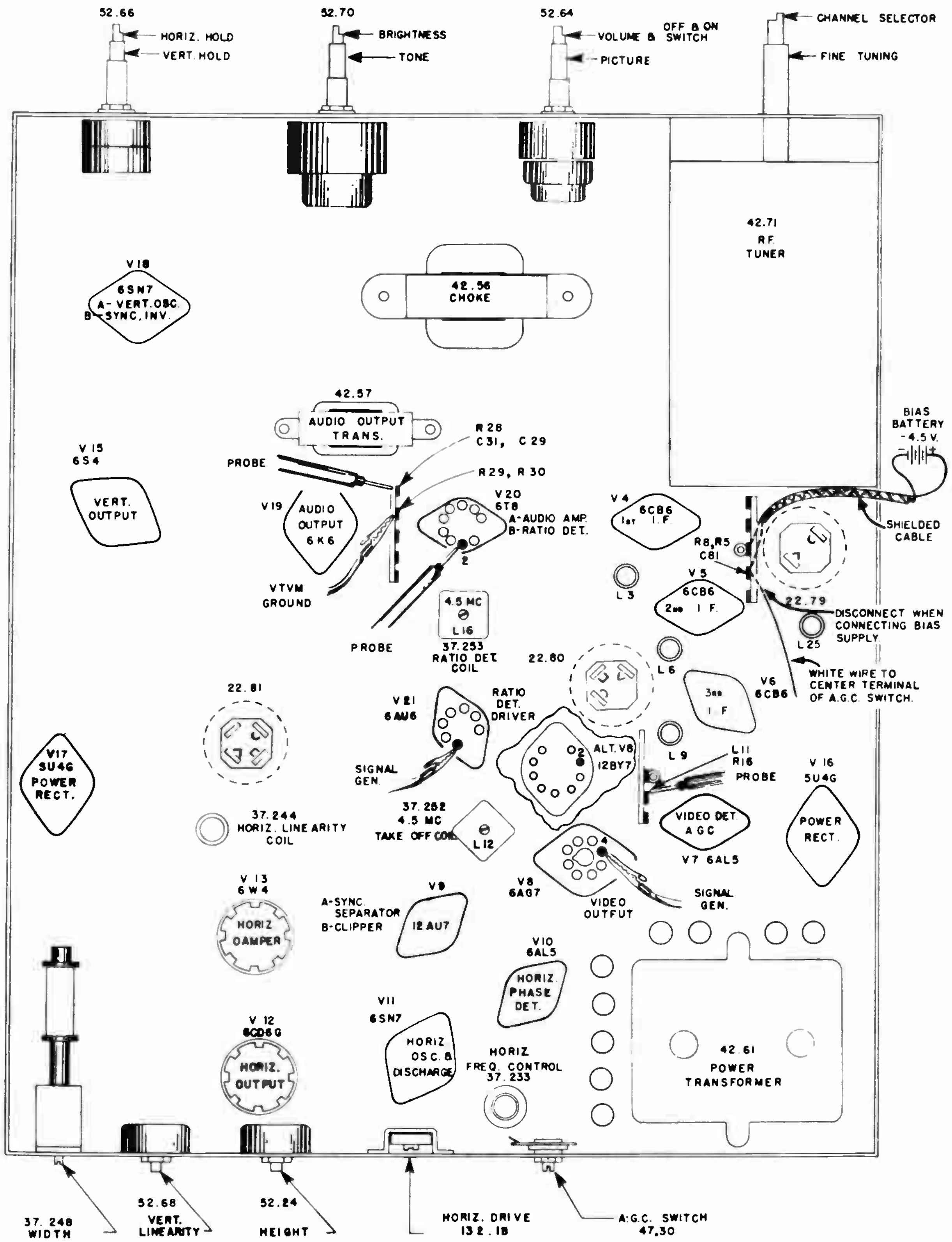


FIG. 11. BOTTOM VIEW OF CHASSIS

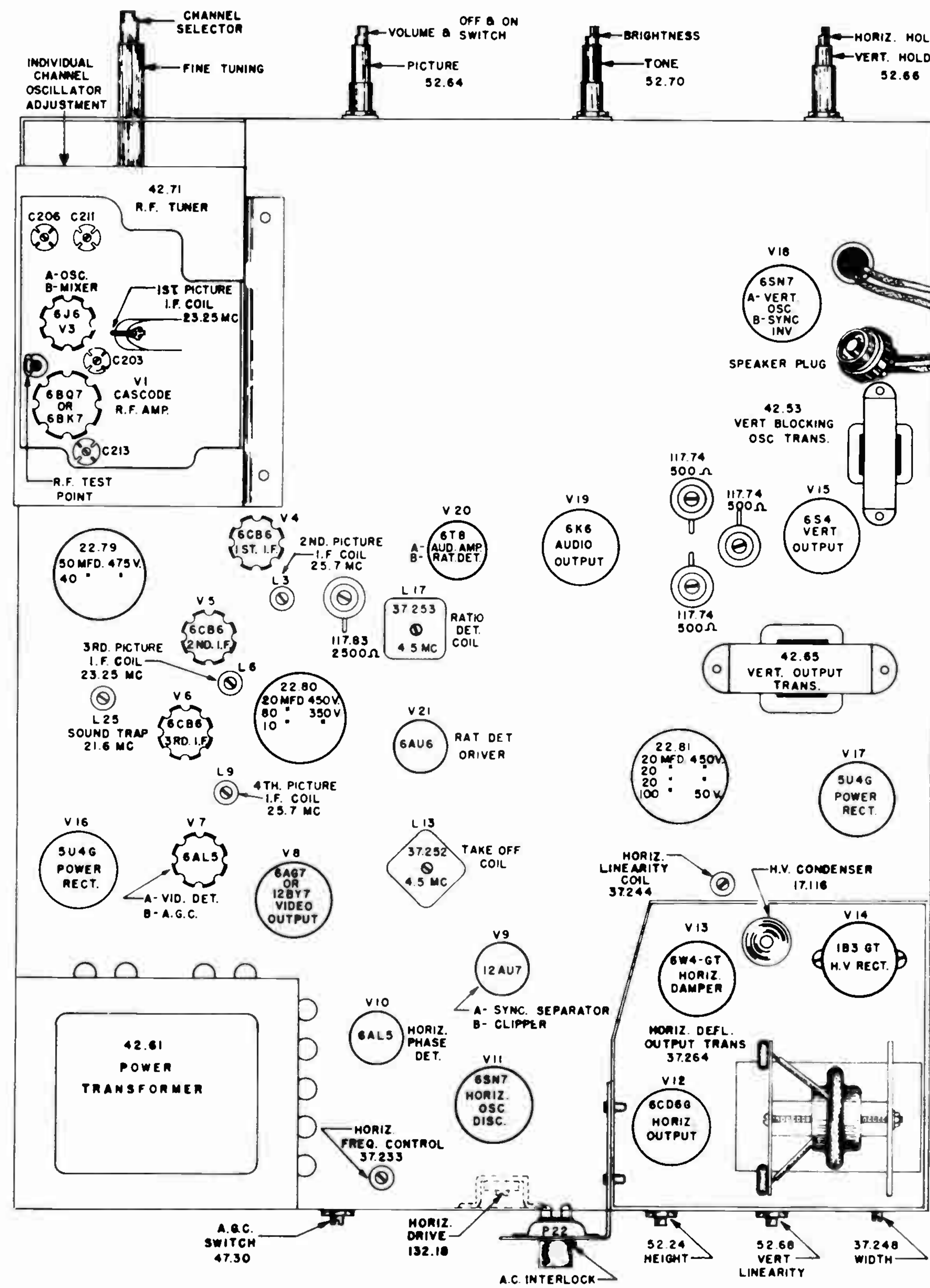
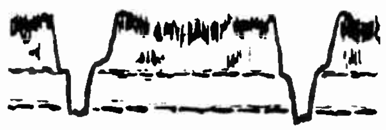
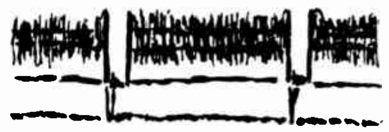


FIG. 12. TOP VIEW OF CHASSIS

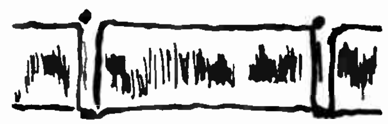
WAVE FORMS



PIN 7 (V7A) 6AL5
VIDEO DETECTOR (HORIZ. SCOPE)
3 VOLTS PP

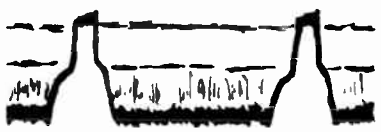


PIN 7 (V7A) 6AL5
VIDEO DETECTOR (VERT. SCOPE)
3 VOLTS PP



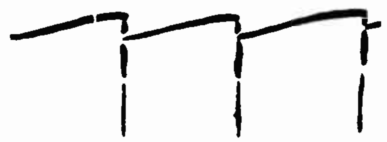
PIN 3 (V18B) 6SN7GT
SYNC. INVERTER (VERT. SCOPE)
25 VOLTS PP

PIN 4 (V18A) 6SN7GT
VERTICAL OSCILLATOR
48 VOLTS PP



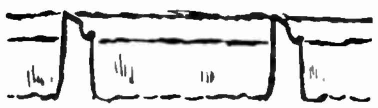
PIN 8 (V8) 6AG7
VIDEO OUTPUT (HORIZ. SCOPE)
65 VOLTS PP

PIN 8 (V8) 6AG7
VIDEO OUTPUT (VERT. SCOPE)
65 VOLTS PP

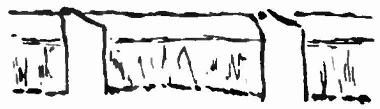


PIN 6 (V15) 6S4
VERTICAL OUTPUT
48 VOLTS PP

PIN 9 (V15) 6S4
VERTICAL OUTPUT
850 VOLTS PP



PIN 2 (V9A) 12AU7
SYNC. SEPARATOR (HORIZ. SCOPE)
45 VOLTS PP



PIN 2 (V9A) 12AU7
SYNC. SEPARATOR (VERT. SCOPE)
45 VOLTS PP

PIN 1 (V10) 6AL5
HORIZ. PHASE DETECTOR
20 VOLTS PP

PIN 2 (V10) 6AL5
HORIZ. PHASE DETECTOR
20 VOLTS PP

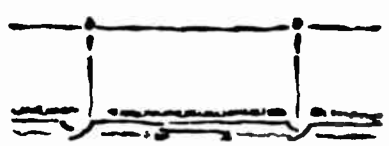
PIN 1 (V9A) 12AU7
SYNC. SEPARATOR (HORIZ. SCOPE)
16 VOLTS PP

PIN 1 (V9A) 12AU7
SYNC. SEPARATOR (VERT. SCOPE)
16 VOLTS PP

PIN 5 & 7 (V10) 6AL5
HORIZ. PHASE DETECTOR
16 VOLTS PP

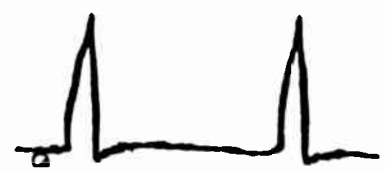
PIN 2 (V11) 6SN7GT
HORIZ. OSC. & DISCHARGE
38 VOLTS PP

PIN 6 (V9B) 12AU7
SYNC. CLIPPER (HORIZ. SCOPE)
65 VOLTS PP



PIN 6 (V9B) 12AU7
SYNC. CLIPPER (VERT. SCOPE)
65 VOLTS PP

PIN 5 (V12) 6CD6G
HORIZ. OUTPUT
65 VOLTS PP



PIN 9 T4
HORIZ. WIDTH COIL
250 VOLTS PP

"POWER PLUS" SWITCH, ITS FUNCTION AND USE

The new Fada television receiver with "Power Plus" control has been designed for optimum performance in all areas. This has been achieved by the utilization of two types of automatic gain control (AGC) circuits. The AGC circuit in use is controlled by the AGC "Power Plus" switch located on the rear apron of the receiver chassis.

In normal or strong signal areas, the AGC switch is rotated to its maximum clockwise position. This introduces a peak detector type of AGC which is fast acting, has good limiting and prevents overloading, all of which are desirable features for superior reception in these areas.

In weak and noisy signal areas, the AGC switch is rotated to its maximum counterclockwise position. This introduces an average detector type of AGC which is completely immune to the impulse type of noises prominent in weak signal areas. Another desirable feature of this type of AGC for weak signal areas is that a lower value of bias is developed for a fixed signal strength, thereby giving better noise factor and superior contrast. These characteristics give a picture which has a minimum of snow, which is free of noise, and which is free of horizontal and vertical jitter.

SERVICE SUGGESTIONS

No Raster on Kinescope
Incorrect adjustment of ion trap magnet.
Defective Kinescope.
No high voltage. Check V11, V12, V13, V14. Check all voltages and waveforms associated with these tubes.
Incorrect setting of horizontal drive control (C61).
Check fuse F1.

Horizontal Deflection Only
Check V15, V18A, T5, T6, L18, L19, R60 and R68
Check voltage and waveforms on grids and plates of V15, V18A.

Poor Horizontal Linearity
Check V12, V13, L21, L23, L24, C65 and C66.

Small Raster
Low B or low line voltage.
Check V15 and V17.

Raster—No Sound No Picture with Control Over Brightness
Check V4, V5, V6, V7, V8 and their associated circuits.
Check R. F. Unit.

Raster — No Sound No Picture and No Control Over Brightness
Check 130 volts supply and R95.

Raster Picture and No Sound
Check V19, V20 A and B, V21.
Check alignment of L12, L13, L16, and L17.

Poor or No Horizontal Sync.
Check for gassy Kinescope.
Check V9, V10, V18B and their associated circuits.

Poor or No Vertical Sync.
Check V9, V18B and their associated circuits.

Picture Smear
Check Video peaking coils L10, L11, L14, and L15.
Check V7, V8, and their associated circuits.
Check video I. F. Alignment.

Arcing in High Voltage Supply
When replacing a component in the high voltage supply all soldered connections should be made round so that there are no sharp ends. This will eliminate any possibility of corona.

4.5 mc Beat in Picture
Check L25, L12, L13 and their associated circuits.
Check alignment of L25, L12, L13.

LIST OF PARTS — R.F. UNIT

CAPACITORS

Symbol	Description
C201	800 mmf, GMV, Disc Ceramic on centershield assembly
C202	1000 mmf GMV Ceramic
C203	0.5-3 mmf Ceramic Trimmer
C204	120 mmf 5% N750 Ceramic
C205	100 mmf 20% N750 Ceramic
C206	0.5-3 mmf Ceramic Trimmer
C207	10 mmf 5% NPO Ceramic
C208	10 mmf 5% N750 Ceramic
C209	2.2 mmf ± .25 mmf N330 ± 500 Ceramic
C210	20 mmf 10% NPO Ceramic
C211	0.5-3 mmf Ceramic Trimmer
C212	Fine Tuning Variable Capacitor
C213	3-9 mmf Ceramic Trimmer
C214, C215, C216, C217	800 mmf GMV Feed Thru Capacitors on Centershield Assembly
C218	120 mmf 10% N750 Ceramic
C219	1000 mmf GMV Ceramic

RESISTORS

Symbol	Description
R201	220 K ohms 20% ½ Watt
R202	180 K ohms 10% ½ Watt
R203	4.7 K ohms 10% ½ Watt
R204	1.0 K ohm 20% ½ Watt
R205	220 K ohms 20% ½ Watt
R206	10 K ohms 10% ½ Watt
R207	22 K ohms 20% ½ Watt
R208	47 K ohms 20% ½ Watt
R209	10 K ohms 10% ½ Watt
R210	10 K ohms 10% ½ Watt
R211	15 K ohms 20% ½ Watt

COILS

Symbol	Description
L201	Antenna Section, separate for each channel
L202	Antenna Section, separate for each channel
L203	R.F. Section, separate for each channel
L204	R.F. Section, separate for each channel
L205	R.F. Section, separate for each channel
L206	Heater Choke
L207	Neutralizing Coil
L208	Heater Choke
L209	Tuned I.F. Coil

MISCELLANEOUS

Description
Tube—6BK7/6BQ7
Tube—6J6

LIST OF PARTS

Symbol	Part No.	Description
R1	32.11	10K 10% ½W.
R2	32.67	330 10% ½W.
R3	32.197	47 10% ½W.
R4	32.173	470 20% ½W.
R5	32.67	330 10% ½W.
R6	32.2	100 10% ½W.
R7	32.2	100 10% ½W.
R8	32.77	8.2K 10% ½W.
R9	32.197	47 10% ½W.
R10	32.2	100 10% ½W.
R11	32.126	5.6K 10% ½W.
R12	32.118	120 10% ½W.
R13	32.11	10K 10% ½W.
R14	32.2	100 10% ½W.
R15	32.103	39K 10% 1W.
R16	32.77	8.2K 10% ½W.
R17	32.33	1 megohm 10% ½W.
R18	32.35	680K 10% ½W.
R19	32.33	1 megohm 10% ½W.
R20	52.64	750 tapped at 250 (Contrast)
R21	32.125	82 10% ½W.
R22	32.103	39K 10% 1W.
R23	32.660	39K 10% 2W.
R24	32.660	39K 10% 2W.
R25	117.80	5K 10% 10W. W.W.
R26	32.15	47K 10% ½W.
R27	32.74	4.7K 10% 1W.
R28	32.12	15K 10% ½W.
R29	32.13	22K 10% ½W.
R30	32.13	22K 10% ½W.
R31	52.64	500K (Volume)
R32	32.99	10 megohm 20% ½W.
R33	32.18	220K 20% ½W.
R34	32.92	470K 10% ½W.
R35	32.115	680 10% 1W.
R36	32.399	470 10% 1W.
R37	32.92	470K 10% ½W.
R38	32.205	330K 10% ½W.
R39	52.70	50K (Brightness)
R40	32.183	22K 20% ½W.
R41	32.208	1.8 megohm 10% ½W.
R42	32.14	33K 10% ½W.
R43	32.11	10K 10% ½W.
R44	32.15	47K 10% ½W.
R45	32.103	39K 10% 1W.
R46	32.208	1.8 megohm 10% ½W.
R47	32.46	6.8 megohm 10% ½W.
R48	32.60	2.2K 10% ½W.
R49	32.8	1K 10% ½W.
R50	32.60	2.2K 10% ½W.
R51	32.142	12K 10% ½W.
R52	32.411	68K 10% 1W.
R53	32.89	100K 10% ½W.
R54	32.89	100K 10% ½W.
R55	32.98	4.7 megohm 10% ½W.
*R56	32.13	22K 10% ½W.
*R57	32.77	8.2K 10% ½W.
*R58	32.77	8.2K 10% ½W.
R59	32.147	1.5 megohm 10% ½W.
R60	52.66	1 megohm (Vertical Hold)
R61	32.15	47K 10% ½W.
R62	32.34	2.2 megohm 10% ½W.
R63	32.33	1 megohm 10% ½W.
R64	52.24	2.5 megohm (Height)
R65	32.142	12K 10% ½W.
R66	32.34	2.2 megohm 10% ½W.
R67	32.67	330 10% ½W.

Symbol	Part No.	Description
R68	52.68	5K (Vertical Linearity)
R69	32.15	47K 10% ½W.
R70	117.81	7.5K 10% 10W. W.W.
R71	32.18	220K 20% ½W.
R72	32.18	220K 20% ½W.
R73	32.68	560 10% ½W.
R74	32.68	560 10% ½W.
R75	32.8	1K 10% ½W.
R76	32.92	470K 10% ½W.
R77	32.126	5.6K 10% ½W.
R78	32.265	1.5K 5% ½W.
R79	32.15	47K 10% ½W.
R80	32.89	100K 10% ½W.
R81	52.66	50K (Horizontal Hold)
R82	32.90	150K 10% ½W.
R83	32.202	3.9K 10% ½W.
R84	32.92	470K 10% ½W.
R85	32.655	15K 10% 2W.
R86	32.2	100 10% ½W.
R87	32.635	100 10% 2W.
R88	117.71	17.5K 10% 10W. W.W.
R90	32.137	5.1 10% ½W. I.R.C.-W.W.
R91	32.373	100K 20% 1W.
R92	117.74	500 10% 20W. W.W.
R93	117.74	500 10% 20W. W.W.
R94	117.74	500 10% 20W. W.W.
R95	117.83	2500 10% 25W. W.W.
R100	32.10	6.8K 10% ½W.
R101	32.660	39K 10% 2W.
R117	32.412	82K 10% 1W.
R118	32.126	5.6K 10% ½W.
R120	52.70	500K ohms (Tone)
*R56, *R57, *R58	167.1	Vertical Integrator. Three Resistors in one unit, plus C50, C51, C52.
C1	17.44	.005 mf GMV Disc 500V.
C2	17.44	.005 mf GMV Disc 500V.
C3	17.45	1500 mmf 20% 500V. Ceramic
C4	17.106	120 mmf 20% 500V. Ceramic
C5	17.44	.005 mf GMV Disc 500V.
C6	17.106	120 mmf 20% 500V. Ceramic
C7	17.130	47 mmf 10% NPO 500V. Ceramic
C8	17.127	2 mmf 10% 500V. Ceramic
C9	17.44	.005 mf GMV Disc 500V.
C10	17.44	.005 mf GMV Disc 500V.
C11	17.44	.005 mf GMV Disc 500V.
C12	17.44	.005 mf GMV Disc 500V.
C13	17.106	120 mmf 20% 500V. Ceramic
C14	17.106	120 mmf 20% 500V. Ceramic
C15	17.44	.005 mf GMV Disc 500V.
C16	17.131	3 mmf 20% 500V. Ceramic
C17	12.49	.1 mf 20% 200V.
C18	17.44	.005 mf GMV Disc 500V.
C19	17.79	5 mmf 10% 500V. Ceramic
C20	12.72	.01 mf 20% 400V.
C21	12.49	.1 mf 20% 200V.
C22	17.108	680 mmf 20% 500V. Ceramic
C23	17.107	470 mmf 10% 500V. Ceramic
C24A	22.80D	25 mf 450V. Electrolytic
C24B	22.80D	80 mf 350V. Electrolytic
C24C	22.80D	10 mf 350V. Electrolytic
C25	17.59	2 mmf 20% 500V. Ceramic
C26	17.105	39 mmf 20% 500V. Ceramic

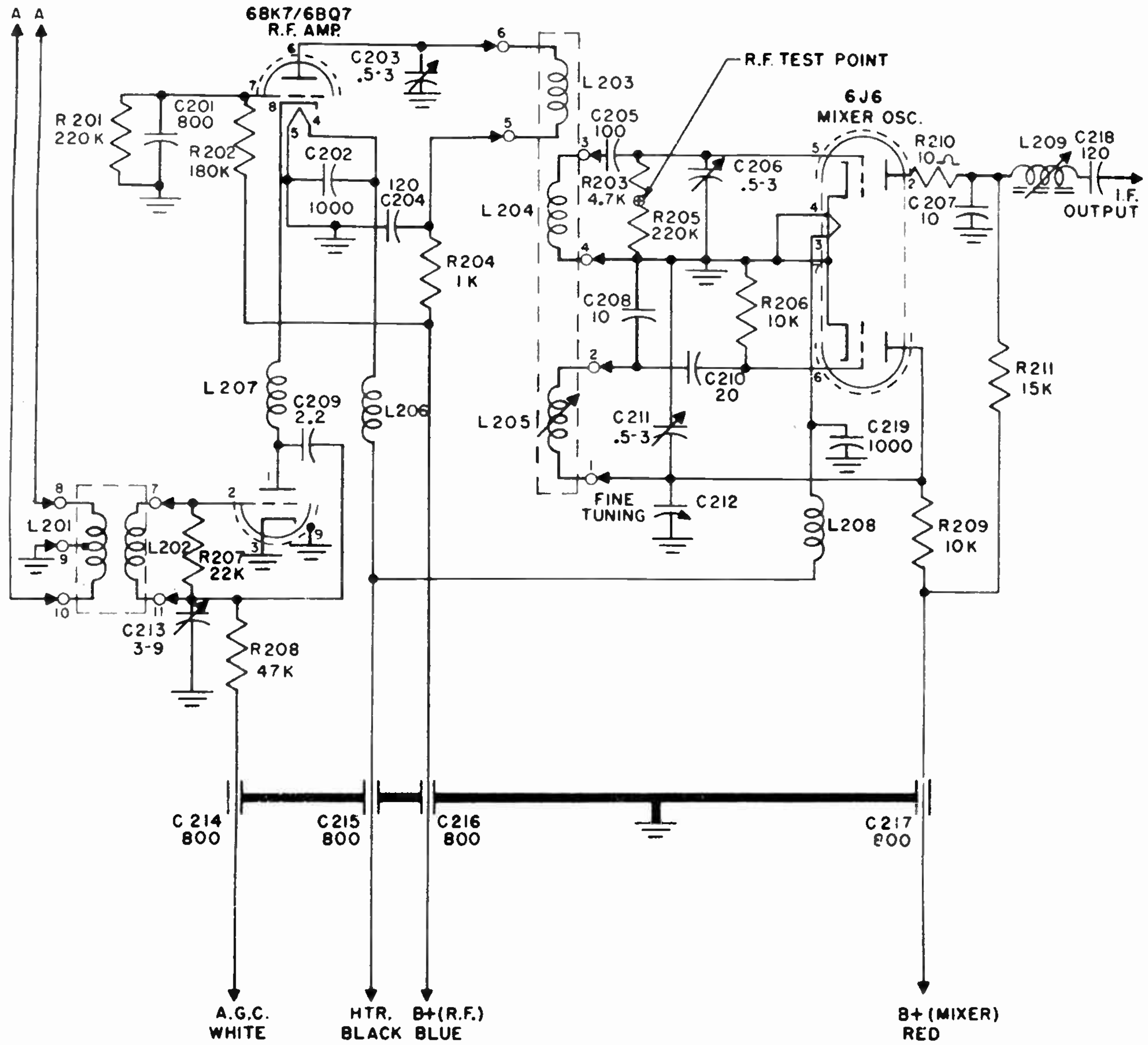
Symbol	Part No.	Description
C27	17.80	.01 mf GMV Disc 350V.
C28	17.125	620 mmf 10% 350V. Ceramic or Mica
C29	12.71	.0039 mf 20% 400V.
C30	22.70	1 mf 150V. Electrolytic
C31	12.72	.01 mf 20% 400V.
C32	12.68	.005 mf 20% 400V.
C33	12.82	.02 mf 20% 400V.
C34	22.66	25 mf 50V. Electrolytic
C35	12.68	.005 mf 20% 400V.
C36	12.60	.1 mf 20% 600V.
C37	12.75	.1 mf 20% 400V.
C38	12.67	.05 mf 20% 400V.
C39	12.82	.02 mf 20% 400V.
C40	17.80	.01 mf GMV Disc 500V.
C41	12.92	.5 mf 20% 200V.
C42	17.109	1000 mmf 10% 500V. Ceramic
C43	17.109	1000 mmf 10% 500V. Ceramic
C44	12.72	.01 mf 20% 400V.
C45	17.132	43 mmf 5% 1500V. Mica
C46A	22.81	20 mf 450V. Electrolytic
C46B	22.81	20 mf 450V. Electrolytic
C46C	22.81	20 mf 450V. Electrolytic
C46D	22.81	100 mf 50V. Electrolytic
C47	22.85	40 mf 350V. Electrolytic
C48	12.75	.1 mf 20% 400V.
C49	12.67	.05 mf 20% 400V.
*C50	12.86	.002 mf 20% 400V.
*C51	12.68	.005 mf 20% 400V.
*C52	12.68	.005 mf 20% 400V.
C53	12.83	.005 mf 20% 600V.
C54	12.68	.005 mf 20% 400V.
C55	12.67	.05 mf 20% 400V.
C56	12.77	.25 mf 20% 400V.
C57	17.113	3900 mmf 5% 500V. Silver Mica
C58	17.69	330 mmf 10% 500V. Silver Mica
C59	17.123	270 mmf 10% 500V. Mica
C61	132.18	25-280 mmf Ceramic Trimmer
C62	17.129	100 mmf 10% 1000V. Mica
C63	22.56	5 mf 50V. Electrolytic
C64	12.66	.05 mf 20% 600V.
C65	12.77	.25 mf 20% 400V.
C66	12.67	.047 mf 20% 400V.
C67	17.116	500 mmf 20KV. H.V. Condenser
C68A	22.79	50 mf 475V. Electrolytic
C68B	22.79	40 mf 475V. Electrolytic
C69	22.82	40 mf 450V. Electrolytic
C70	17.136	.01 mf GMV Disc 500V.
C71	17.136	.01 mf GMV Disc 500V.
C80	17.35	6800 mmf 20% 350V. Ceramic
C81	17.44	.005 mf GMV Disc 350V.
C83	17.123	270 mmf 10% 500V. Mica
C85	12.68	.005 20% 400V
*C50, C51, C52	167.1	Vertical Integrator, Three Capacitors in One Unit Plus R56, R57, R58.
L2	37.89	Filament Choke
L3	37.99	I.F. Coil
L4	37.89	Filament Choke

Symbol	Part No.	Description
L5	37.197	I.F. Choke
L6	37.99	I.F. Coil
L7	37.89	Filament Choke
L8	37.197	I.F. Choke
L9	37.99	I.F. Coil
L10	37.234	Video Coil 120uh
L11	37.235	Video Coil 600uh
L12	37.252	4.5 Mc Take-Off Coil
L13	37.252	4.5 Mc Take-Off Coil
L14	37.236	Video Coil 190uh + 18K-R
L15	37.237	Video Coil 245uh
L16	37.253	4.5 Mc Ratio Detector
L17	37.253	4.5 Mc Ratio Detector
L18	37.265	Vertical Yoke Coil
L19	37.265	Vertical Yoke Coil
L20	37.233	Horizontal AFC Coil
L21	37.244	Horizontal Linearity Coil
L22	37.248	Width Coil
L23	37.265	Horizontal Yoke Coil
L24	37.265	Horizontal Yoke Coil
L25	37.268	I.F. Sound Trap
T1	42.61	Power Transformer
T2	42.56	Choke
T4	37.264	Horiz. Defl. Output Trans.
T5	42.53	Vert. Osc. Trans.
T6	42.65	Vert Output Trans.
T7	42.57	Audio Output Trans.
	42.71	R.F. Unit and Tubes

Model DL21T Part No.	Model 21T Part No.	Description
92.537	92.533	Safety Glass
92.538	92.367	Bottom Plate for Cabinet
92.381-1	92.381-1	Escutcheon
92.114	92.114	Escutcheon Mtg. Spring
97.339	97.339	Grille Cloth
97.472	97.473	Cabinet
97.474	97.485	Cabinet Back
97.481	97.483	Mask
142.94	142.94	Knob—Outside Shaft
142.93	142.93	Knob—Inside Shaft
142.91	142.91	Knob—Channel Selector
142.92	142.92	Knob—Fine Tuning
107.46	107.46	Speaker
92.375	92.375	FADA Nameplate
	102.701	Decorative Nameplate
	62.389	Nameplate Mtg. Bracket
112.23	112.23	Ion Trap
112.38	112.38	P.M. Focalizer
	97.482	Control Panel

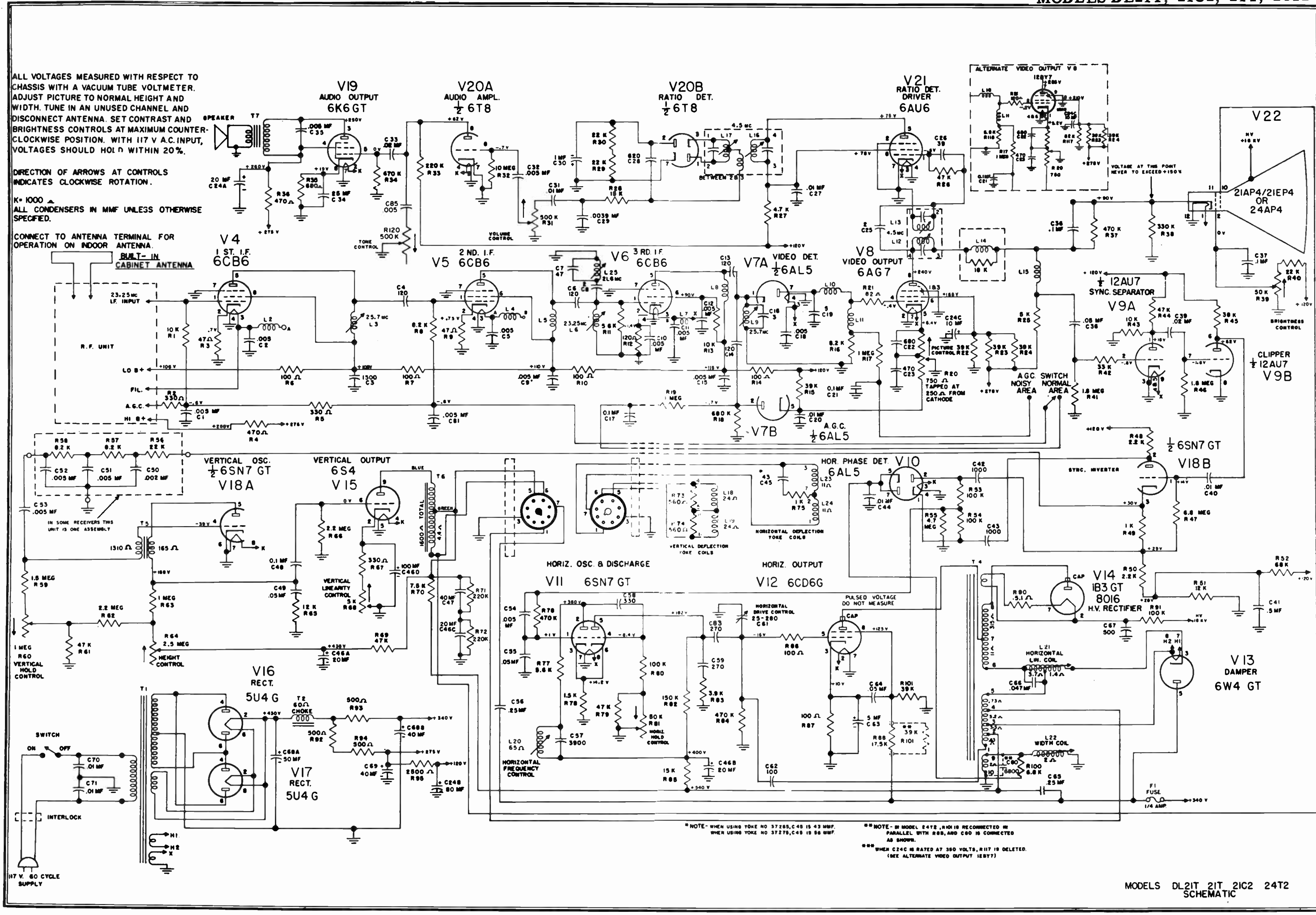
Model 24T2 Part No.	Model 21C2 Part No.	Description
92.502	92.403	Safety Glass
92.500	92.474	Bottom Plate for Cabinet
92.504-1	92.504-1	Escutcheon
92.114	92.114	Escutcheon Mtg. Spring
97.461	97.394	Grille Cloth
97.455	97.360	Cabinet
97.460	97.379	Cabinet Back
97.459-1	97.469	Mask
142.94	142.94	Knob—Outside Shaft
142.93	142.93	Knob—Inside Shaft
142.91	142.91	Knob—Channel Selector
142.92	142.92	Knob—Fine Tuning
107.53	107.47	Speaker
92.375	92.375	FADA Nameplate
112.23	112.23	Ion Trap
112.38	112.38	P.M. Focalizer

ALL OTHER PARTS, ORDER ACCORDING TO MODEL NUMBER OF RECEIVER.



1. ALL CAPACITANCE VALUES STATED IN MMF.
2. R201 & R202 MAY BOTH BE CODED 220K, BUT ARE SELECTED.
3. INTERCHANGE OF TUBE TYPE IN R.F. AMPLIFIER REQUIRES REALIGNMENT OF C203, C206, & C213.

SCHEMATIC R.F. UNIT


ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS WITH A VACUUM TUBE VOLTMETER. ADJUST PICTURE TO NORMAL HEIGHT AND WIDTH. TUNE IN AN UNUSED CHANNEL AND DISCONNECT ANTENNA. SET CONTRAST AND BRIGHTNESS CONTROLS AT MAXIMUM COUNTER-CLOCKWISE POSITION. WITH 117 V A.C. INPUT, VOLTAGES SHOULD HOLD WITHIN 20%.
DIRECTION OF ARROWS AT CONTROLS INDICATES CLOCKWISE ROTATION.
K= 1000
ALL CONDENSERS IN MMF UNLESS OTHERWISE SPECIFIED.
CONNECT TO ANTENNA TERMINAL FOR OPERATION ON INDOOR ANTENNA.
BUILT-IN CABINET ANTENNA
R.F. UNIT
V19 AUDIO OUTPUT 6K6GT
V20A AUDIO AMPL. ½ 6T8
V20B RATIO DET. ½ 6T8
V21 RATIO DET. DRIVER 6AU6
ALTERNATE VIDEO OUTPUT V8 12BY7
V22 21AP4/21EP4 OR 24AP4
V4 1 ST. I.F. 6CB6
V5 2 ND. I.F. 6CB6
V6 3 RD. I.F. 6CB6
V7A VIDEO DET. ½ 6AL5
V8 VIDEO OUTPUT 6AG7
½ 12AU7 SYNC. SEPARATOR V9A
CLIPPER ½ 12AU7 V9B
V7B A.G.C. ½ 6AL5
AGC SWITCH NOISY AREA NORMAL AREA
½ 6SN7 GT V18B SYNC. INVERTER
VERTICAL OSC. ½ 6SN7 GT V18A
VERTICAL OUTPUT 6S4 V15
HOR. PHASE DET. V10 6AL5
VERTICAL DEFLECTION YOKE COILS
HORIZONTAL DEFLECTION YOKE COILS
IN SOME RECEIVERS THIS UNIT IS ONE ASSEMBLY
VERTICAL HOLD CONTROL
HEIGHT CONTROL
VERTICAL LINEARITY CONTROL
HORIZ. OSC. & DISCHARGE V11 6SN7 GT
HORIZ. OUTPUT V12 6CD6G
HORIZONTAL DRIVE CONTROL
PULSED VOLTAGE DO NOT MEASURE
V14 1B3 GT 8016 H.V. RECTIFIER
V13 DAMPER 6W4 GT
L21 HORIZONTAL LIN. COIL
L22 WIDTH COIL
HORIZ. HOLD CONTROL
HORIZONTAL FREQUENCY CONTROL
V16 RECT. 5U4 G
V17 RECT. 5U4 G
T2 60Ω CHOKE
SWITCH ON OFF
INTERLOCK
117 V. 60 CYCLE SUPPLY
F1 FUSE 1/4 AMP
PICTURE CONTROL
BRIGHTNESS CONTROL
TONE CONTROL
VOLUME CONTROL
VOLTAGE AT THIS POINT NEVER TO EXCEED +150%
* NOTE - WHEN USING YOKE NO 57265, C45 IS 43 MMF. WHEN USING YOKE NO 37275, C45 IS 56 MMF.
** NOTE - IN MODEL 24T2, R101 IS RECONNECTED IN PARALLEL WITH R88, AND C60 IS CONNECTED AS SHOWN.
*** WHEN C24C IS RATED AT 350 VOLTS, R117 IS DELETED. (SEE ALTERNATE VIDEO OUTPUT 12BY7)
MODELS DL21T 21T 21C2 24T2 SCHEMATIC

NO.	CODE NO.	DESCRIPTION
13-G-114	105-2-81700	17" Mahogany Table Model
13-G-114A	105-2-81700	17" Mahogany Metal Table Model
13-G-117	105-2-81700	17" Mahogany Open Face Consollette
13-G-118	105-2-82100	21" Mahogany Open Face Console
13-G-124	105-2-82000	20" Mahogany Metal Table Model
13-G-125	105-2-81700	17" Ebony Metal Table Model
13-G-122	105-2-82001	20" Mahogany Open Face Console

TELEVISION ALIGNMENT PROCEDURE

Aligning a television receiver is an exacting procedure and involves the use of bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the customer's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble:

1 – The antenna and installation.
2 – Front panel and rear chassis controls, including picutre tube adjustments.
3 – Reception on all available channels.
4 – Tube failures. Substitute from your kit of known good replacements.
5 – Visual inspection of underside of chassis for obvious faults, such as loose connections, etc.

TEST EQUIPMENT REQUIRED FOR ALIGNMENT

The equipment specified below is desirable, but in cases where this equipment is not available, it is possible to align the receiver by use of a 20 to 30 mc. modulated r-f signal generator, using the picture and speaker as indication of alignment.

1 – Signal Generator with an output variable between 100 and 100,000 microvolts, and crystal controlled or crystal-calibrated at the following frequencies:
  a– 4.5 megacycles
  b– 22.8 megacycles
  c– 25.4 megacycles
  d– 21.25 megacycles
2 – DC Vacuum Tube Voltmeter with 5 volt and 10 volt scales.
3 – A pair of balanced (± 1%) 100K carbon resistors.

TEST EQUIPMENT
REQUIRED FOR SWEEP ALIGNMENT CHECK

1 – R-F sweep generator with frequencies ranging from 40 to 220 megacycles, having sweep width of approximately 10 megacycles, and having adjustable output to approximately 0.1 volt.
2 – Crystal-controlled or crystal-calibrated markers for the picture and sound carriers of each channel.
3 – Cathode Ray Oscilloscope with good low frequency response.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A HIGH POTENTIAL. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE COLOR PLUG FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

I.F. ALIGNMENT PROCEDURE

1 – Connect "high" lead of signal generator to the test point located on the top of the RF tuner unit (Refer to the R-F tuner location diagram located on inside of cabinet). Connect ground to chassis.
2 – Connect DC VTVM lead (through 10K isolating resistor) to 4.7K diode load resistor (R113); ground to chassis. Set VTVM to 5 volt scale, negative polarity.
3 – Set I.F. generator to 25.4 megacycles with sufficient output to read approximately 3 volts on the VTVM.
4 – Carefully adjust L101 and L104 (see tube and tuner location) for maximum deflection on VTVM. Adjust sweep generator output to keep meter reading approximately 3 volts.
5 – Set I.F. signal generator to 22.8 megacycles with sufficient output to read approximately 3 volts on the VTVM.
6 – Carefully adjust L404, L103 (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator output to keep meter reading approximately 3 volts.
7 – Set I.F. signal generator to 21.25 megacycles, set VTVM to 10 volt scale (negative polarity), and adjust signal generator output for convenient deflection on VTVM.
8 – Adjust L114 for minimum deflection on VTVM.

SWEEP ALIGNMENT CHECK

Although not essential, a sweep alignment check is a desirable verification of good R-F and I.F. response. Proceed as follows:

1 – Connect R-F sweep generator to antenna terminals (antenna impedance 300 ohms.)
2 – Calibrate oscilloscope for convenient 5 volts peak-to-peak vertical deflection (5 volts peak-to-peak is approximately 1/4 of the peak-to-peak voltage of the 6.3V A.C. filament).
3 – Connect vertical input of oscilloscope (through 10K isolating resistor) to 4.7 diode load resistor (R113); ground to chassis. Connect horizontal input of oscilloscope to "scope" terminals of R-F generator; adjust for convenient horizontal sweep.
4 – Set R-F sweep generator to channel 3, television receiver to channel 3, and if necessary, adjust sweep generator output, sweep width, and scope horizontal setting for convenient band-pass display having 5 volts vertical deflection as previously calibrated. (If you must touch scope vertical settings during these adjustments recalibrate scope for 5 volts peak-to-peak as in step 2 above).
5 – Couple crystal-controlled R-F carrier markers very loosely to antenna terminals, adjust receiver FINE TUNING control till video carrier marker is 1/2 down on curve. Turn up marker output till R-f sound carrier is visible on bandpass and adjust sound trap (L114) to minimize effect of sound carrier marker.
6 – Check all channels as above.

SOUND ALIGNMENT

1 – Connect 4.5 megacycle signal generator to pin 2 of 12BH7 (V7) video amplifier.
2 – Connect DC V.T.V.M. lead to pin 7 of 6AL6 (V9) ratio detector, negative polarity.
3 – Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.
4 – Adjust L113 and bottom of T100 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.
5 – Attach two series-connected 100K(± 1%) resistors across R126 (Ratio Detector Load Resistor). Connect DC V.T.V.M. to center-tap of 100K resistors, and connect ground wire of V.T.V.M. to junction of C119 and C120 (Audio Take-Off of T100).
6 – Adjust top of T100 for zero reading on V.T.V.M. between a plus and a minus peak.

VIDEO AMPLIFIER TRAP

When necessary, the video amplifier 4.5 mc trap (L110) should be adjusted as follows:

1 – Connect 4.5 mc signal generator "high" lead to picture tube grid; ground to chassis.
2 – Connect DC V.T.V.M. to pin 7 of 6AL5 (V9) ratio detector, 10 volt scale, negative polarity.
3 – Adjust L110 for minimum deflection on V.T.V.M.

R-F OSCILLATOR

If all channels are not within range of FINE TUNING control, adjust two screws located in front of r-f tuner unit for adjustment of either low or high band. CAUTION: Do not touch adjustments on top of r-f tuner unit, other than converter plate coil, L404, during IF Alignment.

HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.

DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

1 – The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.
2 – The Brightness control should be turned to maximum (clockwise) and the Contrast control should be turned to minimum (counterclockwise).
3 – The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on screen.
4 – The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.
5 – The Brightness control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.
6 – With Brightness and Contrast controls at normal positions, adjust the Focus control (rear of chassis) for well-defined scanning lines.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area outlined by the mask.

The Width control (rear of H.V. cage) should be adjusted to give a picture that will fill the mask horizontally.

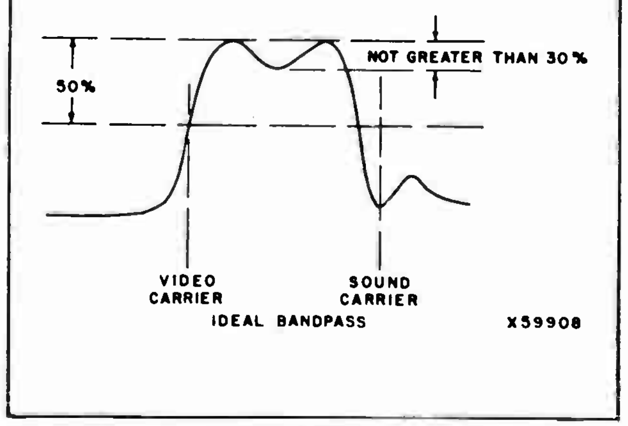
The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically.

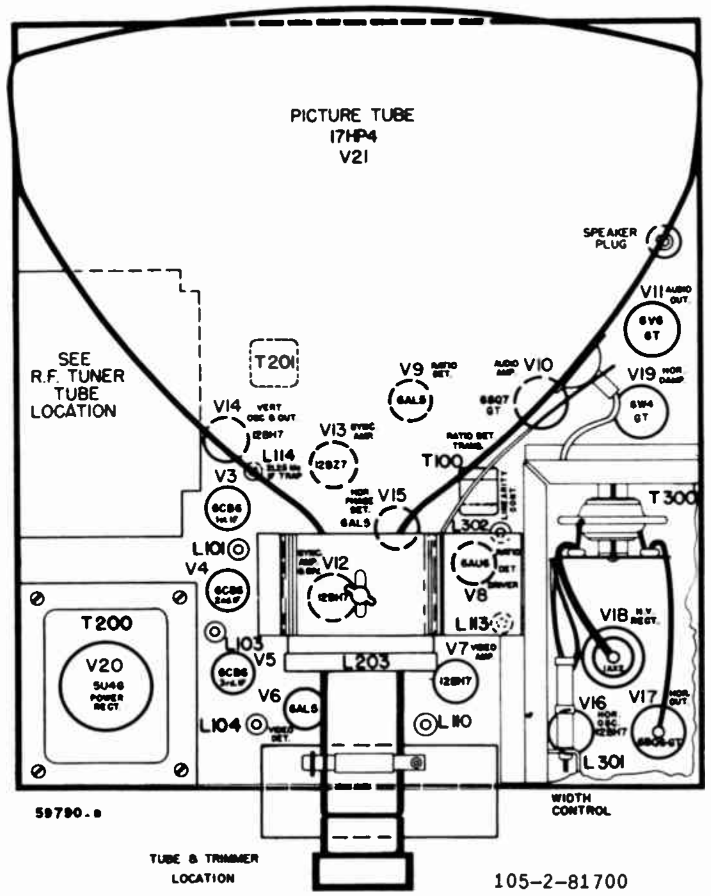
PICTURE TUBE HANDLING PRECAUTIONS

The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow of a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.

HIGH VOLTAGE WARNING

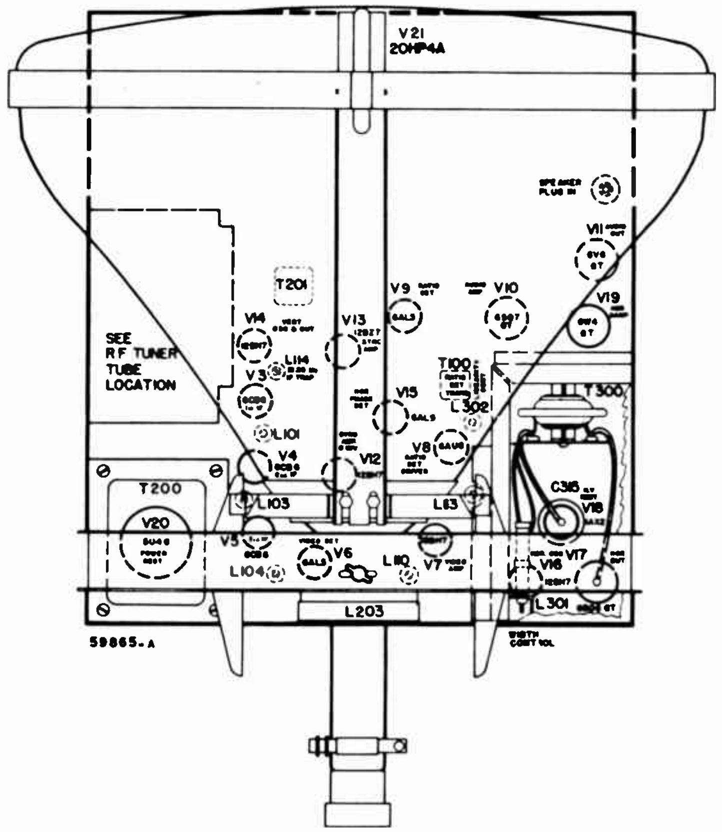
Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.





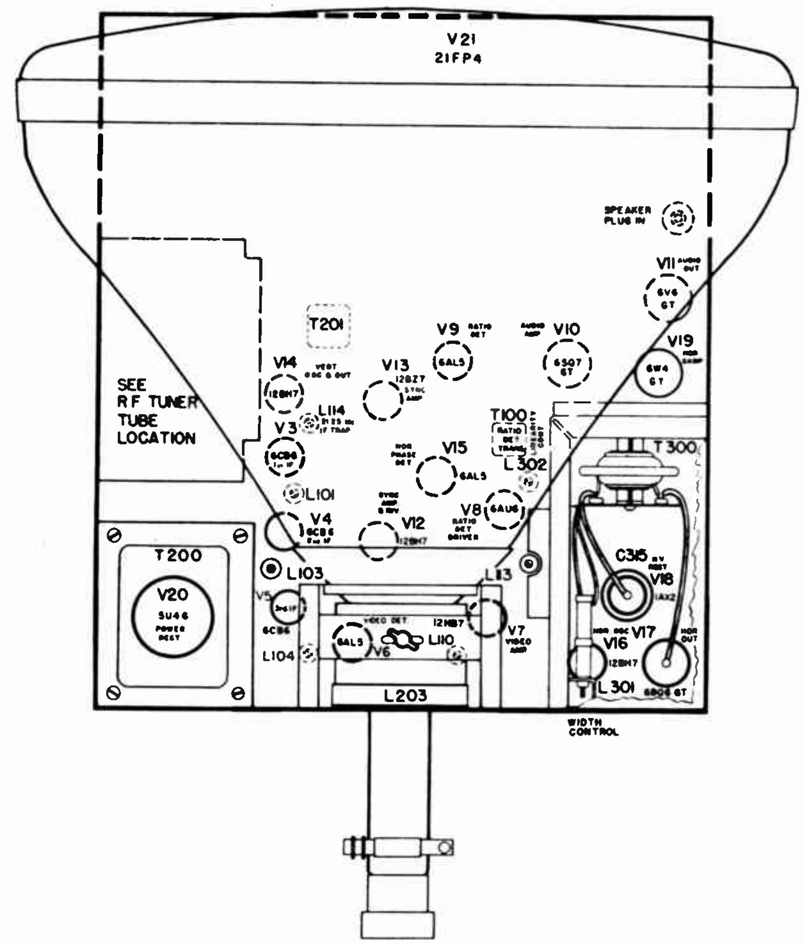
TUBE & TRIMMER LOCATION

105-2-81700



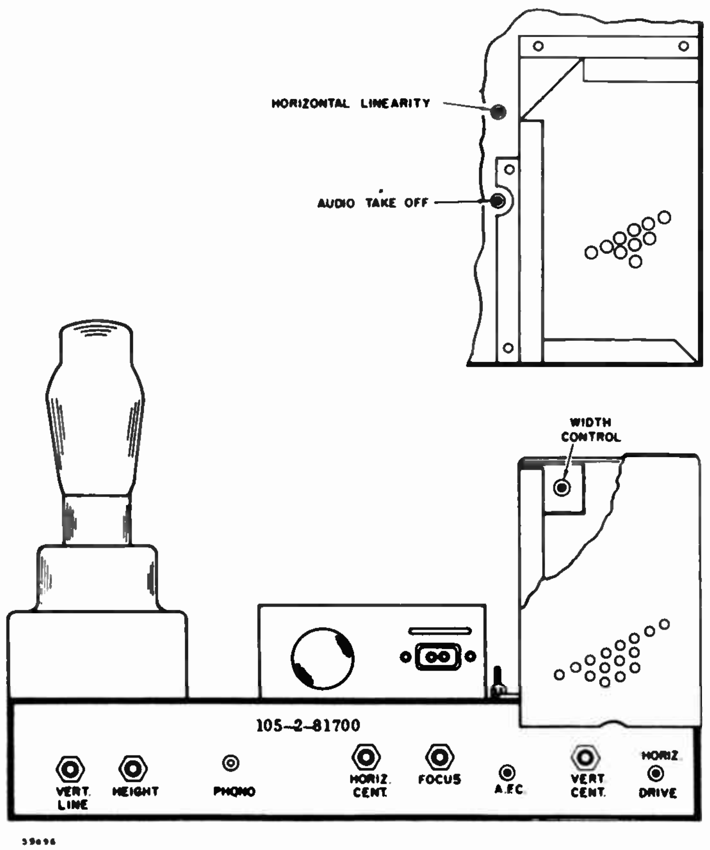
TUBE & TRIMMER LOCATION

105-2-82000

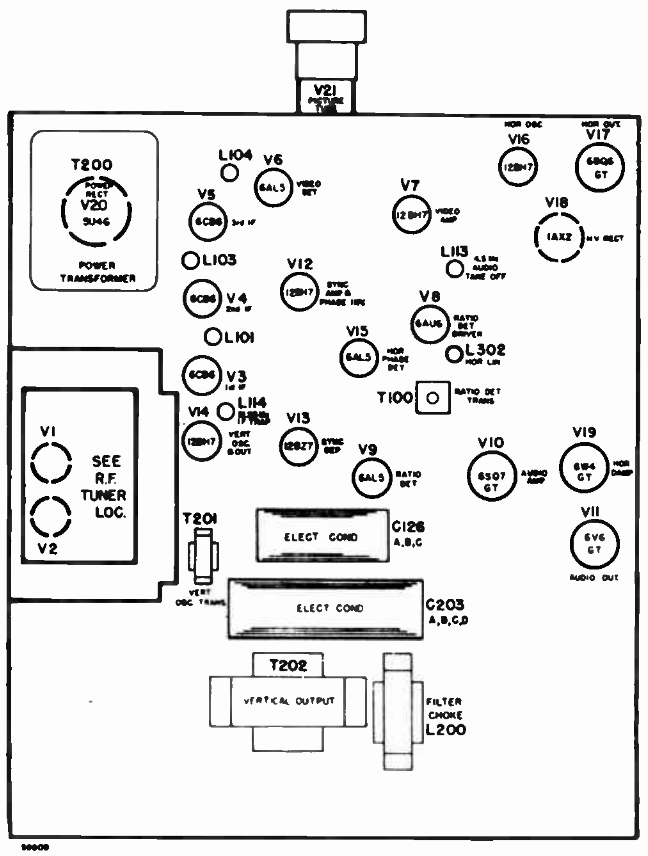


TUBE & TRIMMER LOCATION

105-2-82100

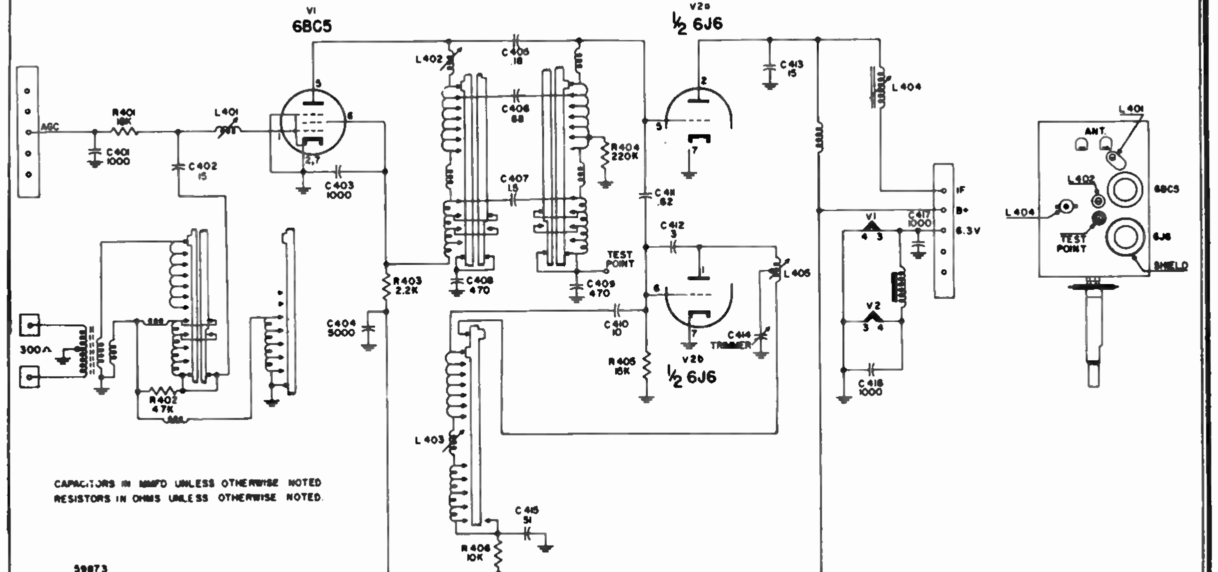


REAR CHASSIS CONTROLS



BOTTOM VIEW

800 SERIES



TUNER SCHEMATIC & TUBE LOCATION

RESISTANCE MEASUREMENTS ON 105-2-82100 CHASSIS

TUBE LOC.	TUBE TYPE	1	2	3	4	5	6	7	8	9
		PIN NUMBERS								
V1	6BC5	150K	0	0	0	25K	25K	0	—	—
V2	6J6	33K	23K	0	0	220K	15K	0	—	—
V3	6CB6	132K	47	0.3	0	23K	23K	0	—	—
V4	6CB6	148K	56	0.3	0	23K	23K	0	—	—
V5	6CB6	0.2	150	0.2	0	23K	23K	0	—	—
V6	6AL5	2.5	0	0	0	0	0	4.7K		
V7	12BH7	26K	4.7K	220	0	0	31K	1M	0 to 5K [A]	0
V8	6AU6	100K	0	0	0	25K	125K	0	—	—
V9	6AL5	∞	∞	0.6	0	0	0	47K	—	—
V10	6SQ7GT	0	10M	0	0	0	500K	0	0	
V11	6V6GT	X	0	29K	29K	470K	X	0	330	—
V12	12BH7	31K	0.5M	2.7K	0	0	91K	11.5K	0	0
V13	12BZ7	20K	2.2M	0	0	0	20K	4.7M	0	0
V14	12BH7	216K	1.5M	3.3K	0	0	1.7M [E]	2.1M [F]	0	0
V15	6AL5	3.4M	3.4M	0	0.6	22K	0	22K	—	—
V16	12BH7	32K	3.8M	1.8K	0.0	0.0	246K	100 to 105K [G]	1.8K	0
V17	6BQ6GT	XX	0	X	36K	470K	X	0	220	Plate=204K
V18	1X2A	Hi-Voltage Rectifier Plate = 204K								
V19	6W4GT	XX	X	204K	X	26K	X	204K	204K	—
V20	5U4G	X	26K	X	100	X	100	X	26K	—
V21	21FP4	Pin1: 0; Pin2: 1M; Pin10: 500K; Pin 11: 370K to 270K [C]; Pin12: 0; Pin6: 210K								

NOTE: Resistances measured from Pin to ground with Phono-TV Switch, if any, in TV position.
X. Indicates that pin is not used as terminal post for another part of the Circuit.
XX. Indicates that pin is used as terminal post for another part of the Circuit.
[A] Varies with contrast (picture) Setting.
[C] Varies with brightness setting.
[D] Varies with linearity setting; reading given is nominal.
[E] Varies with height setting; reading given is nominal.
[F] Varies with vertical speed setting; reading given is nominal.
[G] Varies with Horizontal Hold Control Setting.

TUBE SOCKET VOLTAGES – 105-2-82100 CHASSIS

TUBE LOC.	TUBE TYPE	1	2	3	4	5	6	7	8	9
		PIN NUMBERS								
V1	6BC5	-1	0	0	6.2 ac	105	105	0		
V2	6J6	120	75	0	6.2 ac	-2.5	-4	0		
V3	6CB6	-0.4	0.6	6.0 ac	0	120	120	0		
V4	6CB6	-0.4	0.6	6.0 ac	0	120	120	0		
V5	6CB6	0	1.0	6.1 ac	0	120	120	0		
V6	6AL5	0	0	0	6.3 ac	0	0	-0.4		
V7	12BH7	90	-0.4	2.0	6.3 ac	6.3 ac	165 to [A] 175	0.5 to [A] 40	3.5 to [A] 70	0
V8	6AU6	-0.5	0	0	6.3 ac	120	50	0		
V9	6AL5	-0.5	-0.5	5.5 ac	0	0	0	-1.5		
V10	6SQ7GT	0	-1	0	0	0	85	6.3 ac	0	
V11	6V6GT	0	0	200	210	0	0	6.3 ac	10	
V12	12BH7	60	20	20	0	0	20	-0.4	0	6.3 ac
V13	12BZ7	90	-0.8	0	0	0	90	-0.9	0	6.3 ac
V14	12BH7	420	-.3 [D]	22 [D]	0	0	100 [G]	-30	0	6.3 ac
V15	6AL5	12	-12	0	5.5 ac	0.1	0	0.1		
V16	12BH7	290	0.1	15	6.3 ac	6.3 ac	120	-5	15	0
V17 [E]	6BQ6GT	-20	0	0	155	-20	0	6.3 ac	15	
V18	1X2A	High – Voltage Rectifier								
V19	6W4GT	320	0	525	0	310	0	525 [F]	525 [F]	
V20	5U4G		340		320 ac		320 ac.		340	
V21	21FP4	Pin 1:0; Pin 2: 3 to 6; [A] Pin 10: 515; Pin 11: 40 to 150; [C] Pin 12: 6.3 ac;								

NOTE: All voltages measured with V. T. V. M. from pin to ground with line voltage of 117V ac and antenna terminals shorted. Values are DC unless otherwise noted. The Phono-TV switch, if provided, is in the TV position.
[A] Varies with contrast (picture) setting.
[C] Varies with brightness setting.
[D] Varies with linearity setting.
[E] Varies with Horizontal Hold setting.
[F] Pins 7 and 8 are filament terminals.
[G] Varies with height setting.

RESISTANCE MEASUREMENTS ON 105-2-81700 and 105-2-82000 CHASSIS

TUBE LOC.	TUBE TYPE	1	2	3	4	5	6	7	8	9
		PIN NUMBERS								
V1	6BC5	150K	0	0	0	25K	25K	0	—	—
V2	6J6	33K	23K	0	0	220K	15K	0	—	—
V3	6CB6	132K	47	0.3	0	23K	23K	0	—	—
V4	6CB6	148K	56	0.3	0	23K	23K	0	—	—
V5	6CB6	0.2	150	0.2	0	23K	23K	0	—	—
V6	6AL5	2.5	0	0	0	0	0	4.7K		
V7	12BH7	26K	4.7K	220	0	0	31K	1M	0 to 5K [A]	0
V8	6AU6	100K	0	0	0	25K	125K	0	—	—
V9	6AL5	∞	∞	0.6	0	0	0	47K	—	—
V10	6SQ7GT	0	10M	0	0	0	500K	0	0	
V11	6V6GT	X	0	29K	29K	470K	X	0	330	—
V12	12BH7	31K	0.5M	2.7K	0	0	91K	11.5K	0	0
V13	12BZ7	20K	2.2M	0	0	0	20K	4.7M	0	0
V14	12BH7	216K	1.5M	3.3K	0	0	1.7M [E]	2.1M [F]	0	0
V15	6AL5	3.4M	3.4M	0	0.6	22K	0	22K	—	—
V16	12BH7	32K	3.8M	1.8K	0.0	0.0	246K	100 to 105K [G]	1.8K	0
V17	6BQ6GT	XX	0	X	36K	470K	X	0	220	Plate=204K
V18	1X2A	Hi-Voltage Rectifier Plate = 204K								
V19	6W4GT	XX	X	204K	X	26K	X	204K	204K	—
V20	5U4G	X	26K	X	100	X	100	X	26K	—
V21	17HP4 [B]	Pin1: 0; Pin2: 1M; Pin10: 500K; Pin 11: 370K to 270K [C]; Pin12: 0; Pin6: 210K								

NOTE: Resistances measured from Pin to ground with Phono-TV Switch, if any, in TV position.
X. Indicates that pin is not used as terminal post for another part of the Circuit.
XX. Indicates that pin is used as terminal post for another part of the Circuit.
[A] Varies with contrast (picture) Setting.
[B] On 820 and 820-1 tube type is 20HP4A and Pin 6 = 210K
[C] Varies with brightness setting.
[D] Varies with linearity setting; reading given is nominal.
[E] Varies with height setting; reading given is nominal.
[F] Varies with vertical speed setting; reading given is nominal.
[G] Varies with Horizontal Hold Control Setting.

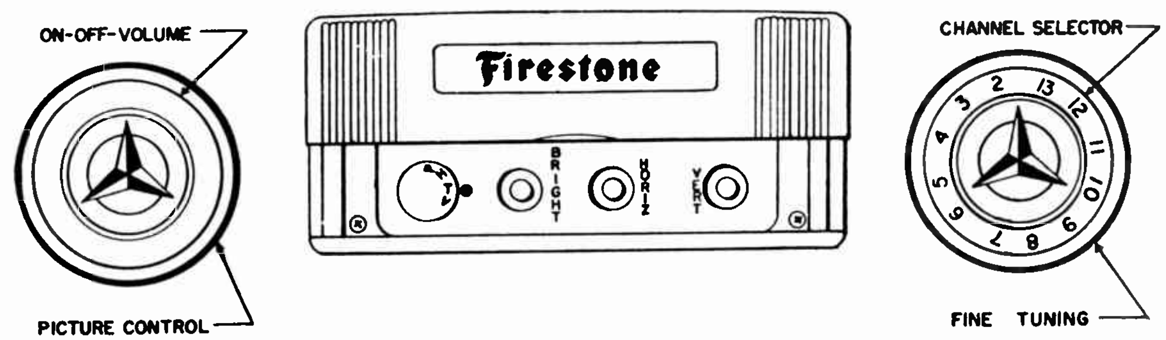
TUBE SOCKET VOLTAGES ON 105-2-81700 and 105-2-82000 CHASSIS

TUBE LOC.	TUBE TYPE	1	2	3	4	5	6	7	8	9
		PIN NUMBERS								
V1	6BC5	-1	0	0	6.2 ac	105	105	0		
V2	6J6	120	75	0	6.2 ac	-2.5	-4	0		
V3	6CB6	-0.4	0.6	6.0 ac	0	120	120	0		
V4	6CB6	-0.4	0.6	6.0 ac	0	120	120	0		
V5	6CB6	0	1.0	6.1 ac	0	120	120	0		
V6	6AL5	0	0	0	6.3 ac	0	0	-0.4		
V7	12BH7	90	-0.4	2.0	6.3 ac	6.3 ac	165 to [A] 175	0.5 to [A] 40	3.5 to [A] 70	0
V8	6AU6	-0.5	0	0	6.3 ac	120	50	0		
V9	6AL5	-0.5	-0.5	5.5 ac	0	0	0	-1.5		
V10	6SQ7GT	0	-1	0	0	0	85	6.3 ac	0	
V11	6V6GT	0	0	200	210	0	0	6.3 ac	10	
V12	12BH7	60	20	20	0	0	20	-0.4	0	6.3 ac
V13	12BZ7	90	-0.8	0	0	0	90	-0.9	0	6.3 ac
V14	12BH7	420	-.3 [D]	22 [D]	0	0	100 [G]	-30	0	6.3 ac
V15	6AL5	12	-12	0	5.5 ac	0.1	0	0.1		
V16	12BH7	290	0.1	15	6.3 ac	6.3 ac	120	-5	15	0
V17 [E]	6BQ6GT	-20	0	0	155	-20	0	6.3 ac	15	
V18	1X2A	High – Voltage Rectifier								
V19	6W4GT	320	0	525	0	310	0	525 [F]	525 [F]	
V20	5U4G		340		320 ac		320 ac.		340	
V21	17HP4 [B]	Pin 1:0; Pin 2: 3 to 6; [A] Pin 10: 515; Pin 11: 40 to 150; [C] Pin 12: 6.3 ac;								

NOTE: All voltages measured with V. T. V. M. from pin to ground with line voltage of 117V ac and antenna terminals shorted. Values are DC unless otherwise noted. The Phono-TV switch, if provided, is in the TV position.
[A] Varies with contrast (picture) setting.
[B] On 820 and 820-1 tube type is 20HP4A and Pin 6 = 515V
[C] Varies with brightness setting.
[D] Varies with linearity setting.
[E] Varies with Horizontal Hold setting.
[F] Pins 7 and 8 are filament terminals.
[G] Varies with height setting.

NO. 13-G-118 CODE NO. 105-2-82100

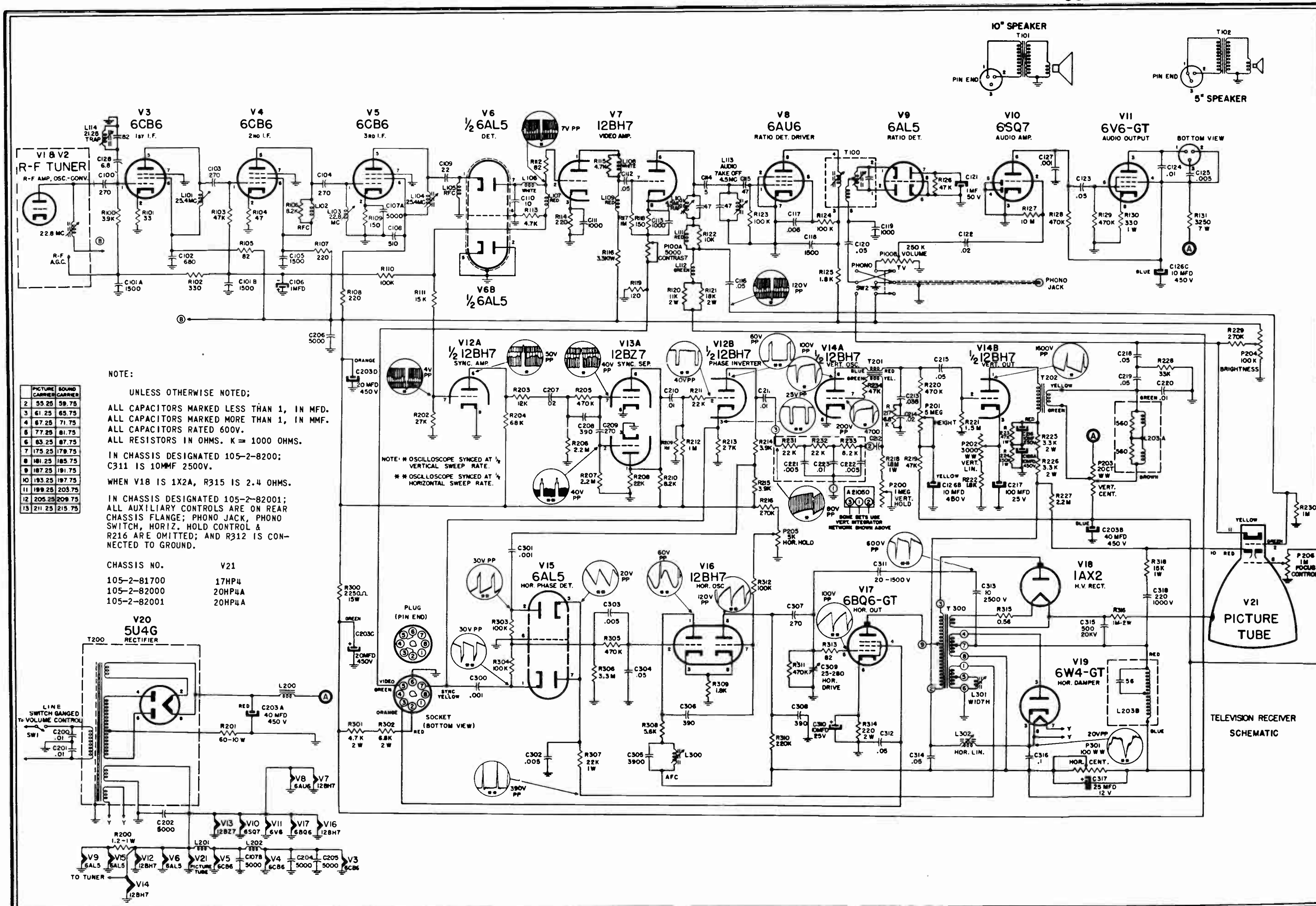
The safety glass of this receiver is removable so that the face of the picture tube may be cleaned. To accomplish this remove power cord from wall socket. Remove the upper strip that holds the safety glass in place by removing the five screws which secure the strip, supporting the safety glass so that it does not fall forward. Remove the safety glass by tilting it forward and lifting it out of the slot in the lower glass retaining strip. Be careful not to scratch or strike the surface of the picture tube with any object. Carefully clean face of picture tube and the inside surface of the safety glass with a soft, clean, dry cloth. DO NOT ATTEMPT TO REMOVE THE PICTURE TUBE MASK. Reassemble by inserting glass in slot of lower strip. Replace upper strip and tighten the screws securely.



FRONT PANEL CONTROLS

CABINET PARTS REPAIR LIST

PART NAME	CODE NO. / STOCK NO.	13-G-114 105-2-81700	13-G-114A 105-2-81700	13-G-117 105-2-81700	13-G-118 105-2-82100	13-G-124 105-2-82000	13-G-125 105-2-81700
Cabinet		A60168-1F	A60165-1F	A60170-1F	A60164-1F	A60166-1F	A60165-3F
Trapdoor, Cover		A44101	A44101	A44101	A44101	A44101	A44101
Trapdoor, Base		A4498	A4498	A4498	A4498	A4498	A4498
Safety Glass		A62290	A62327	A62368	A62409	A62361	A62327
Mask		A62367-1	—	A62366-3	A62424	—	—
Glass Retainer Strip, (Upper)		—	—	—	A62410-1	—	—
Glass Retainer Strip, (Lower)		—	—	—	A62427-1	—	—
Back Cover		A62452	A62329	A62429	A62430	A62360	A62329
Speaker		A5866 5" PM	A5866 5" PM	A58124 8" PM	A58129 7-1/2" PM	A5866 5" PM	A5866 5" PM
Knob, Channel Selector		A39242-1	A39242-1	A39242-1	A39242-1	A39242-1	A39242-2
Knob, Vernier		A39240-3	A39240-3	A39240-3	A39240-3	A39240-3	A39240-3
Knob, On-Off-Volume		A39241-1	A39241-1	A39241-1	A39241-1	A39241-1	A39241-2
Knob, Pix Control		A39239-3	A39239-3	A39239-3	A39239-3	A39239-3	A39239-3
Knob, Phono-TV Switch		A39249	A39249	A39249	A39243	A39249	A39249



	PICTURE CARRIER	SOUND CARRIER
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

NOTE:

UNLESS OTHERWISE NOTED;

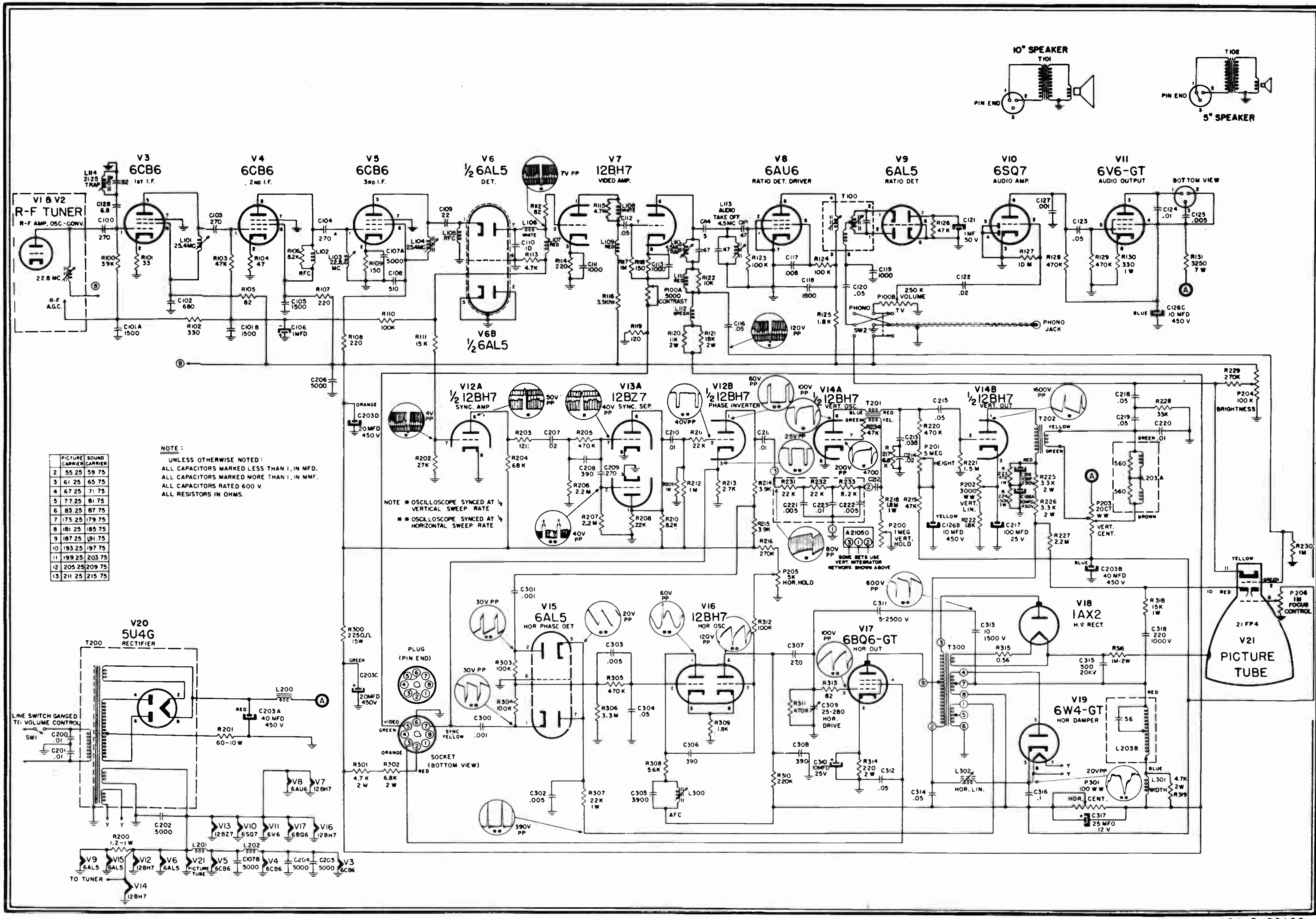
ALL CAPACITORS MARKED LESS THAN 1, IN MFD.
ALL CAPACITORS MARKED MORE THAN 1, IN MMF.
ALL CAPACITORS RATED 600V.
ALL RESISTORS IN OHMS. K = 1000 OHMS.

IN CHASSIS DESIGNATED 105-2-8200;
C311 IS 10MMF 2500V.

WHEN V18 IS 1X2A, R315 IS 2.4 OHMS.

IN CHASSIS DESIGNATED 105-2-82001; ALL AUXILIARY CONTROLS ARE ON REAR CHASSIS FLANGE; PHONO JACK, PHONO SWITCH, HORIZ. HOLD CONTROL & R216 ARE OMITTED; AND R312 IS CONNECTED TO GROUND.

CHASSIS NO.	V21
105-2-81700	17HP4
105-2-82000	20HP4A
105-2-82001	20HP4A



NOTE:

UNLESS OTHERWISE NOTED:

ALL CAPACITORS MARKED LESS THAN 1, IN MFD.

ALL CAPACITORS MARKED MORE THAN 1, IN MMF.

ALL CAPACITORS RATED 600 V.

ALL RESISTORS IN OHMS.

	PICTURE CARRIER	SOUND CARRIER
2	55 25	59 75
3	61 25	65 75
4	67 25	71 75
5	77 25	81 75
6	83 25	87 75
7	175 25	179 75
8	181 25	185 75
9	187 25	191 75
10	193 25	197 75
11	199 25	203 75
12	205 25	209 75
13	211 25	215 75

REPAIR PARTS LIST

CAPACITORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
C100		A190-133	Mica 270 mmf 500V ± 10%
C101		A19147	Ceramic; 1500 mmf Dual Disc (Insul.)
C102		A556-234	Ceramic Tubular; 680 mmf 350V ± 10%
C103		A190-133	Mica 270 mmf 500V ± 10%
C104		A190-133	Mica 270 mmf 500V ± 10%
C105		A19148	Ceramic; 1500 mmf Single Disc (Insul.)
C106		A20138	Electrolytic; 1 mfd 50V.
C107		A19163	Ceramic 5000 mmf Dual Disc (Insul.)
C108		A556-233	Ceramic Tubular; 510 mmf 500V ± 10%
C109		A190-107	Mica; 22 mmf 500V ± 10%
C110		A555-101	Ceramic Tubular 10 mmf 500V ± 20% (Uninsul.)
C111		A555-136	Ceramic Tubular: 1000 mmf 350V ± 20% (Uninsul.)
C112		A194-160	Paper; .05 mfd 600V ± 20%
C113		A155-136	Ceramic Tubular; 1000 mmf 350V ± 20% (Uninsul.)
C114		A555-100	Ceramic Tubular: 5 mmf 500V ± 20% (Uninsul.)
C115		A555-113	Ceramic Tubular; 47 mmf 500V ± 20% (Uninsul.) NPO
C116		A194-160	Paper; .05 mfd 600V ± 20%
C117		A194-151	Paper; .005 mfd 600V ± 20%
C118		A19148	Ceramic; 1500 mmf Single Disc
C119		A556-236	Ceramic Tubular: 1000 mmf 350V ± 10% (Insul.)
C120		A194-160	Paper; .05 mfd 600V ± 20%
C121		A20138	Electrolytic; 1 mfd 50V
C122		A194-156	Paper; .02 mfd 600V ± 20%
C123		A194-160	Paper; .05 mfd 600V ± 20%
C124		A194-155	Paper; .01 mfd 600V ± 20%
C125		A194-151	Paper; .005 mfd 600V ± 20%
C126		A20135	Electrolytic; 10-10-10-mfd 450V
C127		A194-145	Paper; .001 mfd 600V ± 20%
C128		A19177	Ceramic Tubular; 6.8 mmf 500V ± 10% (Insul.)
C200		A19106	Paper .01 mfd 600V ± 20% (Phenolic Enclosed)
C201		A19106	Paper .01 mfd 600V ± 20% (Phenolic Enclosed)
C202		A19109	Ceramic; 5000 mmf Single Disc
C203		A20144	Electrolytic; 40-40-20-20-mfd 450V
C204		A19109	Ceramic 5000 mmf Single Disc
C205		A19109	Ceramic, 5000 mmf Single Disc
C206		A19109	Ceramic, 5000 mmf Single Disc
C207		A194-156	Paper; .02 mfd 600V ± 20%
C208		A190-137	Mica: 390 mmf 500V ± 10%
C209		A190-133	Mica; 270 mmf 500V ± 10%
C210		A194-155	Paper; .01 mfd 600V ± 20%
C211		A194-155	Paper .01 600V ± 20% mfd
C212		A192-163	Mica; 4700 mmf 500V ± 10%
C213		A194-159	Paper; .035 mfd 600V ± 20%
C214		A194-156	Paper; .02 mfd 600V ± 20%
C215		A194-160	Paper; .05 mfd 600V ± 20%
C216		A20145	Electrolytic; 10 mfd 250V
C217		A20130	Electrolytic; 100 mfd 25V
C218		A194-160	Paper; .05 mfd 600V ± 20%
C219		A194-160	Paper; .05 mfd 600V ± 20%
C220		A194-155	Paper; .01 mfd 600V ± 20%
C221		A194-151	Paper; .005 mfd 600V ± 20%
C222		A194-151	Paper; .005 mfd 600V ± 20%
C223		A194-155	Paper; .01 mfd 600V ± 20%
C300		A194-145	Paper; .001 mfd 600V ± 20%
C301		A194-145	Paper; .001 mfd 600V ± 20%
C302		A194-151	Paper; .005 mfd 600V ± 20%
C303		A194-151	Paper; .005 mfd 600V ± 20%
C304		A194-160	Paper; .05 mfd 600V ± 20%
C305		A195-261	Silver Mica; 3900 mmf 500V ± 5%
C306		A190-137	Mica; 390 mmf 500V ± 10%
C307		A190-133	Mica; 270 mmf 500V ± 10%
C308		A190-137	Mica; 390 mmf 500V ± 10%
C309		A1772	Trimmer; 25-280 mmf
C310		A20137	Electrolytic; 10 mfd 25V
C311	105-2-81700	A19172	Mica; 20 mmf 1500V ± 20%
C311	105-2-82000	A19146	Mica; 10 mmf 2500V ± 20%
C311	105-2-82100	A19145	Mica. 5 mmf 2500V ± 20%
C312		A194-160	Paper; .05 mfd 600V ± 20%
C313		A19146	Mica, 10 mmf 2500 V ± 20%
C314		A194-160	Paper; .05 mfd 600V ± 20%
C315		A1998-3	Ceramic; 500 mmf 20 kv.
C316		A194-162	Paper; .1 mfd 600V ± 20%
C317		A20147	Electrolytic; 25 mfd 12V
C318		A19180	Mica; 220 mmf 1000V ± 10%

RESISTORS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
R100		A231-1163	Carbon; 3900 Ohm 1/2W ± 10%
R101		A231-1113	Carbon; 33 Ohm 1/2W ± 10%
R102		A231-1137	Carbon; 330 Ohm 1/2W ± 10%
R103		A231-1189	Carbon; 47K Ohm 1/2W ± 10%
R104		A231-1117	Carbon; 47 Ohm 1/2W ± 10%
R105		A231-1123	Carbon; 82 Ohm 1/2W ± 10%
R106		A231-1171	Carbon; 8200 Ohm 1/2W ± 10%
R107		A231-1133	Carbon; 220 Ohm 1/2W ± 10%
R108		A231-1133	Carbon; 220 Ohm 1/2W ± 10%
R109		A231-1129	Carbon; 150 Ohm 1/2W ± 10%
R110		A231-1197	Carbon; 100k Ohm 1/2W ± 10%
R111		A231-1177	Carbon; 15k Ohm 1/2W ± 10%
R112		A231-1123	Carbon; 82 Ohm 1/2W ± 10%
R113		A231-1165	Carbon; 4700 Ohm 1/2W ± 10%
R114		A231-1133	Carbon; 220 Ohm 1/2W ± 10%
R115		A231-1165	Carbon; 4700 Ohm 1/2W ± 10%
R116		A232-1161	Carbon; 3300 Ohm 1W ± 10%
R117		A231-1221	Carbon; 1.0 Megohm 1/2W ± 10%
R118		A231-1129	Carbon; 150 Ohm 1/2W ± 10%
R119		A231-1127	Carbon; 120 Ohm 1/2W ± 10%
R120		A233-74	Carbon; 11k Ohm 2W ± 5%
R121		A233-1179	Carbon; 18k Ohm 2W ± 10%
R122		A231-1173	Carbon; 10k Ohm 1/2W ± 10%
R123		A231-1197	Carbon; 100k Ohm 1/2W ± 10%
R124		A231-1197	Carbon; 100k Ohm 1/2W ± 10%
R125		A231-1155	Carbon; 1800 Ohm 1/2W ± 10%
R126		A231-1189	Carbon; 47k Ohm 1/2W ± 10%
R127		A231-1245	Carbon; 10 Megohm 1/2W ± 10%
R128		A231-1213	Carbon; 470k Ohm 1/2W ± 10%
R129		A231-1213	Carbon; 470k Ohm 1/2W ± 10%
R130		A232-1137	Carbon; 330 Ohm 1W ± 10%
R131		A21134-4	Wirewound 3250 Ohm 7W ± 10%
R200		A23151	Wirewound; 1.2 Ohm 1W ± 10%
R201		A21134-2	Wirewound; 60 Ohm 10W ± 10%
R202		A231-1183	Carbon; 27k Ohm 1/2W ± 10%
R203		A231-1175	Carbon; 12k Ohm 1/2W ± 10%
R204		A231-1193	Carbon; 68k Ohm 1/2W ± 10%
R205		A231-1213	Carbon; 470k Ohm 1/2W ± 10%
R206		A231-1229	Carbon; 2.2 Megohm 1/2W ± 10%
R207		A231-1229	Carbon; 2.2 Megohm 1/2W ± 10%
R208		A231-1181	Carbon; 22k Ohm 1/2W ± 10%
R209		A231-1221	Carbon; 1.0 Megohm 1/2W ± 10%
R210		A231-1171	Carbon; 8200 Ohm 1/2W ± 10%
R211		A231-1181	Carbon; 22k Ohm 1/2W ± 10%
R212		A231-1221	Carbon; 1.0 Megohm 1/2W ± 10%
R213		A231-1159	Carbon; 2700 Ohm 1/2W ± 10%
R214		A231-1163	Carbon; 3900 Ohm 1/2W ± 10%
R215		A231-1163	Carbon; 3900 Ohm 1/2W ± 10%
R216		A231-1207	Carbon; 270k Ohm 1/2W ± 10%
R217		A231-1169	Carbon; 6800 Ohm 1/2W ± 10%
R218		A232-127	Carbon, 1.8 Megohm 1W ± 5%
R219		A231-1189	Carbon; 47k Ohm 1/2W ± 10%
R220		A231-1213	Carbon; 470k Ohm 1/2W ± 10%
R221		A231-1225	Carbon; 1.5-Megohm 1/2W ± 10%
R222		A231-1155	Carbon 1800 Ohm 1/2W ± 10%
R223		A221-1189	Carbon 47k Ohm 1W ± 10%
R224		A232-1201	Carbon; 150k Ohm 1W ± 10%
R225		A233-1161	Carbon; 3300 Ohm 2W ± 10%
R226		A233-1161	Carbon; 3300 Ohm 2W ± 10%
R227		A231-1229	Carbon; 2.2 Megohm 1/2W ± 10%
R228		A231-1185	Carbon; 33k Ohm 1/2W ± 10%
R229		A231-1207	Carbon; 270k Ohm 1/2W ± 10%
R230		A231-1221	Carbon; 1.0 Megohm 1/2W ± 10%
R231		A231-1181	Carbon; 22k Ohm 1/2W ± 10%
R232		A231-1181	Carbon; 22k Ohm 1/2W ± 10%
R233		A231-1171	Carbon; 8200 Ohm 1/2W ± 10%
R234		A231-1189	Carbon; 47k Ohm 1/2W ± 10%
R300		A21134-16	Wirewound 2250 Ohm 15W ± 10%
R301		A233-1165	Carbon; 4700 Ohm 2W ± 10%
R302		A233-1169	Carbon, 6800 Ohm 2W ± 10%
R303		A231-1197	Carbon, 100k Ohm 1/2W ± 10%
R304		A231-1197	Carbon, 100k Ohm 1/2W ± 10%
R305		A231-1213	Carbon, 470K Ohm 1/2W ± 10%
R306		A231-1233	Carbon; 3.3 Megohm 1/2W ± 10%
R307		A232-1181	Carbon; 22k Ohm 1W ± 10%
R308		A231-1167	Carbon; 5600 Ohm 1/2W ± 10%
R309		A231-1155	Carbon; 1800 Ohm 1/2W ± 10%
R310		A231-1205	Carbon; 220k Ohm 1/2W ± 10%
R311		A231-1213	Carbon; 470k Ohm 1/2W ± 10%
R312		A231-1197	Carbon; 100k Ohm 1/2W ± 10%
R313		A231-1123	Carbon; 82 Ohm 1/2W ± 10%
R314		A233-1133	Carbon; 220 Ohm 2W ± 10%
R315		A231-63	Carbon; 0.56 Ohm 1/2W ± 10%
R316		A233-2321	Carbon; 1.0 Megohm 2W ± 20% (Allan Bradley)
R318		A232-1177	Carbon; 15k Ohm 1W ± 10%
R319	105-2-82100	A233-1165	Carbon; 4700 Ohm 2W ± 10%

CHOKES & COILS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
L101		A3392	Coil, Pix IF
L102		A28253	Choke, RF
L103		A3392	Coil, Pix IF
L104		A3392	Coil, Pix IF
L105		A28253	Choke, RF
L106		A28255-2	Coil, Peaking (White)
L107		A28255-1	Coil, Peaking (Red)
L108		A28255-2	Coil, Peaking (White)
L109		A28255-1	Coil, Peaking (Red)
L110		A28286	Coil, 4.5 MC. Trap
L111		A28255-1	Coil, Peaking (Red)
L112		A28255-4	Coil, Peaking (Green)
L113		A28286	Coil, 4.5 MC Audio Takeoff
L114		A28314	Coil, 21.25 MC IF Trap
L200		A1406	Coil, Filter Choke
L201		A28276	Choke, Filament
L202		A28276	Choke, Filament
L203	105-2-81700	A28278-3	Coil, Deflection Yoke
L203	105-2-82000	A28322-1	Coil, Deflection Yoke
L203	105-2-82100	A28323-1	Coil, Deflection Yoke
L300		A28263	Coil, Horiz.Freq. Control
L301	105-2-81700 / 105-2-82000	A28279-1	Coil, Width Control
L301	105-2-82100	A28318-1	Coil, Width Control
L302		A28292	Coil, Horiz. Linearity

MISC. CHASSIS ACCESS. & PARTS – ALL CHASSIS

PART NO.	DESCRIPTION
A65100K	Chassis
A5355	Shield, H.V. Supply
A5356	Cover, H.V. Supply Shield
A54609	Bracket, Horiz. Freq. Control Coil
A541059	Bracket, Combination Interlock & Color Socket
A18177 or A18179	Dummy Plug Assembly, Male Octal (ColorSocket)
A541242	Grounding Spring CRT Coating
A540-62	Terminal Strip, AAEAAAEAA
A540-67	Terminal Strip, AAAEAA
A540-44	Terminal Strip, AAEAA
A540-19	Terminal Strip, AEA
A540-34	Terminal Strip, AAEA
A18155	Socket, Octal Moulded
A18210	Socket, Octal Moulded Bakelite Saddle
A18173	Socket, 9 Pin Moulded
A18171	Socket, 9 Pin Moulded No Saddle
A18157	Socket, 9 Pin Wafer
A18147	Socket, 7 Pin Wafer
A18101	Socket, Speaker-Plug
A541131	Socket, H.V. Cond.
A562-6	Capacitor Clips; 1-3/8
A562-3	Capacitor Clips; 3/4
A54618-1	Tube Shield
A3206	Ion Trap
A18174	Socket, Phono

MISC. CHASSIS ACCESS. & PARTS – 17" TUBE

PART NO.	DESCRIPTION
A54851	Bracket, Yoke Hood & Support
A541084-1	Channel, CRT Front Support; Left
A541084-2	Channel, CRT Front Support; Right
A54827	Strap, CRT; Right
A54828	Strap, CRT; Left
A541086	Bracket, CRT Stop
A55141-1	Anode Connector Assembly
A54943	Anode Lead Holder
A541085	Cushion, Rubber; CRT Channel
A541110-2	Cushion, Sponge Rubber; CRT Strap, Right
A541110-1	Cushion, Sponge Rubber; CRT Strap, Left
A54971-18	Cushion, Cork; CRT Stop Bkt.
A18197-3	Socket, Kinescope

MISC. CHASSIS ACCESS. & PARTS – 20" TUBE

PART NO.	DESCRIPTION
A54983-4	Bridge Bkt., Focus Coil & Yoke Support
A541000	CRT Rubber Grommet
A541023	Bracket, CRT Rubber Grommet Support
A541002	Upper CRT Support
A541018-1	CRT Front Support, Left
A541018-2	CRT Front Support, Right
A54999	Rubber Channel, CRT Front Support, Left
A54998	Rubber Channel, CRT Front Support, Right
A54997	Rubber Channel, CRT Front Supports (Rear)
A541003	Strap, CRT
A541004-1	Spade Bolt, CRT Strap Assembly
A55141-2	Anode Connector Assembly
A541239	Anode Lead Holder
A54971-14	Cushion, Cork, Upper CRT Support
A54971-15	Cushion, Cork, CRT Stop Bkts.
A541102-4	Cushion, Rubber, CRT Strap
A18197-4	Socket, Kinescope

TRANSFORMERS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
T100		A1201 or 1202	Ratio Detector
T200		A10109	Power
T201		A10106	Vertical Oscillator
T202		A10152-1	Vertical Output
T300		A10136	Horizontal Output

CONTROLS

SCHEM. LOC.	CHASSIS*	PART NO.	DESCRIPTION
P100		A24142	Contrast-Volume, 5K-250K ohm
P200		A24112	Vertical Hold, 1.0 Megohm
P201		A24111	Vertical Size, 5.0 Megohm
P202		A24114	Vertical Linearity, 3K ohm Wirewound
P203		A24118	Vertical Centering, 20 ohm C.T. Wirewound
P204		A24110	Brightness, 100K ohm
P205		A24141	Horizontal Hold, 5K ohm
P206		A24112	Focus Control, 1.0 Megohm
P301		A24116	Hor. Centering, 100 ohm Wirewound
SW2		A37105	Switch, Phono-TV

MISC. CHASSIS ACCESS. & PARTS – 21" CHASSIS

PART NO.	DESCRIPTION
A541248-1	Bracket, CRT Rear Support (Left)
A541248-2	Bracket, CRT Rear Support (Right)
A541000	CRT Rubber Grommet
A541246	Bracket, Yoke Hood and CRT Grommet
A541250-1	Bracket, Yoke Hood Support (Left)
A541250-2	Bracket, Yoke Hood Support (Right)
A541243	Bracket, CRT Front Support and Stop
A541249	Bracket, Tie Rod
A541254	CRT Strap Assembly
A541261-1	Rubber Cushion (CRT Front Support and Stop Bkt.)
A541261-2	Rubber Cushion (CRT Front Support and Stop Bkt.)
A541102-6	Rubber Cushion (CRT Strap)
A55141-3	Anode Connector Assembly
A541239	Anode Lead Holder
A18197-6	Socket, Kinescope

T55AL. RF-TUNER PARTS (ALL CHASSIS)

SCH. LOC.	PART NO.	DESCRIPTION
R401	A231-1179	AGC Resistor 18K Ohm 1/2w ±10%
R402	A231-1165	R.F. Grid Resistor 4.7K Ohm 1/2w ±10%
R403	A231-1157	R.F. Screen Resistor 2.2K Ohm 1/2w ±10%
R404	A231-1205	High Band 220K Ohm 1/2w ±10%
R405	A231-2277	Oscillator Grid Resistor 15K Ohm 1/2w ±20%
R406	A231-1173	Oscillator Plate Resistor 10K Ohm 1/2w ±10%
C401	A19132	AGC by-pass Capacitor 1000 mmf GMV Disc
C402	A556-203	R.F. Grid Coupling Capacitor 15 mmf ±10% Ceramic
C403	A19132	R.F. Screen by-pass Capacitor 1000 mmf GMV Disc
C404	A19109	Decoupling Capacitor 5000 mmf GMV Disc
C405	A19181	Coupling Capacitor 0.18 mmf ±10%
C406	A19182	Coupling Capacitor 0.68 mmf ±10%
C407	A19183	Coupling Capacitor 1.5 mmf ±10%
C408	A191-39	Decoupling Capacitor 470 mmf ±20% Ceramic
C409	A191-39	Decoupling Capacitor 470 mmf ±20% Ceramic
C410	A556-201-2	Coupling Capacitor 10 mmf ±10% Ceramic
C411	A19184	Coupling Capacitor 0.82 mmf ±10%
C412	A19154	Coupling Capacitor 3 mmf ±5%
C413	A556-203	Mixer Plate Capacitor 15 mmf ±10% Ceramic
C414	A19155	Oscillator Trimmer Capacitor
C415	A19152	Oscillator Plate by-pass Capacitor 0.51 mmf ±10%
C416	A19132	Decoupling Capacitor 1000 mmf GMV Disc
C417	A19132	Decoupling Capacitor 1000 mmf GMV Disc
L401	A28280-20	R.F. Grid Coil
L402	A28280-21	R.F. Plate Coil
L403	A28280-3	Oscillator Coil (Cb. 6)
L404	A28280-19	I.F. Converter Coil
L405	A28280-22	Oscillator Coil (Cb. 13)
L406	A28280-23	Filament Choke
T401	A28280-24	Input Transformer

STOCK NO. 13-G-121 CODE NO. 105-2-82001

20" Mahogany Console Combination

TELEVISION ALIGNMENT PROCEDURE

Aligning a television receiver is an exacting procedure and involves the use of bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the customer's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble:

1 – The antenna and installation.

2 – Front panel and rear chassis controls, including picutre tube adjustments.

3 – Reception on all available channels.

4 – Tube failures. Substitute from your kit of known good replacements.

5 – Visual inspection of underside of chassis for obvious faults, such as loose connections, etc.

TEST EQUIPMENT REQUIRED FOR ALIGNMENT

The equipment specified below is desirable, but in cases where this equipment is not available, it is possible to align the receiver by use of a 20 to 30 mc. modulated r-f signal generator, using the picture and speaker as indication of alignment.

1 – Signal Generator with an output variable between 100 and 100,000 microvolts, and crystal controlled or crystal-calibrated at the following frequencies:

a– 4.5 megacycles
b– 22.8 megacycles
c– 25.4 megacycles
d– 21.25 megacycles

2 – DC Vacuum Tube Voltmeter with 5 volt and 10 volt scales.

3 – A pair of balanced (± 1%) 100K carbon resistors.

TEST EQUIPMENT REQUIRED FOR SWEEP ALIGNMENT CHECK

1 – R-F sweep generator with frequencies ranging from 40 to 220 megacycles, having sweep width of approximately 10 megacycles, and having adjustable output to approximately 0.1 volt.

2 – Crystal-controlled or crystal-calibrated markers for the picture and sound carriers of each channel.

3 – Cathode Ray Oscilloscope with good low frequency response.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A HIGH POTENTIAL. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE COLOR PLUG FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

I.F. ALIGNMENT PROCEDURE

1 – Connect "high" lead of signal generator to the test point located on the top of the RF tuner unit (Refer to the R-F tuner location diagram located on inside of cabinet). Connect ground to chassis.

2 – Connect DC VTVM lead (through 10K isolating resistor) to 4.7K diode load resistor (R113); ground to chassis. Set VTVM to 5 volt scale, negative polarity.

3 – Set I.F. generator to 25.4 megacycles with sufficient output to read approximately 3 volts on the VTVM.

4 – Carefully adjust L101 and L104 (see tube and tuner location) for maximum deflection on VTVM. Adjust sweep generator output to keep meter reading approximately 3 volts.

5 – Set I.F. signal generator to 22.8 megacycles with sufficient output to read approximately 3 volts on the VTVM.

6 – Carefully adjust L404, L103 (see tube and tuner location) for maximum deflection on VTVM. Adjust signal generator output to keep meter reading approximately 3 volts.

7 – Set I.F. signal generator to 21.25 megacycles, set VTVM to 10 volt scale (negative polarity), and adjust signal generator output for convenient deflection on VTVM.

8 – Adjust L114 for minimum deflection on VTVM.

SWEEP ALIGNMENT CHECK

Although not essential, a sweep alignment check is a desirable verification of good R-F and I.F. response. Proceed as follows:

1 – Connect R-F sweep generator to antenna terminals (antenna impedance 300 ohms.)

2 – Calibrate oscilloscope for convenient 5 volts peak-to-peak vertical deflection (5 volts peak-to-peak is approximately 1/4 of the peak-to-peak voltage of the 6.3V A.C. filament).

3 – Connect vertical input of oscilloscope (through 10K isolating resistor) to 4.7 diode load resistor (R113); ground to chassis. Connect horizontal input of oscilloscope to "scope" terminals of R-F generator; adjust for convenient horizontal sweep.

4 – Set R-F sweep generator to channel 3, television receiver to channel 3, and if necessary, adjust sweep generator output, sweep width, and scope horizontal setting for convenient band-pass display having 5 volts vertical deflection as previously calibrated. (If you must touch scope vertical settings during these adjustments recalibrate scope for 5 volts peak-to-peak as in step 2 above).

5 – Couple crystal-controlled R-F carrier markers very loosely to antenna terminals, adjust receiver FINE TUNING control till video carrier marker is 1/2 down on curve. Turn up marker output till R-f sound carrier is visible on bandpass and adjust sound trap (L114) to minimize effect of sound carrier marker.

6 – Check all channels as above.

SOUND ALIGNMENT

When necessary, the video amplifier 4.5 mc trap (L110) should be adjusted as follows:

1 – Connect 4.5 mc signal generator "high" lead to picture tube grid; ground to chassis.

2 – Connect DC V.T.V.M. to pin 7 of 6AL5 (V9) ratio detector, 10 volt scale, negative polarity.

3 – Adjust L110 for minimum deflection on V.T.V.M.

R-F OSCILLATOR

1 – Connect 4.5 megacycle signal generator to pin 2 of 12BH7 (V7) video amplifier.

2 – Connect DC V.T.V.M. lead to pin 7 of 6AL6 (V9) ratio detector, negative polarity.

3 – Adjust signal generator to precisely 4.5 megacycles; adjust output to read approximately 5 volts on V.T.V.M.

4 – Adjust L113 and bottom of T100 for maximum deflection on V.T.V.M. Keep V.T.V.M. reading below 10 volts at all times.

5 – Attach two series-connected 100K(± 1%) resistors across R126 (Ratio Detector Load Resistor). Connect DC V.T.V.M. to center-tap of 100K resistors, and connect ground wire of V.T.V.M. to junction of C119 and C120 (Audio Take-Off of T100).

6 – Adjust top of T100 for zero reading on V.T.V.M. between a plus and a minus peak.

VIDEO AMPLIFIER TRAP

If all channels are not within range of FINE TUNING control, adjust two screws located in front of r-f tuner unit for adjustment of either low or high band. CAUTION: Do not touch adjustments on top of r-f tuner unit, other than converter plate coil, L404, during IF Alignment.

HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal A.F.C. adjustment screw. Check the hold control action on various channels and alter the screw adjustment as required to provide sync on all channels.

DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The receiver should be turned on but not connected to an antenna. These steps should then be taken in the following order:

1 – The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.

2 – The Brightness control should be turned to maximum (clockwise) and the Contrast control should be turned to minimum (counterclockwise).

3 – The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on screen.

4 – The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.

5 – The Brightness control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.

6 – With Brightness and Contrast controls at normal positions, adjust the Focus control (rear of chassis) for well-defined scanning lines.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area outlined by the mask.

The Width control (rear of H.V. cage) should be adjusted to give a picture that will fill the mask horizontally.

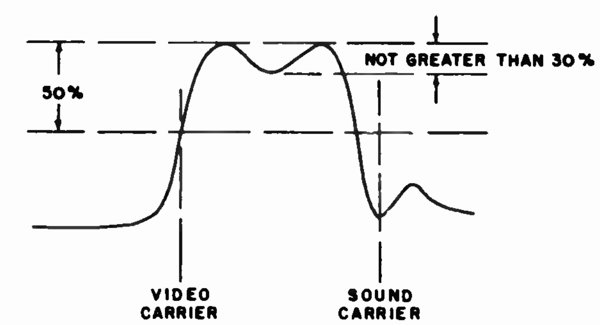
The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically.

PICTURE TUBE HANDLING PRECAUTIONS

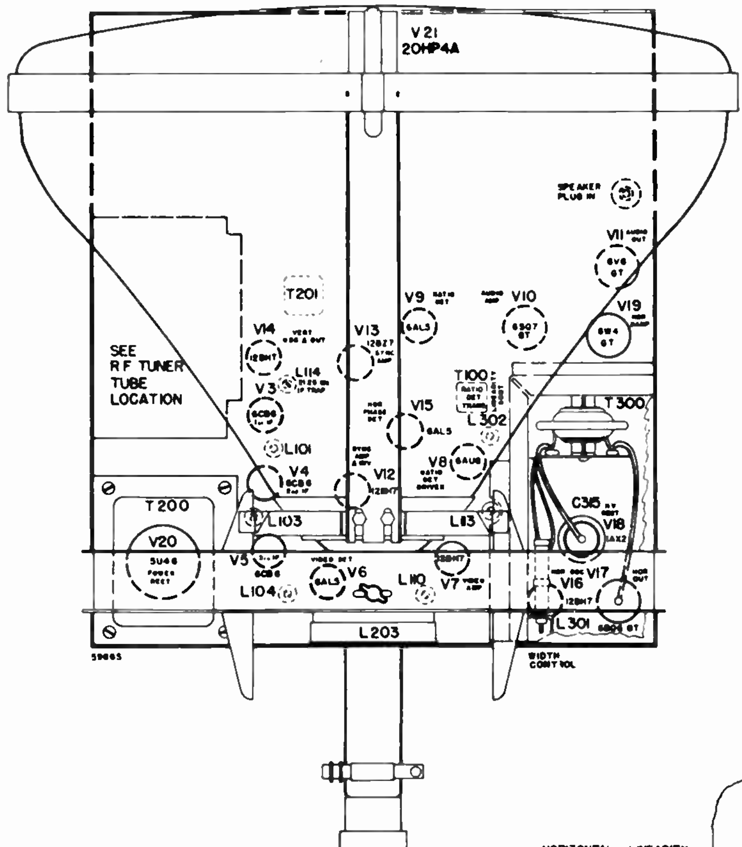
The picture tube encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow at a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.

HIGH VOLTAGE WARNING

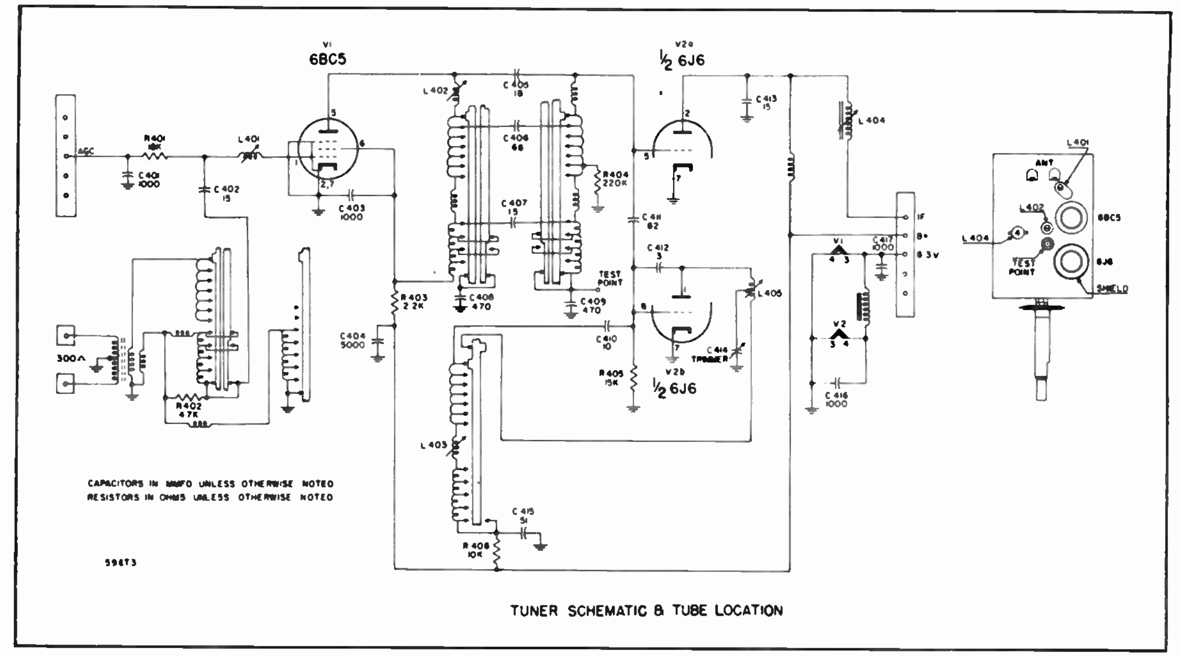
Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.



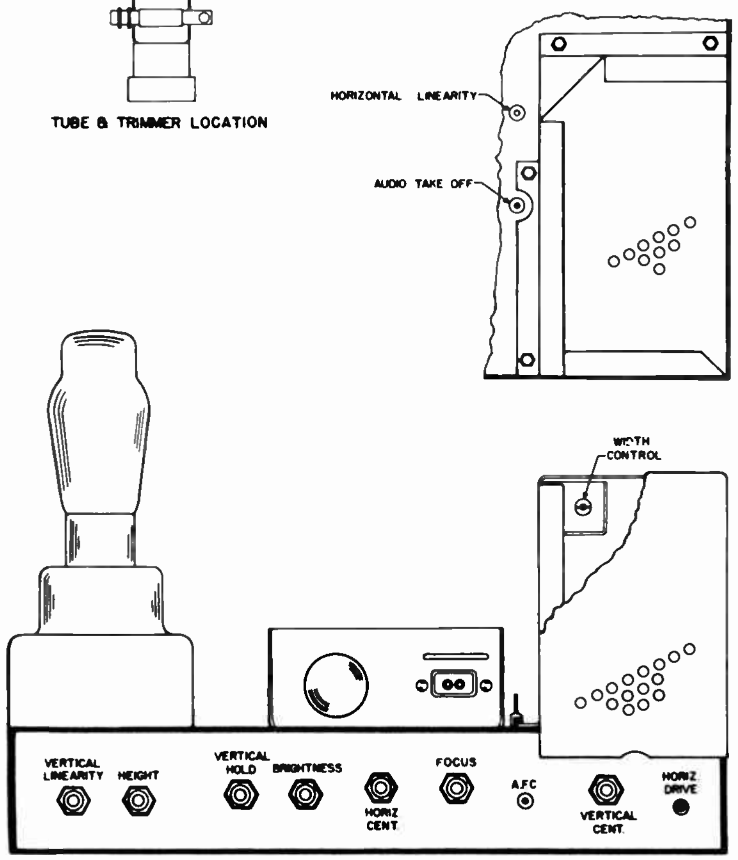
IDEAL BANDPASS X59908



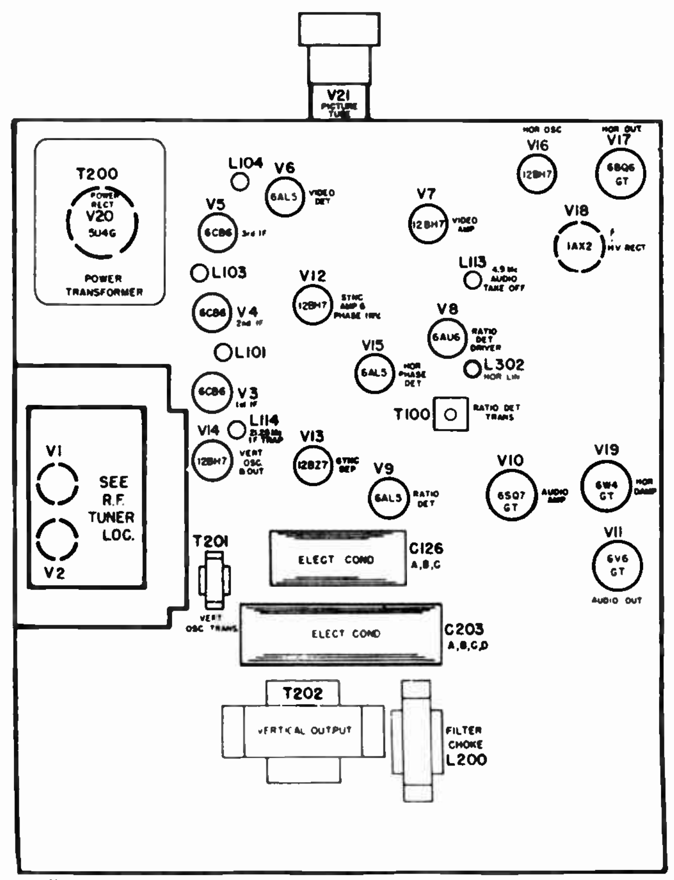
TUBE & TRIMMER LOCATION



TUNER SCHEMATIC & TUBE LOCATION



REAR CONTROLS



BOTTOM VIEW

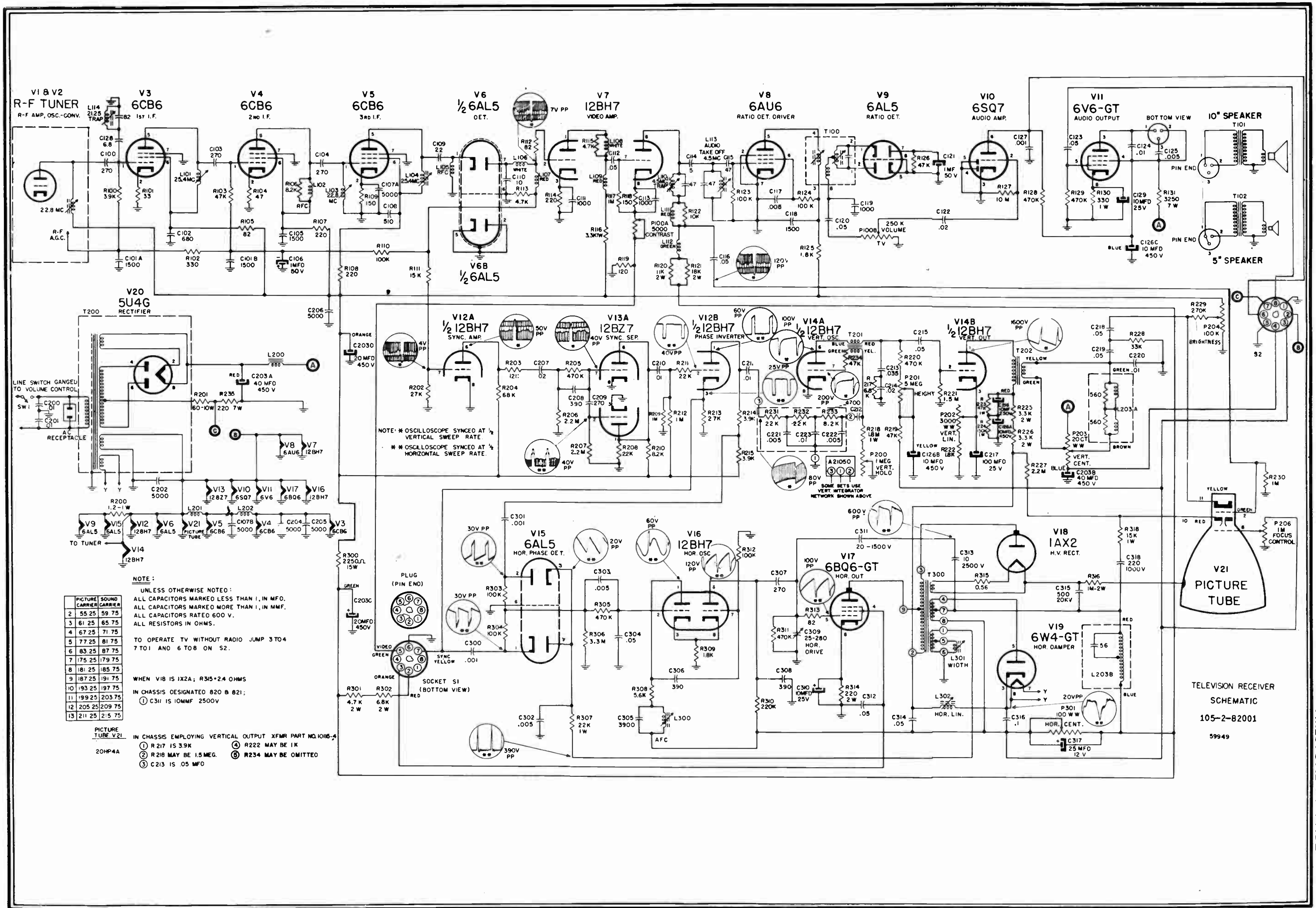
TUBE SOCKET VOLTAGES ON CHASSIS 105-2-82001

TUBE LOC.	TUBE TYPE	PIN NUMBERS 1	2	3	4	5	6	7	8	9
V1	6BC5	-1	0	0	6.2 ac	105	105	0		
V2	6J6	120	75	0	6.2 ac	-2.5	-4	0		
V3	6CB6	-0.4	0.6	6.0 ac	0	120	120	0.		
V4	6CB6	-0.4	0.6	6.0 ac	0	120	120	0		
V5	6CB6	0	1.0	6.1 ac	0	120	120	0		
V6	6AL5	0	0	0	6.3 ac	0	0	-0.4		
V7	12BH7	90	-0.4	2.0	6.3 ac	6.3 ac	165 to[A] 175	0.5 to[A] 40	3.5 to[A] 70	0
V8	6AU6	-0.5	0	0	6.3 ac	120	50	0		
V9	6AL5	-0.5	-0.5	5.5 ac	0	0	0	-1.5		
V10	6SQ7GT	0	-1	0	0	0	85	6.3 ac	0	
V11	6V6GT	0	0	200	210	0	0	6.3 ac	10	
V12	12BH7	60	20	20	0	0	20	-0.4	0	6.3 ac
V13	12BZ7	90	-0.8	0	0	0	90	-0.9	0	6.3 ac
V14	12BH7	420	-.3[D]	22[D]	0	0	100[G]	-80	0	6.3 ac
V15	6AL5	12	-12	0	5.5 ac	0.1	0	0.1		
V16	12BH7	290	0.1	15	6.3 ac	6.3 ac	120	-5	15	0
V17	6BQ6GT	-25	0	0	155	-20	0	6.3 ac	15	
V18	1X2A	High — Voltage Rectifier								
V19	6W4GT	320	0	525	0	310	0	525[F]	525[F]	
V20	5U4G		340		320 ac		320 ac.		340	.
V21	20HP4A	Pin 1:0;	Pin2: 3 to 6;[A]		Pin10: 515;		Pin 11: 40 to 150;[C]		Pin 12: 6.3 ac;	

NOTE: All voltages measured with V. T. V. M. from pin to ground with line voltages of 117vac and antenna terminals shorted. Values are DC unless otherwise noted.

[A] Varies with contrast (picture) setting.
[C] Varies with brightness setting.
[D] Varies with linearity setting.
[F] Pins 7 and 8 and filament terminals.
[G] Varies with height setting.
[H] Above voltages apply only when vertical output transformer is marked PC10152. If vertical output transformer is marked PC19115, the following voltages apply:

TUBE LOC.	TUBE TYPE	1	2	3	4	5	6	7	8	9
V14	12BH7	410[D]	0.2[D]	20[D]	0	0	200[G]	-80	0	6.3 ac



	PICTURE CARRIER	SOUND CARRIER
2	55 25	59.75
3	61 25	65.75
4	67 25	71.75
5	77.25	81 75
6	83.25	87 75
7	175 25	179 75
8	181 25	185 75
9	187 25	191 75
10	193 25	197 75
11	199 25	203 75
12	205 25	209 75
13	211 25	215 75

PICTURE TUBE V21

20HP4A

NOTE:

UNLESS OTHERWISE NOTED:
ALL CAPACITORS MARKED LESS THAN 1, IN MFD.
ALL CAPACITORS MARKED MORE THAN 1, IN MMF.
ALL CAPACITORS RATED 600 V.
ALL RESISTORS IN OHMS.

TO OPERATE TV WITHOUT RADIO JUMP 3 TO 4 7 TO 1 AND 6 TO 8 ON S2.

WHEN V18 IS 1X2A; R315 = 2.4 OHMS

IN CHASSIS DESIGNATED 820 & 821;
① C311 IS 10MMF 2500V

IN CHASSIS EMPLOYING VERTICAL OUTPUT XFMR PART NO. 10116-4
① R 217 IS 3.9K
② R 218 MAY BE 1.5 MEG.
③ C 213 IS .05 MFD
④ R222 MAY BE 1K
⑤ R234 MAY BE OMITTED

PARTS LIST

CAPACITORS

SCHEM. LOC.	PART NO.	DESCRIPTION
C100	A190-133	Mica 270 mmf 500V ± 10%
C101	A19147	Ceramic; 1500 mmf Dual Disc (Insul.)
C102	A556-234	Ceramic Tubular; 680 mmf 350V ± 10%
C103	A190-133	Mica 270 mmf 500V ± 10%
C104	A190-133	Mica 270 mmf 500V ± 10%
C105	A19148	Ceramic; 1500 mmf Single Disc (Insul.)
C106	A20138	Electrolytic; 1 mfd 50V.
C107	A19163	Ceramic 5000 mmf Dual Disc (Insul.)
C108	A556-233	Ceramic Tubular; 510 mmf 500V ± 10%
C109	A190-107	Mica; 22 mmf 500V ± 10%
C110	A555-101	Ceramic Tubular 10 mmf 500V ± 20% (Uninsul.)
C111	A555-136	Ceramic Tubular: 1000 mmf 350V ± 20% (Uninsul.)
C112	A194-160	Paper; .05 mfd 600V ± 20%
C113	A155-136	Ceramic Tubular; 1000 mmf 350V ± 20% (Uninsul.)
C114	A555-100	Ceramic Tubular: 5 mmf 500V ± 20% (Uninsul.)
C115	A555-113	Ceramic Tubular; 47 mmf 500V ± 20% (Uninsul.) NPO
C116	A194-160	Paper; .05 mfd 600V ± 20%
C117	A194-151	Paper; .005 mfd 600V ± 20%
C118	A19148	Ceramic; 1500 mmf Single Disc
C119	A556-236	Ceramic Tubular: 1000 mmf 350V ± 10% (Insul.)
C120	A194-160	Paper; .05 mfd 600V ± 20%
C121	A20138	Electrolytic; 1 mfd 50V
C122	A194-156	Paper; .02 mfd 600V ± 20%
C123	A194-160	Paper; .05 mfd 600V ± 20%
C124	A194-155	Paper; .01 mfd 600V ± 20%
C125	A194-151	Paper; .005 mfd 600V ± 20%
C126	A20135	Electrolytic; 10-10-10-mfd 450V
C127	A194-145	Paper; .001 mfd 600V ± 20%
C128	A19177	Ceramic Tubular; 6.8 mmf 500V ± 10% (Insul.)
C129	A20137	Electrolytic; 10 mfd 25V
C200	A19106	Paper .01 mfd 600V ± 20% (Phenolic Enclosed)
C201	A19106	Paper .01 mfd 600V ± 20% (Phenolic Enclosed)
C202	A19109	Ceramic; 5000 mmf Single Disc
C203	A20144	Electrolytic; 40-40-20-20-mfd 450V
C204	A19109	Ceramic 5000 mmf Single Disc
C205	A19109	Ceramic, 5000 mmf Single Disc
C206	A19109	Ceramic, 5000 mmf Single Disc
C207	A194-156	Paper; .02 mfd 600V ± 20%
C208	A190-137	Mica: 390 mmf 500V ± 10%
C209	A190-133	Mica; 270 mmf 500V ± 10%
C210	A194-155	Paper; .01 mfd 600V ± 20%
C211	A194-155	Paper .01 600V ± 20% mfd
C212	A194-163	Mica; 4700 mmf 500V ± 10%
C213	A194-159	Paper; .035 mfd 600V ± 20%
C214	A194-156	Paper; .02 mfd 600V ± 20%
C215	A194-160	Paper; .05 mfd 600V ± 20%
C216	A20145	Electrolytic; 10 mfd 250V
C217	A20130	Electrolytic; 100 mfd 25V
C218	A194-160	Paper; .05 mfd 600V ± 20%
C219	A194-160	Paper; .05 mfd 600V ± 20%
C220	A194-155	Paper; .01 mfd 600V ± 20%
C221	A194-151	Paper; .005 mfd 600V ± 20%
C222	A194-151	Paper; .005 mfd 600V ± 20%
C223	A194-155	Paper; .01 mfd 600V ± 20%
C300	A194-145	Paper; .001 mfd 600V ± 20%
C301	A194-145	Paper; .001 mfd 600V ± 20%
C302	A194-151	Paper; .005 mfd 600V ± 20%
C303	A194-151	Paper; .005 mfd 600V ± 20%
C304	A194-160	Paper; .05 mfd 600V ± 20%
C305	A195-261	Silver Mica; 3900 mmf 500V ± 5%
C306	A190-137	Mica; 390 mmf 500V ± 10%
C307	A190-133	Mica; 270 mmf 500V ± 10%
C308	A190-137	Mica; 390 mmf 500V ± 10%
C309	A1772	Trimmer; 25-280 mmf
C310	A20137	Electrolytic; 10 mfd 25V
C311	A19146	Mica; 10 mmf 2500V ± 20%
C312	A194-160	Paper; .05 mfd 600V ± 20%
C313	A19146	Mica, 10 mmf 2500 V ± 20%
C314	A194-160	Paper; .05 mfd 600V ± 20%
C315	A1998-3	Ceramic; 500 mmf 20 kv.
C316	A194-162	Paper; .1 mfd 600V ± 20%
C317	A20147	Electrolytic; 25 mfd 12V
C318	A19180	Mica; 220 mmf 1000V ± 10%

RESISTORS

SCHEM. LOC.	PART NO.	DESCRIPTION
R100	A231-1163	Carbon; 3900 Ohm 1/2W ± 10%
R101	A231-1113	Carbon; 33 Ohm 1/2W ± 10%
R102	A231-1137	Carbon; 330 Ohm 1/2W ± 10%
R103	A231-1189	Carbon; 47K Ohm 1/2W ± 10%
R104	A231-1117	Carbon; 47 Ohm 1/2W ± 10%
R105	A231-1123	Carbon; 82 Ohm 1/2W ± 10%
R106	A231-1171	Carbon; 8200 Ohm 1/2W ± 10%
R107	A231-1133	Carbon; 220 Ohm 1/2W ± 10%
R108	A231-1133	Carbon; 220 Ohm 1/2W ± 10%
R109	A231-1129	Carbon; 150 Ohm 1/2W ± 10%
R110	A231-1197	Carbon; 100k Ohm 1/2W ± 10%
R111	A231-1177	Carbon; 15k Ohm 1/2W ± 10%
R112	A231-1123	Carbon; 82 Ohm 1/2W ± 10%
R113	A231-1165	Carbon; 4700 Ohm 1/2W ± 10%
R114	A231-1133	Carbon; 220 Ohm 1/2W ± 10%
R115	A231-1165	Carbon; 4700 Ohm 1/2W ± 10%
R116	A232-1161	Carbon; 3300 Ohm 1W ± 10%
R117	A231-1221	Carbon; 1.0 Megohm 1/2W ± 10%
R118	A231-1129	Carbon; 150 Ohm 1/2W ± 10%
R119	A231-1127	Carbon; 120 Ohm 1/2W ± 10%
R120	A233-74	Carbon; 11k Ohm 2W ± 5%
R121	A233-1179	Carbon; 18k Ohm 2W ± 10%
R122	A231-1173	Carbon; 10k Ohm 1/2W ± 10%
R123	A231-1197	Carbon; 100k Ohm 1/2W ± 10%
R124	A231-1197	Carbon; 100k Ohm 1/2W ± 10%
R125	A231-1155	Carbon; 1800 Ohm 1/2W ± 10%
R126	A231-1189	Carbon; 47k Ohm 1/2W ± 10%
R127	A231-1245	Carbon; 10 Megohm 1/2W ± 10%
R128	A231-1213	Carbon; 470k Ohm 1/2W ± 10%
R129	A231-1213	Carbon; 470k Ohm 1/2W ± 10%
R130	A232-1137	Carbon; 330 Ohm 1W ± 10%
R131	A21134-4	Wirewound 3250 Ohm 7W ± 10%
R200	A23151	Wirewound; 1.2 Ohm 1W ± 10%
R201	A21134-2	Wirewound; 60 Ohm 10W ± 10%
R202	A231-1183	Carbon; 27k Ohm 1/2W ± 10%
R203	A231-1175	Carbon; 12k Ohm 1/2W ± 10%
R204	A231-1193	Carbon; 68k Ohm 1/2W ± 10%
R205	A231-1213	Carbon; 470k Ohm 1/2W ± 10%
R206	A231-1229	Carbon; 2.2 Megohm 1/2W ± 10%
R207	A231-1229	Carbon; 2.2 Megohm 1/2W ± 10%
R208	A231-1181	Carbon; 22k Ohm 1/2W ± 10%
R209	A231-1221	Carbon; 1.0 Megohm 1/2W ± 10%
R210	A231-1171	Carbon; 8200 Ohm 1/2W ± 10%
R211	A231-1181	Carbon; 22k Ohm 1/2W ± 10%
R212	A231-1221	Carbon; 1.0 Megohm 1/2W ± 10%
R213	A231-1159	Carbon; 2700 Ohm 1/2W ± 10%
R214	A231-1163	Carbon; 3900 Ohm 1/2W ± 10%
R215	A231-1163	Carbon; 3900 Ohm 1/2W ± 10%
R217	A231-1169	Carbon; 6800 Ohm 1/2W ± 10%
R218	A232-127	Carbon, 1.8 Megohm 1W ± 5%
R219	A231-1189	Carbon; 47k Ohm 1/2W ± 10%
R220	A231-1213	Carbon; 470k Ohm 1/2W ± 10%
R221	A231-1225	Carbon; 1.5-Megohm 1/2W ± 10%
R222	A231-1155	Carbon 1800 Ohm 1/2W ± 10%
R223	A221-1189	Carbon 47k Ohm 1W ± 10%
R224	A232-1201	Carbon; 150k Ohm 1W ± 10%
R225	A233-1161	Carbon; 3300 Ohm 2W ± 10%
R226	A233-1161	Carbon; 3300 Ohm 2W ± 10%
R227	A231-1229	Carbon; 2.2 Megohm 1/2W ± 10%
R228	A231-1185	Carbon; 33k Ohm 1/2W ± 10%
R229	A231-1207	Carbon; 270k Ohm 1/2W ± 10%
R230	A231-1221	Carbon; 1.0 Megohm 1/2W ± 10%
R231	A231-1181	Carbon; 22k Ohm 1/2W ± 10%
R232	A231-1181	Carbon; 22k Ohm 1/2W ± 10%
R233	A231-1171	Carbon; 8200 Ohm 1/2W ± 10%
R234	A231-1189	Carbon; 47k Ohm 1/2W ± 10%
R235	A23114-18	Wirewound 220 Ohm 7W ± 10%
R300	A21134-16	Wirewound 2250 Ohm 15W ± 10%
R301	A233-1165	Carbon; 4700 Ohm 2W ± 10%
R302	A233-1169	Carbon, 6800 Ohm 2W ± 10%
R303	A231-1197	Carbon, 100k Ohm 1/2W ± 10%
R304	A231-1197	Carbon, 100k Ohm 1/2W ± 10%
R305	A231-1213	Carbon, 470K Ohm 1/2W ± 10%
R306	A231-1233	Carbon; 3.3 Megohm 1/2W ± 10%
R307	A232-1181	Carbon; 22k Ohm 1W ± 10%
R308	A231-1167	Carbon; 5600 Ohm 1/2W ± 10%
R309	A231-1155	Carbon; 1800 Ohm 1/2W ± 10%
R310	A231-1205	Carbon; 220k Ohm 1/2W ± 10%
R311	A231-1213	Carbon; 470k Ohm 1/2W ± 10%
R312	A231-1197	Carbon; 100k Ohm 1/2W ± 10%
R313	A231-1123	Carbon; 82 Ohm 1/2W ± 10%
R314	A233-1133	Carbon; 220 Ohm 2W ± 10%
R315	A231-63	Carbon; 0.56 Ohm 1/2W ± 10%
R316	A233-2321	Carbon; 1.0 Megohm 2W ± 20% (Allan Bradley)
R318	A232-1177	Carbon; 15k Ohm 1W ± 10%

CHOKES & COILS

SCHEM. LOC.	PART NO.	DESCRIPTION
L101	A3392	Coil, Pix IF
L102	A28253	Choke, RF
L103	A3392	Coil, Pix IF
L104	A3392	Coil, Pix IF
L105	A28253	Choke, RF
L106	A28255-2	Coil, Peaking (White)
L107	A28255-1	Coil, Peaking (Red)
L108	A28255-2	Coil, Peaking (White)
L109	A28255-1	Coil, Peaking (Red)
L110	A28286	Coil, 4.5 MC. Trap
L111	A28255-1	Coil, Peaking (Red)
L112	A28255-4	Coil, Peaking (Green)
L113	A28286	Coil, 4.5 MC Audio Takeoff
L114	A28314	Coil, 21.25 MC IF Trap
L200	A1406	Coil, Filter Choke
L201	A28276	Choke, Filament
L202	A28276	Choke, Filament
L203	A28322-1	Coil, Deflection Yoke
L300	A28263	Coil, Horiz. Freq. Control
L301	A28279-1	Coil, Width Control
L302	A28292	Coil, Horiz. Linearity

TRANSFORMERS

SCHEM. LOC.	PART NO.	DESCRIPTION
T100	A1201 or 1202	Ratio Detector
T200	A10109	Power
T201	A10106	Vertical Oscillator
T202	A10152-1	Vertical Output
T300	A10136	Horizontal Output

CONTROLS

SCHEM. LOC.	PART NO.	DESCRIPTION
P100	A24142	Contrast-Volume, 5K-250K ohm
P200	A24112	Vertical Hold, 1.0 Megohm
P201	A24111	Vertical Size, 5.0 Megohm
P202	A24114	Vertical Linearity, 3K ohm Wirewound
P203	A24118	Vertical Centering, 20 ohm C.T. Wirewound
P204	A24110	Brightness, 100K ohm
P206	A24112	Focus Control, 1.0 Megohm
P301	A24116	Hor. Centering, 100 ohm Wirewound

T55AL. RF-TUNER PARTS (ALL CHASSIS)

SCH. LOC.	PART NO.	DESCRIPTION
R401	A231-1179	AGC Resistor 18K Ohm 1/2w ±10%
R402	A231-1165	R.F. Grid Resistor 4.7K Ohm 1/2w ±10%
R403	A231-1157	R.F. Screen Resistor 2:2K Ohm 1/2w ±10%
R404	A231-1205	High Band 220K Ohm 1/2w ±10%
R405	A231-2277	Oscillator Grid Resistor 15K Ohm 1/2w ±20%
R406	A231-1173	Oscillator Plate Resistor 10K Ohm 1/2w ±10%
C401	A19132	AGC by-pass Capacitor 1000 mmf GMV Disc
C402	A556-203	R.F. Grid Coupling Capacitor 15 mmf ±10% Ceramic
C403	A19132	R.F. Screen by-pass Capacitor 1000 mmf GMV Disc
C404	A19109	Decoupling Capacitor 5000 mmf GMV Disc
C405	A19181	Coupling Capacitor 0.18 mmf ±10%
C406	A19182	Coupling Capacitor 0.68 mmf ±10%
C407	A19183	Coupling Capacitor 1.5 mmf ±10%
C408	A191-39	Decoupling Capacitor 470 mmf ±20% Ceramic
C409	A191-39	Decoupling Capacitor 470 mmf ±20% Ceramic
C410	A556-201-2	Coupling Capacitor 10 mmf ±10% Ceramic
C411	A19184	Coupling Capacitor 0.82 mmf ±10%
C412	A19154	Coupling Capacitor 3 mmf ±5%
C413	A556-203	Mixer Plate Capacitor 15 mmf ±10% Ceramic
C414	A19155	Oscillator Trimmer Capacitor
C415	A19152	Oscillator Plate by-pass Capacitor 0.51 mmf ±10%
C416	A19132	Decoupling Capacitor 1000 mmf GMV Disc
C417	A19132	Decoupling Capacitor 1000 mmf GMV Disc

SCHEM. LOC.	PART NO.	DESCRIPTION
L401	A28280-20	R.F. Grid Coil
L402	A28280-21	R.F. Plate Coil
L403	A28280-3	Oscillator Coil (Ch. 6)
L404	A28280-19	I.F. Converter Coil
L405	A28280-22	Oscillator Coil (Ch. 13)
L406	A28280-23	Filament Choke
T401	A28280-24	Input Transformer

MISC. CHASSIS ACCESS. & PARTS

PART NO.	DESCRIPTION
A65100K	Chassis
A5355	Shield, H.V. Supply
A5356	Cover, H.V. Supply Shield
A54609	Bracket, Horiz. Freq. Control Coil
A541059	Bracket, Combination Interlock & Color Socket
A18177 or A18179	Dummy Plug Assembly, Male Octal (Color Socket)
A541242	Grounding Spring CRT Coating
A540-62	Terminal Strip, AAEAAAEAA
A540-67	Terminal Strip, AAAEAA
A540-44	Terminal Strip, AAEAA
A540-19	Terminal Strip, AEA
A540-34	Terminal Strip, AAEA
A18155	Socket, Octal Moulded
A18210	Socket, Octal Moulded Bakelite Saddle
A18173	Socket, 9 Pin Moulded
A18171	Socket, 9 Pin Moulded No Saddle
A18157	Socket, 9 Pin Wafer
A18147	Socket, 7 Pin Wafer
A18101	Socket, Speaker-Plug
A541131	Socket, H.V. Cond.
A562-6	Capacitor Clips; 1-3/8
A562-3	Capacitor Clips; 3/4
A54618-1	Tube Shield
A3206	Iron Trap
A18174	Socket, Phono
A54983-4	Bridge Bkt., Focus Coil & Yoke Support
A541000	CRT Rubber Grommet
A541023	Bracket, CRT Rubber Grommet Support
A541002	Upper CRT Support
A541018-1	CRT Front Support, Left
A541018-2	CRT Front Support, Right
A54999	Rubber Channel, CRT Front Support, Left
A54998	Rubber Channel, CRT Front Support, Right
A54997	Rubber Channel, CRT Front Supports (Rear)
A541003	Strap, CRT
A541004-1	Spade Bolt, CRT Strap Assembly
A55141-2	Anode Connector Assembly
A541239	Anode Lead Holder
A54971-14	Cushion, Cork, Upper CRT Support
A54971-15	Cushion, Cork, CRT Stop Bkts.
A541102-4	Cushion, Rubber, CRT Strap
A18197-4	Socket, Kinescope

CABINET PARTS REPAIR LIST

STOCK NO. 13-G-121

CODE NO. 105-2-82001

PART NAME	PART NO.
Cabinet	A60171-1F
Safety Glass	A62421
Mask	A62422
Back Cover	A62426
Speaker	A58124
Knob, Channel Selector	A39242-1
Knob, Vernier	A39240-3
Knob, On-Off-Volume	A39241-1
Knob, Picture Control	A39239-3
Knob, AM/FM Chassis w/Marker	A39247-1
Knob, AM/FM Chassis	A39246-1
Record Changer	A6426-4

INSTALLATION

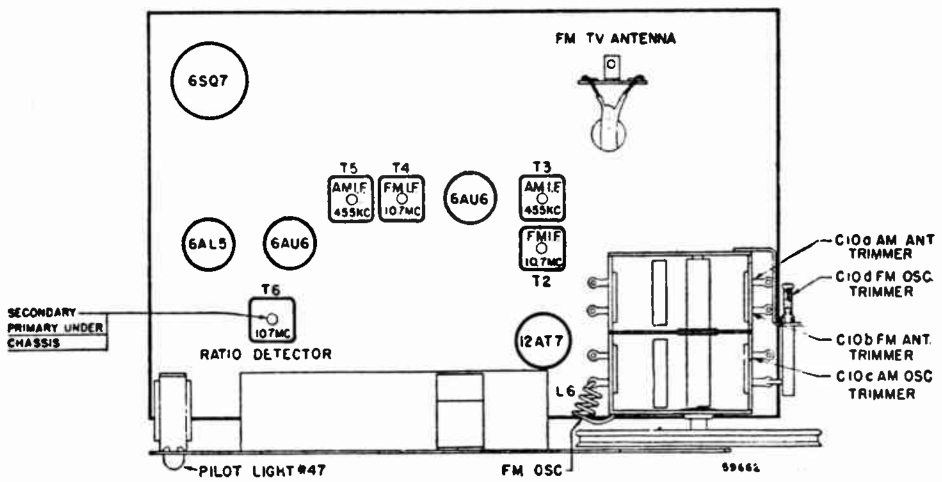
PREPARING THE RECEIVER FOR INSTALLATION:

Do not connect this unit to an electric outlet until these unpacking instructions have been followed and rechecked.

1. Remove shipping Bracket which is located at the rear of the record changer compartment drawer.
2. The record changer is floated on spring mountings. For shipping purposes only, these mountings are made rigid. To float the changer, remove the turntable by lifting it straight up the spindle. Turn the two shipping bolts (identified by large, round heads) in a clockwise direction as far as possible and replace the turntable. Replace the turntable with a counterclockwise turning motion, making sure that the driver wheel is in position against the inside flange of the turntable.
3. For proper operation, the radio chassis must be allowed to float on the rubber shock mounts on which it is mounted. This is done by loosening the two bolts which hold the shock mounts secure. These bolts are at the ends of the chassis with a cardboard "Shim" under them. The bolts can be reached from the underside of the compartment, and from the television compartment.

TUBES:

The receiver is shipped with all of the tubes in their respective sockets. Be sure that each tube is pushed all the way down in its socket. The location of the tubes are shown below.



TUBE-TRIMMER LOCATION

ELECTRICAL AND MECHANICAL DATA

Frequency Range .... (AM) 535 KC to 1620 KC
(FM) 87 MC to 109 MC

Intermediate Frequency .... (AM) 455 KC (FM) 10.7 MC

Power Supply .... 117 volts AC, 60 cycles

Speaker .... PM

TUBE COMPLEMENT

1	12AT7	Oscillator-Converter
1	6AU6	1st IF Amplifier
1	6AU6	2nd IF Amplifier
1	6SQ7	AM Detector—1st Audio (AM-FM)
1	6AL5	FM Detector

SOCKET VOLTAGES

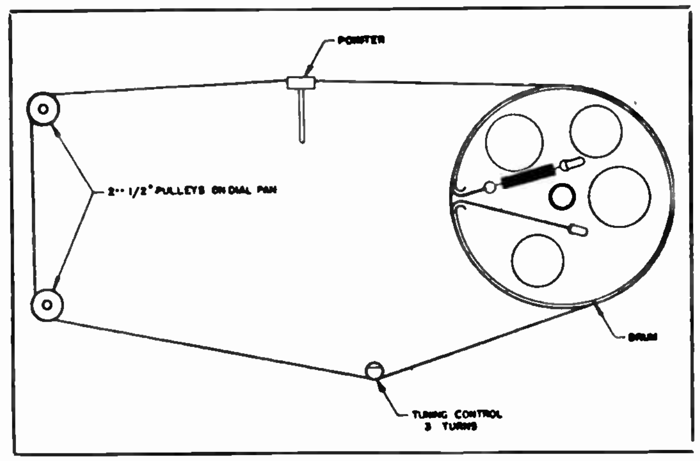
TUBE	POSITION	1	2	3	4	5	6	7	8
12AT7	Oscillator-Converter	245	0	4.2 AC	6.3 AC	6.3 AC	245	−4.5	0
6AU6	1st IF. Amplifier	−0.5	0	0	6.3 AC	250	155	1.1	....
6AU6	2nd IF. Amplifier	0	0	0	6.3 AC	225	160	1.2	....
6SQ7	AM Detector 1st Audio (AM-FM)	0	0.8	0	0	−0.5	92	6.3 AC	0
6AL5	FM Detector	−1.6	−1.4	6.3 AC	0	0	0	−2.5	....

NOTE: All DC voltages measured with V.T.V.M. from Chassis to socket contact indicated. All voltages are positive DC unless otherwise marked.
Volume control full on. Zero signal input.
Tone control in counter-clockwise position.
Band switch in "AM" position.
Variable condenser set at minimum.
Line voltage 117 volts, 60 cycle AC.

CHASSIS REMOVAL

Remove the power cord from the electrical outlet before starting to remove chassis.

1. Remove the four knobs.
2. Remove the back cover.
3. Remove loop and dipole antenna leads from their respective terminals.
4. Detach the phono-motor cord. (Plug and socket connection.)
5. Remove the phono-input lead from the receptacle on the chassis.
6. Remove the interconnecting cables from receptacle in T.V. chassis.
7. Remove chassis mounting screws. The chassis may now be removed from the cabinet.



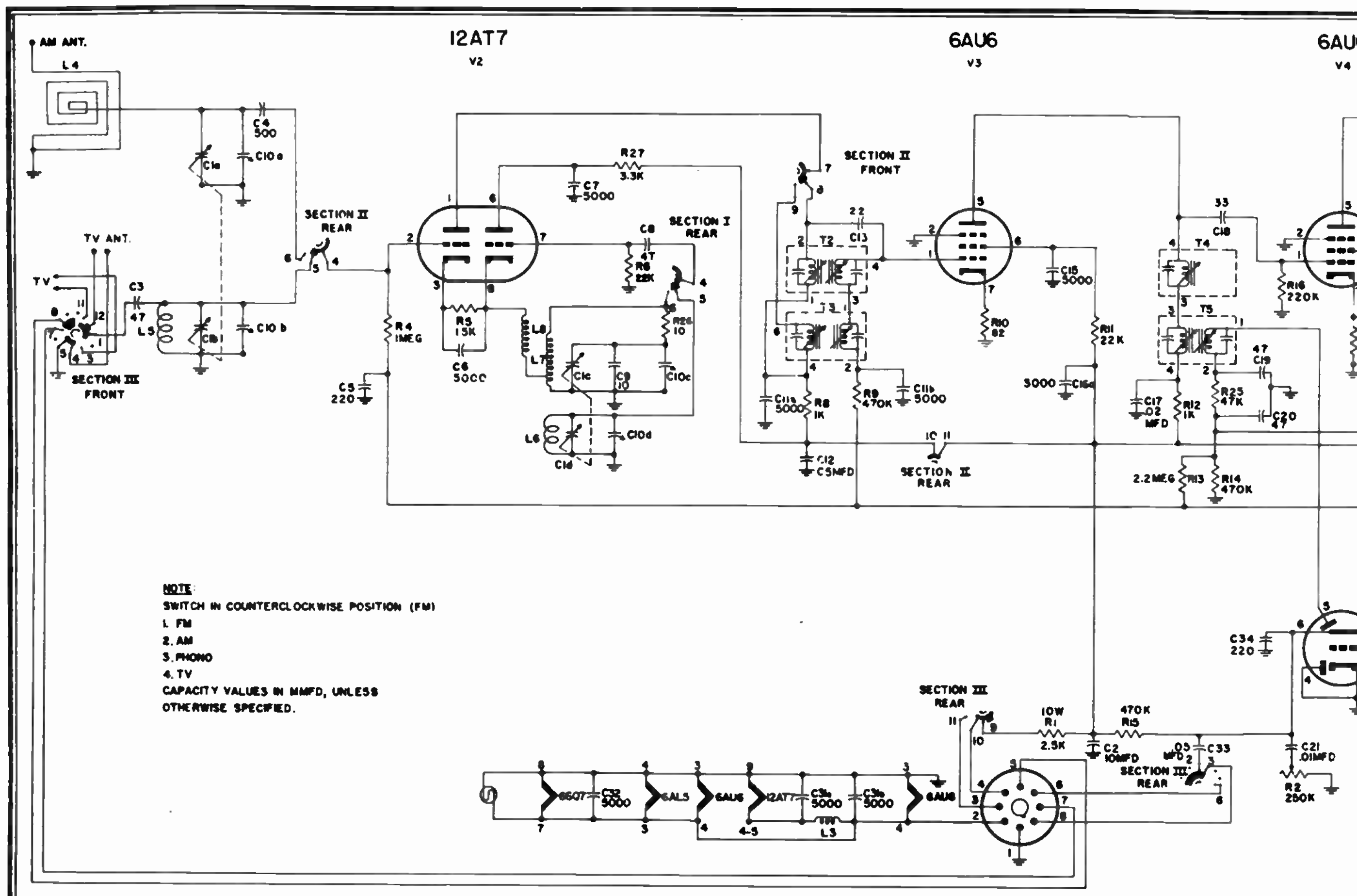
DIAL STRINGING

ALIGNMENT PROCEDURE

The following equipment is necessary to properly align this receiver:

1. AM signal generator with frequency coverage from 455 kc. to 1700 kc.
2. FM or CW signal generator covering the FM band from 87 mc. to 109 mc. and the 10.7 mc. for FM IF alignment.
3. Vacuum Tube Voltmeter (VTVM).
4. Output meter—to match 4 ohms, 5 watts maximum.
5. Insulated alignment screwdriver.
6. Dummy antenna—0.1 mfd. capacitor, 300 ohm carbon resistor and inductive loop (fashioned from several turns of wire).

NOTE: Oscilloscope equipment not required if aligned according to the following procedure:



Reference Notes to Alignment Chart

Note A: Put two 100,000 ohm resistors in series across R-23 (30,000 ohms). Negative lead of V.T.V.M. is attached to the junction of these two resistors. Positive lead of V.T.V.M. is ground. V.T.V.M. on 3 volt scale.

Note B: Negative lead of V.T.V.M. same as in Note A, positive lead of V.T.V.M. at junction of R-22 (27K ohm) and shielded lead, on terminal strip at ratio detector.

Note C: The FM R.F. and OSC. coils are made of stiff wire. To adjust these coils for bandwidth and tracking move coils together or apart as required.

Note D: Tune F.M. antenna trimmer (ClOb) and at the same time rock the signal generator frequency back and forth for maximum deflection on the meter.

Before starting alignment, painter must be set 87.5 MC. mark with gang fully closed.

ALIGNMENT CHART

Step No.	Band Switch in Position	Dummy Antenna	Signal Generator Freq.	Signal Generator Connection	Dial Position	Output Meter	Adjust C or L	Adjust For	Remarks
1	AM	0.1 Mfd.	455 kc.	Pin #2 12AT7	1620 kc.	Across Speaker	T5 & T3	Maximum Reading	
2	AM	....	1600 kc.	Radiating Loop	1600 kc.	Across Speaker	C10c Osc. Trimmer	Maximum Reading	
3	AM	....	600 kc.	Radiating Loop	600 kc.	Across Speaker	L7 Osc. Coil	Maximum Reading	Repeat Nos. 2 & 3 Until No Change Noticed
4	AM	....	1500	Radiating Loop	1500 kc.	Across Speaker	C10a Ant. Trimmer	Maximum Reading	Repeat Nos. 4 & 5 Until No Change Noticed
5	AM	....	600 kc.	Radiating Loop	600 kc.	Across Speaker	Loop Ant. 2 Taped Wires	Maximum Reading	
6	FM	0.1 Mfd.	10.7 mc. (0.1 volt)	V4 Pin #1 6AU6	....	VTVM at A.V.C.	Bottom of T6	Maximum Reading	See Note A
7	FM	0.1 Mfd.	10.7 mc.	V4 Pin #1 6AU6	....	VTVM at Audio	Top of T6	Zero Volts	See Note B
8	FM	300 ohms	10.7 mc.	Ant. Terminal	....	VTVM at A.V.C.	T4 & T2	Maximum Reading	See Note A
9	FM	300 ohms	108 mc.	Ant. Terminal	108	VTVM at A.V.C.	C10d Osc. Trimmer	Maximum Reading	
10	FM	300 ohms	90 mc.	Ant. Terminal	90	VTVM at A.V.C.	L6 F.M. Osc. Coil	Maximum Reading	See Note C
11	FM	300 ohms	90 mc.	Ant. Terminal	90	VTVM at A.V.C.	C10b FM. Ant.	Maximum Reading	See Note D

CAPACITORS FOR AM-FM TUNER

SCHEM. LOCATION	PART NO.	DESCRIPTION
C 1	A16108	Capacitor, variable, AM FM w/drum
C 2	A555-236	Ceramic 1000 mmf, ± 10% Uninsulated
C 3	A555-218	Ceramic 100 mmf, ± 10% Uninsulated
C 4	A19109	Ceramic Disc 5000 mmf
C 5	A555-204	Ceramic 18 mmf, ± 10% Uninsulated
C 6	A555-214	Ceramic 50 mmf, ± 10% Uninsulated
C 7	A555-214	Ceramic 50 mmf, ± 10% Uninsulated
C 8	A19109	Ceramic Disc 5000 mmf
C 9	A19109	Ceramic Disc 5000 mmf
C 10	A555-208	Ceramic 25 mmf, ± 10% Insulated
C 11	A1985	Mica 500 mmf
C 12	A555-232	Ceramic 500 mmf, ± 10%
C 13	A19109	Ceramic Disc 5000 mmf
C 14	A19109	Ceramic Disc 5000 mmf
C 15	A19109	Ceramic Disc 5000 mmf
C 16	A191-23	Mica 100 mmf
C 17	A191-23	Mica 100 mmf
C 18	A19109	Ceramic Disc 5000 mmf
C 19	A19109	Ceramic Disc 5000 mmf
C 20	A196-97	Paper .001 mfd 400 V. ± 20%
C 22	A20132	Electrolytic 10 mfd, 25V.
C 23	A19109	Ceramic Disc 5000 mmf
C 24	A196-97	Paper .001 mfd 400 V. ± 20%
C 25	A196-112	Paper .05 mfd 400 V. ± 20%
C 28	A20131	Electrolytic 20-10 @ 350 V.
C 29	A196-112	Paper .05 mfd 400 V. ± 20%
C 30	A196-107	Paper .01 mfd 400 V. ± 20%
C 32	A196-112	Paper .05 mfd 400 V. ± 20%
C 34	A196-107	Paper .01 mfd 400 V. ± 20%
C 31	A191-23	Mica 100 mmf
C 38	A20131	Electrolytic 20-10 @ 350 V.
C 40	A196-107	Paper .01 mfd 400 V. ± 20%
C 41	A1773	Trimmer, A.S.P.
C 42	A5556-200-9	Ceramic 500 mmf, ± 5% mmf N750 Insul.
C 43	A19109	Ceramic Disc 5000 mmf
C 47	A19109	Ceramic Disc 5000 mmf
C 48	A191-102	Mica 10 mmf, ± 10%

RESISTORS FOR AM-FM TUNER

SCHEM. LOCATION	PART NO.	DESCRIPTION
R 1	A230-2321	Carbon 1 Meg ohm 1/4 W. ± 20%
R 2	A230-2225	Carbon 100 Ohm 1/4 W. ± 20%
R 3	A230-2265	Carbon 4.7K Ohm 1/4 W. ± 20%
R 4	A230-1101	Carbon 10 Ohm 1/4 W. ± 20%
R 5	A230-2313	Carbon 470,000 Ohm 1/4 W. ± 20%
R 6	A230-2281	Carbon 22,000 Ohm 1/4 W. ± 20%
R 7	A230-1183	Carbon 27,000 Ohm 1/4 W. ± 20%
R 8	A230-2265	Carbon 4.7K Ohm 1/4 W. ± 20%
R 9	A230-2261	Carbon 3300 Ohm 1/4 W. ± 20%
R 10	A230-2329	Carbon 2.2 Meg ohm 1/4 W. ± 20%
R 11	A230-2221	Carbon 68 Ohm 1/4 W. ± 20%
R 12	A231-1171	Carbon 8200 Ohm 1/2 W. ± 10%
R 13	A230-2281	Carbon 22,000 Ohm 1/4 W. ± 20%
R 14	A230-2329	Carbon 2.2 Meg ohm 1/4 W. ± 20%
R 15	A230-2221	Carbon 68 Ohm 1/4 Ohm ±20%
R 16	A232-68	Carbon 6200 Ohm 1 W. ± 5%
R 17	A230-2305	Carbon 220,000 Ohm 1/4 W. ± 20%
R 18	A230-1177	Carbon 15,000 Ohm 1/4 W. ± 10%
R 20	A230-2313	Carbon 470,000 Ohm 1/4 W. ± 20%
R 21	A230-2281	Carbon 22,000 Ohm 1/4 W. ± 20%
R 24	A232-2277	Carbon 15,000 Ohm 1 W. ± 20%
R 26	A230-2305	Carbon 220,000 Ohm 1/4 W. ± 20%
R 28	A230-2345	Carbon 10 Meg ohm 1/4 W. ± 20%
R 30	A230-2313	Carbon 470,000 Ohm 1/4 W. ± 20%

MISC. PARTS FOR AM-FM TUNER

SCHEM. LOCATION	PART NO.	DESCRIPTION
L 3	28283	Choke FM Osc.
L 4	A62298	Choke AM Loop
L 5	A28288	Coil FM Antenna
L 6	A28287	Coil FM Osc.
L 7	A28285	Coil AM Osc.
L 8	A28283	Choke FM Osc.
S 1	A37102	Switch AM/FM Phono TV
T 2	A3395	Transformer FM IF 1st
T 3	A3396	Transformer AM IF 1st
T 4	A3394	Transformer AM IF 2nd
T 5	A3399	Transformer AM IF 2nd
T 6	A3397	Transformer Ratio Detector
	A4114	Pointer Dial Scale

INSTALLATION

PREPARING THE RECORD CHANGER FOR OPERATION

Do not connect this unit to a power outlet until all shipping items on the record changer have been removed.

The record changer is floated on spring mountings. For shipping purposes only, these mountings are made rigid. To float the changer, remove the turntable by lifting it straight up the spindle. Turn the two shipping bolts (identified by large, round heads) in a clockwise direction as far as possible and replace the turntable. Replace the turntable with a counterclockwise turning motion, making sure that the driver wheel is in position against the inside flange of the turntable.

It is essential to have the record changer absolutely level. Use a torpedo or similar type level on the changer baseplate. Use adequate shims under the radio combination cabinet to achieve perfect level.

RECORD CHANGER CONNECTION

See that the connections from the pickup arm and from the turntable motor are plugged into their sockets on the radio chassis.

POWER SUPPLY

The record changer is designed for operation from 105-125 volt, 60 cycle, alternating current (AC) supply only. Never connect to a supply having a different frequency or voltage than that specified.

OPERATION

This Intermix Record Changer is designed to automatically play standard 78 RPM records, and 45 RPM and 33 1/3 RPM records of standard commerical dimensions. Any of these type records up to 12″ in diameter may be played manually.

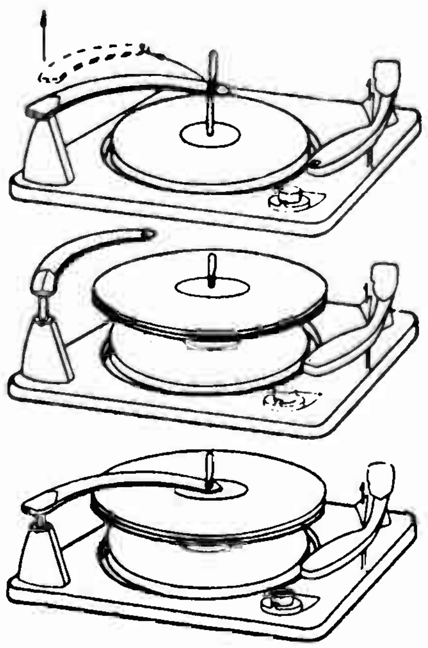
The changer will automatically play as many as ten 12″, twelve 10″, or any assortment of ten records intermixed. However, only intermix records of the same type—either standard (78 RPM) or long play (33 1/3 RPM).

A full stack of twelve 7″, 33 1/3 RPM, long-play records, a full stack of twelve 7″, 45 RPM, fine-groove records (with the proper adapter inserted in the record), or a full stack of twelve 7″ 78 RPM records (children's records) with lead-in and finishing grooves will also automatically play on this changer. Changer shuts off after the last record has been played.

Those children's records and home recordings that do not have lead-in and finishing grooves must be played manually.

LOADING THE RECORDS FOR AUTOMATIC OPERATION

1. Lift up on the record support knob until it clears the spindle and swing it to the left.
2. Carefully place the records on the spindle and lower them to the off-set shoulder. Steady the records with one hand and replace the record support over the spindle. Gently push down on the record support knob until the records are held parallel with the turntable.
3. The record to be played first should be at the bottom of the stack; the second record to be played next, etc. The side of the record to be played should face upward.

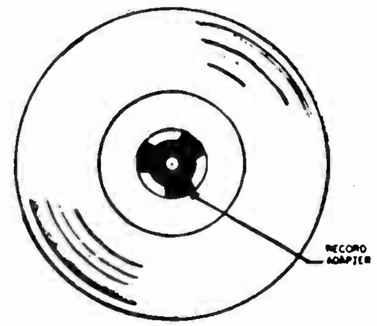


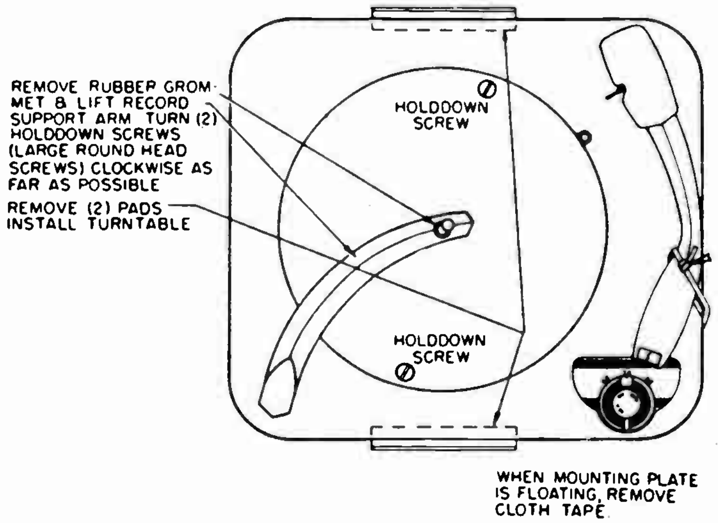
TO PLAY STANDARD RECORDINGS (78 RPM)

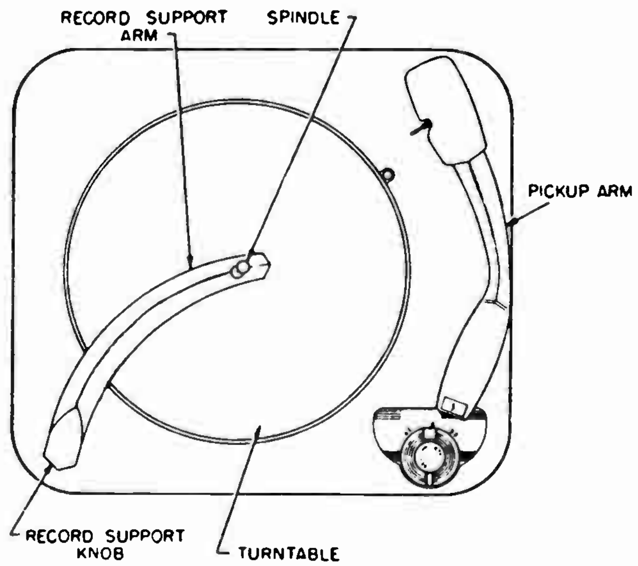
1. Motor speed control knob must be in the 78 position. A stack of 10″ and 12″ standard records (78 RPM) may be intermixed.

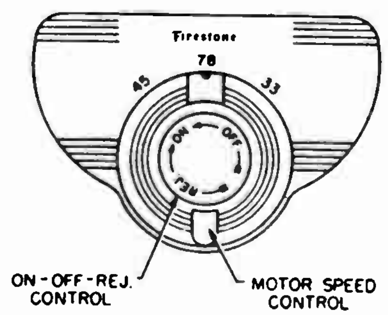
TO PLAY LONG-PLAY (33 1/3 RPM) RECORDS

1. Motor speed control knob must be in the "33" position a stock of 10″ and 12″ long play records (33 1/3 RPM) may be intermixed, or a full stack of 7″ long play records (33 1/3 RPM) may be played.









TO PLAY FINE-GROVE (45 RPM) RECORDS

1. Motor speed control knob must be in the "45" position. Your fine-groove 45 RPM records are manufactured with a 1½″ spindle hole. Because of this it is essential before playing these records that a record adapter be inserted (as shown in the illustration) in each 45 RPM record to be played. A full stack of 7″ Fine Groove (45 RPM) records may be played.

STARTING THE MECHANISM

The pickup arm should be in place on the pickup arm rest.

1. Turn the receiver on and set the selector switch to phono position.
2. Turn the changer control knob clockwise (to the right) to "REJ." and release it. This will release the bottom record from the stack and will cause the pickup arm to come to its proper position on the record and start playing. When the record is finished, the mechanism will automatically lift the pickup arm and drop the next record into position for playing. When the last record is played, the mechanism will automatically shut off.

NOTE: If when the line cord is first connected to an A.C. outlet, the turntable does not revolve and the ON-OFF Reject Control cannot be turned to its "ON" position it will be necessary to rotate the turntable in a clockwise direction by hand until the pickup arm is on its rest.

TO REJECT A RECORD

To reject a record you don't want to hear, turn the changer control knob to "REJ." and release it. This will lift the pickup arm from the record and drop the next record into position for playing.

TURNING OFF

To turn off the changer before the last record has been played, turn the changer control knob to "OFF," lift the pickup arm from the record and place it on the rest.

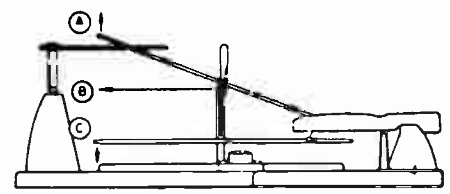
TO REMOVE RECORDS

Lift and turn the record support arm to the left. Lift the records from the turntable.

MANUAL OPERATION

To play records one at a time as with an ordinary phonograph:

1. Lift up on the record support knob until it clears the spindle. Swing it to the left until the pin in the shaft drops into the locating groove.
2. Place the record on the off-set shoulder of the spindle and tilt it toward the back of the pickup arm (A).



This will guide the push-off finger into the center hole of the record. Pull the record (B) so the center hole is over the main part of the spindle. The record can now drop to the turntable (C) and be played in the usual manner.

3. Turn the changer control knob to "ON".
4. Place the needle in the starting grooves of the record.

TONE AND VOLUME CONTROLS

The tone and the volume controls will affect record reproduction and volume in the manner as for the radio.

CARE OF RECORDS

To insure long life for your records requires only slight effort. Do not expose them to heat from the sun or from nearby stoves or radiators. Store them preferably in albums, but in any case keep them always in a cool, dry place, resting vertically. Remove dust and dirt, using a soft cloth and a light circular motion.

SUGGESTIONS

When loading and unloading the changer use care to prevent bending of spindle. Records should not be left on the spindle except during operation of changer. Records will warp. When machine is not in use, it is suggested that the motor control be left in the "78" position. For best reproduction keep needle and records clean.

IF NOISE DEVELOPS

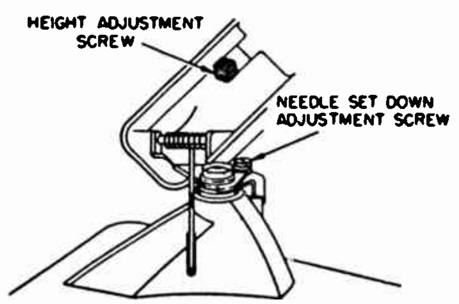
Noisy scratching indicates worn records. Some records will wear longer than others, even if kept equally clean. This is due not only to quality of manufacture and care given the records but also to the kind of music recordered.

SELECTION OF NEW RECORDS

When buying records inspect them carefully to be sure that they do not have chipped edges and that they are perfectly flat. Records that are warped or "saucer shaped" or that have chipped edges may not operate properly in the record changer.

SPECIAL INSTRUCTIONS

1. The set-down position of the needle is adjusted by means of an adjusting screw. See illustration. Turn this screw in either direction until correct set-down is obtained for a 10" record. When correct set-down is obtained for the 10" position, the 12" and 7" set-down positions also will be correct.



2. The pickup arm height is adjusted by the height adjustment screw. See illustration. Turn the screw in or out until the underneath side of the pickup arm lifts 1/4" above a 1 1/8" stack of records on the turntable during start of cycle.
3. The pickup arm is equipped with a cartridge having a osmium tipped unipoint needle. Insert new needle and tighten thumb nut firmly by hand.

The replacment needle will have to be adjusted before it is tightened in the pickup cartridge to insure that the needle shank is securely held by the knurled thumb nut.

***CAUTION:* DO NOT USE PLIERS ON KNURLED THUMB NUT.**

TIGHTEN WITH FINGERS ONLY.

PARTS LIST FOR RECORD CHANGER

PART No. A6426-4

PART NUMBER	DESCRIPTION
K3466	Base Plate
K2110	"C" Washer—Record Support Assy.
K2594	"C" Washer—Switch Control
K1719	"C" Washer—Main Gear Assy.
K1588	"C" Washer—12" Record Selector
K1588	"C" Washer—Conical Lift Pin Spring
K1588	"C" Washer—Slide Retainer
K2935	Control Link
K2593	Control Shaft Bearing
K2284	Control Shaft Assy.
K2262	Conical Lift Pin Spring
K2597	Control Shaft Assy.
K2525	Die Cast Frame Only
K3285	Escutcheon
K3499	Escutcheon Screws
K2571	Ejector Link Assy.
K2829	Fibre Washer—Trip Lever Assy.
K2583	Fibre Washer—Idler Wheel
K2274	Flat Washer—Slide and Cam Assy.
K2221	Fibre Washer—Main Gear Assy.
K2931	Fibre Strip—Switch
K3361	Hairpin Clip—Idler Wheel
K2310	Hinge Pivot Screw
K2294	Hinge Assy.—Lift Pin
K2509	Hinge Spring
K2998	Hinge Arm Assy.
K2269	Eccentric for Set-Down
K2505	Hinge Arm
K2995	Hinge Spring (Tortional)
K2926	Tinnerman Speed Nut
K2904	Cartridge Mounting Screws
K3560	Cartridge (Astatic "GCAG-M")
K3561	Osmium Duo Point Needle
K3689-13	Cable and Clip Assy.
K2275	Strengthener Screw
K2255	Lock Spring
K2912	Lift Screw
K3353	Idler Wheel
K2220	Lift Pin
K2591	Lever Assy.—Shut-Off
K2561	Locator—Tone Arm Return
K2271	Locator Ring—Tone Arm Return Cam
K2255	Lock Spring
K2912	Lift Screw
K3211-H	Motor Assembly—(Russell)
K1685	Motor Fastener
K2942	Motor Speed Control Rod
K2575	Main Gear Assy.
K1588	"C" Washer—Trip Lever Assy.
K2977	Roller
K2226	Shaft
K2227	Rivet
K2512	Gear Only
K2516	Spring Washer—Trip Lever Assy.
K2517	Bushing
K2559	Bracket
K2569	Trip Lever Assy.
K2829	Fibre Washer—Trip Lever Assy.
K2329	Pawl
K2940	Pawl Lever
K2943	Rivet
K1975	Pal Nut
K2918	Plastic Support Leg
K2208	Pal Nut for Spindle

PART NUMBER	DESCRIPTION
K2907-P	Reject Knob
K1721	Reject Spring—Shut-Off Rod
K2560	Reset Lever
K2574	Return Spring—Tone Arm
K2580	Rubber Bumper
K2765	Rubber Grommet
K2908-B	Record Support Assy.
K3286-P	Plastic Button
K2530	Record Support Rod
K 409	Screw—10-24 x 5/16 and Lock-Washer
K2516	Spring Washer
K2978	Shut-Off Spring—Control Link
K2586	Shut Off Bracket Assy.
K2053	Screw—6 x 5/16 Sheet Metal—Shut-Off Bracket
K2087	Screw—6-32 x 1/4
K2247	Safety Spring
K2249	Safety Plate—Lift Pin
K2077	Shipping Bolt
K26[illegible]0	Shut-Off Rod
K1720	Speed Nut—Spring
K2925	Spring for Reset Lever
K 467	Switch Only
K2573	Switch Cover
K2910	Spring—Compression—Switch Control Lever
K2579	Spring for Set-Down Lever
K2585	Spring for Shut-Off Lever
K2953	Spring Washer—Compression
K2932	Screw—4-40 Hex Head
K2288	Slide and Cam Assy.
K2246	Spring for Slide
K2211	Slide Bearing
K2599	Switch Control Lever Assy.
K2275	Strengthener Screw—#4 x 1/4 Thread Cutting
K3284-P	Speed Control Knob
K2917	Strengthener and Bracket Assy.
K2576	Spindle and Bearing Assy.
K2536	Spindle Assy. less Ball Race and Washers
K2128	Spindle Guide
K1529	Record Pusher
K2537	Spindle Body and Base Assy.
K2078	Retainer Ring—Spindle Assy.
K2639	Bearing Washer—Spindle Assy.
K2624	Bearing (Ball Race)—Spindle Assy.
K2639	Bearing Washer—Spindle Assy.
K1527	Pusher Spring—Spindle Guide
K2552	Pusher Shaft Spring—Record Pusher
K2539	Pusher Shaft and Housing Assy. (Complete)
K2528-A	Turntable and Hub Assy.
K2569	Trip Lever Assy.
K2939	Trip Pawl
K2958	Trip Link
K2921	Tone Arm Shaft and Sleeve
K2558-G	Tone Arm Rest Post
K2442	Trip Spring—Control Link
K2951	Terminal Strip
K2520	Trip Finger—Cam
K2999	Tone Arm and Hinge Assy.
K2917	Strengthener Assy.
K3423-P	Plastic Tone Arm Only
K2937	Washer—1/4 I.D. x 1/2 O.D. x 1/16—Lift Pin
K 492	Washer—"Flat-Steel"
K2909	Washer—Control Lever Assy.
K2957	12" Record Selector
K2581	7" Set-down Lever

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ELECTRICAL SPECIFICATIONS

Power Supply . . . . .105-125 Volts AC
60 Cycles only
Power Consumption . . . . . . .210 Watts
Power Output . . . . .2.4 Watts (Max.)
1.8 Watts (10% Distortion)
Tuning Range . . . . .12 Channel
Antenna Input Imp. . . . . . . .300 Ohms balanced
Intermediate
Frequencies . . . . .Picture 26.20 MC
Sound 21.70 MC
Intercarrier Sound
System . . . . .4.5 MC
Loud Speaker . . . . .12" PM Dynamic
Voice Coil Imp. . . . . .3.2 Ohms 400 Cycles

TUBE COMPLEMENT

Symbol	Type	Function
Tuner	6J6	R-F Osc. and Mixer
*Tuner	6BQ7	R-F Amplifier
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V-5 A & B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20	5U4-G	Low Voltage Rectifier
V-21	21MP4	Picture Tube 21" Metal Rectangular (Electrostatic)

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

RADIO FREQUENCY RANGES

Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc	Receiver R-F Osc. Frequency Mc
2	54-60	55.25	59.75	81.45
3	60-66	61.25	65.75	87.45
4	66-72	67.25	71.75	93.45
5	76-82	77.25	81.75	103.45
6	82-88	83.25	87.75	109.45
7	174-180	175.25	179.75	201.45
8	180-186	181.25	185.75	207.45
9	186-192	187.25	191.75	213.45
10	192-198	193.25	197.75	219.45
11	198-204	199.25	203.75	225.45
12	204-210	205.25	209.75	231.45
13	210-216	211.25	215.75	237.45

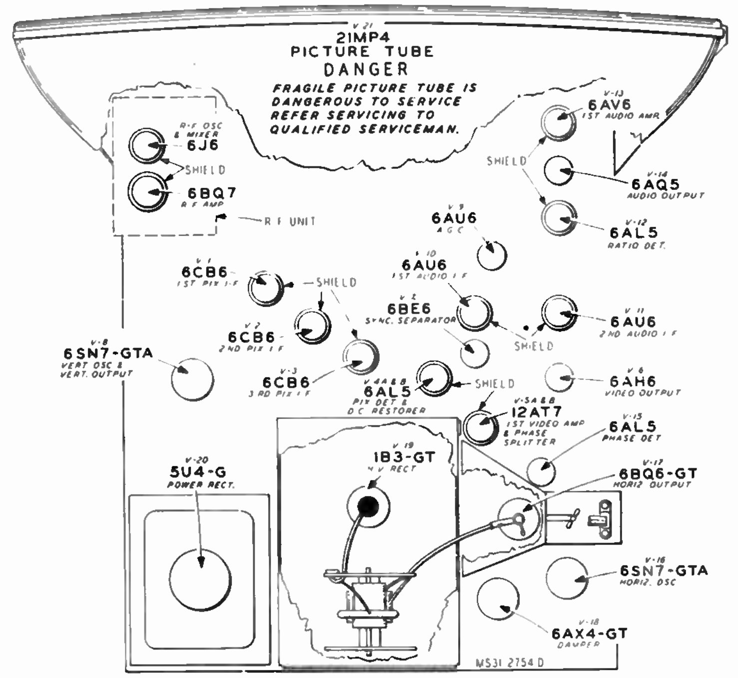


Fig. 1—Tube Layout.

RECEIVER LOCATION — Advise the owner as to the proper location for the television receiver. The following may be used as a guide:

1. Choose an area in the home where sunlight or light from lamps does not strike the face of the picture tube and cause glare.
2. Remember the necessity of an electrical outlet and the location of the point at which the antenna leads enter the room.
3. The receiver should be placed a short distance from the wall to allow adequate ventilation.
4. The receiver should be placed to permit easy access for operation and comfortable viewing from all angles.

ANTENNA — This receiver has been designed to use an antenna with a 300 ohm balanced transmission line. This line must be as short as possible because the longer the line the greater the chances are for picking up electrical disturbances. Stand-off insulation should be used to keep the line away from the mast, metal or walls. Twist this line about one turn per foot throughout the line to cancel out direct signal and/or noise pickup by the transmission line. It should also be securely anchored in place so that a change in weather will not affect its position.

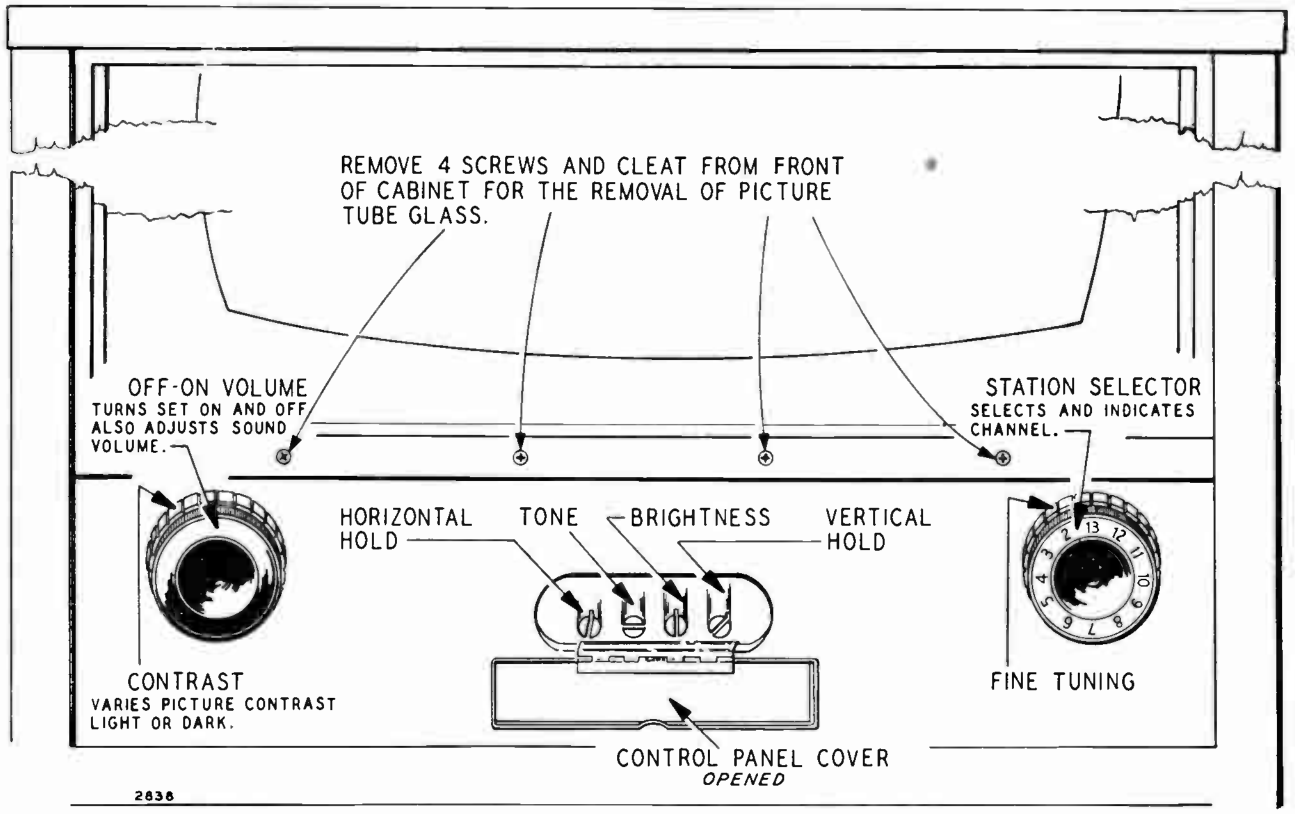
HIGH VOLTAGE WARNING

This television receiver contains high voltages which are dangerous to life. Never operate or service the receiver outside of the cabinet or with the covers removed until all the safety precautions necessary for working with high voltage equipment have been observed.

PICTURE TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves must be worn by individuals while handling the picture tube or installing the picture tube into the receiver.

The picture tube encloses a high vacuum and due to the large surface area, is subjected to very high air pressure. Therefore, care should be taken not to bump or scratch the picture tube accidentally as it may cause the tube to implode resulting in damage to property or injury to an individual.



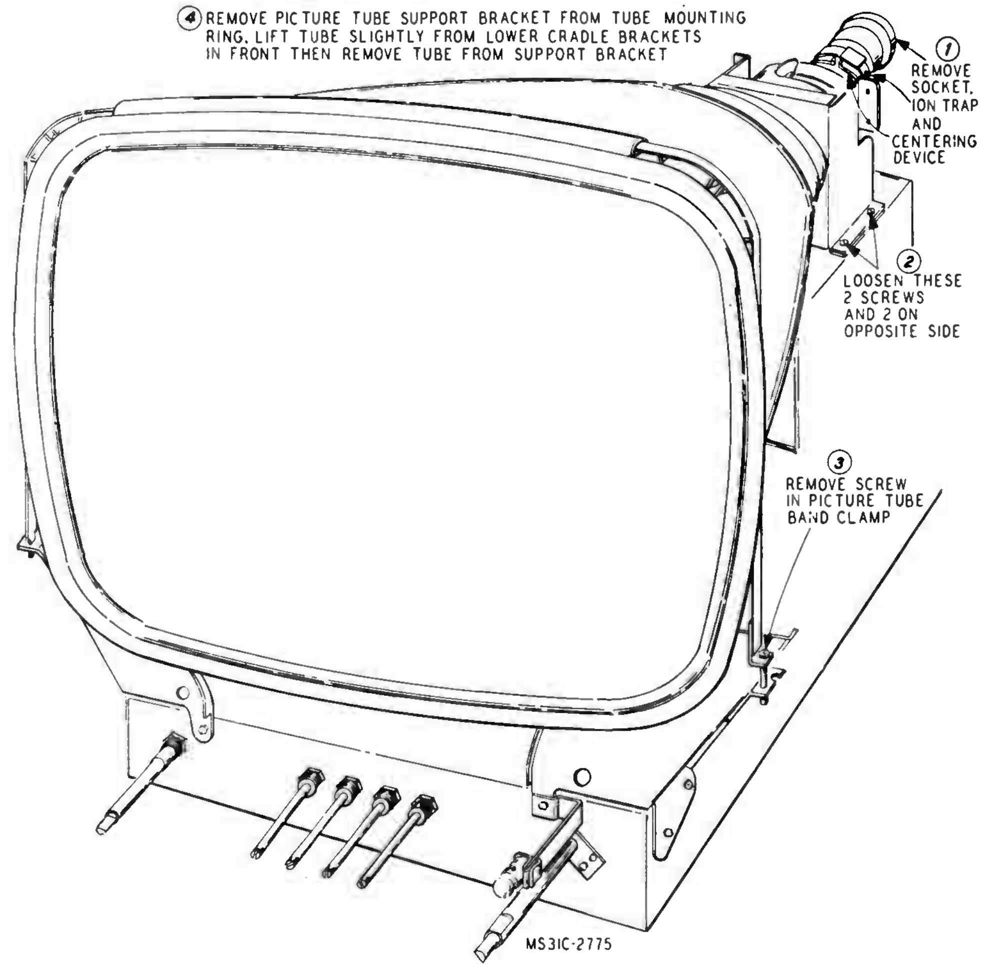


Fig. 3—Removal of Picture Tube

TUNING PROCEDURE

1. To turn the television receiver on, turn the OFF-ON VOLUME control clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.
2. Turn the STATION SELECTOR control to the desired channel. This control may be turned in either direction.
3. Turn the CONTRAST control clockwise until activity or definite form is noted on the screen.
4. Adjust the FINE TUNING control for clearest picture and the VOLUME control for desired volume.
5. To turn off the receiver, turn only the OFF-ON VOLUME control counterclockwise until a click is heard.

OCCASIONAL ADJUSTMENTS TO IMPROVE PICTURE RECEPTION

There are four controls at the front of the chassis which are accessible when the hinged control panel is pulled downword. See illustration (Figure 2). These controls are pre-set at the factory and may occasionally need adjustment due to aging of the components in the receiver and the fluctuating line voltages in different areas.

If any adjustments are necessary follow the instructions under "Controls and Functions."

IMPORTANT — Be sure that the FINE TUNING control has been set for the clearest picture before adjusting any controls.

CONTROLS AND FUNCTIONS

HORIZONTAL HOLD—Stops horizontal movement (diagonal bars.)

TONE—Adjusts for tonal quality bass or treble.

BRIGHTNESS—Adjusts for desired picture brilliance.

VERTICAL HOLD—Stops upward or downward picture movement.

PICTURE TUBE SAFETY GLASS

It will be necessary to clean the picture tube safety glass and the face of the picture tube occasionally. Remove the screws and cleat as outlined in the illustration. Insert your fingers into the opening at the center of the frame and carefully lift up and pull out the safety glass. Clean the safety glass and the face of the picture tube with a soft lint-free cloth dampened with water or mild soapsuds.

WARNING — Before handling the picture tube, it will be necessary to remove the static charge. In receivers with glass picture tubes, ground the anode lead to chassis, and insert an insulated wire from the well in the tube to chassis. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

PICTURE TUBE REPLACEMENT — To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove the cabinet back.
3. Disconnect the leads from the speaker, remove the antenna terminal board at the rear of the cabinet and then the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

FRONT OF CHASSIS

(Accessible After Opening Front Panel Control Cover)

Horizontal Hold	R-94
Brightness	R-25
Vertical Hold	R-51
Tone	R-72

NON-OPERATING CONTROLS REAR OF CHASSIS

Horizontal Centering	Centering Device
Vertical Centering	Centering Device
Ion Trap Magnet	Wing Nut Adjustment
Deflection Yoke	Wing Screw
Width	L-15
Horizontal Linearity	L-16
Horizontal Drive	R-89
Horizontal Frequency	L-14
Vertical Linearity	R-49
Height	R-54
Sync Stability	R-39
AGC Threshold Control	R-108

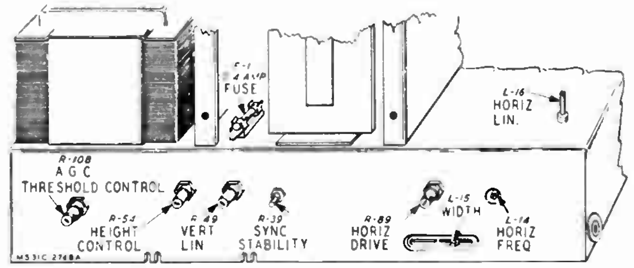


Fig. 4—Adjustments Rear of Chassis

ION TRAP MAGNET ADJUSTMENT—The ion trap magnet should be positioned close to the base of the tube with the magnet of the ion trap on the side where the electron gun is nearest the glass neck of the picture tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to make sure that the ion trap magnet is correctly adjusted.

DEFLECTION YOKE ADJUSTMENT — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

CENTERING ADJUSTMENT — If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained. If a clamp type centering device is used, rotate the device to the left or right and turn the knob located at the top of the device until the picture is centered correctly.

PICTURE ADJUSTMENT — For further adjustments, obtain a test pattern on the receiver. Turn on receiver and follow tuning procedure on page 16. When a test pattern is obtained it may be necessary to slightly re-adjust the fine tuning control for clearest picture.

ADJUSTMENT OF AGC THRESHOLD CONTROL — Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL — When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control fully counter-clockwise, then, while observing the picture, turn the control slowly clockwise until a minimum amount of bending occurs. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.

When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT — With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT — Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS— While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (R-89) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (R-89) will be necessary. Adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

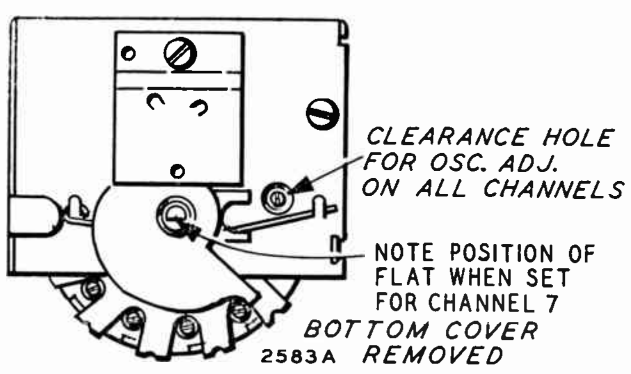


Fig. 5—Tuner Oscillator Adjustments

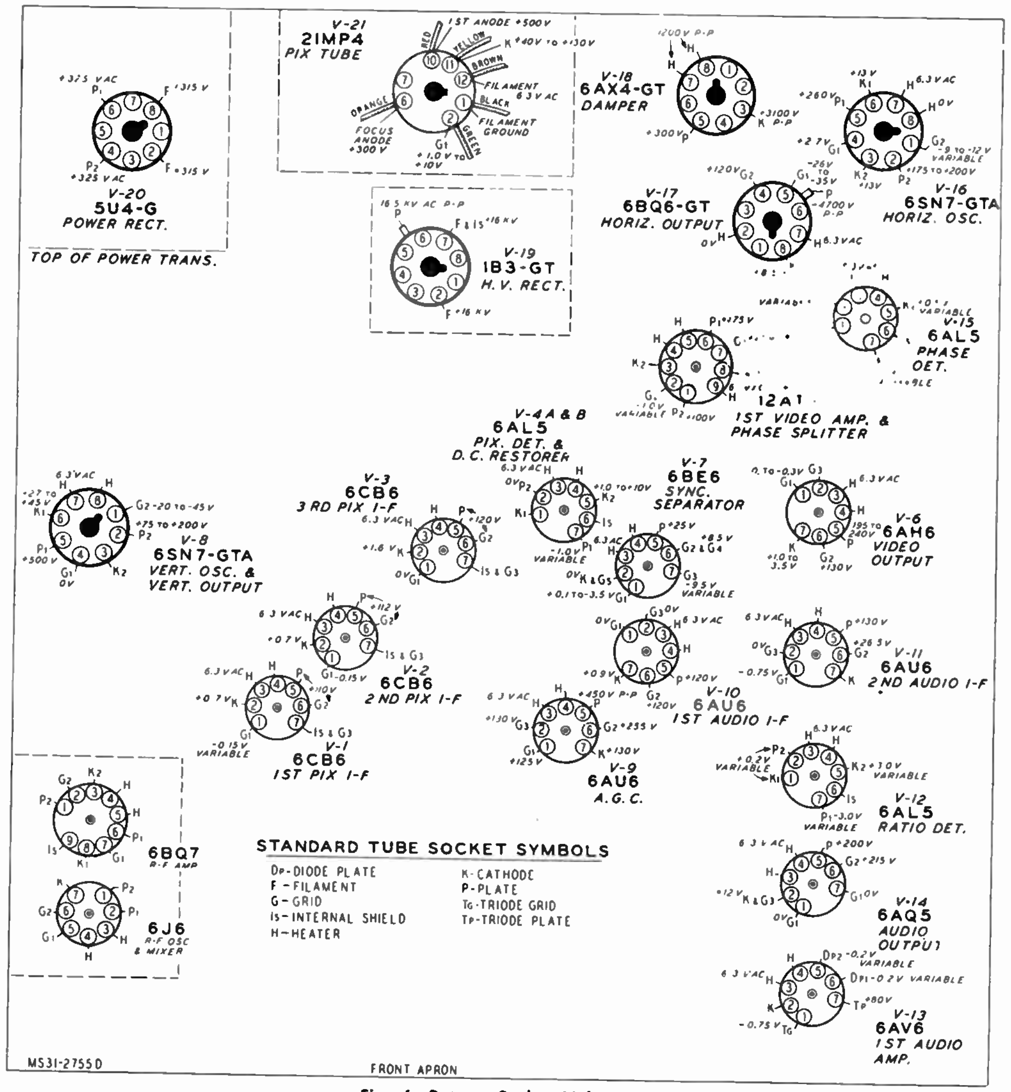


Fig. 6—Bottom Socket Voltages

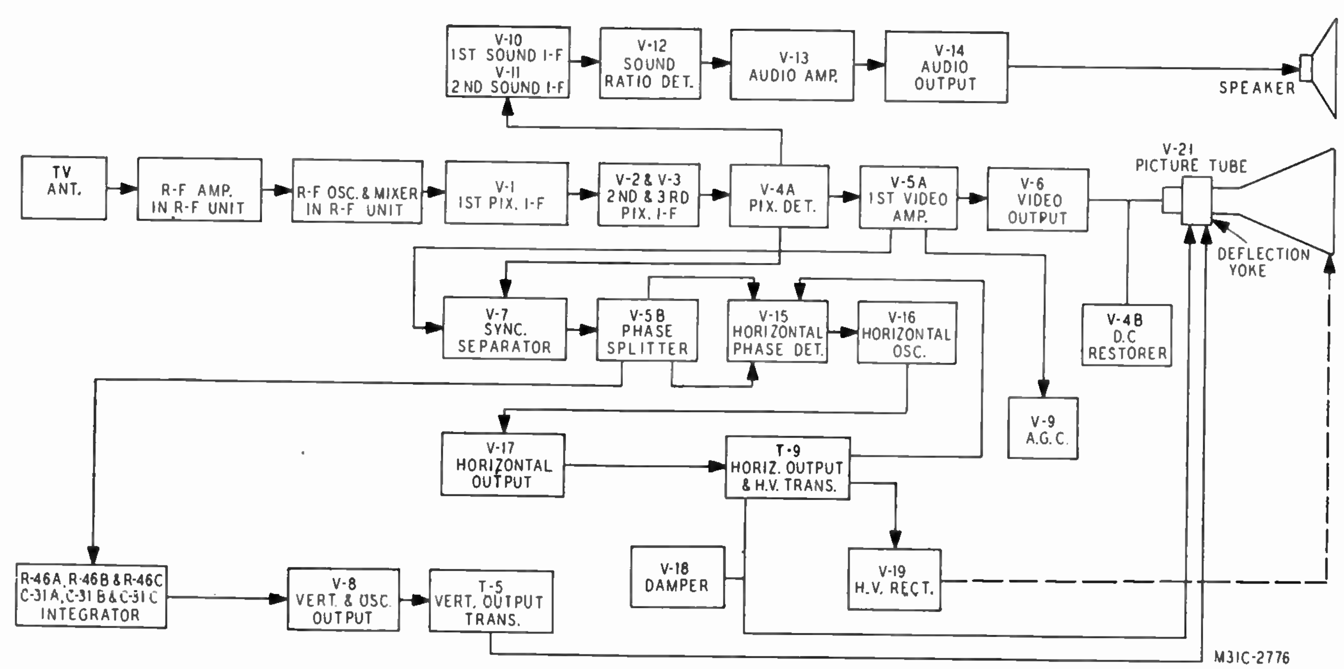


Fig. 7—Block Diagram

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.
1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
(A) Horizontal output tube V-17 (6BQ6-GT)
(B) Check damper tube V-18 (6AX4-GT).
(C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
(D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
(E) Check DC resistance of T-9.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-99 and C-78 defective or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:
1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.
1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-35A, C-39 or C-70 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitor C-37, or open or incorrect value of resistors R-55 & R-56.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-36 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:
1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6AX4-GT).
3: Check capacitors C-74, C-76, C-77 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER
1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:
1: Defective yoke due to C-75 or R-98 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2: V-18 (6AX4-GT) defective.

SMALL RASTER — This condition can be caused by:
1: Low +B or line voltage. Check V-20 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control R-89.
5: V-18 (6AX4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND — This condition can be caused by:
1: No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY — A condition of this nature can be caused by:
1: Defective sync separator V-7 or phase splitter V-5B.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY — If this condition is encountered, check:
1: Vertical integrating network capacitors C-31A, B & C, and resistors R-46 A, B & C.
2: Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY
1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:
1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (6AH6).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5: Leakage in V-6 (6AH6) grid capacitor C-11. If the capacitor is not found to be defective, check the following:
  1: Check all potentials in video circuits.
  2: Check picture tube grid circuit for poor or dirty contact.
  3: Check and realign, if necessary, the picture I-F and R-F circuits.

SERVICE SUGGESTIONS—(continued)

PICTURE SMEAR:
1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc)
1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S-ING
1: Check sync stability control adjustment.
2: Check capacitors C-35B and C-79B.
3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4: Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5: Check AGC threshold control.

PICTURE NORMAL—NO SOUND OR WEAK OR DISTORTED SOUND
1: Check sound I-F alignment.
2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

POOR FOCUS
1: Improper setting of Ion Trap magnet.
2: Defective picture tube or picture tube socket.

PICTURE JITTER:
1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).
6: Check for improper setting of sync stability control.
7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8: Check AGC threshold control.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:
(a) Frequency ranges:
  18 to 30 mc, 10 mc sweep width
  40 to 90 mc, 10 mc sweep width
  170 to 225 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)
(a) Intermediate alignment frequencies.
  23.1 mc first picture I-F coil.
  24.1 mc third picture I-F coil.
  25.9 mc second picture I-F coil.
  21.7 mc sound trap.
  4.5 mc video trap & sound I-F.
  25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-99.

ALIGNMENT PROCEDURE
PIX I-F

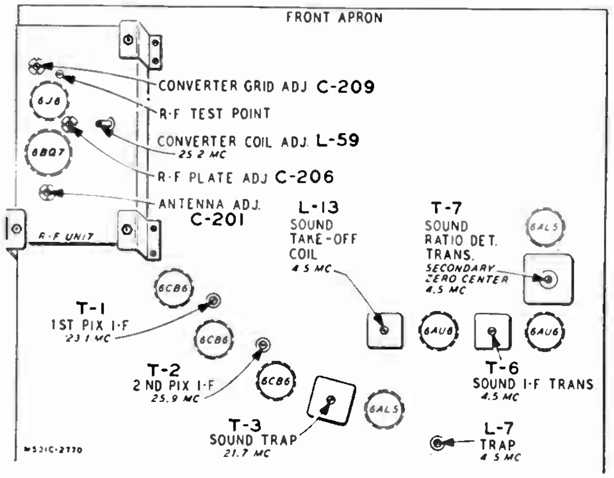


Fig. 8—Top Chassis Video and Audio I-F Adjustments

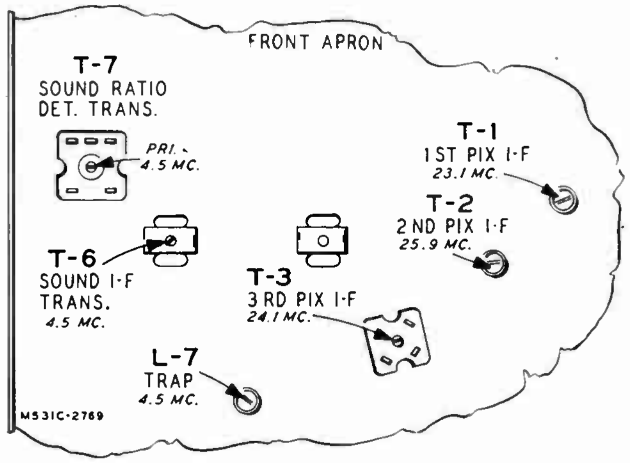


Fig. 9—Bottom Chassis Video and Audio I-F Adjustments.

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-100) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line.

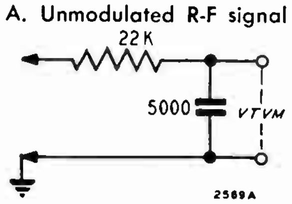


Fig. 10—VTVM Connections

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-100 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery).

Tuner should be switched to dead channel so as not to cause interference.

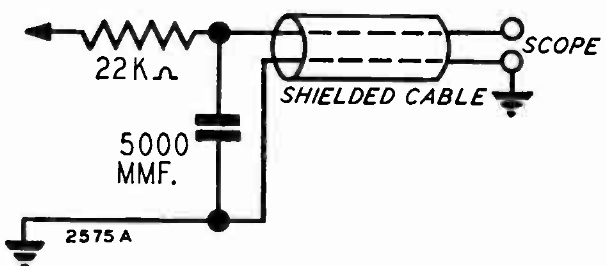


Fig. 11—Oscilloscope Connections

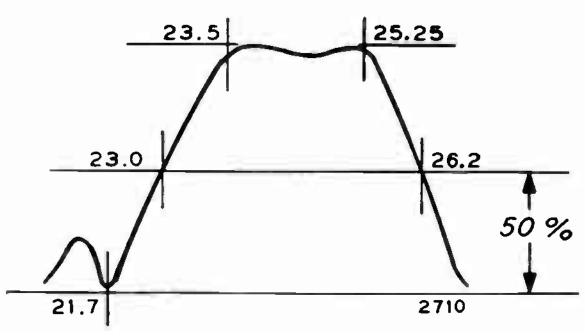


Fig. 12—Overall Response Curve

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

ALIGNMENT PROCEDURE (Continued)

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-62 and C-46, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-66, R-69 and C-50, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect 1½ V bias to AGC line at junction of R-33 and C-20 on the receiver.

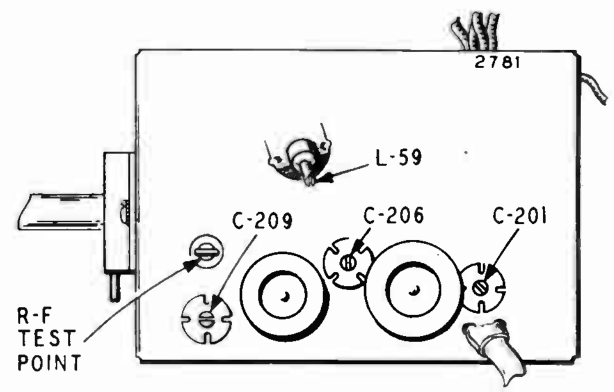


Fig. 13—Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

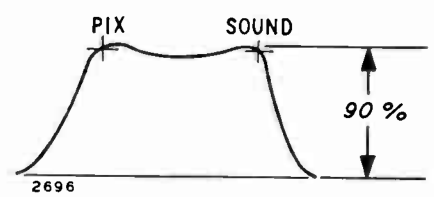


Fig. 14—Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-21.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.

TUNER ASSEMBLY INFORMATION

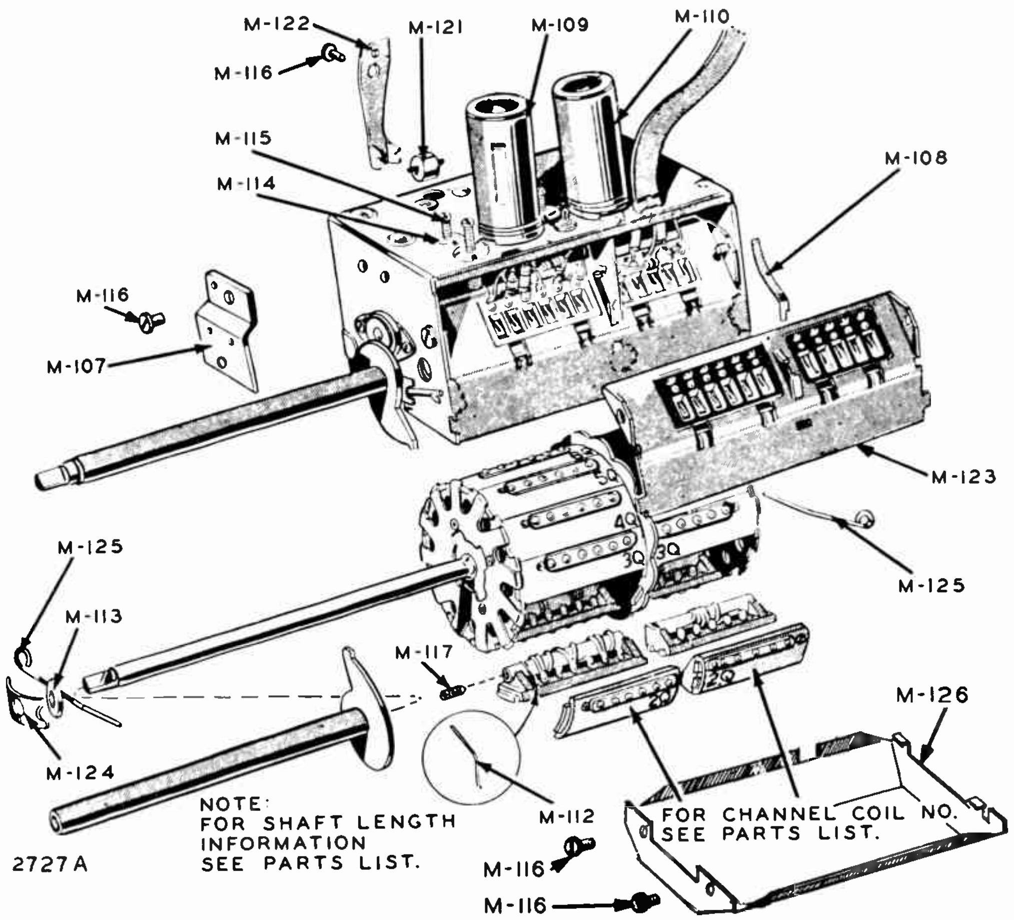


Fig. 15—"Q" Tuner Pictorial

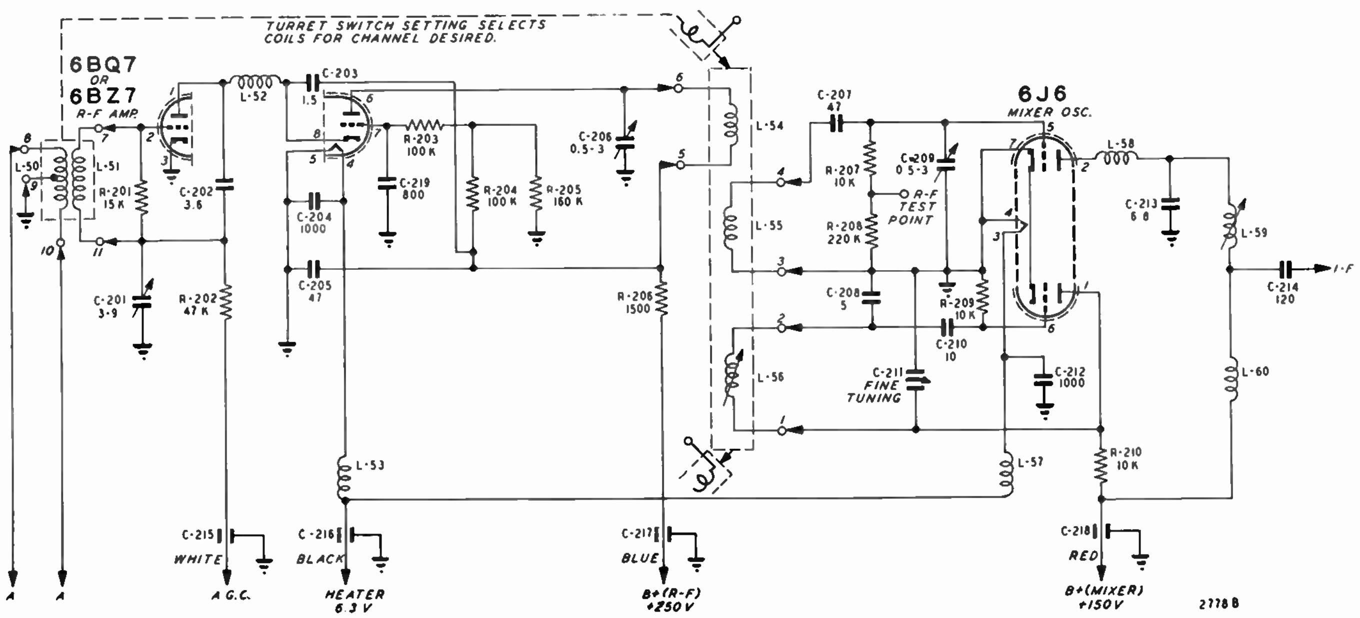


Fig. 16—"Q" Tuner Schematic Diagram.

TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	±10%	0.5
R-202	12A-039	47 K	±20%	0.5
R-203	12A-094	100 K	±10%	0.5
R-204	12A-166	100 K	±5%	0.5
R-205	12A-167	160 K	±5%	0.5
R-206	12A-183	1500	±10%	0.5
R 207, R 209, R 210	12A-040	10 K	±10%	0.5
R 208	12A-041	220 K	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204, C-212	CD8X102Z	1000 mmf	
C-205, C-207	CD8Q470K	47 mmf	±10%
C-206, C-209	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215, C-216, C-217, C-218	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	9A2278-1	Antenna Coil	2-Q
	9A2278-2	Antenna Coil	3-Q
	9A2278-3	Antenna Coil	4-Q
	9A2278-4	Antenna Coil	5-Q
	9A2278-5	Antenna Coil	6-Q
	9A2278-6	Antenna Coil	7-Q
	9A2278-7	Antenna Coil	8-Q
	9A2278-8	Antenna Coil	9-Q
	9A2278-9	Antenna Coil	10-Q
	9A2278-10	Antenna Coil	11-Q

COILS AND CHOKES (Continued)

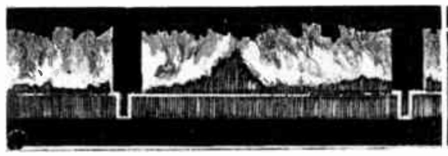
Ref. No.	Part No.	Description	Channel & Code No.
	9A2278-11	Antenna Coil	12-Q
	9A2278-12	Antenna Coil	13-Q
	9A2279-1	Oscillator Coil	2-Q
	9A2279-2	Oscillator Coil	3-Q
	9A2279-3	Oscillator Coil	4-Q
	9A2279-4	Oscillator Coil	5-Q
	9A2279-5	Oscillator Coil	6-Q
	9A2279-6	Oscillator Coil	7-Q
	9A2279-7	Oscillator Coil	8-Q
	9A2279-8	Oscillator Coil	9-Q
	9A2279-9	Oscillator Coil	10-Q
	9A2279-10	Oscillator Coil	11-Q
	9A2279-11	Oscillator Coil	12-Q
	9A2279-12	Oscillator Coil	13-Q
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L59	31A-078	Converter Plate Coil	
L-60	31B-230	Choke, Coil	

MISCELLANEOUS MECHANICAL PARTS

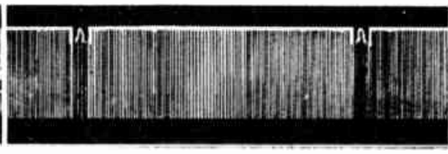
Ref. No.	Part No.	Description
M-107	31B-012	Bracket, Sharp Tuning Rotor Retaining
M-108	31B-048	Spring, Detent Plate Grounding
M-109	16S-006	Shield, Tube (6J6)
M-110	16S-004	Shield, Tube (6BQ7)
M-112	31A-010	Spring, Slug Retaining (Oscillator Coil)
M-113	11D-022	Washer, Fibre Spacer (1/4" ID by 1/2" OD)
M-114	10E-401	Nut, Locking Spring (for trimmers)
M-115	9A-410-7	Screw, Trimmer
M-116	9A-629-3	Screw, Bracket Mounting (6/32" by 1/4")
M-117	31B-029	Osc. Slug Trimmer
M-121	31B-016	Roller, Detent (3/8" dia., 3/32" dia. bearing)
M-122	31B-005	Spring, Detent (2-5/16" long)
M-123	31B-278	Contact Plate and Bracket Assembly
M-124	31B-008	Spring, Sharp Tuning Rotor Contact (Flat Bronze 1-7/16" by 1/2")
M-125	31B-030	Spring, Front and Rear Turret Shaft (Wire 2-3/4" long, 3/64" dia.)
M-126	31B-103	Shield, Bottom Cover
	31A-066-26	Fine Tuning Shaft (Sharp Tuning) used with 25A1095 Tuner

OSCILLOSCOPE WAVEFORM PATTERNS

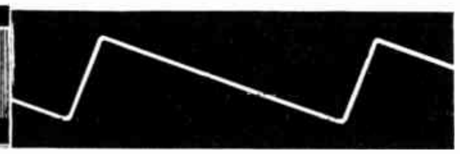
The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.
The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.



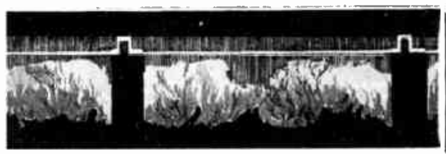
No. 1—6AL5 Pix Det. Plate
3.5V P-P 60 C.P.S.
No. 4—6BE6 Sync Sep.
Grid No. 1 .2V P-P 60 C.P.S.



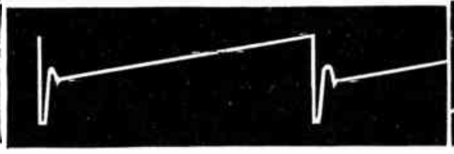
No. 7—12AT7 Phase Splitter Plate
45V P-P 60 C.P.S.



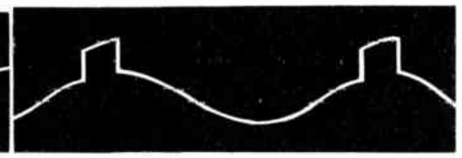
No. 13—6AL5 Phase Det.
18V P-P 15,750 C.P.S.



No. 2—12AT7 Plate
35V P-P 60 C.P.S.
No. 2—6AH6 Grid
8V P-P 60 C.P.S.

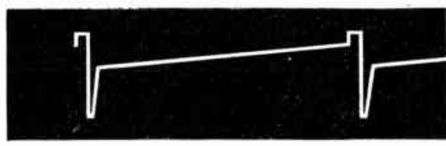


No. 8—6SN7-GTA—Vert. Osc. Plate
125V P-P 60 C.P.S.

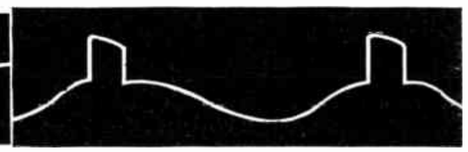


No. 14—6SN7—Hor. Osc. Plate
50V P-P 15,750 C.P.S.

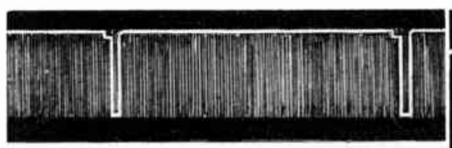
No. 3—Pix Tube Grid
20-100V P-P 60 C.P.S.



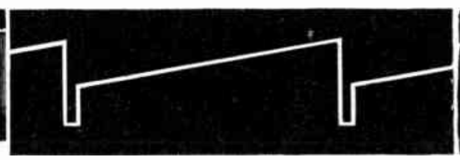
No. 9—6SN7-GTA Vert. Osc. Grid
170V P-P 60 C.P.S.



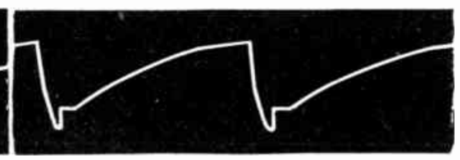
No. 15—6SN7 Hor. Osc. Grid
48V P-P 15,750 C.P.S.



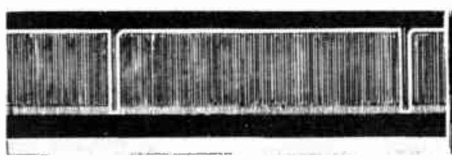
No. 5—6BE6 Sync Sep. Plate
20V P-P 60 C.P.S.



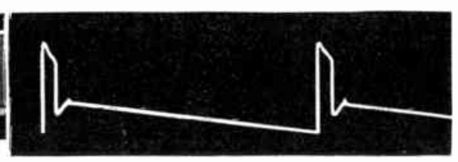
No. 10—6SN7-GTA Vert. Output Grid
150V P-P 60 C.P.S.



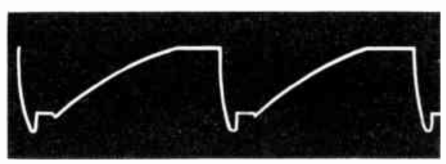
No. 16—6SN7 Hor. Osc. Plate
135V P-P 15,750 C.P.S.



No. 6—12AT7 Phase Splitter Cathode
18V P-P 60 C.P.S.

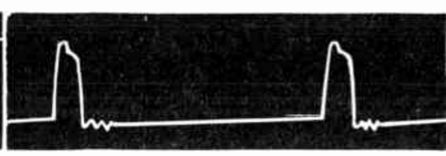


No. 11—Vert. Def. Coil
100V P-P 60 C.P.S.

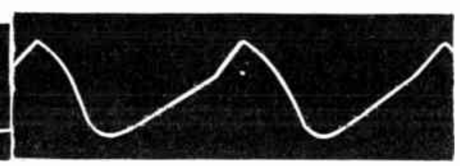


No. 17—6BQ6 Grid
120V P-P 15,750 C.P.S.

No. 6—12AT7 Phase Splitter Cathode
18V P-P 15,750 C.P.S.



No. 12—6AU6 A.G.C.
450V P-P 15,750 C.P.S.



No. 18—6AX4-GT Damper Plate
120V P-P 15,750 C.P.S.

PARTS LIST

Use only GENUINE factory tested parts to insure service jobs you can depend on and to obtain original set performance.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

ORDERING PARTS

Order parts from your nearest Firestone Home and Auto Supply Warehouse. When ordering parts, it is important that the correct code number and stock number, be given with the correct part name and part number as shown in the parts list. You will find the stock number and code number stamped on the chassis pan. The stock and code number also appears on the front cover of this booklet.

RETURNING DEFECTIVE PARTS

All parts on adjustments must be returned to your District Office Service Department with claim form completely filled out. This receiver is so constructed that it can be repaired locally by an experienced repairman.

CAPACITORS

					List Price
C-1, C-3, C-4, C-5, C-16, C-17, C-18, C-19, C-26, C-28, C-29, C-40, C-50, C-73, C-83	80X1	1000 mmf		Ceramic......	$ .20
C-2A, C-2B, C-21A, C-21B	80X3	1000 mmf		Dual Ceramic..	.30
C-6	47X603	47 mmf	500 V	Ceramic......	.20
C-7	Part of T-3				
C-8	47X562	5 mmf	500 V	Ceramic......	.80
C-9	47X584	1.5 mmf		Composition...	.10
C-10	47X568	360 mmf	500 V	Molded Mica..	.20
C-11, C-27, C-58, C-72, C-77	RCP10M4473M	.047 mf	400 V	Tubular......	.30
C-12, C-66, C-74, C-85	RCP10M4104M	.1 mf	400 V	Tubular......	.35
C-13, C-37	RCP10M6473M	.047 mf	600 V	Tubular......	.35
C-14	RCP10M6153M	.015 mf	600 V	Tubular......	.30
C-15	RCP10M2104M	.1 mf	200 V	Tubular......	.30
C-20, C-23, C-63	RCP10M2224M	.22 mf	200 V	Tubular......	.45
C-25, C-56, C-60	RCP10M4103M	.01 mf	400 V	Tubular......	.25
C-30A, C-30B, C-30C	45X392	20 mf 40 mf 10 mf	400 V 50 V 400 V	Dry Electrolytic	2.50
C-31A, C-31B, C-31C	Part of 76X7 (See Miscellaneous)				
C-32, C-65	47X543	4700 mmf	500 V	Molded Mica..	.85
C-33, C-54, C-55, C-61	RCP10M4472M	.0047 mf	400 V	Tubular......	.25
C-34, C-46	47X604	100 mmf	500 V	Ceramic......	.20

CAPACITORS—Continued

					List Price
C-35A, C-35B	45X391	100 mf / 80 mf	50 V / 400 V	Dry Electrolytic	3.70
C-36, C-39	RCP10M6104M	.1 mf	600 V	Tubular	.50
C-38	RCP10M6103M	.01 mf	600 V	Tubular	.30
C-41	45X361	4 mf	100 V	Dry Electrolytic	1.00
C-42	Part of L-13				
C-43, C-44	Part of T-6				
C-45, C-47, C-49	47X507	5000 mmf		Ceramic	.30
C-48, C-84	Part of T-7				
C-51, C-71	45X378	5 mf	25 V	Dry Electrolytic	.95
C-52, C-64	RCP10M2473M	.047 mf	200 V	Tubular	.30
C-53	47X525	470 mmf	500 V	Molded Mica	.25
C-57	Part of 76X5 (See Miscellaneous)				
C-59	RCP10M6472M	.0047 mf	600 V	Tubular	.25
C-62	RCM20A271K	270 mmf	500 V	Molded Mica	.25
C-67	RCM20B431K	430 mmf	500 V	Molded Mica	.30
C-68	47X570	330 mmf	500 V	Molded Mica	.25
C-69	RCM20A221K	220 mmf	500 V	Molded Mica	.52
C-70, C-80	45X393	30 mf	400 V	Dry Electrolytic	1.75
C-75	47X598	56 mmf	1500 V	Ceramic	.35
C-76	RCP10M4154M	.15 mf	400 V	Tubular	.40
C-78	47X560	500 mmf	20KV	Ceramic	2.00
C-79A, C-79B	45X390	60 mf / 80 mf	400 V / 400 V	Dry Electrolytic	4.45
C-81, C-82	47X615	.01 mf		Ceramic	.45

RESISTORS

		Ohms	Watts		
R-1	883822	8.2 K	0.5	Carbon	.20
R-2, R-5	B83470	47	0.5	Carbon	.20
R-3, R-6, R-27, R-61, R-65	B85102	1 K	0.5	Carbon	.10
R-4, R-7	B83223	22 K	0.5	Carbon	.20
R-8	B84181	180	0.5	Carbon	.15
R-9, R-12	B84152	1.5 K	0.5	Carbon	.15
R-10	Part of L-5				
R-11	C84562	5.6 K	1.0	Carbon	.20
R-13, R-19	B84105	1.0 Meg.	0.5	Carbon	.15
R-14, R-60	B84101	100	0.5	Carbon	.15
R-15	Part of L-10				
R-16	C83472	4.7 K	1.0	Carbon	.25
R-18, R-24	B85104	100 K	0.5	Carbon	.10
R-20, R-63, R-85	B84333	33 K	0.5	Carbon	.15
R-21	B84222	2.2 K	0.5	Carbon	.15
R-22, R-71	78X12	1.5 K / 1.0 meg.		Contrast and Volume Control	2.70
R-23, R-67, R-68	B84223	22 K	0.5	Carbon	.15
R-25	40X333	500 K		Brightness Control	.70
R-26, R-74	B85473	47 K	0.5	Carbon	.10

RESISTORS—Continued

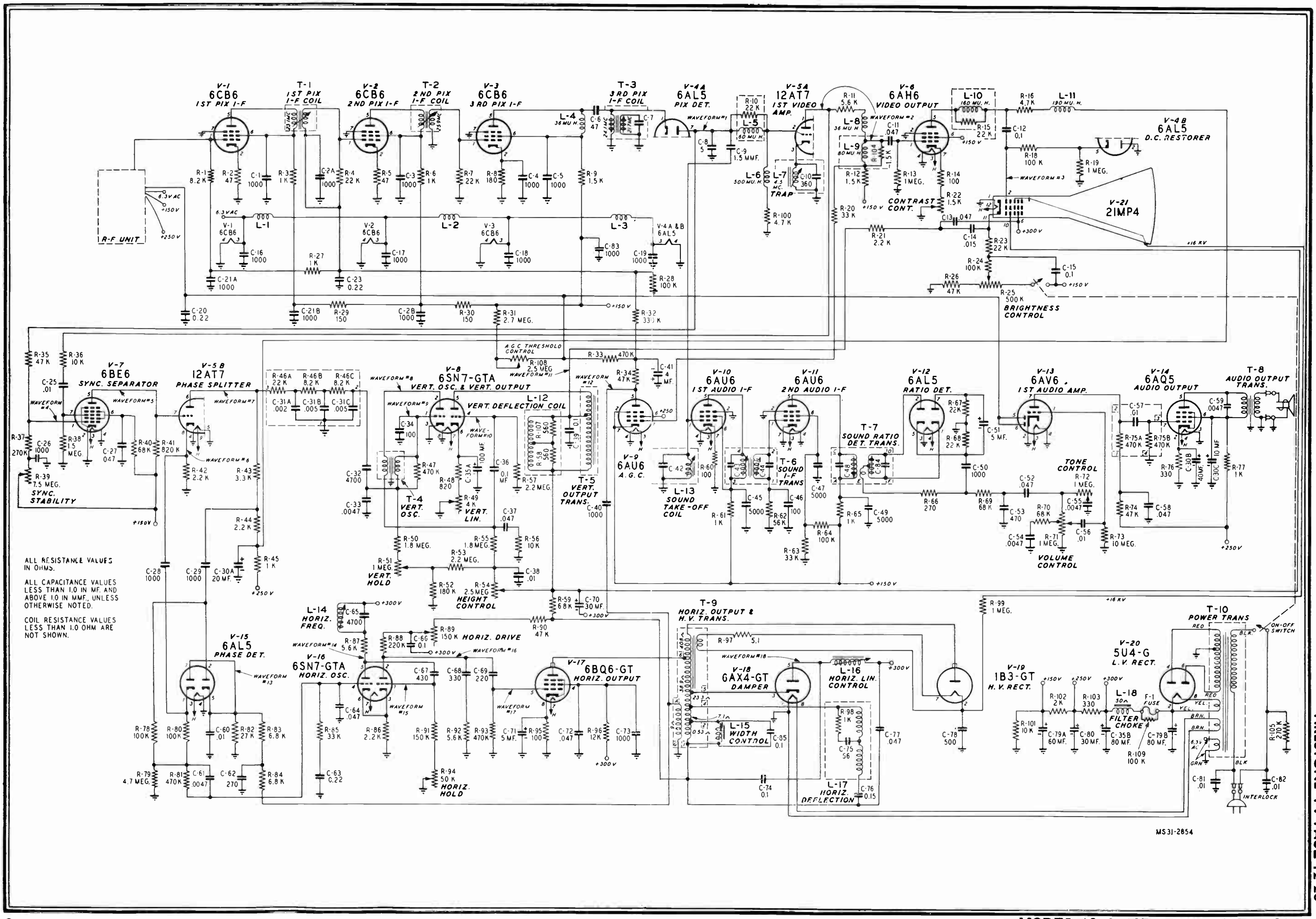
		Ohms	Watts		List Price
R-28, R-64, R-78, R-80	B84104	100 K	.05	Carbon	.15
R-29, R-30	B85151	150	0.5	Carbon	.10
R-31	B84275	2.7 meg.	0.5	Carbon	.15
R-32	B83334	330 K	0.5	Carbon	.20
R-33, R-93	B84474	470 K	0.5	Carbon	.15
R-34, R-35, R-90	B84473	47 K	0.5	Carbon	.15
R-36, R-56	B84103	10 K	0.5	Carbon	.15
R-37	B84274	270 K	0.5	Carbon	.15
R-38	B84155	1.5 meg.	0.5	Carbon	.15
R-39	40X363	7.5 meg.		Syn Stability Control	.80
R-40, R-69, R-70	B84683	68 K	0.5	Carbon	.15
R-41	B84824	820 K	0.5	Carbon	.15
R-42, R-44, R-86	B83222	2.2 K	0.5	Carbon	.20
R-43	B84332	3.3 K	0.5	Carbon	.15
R-45	C84102	1 K	1.0	Carbon	.20
R-46A, R-46B, R-46C	Part of 76X7 (See Miscellaneous)				
R-47, R-81	B85474	470 K	0.5	Carbon	.10
R-48	B84821	820	0.5	Carbon	.15
R-49	40X368	4 K		Vertical Lin. Control	.70
R-50, R-55	B84185	1.8 meg.	0.5	Carbon	.15
R-51	40X334	1.0 meg.		Vertical Hold Control	.90
R-52	B84184	180 K	0.5	Carbon	.15
R-53, R-57	B84225	2.2 meg.	0.5	Carbon	.15
R-54	40X364	2.5 meg.		Height Control	.70
R-58, R-107	B84561	560	0.5	Carbon	.15
R-59	D84682	6.8 K	2.0	Carbon	.30
R-62	B84563	56 K	0.5	Carbon	.15
R-66	B84271	270	0.5	Carbon	.15
R-72	40X334	1.0 meg.		Tone Control	.90
R-73	B85106	10.0 meg.	0.5	Carbon	.10
R-75A, R-75B	Part of 76X5 (See Miscellaneous)				
R-76	C84331	330	1.0	Carbon	.20
R-77	D84102	1 K	2.0	Carbon	.30
R-79	B85475	4.7 meg.	0.5	Carbon	.10
R-82	B84273	27 K	0.5	Carbon	.15
R-83, R-84	C84682	6.8 K	1.0	Carbon	.20
R-87	B84562	5.6 K	0.5	Carbon	.15
R-88	B83224	220 K	0.5	Carbon	.20
R-89	40X331	150 K		Horizontal Drive Control	.75
R-91	B83154	150 K	0.5	Carbon	.20
R-92	C83562	5.6 K	1.0	Carbon	.25
R-94	40X361	50 K		Horizontal Hold Control	.85
R-95	D84101	100	2.0	Carbon	.30
R-96	43X276	12 K	5.0	Wirewound	1.05
R-97	43X239	5.1	0.5	Wirewound	.40
R-98	B85102	1 K	0.5	Carbon	.10
R-99	C85105	1.0 meg.	1.0	Carbon	.10
R-100	B83472	4.7 K	0.5	Carbon	.20
R-101	43X272	10 K	5.0	Wirewound	.80
R-102	43X277	2 K	15.0	Wirewound	1.00
R-103	43X273	330	10.0	Wirewound	.80
R-104	Part of L-9				
R-105	B85274	270 K	0.5	Carbon	.10
R-108	40X364	2.5 meg.		AGC	.70
R-109	D85104	100 K	2.0	Carbon	.25

TRANSFORMERS AND COILS

			List Price
L-1, L-2, L-3	9A2033	R-F Heater Choke	.20
L-4, L-8	9A1979	Peaking Coil 36 mh	.50
L-5	36A10	Peaking Coil 60 mh	.40
L-6	36A11	Peaking Coil 500 mh	.45
L-7	9A2074	4.5 MC Trap	.60
L-9	36A16	Peaking Coil 80 mh	.45
L-10	36A12	Peaking Coil 160 mh	.40
L-11	36A2	Peaking Coil 190 mh	.50
L-12, L-17	Part of Deflection Yoke Assembly		
L-13	9A2168	Sound Take-Off Coil	1.10
L-14	9A2096	Horizontal Frequency Coil	1.10
L-15	9A2183	Width Control	1.60
L-16	9A2262	Horizontal Linearity Control	.75
L-18	52X91	Filter Choke	3.70
T-1, T-2	9A2230	1st and 2nd Pix I-F Coils	.75
T-3	9A2226	3rd Pix I-F Coil	1.80
T-4	54X8	Vertical Osc. Transformer	2.35
T-5	51X156	Vertical Output Transformer	4.05
T-6	9A2170	Sound I-F Transformer	1.60
T-7	9A2269	Sound Ratio Det. Transformer	2.75
T-8	51X150	Audio Output Transformer	2.70
T-9	53X330	Horizontal Output Transformer	9.60
T-10	53X331	Power Transformer	20.60

MISCELLANEOUS

25A1095	R-F Tuner Assembly		
2A426	Centering Device		1.15
76X5	Multiple Resistar Capacitor Assembly		.65
76X7	Multiple Resistar Capacitor Assembly		.90
9A2274	Deflection Yoke Assembly		9.50
2A407	Ion Trap Magnet		.80
4A408	Antenna Terminal Strip		.40
3A427	Tube Socket (6AQ5)		.25
3A458	Tube Socket (6CB6) (6AU6) (6AL5)		.20
3A463	Tube Socket (12AT7)		.40
3A464	Tube Socket (6BQ6) (6SN7)		.15
3A466	Tube Socket (1B3)		.60
3A470	Tube Socket (Octal)		.15
3A445	Tube Socket (6AX4)		.25
13X817	Pix Tube Socket		.95
32X403	Tube Shield (3A458 Socket)		.10
32X405	Tube Shield (3A463 Socket)		.20
S-6A1	Anode Connector & Lead Assembly		.50
8X227	Collar, Pix Tube Rear Mtg.		.55
S-25X85	Tube Mtg. Strap Assembly		1.00
20X1652	Wing Screw (Deflection Yoke)		.05
6X67	Rubber Grammet		.03
25X1815	Bracket, Tube Front Support (R.H.)		1.10
25X1816	Bracket, Tube Front Support, (L.H.)		1.10
16X146	Fuse Holder		.25
16X147-3	Fuse 4/10 Amp. 125-250 V.		.40
4X1157	Pix Tube Mtg. Ring		4.75
	No. 6-32 Wing Nut		.05
S-34X19	Tube Cover & Power Cord Assembly		2.25
7A240	Pilot Light Socket Assembly (Channel Selector)		.20
7A32	No. 51 Pilot Bulb		.15
25X1828	Bracket Pix Tube Rear Mtg.		1.90
10A820-1	Knob, Fine Tuning	Maroon	1.50
10A821-1	Knob, Contrast	Maroon	1.15
10A812	Knob, Channel Selector	Maroon	1.45
10A779	Knob, Volume	Maroon	1.20
12A502	Speaker, 12" PM Dynamic		12.30
2110-15	Casters, Rubber Wheel (Console Cabinet)		
S-4X21-1	Escutcheon Assembly (Control Panel)		3.30
S-14X66	Cabinet Back Assembly		2.90
4X1212-1	Pix Mask		4.30
17X175	Pix Crystal		8.20


V-1 6CB6 1ST PIX I-F
T-1 1ST PIX I-F COIL
V-2 6CB6 2ND PIX I-F
T-2 2ND PIX I-F COIL
V-3 6CB6 3RD PIX I-F
T-3 3RD PIX I-F COIL
V-4A 6AL5 PIX DET.
V-5A 12AT7 1ST VIDEO AMP.
V-6 6AH6 VIDEO OUTPUT
V-4B 6AL5 D.C. RESTORER
V-21 21MP4
R-F UNIT
CONTRAST CONT.
BRIGHTNESS CONTROL
A.G.C. THRESHOLD CONTROL
V-7 6BE6 SYNC. SEPARATOR
V-5B 12AT7 PHASE SPLITTER
SYNC. STABILITY
V-8 6SN7-GTA VERT. OSC. & VERT. OUTPUT
L-12 VERT. DEFLECTION COIL
T-4 VERT. OSC.
VERT. LIN.
VERT. HOLD
HEIGHT CONTROL
T-5 VERT. OUTPUT TRANS.
V-9 6AU6 A.G.C.
V-10 6AU6 1ST AUDIO I-F
L-13 SOUND TAKE-OFF COIL
V-11 6AU6 2ND AUDIO I-F
T-6 SOUND I-F TRANS
T-7 SOUND RATIO DET. TRANS.
V-12 6AL5 RATIO DET.
V-13 6AV6 1ST AUDIO AMP.
TONE CONTROL
VOLUME CONTROL
V-14 6AQ5 AUDIO OUTPUT
T-8 AUDIO OUTPUT TRANS.
ALL RESISTANCE VALUES IN OHMS.
ALL CAPACITANCE VALUES LESS THAN 1.0 IN MF. AND ABOVE 1.0 IN MMF., UNLESS OTHERWISE NOTED.
COIL RESISTANCE VALUES LESS THAN 1.0 OHM ARE NOT SHOWN.
L-14 HORIZ. FREQ.
V-15 6AL5 PHASE DET.
V-16 6SN7-GTA HORIZ. OSC.
HORIZ. DRIVE
HORIZ. HOLD
V-17 6BQ6-GT HORIZ. OUTPUT
T-9 HORIZ. OUTPUT & H.V. TRANS.
V-18 6AX4-GT DAMPER
L-15 WIDTH CONTROL
L-16 HORIZ. LIN. CONTROL
L-17 HORIZ. DEFLECTION
V-19 1B3-GT H.V. RECT.
V-20 5U4-G L.V. RECT.
L-18 FILTER CHOKE
F-1 FUSE
T-10 POWER TRANS
ON-OFF SWITCH
INTERLOCK
MS31-2854

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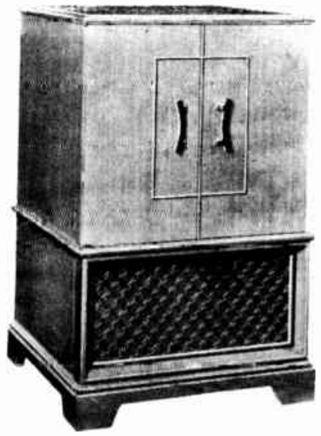
MODEL 13-G-128 (MAH.)
MODEL 13-G-129 (OAK)

MODEL 13-G-130



MODEL 13-G-132

MODEL 13-G-145 (MAH.)
MODEL 13-G-146 (OAK)

ELECTRICAL SPECIFICATIONS

Power Supply . . . . 105-125 Volts AC
60 Cycles Only
Power Consumption . . . . 210 Watts
Power Output . . . . 2.4 Watts (Max.)
1.8 Watts (10% Distortion)
Tuning Ranges . . . . VHF — Channels 2 thru 13
UHF — Channels 14 thru 83
Antenna Input Imp. . . . . 300 Ohms Balanced
Intermediate Frequencies . . . . Picture 26.20 MC
Sound 21.70 MC
I-F (UHF Position Only) . . . . . . Picture 121.75
Sound 126.25
Intercarrier Sound System . . . 4.5 MC
Loud Speaker . . . . See Parts List
Voice Coil Imp. . . . . 3.2 Ohms 400 Cycles

TUBE COMPLEMENT

Symbol	Type	Function
VHF Tuner	6J6	R-F Osc. and Mixer
*VHF Tuner	6BQ7	R-F Amplifier
UHF Tuner	6AF4	R-F Osc.
UHF Tuner	1N72 or 1N82	Crystal Mixer

TUBE COMPLEMENT—Continued

Symbol	Type	Function
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V-5 A & B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20 & V-22	5U4-G	Low Voltage Rectifier
V-21	21MP4	Picture Tube 21" Metal Rectangular (Electrostatic)

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

RADIO FREQUENCY RANGES

Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc	Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc
2	54-60	55.25	59.75	43	644-650	645.25	649.75
3	60-66	61.25	65.75	44	650-656	651.25	655.75
4	66-72	67.25	71.75	45	656-662	657.25	661.75
5	76-82	77.25	81.75	46	662-668	663.25	667.75
6	82-88	83.25	87.75	47	668-674	669.25	673.75
7	174-180	175.25	179.75	48	674-680	675.25	679.75
8	180-186	181.25	185.75	49	680-686	681.25	685.75
9	186-192	187.25	191.75	50	686-692	687.25	691.75
10	192-198	193.25	197.75	51	692-698	693.25	697.75
11	198-204	199.25	203.75	52	698-704	699.25	703.75
12	204-210	205.25	209.75	53	704-710	705.25	709.75
13	210-216	211.25	215.75	54	710-716	711.25	715.75
14	470-476	471.25	475.75	55	716-722	717.25	721.75
15	476-482	477.25	481.75	56	722-728	723.25	727.75
16	482-488	483.25	487.75	57	728-734	729.25	733.75
17	488-494	489.25	493.75	58	734-740	735.25	739.75
18	494-500	495.25	499.75	59	740-746	741.25	745.75
19	500-506	501.25	505.75	60	746-752	747.25	751.75
20	506-512	507.25	511.75	61	752-758	753.25	757.75
21	512-518	513.25	517.75	62	758-764	759.25	763.75
22	518-524	519.25	523.75	63	764-770	765.25	769.75
23	524-530	525.25	529.75	64	770-776	771.25	775.75
24	530-536	531.25	535.75	65	776-782	777.25	781.75
25	536-542	537.25	541.75	66	782-788	783.25	787.75
26	542-548	543.25	547.75	67	788-794	789.25	793.75
27	548-554	549.25	553.75	68	794-800	795.25	799.75
28	554-560	555.25	559.75	69	800-806	801.25	805.75
29	560-566	561.25	565.75	70	806-812	807.25	811.75
30	566-572	567.25	571.75	71	812-818	813.25	817.75
31	572-578	573.25	577.75	72	818-824	819.25	823.75
32	578-534	579.25	533.75	73	824-830	825.25	829.75
33	534-590	585.25	539.75	74	830-836	831.25	835.75
34	590-596	591.25	595.75	75	836-842	837.25	841.75
35	596-602	597.25	601.75	76	842-848	843.25	847.75
36	602-608	603.25	607.75	77	848-854	849.25	853.75
37	608-614	609.25	613.75	78	854-860	855.25	859.75
38	614-620	615.25	619.75	79	860-866	861.25	865.75
39	620-626	621.25	625.75	80	866-872	867.25	871.75
40	626-632	627.25	631.75	81	872-878	873.25	877.75
41	632-638	633.25	637.75	82	878-884	879.25	883.75
42	638-644	639.25	643.75	83	884-890	885.25	889.75

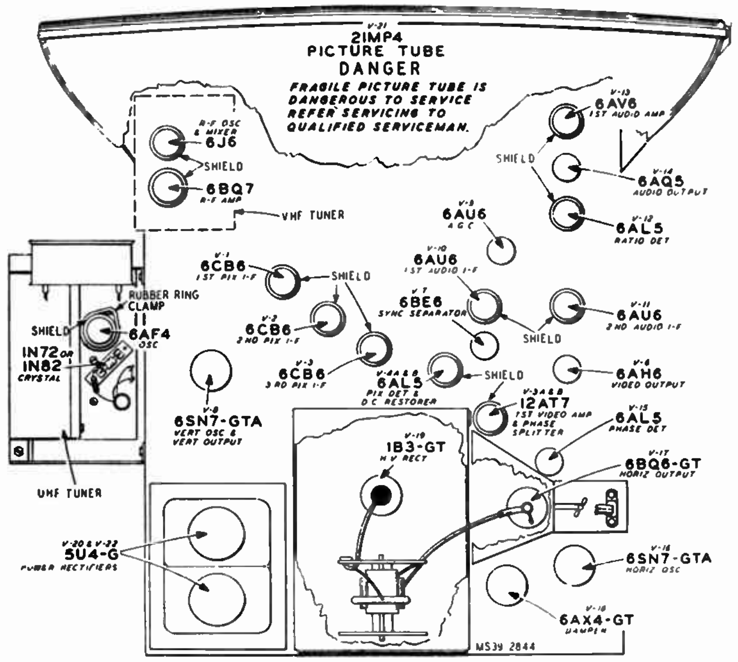


Fig. 1—Tube Layout.

RECEIVER LOCATION — Advise the owner as to the proper location for the television receiver. The following may be used as a guide:

1. Choose an area in the home where sunlight or light from lamps does not strike the face of the picture tube and cause glare.
2. Remember the necessity of an electrical outlet and the location of the point at which the antenna leads enter the room.
3. The receiver should be placed a short distance from the wall to allow adequate ventilation.
4. The receiver should be placed to permit easy access for operation and comfortable viewing from all angles.

ANTENNA — This receiver has been designed to use an antenna with a 300 ohm balanced transmission line. This line must be as short as possible because the longer the line the greater the chances are for picking up electrical disturbances. Stand-off insulation should be used to keep the line away from the mast, metal or walls. Twist this line about one turn per foot throughout the line to cancel out direct signal and/or noise pickup by the transmission line. It should also be securely anchored in place so that a change in weather will not affect its position.

HIGH VOLTAGE WARNING

This television receiver contains high voltages which are dangerous to life. Never operate or service **the receiver outside of the cabinet or with the covers removed until all the safety precautions necessary for working with high voltage equipment have been observed.**

PICTURE TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves must be worn by individuals while handling the picture tube or installing the picture tube into the receiver.

The picture tube encloses a high vacuum and due to the large surface area, is subjected to very high air pressure. Therefore, care should be taken not to bump or scratch the picture tube accidentally as it may cause the tube to implode resulting in damage to property or injury to an individual.

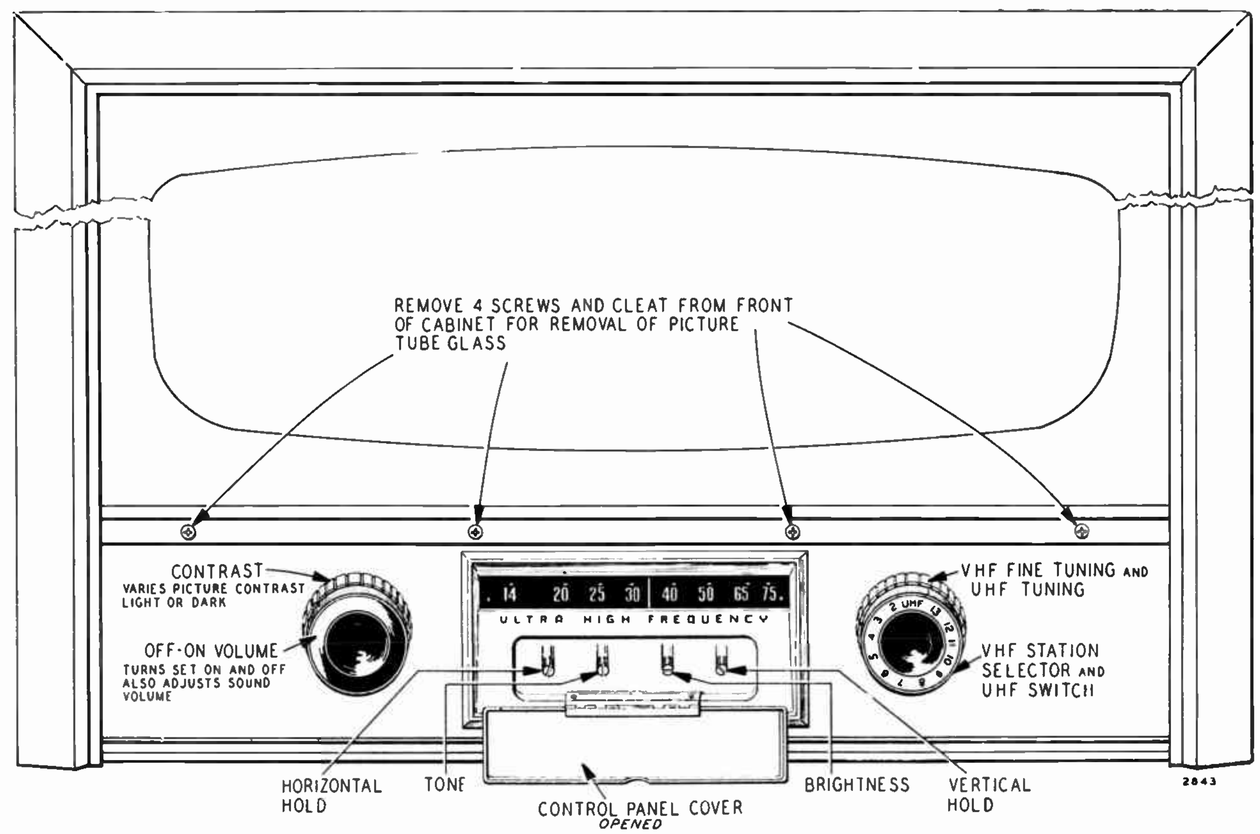


Fig. 2—Front Panel Controls

TUNING PROCEDURE

1. To turn the television receiver on, turn the OFF-ON VOLUME control clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.
2. Turn the STATION SELECTOR control to the desired channel. This control may be turned in either direction.
3. Turn the CONTRAST control clockwise until activity or definite form is noted on the screen.
4. Adjust the FINE TUNING control for clearest picture and the VOLUME control for desired volume.
5. To turn off the receiver, turn only the OFF-ON VOLUME control counterclockwise until a click is heard.
6. TONE CONTROL — When this Control is turned clockwise, the high notes will predominate and when turned counterclockwise, a deep bass effect will result.
7. In localities where UHF programs are available, turn the STATION SELECTOR control to the UHF position and tune in the desired station with the UHF Tuning Control. The dial scale is calibrated in channel numbers and covers the entire UHF range of channels 14 through 83.

OCCASIONAL ADJUSTMENTS TO IMPROVE PICTURE RECEPTION

There are four controls at the front of the chassis which are accessible when the hinged control panel is pulled downward. See illustration Figure 2. These controls are pre-set at the factory and may occasionally need adjustment due to aging of the components in the receiver and the fluctuating line voltages in different areas. If any adjustments are necessary follow the instructions under "Controls and Functions."

IMPORTANT — Be sure that the FINE TUNING control has been set for the clearest picture before adjusting any controls.

CONTROLS AND FUNCTIONS

HORIZONTAL HOLD—Stops horizontal movement (diagonal bars.)

TONE—Adjusts for tonal quality bass or treble.

BRIGHTNESS—Adjusts for desired picture brilliance.

VERTICAL HOLD—Stops upward or downward picture movement.

PICTURE TUBE SAFETY GLASS

PICTURE TUBE SAFETY GLASS — It will be necessary to clean the picture tube safety glass and the face of the picture tube occasionally. Remove the screws and cleat as outlined in the illustration. Insert your fingers into the opening at the center of the frame and carefully lift up and pull out the safety glass. Clean the safety glass and the face of the picture tube with a soft lint-free cloth dampened with water or mild soapsuds.

For models that have the cleat and screws at the top of the cabinet the following caution must be observed.

CAUTION — UPON REMOVAL OF THE LAST SCREW AND THE CLEAT THE GLASS MAY FALL FORWARD. SUPPORT THE GLASS WITH ONE HAND AS YOU LIFT IT GENTLY FROM THE CABINET.

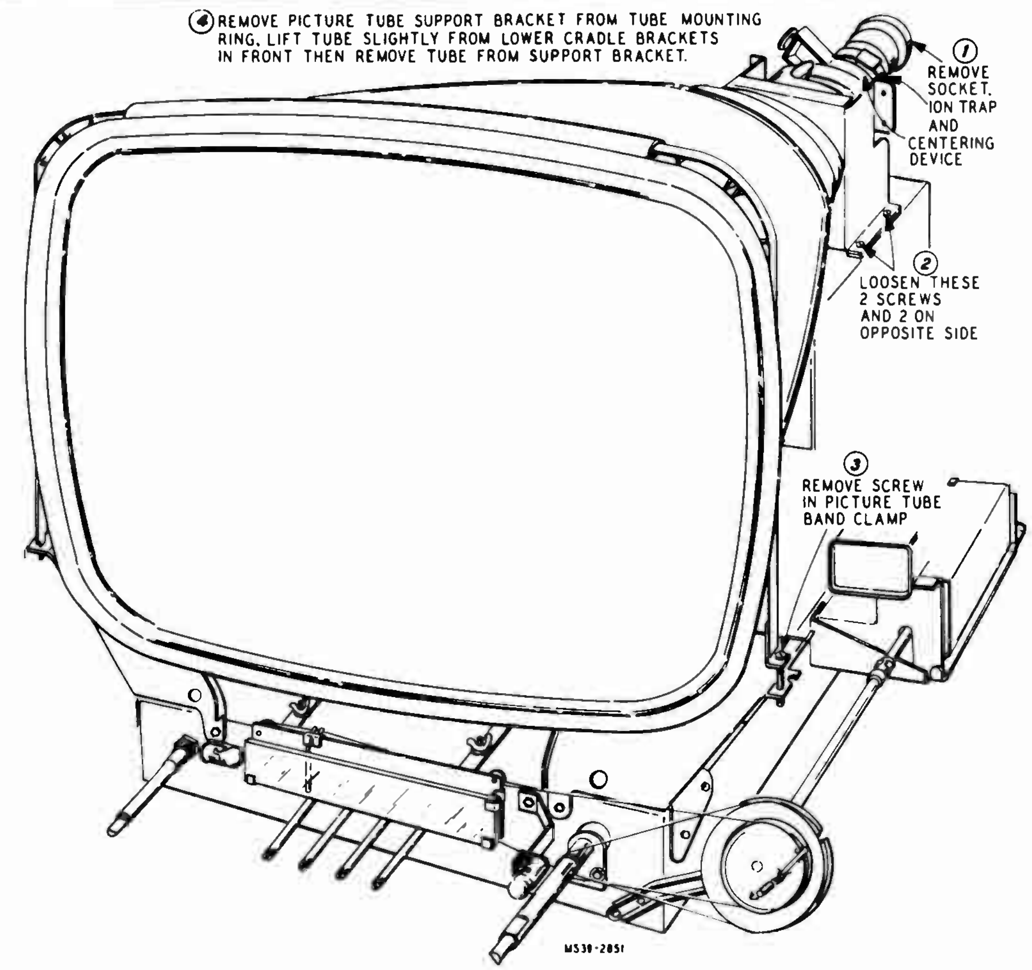


Fig. 3—Removal of Picture Tube

WARNING — Before handling the picture tube, it will be necessary to remove the static charge. In receivers with glass picture tubes, ground the anode lead to chassis, and insert an insulated wire from the well in the tube to chassis. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

PICTURE TUBE REPLACEMENT — To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove the cabinet back.
3. Disconnect the leads from the speaker, remove the antenna terminal board at the rear of the cabinet and then the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

FRONT OF CHASSIS

(Accessible After Opening Front Panel Control Cover)

Horizontal Hold	R-94
Brightness	R-25
Vertical Hold	R-51
Tone	R-72

NON-OPERATING CONTROLS REAR OF CHASSIS

Horizontal Centering	Centering Device
Vertical Centering	Centering Device
Ion Trap Magnet	See paragraph,
Deflection Yoke	Wing Screw
Width	L-15
Horizontal Linearity	L-16
Horizontal Drive	R-89
Horizontal Frequency	L-14
Vertical Linearity	R-49
Height	R-54
Sync Stability	R-39
AGC Threshold Control	R-108

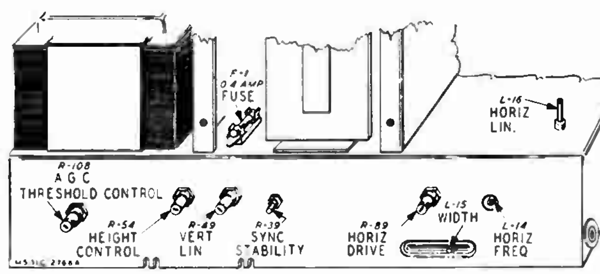


Fig. 4—Adjustments Rear of Chassis

ION TRAP MAGNET ADJUSTMENT—The ion trap magnet should be positioned close to the base of the tube with the magnet of the ion trap on the side where the electron gun is nearest the glass neck of the picture tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to make sure that the ion trap magnet is correctly adjusted.

DEFLECTION YOKE ADJUSTMENT — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

CENTERING ADJUSTMENT — If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained. If a clamp type centering device is used, rotate the device to the left or right and turn the knob located at the top of the device until the picture is centered correctly.

PICTURE ADJUSTMENT — For further adjustments, obtain a test pattern on the receiver. Turn on receiver and follow tuning procedure . When a test pattern is obtained it may be necessary to slightly re-adjust the fine tuning control for clearest picture.

ADJUSTMENT OF AGC THRESHOLD CONTROL — Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL — When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control slowly clockwise until bending occurs at top of picture. Then turn the control a few degrees counter-clockwise until bending disappears. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.

When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT — With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT — Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS— While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (R-89) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (R-89) will be necessary. Adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

Caution — These adjustments are intended only for VHF Channels. For information regarding UHF alignment, see paragraph "Tuner Alignment",

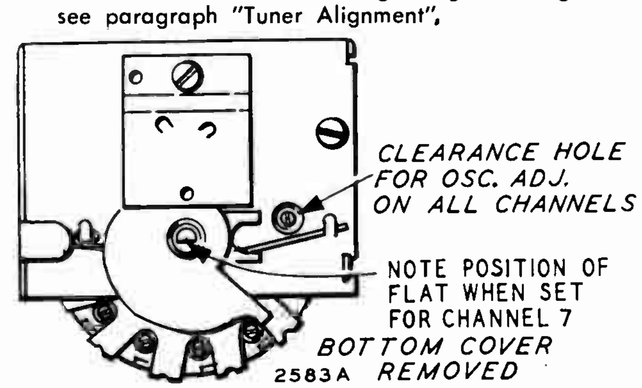


Fig. 5—Tuner Oscillator Adjustments

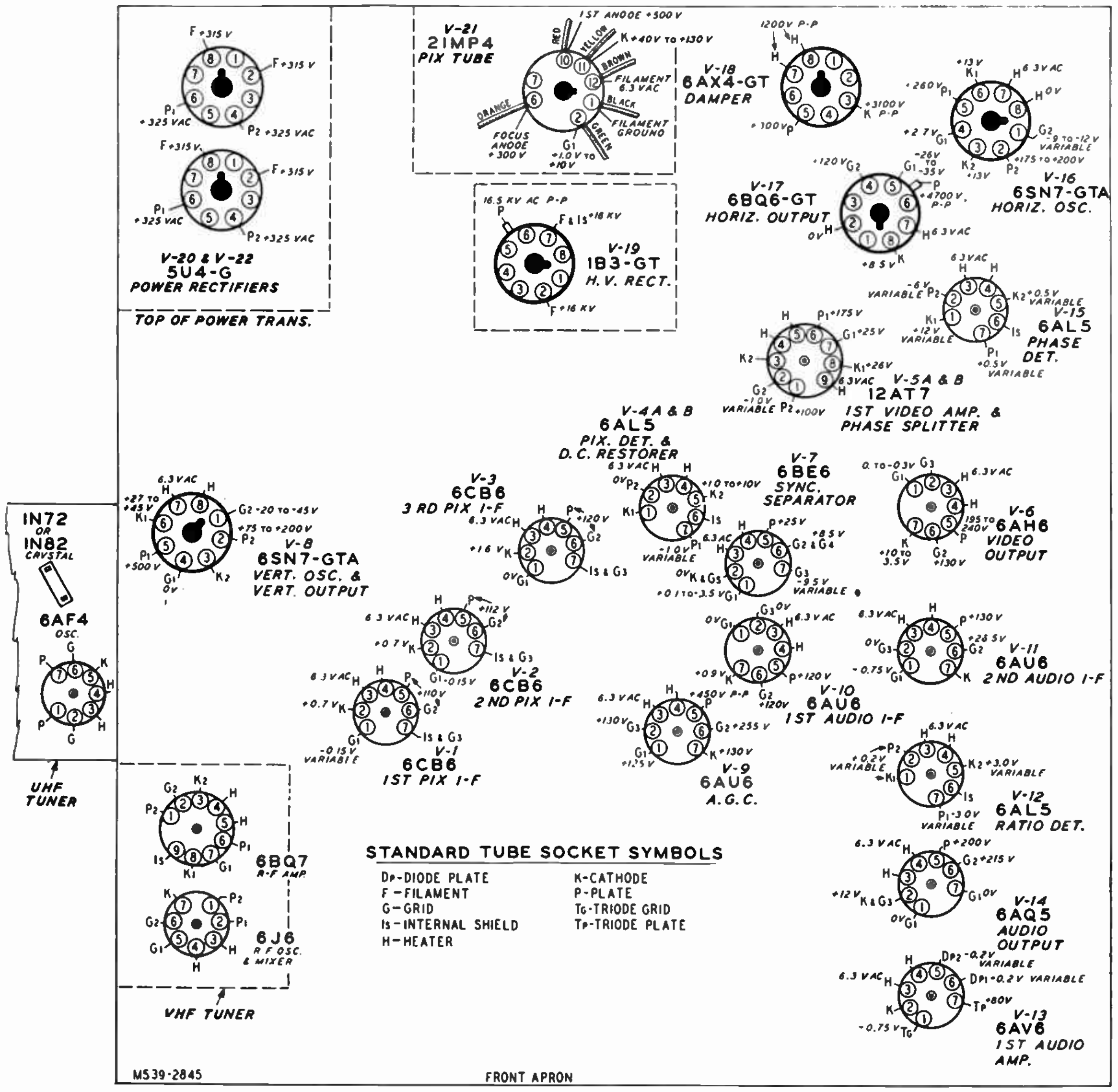


Fig. 6—Bottom Socket Voltages

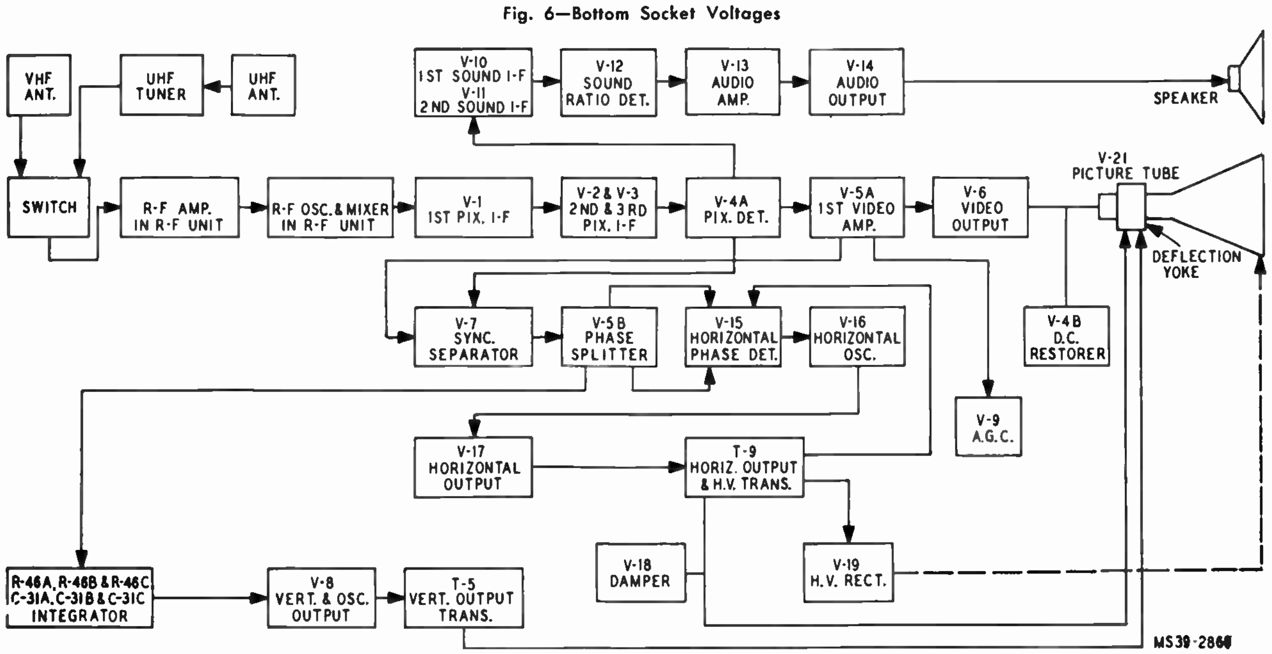


Fig. 7—Block Diagram

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.
1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
(A) Horizontal output tube V-17 (6BQ6-GT)
(B) Check damper tube V-18 (6AX4-GT).
(C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
(D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
(E) Check DC resistance of T-9.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-99 and C-78 defective or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:
1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.
1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-35A, C-39 or C-70 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitor C-37, or open or incorrect value of resistors R-55 & R-56.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-36 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:
1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6AX4-GT).
3: Check capacitors C-74, C-76, C-77 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER
1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:
1: Defective yoke due to C-75 or R-98 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2: V-18 (6AX4-GT) defective.

SMALL RASTER — This condition can be caused by:
1: Low +B or line voltage. Check V-20 & V-22 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control R-89.
5: V-18 (6AX4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND — This condition can be caused by:
1: No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY — A condition of this nature can be caused by:
1: Defective sync separator V-7 or phase splitter V-5B.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY — If this condition is encountered, check:
1: Vertical integrating network capacitors C-31A, B & C, and resistors R-46 A, B & C.
2: Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY
1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:
1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (6AH6).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5: Leakage in V-6 (6AH6) grid capacitor C-11. If the capacitor is not found to be defective, check the following:
1: Check all potentials in video circuits.
2: Check picture tube grid circuit for poor or dirty contact.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:

1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).

2: This trouble can also originate at the transmitter. Check reception from another station.

3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc)

1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.

2: Check sound I-F alignment.

BENDING OR S-ING

1: Check sync stability control adjustment.

2: Check capacitors C-35B and C-79B.

3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.

4: Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.

5: Check AGC threshold control.

PICTURE NORMAL—NO SOUND OR WEAK OR DISTORTED SOUND

1: Check sound I-F alignment.

2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

RASTER ON TUBE BUT NO PICTURE OR SOUND

This condition can be caused by,

1: Defective pix I-F Amplifier tubes V-1, V-2 or V-3

2: Defective pix detector tube V-4A (6AL5). Check tube and its associated circuit.

3: Defective R-F Amplifier or oscillator mixer tubes in the tuner.

4: UHF-VHF switch defective.

POOR FOCUS

1: Improper setting of Ion Trap magnet.

2: Defective picture tube or picture tube socket.

PICTURE JITTER:

1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.

2: Vertical instability may be due to loose connections or noise received with the signal.

3: Horizontal instability may be due to unstable transmitted sync.

4: Check receiver AGC system for proper operation.

5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).

6: Check for improper setting of sync stability control.

7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.

8: Check AGC threshold control.

NO PICTURE OR SOUND OR WEAK PICTURE OR SOUND IN UHF POSITION

If this condition is encountered

1: Check to see whether or not a UHF station is operating in the vicinity.

2: The 6AF4 oscillator tube or the IN72 (or IN82) crystal may be defective.

3: Pre-selector in UHF tuner defective.

4: Low pass filter defective.

5: The UHF antenna and oscillator strips in the VHF tuner defective.

6: Defective switch on UHF tuner.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:

(a) Frequency ranges:
- 18 to 30 mc, 10 mc sweep width
- 40 to 90 mc, 10 mc sweep width
- 120 to 130 mc, 10 mc sweep width
- 170 to 225 mc, 10 mc sweep width
- 470 to 890 mc, 10 mc sweep width

(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)

(a) Intermediate alignment frequencies.
- 23.1 mc first picture I-F coil.
- 24.1 mc third picture I-F coil.
- 25.9 mc second picture I-F coil.
- 21.7 mc sound trap.
- 4.5 mc video trap & sound I-F.
- 25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-99.

ALIGNMENT PROCEDURE
PIX I-F

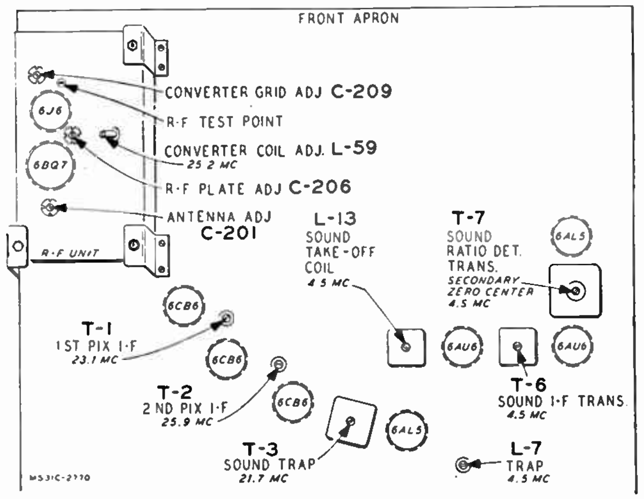


Fig. 8—Top Chassis Video and Audio I-F Adjustments

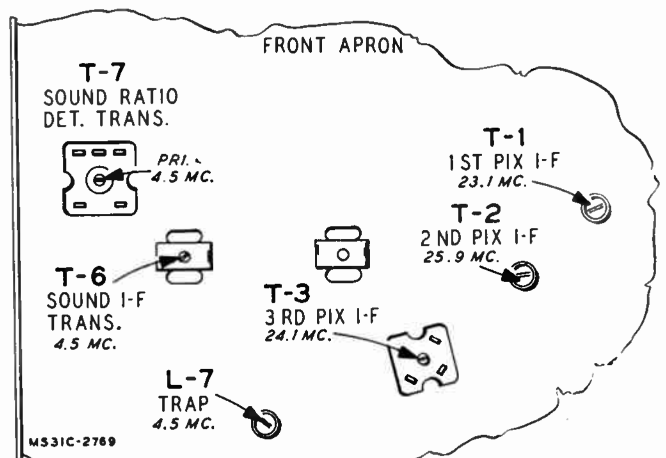


Fig. 9—Bottom Chassis Video and Audio I-F Adjustments.

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-100) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line.

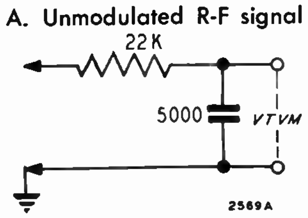


Fig. 10—VTVM Connections

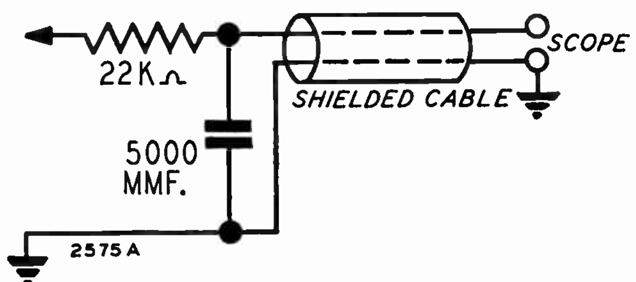


Fig. 11—Oscilloscope Connections

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

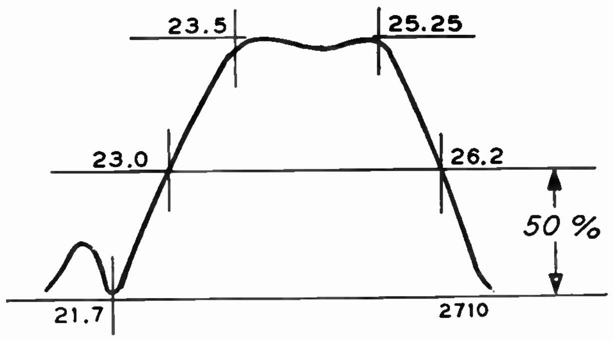


Fig. 12—Overall Response Curve

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-100 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery). Tuner should be switched to dead channel so as not to cause interference.

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-62 and C-46, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-66, R-69 and C-50, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect 1½ V bias to AGC line at junction of R-33 and C-20 on the receiver.

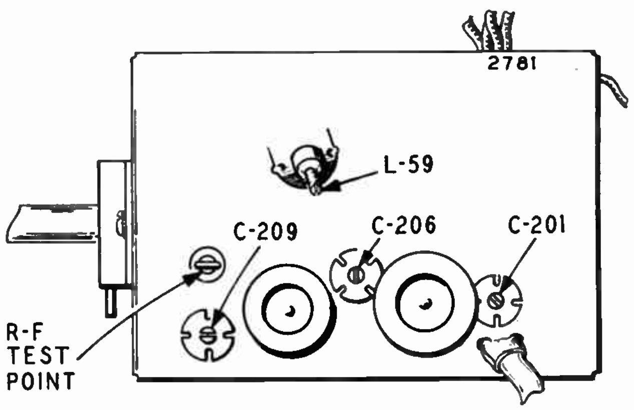


Fig. 13—Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

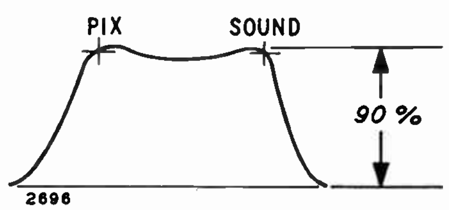


Fig. 14—Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-21.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.
4. To adjust oscillator on UHF position, feed the sweep generator with center frequency of 124 MC and markers at 121.75 and 126.25 into the input of the low pass filter (output of UHF tuner). Adjust oscillator slug in the VHF tuner so that the 121.75 pix carrier marker is at 50% and that 126.25 marker is in the sound notch. If a sweep generator is not available, a single frequency generator set to 126.25 MC and VTVM may be used. Connect VTVM to the pix detector load resistor R-100. Feed generator into the low pass filter. Adjust oscillator slug in the VHF tuner so that the 126.25 marker is in the sound notch of the I-F curve.

If the 6AF4 oscillator tube in the UHF tuner is replaced, it may be necessary to adjust the oscillator trimmer C-309 on the UHF tuner located underneath the chassis. (See Figure 15). Adjust this trimmer until the tuner will cover a range of below 470 MC to above 890 MC.

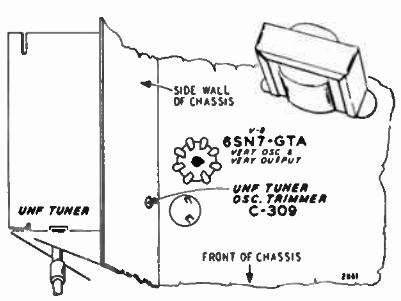


Fig. 15—UHF Tuner Adjustment.

VHF TUNER ASSEMBLY INFORMATION

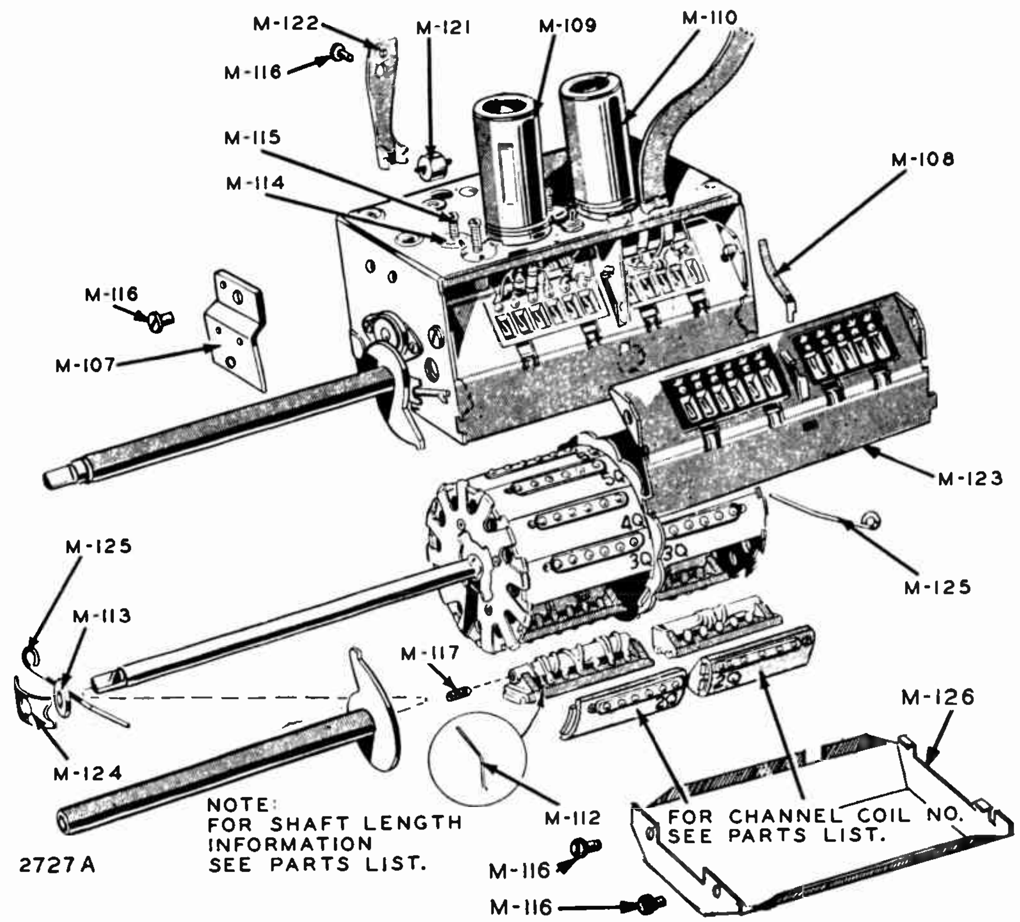


Fig. 16—"Q" Tuner Pictorial.

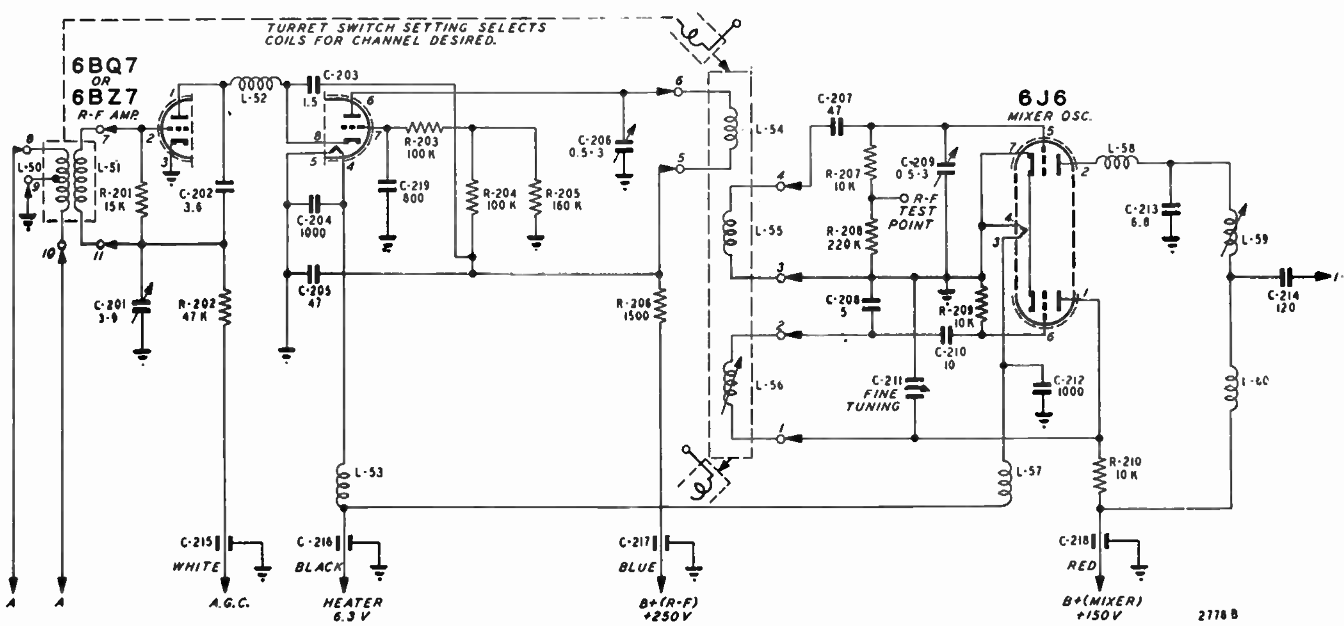


Fig. 17—"Q" Tuner Schematic Diagram.

UHF TUNER INFORMATION

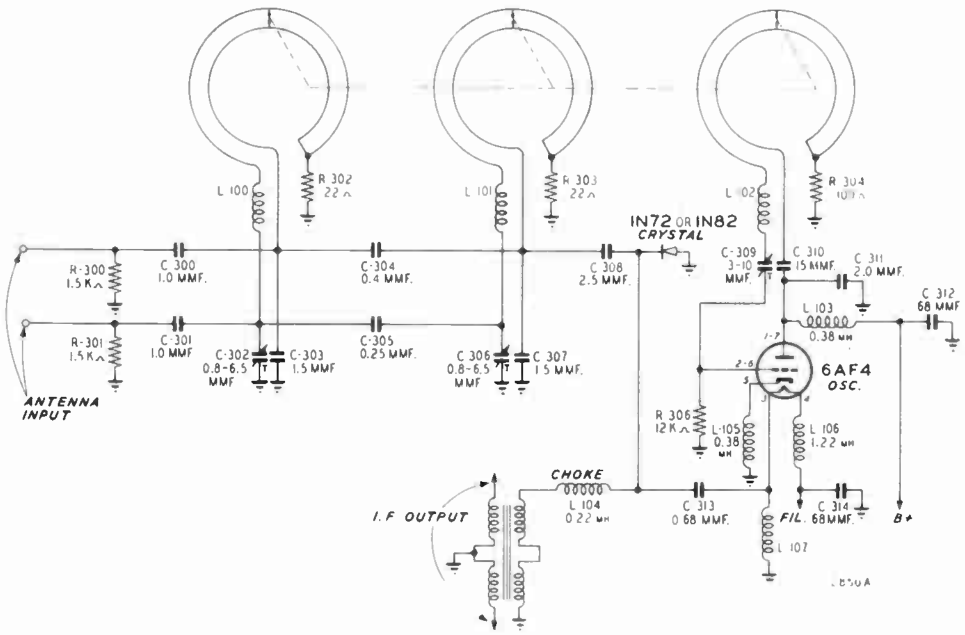


Fig. 18—UHF Tuner Schematic Diagram.

Due to the complexity of the UHF tuner, neither servicing nor aligning is encouraged in the field because replacement of any component within the R-F circuit may disturb the band-pass characteristics of the tuner. However, the 6AF4 tube or the 1N72 (or 1N82) crystal may be replaced in the field if found to be defective. A schematic diagram of this tuner is shown only for the purpose of outlining the circuit used.

If the UHF tuner does not operate satisfactorily after the tube or crystal replacement, disconnect the tuner and return it to the factory for repair.

DRIVE CORD REPLACEMENT

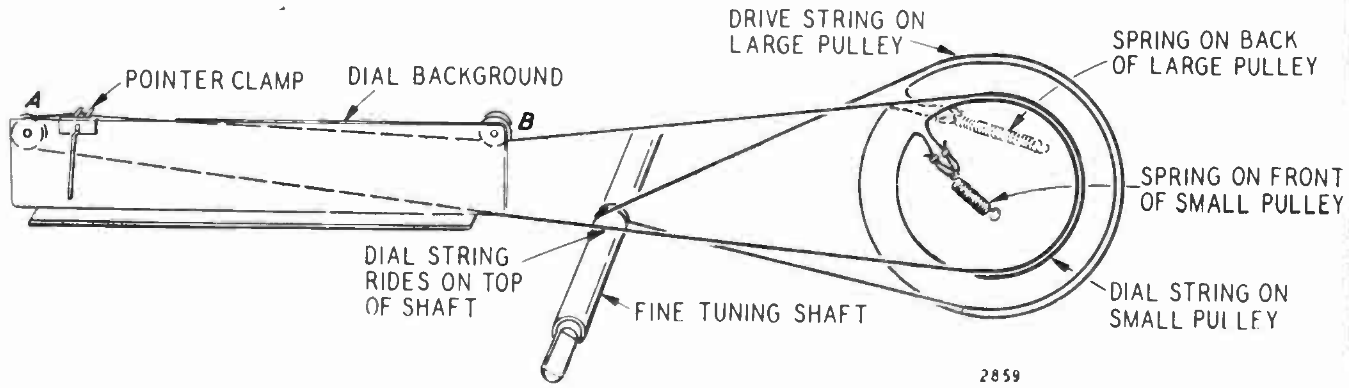


Fig. 19—Drive Cord Stringing.

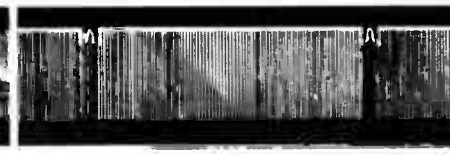
You will note that there are two cords used for the pointer drive system on this receiver. Part number 10X88 Drive Cord assembly and part number 28X603 Spring are used on the tuning shaft and large pulley, while part number 10X89 Drive Cord and a part number 28X603 Spring are used on the small pulley system and the pointer. Install the cords as shown in the illustration. After completing the installation rotate the fine tuning shaft a few turns to take up the slack in the cord.

OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.

The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.

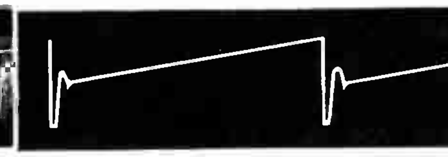
No. 1—6AL5 Pix Det. Plate
3.5V P-P 60 C.P.S.
No. 4—6BE6 Sync Sep.
Grid No. 1 .2V P-P 60 C.P.S.



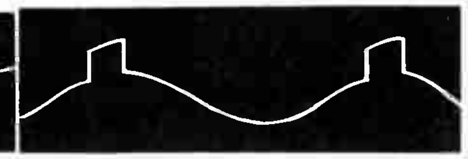
No. 7—12AT7 Phase Splitter Plate
45V P-P 60 C.P.S.

No. 13—6AL5 Phase Det.
18V P-P 15,750 C.P.S.

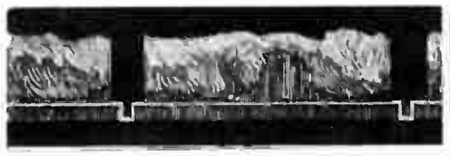
No. 2—12AT7 Plate
35V P-P 60 C.P.S.
No. 2—6AH6 Grid
8V P-P 60 C.P.S.



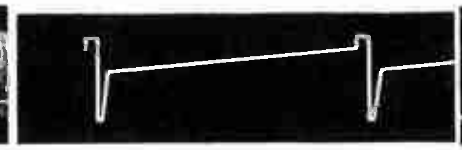
No. 8—6SN7-GTA—Vert. Osc. Plate
125V P-P 60 C.P.S.



No. 14—6SN7—Hor. Osc. Plate
50V P-P 15,750 C.P.S.



No. 3—Pix Tube Grid
20-100V P-P 60 C.P.S.

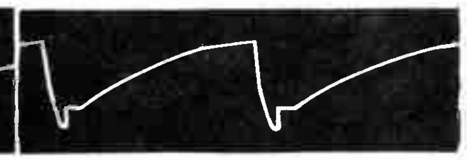


No. 9—6SN7-GTA Vert. Osc. Grid
170V P-P 60 C.P.S.

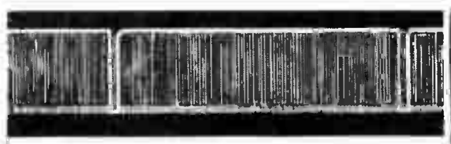
No. 15—6SN7 Hor. Osc. Grid
48V P-P 15,750 C.P.S.

No. 5—6BE6 Sync Sep. Plate
20V P-P 60 C.P.S.

No. 10—6SN7-GTA Vert. Output Grid
150V P-P 60 C.P.S.

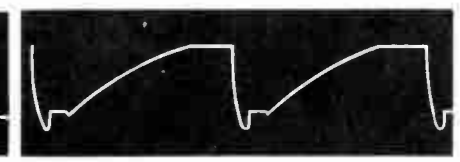


No. 16—6SN7 Hor. Osc. Plate
135V P-P 15,750 C.P.S.



No. 6—12AT7 Phase Splitter Cathode
18V P-P 60 C.P.S.

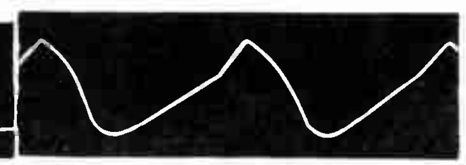
No. 11—Vert. Def. Coil
100V P-P 60 C.P.S.



No. 17—6BQ6 Grid
120V P-P 15,750 C.P.S.

No. 6—12AT7 Phase Splitter Cathode
18V P-P 15,750 C.P.S.

No. 12—6AU6 A.G.C.
450V P-P 15,750 C.P.S.



No. 18—6AX4—GT Damper Plate
120V P-P 15 750 C.P.S.

VHF TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	±10%	0.5
R-202	12A-039	47 K	±20%	0.5
R-203	12A-094	100 K	±10%	0.5
R-204	12A-166	100 K	±5%	0.5
R-205	12A-167	160 K	±5%	0.5
R-206	12A-183	1500	±10%	0.5
R 207, R 209, R 210	12A-040	10 K	±10%	0.5
R 208	12A-041	220 K	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204, C-212	CD8X102Z	1000 mmf	
C-205, C-207	CD8Q470K	47 mmf	±10%
C-206, C-209	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215, C-216, C-217, C-218	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	A9A2297-2	Antenna Coil	2-Q..............
	A9A2297-3	Antenna Coil	3-Q..............
	A9A2297-4	Antenna Coil	4-Q..............
	A9A2297-5	Antenna Coil	5-Q..............
	A9A2297-6	Antenna Coil	6-Q..............
	A9A2297-7	Antenna Coil	7-Q..............
	A9A2297-8	Antenna Coil	8-Q..............
	A9A2297-9	Antenna Coil	9-Q..............
	A9A2297-10	Antenna Coil	10-Q..............
	A9A2297-11	Antenna Coil	11-Q..............
	A9A2297-12	Antenna Coil	12-Q..............
	A9A2297-13	Antenna Coil	13-Q..............

Ref. No.	Part No.	Description	Channel & Code No.
	A9A2297-91	Antenna Coil	UHF Position........
	A9A2298-2	Oscillator Coil	2-Q..............
	A9A2298-3	Oscillator Coil	3-Q..............
	A9A2298-4	Oscillator Coil	4-Q..............
	A9A2298-5	Oscillator Coil	5-Q..............
	A9A2298-6	Oscillator Coil	6-Q..............
	A9A2298-7	Oscillator Coil	7-Q..............
	A9A2298-8	Oscillator Coil	8-Q..............
	A9A2298-9	Oscillator Coil	9-Q..............
	A9A2298-10	Oscillator Coil	10-Q..............
	A9A2298-11	Oscillator Coil	11-Q..............
	A9A2298-12	Oscillator Coil	12-Q..............
	A9A2298-13	Oscillator Coil	13-Q..............
	A9A2298-91	Oscillator Coil	UHF Position........
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A-575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L-59	31A-078	Converter Plate Coil	
L-60	31B230	Choke, Coil	

MISCELLANEOUS MECHANICAL PARTS

Ref. No.	Part No.	Description
M-107	31B-012	Bracket, Sharp Tuning Rotor Retaining
M-108	31B-048	Spring, Detent Plate Grounding....
M-109	16S-006	Shield, Tube (6J6) ....
M-110	16S-004	Shield, Tube (6BQ7) ....
M-112	31A-010	Spring, Slug Retaining (Oscillator Coil) ....
M-113	11D-022	Washer, Fibre Spacer (¼" ID by ½" OD) ....
M-114	10E-401	Nut, Locking Spring (for trimmers)..
M-115	9A-410-7	Screw, Trimmer ....
M-116	9A-629-3	Screw, Bracket Mounting .... (6/32" by ¼") ....
M-117	31B-029	Osc. Slug Trimmer ....
M-121	31B-016	Roller, Detent (⅜" dia., 3/32" dia. bearing) ....
M-122	31B-005	Spring, Detent (2-5/16" long) ......
M-123	31B-278	Contact Plate and Bracket Assembly
M-124	31B-008	Spring, Sharp Tuning Rotor Contact (Flat Bronze 1-7/16" by ½") ......
M-125	31B-030	Spring, Front and Rear Turret Shaft (Wire 2-3/4" long, 3/64" dia.)....
M-126	31B-103	Shield, Bottom Cover ....
	31B-655-3	Fine Tuning Shaft (Sharp Tuning) used with 25A1104 ....

PARTS LIST

Use only GENUINE factory tested parts to insure service jobs you can depend on and to obtain original set performance.

CAPACITORS

C-1, C-3, C-4, C-5, C-16, C-17, C-18, C-19, C-26, C-28, C-29, C-40, C-50, C-73, C-83	80X1	1000 mmf		Ceramic......
C-2A, C-2B, C-21A, C-21B	80X3	1000 mmf		Dual Ceramic..
C-6	47X603	47 mmf	500 V	Ceramic......
C-7	Part of T-3			
C-8	47X562	5 mmf	500 V	Ceramic......
C-9	47X584	1.5 mmf		Composition..
C-10	47X568	360 mmf	500 V	Molded Mica..
C-11, C-27, C-58, C-72, C-77	RCP10M4473M	.047 mf	400 V	Tubular......
C-12, C-66, C-74, C-85	RCP10M4104M	.1 mf	400 V	Tubular......
C-13, C-37	RCP10M6473M	.047 mf	600 V	Tubular......
C-14	RCP10M6153M	.015 mf	600 V	Tubular......
C-15	RCP10M2104M	.1 mf	200 V	Tubular......
C-20, C-23, C-63	RCP10M2224M	.22 mf	200 V	Tubular......
C-25, C-56, C-60	RCP10M4103M	.01 mf	400 V	Tubular......
C-30A, C-30B, C-30C	45X392	20 mf / 40 mf / 10 mf	400 V / 50 V / 400 V	Dry Electrolytic
C-31A, C-31B, C-31C	Part of 76X7 (See Miscellaneous)			
C-32, C-65	47X543	4700 mmf	500 V	Molded Mica..
C-33, C-54, C-55, C-61	RCP10M4472M	.0047 mf	400 V	Tubular......
C-34, C-46	47X604	100 mmf	500 V	Ceramic......
C-35A, C-35B	45X391	100 mf / 80 mf	50 V / 400 V	Dry Electrolytic
C-36, C-39	RCP10M6104M	.1 mf	600 V	Tubular......
C-38	RCP10M6103M	.01 mf	600 V	Tubular......
C-41	45X361	4 mf	100 V	Dry Electrolytic
C-42	Part of L-13			
C-43, C-44	Part of T-6			
C-45, C-47, C-49	47X507	5000 mmf		Ceramic......
C-48, C-84	Part of T-7			
C-51, C-71	45X378	5 mf	25 V	Dry Electrolytic
C-52, C-64	RCP10M2473M	.047 mf	200 V	Tubular......
C-53	47X525	470 mmf	500 V	Molded Mica..
C-57	Part of 76X5 (See Miscellaneous)			
C-59	RCP10M6472M	.0047 mf	600 V	Tubular......
C-62	RCM20A271K	270 mmf	500 V	Molded Mica..

CAPACITORS—Continued

C-67	RCM20B431K	430 mmf	500 V	Molded Mica..
C-68	47X570	330 mmf	500 V	Molded Mica..
C-69	RCM20A201K	200 mmf	500 V	Molded Mica..
C-70, C-80	45X393	30 mf	400 V	Dry Electrolytic
C-75	47X598	56 mmf	1500 V	Ceramic......
C-76	RCP10M4154M	.15 mf	400 V	Tubular......
C-78	47X560	500 mmf	20 KV	Ceramic......
C-79A, C-79B	45X390	60 mf 80 mf	400 V 400 V	Dry Electrolytic
C-81, C-82	47X615	.01 mf		Ceramic......

RESISTORS

		Ohms	Watts	
R-1	B83822	8.2 K	0.5	Carbon......
R-2, R-5	B83470	47	0.5	Carbon......
R-3, R-6, R-27, R-61, R-65	B85102	1 K	0.5	Carbon......
R-4, R-7	B83223	22 K	0.5	Carbon......
R-8	B84181	180	0.5	Carbon......
R-9, R-12	B84152	1.5 K	0.5	Carbon......
R-10	Part of L-5			
R-11	C84562	5.6 K	1.0	Carbon......
R-13, R-19	B84105	1.0 Meg.	0.5	Carbon......
R-14, R-60	B84101	100	0.5	Carbon......
R-15	Part of L-10			
R-16	C83472	4.7 K	1.0	Carbon......
R-18, R-24	B85104	100 K	0.5	Carbon......
R-20, R-63, R-85	B84333	33 K	0.5	Carbon......
R-21	B84222	2.2 K	0.5	Carbon......
R-22, R-71	78X12	1.5 K 1.0 meg.	Contrast and Volume Control ..	
R-23, R-67, R-68	B84223	22 K	0.5	Carbon......
R-25	40X333	500 K	Brightness Control	
R-26, R-74	B85473	47 K	0.5	Carbon......
R-28, R-64, R-78, R-80	B84104	100 K	.05	Carbon......
R-29, R-30	B85151	150	0.5	Carbon......
R-31	B84275	2.7 meg.	0.5	Carbon......
R-32	B83334	330 K	0.5	Carbon......
R-33, R-93	B84474	470 K	0.5	Carbon......
R-34, R-35, R-90	B84473	47 K	0.5	Carbon......
R-36, R-56	B84103	10 K	0.5	Carbon......
R-37	B84274	270 K	0.5	Carbon......
R-38	B84155	1.5 meg.	0.5	Carbon......
R-39	40X363	7.5 meg.	Sync Stability Control..	
R-40, R-69, R-70	B84683	68 K	0.5	Carbon......
R-41	B84824	820 K	0.5	Carbon......
R-42, R-44, R-86	B83222	2.2 K	0.5	Carbon......
R-43	B84332	3.3 K	0.5	Carbon......
R-45	C84102	1 K	1.0	Carbon......

RESISTORS—Continued

		Ohms	Watts	
R-46A, R-46B, R-46C	Part of 76X7 (See Miscellaneous)			
R-47, R-81	B85474	470 K	0.5	Carbon......
R-48	B84821	820	0.5	Carbon......
R-49	40X368	4 K	Vertical Lin. Control	
R-50, R-55	B84185	1.8 meg.	0.5	Carbon......
R-51	40X334	1.0 meg.	Vertical Hold Control	
R-52	B84184	180 K	0.5	Carbon......
R-53, R-57	B84225	2.2 meg.	0.5	Carbon......
R-54	40X364	2.5 meg.	Height Control	
R-58, R-107	B84561	560	0.5	Carbon......
R-59	D84682	6.8 K	2.0	Carbon......
R-62	B84563	56 K	0.5	Carbon......
R-66	B84271	270	0.5	Carbon......
R-72	40X334	1.0 meg.	Tone Control..	
R-73	B85106	10.0 meg.	0.5	Carbon......
R-75A, R-75B	Part of 76X5 (See Miscellaneous)			
R-76	C84331	330	1.0	Carbon......
R-77	D84102	1 K	2.0	Carbon......
R-79	B85475	4.7 meg.	0.5	Carbon......
R-82	B84273	27 K	0.5	Carbon......
R-83, R-84	C84682	6.8 K	1.0	Carbon......
R-87	B84562	5.6 K	0.5	Carbon......
R-88	B83224	220 K	0.5	Carbon......
R-89	40X331	150 K	Horizontal Drive Control	
R-91	B83154	150 K	0.5	Carbon......
R-92	C83562	5.6 K	1.0	Carbon......
R-94	40X361	50 K	Horizontal Hold Control	
R-95	D84101	100	2.0	Carbon......
R-96	43X276	12 K	5.0	Wirewound...
R-97	43X239	5.1	0.5	Wirewound...
R-98	B85102	1 K	0.5	Carbon......
R-99	C85105	1.0 meg.	1.0	Carbon......
R-100	B83472	4.7 K	0.5	Carbon......
R-101	43X272	10 K	5.0	Wirewound...
R-102	43X275	1.5 K	15.0	Wirewound...
R-103	43X273	330	10.0	Wirewound...
R-104	Part of L-9			
R-105	B85274	270 K	0.5	Carbon......
R-108	40X364	2.5 meg.	AGC........	
R-109	D85104	100 K	2.0	Carbon......
R-110	43X279	8 K	5.0	Wirewound...
R-111	D84123	12 K	2.0	Carbon......

TRANSFORMERS AND COILS

L-1, L-2, L-3	9A2033	R-F Heater Choke ....
L-4, L-8	9A1979	Peaking Coil 36 mh ....
L-5	36A10	Peaking Coil 60 mh ....
L-6	36A11	Peaking Coil 500 mh ....
L-7	9A2074	4.5 MC Trap ....
L-9	36A16	Peaking Coil 80 mh ....
L-10	36A12	Peaking Coil 160 mh ....
L-11	36A2	Peaking Coil 190 mh ....
L-12, L-17	Part of Deflection Yoke Assembly	
L-13	9A2168	Sound Take-Off Coil ....
L-14	9A2096	Horizontal Frequency Coil ....
L-15	9A2183	Width Control ....
L-16	9A2262	Horizontal Linearity Control ......
L-18	52X91	Filter Choke ....
T-1, T-2	9A2230	1st and 2nd Pix I-F Coils ....
T-3	9A2226	3rd Pix I-F Coil ....
T-4	54X8	Vertical Osc. Transformer ....
T-5	51X156	Vertical Output Transformer ....
T-6	9A2170	Sound I-F Transformer ....
T-7	9A2269	Sound Ratio Det. Transformer ......
T-8	51X150	Audio Output Transformer ....
T-9	53X330	Horizontal Output Transformer .....
T-10	53X333	Power Transformer ....

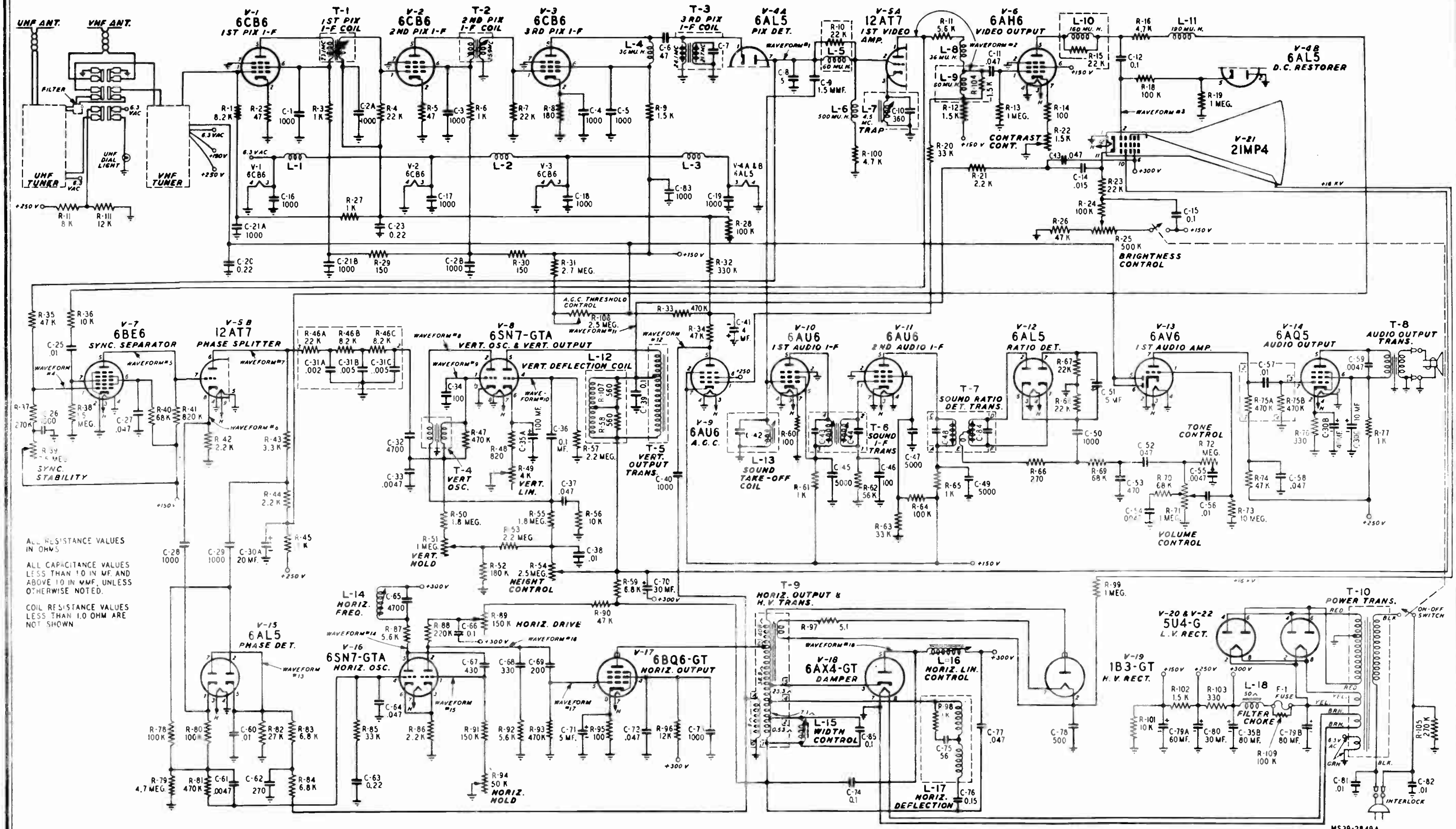
MISCELLANEOUS

2A426	Centering Device ....
76X5	Multiple Resistor Capacitor Assembly ....

MISCELLANEOUS—Continued

76X7	Multiple Resistor Capacitor Assembly	
9A2274	Deflection Yoke Assembly	
2A407	Ion Trap Magnet	
4A408	Antenna Terminal Strip	
3A427	Tube Socket (6AQ5)	
3A458	Tube Socket (6CB6) (6AU6) (6AL5)	
3A463	Tube Socket (12AT7)	
3A464	Tube Socket (6BQ6) (6SN7)	
3A466	Tube Socket (1B3)	
3A470	Tube Socket (Octal)	
3A445	Tube Socket (6AX4)	
13X817	Pix Tube Socket	
32X403	Tube Shield (3A458 Socket)	
32X405	Tube Shield (3A463 Socket)	
S-6A1	Anode Connector & Lead Assembly	
8X227	Collar, Pix Tube Rear Mtg.	
S-25X85	Tube Mtg. Strap Assembly	
20X1652	Wing Screw (Deflection Yoke)	
6X67	Rubber Grommet	
25X1815	Bracket, Tube Front Support (R.H.)	
25X1816	Bracket, Tube Front Support (L.H.)	
16X146	Fuse Holder	
16X147-3	Fuse 4/10 Amp. 125-250 V.	
S-34X19	Tube Cover & Power Cord Assembly	
4X1157	Pix Tube Mtg. Ring	
	No. 6-32 Wing Nut	
7A246	Pilot Light Socket Assembly (UHF Dial)	
7A247	Pilot Light Socket Assembly (Channel Selector)....	
7A32	No. 51 Pilot Bulb	
25X1828	Bracket Pix Tube Rear Mtg.	
10X88	UHF Tuner Drive Cord Assembly	
28X603	UHF Tuner Drive Cord Tension Spring........	
25A1105	UHF Tuner R. F. (Mallory)	
25A1104	VHF Tuner R. F. (Standard Coil)	
26X528	Shaft & Pulley Assembly	
S-37X4	Shaft Coupling Assembly	
S-37X3	Switch Cam Assembly	
2A430	Switch Assembly (VHF-UHF)	
11X163	Switch Assembly Cover	
25X1887	Dial Bracket	
19X108	Flat Washer	
10X89	Dial Drive Cord Assembly	
28X603	Dial Drive Cord Tension Spring	
58X767	Dial Glass	
15X277	Pointer	
41X92	Light Shield (Pilot Light)	
52X92	Filter Low Pass	
28X564	Spring Clips	
28X604	Spring Washer	
25X1886	Tuner Shaft Support Bracket	
4X1210-2	Escutcheon Plate	
20X1772	Compression Ring (10A820 Knob)	
12A502	12" P.M. Speaker (All Consoles)	
S-4X21-1	Escutcheon Control (Panel Assembly)	....
10A820-1	Knob (Maroon) (Fine Tuning)	Models ..
10A821-1	Knob (Maroon) (Contrast)	13-G-128.
10A822-1	Knob (Maroon) (Channel Selector) ...	13-G-130.
10A779	Knob (Maroon) (Volume)	13-G-145.
S-4X21-2	Escutcheon Control (Panel Assembly)	....
10A820-2	Knob (Beige) (Fine Tuning)	Models ..
10A821-3	Knob (Beige) (Contrast))	13-G-129.
10A822-3	Knob (Beige) (Channel Selector)	13-G-132.
10A812-4	Knob (Beige) (Volume)	13-G-146.
17X179	Pix Crystal	Models 13-G-128 & 129......
4X1219-1	Plastic Molding	Code 334-3-MS39B ....
17X176	Pix Crystal	....
7A233	Pilot Light Socket Assembly	Models..........
7A32	No. 51 Pilot Light Bulb	13-G-130........
7A230	Jewel — (Red)	13-G-132........
S-14X74	Cabinet Back Assembly	....
17X175	Pix Crystal	Model 13-G-128 ....
4X1212-1	Pix Mask	Code 334-3-MS39A ....
4X1220-1	Pix Mask (Model 13-G-128)	....
4X1220-2	Pix Mask (Model 13-G-129)	Code ....
4X1211-1	Pix Mask (Model 13-G-130)	334-3-MS39B ....
4X1211-3	Pix Mask (Model 13-G-132)	....
S-14X69	Cabinet Back Assembly (Models 13-G-128 & 13-G-129)	
12A504	6" P.M. Speaker	Models ....
17X177	Pix Crystal	13-G-145 ....
S-4X70	Cabinet Back Assembly	13-G-146 ....
4X1214-1	Pix Mask (Model 13-G-145)	
4X1214-3	Pix Mask (Model 13-G-146)	

21" UHF-VHF TELEVISION RECEIVER



PRODUCTION CHANGES

There are two different ratio detector transformers (T-7) used in these receivers, Part Numbers 9A2269 and 9A2295. The T-7 circuit shown in this schematic diagram covers the 9A2269 ratio detector. Receivers using the 9A2295 ratio detector can be identified by the following changes:

C-50 becomes 47X570 330 mmf molded mica condenser

R-64 becomes B84333 33K ohm 0.5 W carbon resistor

R-67, R-68 } become B83103 10K ohm 0.5 W carbon resistors

In addition, the 9A2295 ratio detector has terminals with numerical identification (1, 2, 3 etc.) whereas the 9A2269 ratio detector has terminals with alphabetical identification (A, B, C etc.)

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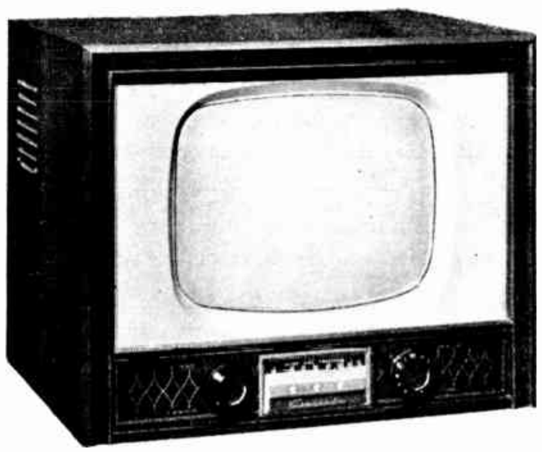


IMPORTANT

Models 35TV2-43-9023A and 45TV2-43-9023B are identical except for a few minor changes in cabinet construction and design. For differences between the "A" & "B" models, see the replacement parts list section.

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles Only
Power Consumption	200 Watts
Power Output	2.4 Watts (Max.) 1.8 Watts (10% Distortion)
Tuning Ranges	VHF — Channels 2 thru 13 UHF — Channels 14 thru 83
Antenna Input Imp.	300 Ohms Balanced
Intermediate Frequencies	Picture 26.20 MC Sound 21.70 MC
I-F (UHF Position Only)	Picture 121.75 Sound 126.25
Intercarrier Sound System . . .	4.5 MC
Loud Speaker	See Parts List
Voice Coil Imp.	3.2 Ohms 400 Cycles

TUBE COMPLEMENT

Symbol	Type	Function
VHF Tuner	6J6	R-F Osc. and Mixer
*VHF Tuner	6BQ7	R-F Amplifier
UHF Tuner	6AF4	R-F Osc.
UHF Tuner	1N72 or 1N82	Crystal Mixer
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V-5 A & B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20 & V-22	5U4-G	Low Voltage Rectifier
V-21	17HP4	Picture Tube 17" Glass Rectangular (Electrostatic)

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

RADIO FREQUENCY RANGES

Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc	Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc
2	54-60	55.25	59.75	43	644-650	645.25	649.75
3	60-66	61.25	65.75	44	650-656	651.25	655.75
4	66-72	67.25	71.75	45	656-662	657.25	661.75
5	76-82	77.25	81.75	46	662-668	663.25	667.75
6	82-88	83.25	87.75	47	668-674	669.25	673.75
7	174-180	175.25	179.75	48	674-680	675.25	679.75
8	180-186	181.25	185.75	49	680-686	681.25	685.75
9	186-192	187.25	191.75	50	686-692	687.25	691.75
10	192-198	193.25	197.75	51	692-698	693.25	697.75
11	198-204	199.25	203.75	52	698-704	699.25	703.75
12	204-210	205.25	209.75	53	704-710	705.25	709.75
13	210-216	211.25	215.75	54	710-716	711.25	715.75
14	470-476	471.25	475.75	55	716-722	717.25	721.75
15	476-482	477.25	481.75	56	722-728	723.25	727.75
16	482-488	483.25	487.75	57	728-734	729.25	733.75
17	488-494	489.25	493.75	58	734-740	735.25	739.75
18	494-500	495.25	499.75	59	740-746	741.25	745.75
19	500-506	501.25	505.75	60	746-752	747.25	751.75
20	506-512	507.25	511.75	61	752-758	753.25	757.75
21	512-518	513.25	517.75	62	758-764	759.25	763.75
22	518-524	519.25	523.75	63	764-770	765.25	769.75
23	524-530	525.25	529.75	64	770-776	771.25	775.75
24	530-536	531.25	535.75	65	776-782	777.25	781.75
25	536-542	537.25	541.75	66	782-788	783.25	787.75
26	542-548	543.25	547.75	67	788-794	789.25	793.75
27	548-554	549.25	553.75	68	794-800	795.25	799.75
28	554-560	555.25	559.75	69	800-806	801.25	805.75
29	560-566	561.25	565.75	70	806-812	807.25	811.75
30	566-572	567.25	571.75	71	812-818	813.25	817.75
31	572-578	573.25	577.75	72	818-824	819.25	823.75
32	578-584	579.25	583.75	73	824-830	825.25	829.75
33	584-590	585.25	589.75	74	830-836	831.25	835.75
34	590-596	591.25	595.75	75	836-842	837.25	841.75
35	596-602	597.25	601.75	76	842-848	843.25	847.75
36	602-608	603.25	607.75	77	848-854	849.25	853.75
37	608-614	609.25	613.75	78	854-860	855.25	859.75
38	614-620	615.25	619.75	79	860-866	861.25	865.75
39	620-626	621.25	625.75	80	866-872	867.25	871.75
40	626-632	627.25	631.75	81	872-878	873.25	877.75
41	632-638	633.25	637.75	82	878-884	879.25	883.75
42	638-644	639.25	643.75	83	884-890	885.25	889.75

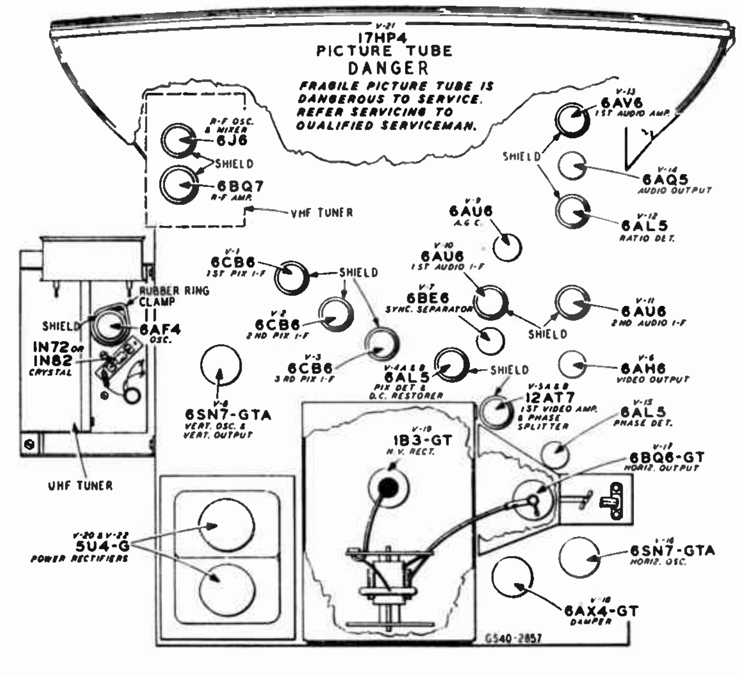
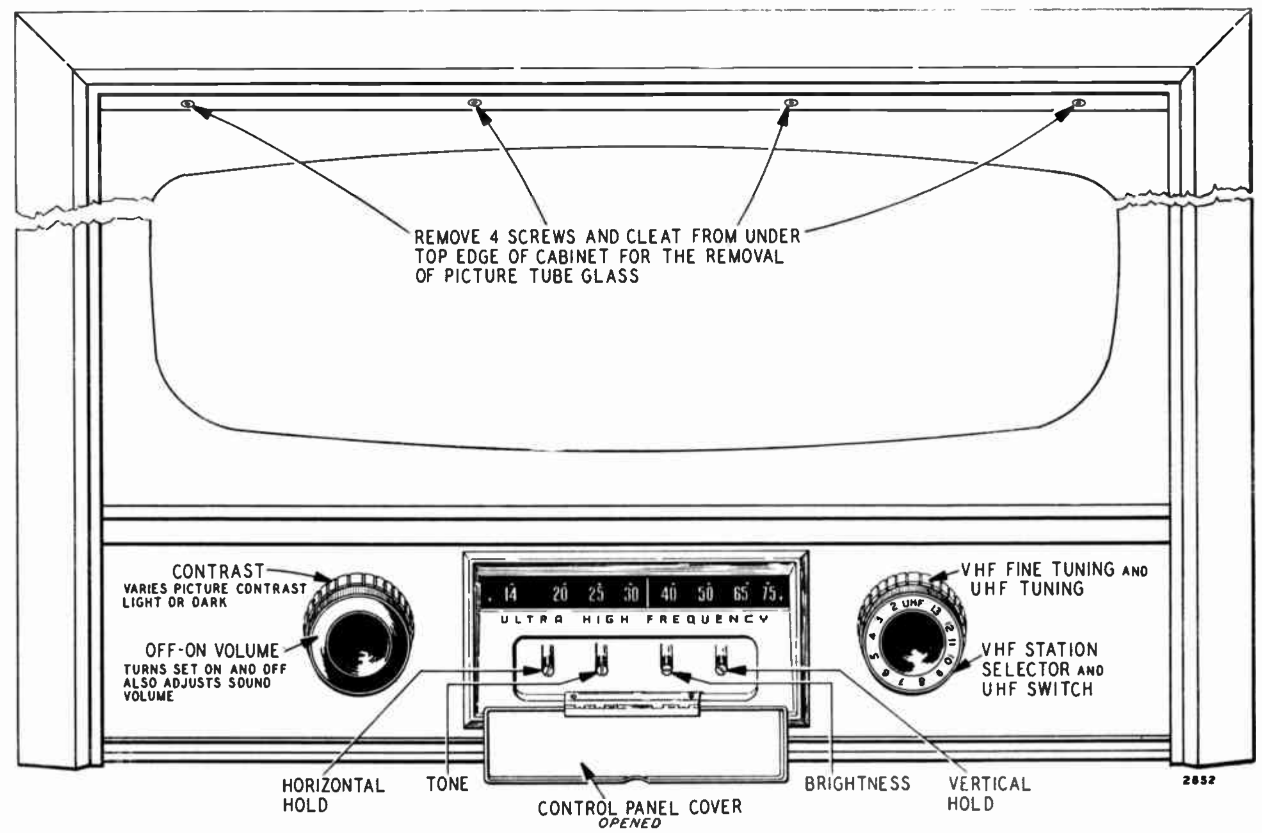


Fig. 1—Tube Layout.



NOTE — In some receivers it may be necessary to remove 5 screws and cleat from under top edge of cabinet for the removal of picture tube glass.

Fig. 2—Front Panel Controls

RECEIVER LOCATION — Advise the owner as to the proper location for the television receiver. The following may be used as a guide:

1. Choose an area in the home where sunlight or light from lamps does not strike the face of the picture tube and cause glare.
2. Remember the necessity of an electrical outlet and the location of the point at which the antenna leads enter the room.
3. The receiver should be placed a short distance from the wall to allow adequate ventilation.
4. The receiver should be placed to permit easy access for operation and comfortable viewing from all angles.

ANTENNA — This receiver has been designed to use an antenna with a 300 ohm balanced transmission line. This line must be as short as possible because the longer the line the greater the chances are for picking up electrical disturbances. Stand-off insulation should be used to keep the line away from the mast, metal or walls. Twist this line about one turn per foot throughout the line to cancel out direct signal and/or noise pickup by the transmission line. It should also be securely anchored in place so that a change in weather will not affect its position.

HIGH VOLTAGE WARNING

This television receiver contains high voltages which are dangerous to life. Never operate or service the receiver outside of the cabinet or with the covers removed until all the safety precautions necessary for working with high voltage equipment have been observed.

PICTURE TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves must be worn by individuals while handling the picture tube or installing the picture tube into the receiver.

The picture tube encloses a high vacuum and due to the large surface area, is subjected to very high air pressure. Therefore, care should be taken not to bump or scratch the picture tube accidentally as it may cause the tube to implode resulting in damage to property or injury to an individual.

TUNING PROCEDURE

1. To turn the television receiver on, turn the OFF-ON VOLUME control clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.
2. Turn the STATION SELECTOR control to the desired channel. This control may be turned in either direction.
3. Turn the CONTRAST control clockwise until activity or definite form is noted on the screen.
4. Adjust the FINE TUNING control for clearest picture and the VOLUME control for desired volume.
5. To turn off the receiver, turn only the OFF-ON VOLUME control counterclockwise until a click is heard.
6. TONE CONTROL — When this Control is turned clockwise, the high notes will predominate and when turned counterclockwise, a deep bass effect will result.
7. In localities where UHF programs are available, turn the STATION SELECTOR control to the UHF position and tune in the desired station with the UHF Tuning Control. The dial scale is calibrated in channel numbers and covers the entire UHF range of channels 14 through 83.

OCCASIONAL ADJUSTMENTS TO IMPROVE PICTURE RECEPTION

There are four controls at the front of the chassis which are accessible when the hinged control panel is pulled downward. See illustration Figure 2. These controls are pre-set at the factory and may occasionally need adjustment due to aging of the components in the receiver and the fluctuating line voltages in different areas.

If any adjustments are necessary follow the instructions under "Controls and Functions."

IMPORTANT — Be sure that the FINE TUNING control has been set for the clearest picture before adjusting any controls.

CONTROLS AND FUNCTIONS

HORIZONTAL HOLD—Stops horizontal movement (diagonal bars.)

TONE—Adjusts for tonal quality bass or treble.

BRIGHTNESS—Adjusts for desired picture brilliance.

VERTICAL HOLD—Stops upward or downward picture movement.

PICTURE TUBE SAFETY GLASS

PICTURE TUBE SAFETY GLASS — It will be necessary to clean this glass and the face of the picture tube occasionally. Remove the safety glass carefully as outlined in the illustration.

CAUTION — UPON REMOVAL OF THE LAST SCREW AND THE CLEAT THE GLASS MAY FALL FORWARD. SUPPORT THE GLASS WITH ONE HAND AS YOU LIFT IT GENTLY FROM THE CABINET. Clean the safety glass and the face of the picture tube with a soft lint-free cloth dampened with water or mild soapsuds.

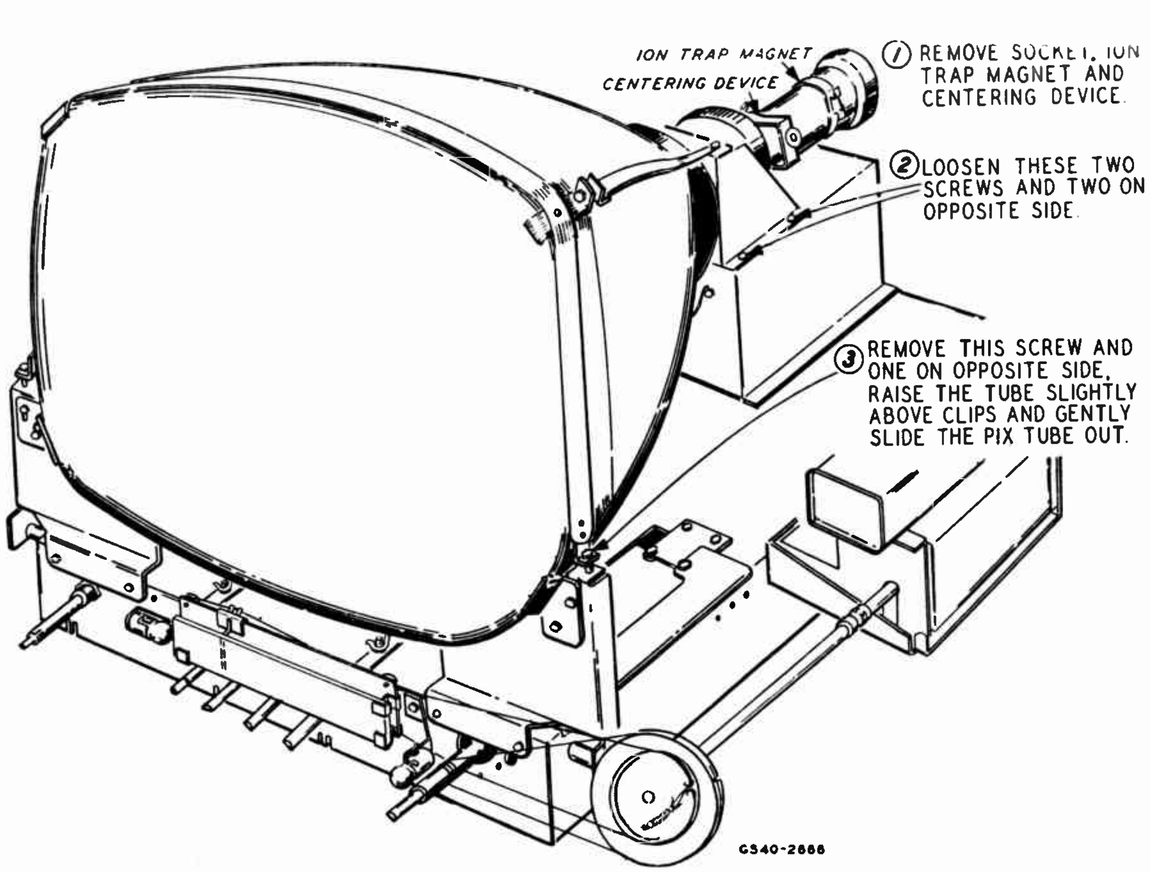


Fig. 3—Removal of Picture Tube

WARNING — Before handling the picture tube, it will be necessary to remove the static charge. In receivers with glass picture tubes, ground the anode lead to chassis, and insert an insulated wire from the well in the tube to chassis. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

PICTURE TUBE REPLACEMENT — To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove the cabinet back.
3. Disconnect the leads from the speaker, remove the antenna terminal boards at the rear of the cabinet and then the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

FRONT OF CHASSIS

(Accessible After Opening Front Panel Control Cover)

Horizontal Hold	R-94
Brightness	R-25
Vertical Hold	R-51
Tone	R-72

NON-OPERATING CONTROLS REAR OF CHASSIS

Horizontal Centering	Centering Device
Vertical Centering	Centering Device
Ion Trap Magnet	See paragraph.
Deflection Yoke	Wing Screw
Width	L-15
Horizontal Linearity	L-16
Horizontal Drive	R-89
Horizontal Frequency	L-14
Vertical Linearity	R-49
Height	R-54
Sync Stability	R-39
AGC Threshold Control	R-108

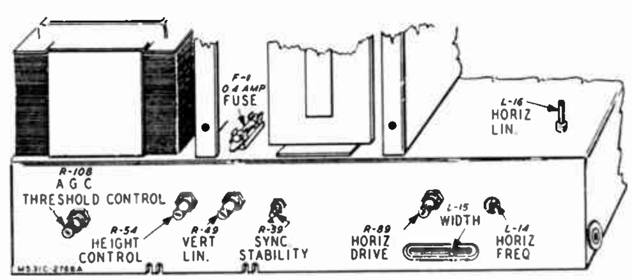


Fig. 4—Adjustments Rear of Chassis

ION TRAP MAGNET ADJUSTMENT—The ion trap magnet should be positioned close to the base of the tube with the magnet of the ion trap on the side where the electron gun is nearest the glass neck of the picture tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to make sure that the ion trap magnet is correctly adjusted.

DEFLECTION YOKE ADJUSTMENT — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

CENTERING ADJUSTMENT — If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained. If a clamp type centering device is used, rotate the device to the left or right and turn the knob located at the top of the device until the picture is centered correctly.

PICTURE ADJUSTMENT — For further adjustments, obtain a test pattern on the receiver. Turn on receiver and follow tuning procedure. When a test pattern is obtained it may be necessary to slightly re-adjust the fine tuning control for clearest picture.

ADJUSTMENT OF AGC THRESHOLD CONTROL — Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL — When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control slowly clockwise until bending occurs at top of picture. Then turn the control a few degrees counter-clockwise until bending disappears. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.

When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT — With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT — Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS— While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (R-89) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (R-89) will be necessary. Adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

Caution — These adjustments are intended only for VHF Channels. For information regarding UHF alignment, see paragraph "Tuner Alignment".

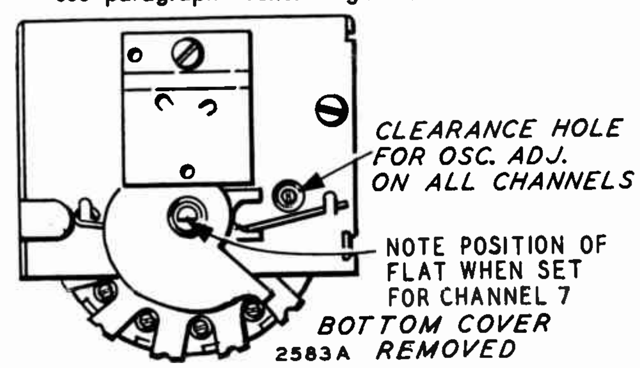


Fig. 5—Tuner Oscillator Adjustments

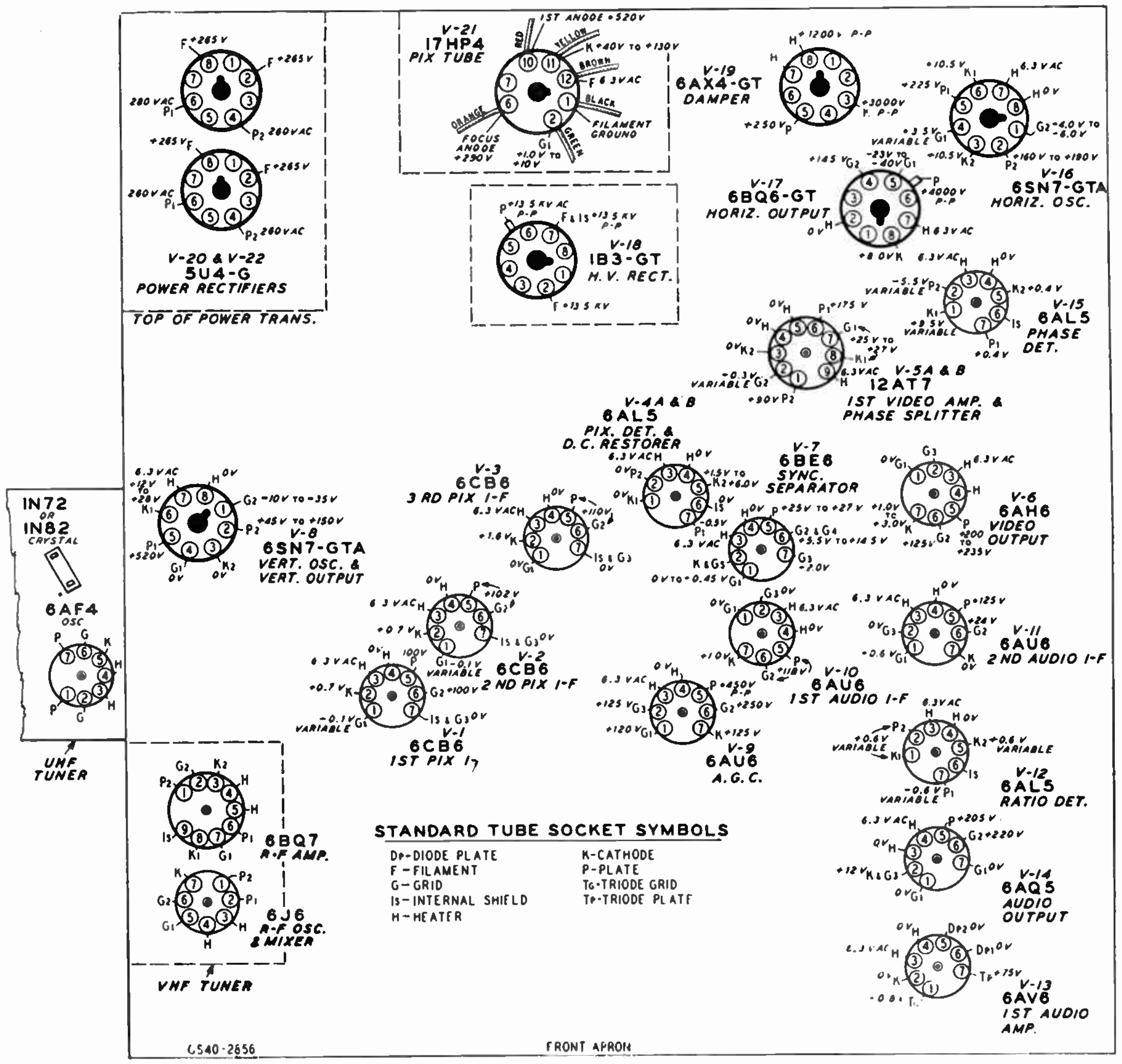


Fig. 6—Bottom Socket Voltages

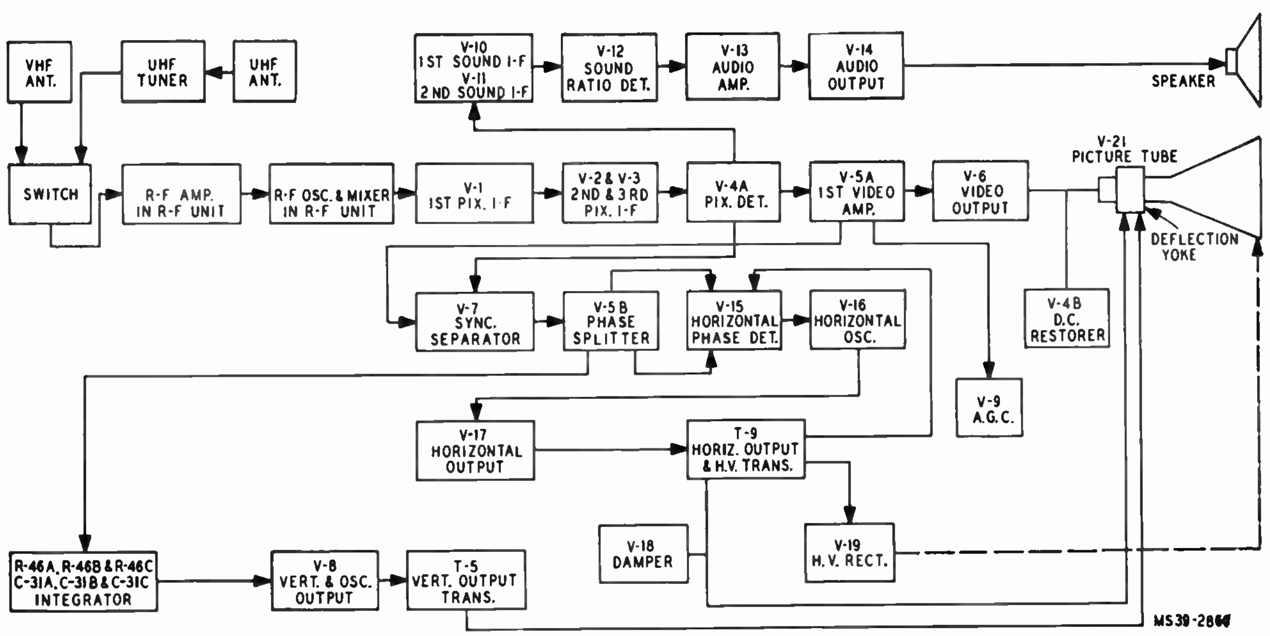


Fig. 7—Block Diagram

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.

1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
   (A) Horizontal output tube V-17 (6BQ6-GT)
   (B) Check damper tube V-18 (6AX4-GT).
   (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
   (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (1-9) and the chassis.
   (E) Check DC resistance of T-9.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-99 and C-78 defective or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:

1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.

1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-35A, C-39 or C-70 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitor C-37, or open or incorrect value of resistors R-55 & R-56.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-36 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:

1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6AX4-GT).
3: Check capacitors C-74, C-76, C-77 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER

1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:

1: Defective yoke due to C-75 or R-98 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2: V-18 (6AX4-GT) defective.

SMALL RASTER — This condition can be caused by:

1: Low +B or line voltage. Check V-20 & V-22 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control R-89.
5: V-18 (6AX4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND — This condition can be caused by:

1: No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY — A condition of this nature can be caused by:

1: Defective sync separator V-7 or phase splitter V-5B.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY — If this condition is encountered, check:

1: Vertical integrating network capacitors C-31A, B & C, and resistors R-46 A, B & C.
2: Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY

1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:

1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (6AH6).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9, L-10 and L-11 have shunting resistors.
5: Leakage in V-6 (6AH6) grid capacitor C-11. If the capacitor is not found to be defective, check the following:
   1: Check all potentials in video circuits.
   2: Check picture tube grid circuit for poor or dirty contact.
   3: Check and realign, if necessary, the picture I-F and R-F circuits.

SERVICE SUGGESTIONS—(continued)

PICTURE SMEAR:

1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc)

1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S-ING

1: Check sync stability control adjustment.
2: Check capacitors C-35B and C-79B.
3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4: Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5: Check AGC threshold control.

PICTURE NORMAL—NO SOUND OR WEAK OR DISTORTED SOUND

1: Check sound I-F alignment.
2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

RASTER ON TUBE BUT NO PICTURE OR SOUND

This condition can be caused by,
1: Defective pix I-F Amplifier tubes V-1, V-2 or V-3
2: Defective pix detector tube V-4A (6AL5). Check tube and its associated circuit.
3: Defective R-F Amplifier or oscillator mixer tubes in the tuner.
4: UHF-VHF switch defective.

POOR FOCUS

1: Improper setting of Ion Trap magnet.
2: Defective picture tube or picture tube socket.

PICTURE JITTER:

1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).
6: Check for improper setting of sync stability control.
7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8: Check AGC threshold control.

NO PICTURE OR SOUND OR WEAK PICTURE OR SOUND IN UHF POSITION

If this condition is encountered
1: Check to see whether or not a UHF station is operating in the vicinity.
2: The 6AF4 oscillator tube or the IN72 (or IN82) crystal may be defective.
3: Pre-selector in UHF tuner defective.
4: Low pass filter defective.
5: The UHF antenna and oscillator strips in the VHF tuner defective.
6: Defective switch on UHF tuner.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:
(a) Frequency ranges:
18 to 30 mc, 10 mc sweep width
40 to 90 mc, 10 mc sweep width
120 to 130 mc, 10 mc sweep width
170 to 225 mc, 10 mc sweep width
470 to 890 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)
(a) Intermediate alignment frequencies.
23.1 mc first picture I-F coil.
24.1 mc third picture I-F coil
25.9 mc second picture I-F coil.
21.7 mc sound trap.
4.5 mc video trap & sound I-F.
25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal boards at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-99.

ALIGNMENT PROCEDURE
PIX I-F

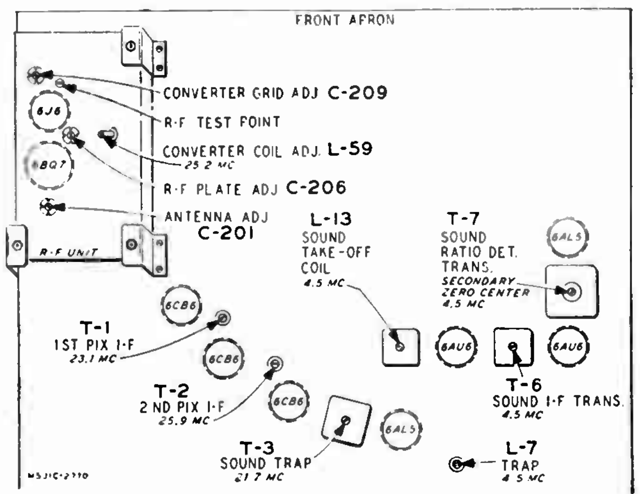


Fig. 8—Top Chassis Video and Audio I-F Adjustments

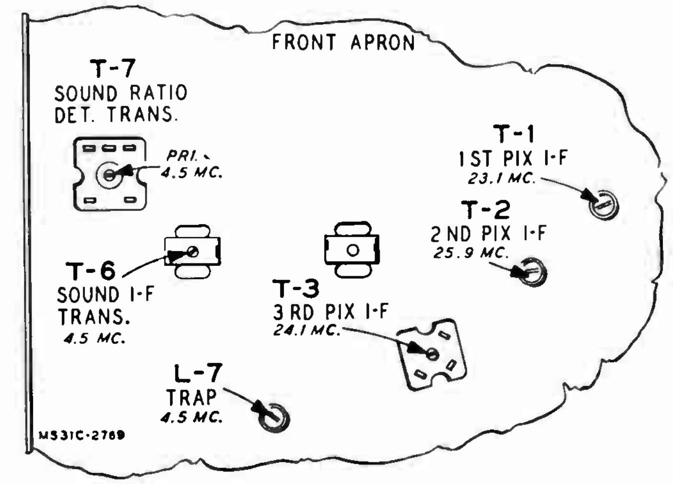


Fig. 9—Bottom Chassis Video and Audio I-F Adjustments.

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-100) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line.

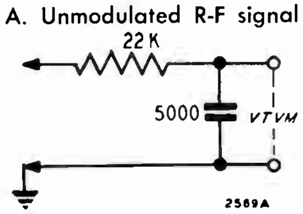


Fig. 10—VTVM Connections

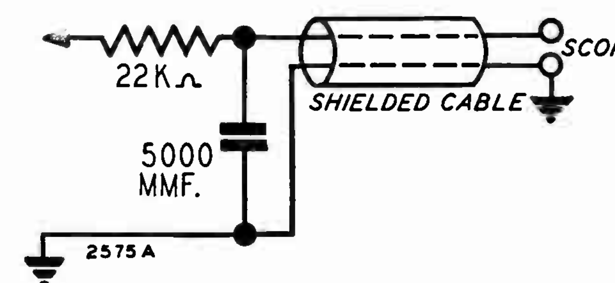


Fig. 11—Oscilloscope Connections

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

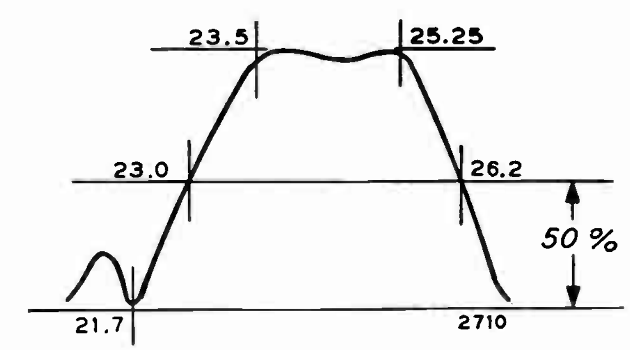


Fig. 12—Overall Response Curve

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-100 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery).

Tuner should be switched to dead channel so as not to cause interference.

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-62 and C-46, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-66, R-69 and C-50, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect 1½ V bias to AGC line at junction of R-33 and C-20 on the receiver.

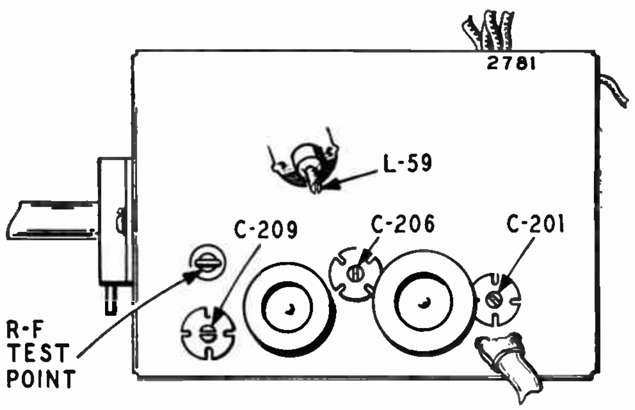


Fig. 13—Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

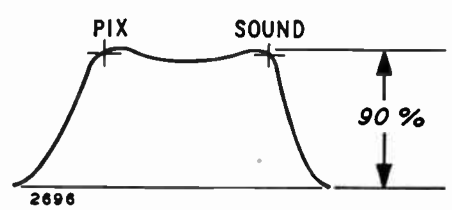


Fig. 14—Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-21.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.
4. To adjust oscillator on UHF position, feed the sweep generator with center frequency of 124 MC and markers at 121.75 and 126.25 into the input of the low pass filter (output of UHF tuner). Adjust oscillator slug in the VHF tuner so that the 121.75 pix carrier marker is at 50% and that 126.25 marker is in the sound notch. If a sweep generator is not available, a single frequency generator set to 126.25 MC and VTVM may be used. Connect VTVM to the pix detector load resistor R-100. Feed generator into the low pass filter. Adjust oscillator slug in the VHF tuner so that the 126.25 marker is in the sound notch of the I-F curve.
5. If the 6AF4 oscillator tube in the UHF tuner is replaced, it may be necessary to adjust the oscillator trimmer C-309 on the UHF tuner located underneath the chassis. (See Figure 15). Adjust this trimmer until the tuner will cover a range of below 470 MC to above 890 MC.

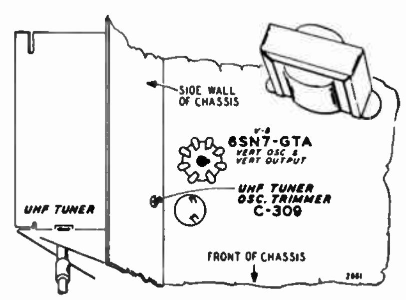


Fig. 15—UHF Tuner Adjustment.

VHF TUNER ASSEMBLY INFORMATION

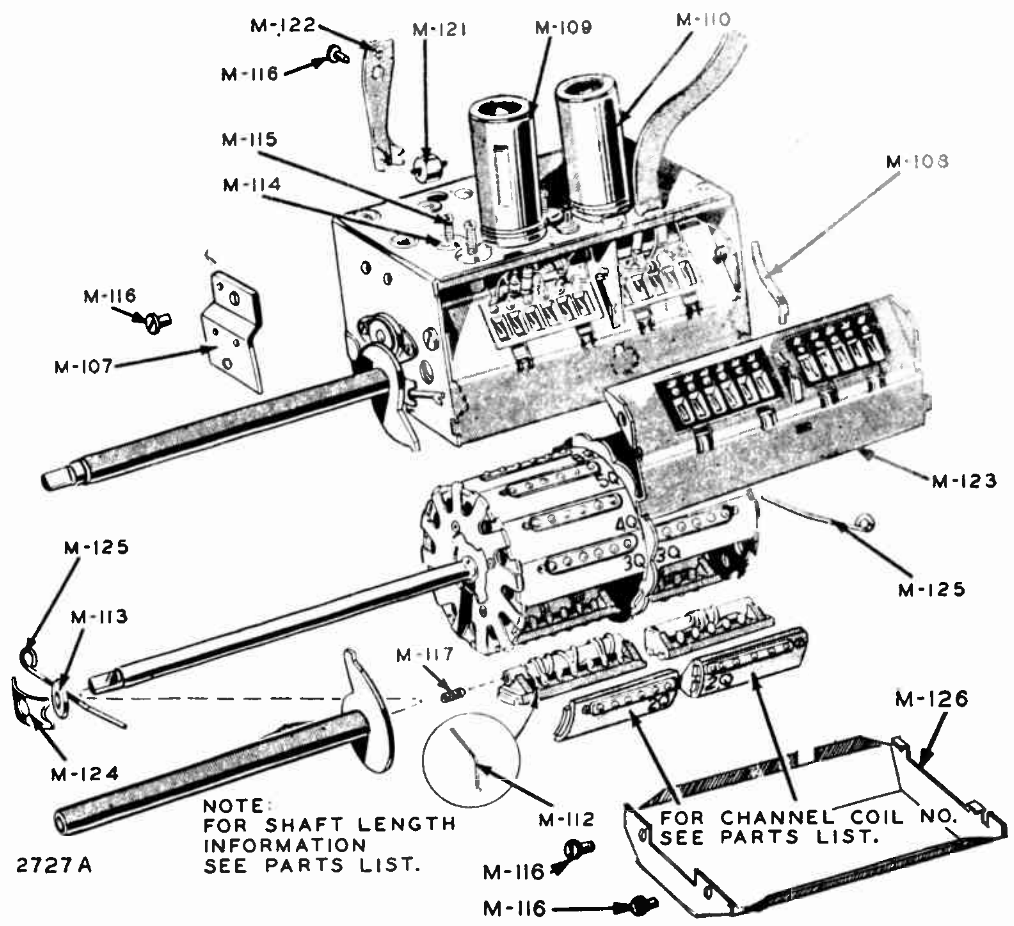


Fig. 16—"Q" Tuner Pictorial.

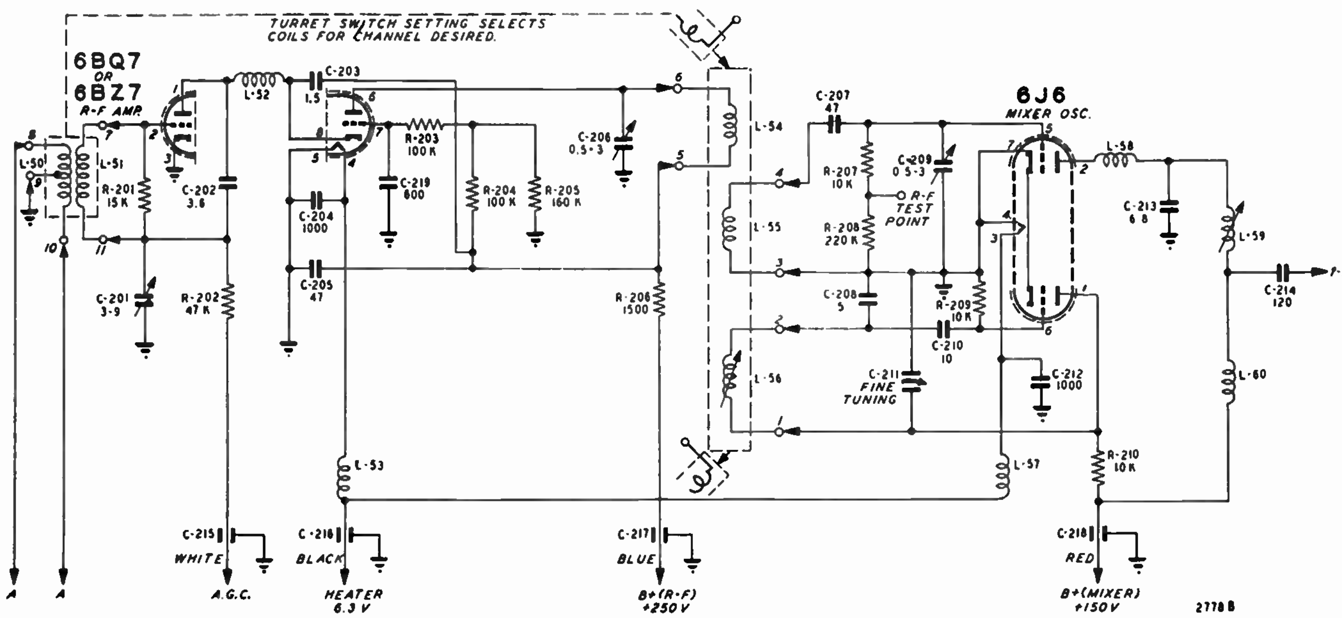


Fig. 17—"Q" Tuner Schematic Diagram.

UHF TUNER INFORMATION

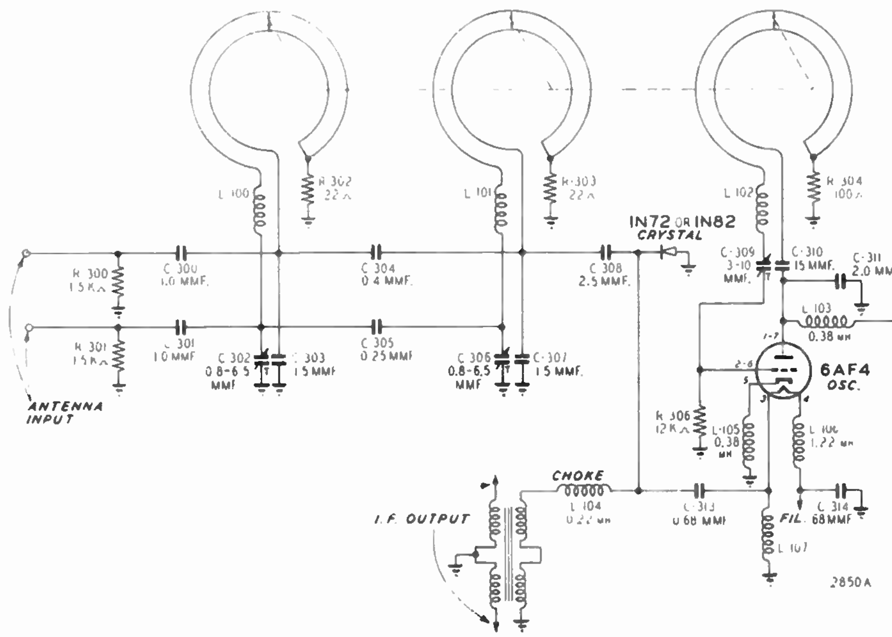


Fig. 18—UHF Tuner Schematic Diagram.

Due to the complexity of the UHF tuner, neither servicing nor aligning is encouraged in the field because replacement of any component within the R-F circuit may disturb the band-pass characteristics of the tuner. However, the 6AF4 tube or the 1N72 (or 1N82) crystal may be replaced in the field if found to be defective. A schematic diagram of this tuner is shown only for the purpose of outlining the circuit used.

If the UHF tuner does not operate satisfactorily after the tube or crystal replacement, disconnect the tuner and return it to the factory for repair.

DRIVE CORD REPLACEMENT

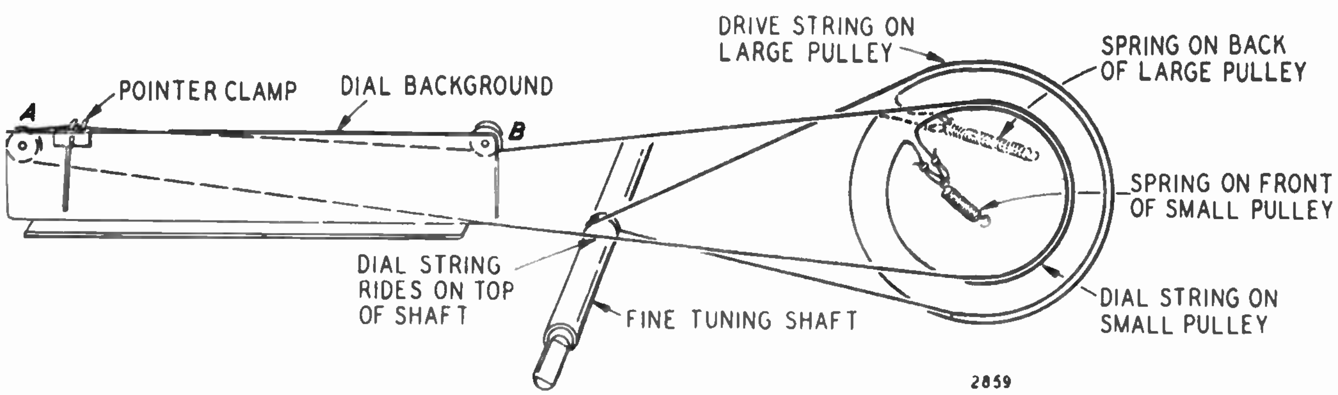
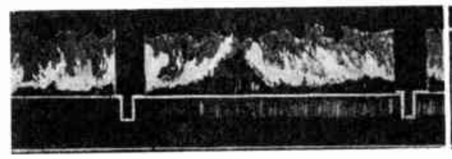


Fig. 19—Drive Cord Stringing.

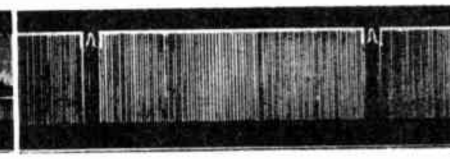
You will note that there are two cords used for the pointer drive system on this receiver. Part number 10X88 Drive Cord assembly and part number 28X603 Spring are used on the tuning shaft and large pulley, while part number 10X89 Drive Cord and a part number 28X603 Spring are used on the small pulley system and the pointer. Install the cords as shown in the illustration. After completing the installation rotate the fine tuning shaft a few turns to take up the slack in the cord.

OSCILLOSCOPE WAVEFORM PATTERNS

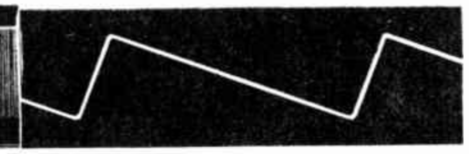
The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.
The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.



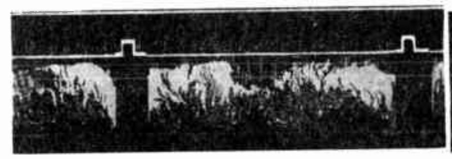
No. 1—6AL5 Pix Det. Plate
3.5V P-P 60 C.P.S.
No. 4—6BE6 Sync Sep.
Grid No. 1 .2V P-P 60 C.P.S.



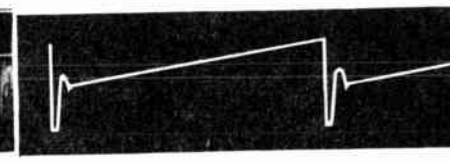
No. 7—12AT7 Phase Splitter Plate
45V P-P 60 C.P.S.



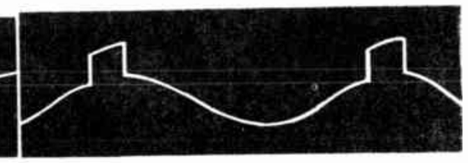
No. 13—6AL5 Phase Det.
18V P-P 15,750 C.P.S.



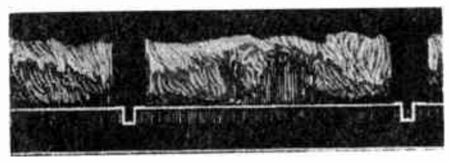
No. 2—12AT7 Plate
35V P-P 60 C.P.S.
No. 2—6AH6 Grid
8V P-P 60 C.P.S.



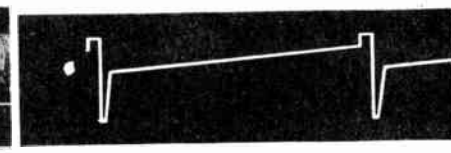
No. 8—6SN7-GTA—Vert. Osc. Plate
100V P-P 60 C.P.S.



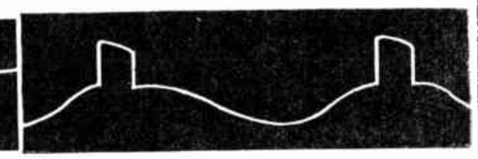
No. 14—6SN7—Hor. Osc. Plate
50V P-P 15,750 C.P.S.



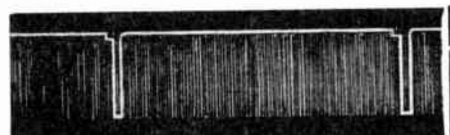
No. 3—Pix Tube Grid
20-100V P-P 60 C.P.S.



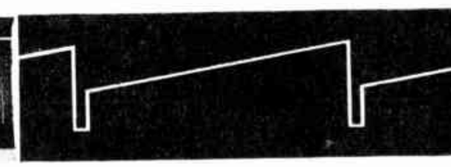
No. 9—6SN7-GTA Vert. Osc. Grid
130V P-P 60 C.P.S.



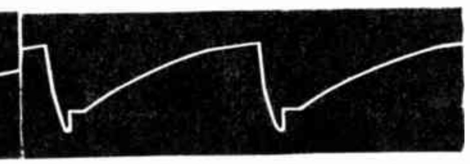
No. 15—6SN7 Hor. Osc. Grid
48V P-P 15,750 C.P.S.



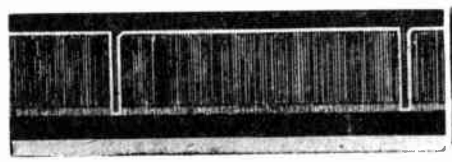
No. 5—6BE6 Sync Sep. Plate
20V P-P 60 C.P.S.



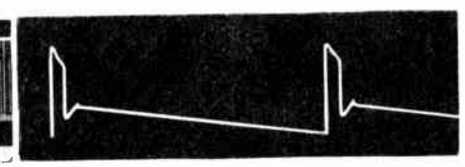
No. 10—6SN7-GTA Vert. Output Grid
120V P-P 60 C.P.S.



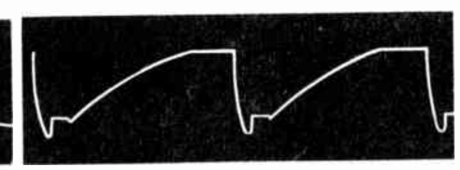
No. 16—6SN7 Hor. Osc. Plate
135V P-P 15,750 C.P.S.



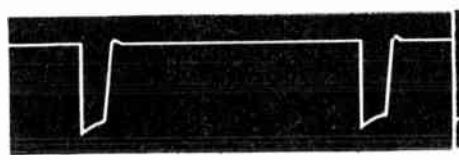
No. 6—12AT7 Phase Splitter Cathode
18V P-P 60 C.P.S.



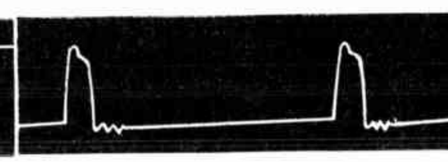
No. 11—Vert. Def. Coil
85V P-P 60 C.P.S.



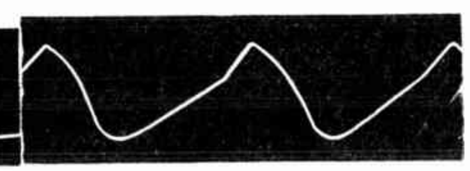
No. 17—6BQ6 Grid
120V P-P 15,750 C.P.S.



No. 6—12AT7 Phase Splitter Cathode
18V P-P 15,750 C.P.S.

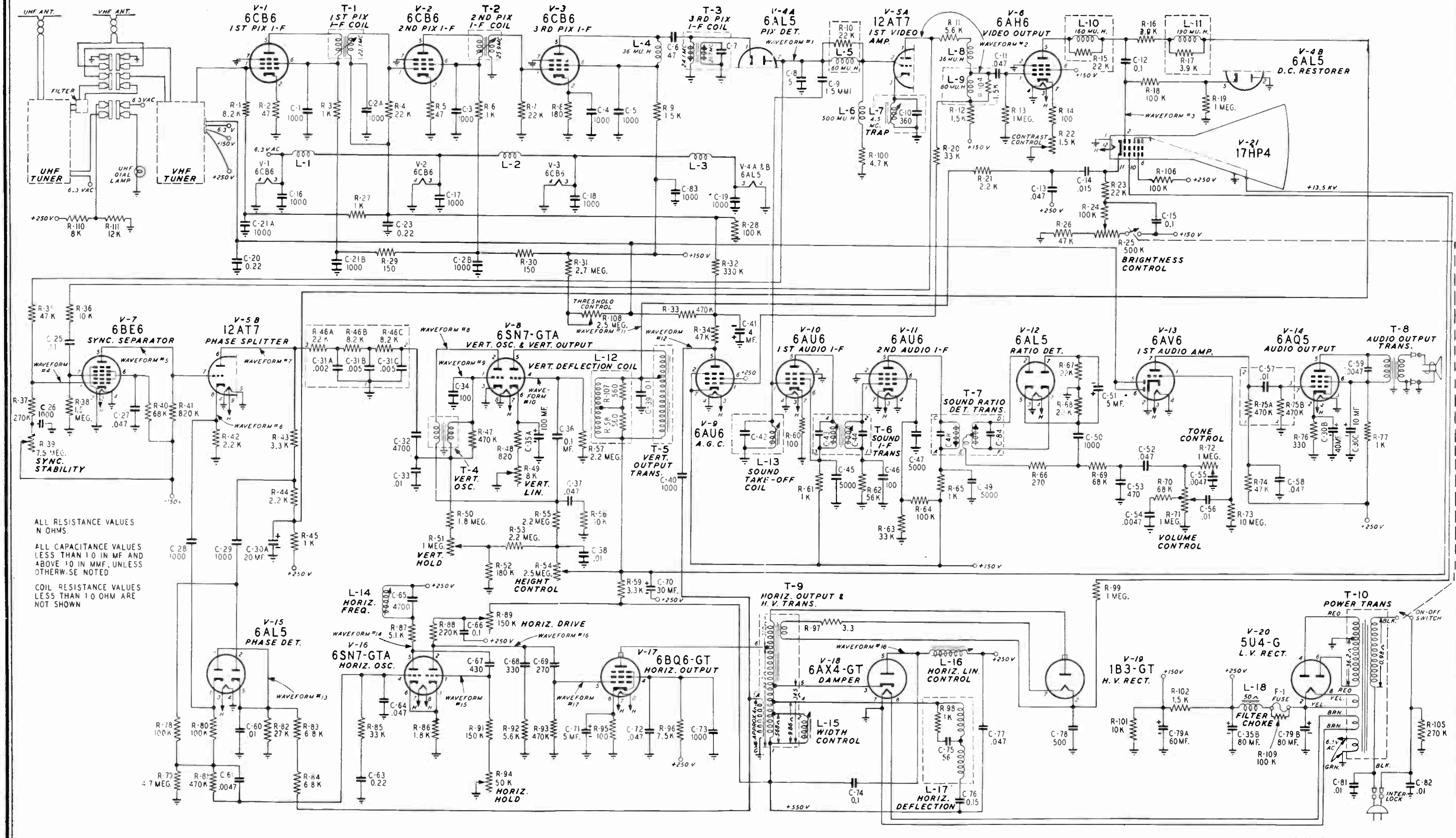


No. 12—6AU6 A.G.C.
450V P-P 15,750 C.P.S.



No. 18—6AX4—GT Damper Plate
120V P-P 15,750 C.P.S.

17" UHF-VHF TELEVISION RECEIVER



PRODUCTION CHANGES

There are two different ratio detector transformers (T-7) used in these receivers, Part Numbers 9A2269 and 9A2295. The T-7 circuit shown in this schematic diagram covers the 9A2269 ratio detector. Receivers using the 9A2295 ratio detector can be identified by the following changes:

C-50 becomes 47X570 330 mmf molded mica condenser

R-64 becomes B84333 33K ohm 0.5 W carbon resistor

R-67, R-68 become B83103 10K ohm 0.5 W carbon resistors

In addition, the 9A2295 ratio detector has terminals with numerical identification (1, 2, 3 etc.) whereas the 9A2269 ratio detector has terminals with alphabetical identification (A, B, C etc.)

VHF TUNER ASSEMBLY PARTS LIST

Use only GENUINE factory tested parts to insure service jobs you can depend on and to obtain original set performance.

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	±10%	0.5
R-202	12A-039	47 K	±20%	0.5
R-203	12A-094	100 K	±10%	0.5
R-204	12A-166	100 K	±5%	0.5
R-205	12A-167	160 K	±5%	0.5
R-206	12A-183	1500	±10%	0.5
R 207, R 209, R 210	12A-040	10 K	±10%	0.5
R 208	12A-041	220 K	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204, C-212	CD8X102Z	1000 mmf	
C-205, C-207	CD8Q470K	47 mmf	±10%
C-206, C-209	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215, C-216, C-217, C-218	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	A9A2297-2	Antenna Coil	2-Q
	A9A2297-3	Antenna Coil	3-Q
	A9A2297-4	Antenna Coil	4-Q
	A9A2297-5	Antenna Coil	5-Q
	A9A2297-6	Antenna Coil	6-Q
	A9A2297-7	Antenna Coil	7-Q
	A9A2297-8	Antenna Coil	8-Q
	A9A2297-9	Antenna Coil	9-Q
	A9A2297-10	Antenna Coil	10-Q
	A9A2297-11	Antenna Coil	11-Q
	A9A2297-12	Antenna Coil	12-Q
	A9A2297-13	Antenna Coil	13-Q

COILS AND CHOKES (Continued)

Ref. No.	Part No.	Description	Channel & Code No.
	A9A2297-91	Antenna Coil	UHF Position
	A9A2298-2	Oscillator Coil	2-Q
	A9A2298-3	Oscillator Coil	3-Q
	A9A2298-4	Oscillator Coil	4-Q
	A9A2298-5	Oscillator Coil	5-Q
	A9A2298-6	Oscillator Coil	6-Q
	A9A2298-7	Oscillator Coil	7-Q
	A9A2298-8	Oscillator Coil	8-Q
	A9A2298-9	Oscillator Coil	9-Q
	A9A2298-10	Oscillator Coil	10-Q
	A9A2298-11	Oscillator Coil	11-Q
	A9A2298-12	Oscillator Coil	12-Q
	A9A2298-13	Oscillator Coil	13-Q
	A9A2298-91	Oscillator Coil	UHF Position
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A-575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L-59	31A-078	Converter Plate Coil	
L-60	31B-230	Choke, Coil	

MISCELLANEOUS MECHANICAL PARTS

Ref. No.	Part No.	Description
M-107	31B-012	Bracket, Sharp Tuning Rotor Retaining
M-108	31B-048	Spring, Detent Plate Grounding
M-109	16S-006	Shield, Tube (6J6)
M-110	16S-004	Shield, Tube (6BQ7)
M-112	31A-010	Spring, Slug Retaining (Oscillator Coil)
M-113	11D-022	Washer, Fibre Spacer (¼" ID by ½" OD)
M-114	10E-401	Nut, Locking Spring (for trimmers)
M-115	9A-410-7	Screw, Trimmer
M-116	9A-629-3	Screw, Bracket Mounting (6/32" by ¼")
M-117	31B-029	Osc. Slug Trimmer
M-121	31B-016	Roller, Detent (⅜" dia., 3/32" dia. bearing)
M-122	31B-005	Spring, Detent (2-5/16" long)
M-123	31B-278	Contact Plate and Bracket Assembly
M-124	31B-008	Spring, Sharp Tuning Rotor Contact (Flat Bronze 1-7/16" by ½")
M-125	31B-030	Spring, Front and Rear Turret Shaft (Wire 2-3/4" long, 3/64" dia.)
M-126	31B-103	Shield, Bottom Cover
	31B-655-5	Fine Tuning Shaft (Sharp Tuning) used with 25A1109

PARTS LIST

CAPACITORS

C-1, C-3, C-4, C-5, C-16, C-17, C-18, C-19, C-26, C-28, C-29, C-40, C-50, C-73, C-83	80X1	1000 mmf		Ceramic
C-2A, C-2B, C-21A, C-21B	80X3	1000 mmf		Dual Ceramic
C-6	47X603	47 mmf	500 V	Ceramic
C-7	Part of T-3			
C-8	47X562	5 mmf	500 V	Ceramic
C-9	47X584	1.5 mmf		Composition
C-10	47X568	360 mmf	500 V	Molded Mica
C-11, C-27, C-58, C-72, C-77	RCP10M4473M	.047 mf	400 V	Tubular
C-12, C-66, C-74	RCP10M4104M	.1 mf	400 V	Tubular
C-13, C-37	RCP10M6473M	.047 mf	600 V	Tubular
C-14	RCP10M6153M	.015 mf	600 V	Tubular
C-15	RCP10M2104M	.1 mf	200 V	Tubular
C-20, C-23, C-63	RCP10M2224M	.22 mf	200 V	Tubular
C-25, C-33, C-56, C-60	RCP10M4103M	.01 mf	400 V	Tubular
C-30A, C-30B, C-30C	45X399	20 mf, 40 mf, 10 mf	300 V, 50 V, 300 V	Dry Electrolytic
C-31A, C-31B, C-31C	Part of 76X7 (See Miscellaneous)			
C-32, C-65	47X543	4700 mmf	5000 V	Molded Mica
C-34, C-46	47X604	100 mmf	500 V	Ceramic
C-35A, C-35B	45X395	100 mf, 80 mf	50 V, 300 V	Dry Electrolytic
C-36, C-39	RCP10M6104M	.1 mf	600 V	Tubular
C-38	RCP10M6103M	.01 mf	600 V	Tubular
C-41	45X361	4 mf	100 V	Dry Electrolytic
C-42	Part of L-13			
C-43, C-44	Part of T-6			
C-45, C-47, C-49	47X507	5000 mmf		Ceramic
C-48, C-84	Part of T-7			
C-51, C-71	45X378	5 mf	25 V	Dry Electrolytic
C-52, C-64	RCP10M2473M	.047 mf	200 V	Tubular
C-53	47X525	470 mmf	500 V	Molded Mica
C-54, C-55, C-61	RCP10M4472M	.0047 mf	400 V	Tubular
C-57	Part of 76X5 (See Miscellaneous)			
C-59	RCP10M6472M	.0047 mf	600 V	Tubular
C-67	RCM20B431K	430 mmf	500 V	Molded Mica
C-68	47X570	330 mmf	500 V	Molded Mica

CAPACITORS—Continued

C-69	RCM20A271K	270 mmf	500 V	Molded Mica..
C-70	45X393	30 mf	400 V	Dry Electrolytic
C-75	47X598	56 mmf	1500 V	Ceramic......
C-76	RCP10M4154M	.15 mf	400 V	Tubular......
C-78	47X560	500 mmf	20 KV	Ceramic......
C-79A, C-79B	45X397	60 mf / 80 mf	300 V / 300 V	Dry Electrolytic
C-81, C-82	47X615	.01 mf		Ceramic......

RESISTORS

		Ohms	Watts	
R-1	B83822	8.2 K	0.5	Carbon......
R-2, R-5	B83470	47	0.5	Carbon......
R-3, R-6, R-27, R-61, R-65	B85102	1 K	0.5	Carbon......
R-4, R-7	B83223	22 K	0.5	Carbon......
R-8	B84181	180	0.5	Carbon......
R-9, R-12	B84152	1.5 K	0.5	Carbon......
R-10	Part of L-5			
R-11	C84562	5.6 K	1.0	Carbon......
R-13, R-19	B84105	1.0 Meg.	0.5	Carbon......
R-14, R-60	B84101	100	0.5	Carbon......
R-15	Part of L-10			
R-16	C83392	3.9 K	1.0	Carbon......
R-17	Part of L-11			
R-18, R-24, R-106	B85104	100 K	0.5	Carbon......
R-20, R-63, R-85	B84333	33 K	0.5	Carbon......
R-21	B84222	2.2 K	0.5	Carbon......
R-22, R-71	78X13	1.5 K / 1.0 meg.		Contrast and Volume Control
R-23, R-67, R-68	B84223	22 K	0.5	Carbon......
R-25	40X290	500 K		Brightness Control
R-26, R-74	B85473	47 K	0.5	Carbon......
R-28, R-64, R-78, R-80	B84104	100 K	.05	Carbon......
R-29, R-30	B85151	150	0.5	Carbon......
R-31	B84275	2.7 meg.	0.5	Carbon......
R-32	B83334	330 K	0.5	Carbon......
R-33, R-93	B84474	470 K	0.5	Carbon......
R-34, R-35	B84473	47 K	0.5	Carbon......
R-36, R-56	B84103	10 K	0.5	Carbon......
R-37	B84274	270 K	0.5	Carbon......
R-38	B84155	1.5 meg.	0.5	Carbon......
R-39	40X363	7.5 meg.		Sync Stability Control..
R-40, R-69, R-70	B84683	68 K	0.5	Carbon......
R-41	B84824	820 K	0.5	Carbon......
R-42, R-44	B83222	2.2 K	0.5	Carbon......
R-43	B84332	3.3 K	0.5	Carbon......
R-45	C84102	1 K	1.0	Carbon......

RESISTORS—Continued

		Ohms	Watts	
R-46A, R-46B, R-46C	Part of 76X7 (See Miscellaneous)			
R-47, R-81	B85474	470 K	0.5	Carbon......
R-48	B84821	820	0.5	Carbon......
R-49	40X362	8 K		Vertical Lin. Control
R-50	B84185	1.8 meg.	0.5	Carbon......
R-51	40X291	1.0 meg.		Vertical Hold Control
R-52	B84184	180 K	0.5	Carbon......
R-53, R-55, R-57	B84225	2.2 meg.	0.5	Carbon......
R-54	40X364	2.5 meg.		Height Control
R-58, R-107	B84561	560	0.5	Carbon......
R-59	C84332	3.3 K	1.0	Carbon......
R-62	B84563	56 K	0.5	Carbon......
R-66	B84271	270	0.5	Carbon......
R-72	40X291	1.0 meg.		Tone Control..
R-73	B85106	10.0 meg.	0.5	Carbon......
R-75A, R-75B	Part of 76X5 (See Miscellaneous)			
R-76	C84331	330	1.0	Carbon......
R-77	D84102	1 K	2.0	Carbon......
R-79	B85475	4.7 meg.	0.5	Carbon......
R-82	B84273	27 K	0.5	Carbon......
R-83, R-84	C84682	6.8 K	1.0	Carbon......
R-86	B83182	1.8 K	0.5	Carbon......
R-87	C83512	5.1 K	1.0	Carbon......
R-88	B83224	220 K	0.5	Carbon......
R-89	40X331	150 K		Horizontal Drive Control
R-91	B83154	150 K	0.5	Carbon......
R-92	B84562	5.6 K	0.5	Carbon......
R-94	40X292	50 K		Horizontal Hold Control
R-95	D84101	100	2.0	Carbon......
R-96	D84752	7.5 K	2.0	Carbon......
R-97	43X238	3.3	0.5	Wirewound...
R-98	B85102	1 K	0.5	Carbon......
R-99	C85105	1.0 meg.	1.0	Carbon......
R-100	B83472	4.7 K	0.5	Carbon......
R-101	43X272	10 K	5.0	Wirewound...
R-102	43X275	1.5 K	15.0	Wirewound...
R-104	Part of L-9			
R-105	B85274	270 K	0.5	Carbon......
R-108	40X364	2.5 meg.		AGC........
R-109	D85104	100 K	2.0	Carbon......
R-110	43X279	8 K	5.0	Wirewound...
R-111	D84123	12 K	2.0	Carbon......

TRANSFORMERS AND COILS

L-1, L-2, L-3	9A2033	R-F Heater Choke ....
L-4, L-8	9A1979	Peaking Coil 36 mh ....
L-5	36A10	Peaking Coil 60 mh ....
L-6	36A11	Peaking Coil 500 mh ....
L-7	9A2074	4.5 MC Trap ....
L-9	36A16	Peaking Coil 80 mh ....
L-10	36A12	Peaking Coil 160 mh ....
L-11	36A13	Peaking Coil 190 mh ....
L-12, L-17	Part of Deflection Yoke Assembly	
L-13	9A2168	Sound Take-Off Coil ....
L-14	9A2096	Horizontal Frequency Coil ....
L-15	9A2183	Width Control ....
L-16	9A2262	Horizontal Linearity Control ......
L-18	52X91	Filter Choke ....
T-1, T-2	9A2230	1st and 2nd Pix I-F Coils ....
T-3	9A2226	3rd Pix I-F Coil ....
T-4	54X8	Vertical Osc. Transformer ....
T-5	51X156	Vertical Output Transformer ....
T-6	9A2170	Sound I-F Transformer ....
T-7	9A2269	Sound Ratio Det. Transformer ......
T-8	51X150	Audio Output Transformer ....
T-9	53X329	Horizontal Output Transformer .....
T-10	53X334	Power Transformer ....

MISCELLANEOUS

2A426	Centering Device ....
76X5	Multiple Resistor Capacitor Assembly ....
76X7	Multiple Resistor Capacitor Assembly ....
9A2261	Deflection Yoke Assembly ....
2A421	Ion Trap Magnet ....
4A408	Antenna Terminal Strip ....
3A427	Tube Socket (6AQ5) ....
3A458	Tube Socket (6CB6) (6AU6) (6AL5) ....
3A463	Tube Socket (12AT7) ....
3A464	Tube Socket (6BQ6) (6SN7) ....
3A466	Tube Socket (1B3) ....
3A470	Tube Socket (Octal) ....
3A445	Tube Socket (6AX4) ....
13X816	Pix Tube Socket ....
32X403	Tube Shield (3A458 Socket) ....
32X405	Tube Shield (3A463 Socket) ....
6A320	Anode Connector & Lead Assembly ....
8X227	Collar, Pix Tube Rear Mtg. ....
S-25X69	Tube Mtg. Strap Assembly ....
S-25X70	Tube Mtg Strap Assembly (Top) ....
20X1652	Wing Screw (Deflection Yoke) ....
6X67	Rubber Grommet ....
25X1844	Bracket, Tube Front Support (R.H.) ....
25X1845	Bracket, Tube Front Support (L.H.) ....
16X146	Fuse Holder ....
16X147-3	Fuse 4/10 Amp. 125-250 V. ....
S-34X19	Tube Cover & Power Cord Assembly ....
	No. 6-32 Wing Nut ....
7A246	Pilot Light Socket Assembly (UHF Dial) ....
7A234	Pilot Light Socket Assembly (Channel Selector)...
7A32	No. 51 Pilot Bulb ....
25X1827	Bracket, Pix Tube Rear Mtg. ....
10X88	UHF Tuner Drive Cord Assembly ....
28X603	UHF Tuner Drive Cord Tension Spring........
25A1105	UHF Tuner R. F. (Mallory) ....
25A1109	VHF Tuner R. F. (Standard Coil) ....
26X530	Shaft & Pulley Assembly ....
S-37X4	Shaft Coupling Assembly ....
S-37X3	Switch Cam Assembly ....
2A430	Switch Assembly (VHF-UHF) ....
11X163	Switch Assembly Cover ....
25X1887	Dial Bracket ....
19X108	Flat Washer ....
10X89	Dial Drive Cord Assembly ....
28X603	Dial Drive Cord Tension Spring ....
58X767	Dial Glass ....
15X277	Pointer ....
41X92	Light Shield (Pilot Light) ....
52X92	Filter Low Pass ....
28X564	Spring Clips ....
28X604	Spring Washer ....
25X1804	Tuner Shaft Support Bracket ....
4X1210-2	Escutcheon Plate ....
20X1772	Compression Ring (10A820 Knob) ....
12A504	6" PM Speaker ....
17X178	Pix Crystal ....
S-14X73	Cabinet Back Assembly ....
10A820-1	Knob (Fine Tuning) ....
10A821-1	Knob (Contrast) ....
10A822-1	Knob (Channel Selector) ....
10A779	Knob (Volume) ....
S-4X29	Escutcheon Control Panel Assembly (Model 9023A)
S-4X29-3	Escutcheon Control Panel Assembly (Model 9023B)
4X1219-3	Plastic Molding (Model 9023B) ....
8X234	Mounting Foot, Felt ....
4X1217-1	Pix Mask (Model 9023A) ....
4X1217-2	Pix Mask (Model 9023B) ....

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MODEL 43-9061A

MODEL 43-9050A

MODEL 43-9061B (MAH.)
MODEL 43-9064A (OAK)

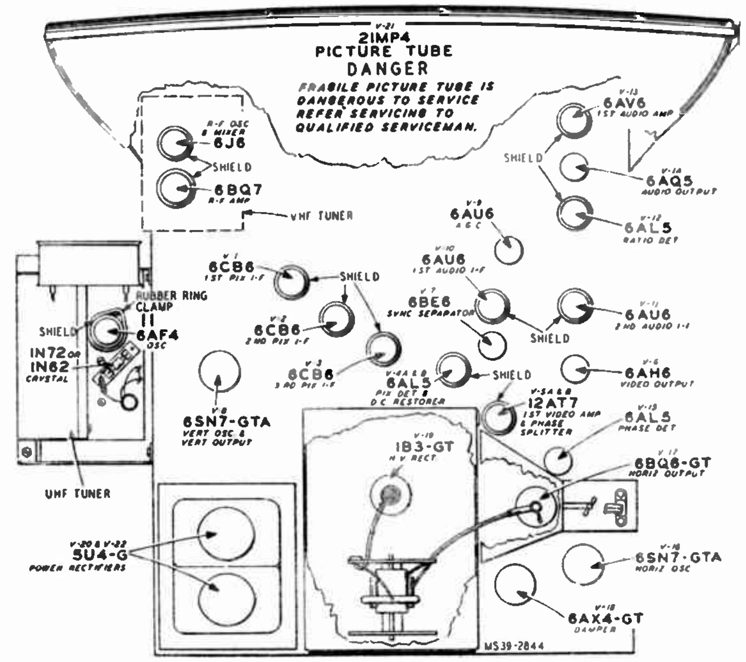


Fig. 1- Tube Layout.

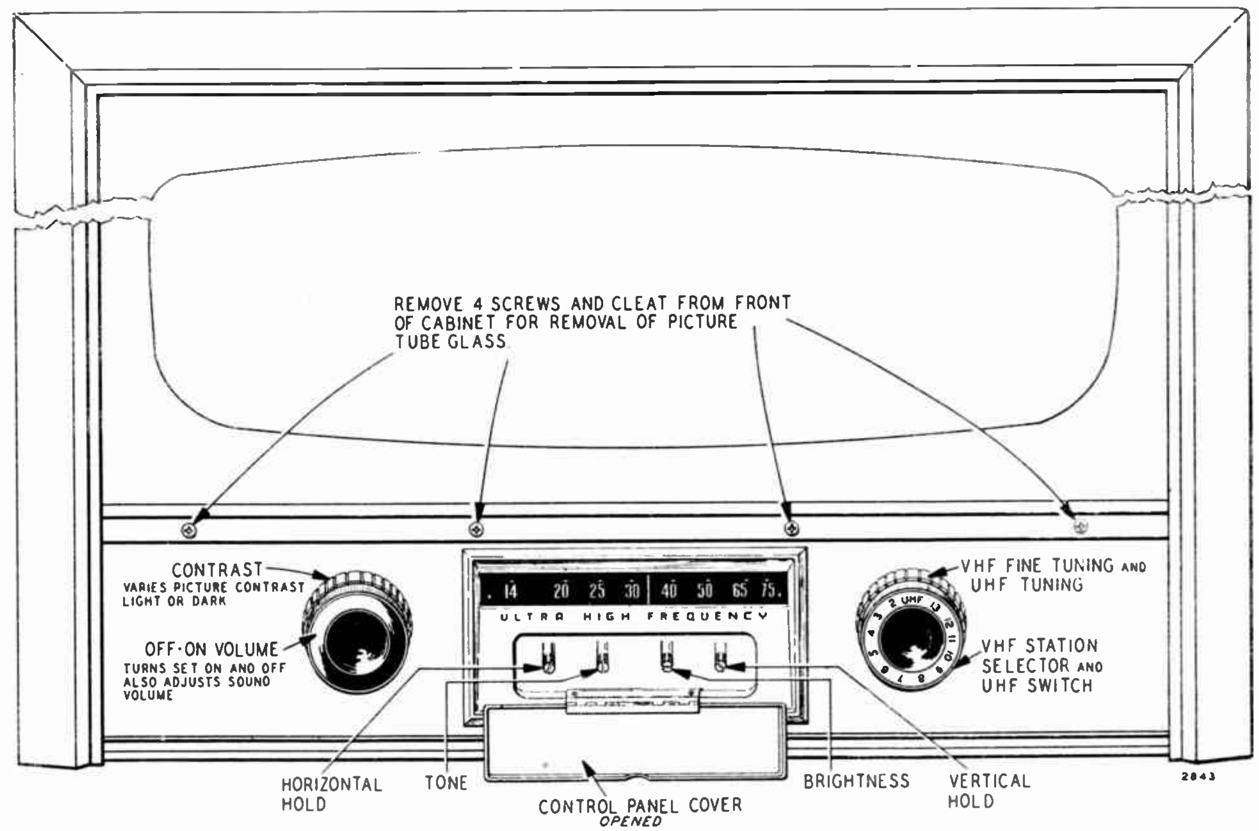


Fig. 2—Front Panel Controls

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles Only
Power Consumption	210 Watts
Power Output	2.4 Watts (Max.) 1.8 Watts (10% Distortion)
Tuning Ranges	VHF — Channels 2 thru 13 UHF — Channels 14 thru 83
Antenna Input Imp.	300 Ohms Balanced
Intermediate Frequencies	Picture 26.20 MC Sound 21.70 MC
I-F (UHF Position Only)	Picture 121.75 Sound 126.25
Intercarrier Sound System	4.5 MC
Loud Speaker	See Parts List
Voice Coil Imp.	3.2 Ohms 400 Cycles

TUBE COMPLEMENT

Symbol	Type	Function
VHF Tuner	6J6	R-F Osc. and Mixer
*VHF Tuner	6BQ7	R-F Amplifier
UHF Tuner	6AF4	R-F Osc.
UHF Tuner	1N72 or 1N82	Crystal Mixer

TUBE COMPLEMENT—Continued

Symbol	Type	Function
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V-5 A & B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20 & V-22	5U4-G	Low Voltage Rectifier
V-21	21MP4	Picture Tube 21" Metal Rectangular (Electrostatic)

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

PICTURE TUBE SAFETY GLASS

PICTURE TUBE SAFETY GLASS — It will be necessary to clean the picture tube safety glass and the face of the picture tube occasionally. Remove the screws and cleat as outlined in the illustration. Insert your fingers into the opening at the center of the frame and carefully lift up and pull out the safety glass. Clean the safety glass and the face of the picture tube with a soft lint-free cloth dampened with water or mild soapsuds.

For models that have the cleat and screws at the top of the cabinet the following caution must be observed. CAUTION — UPON REMOVAL OF THE LAST SCREW AND THE CLEAT THE GLASS MAY FALL FORWARD. SUPPORT THE GLASS WITH ONE HAND AS YOU LIFT IT GENTLY FROM THE CABINET.

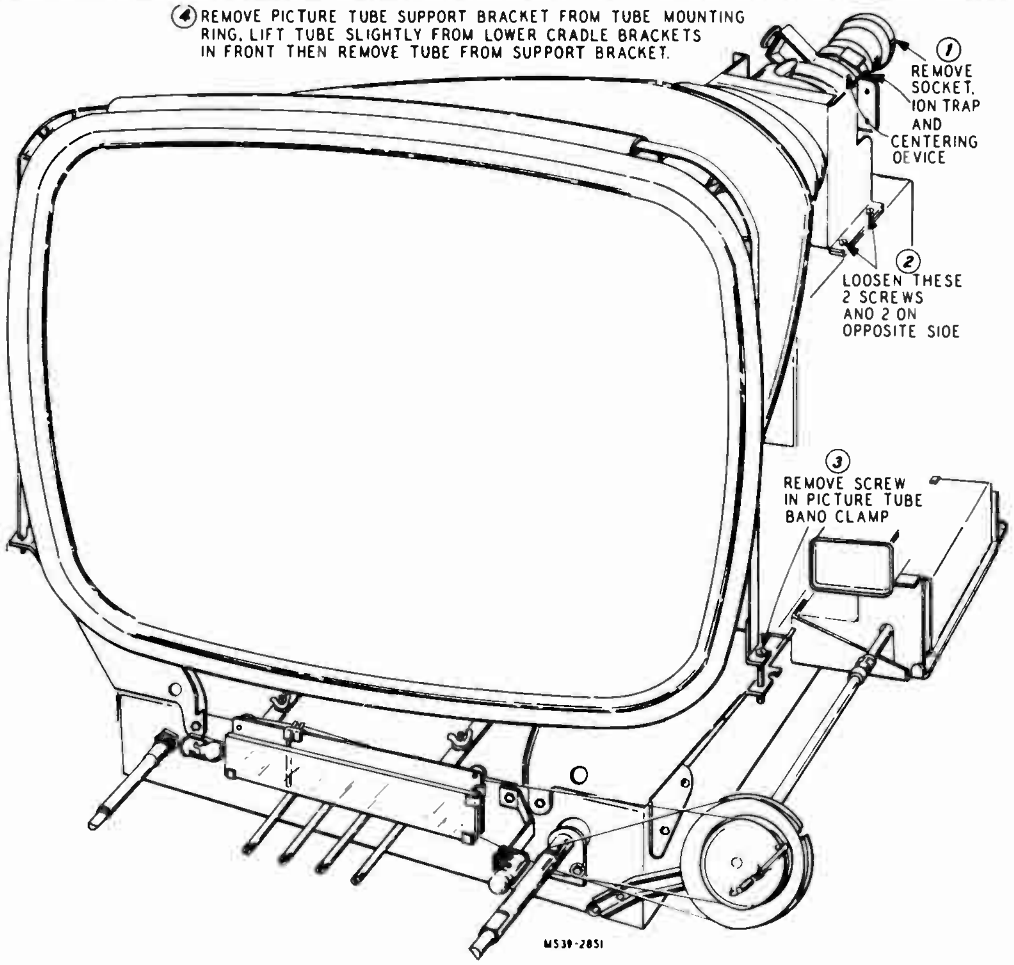


Fig. 3—Removal of Picture Tube

WARNING — Before handling the picture tube, it will be necessary to remove the static charge. In receivers with glass picture tubes, ground the anode lead to chassis, and insert an insulated wire from the well in the tube to chassis. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

PICTURE TUBE REPLACEMENT — To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove the cabinet back.
3. Disconnect the leads from the speaker, remove the antenna terminal board at the rear of the cabinet and then the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

FRONT OF CHASSIS

(Accessible After Opening Front Panel Control Cover)

Horizontal Hold	R-94
Brightness	R-25
Vertical Hold	R-51
Tone	R-72

NON-OPERATING CONTROLS REAR OF CHASSIS

Horizontal Centering	Centering Device
Vertical Centering	Centering Device
Ion Trap Magnet	See paragraph,
Deflection Yoke	Wing Screw
Width	L-15
Horizontal Linearity	L-16
Horizontal Drive	R-89
Horizontal Frequency	L-14
Vertical Linearity	R-49
Height	R-54
Sync Stability	R-39
AGC Threshold Control	R-108

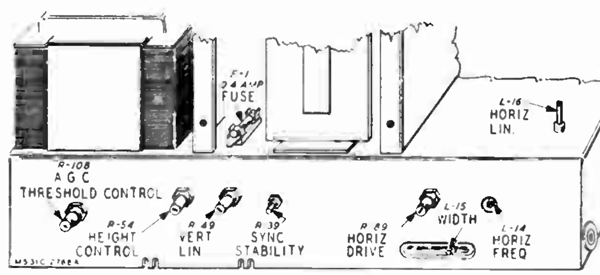


Fig. 4—Adjustments Rear of Chassis

ION TRAP MAGNET ADJUSTMENT—The ion trap magnet should be positioned close to the base of the tube with the magnet of the ion trap on the side where the electron gun is nearest the glass neck of the picture tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to make sure that the ion trap magnet is correctly adjusted.

DEFLECTION YOKE ADJUSTMENT — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

CENTERING ADJUSTMENT — If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained. If a clamp type centering device is used, rotate the device to the left or right and turn the knob located at the top of the device until the picture is centered correctly.

PICTURE ADJUSTMENT — For further adjustments, obtain a test pattern on the receiver. Turn on receiver and follow tuning procedure. When a test pattern is obtained it may be necessary to slightly re-adjust the fine tuning control for clearest picture.

ADJUSTMENT OF AGC THRESHOLD CONTROL — Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL — When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control slowly clockwise until bending occurs at top of picture. Then turn the control a few degrees counter-clockwise until bending disappears. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.

When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT — With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT — Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS— While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (R-89) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (R-89) will be necessary. Adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

Caution — These adjustments are intended only for VHF Channels. For information regarding UHF alignment, see paragraph "Tuner Alignment".

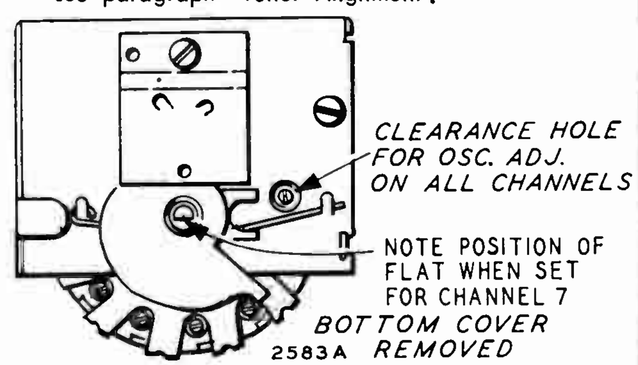


Fig. 5—Tuner Oscillator Adjustments

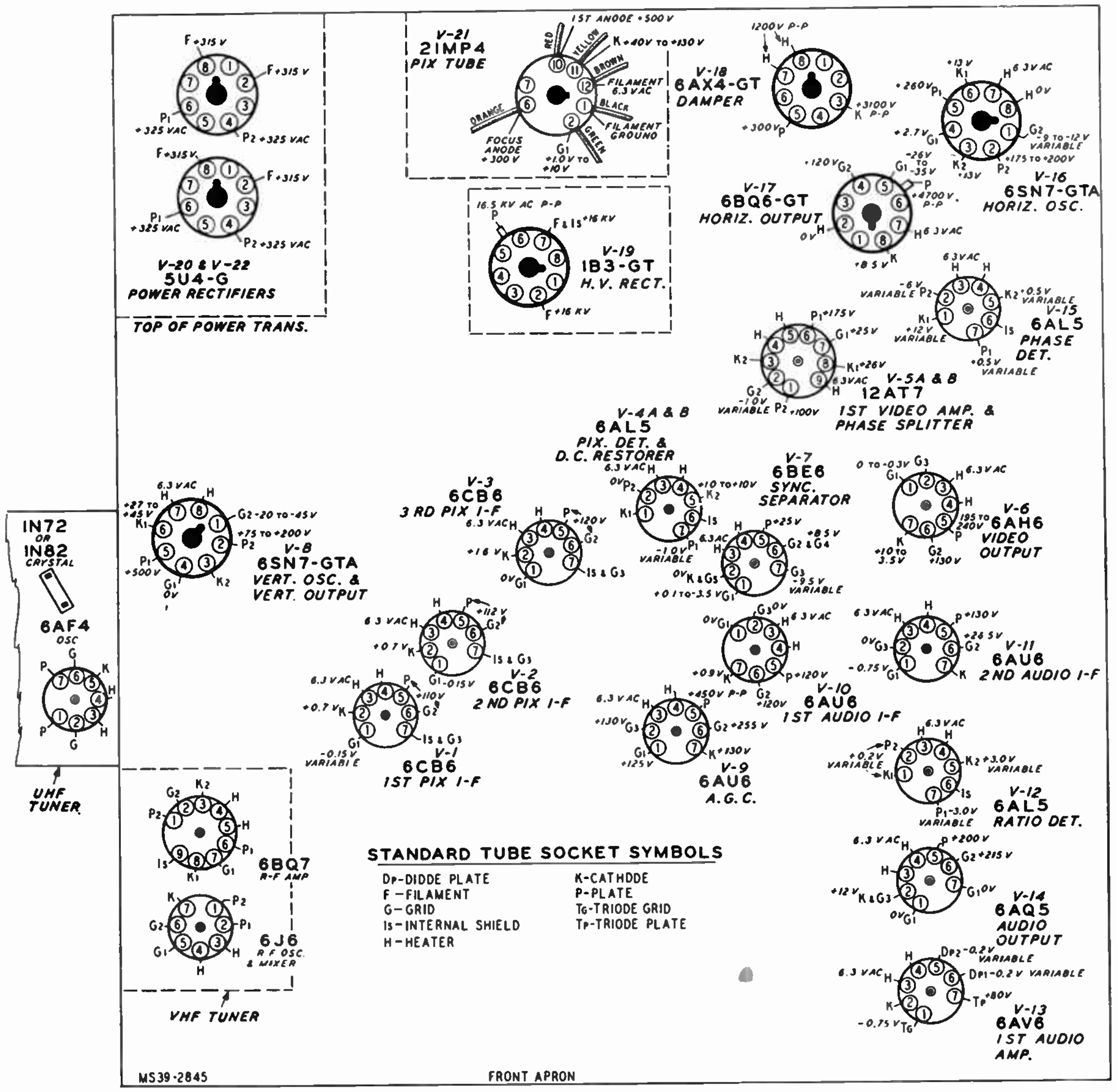


Fig. 6—Bottom Socket Voltages

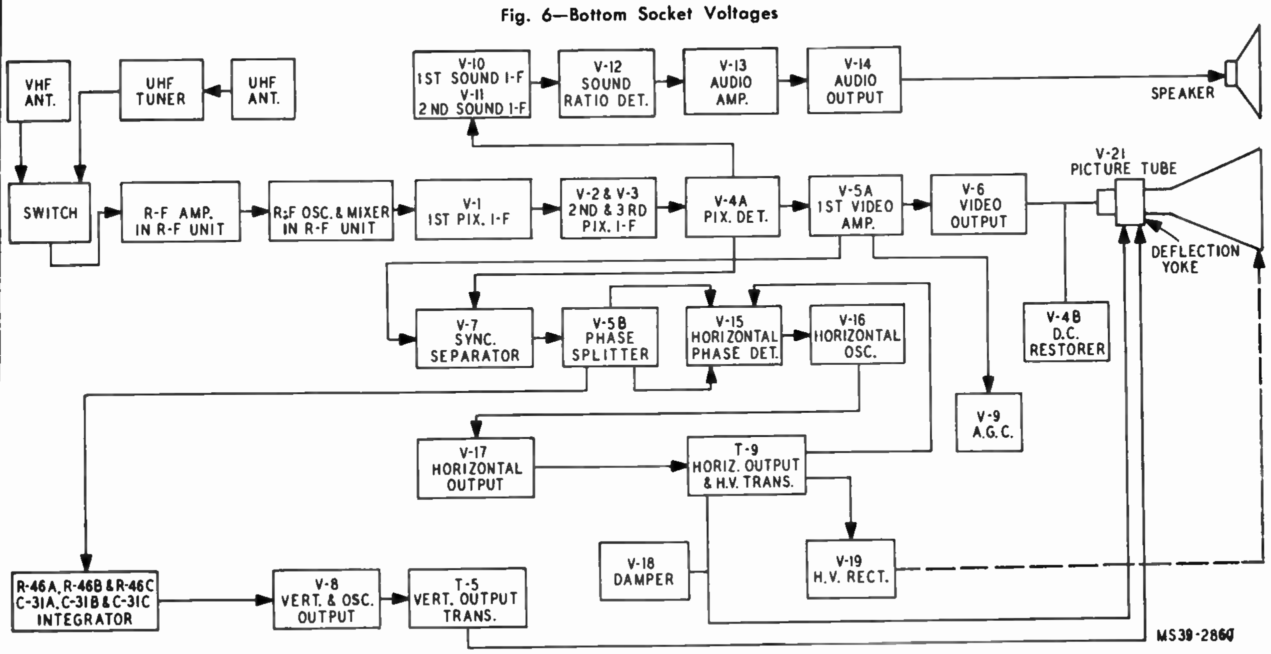


Fig. 7—Block Diagram

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.

1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
   (A) Horizontal output tube V-17 (6BQ6-GT)
   (B) Check damper tube V-18 (6AX4-GT).
   (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
   (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
   (E) Check DC resistance of T-9.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-99 and C-78 defective or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:

1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.

1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-35A, C-39 or C-70 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitor C-37, or open or incorrect value of resistors R-55 & R-56.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-36 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:

1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6AX4-GT).
3: Check capacitors C-74, C-76, C-77 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER

1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:

1: Defective yoke due to C-75 or R-98 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2: V-18 (6AX4-GT) defective.

SMALL RASTER — This condition can be caused by:

1: Low +B or line voltage. Check V-20 & V-22 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control R-89.
5: V-18 (6AX4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND — This condition can be caused by:

1: No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY — A condition of this nature can be caused by:

1: Defective sync separator V-7 or phase splitter V-5B.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY — If this condition is encountered, check:

1: Vertical integrating network capacitors C-31A, B & C, and resistors R-46 A, B & C.
2: Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY

1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:

1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (6AH6).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5: Leakage in V-6 (6AH6) grid capacitor C-11. If the capacitor is not found to be defective, check the following:
   1: Check all potentials in video circuits.
   2: Check picture tube grid circuit for poor or dirty contact.
   3: Check and realign, if necessary, the picture I-F and R-F circuits.

SERVICE SUGGESTIONS—(continued)

PICTURE SMEAR:

1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc)

1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S-ING

1: Check sync stability control adjustment.
2: Check capacitors C-35B and C-79B.
3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4: Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5: Check AGC threshold control.

PICTURE NORMAL—NO SOUND OR WEAK OR DISTORTED SOUND

1: Check sound I-F alignment.
2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

RASTER ON TUBE BUT NO PICTURE OR SOUND

This condition can be caused by,
1: Defective pix I-F Amplifier tubes V-1, V-2 or V-3
2: Defective pix detector tube V-4A (6AL5). Check tube and its associated circuit.
3: Defective R-F Amplifier or oscillator mixer tubes in the tuner.
4: UHF-VHF switch defective.

POOR FOCUS

1: Improper setting of Ion Trap magnet.
2: Defective picture tube or picture tube socket.

PICTURE JITTER:

1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).
6: Check for improper setting of sync stability control.
7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8: Check AGC threshold control.

NO PICTURE OR SOUND OR WEAK PICTURE OR SOUND IN UHF POSITION

If this condition is encountered
1: Check to see whether or not a UHF station is operating in the vicinity.
2: The 6AF4 oscillator tube or the IN72 (or IN82) crystal may be defective.
3: Pre-selector in UHF tuner defective.
4: Low pass filter defective.
5: The UHF antenna and oscillator strips in the VHF tuner defective.
6: Defective switch on UHF tuner.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:
(a) Frequency ranges:
18 to 30 mc, 10 mc sweep width
40 to 90 mc, 10 mc sweep width
120 to 130 mc, 10 mc sweep width
170 to 225 mc, 10 mc sweep width
470 to 890 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)
(a) Intermediate alignment frequencies.
23.1 mc first picture I-F coil.
24.1 mc third picture I-F coil.
25.9 mc second picture I-F coil.
21.7 mc sound trap.
4.5 mc video trap & sound I-F.
25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-99.

ALIGNMENT PROCEDURE
PIX I-F

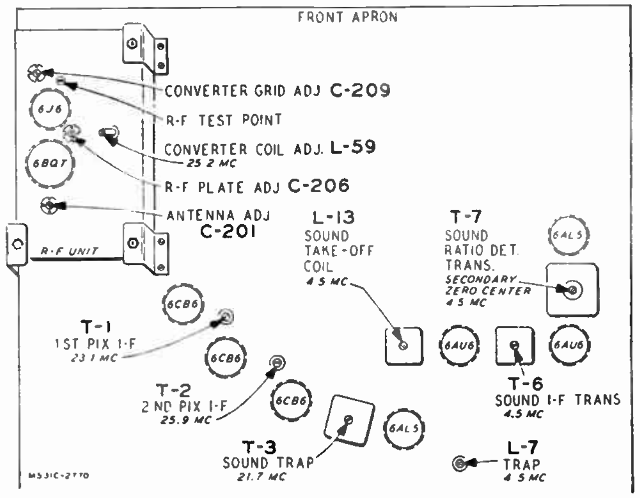


Fig. 8—Top Chassis Video and Audio I-F Adjustments

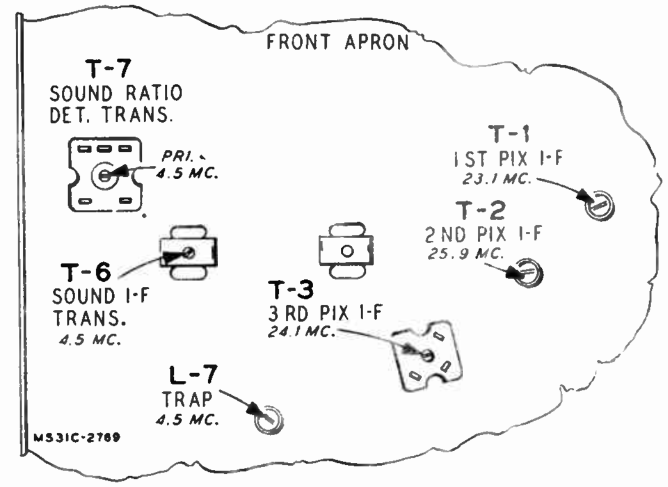


Fig. 9—Bottom Chassis Video and Audio I-F Adjustments.

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-100) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line.

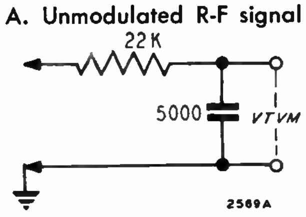


Fig. 10—VTVM Connections

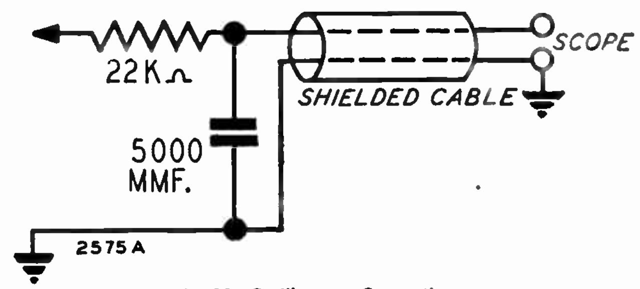


Fig. 11—Oscilloscope Connections

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-100 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery). Tuner should be switched to dead channel so as not to cause interference.

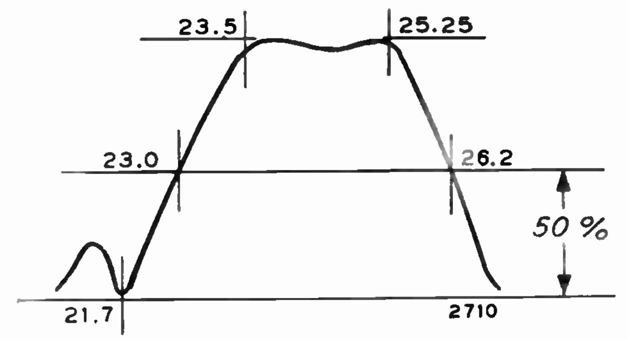


Fig. 12—Overall Response Curve

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

ALIGNMENT PROCEDURE (Continued)

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-62 and C-46, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-66, R-69 and C-50, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect 1½ V bias to AGC line at junction of R-33 and C-20 on the receiver.

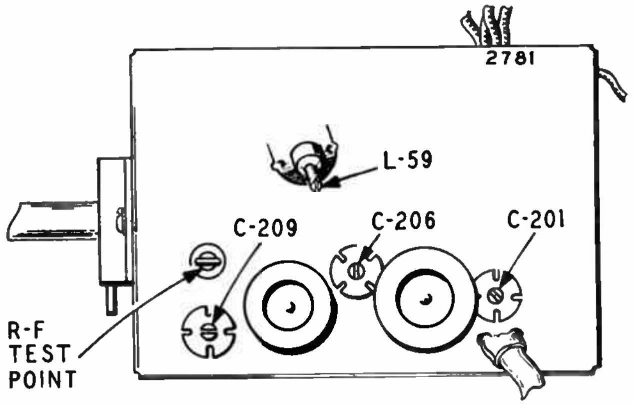


Fig. 13—Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

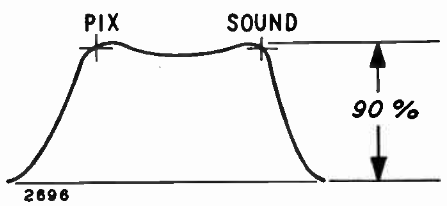


Fig. 14—Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-21.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.
4. To adjust oscillator on UHF position, feed the sweep generator with center frequency of 124 MC and markers at 121.75 and 126.25 into the input of the low pass filter (output of UHF tuner). Adjust oscillator slug in the VHF tuner so that the 121.75 pix carrier marker is at 50% and that 126.25 marker is in the sound notch. If a sweep generator is not available, a single frequency generator set to 126.25 MC and VTVM may be used. Connect VTVM to the pix detector load resistor R-100. Feed generator into the low pass filter. Adjust oscillator slug in the VHF tuner so that the 126.25 marker is in the sound notch of the I-F curve.
5. If the 6AF4 oscillator tube in the UHF tuner is replaced, it may be necessary to adjust the oscillator trimmer C-309 on the UHF tuner located underneath the chassis. (See Figure 15). Adjust this trimmer until the tuner will cover a range of below 470 MC to above 890 MC.

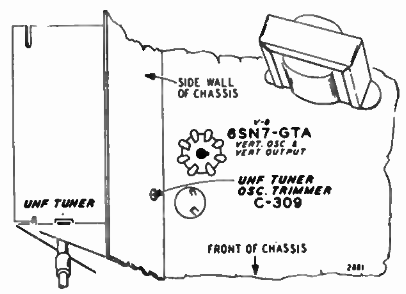


Fig. 15—UHF Tuner Adjustment.

VHF TUNER ASSEMBLY INFORMATION

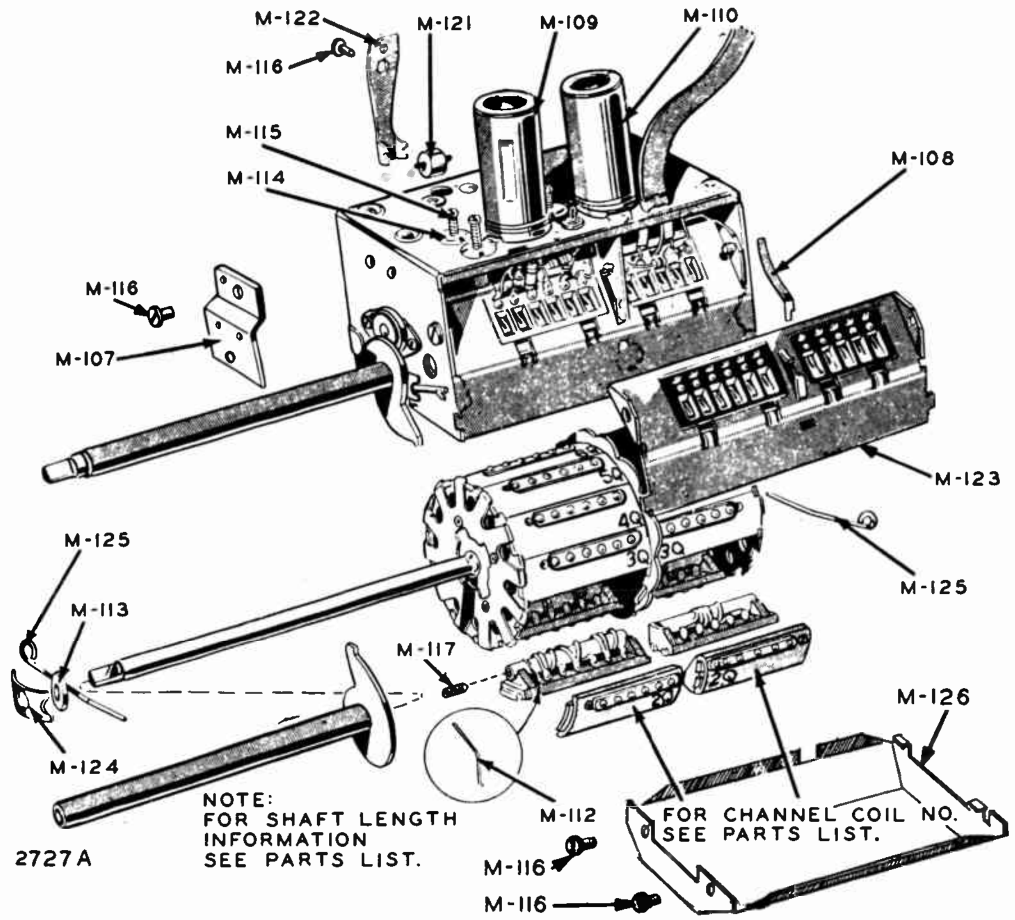


Fig. 16—"Q" Tuner Pictorial.

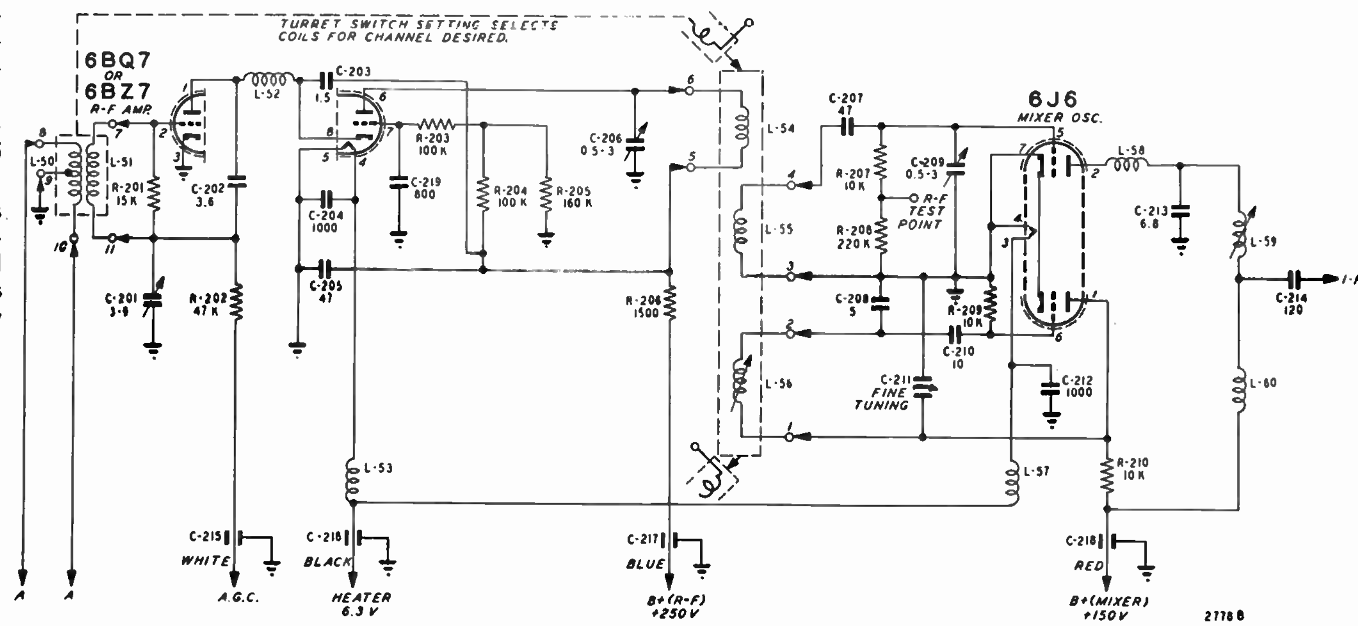


Fig. 17—"Q" Tuner Schematic Diagram.

UHF TUNER INFORMATION

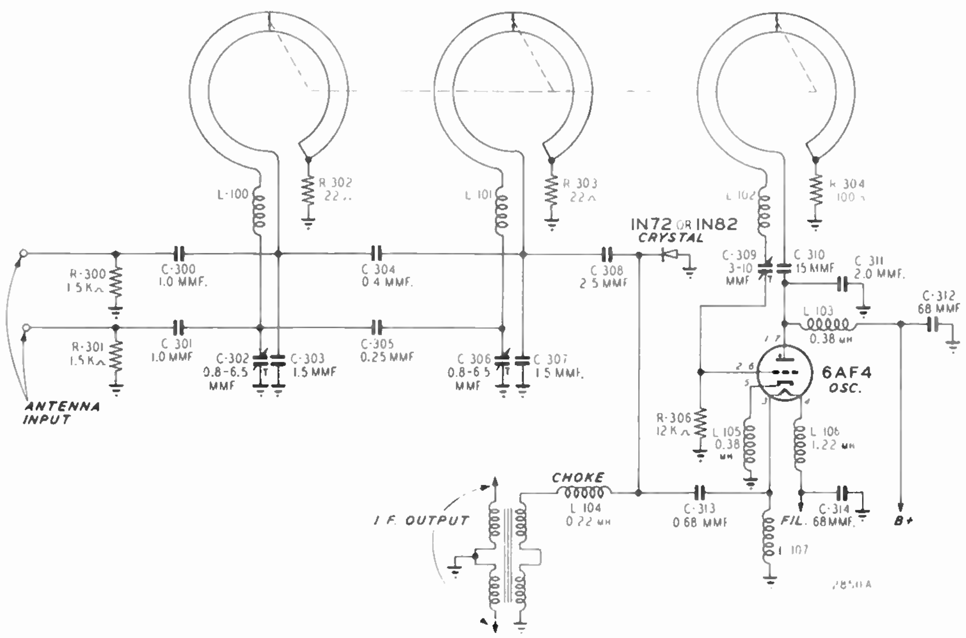


Fig. 18—UHF Tuner Schematic Diagram.

Due to the complexity of the UHF tuner, neither servicing nor aligning is encouraged in the field because replacement of any component within the R-F circuit may disturb the band-pass characteristics of the tuner. However, the 6AF4 tube or the 1N72 (or 1N82) crystal may be replaced in the field if found to be defective. A schematic diagram of this tuner is shown only for the purpose of outlining the circuit used.

If the UHF tuner does not operate satisfactorily after the tube or crystal replacement, disconnect the tuner and return it to the factory for repair.

DRIVE CORD REPLACEMENT

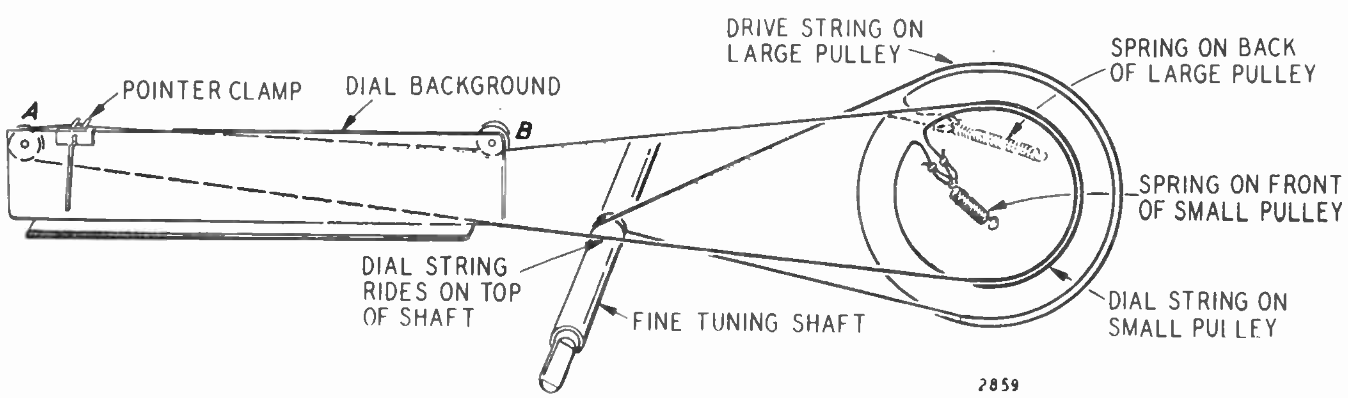


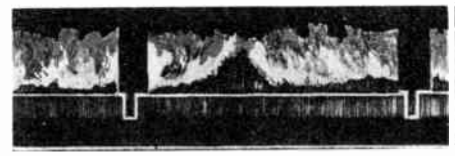
Fig. 19—Drive Cord Stringing.

You will note that there are two cords used for the pointer drive system on this receiver. Part number 10X88 Drive Cord assembly and part number 28X603 Spring are used on the tuning shaft and large pulley, while part number 10X89 Drive Cord and a part number 28X603 Spring are used on the small pulley system and the pointer. Install the cords as shown in the illustration. After completing the installation rotate the fine tuning shaft a few turns to take up the slack in the cord.

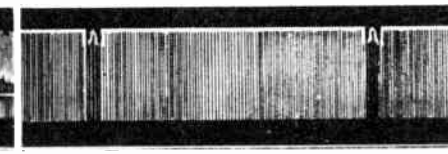
OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.

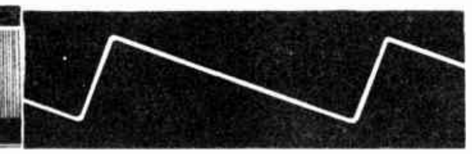
The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.



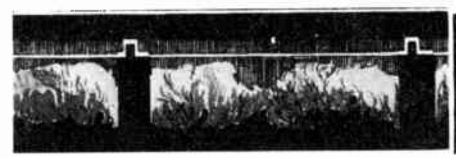
No. 1—6AL5 Pix Det. Plate
3.5V P-P 60 C.P.S.
No. 4—6BE6 Sync Sep.
Grid No. 1 .2V P-P 60 C.P.S.



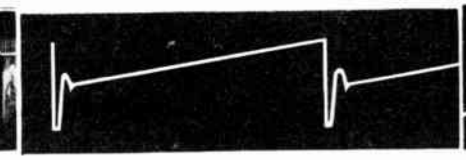
No. 7—12AT7 Phase Splitter Plate
45V P-P 60 C.P.S.



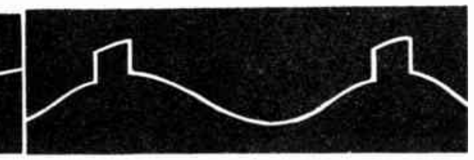
No. 13—6AL5 Phase Det.
18V P-P 15,750 C.P.S.



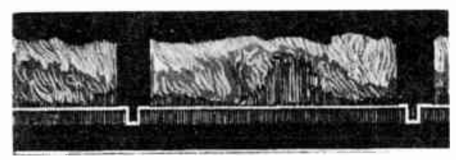
No. 2—12AT7 Plate
35V P-P 60 C.P.S.
No. 2—6AH6 Grid
8V P-P 60 C.P.S.



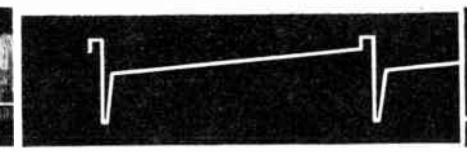
No. 8—6SN7-GTA—Vert. Osc. Plate
125V P-P 60 C.P.S.



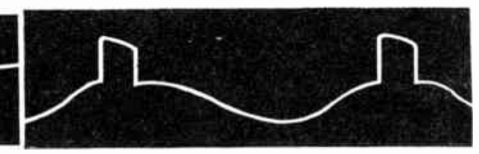
No. 14—6SN7—Hor. Osc. Plate
50V P-P 15,750 C.P.S.



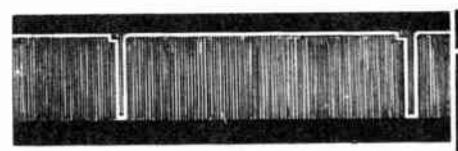
No. 3—Pix Tube Grid
20-100V P-P 60 C.P.S.



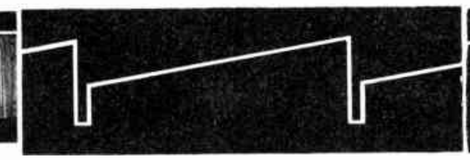
No. 9—6SN7-GTA Vert. Osc. Grid
170V P-P 60 C.P.S.



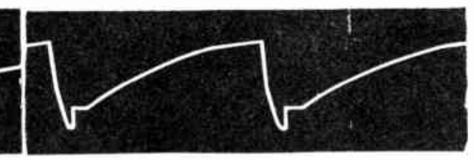
No. 15—6SN7 Hor. Osc. Grid
48V P-P 15,750 C.P.S.



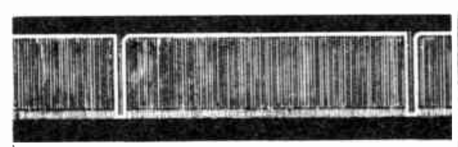
No. 5—6BE6 Sync Sep. Plate
20V P-P 60 C.P.S.



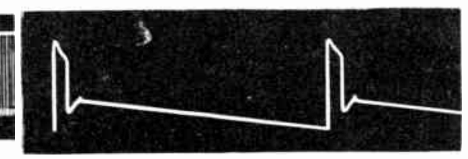
No. 10—6SN7-GTA Vert. Output Grid
150V P-P 60 C.P.S.



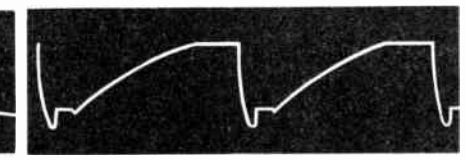
No. 16—6SN7 Hor. Osc. Plate
135V P-P 15,750 C.P.S.



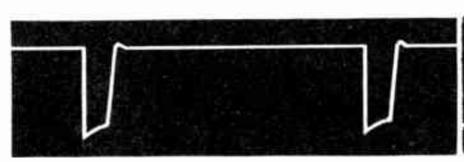
No. 6—12AT7 Phase Splitter Cathode
18V P-P 60 C.P.S.



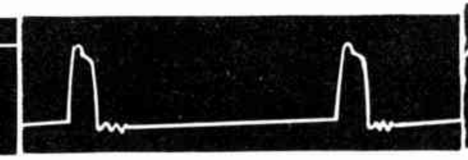
No. 11—Vert. Def. Coil
100V P-P 60 C.P.S.



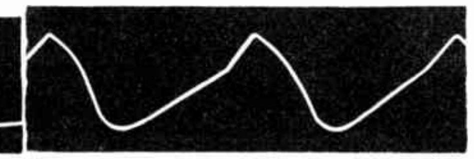
No. 17—6BQ6 Grid
120V P-P 15,750 C.P.S.



No. 6—12AT7 Phase Splitter Cathode
18V P-P 15,750 C.P.S.

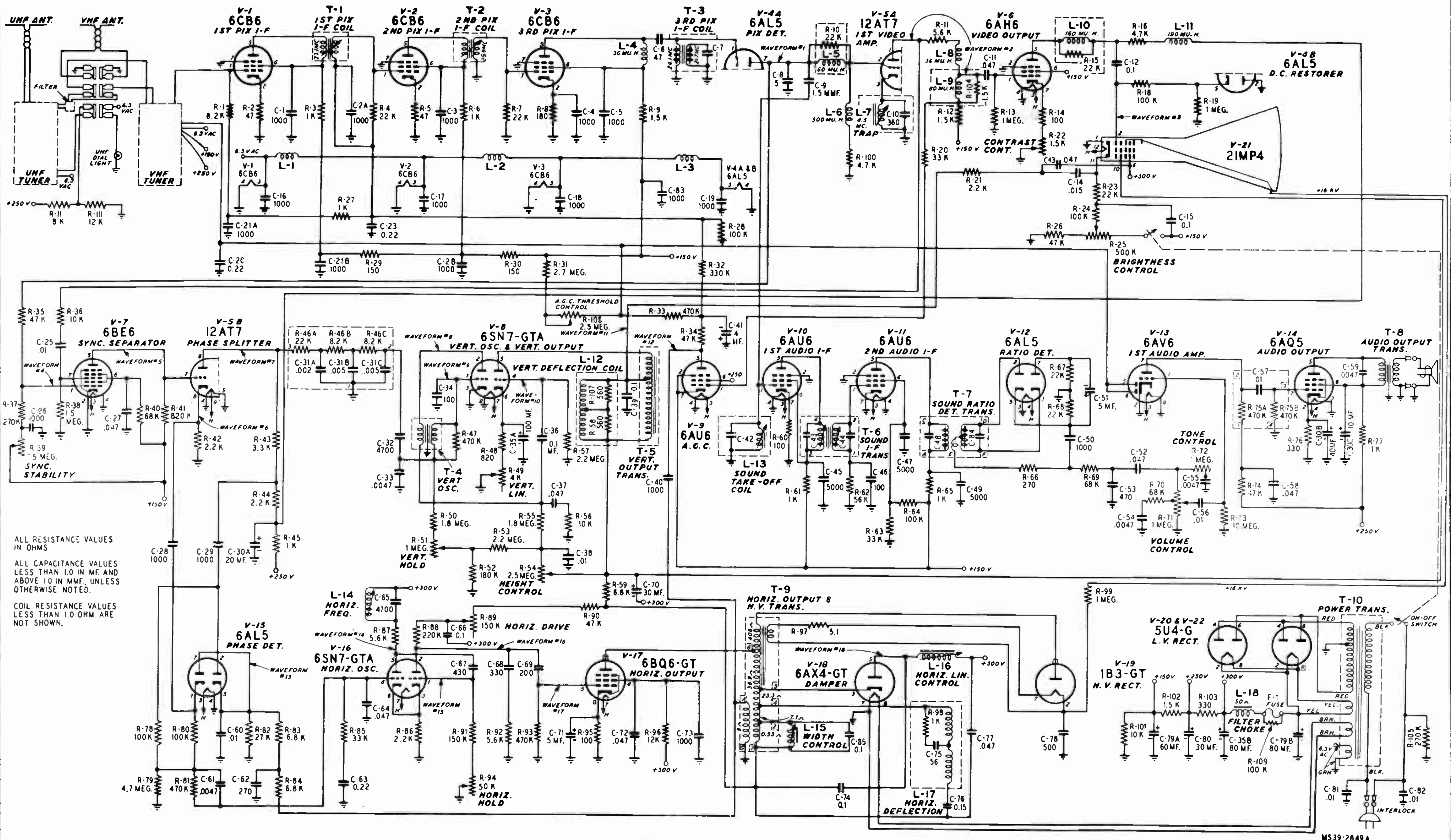


No. 12—6AU6 A.G.C.
450V P-P 15,750 C.P.S.



No. 18—6AX4-GT Damper Plate
120V P-P 15,750 C.P.S.

21" UHF-VHF TELEVISION RECEIVER



ALL RESISTANCE VALUES IN OHMS

ALL CAPACITANCE VALUES LESS THAN 1.0 IN MF. AND ABOVE 1.0 IN MMF., UNLESS OTHERWISE NOTED.

COIL RESISTANCE VALUES LESS THAN 1.0 OHM ARE NOT SHOWN.

PRODUCTION CHANGES

There are two different ratio detector transformers (T-7) used in these receivers, Part Numbers 9A2269 and 9A2295. The T-7 circuit shown in this schematic diagram covers the 9A2269 ratio detector. Receivers using the 9A2295 ratio detector can be identified by the following changes:

C-50 becomes 47X570 330 mmf molded mica condenser

R-64 becomes B84333 33K ohm 0.5 W carbon resistor

R-67 } R-68 } become B83103 10K ohm 0.5 W carbon resistors

In addition, the 9A2295 ratio detector has terminals with numerical identification (1, 2, 3 etc.) whereas the 9A2269 ratio detector has terminals with alphabetical identification (A, B, C etc.)

VHF TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	±10%	0.5
R-202	12A-039	47 K	±20%	0.5
R-203	12A-094	100 K	±10%	0.5
R-204	12A-166	100 K	±5%	0.5
R-205	12A-167	160 K	±5%	0.5
R-206	12A-183	1500	±10%	0.5
R 207, R 209, R 210	12A-040	10 K	±10%	0.5
R 208	12A-041	220 K	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204, C-212	CD8X102Z	1000 mmf	
C-205, C-207	CD8Q470K	47 mmf	±10%
C-206, C-209	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215, C-216, C-217, C-218	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

CAPACITORS

C-1, C-3, C-4, C-5, C-16, C-17, C-18, C-19, C-26, C-28, C-29, C-40, C-50, C-73, C-83	80X1	1000 mmf		Ceramic......
C-2A, C-2B, C-21A, C-21B	80X3	1000 mmf		Dual Ceramic..
C-6	47X603	47 mmf	500 V	Ceramic......
C-7	Part of T-3			
C-8	47X562	5 mmf	500 V	Ceramic......
C-9	47X584	1.5 mmf		Composition..
C-10	47X568	360 mmf	500 V	Molded Mica..
C-11, C-27, C-58, C-72, C-77	RCP10M4473M	.047 mf	400 V	Tubular......
C-12, C-66, C-74, C-85	RCP10M4104M	.1 mf	400 V	Tubular......
C-13, C-37	RCP10M6473M	.047 mf	600 V	Tubular......
C-14	RCP10M6153M	.015 mf	600 V	Tubular......
C-15	RCP10M2104M	.1 mf	200 V	Tubular......
C-20, C-23, C-63	RCP10M2224M	.22 mf	200 V	Tubular......
C-25, C-56, C-60	RCP10M4103M	.01 mf	400 V	Tubular......
C-30A, C-30B, C-30C	45X392	20 mf, 40 mf, 10 mf	400 V, 50 V, 400 V	Dry Electrolytic
C-31A, C-31B, C-31C	Part of 76X7 (See Miscellaneous)			
C-32, C-65	47X543	4700 mmf	500 V	Molded Mica..
C-33, C-54, C-55, C-61	RCP10M4472M	.0047 mf	400 V	Tubular......
C-34, C-46	47X604	100 mmf	500 V	Ceramic......
C-35A, C-35B	45X391	100 mf, 80 mf	50 V, 400 V	Dry Electrolytic
C-36, C-39	RCP10M6104M	.1 mf	600 V	Tubular......
C-38	RCP10M6103M	.01 mf	600 V	Tubular......
C-41	45X361	4 mf	100 V	Dry Electrolytic
C-42	Part of L-13			
C-43, C-44	Part of T-6			
C-45, C-47, C-49	47X507	5000 mmf		Ceramic......
C-48, C-84	Part of T-7			
C-51, C-71	45X378	5 mf	25 V	Dry Electrolytic
C-52, C-64	RCP10M2473M	.047 mf	200 V	Tubular......
C-53	47X525	470 mmf	500 V	Molded Mica..
C-57	Part of 76X5 (See Miscellaneous)			
C-59	RCP10M6472M	.0047 mf	600 V	Tubular......
C-62	RCM20A271K	270 mmf	500 V	Molded Mica..
C-67	RCM20B431K	430 mmf	500 V	Molded Mica..
C-68	47X570	330 mmf	500 V	Molded Mica..
C-69	RCM20A201K	200 mmf	500 V	Molded Mica.
C-70, C-80	45X393	30 mf	400 V	Dry Electrolytic

CAPACITORS—Continued

C-75	47X598	56 mmf	1500 V	Ceramic......
C-76	RCP10M4154M	.15 mf	400 V	Tubular......
C-78	47X560	500 mmf	20 KV	Ceramic......
C-79A, C-79B	45X390	60 mf, 80 mf	400 V, 400 V	Dry Electrolytic
C-81, C-82	47X615	.01 mf		Ceramic......

RESISTORS

		Ohms	Watts	
R-1	B83822	8.2 K	0.5	Carbon......
R-2, R-5	B83470	47	0.5	Carbon......
R-3, R-6, R-27, R-61, R-65	B85102	1 K	0.5	Carbon......
R-4, R-7	B83223	22 K	0.5	Carbon......
R-8	B84181	180	0.5	Carbon......
R-9, R-12	B84152	1.5 K	0.5	Carbon......
R-10	Part of L-5			
R-11	C84562	5.6 K	1.0	Carbon......
R-13, R-19	B84105	1.0 Meg.	0.5	Carbon......
R-14, R-60	B84101	100	0.5	Carbon......
R-15	Part of L-10			
R-16	C83472	4.7 K	1.0	Carbon......
R-18, R-24	B85104	100 K	0.5	Carbon......
R-20, R-63, R-85	B84333	33 K	0.5	Carbon......
R-21	B84222	2.2 K	0.5	Carbon......
R-22, R-71	78X12	1.5 K, 1.0 meg.		Contrast and Volume Control ..
R-23, R-67, R-68	B84223	22 K	0.5	Carbon......
R-25	40X333	500 K		Brightness Control
R-26, R-74	B85473	47 K	0.5	Carbon......
R-28, R-64, R-78, R-80	B84104	100 K	.05	Carbon......
R-29, R-30	B85151	150	0.5	Carbon......
R-31	B84275	2.7 meg.	0.5	Carbon......
R-32	B83334	330 K	0.5	Carbon......
R-33, R-93	B84474	470 K	0.5	Carbon......
R-34, R-35, R-90	B84473	47 K	0.5	Carbon......
R-36, R-56	B84103	10 K	0.5	Carbon......
R-37	B84274	270 K	0.5	Carbon......
R-38	B84155	1.5 meg.	0.5	Carbon......
R-39	40X363	7.5 meg.		Sync Stability Control..
R-40, R-69, R-70	B84683	68 K	0.5	Carbon......
R-41	B84824	820 K	0.5	Carbon......
R-42, R-44, R-86	B83222	2.2 K	0.5	Carbon......
R-43	B84332	3.3 K	0.5	Carbon......
R-45	C84102	1 K	1.0	Carbon......
R-46A, R-46B, R-46C	Part of 76X7 (See Miscellaneous)			
R-47, R-81	B85474	470 K	0.5	Carbon......
R-48	B84821	820	0.5	Carbon......
R-49	40X368	4 K		Vertical Lin. Control
R-50, R-55	B84185	1.8 meg.	0.5	Carbon......
R-51	40X334	1.0 meg.		Vertical Hold Control
R-52	B84184	180 K	0.5	Carbon......
R-53, R-57	B84225	2.2 meg.	0.5	Carbon......

RESISTORS—Continued

		Ohms	Watts	
R-54	40X364	2.5 meg.		Height Control
R-58, R-107	B84561	560	0.5	Carbon......
R-59	D84682	6.8 K	2.0	Carbon......
R-62	B84563	56 K	0.5	Carbon......
R-66	B84271	270	0.5	Carbon......
R-72	40X334	1.0 meg.		Tone Control..
R-73	B85106	10.0 meg.	0.5	Carbon......
R-75A, R-75B	Part of 76X5 (See Miscellaneous)			
R-76	C84331	330	1.0	Carbon......
R-77	D84102	1 K	2.0	Carbon......
R-79	B85475	4.7 meg.	0.5	Carbon......
R-82	B84273	27 K	0.5	Carbon......
R-83, R-84	C84682	6.8 K	1.0	Carbon......
R-87	B84562	5.6 K	0.5	Carbon......
R-88	B83224	220 K	0.5	Carbon......
R-89	40X331	150 K		Horizontal Drive Control
R-91	B83154	150 K	0.5	Carbon......
R-92	C83562	5.6 K	1.0	Carbon......
R-94	40X361	50 K		Horizontal Hold Control
R-95	D84101	100	2.0	Carbon......
R-96	43X276	12 K	5.0	Wirewound...
R-97	43X239	5.1	0.5	Wirewound...
R-98	B85102	1 K	0.5	Carbon......
R-99	C85105	1.0 meg.	1.0	Carbon......
R-100	B83472	4.7 K	0.5	Carbon......
R-101	43X272	10 K	5.0	Wirewound...
R-102	43X275	1.5 K	15.0	Wirewound...
R-103	43X273	330	10.0	Wirewound...
R-104	Part of L-9			
R-105	B85274	270 K	0.5	Carbon......
R-108	40X364	2.5 meg.		AGC........
R-109	D85104	100 K	2.0	Carbon......
R-110	43X279	8 K	5.0	Wirewound...
R-111	D84123	12 K	2.0	Carbon......

TRANSFORMERS AND COILS

L-1, L-2, L-3	9A2033	R-F Heater Choke ....
L-4, L-8	9A1979	Peaking Coil 36 mh ....
L-5	36A10	Peaking Coil 60 mh ....
L-6	36A11	Peaking Coil 500 mh ....
L-7	9A2074	4.5 MC Trap ....
L-9	36A16	Peaking Coil 80 mh ....
L-10	36A12	Peaking Coil 160 mh ....
L-11	36A2	Peaking Coil 190 mh ....
L-12, L-17	Part of Deflection Yoke Assembly	
L-13	9A2168	Sound Take-Off Coil ....
L-14	9A2096	Horizontal Frequency Coil ....
L-15	9A2183	Width Control ....
L-16	9A2262	Horizontal Linearity Control ....
L-18	52X91	Filter Choke ....
T-1, T-2	9A2230	1st and 2nd Pix I-F Coils ....
T-3	9A2226	3rd Pix I-F Coil ....
T-4	54X8	Vertical Osc. Transformer ....
T-5	51X156	Vertical Output Transformer ....
T-6	9A2170	Sound I-F Transformer ....
T-7	9A2269	Sound Ratio Det. Transformer ....
T-8	51X150	Audio Output Transformer ....
T-9	53X330	Horizontal Output Transformer ......
T-10	53X333	Power Transformer ....

MISCELLANEOUS

2A426	Centering Device	
76X5	Multiple Resistor Capacitor Assembly	
76X7	Multiple Resistor Capacitor Assembly	
9A2274	Deflection Yoke Assembly	
2A407	Ion Trap Magnet	
12A480	10" P.M. Speaker	Models 9061A & B.... 9064A
S-14X69	Cabinet Back Assembly	Models 9061A & B.... 9064A
17X179	Pix Crystal	Model 9061B & 9064A
4X1220-1	Pix Mask	Model 9061B & 9064A
S-4X29-3	Escutcheon Control Panel Assembly	Model 9061B & 9064A
17X175	Pix Crystal	Model 9061A
4X1212-1	Pix Mask	Model 9061A
4X1219-1	Plastic Molding (Model 9061B)	
4X1219-2	Plastic Molding (Model 9064A)	

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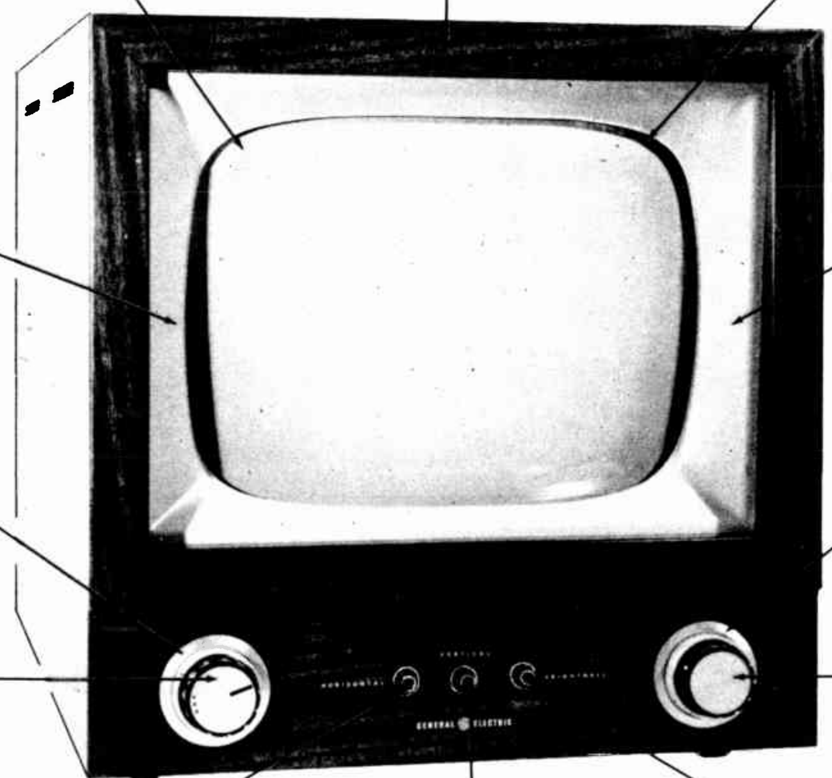
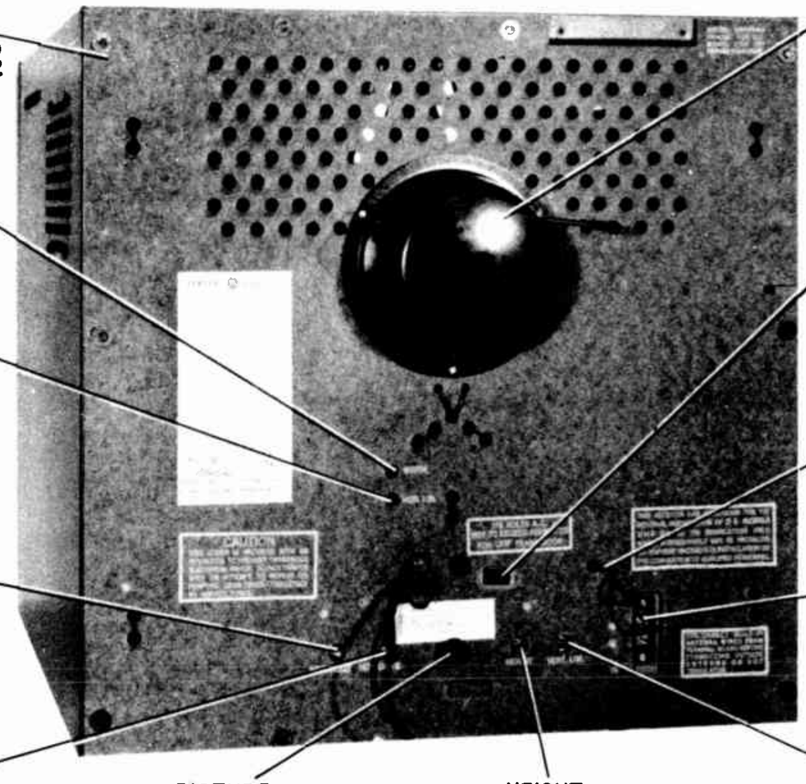


MODEL 17T10



Rear View, All Receivers

CAUTION NOTICE

HIGH VOLTAGES ARE USED IN THE OPERATION OF THIS TELEVISION RECEIVER. THE BACK COVER PREVENTS ACCIDENTAL CONTACT WITH THESE HIGH VOLTAGES AND SHOULD NOT BE REMOVED EXCEPT BY A QUALIFIED TELEVISION TECHNICIAN.

THE PICTURE TUBE IS A HIGH VACUUM TUBE AND, IF BROKEN, PIECES OF GLASS MAY FLY WITH FORCE IN ALL DIRECTIONS. ANY WEAKENING OF THE GLASS BULB CAUSED BY CHIPPING, SCRATCHING OR ABNORMAL PRESSURE MAY CAUSE BREAKAGE. THE USE OF SAFETY GLASSES IS RECOMMENDED WHEN EXPOSING THE PICTURE TUBE.

IMPORTANT NOTE: WHEN SERVICING OR ALIGNING THIS RECEIVER ALWAYS USE AN ISOLATION TRANSFORMER TO PROTECT TEST EQUIPMENT.

POWER SHOULD NOT BE APPLIED TO THE RECEIVER FOR ANY GREAT LENGTH OF TIME WITHOUT THE ION TRAP (SEE FIG. 2) SET FOR BEST ILLUMINATION.

SPECIFICATIONS

Over-all Dimensions	Type	Height (Inches)	Width (Inches)	Depth (Inches)
	17T10 17T10-UHF (Metal)	$20\frac{9}{16}$	$19\frac{3}{4}$	$20\frac{3}{8}$
	17T11 17T11-UHF (Mahog.)	$19\frac{13}{16}$	$19\frac{3}{4}$	$20\frac{1}{2}$
	17T12 17T12-UHF (Mahog.)	$20\frac{3}{16}$	$19\frac{3}{4}$	$20\frac{11}{16}$
	21T2 (Metal)	23	$23\frac{3}{4}$	$23\frac{3}{8}$

Electrical Input Rating:	Frequency . . . . 60 cycles Voltage . . . . 115 volts Wattage . . . . 170 watts
R-F Frequency Range:	Channels . . . . No. 2 through No. 13 Models 17T10-UHF, 17T11-UHF, 17T-12-UHF cover entire UHF spectrum . . . . 470-890 mc (See page 12 for complete chart) Frequencies . . . . 54-88 mc, 174-216 mc
Operational Frequencies:	Picture I-F Carrier Frequency . . . . 45.75 mc Adjacent Channel I-F Sound Trap . . . . . 47.25 mc Sound I-F Carrier Frequency . . . . 41.25 mc Intercarrier Sound I-F Take-off Trap . . . 4.5 mc
Audio Power Output:	Undistorted . . . . 1.5 watts Maximum . . . . 2.5 watts

Loudspeaker: S-527D-7	Type . . . . . Alnico PM Dynamic Cone Diameter . . . . . 5¼ inches Voice Coil Impedance at 400 cps . . . . . 3.2 ohms
Picture Tube:	Type . . . . . (for 21T2) 21EP4B Type . . . . . (for 17-inch models) 17BP4A Screen . . . . . Aluminum-coated Construction . . . . . Glass tube Deflection and Focus . . . . . Magnetic Deflection Angle . . . . . 70 Degrees Shape . . . . . Rectangular
Antenna Input:	Built-in antenna provided* External antenna terminals Impedance—300 ohms, balanced to ground

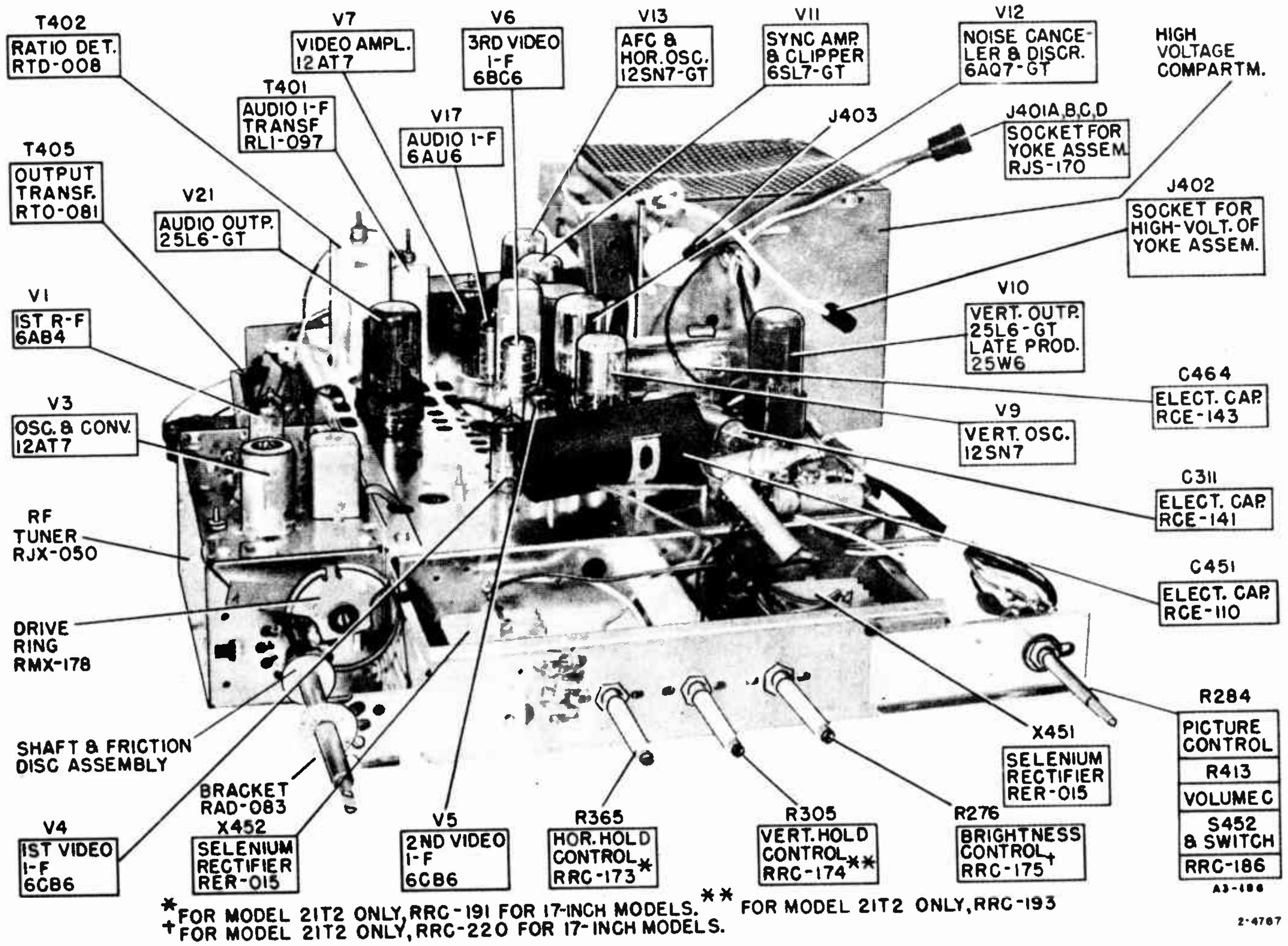
* Built-in antenna is connected in the factory, and must be disconnected if it is desired to use an outside antenna.

Tubes and Rectifiers	Symbol	Purpose	Type
	V1	1st R-F Amplifier	6AB4
	V2	2nd R-F Amplifier	6AK5
	V3	Converter-Oscillator	12AT7
	V4	1st Video I-F Amplifier	6CB6
	V5	2nd Video I-F Amplifier	6CB6
	V6	3rd Video I-F Amplifier	6CB6
	V7	1st and 2nd Video Amplifier	12AT7
	V8	Picture Tube, Model 21T2	21EP4B
		17-inch models	17BP4A
	V9	Vertical Sweep Generator	12SN7-GT
	V10	Vertical Output	25L6-GT
		Late production	25W6-GT
	V11	Sync Amplifier and Clipper	6SL7-GT
	V12	Noise Canceller and Horizontal AFC Discriminator	6AQ7-GT
	V13	Horizontal AFC and Oscillator	12SN7-GT
	V14	Horizontal Sweep Output	25BQ6-GT
	V15	High-voltage Rectifier	1X2-A
	V16	Horizontal Damper Tube	25W4-GT
	V17	Audio I-F (4.5 MC) Amplifier	6AU6
	V18	Audio I-F (4.5 MC) Amplifier and Limiter	6AU6
	V19	Ratio Detector	6AL5
	V20	Audio Amplifier	6SQ7
	V21	Audio Output	25L6-GT
	Y1	Video Detector (Germanium Diode)	1N64
	X451	Selenium Rectifier	350 ma.
	X452	Selenium Rectifier	350 ma.
	F460	Fuse	1.25 amp
		UHF-103 TUNER	
	Y200	Detector (Germanium Diode)	1N72
	V202	I-F Amplifier	6BK7
	V201	Oscillator	6AF4

GENERAL INFORMATION

Features of this series include a balanced input to a two-stage r-f amplifier, intercarrier sound, ratio-detector, B+ boost circuit, automatic frequency control for horizontal sweep synchronization, noise canceller circuit with picture stabilizer control, selenium type rectifiers, electromagnetic deflection, PM focus unit and power outlet for an UHF translator.

The models 17T10-UHF, 17T11-UHF and 17T12-UHF contain an ultra-high frequency tuner, Model UHF-103, for reception of stations in the UHF spectrum. The tuner has three switch positions, which can be preset to any channel in the entire UHF spectrum. The tuner employs a heterodyne circuit consisting of a crystal diode, a beat oscillator and an I-F amplifier which are energized by a separate power supply.



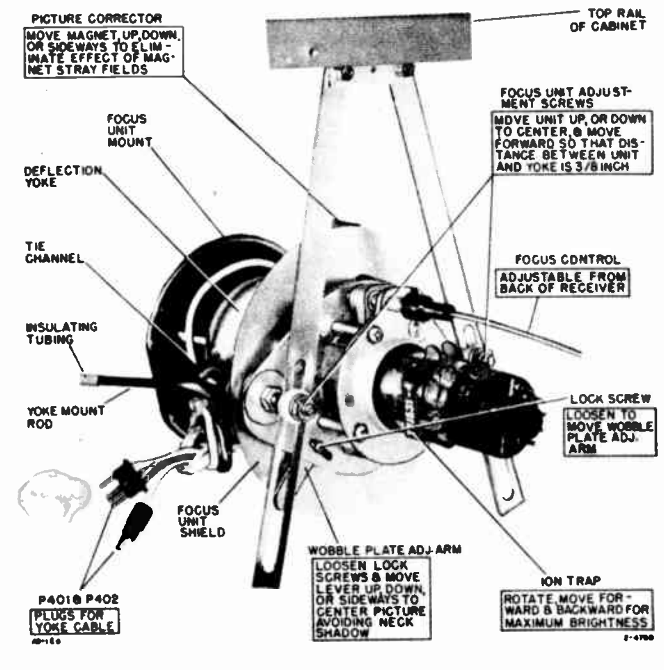
Note: Front apron is insulated from chassis.

Fig. 1. Front View of Chassis

RECEIVER INSTALLATION

The receiver is shipped from the factory with the picture tube installed and all controls pre-adjusted for normal operation. However, if in checking receiver performance, it is evident that one or more of the preset controls are out of adjustment due to handling, it is necessary to readjust the affected controls.

1. Remove cabinet back.
2. With power applied to the receiver set the Brightness control on the front panel to a maximum clockwise position.
3. Set the Horizontal and Vertical Hold control in the middle of their respective ranges.
4. Check to make sure that the deflection yoke is seated firmly against bell of picture tube.
5. Alternately turn and slide ion trap along picture tube neck for maximum brilliance of raster.
6. Tilt deflection yoke slightly left or right, using yoke lever to position picture within mask.
7. Tune in a television signal.
8. With the front panel Horizontal Hold control set at the center of its range, adjust the core of the horizontal oscillator coil, L351, until picture is synced horizontally.
9. Adjust the Horizontal Drive control on the back apron of chassis for maximum width of picture with good linearity and without foldover.
10. Adjust P.M. Focus unit to center and focus picture and to eliminate neck shadow.
11. Readjust ion trap for maximum brightness.
12. Adjust Height and Vertical Linearity controls on the back apron of chassis for correct height and best vertical linearity.
13. Adjust Width and Linearity controls on back apron of chassis for correct width and best horizontal linearity.
14. Recheck adjustments of steps 10 through 13 and tighten all screws properly.



NOTE: Late production receivers do not use flexible focus control but use crimp funnel instead

Fig. 2. Picture Tube Adjustment

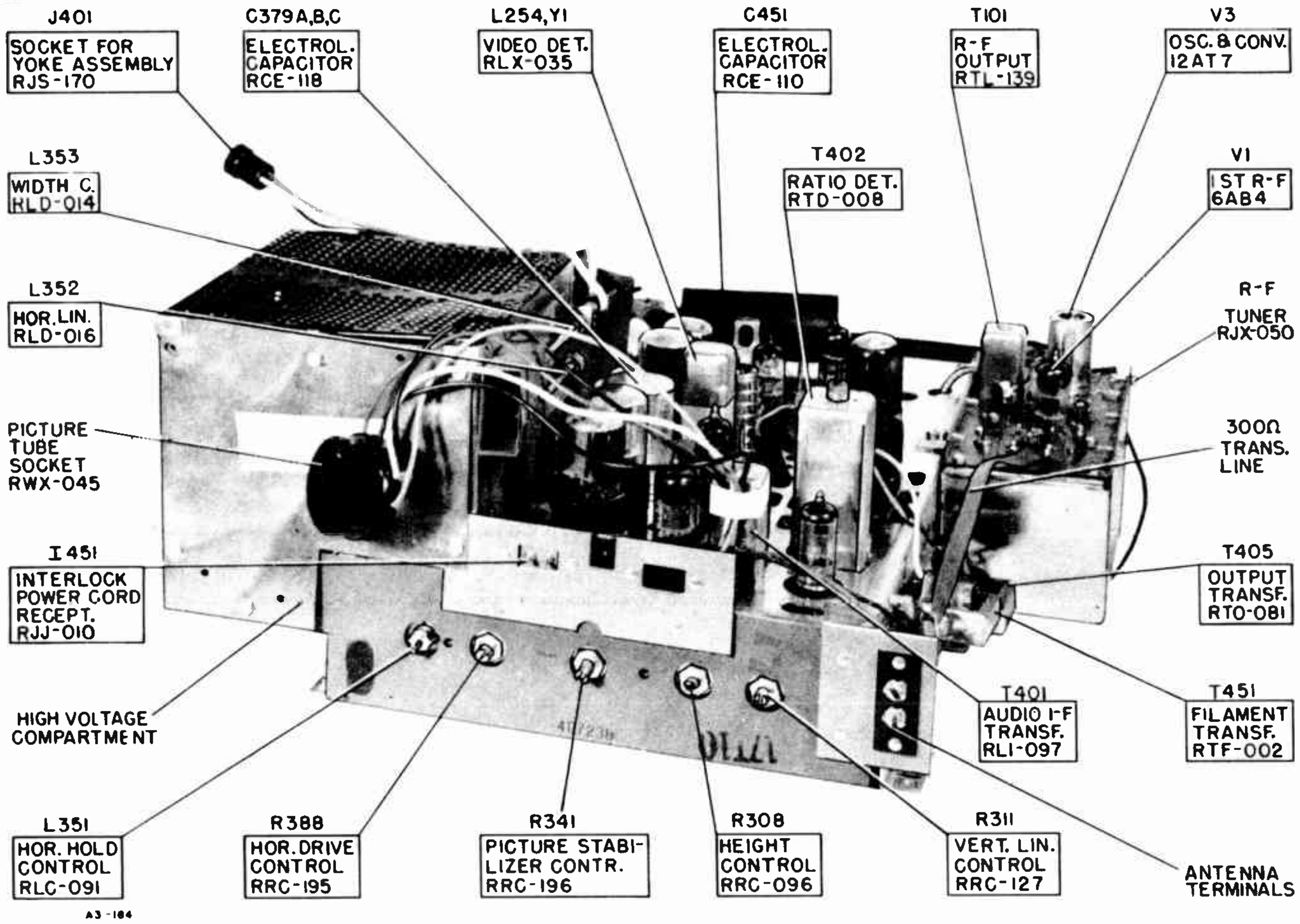


Fig. 3. Rear View of Chassis

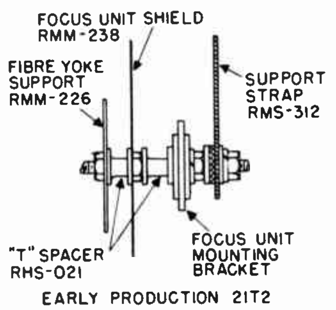
Late production 17-inch models incorporate a screwdriver method of adjustment instead of the earlier flexible shaft and knob as illustrated in Fig. 2.

It is important when adjusting this new focus unit that a non-magnetic screwdriver be used. When inserting the screwdriver, be sure that it enters the screw funnel, otherwise the ion trap may become disturbed which would require removal of the cabinet back to allow readjustment of the ion trap.

REPLACEMENT OF PICTURE TUBE

MODELS 17T10, 17T11, 17T12, 17T10-UHF, 17T11-UHF AND 17T12-UHF

1. Remove chassis.
2. Place cabinet on its front, being sure not to scratch it.
3. Remove ion trap (see Fig. 2).
4. Remove the two mounting screws fastening the support straps to the support bracket.
5. Remove the two mounting draw nuts and pull out the two yoke mount rods.
6. Slide out complete yoke assembly with attached PM focus unit.
7. Remove the two nuts which press the tube strap assembly against picture tube and remove the strap assembly.
8. Lift picture tube out of the cabinet and remove dust seal.
9. Place dust seal into notches located around the tube mask.
10. Place picture tube into cabinet and reposition tube strap assembly and tighten nuts holding tube strap assembly so that picture tube is held in place.
11. Release the dust seal from notches so that it contacts both tube and tube mask.
12. Install yoke and PM focus unit assembly and fasten the two yoke mounting rods to the picture-tube mounting rods. Be sure that yoke and PM focus unit are perpendicular to and concentric with picture-tube neck.
13. Install ion trap.
14. Replace chassis and connect picture-tube socket to base of tube, high-voltage lead to picture tube anode, two yoke plugs and loudspeaker leads.
15. Install knobs and chassis mounting screws and cabinet back.



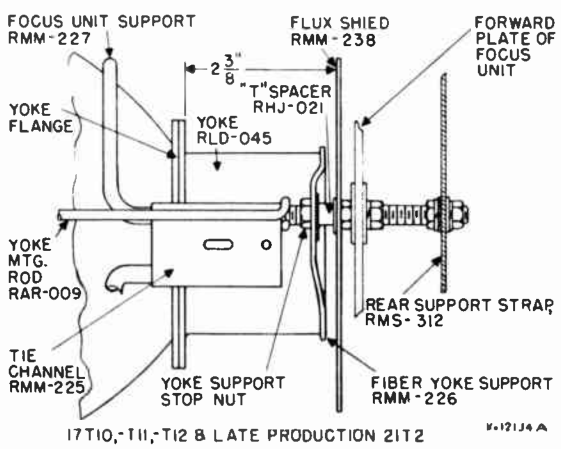


Fig. 4. Side View of Yoke and Focus Assembly

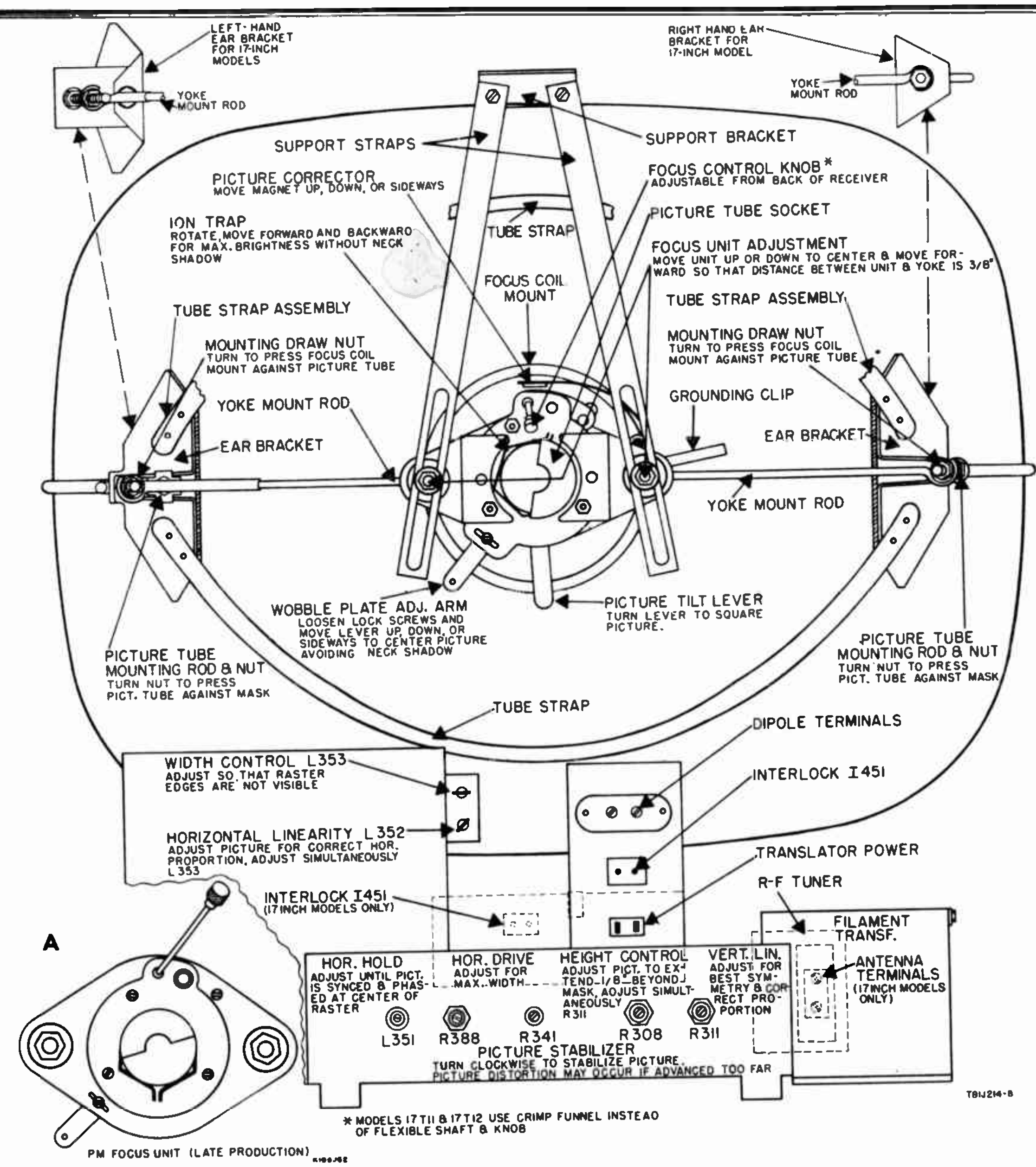


Fig. 5. Preset Controls and Picture Tube Adjustments

REPLACEMENT OF PICTURE TUBE MODEL 21T2

1. Follow steps 1 through 9 of preceding paragraph.
2. Place picture tube into cabinet, reposition tube strap assembly, assemble left picture-tube mounting nut flush with end of mounting rod, see Fig. 6.
3. Tighten the right picture-tube mounting nut.
4. Tighten the left picture-tube mounting nut.
5. Place yoke mount rod as indicated in Fig. 5 and tighten with nut provided.
6. Make sure that the focus unit is perpendicular to and concentric with the picture-tube neck.

REPLACEMENT OF YOKE AND PM FOCUS UNIT

There are two types of PM focus units: the early type with riveted-on bracket, Fig. 5, and the later production type which is identical to that used on Model 21T4, Fig. 5A. When reassembling follow this procedure (see Fig. 4):

1. Turn nut on the fiber yoke support by fingers fully forward.
2. The nut immediately to the rear of the focus unit shield should be set for 2⅜ inches between the disk and the yoke flange.
3. The yoke support stop nut is now unscrewed towards the fiber yoke support and suitably tightened.
4. Make sure that the focus unit is placed perpendicular and concentric about the picture-tube neck.
5. The two rear assembly supporting straps should be positioned on the focus unit support rods as far back from the focus unit as possible while still maintaining their vertical position, see Fig. 4.

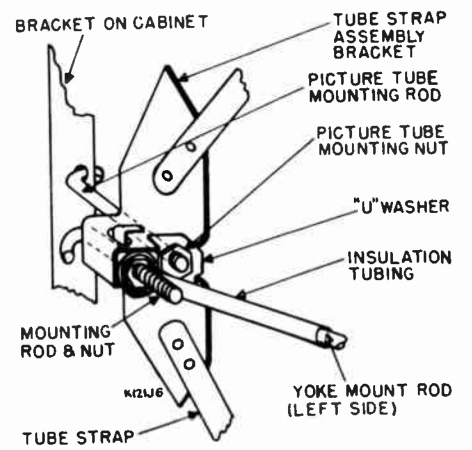


Fig. 6. Tube Strap Assembly Mount, Model 21T2

RECEIVER ALIGNMENT

GENERAL:

In most cases the circuits in the receiver should need realignment only when components have been replaced in the tuned circuits or the adjustments have been tampered with. When the decision is reached that the trouble lies in improper alignment of the circuits, the alignment should be undertaken only if proper test equipment is available.

The alignment procedure described follows the sweep method using General Electric test equipment. When other than General Electric sweep equipment is used, make sure that it meets the requirements listed below. If an accurately calibrated marker generator is not available, a conventional signal generator may be used to supply the markers. Its output should be loosely coupled to the sweep generator output terminals and must be kept as low as possible to prevent distortion of the sweep waveform.

Before proceeding with the alignment make sure to read all notes and consult the connection diagrams. Allow the test equipment and receiver to warm up for at least 15 minutes before starting the alignment. It is often advisable to perform the alignment with the picture tube disconnected. The filament circuit can be completed by using a type 6SN7 tube with all pins clipped off except pins No. 7 and No. 8 which must be plugged in to pins No. 1 and No. 12 of the picture tube socket.

TEST EQUIPMENT

The following test equipment is necessary in order to effect alignment of the tuned circuits of the receiver:

1. ***R-F SWEEP GENERATOR***

   (G-E Type ST-4A or Equivalent)

   a. Frequency requirements:
      4.5 MC with 500 KC and 2 MC sweep width.
      40–50 MC with approximately 10 MC sweep width.
      50–90 MC, 170–220 MC with 15 MC sweep width.

   b. Constant output in the sweep range.

   c. Minimum output 0.1 volt.

2. ***MARKER GENERATOR***

   (G-E Type ST-5A or Equivalent)

   The marker generator must have good frequency stability, accurate calibration and must cover the following frequencies:

   a. 41.25 MC for video IF
      42.50 MC for video IF
      44.10 MC for video IF
      45.00 MC for video IF
      45.75 MC for video IF
      47.25 MC for video IF

   b. 4.5 MC for sound IF and trap alignment.

   c. Picture and sound carrier frequencies for Channel No. 2 through No. 13.

3. ***BALANCED OUTPUT ADAPTER***

   (G-E ST-8A or Equivalent)

   See R-F Alignment, note 2.

4. ***OSCILLOSCOPE***

   (G-E Type ST-2A or Equivalent)

   The oscilloscope should have good sensitivity and preferably a 5-inch screen with a good wide-band frequency response in the vertical deflection circuits. Although the high frequency response is not necessary for alignment, it is imperative when making waveform measurements.

5. ***DETECTOR NETWORK***

   A crystal detector network as shown in Fig. 19 is necessary when aligning the 4.5 mc trap, L260.

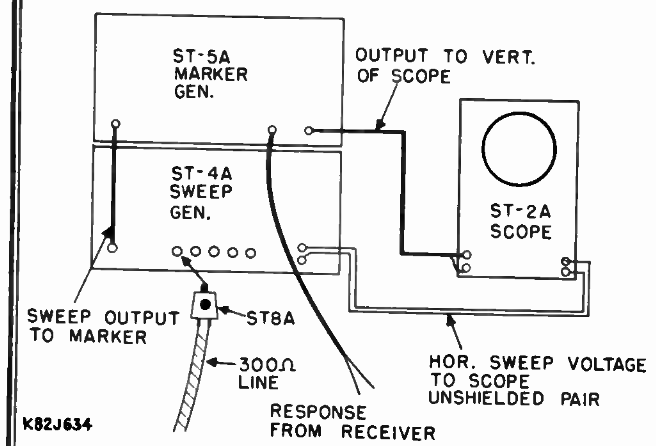


Fig. 7. R-F Alignment Equipment Connections

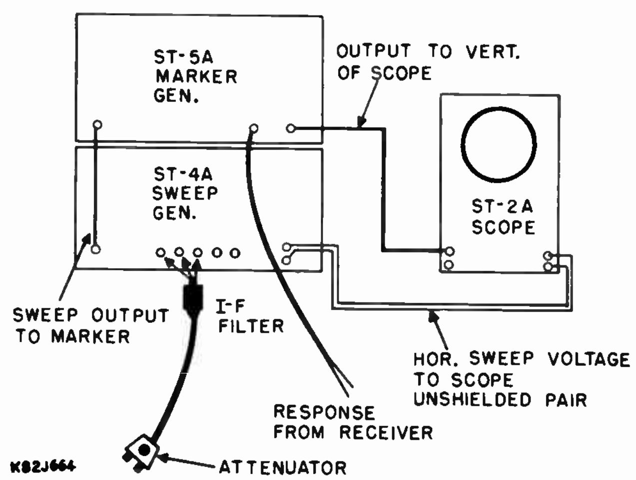
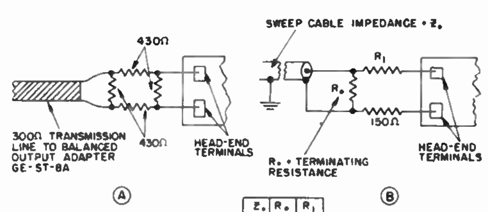


Fig. 8. I-F Alignment Equipment Connections



Z_o	R_o	R_1
50Ω	56Ω	120Ω
72Ω	82Ω	110Ω
92Ω	110Ω	100Ω

Fig. 9. Sweep Generator Termination

R-F Tuner Alignment

Notes:

1. The R-F tuner may be aligned without removing it from the main chassis. Disconnect the 300-ohm transmission line from the antenna input transformer, T100 and disconnect the B+ to the oscillator. To do this remove the self-tapping screws which hold the rear shield, so that the terminal boards are exposed. Unsolder the jumper between terminals 3 and 4 of the top terminal (see Fig. 14) and connect choke L141 to terminal 3.
2. Connect the sweep generator to the R-F tuner antenna input transformer using the G-E ST8A balanced adapter to obtain 300 ohms output, see Fig. 7. The adapter should be connected to the R-F tuner through approximately three feet of 300-ohm transmission line and a resistor pad, as shown in Fig. 9A. When using other test equipment of the unbalanced output type, a pad as shown in Fig. 9B should be used instead.
3. Connect a 3-volt battery to the AGC terminal of the R-F tuner, see Fig. 14, with the positive lead of the battery connected to the main chassis.
4. The inductance of the coils is adjusted by means of brass screws. In general, good tracking can be obtained by this adjustment. On the high channels proper tracking can be achieved by dressing the coil L122, Fig. 13. This coil is available through the opening obtained by removing a self-tapping screw and bending up the flap on the tuner shield, see Fig. 11. Use an insulated tool for dressing this coil, since it is connected to B+.
5. It is possible to obtain two different settings of C105, Fig. 11, that will give the proper R-F band width. The correct setting may be determined by switching from Channel 13 to Channel 12 and observing the change in band width. The correct setting will result in a slightly greater band width on Channel 12.
6. When proper tracking on the low channels cannot be achieved with the provided screw adjustments, the inductance of the coils L110, L111, L117, L118, L125 and L126 (Fig. 12, 13, and 16) may be varied by inserting a knife blade between the windings. This method of adjustment requires the removal of the tuner shield, a procedure which will detune the circuits. However, in most cases the provided screw-type adjustments will suffice to achieve proper tracking through all channels after the shield has been replaced.
7. The picture and sound carrier marker should not be less than 75% of the peak of the R-F response curve. Refer to the "limits" curves shown in the accompanying alignment chart.
8. Seal trimmer screw of C105 and the brass cores in the coils L114, L112, L109, L119, L116, L127 and L124, Fig. 11, with wax to prevent detuning. Seal the tuning screws in trimmers C104, C106 and C108, Fig. 10, with glue. Reconnect the jumper on the R-F tuner terminal board and connect the transmission line to R-F tuner input transformer. Mount the rear R-F tuner shield.
9. For over-all alignment check see page 6.

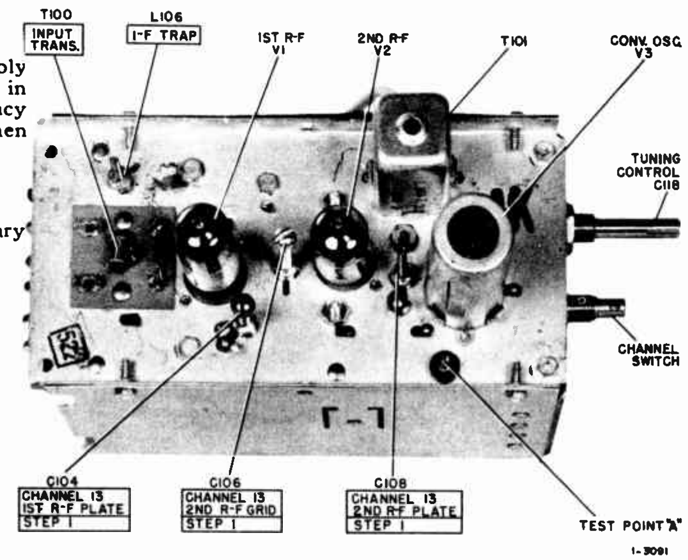


Fig. 10. R-F Tuner, Top View

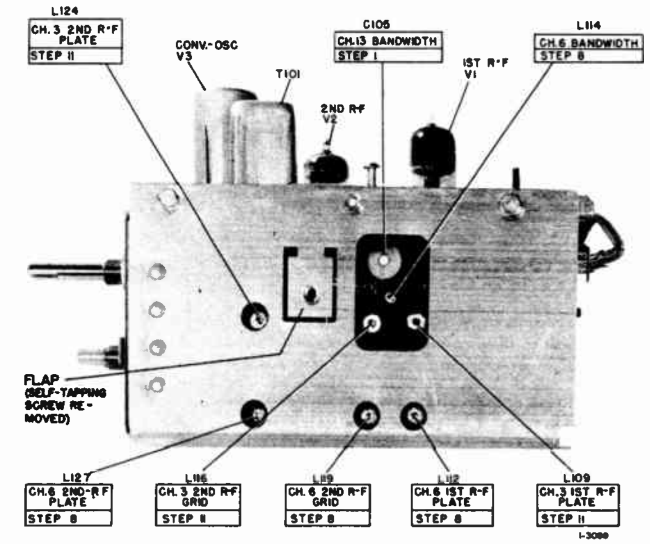


Fig. 11. R-F Tuner, Side View

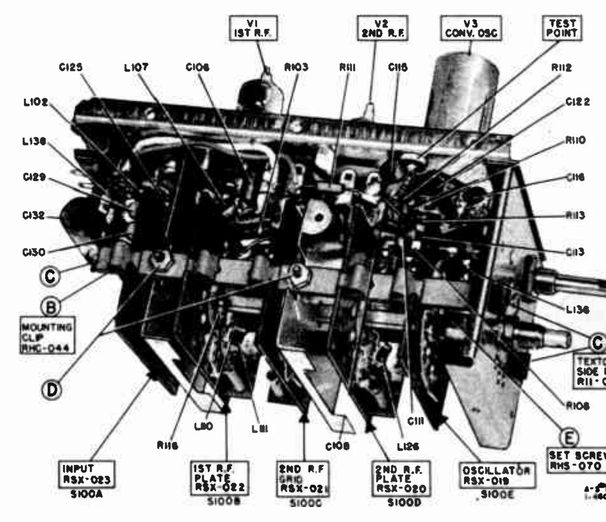


Fig. 12. R-F Tuner, Side View

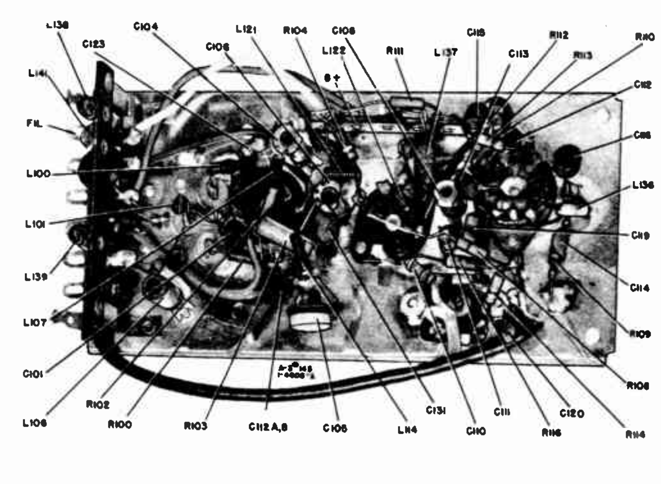
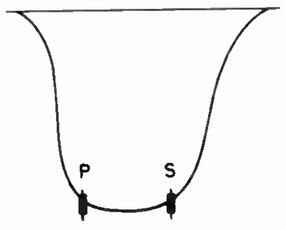


Fig. 13. Bottom Plate of R-F Tuner, Switch Removed

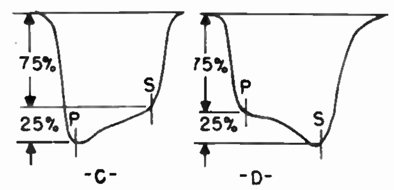
R-F Alignment Chart

(a) Set generator sweep width to 10-15 mc.
(b) Signal input point at r-f tuner input transformer, T100.
(c) Observe response curve at test point "A," Fig. 10, through 10,000-ohm resistor. Connect test equipment ground lead to r-f tuner chassis.
(d) Adhere to following order when performing a complete alignment.
(e) When following the procedure below, an attempt should be made to obtain the indicated ideal response curves. Minor deviations from the ideal curves may occur, the maximum limits of "tilt" and/or band width being shown in the "Remarks" column.

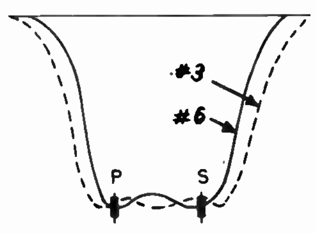
Step	Receiver and Sweep Generator Channel	Marker Generator Frequency MC	Adjust	Remarks
1	No. 13	211.25 215.75	C104, C105 and C108 (Fig. 10 and 11) for maximum gain and proper band width of 4.5 mc to obtain curve "A"; limits shown in last column.	Retune C108 and/or redress L122 (Fig. 13) for proper tracking; see note 4; C105 controls band width, C104, C106 and C108 brings circuit into resonance.
2	No. 12	205.25 209.75	No adjustments; check tracking; obtain curve "A"; limits shown in last column.	
3	No. 11	199.25 203.75		
4	No. 10	193.25 197.75		
5	No. 9	187.25 191.75		
6	No. 8	181.25 185.75		
7	No. 7	175.25 179.75		
8	No. 6	83.25 87.75	L112, L114, L119 and L127, Fig. 11, for maximum gain, optimum curve flatness and 4.5 mc band width; see curve "B"	
9	No. 5	77.25 81.75	No adjustments, check tracking; see curve "B"	
10	No. 4	67.25 71.75		
11	No. 3	61.25 65.75	L109, L116 and L124, Fig. 11, for maximum gain and optimum curve flatness. See curve "B"	
12	No. 2	55.25 59.75	No adjustments, check tracking; see curve "B"	See note 6.



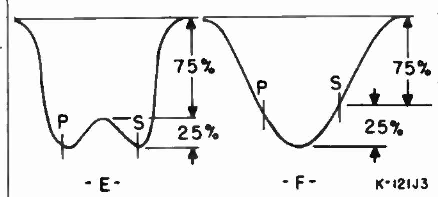
A
Ideal curve



Sound Carrier 25% down
Picture carrier 25% down
Tilt Limit Curves



B
Ideal curve



Wide limit
Narrow limit
Band Width Limit Curves

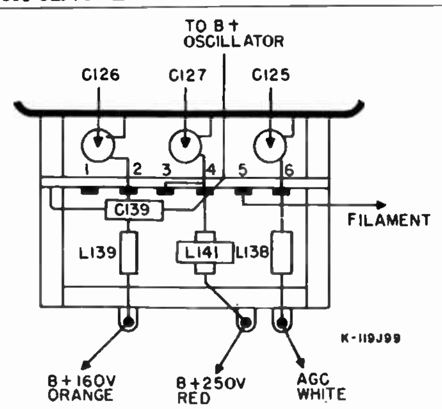


Fig. 14. R-F Tuner, Terminal Board

OSCILLATOR ALIGNMENT

GENERAL—Two methods of oscillator frequency adjustment are given below. The first method uses a transmitting station for the adjustment while the second method uses a sweep generator to align the oscillator coils.

A. *"On Station Signal" Alignment*

R-F and video I-F alignment must be correct before attempting oscillator alignment. An operating transmitting station is needed for each one of the coils being adjusted. Tune in the station starting with the higher channels and adjust the tuning screws for all available stations so that with the fine tuning control in the full clockwise position, audio is just visible in the picture. Then, check to see that best picture response on all channels takes place approximately in the center of the oscillator tuning range.

B. *Sweep Alignment*

1. R-F and video I-F must be properly aligned before aligning the oscillator.
2. Connect a 3-volt battery to the AGC terminal of the R-F tuner, see Fig. 14, with the positive lead of the battery connected to the main chassis.
3. Disconnect the 300-ohm transmission line from the antenna terminals to the R-F terminals and connect the sweep generator to the R-F tuner terminals as described in note 2 on page 4.
4. Set the fine tuning knob 180° (½ turn) from the counterclockwise limit of its rotation, i.e. rotate the fine tuning knob counterclockwise to the end of its travel, then turn the fine tuning control knob 180° (½ turn) clockwise. This setting of the fine tuning control should be maintained for all oscillator adjustments.
5. Make the indicated adjustments so that the picture carrier marker for the channel falls at 50% on the high frequency side of the response curve.

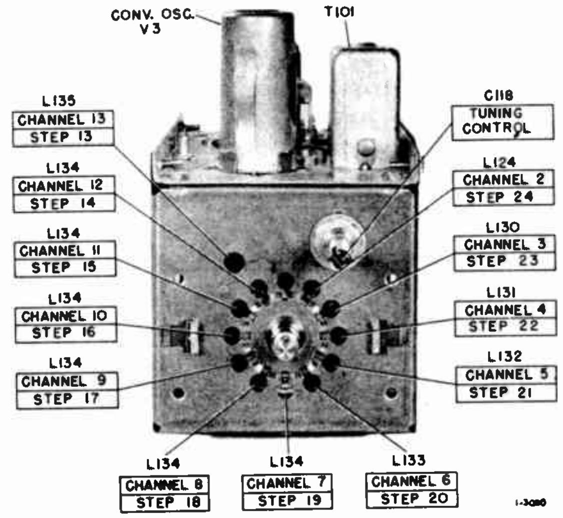


Fig. 15. Oscillator Adjustments

OSCILLATOR ALIGNMENT CHART

Sweep Generator Sweep Width 10-15 MC

Step No.	Receiver and Marker Position	Marker Generator Frequency	Signal Input Point	Observe Response Curve at	Adjust	See Note
13	No. 13	211.25 MC	Antenna terminals (see Note 3)	Junction of L256, R292, L268 thru 10K ohms and chassis	L135 Channel No. 13 oscillator adjustment.	1, 2, 3, 4, 5
14	No. 12	205.25 MC			L134 Channel No. 12 oscillator adjustment.	
15	No. 11	199.25 MC			L134 Channel No. 11 oscillator adjustment.	
16	No. 10	193.25 MC			L134 Channel No. 10 oscillator adjustment.	
17	No. 9	187.25 MC			L134 Channel No. 9 oscillator adjustment.	
18	No. 8	181.25 MC			L134 Channel No. 8 oscillator adjustment.	
19	No. 7	175.25 MC			L134 Channel No. 7 oscillator adjustment.	
20	No. 6	83.25 MC			L133 Channel No. 6 oscillator adjustment.	
21	No. 5	77.25 MC			L132 Channel No. 5 oscillator adjustment.	
22	No. 4	67.25 MC			L131 Channel No. 4 oscillator adjustment.	
23	No. 3	61.25 MC			L130 Channel No. 3 oscillator adjustment.	
24	No. 2	55.25 MC			L129 Channel No. 2 oscillator adjustment.	

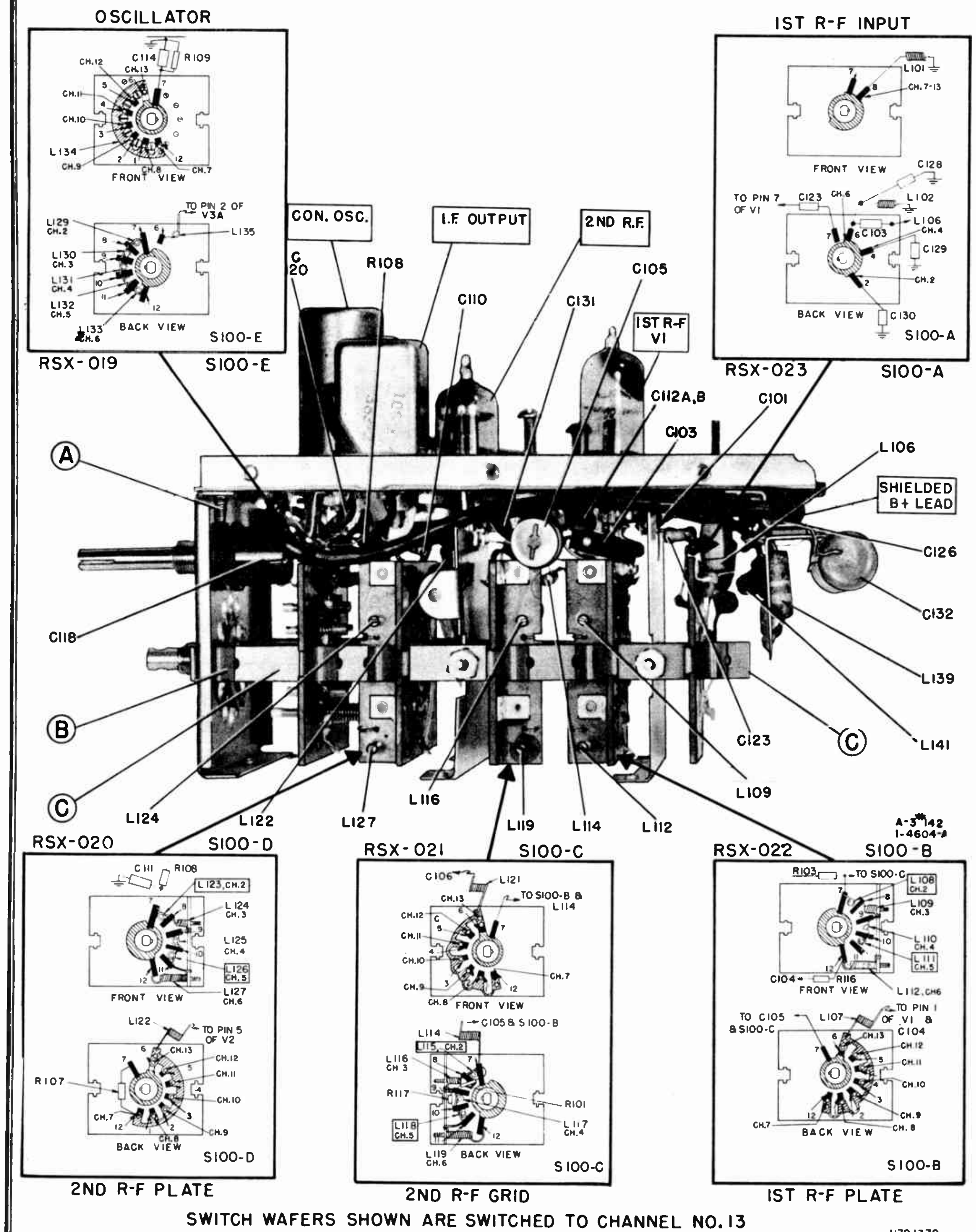


Fig. 16. R-F Tuner with Switch Wafer Wiring

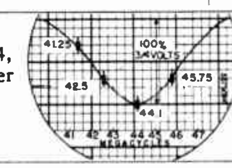
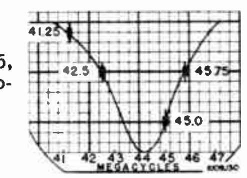
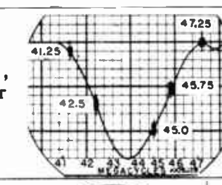
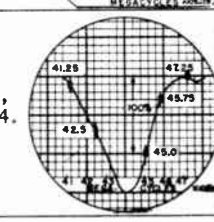
VIDEO I-F ALIGNMENT

NOTES:

1. Connect a 3-volt bias battery from the junction C284, R288 and picture control, R284 to chassis, see Fig. 27.
2. Set channel switch to Channel No. 11 and turn Fine Tuning control to the counterclockwise stop.
3. The noise canceller V12 should be biased off during alignment by rotating the Picture Stabilizer at the rear of the receiver to the counterclockwise stop.
4. The sweep generator should be properly terminated in its characteristic impedance. Couple the signal to the point of input through the capacitor specified and adjust signal input to give a video response curve of ¾ volts.
5. In most cases it is only necessary to perform an over-all alignment of the video i-f to obtain the final curve. L251 will adjust the marker 42.5 mc of the audio or low-frequency side of the response curve; coil L266 will adjust the marker 45.75 mc of the video or high-frequency side of the curve. T101 and L254 should be adjusted simultaneously to obtain maximum gain and flatness of the curve, see Fig. 17. Then L266 is readjusted to give the final curve as in step 5.
6. It is necessary to detune the i-f coils by shorting as noted in the alignment chart to prevent the coil preceding the signal input point from influencing the response curve.
7. It is important that the cores of all coils, including traps, be tuned on the outside of their respective coils.

VIDEO I-F ALIGNMENT

(a) SWEEP GENERATOR FREQUENCY 40 TO 50 MC.
(b) OBSERVE RESPONSE CURVE AT JUNCTION L256, R292, AND L268 THROUGH 10,000 OHMS RESISTOR AND CHASSIS.

Step	Marker Generator Frequency	Signal Points Between	Adjust	Remarks
1	47.25 MC	Test Point "A" on head-end thru 100 mmf capacitor and head-end chassis.	Cores of L265 and L267 for minimum output at 47.25 MC.	Make this adjustment with high scope gain.
2	42.50 MC 44.10 MC 45.75 MC	V6 grid (pin 1) thru .01 mf capacitor and chassis; short L266.	Core of L254, 3rd- if for proper curve.	
3	41.25 MC 42.50 MC 45.00 MC 45.75 MC	V5 grid (pin 1) thru .01 mf capacitor and chassis, short L251 and remove short on L266.	Core of L266, 2nd i-f for proper curve.	
4		V4 grid (pin 1) thru .01 mf capacitor and chassis, remove short on L251.	Core of L251, 1st i-f for proper curve.	
5	41.25 MC 42.50 MC 45.00 MC 45.75 MC 47.25 MC	Test Point "A" on head-end thru 100 mmf capacitor and head-end chassis.	Core of T201, T101 and L254.	 41.25 mc-Marker should be at 7% with 45.0 mc marker at 100%. 45.75 mc marker may vary between the limits 25% and 35% (nominal 30%). 42.5 mc marker may vary between 50% and 90% (nominal 70%). Peak of the curve should approximately equal 150% referred to the 100% 45 mc marker.

OVER-ALL (RF-IF) ALIGNMENT CHECK

A receiver which has been properly R-F aligned and I-F aligned must not be considered as a properly aligned receiver until the over-all check and adjustments have been made. Because the converter grid and cathode are utilized as a detector diode in the R-F alignment process, a certain degree of "tilt" or R-F detuning will occur. The only method of determining the degree of introduced "tilt" and the correction thereof must be done by observing the over-all curve.

In general, a receiver which has been properly R-F aligned will display an over-all curve (antenna to diode) which will duplicate the I-F system curve, since the major portion of the receiver selectivity occurs in the I-F system. It is to be expected, however, that minor variations in the over-all curve will occur when checking each of the various channels.

The procedure given here is quite simple, and assures optimum picture detail and receiver sensitivity. After the receiver has been properly aligned according to the data given for R-F and I-F alignment, proceed as follows:

a. Couple R-F sweep and channel marker signals to antenna input terminals.

b. Connect oscilloscope to junction of L256, R292 and L268 through 10,000 ohms, see Fig. 27.

c. Sweep each channel, starting with channel #13, and observe resulting curve. Adjust the Fine Tuning control so that the resulting sound and picture I-F markers fall in the approximate positions shown in Fig. 17.

d. Should the observed curve not agree with that shown in Fig. 17, the following adjustments should be made:

I. On channels 7–13, adjust C108 (Fig. 10) to produce desired curve shape and amplitude. CAUTION: Do not move C108 adjustment core more than three turns in either direction—usually one turn will suffice to produce the desired curve compensation.

II. On channels 4, 5 and 6 adjust L127 for proper curve compensation if required (Fig. 11).

III. On channels 2 and 3 adjust L124.

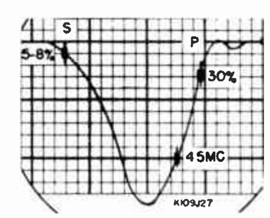


Fig. 17. Over-all Curve

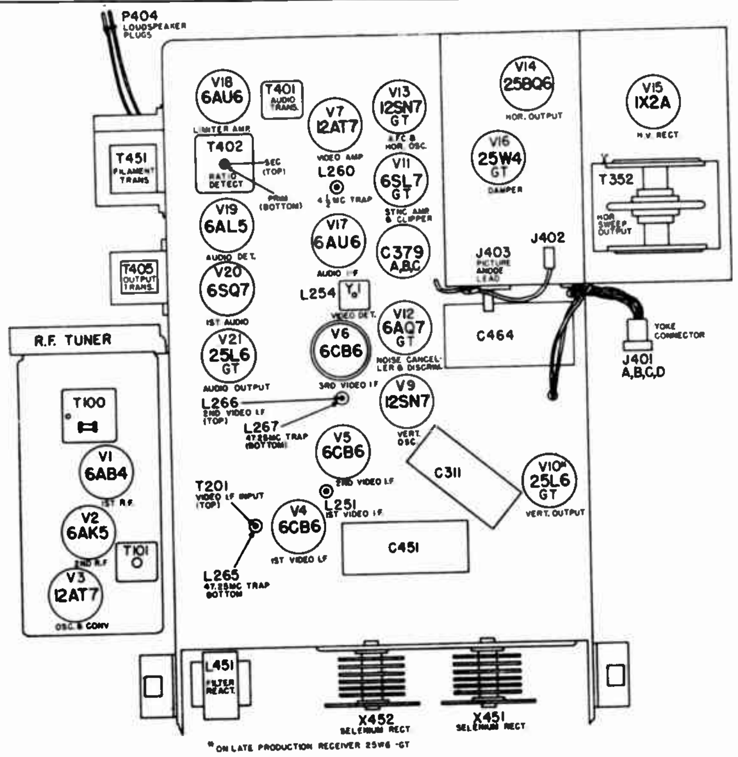


Fig. 18. Tube and Trimmer Location

TRAP ADJUSTMENTS

Alignment of L106 I-F Trap (R-F Tuner)

The trap, L106, Fig. 10, is for the purpose of removing any frequency in the i-f range which may cause interference and it should be aligned for minimum interference.

The trap, L106, may be aligned by tuning for minimum i-f channel interference pattern on the screen.

If the interference frequency is known, L106 may also be aligned for minimum interference as outlined below.

1. Connect 3 volts bias from the AGC line on head-end terminal board, Fig. 14, to chassis. Connect the positive of the bias battery to chassis.

2. Use an accurate marker generator to furnish marker of the same frequency as the interfering frequency.

Connect the scope to view the response curve at output of the video detector.

Use a sweep generator with its center frequency set approximately at the interference frequency.

3. Do not tune L106 so it will attenuate Channel No. 2.

4. Use the GE-ST8A balanced adapter and a 3-foot piece of 300-ohm transmission line to couple the r-f sweep to the antenna terminals of the receiver, to properly match the input impedance of this receiver.

If the shape of the response curve changes when you grasp the 300-ohm transmission line, a resistor pad, as shown in Fig. 9, should be inserted at the head-end antenna terminals. In most cases as you grasp the 300-ohm transmission line the amplitude of the response curve will decrease, the shape will not change.

L106 ALIGNMENT CHART

Marker Frequency	Sweep Frequencies and Input Points	Observe Response Curve at	Channel Switch Setting	Adjust	See Note
Interference frequency	40 to 50 MC to antenna terminals	Junction R292, L256 and L268	2	Core of L106 for minimum amplitude of curve at marker.	1, 2, 3, 4

AUDIO I-F ALIGNMENT

1. Feed a 4.5 mc signal with a 500 kc sweep and adjust for proper response curve as indicated in the chart.

2. Keep the input signal of the sweep generator low enough so that limiting does not take place, otherwise the response curve will broaden out, preventing correct adjustment. Check by increasing the output of the generator: the response curve should increase in amplitude.

3. An alternate method to the visual alignment is the sound output method using an operating television station, preferably when transmitting tone modulation during test pattern transmission.

(a) Tune the receiver for best detail.

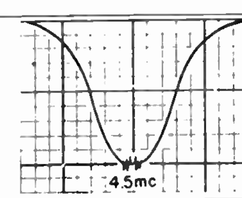
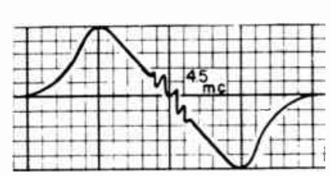
(b) Set the picture control to give reduced contrast or by using a resistor pad in the antenna circuit.

(c) Adjust transformer T401 and primary of T402 for maximum sound output.

(d) Adjust the secondary of T402 for best quality audio reception and for minimum buzz in the output.

AUDIO I-F ALIGNMENT CHART

(a) MARKER GENERATOR FREQUENCY 4.5 MC
(b) SWEEP GENERATOR FREQUENCY 4.5 MC ±500 KC
KEEP SIGNAL BELOW LIMITING LEVEL OF RECEIVER.

Step No.	Signal Input Points Between	Observe Response Curve at	Adjust	
1	Pin 1 of V17 thru .01 mf capacitor and chassis	Junction of R404, C404, and secondary of T401 thru 10 K-ohm resistor and chassis.	Primary and secondary of T401 for max. amplitude and symmetry of curve.	
2			Secondary of T402 to place zero beat of 4.5 mc marker and sweep at the cross-over of the curve and base line.	
3	Pin 1 of V18 thru .01 mf capacitor and chassis	Junction of R408, C411, and R411 thru 10 K-ohm resistor and chassis.	Primary of T402 for equal amplitude of the positive and negative peaks with a straight line connecting these peaks.	
4			Secondary of T402 to place zero beat of 4.5 mc marker at cross-over point of curve and the base line.	
5	Recheck alignment of Step 4 on operating station as in Note 3.			

ADJUSTMENT OF VIDEO AMPLIFIER 4.5 MC TRAP (L260)

NOTES:

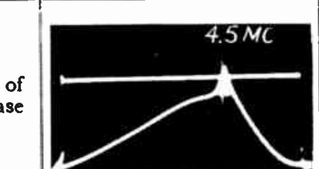
This trap is used to remove 4.5 mc audio i-f from the video amplifier which shows up in the picture as a cross-hatch pattern. This trap will very rarely require adjustment. If adjustment is necessary, proceed as follows:

1. The trap (L260, C271) is adjusted for minimum amplitude of the 4.5 mc marker. Use a detector network as shown in Fig. 19, connected from junction of L271 and C275 to chassis to detect the signal.

2. Adjust the Vertical Hold control to remove the vertical pulses from the response curve.

L260 ALIGNMENT CHART

(a) Marker Generator Frequency 4.5 MC.
(b) Sweep Generator Frequency 4.5 MC ±1 MC.

Signal Input Points Between	Signal Oscilloscope	Adjust		See Note No.
Junction L256, R292, L268 and chassis thru .01 mf capacitor.	Across 100 K-ohm resistor as shown in Fig. 19. See Note 1.	L260 for min. amplitude of 4.5 mc marker. Increase scope gain.		1, 2

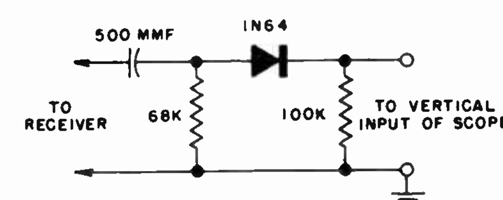


Fig. 19. Detector Network

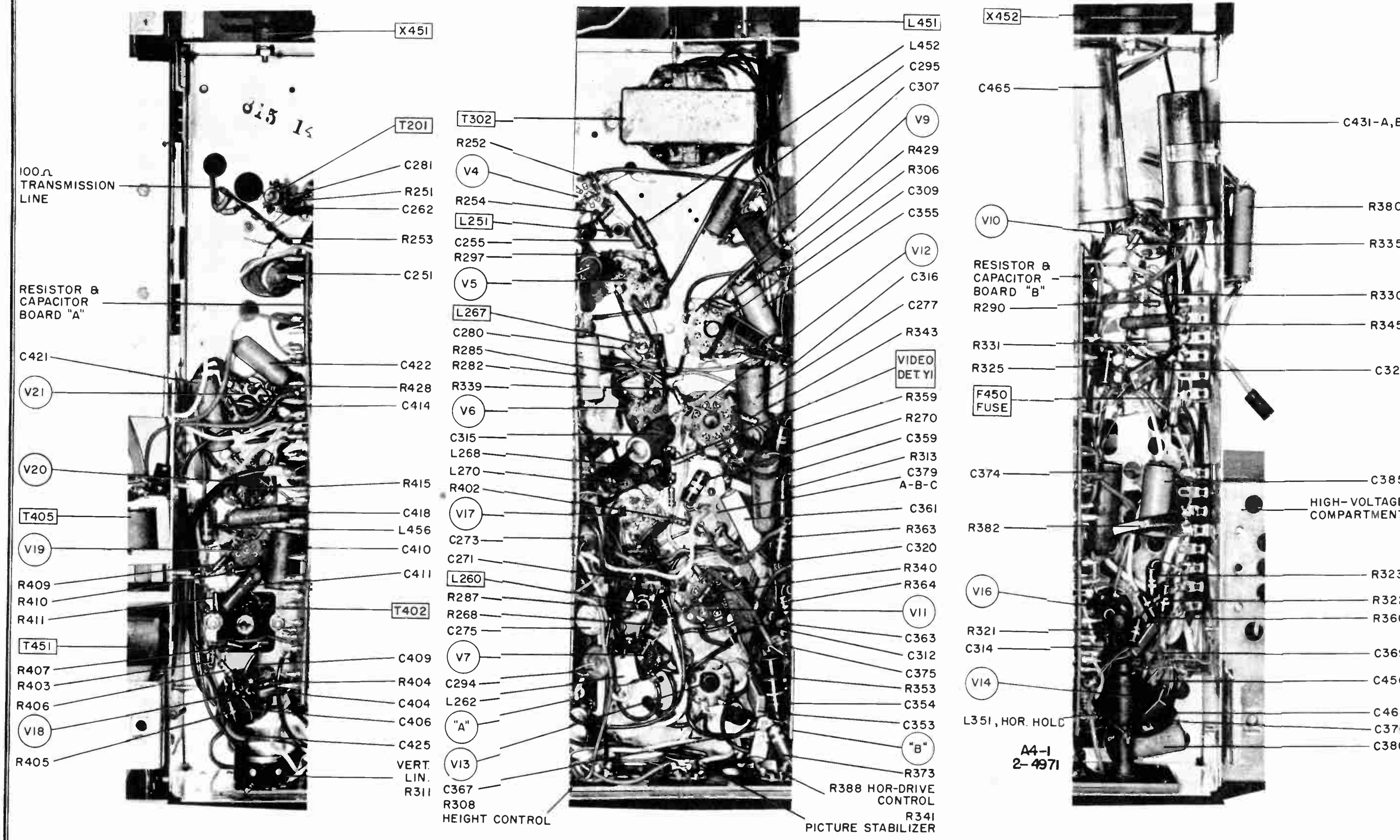
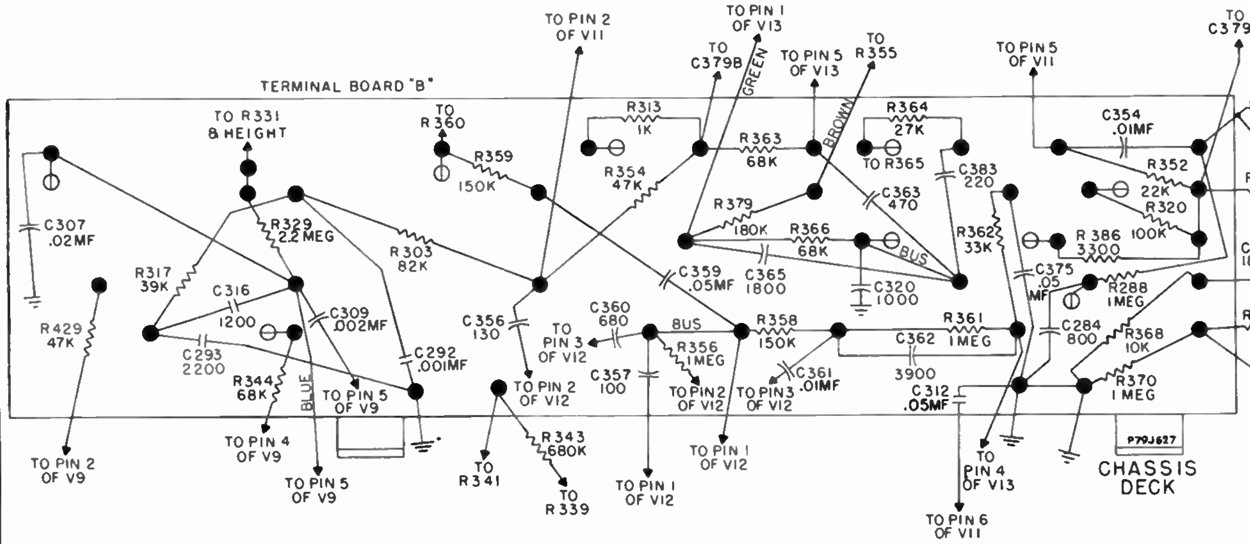
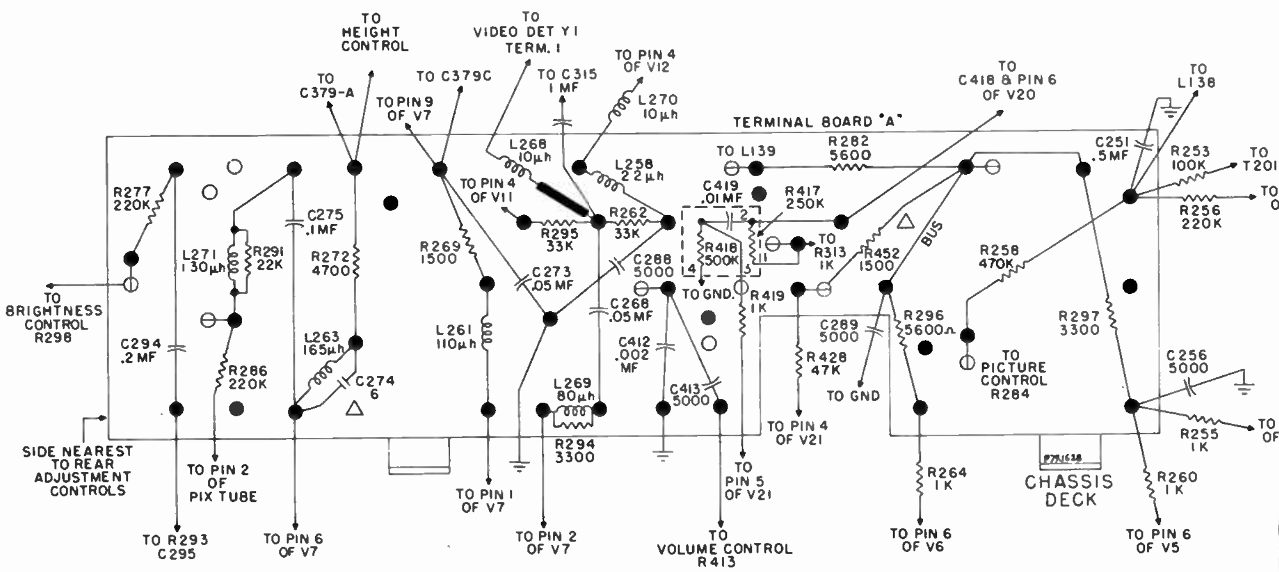


Fig. 20. Tube and Component Layout, Bottom View



Terminal Board "A"



Terminal Board "B"

Fig. 21. Resistor and Capacitor Boards

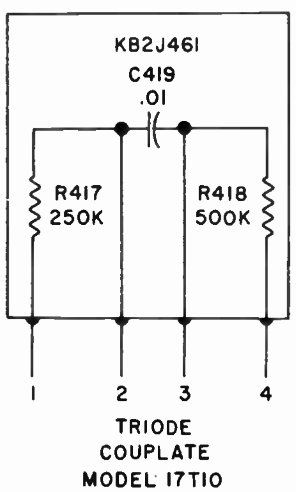


Fig. 20. Tube and Component Layout, Bottom View

UHF-TUNER MODEL UHF-103

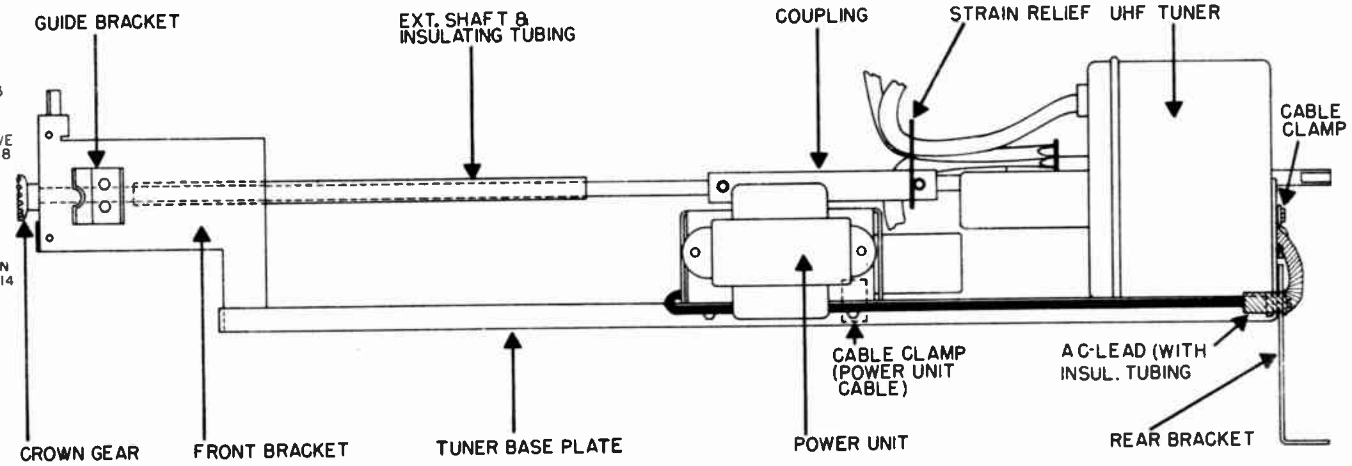


Fig. 23. UHF-103 Tuner Assembly

Installation

The tuner unit consists of a turret tuner and a power unit mounted to a base plate, see Fig. 23. The tuner is switched from the front of the receiver by means of a switch knob or knob ring which engages a crown gear, see Fig. 24. The movement of knob is transferred to the turret tuner by means of an extension shaft and coupling.

The tuner is held in place in front by a locating plate and locating pin and in the rear by a rear bracket fastened to the cabinet.

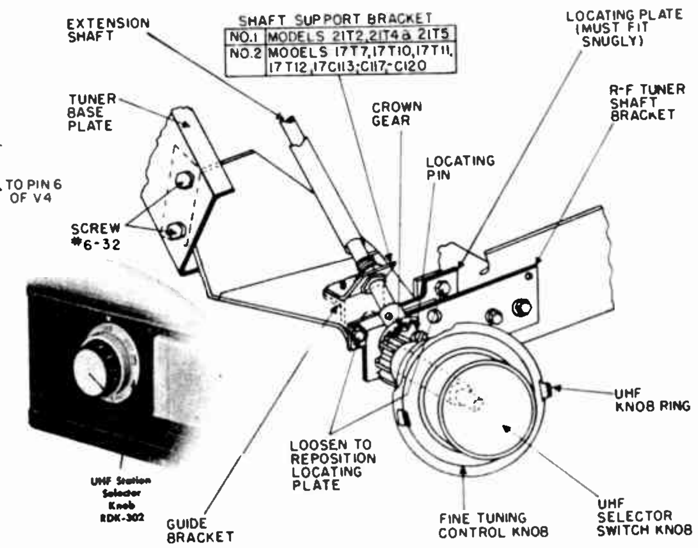


Fig. 24. UHF-Tuner Front Assembly

UHF Tuner Adjustments

General

The UHF Tuner, as shipped from the factory, has its output stage tuned to Channel No. 5, to which the television receiver must be tuned. This output stage may need realignment for Channel No. 6 operation for reasons given below. The actual realignment is very simple and can be done without the use of test equipment.

The service technician must individually adjust each of the three UHF positions for operation upon the local active UHF channels. This may be done without the use of special test equipment. The tuning ranges of the three UHF positions are all identical and cover the entire UHF spectrum.

UHF—I-F Adjustments

Before making the I-F adjustments it will probably be more convenient to remove the tuner unit from the cabinet.

The I-F preamplifier in the UHF Tuner has been factory-aligned to Channel No. 5. If there is a station operating on Channel No. 5, the Tuner I-F preamplifier should be adjusted to function on Channel No. 6. For example, it is not desirable to convert the UHF signal to Channel No. 5 if there is a strong television station operating on Channel No. 5 in your area. It is quite obvious that if the VHF station signal on Channel No. 5 is fairly strong, it will be picked up by the television receiver even when the Tuner is operating and thereby impairing the quality of the UHF picture.

To readjust the preamplifier for operation on Channel No. 6 instead of No. 5, as shipped from the factory, proceed as follows:

(a) Turn core "A" (see Fig. 25) approximately three turns counterclockwise.

(b) Turn core "B" approximately two and a half turns counter-clockwise.

The UHF Tuner is now ready for operation on Channel No. 6.

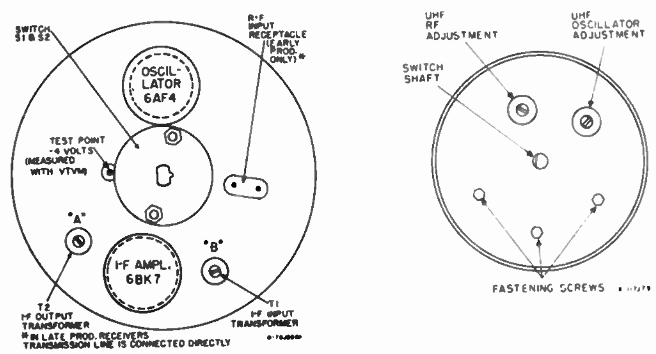


Fig. 25. UHF Adjustments

UHF Channel Adjustments

Notes:

(a) Always allow approximately 15 minutes warm-up time before proceeding with the adjustments.

(b) Set the Tuner knob ring to "UHF-1" position and the television receiver channel selector knob on either Channel No. 5 or No. 6 according to preceding information. Set the Fine Tuning control on the television receiver to the middle of its range.

ALIGNMENT PROCEDURE

1. Turn the oscillator tuning core (see Fig. 25) fully counter-clockwise.
2. From this "starting point," gradually turn the oscillator tuning core clockwise into the coil until a UHF picture and accompanying sound signal are received. While turning the oscillator core clockwise into the coil, two strong picture responses may be noticed. However, the first response to be noted while turning the core clockwise from its maximum counterclockwise position is the response to be used. Be careful not to exert any pressure when turning the core into the coil, to avoid any damage to the coil.
3. Adjust the R-F tuning core for maximum picture signal.
4. The oscillator tuning core should now be readjusted so that the Fine Tuning control on the television receiver will permit tuning slightly into accompanying audio bars or "beats." Be sure that you can tune away from any adjacent channel interference.
5. The Tuner is now aligned for operation on one UHF channel. Repeat steps 1 to 4 on the two remaining UHF positions, if more than one UHF channel is available in your area.

UHF-103 CIRCUIT DESCRIPTION

Refer to diagram, Fig. 27, page 11.

Conversion of UHF to VHF is achieved by mixing the incoming UHF signal with a signal which is generated by a local high-frequency 6AF4 oscillator. This mixing takes place in a 1N72 crystal diode, the output of which is amplified by the low-noise 6BK7 cascode amplifier. The output of this amplifier is then link-coupled to the television receiver antenna terminals.

Two antenna inputs are provided; one for the VHF antenna and one for the UHF antenna. Switches S1 and S2 are mechanically ganged with the UHF coil plate. The switch, S1 permits switching of the VHF receiver antenna input lead to either the VHF antenna directly, or to the Translator output link.

On the VHF position, switch S2 un-shorts R11. Thus, a small amount of current is permitted to flow through the tubes, even while on the VHF position.

In the UHF-1 position, as shown, the signal is fed into the input circuits consisting of C1, C2, C3, C4 and L1. L1 is a ¼-wave shorted line, the electrical length of which is varied by adjustment of the shorting core. For mechanical convenience, this ¼-wave line is wound into a spiral form and should not be considered as a conventional "coil."

The values of C1, C2, C3, C4 are chosen so that the input circuit impedance closely approximates 300 ohms across the UHF band, while the impedance at the junctions of C1 and C4 and the ends of the transmission line L1, is very high—in the order of several thousand ohms. C7, C8, L7 and L8 maintain accurate balance of the input circuits. C9 and the 1N72 diode are tied in series across the line. Their midpoint is used for extraction of the VHF converted signal as well as for injection of the local UHF oscillator signal. C9 is critical in value since together with the diode it also affects the balance of the line.

The oscillator, a 6AF4 tube, is connected in an ultra-audion oscillator circuit. Its plate voltage is "shunt-fed" through L17 which presents a high impedance at frequencies above approximately 250 mc. The oscillator tank circuit, L2, is also a tunable shorted ¼-wave line. Oscillator output is taken from the cathode circuit across L14 and coupled through C11 into the 1N72 diode.

L9 furnishes the d-c return path for rectified diode current, while C18 resonates with other circuit constants to the VHF output frequency. The converted UHF signal is coupled through C19 into the cascode 6BK7 amplifier.

This amplifier consists of two stages. The first stage is a conventional triode, grounded-cathode stage, whose input circuit is tuned to the VHF frequency, (approximately 79 to 85 mc). The cathode circuit, consisting of R1 and C20, is only used to obtain d-c bias. L12 is a high-impedance, shunt-fed R-F choke. The output of the first stage is capacity-coupled into the second triode which is a grounded-grid amplifier. In the cathode of the second stage is connected a conventional bias resistor, R4, and its R-F bypass capacitor, C23. L11 provides the d-c cathode return through T1 to ground and also provides neutralization of the first triode stage to prevent it from oscillating. This neutralizing coil is somewhat critical in value and must, if damaged, be replaced by a proper coil if the low-noise advantages of this circuit are to be maintained.

SERVICING THE UHF-103 TUNER

Before replacing components check first the tubes. Check to see that the oscillator is working properly: the voltage on test point (see Fig. 25) should read −4 volt as measured with VTVM. With the exception of the oscillator socket, the components thereon and the UHF coils, the replacement of components in the tuner is comparatively simple, requiring no special considerations other than the usual lead dress precautions common in VHF practice. However, because of the small size of most components be sure to prevent overheating of components by using a small soldering iron.

The oscillator circuit wiring and the UHF coils are critical and require special attention.

Replacement of Oscillator Tube Socket

1. Remove the coil turret assembly by loosening the four set screws in the long coupling (Fig. 23) and the one set screw in the short coupling. Then, by lifting the detent roller and turning the assembly so one of the detent slots matches the bracket screw, the turret can be slid out of the unit.
2. Unsolder all connections to the V-shaped contactor board. Remove contactor board from the assembly by removing the one Phillips-head screw.
3. Carefully unsolder the components to the tube socket, not disturbing their position any more than necessary.
4. Drill out the two rivets holding the detent roller bracket. After removing this bracket the oscillator tube socket can be removed.
5. When reinstalling new socket be sure to place components in the original position (see Fig. 26). Positioning is so critical that it is not advisable to wiggle the tube back and forth when removing or inserting it but to pull or push it straight from the socket.

Replacement of UHF Coils

1. Remove small spring split washer (Truarc clip) on turret shaft that holds textolite coil bracket. To facilitate this operation a set of Truarc pliers should be used which may be obtained at your General Electric dealer (order number WH 50 x 58).
2. After removing old coil solder new coil assembly in place with the coil leads in their normal position. Flow the solder between the lead and the contact, making sure that the iron does not put any stress on the lead which might deform it.

The tuning cores for the coils are of different sizes and are selected to fit the coils. Therefore, do not interchange cores from one coil to another. Coils are supplied from the factory complete with their cores; be sure to replace as such.

3. With proper care it is possible to replace coil without removing coil bracket. Bend carefully the textolite plate upward just above the coil to be removed. Push the coil to the right until the top of the coil clears the retaining hole.
4. Gently release the textolite plate, and while holding the coil in this cocked position, apply the soldering iron to the two coil terminals simultaneously. As soon as the solder melts tilt the coil still further to the right and remove it. Wipe the contacts clean of all solder.
5. When replacing new coil bend textolite plate gently upward and put the new coil into position, being careful not to even slightly bend the coil leads in any direction. This precaution is very important as poor frequency stability will probably result if it is not followed. In soldering the new coil leads in place use the same precaution as outlined above.

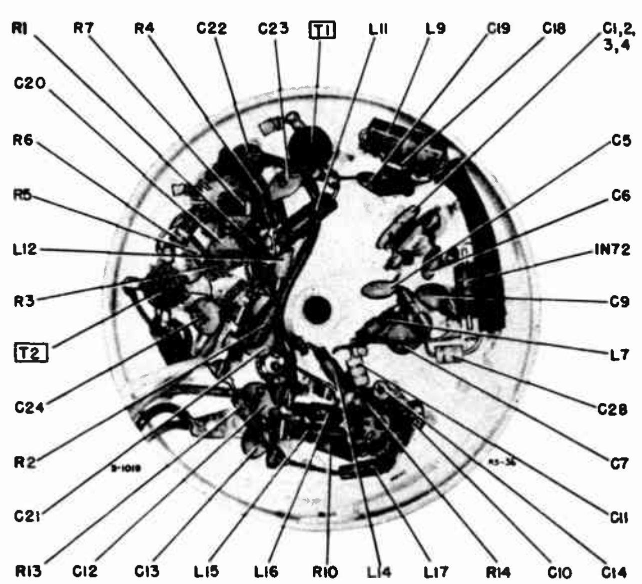
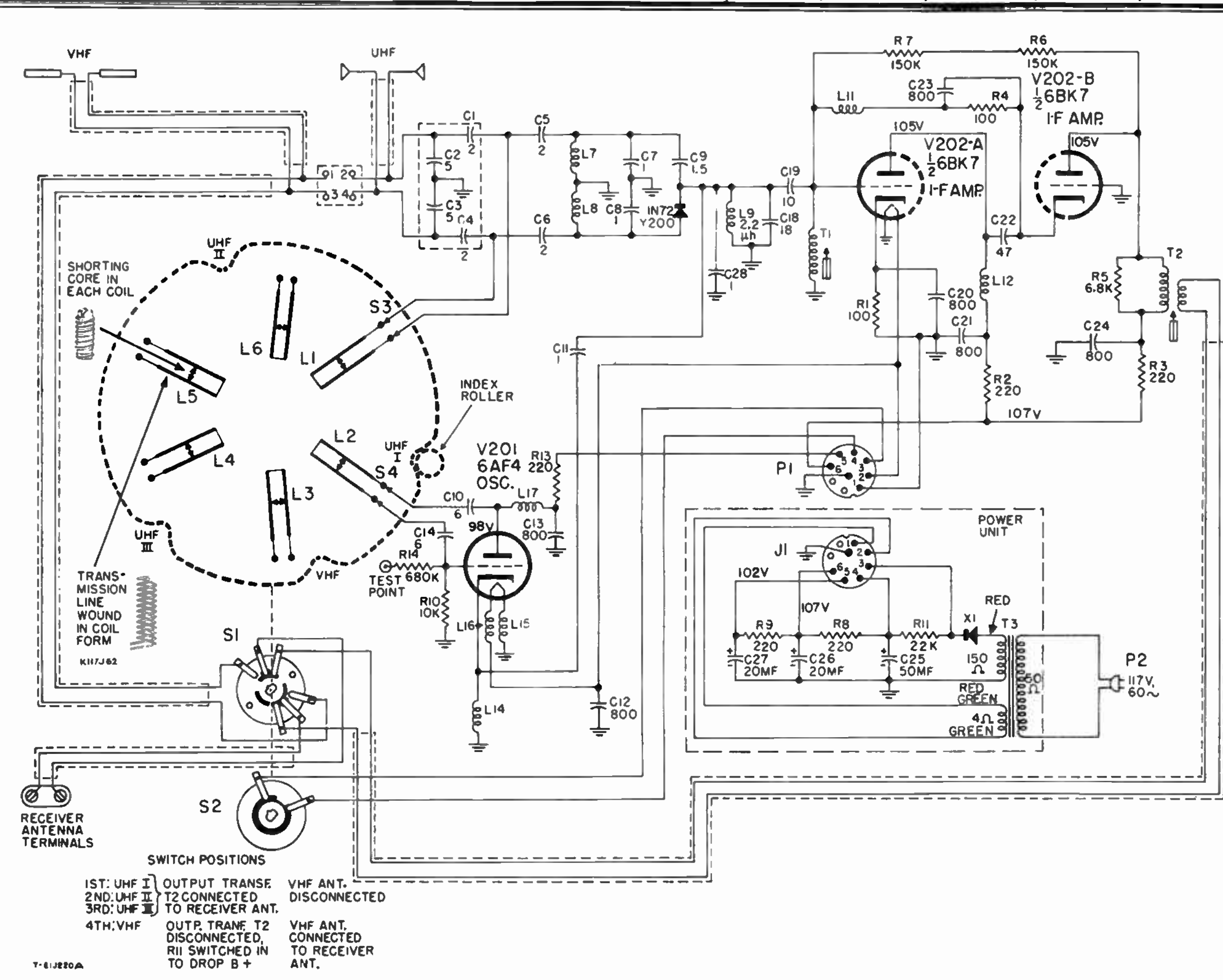
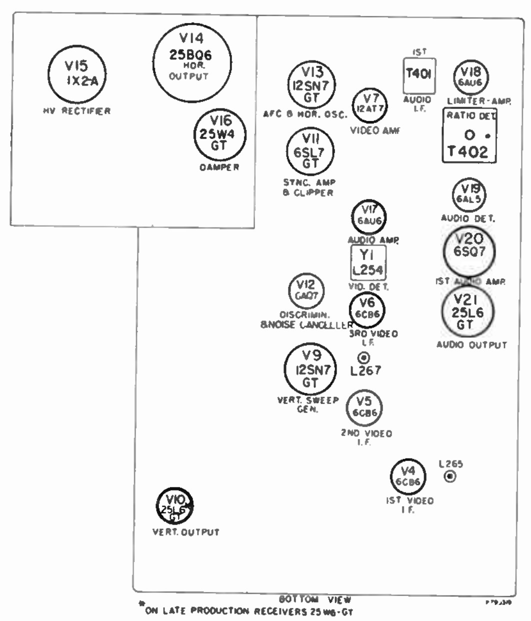
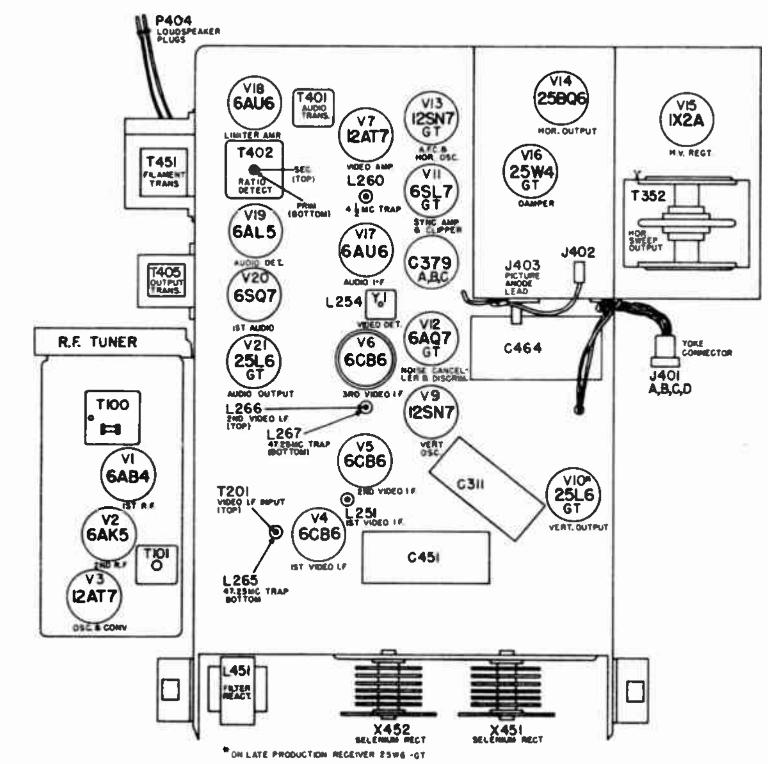


Fig. 26. UHF-103 Tube and Component Layout, Bottom View



Schematic Diagram UHF-103





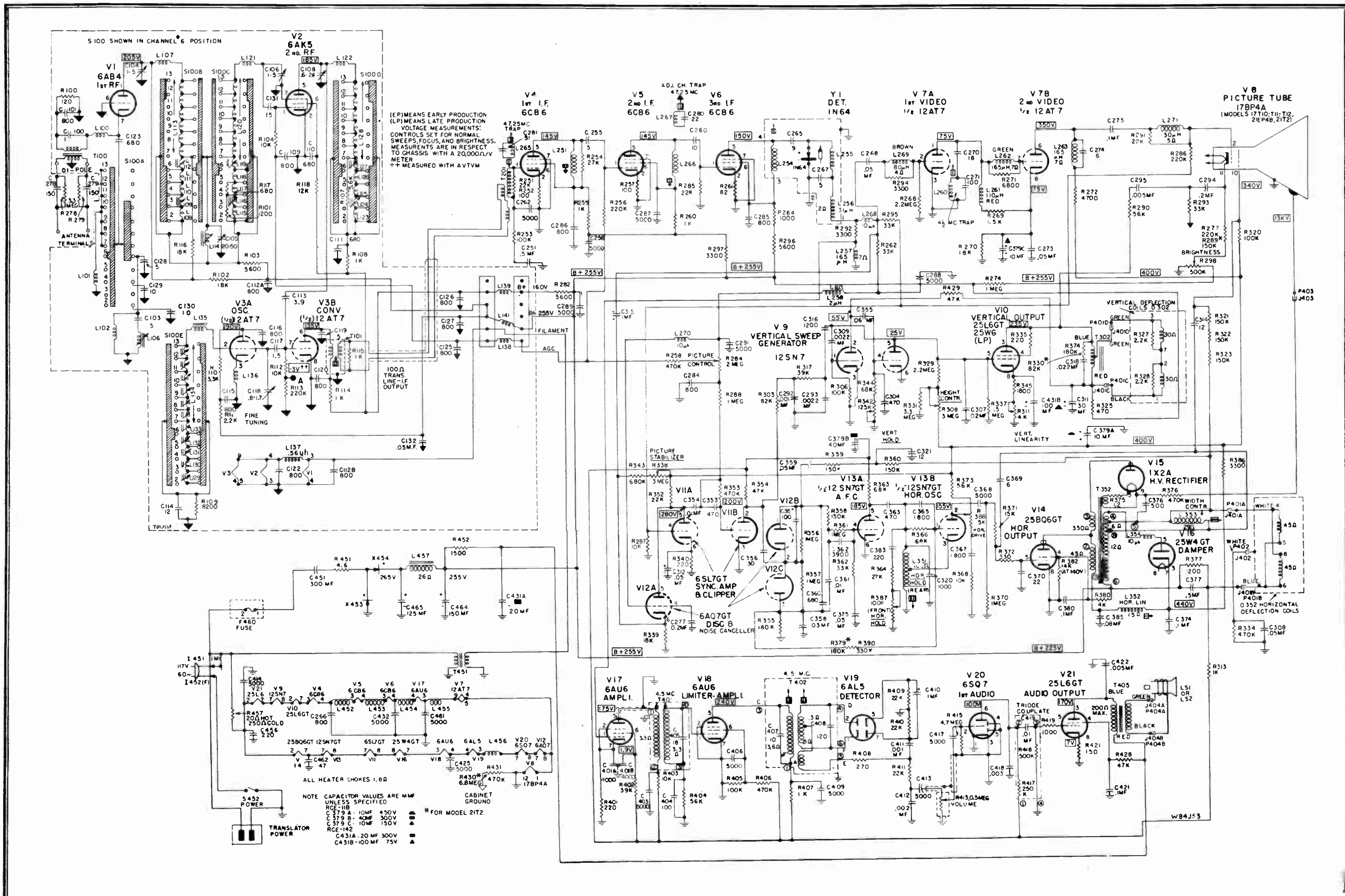


Fig. 27. Schematic Diagram, Models 17T10-T11-T12 and 21T2
17T10-UHF, 17T11-UHF and 17T12-UHF

COMPLETE LIST OF TV CHANNEL FREQUENCIES

CHANNEL NO.	FREQUENCY RANGE MC	PICTURE CARRIER MC	SOUND CARRIER MC	CHANNEL NO.	FREQUENCY RANGE MC	PICTURE CARRIER MC	SOUND CARRIER MC
2	54-60	55.25	59.75	43	644-650	645.25	649.75
3	60-66	61.25	65.75	44	650-656	651.25	655.75
4	66-72	67.25	71.75	45	656-662	657.25	661.75
5	76-82	77.25	81.75	46	662-668	663.25	667.75
6	82-88	83.25	87.75	47	668-674	669.25	673.75
7	174-180	175.25	179.75	48	674-680	675.25	679.75
8	180-186	181.25	185.75	49	680-686	681.25	685.75
9	186-192	187.25	191.75	50	686-692	687.25	691.75
10	192-198	193.25	197.75	51	692-698	693.25	697.75
11	198-204	199.25	203.75	52	698-704	699.25	703.75
12	204-210	205.25	209.75	53	704-710	705.25	709.75
13	210-216	211.25	215.75	54	710-716	711.25	715.75
14	470-476	471.25	475.75	55	716-722	717.25	721.75
15	476-482	477.25	481.75	56	722-728	723.25	727.75
16	482-488	483.25	487.75	57	728-734	729.25	733.75
17	488-494	489.25	493.75	58	734-740	735.25	739.75
18	494-500	495.25	499.75	59	740-746	741.25	745.75
19	500-506	501.25	505.75	60	746-752	747.25	751.75
20	506-512	507.25	511.75	61	752-758	753.25	757.75
21	512-518	513.25	517.75	62	758-764	759.25	763.75
22	518-524	519.25	523.75	63	764-770	765.25	769.75
23	524-530	525.25	529.75	64	770-776	771.25	775.75
24	530-536	531.25	535.75	65	776-782	777.25	781.75
25	536-542	537.25	541.75	66	782-788	783.25	787.75
26	542-548	543.25	547.75	67	788-794	789.25	793.75
27	548-554	549.25	553.75	68	794-800	795.25	799.75
28	554-560	555.25	559.75	69	800-806	801.25	805.75
29	560-566	561.25	565.75	70	806-802	807.25	811.75
30	566-572	567.25	571.75	70	812-818	813.25	817.75
31	572-578	573.25	577.75	72	818-824	819.25	823.75
32	578-584	579.25	583.75	73	824-830	825.25	829.75
33	584-590	585.25	589.75	74	830-836	831.25	835.75
34	590-596	591.25	595.75	75	836-842	837.25	841.75
35	596-602	597.25	601.75	76	842-848	843.25	847.75
36	602-608	603.25	607.75	77	848-854	849.25	853.75
37	608-614	609.25	613.75	78	854-860	855.25	859.75
38	614-620	615.25	619.75	79	860-866	861.25	865.75
39	620-626	621.25	625.75	80	866-872	867.25	871.75
40	626-632	627.25	631.75	81	872-878	873.25	877.75
41	632-638	633.25	637.75	82	878-884	879.25	883.75
42	638-644	639.25	643.75	83	884-890	885.25	889.75

PRODUCTION CHANGES

1. Vertical Sweep Circuit (Models 17T10-T11-T12 only).

(a). To reduce height changes with different settings of the Brightness control, R276, the resistor in the cathode of the picture tube was changed from R289, 150,000 ohms (URD-101) to R277, 220,000 ohms (URD-105).

(b). To eliminate compression at the top of the picture, the resistor across the vertical output transformer, T302, was changed from R330, 82,000 ohms (URD-095) to R374, 180,000 ohms, (URD-103).

2. Horizontal Sync Circuit (Models 17T10-T11-T12 only).

To improve horizontal sync stability under various conditions of signal strength levels, the feed-back resistor connected from the grid of the horizontal oscillator (V13B) to the discriminator (V12) plate was changed from R279, 180,000 ohms (URD-103) to R390, 330,000 ohms (URD-109).

3. Vertical Output Circuit.

To improve the vertical linearity, the vertical output tube was changed from 25L6-GT to 25W6-GT. These tubes are interchangeable and no change in tube socket wiring was necessary.

4. UHF-103 in Metal Cabinet 17T10, 21T2

When the UHF-103 Tuner is installed in a metal cabinet-type receiver, there is a tendency for the cabinet to induce horizontal sync pulses into the vertical system. The condition is recognized by the fact that the vertical sync is weak and unstable.

To eliminate this trouble, connect a .01 mf. 600 v molded paper capacitor between the front control apron and chassis.

A convenient location for this capacitor is on the right-hand side of the chassis looking at the front. Connect one lead of the capacitor to the center ground lug of the existing terminal board and the other lead to a soldering lug to be mounted under one of the screws fastening the front chassis mounting foot.

PARTS LIST MODELS 17T10-T11-T12, 21T2

Cat. No.	Symbol	Description	List Price
		CAPACITORS	
		Paper	
*RCC-016	C251, 377	.5 mf., 200 v.	$0.60
RCC-059	C422	.005 mf., 1000 v.	.40
*RCC-102	C132, 308. 312, 359	.05 mf., 600 v.	.40
*RCC-105	C268, 273, 375	.05 mf., 200 v.	.25
*RCC-112	C355	.06 mf., ±10%, 600 v.	.45
*RCC-113	C307	.02 mf., ±10%, 600 v.	.40
RCC-114	C385	.08 mf., 600 v.	.40
RCC-115	C316	.0012 mf., ±10%, 600 v.	.30
*RCN-018	C354	.01 mf., 600 v.	.30
*RCN-025	C361	.01 mf., ±10%, 600 v., (molded)	.35
*RCN-031	C275	.1 mf., 600 v. (molded)	.70
*RCN-033	C365. 367	1800 mmf., ±10%, 600 v.	.35
*RCN-034	C362	3900 mmf., ±10%, 600 v.	.35
*RCN-035	C376	500 mmf., 20,000 v.	2.50
*RCN-044	C318	.022 mf., 1000 v. (molded)	.60
*RCN-060	C293, 309	.0022 mf., 600 v.	.35
*RCN-062	C292, 320	1000 mmf., ±10%, 600 v., (molded)	.40
*UCC-035	C411	.001 mf., 600 v.	.25
*UCC-036	C412	.002 mf., 600 v.	.25
*UCC-037	C418	.003 mf., 600 v.	.25
*UCC-039	C295	.005 mf., 600 v.	.25
*UCC-042	C358	.03 mf., 600 v.	.30
*UCC-048	C374, 380, 421	.1 mf., 600 v.	.45
*UCC-050	C277, 294	.2 mf., 600 v.	.55
		Electrolytic	
*RCE-090	C315, 410	1 mf., 50 v.	1.20
*RCE-110	C451	300 mf., 150 v.	3.50
*RCE-118	C379, A, B, C	10 mf., 450 v., 40 mf., 300 v., 10 mf., 150 v.	3.10
*RCE-140	C465	125 mf., 350 v.	4.60
*RCE-141	C311	30 mf., 300 v.	2.10
*RCE-142	C431, A, B	20 mf., 300 v., 100 mf., 75 v.	2.65
*RCE-143	C464	150 mf., 300 v.	4.60
		Mica and Ceramic	
*RCN-027	C112A, B	800-800 mmf., ceramic	
*RCN-029	C265	9 mmf., 500 v., silver mica.	.35
*RCN-047	C401A, B	4000-4000 mmf., dual, 450 v., ceramic	.65
*RCN-055	C113	3.9 mmf., mica	.25
*RCU-294	C360	680 mmf., 500 v., mica, ±20%	.35
*RCU-299	C356	130 mmf., ±5%, 800 v., mica	.35
*RCU-300	C369	6 mmf., ±25%, 1500 v., mica	.45
RCU-305	C314	12 mmf., 1500 v., mica, ±10%	.45
RCU-309	C383	220 mmf.	
RCU-310	C321	12 mmf., 1000 v.	
*RCW-3014	C256, 262, 287, 288, 289, 291, 368, 403, 406, 409, 413, 414, 417, 425, 432, 461	5000 mmf., 450 v., ceramic.	.25
*RCW-3027	C111	680 mmf., ceramic	.90
*RCW-3037	C101, 109, 115, 116, 120, 121, 122, 125, 126, 127, 284, 285, 286	800 mmf., 500 v., ceramic.	.25
*RCW-3045	C110, 123	680 mmf., ceramic	.30
*RCW-3046	C117	1.5 mmf., ±10%, ceramic	.60
*RCW-3057	C128	5 mmf., ±5%, ceramic	.25
*RCW-3066	C129, 130	10 mmf., ±5%, ceramic	.25
*RCW-3074	C114	12 mmf., ±5%, ceramic	.25
*RCW-3076	C131	15 mmf., ±10%, ceramic	.25
*UCG-002	C274	6 mmf., 500 v., mica, ±25%	.25
*UCG-1005	C103, 119, 255, 267	5 mmf., ±5%, silver mica, 500 v.	.35
*UCG-1012	C280, 370	22 mmf., ±10%, 500 v., silver mica	.35
*UCG-1020	C462	47 mmf., ±10%, 500 v., silver mica	.25
*UCG-2004	C260	10 mmf., ±10%, 500 v., silver mica	.25
*UCG-2010	C270, 405	18 mmf., ±5%, silver mica, 500 v.	.35
*UCG-2021	C281	51 mmf., ±5%, silver mica, 500 v.	.30
		Mica and Ceramic (Cont'd)	
*UCG-2030	C408	120 mmf., ±5%, silver mica, 500 v.	$0.30
*UCU-028	C357, 404	100 mmf., 500 v., mica, ±20%	.25
*UCU-036	C456	220 mmf., 500 v., mica, ±20%	.30
*UCU-532	C278, 279	150 mmf., 1500 v., mica	.30
*UCU-1044	C304, 353, 363	470 mmf., ±10%, 500 v., mica	.30
*UCU-1528	C271	100 mmf., ±10%, silver mica, 500 v.	.30
*UCW-2004	C407	10 mmf., ±5%, ceramic, 500 v.	.60
		Trimmers	
*RCY-048	C108	.6–2.4 mmf.	.40
*RCY-065	C104, 106	1–5 mmf., glass tube type	.50
*RCY-066	C105	20–50 mmf., temperature comp.	1.25
*RCY-067	C118	.8-1.7 mmf., Fine Tuning control	2.00
		RESISTORS	
		Corbon ½ W.	
*URD-023	R261	82 ohms	.13
*URD-025	R252, 257	100 ohms	.13
*URD-027	R100	120 ohms	.13
*URD-033	R335, 340, 401	220 ohms	.13
*URD-035	R408	270 ohms	.13
*URD-037	R372	330 ohms	.13
*URD-045	R117	680 ohms	.13
*URD-049	R108, 114, 115, 255, 260, 264, 407, 419	1000 ohms	.13
*URD-051	R101, 377	1200 ohms	.13
*URD-053	R269	1500 ohms	.13
*URD-057	R111, 327, 328	2200 ohms	.13
*URD-061	R110	3300 ohms	.13
*URD-067	R107	5600 ohms	.13
*URD-071	R109	8200 ohms	.13
*URD-073	R104, 112, 287, 368, 403	10,000 ohms	.13
*URD-075	R118	12,000 ohms	.13
*URD-077	R371	15,000 ohms	.13
*URD-079	R102, 116, 339	18,000 ohms	.13
*URD-081	R251, 285, 291, 411	22,000 ohms	.13
*URD-083	R254, 364	27,000 ohms	.13
*URD-085	R262, 293, 295, 362	33,000 ohms	.13
*URD-087	R317, 402	39,000 ohms	.13
*URD-089	R354, 428	47,000 ohms	.13
*URD-091	R290, 404	56,000 ohms	.13
*URD-093	R344, 366	68,000 ohms	.13
*URD-095	R303, 330†	82,000 ohms	.13
*URD-097	R253	100,000 ohms	.13
*URD-101	R289†, 358	150,000 ohms	.13
*URD-103	R355, 374††	180,000 ohms	.13
*URD-105	R113, 256, 286	220,000 ohms	.13
URD-109	R390	330,000 ohms	.13
*URD-113	R258, 334, 353, 406, 431	470,000 ohms	.13
*URD-117	R343	680,000 ohms	.13
*URD-121	R274, 288, 356, 357, 361, 370	1 meg.	.13
*URD-125	R337	1.5 meg.	
*URD-129	R268, 329	2.2 meg.	.13
*URD-133	R278, 279 331	3.3 meg.	.13
*URD-137	R415	4.7 meg.	
*URD-1061	R292	3,300 ohms, ±5%	.24
*URD-1081	R409, 410	22,000 ohms, ±5%	.24
*URD-1097	R306, 320, 405	100,000 ohms, ±5%	.24
		Carbon 1 W.	
*URE-029	R421	150 ohms	.17
*URE-041	R325	470 ohms	.17
*URE-049	R313	1,000 ohms	.17
*URE-067	R103	5,600 ohms,	.17

PRICES ARE SUGGESTED LIST PRICES AND SUBJECT TO CHANGE WITHOUT NOTICE.

Resistor value tolerance is ±10% unless otherwise specified.
*Parts used on previous receivers.
†Model 21T2 only.
††17-inch models only.

PARTS LIST MODELS 17T10-T11-T12, 21T2

RESISTORS, 1W CARBON (Cont'd)

Cat. No.	Symbol	Description	List Price
*URE-081	R352	22,000 ohms	$0.17
*URE-089	R429	47,000 ohms	.17
*URE-093	R363	68,000 ohms	.17
*URE-101	R321, 322, 323, 359, 360	150,000 ohms	.17
*URE-113	R376	470,000 ohms	.17

Carbon 2 W.

Cat. No.	Symbol	Description	List Price
*URF-055	R345	1,800 ohms	.25
*URF-061	R386	3,300 ohms	.25
*URF-065	R272	4,700 ohms	.25
*URF-067	R296	5,600 ohms	.25
*URF-079	R270	18,000 ohms	.25
*URF-091	R373	56,000 ohms	.25

POTENTIOMETERS

Cat. No.	Symbol	Description	List Price
*RRC-096	R308	3 meg., Height control, 2W.,	1.25
*RRC-127	R311	4000 ohms, 2W. Vertical Linearity control	1.65
*RRC-173	R365	100,000 ohms, Horizontal Hold control, Model 21T2 only	1.25
*RRC-174	R305	125,000 ohms, Vertical Hold control, Model 2172 only	1.25
*RRC-175	R276	500,000 ohms, Brightness control, Model 21T2	1.25
*RRC-186	R284, 413	2 meg., and .5 meg., Picture and Volume dual control	2.80
*RRC-191	R387	Horizontal Hold 100,000 ohms, 17-inch models only	1.40
*RRC-193	R342	Vertical Hold, 125,000 ohms, 17-inch models only	1.40
*RRC-195	R388	5000 ohms, ½ watt, Horizontal Drive control	1.65
*RRC-196	R341	3 meg., Picture Stabilizer Model 21T2 only	1.00
*RRC-200	R298	Brightness control, 500,000 ohms, 17-inch models only	1.35
RRC-201	R338	3 meg., Picture Stabilizer, 17-inch models	1.00

RESISTORS

Wire Wound and Special

Cat. No.	Symbol	Description	List Price
*REK-002	C419, R417, 418	TRIODE COUPLATE—.01 mf., 250,000 ohms, 500,000 ohms	1.00
*RRW-048	R451	4.6 ohms, 5 w., wire wound, ±20%	.45
*RRW-051	R457	20 ohms, globar	1.75
*RRW-053	R380	4,000 ohms, 7 w., wire wound ±10%	.65
*RRW-058	R375	1.2 ohms, ±10%, ½ w., wire wound	.20
*RRW-079	R282	5600 ohms, 5 w., wire wound ±10%	.60
*RRW-082	R452	1500 ohms, ±10%, 5 w. wire wound	.60
*RRW-088	R382	14,000 ohms at 140 v., globar ±15%	1.50
*RRW-098	R297	3300 ohms, 10 w., wire wound ±10%	1.00

COILS AND TRANSFORMERS

Cat. No.	Symbol	Description	List Price
*RJX-050		HEAD-END—R-F tuner, assem. complete with tubes and aligned††	75.00
*RLA-037	T100	TRANSFORMER — Antenna input	1.80
*RLC-091	L351	COIL—Horizontal Hold coil and adjustment slug.	1.75
*RLD-014	L353	COIL—Width control with adjustment core	1.30
*RLD-016	L352	COIL—Horizontal Linearity coil and tuning core	1.30
RLD-045	D302, 352, R388, 389	DEFLECTION YOKE—Horizontal and vertical deflection coils with resistors	15.00
*RLF-024	L255, 256	COILS—31 μh. R-F choke, part of video detector assembly	.65
*RLF-051	L451	CHOKE—B+ supply filter choke 0.9 H	3.75
*RLI-096	L266, 267, 280	COIL—2nd. video I-F coil and tuning core	.85
*RLI-097	T401, C405	COIL—1st. audio I-F and tuning core	2.25

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*Parts used on previous models.
†Normal discount does not apply.

COILS AND TRANSFORMERS (Cont'd)

Cat. No.	Symbol	Description	List Price
*RLI-100	L260, C270, 271	COIL—4.5 mc. video trap coil	$1.80
*RLI-108	L261	CHOKE — Video peaking coil, 110 μh., 4.85 ohms single coil pi wound	.45
*RLI-122	L258, 402, 452, 453, 454, 455	COIL—Heater choke coil, 2 μh	.25
*RLI-138	L270, 354	CHOKE—10 μh., in horizontal sweep output circuit	.25
*RLI-144	L137	CHOKE—.56 μh., heater choke for V2 and V3	.25
*RLI-145	L136	CHOKE—1.4 μh., V3A oscillator cathode	.35
*RLI-152	L141	CHOKE—R-F choke	.65
*RLI-154	L138, 139	CHOKE—3.3 μh., choke coil, orange, molded	.25
*RLI-159	L106	TRAP—I-F trap coil and tuning core in head-end	.75
*RLI-161	L262, R271	CHOKE—Video compensating	.70
*RLI-162	L257, 263	CHOKE—Video compensating, 165 μh.	.45
*RLI-165	L100	CHOKE—R-F input	.35
RLI-173	L266, 277	COIL—3rd. video I-F coil and tuning core	1.75
RLI-174	L269, R294	CHOKE—Video comp. 80 μh and 3300-ohm resistor	.50
RLI-185	L271, R291	CHOKE — Video comp. choke, 130 μh. and 22,000-ohm resistor	.60
*RLX-035	C265, 267, L254, 255, 256	VIDEO DETECTOR ASS'Y.—In shield can includes 1N64 diode, capacitors, coils and tuning slugs	6.00
*RTD-008	T402, C407, 408	TRANSFORMER — Ratio detector transformer assembly with capacitors and cores	5.25
*RTF-002	T451	TRANSFORMER — Filament for V1, V2, and V3	3.60
RTL-137	T201, C281, L265	TRANSFORMER—I-F input with tuning core in shield can	2.90
*RTL-139	T101	TRANSFORMER — Video I-F head end output with tuning core in shield can	1.95
RTO-081	T405	TRANSFORMER — Audio output	2.25
*RTO-116	T352	TRANSFORMER — Horizontal sweep output	12.65
*RTO-117	⊢302	TRANSFORMER — Vertical sweep output	7.60

MISCELLANEOUS ELECTRICAL

Cat. No.	Symbol	Description	List Price
*REC-006		CAP—High voltage rectifier	
*REF-008	F459	FUSE—1.6 amp., 125 v., slo blo line fuse	.05
*REI-014		CORE—Brass (screw type) tuning core for R-F tuner coils	.05
*REI-016		CORE—Tuning core composition iron with screw stud for RLI-097, RLI-100, RLX-035	.20
*REI-027		CORE — Width control, composition iron with screw stud	.60
*REI-033		CORE—Tuning core for ratio detector transf., RTD-008	.25
*REI-034		CORE—Brass (screw type), large head, for RSX-019	.10
*REI-035		CORE—Brass (screw type, ½ inch long) tuning slug for oscillator coils L129, L130, L131, L132, or R-F coilsL105,L109,L116,L124	.10
*REI-036		CORE—Brass (screw type. ¾ inch long tuning, slug for R-F tuner coils L112, L119, L127 and L133	.10
*REI-038		CORE—Tuning core composition iron with screw stud for trap coil T201	.20
*REI-040		CORE—Tuning core composition iron with screw stud for T101	.20
RER-015	X451, 452	RECTIFIER—350 ma., selenium	
*RET-014		ION TRAP—PM magnet ring on neck of picture tube	1.45
*RII-057		STRIP—Head-end switch wafer mounting insulator, textolite side rails	.25

MISCELLANEOUS ELECTRICAL (Cont'd)

Cat. No.	Symbol	Description	List Price
*RII-067		INSULATOR — Textolite bushing insulates volume control shaft from chassis	$0.05
RII-072		INSULATOR—For rear apron potentiometers.	.35
*RII-074		INSULATOR GUIDE—On channel switch bracket	.15
RII-075		INSULATOR—Left hand control mounting bracket	.15
RII-076		INSULATOR—Right hand control mounting bracket	.15
*RJC-015	P402	PLUG—Single connector male plug for deflection yoke	.30
*RJC-019	P404	SPEAKER PIN — Loudspeaker lead connector	.02
*RJC-020		CONNECTOR — Anode, Model 17T10-T11-T12	.60
RJC-025		CONNECTOR — Anode connector 17T11 and 17T-12	.70
*RJJ-008	S452	RECEPTACLE — Translator power	.35
*RJJ-010	I451	RECEPTACLE — Power cord	.20
RJP-039	P401	PLUG—Yoke connector, male, 4 pins	.15
*RJS-003		SOCKET—Tube socket, octal 1 5/16 inch for 6SQ7	.20
*RJS-025		SOCKET—Molded octal socket, wax impregn. for 25W4	.20
*RJS-026		SOCKET—Tube socket, octal, 1 1/16 inch for V21	.20
*RJS-031		SOCKET—Octal tube socket for tube V14	.25
*RJS-118		SOCKET Wafer socket, 9 pins, 1⅛ inch mtg., for 12AT7	.35
*RJS-132		SOCKET—Seven pin tube socket, 1 1/16 inch for V12 and V9	.20
*RJS-133		SOCKET—Tube socket, 7 pin shielded for V5, V6, V18	.20
*RJS-135		SOCKET — Octal shock mount for V13	.25
RJS-145		SOCKET—Miniature, 7 pin, wafer for 6CB6	.30
*RJS-148		SOCKET—Molded, tube socket, 9 pin, for high voltage rectifier V15	.25
*RJS-159	J402, 403	SOCKET — Female receptacle, 1 pin, for hi-voltage lead of yoke assy., and pix anode connector	.20
*RJS-160		SOCKET—Miniature 7 pin, for V1 and V2	.25
*RJS-161		SOCKET—Miniature 9 pin for V3	.30
*RJS-170	J401	SOCKET—Yoke connector, 4 pin female receptacle.	.25
*RJS-179		SOCKET—7 pin, shielded for 6AU6	.20
RLF-059		PM FOCUS ASSEMBLY—Less flexible shaft, 17T10 and 21T1	11.00
RLF-060		PM FOCUS ASSEMBLY—17T11 and 17T12	11.00
*RSX-019	S100-E, L134	SWITCH WAFER—Channel switch wafer with oscillator coils (first from knob)	7.00
*RSX-020	S100-D, L128	WAFER COIL ASSY.—Switch wafer - channel switch wafer with 2nd R-F plate coil (2nd from knob)	7.00
*RSX-021	S100-C, L120	SWITCH WAFER—With 2nd R-F grid coils (3rd from knob)	7.00
*RSX-022	S100-B, L113	SWITCH WAFER—With 1st R-F. plate coils (4th from knob)	6.50
*RSX-023	S100-A	SWITCH WAFER—Channel switch wafer with capacitors and coils (5th from knob)	5.75
*RWL-027		POWER CORD—A-c power cord and plug	1.20
*RWX-045		SOCKET—Picture tube socket	.90
S-527D-7	LS1	SPEAKER—PM, 5¼ inch	4.60

PRICES ARE SUGGESTED LIST PRICES AND SUBJECT TO CHANGE WITHOUT NOTICE.
*Parts used on previous receivers.
††Without C132 and jumper lead across terminals 3 and 4, see Fig. 14.

MISCELLANEOUS MECHANICAL

Cat. No.	Description	List Price
*RAD-083	BRACKET—For On-Off, volume and switch control	$0.25
RAD-096	BRACKET—Focus unit support bracket, Model 21T2	.25
*RAP-023	DETENT PLATE—Detent index plate for channel switch	.60
RAR-009	ROD—Pix tube mounting rod, Model 21T2	.85
RAR-010	ROD—Picture tube mounting rod, 17-inch models	.75
RAR-011	ROD—Yoke mount rod, Model 21T2	.65
RAR-012	ROD—Yoke mount rod, Model 17T10	.60
RAR-015	ROD—Picture tube mounting rod 17-inch models	.70
RAR-023	ROD—Yoke mounting rod, Model 17T12	.30
RAR-024	ROD—Yoke mounting rod, 17T10 and 17T11	.30
REA-002	PICTURE CORRECTOR—Bar magnet mounted on tie channel, Model 17T10 and 21T2	.65
RET-014	ION TRAP—PM magnet ring on neck of picture tube	1.45
RHC-008	CLIP—Mounting clip, 1 inch for elect. cap.	.10
RHG-010	GROMMET—Shock mount for tube V10	.05
RHG-021	GROMMET—Rubber grommet for speaker mounting	.05
RHJ-021	SPACER—"T" spacer on PM focus mount assy.	.10
RHM-072	FUNNEL—Crimp funnel on focus adjustment screw, Models 17T11 and 17T12	.15
RHN-016	NUT—Coupling nut for screws in channel selector shaft coupling RMK-006	.15
RHS-088	SHIELD—For tube V3	.30
RHS-089	BASE—Tube shield base for RHS-088 clip-on type	.15
*RHW-032	WASHER—Shoulder washer on head-end mounting	.02
RHW-033	WASHER—Rubber washer for loudspeaker mounting	.02
*RHW-038	WASHER—"U" washer on tube mounting rod, Model 21T2	.02
RHW-043	WASHER—Rubber washer for speaker mounting	.05
*RMC-017	CLIP—Mtg., clip, 1⅜ inch for electrolytic cap.	.10
*RMK-006	COUPLING—Shaft coupling (composition), less screws and nuts, couples head-end selector switch assembly shaft to control knob shaft	.35
RMM-222	CUSHION—Tube cushion Model 21T2	.25
RMM-225	CHANNEL—Tie channel, metal piece to hold PM focus unit mount	.15
RMM-226	SUPPORT—Yoke support plate, fibre	.25
RMM-227	MOUNT—Focus coil mount brass rod	1.20
RMM-228	CUSHION—Tube cushion, Models 17T11, 17T12	.15
RMM-234	SUPPORT—Anode lead support Model 21T2	.40
RMM-235	SUPPORT—Anode lead support 17-inch models	.35
RMM-238	DISC—Focus unit disc	1.20
RMS-310	SPRING—For head-end fine tuning control, for 17-inch models	.10
RMS-311	SPRING—Picture tube ground spring, Model 21T2	.10
RMS-312	STRAP—Support strap for focus coil, 17T10 and 21T2	.40
RMS-313	ASSEMBLY—Tube strap assembly, Model 21T2	2.75
RMS-314	ASSEMBLY—Tube strap assembly, Model 17T10	2.10
RMS-315	SPRING—Grounding spring, Model 21T2	.10
*RMS-316	STRAP—Support strap for focus coil, Models 17T11 and 17T12	.40
*RMU-055	SHAFT—Extension shaft for RLD-014 and RLD-016	.25
RMU-084	SHAFT—Switch shaft for channel switch, Model 21T2 only	.75
*RMU-087	SHAFT—Flexible shaft for PM focus unit, 17T10 and 21T2	1.85
RMU-089	SHAFT—Switch shaft for channel switch, 17-inch models only	.75
*RMX-178	RING ASSEMBLY—Ring, hub-flange assembly on fine tuning control shaft	.55
*RMX-211	SHAFT ASSEMBLY—Front panel tuning shaft (tubular) assembly, includes spacer and friction disc, Model 21T2 only	1.70
RMX-228	SHAFT ASSEMBLY—Front panel tuning shaft (tubular) assembly, includes space and friction disc, 17-inch models only	1.85
RMX-230	STRAP—Picture tube strap assembly, models 17T11 and 17T12	1.35

CABINETS AND CABINET PARTS

Cat. No.	Description	List Price
RAB-196	BACK—Cabinet back, Model 21T2	2.30
RAB-197	BACK—Cabinet back, Model 17T10	2.20
RAB-204	BACK—Cabinet back, Model 17T12	2.20
RAB-207	BACK—Cabinet back, Model 17T11	
*RAC-115	CAP—For cabinet back, Model 21T2	1.80
RAC-120	CAP—For cabinet back, Model 17T10	1.90
RAC-122	CAP—For cabinet back, Models 17T11-T12	
*RAD-084	DOOR—Trap door for knob escutcheon, Model 21T2	2.40
RAG-054	BAFFLE—Baffle and grille assy. for loudspeaker, 17T10 and 21T2	.95
RAV-204	CABINET—Metal cabinet, less mask and safety glass, Model 21T2	95.00†
RAV-205	CABINET—Metal cabinet, less mask and safety glass, Model 17T10	70.00†
RAV-209	CABINET—Mahog. cabinet, less mask and safety glass, 17T12	85.00†
RAV-213	CABINET—Mahog. cabinet, less mask and safety glass, Model 17T11	65.00†
*RDE-125	ESCUTCHEON—Control knob escutcheon less springs and clips, Model 21T2	1.25

CABINETS AND CABINET PARTS (Cont'd)

Cat. No.	Description	List Price
*RDK-244	KNOB—Concealed knobs, fawn for Model 21T2	.15
*RDK-263	KNOB—Knob for Off-On and volume control	.30
*RDK-291	KNOB—Knob for picture stabilizer	.15
RDK-299	KNOB—Knob for selector switch	1.20
RDK-300	KNOB—Secondary knobs, Models 17T10-T11-T12	.15
*RDK-308	KNOB AND SKIRT ASSY.—For tuning control	1.10
*RDK-309	KNOB AND SKIRT ASSY.—For picture control	1.20
*RDM-032	MASK—Picture tube mask, metal Model 21T2	17.50
RDM-033	MASK—Picture tube mask, Model 17T10	11.50
RDM-039	MASK—Picture tube mask, Model 17T12	
RDM-040	MASK—Picture tube mask, Model 17T11	15.95
*RDW-061	GLASS—Safety glass for picture tube, Model 21T2	11.95
RDW-062	GLASS—Safety glass for picture tube, Models 17T10-T11-T12	8.00
RMM-232	CUSHION—For safety glass 17 1/16-inch long, Models 17T10-T11-T12	$0.30
RMM-233	CUSHION—For safety glass 12 11/16-inch long, 17-inch models	.20
RMM-246	CUSHION—For picture tube	
*RMS-222	SPRING—Right hand spring for knob escutcheon, Model 21T2	.05
*RMS-223	SPRING—Left hand spring for knob escutcheon, Model 21T2	.05
*RMS-272	COMPRESSION RING—For tuning knob assembly	.05
*RMS-273	COMPRESSION RING—For picture knob assembly	.04
*RHC-036	CLIP—For escutcheon door pin springs, Model 21T2	$0.05
RHW-033	WASHER—Cup washer for escutcheon mounting 21T2	.02
*RIG-010	DUST SEAL—Rubber ring, Model 21T2, located between picture tube and safety glass	1.60
RIG-011	DUST SEAL—Rubber ring Models 17T10-T11-T12 located between picture tube and safety glass	1.40
*RMM-222	CUSHION—Picture tube cushion, Model 21T2	.25
RMM-228	CUSHION—Picture tube cushion, Models 17T10-T11-T12	.15
RMM-230	CUSHION—For safety glass 21⅛-inch long, Model 21T2	.25
RMM-231	CUSHION—For safety glass 15⅝-inch long, Model 21T2	.20

PARTS LIST—MODEL UHF-103

RESISTORS

Cat. No.	Symbol	Description	List Price
*URD-025	R1, 4	RESISTOR—100 ohms, ½ w., carbon	$0.13
*URD-033	R2, 3, 9, 13	RESISTOR—220 ohms, ½ w., carbon	.13
*URD-069	R5	RESISTOR—6800 ohms, ½ w., carbon	.13
*URD-073	R10	RESISTOR—10,000 ohms, ½ w., carbon	.13
*URD-081	R11	RESISTOR—22,000 ohms, ½ w., carbon	.13
URD-101	R6, 7	RESISTOR—150,000 ohms, ½ w., carbon	.13
*URD-117	R14	RESISTOR—680,000 ohms, ½ w., carbon	.13
URE-033	R8	RESISTOR—220 ohms, 1 w., carbon	.13

CAPACITORS

Cat. No.	Symbol	Description	List Price
RCE-150	C25, 26, 27	CAPACITOR—50 mf., 150 v. —20 mf., 150 v. —20 mf., 150 v.	3.00
*RCN-001	C11, 25	CAPACITOR—1 mmf., ceramic, min.	.20
*RCW-3037	C12, 13, 20, 21, 23, 24	CAPACITOR—800 mmf., ceramic	.25
*RCW-3070	C1, 2, 3, 4	CAPACITOR—2-2-5-5 mmf., ±.5 mmf. ceramic	1.75
RCW-3082	C5, 6	CAPACITOR—2 mmf., ceramic	.25
RCW-3083	C7, 8	CAPACITOR—1 mmf., ceramic, ±.25 mmf	.25
RCW-3084	C9	CAPACITOR—1.5 mmf., ±.25 mmf	.25
RCW-3085	C19	CAPACITOR—10 mmf., ±10%, ceramic	.25
RCW-3086	C18	CAPACITOR—18 mmf., ±10%, ceramic	.25
RCW-3087	C22	CAPACITOR—47 mmf., ceramic	.25
RCW-3088	C10, 14	CAPACITOR—6 mmf., ±5%, ceramic	.25

COILS AND TRANSFORMERS

Cat. No.	Symbol	Description	List Price
*RLI-122	L9	CHOKE—I-F choke, molded 2.2 mh.	.25
*RLI-168	L7, 8	CHOKE—R-F choke, 10 turns	.35
RLI-187	L11	COIL—Neutralizer coil	.85
RLI-188	L12	COIL—Interstage tuning coil	.60
RLI-189	L14, 15, 16, 17	COIL—Filament choke coil, 15 turns	
RLX-037	L1, 2, 3, 4, 5, 6	ASSEMBLY—Coil form assembly, including tuning core	4.25
RTL-140	T1	TRANSFORMER—I-F input transformer	1.20
RTL-141	T2	TRANSFORMER—I-F output transformer	1.65
RTP-313	T3	TRANSFORMER—Power transformer	4.75

MISCELLANEOUS ELECTRICAL

Cat. No.	Symbol	Description	List Price
RER-016	X1	RECTIFIER—Selenium rectifier	3.00
RJB-023		TERMINAL BOARD—2 terminals	.25
RJB-024		TERMINAL BOARD—3 terminals	.25
RJB-025		TERMINAL BOARD—5 terminals	.35
RJB-026		BOARD—Antenna terminal board and bracket, 4 terminals	2.00
RJP-046	P1	PLUG—Power plug, 7 pin	$0.20
RJP-047		PLUG—2 pin, for transmission lines, early production	.25
RJS-174		SOCKET—Tube socket for I-F tube 6BK7, 9 pin	.40
RJS-185	J1	SOCKET—Power socket, 7 pin	.30
RJS-186		SOCKET—Tube socket for oscillator tube, 6AF4	.40
RJS-187		SHELL—Connector shell for RJP-046	.25
RMM-245		ASSEMBLY—Crystal board assembly	.90
RSW-095	S1, 2	SWITCH—Wafer switch	.80
*RWL-009	P2	POWER CORD—6 feet long, with plug	.70

MISCELLANEOUS MECHANICAL

Cat. No.	Description	List Price
RAC-127	CAP—Retaining cap washers	$0.05
RAD-105	BRACKET—Front bracket, Models 21T2, 21T4	3.10
*RAD-106	BRACKET—Front bracket, Models 17T10, 17T11, and 17T12	3.00
RAD-107	BRACKET—Front bracket, Model 20T2	3.25
RAD-108	BRACKET—Guide bracket, "AK" line	.30
RAD-109	BRACKET—Rear bracket, Model 21T2	1.25
RAD-110	BRACKET—Rear bracket, Model 17T10	1.15
RAD-113	BRACKET—Rear bracket, Model 20T2	1.30
RAD-115	BRACKET—Rear bracket, Models 17T11 and 17T12	.90
*RDK-261	KNOB—Tuning knob	.15
RDK-302	KNOB—Knob ring, UHF selector	1.20
RDK-307	KNOB—Side mount knob assembly	1.75
RHC-059	RING—Truarc grip ring	.10
RHG-039	GROMMET—For switch shaft	.05
*RHI-017	STRAIN RELIEF—Two piece insulator, power unit	.15
RHJ-019	SPACER—To mount switch in tuner	.05
RHJ-022	SPACER—Knob ring spacer	.05
*RHM-043	"C" WASHER—Retaining ring to hold switch shaft	.01
RHS-091	SHIELD—Tube shield for 6BK7	.20
RHS-103	SCREW—For switch contact mount, ⅛ inch long	.02
RHS-105	SHIELD—Tube shield for 6AF4	.15
RHS-106	SCREW—Set screw for shaft coupling, No. 6-32	.15
RHS-107	SCREW—Set screw, No. 8-32	.15
RMB-030	BUSHING—Front bushing for "AK" line	.15
RMC-055	COLLAR—On turret tuner shaft	.35
RMG-014	GEAR—Crown gear, "AK" line	1.00
RMK-008	COUPLING—Switch shaft coupling	1.20
RMM-244	SUPPORT—Coil top support, round metal plate	.35
RMR-013	ROLLER—Detent roller, tuner	.15
*RMS-272	RING—Compression ring for knob	.05
RMS-318	SPRING—Detent spring, tuner	.35
RMS-320	SPRING—Short detent spring, tuner	.35
RMU-090	SHAFT—Switch shaft	.75
RMU-091	SHAFT—For large gear wheel	.15
RMU-092	SHAFT—Idler gear wheel	.15
RMX-234	SHAFT—Shaft and rotor assembly	2.90

PRICES ARE SUGGESTED LIST PRICES AND SUBJECT TO CHANGE WITHOUT NOTICE.
Mica and ceramic capacitors are 500 volts unless otherwise specified.
Resistor value tolerance is ±10% unless otherwise specified.
*Parts used on previous receivers.

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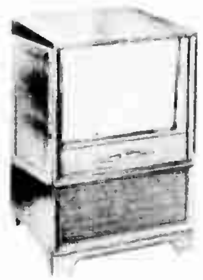
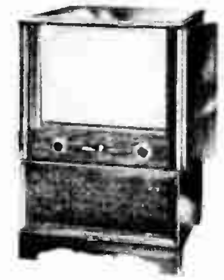
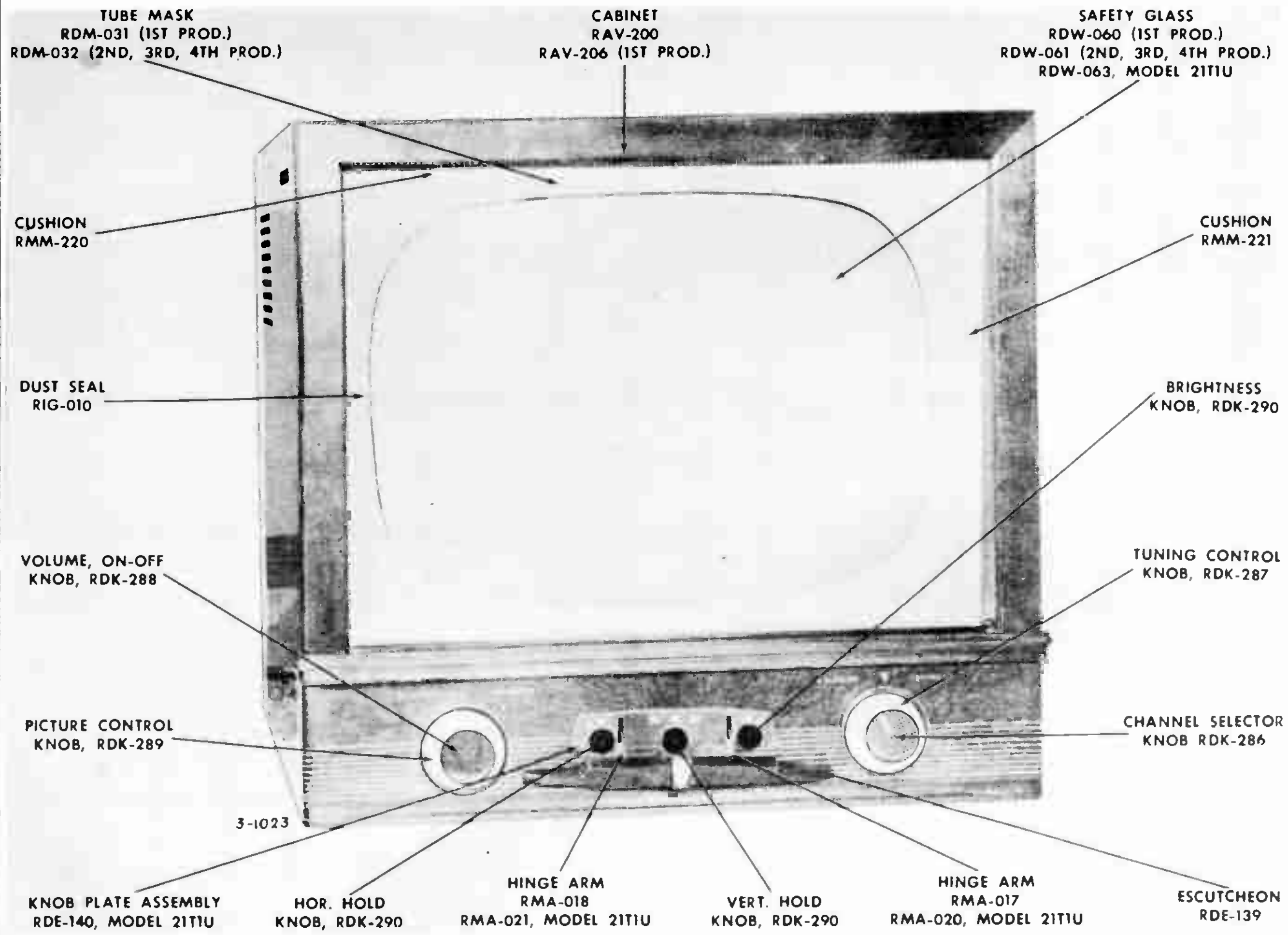
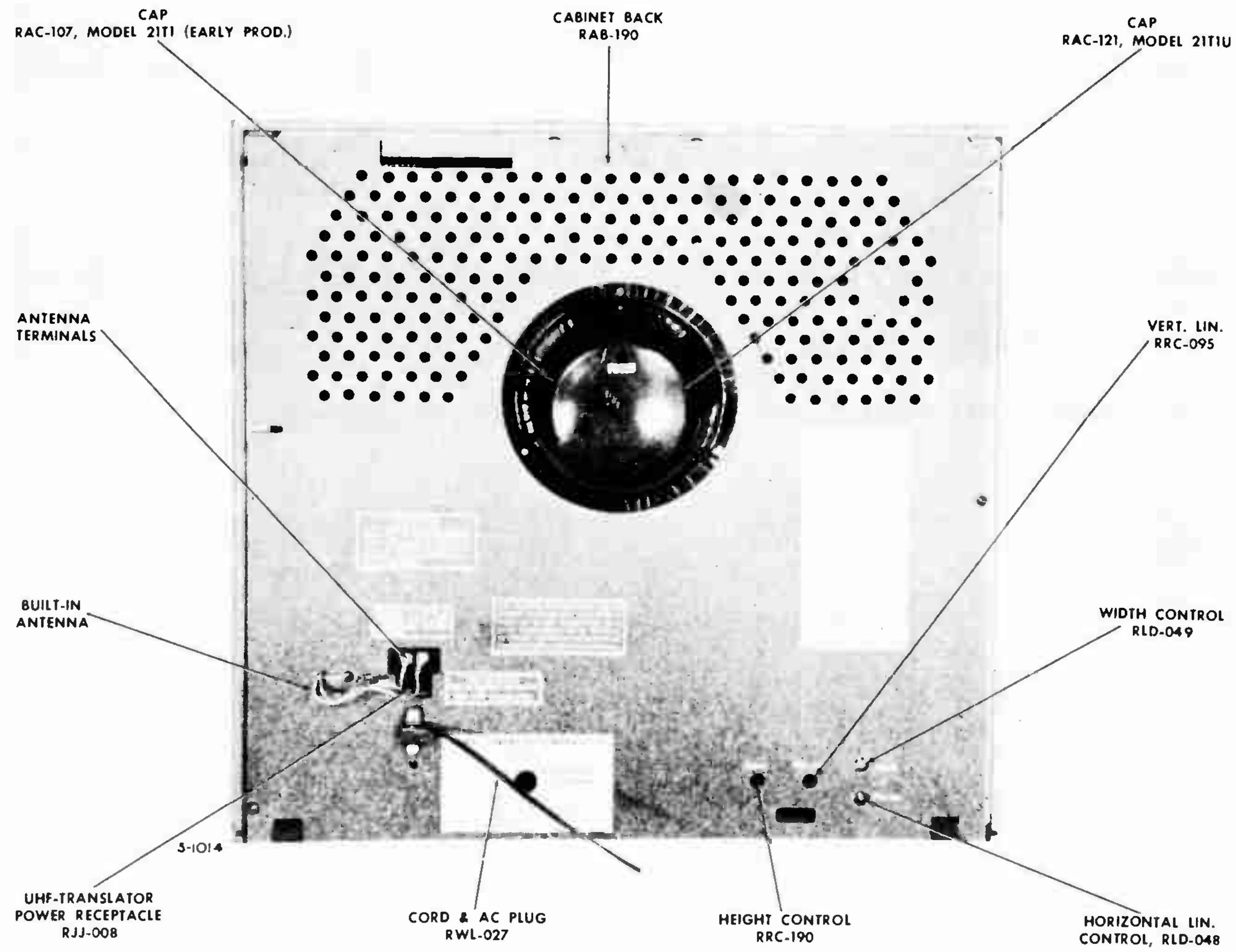




MODEL 21T1, 21T1U



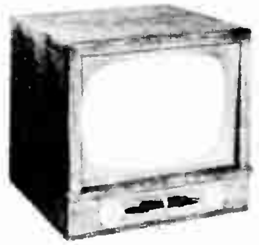


MODEL 21C201
CABINET RAV-199

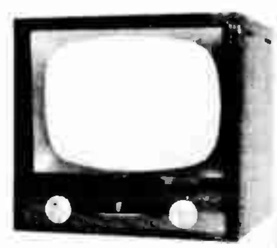
MODEL 17C125
CABINET RAV-207

MODEL 20C107
CABINET RAV-208

MODEL 21C202
CABINET RAV-201



MODEL 21T3
CABINET RAV-211



MODEL 21T6
CABINET RAV-212

SPECIFICATIONS

MODEL	CABINET DIMENSIONS HEIGHT (inches)	WIDTH (inches)	DEPTH (inches)	RECEIVER WEIGHT (PACKED) (lbs.)
17C125	34¾	22	22½	106
20C107	36	22	22⅞	121
21C201	38½	24½	23⅝	142
21C202	38½	24½	23⅝	145
21C204	38	25⅝	24⅝	147
21C206	38	26¾	25¼	147
21C208	37 3/16	23¾	22⅞	128
21C208-U	37 3/16	23¾	22⅞	128
21C210	37 3/16	23¾	22⅞	130
21C214	38	25⅝	24⅝	147
21T1	23⅛	24⅜	23⅛	109
21T1-U	23⅛	24⅜	23⅛	109
21T3	23⅛	24⅜	23⅛	113
21T6	23⅛	23 13/16	22 23/32	111

NOTE: For above models equipped with UHF Tuner Unit add 10 lbs.

POWER INPUT RATING:	Frequency........60 cycles Voltage........115 volts Wattage........200 watts
R-F FREQ. RANGE; VHF RECEIVERS	Channels........No. 2 thru No. 13 Frequencies........54–88 mc, 174–216 mc
RECEIVERS EQUIPPED WITH UHF	Channels........No. 2 thru No. 83 Frequencies..54–88 mc, 174–216 mc, 470–890 mc (For complete Channel Frequency Chart see page)
INTERMEDIATE FREQUENCIES:	Picture I-F Carrier........45.75 mc Adjacent Channel Audio Traps........47.25 mc Sound I-F Carrier........41.25 mc Adjacent Channel Video Traps........38.00 mc Intercarrier Sound Take-off........4.5 mc
PRIMARY FUSE:	Type........Pig-tail Rating........1.6 amp., 250 volts Size........¼ in. dia. x 1¼ in. long (Located beneath chassis)
AUDIO POWER OUTPUT:	Undistorted........2 watts Maximum........4 watts
LOUDSPEAKERS:	Type........Alnico PM Voice Coil Impedance.....3.2 ohms — 400 cps. Cone Diameter, 21T1 (1st production) 5¼ inches Cone Diameter, 17C125, 21T1 (2nd, 3rd, 4th production) 21T1-U, 21T3........8 inches Cone Diameter, 21" console models...12 inches Cone Diameter, 20C107........10 inches Cone Diameter, 21T6........6½ inches
ANTENNA INPUT:	Built-in antenna provided External antenna terminals Impedance—300 ohms balanced to ground

TUBE & RECTIFIERS:

SYMBOL	PURPOSE	TYPE
V101	1st R-F Amplifier	6AB4
V102	2nd R-F Amplifier	6AK5
V103	Mixer-oscillator	12AT7
V104	1st I-F Amplifier	6CB6
V105	2nd I-F Amplifier	6CB6
V106	3rd I-F Amplifier	6CB6
V107	Video Amplifier (early production)	12BH7
V107	Video Amplifier (late production)	6BK7-A
V108	Picture Tube	See Below
V109	Audio I-F Amplifier	6CB6
V111	Ratio Detector & 1st Audio Amplifier	6T8
V112	Audio Power Output	6AQ5
V113	Sync Amplifier & Noise Inverter	12AT7
V114	Vertical Oscillator	12BH7
V115	Vertical Amplifier	6BX7-GT
V116	Sync Clipper & Horizontal Blanking	12AX7
V117	Horizontal Phase Detector & Horizontal Discharge Tube	12AU7
V118	Horizontal React. & Horizontal Oscillator	12AU
V119	Horizontal Output (early production)	25AV
V119	Horizontal Output (late production)	25BQ
V120	Horizontal Damper	6V
V121	High Voltage Rectifier	1X2A
V122	High Voltage Rectifier, (21-inch STRATO-POWER models only)	1X2A
V123	High Voltage Rectifier	1X2A
V201	UHF Oscillator (UHF Models only)	6AF4
V202	Cascode Amplifier (UHF Models only)	6BK7-A
Y151	Video Detector Diode	RED-001
Y200	UHF Converter Diode (UHF Models only)	1N72

PICTURE TUBES:

MODEL	TYPE
17C125	17BP4
20C107	20CP4-A or 20DP4-A
21T1, 21C204-C208	21EP4-A
21T1-U, 21C201-C202-C206-C208-U-C210-C214	21EP4-B

GENERAL INFORMATION

These Stratopower receivers are 12 channel models, into some of which the General Electric model UHF-103 UHF Tuner has been installed. Located at the rear of the receiver is a power outlet receptacle designated "UHF TRANSLATOR" into which the UHF Tuner should be plugged.

The 21-inch Stratopower chassis contains 20 tubes plus 6 receifiers (3 high-voltage rectifiers, 2 selenium power rectifiers and a crystal diode detector). The 17- and 20-inch models contain only two high-voltage rectifiers. Receivers equipped with a UHF Tuner Unit contain 2 additional tubes and one additional crystal diode.

Some of the features of these receivers are: Two r-f amplifiers, automatic noise cancellation, automatic horizontal frequency control, vertical and horizontal retrace blanking and automatic gain control.

The receiver performance may be optimized for weak or strong signal areas by the adjustment of the labeled control located at the rear of the receiver.

An i-f interference trap is incorporated in the r-f tuner unit. This trap is effective on channels 2 through 6 and may be adjusted to offending signals in the 40 to 50 mc i-f range. In most cases, this trap has been factory preset to 43.0 mc.

CHANNEL FREQUENCIES

CHANNEL NO.	FREQUENCY RANGE MC	PICTURE CARRIER MC	SOUND CARRIER MC	CHANNEL NO.	FREQUENCY RANGE MC	PICTURE CARRIER MC	SOUND CARRIER MC
2	54–60	55.25	59.75	43	644–650	645.25	649.75
3	60–66	61.25	65.75	44	650–656	651.25	655.75
4	66–72	67.25	71.75	45	656–662	657.25	661.75
5	76–82	77.25	81.75	46	662–668	663.25	667.75
6	82–88	83.25	87.75	47	668–674	669.25	673.75
7	174–180	175.25	179.75	48	674–680	675.25	679.75
8	180–186	181.25	185.75	49	680–686	681.25	685.75
9	186–192	187.25	191.75	50	686–692	687.25	691.75
10	192–198	193.25	197.75	51	692–698	693.25	697.75
11	198–204	199.25	203.75	52	698–704	699.25	703.75
12	204–210	205.25	209.75	53	704–710	705.25	709.75
13	210–216	211.25	215.75	54	710–716	711.25	715.75
14	470–476	471.25	475.75	55	716–722	717.25	721.75
15	476–482	477.25	481.75	56	722–728	723.25	727.75
16	482–488	483.25	487.75	57	728–734	729.25	733.75
17	488–494	489.25	493.75	58	734–740	735.25	739.75
18	494–500	495.25	499.75	59	740–746	741.25	745.75
19	500–506	501.25	505.75	60	746–752	747.25	751.75
20	506–512	507.25	511.75	61	752–758	753.25	757.75
21	512–518	513.25	517.75	62	758–764	759.25	763.75
22	518–524	519.25	523.75	63	764–770	765.25	769.75
23	524–530	525.25	529.75	64	770–776	771.25	775.75
24	530–536	531.25	535.75	65	776–782	777.25	781.75
25	536–542	537.25	541.75	66	782–788	783.25	787.75
26	542–548	543.25	547.75	67	788–794	789.25	793.75
27	548–554	549.25	553.75	68	794–800	795.25	799.75
28	554–560	555.25	559.75	69	800–806	801.25	805.75
29	560–566	561.25	565.75	70	806–812	807.25	811.75
30	566–572	567.25	571.75	71	812–818	813.25	817.75
31	572–578	573.25	577.75	72	818–824	819.25	823.75
32	578–584	579.25	583.75	73	824–830	825.25	829.75
33	584–590	585.25	589.75	74	830–836	831.25	835.75
34	590–596	591.25	595.75	75	836–842	837.25	841.75
35	596–602	597.25	601.75	76	842–848	843.25	847.75
36	602–608	603.25	607.75	77	848–854	849.25	853.75
37	608–614	609.25	613.75	78	854–860	855.25	859.75
38	614–620	615.25	619.75	79	860–866	861.25	865.75
39	620–626	621.25	625.75	80	866–872	867.25	871.75
40	626–632	627.25	631.75	81	872–878	873.25	877.75
41	632–638	633.25	637.75	82	878–884	879.25	883.75
42	638–644	639.25	643.75	83	884–890	885.25	889.75

CAUTION NOTICE

THE NORMAL B+ VOLTAGES IN THIS RECEIVER ARE DANGEROUS. USE EXTREME CAUTION WHEN SERVICING THIS RECEIVER. THE HIGH VOLTAGE AT THE PICTURE TUBE ANODE (16,000 VOLTS) WILL GIVE AN UNPLEASANT SHOCK BUT DOES NOT SUPPLY ENOUGH CURRENT TO GIVE A FATAL BURN OR SHOCK. HOWEVER, SECONDARY HUMAN REACTIONS TO OTHERWISE HARMLESS SHOCKS HAVE BEEN KNOWN TO CAUSE INJURY. ALWAYS DISCHARGE THE PICTURE TUBE ANODE TO THE CHASSIS BEFORE HANDLING THE TUBE.

THE PICTURE TUBE IS HIGHLY EVACUATED AND IF BROKEN, IT WILL VIOLENTLY EXPEL GLASS FRAGMENTS. WHEN HANDLING THE PICTURE TUBE, ALWAYS WEAR GOGGLES.

INSTALLATION INSTRUCTIONS

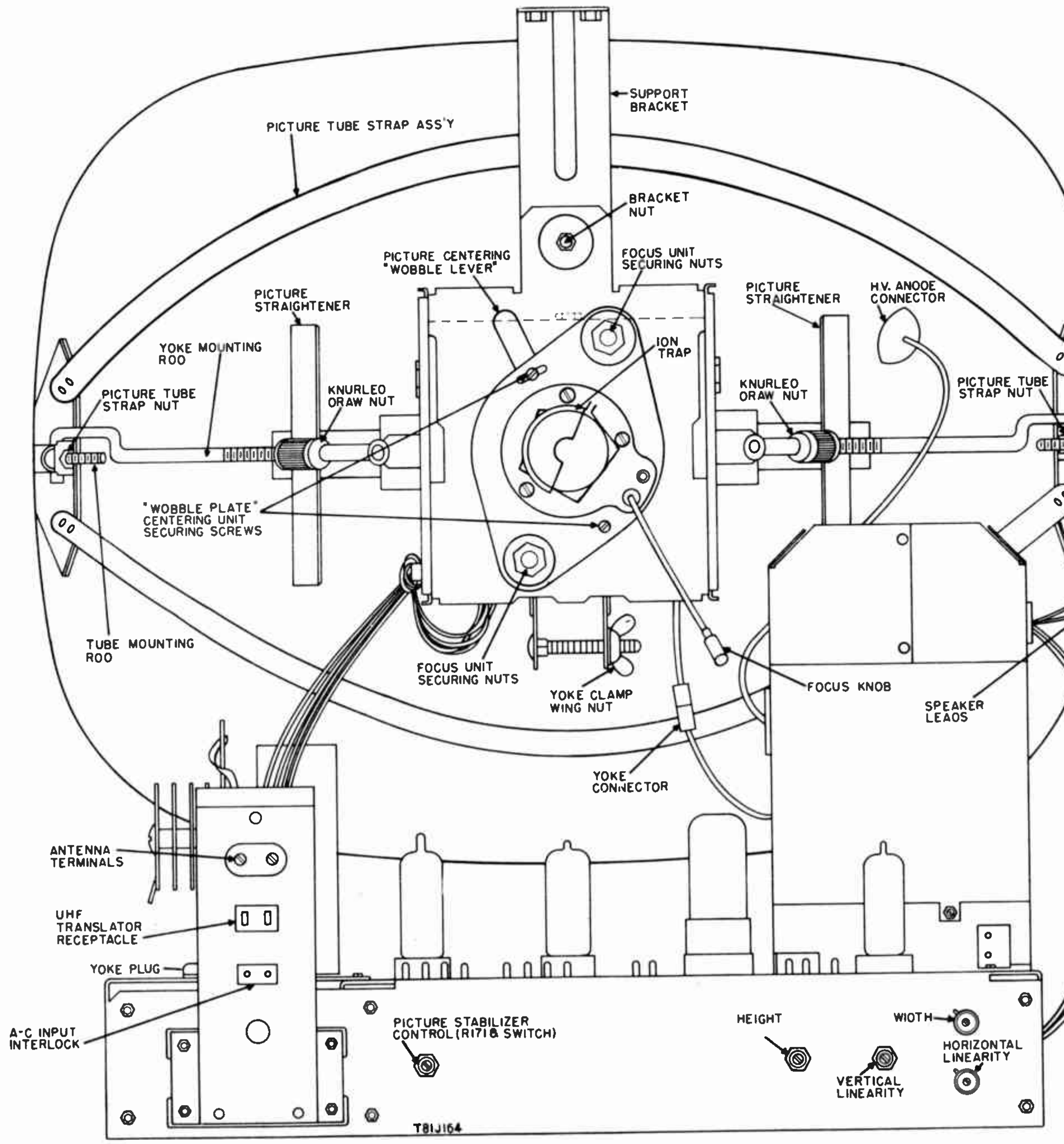
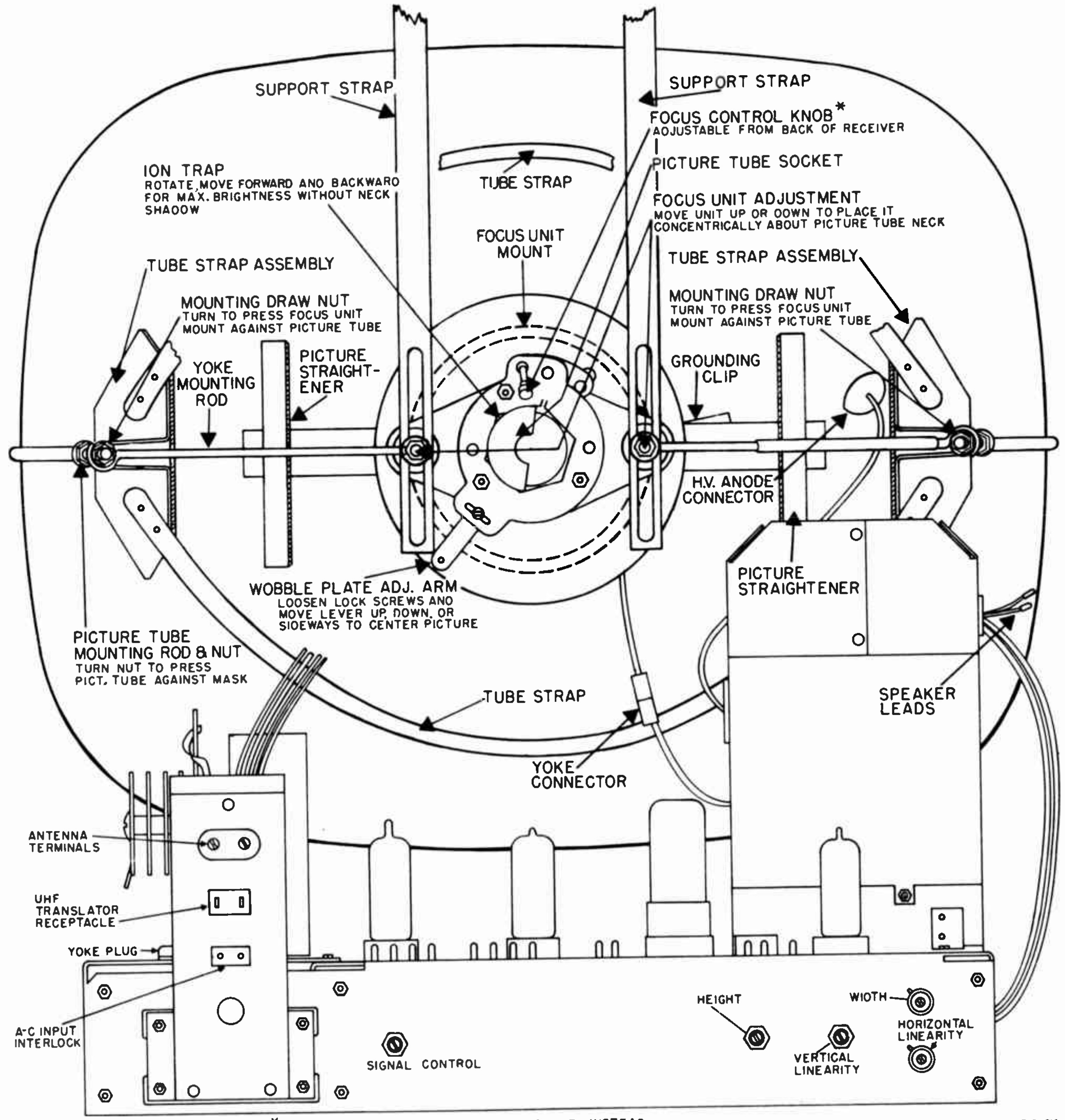


Fig. 1. Chassis and 21-inch Picture Tube Assembly, Rear View (Early Production)



*LATE PRODUCTION MODELS USE GUIDE FUNNEL INSTEAD OF FLEXIBLE SHAFT

Fig. 2. Chassis and 21-inch Picture Tube Assembly, Rear View (Middle and Late Production)

IMPORTANT—PRODUCTION CHANGE NOTICE

Because these models have undergone several mechanical and electrical changes during production, frequent reference is made herein to first, second, third and fourth production versions. NOTE: References made to various versions refer only to the portion of the receiver under discussion. Changes in early production, mid-production and late production of the picture tube assembly do not necessarily coincide chronologically with electrical circuit changes in the chassis. See page 31 for a review of major production changes.

INSTALLATION ADJUSTMENTS

GENERAL: These receivers are shipped from the factory with the picture tube installed and all controls pre-adjusted for normal operation. It is necessary therefore, to merely plug in the receiver and, where required, connect it to a suitable antenna system. The various operating controls should then be checked for proper operation. The rear apron signal control should be adjusted for optimum receiver performance as indicated by its label.

If it becomes evident that one or more of the preset controls are out of adjustment due to handling, adjust the necessary controls according to the following information.

ELECTRICAL INSTALLATION ADJUSTMENTS

The following information is applicable to all Stratopower receivers. It is recommended that the receiver be permitted to operate for at least 15 minutes before the final raster adjustments are made.

HEIGHT AND VERTICAL LINEARITY: These controls should be adjusted simultaneously to provide proper picture height consistent with good vertical linearity. The final adjustment should extend the picture approximately 1/8 inch beyond the mask limits.

HORIZONTAL SIZE (WIDTH) & HORIZONTAL LINEARITY: These controls should be adjusted simultaneously to provide proper picture width, consistent with good horizontal linearity. The adjustments, when completed, should extend the picture approximately 1/4 inch beyond the mask limits.

HORIZONTAL HOLD: The coil, L351, see Fig. 30, should be adjusted so that the horizontal sync will remain locked over the entire range of the horizontal hold control, R363. Also, the "pull-in" range of sync should be evenly distributed on each end of the horizontal hold control range. This may be checked by switching off and on a station and observing the "pull-in" ability at either extreme of the control.

I-F INTERFERENCE TRAP: The R-F Tuner unit incorporates a tunable I-F interference trap in the 40–50 mc range. This trap should be adjusted after it has been determined that interfering signals in the I-F range are causing picture degradation. This trap adjustment is the rear-most adjustment on the top of the R-F Tuner. See Fig. 25 on page 23 for the location of this trap. It is designated as L106. If there is a station in the area on Channel 2, check to see that the tuning of the i-f trap has not affected the Channel 2 response. For complete adjustment instruction refer to page 27.

ADJUSTMENT OF THE AGC & SYNC GAIN CONTROL: (EARLY AND MID-PRODUCTION ONLY): This control is located at the rear of the receiver and should be adjusted at the time of the receiver installation. On some receivers, this control is labeled "Signal Control," "Signal Strength Compensator," or "Picture Stabilizer."

Adjust this control so that the strongest signal to be received does not cause picture sync distortion. The extreme clockwise "switch" position of the control should be used in the weaker signal areas to improve the sync stability in the presence of ignition and similar interferences.

SYNC GAIN CONTROL: Late production Stratopower receivers incorporating "Delayed AGC" are equipped with a simple two-position rotary switch instead of the above mentioned control.

INSTALLATION INSTRUCTIONS (Cont'd)

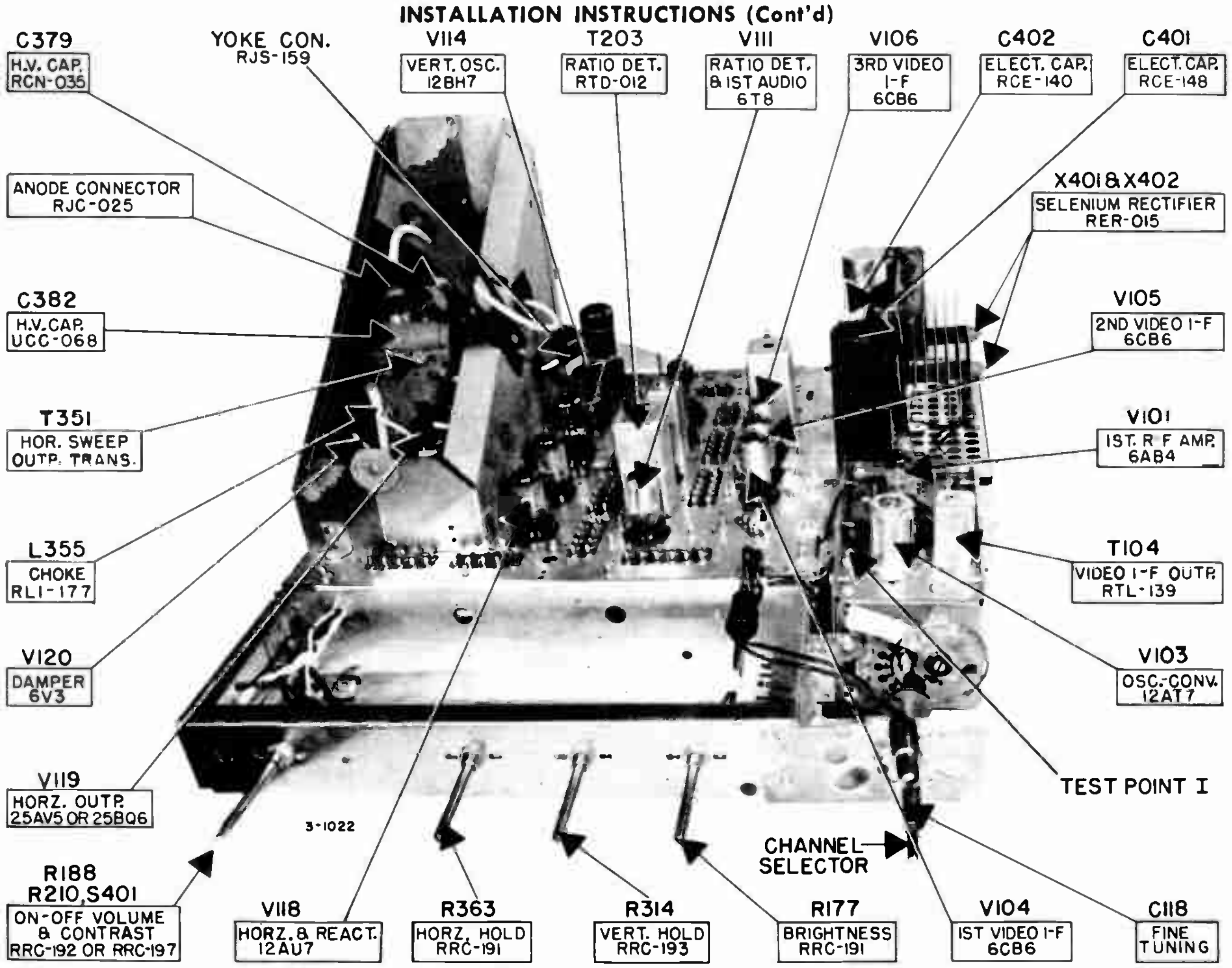


Fig. 3. Front View of Chassis

This switch (Normal-Fringe) increases or decreases the sync gain thus permitting optimum sync system operation under strong or weak signal conditions.

OVER-LOAD PROTECTION: A "slow-blow" 1.6 ampere fuse is incorporated in this receiver to protect the power supply rectifiers from overload. Should the receiver fail to operate, the fuse should be checked and the cause of overload remedied. This fuse is wired into the power supply compartment beneath the chassis, see Figure 33, page 90.

THE PICTURE TUBE ASSEMBLY

GENERAL: Two basic types of picture tube assemblies have been used in the production of the STRATOPOWER family of receivers. Figures 4 and 8 indicate the differences between these units. Both assemblies are similar in that the picture tube is held forward against the mask by a strap assembly which, in turn, is secured to the cabinet or mask assembly. The yoke and focus unit are held in position against the bell of the picture tube by side rods which engage the picture tube strap assembly. The yoke and focus assembly is also top supported by a bracket or, in the "late" unit, by two vertical straps. Note that the picture tube need not be removed when the yoke is removed for service, providing that the picture tube strap assembly is properly tightened.

In order to avoid neck shadow, the focus unit in both the "early" and "late" assembly must be perpendicular to the picture tube neck and concentric about it. Also, the deflection yoke must be properly positioned in the "early" unit, as described below.

Since the picture tube in 21-inch models is of the "cylindrical face" type, picture straightening magnets are used to avoid a "pincushioning" effect in the raster. These magnets should be perfectly vertical in their position and be centered about the center line of the picture tube as shown in Fig. 1, 2, 4 and 6. Failure to properly position these magnets will result in either a "pincushioning" or "parallelogramming" of the picture.

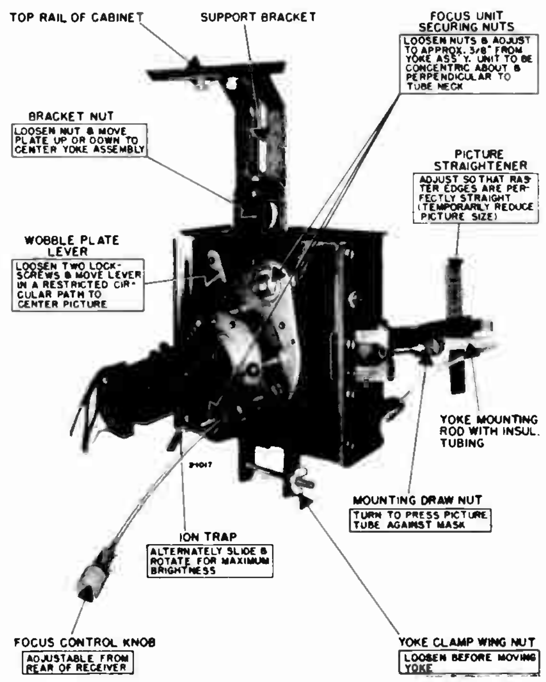


Fig. 4. Picture Tube Adjustments, (Early Production)

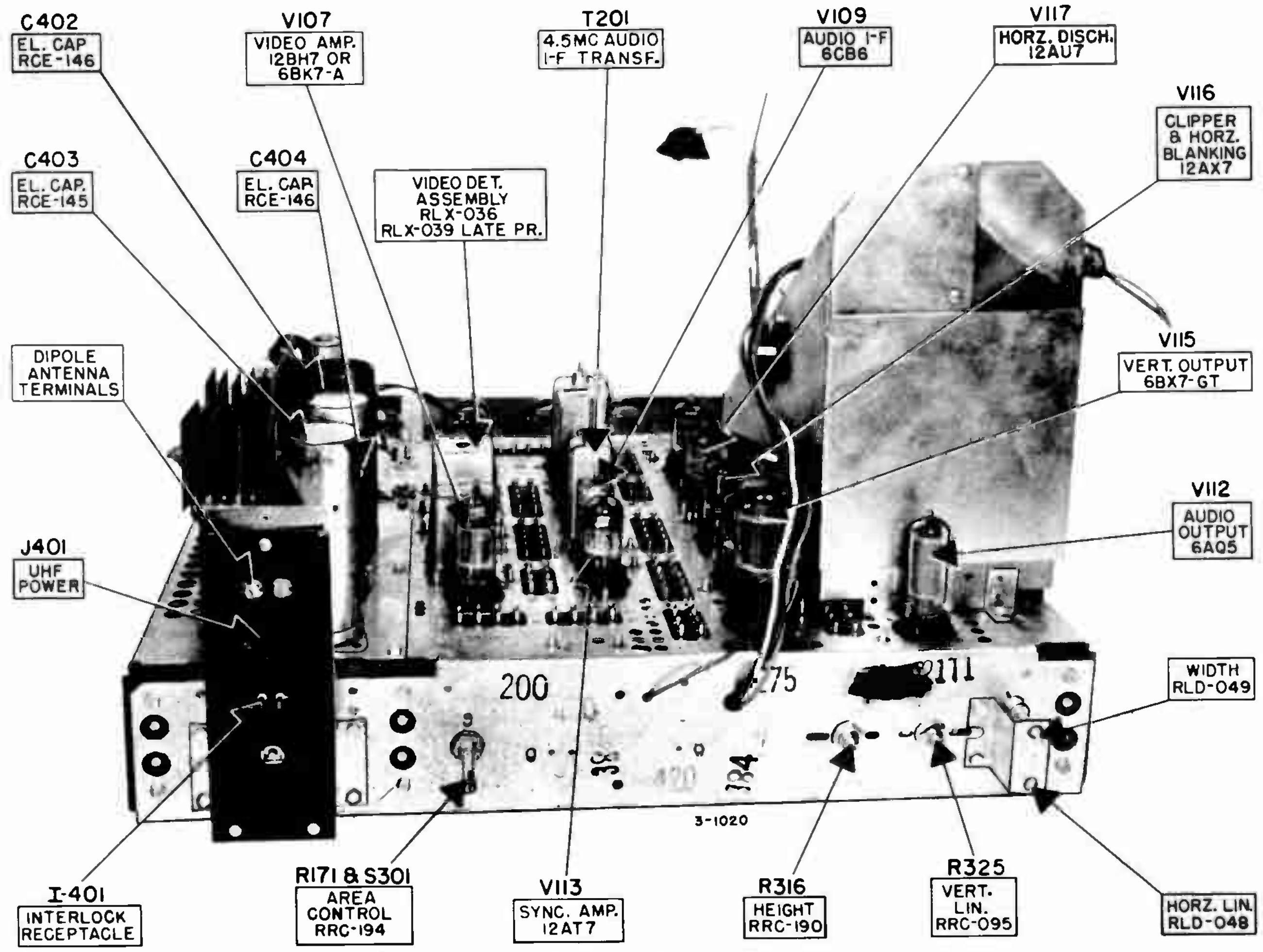


Fig. 5. Rear View of Chassis (1st, 2nd and 3rd Production)

PICTURE TUBE ASSEMBLY ADJUSTMENTS (EARLY ASSEMBLY)

The following data refers to the early assembly shown in Fig. 1 and 4.

1. Remove cabinet back.
2. Apply power to the receiver, turn set on and tune in a test pattern.
3. Adjust the necessary controls to correct any existing maladjustments. These control functions are as follows:

ION TRAP: Set the brightness control (under front panel control door) to its maximum clockwise position and alternately slide and rotate the ion trap for maximum brightness.

YOKE POSITIONING: Loosen the yoke clamp wing nut and make sure that the yoke is firmly seated against the bell of the picture tube. Picture tilt may be corrected by rotating the yoke to square the picture within the mask. Retighten the clamp wing nut after completing this adjustment.

FOCUS UNIT: Loosen the focus unit securing nuts and laterally adjust the focus unit to approximately 3/8 inch from the yoke assembly. Make sure the circular focus magnet remains concentric about and perpendicular to the tube neck. Tighten the focus unit securing nuts. Adjust the focus control for best focus.

PICTURE CENTERING: The wobble plate lever which is located on the forward end of the focus unit is the centering control. Loosen its two securing screws and move the lever in a restricted circular path until the picture is centered. Readjust the focus knob if the picture centering process disturbed the focus adjustment.

NECK SHADOW—IMPORTANT: If, after having made the above mechanical adjustments and it is impossible to eliminate neck shadow, the following procedure should be followed.

It is important that the entire yoke assembly and focus unit be concentric about the tube neck. Also the mounting bracket assembly should be perpendicular to the neck of the picture tube. To accomplish this, loosen the two yoke adjustment nuts on the sides of the yoke assembly, the yoke adjustment nut on the top assembly bracket and the yoke clamp wing screw. Then push the entire assembly towards the bell of the picture tube and tighten the rod draw nuts and the above mentioned nuts. Next, loosen the securing nuts on the focus unit bracket. Set the focus unit flush with the yoke tail and position the focus assembly so that it is perpendicular to and concentric about the tube neck. Tighten the securing nuts and recheck for proper picture centering, focus and ion trap adjustment.

PICTURE STRAIGHTENERS: These are the two anti-pincushioning magnets mounted near the bell of the picture tube. Adjust these magnets as follows:

(a) Reduce the picture size so that the raster edges are visible.
(b) Adjust the straightening magnets so that the raster edges are perfectly straight. These magnets will have an effect upon the width, but their important function is to keep the raster edges from being "bowed" in or out.
(c) Return picture to normal size with the size controls.

A. TO REMOVE PICTURE TUBE (Early Assembly):

1. Remove chassis.
2. Lay cabinet, face down, on a soft, nonscratching surface.
3. Loosen the two knurled draw nuts and move the yoke mounting rods away from yoke assembly.
4. Remove screw holding yoke assembly top supporting bracket.
5. Remove ion trap.
6. Remove yoke assembly from tube.
7. Loosen picture tube strap nuts and remove strap.
8. Remove picture tube.

B. TO REPLACE PICTURE TUBE (Early Assembly):

1. With the cabinet lying on its front, insert the picture tube into mask with its high voltage anode to the right (above volume

INSTALLATION INSTRUCTIONS (Cont'd)

control shaft hole). NOTE: Before replacing picture tube into receivers equipped with a metal mask, place the dust seal into the space between the mask front bezel and the inside rim. The dust seal should then be pulled through the eight tab holes which are arranged around the mask inside rim. Hook the dust seal on the eight provided tabs.

2. Place picture tube strap over tube and secure strap with the provided nuts and "U" washers.

3. Slide yoke assembly over tube neck and secure with screw to top support bracket.

4. Position both yoke mounting rods and tighten knurled draw nuts.

5. Install ion trap.

6. This step applies only to those receivers equipped with a metal mask.

After the side rods have been tightened and the assembly secured so that the picture tube can't possibly move or shift, the dust seal may be positioned. Push the dust seal off of the eight tabs in the mask rim. The dust seal will then fall into its proper place between the picture tube and the mask.

7. Restore cabinet to normal upright position and install chassis.

8. Bolt chassis to cabinet and install knobs.

9. Connect all leads and cables.

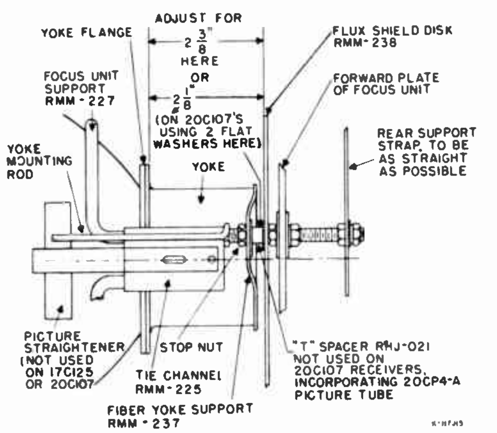


Fig. 6. Side View of Late Picture Tube Mount Assembly

"LATE" 21-INCH PICTURE TUBE ASSEMBLY

GENERAL: This information refers to the assembly shown in Fig. 2, 6, 7, 8, 9 and 10. In mid-production, the yoke and focus unit assembly was changed to incorporate a later design which somewhat simplified the installation adjustments and service procedure. Basically, this assembly is similar to the earlier unit in that the picture tube is held forward by a strap assembly which, in turn, is secured to the cabinet. The yoke and focus assembly is held in position against the bell of the picture tube by side rods in a manner similar to that used in the earlier assembly. The yoke is supported by the tube neck and hence need not be specially positioned to assure lack of neck shadow etc. It is necessary however to make sure that the focus unit is concentric about and perpendicular to the tube neck.

On some receivers using this assembly, the brass focus unit support rods must be "cocked" slightly clockwise (approximately 5 degrees) so that the picture straightening magnets will be reasonably vertical in their position to prevent a "Parallelogram" effect in the picture. See Fig. 7. This is not necessary in later production receivers using the new assembly since the picture straighteners were re-designed with off-set brass supporting straps which will properly position them without "cocking" the entire assembly.

Late production focus units utilize a screw driver method o adjustment rather than the flexible shaft and knob found on earlier versions. It is important when adjusting this new focus unit that a nonmagnetic screw driver be used to simplify the procedure. Also, when attempting to adjust the focus unit through the cabinet back, be sure that the screw driver enters the screw funnel otherwise the ion trap may become disturbed. This would require removal of the cabinet back to allow re-adjustment of the ion trap.

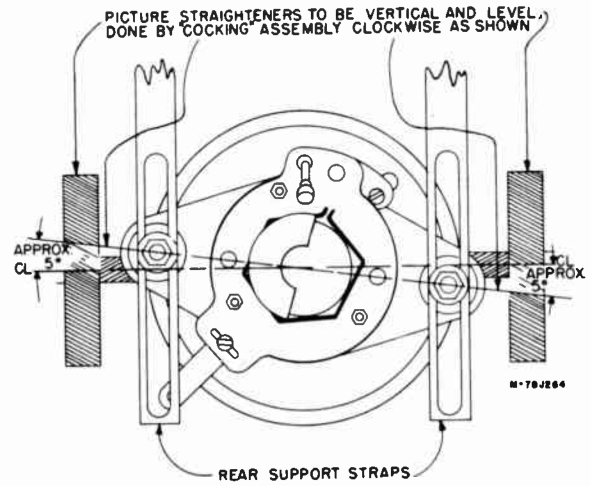


Fig. 7. Rear View, 21-inch Models

PICTURE TUBE ASSEMBLY ADJUSTMENTS (LATE ASSEMBLY)

The following data refers to the late assembly shown in Figures 2, 6, 7 and 8.

1. Remove cabinet back.
2. Apply power to the receiver, turn set on and tune in a test pattern.
3. Adjust the necessary controls to correct any existing mal-adjustments. These control functions are as follows:

ION TRAP: Set the brightness control (under front panel control door) to its maximum clockwise position and alternately slide and rotate the ion trap for maximum brightness.

YOKE POSITIONING: Rotate yoke to square picture within the mask. It is not necessary to loosen any part of the assembly for this operation.

FOCUS UNIT: Loosen the focus unit securing nuts and laterally adjust the focus unit for the dimension shown in Fig. 6. Make sure the circular focus magnet remains concentric about and perpendicular to the tube neck. Tighten the focus unit securing nuts. Adjust the focus control for best focus.

PICTURE CENTERING: The wobble plate lever which is located on the forward end of the focus unit is the centering control. Loosen its two securing screws and move the lever in a restricted circular path until the picture is centered. Readjust the focus knob if the picture centering process disturbed the focus adjustment.

PICTURE STRAIGHTENERS: These are the two anti-pincushioning magnets mounted near the bell of the picture tube. Adjust these magnets as follows:

(a) Reduce the picture size so that the raster edges are visible.
(b) Adjust the straightening magnets so that the raster edges are perfectly straight. These magnets will have an effect upon the width, but their important function is to keep the raster edges from being "bowed" in or out.
(c) Return picture to normal size with the size controls.

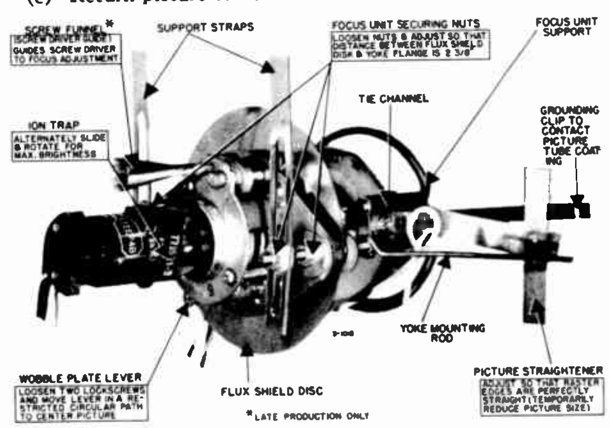


Fig. 8. Picture Tube Adjustments (Late Production)

INSTALLATION INSTRUCTIONS (Cont'd)

A. TO REMOVE PICTURE TUBE (Late Assembly):

1. Disconnect all cables and leads. Remove chassis.
2. Lay cabinet, face down on a soft, nonscratching surface.
3. Remove ion trap.
4. Loosen and remove nuts and washers which secure the yoke mounting rods to the picture tube strap assembly.
5. Remove rear support strap nuts and move straps aside.
6. Remove entire yoke and focus assembly.
7. Remove picture tube strap assembly and picture tube.

B. TO REPLACE PICTURE TUBE (Late Assembly):

1. This step applies only to those receivers equipped with a metal mask. Before inserting picture tube into mask, the sponge rubber dust seal should be placed into the space between the mask front bezel and the inside rim. The dust seal should then be pulled through the eight tab holes arranged around the mask inside rim. Hook the dust seal on the eight tabs.

2. Replace picture tube.

3. Replace, in reverse order, all yoke and focus assembly parts removed in "A" above.

4. After the side rods have been tightened and the assembly secured so that the picture tube can't possibly move or shift, the dust seal may be positioned. Push the dust seal off of the eight tabs in the mask rim. The dust seal will then fall into its proper place between the picture tube and the mask.

5. The nut between the fiber yoke support and the tie channel should be turned by finger fully forward. The nut immediately to the rear of the flux shield (large disc) should be set for $2\frac{3}{8}$ inches between the disc and the flange as shown in Fig. 6. The fiber yoke support stop nut should now be unscrewed toward the fiber yoke support and suitably tightened. Next, tighten the nut behind the forward plate of the focus unit thus maintaining it in its maximum forward position.

6. Replace ion trap.

7. Replace chassis and connect all leads and cables.

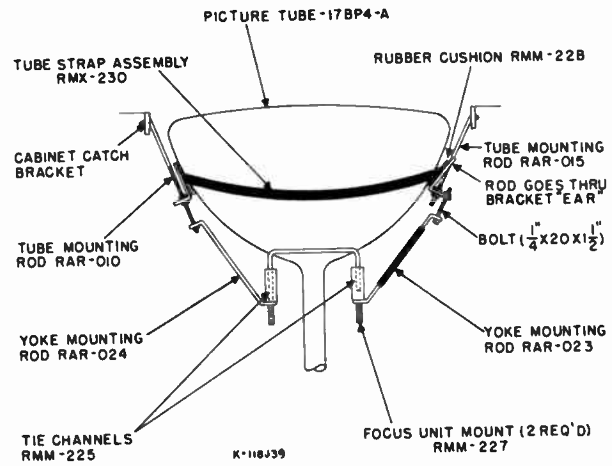


Fig. 9. Picture Tube Assembly, Model 17C125 (Top View) (Yoke and Focus Unit Not Shown)

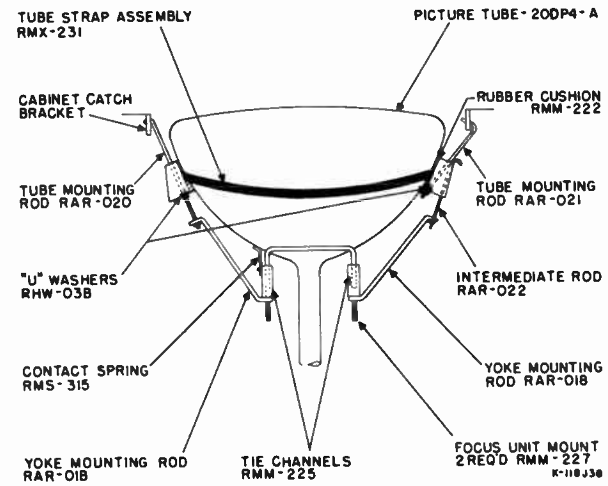


Fig. 10. Picture Tube Assembly, Model 20C107 (Top View) (Yoke and Focus Unit Not Shown)

RECEIVER CIRCUIT ANALYSIS

A brief description of the operation of each circuit is given in the following paragraphs. A block diagram of the receiver is shown in Fig. 11 to better visualize the operation of the receiver.

The incoming signal is amplified by two r-f amplifier stages V101, 6AB4, and V102, 6AK5. The signal is then mixed in the converter V103B, 1/2 12AT7, with a signal developed by the local oscillator V103A, 1/2 12AT7. The resulting intermediate frequencies (both sound and picture) are then coupled via a transmission line into the video i-f strip consisting of the tubes V104, V105 and V106 (6CB6 tubes). After amplification these signals are then rectified or detected by a crystal diode, Y151.

Across the diode load circuit appears a 4.5 mc FM signal containing the sound information. This 4.5 mc FM sound i-f carrier is amplified by V109, 6CB6 and then passed to a limiter, V110, 6AU6. The output of the limiter is detected by a ratio detector V111A, 1/2 6T8. Tubes V111B, 1/2 6T8 and V112, 6AQ5 comprise the remainder of the audio system. The audio signal is then fed to the loudspeaker.

Composite sync and video information also appears across the video detector diode load and is passed to the video amplifier V107 and thence to the grid of the picture tube, V108.

A portion of the composite sync and video voltage appearing across the diode load is picked off and amplified by the sync amplifier V113A, 1/2 12AT7. In order to remove the deleterious effects of strong impulse noise upon picture stability, a noise canceller circuit is incorporated in this receiver. The noise canceller V113B, 1/2 12AT7 is tied across the output of the sync amplifier in such a manner that it will eliminate the noise impulses. This will be more completely described on page 20.

After removal of noise pulses if any the composite video and sync information is passed to the sync clipper wherein the video information and blanking pedestals are stripped off leaving only the vertical and horizontal sync information. Another function of the clipper is to provide an automatic gain control (AGC) voltage which is used in conjunction with diode d-c voltage to control the gain of the r-f and i-f stages.

This is partially accomplished by clipper grid rectification of the sync pulses together with a "minimum" bias developed by the diode detector. Since the sync information is held at a constant level throughout the transmission, these pulses provide an excellent amplitude reference for purposes of AGC operation. The horizontal and vertical sync pulses are separated after the clipper and fed to their respective sweep frequency controlling devices.

The vertical sync information is integrated in the integrator network P301 to form the vertical sync pulse. This pulse is applied to one grid of the vertical multivibrator V114, 12BH7, to control its frequency. The produced vertical sweep pulse is properly shaped and amplified by the vertical amplifier V115, 6BX7. This amplified voltage is then applied to the vertical windings of the deflection yoke. A portion of the vertical sweep pulse is picked off at the output of tube V115, and after proper shaping, is applied to the cathode of the picture tube. This vertical blanking pulse is used to blank or cut off the picture tube during the vertical retrace time, thus eliminating the annoying diagonal white lines that may appear in the picture should the brightness be turned up too far or if the blanking pedestal pulse from the

RECEIVER CIRCUIT ANALYSIS (Cont'd)

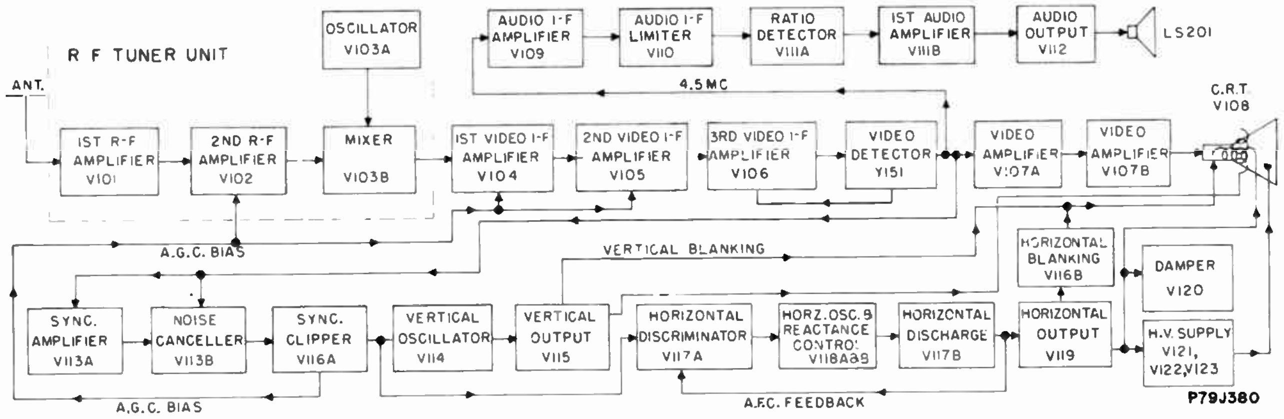


Fig. 11. Block Diagram (21-inch Models)

transmitter is of insufficient amplitude to accomplish vertical blanking.

The horizontal pulse information from the clipper tube, V116A, 1/2 12AX7, is coupled into the horizontal phase detector V117A, 1/2 12AU7, wherein a comparison is made between the phase or frequency of the sync pulses and the horizontal sweep pulse. This comparison results in a d-c correction voltage which is then applied to the reactance control tube V118A, 1/2 12AU7, which in turn controls the frequency and/or phase of the horizontal oscillator, V118B, 1/2 12AU7.

The pulse generated by the horizontal oscillator is properly shaped in the horizontal discharge stage, V117B, 1/2 12AU7, and applied to the horizontal output amplifier V119, 25AV5 or 25BQ6. This tube provides the necessary pulses for horizontal sweep and the development of the high-voltage for the picture tube anode. A damper tube V120, 6V3 is connected in a high-efficiency "flyback" type circuit. Its dual purpose is to dampen out or remove the train of oscillations appearing at the beginning of each sweep pulse and to use these pulses, after rectification, to provide boosted d-c voltage for the plate of the horizontal output tube, V119.

A portion of the horizontal scanning pulse, as it appears across the width coil, is picked off and applied to the grid of a cathode follower stage, V116B, 1/2 12AX7, from which is derived a horizontal retrace blanking pulse. This pulse prevents the appearance of horizontal retrace effects.

The high voltage is derived from a voltage doubler circuit. In the 21-inch models a high-efficiency doubler circuit consisting of V121, V122 and V123 (1X2A tubes) is used. It is the inclusion of V122 as a coupling diode which brings about the higher efficiency and greatly stabilized voltage regulation of the high-voltage rectifier system. Because of the lower high-voltage requirements of tubes smaller than 21 inches, a straight-forward voltage doubler is used in 17- and 20-inch receivers.

In the following paragraphs a detailed description of some new circuits is given.

VIDEO I-F SYSTEM ANALYSIS

The video i-f system consists of three pentode amplifiers, the output of which is detected by a crystal diode, Y151.

The input signal is delivered from the r-f tuner via link coupling. The grid winding or secondary of T151 is tuned approximately to the center of the video i-f pass band. A 38.0 mc series-tuned absorption trap, L152, is tied across the input grid circuit. Also, an absorption trap, L151, is inductively coupled to T151 to reject any adjacent channel audio carrier interference.

The next two plate coils, L153 and L155, are tuned to opposite sides of the pass band center frequency in such a manner as to provide the desired 45–55% response at 42.5 mc and 45.75 mc. Inductive absorption traps are coupled to each of these coils. L154 is the second 47.25 mc trap. L156 is tuned to the "accompanying" sound frequency of 41.25 mc. It is not the purpose of this trap to eliminate the 41.25 mc carrier since this would remove the sound signal when the receiver is properly tuned. Rather, this trap is incorporated to somewhat lower the percentage of audio i-f carrier present in the i-f system to prevent excessive 4.5 mc "crystallization" effects in the picture when the receiver is tuned for best picture detail. (The very high gain of the audio i-f system plus its limiting stage more than compensates for this inserted loss).

The coil, L157, is also tuned to the i-f pass-band center frequency. A 38.0 mc trap, L158, is inductively coupled to L157.

The frequency of the adjacent channel audio i-f carrier traps would normally be expected to fall at 39.75 mc. However, in the fringe areas where the operator will tune for maximum picture gain and hence place the carrier near the peak of the response curve, it becomes necessary to correspondingly shift the adjacent channel audio trap lower in frequency. For this reason the adjacent channel audio carrier traps are tuned to 38.0 mc.

The two i-f carrier signals present at the plate of the third i-f (V106) are capacitively coupled to the crystal diode "shunt-type" detector. L168 is incorporated as a "tweet" filter and eliminates upper-order harmonics of the i-f frequencies present in the crystal output which would cause tuneable interference patterns on some channels.

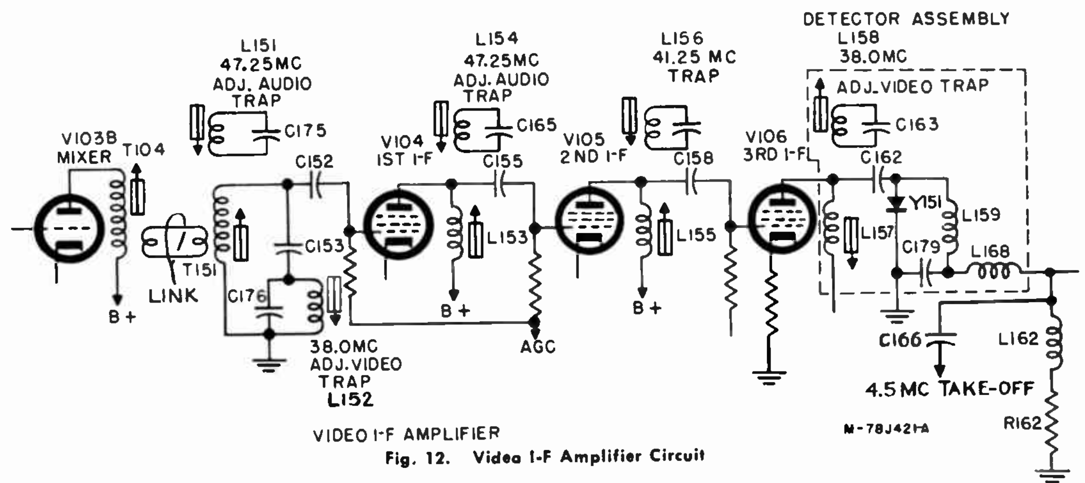


Fig. 12. Video I-F Amplifier Circuit

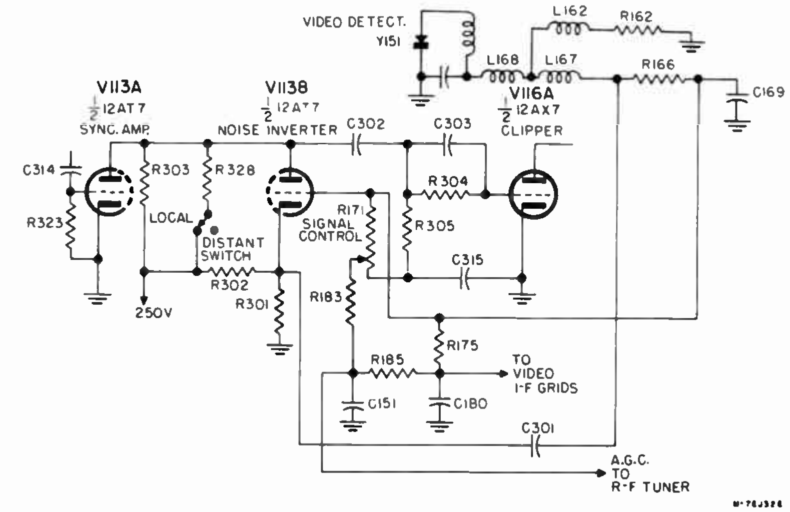


Fig. 13. Noise Canceller Circuit (1st and 2nd Production)

The crystal diode output consists of composite video information (positive white) which is coupled to the video amplifier V107, for further amplification. The crystal diode output also contains a 4.5 mc FM carrier which is coupled to the audio i-f system for further amplification and detection to provide the program sound intelligence.

SYNC AMPLIFIER, CLIPPER AND NOISE CANCELLER

A portion of the crystal diode (Y151) output is picked off and fed to the grid of the sync amplifier, V113A. See Fig. 13. This stage is a voltage amplifier, the output level of which may be adjusted to suit a particular signal area or to optimize the sync stability of the receiver under noisy, weak signal conditions. This may be done by raising or lowering the value of its plate load resistor by closing or opening the local-distant switch. (In some earlier models, this switch was attached to the AGC control potentiometer.)

The output of the sync amplifier is coupled to the clipper grid through C302. The clipper, V116A, strips off all video information leaving only the sync pulses which are then used to synchronize both the vertical and horizontal oscillators in the sweep system.

The noise inverter or canceller, V113B, is tied across the output of the sync amplifier V113A. The cathode of the canceller has a fixed positive bias applied by virtue of R301, R302. Its grid is maintained at some negative bias voltage which is proportional to the strength of the incoming signal. This negative grid bias is obtained from the crystal diode Y151, and is suitably filtered by R166 and C169. These two bias voltages combine to cut off the canceller tube, V113B, so that it will normally not conduct in the presence of a received television signal.

The cathode of the canceller, V113B, is fed a signal consisting of video and negative-going sync as well as impulse noise, if any. Since the canceller is biased off and will not pass any signals less than the sync-tip level, nothing happens until a noise burst of greater-than-sync-tip level occurs. When this happens, the canceller tube, V113B, will conduct heavily, and hence will drop the instantaneous sync amplifier output below the clipping level which has already been established in the clipper V116A.

Because of this, neither sync nor noise will be present in the clipper output for the duration of the noise burst. At these times, the inertia or "fly-wheel" effect of the sweep circuits and the horizontal AFC system is relied upon to maintain proper frequency. After the noise burst ceases, the canceller tube, V113B, no longer conducts and the circuits return to normal operation. (For maximum efficiency, however, the canceller is normally biased in such a manner as to *slightly* wipe sync. This is permissible since the sync information amplitude is more than adequate. This is mentioned here instead of earlier to prevent confusion.)

AGC SYSTEM

In all the included models, AGC bias is derived from the clipper grid circuit by means of grid rectification of the applied video and sync waveform—and partially from the crystal diode detector. Some earlier models incorporated a rear-apron AGC potentiometer, R171, which should be adjusted just below the point of sync overload on the strongest available signal. The AGC voltage is then distributed to the r-f stage and to the first and second video i-f amplifiers.

Later production receivers incorporate a Delayed AGC system which prevents the application of negative AGC bias to the r-f tuner unit on all signals below a predetermined signal level. Thus on weak signals the r-f amplifier operates at maximum gain and hence improves the signal-to-noise ratio. The i-f stages, however, receive the normal nondelayed AGC voltage from the clipper circuit, or from the crystal diode.

AGC delay is achieved as follows: (Refer to Fig. 14.) AGC voltage which originates from the clipper grid circuit is fed through R223 and thence to the r-f tuner through the decoupling filter consisting of R183 and C151. R222 feeds a small positive d-c voltage into the junction of R223 and the by-pass capacitor C181. The diode of V111B is tied between this point and ground, the purpose of which is to prevent the voltage at this point from going positive in the absence of signal or in the presence of weak signals. Hence the voltage appearing on the r-f tuner AGC lead will theoretically remain at zero volts d-c until a sufficiently strong signal is received which will develop enough negative AGC bias voltage to overcome the small applied positive delay voltage. In actual practice, however, the zero signal or weak signal r-f tuner bias voltage is never at absolute zero volts, since a small amount of contact potential is developed by the delay diode and by the 2nd r-f amplifier. This voltage will usually measure from $-\frac{1}{2}$ to $-1\frac{1}{2}$ volts.

Delayed AGC was incorporated in 3rd and 4th-production models, which may be readily identified by the rear apron compensator control which is a simple two-position switch rather than a switch and potentiometer combination, as was used in earlier production receivers.

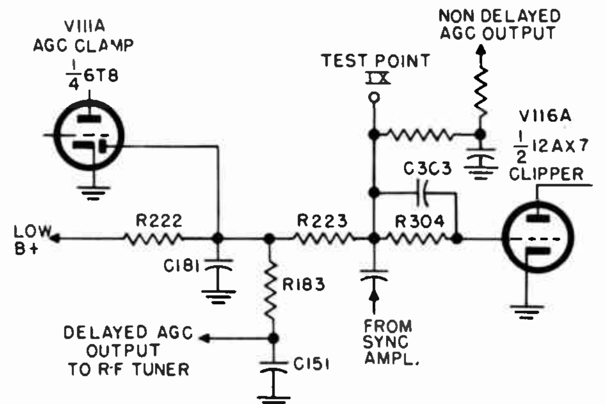


Fig. 14. Delayed AGC Circuit

RETRACE BLANKING

These receivers incorporate both vertical and horizontal retrace blanking which removes the annoying diagonal white lines or the white irregular vertical band frequently noticed on receivers not equipped with retrace blanking facilities.

VERTICAL RETRACE BLANKING—The coupling network consisting of C313 and R329 (see Fig. 38) differentiates the saw-tooth waveform originating at the vertical output stage plate (V115) and forms a steep positive "spike" voltage. This voltage is coupled through C172 into the picture tube cathode and hence drives it to cut-off during the retrace portion of the vertical sweep cycle. (C318 and R326 are required for the horizontal blanking system as explained below. These components have little or no effect on the vertical blanking pulse.)

HORIZONTAL RETRACE BLANKING—Horizontal blanking is also accomplished by the application of a suitable positive pulse to the picture tube cathode.

A "sample" of the width coil pulse is fed to the grid of the horizontal blanking tube, V116B, after suitable shaping. V116B functions as a cathode follower and provides isolation between the pulse source and the picture tube circuits. This system provides a suitably low impedance source of horizontal blanking pulses.

The developed blanking pulses appear across R326. As far as the *horizontal* blanking pulses are concerned, the bottom end of R326 is virtually grounded, since C318 provides a low impedance return path at the 15,750 cps. frequency. C318 is used additionally to prevent the appearance of horizontal pulse information in the vertical output circuits which would otherwise destroy picture interlace.

HORIZONTAL SYNCHRONIZATION

Horizontal synchronization is accomplished by comparing the phase and/or frequency of the incoming horizontal sync pulses with the phase and/or frequency of the horizontal sweep pulses which are generated within the receiver.

This comparison is made in the horizontal phase detector circuit (V117A) which then, by means of this comparison, provides a d-c output voltage. The polarity and amplitude of this voltage will depend upon any difference between the phase or frequency of the sync pulses and the locally generated sweep pulses.

This "correction" voltage is next applied, after suitable filtering, to the reactance tube (V118A) which, in turn, retards or advances the firing time of the horizontal oscillator thus causing it to remain accurately in step with the sync pulses.

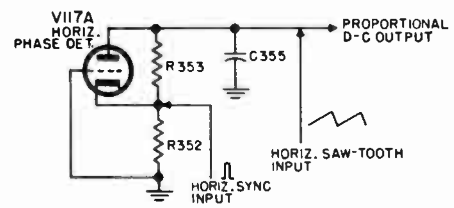


Fig. 15. Basic Horizontal Phase Detector

A triode-type tube is used as the phase detector. In general, the application of a small, identical positive voltage to both the grid and plate will cause identical currents to flow in each element. Figure 15 shows the basic horizontal phase detector circuit. R352 and R353, being nearly equal in value, will have developed across each of them, an equal but opposing d-c voltage due to the application of the negative polarity sync signals to the cathode. (R352 and R353 differ in value only to correct for the slight impedance difference between the grid to cathode and plate to cathode paths.)

A sample of the horizontal saw-tooth voltage, obtained from the discharge stage (V117B) plate circuit, is fed into the plate circuit of the phase detector, V117A, and hence modulates its plate current. The resulting effects are shown in Fig. 16. As indicated in condition 1, if the horizontal oscillator is properly timed, the developed saw-tooth will be so positioned that the sync pulses will occur exactly at the center of the retrace slope. Therefore, the grid and plate currents will be equal, and because they are of opposite polarity, a total of zero d-c volts will appear at the detector output.

Conditions 2 and 3 show the effect of either a leading or lagging saw-tooth pulse. In either case, a current unbalance will exist which will cause a positive or negative d-c voltage to be developed which in turn will be used to correct the oscillator timing. If the

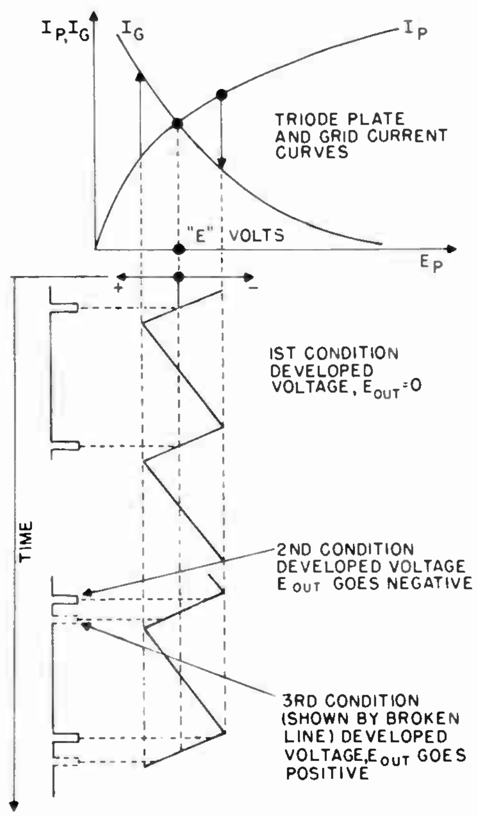


Fig. 16. Phase Detector Operation

horizontal oscillator of the receiver fires too late (i.e. the saw-tooth is "lagging") as shown in condition 2, the plate current increases, causing a negative output voltage. This will cause a speeding up of the horizontal oscillator by virtue of the reactance tube (to be discussed below). If the saw-tooth leads, as shown in condition 3, the negative developed voltage at the plate will be less than the positive voltage appearing at the cathode, thus resulting in a positive output voltage which in turn will retard the oscillator firing time.

The reactance tube, as shown in Fig. 17, acts as a variable resistance which is connected in series with C358 across the oscillator tank circuit to vary its frequency. As the d-c output from the phase detector changes amplitude or polarity, the reactance tube plate resistance will change accordingly. A positive voltage on the grid will cause the tube to conduct more heavily, thereby lowering the resistance between the capacitor C358 and ground. This increases the effective capacitive reactance of C358 across the oscillator tank circuit and causes a consequent lowering of its natural resonant frequency. Conversely, the application of a negative grid correcting voltage will result in a higher natural resonant frequency of the oscillator tank circuit.

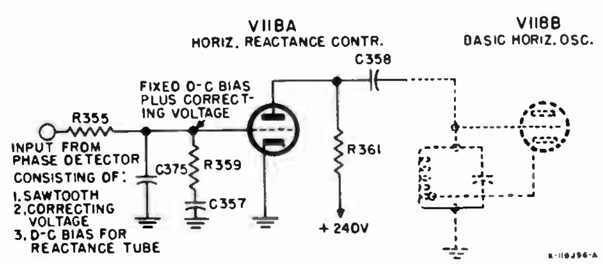


Fig. 17. Reactance Tube Circuit

R-F TUNER UNIT

GENERAL DESCRIPTION

The r-f amplifier, converter and local oscillator are constructed as a complete unit sub-assembly which can be easily dismounted from the main chassis.

This unit is designed and shielded to reduce oscillator radiation to a minimum.

This r-f tuner unit employs two r-f amplifiers, a converter and an oscillator. The intermediate output frequencies are: 45.75 megacycles for picture and 41.25 megacycles for sound.

The circuits are tuned by series coils and their distributed capacity, the tube capacity, and the capacity of three trimmers. As the channel selector is switched to lower channels, coils are added in series to lower the frequency. The oscillator section has a tuning adjustment for each channel so that the oscillator frequency may be correctly adjusted for every channel with one setting of the fine tuning control at the center of its range:

The antenna is coupled to the cathode of the first r-f amplifier by a balanced input transformer to reduce noise pick-up.

The r-f tuner unit includes an intermediate frequency trap in the cathode circuit of the first r-f amplifier to remove interfering frequencies, in the intermediate frequency pass-band, which may be picked by the antenna system. The trap is connected into the circuit when the receiver is tuned to the critical channels, 2 through 6.

Automatic gain control bias is applied to the second r-f amplifier.

The i-f output of the converter is applied to the first i-f amplifier through a transformer link coupled to the i-f input transformer.

A test point is added at the converter grid which is isolated from the grid by a 10,000-ohm resistor.

SERVICE ON R.F. TUNER UNIT

The r-f tuner unit has been carefully designed for trouble-free operation and ease in servicing. All parts including the switch wafers with the coils mounted are readily replaceable.

It is recommended that any trouble be definitely located before removing the r-f tuner unit. Make the following checks to help ascertain whether or not the trouble is in the r-f tuner.

1. If video or sound is present this usually eliminates the r-f tuner unit as a source of trouble. If both video and sound are absent, but the raster is normal, the trouble may be in the video i-f stages as well as in the r-f tuner unit.

2. If a noise pattern is evident on the screen, it usually indicates that the r-f tuner unit, the video i-f and the video amplifier circuits are operating normally. Check for a short or an open circuit in the antenna or antenna input circuits or first r-f stage.

3. Replace head-end tubes with known good tubes. Note: When a new tube is used, slight differences in interelectrode capacities between tubes may cause a slight detuning of r-f circuits. If an oscillator tube is replaced, the fine tuning range should be checked.

4. Check for proper AGC bias voltage at test point No. VII. A or B Normal signal with normal contrast control setting should produce approximately −3 volts VTVM reading.

5. The oscillator may be checked by measuring the voltage at test point No. 1. If the oscillator is functioning it should develop approximately −4 volts as measured by a vacuum tube voltmeter. If the oscillator is inoperative the voltage at test point No. 1 will drop below 1 volt.

6. Check the i-f link output coupling for open or short circuit.

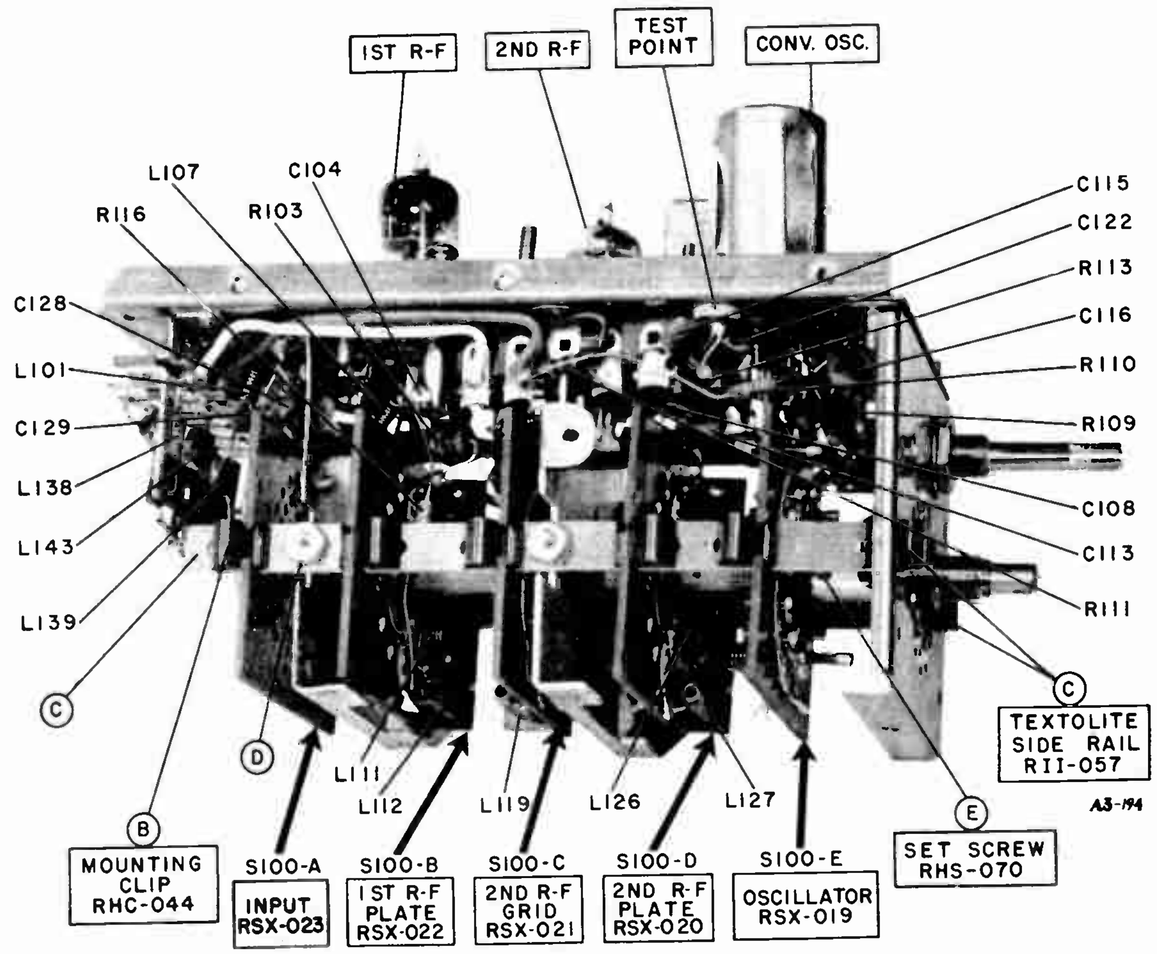


Fig. 18. R-F Tuner, Side View

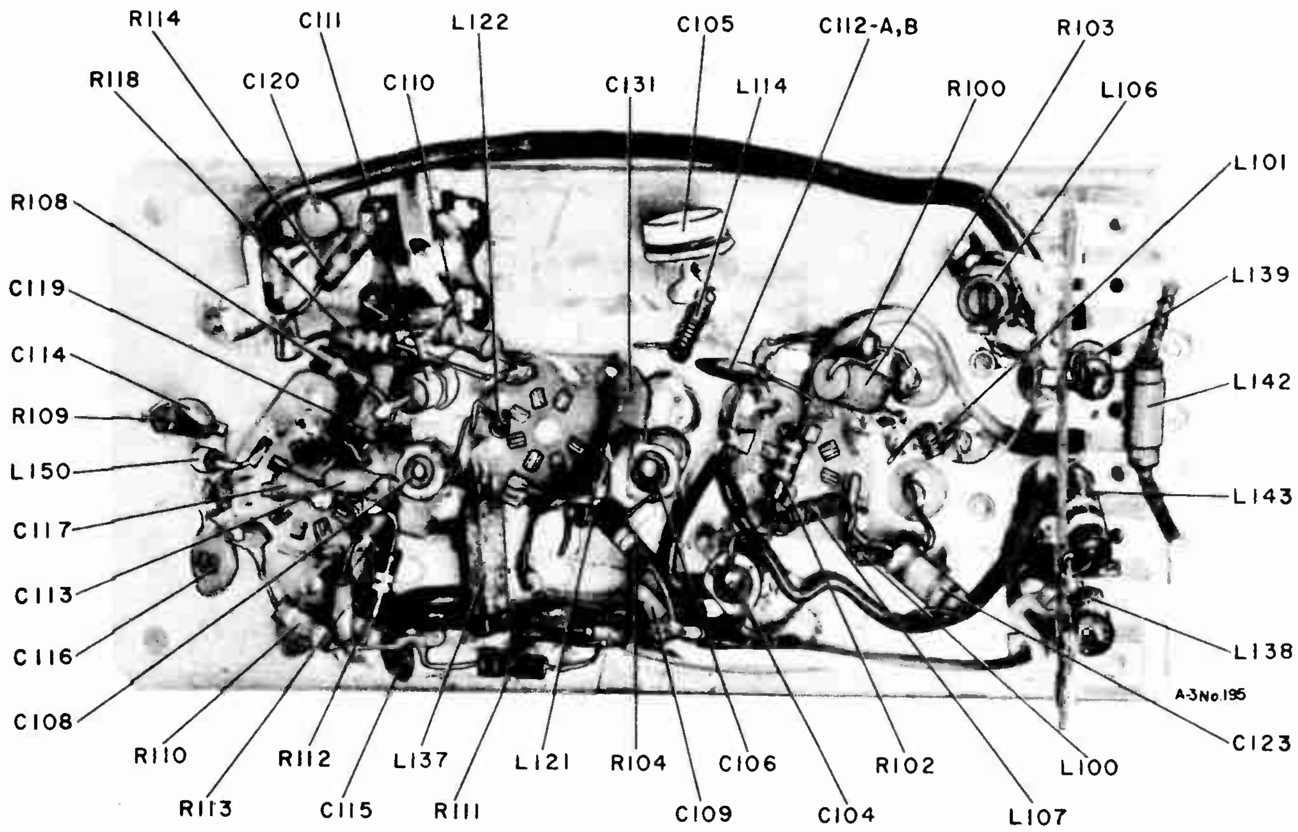


Fig. 19. R-F Tuner, Bottom View, Switch Removed

7. Couple a 44-megacycle 400-cycle amplitude modulated signal to test point No. 1. If the 400-cycle modulation is present at the output of the video amplifier plate as seen on an oscilloscope or observed on the screen of the picture tube in the form of horizontal bars, it is highly probable that the trouble lies somewhere in the R-F tuner unit ahead of the converter, V103B, grid (pin 7). However, should this 400-cycle information fail to appear in the receiver output, a check should be made of the first, second and third viedo i-f amplifier stages, the crystal diode and the video amplifier.

8. Check r-f tuner socket voltages shown in Fig. 36, page 31.

REMOVAL OF TUNER UNIT FROM CHASSIS—

1. Disconnect the antenna transmission line and the tuner output 100-ohm i-f coupling link at the i-f assembly.

2. Remove self-tapping screws holding the tuner to the mounting brackets at the rear and side of the tuner.

3. Disconnect the following leads from the r-f tuner terminal board: AGC, 6.3-volt heater, high B+ and low B+, see Fig. 27.

4. Disconnect the black phenolic coupling from the r-f tuner switch shaft. The tuner assembly is now free for removal.

REPLACEMENT OF SWITCH WAFERS—See Fig. 18 and 20.

1. Remove the r-f tuner unit from the chassis and remove its shield.

2. Loosen setscrew (E) which holds Textolite switch shaft into the brass coupling RMK-006 and slide shaft out of the rear of the switch.

3. Remove the spring clips (B) which secure the switch wafer to the Textolite side rails (C). There are six of these springs on each side. These may be removed by lifting the tab out of the hole in the Textolite side rails.

4. Unscrew the four hex nuts (D) which secure the side rails (C) to the shields. The side rails may be lifted out of the switch wafers.

5. Unsolder the connections to the wafer to be removed and replace with the new wafer.

TO REMOVE THE OSCILLATOR WAFER ONLY—See Fig. 18 and 20.

1. Remove the r-f tuner from the chassis and remove the r-f tuner unit shield.

2. Loosen the Allen setscrew (E) which holds the Textolite switch shaft to the coupling and pull the shaft out of the oscillator wafer.

3. Remove the four spring clips (B) which secure the Textolite side rails (C) to the r-f tuner unit front apron and the oscillator wafer.

4. Remove the two self-tapping screws (A) which hold the r-f tuner unit front apron to the chassis, and pull the front apron forward so that the oscillator wafer may be removed. Use care not to break the connection to the tuning capacitor, C118.

5. Unsolder the connections to the oscillator wafer and remove it by springing up the Textolite side rails (C).

When reassembling the r-f tuner unit and replacing switch wafers, use care not to damage or distort any of the coils mounted on the switch wafers. Reassemble the r-f tuner unit in the reverse order that it was disassembled.

REMOVAL OF TUNING CAPACITOR OR DETENT ASSEMBLY—See Fig. 18 and 20.

1. Remove the r-f tuner unit from the chassis as outlined.

2. Remove the r-f tuner unit shield.

3. Remove the two spring clips (B) which hold the Textolite side rails.

4. Loosen the rear setscrew which holds the Textolite shaft into the brass coupling (RMK-006) and slide the Textolite shaft out of the coupling.

5. Remove the two self-tapping screws which secure the front apron to the r-f tuner unit chassis.

6. Spring up the Textolite side rails (C) to release the front apron for access to the tuning capacitor.

7. Unsolder the tuning capacitor lead at the 12AT7 socket.

8. To remove the detent assembly, remove the "C" washer on brass shaft.

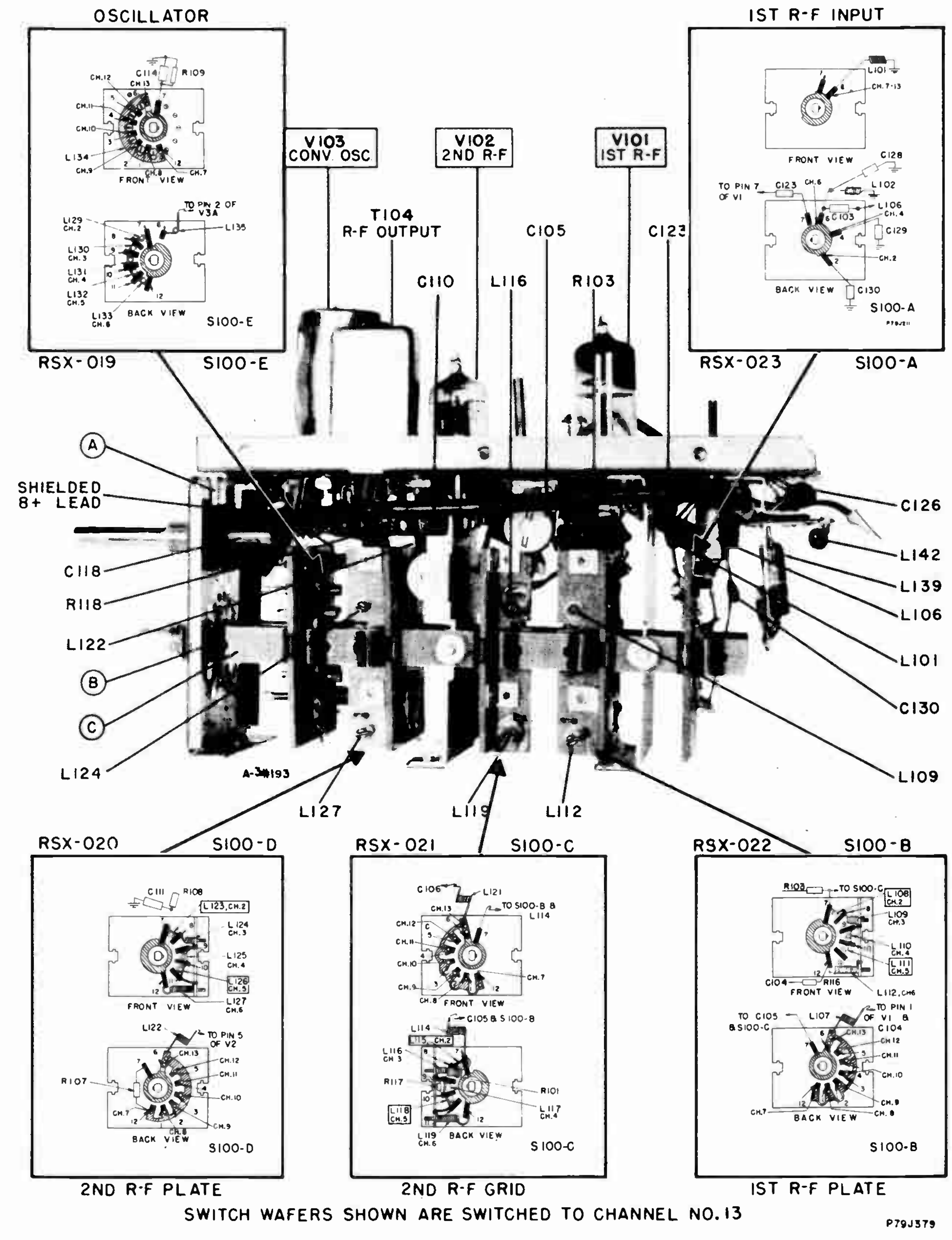


Fig. 20. R-F Tuner and Switch, Wafer Wiring

RECEIVER ALIGNMENT

GENERAL:

The following procedure covers the alignment of the R-F Tuner Unit, Video I-F System, Audio I-F System and Video Amplifier Trap.

In most cases the circuits in the receiver should need realignment only when tubes or components in the tuned circuits have been replaced, or the adjustments have been tampered with. When the decision is reached that the trouble lies in improper alignment of the circuits, the alignment should be undertaken only if proper test equipment is available. In many cases, the "over-all" receiver alignment may be first checked to determine the source of the difficulty.

The alignment procedure described follows the sweep method using General Electric test equipment. When other than General Electric sweep equipment is used, make sure that it meets the requirements listed below. If an accurately calibrated marker generator is not available, a conventional signal generator may be used to supply the markers. Its output should be loosely coupled to the sweep generator output terminals and must be kept as low as possible to prevent distortion of the sweep wave-form.

Before proceeding with the alignment make sure to read all notes and consult the connection diagrams. Allow the test equipment and receiver to warm up for at least 15 minutes before starting the alignment.

ALWAYS USE AN ISOLATION TRANSFORMER TO PROTECT TEST EQUIPMENT

TEST EQUIPMENT

The following test equipment is necessary in order to effect alignment of the tuned circuits of the receiver:

1. R-F SWEEP GENERATOR

(G-E Type ST-4A or Equivalent)

a. Frequency requirements:
   4.5 MC with approximately 2 MC sweep width.
   37-48 MC with approximately 10 MC sweep width.
   50-90 MC, 170-220 MC with 15 MC sweep width.

b. Constant output in the sweep range.

c. Minimum output 0.1 volt.

2. MARKER GENERATOR

(G-E Type ST-5A or Equivalent)

The marker generator must have good frequency stability, accurate calibration and must cover the following frequencies:

a. 38.00 MC
   41.25 MC
   42.50 MC
   45.00 MC
   45.75 MC
   47.25 MC

b. 4.5 MC for video amplifier trap alignment.

c. Picture and sound carrier frequencies for Channel No. 2 through No. 13.

3. BALANCED OUTPUT ADAPTER

(G-E ST-8A or Equivalent)
See R-F Alignment, note 2.

4. OSCILLOSCOPE

(G-E Type ST-2A or Equivalent)

The oscilloscope should have good sensitivity and preferably a 5-inch screen with a good wide-band frequency response in the vertical deflection circuits. Although the high frequency response is not necessary for alignment, it is imperative when observing video waveforms.

5. DETECTOR NETWORK

A crystal detector network as shown in Fig. 31 is necessary when aligning the 4.5 mc video amplifier trap.

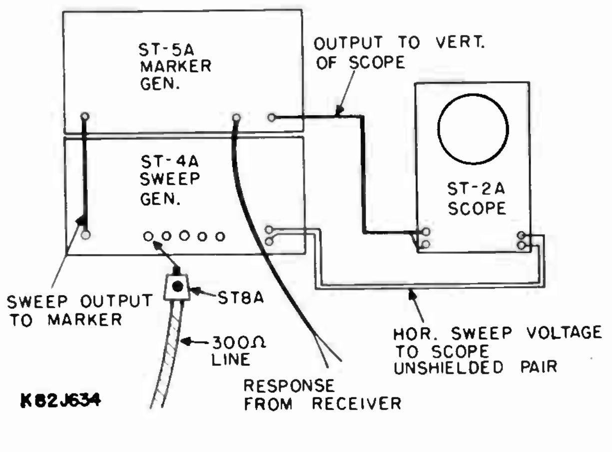


Fig. 21. R-F Sweep Equipment Connecting Diagram

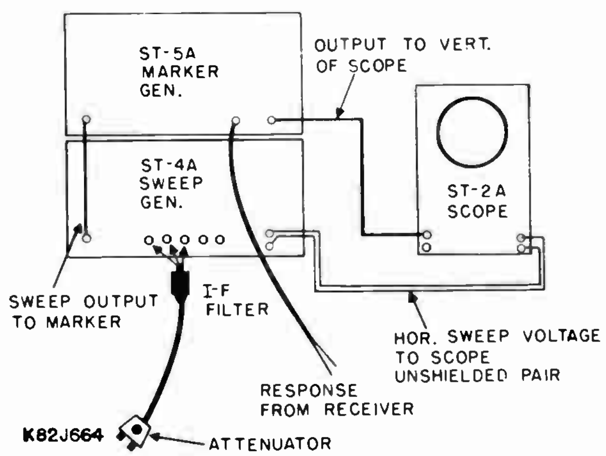
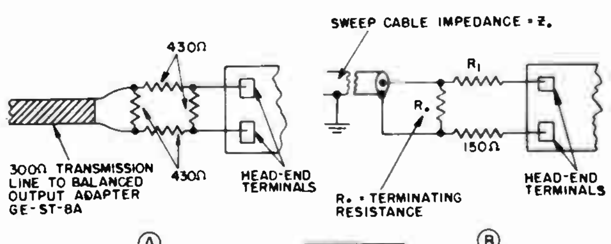


Fig. 22. I-F Sweep Equipment Connecting Diagram



Z	R₂	R₁
50Ω	56Ω	120Ω
72Ω	82Ω	110Ω
92Ω	100Ω	100Ω

Fig. 23. Sweep Equipment Termination

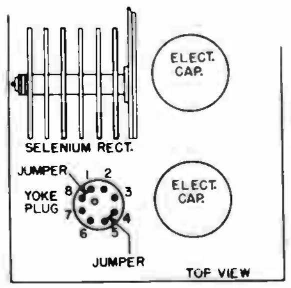


Fig. 24. Yoke Interlock Jumper

R-F Tuner Unit

INTRODUCTION:

Before actually starting the Alignment procedure, it would be well to first comprehend the objectives to be achieved.

In general, the R-F Tuner "channel frequency" response should be "flat" across each channel. As previously noted, the major portion of the receiver selectivity will be found in the I-F system, the desired response of which is predicated upon the characteristics of the transmitted signal. Hence, the R-F Tuner response should permit conversion of the incoming signal to the I-F spectrum without disturbing the amplitude relationship of the two carriers and their associated sidebands.

Additionally, the R-F Tuner must provide a reasonable degree of selectivity to prevent cross-modulation of the television signal by other VHF services and to prevent signals in the 40 to 48 mc band from being passed to the I-F amplifier with a consequent degradation of the picture.

In the following procedure, the tuner may be aligned without removing it from the main chassis. The alignment procedure is in two parts; the first portion deals with alignment and frequency response shaping of the signal frequency circuits and the second portion with the adjustment of the local oscillator. The signal frequency circuits, as may be noted on the schematic diagram, Fig. 36, are brought into resonance by adjustment of some of the inductances and, in some cases, by the adjustment of low value trimmer capacitors.

The only adjustment in the cathode of the first R-F amplifier, V101, is the I-F interference trap, L106. This trap is pre-set at the factory at approximately 43.0 mc and may be readjusted, if required, to any offending signal in the 40-50 mc range. (Caution: when adjusting this trap—make sure that it has not changed the normal channel No. 2 response).

The first R-F amplifier plate and second R-F amplifier grid circuits are tuned by switch-tapped coils and trimmer capacitors C104 and C106. Channels 7-13 are brought into resonance by the adjustment of these trimmers. Channels 2 thru 6 are brought into resonance by the adjustment of inductances L109, L112, L116 and L119. Coupling between these stages is controlled by the common impedances L114 and C105. L114 controls the bandwidth on channels 2–6, while C105 controls the bandwidth on channels 7-13. Although the following procedure indicates the above adjustments are to be made only on a few specific channels, the final adjustment will represent an excellent compromise setting for all channels.

The second R-F plate and Converter grid circuits are tuned by the tank circuits associated with switch wafer S100D. C108 is used to resonate the circuits in channels 7-13. L124 and L127 resonate the circuits on channels 2–6. In the "over-all" receiver alignment procedure, page 26, these three adjustments are used to correct for "Tilt" in the over-all response.

The oscillator frequency is changed from channel to channel by switching additional inductances in series with the channel No. 13 oscillator coil progressively down to channel No. 2. Each of these coils is adjustable through the front detent plate of the Tuner unit.

R-F Alignment

NOTES:

1. The R-F tuner may be aligned without removing it from the main chassis. Disconnect the 300-ohm transmission line from the antenna input transformer, T100 and disconnect the B+ to the oscillator. To do this, on 4th-production R-F tuner units (those incorporating a 470-ohm, R125 resistor on the rear terminal boards) merely open the jumper between the two center terminals on the upper board. On earlier units disconnect this jumper and transpose L142 from terminal 4 to terminal 3 (see Fig. 27). Failure to transpose L142 will remove plate voltage from the 1st R-F amplifier and hence will result in improper alignment and reduced gain.
2. Connect the sweep generator to the R-F tuner antenna input transformer using the G-E ST-8A balanced adapter to obtain 300 ohms output, see Fig. 21. The adapter should be connected to the R-F tuner through approximately three feet of 300-ohm transmission line and a resistor pad, as shown in Fig. 23A. When using other test equipment of the unbalanced output type, a pad as shown in Fig. 23B should be used instead.
3. Connect a 3-volt battery to the AGC terminal of the R-F tuner, see Fig. 27, with the positive lead of the battery connected to the tuner chassis.
4. Should it become difficult to obtain proper tracking on channels 7-13 with the indicated adjustments, proper tracking may be achieved by dressing the coil L122. See Fig. 20. This coil is available through the opening obtained by removing the self-tapping screw on the side flap and bending the flap up. See Fig. 26. This coil should be dressed with an insulated tool to prevent a B+ short.
5. It is possible to obtain two different settings of C105, Fig. 26, that will give the proper R-F bandwidth. The correct setting may be determined by switching from Channel 13 to Channel 12 and observing the change in bandwidth. The correct setting will result in a slightly greater bandwidth on Channel 12.
6. When proper tracking on the low channels cannot be achieved with the provided screw adjustments, the inductance of the coils L110, L111, L117, L118, L125 and L126 (Fig. 18 and 20) may be varied by inserting a knife blade between the windings. This method of adjustment requires the removal of the tuner shield, a procedure which will detune the circuits. However, in most cases the provided screw-type adjustments will suffice to achieve proper tracking through all channels after the shield has been replaced.
7. The picture and sound carrier marker should not be less than 75% of the peak of the R-F response curve. Refer to the "limits" curves shown in the accompanying alignment chart.
8. Seal trimmer screw of C105 and the brass cores in the coils L114, L112, L109, L119, L116, L127 and L124, Fig. 26, with wax to prevent detuning. Seal the tuning screws in trimmers C104, C106 and C108, Fig. 25, with glue. Reconnect the jumper on the R-F tuner terminal board and connect the transmission line to R-F tuner input transformer.
9. For receiver over-all alignment check, see page 26.

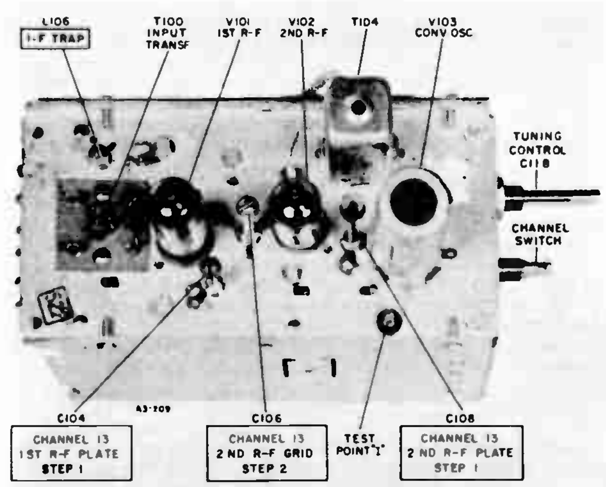


Fig. 25. R-F Tuner Adjustments, Top View

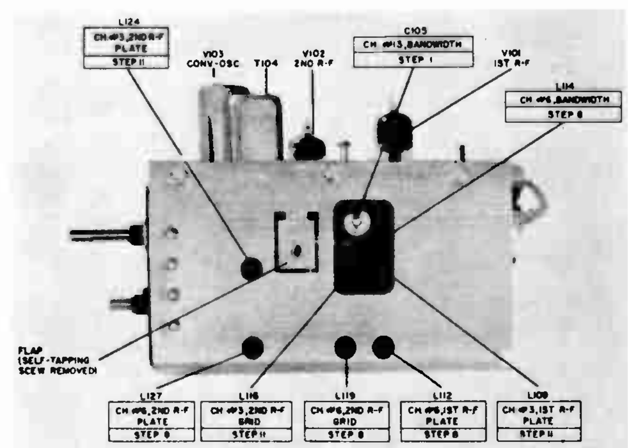
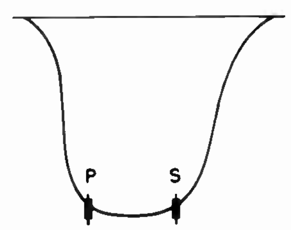


Fig. 26. R-F Tuner Adjustments, Side View

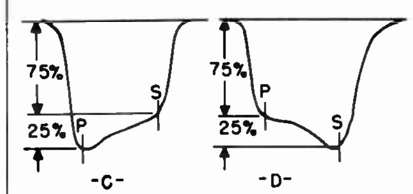
R-F Alignment Chart

(a) Set generator sweep width to 10–15 mc.
(b) Signal input point at r-f tuner input transformer, T100.
(c) Observe response curve at test point I, Fig. 25, through 10,000-ohm resistor. Connect test equipment ground lead to r-f tuner chassis.
(d) Adhere to following order when performing a complete alignment.
(e) When following the procedure below, an attempt should be made to obtain the indicated ideal response curves. Minor deviations from the ideal curves may occur, the maximum limits of "tilt" and/or bandwidth being shown in the "Remarks" column.

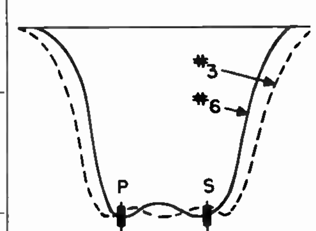
Step	Receiver and Sweep Generator Channel	Marker Generator Frequency MC	Adjust	Remarks
1	No. 13	211.25 215.75	C104, C105 and C108 (Fig. 25 and 26) for maximum gain and proper bandwidth of 4.5 mc to obtain curve "A" below. Limits are shown in last column.	Retune C108 and/or redress L122 (Fig. 20) for proper tracking; see note 4; C105 controls bandwidth, C104, C106 and C108 brings circuits into resonance.
2	No. 12	205.25 209.75	No adjustments; check tracking; obtain curve "A"; limits shown in last column.	
3	No. 11	199.25 203.75		
4	No. 10	193.25 197.75		
5	No. 9	187.25 191.75		
6	No. 8	181.25 185.75		
7	No. 7	175.25 179.75		
8	No. 6	83.25 87.75	L112, L114, L119 and L127, Fig. 26, for maximum gain, optimum curve flatness and 4.5 mc bandwidth; see curve "B"	
9	No. 5	77.25 81.75	No adjustments, check tracking; see curve "B"	
10	No. 4	67.25 71.75		
11	No. 3	61.25 65.75	L109, L116 and L124, Fig. 26, for maximum gain and optimum curve flatness. See curve "B"	
12	No. 2	55.25 59.75	No adjustments, check tracking; see curve "B"	See note 6.



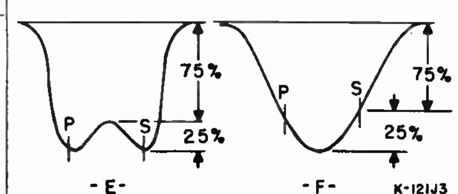
A
Ideal curve



Sound Carrier 25% down
Picture carrier 25% down
Tilt Limit Curves



B
Ideal curve



Wide limit
Narrow limit
Bandwidth Limit Curves

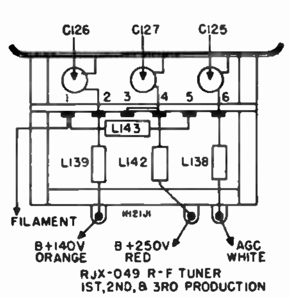
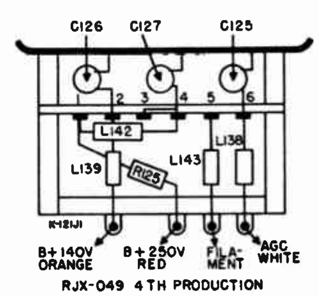


Fig. 27. R-F Tuner Terminal Boards



Oscillator Alignment

GENERAL. Two methods of oscillator frequency adjustment are given below. The first method uses a transmitting station for the adjustment while the second method requires a sweep generator to align the oscillator coils.

A. "ON Station Signal" Alignment

R-F and video I-F alignment must be correct before attempting oscillator alignment. A transmitted station signal is needed for each one of the coils being adjusted. Tune in the stations starting with the highest frequency channels and adjust the tuning screws for all available stations so that with the fine tuning control in the full-clockwise position, audio is just visible in the picture. Then, check to see that best picture response on all channels takes place approximately in the center of the oscillator fine tuning range.

B. Sweep Alignment

1. R-F and video I-F must be properly aligned before aligning the oscillator.
2. Connect a 3-volt battery to the AGC terminal of the R-F tuner, see Fig. 27, with the positive lead of the battery connected to the tuner chassis.
3. Disconnect the 300-ohm transmission line from the antenna terminals to the R-F terminals and connect the sweep generator to the R-F tuner terminals as described in note 2 on page 18.
4. Set the fine tuning knob 180° (½ turn) from the counter-clockwise limit of its rotation, i.e. rotate the fine tuning knob counterclockwise to the end of its travel, then turn the fine tuning control knob 180° (½ turn) clockwise. This setting of the fine tuning control should be maintained for all oscillator adjustments.
5. Make the indicated adjustments so that the picture carrier marker for the channel falls at 50% on the high frequency side of the response curve.

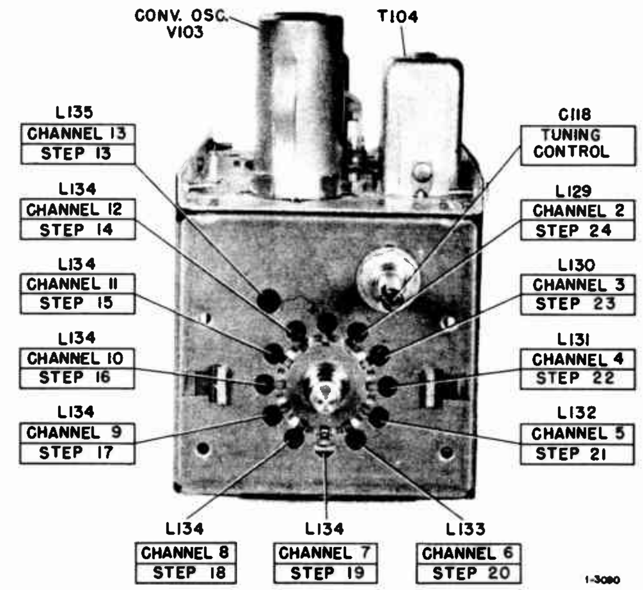


Fig. 28. Oscillator Adjustments

OSCILLATOR ALIGNMENT CHART

Sweep Generator Sweep Width 10–15 MC

Step No.	Receiver and Marker Position	Marker Generator Frequency	Signal Input Point	Observe Response Curve at	Adjust	See Note
13	No. 13	211.25 MC	Antenna terminals (see Note 3)	Test Point III (Video detector diode load)	L135 Channel No. 13 oscillator adjustment.	1, 2, 3, 4, 5
14	No. 12	205.25 MC			L134 Channel No. 12 oscillator adjustment.	
15	No. 11	199.25 MC			L134 Channel No. 11 oscillator adjustment.	
16	No. 10	193.25 MC			L134 Channel No. 10 oscillator adjustment.	
17	No. 9	187.25 MC			L134 Channel No. 9 oscillator adjustment.	
18	No. 8	181.25 MC			L134 Channel No. 8 oscillator adjustment.	
19	No. 7	175.25 MC			L134 Channel No. 7 oscillator adjustment.	
20	No. 6	83.25 MC			L133 Channel No. 6 oscillator adjustment.	
21	No. 5	77.25 MC			L132 Channel No. 5 oscillator adjustment.	
22	No. 4	67.25 MC			L131 Channel No. 4 oscillator adjustment.	
23	No. 3	61.25 MC			L130 Channel No. 3 oscillator adjustment.	
24	No. 2	55.25 MC			L129 Channel No. 2 oscillator adjustment.	

Audio I-F Alignment

GENERAL:

The preferred method of audio i-f alignment involves the use of the station signal. The 4.5 mc audio i-f circuits are then tuned for proper indication on a d-c voltmeter as indicated below.

Meter Alignment

NOTES:

1. Tune in a television signal. This will provide a 4.5 mc signal source for audio alignment. Keep the volume control turned down unless the speaker is connected.
2. Figure 29 shows a simple resistor network needed for the alignment of T203 secondary. These two 100K resistors should be chosen as accurately as possible, for equal resistance. Be sure to remove these resistors after completing the alignment. Align according to chart below.

IN THE ABSENCE OF TEST EQUIPMENT, the audio I-F System may be aligned by tuning the various circuits for maximum volume output as follows:

1. Tune in a weak station signal—preferably one with test pattern and tone modulation. A strong signal will require sufficient attenuation (by shorting the antenna terminals or similar means), in order to lower the audio I-F Signal Strength below limiting.
2. Adjust L160 and T201 (top and bottom cores) for maximum audio output.
3. Adjust T203 (bottom core) for maximum audio output.
4. Adjust T203 (top core) for maximum audio output and minimum distortion and/or buzz.
5. Repeat steps 3 and 4 above to assure proper final adjustment.
6. Check audio limiting on normal-strength signal. Readjust T203 top core if necessary.

ALIGNMENT CHART

STEP NO.	CONNECT VTVM OR 20,000 OHMS/VOLT METER	ADJUST	METER INDICATION	REMARKS
1	To test point VI and chassis. (Limiter grid)	L160 and T201 (top and bottom cores)	Adjust for Maximum Deflection	Voltage to be read is negative with respect to chassis.
2	V111, Pin 2 and chassis. See Figure 29.	T203 primary (bottom core)		
3	Test Point V and center of two 100K resistors. See Figure 29.	T203 Secondary (top core)	Adjust for zero volts, D-C, output.	Repeat steps two and three to assure proper final adjustment.

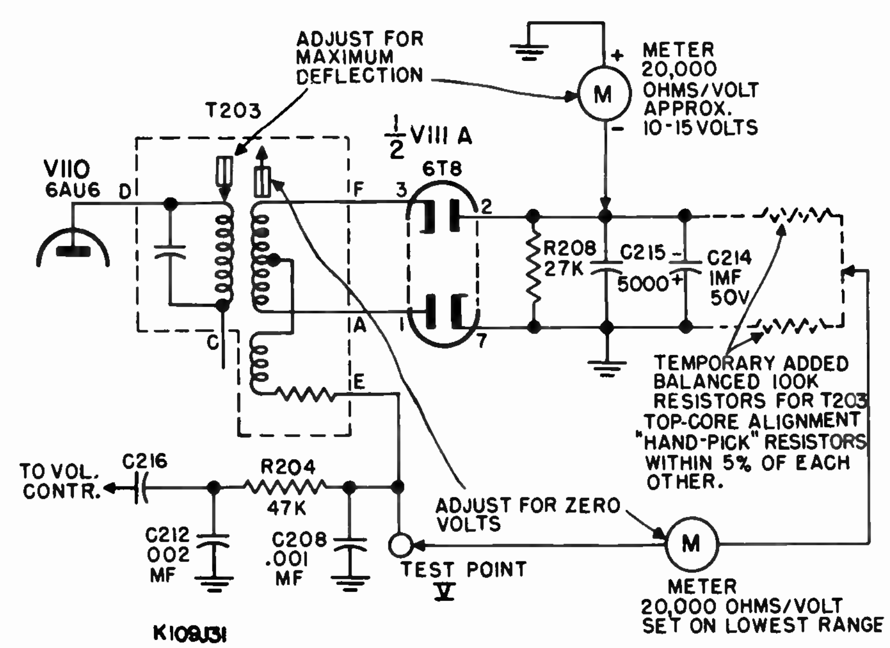


Fig. 29. Audio I-F Meter Connections

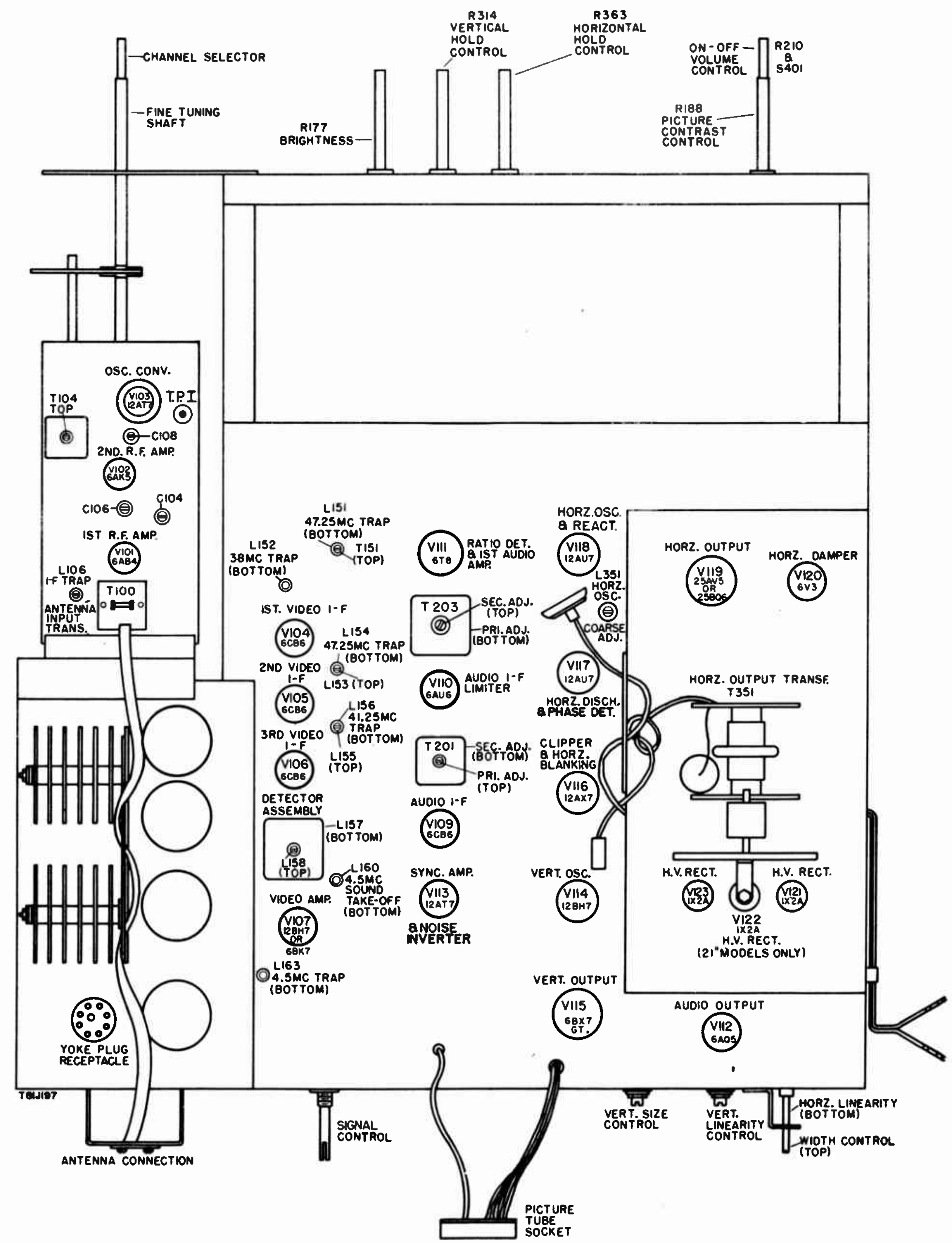


Fig. 30. Tube and Trimmer Location

RECEIVER ALIGNMENT (Cont'd)

I-F AMPLIFIER ALIGNMENT

GENERAL:

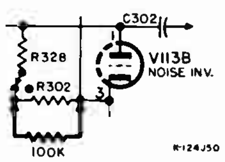
As indicated on the accompanying schematic diagrams, two basically different video amplifiers have been used. Since the frequency and transient response of these amplifiers differ somewhat, the desired i-f response curves must also differ in order to achieve the same over-all frequency and transient response in both systems.

The "Desired Waveform," "Remarks" columns in the following chart are each identified by the designation "12BH7" or "6BK7-A." Before sweep aligning a receiver, determine its video amplifier (V107) tube type and use the corresponding curves to achieve proper alignment.

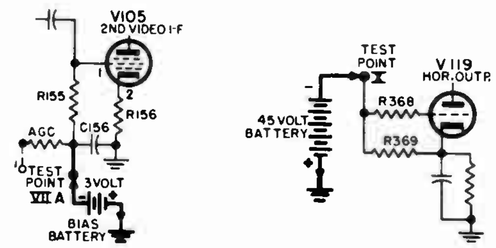
The usual precautions should be observed regarding the proper termination of the sweep output cable, warm-up time, equipment cable dress, etc. Always use an *Isolation Transformer* when servicing these receivers.

NOTES:

1. Connect a 100,000-ohm ½-watt resistor across R302 to bias off the noise inverter which otherwise would cause a false i-f curve indication, see figure below. *Remove this resistor after completing the alignment.*



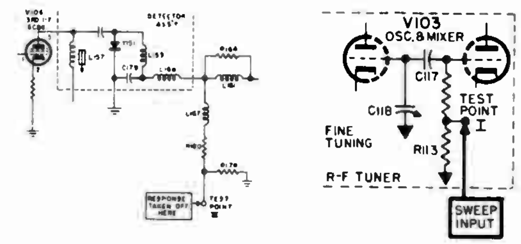
2. Connect the negative lead of a 3-volt bias battery to test point VIIA. Connect the positive lead to the nearest top-chassis ground point. Similarly, insert a 45.0-volt negative bias at test point X to prevent horizontal pulse information from appearing on the sweep waveforms.



3. Set contrast control and rear apron AGC control (if receiver is so equipped) fully counterclockwise.

4. Calibrate the vertical gain of the oscilloscope so that ¾-volt A-C will provide the desired curve size. Receiver response should be observed at test point III as indicated in the following diagram. Connect the ground side of the cable to the nearest top-chassis ground point.

5. Set channel selector switch to Channel 11 position and turn the fine tuning control fully counterclockwise.



6. Refer to Fig. 22 and 23 for proper connection and termination of sweep generator.

7. In many cases, it will only be necessary to start with Step 2 of the procedure below. Step 1 is included only as a "Starting" point for use in cases where the receiver has become seriously misaligned, or when the correct setting of the 38.0 mc trap (L158) is difficult to determine in the "over-all" i-f curve.

8. Note that in the following procedure, the 45.0 mc marker is used as the 100% reference point in the "12BH7" alignment, while the curve peak is used as the 100% reference point in the "6BK7-A" alignment procedure. Align as indicated in the chart below.

Over-all (RF-IF) Alignment Check

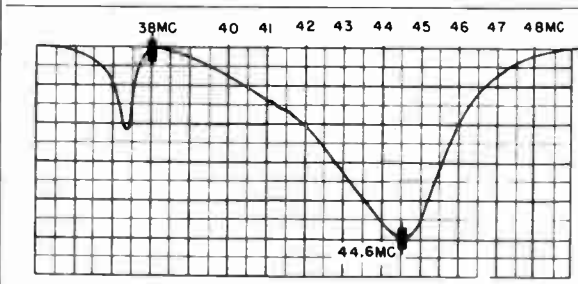
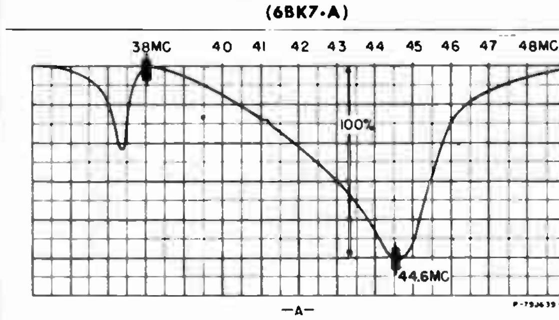
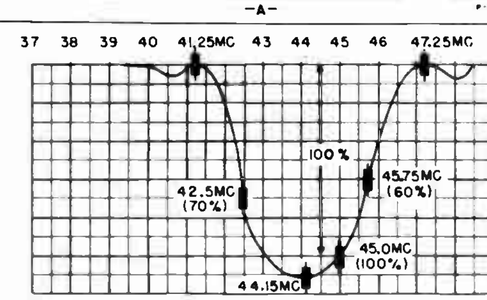
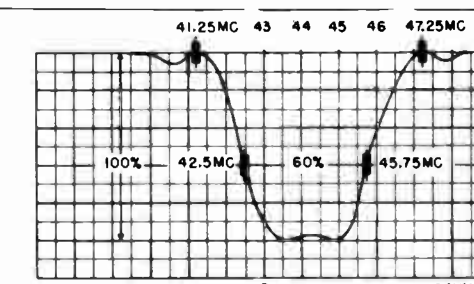
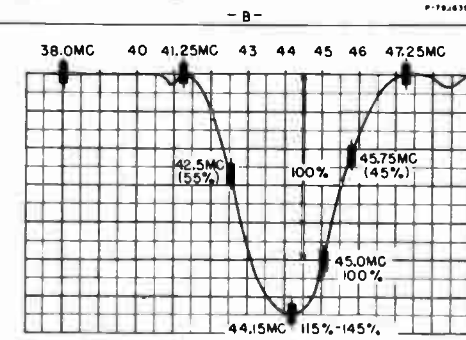
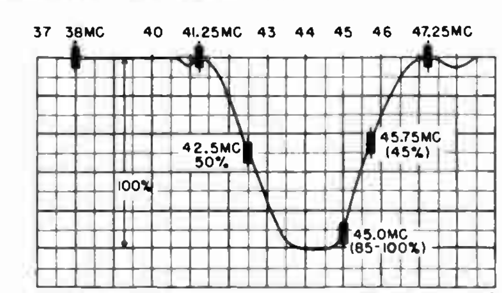
A receiver which has been properly r-f aligned and i-f aligned must not be considered as a properly aligned receiver until the over-all check and adjustments have been made. Because the converter grid and cathode are utilized as a detector diode in the r-f alignment process, a certain degree of "tilt" or r-f detuning will occur. The only method of determining the degree of introduced "tilt" and the correction thereof must be done by observing the over-all curve.

In general, a receiver which has been properly r-f aligned will display an over-all curve (antenna to diode) which will closely duplicate the i-f system curve, since the major portion of the receiver selectivity occurs in the i-f system. It is to be expected, however, that minor variations in the over-all curve will occur when checking each of the various channels.

The procedure given below is quite simple, and assures optimum picture detail and receiver sensitivity. After the receiver has been properly aligned according to the data given for r-f and i-f alignment, proceed as follows:

a. Couple r-f sweep and channel marker signals to antenna input terminals.
b. Observe receiver response at Test Point III.
c. Sweep each channel, starting with Channel 13, and observe resulting curve. Adjust the Fine Tuning control so that the resulting sound and picture I-F markers fall in the approximate positions shown in step 3 of the chart below.
d. Should the observed curve not agree with that shown in step 3, the following adjustments should be made:
   I. On Channels 7–13, adjust C108 (Fig. 24) to produce desired curve shape and amplitude.
   CAUTION: Do not move C108 adjustment core more than three turns in either direction—usually one turn will suffice to produce the desired curve compensation.
   II. On Channels 4, 5 and 6 adjust L127 for proper curve compensation if required.
   III. On Channels 2 and 3 adjust L124.

VIDEO I-F ALIGNMENT CHART

STEP	SWEEP INPUT	ADJUST	DESIRED RESPONSE (12BH7)	REMARKS (12BH7)	DESIRED RESPONSE (6BK7-A)	REMARKS (6BK7-A)
1	Into Pin 1 of V106 thru .001 mf capacitor. Center sweep frequency approx. 44 mc. Sweep width approx. 15 mc	L158 (Trap) to 38.0 mc L157 (V106 plate) to peak at 44.6 mc		Use full available sweep width		Use full available sweep width
2	Into Test Point II (refer to schematic diagrams) thru .001 mf capacitor. Center sweep frequency approx. 44 mc. Sweep width approx. 10 mc	L156 (Trap) to 41.25 mc L154 (Trap) to 47.25 mc L153 (V104 plate) set 45.75 mc marker L155 (V105 plate) set 42.5 mc marker L157 (V106 plate) balance curve		Use 45.0 mc as 100% reference Set 45.75 mc @ 60% Set 42.5 mc @ 70% L157 should be peaked @ 44.15 mc		Peak of curve = 100% Set 45.75 mc @ 60% Set 42.5 mc @ 60 % L157 should be adjusted for symmetrical skirt response
3	Into Test Point I (on r-f tuner) thru .001 mf cap. Center sweep frequency approx. 44 mc. Sweep width approx. 10 mc	L152 (Trap) to 38.0 mc L151 (Trap) to 47.25 mc T151 (V104 grid) and T104 (R-F Tuner) for curve shown, check percentages as indicated in "Remarks" column		Use 45.0 mc as 100% reference *simultaneously* "rock" T151 & T104 for symmetrical skirts consistent with optimum gain. Max. curve peak 145%, min. curve peak 115%		Peak of curve = 100% Adjust T151 and T104 for *flat* peak. Adjust L157 to correct for any "Tilt." 45.0 mc may fall between limits of 85–100%

TRAP ADJUSTMENT

ALIGNMENT OF L106 I-F TRAP

The trap, L106 (Fig. 30) is incorporated in the r-f tuner to remove or attenuate any interfering frequency in the i-f range. The trap should be aligned by tuning for minimum i-f channel interference pattern on the screen. If the interference is intermittent and the interfering frequency is known, L106 may also be aligned by the use of a calibrated signal generator.

NOTES:

1. Connect 3 volts bias from the AGC line on the r-f tuner (see Fig. 27) to chassis with the positive terminal of the battery connected to chassis.

2. Use an accurate marker generator to furnish a signal of the same frequency as the interfering frequency and a sweep generator with its center frequency set approximately at the interference frequency. Connect the scope to view the response curve at the output of the video detector.

3. Use the GE-ST-8A balanced adapter and a 3-foot piece of 300-ohm transmission line to couple the r-f sweep to the antenna terminals of the receiver.

4. Be sure not to tune the trap so that it will attenuate channel No. 2.

L106 ALIGNMENT CHART

Marker Frequency	Sweep Frequencies and Input Point	Observe Response Curve at	Channel Switch Setting	Adjust
Interference frequency	40 to 50 mc to antenna terminals	Test Point III	2	Core of L106 for minimum amplitude of curve at marker

ADJUSTMENT OF 4.5 MC TRAP (L163)

ADJUSTMENT NOTES:

This trap is pre-set at the factory and should not require readjustment due to its stable design characteristics. However, should it become damaged, it may require re-alignment. The experienced service technician may, if desired, tune the trap for a minimum 4.5 mc "beat" effect in the picture. This requires that a strong, noise-free television station signal be used. Otherwise the following method given in the procedure of the accompanying alignment chart in accordance with the notes below should be used.

1. Remove tube V103 to remove circuit noise.

2. Inject an accurate amplitude modulated 4.5 mc signal into test point VIII.

3. Connect a diode network as shown in Fig. 31 to test point IV. Ground the bottom of the network (Junction 68K and 100K) to the receiver chassis.

4. Tune the trap for minimum signal amplitude response as observed on the oscilloscope (Fig. 32).

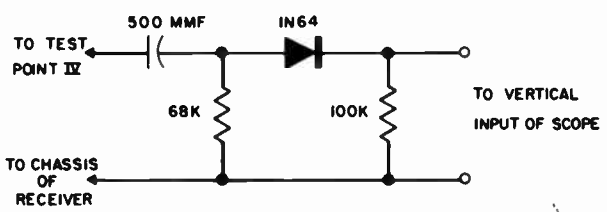
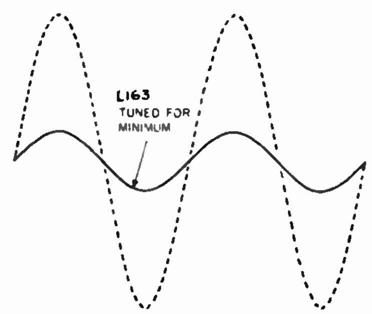


Fig. 31. Diode Detector Network



Hor. sweep of scope synced at ½ modulating frequency

Fig. 32. 4.5 MC Trap Tuning Response

L163 TRAP ALIGNMENT CHART

AM SIGNAL GENERATOR FREQ. MC	SIGNAL INPUT TO CHASSIS AND	CONNECT OSCILLOSCOPE	ADJUST	SEE NOTE
4.5	Test Point VIII	Across 100K resistor, as shown in Fig. 31	Core of L163 for minimum signal recovery. See Fig. 32.	1, 2, 3, 4

TROUBLE SHOOTING

In many cases a circuit difficulty may be localized by observing the picture or test pattern and by noting the presence or absence of sound. In general, the tubes in defective circuits should be checked first since this check does not take much time and the probability of failure is higher in tubes than in components. When substituting tubes in r-f or video i-f circuits, the original tube should be replaced in the socket if it is found to be satisfactory.

Always make sure that all tubes are making good socket contact. In some cases it may be necessary to clean the tube pins to eliminate intermittances.

To facilitate trouble shooting the waveforms of Figures 38, 39, and 44 should be consulted. Alignment equipment may be used to isolate defective r-f or video i-f stages by checking for the response curves given in the alignment procedure.

For a detailed description of circuit analysis and an illustrated trouble shooting guide refer to General Electric publication RSM4-TV53.

SYMPTOM	CHECK FOR
DEFECTS OF THE R-F AND I-F CIRCUITS	
A. No sound, no picture	1. Inoperative local oscillator, V103A 2. Open video i-f coupling capacitors, C152, C155, C158, C162 3. Improper or no screen or plate voltage at r-f or i-f tubes due to shorted screen by-pass capacitor or open resistor 4. Open video detector crystal, Y151
B. No picture, sound possibly weak, raster satisfactory	1. Shorted capacitor, C166 2. Open coupling capacitor, C162 3. Defective crystal diode, Y151
C. Noisy picture (Low signal strength)	1. Open input circuit and components of antenna input circuit, such as open capacitors, C173, C174, or open transformer, T100 2. Defective antenna, or antenna transmission line 3. Antenna orientation 4. Open filament, V101
D. Wiggles in picture background, trailing whites, sound normal	1. Open capacitors, C412, C413, C414 2. Alignment of i-f amplifier and associated traps
E. "Motorboat" or flutter in picture and/or audio	1. Open by-pass, C151 on AGC bus 2. Open AGC filter capacitor C180 3. Alignment of r-f and video i-f amplifiers
F. Lack of picture detail (Focus satisfactory)	1. Misalignment of video i-f amplifier 2. Misalignment of r-f amplifier 3. Mismatch of input impedances at antenna input terminals of receiver 4. Overloading of r-f stages (also check for leakage in capacitors C155, C158) 5. Defective peaking coil
G. Sound bars in picture	1. For microphonic tubes: V101, V102, V103, V104, V105, V106, V107 and V108 2. For misalignment of adjacent channel sound traps L151 and L154 or misalignment of accompanying sound trap L156

DEFECTS OF THE VIDEO AMPLIFIER

A. No picture, sound satisfactory, raster satisfactory	1. Open compensating choke L165 (1st, 2nd, 3rd prod.) 2. Shorted capacitor, C403C in cathode V107B (1st, 2nd, 3rd prod.) 3. Open input coupling capacitor, C170 to tube V107A 4. Open plate resistors at tube V107A or V107B. Check plate voltages 5. Short of grid to cathode in picture tube
B. Lack of picture detail (focus satisfactory)	1. Shorted peaking coils 2. Open peaking coils (only those coils shunted by resistors) 3. Increase in value of diode load and video amplifier plate resistors
C. Trailing Whites	1. Decrease in value of diode load and/or video amplifier plate resistors

TROUBLE SHOOTING (Cont'd)

DEFECTS OF THE SYNC SECTION

SYMPTOM	CHECK FOR
A. Weak or no horizontal sync; vertical sync, picture and sound satisfactory	1. Sync amplitude at input to discriminator tube, V117A. 2. Bias and plate voltage on control tube V118A 3. Sine-wave oscillator components, L351, C361, C358, C359 and R362 4. Leaky or shorted capacitors, C368 and C355 5. Waveform feedback components, C356, R358, R365 and C352.
B. Weak or composite sync, otherwise picture and sound normal	1. Open or low capacity of input coupling capacitor, C314 2. Defective coupling capacitor C302 or C303, to clipper tube 3. Incorrect value of plate resistor, R307, in clipper 4. Insufficient amplitude of composite signal applied to sync amplifier from video detector; check video detector circuit
C. No vertical sync, hor. sync satisfactory	1. Sync pulse at input of vert. oscillator, check integrator plate P301 2. Vert. oscillator frequency, if far off from 60 cps, check vert. oscillator components such as C309 and R313 3. Leakage in feedback capacitor, C308
D. Picture displaced to left, right edge wavy	1. Open or low value of capacitor, C303
E. Horizontal sync out, bright bar or bars in picture	1. Shorted, open or leaky capacitor, C360 2. Improper value resistor, R364
F. "Gear Tooth" effect	1. Open or low value capacity of C357 2. Open or high resistance of R359
G. Noise "tearing" picture (noise inverter failure)	1. Low value, R302 2. Open C301 3. Open or high value, R301
H. No horizontal or vertical sync Poor composite sync (attributable to noise inverter failure)	1. Open or high value of R302 2. Low value R301 3. Leaky or shorted C301 4. Shorted C169 or C177

DEFECTS OF THE VERTICAL DEFLECTION CIRCUIT

SYMPTOM	CHECK FOR
A. Poor vertical linearity, inadequate height	1. Low emission of sweep output tube, V115 2. Improper grid input "drive" voltage at V115 3. Defective sweep output transformer, T301 4. Low B+ voltage to sweep output tube, V115 5. Low value of cathode capacitor, C403B
B. Inadequate picture height	1. Rise in resistance value of vert. oscillator plate resistor, R315 or R330 2. Leakage in capacitor C317 3. Incorrect value of plate, or grid voltages on output tube, V115 4. Low value capacitor in cathode of vert. output tube, C403B. (This usually results in poor linearity) 5. Weak vertical deflection tube, V114 or V115
C. No vertical deflection	1. Open vertical deflection coils, D301 2. Defective sweep output transformer, T301 3. Vertical sweep tube, V114 or V115 not operating 4. Poor contacts in yoke plug
D. Poor vertical linearity, height satisfactory	1. Linearity control components such as cathode capacitor, C403B, for leakage or improper value or improper value of R318 2. Low value capacitor, C311 3. Leaky capacitor, C316 4. Vertical output tube, V115
E. Excessive height	1. Too low value of resistor R315 or R330 or defective Height control, R316
F. Poor vertical linearity, fold-over at bottom of picture, picture height excessive	1. Low resistance leakage of capacitor, C310 2. Low value of charging capacitor, C311
G. Vertical keystoning	1. External short across vertical deflection coils 2. Defective vertical deflection coil, D301

TROUBLE SHOOTING (Cont'd)

DEFECTS OF THE HORIZONTAL DEFLECTION CIRCUITS

SYMPTOM	CHECK FOR
A. Too great sweep width, reception normal otherwise.	1. Open width control coil 2. Open winding between width coil taps on horizontal output transformer, T351
B. Inadequate sweep width	1. Correct waveshape and amplitude of input "drive" voltage at test point X 2. Shorted Width control L352 or defective deflection coil, D351 3. Defective output transformer T351—shorted turns or arc-over 4. Low emission of damper tube, V120 5. Low B+ voltage to tubes V117B, V118B, V119
C. Single vertical line in center, sound normal	1. Open horizontal deflection coils, D351 2. Open capacitor, C382 3. Open choke, L357 4. Open yoke plug connection
D. Poor horizontal linearity	1. Shorted linearity control 2. Defective feed-back capacitor, C385 3. Defective yoke, D351 4. Defective capacitors C370, C371
E. Poor horizontal linearity, bright vertical bars, inadequate width	1. Open or low value of capacitor, C371 2. Defective damper tube, V120
F. Black "beady" vertical line or lines, receiver normal otherwise	1. Defective output tube, V119 2. Defective output transformer, T351 3. Defective deflection yoke, D351
G. No raster—sound satisfactory	1. Shorted capacitor, C378 2. Defective sweep output tube, V119 or damper tube, V120 3. Defective tubes, V117B, V118B 4. No voltage at T351 primary 5. Shorted capacitor C371 6. No screen voltage on V119 7. Adequate drive at grid of V119 8. Shorted Width control 9. Open Linearity control 10. Defective sweep output transformer, T351

DEFECTS OF THE POWER SUPPLY

SYMPTOM	CHECK FOR
A. No raster, no sound	1. Power supply interlocks and/or fuse open 2. Power cord plug and cable 3. Rectifier components 4. Open filter choke 5. Open tube filament in series filament string 6. Open input capacitor, C401 7. Yoke plug not connected
B. Picture size small, brilliance low, sound normal	1. Open or low value of input filter capacitor, C402 of power supply 2. Defective rectifier, X401 or X402
C. Picture blooms	1. Defective H.V. rectifiers, V121, V122, (21-inch models only), V123 2. Defective picture tube
D. Hum bar in picture, waviness in edges of raster ("Mae West" movement)	1. Open or low value of filter capacitor, C403A
E. Low picture brilliance, sound satisfactory	1. Low voltage at H.V. anode of picture tube, caused by leaky capacitors C378 and C379, defective rectifiers, V121, V122 (21-inch models only) and V123 2. Improper adjustment of ion trap 3. Defective Brightness control circuit 4. Low voltage at 1st anode of picture tube (pin 10) 5. Defective picture tube

MISCELLANEOUS DEFECTS

SYMPTOM	CHECK FOR
A. No raster—sound satisfactory	1. Open or shorted picture tube heater 2. No voltage at 1st anode of picture tube (pin 10) 3. Excessively high bias voltage at cathode of picture tube 4. Defective picture tube, check by substitution.
B. AGC control ineffective (1st, 2nd production receivers only)	1. Shorted capacitor, C302. This will result in excessive RF-IF gain and the AGC control will work backwards 2. Shorted AGC by-pass C151. This will result in no AGC and too much contrast 3. Insufficient signal at clipper. Check for normal voltages with oscilloscope. Check V113 and V116 4. Leaky capacitor C155 and C131 (R-F Tuner unit)

TROUBLE SHOOTING (Cont'd)

SYMPTOM	CHECK FOR
C. Receiver overloads on moderate to strong signals (3rd & 4th production receivers only)	1. AGC clamp tube failure (1/4 V111B) 2. Shorted C151
D. Brightness control partially or completely inoperative	1. Defective Brightness control, R177, or circuit components 2. Defective (short or leaky) capacitor, C171 3. Defective (gassy) picture tube
E. Picture pulled out of shape on one side or corner	1. Proper orientation of the Picture Straighteners
F. Poor focus	1. Proper focus unit adjustment and position 2. Defective picture tube
G. Vertical retrace lines visible	1. Open input capacitor to blanking circuit, C313 2. Check for shorted capacitor in blanking circuit, C318 3. Open coupling capacitor C172 to picture tube cathode
H. Horizontal blanking inoperative	1. Defective horizontal blanking tube, V116B 2. Open capacitor, C381 3. Shorted capacitor, C384
I. Cramping of last 1½ inches on right side of picture	1. Open capacitor, C385
J. Dark shading on left edge of picture	1. Open capacitor, C383

5. NOISE INVERTER CHECK

A simple oscillographic check may be performed which will display the operation of the noise inverter. The procedure is based upon noise pulse inversion in the absence of signal.

1. Turn on receiver. Set channel selector switch to an unoccupied channel.
2. Connect oscilloscope to test point IX (Junction of C302 and C303).
3. Bias off the noise inverter (V113B) by connecting a 100,000 ohm resistor between its pin No. 3 and +250 volts.
4. Supply a moderate-amplitude noise signal to the antenna input terminals. A suitable noise source would be an electric shaver or similar "spark" type noise generator.
5. Observe positive polarity of noise pulses on oscilloscope. Removal of the temporarily added 100,000 ohm resistor should cause the noise signal to reverse itself and hence become negative in polarity.

FILAMENT GLOBAR CHECK

Those tubes having 300 ma. heaters are connected in a series circuit containing a globar resistor R402. This resistor is designed so that its "cold" resistance is in the order of 200 or 300 ohms, and when at operating temperature approximately 31 ohms. A "cold" resistance check is almost valueless since the resistance reading may vary widely between resistors.

The surest method of checking R402 is to read the voltage drop across it. This should be in the vicinity of 10 volts with the receiver operating on a 117 volt A-C line.

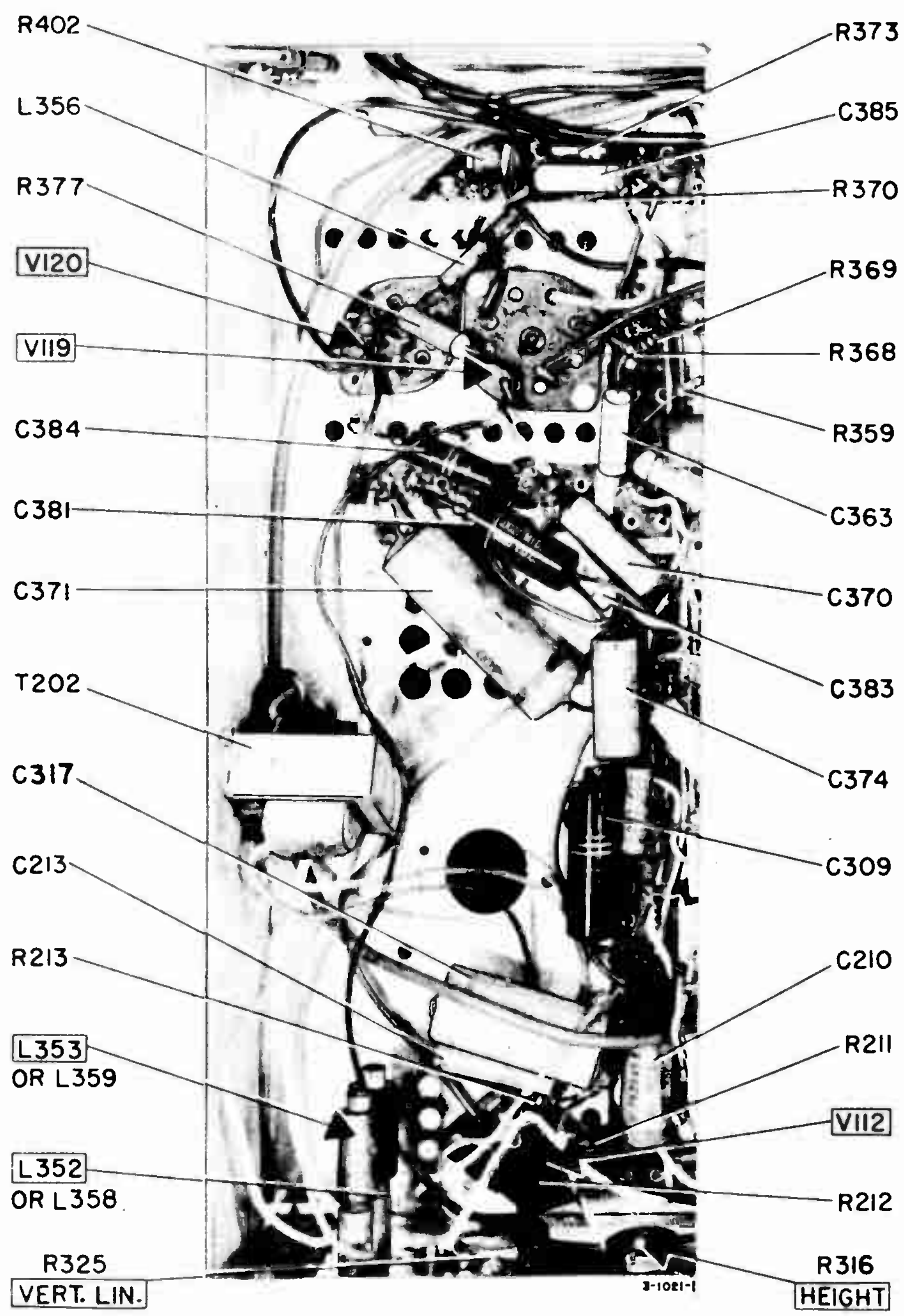
GENERAL SERVICE INFORMATION

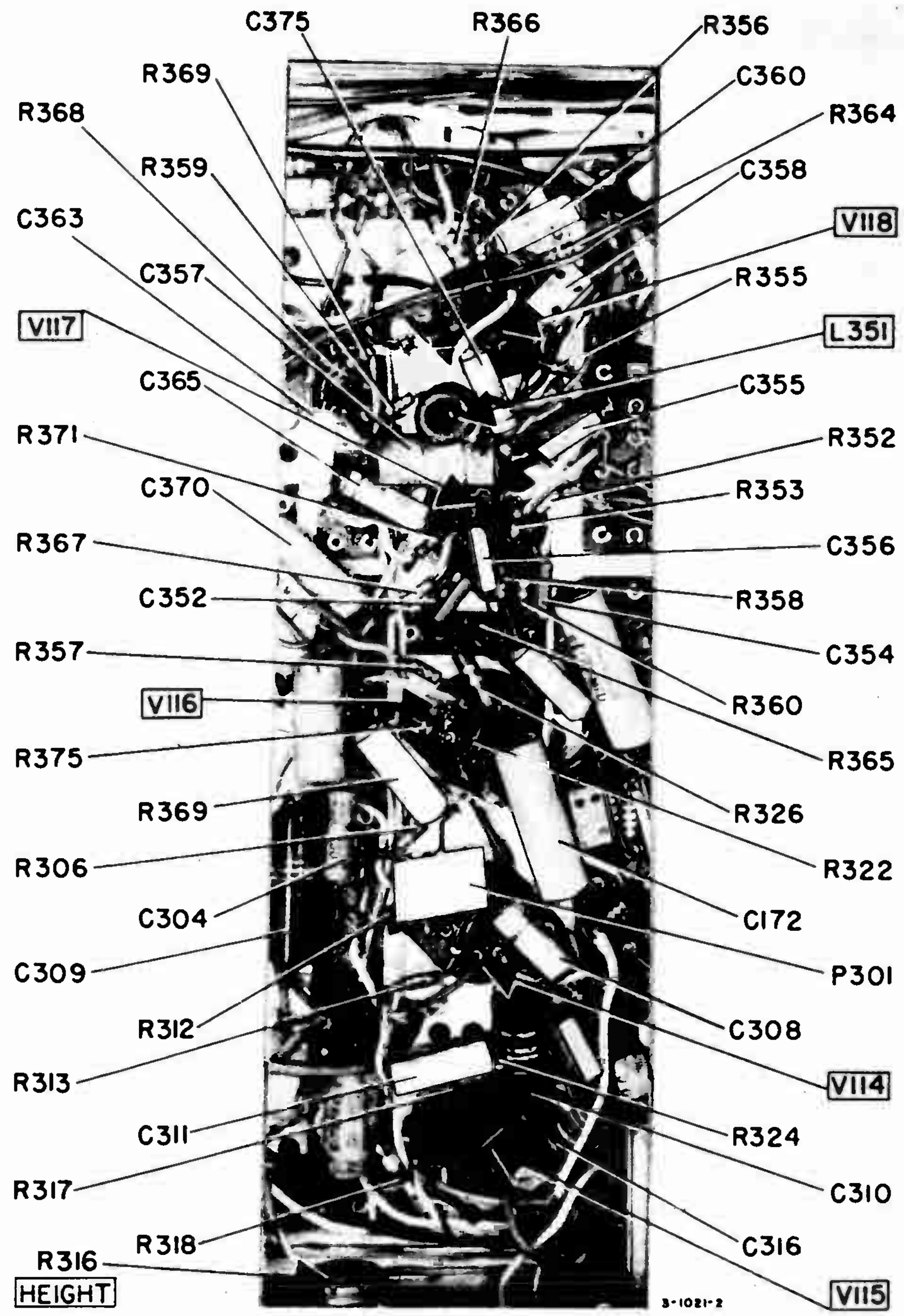
1. *CRITICAL LEAD DRESS*—To prevent the effects of undesired 4.5 mc harmonic radiation, it is essential that all audio and video i-f components be replaced in exactly the same position they occupied when they were wired in at the factory. All r-f, video and sync carrying leads should be made as short as possible. Check lead dress of picture tube anode lead to prevent high-voltage arc-over.

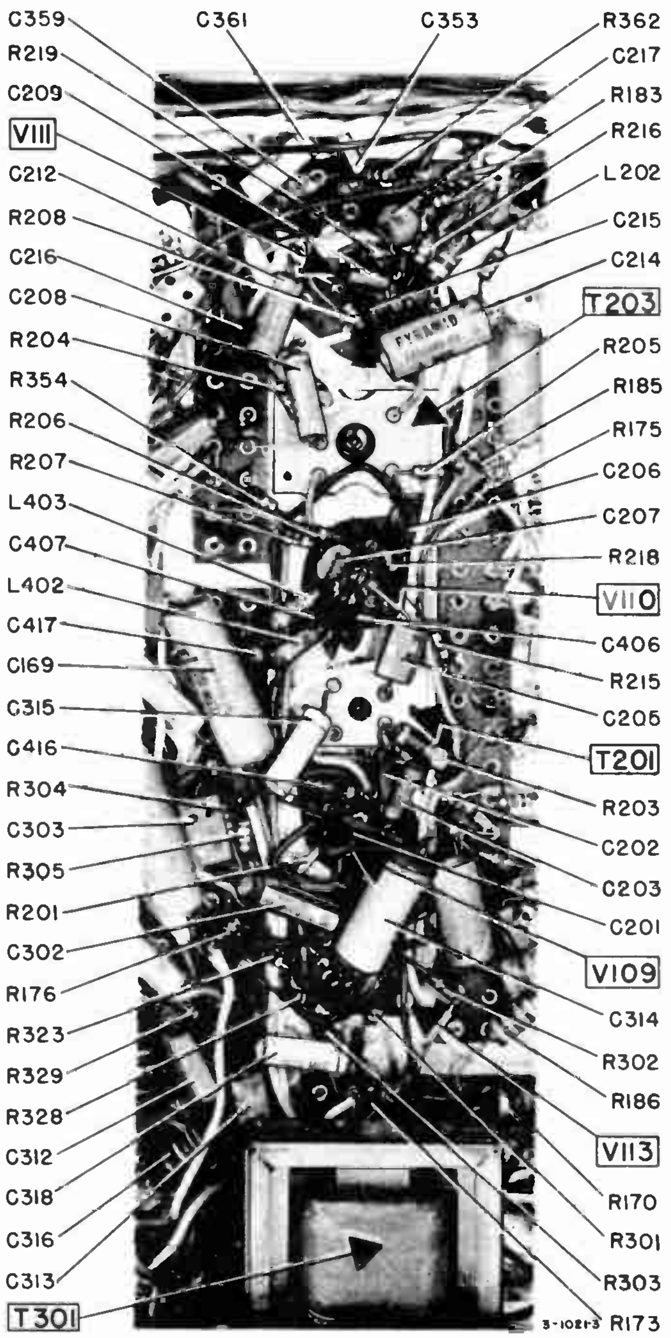
2. *ARC-OVER IN HIGH VOLTAGE COMPARTMENT (21-INCH MODELS)*—Under humid conditions poor lead or component dress on the high-voltage rectifier bracket may cause arc-over. It may occur between the plate cap of input rectifier (V121) and the solder lug which is fastened to the center of the socket of the middle rectifier (V122). To remedy this condition dress tube V121 away from the middle rectifier tube (V122). Also bend the above mentioned solder lug up and away from the plate cap of rectifier tube V121.

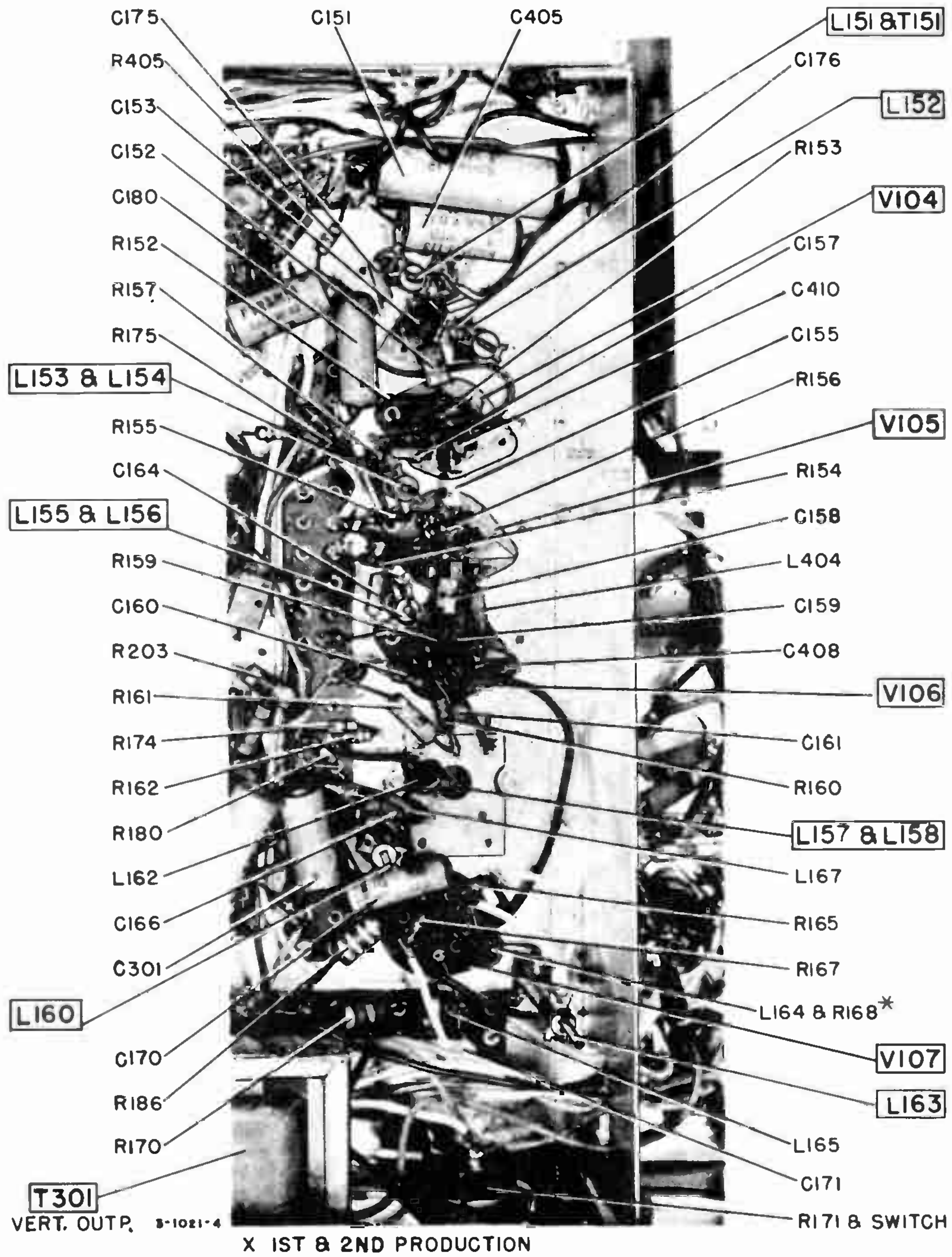
3. *REPLACEMENT OF CRYSTAL DIODE*—For replacement purposes special diodes (Cat. No. RED-001) are being supplied. To insure proper receiver operation it is not recommended that any other type diode be used for replacement purposes.

4. *REPLACEMENT OF FILAMENT TRANSFORMER*—(4th Prod. only) When replacing the filament transformer, T401, be sure to measure the voltage at pin 3 of V106 (3rd video i-f). This voltage should read approximately 12.0 volts. If zero or near zero volts are measured at this point the *primary* leads should be reversed.









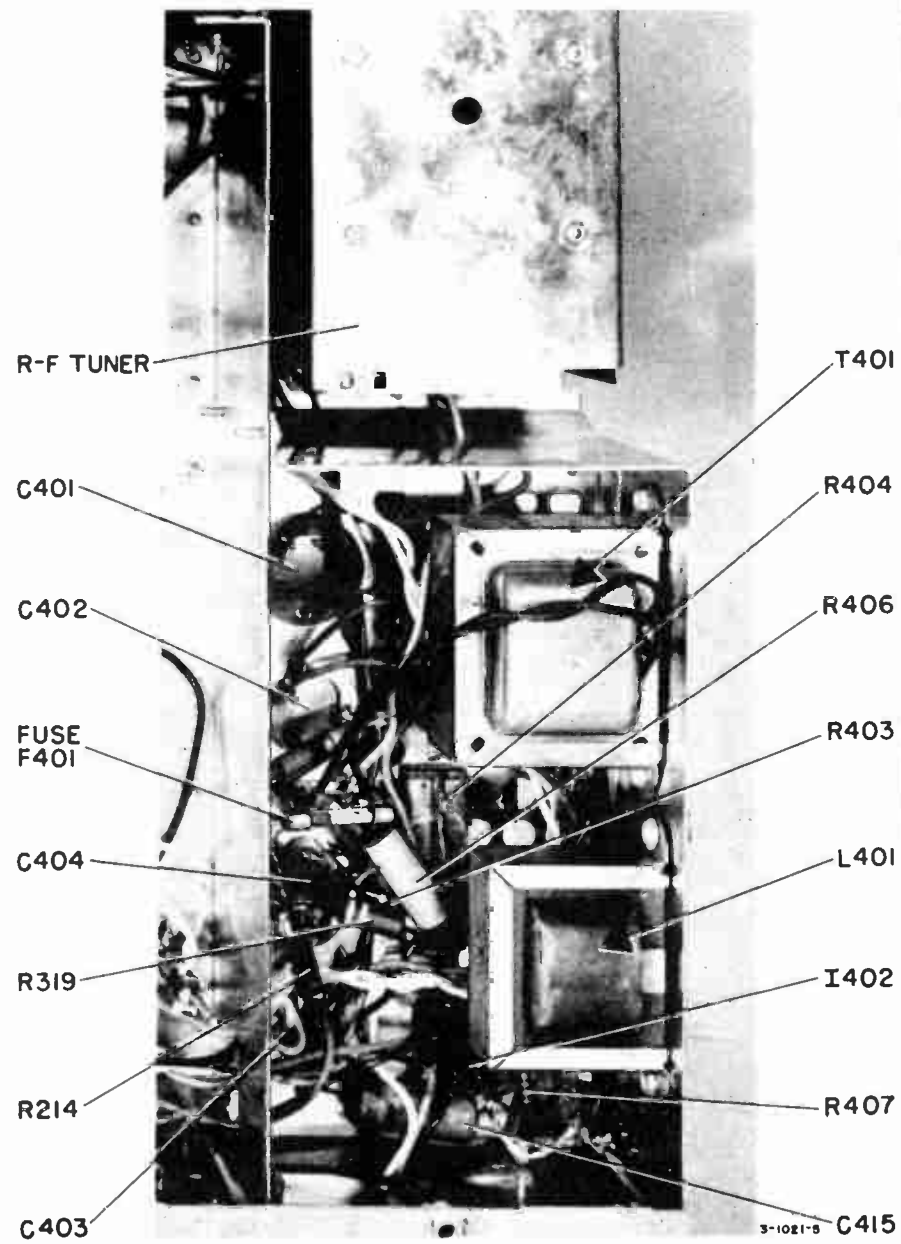


Fig. 33. Bottom View of Chassis (Represents typical layout; minor variations may be encountered)

MAJOR PRODUCTION CHANGES

GENERAL:

As previously noted, several mechanical and electrical changes have occurred during the production of this family of receivers. Listed below are the various items to be considered with reference to specific production versions. It should be noted that electrical circuit changes are not chronologically related to those changes which occurred in the various mechanical assemblies. To prevent confusion, electrical circuit changes shall be denoted as 1st, 2nd, 3rd or 4th production versions, while mechanical assembly changes shall be referred to as "early," "mid" and "late" production items.

MECHANICAL ITEMS

1. PICTURE TUBE ASSEMBLY:

Two basic types of picture tube assemblies have been used during production, each of which is described on pages 5 through 10. The "early" models 21T1, 21C204 and 21C214 use the "square" type assembly depicted on page 5. All later production of these models utilize the "late" type assembly described on page 19.

MASK AND OVERLAY:

Two different masks, one metal and one plastic, have been used in these receivers. These masks are interchangeable. It should be noted however, that the metal type mask requires the use of a rubber dust seal (Cat. No. RIG-010, 011 or 012) between the mask and the picture tube. The dust seal should be installed according to instructions found on pages 18 and 19. The plastic type mask was used in early and midproduction receivers. The metal type mask is to be found in middle and late production units.

2. ANCHORING OF MASK:

On late production metal masks two overlay anchors are projection welded to the lower edge of the mask to permit securing the mask to the cabinet by means of No. 8 x 3/4 inch wood screws. This was done to eliminate shifting of the mask or picture tube during transportation.

3. FOCUS UNIT ASSEMBLY

Early and midproduction focus units utilized a flexible extension shaft and knob assembly which extended out of the rear of the receiver for the purpose of focus adjustment.

Late production focus units utilize a screw driver and associated guide funnel type adjustment. These two focus units are otherwise similar as may be noted in Figs. 4 and 8.

5. DETECTOR CAN ASSEMBLY:

1st and 2nd production chassis incorporated the detector can assembly shown in Fig. 38, page 38. In this assembly, the diode detector is located under the removable "hat."

3rd and 4th production receivers utilize the detector assembly shown in Fig. 44. To change the diode or any other component within this assembly, it is merely necessary to remove the two self-tapping screws at the base of the assembly. The entire assembly may then be pulled off of the mounting plate. The shield can may then be removed from the assembly by compressing the two spring tabs on the top tuning core securing clip.

ELECTRICAL ITEMS

1. HORIZONTAL OUTPUT TUBE—Horizontal output tube was changed from 25AV5 to 25BQ6. The 25AV5 tube was used in first production models only.

2. IMPROVEMENT IN PICTURE QUALITY—The diode load resistor, R162, was changed from 3900 ohms to 3000 ohms. For identification these receivers were rubber-stamped on the back apron of the chassis with No. 420.

3. HORIZONTAL SWEEP OUTPUT TRANSFORMER AND YOKE—In 3rd and 4th production models the horizontal output transformer and yoke were changed. Receivers using these revised sweep components bear a label on the high-voltage compartment rear door which indicates the catalog numbers of the horizontal output transformer and yoke contained therein. Models 17C125 and 20C107 use horizontal output transformer RTO-130, 21 models use RTO-129. The yoke to be used with either of these transformers is RLD-050. These components should not be used in those receivers which used the "early" type transformer and yoke, unless a "late" transformer and a "late" yoke are simultaneously installed. These receivers using these "late" sweep components are rubber-stamped with No. 430 and include changes of No. 420.

4. DELAYED AGC—In order to improve the operation of the receiver a new AGC circuit was incorporated in the 3rd and 4th production. Receivers using this new circuit may be identified by noting the "Local-Fringe Stabilizer" two-position switch label located on the cabinet back. This control replaces the original potentiometer and switch, the label of which reads "Picture Stabilizer" or "Signal Strength Compensator."

The purpose of this new circuit is two-fold:

a. To prohibit the development of AGC bias for the 2nd r-f stage until a sufficiently strong signal is received which will remove all conversion noise in the picture. This results in an improvement of the signal-to-noise ratio on weak signals while still permitting AGC action by virtue of a non-delayed AGC voltage which is applied to the i-f system.

b. To make the AGC fully automatic, thus eliminating the necessity of adjusting an AGC level potentiometer to suit particular installation conditions. For easy identification these receivers were rubber-stamped with No. 401 which also include changes No. 420 and No. 430. See page 20 for detailed description of this circuit.

5. NEW VIDEO AMPLIFIER—A new video amplifier circuit using a 6BK7-A instead of 12BH7 tube was used in the 4th production receivers. Receivers and cartons bearing these receivers are stamped with the number 1140.

This new circuit has been incorporated, to increase the overall receiver bandwidth and to improve the video transient response. Since this circuit change was incorporated after the delayed AGC circuit, all receivers equipped with the new video amplifier also include delayed AGC.

Together with this circuit change, the capacitor C162 in the video detector is changed from 5 mmf to 9 mmf. The new type tube necessitated a change in the filament string wiring which permits the operation of a 450 ma. heater (6BK7-A) partially in series with other filaments and partially from the filament transformer. When replacing the filament transformer, observe the precaution outlined . For detailed circuit analysis and alignment notes refer to pages 20 and 26. For easy identification receivers incorporating this circuit change were rubber-stamped with No. 1140. These receivers include a 3000-ohm diode load resistor and delayed AGC.

6. CHANGE OF PICTURE TUBE IN MODEL 20C107 RECEIVERS—Late production 20C107 receivers were equipped with a 20DP4A picture tube instead of 20CP4A as used in the earlier production. Receivers using a 20CP4A tube require two flat washers on each support rod (see Fig. 6) as a spacing medium between the flux shield disk and the fibre yoke support.

Receivers using a 20DP4 picture tube require a "T" spacer and one flat washer on each support rod as is also required for the 21-inch models.

7. "LATE" TYPE VIDEO DETECTOR ASSEMBLY—First, second and third production receivers incorporate a video detector assembly in which the value of C162 is 5 mmf. The video detector of 4th production receivers incorporate a 9 mmf capacitor, C162. This change appears in all receivers which incorporate the 6BK7-A type video amplifier.

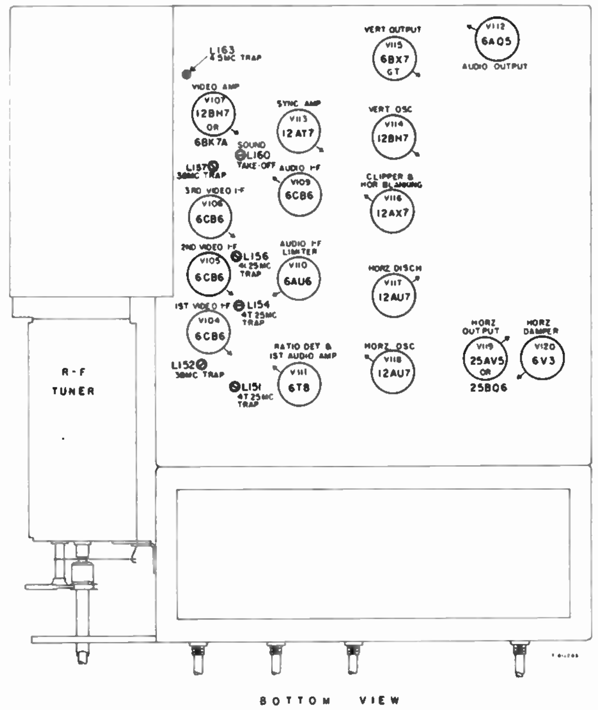


Fig. 34. Tube Location, Bottom View

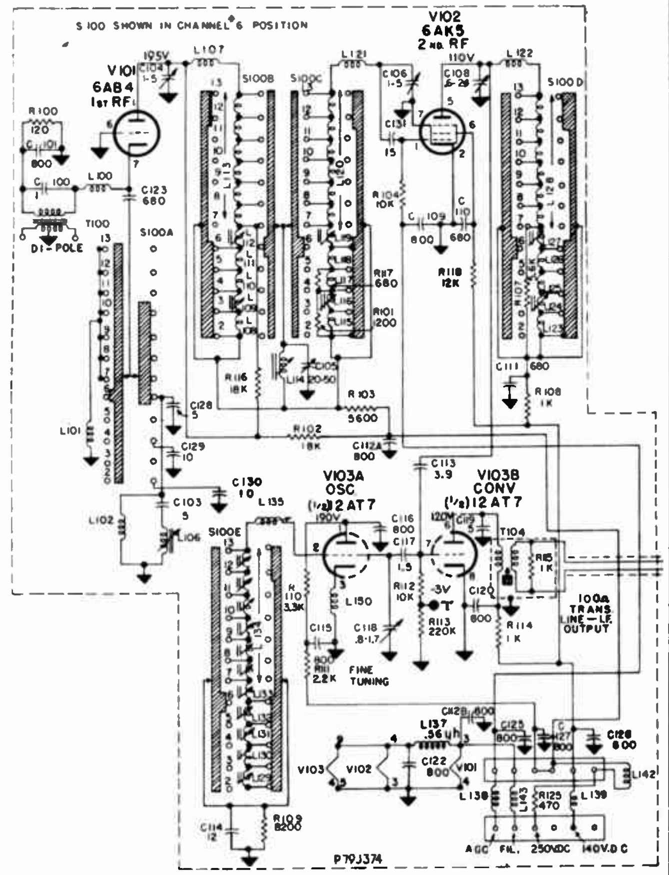


Fig. 36. R-F Tuner, Schematic Diagram (4th Production). See also Fig. 27

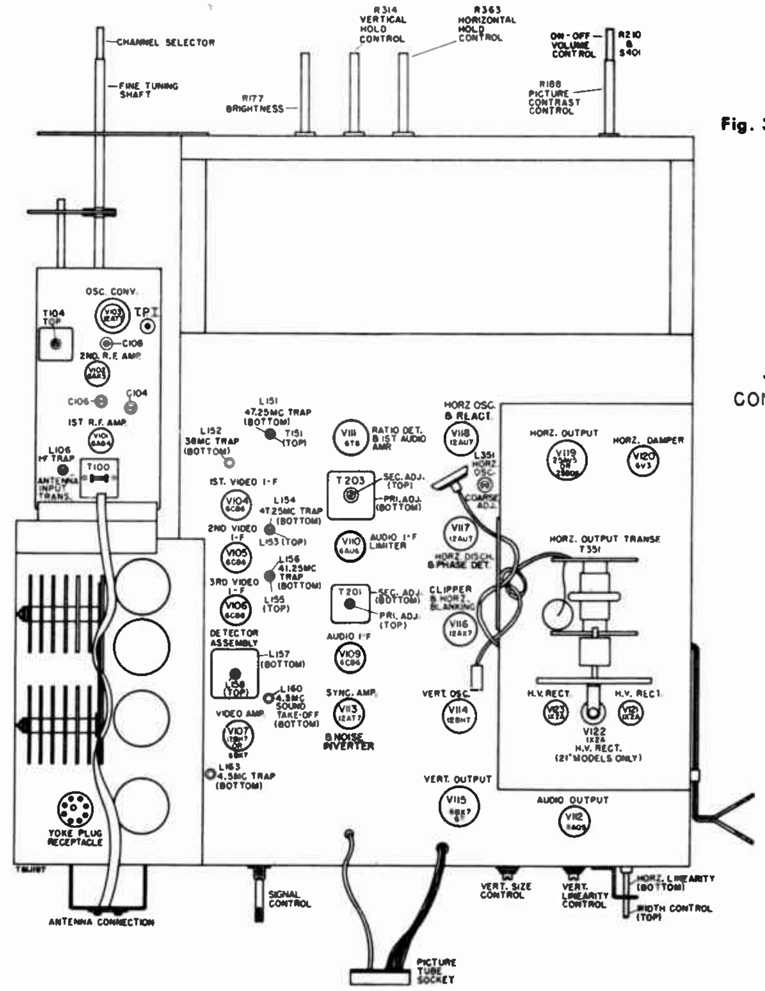


Fig. 35. Tube and Trimmer Location

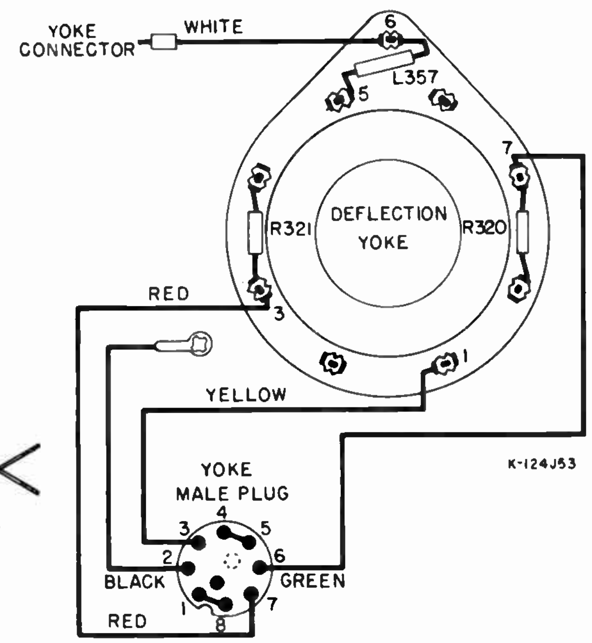
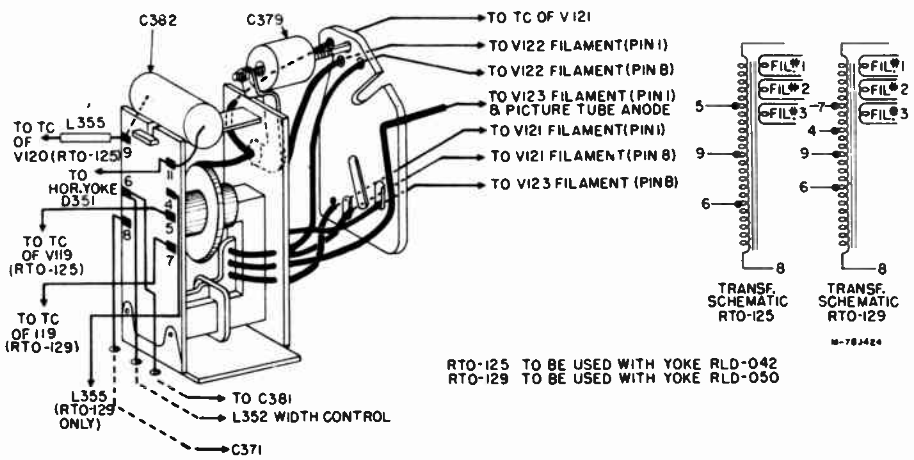
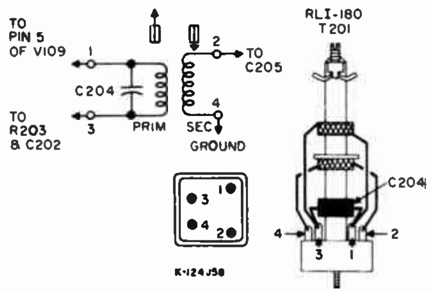


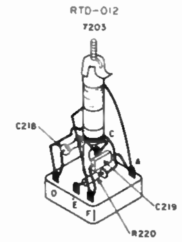
Fig. 37. Deflection Yoke Wiring



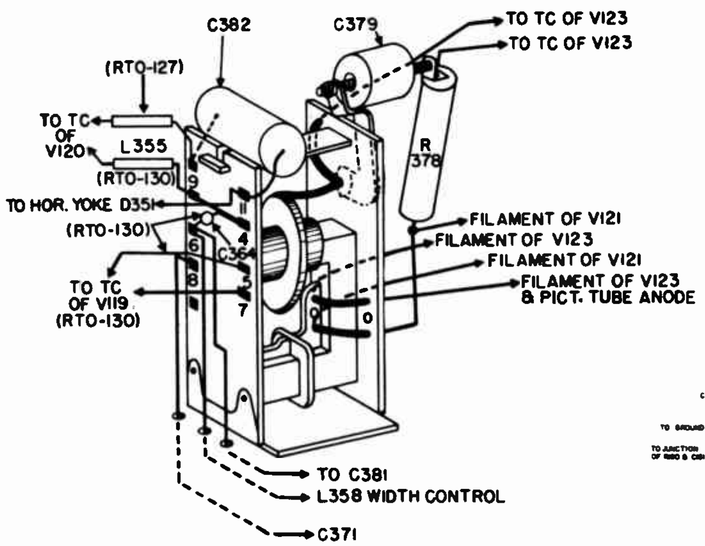
Wiring Diagram for Horizontal Sweep Output Transformer (21-inch Models)



Wiring Diagram for 4.5 MC Interstage Transf T-201

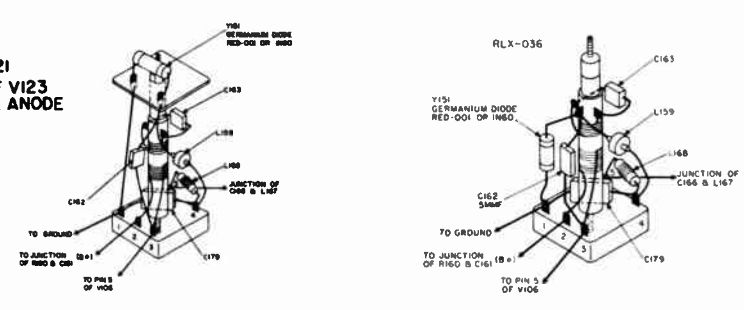


Wiring Diagram for Ratio Detector, T203



RTO-127 TO BE USED WITH YOKE RLD-042
RTO-130 TO BE USED WITH YOKE RLD-050
MODEL 17C125 OR 20C107

Wiring Diagrams for Horizontal Sweep Output Transformer (Model 17C125 or 20C107)



Wiring Diagram for Video Detector Assembly

UHF-TUNER MODEL UHF-103

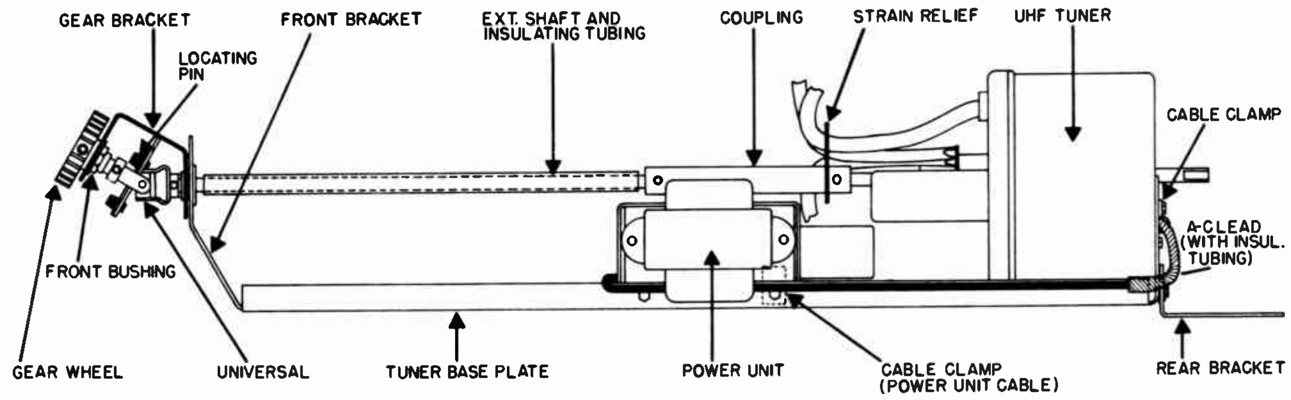


Fig. 40. UHF-103 Tuner Assembly

Installation

All receivers marked with UHF have the UHF Tuner installed in the factory. However, due to the fact that this tuner is also available in kit form, some unmarked receivers may contain this tuner. Each tuner kit includes the detailed installation instruction ER-A-UHF103-1.

If the tuner unit had been removed for service be sure to check for proper meshing of knob gear and gear drive after completing the assembly. In case of improper operation readjust locating pin plate (see Fig. 42). Its position may be adjusted by loosening the two adjustment screws available from the front of the receiver. Make sure that the UHF Selector detent roller locks into each of the four positions without any difficulty.

The tuner unit consists of a turret tuner and a power unit mounted to a base plate, see Fig. 40. The tuner is operated from the front of the receiver by means of a knob ring. The movement of the knob is transferred to the tuner turret by means of a gear, an extension shaft and coupling.

The tuner is held in place in front by a locating pin plate and locating pins and in the rear by a rear bracket fastened to the cabinet.

It is assumed that the television receiver with which the UHF tuner is used is in proper alignment, particularly with respect to adjacent channel attenuation. If the receiver adjacent channel attenuation is unsatisfactory, the converted UHF signal may be interfered with.

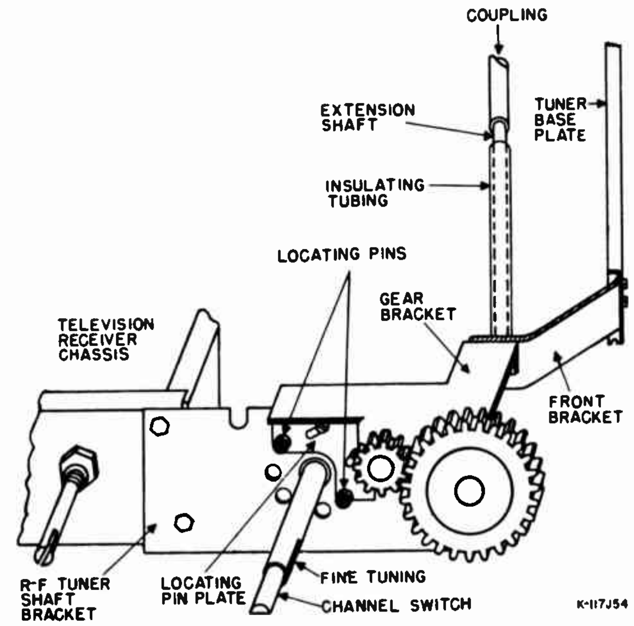
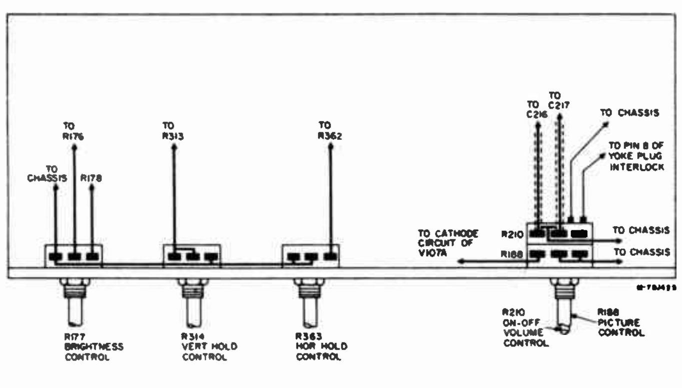
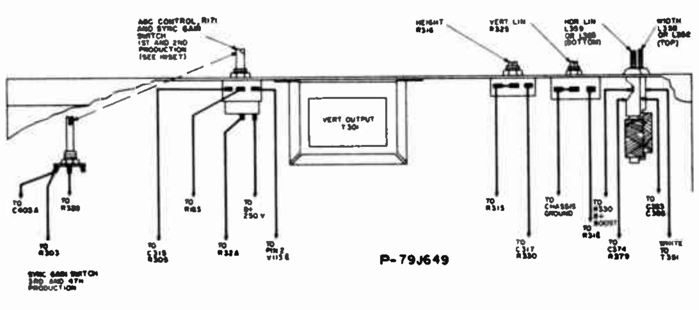


Fig. 42. UHF-Tuner Front Assembly, 21- Models



Front Panel Control Wiring (Bottom View)



Rear Panel Control Wiring

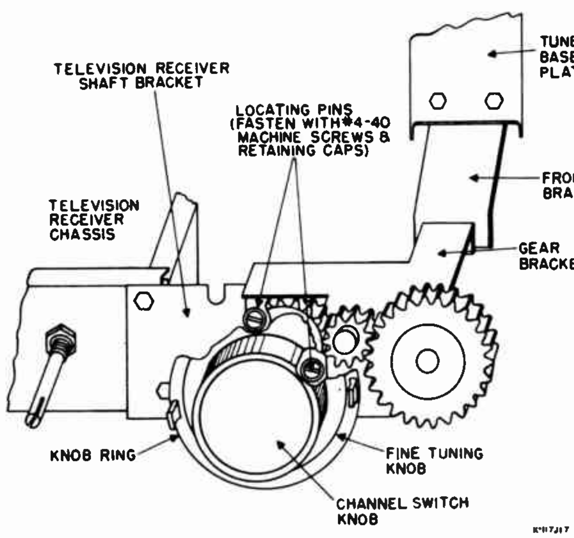


Fig. 41. UHF-Tuner Front Assembly, Models 17C125 and 20C107

UHF Tuner Adjustments

General

The UHF Tuner, as shipped from the factory, has its output stage tuned to Channel No. 5, to which the television receiver should be tuned. This output stage may need realignment for Channel No. 6 operation for reasons given below. The actual realignment is very simple and can be done in most cases without the use of test equipment.

The service technician must individually adjust each of the three UHF positions for operation upon the local active UHF channels. This may be done also without the use of special test equipment. The tuning ranges of the three UHF positions are all identical and cover the entire UHF spectrum.

UHF—I-F Adjustments

Before installing the tuner in the receiver it will probably be more convenient to make the necessary UHF I-F adjustments.

The I-F preamplifier in the UHF Tuner has been factory-aligned to Channel No. 5. If there is a station operating on Channel No. 5, the Tuner I-F preamplifier should be adjusted to function on Channel No. 6. It is not desirable to convert the UHF signal to Channel No. 5 if there is a strong television station operating on Channel No. 5 in your area. It is quite obvious that if the VHF station signal on Channel No. 5 is fairly strong, it will be picked up by the television receiver even when the UHF Tuner is operating and would thereby impair the quality of the UHF picture.

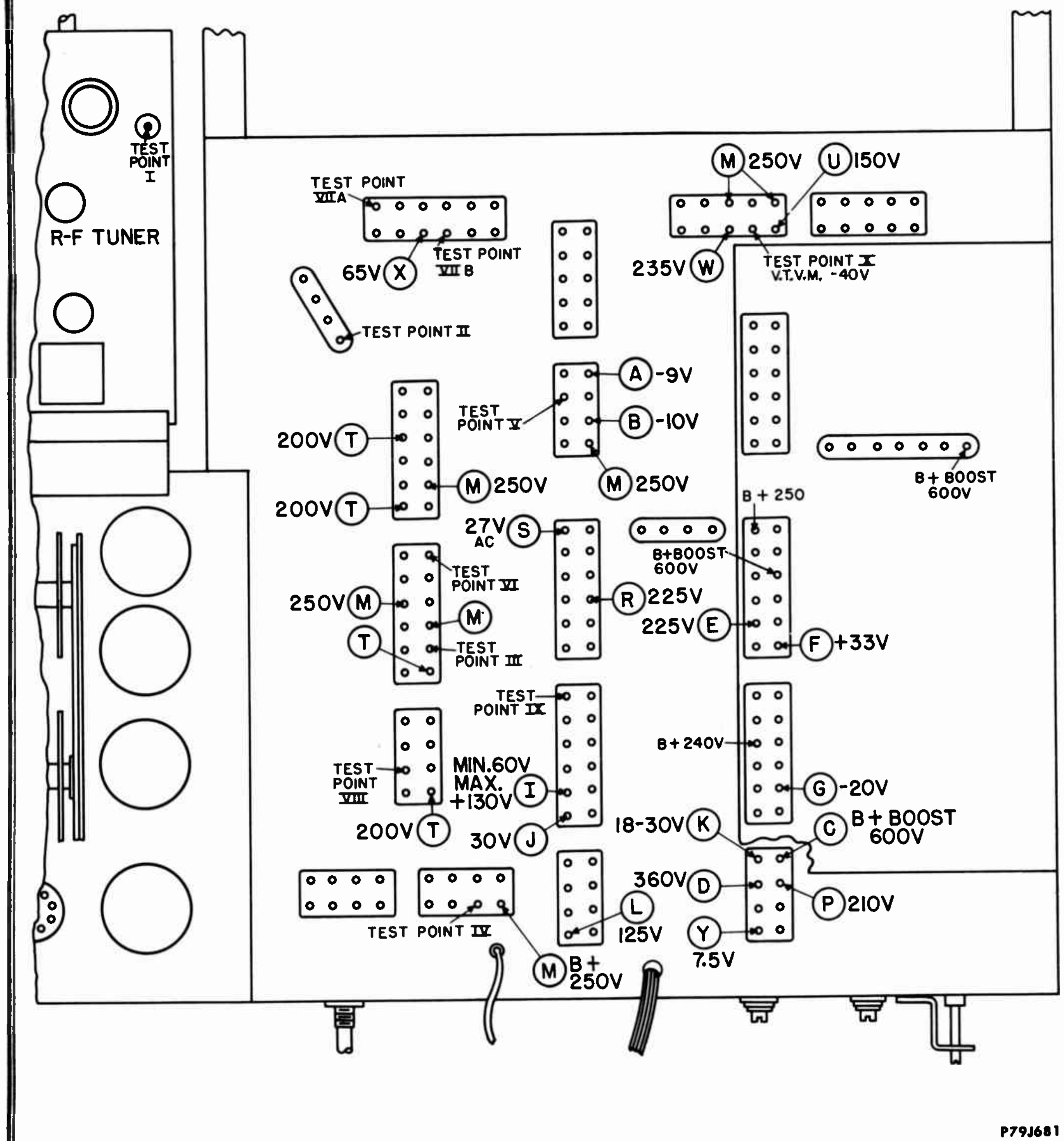


Fig. 43. Test Point Diagram (Represents a typical receiver, though minor variations may be encountered)

To readjust the preamplifier for operation on Channel No. 6 instead of No. 5, as shipped from the factory, proceed as follows:

(a) Turn core "A" (see Fig. 45) approximately three turns counterclockwise.

(b) Turn core "B" approximately two and a half turns counterclockwise.

The UHF Tuner is now ready for operation on Channel No. 6.

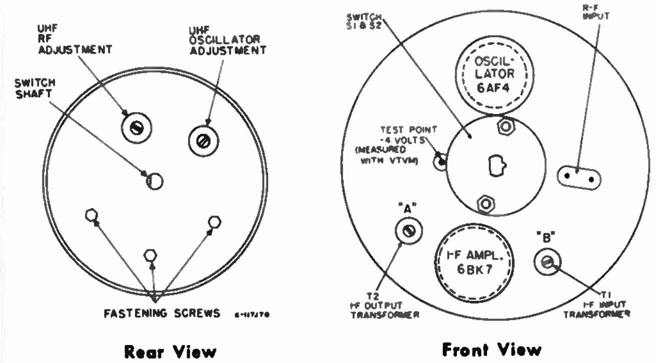


Fig. 45. UHF Adjustments

UHF Channel Adjustments

Notes:

(a) Always allow approximately 15 minutes warm-up time before proceeding with the adjustments.

(b) Set the Tuner knob ring to "UHF-1" position and the television receiver channel selector knob on either Channel No. 5 or No. 6 according to preceding information. Set the Fine Tuning control on the television receiver to the middle of its range.

ALIGNMENT PROCEDURE

1. Turn the oscillator tuning core (see Fig. 45) fully counterclockwise.
2. From this "starting point," gradually turn the oscillator tuning core clockwise into the coil until a UHF picture and accompanying sound signal are received. While turning the oscillator core clockwise into the coil, several minor responses as well as two strong picture responses may be noticed. However, the first strong response to be noted while turning the core clockwise from its maximum counterclockwise position is the response to be used. Be careful not to exert any undue pressure when turning the core into the coil, since damage to the coil may result.
3. Adjust the R-F tuning core for maximum picture signal.
4. The oscillator tuning core should now be readjusted so that the Fine Tuning control on the television receiver will permit tuning slightly into accompanying audio bars or "beats." Be sure that you can tune away from any adjacent channel interference.
5. The Tuner is now aligned for operation on one UHF channel. Repeat steps 1 to 4 on the two remaining UHF positions, if more than one UHF channel is active in your area.

UHF-103 CIRCUIT DESCRIPTION

Refer to diagram, Fig. 47.

Conversion of UHF to VHF is achieved by mixing the incoming UHF signal with a signal which is generated by a local high-frequency 6AF4 oscillator. This mixing takes place in a 1N72 crystal diode, the output of which is amplified by the low-noise 6BK7 cascode amplifier. The output of this amplifier is then link-coupled to the television receiver antenna terminals.

Two antenna inputs are provided; one for the VHF antenna and one for the UHF antenna. Switches S1 and S2 are mechanically ganged with the UHF coil plate. The switch, S1 permits switching of the VHF receiver antenna input lead to either the VHF antenna directly, or to the UHF Tuner output link.

On the VHF position, switch S2 un-shorts R11. Thus, a small amount of current is permitted to flow through the tubes, even while on the VHF position.

In the UHF-1 position, as shown, the signal is fed into the input circuits consisting of C1, C2, C3, C4 and L1. L1 is a ¼-wave shorted line, the electrical length of which is varied by adjustment of the shorting core. For mechanical convenience, this ¼-wave line is wound into a spiral form and should not be considered as a conventional "coil."

The values of C1, C2, C3, C4 are chosen so that the input circuit impedance closely approximates 300 ohms across the entire UHF band, while the impedance at the junctions of C1 and C4 and the ends of the transmission line L1, is very high—in the order of several thousand ohms. C7, C8, L7 and L8 maintain accurate balance of the input circuits. C9 and the 1N72 diode are tied in series across the line. Their midpoint is used for extraction of the VHF converted signal as well as for injection of the local UHF oscillator signal. C9 is critical in value since together with the diode it also affects the balance of the line.

The oscillator, a 6AF4 tube, is connected in an ultra-audion oscillator circuit. Its plate voltage is "shunt-fed" through L17 which presents a high impedance at all frequencies above approximately 250 mc. The oscillator tank circuit, L2, is also a tunable

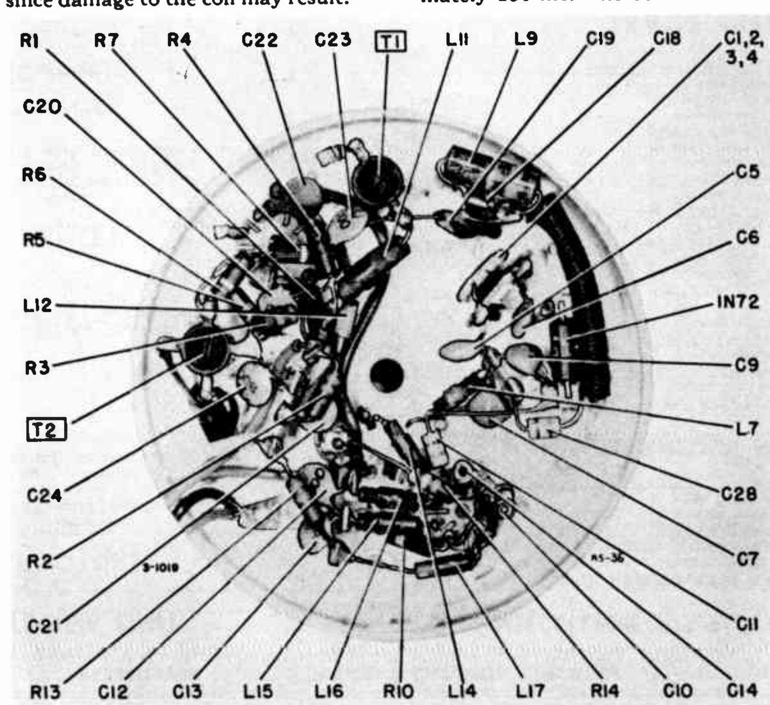


Fig. 46 Bottom View of Turret Tuner Chassis

UHF TUNER (Cont'd)

shorted ¼-wave line. Oscillator output is taken from the cathode circuit across L14 and coupled through C11 into the 1N72 diode.

L9 furnishes the d-c return path for rectified diode current, while C18 resonates with other circuit constants to the VHF output frequency. The converted UHF signal is coupled through C19 into the cascode 6BK7 amplifier.

This amplifier consists of two stages. The first stage is a conventional triode, grounded-cathode stage, whose input circuit is tuned to the VHF frequency (approximately 79 to 85 mc). The cathode circuit, consisting of R1 and C20, is only used to obtain d-c bias. L12 is a high-impedance, shunt-feed R-F choke. The output of the first stage is capacity-coupled into the second triode which is a grounded-grid amplifier. In the cathode of the second stage is connected a conventional bias resistor, R4, and its R-F bypass capacitor, C23. L11 provides the d-c cathode return through T1 to ground and also provides neutralization of the first triode stage. This neutralizing coil is somewhat critical in value and must, if damaged, be replaced by an exact replacement coil if the low-noise advantages of this circuit are to be maintained.

SERVICING THE UHF-103 TUNER

With the exception of the oscillator socket, the components thereon and the UHF coils, the replacement of components in the tuner is comparatively simple, requiring no special considerations other than the usual lead dress precautions common to VHF practice. However, because of the small size of most components be sure to prevent overheating of components by using a small soldering iron.

The oscillator circuit wiring and the UHF coils are critical and require special attention.

Replacement of Oscillator Tube Socket

1. Remove the coil turret assembly by loosening the four set screws in the long coupling (Fig. 40) and the one set screw in the short coupling. Then, by lifting the detent roller and turning the assembly so one of the detent slots matches the bracket screw, the turret can be slid out of the unit.

2. Unsolder all connections to the V-shaped contactor board. Remove contactor board from the assembly by removing the Phillips-head screw.

3. Carefully unsolder the components at the tube socket, being careful to note their exact position.

4. Drill out the two rivets holding the detent roller bracket. After removing this bracket the oscillator tube socket can be removed by drilling out its securing rivets.

5. When reinstalling new socket be sure to place the components in their original positions (see Fig. 46). Positioning is somewhat critical hence is not advisable to wiggle the tube back and forth when removing or inserting it but rather to pull or push it straight from the socket. Even minor distortion of the tube socket pins has a most detrimental effect at ultra high frequencies.

Replacement of UHF Coils

1. Remove small pring split washer (Truarc clip) on turret shaft that holds textolite coil bracket. To facilitate this operation a set of Truarc pliers should be used which may be obtained at your General Electric dealer (order number WH-50 x 59).

2. After removing old coil, solder new coil assembly in place with the coil leads in their normal position. Flow the solder between the lead and the contact, making sure that the iron does not put any stress on the lead which might deform it.

The tuning cores for the coils are of different sizes and are selected to fit the coils. Therefore, do not interchange cores from one coil to another. Coils are supplied from the factory complete with their cores; be sure to replace as such.

3. With reasonable care it is possible to replace a coil without removing the coil bracket. Carefully bend the textolite plate upward just above the coil to be removed. Push the coil to the right until the top of the coil clears the retaining hole.

4. Gently release the textolite plate, and while holding the coil in this cocked position, apply the soldering iron to the two coil terminals simultaneously. As soon as the solder melts, tilt the coil still further to the right and remove it. Wipe the contacts clean of all solder.

5. When replacing new coil gently bend textolite plate upward and put the new coil into position, *being careful not to bend the coil leads in any direction*. This precaution is very important as poor frequency stability will probably result if it is not followed. In soldering the new coil leads in place use the same precaution as outlined above.

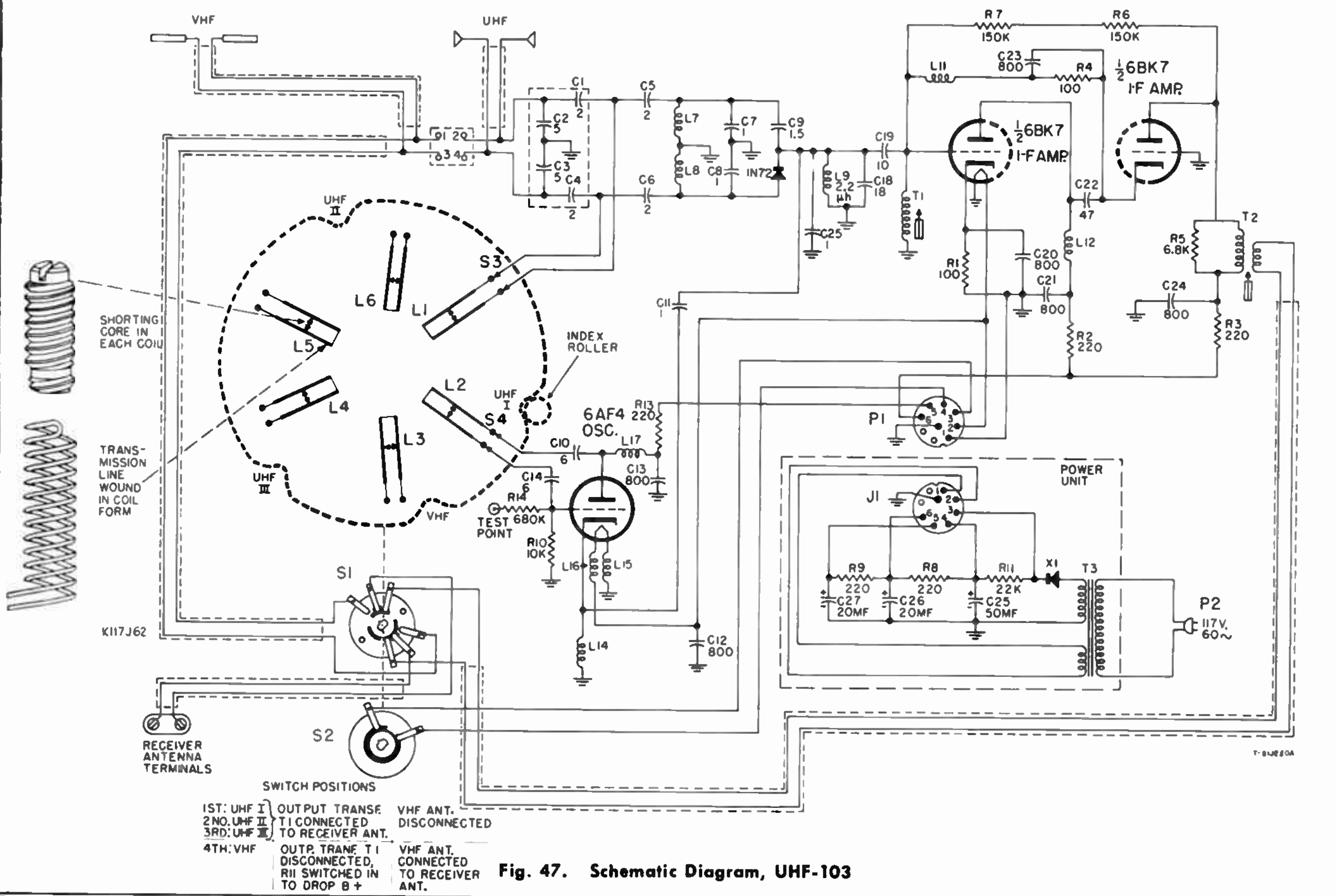


Fig. 47. Schematic Diagram, UHF-103

PARTS LIST

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
R-F TUNER UNIT			
CAPACITORS			
*RCN-001	C100	1 mmf., ceramic	$0.20
*RCN-027	C112 A, B	800-800 mmf., ceramic	.65
*RCN-055	C113	3.9 mmf., mica	.25
*RCW-3027	C111	680 mmf., ceramic	.90
*RCW-3037	C101, 109, 115, 116, 120, 122, 125, 126, 127	800 mmf., ceramic	.25
*RCW-3045	C110, 123	680 mmf., ceramic	.30
*RCW-3046	C117	1.5 mmf., ±10%, ceramic	.60
*RCW-3057	C128	5 mmf., ±5%, ceramic	.25
*RCW-3066	C129, 130	10 mmf., ±5%, ceramic	.25
*RCW-3074	C114	12 mmf., ±5%, ceramic	.25
*RCW-3076	C131	15 mmf., ceramic	.25
*UCG-1005	C103, 119	5 mmf., ±5%, silver mica	.35
TRIMMERS			
*RCY-048	C108	.6-2.4 mmf.	.40
*RCY-065	C104, 106	1-5 mmf., glass tube type	.50
*RCY-066	C105	20-50 mmf., Temp. Comp.	1.25
*RCY-067	C118	.8-1.7 mmf., Fine Tuning control	2.00
RESISTORS (Carbon)			
*URD-027	R100	120 ohms, ½ W.	.13
*URD-041	R125*, 125**	470 ohms, ½ W.	.13
*URD-045	R117	680 ohms, ½ W.	.13
*URD-049	R108, 114, 115	1000 ohms, ½ W.	.13
*URD-051	R101	1200 ohms, ½ W.	.13
*URD-057	R111	2200 ohms, ½ W.	.13
*URD-061	R110	3300 ohms, ½ W.	.13
*URD-067	R107	5600 ohms, ½ W.	.13
*URD-071	R109	8200 ohms, ½ W.	.13
*URD-073	R104, 112	10,000 ohms, ½ W.	.13
*URD-075	R118	12,000 ohms, ½ W.	.13
*URD-079	R102, 116	18,000 ohms, ½ W.	.13
*URD-105	R113	220,000 ohms, ½ W.	.13
*URE-067	R103	5600 ohms, 1 W.	.17
COILS and TRANSFORMERS			
*RLA-037	T100	TRANSFORMER—Antenna input	1.80
*RLI-142	L143	CHOKE—1.4 uh heater choke	.45
*RLI-144	L137	CHOKE—Heater choke	.25
*RLI-145	L150	CHOKE—1.4 uh., V103A oscillator cathode	.35
*RLI-154	L138, 139, 142	CHOKE—RF choke	.25
*RLI-159	L106	TRAP—I-F trap and tuning core in r-f tuner	.75
*RLI-165	L100	CHOKE—R-F input	.35
*RTL-139	T104	TRANSFORMER—Video IF output transformer	1.95
MISCELLANEOUS ELECTRICAL			
*REI-014		CORE—Brass (screw type) tuning core for r-f coupling coil L114	.05
*REI-034		CORE—Brass (screw type, large head) tuning slug for oscillator coil segment L134	.10
*REI-035		CORE—Brass (screw type, ¼ inch long) tuning slug for oscill. coils L129, L130, L131, L132 or r-f coils L109, L116, L124 or L105	.10
*REI-036		CORE—Brass (screw type, ¾ inch long) tuning slug for oscillator or coil L133 or for r-f coils L112, L119 or L127	.10
*RII-057		INSULATOR — Switch wafer mounting insulator (textolite side rail)	.25
*RJS-160		SOCKET—Miniature 7-pin, textolite wafer for V101 or V102	.25
*RJS-161		SOCKET—Miniature 9-pin, composition wafer with center shield for V103	.30
*RSX-019	S100-E	SWITCH WAFER—Channel switch wafer with oscillator coils (1st from knob)	7.00
*RSX-020	S100-D, L128	SWITCH WAFER—Channel switch wafer with 2nd r-f plate coils (2nd from knob)	7.00
*RSX-021	S100-C, L120	SWITCH WAFER—Channel switch wafer with 2nd r-f grid coils (3rd from knob)	7.00

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
MISCELLANEOUS ELECTRICAL (Cont'd)			
*RSX-022	S100-B, L113	SWITCH WAFER—Channel switch wafer with 1st r-f plate coils (4th from knob)	$6.50
*RSX-023	S100-A	SWITCH WAFER—Channel switch wafer with 1st r-f cathode coils (5th from knob)	5.75
MISCELLANEOUS MECHANICAL			
*RAP-023		DETENT PLATE—Detent index plate for channel switch	.60
*RHS-070		SCREW — Setscrew for channel switch shaft coupling	.05
*RHS-088		SHIELD—Tube shield for V103 clip-on type used with base, RHS-089	.30
*RHS-089		SHIELD BASE — Tube shield mounting base for V103, clip-on type used with shield, RHS-088	.15
*RHW-027		WASHER—"C" washer for RMX-179 channel switch shaft	.02
*RMB-023		DETENT BALL—Channel switch detent index ball	.03
*RMK-007		COUPLING—Channel switch shaft coupling (couples detent shaft to textolite channel switch shaft)	.03
*RMX-179		SHAFT — Channel switch shaft (metal, with detent index spring)	1.60
*RMX-182		SHAFT—Textolite shaft for r-f switch wafer	.50
MAIN CHASSIS			
CAPACITORS (Paper)			
*RCC-016	C151, 372**	.5 mf., 200 v.	.60
*RCC-101	C370	.025 mf., ±10%, 200 v.	.25
RCC-102	C210, 405, 411, 415	.05 mf., ±10%, 600 v.	.40
*RCC-103	C181**, 182*†, 220†, 314, 357	.1 mf., ±10%, 200 v.	.35
*RCC-105	C170, 180	.05 mf., ±10%, 200 v.	.25
RCC-119	C208	1000 mmf., 400 v.	.35
RCN-014	C373, 374	.047 mf., 600 v., molded	.25
*RCN-025	C311	.01 mf., ±10%, 600 v.	.35
*RCN-031	C171	.1 mf., 600 v.	.70
RCN-033	C318†, 360	.0018 mf., ±10%	.35
RCN-034	C316, 318, 383	.0039 mf., ±10%, 600 v.	.35
*RCN-041	C309†, 310	.047 mf., ±10%, 600 v.	.55
*RCN-051	C315, 363, 365, 385	.0047 mf., 600 v.	.40
*RCN-062	C361, 375	.001 mf., 600 v.	.40
*RCN-063	C302	.01 mf., 600 v., molded	.35
*RCN-064	C309	.056 mmf., ±10%, 600 v., molded	.55
RCN-066	C368	3300 mmf., ±10%, 500 v., molded	.30
RCN-068	C384	.015 mf., ±10%, 600 v., molded	.45
RCN-069	C381	2700 mmf., ±10%, 3000 v.	1.25
*UCC-011	C314†	.05 mf., 200 v.	.30
*UCC-014	C169, 172	.2 mf., 200 v.	.40
*UCC-035	C208	.001 mf., 600 v.	.25
UCC-036	C212	.002 mf., 600 v.	.25
UCC-037	C304	.003 mf., 600 v.	.25
UCC-039	C308	.004 mf., 600 v.	.25
*UCC-040	C211, 369	.01 mf., 600 v.	.25
*UCC-041	C313, 351	.02 mf., ±10%, 600 v.	.25
*UCC-045	C367	.05 mf., 600 v.	.30
*UCC-050	C371	.25 mf., 600 v.	.55
UCC-052	C151*, 151**, 151††	.5 mf., 600 v.	.80
UCC-061	C213	.008 mf., 1000 v.	.30
*UCC-068	C317, 382	.1 mf., 1000 v.	.75
Electrolytics			
*RCE-090	C301, 214	1 mf., 50 v.	1.20
RCE-140	C402	125 mf., 350 v.	5.15
RCE-145	C403 A, B, C*, 403 A, B, C**†	125 mf., 350 v., 100 mf., 75 v., 5 mf., 200 v.	5.75
RCE-146	C404 A†, A††, C404 B, C404C, D 4	50 mf., 25 v., 40 mf., 300 v., 30 mf., 20 mf., 300 v.	5.00
RCE-148	C401	300 mf., 150 v.	4.00
RCE-152	C403 A, B††	125 mf., 350 v., 100 mf., 75 v.	3.90
RCE-153	C183	5 mf., 350 v.	1.50

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PARTS LIST (Cont'd)

Micas & Ceramics

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
*RCN-028	C204	3.3 mmf., silver mica	$0.35
*RCN-035	C378, 379	500 mmf., 20 kv., ceramic	2.50
*RCN-047	C206*†, 207*†	4000-4000 mmf., dual, ceramic	.65
RCU-307	C354	180 mmf., ±10%, 800 v., mica	.40
RCU-308	C352	300 mmf., ±10%, mica	.35
RCW-3014	C201, 202, 206, 207, 215, 217, 406, 407	5000 mmf., ceramic	.35
*RCW-3037	C156, 159, 161, 168, 177, 408, 409, 410, 412, 413, 414, 416, 417	800 mmf., ceramic	.25
*RCW-3051	C154, 157	680 mmf., ±10%, ceramic	.30
*RCW-3052	C160	820 mmf., ±10%, ceramic	.30
RCW-3053	C203	1300 mmf., ceramic	.30
RCW-3054	C216	.01 mf., 450 v., ceramic	.35
RCW-3078	C153	2.2 mmf., ±5%, 500 v., ceramic	.20
RCW-3081	C155	24 mmf., ±5%, 500 v., ceramic	.25
RCW-3094	C364††	120 mmf., 3000 v., ceramic	.45
UCG-1005	C162, 166, 179	5 mmf., ±10%, 500 v., silver mica	.35
*UCG-1036	C359	220 mmf., ±10%, 500 v., silver mica	.35
UCG-2004	C218	10 mmf., ±5%, silver mica	.25
*UCG-2010	C158	18 mmf., ±5%, 500 v., silver mica	.25
UCG-2011	C167	20 mmf., 500 v., silver mica	.25
*UCG-2019	C209	43 mmf., ±10%, silver mica	.30
UCG-2021	C175	51 mmf., ±5%, silver mica	.30
UCG-2023	C176	62 mmf., ±5%, 500 v., silver mica	.30
*UCG-2026	C163	82 mmf., ±5%, 500 v., silver mica	.30
UCG-2030	C219	120 mmf., ±5%, silver mica	.30
UCG-2044	C152	470 mmf., ±5%, 500 v., silver mica	.80
UCU-520	C205	47 mmf., ±20%, mica	.30
*UCU-544	C303	470 mmf., ±20%, mica	.30
*UCU-1052	C355	1000 mmf., ±10%, mica	.40
*UCU-1528	C178, 353, 362	100 mmf., ±10%, mica	.30
*UCU-1532	C173, 174	150 mmf., ±10%, mica	.30
*UCU-1544	C356, 358	470 mmf., ±10%, mica	.35
UCU-1548	C312	680 mmf., ±10%, 500 v., mica	.35

RESISTORS

Carbon, ½W.

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
URD-017	R213	47 ohms	$0.13
URD-031	R159, 201	180 ohms	.13
URD-035	R220	270 ohms	.13
*URD-037	R368	330 ohms	.13
*URD-049	R154, 157, 184, 211, 370	1000 ohms	.13
URD-053	R163*, 163**	1500 ohms	.13
URD-057	R320, 321	2200 ohms	.13
*URD-069	R365	6800 ohms	.13
*URD-073	R174, 180, 306, 358	10,000 ohms	.13
*URD-077	R301, 326	15,000 ohms	.13
*URD-079	R160, 202	18,000 ohms	.13
*URD-081	R307, 329	22,000 ohms	.13
URD-083	R205, 208, 362	27,000 ohms	.13
URD-085	R166, 209, 357, 359, 367	33,000 ohms	.13
*URD-089	R204, 218, 221†	47,000 ohms	.13
URD-093	R313, 360, 361, 364	68,000 ohms	.13
*URD-095	R327	82,000 ohms	.13
*URD-097	R178, 206, 215, 353, 372	100,000 ohms	.13
*URD-099	R352	120,000 ohms	.13
*URD-101	R303	150,000 ohms	.13
*URD-103	R308	180,000 ohms	.13
*URD-105	R356	220,000 ohms	.13
*URD-107	R176	270,000 ohms	.13
*URD-113	R183, 207, 216, 217, 304, 305, 405	470,000 ohms	.13
*URD-115	R354	560,000 ohms	.13
*URD-117	R223†, 302††	680,000 ohms	.13
*URD-121	R165, 173, 185, 322, 323, 324, 355, 369, 371	1.0 meg.	.13

RESISTORS (Cont'd)

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
*URD-125	R330	1.5 meg.	$0.13
*URD-129	R175, 302, 331, 374	2.2 meg.	.13
URD-133	R181, 182, 317, 375	3.3 meg.	.13
*URD-135	R315	3.9 meg.	.13
URD-141	R219, 222††	6.8 meg.	.13
*URD-1017	R153, 156	47 ohms, ±5%	.24
URD-1047	R167††	820 ohms, ±5%	.24
URD-1060	R162†, 162††	3000 ohms, ±5%	.24
*URD-1063	R162, 168	3900 ohms, ±5%	.24
*URD-1067	R155	5600 ohms, ±5%	.24
*URD-1080	R152, 158	20,000 ohms, ±5%	.24

Carbon, 1 Watt

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
URE-033	R212	220 ohms	0.17
*URE-037	R379	330 ohms	.17
*URE-051	R403	1200 ohms	.17
*URE-065	R161, 203	4700 ohms	.17
URE-079	R373	15,000 ohms	.17
URE-081	R328	22,000 ohms	.17
URE-085	R366	33,000 ohms	.17

Carbon, 2 Watt

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
URF-041	R214, 318, 319	470 ohms	.25
URF-067	R187††	5600 ohms	.25
*URF-069	R170*	6800 ohms	.25
*URF-081	R169, 186†, 187, 373†	22,000 ohms	.25
URF-085	R186*, 186**†	33,000 ohms	.25
*URF-089	R312	47,000 ohms	.25

Potentiometers

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
*RRC-095	R325	2000 ohms, Vertical Linearity control	1.95
RRC-190	R316	4 meg., Height control	1.25
RRC-191	R363, 177	100,000 ohms, Horizontal Hold & Brightness controls	1.40
RRC-192	R188, 210	Dual, 500,000 ohms and 3000 ohms, Volume & Contrast control, table models only	3.60
RRC-193	R314	125,000 ohms, Vertical Hold control	1.40
RRC-194	R171	2 meg., AGC control, with LOCAL-DISTANT switch	1.75
RRC-197	R188, 210	Dual, 500,000 ohms and 3000 ohms, Volume and Contrast control with tap, console models	3.50

Wirewound & Special

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
*REK-001	P301	Vertical integrator couplate	1.25
*RRW-048	R401	4.6 ohms, ±10%, 5 w.	.45
*RRW-079	R406	5600 ohms, 5 w., w.w.	.60
RRW-095	R404*	3000 ohms, ±10%, 7.5 w., w.w.	.85
RRW-097	R402	31 ohms, Globar, 300 ma.	1.75
RRW-099	R378	5 meg., carbon deposit high-volt., type, Models 17C125, & 20C107	3.25
RRW-100	R377	150 ohms, ±10%, 5 w., w.w.	.60
RRW-101	R404**, 404†, 404††	4000 ohms, ±10%. 10 w., w.w.	.90
RRW-102	R318, 319	470 ohms, 5 w., w.w.	.90

COILS AND TRANSFORMERS

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
RJX-049		R-F TUNER—R-F head-end unit completely aligned, includes tubes	75.00
RLC-091	L351	COIL—Horizontal oscillator coil	1.75
RLD-042	D301*, 301**, 351*, 351**	DEFLECTION YOKE—Deflection coil assy. with resistors & choke for use in receivers employing horizontal sweep output transformers RTO-125 or RTO-127	13.00
RLD-048	L353*, 359†, 353**, 359††	COIL—Horizontal linearity coil & adjustment core	1.80
RLD-049	L352, 352**, 358†, 358††	COIL—Width control coil & adjustment core	1.80
RLD-050	D301†, 301††, 351*, 351**	DEFLECTION YOKE—Deflection coil assy. with resistors & choke, for use in receivers employing horizontal sweep output transformers, RTO-129 or RTO-130	15.95
RLF-024	L159	COIL—Choke 31 uh.	.65
RLF-056	L401	CHOKE—Filter choke, 1 hy., 26 ohms	3.45
RLI-122	L402, 403, 405	CHOKE COIL—Choke 2.2 uh.	.25

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PARTS LIST (Cont'd)

COILS & TRANSFORMERS (Cont'd)

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
*RLI-138	L167, 172†† 356, 357	CHOKE—Choke, 10 uh.	$0.25
*RLI-142	L168, 404	CHOKE COIL—Choke 1.4 uh.	.45
RLI-154	L202	CHOKE—Choke 3.3 uh.	.25
RLI-175	L164, R168	PEAKING COIL—Peaking coil, 120 uh., wound on 3900 ohms, ½ w., resistor, (1st, 2nd and 3rd production)	.80
RLI-176	L161, R164	PEAKING COIL—Peaking coil 120 uh., wound on 15,000 ohms, ½ w., resistor	.70
RLI-177	L355	CHOKE—Choke, 30 uh., flexible	.60
RLI-179	L152, C176	TRAP COIL—38 mc trap coil, with 62 mmf., capacitor & tuning core	2.00
RLI-180	T201, C204	TRANSFORMER—Interstage transformer (4.5 mc) includes tuning cores & 47 mmf. cap	3.25
RLI-181	L163, C178	TRAP—4.5 mc trap, includes tuning core & capacitor, for use in receivers incorporating a 12BH7 video ampl.	2.25
RLI-182	L160, C166, 167	COIL—4.5 mc., audio take-off trap coil, incls. cap. & tuning core	2.10
RLI-183	L166, R172	PEAKING COIL—Peaking coil, 165 uh., wound on 8200 ohms, ½ w., resistor	.60
RLI-184	L162	COIL—Peaking coil, 265 uh.	.50
RLI-186	L165	PEAKING COIL—Peaking coil 425 uh.	.50
RLI-190	L169††	COIL—Choke coil 80 uh.	.40
RLI-191	L170††	COIL—Choke coil 6.8 uh.	.40
RLI-202	L163, C178	COIL—4.5 mc. trap coil, for use in receivers incorporating a 6BK7 video amplifier	2.00
RLP-020	L153, 154, C165	COIL—1st video I-F plate and trap coil, with cap. & tuning cores	2.50
RLP-021	L155*†, 156*†, C164*†, C164**, L155**, 156**	COIL—2nd video I-F plate & trap coil with cap. & tuning cores	2.50
RLP-022	L155††, 156††, C164††	COIL—2nd video I-F plate coil and trap coil with capacitors and tuning cores	2.00
RLX-036	L157*, 158*, C163*, L157**, 158**, C163**, L157†, 158†, C163†	VIDEO DET. ASS'Y.—Assembly complete in shield can, includes 1N64 crystal detector, coils with tuning cores & capacitors for use in receivers incorporating a 12BH7 video amplifier	7.95
RLX-039	L157, 158, C163	VIDEO DET. ASS'Y.—Assembly complete in shield can, for use in receivers incorporating a 6BK7 video amplifier	7.15
RTD-012	T203, C218, 219, R220	TRANSFORMER—4.5 mc ratio detector transformer including cap., resistors and tuning cores	4.25
RTF-003	T401	TRANSFORMER—Filament transformer, 6.3 V., output at 6 amperes	6.15
RTL-138	T151, L151, C175	TRANSFORMER—Video I-F input transf. includes cap., with tuning cores for use in receivers incorporating 12BH7 video amplifier	2.95
RTL-147	T151, L151	TRANSFORMER—Video I-F input transf. includes cap. with tuning cores for use in receivers incorporating 6BK7 video amplifier	
RTO-121	T301	TRANSFORMER—Vertical sweep output transformer	7.00
RTO-123	T202	TRANSFORMER—Audio output transformer, table models only	2.80
RTO-124	T202	TRANSFORMER—Audio output transformer, console models only	3.50
RTO-125	T351*, 351**	TRANSFORMER—Horizontal sweep output transformer for use with yoke RLD-042, for 21" models	13.00
RTO-127	T351	TRANSFORMER—Horizontal sweep output transformer for use with RLD-042 for 17C125 and 20C107 only	14.50
RTO-129	T351†, 351††	TRANSFORMER—Horizontal sweep output transformer for use with RLD-050 yoke for 21" models	13.00
RTO-130	T351†	TRANSFORMER—Horizontal sweep output transformer to be used with yoke RLD-050 for models 17C125 and 20C107 only	12.75

MISCELLANEOUS ELECTRICAL

CAT. NO.	MODEL	DESCRIPTION	PRICE
REA-003	21T1 (early) 21C201-C202-C204-C206-C214	PICTURE STRAIGHTENER—Picture straightener with support (for early "square" type yoke housing)	$0.75
REA-004	21T1 (late) 21T1-U, 21T3-T6, 21C201-C202-C206-C208-C208-U-C210-C214	PICTURE STRAIGHTENER—Picture straightener (for use with "late" type yoke support)	.75
REC-006		GRID CAP—Spring cap for 6V3	.05
REF-008		FUSE—1.6 amp., 125 v., slow-blow line fuse, pigtails (F401)	.45
RED-001		CRYSTAL DIODE—Crystal diode with leads (Y151)	1.90
*REI-016		CORE—Tuning core for L157, T151, T201	.20
REI-037		CORE—Tuning core, composition iron with screw stud for RLI-179	.20
*REI-038		TUNING CORE—For L151, L158	.20
RER-015		SELENIUM RECTIFIER—Selenium rectifier, 350 ma., 6 plates, 2 x 2 in. (X401, 402)	6.50
*RET-013		ION TRAP—Single magnet	1.45
RHB-017		BUTTON—Corona button	.25
*RII-069		INSULATOR—Insulator, fiber for yoke "Hot" lead	.02
RII-080	17C125, 20C107	INSULATOR—Insulator, standoff for 1X2A socket	.25
RJC-015		YOKE PLUG—Male, for yoke horizontal "Hot" lead	.30
RJC-019		PIN—Speaker pin	.02
*RJC-025		ANODE CONNECTOR—Picture tube anode connector	.50
RJJ-008		RECEPTACLE—Translator power receptable	.35
RJJ-010		RECEPTACLE—Power cord receptacle (I401)	.20
RJP-003		PLUG—Pilot light plug, 2-prong	.15
*RJP-031		PLUG—Male plug, 9-pin with locator pin 1-in. dia.	.15
RJP-034		PIN PLATE—Tube socket pin plate, 8-pin	.35
RJP-042		PIN PLATE—Tube socket pin plate, 7-pin	.25
RJP-043		PIN PLATE—Tube socket pin plate, 9-pin	.30
RJP-044		PIN PLATE—Tube socket pin plate, 8-pin	.25
RJS-049		SOCKET—2-prong socket, for RJP-003	.25
*RJS-148		SOCKET—Socket 7-pin miniature for 1X2A	.25
RJS-159		CONNECTOR—Yoke connector female receptacle, 1-pin	.20
RJS-164		SOCKET—Tube adapter socket, 8-pin for V115 or V119	.35
RJS-166		SOCKET ADAPTER—7-pin for tubes V104, V105, V106, V109, V110 or V112	.30
RJS-168		SOCKET—Tube adapter socket 9-pin, black phenolic for V107, V111, V113, V114, V116, V117, V118 or V120	.35
RJS-183		SOCKET—Yoke connector, socket, female 9-pin	.30
RJS-184		SOCKET—Tube socket, 9-pin, 29/32 in. dia., single screw center mtg., mica filled molded phenolic	.25
RLF-055	21T1 (early) 21C204	FOCUS UNIT—PM focus unit	11.00
RLF-058	17C125, 20C107 21T1-U, 21T1 (late) 21C201-C202-C206-C208-C208-U-C210, C214, 21T3-T6	FOCUS UNIT—PM focus unit	11.00
RMX-232	21T1 (early & late), 21C201-C202-C204-C206-C208-C208-U-C214	MOUNT SUB-ASSEMBLY—High-voltage assembly consisting of textolite bracket, high-voltage capacitor, sockets, corona shield & eyelet	1.75

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PARTS LIST (Cont'd)

MISCELLANEOUS ELECTRICAL (Cont'd)

CAT. NO.	MODEL	DESCRIPTION	PRICE
ROP-025	21T1 (late) 21T1-U, 21T3	SPEAKER—Loudspeaker 8-inch PM, 3.2 ohms	$13.50
RSW-098		SWITCH—Local-distance switch	1.00
RWL-027		POWER CORD—AC power cord assembly	1.20
*RWX-045		SOCKET — Picture tube socket, with leads	1.00
RWX-046		SOCKET—Pilot light socket with leads	.75
*S527D-7	21T1 (early)	SPEAKER—Loudspeaker, 5¼-in. PM, 3.2 ohms	5.00
S650D-7	21T6	SPEAKER—Loudspeaker, 6½-in. Alnico PM, 3.2 ohms	6.10
*S810D-7	17C125	SPEAKER—Speaker 8-in. Alnico PM, 3.2 ohms	13.80
S1012D-7	20C107	SPEAKER—Speaker, 10-in. Alnico PM, 3.2 ohms	11.80
S1212D-7	21C201-C202-C204-C206-C208-C208-U-C210-C214	SPEAKER—Loudspeaker, 12-in. Alnico PM, 3.2 ohms	12.95

MISCELLANEOUS MECHANICAL

CAT. NO.	MODEL	DESCRIPTION	PRICE
*RHG-007		GROMMET — Rubber insulating grommet for white yoke lead	.05
RHG-021	21T1 (early)	GROMMET—Rubber grommet for speaker mounting	.05
RHM-025		WASHER—"C" washer for R-F tuner shaft	.01
*RHN-016		NUT—Coupling nut for screws in channel selector shaft coupling RMK-006	.15
*RHS-010		SHIELD—Miniature tube shield, 1⅜ in. long	.20
RHS-098		SHIELD—Pilot light shield	.20
RHW-044	21T1-T3-T6, 21C201-C202-C204 21C206-C208-C208-U-C210-C214	WASHER—Fiber washer, $^9/_{64}$ x $^7/_{16}$ dia.	.05
RII-077		BUSHING—Insulated bushing	.25
RII-079	17C125, 20C107, 21T1-T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214	GROMMET—Grommet for RJC-025	.10
RJS-004		MOUNTING PLATE—Electrolytic capacitor, mounting plate, textolite, for C401	.10
RJS-012		MOUNTING PLATE—Electrolytic capacitor mounting plate, steel, for C402	.10
*RMK-006		COUPLING — Channel selector coupling	.35
RMU-088		SHAFT—Channel selector shaft	.70
RMX-178		ASSEMBLY—Ring & hub flange assembly	.55
RMX-214		BRACKET ASSEMBLY — R-F tuner shaft bracket, with bearing	.35
RMX-215		SHAFT ASSEMBLY — Tubular tuner shaft with friction drive disk	1.50

YOKE AND FOCUS MOUNT ASSEMBLY

CAT. NO.	MODEL	DESCRIPTION	PRICE
RAD-096	17C125	BRACKET—Focus unit support bracket (screwed to top of cabinet)	.25
RAR-005	21T1 (early) 21C204	ROD—Picture tube mounting rod, 2 x ¼ inch	.60
RAR-006	21T1 (early) 21C204	ROD—Yoke mounting rod, 11¾ x ⅜ inch	.60
*RAR-008	21T1 (late) 21C201-C202-C206-C208-C214-21T3-T6, 21T1-U	ROD—Picture tube mounting, 8¼ x ¼ inch	.65

YOKE AND FOCUS MOUNT ASSEMBLY (Cont'd)

CAT. NO.	MODEL	DESCRIPTION	PRICE
*RAR-010	21T1 (early) & late) 21T1-U, 21T3-T6, 21C201-C202-C206-C208-C208-U-C210-C214	ROD—Picture tube mounting rod, 6¼ x ¼ inch	$0.75
*RAR-014	21T1 (late) 21C201-C202-C206-C208-C208-U-C210-C214	ROD—Yoke mounting rod	.35
RAR-015	17C125	TUBE MOUNTING ROD—Picture tube mounting rod, right side viewing rear of receiver, 5 x ¼ inch	.70
*RAR-017	21T1 (late) 21T1-U, 21T3-T6, 21C201-C202-C206-C208-C208-U-C210-C214	ROD—Yoke mounting rod, 12 x ⅜ in.	.35
*RAR-018	20C107	ROD—Yoke mounting rod, 11⅛ x ⅜ inch	.25
RAR-020	17C125, 20C107	ROD—Tube mounting rod, 7¼ x ¼ inch	.75
RAR-021	20C107	ROD—Right side tube mtg. rod, viewed from rear of receiver, 5 x ¼ inch	.70
RAR-022	20C107	ROD—Intermediate tube mtg. rod, 5¼ x ¼ in.	.70
RAR-023	17C125	YOKE MTG. ROD—Right side, viewing from rear of receiver, 9¼ x ⅜ inch	.30
RAR-024	17C125	YOKE MTG. ROD—Left side, viewing from rear of receiver, 8⅜ x ⅜ inch	.30
RHJ-021	17C125, 20C107 (late), 21T1 (late), 21T1-U, 21T3-T6, 21C201-C202-C206-C208-C208-U-C210-C214	SPACER—For use with "late" 21T1 type picture tube assembly	.10
RHM-072	17C125, 20C107, 21T1 (late) 21T1-U, 21T3-T6, 21C201-C202-C206-C208-C208-U-C210-C214	FUNNEL—Screwdriver guide on focus unit	.15
*RHN-017	21T1 (early) 21C204	NUT—Wing nut, #10, used in picture tube mount assembly	.05
*RHN-026	21T1 (early) 21C204	NUT—Tube mtg. rod nut (knurled)	.65
*RHW-038	21T1 (early & late), 21T1-U 21T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214	WASHER—"U" washer, used with picture tube strap assembly	.02
*RMM-205	21T1 (early) 21C204	CUSHION—Yoke mtg. cushion, rubber	.45
*RMM-225	17C125, 20C107, 21T1 (late) 21T1-U, 21T3-T6, 21C201-C202-C206-C208-C208-U-C210-C214	TIE CHANNEL—Tie channel metal clamp for use with part RMM-227	.15
*RMM-227	17C125 20C107, 21T1 (late), 21T1-U, 21T3-T6, 21C201-C204-C206-C208-C208-U-C210-C214	SUPPORT—Focus unit support, Brass, 5½ in. long	$1.20
RMM-237	17C125, 20C107, 21T1 (late), 21T1-U, 21T3-T6, 21C201-C202-C206-C208-C208-U-C210-C214	SUPPORT—Fiber yoke support	.25
RMM-238	17C125, 20C107, 21T1 (late), 21C201-C202-C206-C208-C208-U-C210-C214, 21T1-U, 21T3-T6	DISK—Focus unit disk, circular plate 5⅝ in., with two holes	1.20
RMM-240	21T1 (early) 21C204	PAD—Rubber pad, around yoke, RLD-042, two required	.75
*RMS-312	20C107, 21T1-(late), 21T3-T6, 21C201-C202-C206-C208-C208-U-C210-C214	STRAP—Picture tube strap	.40
RMS-315	20C107, 21T1 (early & late), 21T1-U, 21T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214	SPRING—Contact spring for picture tube coating	.10
RMS-316	17C125	STRAP—Picture tube support strap, 8$\frac{7}{16}$ inch	.40
*RMU-082	21T1 (early) 21C204	SHAFT—Flexible focus control shaft	1.80
*RMU-087	21T1 (late) 21C201-C202-C206-C208-C214	FLEXIBLE SHAFT—Flexible shaft and knob for PM focus unit ⅛ x 6½ inch, spring steel	1.85
RMX-230	17C125	TUBE STRAP ASSEMBLY—Picture tube mtg. strap assembly, incls. ear bracket & 2 tube straps each 20¾ in. long	1.35
RMX-231	20C107	STRAP ASSEMBLY—Picture tube mtg. strap assy. incls. ear bracket & 2 tube straps—each 23⅞ in. long	1.65
RMX-242	21T1 (early & late), 21T1-U, 21T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214	STRAP ASSEMBLY—Picture tube mtg. strap assy., incls. ear bracket & 2 tube straps, each 25⅝ in. long	

CABINETS, CABINET PARTS AND APPEARANCE ITEMS

CAT. NO.	MODEL	DESCRIPTION	PRICE
RAB-190	21T1-T3	CABINET BACK—Back, less cap, cord & plug	2.30
RAB-191	21C204	CABINET BACK—Less cap, cord & plug	2.85
RAB-192	21C201-C202	CABINET BACK—Less cap, cord & plug	2.85

CABINETS, CABINET PARTS AND APPEARANCE ITEMS (Cont'd)

CAT. NO.	MODEL	DESCRIPTION	PRICE
RAB-193	21C208-C208-U-C210	CABINET BACK—Less cap, cord & plug	$2.50
RAB-198	21C206-C214	CABINET BACK—Less cap, cord & plug	2.85
RAB-199	17C125	CABINET BACK—Less cap, cord & plug	4.75
RAB-200	20C107	CABINET BACK—Less cap, cord & plug	2.30
RAB-206	21T6	BACK—Cabinet, less cap, cord & plug	2.30
*RAC-107	21T1 (early), 21C204	CAP—Protective cap on cabinet back 3⅛ x 7¼ in.	1.90
*RAC-121	21T1 (late) 21T1-U, 21T3-T6, 21C201-C202-C206-C208-C208-U-C210-C214	CAP—Protective cap on cabinet back	2.10
RAC-122	20C107	CAP—Protective cap on cabinet back	1.90
RAV-198	21C204-C214	CABINET—Mahogany, less mask, safety glass and escutcheon, with casters	140.00†
RAV-199	21C201	CABINET—Mahogany, less mask, safety glass and escutcheon	120.00†
RAV-200	21T1 (Reg. Prod.), 21T1-U	CABINET—Mahogany, less mask, safety glass and escutcheon	110.00†
RAV-201	21C202	CABINET — Blonde, less mask, safety glass and escutcheon	125.00†
RAV-202	21C206	CABINET — Black cherry, with casters	145.00†
RAV-203	21C208-C208-U	CABINET—Mahogany, less mask, safety glass and escutcheon, with casters	120.00†
RAV-206	21T1 (early)	CABINET—Mahogany, less mask, safety glass and escutcheon	110.00†
RAV-207	17C125	CABINET—Mahogany, less mask, safety glass and escutcheon	110.00†
RAV-208	20C107	CABINET—Mahogany, less mask, safety glass and escutcheon	115.00†
RAV-210	21C210	CABINET — Blonde, less safety glass, mask and escutcheon	135.00†
RAV-211	21T3	CABINET — Blonde, less mask, safety glass and escutcheon	115.00†
RAV-212	21T6	CABINET—Mahogany, less mask, safety glass and escutcheon	105.00†
RDE-138	21T1 (early) 21C201-C204	KNOB PLATE HALF HINGE ASSEMBLY—Chrome plated, for hidden knobs	6.20
RDE-139	17C125, 20C107, 21T1 (early & late), 21T1-U, 21T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214	ESCUTCHEON—Knob escutcheon, brown, molded polystyrene, 9¾ in. long	1.50
RDE-140	21C202-C206-C208-C208-U-C210-C214, 21T3-T6 21T1 (late), 21T1-U	KNOB PLATE HALF HINGE ASSEMBLY—For hidden knobs.	3.25
RDK-286	17C125, 21T1 (early & late), 21T3-T6, 20C107, 21C201-C202-C204-C206-C208-C208-U-C210-C214	KNOB—Channel selector knob	1.40

PRICES ARE SUGGESTED LIST PRICES AND SUBJECT TO CHANGE WITHOUT NOTICE
*Parts used on previous receivers when referring to "Cat. No." Column. † Normal discount does not apply.

PARTS LIST (Cont'd)

CABINETS, CABINET PARTS AND APPEARANCE ITEMS (Cont'd)

CAT. NO.	MODEL	DESCRIPTION	PRICE
RDK-287	17C125, 21T1 (early & late), 21T3-T6, 20C107, 21C201-C202-C204-C206-C208-C208-U-C210-C214	KNOB—Fine tuning control knob	$1.90
RDK-288	17C125, 20C107, 21T1 (early & late), 21T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214	KNOB—Volume Off-On knob	.80
RDK-289	17C125, 20C107, 21T1 (early & late), 21T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214	KNOB—Contrast control knob	1.90
RDK-290	17C125, 20C107, 21T1-T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214	KNOB—Vertical hold, Horizontal hold, Brightness control	.10
RDK-291	17C125, 20C107, 21T1 (late), 21C201-C202-C204-C206-C208-C208-U-C210-C214	KNOB—AGC control knob on receiver rear apron	.15
RDM-031	21T1 (early)	MASK—Picture tube mask	29.50
RDM-032	21T1 (Reg. Prod.), 21T2, 21C204-C208	MASK—Picture tube mask, 16⅛ x 21¼ in.	17.50
RDM-034	21T6, 21C201-C208-U-C214	MASK—Metal mask in cabinet framing face of picture tube, 16⅛ x 22 inches	17.50
RDM-035	21C202-C210	MASK—Metal mask in cabinet framing face of picture tube 16⅛ x 21¼ inches	17.50
RDM-036	21C206, 21T3	MASK—Metal mask in cabinet framing face of picture tube, 20 11/16 x 15 11/16 inches	17.50
RDM-037	17C125,	MASK—Metal mask in cabinet framing face of picture tube, 18¾ x 13⅝ inches	11.50
RDM-038	20C107	MASK—2 11/16 x 16 x 19¾ inches, aluminum	14.75
RDW-060	21T1 (early Prod.)	GLASS—Safety glass, 21¼ x 16⅛	12.10
RDW-061	21T1 (late Prod.), 21C204-C208	GLASS—Safety glass, 21 7/32 x 16 3/32	11.95
*RDW-063	21T1-U, 21T3-T6, 21C201-C202-C206-C208-U-C210-C214	GLASS—Safety glass in cabinet over face of picture tube, 21 1/16 x 16 1/16 in., dark tinted	16.90
*RMM-233	17C125	CUSHION—Glass mtg. cushion 12 1/16 in. long	$0.20
*RMM-236	21T3-T6, 21C201-C202-C206-C208-U-C210-C214	STRIP—Trim strip, (gold finish), 20 11/16 in. long	.15
RMM-239	17C125	CUSHION—Glass mtg. cushion 18 1/16 in. long	.30

CAT. NO.	MODEL	DESCRIPTION	PRICE
RDW-064	17C125	GLASS—Safety glass in cabinet over face of picture tube, 18 11/16 x 13 1/16 in., tempered glass	$8.50
RDW-065	20C107	GLASS—Safety glass in cabinet over face of picture tube, 19⅝ x 15⅞ in., tempered glass	10.25
*RHF-009	21T1 (early), 21T3	FOOT—Cabinet foot, felt	.20
*RIG-010	21T1 (late) 21T1-U, 21T3-T6, 21C201-C202-C204 C206-C208 C208-U-C210-C214	SEAL—Dust seal, soft black rubber ring between mask and picture tube, 16 in. dia., ⅛ inch thick, for use with metal masks only	1.60
*RIG-011	17C125	SEAL—Dust seal, black, soft rubber ring between mask and picture tube, 13 in. dia., ¼ inch thick, for use with metal masks only	1.40
RIG-012	20C107	SEAL—Dust seal, black, soft rubber ring between mask and picture tube, 14½ in. dia., ¼ in. thick	
RMA-017	21T1 (early) 21C201-(early) C204	ARM—Hinge arm (right hand) for knob door assy	.30
RMA-018	21T1 (early) 21C201-(early) C204	ARM—Hinge arm (left hand) for knob door assy	.30
*RMA-020	17C125, 20C107, 21T1 (late) 21T1-U 21T3-T6, 21C201 (late) 21C202-C206-C208-C208-U-C210-C214	ARM—Hinge arm (right hand) for knob door assy	.20
RMA-021	17C125, 20C107, 21T1 (late) 21T1-U, 21T3-T6, 21T201 (late) 21C202-C206-C208-C208-U-C210-C214	ARM—Hinge arm (left hand) for knob door assy	.20
*RMM-220	21T1-U, 21T3-T6, 21T1 (early & late), 21C201-C202-C204-C206-C208-C208-U-C210-C214	CUSHION—Glass mtg. cushion 21 1/16 in. long	.15
*RMM-221	21T1, 21T1-U, 21T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214	CUSHION—Glass mtg. cushion 15 11/16 in. long	.15
*RMM-222	20C107, 21T1 (early & late), 21T1-U-T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214	CUSHION—Tube mtg. cushion, sponge rubber, 4⅝ x 2⅝ x 1/16 in.	.25
RMM-228	17C125	CUSHION—Tube mtg. cushion, sponge rubber, 3⅝ x 1 x ⅝ in.	.15
RMS-273	17C125, 20C107, 21T1-U-T1-T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-	RING—Compression ring for control knobs, RDK-288	$0.04

PARTS LIST (Cont'd)

CAT. NO.	MODEL	DESCRIPTION	PRICE
RMM-242	20C107	CUSHION—For safety glass, rubber channel, 19½ in. long	.25
RMM-243	20C107	CUSHION—For safety glass, rubber channel, 15¾ in. long	.20
RMM-246	21T1 (late) 21T1-U-21T3, 21C201-C202-C206-C208-C208-U-C210	CUSHION—Picture tube mtg. (for use with metal masks only)	.15
*RMS-272	17C125, 20C107, 21T3-T6, 21T1, 21C201-C202-C204-C206-C208-C208-U-C210, 21T1-U	RING—Compression ring for control knobs, RDK-286	.05

CAT. NO.	MODEL	DESCRIPTION	PRICE
	C214		
*RMS-295	17C125, 20C107, 21T1-T1-U-T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214	SPRING—Hinge spring for knob door	.05
RMS-296	17C125, 20C107, 21T1-T3-T6, 21C201-C202-C204-C206-C208-C208-U-C210-C214, 21T1-U	RING—Compression ring for control knobs RDK-287 or RDK-289	.05

PARTS LIST—MODEL UHF-103

CAPACITORS

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
RCE-150	C25, 26, 27	CAPACITOR—50 mf, 150 v-20 mf, 150 v-20 mf, 150 v.	$3.00
*RCN-001	C11	CAPACITOR—1 mmf, ceramic, miniature	.20
*RCW-3037	C12, 13, 20, 21, 23, 24	CAPACITOR—800 mmf, ceramic, 500 v	.25
*RCW-3070	C1, 2, 3, 4	CAPACITOR—2-2-5-5 mmf, ±.5 mmf, ceramic	1.75
RCW-3082	C5, 6	CAPACITOR—2 mmf, ceramic	.25
RCW-3083	C7, 8	CAPACITOR—1 mmf, ceramic, ±.25 mmf	.25
RCW-3084	C9	CAPACITOR—1.5 mmf, ±.25 mmf	.25
RCW-3085	C19	CAPACITOR—10 mmf, ±10%, ceramic	.25
RCW-3086	C18	CAPACITOR—18 mmf, ±10%, ceramic	.25
RCW-3087	C22	CAPACITOR—47 mmf, ceramic	.25
RCW-3088	C10, 14	CAPACITOR—6 mmf, ±5%, ceramic	.25

RESISTORS

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
*URD-025	R1, 4	RESISTOR—100 ohms, ½ w, carbon	.13
*URD-033	R2, 3, 9, 13	RESISTOR—220 ohms, ½ w, carbon	.13
*URD-069	R5	RESISTOR—6,800 ohms, ½ w, carbon	.13
*URD-073	R10	RESISTOR—10,000 ohms, ½ w, carbon	.13
*URD-081	R11	RESISTOR—22,000 ohms, ½ w, carbon	.13
URD-101	R6, 7	RESISTOR—150,000 ohms, ½ w, carbon	.13
*URD-117	R14	RESISTOR—680,000 ohms, ½ w, carbon	.13
URE-033	R8	RESISTOR—220 ohms, 1 w, carbon	.13

COILS AND TRANSFORMERS

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
*RLI-122	L9	CHOKE—IF choke, molded 2.2 mh	.25
RLI-167	L14, 15, 16, 17	COIL—Filament choke coil, 15 turns	.35
*RLI-168	L7, 8	CHOKE—RF choke, 10 turns	.35
RLI-187	L11	COIL—Neutralizer coil	.85
RLI-188	L12	COIL—Plate choke	.60
RLX-037	L1, 2, 3, 4, 5, 6	ASSEMBLY—Coil form assembly	4.25
RTL-140	T1	TRANSFORMER—IF input transformer	$1.20
RTL-141	T2	TRANSFORMER — IF output transformer	1.65
RTP-313	T3	TRANSFORMER — Power transformer	4.75

MISCELLANEOUS ELECTRICAL

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
RER-016	X1	RECTIFIER—Selenium rectifier	3.00
RJB-023		TERMINAL BOARD—2 terminals	.25
RJB-024		TERMINAL BOARD—3 terminals	.25
RJB-025		TERMINAL BOARD—5 terminals	.35
RJB-026		BOARD—Antenna terminal board & bracket, 4 terminals	2.00
RJP-046	P1	PLUG—Power plug, 7 pin	.20
RJP-047		PLUG—2 pin, for transmission lines, early production	.25
RJS-174		SOCKET—Tube socket for IF tube 6BK7, 9 pin	.40
RJS-185	J1	SOCKET—Power socket, 7 pin	.30
RJS-186		SOCKET—Tube socket for oscillator tube, 6AF4	.40
RJS-187		SHELL—Connector shell for RJP-046	.25
RMM-245		ASSEMBLY—Crystal board assembly	.90
RSW-095	S1, 2	SWITCH—Wafer switch	.80
*RWL-009	P2	POWER CORD—6 feet long, with plug	.70

MISCELLANEOUS MECHANICAL

CAT. NO.	SYMBOL	DESCRIPTION	PRICE
RAC-127		CAP—Retaining cap washers	.05
RAD-097		BRACKET—Gear bracket	1.65
RAD-098		BRACKET—Front bracket, holding switch shaft	.65
RAD-099		BRACKET—Rear bracket, model 17C125	.90
RAD-100		BRACKET—Rear bracket, model 20C107	.90
RAD-101		BRACKET—Rear bracket, models 21T1, 21T3, 21C208, 21C208U & 21C210	.80
RAD-102		BRACKET—Rear bracket, models 21C201, 21C202, 21C204 & 21C206	$0.80
RAP-037		PLATE—Locating pin plate	2.75
*RDK-261		KNOB—Tuning knob	.15
RDK-302		KNOB—Knob ring, UHF selector	1.20
RHC-059		RING—Truarc grip ring	
RHG-039		GROMMET—For switch shaft	.05
*RHI-017		STRAIN RELIEF—Two piece insulator, power unit	.15
RHJ-019		SPACER—To mount switch in tuner	.05
RHJ-022		SPACER—Knob ring spacer	.05
*RHM-043		"C" WASHER—Retaining ring to hold switch shaft	.01
RHS-091		SHIELD—Tube shield for 6BK7	.20
RHS-103		SCREW—For switch contact mount, ⅛" long	.02
RHS-105		SHIELD—Tube shield for 6AF4	.15
RHS-106		SCREW—Set screw for shaft coupling #6-32	.15
RHS-107		SCREW—Set screw, #8-32	.15
RMB-028		BUSHING—For switch shaft	.15
RMB-029		BUSHING—Front bushing for idler gear	$0.15
RMC-055		COLLAR—On turret tuner shaft	.35
RMG-010		GEAR—Small idler gear wheel	.75
RMG-012		GEAR—Large gear wheel	1.25
RMG-013		GEAR—Knob gear	1.50
RMK-008		COUPLING—Switch shaft coupling	1.20
RMM-244		SUPPORT—Coil top support, round metal plate	.35
RMR-013		ROLLER—Detent roller	.15
*RMS-272		RING—Compression ring for knob	.05
RMS-318		SPRING—Detent spring	.35
RMS-320		SPRING—Short detent spring	.35
RMU-090		SHAFT—Switch shaft	.75
RMU-091		SHAFT—For large gear wheel, early production	.15
RMU-092		SHAFT—Idler gear wheel	.15
RMU-095		SHAFT—For large gear wheel with knurled end	.15
RMX-234		SHAFT—Shaft and rotor assembly	2.90
RMX-237		UNIVERSAL—Couples switch shaft to large gear wheel	2.75

PRICES ARE SUGGESTED LIST PRICES AND SUBJECT TO CHANGE WITHOUT NOTICE

*Parts used on previous receivers.

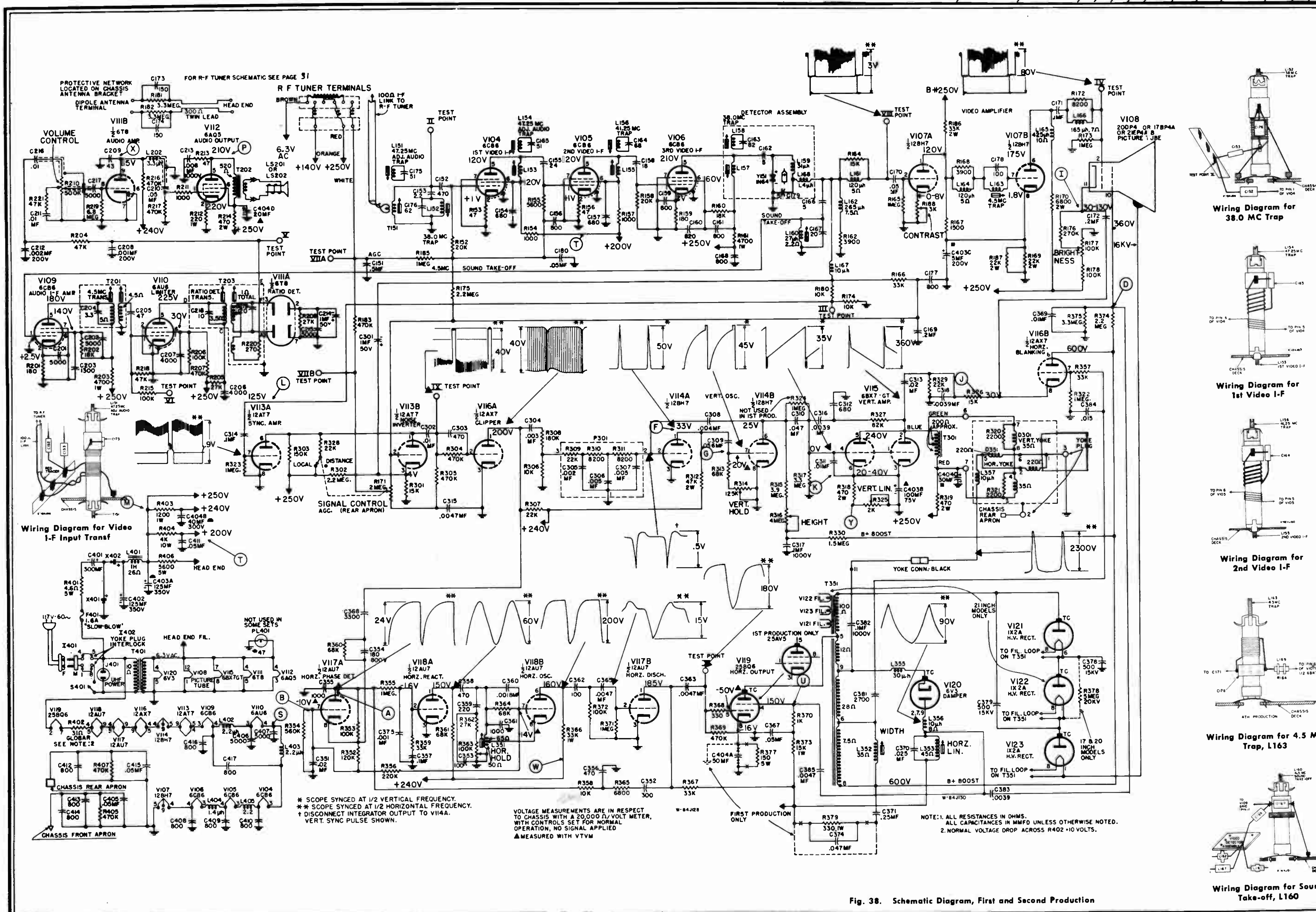


Fig. 38. Schematic Diagram, First and Second Production

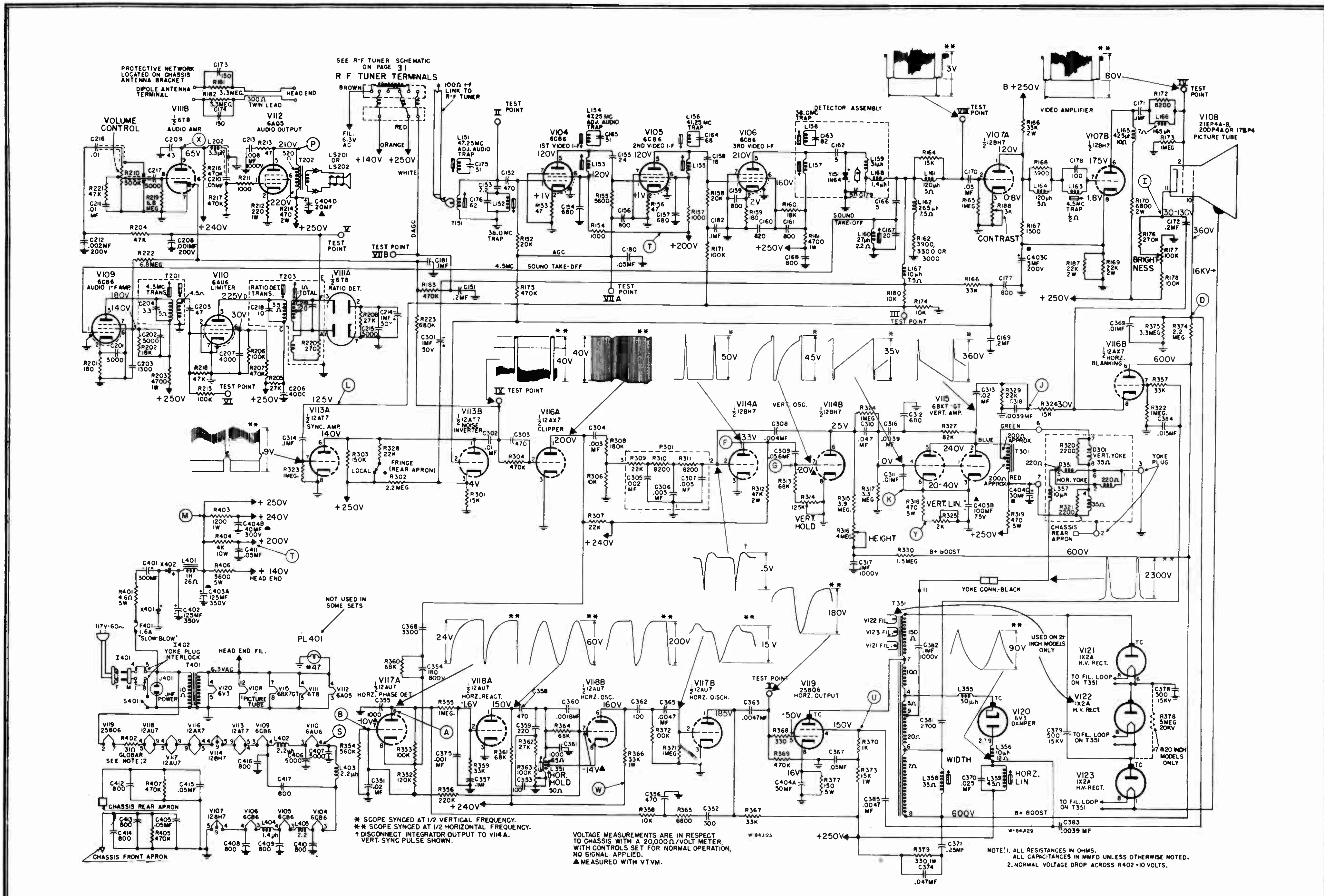


Fig. 39. Schematic Diagram, 3rd Production

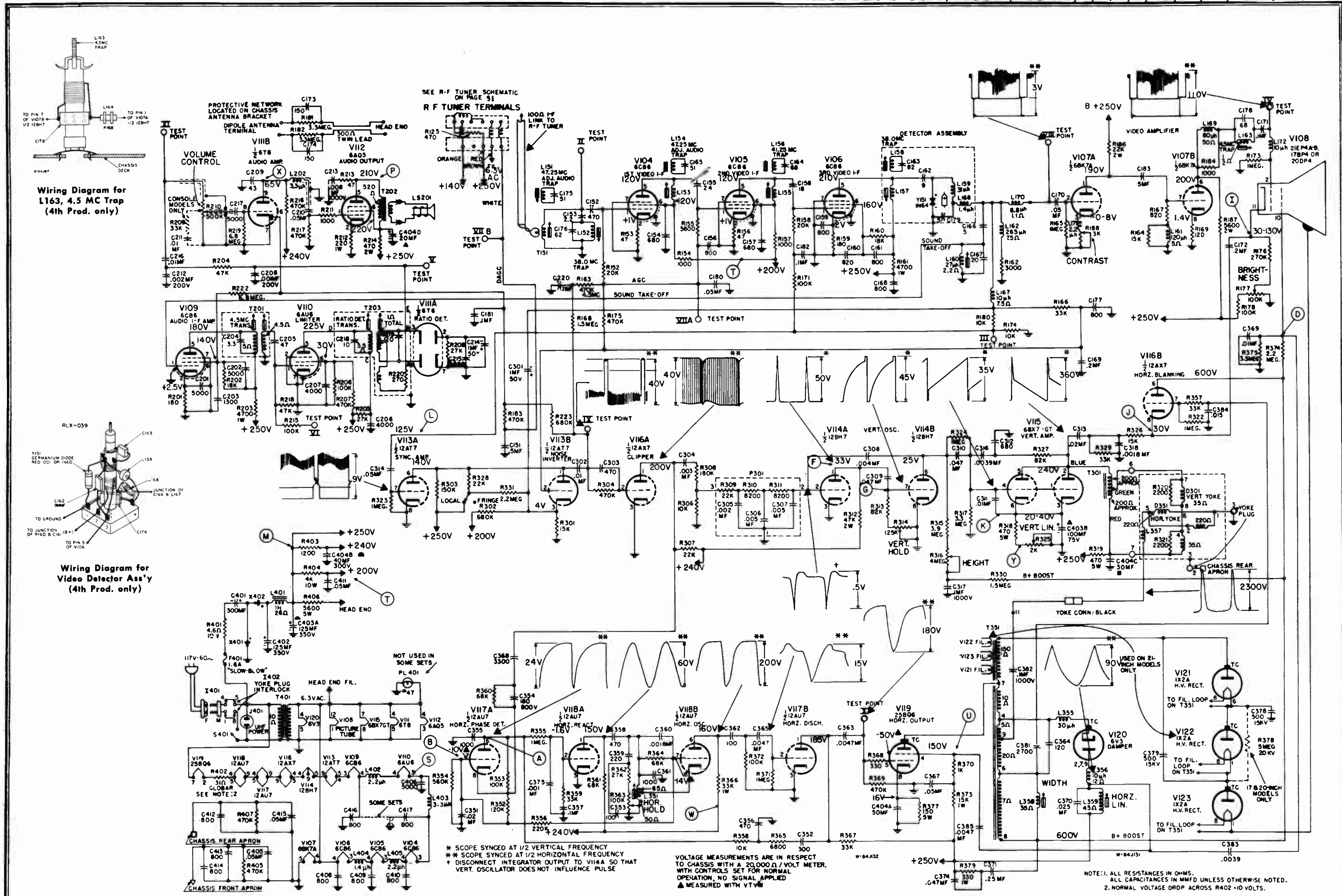


Fig. 44. Schematic Diagram, Fourth Production

GENERAL

The Hallicrafters UHF "Match Box" converter kits are available in two forms. One kit is supplied with a "Match Box" to cover UHF frequencies from 470 to 680 MC (channels 14 thru 48) and the other kit is supplied with a "Match Box" to cover UHF frequencies from 656 to 890 MC (channels 45 thru 83). Thus, it will be possible to receive any single channel in either the upper or the lower range. If reception is desired on a second UHF channel in either the upper or the lower range an additional "Match Box" in either range may be installed in the conversion kit. The "Match Boxes" are easily changed since all necessary connections are made to the "Match Box" by means of a 5 pin plug with the exception of two antenna input connections which must be soldered.

Both kits are supplied completely wired with a heater transformer for supplying the necessary heater voltage for the tube in each Match Box. Only four simple wiring connections are made when wiring the conversion kit into the chassis. Two for the antenna connections, one for the necessary plate voltage and the other for the primary of the heater transformer.

The Hallicrafters UHF Match Box converters consist of a double tuned band pass circuit which couples the 300 ohm UHF antenna input to a crystal diode mixer where the received UHF signal is mixed with the output of a local oscillator. The fundamental frequency of this oscillator may be adjusted so that the output frequency of the Match Box is preset to any VHF channel from 2 through 6.

The local oscillator in each Match Box must be preset by the Service Technician at the time of installation so that the output frequency of the Match Box is the same as the channel frequency for any vacant VHF channel from 2 through 6. For UHF reception the VHF tuner channel selector is set to the selected vacant channel and the VHF-UHF switch in the UHF converter is set in either of the two UHF positions which have a Match Box tuner in place. The fine tuning control in the VHF tuner may then be used as a fine tuner for UHF reception. For VHF reception the VHF tuner channel selector is set to the desired VHF channel and the VHF-UHF switch in the converter is set to the VHF position (full counterclockwise). The set will now operate in the same manner that it did before conversion.

The same antenna terminal on the back of the television receiver is used for both VHF and UHF reception. Either a VHF or a UHF antenna will have to be connected to this terminal depending upon the frequency of the station being received. A multiband VHF-UHF antenna may be used which will eliminate the necessity for changing antennas.

The cabinet modifications required are simple to make on all models. The cabinets for models 1010P, 1012P, 1021P and 1026P require a $1\frac{1}{2}$" hole which must be drilled. A template for the proper location of this hole is provided with the kits. Other cabinets have provisions which require only hand tools for modification. Cabinets for models 1010P, 1012P, 1021P, 1026P, 1051P, 1052P, 1053P and 1054P will require gluing of a small label on the front of the cabinet to cover the four holes left when the Hallicrafters name plate is taken off of the front of the cabinet. This gummed label is supplied with both conversion kits and is coated with a special cement to insure its remaining fixed on the cabinet.

The high voltage power supply shield used in some of the earlier series 1200D chassis was rectangular in shape and must be replaced in order to provide mounting space for the Match Box assembly. The correct replacement shield is available as an accessory under part number 69D547. Before this shield is installed, as directed in the step by step instructions, the inside of it must be covered with "Scotch" #21 electrical tape as specified in the instructions. This tape is available from Hallicrafters under stock number 8A2085. Approximately $16\frac{1}{2}$" of tape 4" wide are required to properly cover one of the 69D547 shields. Tape of narrower width may be used provided the strips are overlapped and the area shown in the instructions is covered.

The A, K, & W1200D chassis used in models 1010P and 1012P and the D, L, & X1200D chassis used in models 1021P and 1026P have a front chassis cover plate which is not easily drilled for the mounting holes necessary for the Match Box sub-chassis. For this reason a new front chassis cover plate part number 63C958 is supplied with the kit for use only on these chassis. Other chassis may or may not require drilling the 7/8" or larger hole and the two 3/16" holes. Templates are supplied for the proper location of these holes on the various other chassis.

INSTALLATION OF UHF MATCH BOX CONVERTER SUB-CHASSIS

Before starting the installation of either the 1X1658 or the 1X1678 conversion kits be sure to read the general instructions given on page 2.

MECHANICAL CHASSIS CHANGES

1. Remove the chassis from the cabinet.
2. On chassis with a removeable front chassis cover plate, remove the plate and drill the necessary mounting holes for the Match Box sub-chassis. Use the chart on page 1953-203 to determine which drilling template should be used. On chassis which do not have a removeable front plate it will not be necessary to drill mounting holes as these chassis already have the necessary provisions for adding the Match Box sub-chassis. A new front chassis plate is provided with the kits for use on A, D, K, L, W & X1200D chassis.
3. Replace the new or drilled front chassis cover plate from step 2.
4. Remove the high voltage compartment shield. If the shield is rectangular in shape (part number 69D492) it should be discarded. It will be replaced in a later step by a new shield part number 69D547. The 69D547 shield must be ordered separately as it is not supplied with either of the Match Box conversion kits.
5. Insert the converter sub-chassis in the TV chassis and secure to the front apron or front chassis cover plate by means of the two 6-32 x $\frac{1}{4}$" hex head self tapping screws supplied with each conversion kit. On chassis with the front cover plate use the two 3/16" holes on each side of the switch shaft. On chassis without the removeable front chassis cover plate use two diagonally opposite holes in the corners of the sub-chassis.
6. The rear mounting bracket for the converter sub-chassis should now be fastened. On some chassis this bracket rests directly on the chassis and should be secured with one of the 8-32 x $\frac{1}{4}$" hex head self tapping screws supplied. If this rear bracket does not rest directly on the chassis use either the 1/2" or the 3/4" spacer supplied along with the 8-32 x 7/8" hex head self tapping screw. The correct spacer will not bend or warp the sub-chassis or the rear mounting bracket.

WIRING

7. Connect and solder the long black heater transformer primary lead to one of the four outer lugs of the power supply series electrolytic capacitor (C-135 in some chassis and C-161 in others). It will be necessary to remove the 1B3-GT high voltage rectifier tube V-111 and raise the plastic insulating tape on the chassis in order to gain access to the bottom of this capacitor. See Fig. 205A.
8. Press the plastic insulating tape back in place after dressing the transformer lead as shown in Fig. 205A.
9. Replace the 1B3-GT high voltage rectifier tube V-111.
10. Replace the high voltage compartment shield. Be careful to dress the wires running under the edges of this shield through the notches provided so that the wires are not pinched under the edges of the shield. A new shield may be required as described on page 1953-202. Insulate the new shield if used as shown in Fig. 205B.
11. Dress the orange wire from the VHF-UHF switch over to the terminal strip directly behind the VHF tuner. Connect and solder to the lug as shown in Fig. 205A. This wire provides 150V. B+ for the converter and is connected to the B+ supply for the three I.F. tubes in the receiver.
12. Remove and discard R-186, R-187, C-100 and C-101 from the VHF tuner input terminals. The Match Box sub-chassis has the same four components mounted on a terminal strip near the front of the sub-chassis next to the VHF-UHF switch. The 300 ohm twin lead for the antenna lead-in should be disconnected from the terminal strip near the VHF tuner terminals and connected to the terminal strip on the Match Box sub-chassis. Solder the connections. Refer to Fig. 205A. for the location of these terminals.

The 1X1658 and 1X1678 UHF Match Box conversion kits for the series 1200D Hallicrafters television chassis will enable the Service Technician to easily and quickly convert any of the models listed in the following chart.

MODELS	CHASSIS	FRONT CHASSIS COVER PLATE MODIFICATIONS	CABINET MODIFICATIONS
1010P, 1012P	A, K or W1200D	Use new plate 63C958 supplied with both conversion kits.	Remove "H" medallion. Use template 95D251 to drill a $1\frac{1}{4}$" hole in the cabinet. See Fig. 208A. Remove Hallicrafters nameplate and replace with 31B3191 metalized label. Wet back of label with water to activate the special cement coating and place label on the cabinet as shown in Fig. 208A.
1021P, 1026P	D, L, or X1200D		
1053P, 1054P	R1200D	Drill cover plate using template 95C249. See Fig. 208B.	
1051P, 1052P	P1200D	Drill cover plate using template 95C252. See Fig. 208C.	Remove "H" medallion. Cut out thin cabinet section in the front center of the cabinet. Remove Hallicrafters nameplate and replace with 31B3191 metalized label. Wet back of label with water to activate the special cement coating and place label on the cabinet as shown in Fig. 208A.
1055C, 1056C 1060C, 1061C	T1200D	Drill cover plate using template 95C249. See Fig. 208B.	Remove "H" medallion. No other modifications are required since the cabinet is provided with the necessary center hole for the shaft of the VHF-UHF switch.
1062C, 1063C	J1200D		
1050	AL1200D		
1081, 1081A 1085, 1085A 1088, 1088A	AJ1200D		
1081B, 1085B 1088B	AZ1200D		
1072, 1074, 1075, 1078	AG1200D	Chassis have the necessary mounting provisions. Do not have a removeable front chassis plate.	Remove "H" medallion. Cut out thin section in the front bottom center of the cabinet.
1072A, 1074A 1075A, 1078A	AR1200D		
1072AT, 1074AT, 1075AT, 1078AT	AY1200D		

13. Connect and solder the $6\frac{1}{2}$" twin line coming from the VHF-UHF switch to the now vacant antenna terminals of the VHF tuner. Refer to Fig. 205A and carefully note how this short length of twin line and the spaghetti covered antenna lead-in twin line must be dressed to prevent any possible coupling between these two lines.

14. Installation of the Match Box sub-chassis is now complete with the exception of inserting either one or two Match Boxes. Instructions for installing and adjusting the individual Match Boxes are given.

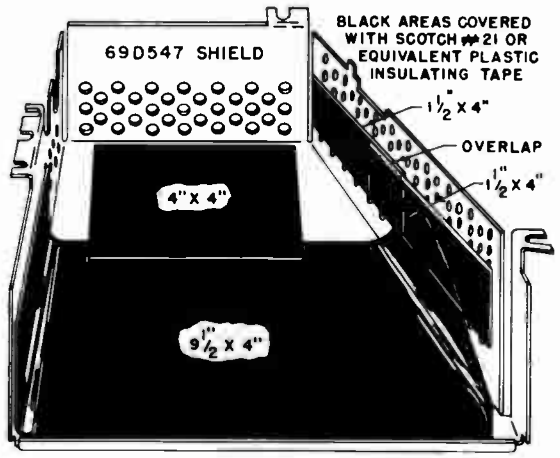


Fig. 205B. Position of Plastic Insulation on 69D547 Shield

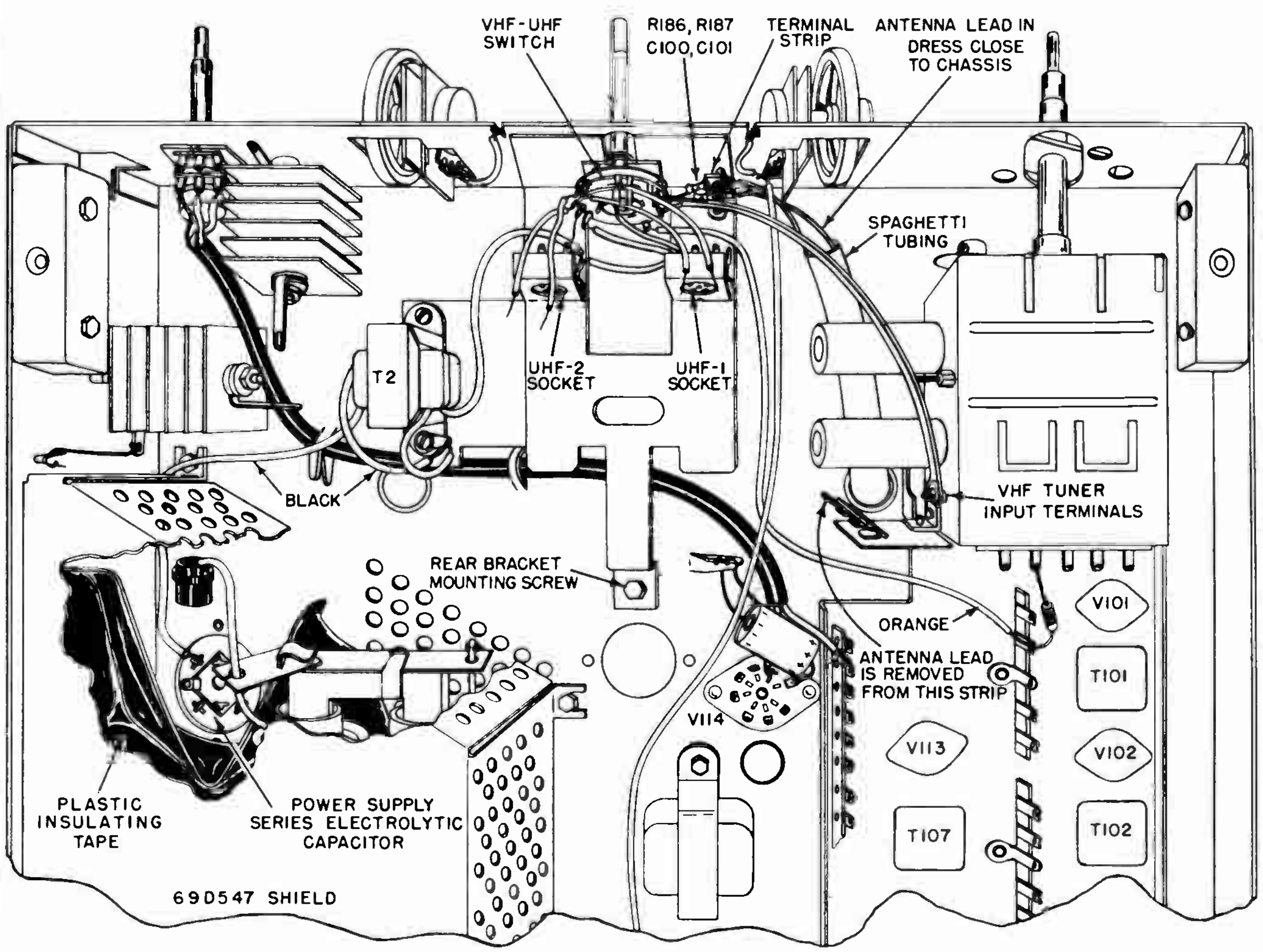


Fig. 205A. Series 1200D Chassis with Match Box UHF Sub-Chassis Installed

INSTALLATION AND ADJUSTMENT OF INDIVIDUAL MATCH BOXES

GENERAL

The UHF Match Box converter sub-chassis is provided with two sockets for plug-in Match Box units. These self contained units operate independently and require oscillator plate supply voltage, obtained from the TV chassis, and heater voltage, obtained from the heater transformer. Each conversion kit is supplied with one Match Box plug-in unit. The Match Box supplied with the 1X1658 kit will cover any UHF channel from 14 through 48 while the one supplied with the 1X1678 kit will cover any channel from 45 through 83.

In order to cover a second UHF channel with either kit, Match Box 1A1664 may be used to cover channels 14 through 48 and Match Box 1A1665 may be used to cover channels 45 through 83.

Each Match Box regardless of the range it covers is supplied with two screws for adjustment of the oscillator. One screw is 5/8" long and the other 7/8" long. The shorter screw must be used to cover the upper half of the tuning range of the Match Box. The longer screw will protrude below the bottom edge of the main TV chassis if used to tune this range. The 5/8" screw will be found taped to the side of each Match Box unit when received in kit form with the sub-chassis or when obtained as an individual unit.

When the VHF-UHF switch is in the UHF-2 position (full clockwise) the Match Box next to the heater transformer is used. With the switch in the UHF-1 position (center) the Match Box next to the VHF tuner is used. In the VHF switch position (full counter-clockwise) neither Match Box is used and the antenna input is connected through C-100 and C-101 to the VHF tuner input terminals.

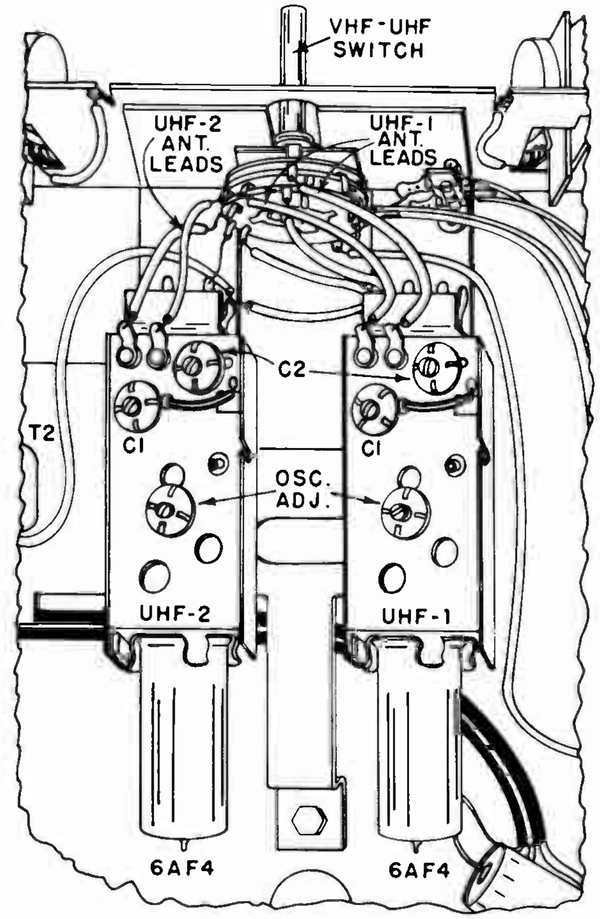


Fig. 206A. Match Box Connections & Adjustments

INSTALLATION

1. Plug the UHF Match Box to be installed into either of the two positions in the conversion sub-chassis. Be sure to hook the two prongs on the Match Box unit over the protrusion on the sub-chassis to support the end of the unit on which the oscillator tube is mounted.
2. Connect and solder the two antenna leads (spaghetti covered) from the VHF-UHF switch to the terminals of the Match Box. See Fig. 206A to determine which pair of leads should be used. If only one Match Box is to be installed, the remaining pair of leads should be dressed over the top of the unused socket bracket as shown in the cover photo and the ends taped.
3. Turn the television receiver on in the usual manner and allow at least a two minute warm up period. Select the most interference free unused channel from 2 through 6 and set the VHF tuner channel selector to this channel. Position the fine tuning control of the VHF tuner to the center of its tuning range.
4. Set the VHF-UHF selector switch in the Match Box converter to the UHF position which corresponds with the position of the Match Box being adjusted. See General text above.
5. Adjust the oscillator tuning screw on the Match Box until the desired UHF channel is received. See Fig. 206A. It is usually possible to receive the desired signal at two different settings of this adjustment. USE THE POSITION THAT PLACES THE ADJUSTMENT SCREW THE FARTHEST INTO THE MATCH BOX. This position places the converter oscillator frequency below the frequency of the incoming signal by an amount equal to the frequency of the VHF channel that was selected in step 3.
6. Adjust the two input tuning adjustment screws (C-1 and C-2) shown in Fig. 206A. for the best possible picture. These adjustments should be carefully made to provide the most desirable compromise between bandwidth (picture definition) and sufficient sensitivity to provide a stable noise free picture.
7. Repeat steps 5 and 6 until reception cannot be further improved.
8. Repeat steps 4 through 7 for a second Match Box if used.

CABINET MODIFICATIONS

The cabinet modifications required for the various receiver models are explained in the chart on page 1953-203.

In some models when the converted chassis is replaced in the cabinet the shaft of the VHF-UHF switch will not pass through the center of the hole in the cabinet. The large knob supplied for the VHF-UHF switch will cover the cabinet hole even if the switch shaft is considerably off of center.

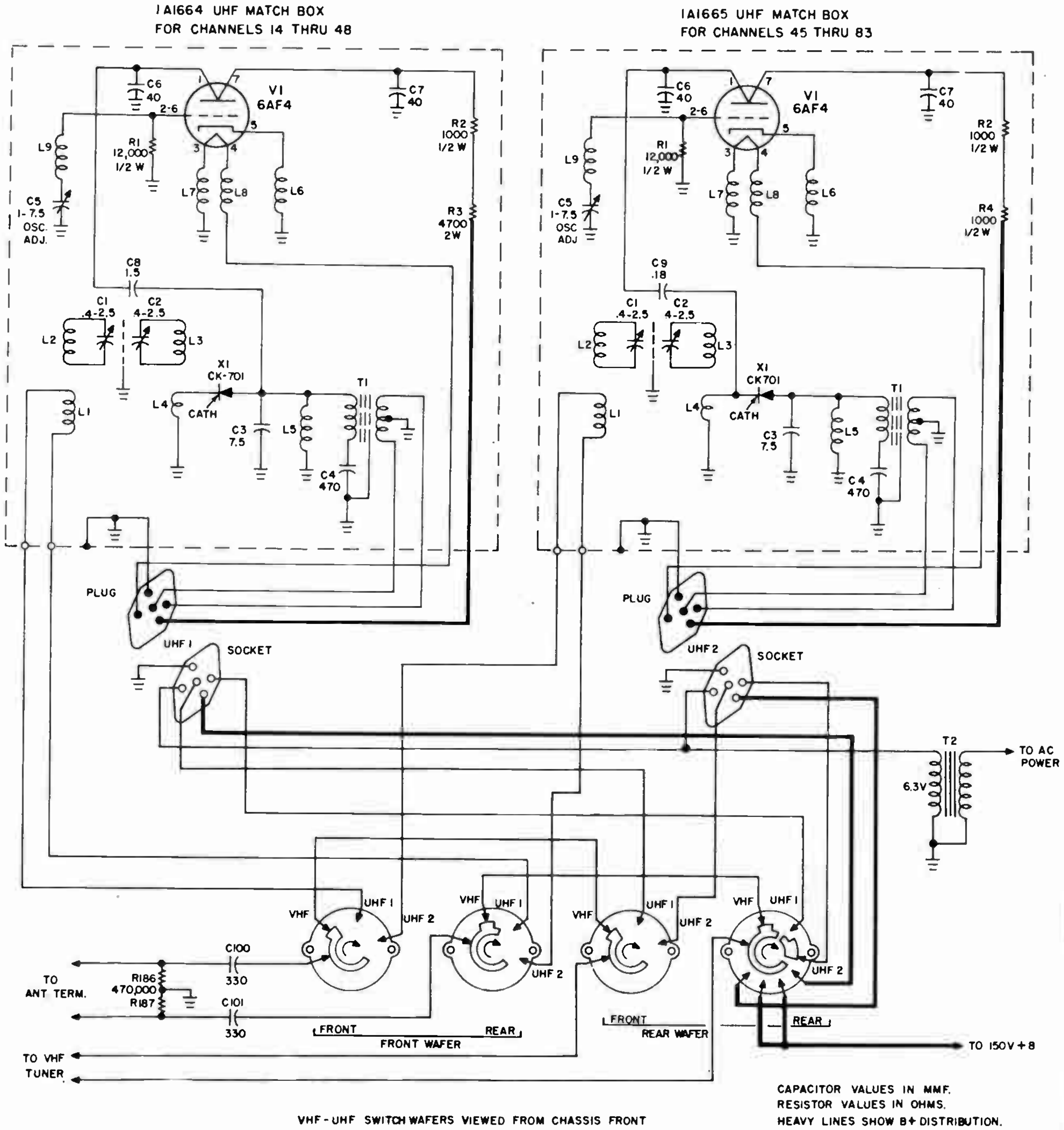


Fig. 207A. Schematic Diagram of Conversion Kit with a 1A1664 and 1A1665 Match Box in Place

SERVICE PARTS LIST

KITS & ACCESSORIES

Wired sub-chassis with Match Box for channels 14 through 48	1X1658
Wired sub-chassis with Match Box for channels 45 through 83	1X1678
Match Box only for channels 14 through 48	1A1664
Match Box only for channels 45 through 83	1A1665
Shield, high voltage compartment	69D547
Tape, electrical; Scotch #21 or equivalent	8A2085

MISCELLANEOUS

Bracket, sub-chassis	67C2218
Bracket, socket mounting	67B2217
Bracket, transformer mounting	63B941
Capacitor, 330 mmf. 500 V. tubular ceramic (C-100 & C-101)	47B20331M5
Insulator plate, VHF-UHF switch mounting	8A1790
Knob, VHF-UHF switch	15C627
Label, gummed; for cabinet front	31B3191
Nut, 3/8 - 32; VHF-UHF switch mounting	2A2142
Plate, front chassis cover; for A, D, K, L, W & X1200D chassis only	63C958
Resistor, 470,000 ohms ½ watt carbon (R-186 & R-187)	23X20X474K
Socket, 5 pin	6A246
Spacer, 1/2 inch	73A824
Spacer, 3/4 inch	73A823
Strip, antenna tie lug; upright type	88A906
Switch, 3 position; VHF-UHF selector	60C546
Transformer, heater	55C206
Washer, extruded fiber; VHF-UHF switch mounting	4A603

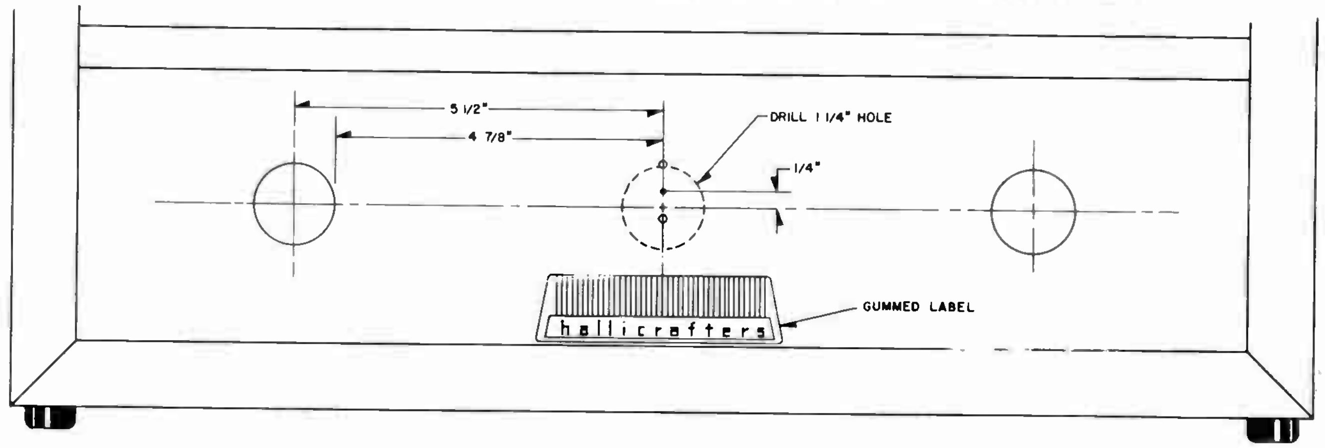


Fig. 208A. Cabinet Modifications for Models 1010P, 1012P, 1026P, 1053P & 1054P

92C1978

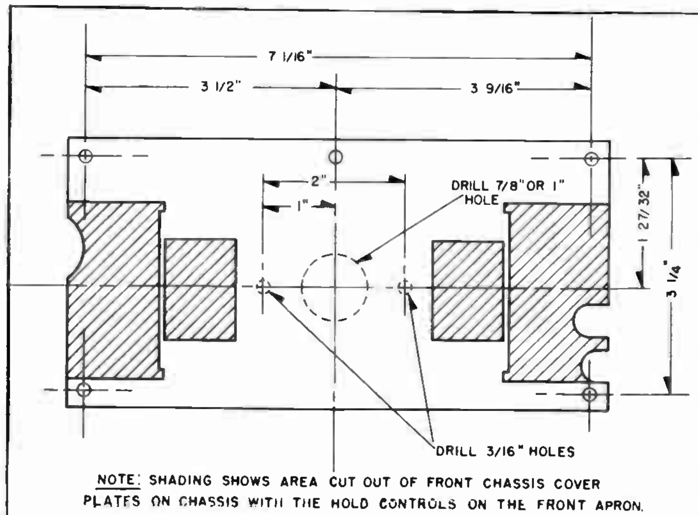


Fig. 208B. Front Chassis Cover Plate Modifications for Chassis J, R, T, AJ, AL & AZ1200D

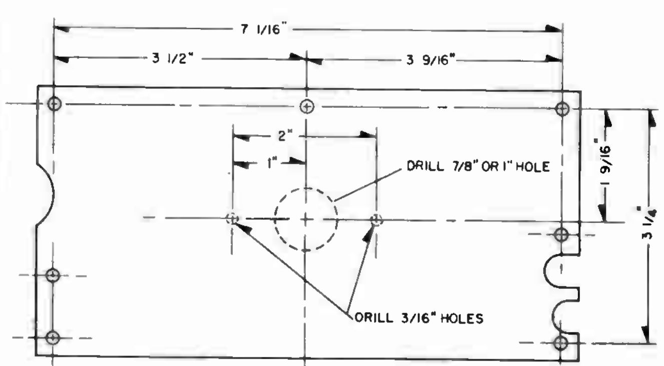


Fig. 208C. Front Chassis Cover Plate Modifications for Chassis P1200D

INSTALLATION & OPERATING INSTRUCTIONS

FOR

HALLICRAFTERS SELF POWERED SINGLE CHANNEL UHF CONVERTER
(SUPPLIED IN TWO FREQUENCY RANGES)

HALLICRAFTERS STOCK NO.	COVERS CHANNELS	FREQUENCY RANGE	CODE STAMP
1X1527	14 through 48	470 mc. to 680 mc.	A
1X1679	45 through 83	656 mc. to 890 mc.	B

The model 1X1527 and model 1X1679 converters provide for the reception of any single UHF television channel. The converter is fixed tuned to the desired channel at the time of installation. This unit may be installed on any standard television receiver that has provision for 300 ohm balanced antenna input. This includes all HALLICRAFTERS TELEVISION RECEIVERS. The Hallicrafters converter has been designed for excellent performance as well as simplicity of installation and operation as illustrated by the following features:

- Self contained power supply.
- Convenient power outlet for the television receiver.
- Utilizes the full amplification of the VHF tuner.
- No alteration of the television receiver is required.
- Test equipment is not required for pre-tuning.
- Single switch selects either UHF or VHF operation.
- Output may be tuned to any of the low VHF channels, 2 through 6. This permits selection of the unused channel that is most interference free in any given signal area.

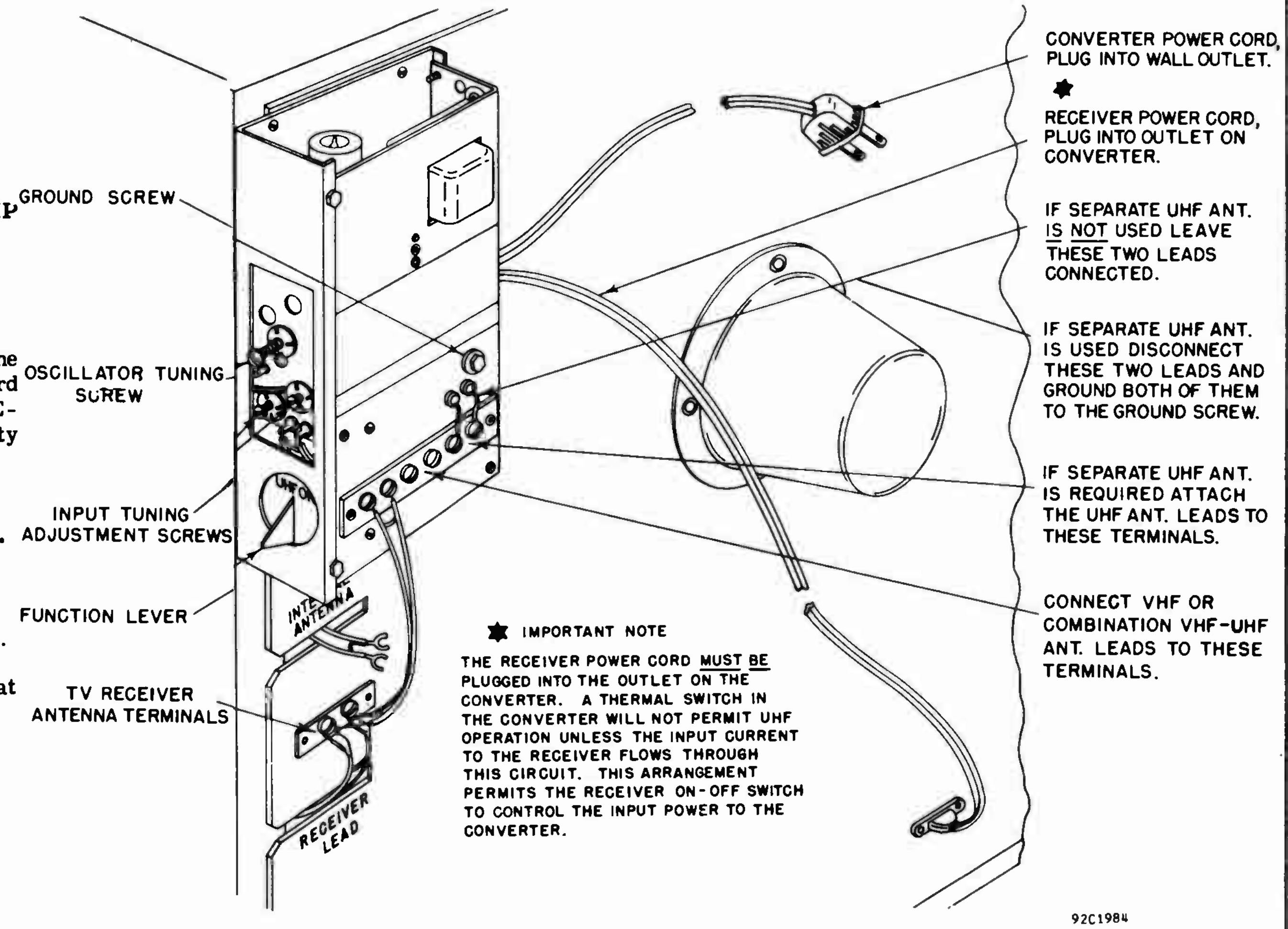


Figure 1.

TO INSTALL AND ADJUST CONVERTER

1. Mount the unit on the cabinet back so that the FUNCTION LEVER protrudes beyond the side of the cabinet as shown in Figure 2.

2. Make the required antenna and power connections as illustrated in Figure 1. The converter is designed to operate from a 115 volt, 60 cycle AC power source.

3. Set the FUNCTION LEVER on the converter to the "UHF ON" (down) position.

4. Turn the television receiver on in the usual manner and allow at least a two minute warm up period. Select the most interference free unused channel (2 through 6) and set the CHANNEL SELECTOR on the television receiver to the channel decided upon. Position the FINE TUNING control to the center of its tuning range.

5. Adjust the OSCILLATOR TUNING screw on the converter until the desired UHF channel is received. It is usually possible to receive the desired signal at two different settings of this adjustment. USE THE POSITION THAT PLACES THE ADJUSTMENT SCREW THE FARTHEST INTO THE CHASSIS. This position places the converter oscillator frequency below the frequency of the incoming signal by an amount equal to the frequency of the VHF channel that has been selected in step 4.

6. Adjust the two INPUT TUNING adjustment screws on the converter for the best reception. These adjustments should be carefully made to provide the most desirable compromise between bandwidth (picture definition) and sufficient sensitivity to provide a stable noise free picture.

7. Repeat steps 5 and 6 until reception cannot be further improved.

OPERATION

1. Turn the television receiver on in the usual manner.

2. Set the converter FUNCTION LEVER to the "UHF ON" (down) position. Allow one minute for the converter tube to reach operating temperature.

3. Set the CHANNEL SELECTOR on the television receiver to the unused channel (2 through 6) that was decided upon at the time the converter was installed. Tune in the UHF channel with the FINE TUNING control on the television receiver.

4. Adjust the other operating controls on the television receiver in the usual manner if required. When UHF operation is completed be sure to retune the converter FUNCTION LEVER to the "VHF ON" (up) position to permit normal operation of the receiver.

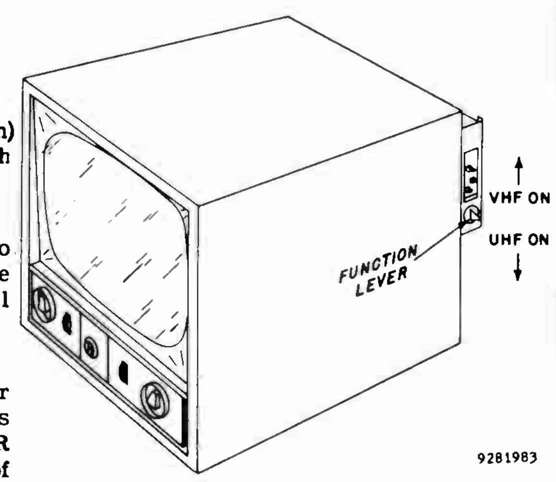


Figure 2.

Picture Area. . . . . 92 square inches

Tubes . . . . Eighteen plus two rectifiers

Speaker . . . . 6-1/2-inch PM (3.2 ohm V.C.)

Antenna . . . . Provision for external antenna using 300-ohm transmission line.

Tuning . . . . Rotary channel selector plus manual fine tuning adjustment.

Tuning Range . . . . Twelve pre-set channels.

Channel No.	Frequency (mc)	Channel No.	Frequency (mc)
2	54-60	8	180-186
3	60-66	9	186-192
4	66-72	10	192-198
5	72-82	11	198-204
6	82-88	12	204-210
7	174-180	13	210-216

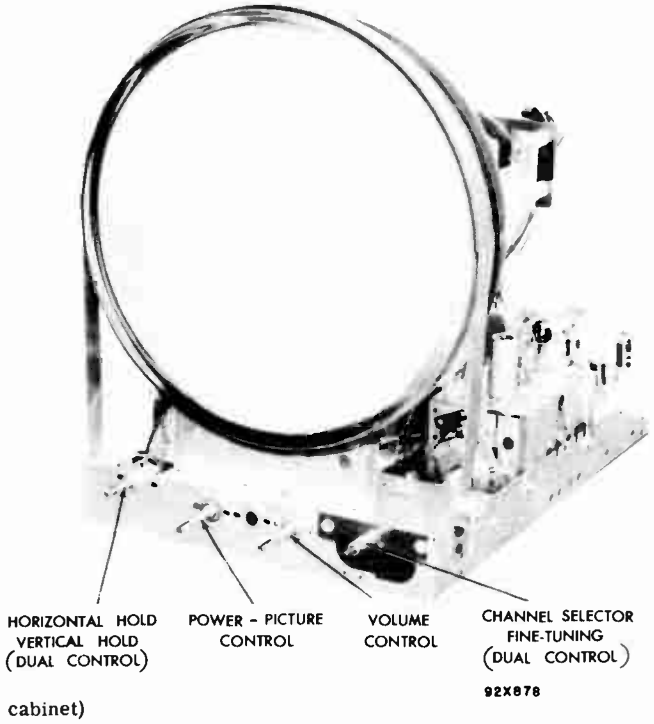
Intermediate Frequency
Picture carrier . . . . 26.25 mc
Sound carrier . . . . 21.75 mc
Intercarrier sound system . 4.5 mc

Power Supply . . . . 105-125 V. 60 cycles AC

Power Consumption. . . . . . 180 Watts

Model Differences. . . . . . . Model 518 - Table model (Plastic cabinet)

Model 521 - Custom installation (Chassis unit)



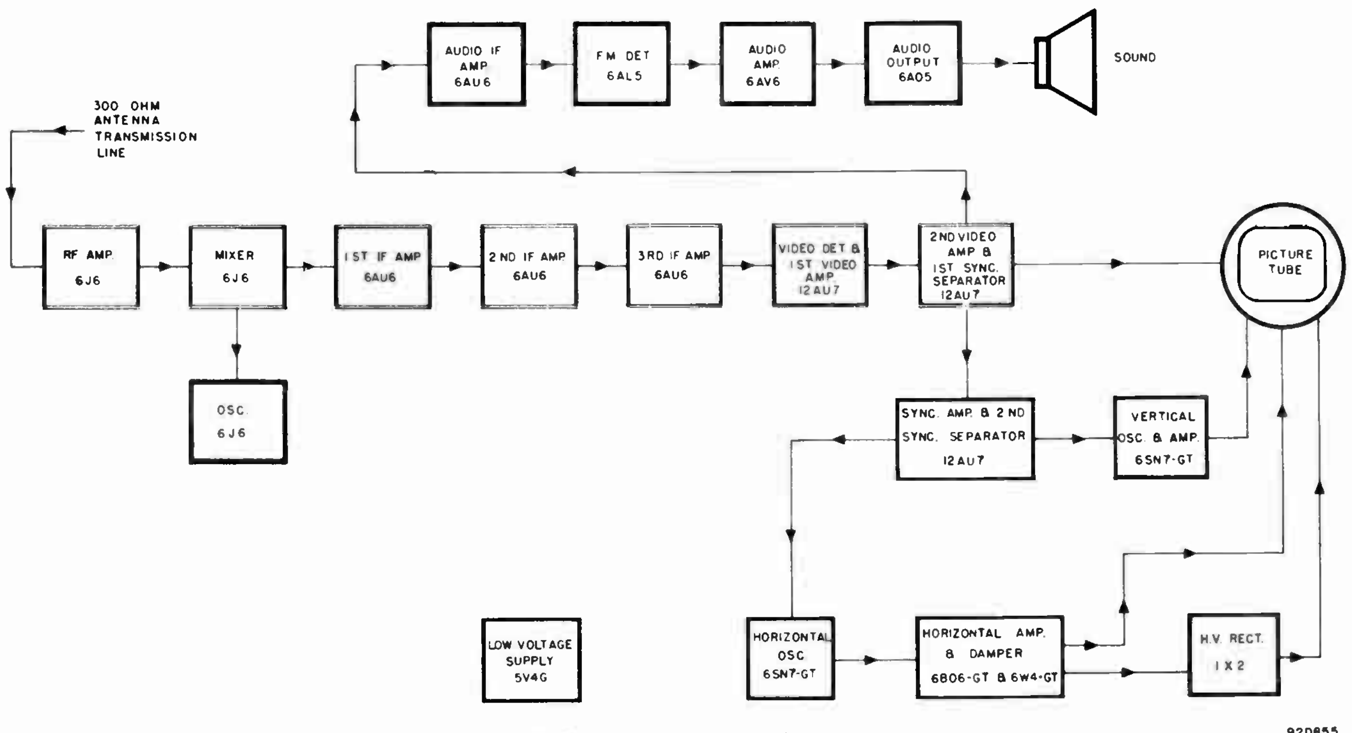


Fig. 1. Functional block diagram.

CARE OF THE KINESCOPE WINDOW

The window in front of the picture tube is made of safety glass, hence may be cleaned by any of the conventional window cleaning processes. Abrasive or strong solvent type cleaning solutions that may scratch the glass or damage the cabinet finish, however, should be avoided.

HIGH VOLTAGE WARNING

Operation of the receiver chassis outside of the cabinet involves a shock hazard. An interlock in the line cord disconnects the power when the back cover is removed. The HIGH VOLTAGE supply, while of low current capacity, operates at a 11,000 volt potential. Exercise all normal HIGH VOLTAGE precautions while working this equipment.

KINESCOPE HANDLING PRECAUTIONS

The kinescope housing provides adequate protection against possible tube implosure while in the cabinet. Do not expose the kinescope or handle it in any way without providing personal protection in the form of shatterproof goggles and heavy gloves. The kinescope should be handled by qualified personnel only.

The kinescope envelope encloses a high vacuum and with the large surface area of glass involved, the stresses set up, particularly at the front rim of the tube, are considerable. An abnormal handling stress, accidental blow at a highly stressed surface, or even a scratch on the surface of the tube could cause it to implode or collapse with destructive violence.

NON-OPERATING CONTROL ADJUSTMENTS

The "non-operating" or screw-driver adjustments normally will require an occasional minor adjustment if any circuit work or tube changing is required. A test pattern, generated either locally in the shop or obtained from a television station is recommended for best results. Normal picture contrast and brightness should be maintained during the following adjustments for best results.

BRIGHTNESS AND FOCUS ADJUSTMENTS

1. Set the HORIZONTAL and VERTICAL HOLD controls for a steady test pattern. Should the HORIZONTAL HOLD control fail to hold the test pattern in the normal manner, set the HORIZONTAL HOLD control in the center of its range and adjust the HORIZONTAL OSC. ADJ. screw for horizontal sync. (See Fig. 11 for location). Note that if horizontal sync. cannot be obtained by adjusting the top slug, turn the top screw approx. two turns down from its top limit and adjust the bottom slug (accessible from the under side of the chassis) for sync.

2. Set the PICTURE control at minimum (counter-clockwise) and advance the BRIGHTNESS control (clockwise) to the point where the retrace lines (widely spaced white lines) on the raster begin to show, then back off the adjustment slightly to eliminate the lines. Reset the PICTURE control for the desired picture brilliance and adjust the FOCUS control for best picture detail. Watch vertical wedges of test pattern for best definition.

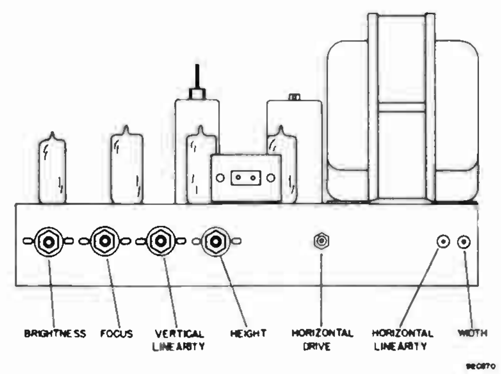


Fig. 2. Rear chassis view, location of "non-operating" controls.

HORIZONTAL — OSC., — DRIVE, — LINEARITY, — CENTERING AND WIDTH ADJUSTMENTS

1. Advance the HORIZONTAL DRIVE control (clockwise) as far as possible without causing fold over of the test pattern. (Vertical white line.) Insufficient horizontal drive will cause the raster to fall short of filling the mask horizontally.

HORIZONTAL DRIVE CONTROL MISADJUSTMENT

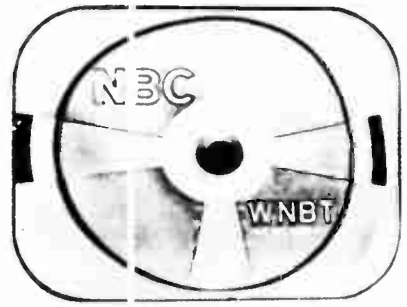


Figure 3.

2. Set the WIDTH control so that the test pattern fits the horizontal dimension of the kinescope escutcheon. A minor adjustment of the focus coil position may be required to recenter the pattern.

WIDTH CONTROL MISADJUSTMENT

Figure 4.

HORIZONTAL CENTERING MISADJUSTMENT

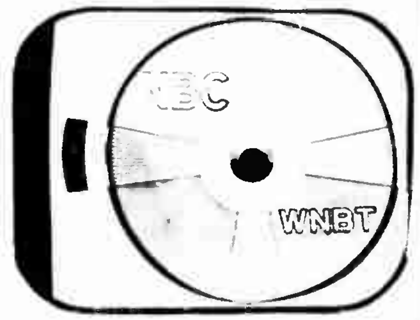


Figure 5.

3. Set the HORIZONTAL LINEARITY control so that the test pattern is symmetrical from left to right. A slight readjustment of the HORIZONTAL DRIVE control may be necessary when making this adjustment.

HORIZONTAL LINEARITY CONTROL MISADJUSTMENT

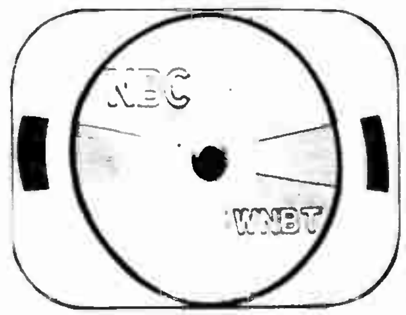


Figure 6.

VERTICAL — CENTERING, — LINEARITY, AND HEIGHT ADJUSTMENTS

HEIGHT CONTROL MISADJUSTMENT

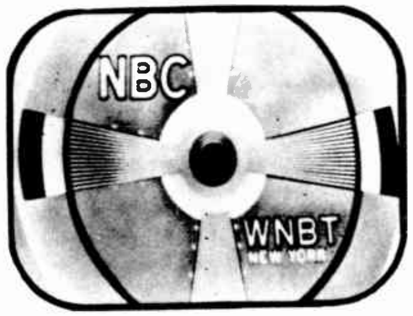


Figure 7.

1. Set the HEIGHT control so that the test pattern fits and centers in the vertical dimension of the kinescope escutcheon. A minor adjustment of the focus coil position may be required to recenter the pattern.

VERTICAL CENTERING MISADJUSTMENT

Figure 8.

VERTICAL LINEARITY CONTROL MISADJUSTMENT

Figure 9.

2. Set the VERTICAL LINEARITY control for a symmetrical test pattern in the vertical dimension. A slight readjustment of the HEIGHT control may be required when making this adjustment.

Note - The sequence of "non-operating" control adjustments outlined above is suggested as a convenient method of approach and not an arbitrary procedure. Variations of the procedure is permitted to obtain the final result.

DISMANTLING FOR KINESCOPE REPLACEMENT OR ALIGNMENT ADJUSTMENTS (MODEL 518)

1. Remove the four front panel control knobs by pulling them straight from their shafts. The dual control knobs must be removed in two pieces, removing the center unit first.

2. Remove the back cover. Note that the line cord and half of the interlock connector come along with the back cover.

3. Unfasten and remove the speaker to clear the KINESCOPE. Remove the two screws holding the antenna terminal strip bracket to the cabinet.

4. Remove the five chassis bolts holding the receiver chassis in the cabinet and slide the entire assembly from the cabinet. The KINESCOPE is now accessible for replacement or adjustment.

REMOVING THE KINESCOPE

Refer to the warning KINESCOPE HANDLING PRECAUTIONS. Read all warning notices on both tube and carton. Follow the dismantling instructions above to expose the KINESCOPE and proceed as follows:

1. Disconnect the KINESCOPE SOCKET at the base of the kinescope.

2. Slip the ION TRAP from the neck of the tube past the kinescope base connector.

3. Measure the distance from the front edge of the steel band to the face of the tube. Keep this dimension handy for installation of a new tube.

4. Remove the steel band at the front rim of the kinescope and carefully slip the neck of the kinescope out of the FOCUS COIL and DEFLECTION YOKE. If the tube fails to slip out smoothly, investigate and remove the cause of the trouble. Do not use force.

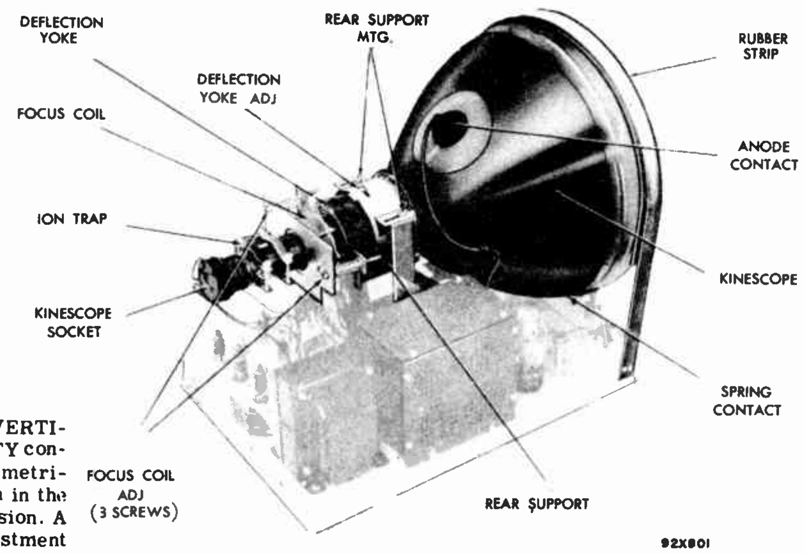


Fig. 10. Kinescope mounting detail.

INSTALLING AND ADJUSTING THE KINESCOPE

1. Wrap the RUBBER STRIP around the front rim of the kinescope and position the tube so that the anode contact is at the top and approximately centered as viewed from the screen.

2. Slip the neck of the kinescope through the REAR SUPPORT, DEFLECTION YOKE and FOCUS COIL and seat the tube firmly against the REAR SUPPORT. If it fails to slip into place smoothly, investigate and remove the cause of the trouble. Do not force the tube. Check the distance from the face of the tube to the front edge of the steel band. Refer to the measurement made in step 3 above. If this dimension is off; loosen the two REAR SUPPORT MTG. screws, position the tube correctly and fasten the steel band firmly about the rim of the tube.

3. The REAR SUPPORT must seat firmly against the flare of the tube and be securely anchored in place by the two REAR SUPPORT MTG. screws. Check the SPRING CONTACT grounding the outer coating of the kinescope tube. A high potential is developed on the outer coating of the tube if this contact is faulty.

4. The DEFLECTION YOKE must seat firmly against the flare of the kinescope. Check by loosening the single DEFLECTION YOKE ADJ. screw and pushing the DEFLECTION YOKE forward as far as it will go. Take up the slack in the screw temporarily to hold the coil in place.

5. Slip the ION TRAP over the neck of the tube. If it is the ring type, the arrow points toward the front of the tube; if it is of the clamp type, the blue coded clamp is toward the front.

6. Reconnect the KINESCOPE SOCKET and anode connector and turn on the receiver.

7. After allowing a few minutes for warm up, turn up the BRIGHTNESS control and set the ION TRAP for maximum raster brilliance, backing off the brightness control adjustment as the maximum point is approached. The ION TRAP must be rotated about the axis of the tube as well as shifted along the neck of the tube to obtain the proper setting. The arrow on the ring type ion trap will generally point at the HV anode connector when properly positioned as far as rotation is concerned, hence a rough setting may be obtained immediately with this type of trap.

With the brightness control set for slightly above average brilliance and the PICTURE control full counter-clockwise, adjust the FOCUS control until the line structure of the raster is clearly visible and readjust the ION TRAP for maximum raster brilliance. The final touches on this adjustment should be made with the BRIGHTNESS control at the maximum position with which good line focus can be maintained, then back off the setting of the BRIGHTNESS control until the retrace lines disappear.

8. Check the position and appearance of the test pattern. If the test pattern is off center or shadowed at the corners (Electron beam striking the neck of the tube), adjust the three FOCUS COIL ADJ. screws for a centered, evenly illuminated raster. Note that the three spring loaded adjustment screws tilt the focus coil to shift the position of the raster on the face of the kinescope. Do not turn all three screws up tight, use them to tilt the FOCUS COIL only.

CAUTION - It is not necessary to tilt the focus coil excessively. Excessive tilt may snap the neck of the kinescope if sufficient force is used. The focus coil may be shifted slightly for additional clearance around the neck of the tube by loosening the two knurled screws holding the coil to the mounting plate. Tighten the screws after the adjustment.

9. If the lines of the raster are not horizontal or square with the escutcheon, loosen the DEFLECTION YOKE ADJ. screw and rotate the DEFLECTION YOKE until this condition is obtained. Tighten the adjustment.

10. Follow the procedure under NON-OPERATING CONTROL ADJUSTMENTS and make any minor adjustments of the FOCUS COIL or DEFLECTION YOKE necessary to obtain the desired results. The final adjustment of the focus coil should leave the test pattern approximately centered.

MEASUREMENT OF H.V. POTENTIAL ON KINESCOPE ANODE

The second anode potential will be approx. 11,000 V., on a receiver that is functioning properly. Since the high potential for the kinescope anode is obtained from the horizontal output transformer, the "non-operating" control adjustments outlined above must be made or be known to be in proper adjustment before the H.V. measurement will have any meaning. Improper operation of the horizontal sweep circuit or circuit faults in the high voltage filter will generally account for an abnormal anode potential. If the anode potential is low, check the HORIZONTAL DRIVE adjustment outlined above.

CAUTION HIGH VOLTAGE

Do not use hand held flexible test leads when making the following measurement. Keep the hands clear of the circuit during measurement. A 11 KV. potential exists in this circuit. Exercise all normal high voltage precautions.

1. Connect a 50-megohm resistor string in series with a 300 microampere meter. Connect the free meter terminal to the chassis and the high side of the resistor string to the anode cap of the kinescope. The connection to the anode cap may be made with a fine wire slipped under the connector. Make up the resistor string with 5-megohm one or two watt resistors to provide a safety factor for voltage breakdown. If 5-megohm resistors are used, a total of ten will be required to obtain the 50 megohms. Make the setup self-supporting and allow adequate clearance between the resistor string and chassis parts to prevent high voltage breakdown.

2. Turn on the receiver and set the BRIGHTNESS and PICTURE controls at minimum. The microammeter will read approx. 220 microamperes for 11,000 V. at the kinescope anode. The anode potential is measured in this manner (PICTURE and BRIGHTNESS control at minimum; meter current approx. 200 microamperes) to simulate the kinescope load on the high voltage power supply.

ALIGNMENT PROCEDURE

Note - The following alignment adjustments do not require the use of the kinescope tube. It is recommended that the tube be removed if extensive alignment adjustments are to be made.

CAUTION - Removal of the kinescope tube exposes the HIGH VOLTAGE anode connector contact. Keep this lead and contact clear of personnel servicing equipment and grounded objects on the service bench. Exercise all normal high voltage precautions while working with the exposed units.

EQUIPMENT REQUIRED

Signal generator covering 4mc to 30 mc
Signal generator covering 40mc to 215 mc
Electronic voltmeter
Two 150-ohm carbon resistors
One .01 mfd. 600 V. tubular paper condenser.

F-M SOUND CHANNEL ALIGNMENT

1. Connect the low frequency signal generator output across resistor (R-118) in the plate circuit of the 12AU7 VIDEO DET. tube (V-104). This resistor is located at the terminal strip near the tube socket.

2. Connect the electronic voltmeter between pin 7 of the 6AL5 FM DET. tube (V-109) and chassis ground.

3. With the signal generator (unmodulated) set at 4.5 mc. set the 4.5 MC LIMITER GRID ADJ. and FM DET PRI. ADJ. (See Fig. 11) for maximum d-c voltage as measured by the electronic voltmeter. Adjust the limiter grid transformer (T-105) before adjusting the f-m detector transformer (T-108) primary. Use just enough signal generator output to obtain approximately one volt at the electronic voltmeter.

4. Connect the electronic voltmeter across the 1000 mmf condenser (C-135) at the output of the f-m detector stage and adjust the FM DET. SEC. ADJ. of the f-m detector transformer (T-108) for the null.

5. Shift the frequency of the signal generator either side of 4.5 mc and touch up the FM DET. PRI. ADJ. for approximately equal peaks. Use just enough signal generator output to obtain one volt peaks for the best results.

6. After completing the alignment procedure and placing the receiver in operation again, carefully tune in a TV test pattern and adjust the 4.5 MC TRAP ADJ. for maximum vertical wedge definition. This adjustment is located on the under side of the chassis and on the same coil form as the 4.5 MC LIMITER GRID ADJ. shown in Fig. 11.

NOTE - The primary adjustment of T-108, the coarse frequency adjustment of T-111 and the 4.5 mc trap adjustment may all be made through the plugged holes in the cabinet bottom if desired.

I-F AMPLIFIER ALIGNMENT

1. Connect the electronic voltmeter across resistor R-118 in the plate circuit of the 12AU7 VIDEO DET. tube (V-104). This resistor is located on the terminal strip near the tube socket.

2. Couple the high side of the signal generator to the mixer tube (V-2) by slipping a tight fitting tube shield or length of copper braid over the bulb of the tube and connecting the generator lead to it. Connect the ground side of the signal generator to the frame of the tuning unit.

3. Set the channel selector at channel 2.

4. Set the signal generator output (unmodulated) to develop one or two volts at the electronic voltmeter and adjust the four i-f amplifier coils, according to the following chart, for maximum d-c voltage as measured by the electronic voltmeter. Readjust the signal generator output as required to maintain the two-volt potential at the electronic voltmeter.

I-F AMPLIFIER ALIGNMENT CHART

Signal Generator Frequency (No Modulation)	Adjustment (Refer to Fig. 11)	Stage Adjusted
23.2 mc	23.2 MC IF ADJ.	1st IF amp
25.2 mc	25.2 MC IF ADJ.	2nd IF amp
26.1 mc	26.1 MC IF ADJ.	3rd IF amp
22.9 mc	22.9 MC IF ADJ.	Video detector

5. Check the i-f amplifier frequency response by tuning the signal generator from 21 mc through 26.25 mc and observing the change in d-c voltage at the electronic voltmeter. If the signal generator output is set for an electronic voltmeter reading of 1.5 volts at the peak i-f amplifier response. the d-c voltage should not drop below one volt between the two peaks normally obtained with this i-f amplifier. If the response is unsatisfactory, repeat the procedure or try slight modifications of the recommended settings to obtain the desired response. Avoid resonating the coils with the iron core at the bottom end of the coil form. (Adjustment screw near limit of its travel.)

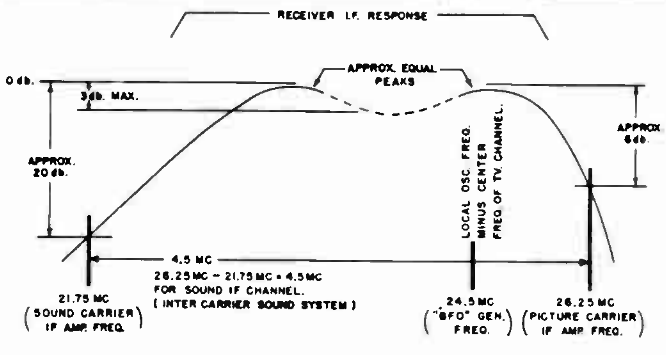


Fig. 12. I-F amplifier response

If a sweep type signal generator and oscilliscope is available the problem of making the final adjustments will be much easier. Check the two carrier i-f responses, 21.75 mc and 26.25 mc. The 21.75 mc response will be approximately 20 db below the peak response (Approx. 0.15 volt) and the 26.25 mc response will fall approximately 6 db below the peak (Approx. 0.4 volt). Refer to Fig. 12.

The average i-f amplifier sensitivity, when feeding the signal generator output through the receiver as described in step 2, will run approx. 1500 to 3000 microvolts for the one volt d-c peak measured at resistor R-118. (Receiver's oscillator operating on channel 2.)

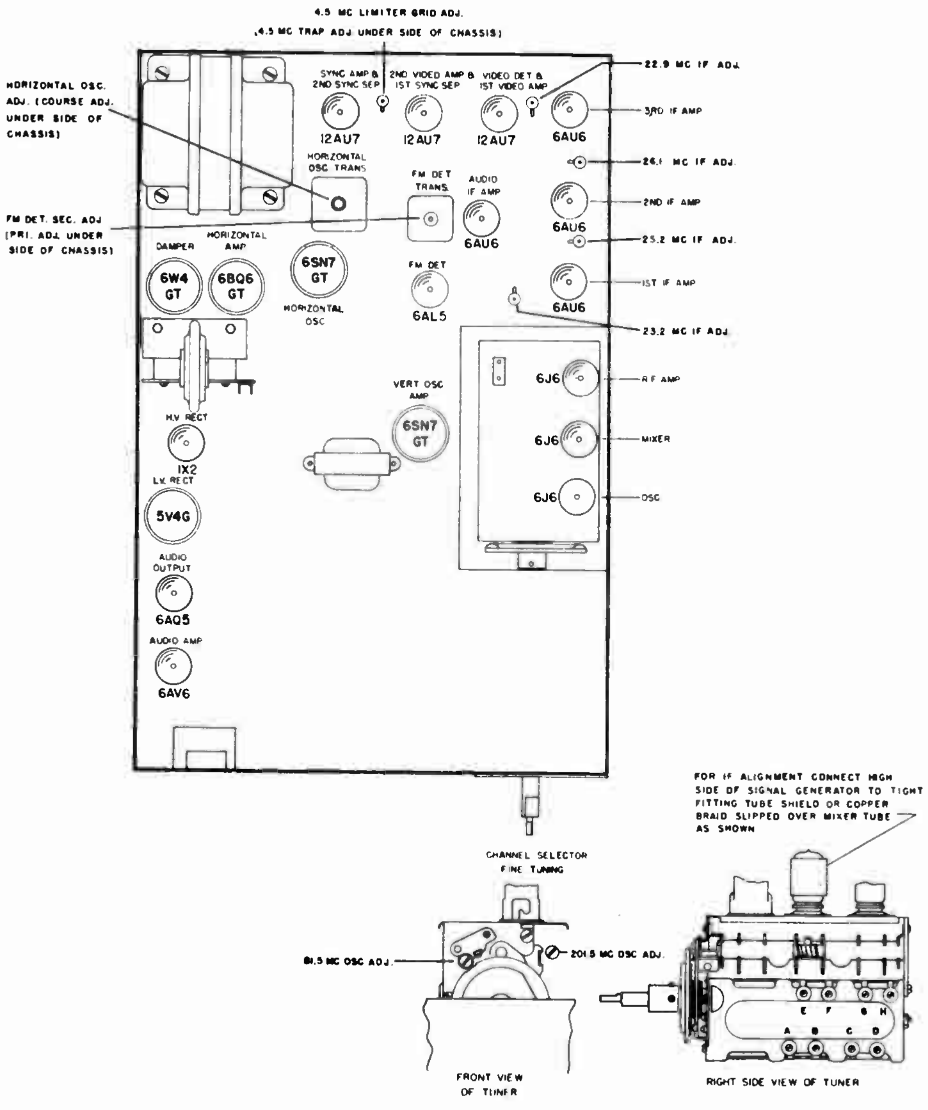


Fig. 11. Top view, alignment points.

STATION CHANNEL ALIGNMENT

1. Due to the broad frequency response of the i-f amplifier, it is necessary to use a 24.5 mc signal generator or oscillator (unmodulated) as a beat frequency oscillator (BFO) in order to locate the center frequency of the i-f amplifier response for the correct local oscillator adjustment. The "BFO" generator should be loosely coupled by means of a wire from the generator output placed in close proximity to the 12AU7 VIDEO DET. tube (V-104).

2. Connect the high frequency signal generator output to the receiver's antenna transmission line through the two 150-ohm carbon resistors, one connected in each conductor of the transmission line.

3 Clip on an .01 mfd condenser between pin 2 of the kinescope (V-117) and pin 1 of the 6AV6 AUDIO AMP tube (V-110). The connection at pin 2 of the kinescope can be made at the terminal strip under the chassis provided for the socket leads of this tube.

4. Set the "BFO" generator at 24.5 mc (No modulation).

5. Set the FINE TUNING control in the center of its range.

*6. Set the channel selector at channel number 2, the high frequency signal generator at 57 mc. and adjust the 81.5 mc OSC. ADJ. screw for a rough audio beat note, using the speaker as a detector.

*7. Set the channel selector at channel number 7, the high frequency signal generator at 177 mc. and adjust the 201.5 MC OSC. ADJ. screw for a rough audio beat note.

8. Disconnect the .01 mfd condenser and connect the electronic voltmeter across resistor R - 118 in the plate circuit of the 12AU7 VIDEO DET. tube (V-104) as for i-f amplifier alignment.

**9. Set the channel selector at channel 6. the high frequency signal generator at 85 mc and adjust trimmers A,B,C and D for maximum voltage as measured by the electronic voltmeter. Use just enough signal generator output to obtain approx. one volt at the electronic voltmeter. Note that trimmers A and B and trimmers C and D must be adjusted simultaneously since the mixer and amplifier tubes are operating in push-pull circuits.

**10. Set the channel selector at channel 13, the high frequency signal generator at 213 mc. and adjust trimmers E,F,G, and H for maximum voltage following the same procedure used in step 9. This completes the alignment of the tuning unit.

The overall sensitivity for the receiver will run approximately 200 microvolts for one volt DC at resistor R-118 when measured in the above manner.

*Note - If local TV stations are operating on channels 2 and 7, the adjustments made in steps 6 and 7 may be made without the use of test equipment. Simply adjust the oscillator for best picture in each case.

**Note - Steps 9 and 10 are not ordinarily required. Adjustment of the trimmers should be undertaken only if the resonant circuits in the tuner have been serviced.

CARRIER vs I-F FREQUENCY CHART

Channel No.	Channel Freq. (mc)	Picture Carrier Freq. (mc)	Sound Carrier Freq. (mc)	Receiver Osc. Freq. (mc)	Picture IF Freq. (mc)	Sound IF Freq. (mc)	Picture IF less Sound IF (mc)
2	54-60	55.25	59.75	81.5	26.25	21.75	4.5
3	60-66	61.25	65.75	87.5	26.25	21.75	4.5
4	66-72	67.25	71.75	93.5	26.25	21.75	4.5
5	76-82	77.25	81.75	103.5	26.25	21.75	4.5
6	82-88	83.25	87.75	109.5	26.25	21.75	4.5
7	174-180	175.25	179.75	201.5	26.25	21.75	4.5
8	180-186	181.25	185.75	207.5	26.25	21.75	4.5
9	186-192	187.25	191.75	213.5	26.25	21.75	4.5
10	192-198	193.25	197.75	219.5	26.25	21.75	4.5
11	198-204	199.25	203.75	225.5	26.25	21.75	4.5
12	204-210	205.25	209.75	231.5	26.25	21.75	4.5
13	210-216	211.25	215.75	237.5	26.25	21.75	4.5

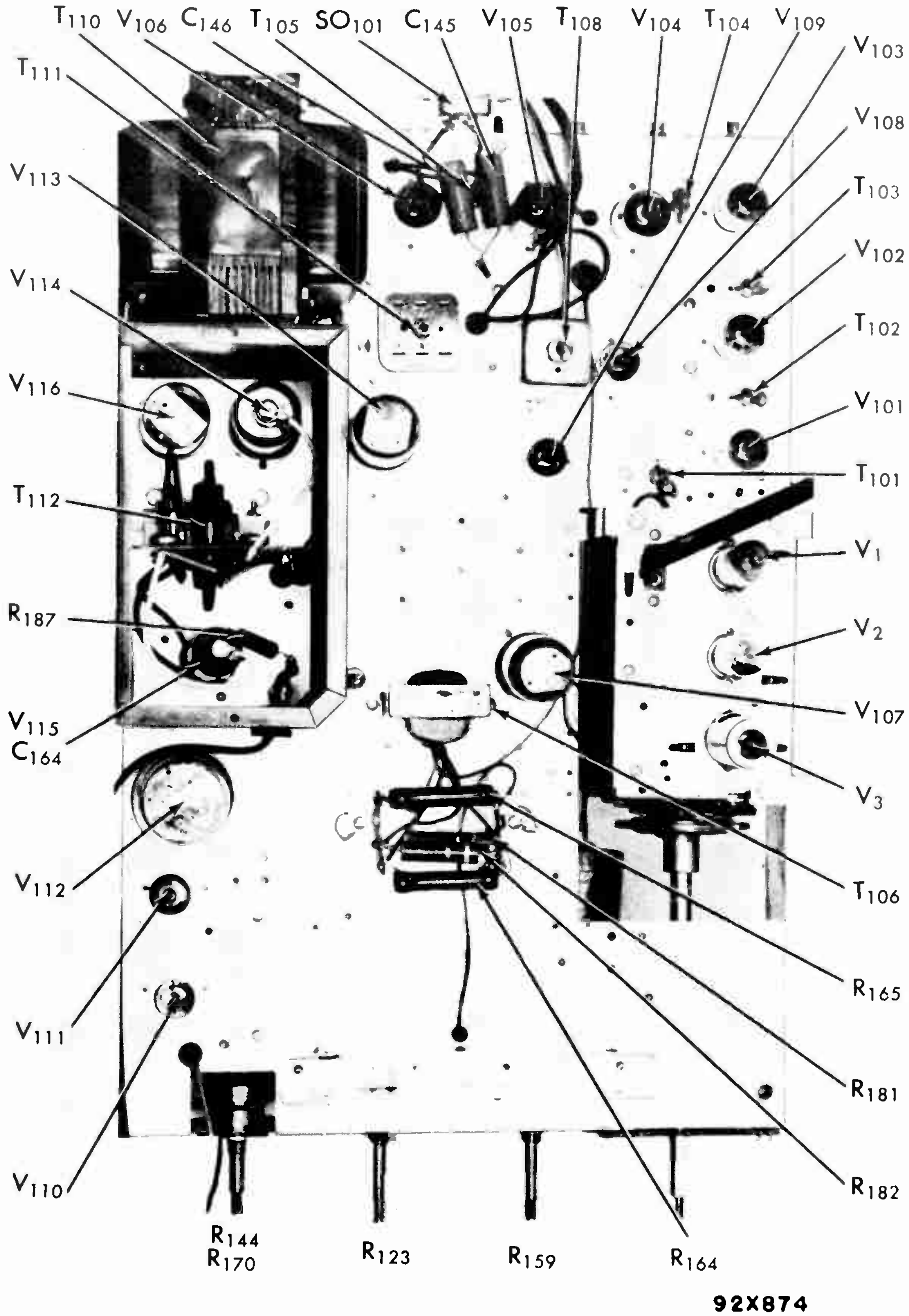


Fig. 13. Top chassis view, component location.

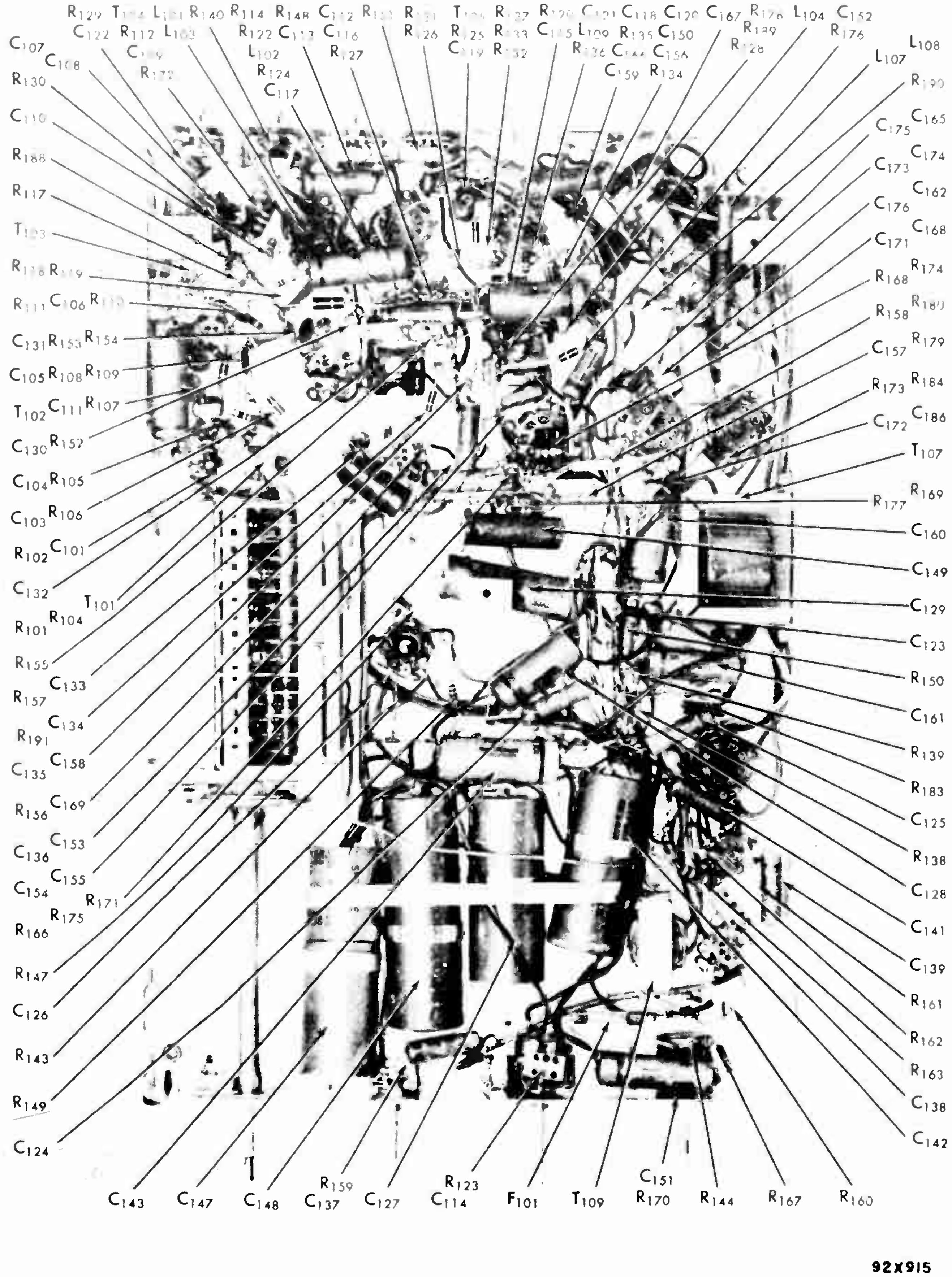
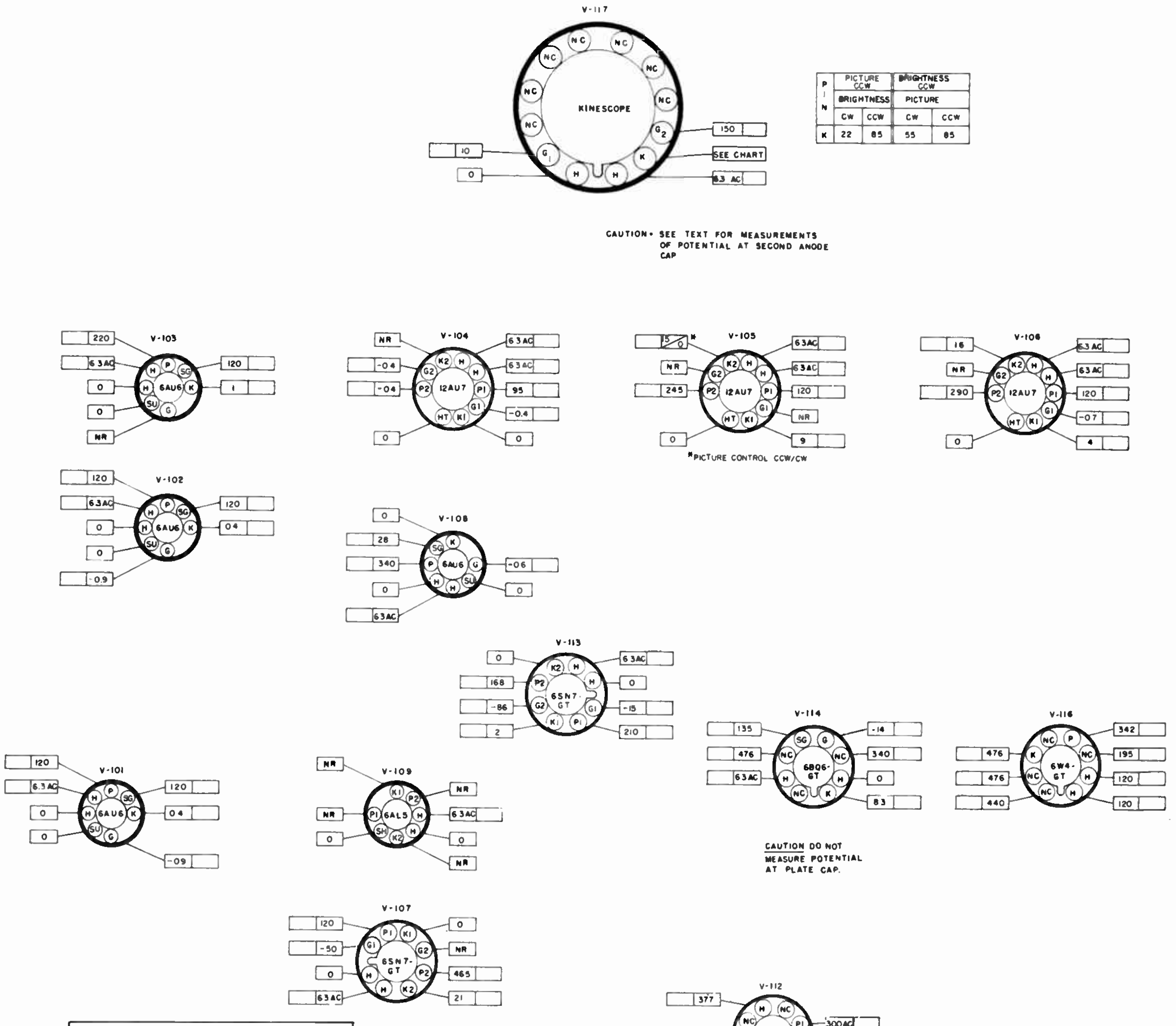
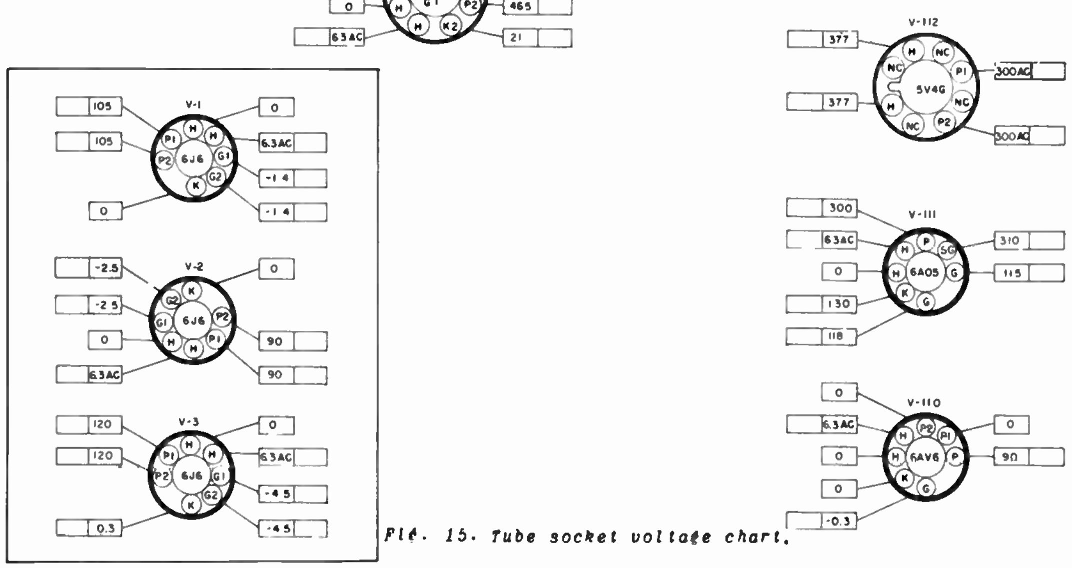


Fig. 14. Bottom chassis view, component location



PIN	PICTURE CCW		BRIGHTNESS CCW	
	BRIGHTNESS		PICTURE	
	CW	CCW	CW	CCW
K	22	85	55	85

CAUTION- SEE TEXT FOR MEASUREMENTS OF POTENTIAL AT SECOND ANODE CAP



1 SOCKET VIEWS ARE BOTTOM VIEWS.
2. ALL VOLTAGES ARE MEASURED BETWEEN TUBE SOCKET TERMINALS AND CHASSIS WITH ZERO SIGNAL INPUT
3 LINE VOLTAGE - 117 V.A.C.
4. ALL VOLTAGES SHOWN ARE DC UNLESS OTHERWISE SPECIFIED.
5. D.C. VOLTAGES SHOWN WERE MEASURED WITH AN ELECTRONIC VOLTMETER.
6 "NC" NO CONNECTION VOLTAGE SHOWN FOR THIS TERMINAL ONLY WHEN TERMINAL IS USED AS A TIE LUG.
7 "NR" NOT READABLE. VOLTAGES MEASURED AT THESE TERMINALS GENERALLY MEANINGLESS.
8. ALL VOLTAGES ON KINESCOPE WERE TAKEN AT TIE POINTS OF TUBE SOCKET LEADS
9 OPERATING CONTROLS SET FOR NORMAL PICTURE UNLESS OTHERWISE SPECIFIED
10 NON-OPERATING CONTROLS SET FOR NORMAL OPERATION
11. MEASUREMENT OF 2ND ANODE POTENTIAL AT KINESCOPE RECOMMENDED FOR CHECK ON 1X2 RECTIFIER.
12. ▭ SPACE PROVIDED FOR SERVICE METER READINGS.

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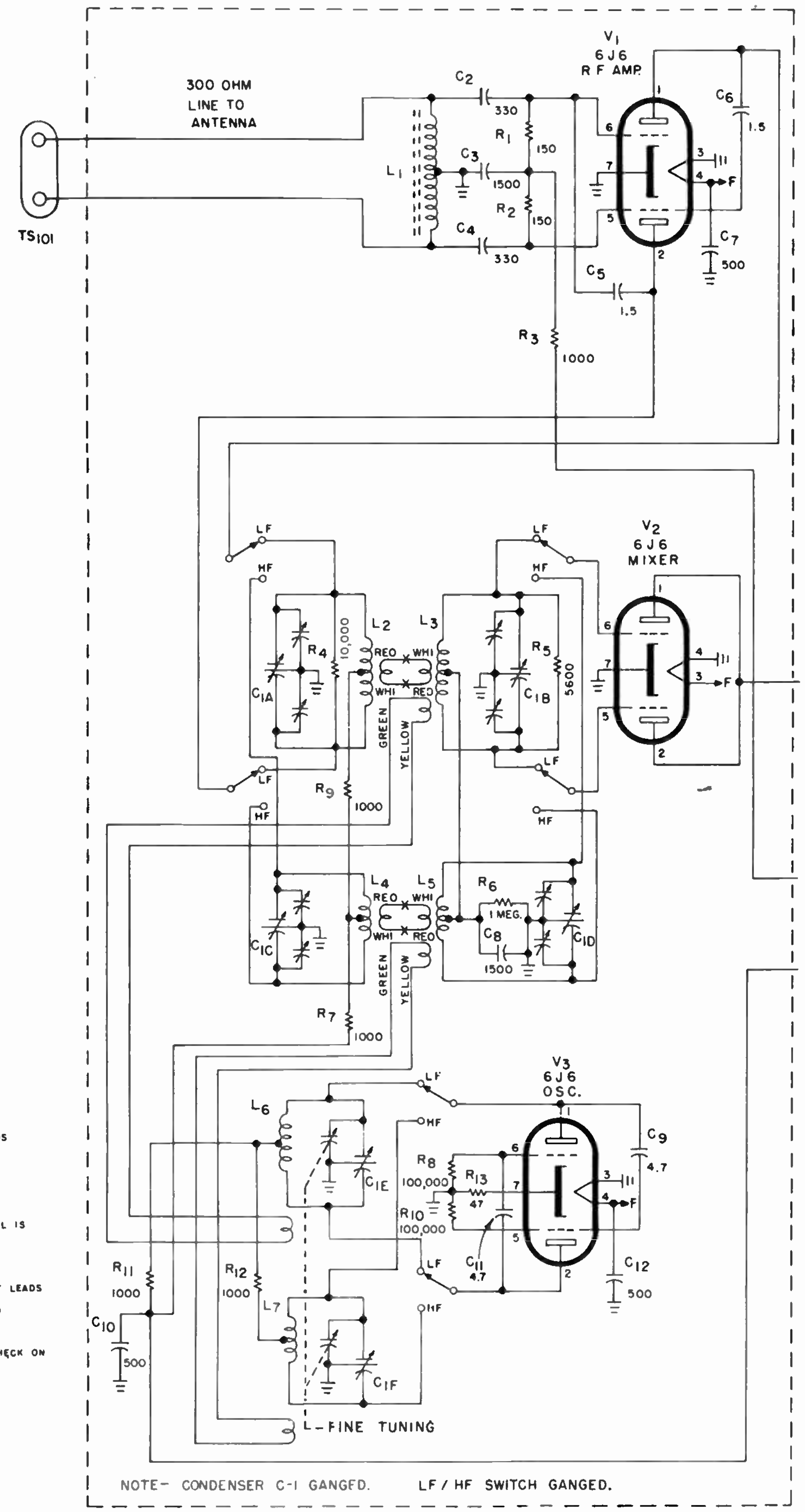
Fig. 15. Tube socket voltage chart.



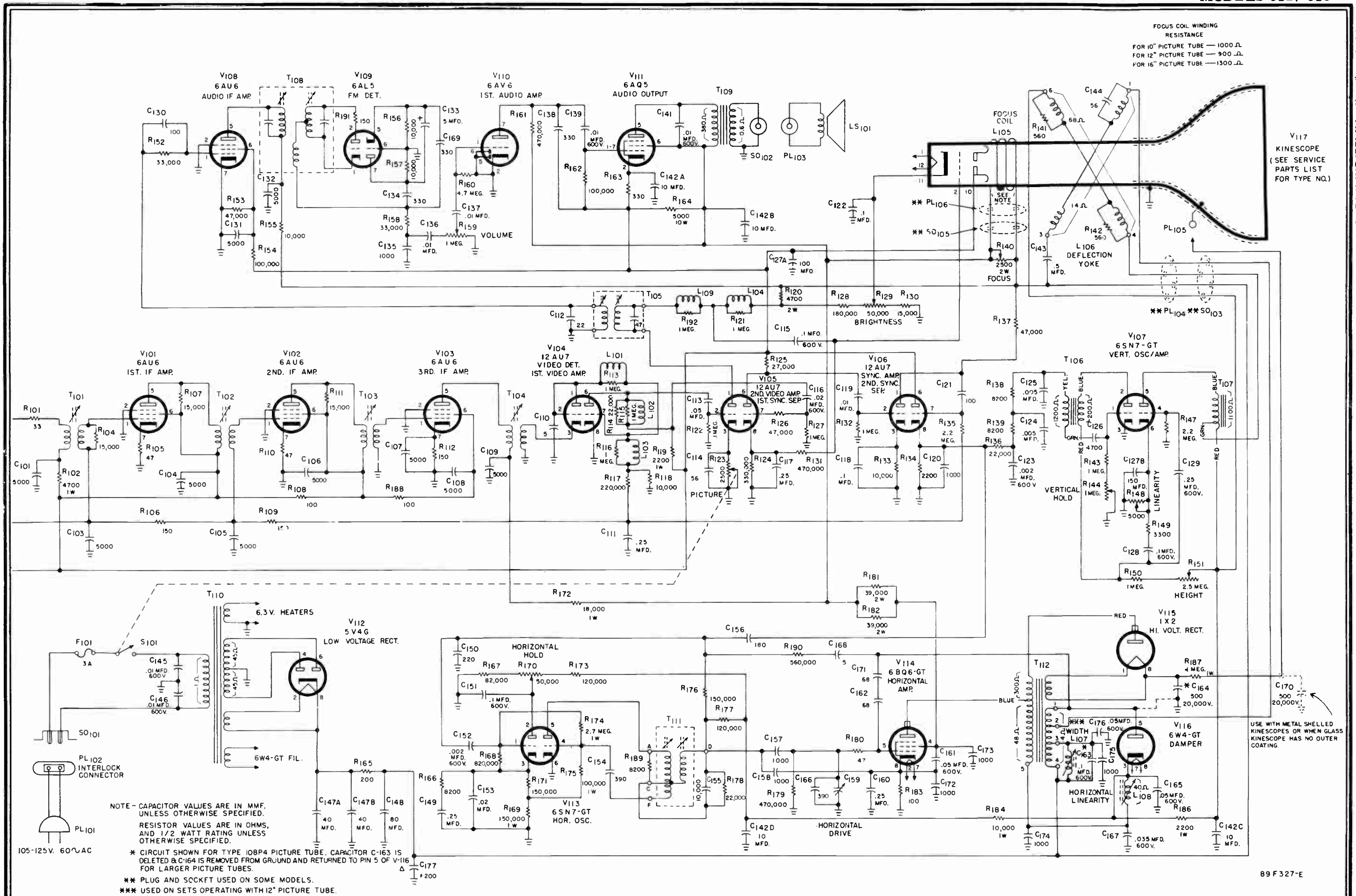


Fig. 16. Schematic diagram

SERVICE PARTS LIST

ELECTRICAL PARTS

TRANSFORMERS AND COILS

Ref. No.	Description	Manufacturer's Part Number
L-1	Coil, antenna (Part of tuner ass'y.)	
L-2	Coil, LF antenna stage (Part of tuner ass'y.)	
L-3	Coil, LF mixer stage (Part of tuner ass'y.)	
L-4	Coil, HF antenna stage (Part of tuner ass'y.)	
L-5	Coil, HF mixer stage (Part of tuner ass'y.)	
L-6	Coil, LF oscillator stage (Part of tuner ass'y.)	
L-7	Coil, HF oscillator stage (Part of tuner ass'y.)	
L-101,102, 109	Coil, video peaking	51A1154
L-103,104	Coil, video peaking	51A1155
L-105	Coil, focus	51B1158
L-106	Deflection yoke	53A180
L-107	Coil, WIDTH control	51B1072-1
L-108	Coil, HORIZONTAL LINE-ARITY control	51B1071
T-101,102, 103,104	Transformer, i-f amplifier	50A431
T-105	Coil, 4.5 mc sound trap	50A432
T-106	Transformer, vertical oscillator	55B115
T-107	Transformer, vertical output	55A128
T-108	Transformer, ratio detector	50B406
T-109	Transformer, audio output	55C134
T-110	Transformer, power	52C185
T-111	Transformer, horizontal osc.	51B1153
T-112	Transformer, horizontal output	55C133

CONDENSERS

Ref. No.	Description	Manufacturer's Part Number
C-1	Tuning capacitor ass'y. (Part of tuner ass'y.)	
C-2,4	330 mmf. 500 V., ceramic	47B20331K5
C-3,8	1500 mmf. 500 V., ceramic	47B20152K5
C-5,6	1.5 mmf. 500 V., bakelite	47A160-3
C-7,10,12	500 mmf. 500 V., ceramic	47B20501K5
C-9,11	4.7 mmf. 500 V., bakelite	47A160-6
C-101,103, 104,105, 106,107, 108,109, 131,132	5000 mmf. 450 V., ceramic	47A168
C-110,168	5 mmf. 500 V., ceramic	47B20050K5
C-111,117, 149,160	.25 mfd. 200 V., tubular	46AT254J
C-112	22 mmf. 500 V., mica	47X20A220K
C-113	.05 mfd. 200 V., tubular	46AU503J
C-114	56 mmf. 500 V., mica	47X20A560M
C-115,128, 151	.1 mf. 600 V., tubular	46AY104J
C-116	.02 mfd. 600 V., tubular	46AY203J
C-118,122	.1 mfd. 200 V., tubular	46AU104J
C-119,136, 137	.01 mfd. 200 V., tubular	46AU103J
C-120,157, 158	1000 mmf. 500 V., mica	47X20A102M
C-121,130	100 mmf. 500 V., ceramic	47B20101K5
C-123,152	.002 mfd. 600 V., tubular	46AZ202J
C-124,125	.005 mfd. 200 V., tubular	46AU502J
C-126	4700 mmf. 500 V., mica	47X35A472M
C-127	100 mfd. 250 V.; 150 mfd. 50 V.; electrolytic	45B156
C-129	.25 mfd. 600 V., tubular	46AX254J
C-133	5 mfd. 50 V., electrolytic	45A109

CONDENSERS (Cont.)

Ref. No.	Description	Manufacturer's Part Number
C-134,169	330 mmf. 500 V., ceramic	47B20331K5
C-135	1000 mmf. 500 V., ceramic	47B20102M5
C-138	330 mmf. 500 V., mica	47X20A331M
C-139,141	.01 mfd. 600 V., tubular	46AY103J
C-142	10-10-10-10 mfd. 450 V., electrolytic	45B157
C-143	.5 mfd. 200 V., tubular	46AT504J
C-144	56 mmf. 500 V., mica	47X15D560K
C-145,146	.01 mfd. 600 V., molded paper	46BR103L6
C-147	40-40 mfd. 450 V., electrolytic	45A159
C-148	80 mfd. 450 V., electrolytic	45B158
C-150	220 mmf. 500 V., mica	47X20A221M
C-153	.02 mfd. 200 V., tubular	46AU203J
C-154,166	390 mmf. 500 V., mica	47X20A391M
C-155	10,000 mmf. 500 V., mica	47X35A103K
C-156	180 mmf. 500 V., mica	47X20A181M
C-159	HORIZONTAL DRIVE, control	44A361
C-161,165, 176	.05 mfd. 600 V., tubular	46AY503J
C-162,171	68 mmf. 500 V., ceramic	47B20680K5
C-164	500 mmf. 20,000 V., ceramic	47A216
C-167	.035 mfd. 600 V., tubular	46AY353J
C-172,173, 174,175	1000 mmf. 500 V., ceramic	47B20A102M5

RESISTORS

Ref. No.	Description	Manufacturer's Part Number
R-1,2	150 ohms 1/2 watt, carbon	23X20X151K
R-3,7,9 11,12	1000 ohms 1/2 watt, carbon	23X20X102K
R-4	10,000 ohms 1/2 watt, carbon	23X20X103K
R-5	5600 ohms 1/2 watt, carbon	23X20X562K
R-6	1 megohm 1/2 watt, carbon	23X20X105K
R-8,10	100,000 ohms 1/2 watt, carbon	23X20X104K
R-13	47 ohms 1/2 watt, carbon	23X20X470K
R-101	33 ohms 1/2 watt, carbon	23X20X330K
R-102	4700 ohms 1 watt, carbon	23X30X472K
R-104,107, 111,130	15,000 ohms 1/2 watt, carbon	23X20X153K
R-105,110, 180	47 ohms 1/2 watt, carbon	23X20X470K
R-106,109, 112,191	150 ohms 1/2 watt, carbon	23X20X151K
R-108,188	100 ohms 1/2 watt, carbon	23X20X101K
R-114,136, 178	22,000 ohms 1/2 watt, carbon	23X20X223K
R-117	220,000 ohms 1/2 watt, carbon	23X20X224K
R-118,133, 155	10,000 ohms 1/2 watt, carbon	23X20X103K
R-119,186	2200 ohms 1 watt, carbon	23X30X222M
R-120	4700 ohms 2 watts, carbon	23X40X472K
R-122,127, 132,143, 150	1 megohm 1/2 watt, carbon	23X20X105K
R-123	2500 ohms WW., PICTURE control	25B790
R-124	330,000 ohms 1/2 watt, carbon	23X20X334M
R-125	27,000 ohms 1/2 watt, carbon	23X20X273K
R-126,137, 153	47,000 ohms 1/2 watt, carbon	23X20X473K
R-128	180,000 ohms 1/2 watt, carbon	23X20X184M
R-129	50,000 ohms, BRIGHTNESS control	25A858
R-131,161, 179	470,000 ohms 1/2 watt, carbon	23X20X474M
R-134	2200 ohms 1/2 watt, carbon	23X20X222K
R-135,147	2.2 megohms 1/2 watt, carbon	23X20X225M

RESISTORS (Cont.)

Ref. No.	Description	Manufacturer's Part Number
R-138,139, 166,189	8200 ohms 1/2 watt, carbon	23X20X822K
R-140	2500 ohms 2 watts, FOCUS control	25B710
R-141,142	560 ohms 1/2 watt, carbon	23X20X561K
R-144,170	1 megohm/50,000, VERTICAL/ HORIZONTAL control (Dual)	25B861
R-148	5,000 ohms, VERTICAL LINE-ARITY control	25B712
R-149	3300 ohms 1/2 watt, carbon	23X20X332K
R-151	2.5 megohms 1/2 watt, HEIGHT control	25B711
R-152,158	33,000 ohms 1/2 watt, carbon	23X20X333K
R-154,162	100,000 ohms 1/2 watt, carbon	23X20X104M
R-156,157	10,000 ohms 1/2 watt, carbon	23X20X103J
R-159	1 megohm, VOLUME control	25A856
R-160	4.7 megohms 1/2 watt, carbon	23X20X475M
R-163	330 ohms 1 watt, carbon	23X30X331K
R-164	5,000 ohms 10 watts, WW	24BG502E
R-165	200 ohms 20 watts, WW	24BH201E
R-167	82,000 ohms 1/2 watt, carbon	23X20X823K
R-168	820,000 ohms 1/2 watt, carbon	23X20X824M
R-169	150,000 ohms 1 watt, carbon	23X30BF154M
R-171,176	150,000 ohms 1/2 watt, carbon	23X20X154M
R-172	18,000 ohms 1 watt, carbon	23X30X183K
R-173,177	120,000 ohms 1/2 watt, carbon	23X20X124M
R-174	2.7 megohms 1 watt, carbon	23X30BF275M
R-175	100,000 ohms 1 watt, carbon	23X30BF104M
R-181,182	39,000 ohms 2 watts, carbon	23X40X393K
R-183	100 ohms 1 watt, carbon	23X30X101K
R-184	10,000 ohms 1 watt, carbon	23X30X103K
R-185	3.3 ohms 1/2 watt, carbon	23X20X033J
R-187	1 megohm 1 watt, carbon	23X30X105M
R-190	560,000 ohms 1/2 watt, carbon	23X20X564K
R-193	5600 ohms 1 watt, carbon	23X30X562K

Tol. on carbon resistors -- M-20%, K-10%, J-5%

TUBE COMPLEMENT

Ref. No.	Description	Manufacturer's Part Number
V-1,2,3	Type 6J6: RF amp; mixer; and osc.	90X6J6
V-101,102, 103,108	Type 6AU6: 1st, 2nd and 3rd IF amp; and audio IF amp.	90X6AU6
V-104,105, 106	Type 12AU7: video detector and 1st video amp; 2nd video amp. and sync. separator; sync. amp. and 2nd sync. separator	90X12AU7
V-107,113	Type 6SN7GT: vertical osc. and amp; and horizontal osc.	90X6SN7GT
V-109	Type 6AL5: f-m detector	90X6AL5
V-110	Type 6AV6: audio amp.	90X6AV6
V-111	Type 6AQ5: audio output	90X6AQ5
V-112	Type 5V4G: low voltage rectifier	90X5V4G
V-114	Type 6BQ6GT: horizontal amp.	90X6BQ6GT
V-115	Type 1X2: high voltage rectifier	90X1X2
V-116	Type 6W4GT: damper	90X6W4GT
V-117	Type 12LP4: kinescope	90X12LP4

MISCELLANEOUS ELECTRICAL PARTS

Ref. No.	Description	Manufacturer's Part Number
	Tuning unit assembly complete	1C834
LS-101	Speaker assembly	85C098

MISCELLANEOUS (Cont.) ELECTRICAL PARTS (Cont.)

Ref. No.	Description	Manufacturer's Part Number
PL-101	Line cord and plug PL-102	87A1668
	Socket, kinescope	6B341
PL-103	Plug, speaker (Includes SO-102)	10A287
PL-105	Plug, kinescope anode	10A300-3
F-101	Fuse, 3 amp. (with wire leads)	39A340

MECHANICAL PARTS

CHASSIS PARTS

Ref. No.	Description	Manufacturer's Part Number
SO-101	Socket, a-c power	10A286
	Socket, octal (Tube)	6A339
	Socket, octal (Tube V-107)	6B296
	Socket, miniature 7 pin (Tube)	6A340
	Socket, miniature 9 pin (Tube)	6B334
	Socket, miniature 9 pin (Tube V-115)	6A343
	Bracket, rear kinescope support	67C1011
	Rear tube support (Deflection yoke housing)	67C1009
	Bracket, rear tube support brace (R.H.)	67C1003
	Bracket, rear tube support brace (L.H.)	67B1082
	Plate, focus coil mtg.	67B1127
	Coil spring, focus coil adj.	75A153
	Machine screw, focus coil adj.	3A1143
	Cradle, kinescope mtg.	67C1006
	Spring, kinescope ground (Riveted to part 67C1006)	75B152
	Clamp, kinescope mtg.	76C474
	Anode lead support	75B151

CABINET PARTS

Ref. No.	Description	Manufacturer's Part Number
TS-101	Antenna terminal strip	88A020
	Bracket, antenna terminal strip mtg.	67A1087
	Escutcheon, kinescope (Model 518)	7D134
	Escutcheon, control panel (Model 518)	7D133
	Glass, safety (Model 518)	22D268
	Knob, VERTICAL & fine tuning	15B195
	Knob, HORIZONTAL	15B194
	Knob, VOLUME & PICTURE	15B196
	Knob, channel selector	15B197
	Dust seal, rubber	16A169
	Ion trap	21B093
	Cabinet top (Model 518)	92A211
	Cabinet bottom (Model 518)	92E210
	Front panel (Model 518)	68D146
	Cabinet back (Model 518)	8D1010
	Foot, rubber (Model 518)	16A150
	Shield, kinescope (Rear cover) (Model 518)	69B292

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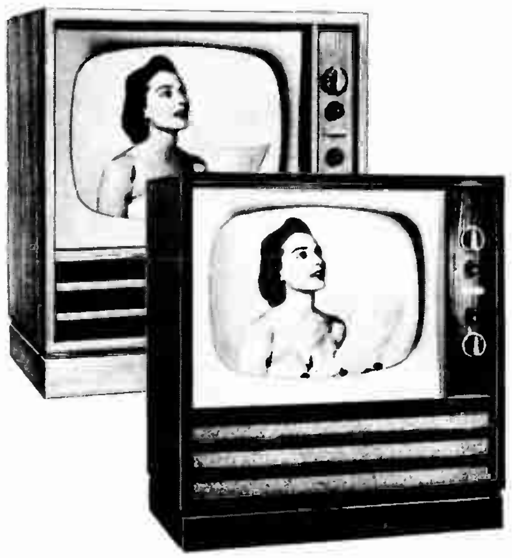

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Fig. 133A. Model 1067 (Mahogany) & 1068 (Blonde)

CHASSIS L1100D

RUN NUMBERS . . . . 1 & 2

GENERAL SPECIFICATIONS

ANTENNA. . . . . EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE . . . . 300 OHMS
TUNING . . . . 12 CHANNELS, 2-13
POWER SUPPLY . . . . 110-120 V, 60 CYCLES
POWER INPUT. . . . . 235 WATTS
TUBES. . . . . 21, INCLUDING 3 RECTIFIERS
SPEAKER. . . . . 10" P.M.
PICTURE CARRIER IF . . . . 26.25 MC
SOUND CARRIER IF. . . . . 21.75 MC
INTERCARRIER SOUND SYSTEM . . . . 4.5 MC
CABINET FINISH. . . . . 1067 MAHOGANY
CABINET FINISH. . . . . 1068 BLOND
PICTURE TUBE. . . . . . 27" RECTANGULAR GLASS
TV TUNER . . . . 1E1441 CASCODE

TUBE COMPLEMENT

V 1	6BK7 or 6BQ7	RF AMPLIFIER
V 2	6J6	OSCILLATOR-MIXER
V 101	6CB6	1ST I-F AMPLIFIER
V 102	6CB6	2ND I-F AMPLIFIER
V 103	6CB6	3RD I-F AMPLIFIER
V 104	6AL5	VIDEO DETECTOR
V 105	6AH6	VIDEO AMPLIFIER
V-106	*12AU7 or 6SN7GT	SYNC AMP & SEP
V 107	6SN7GT	SYNC CLIPPER & VERTICAL OSC
V 108	6AV5	VERTICAL AMPLIFIER
V 109	6AU6	AUDIO I-F AMPLIFIER
V 110	6AL5	AUDIO DETECTOR
V 111	*6AV6 or 6SQ7	1ST AUDIO AMP.
V 112	6AQ5	AUDIO OUTPUT
V 113	6AX5GT	LV RECTIFIER
V 114	5U4G	LV RECTIFIER
V 115	6SN7GT	HORIZONTAL OSCILLATOR
V 116	6CD6	HORIZ. AMP.
V 117	6V3	DAMPER
V 118	1B3GT	HV RECTIFIER
V 119	27EP4	PICTURE TUBE

* These tubes are not directly interchangeable. For socket wiring of each type refer to the Schematic Diagram. When tube replacement is required use the same tube types found in the receiver chassis.

COMPARISON CHASSIS L1100D - Runs 1 & 2

Runs 1 & 2 of the L1100D Chassis are identical except for the voltage supply to the plate of V-111, the audio voltage amplifier, and the screen grid of V-112, the audio output stage.

The connection between Pin 3 of CRL-102 (the audio coupling network) and B plus and the connection betwen Pin 6 of V-112 and the B plus are broken. Pin 3 of CRL-102 and Pin 6 of V-112 are then connected together and then to R-156 (10,000 ohms, 1 watt). The other side of R-156 is connected to B plus at the juncture of R-209, L-119, F-104, and R-186. C-140 (20 mfd., 450 V., electrolytic) then is connected with the positive terminal to junction of Pin 3 of CRL-102 and Pin 6 of V-112, and the negative terminal to the chassis.

The additional filtering provided by this circuit has been found to reduce still further the hum level of the set.

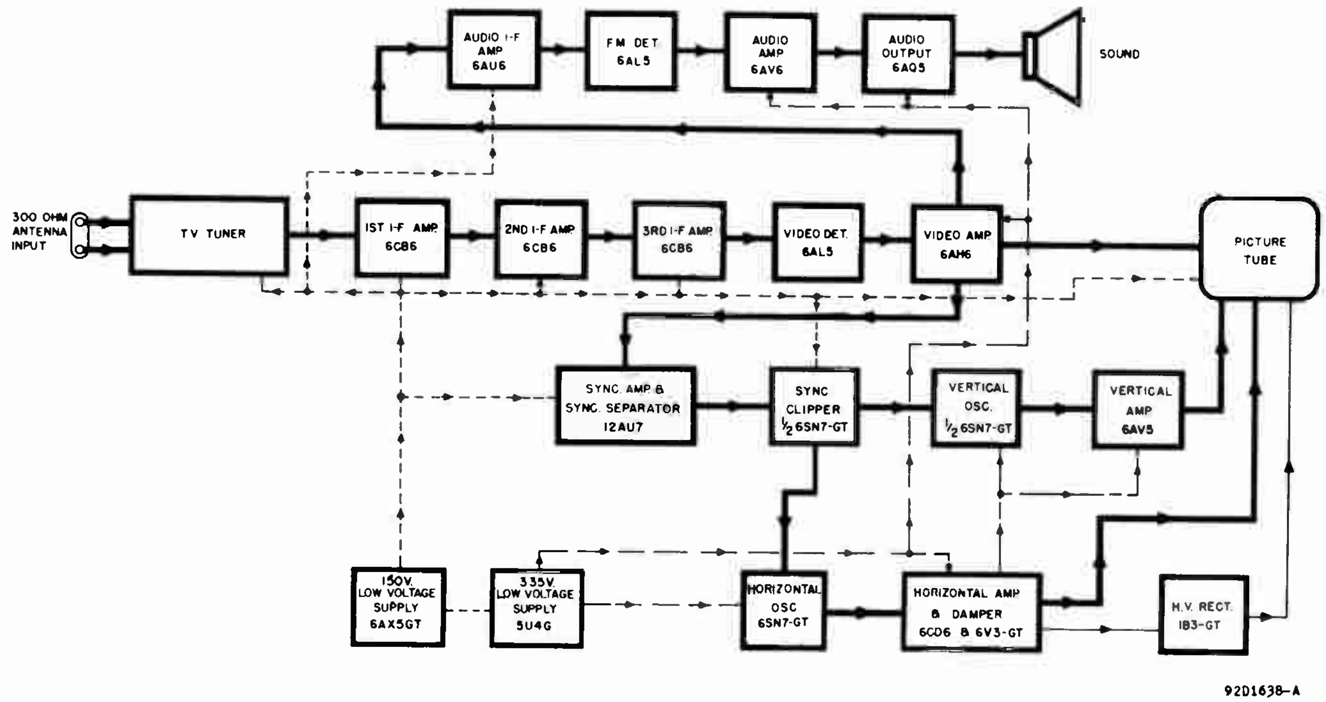

Fig. 44A. Block Diagram of L1100D Chassis

SERVICE ADJUSTMENTS

NOTE: The sequence of "SERVICE ADJUSTMENTS" outlined herein is suggested as a convenient method of approach and is not an arbitrary procedure. Variations of the procedure are permitted to obtain the desired final results. The operating and auxiliary controls, located on the front panel, should be set for as good a pattern as possible before making any of the following adjustments.

Fig. 45A. Improper Centering Adjustments

CENTERING: Loosen the centering lock nut, and adjust the centering lever until the picture is properly centered. Moving the centering lever through the horizontal slot will center the picture vertically. For centering the picture horizontally, grasp the top of the lever, and raise or lower it. If the picture cannot be correctly adjusted by these operations, additional range may be gained by adjusting the screws on each side of the PM focus device. Retighten all adjustment screws and nuts after proper centering has been accomplished.

FOCUS: With the channel selector control tuned to a free channel, adjust the focus control until the lines of the raster are clearly visible. If this operation does not achieve proper focus, the whole PM focus assembly may be moved either backwards or forward by adjustment of the mounting bracket adjustment screws on each side of the rear tube support brackets. Retighten screws after adjustment.

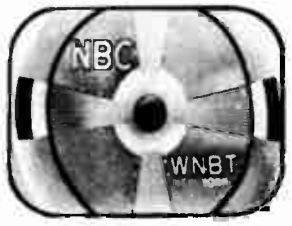

Fig. 45B. Improper Height Control Setting

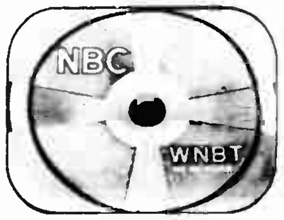

Fig. 45C. Improper Width Control Setting

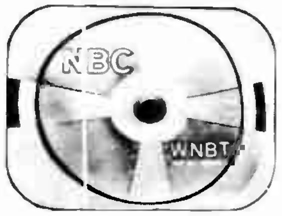

Fig. 45D. Improper Horizontal Drive Control Setting

Adjust the height and width controls so that the picture fills out the dimensions of the screen. A slight readjustment of the centering control may then be necessary.

Adjust the horizontal drive by advancing the control clockwise until a vertical white line appears in the pattern as shown in Fig. 45D. Turn the control in the opposite direction a little further beyond the point at which the line disappears. If a white line does not appear leave the control set to the extreme clockwise position. If, after setting the drive control, the horizontal hold control on the front panel fails to restore synchronization it will be necessary to adjust the horizontal oscillator as described under "HORIZONTAL OSCILLATOR ADJUSTMENT".

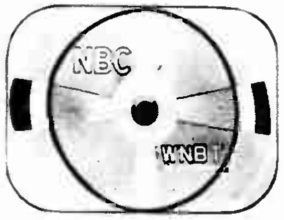

Fig. 45E. Improper Horizontal Linearity Control Setting

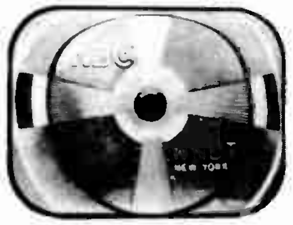

Fig. 45F. Improper Vertical Linearity Control Setting

Adjust the horizontal and vertical linearity controls for a symmetrical pattern. A slight readjustment of the height and width controls may then be necessary.

REMOVAL OF PICTURE TUBE MOUNTING FROM CABINET

1. Remove the 5 Phillips head screws which fasten cabinet back to cabinet. Swing cabinet back open slightly guiding focus control knob through hole in shield cup. Remove internal antenna lead from hole in cabinet back. Swing cabinet back full open.
2. Loosen 6 screws which hold picture tube baseboard to cabinet shelf. (An offset screw driver or other suitable tool will be required to loosen the 2 screws located under the main chassis.)
3. Slide the board out of the cabinet, being careful to protect the tube. (The tube weighs about forty-five pounds.)

NOTE: If no suitable tool is available for loosening the two screws located under the main chassis in the limited clearance available, it will be necessary to remove the chassis. This can be done by pulling off the front knobs, removing the speaker plug, yoke plug, high voltage lead, ground wire lug (black wire) and removing the four screws which hold the chassis mounting board to the side of the cabinet. The chassis can then be pulled back and removed. It can then be replaced after the picture tube adjustment is made.

WARNING!

PICTURE TUBE HANDLING PRECAUTIONS

EXTREME CARE SHOULD BE USED IN REMOVING OR INSTALLING THE PICTURE TUBE. DO NOT FORCE THE NECK OR GRASP THE TUBE BY THE NECK ALONE. THE DESTRUCTIVE EFFECTS OF IMPLOSION INCREASE WITH GREATER SURFACE AREA AND GREATER GLASS THICKNESS.

THE FORTY-FIVE POUND WEIGHT OF THIS TUBE MAKES IT ADVISABLE THAT ITS INSTALLATION OR REMOVAL BE A TWO-MAN OPERATION.

SHATTERPROOF GOGGLES, HEAVY GLOVES, AND PROTECTIVE CLOTHING ARE RECOMMENDED.

REMOVAL OF THE PICTURE TUBE

1. Remove the picture tube from the cabinet according to instructions above.
2. Disconnect the anode plug (PL-105) from the side of the tube and short the plug to the chassis to insure discharge of the high voltage filter capacitor. Discharge the aquadag coating by shorting the anode contact of the tube to the outer tube coating.
3. Remove the anode lead keeper by unhooking the attached springs.
4. Remove the tube socket from the base of the tube.
5. Remove the ion trap from the neck of the picture tube.
6. Remove the two rear support adjustment screws closest to the front of the picture tube.
7. Loosen the two remaining rear support adjustment screws by nine complete turns each but leave them in place.
8. Loosen the three screws which hold the deflection yoke mounting bracket.
9. Loosen the screws for the picture tube mounting strap.
10. Remove mounting strap and rubber strip.
11. Carefully lift tube upward to clear picture tube stop brackets, raising the rear picture tube support to provide enough clearance for the neck. DO NOT FORCE NECK.
12. Move tube forward gently until neck of tube emerges from deflection yoke and rubber collar. Slight twisting motion may be necessary to free neck from the rubber collar.

INSTALLATION AND ADJUSTMENT OF THE PICTURE TUBE

1. With the tube in position so that the anode lead will be located on the right side when viewed from the front face, place the rubber strip across the top and sides along the front rim of the tube.
2. Slide the neck of the picture tube through the rubber collar and the deflection yoke.
3. Seat the tube on the pad so that the face rests against the rubber stop pads, not the brackets for the pads.
4. Place the mounting strap around the rubber strip and tighten the mounting strap screws.
5. Move the rear support so that the rubber collar rests firmly against and supports the cone of the tube. Tighten the rear support adjustment screws.
6. Tighten the three screws on the deflection yoke mounting bracket.
7. Slip the ion trap over neck of tube.
8. Connect the picture tube socket and anode plug (PL-105) and turn on receiver.
9. With the brightness control turned up, adjust the ion trap both along the length of, and around, the neck of the tube. Turn brightness control down as maximum point is approached.
10. With slightly more than normal brightness and the channel selector tuned to a free channel, adjust the focus control until the lines of the raster are most clearly visible. If good focus cannot be obtained in this manner, loosen screws on PM focus mounting bracket, move this bracket forward or back and again adjust the focus control lever. Tighten screws again when perfect focus is obtained.
11. Readjust the brightness control for normal brilliance and touch up ion trap setting.
12. Connect the antenna and tune in a test pattern, if possible.
13. Readjust the contrast control until different shades of the gray scale are clearly visible.

14. If the pattern is off center or shadowed at the corners, loosen the centering lock nut and adjust the centering lever. Rotating this lever through the horizontal slot centers the picture vertically. For moving the picture to right or left, raise or lower this lever. If greater range of adjustment is needed, loosen the screws to the right and left of the focus magnet. Retighten nut and screws after adjustment.

15. If the lines of the raster are not horizontal or square with the escutcheon, loosen the deflection yoke adjustment nut and rotate deflection yoke until proper raster position is obtained. Tighten thumb screw after adjustment.

16. Follow the procedure under "SERVICE ADJUSTMENTS" and make any minor adjustments necessary to obtain properly adjusted pattern.

HIGH VOLTAGE WARNING

OPERATION OF THE RECEIVER CHASSIS OUTSIDE OF THE CABINET INVOLVES DANGER OF ELECTRICAL SHOCK. EXERCISE ALL NORMAL HIGH VOLTAGE PRECAUTIONS WHEN WORKING WITH THIS RECEIVER.

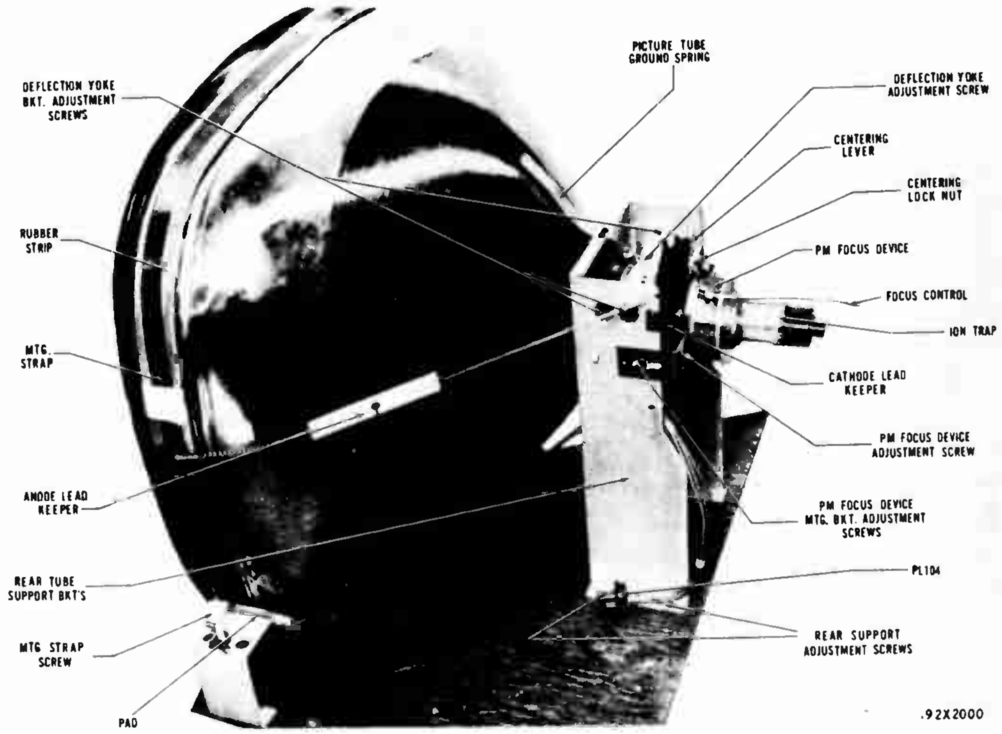

Fig. 48A. 27" Tube Mounting Detail

PICTURE TUBE ANODE HIGH VOLTAGE MEASUREMENT

The second anode potential will be approximately 18,000 volts or higher in a receiver that is functioning properly. If it is possible to obtain good picture brilliance, the second anode potential is correct and need not be measured.

The setting of the horizontal drive control will affect the high voltage on the second anode. Instructions for setting this control are given in the section under the heading of "SERVICE ADJUSTMENTS".

If it is necessary to measure the voltage present on the second anode, a meter specifically designed for high voltage measurements should be used. The contrast and brightness controls should be rotated to the minimum position and PL-105 should be connected to the picture tube. Under these conditions the test meter will load the high voltage power supply approximately the same amount as the picture tube would during normal operation.

SAFETY FIRST

DO NOT USE HAND HELD FLEXIBLE TEST LEADS WHEN MAKING SECOND ANODE HIGH VOLTAGE MEASUREMENTS. ANY ACCIDENTAL CONTACT WITH THE HIGH VOLTAGE PRESENT IN THIS CIRCUIT MAY CAUSE A SEVERE BURN OR IN SOME CASES BE FATAL.

HORIZONTAL OSCILLATOR ADJUSTMENT

If the horizontal hold control on the front panel fails to restore synchronization, the horizontal range adjustment should be reset. Procedure for this adjustment is as follows:

1. Turn the horizontal hold control to the full clockwise position. Adjust the horizontal range adjustment until a vertical bar appears in the pattern as shown in Fig. 49B.

2. Turn the horizontal hold control to the full counterclockwise position. Momentarily set the channel selector to an adjacent channel, and then return it to the original channel being used for adjustment. The resulting picture may or may not be in horizontal synchronization. If it is not in sync., four or less horizontal bars should then appear on the screen as shown in Fig. 49C.

3. If more than four bars appear in step 2, repeat steps 1 and 2.

4. Check the action of the front controls. If the horizontal oscillator is properly adjusted it should be possible to obtain a stable picture on all active channels.

If the above procedure fails to restore stable synchronization, make proper horizontal oscillator waveform adjustments with the aid of an oscilloscope as directed in the following steps.

5. Connect the oscilloscope as shown in Fig. 49A. Adjust the tertiary waveform adjustment until the sine wave is equal in amplitude to the peak of the sawtooth as shown in Fig. 49D. Vary the horizontal range adjustment to keep the picture synchronized.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave (as seen on the oscilloscope) is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious.

On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

6. Remove the oscilloscope and repeat steps 1 and 2 if necessary.

7. Check the action of the front controls and repeat the above steps as required to provide positive synchronization on all active channels.

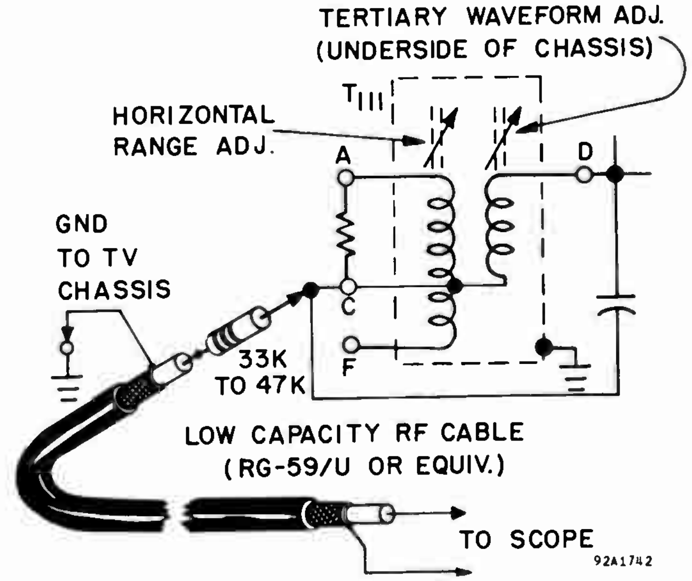

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Fig. 49A. Oscilloscope Connection for Horizontal Oscillator Alignment

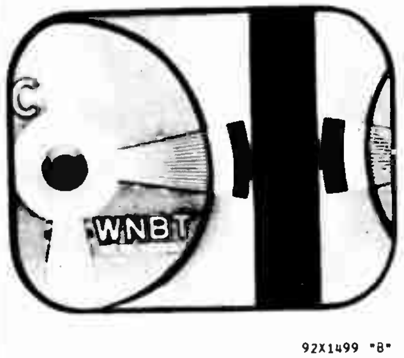


Fig. 49B.

Fig. 49C.

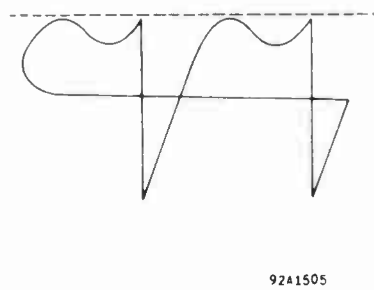


Fig. 49D.

Horizontal Oscillator Test Patterns and Waveforms

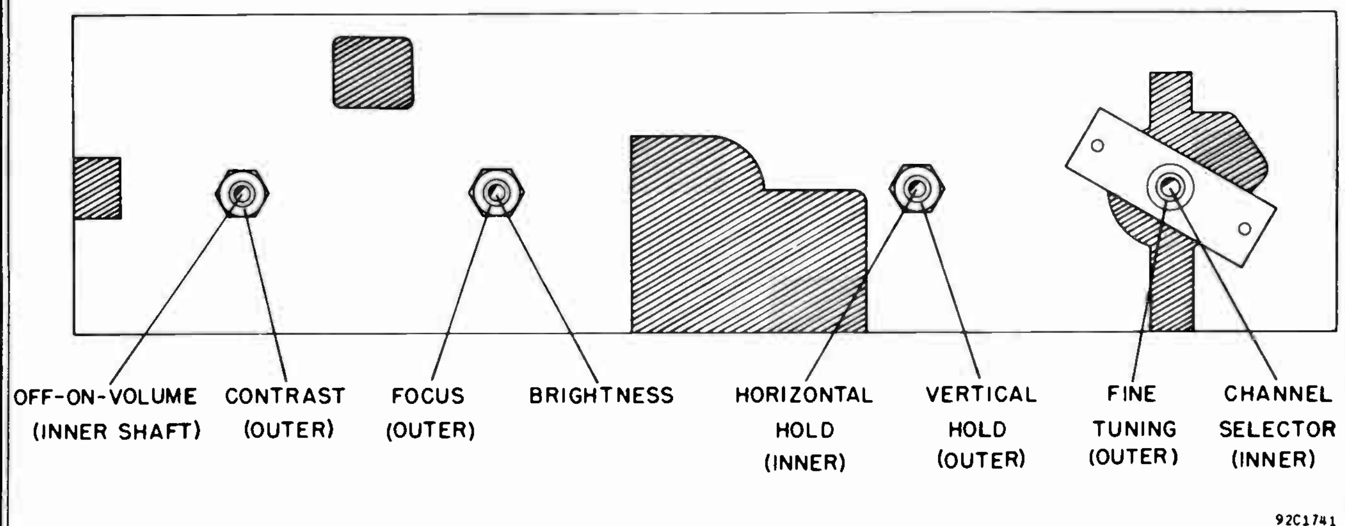


Fig. 50A. L1100D Chassis Front Controls

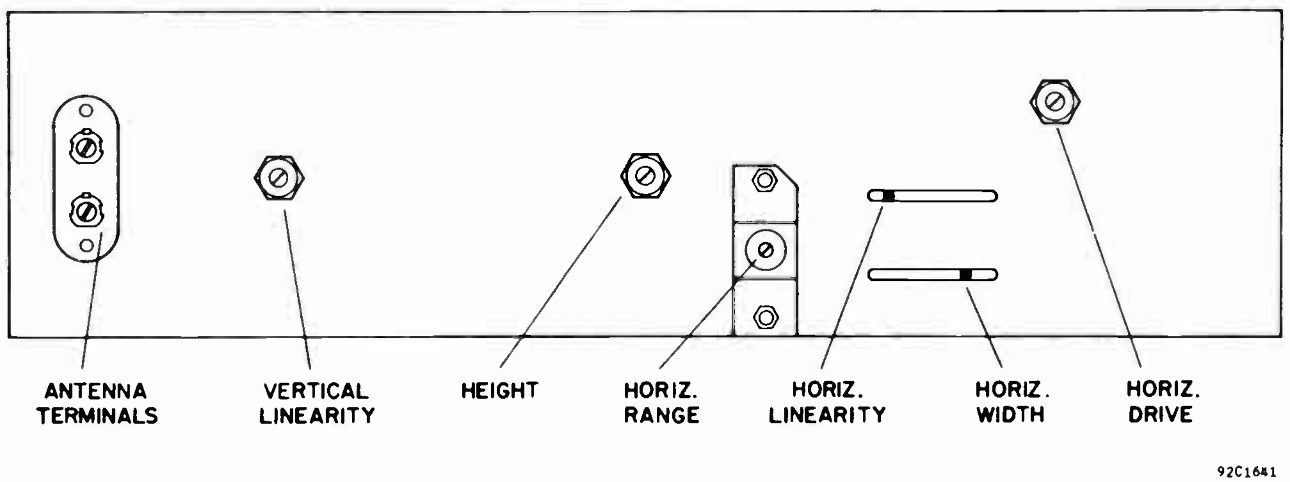


Fig. 50B. L1100L Chassis Rear Controls

FM SOUND CHANNEL ALIGNMENT

EQUIPMENT REQUIRED

Signal generator covering 4 to 30 mc.
Vacuum tube voltmeter (VTVM).
Sound alignment test circuit shown in Fig. 51A.

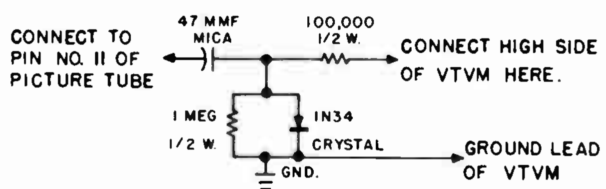


Fig. 51A. Sound Alignment Test Circuit

PROCEDURE

1. Connect the signal generator output through a .005 mfd. capacitor to test terminal (A) which is located on the top of the chassis. This terminal is shown in the chassis top view alignment location illustrations and in the schematic diagrams. Ground the shield of the generator output cable to the chassis near terminal (A).
2. Connect the sound alignment detector circuit and VTVM as shown in Fig. 51A. Adjust the 4.5 mc generator output (unmodulated) to give a 1 volt reading on the VTVM.
3. Adjust the 4.5 mc trap adjustment (L-104) at 4.5 mc for a minimum VTVM reading.
4. Disconnect the test circuit and connect the VTVM to test terminal (B) (Pin 2 of FM detector, V-110).
5. Adjust the 4.5 mc limiter grid adjustment (L-105) and the primary of T-108 (bottom core) at 4.5 mc for a maximum VTVM reading.
6. Connect the VTVM to test terminal (C), shown in the schematic diagram. Adjust the secondary of T-108 (top core) at 4.5 mc for the zero reading which occurs between the positive and negative peaks. If the zero reading occurs at more than one setting, use the position nearest the top limit of the core.
7. Shift the signal generator an equal amount on either side of 4.5 mc and touch up the primary of T-108 (bottom core) for approximately equal peaks. Use just enough signal output to obtain one volt peaks for best results.
8. Disconnect the test equipment and tune in a test pattern. Adjust L-104 for maximum vertical wedge definition.

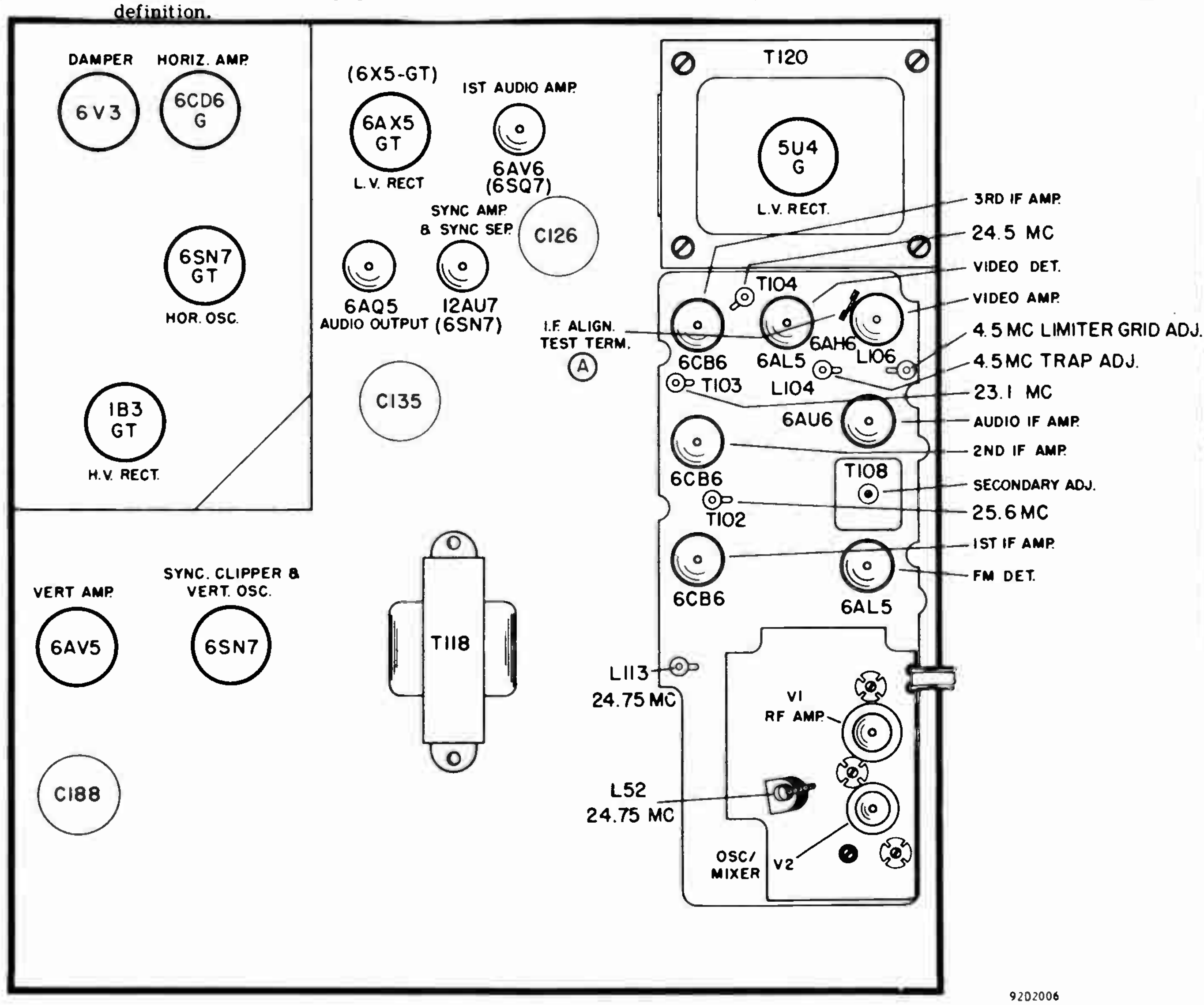


Fig. 52A. Top View Alignment Location

I-F AMPLIFIER ALIGNMENT

1. Connect a VTVM between test terminal (A) and the chassis. Refer to Fig. 52A or the schematic diagram for the particular chassis involved.
2. Connect the high side of a signal generator to the shield of the osc./mixer tube. This connection will capacitively couple the generator output to the tube. Make sure that the shield is ungrounded by raising it above the grounded clips that hold it in place. Connect the ground return of the generator to any chassis point near the base of the tube.
3. Set the channel selector to any vacant channel.
4. Set the signal generator output (unmodulated) for a two volt dc reading on the VTVM and adjust the three i-f transformers, L-113, and L-52 according to the I-F AMPLIFIER ALIGNMENT CHART shown below. Re-adjust the signal generator output as required to maintain the two volt VTVM reading.

I-F AMPLIFIER ALIGNMENT CHART

Signal Generator Frequency (No Modulation)	Adjustment	Location	VTVM Indication
25.6 mc	T-102 (top)	See Fig. 52A	Maximum
23.1 mc	T-103 (top)	See Fig. 52A	Maximum
24.5 mc	T-104 (top)	See Fig. 52A	Maximum
21.75 mc	T-103 (bottom)	Under Chassis	Minimum
24.75 mc	*L-113	See Fig. 52A	Maximum
24.75 mc	**L-52	See Fig. 52A	Maximum

* NOTE: Hold the channel selector between two channels when making this adjustment.

** NOTE: Return the channel selector to the normal position on any vacant channel and shunt the 4700 ohm grid resistor (R-101) of V-101 with a 1000 ohm resistor when making this adjustment. Remove the resistor after adjustment is completed.

5. After adjusting the 21.75 mc sound trap (bottom slug of T-103), recheck the setting of the top core of T-103. Note that the bottom core of T-103 is concealed by wax. Remove and save the wax. After the bottom core has been adjusted, replace the wax and melt it with a soldering iron to secure the core so that the setting will not change when the chassis is subjected to normal operating conditions.
6. Tune the signal generator from 21 mc through 26.25 mc and observe the change in indication on the VTVM. If the generator output is set to the level where a 1.5 volt meter reading is obtained at the peak i-f amplifier response, the reading should not drop below one volt between the two peaks normally obtained with this i-f amplifier. If the band-pass response is not satisfactory, repeat the above procedure or try slight modifications of the recommended settings to obtain the desired results. Avoid resonating the coils with the iron core at the bottom end of the coil form (adjustment screw near the outer limit of its travel). Final adjustments can be made much more easily if a sweep type signal generator and oscilloscope are used.
7. Check the two carrier i-f responses of 21.75 mc and 26.25 mc. The 21.75 mc response will be approximately 26 db below the peak response (approx. 0.075 volt) and the 26.25 mc response will fall approximately 6 db below the peak, (approx. 0.75 volt). Refer to Fig. 54A.

To determine the i-f amplifier sensitivity, connect a signal generator to the osc./mixer tube as directed in step 2 above. Set the generator frequency to either i-f peak. If a generator output of 800 to 1500 microvolts produces a one volt dc reading on a VTVM connected between terminal (A) and ground, the i-f amplifier sensitivity is normal.

TELEVISION CHANNELS vs. CARRIER, OSCILLATOR AND I-F FREQUENCIES

Channel No.	Channel Freq. (mc)	Picture Carrier Freq. (mc)	Sound Carrier Freq. (mc)	Receiver Osc. Freq. (mc)	Picture I-F Freq. (mc)	Sound I-F Freq. (mc)	Picture I-F less Sound I-F (mc)
2	54-60	55.25	59.75	81.5	26.25	21.75	4.5
3	60-66	61.25	65.75	87.5	26.25	21.75	4.5
4	66-72	67.25	71.75	93.5	26.25	21.75	4.5
5	76-82	77.25	81.75	103.5	26.25	21.75	4.5
6	82-88	83.25	87.75	109.5	26.25	21.75	4.5
7	174-180	175.25	179.75	201.5	26.25	21.75	4.5
8	180-186	181.25	185.75	207.5	26.25	21.75	4.5
9	186-192	187.25	191.75	213.5	26.25	21.75	4.5
10	192-198	193.25	197.75	219.5	26.25	21.75	4.5
11	198-204	199.25	203.75	225.5	26.25	21.75	4.5
12	204-210	205.25	209.75	231.5	26.25	21.75	4.5
13	210-216	211.25	215.75	237.5	26.25	21.75	4.5

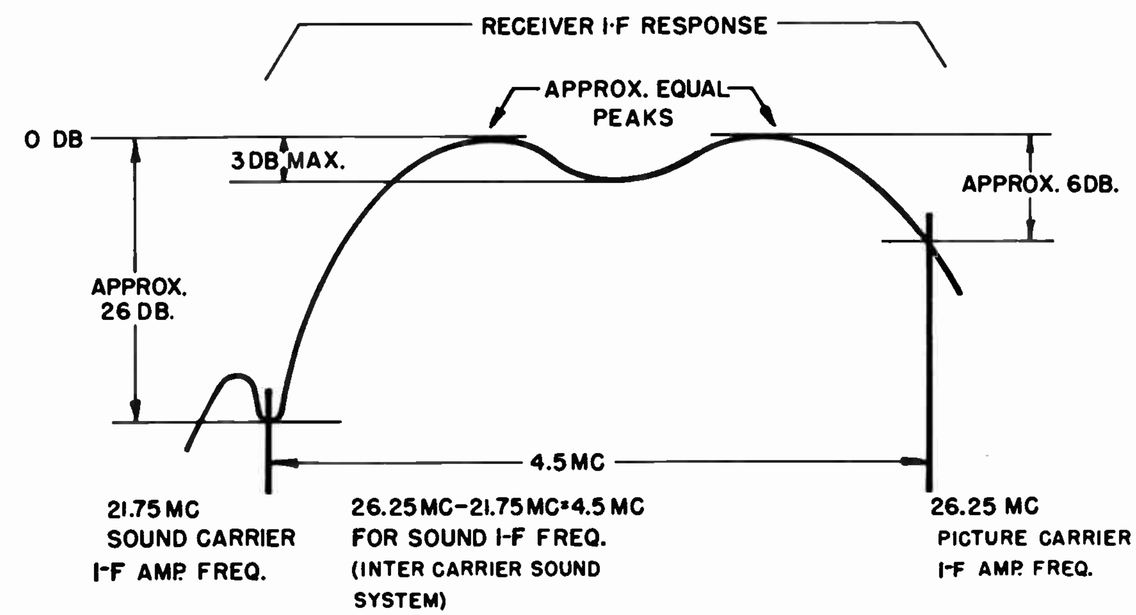


Fig. 54A. Typical I-F Amplifier Response

1E1441 SUPERDYNAMIC TV TUNER ALIGNMENT (ANT. & RF CIRCUITS)

The tuner was carefully aligned at the factory and should not require complete realignment under normal operating conditions. A slight readjustment of the individual oscillator slugs may be required as the tubes in the tuner age or are replaced. In some rare cases it will be necessary to realign the tuner after replacing either of the two tubes. If any service work is performed on the tuner, realignment may or may not be required. NO ATTEMPT TO REALIGN THE TUNER SHOULD BE MADE UNTIL THE BALANCE OF THE TV RECEIVER IS KNOWN TO BE IN PROPER OPERATING CONDITION AND IS PROPERLY ALIGNED.

EQUIPMENT REQUIRED

1. Sweep generator covering all 12 television channels.
2. Marker generator covering the same range as the sweep generator.
3. Oscilloscope.
4. Vacuum tube voltmeter (VTVM)

SET-UP PROCEDURE

1. Set the CHANNEL SELECTOR switch to channel 12.
2. Connect the oscilloscope through a 10,000 ohm resistor to test point TP-9. (See Schematic Diagram and Fig. 56A).
3. Connect the negative pole of a 3 volt dry battery to the terminal where the delayed AGC lead (white wire) from the tuner is connected. Connect the positive pole of the dry battery to the receiver chassis. (See Schematic Diagram).
4. Set the FINE TUNING control at the approximate midpoint of its tuning range.
5. Connect the sweep generator to the antenna terminals and adjust the output to sweep channel 12.
6. Loosely couple the output from the marker generator to the antenna terminals. Use the minimum amount of coupling and signal from the marker generator required to give a good marker or pip on the oscilloscope pattern.

ANTENNA AND RF CIRCUIT ALIGNMENT

7. Adjust C-13, C-3 and C-6 for a flat-top response curve and maximum gain. Check markers on all channels. They should fall in automatically on each channel. Correct marker frequencies for each channel are given in the Picture Carrier and Sound Carrier columns of the chart. Refer to Fig. 56B.
8. Disconnect the battery used to obtain negative bias.
9. Disconnect the test equipment and air check the receiver on all active channels. If it is possible to receive a normal picture on all active channels by adjusting the FINE TUNING control, further alignment will not be necessary.

1E1441 SUPERDYNAMIC TV TUNER ALIGNMENT (OSC. CIRCUIT)

1. Set the FINE TUNING control at the approximate midpoint of its tuning range.
2. Place a non-metallic screwdriver through the openings provided in the front of the chassis and the tuner assembly and adjust the oscillator coil slug for each active channel to give the best possible picture.

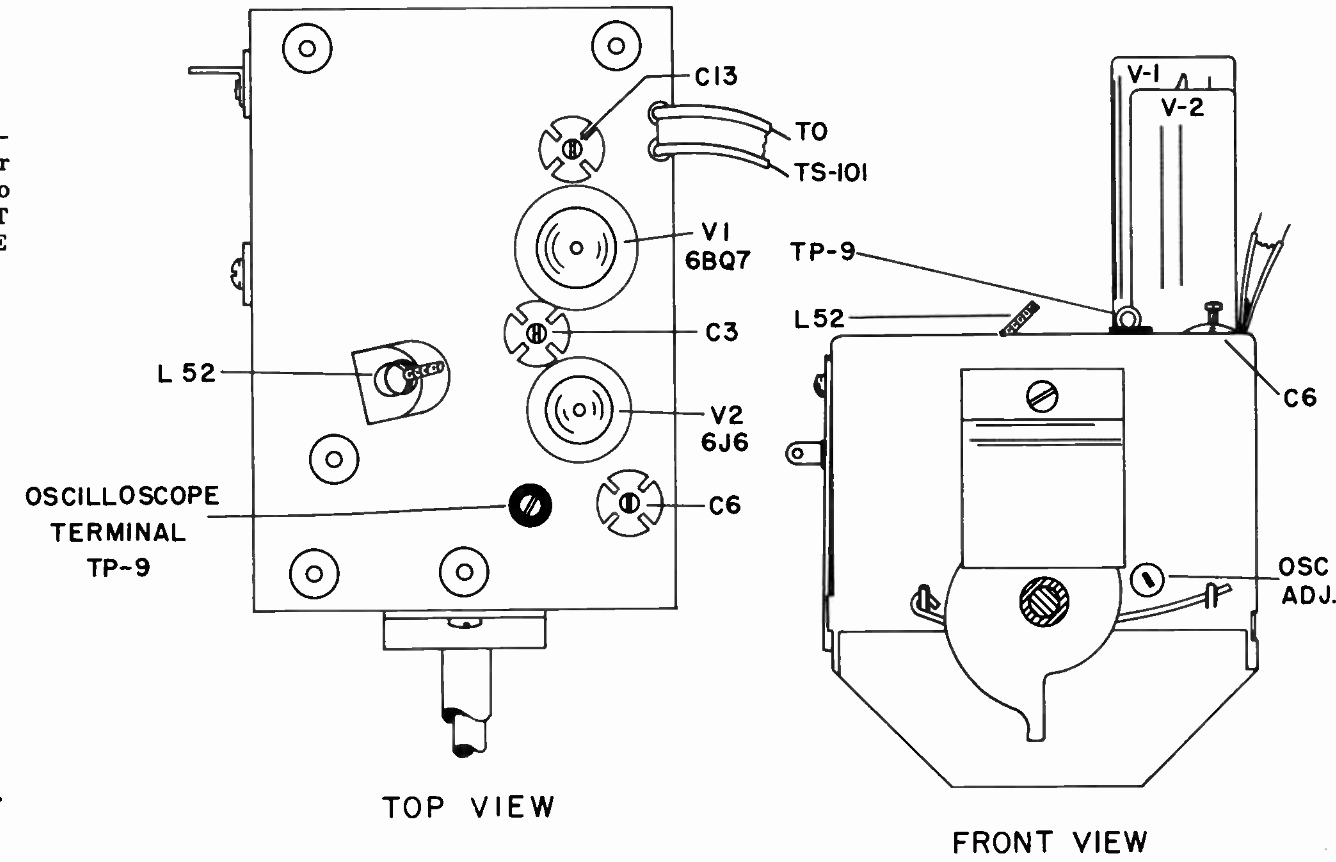


Fig. 56A. Top View Alignment Adjustments for TV Tuner with L-52 & L-113 Coupling Circuit

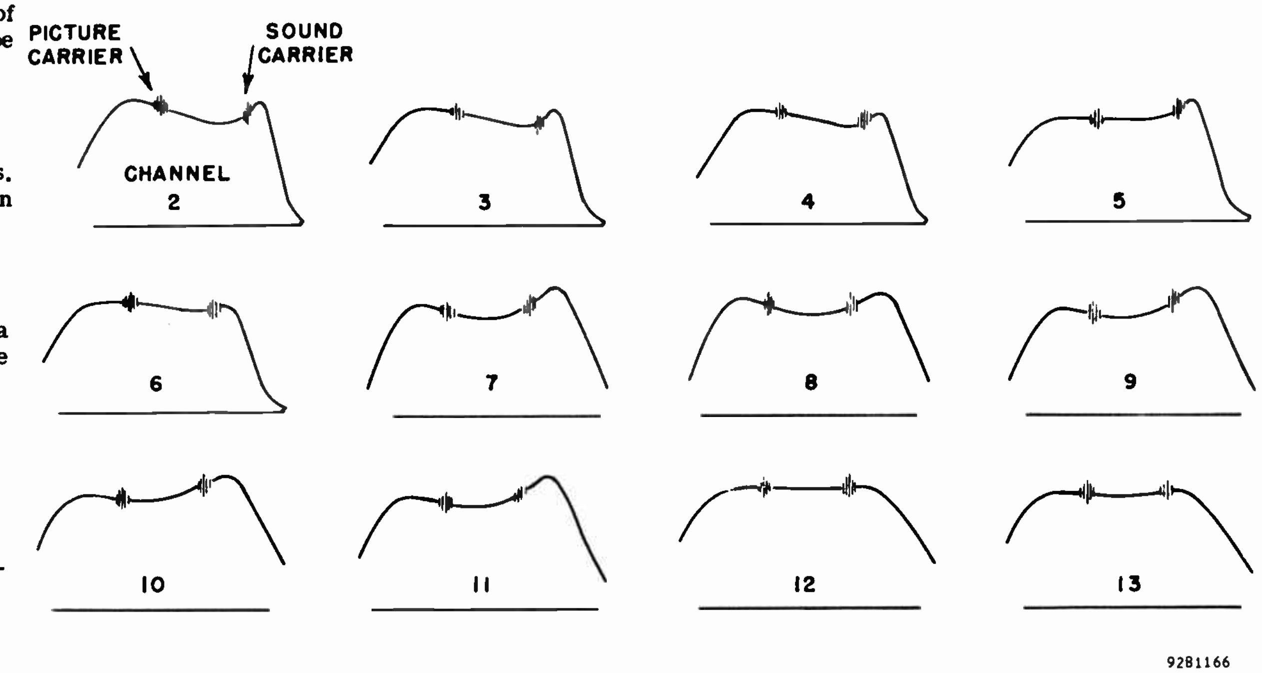


Fig. 56B. Typical Channel Response Curves for TV Tuners

TYPICAL OSCILLOSCOPE PATTERNS FOR L1100D CHASSIS

The patterns given on the following pages are presented as a guide when using an oscilloscope to locate trouble in the video amplifier, sync., horizontal oscillator, horizontal output, vertical oscillator, and vertical output stages of the tv receiver.

Considerable variation may be noted in the amplitude and shape of some of the various waveforms from one receiver to the next. As long as the waveform obtained from the receiver under test contains the same general characteristics as those shown in the illustrations and the relative amplitude is within approximately 25% of the peak to peak voltage or relative amplitude shown below each waveform the pattern obtained may be assumed to be correct. The patterns are observed with the tv receiver tuned to an active channel and the controls adjusted for the best possible picture.

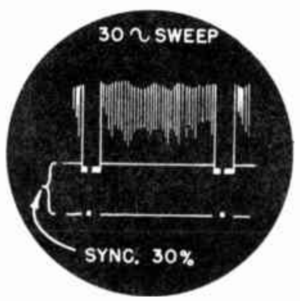
The waveforms shown in the illustrations were obtained on a Dumont type 304 oscilloscope which was used in conjunction with a low capacity 10 to 1 probe such as the Tel-Instrument Co. type 1610. Other types of oscilloscopes will account for a certain amount of variation in the amplitude and shape of the patterns obtained from the actual receiver under test. A low capacity probe must be used in order to obtain satisfactory results.

With the exception of the test pattern obtained across the vertical yoke all patterns are taken with the ground side of the oscilloscope connected to the ground or chassis of the tv chassis and the 10 to 1 probe connected to the specific points in the tv chassis as specified by each pattern.

The patterns obtained from the horizontal amplifier plate, damper cathode, and the high voltage rectifier tube must be observed by means of the high voltage probe which is made from a type 1X2-A tube as shown in Fig. 60A. The tube is used as a high voltage coupling capacitor. Use a new tube for this application because the loose filament of a burned out one may touch the plate. These patterns are also shown with their relative amplitudes indicated with respect to the pattern obtained at the cathode (topcap) of the damper tube, V-118, which is given a unit value of one.

At certain points throughout the tv receiver the oscilloscope pattern obtained will be dependent upon the frequency of the horizontal sweep oscillator in the oscilloscope. The oscilloscope sweep frequency must be either 30 cps (1/2 of the tv vertical oscillator frequency) or 7875 cps (1/2 of the tv horizontal oscillator frequency) depending upon the pattern desired. The sweep frequency required to obtain the patterns shown is given with each pattern.

VIDEO AMPLIFIER



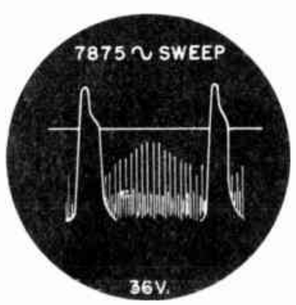
92C1500 1

V-105 Video Amp. grid (Pin 1)

V-105 Video Amp. plate (Pin 5) Adjust the contrast control to give a 40 volt peak to peak reading.

92C1500 7

SYNC. AMPLIFIER SEPARATOR AND CLIPPER



92C1500 8

V-106 Sync. Amp. grid (Pin 2)

V-106 Sync. Amp. plate (Pin 1)

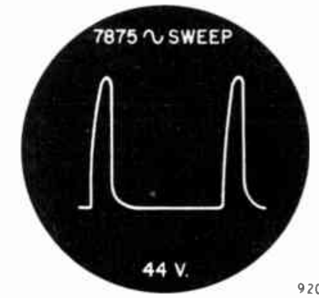
92C1500 9

SYNC. AMPLIFIER, SEPARATOR AND CLIPPER (Cont.)

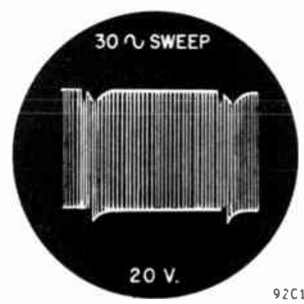
92C1500 10

V-106 Sync. Sep. plate (Pin 6)

V-107 Sync. Clipper Plate (Pin 1)



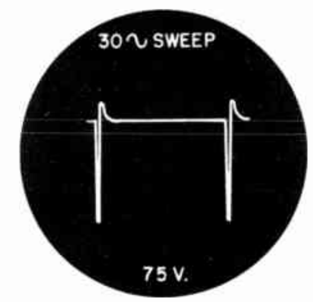
92C1501 4



92C1501 2

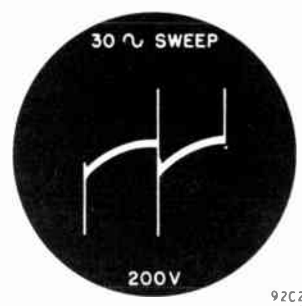
Input to Vertical Integrating Network (Junction of R-131, C-193, & R-129)

Cathode Ray Tube V-119 grid (Pin 2)



92C1501 3

VERTICAL OSCILLATOR AND VERTICAL AMPLIFIER

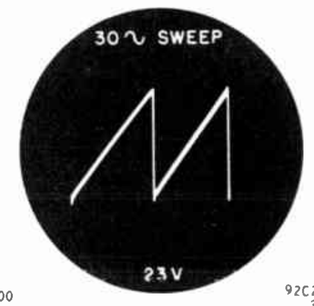


92C2004 1

V-107 Vert. Osc. grid (Pin 4)

V-107 Vert. Osc. plate (Pin 5)

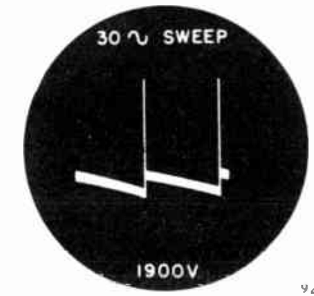
92C2004 2



92C2004 3

V-108 Vert. Amp. grid (Pin 1)

V-108 Vert. Amp. plate (Pin 5)



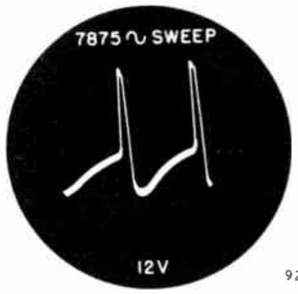
92C2004 4

92C2004
5

Vert. Deflection Yoke (Connect to Red and Green wires of T-107)

NOTE: When observing this test pattern the oscilloscope must not be grounded since the ground side of the 'scope is connected to B+ of the tv power supply. Do not touch the tv chassis and the 'scope during this observation as a severe shock will result.

HORIZONTAL OSCILLATOR



92C2004
6

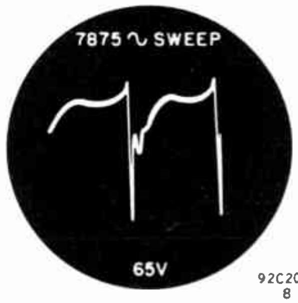
Junction of C-119, C-151 and C-156

V-115 Horiz. Osc. grid (Pin 1)

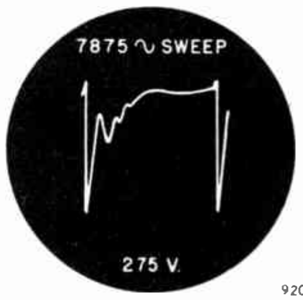
92C2004
7

NOTE: A low capacity probe as described on page 1953-57 must be used when viewing these waveforms. Use of a direct probe that places appreciable load on the circuit may result in an unstable and distorted pattern.

Junction of R-168, R-169, R-170, and R-173



92C2004
8

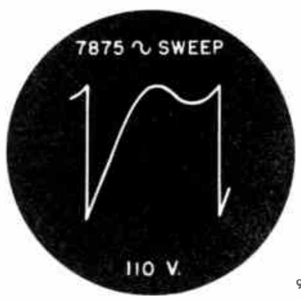


92C1503
7

V-115 Horiz. Osc. grid (Pin 4)

V-115 Horiz. Osc. plate (Pin 5)

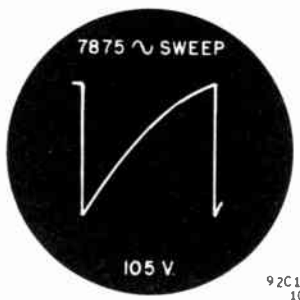
92C2004
9



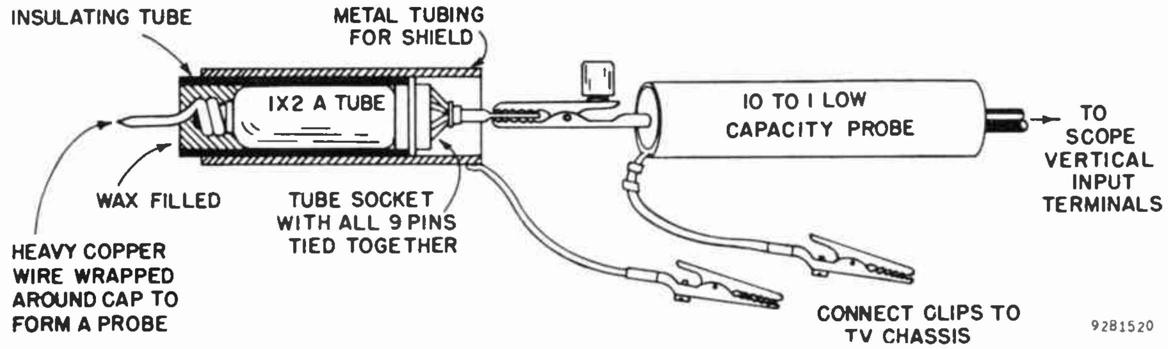
92C1503
9

Horiz. Osc. Trans. T-111 Terminal C

Horiz. Osc. Trans. T-111 Terminal D



92C1503
10



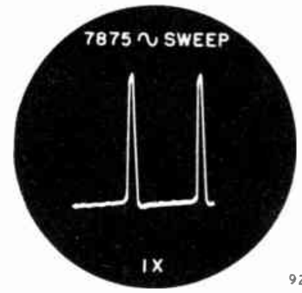
92B1520

Fig. 60A. High Voltage Probe for Waveform Observations

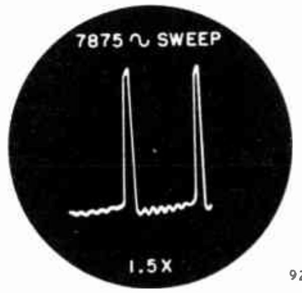
HORIZONTAL AMPLIFIER, DAMPER, AND HIGH VOLTAGE RECTIFIER TYPICAL OSCILLOSCOPE PATTERNS

NOTE: Before endeavoring to view the following waveforms read the notes and instructions at the beginning of this section pertaining to waveforms. The high voltage probe shown below will have to be used.

V-117 Damper Cathode (top cap)



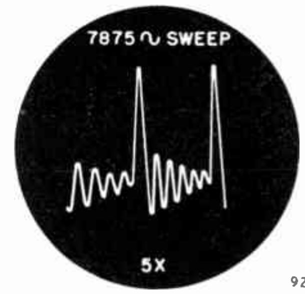
92C2004
10



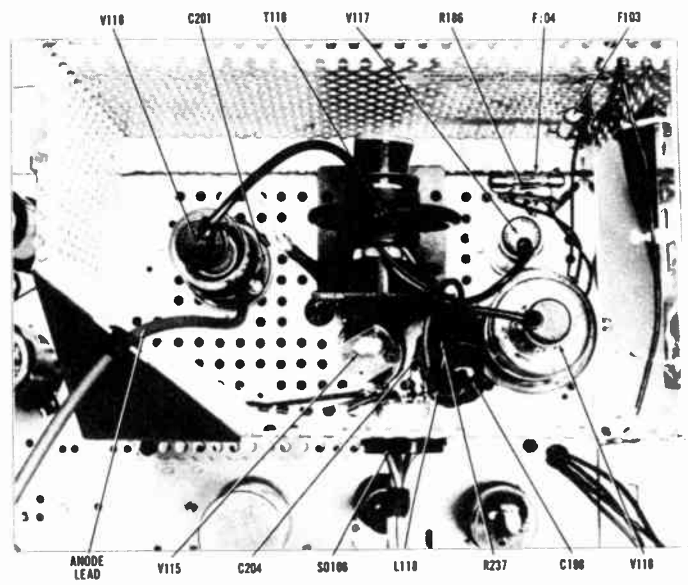
92C2004
11

V-116 Horizontal Amp. Plate (top cap)

V-118 High Voltage Rectifier Plate (top cap)

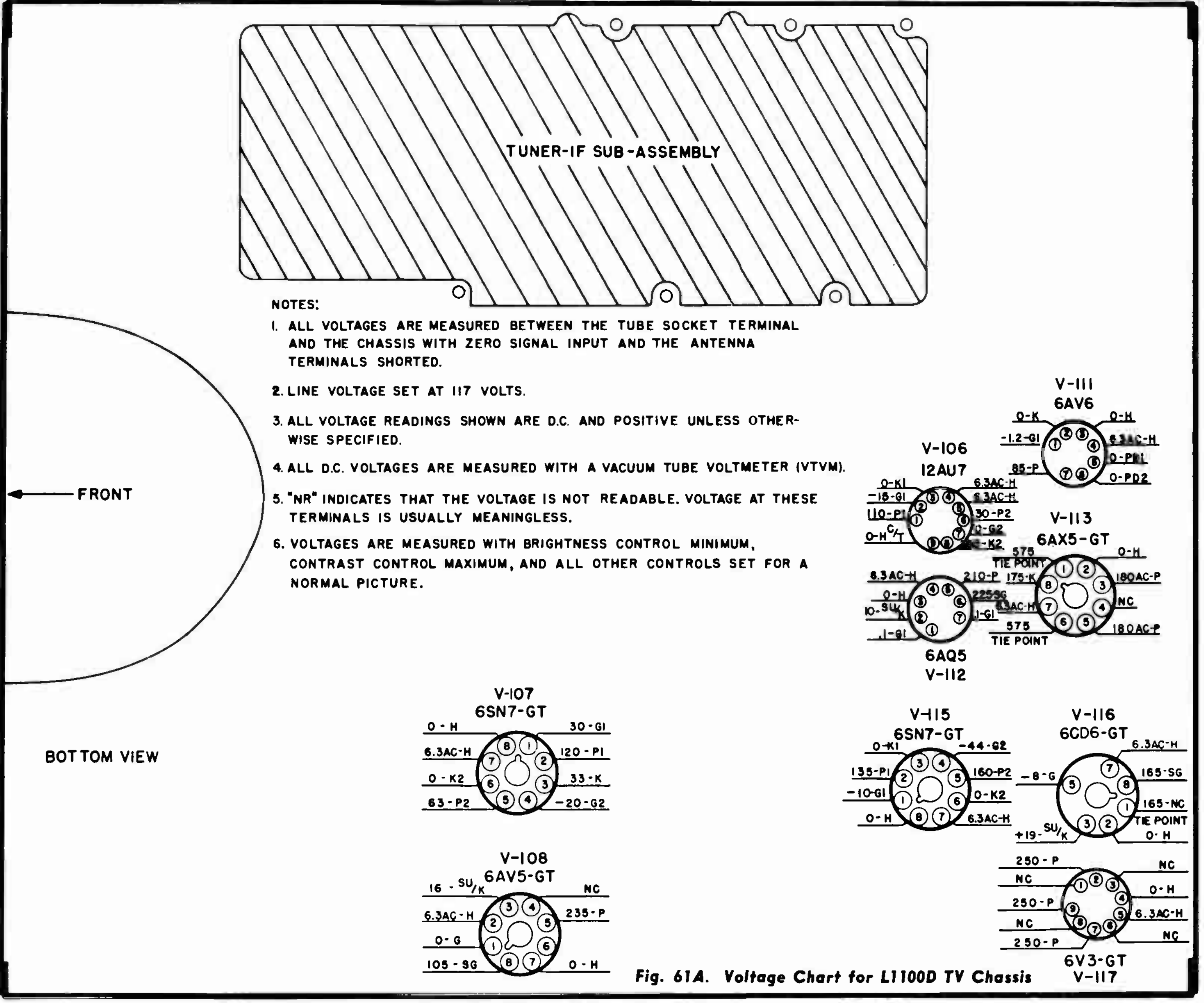


92C2004
12



92X2001

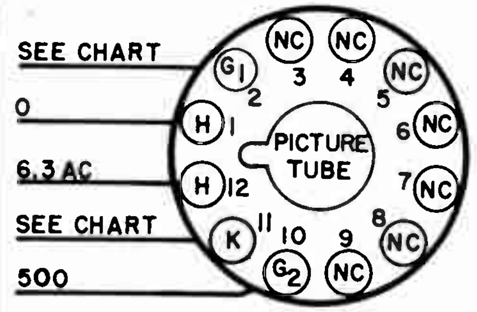
Fig. 60B. High Voltage Compartment Component Location



NOTES:
1. ALL VOLTAGES ARE MEASURED BETWEEN THE TUBE SOCKET TERMINAL AND THE CHASSIS WITH ZERO SIGNAL INPUT AND THE ANTENNA TERMINALS SHORTED.
2. LINE VOLTAGE SET AT 117 VOLTS.
3. ALL VOLTAGE READINGS SHOWN ARE D.C. AND POSITIVE UNLESS OTHERWISE SPECIFIED.
4. ALL D.C. VOLTAGES ARE MEASURED WITH A VACUUM TUBE VOLTMETER (VTVM).
5. "NR" INDICATES THAT THE VOLTAGE IS NOT READABLE. VOLTAGE AT THESE TERMINALS IS USUALLY MEANINGLESS.
6. VOLTAGES ARE MEASURED WITH BRIGHTNESS CONTROL MINIMUM, CONTRAST CONTROL MAXIMUM, AND ALL OTHER CONTROLS SET FOR A NORMAL PICTURE.

Fig. 61A. Voltage Chart for L1100D TV Chassis

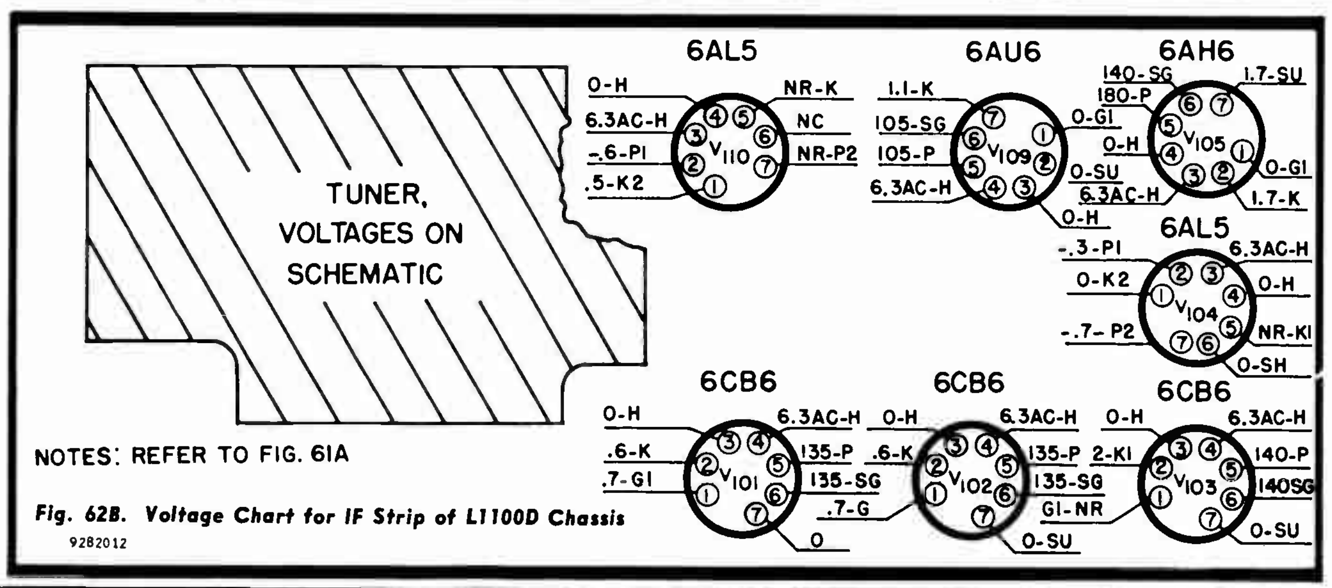
92C2013



PIN	CONTRAST MIN.		BRIGHTNESS MIN.	
	BRIGHTNESS		CONTRAST	
	MAX.	MIN.	MAX.	MIN.
11	155	145	145	145
2	120	22	22	22

9281665-1

Fig. 62A. Socket Voltage of 27" Picture Tube



NOTES: REFER TO FIG. 61A

Fig. 62B. Voltage Chart for IF Strip of L1100D Chassis

9282012

¶THE FOLLOWING KNOBS MAY BE USED FOR REPLACEMENT PROVIDED THEY ARE REPLACED AS A SET.

Knob, Channel Selector	15C589
Knob, Contrast Control	15C587
Knob, Fine Tuning	15C592
Knob, Off-On-Volume Control	15C586

CABINET SERVICE PARTS LIST FOR MODELS 1067 & 1068

For other parts other than those listed below refer to the appropriate chassis and picture tube mounting parts list and any supplementary material that has been added thereto.

DESCRIPTION	HALLICRAFTERS PART NUMBER 1067	1068
Antenna, Silver Vortex	57D147	57D147
Antenna Terminal Strip	88A020	88A020
Cabinet, Console	78F997	78F998
Cabinet Back Assembly	41A15456	41A15456
Cabinet Back Only	8E2026	8E2026
Glass, Safety	22D385	22D385
Knob, Brightness Control	15B581	15B581
¶Knob, Channel Selector	15C579	15C579
¶Knob, Contrast Control	15C517	15C517
¶Knob, Fine Tuning	15C492	15C492
Knob, Horizontal Hold Control	15A582	15A582
¶Knob, Off-On-Volume Control	15C577	15C577
Knob, Vertical Hold Control	15B584	15B584
Mask, Picture Tube	7D406	7D406
Nameplate	13A1046	13A1046
Shield, Picture Tube, Mounted on Cabinet Back	69A593	69A593
Speaker, 10 inch PM	85C147	85C147

SERVICE PARTS LIST

The following parts list may be used to determine replacement parts for the chassis L1200D. To determine the correct replacement parts, first refer to the schematic and determine the correct schematic symbol for the part. Refer to the Service Parts List for the part number and description of the component with the same schematic symbol.

The picture tube and its associated mounting components are listed in a separate parts list. Cabinet parts may be determined by referring to the pages devoted to individual models.

COILS AND TRANSFORMERS

Schematic Symbol	Description	Hallicrafters Part Number
T-102	Transformer, 1st i-f amplifier	50A475
T-103	Transformer, 2nd i-f amplifier	51B1332 or 50A476
T-104	Transformer, 3rd i-f amplifier	50A475
T-108	Transformer, ratio detector	50C473
T-109	Transformer, audio output	55B150
T-111	Transformer, horizontal oscillator	51B1242
T-117	Transformer, vertical oscillator	55B190
T-118	Transformer, vertical output	55C207
T-119	Transformer, horizontal output	55C208
T-120	Transformer, power	52C275
L-101	Coil, video peaking (wound on R-113)	51A1256
L-102	Coil, video peaking (wound on R-114)	51A1260
L-103	Coil, video peaking (wound on R-120)	51A1257
L-104,106	Coil, 4.5 MC TRAP, LIMITER GRID adjustment	51B1333 or 50B474
L-105	Coil, video peaking (wound on R-121)	51A1259
L-112	Choke, heater	53A200
L-113	Coil, mixer i-f	51B1301
L-114	Choke, r-f	53B008
L-116	Coil, HORIZONTAL LINEARITY control	51C1470
L-117	Coil, WIDTH control	51-1637
L-118	Yoke coupling network (wound on C-204)	53B283
L-119	Choke, filter	56B159
L-120	Deflection Yoke	53-277

TUBE COMPLEMENT

Schematic Symbol	Description	Hallicrafters Part Number
V-1	6BK7 or 6BQ7, r-f amp. (part of tuner assembly)	---------
V-2	6J6, oscillator/mixer (part of tuner assembly)	---------
V-101, 102, 103	6CB6, 1st, 2nd & 3rd 1-f amplifiers	90X6CB6
V-104,110	6AL5, video and fm detectors	90X6AL5
V-105	6AH6, video amplifier	90X6AH6
V-106	12AU7, sync amplifier and separator; or	90X12AU7
	6SN7-GT, same as above	90X6SN7-GT
V-107,115	6SN7-GT, sync clipper and vertical osc - horizontal osc	90X6SN7
V-108	6AV5, vertical amplifier	90X6AV5
V-109	6AU6, sound i-f amplifier	90X6AU6
V-111	6AV6, audio amplifier; or	90X6AV6
	6SQ7, same as above	90X6SQ7
V-112	6AQ5, audio output	90X6AQ5
V-113	6AX5-GT, low voltage rectifier	90X6AX5-GT
V-114	5U4G, low voltage rectifier	90X5U4G
V-116	6CD6, horizontal amplifier	90X6CD6
V-117	6V3, damper	90X6V3
V-118	1B3-GT, high voltage rectifier	90X1B3-GT
V-119	27EP4, picture tube	90X27EP4

CAPACITORS

Schematic Symbol	Description	Hallicrafters Part Number
CRL-102	Audio coupling network	49A017
C-101,102,103,104, 106,107,163,164, 176,178,180,199	5000 mmf. 450 V. ceramic	47A168
C-108,177	10 mmf. 500 V., ceramic	47B20100K5
C-109,110	.5 mfd. 25 V., tubular	46A177
C-111	100 mfd. 10 V., electrolytic	45B170
C-113,128	47 mmf. 500 V., ceramic (part of L-104 & L-106)	---------
C-114	220 mmf. 500 V., mica	47X20B221K
C-115,116, 143,146	.05 mfd. 600 V., tubular	46AY503J
C-117	68 mmf. 500 V., ceramic	47B20680K5
C-118	Dual 10 mfd. 450 V., electrolytic	45A172
C-119	120 mmf. 500 V., mica	47X20B121K
C-120,144	.5 mfd. 200 V., tubular	46AT504J
C-124,134,136	.01 mfd. 600 V., tubular	46AY103J
C-126	60-40 mfd. 450 V. 75 mfd. 50 V.; electrolytic	45B173
C-129	Dual 4000 mmf. 450 V., ceramic	47A218
C-132,154	5 mfd. 50 V., electrolytic	45B175
*C-133	330 mmf. 500 V., ceramic	47B20331K5
C-135,188	40-40 mfd. 250 V., 40 mfd. 450 V.; 20 mfd. 25 V.; electrolytic	45B174
C-137,175	.1 mfd. 200 V., tubular	46AU104J
*C-138	.01 mfd., 1000 V., tubular	46BS103J10
C-139	Part of L-120	------------
C-140	20 mfd., 450 V. electrolytic	45B208
C-145	.02 mfd. 600 V., tubular	45AY203J
*C-147	330 mmf. 500 V., silver mica	47X20D331K
*C-148	.01 mfd. 400 V., tubular	46BR103E4
C-150,151	82 mmf. 500 V , mica	47X20B820K
C-156	330 mmf. 500 V., mica	47X20B331K
*C-167	5 mmf. 500 V., ceramic	47B20050K5
C-174	Dual .01 mfd. 500 V., ceramic	47-274
C-185	4.7 mmf. 500 V., ceramic	47A160-6
C-186	2000 mmf. 500 V., ceramic	47B20A202M5
C-187	8 mfd. 475 V., electrolytic	45A103
C-189	.01 mfd. 400 V., tubular	46BS103E4
C-190	.1 mfd. 400 V., tubular	46AV104J
C-191,192	.1 mfd. 400 V., moulded tubular	46BS104L4
C-193,194,195	.0047 mfd. 400 V., moulded tubular	46BS472L4
C-196,197	.047 mfd. 600 V., moulded tubular	46BS473L6
C-198	.47 mfd. 200 V., moulded tubular	46BS474J2
C-200	120 mmf. 3000 V., ceramic	47A296
C-201	500 mmf. 30,000 V., ceramic	47A314
C-202	2200 mmf. 500 V., mica	47X25B222K
C-203	820 mmf. 500 V., silver mica	47X25D821K
C-204	Part of L-118	---------

RESISTORS

Schematic Symbol	Description	Hallicrafters Part Number
R-101,134,163, 222	4700 ohms ½ watt, carbon	23X20X472K
R-102,108,110, 111,210,224	100 ohms ½ watt, carbon	23X20X101K
R-103,106,112, 118,147,203	150 ohms ½ watt, carbon	23X20X151K
R-104,107,229	47 ohms ½ watt, carbon	23X20X470K
R-105,226,227	1200 ohms ½ watt, carbon.	23X20X123K
R-109,122,137, 220	10,000 ohms ½ watt, carbon	23X20X103K
R-113	6800 ohms, (part of L-101)	---------
R-114,121	2200 ohms, (part of L-102 & L-105)	---------
R-115,145	1 megohm ½ watt, carbon	23X20X105K
R-116	3300 ohms ½ watt, carbon	23X20X332K
R-117,123	220,000 ohms ½ watt, carbon	23X20X224K
R-120	15,000 ohms ½ watt, carbon	23X20X153K
R-124	2.2 megohms, ½ watt, carbon	23X20X225K
R-125,194	270,000 ohms, ½ watt, carbon	23X20X274K
R-126,132	47,000 ohms, ½ watt, carbon	23X20X473K
R-127	5600 ohms, 2 watt carbon	23X40X562K
R-128,168,204, 205	820,000 ohms ½ watt, carbon	23X20X824K
R-129,131	2200 ohms ½ watt, carbon	23X20X222K

* USE EXACT REPLACEMENT PARTS ONLY.

SERVICE PARTS LIST (Cont.)

RESISTORS (Cont.)

Schematic Symbol	Description	Hallicrafters Part Number
R-130	6800 ohms ½ watt, carbon	23X20X682K
R-146	2.5 megohms, HEIGHT control	25B711
R-149	270 ohms ½ watt, carbon	23X20X271K
R-150	33,000 ohms ½ watt, carbon	23X20X333K
*R-151,152	10,000 ohms ½ watt, carbon	23X20X103J
R-153	10 megohms ½ watt, carbon	23X20X106K
R-155,235	270 ohms 1 watt, carbon	23X30X271K
R-156	10,000 ohms, 1 watt, carbon	23X30X103K
R-157	100,000 ohms ½ watt, carbon	23X20X104K
R-160,161,162	Part of L-120	---------
R-164	750 ohms 10 watt, WW flat	24A920
R-165	3900 ohms ½ watt, carbon	23X20X334K
*R-166	120,000 ohms 1 watt, carbon	23X30BF124K
*R-169	82,000 ohms 1 watt, carbon	23X30BF823J
*R-170,177	330,000 ohms 1 watt, carbon	23X30BF334J
*R-173	150,000 ohms 1 watt, carbon	23X30BF154J
R-175	8200 ohms ½ watt, carbon	23X20X822K
R-176	50,000 ohms, HORIZONTAL DRIVE CONTROL	25A858
R-179	470,000 ohms ½ watt, carbon	23X20X474K
R-185	1 megohm 1 watt, carbon	23X30X105K
R-186	150,000 ohms ½ watt, carbon	23X20X154K
R-206	47,000 ohms 1 watt, carbon	23X30X473K
R-207	1200 ohms ½ watt, carbon	23X20X122K
R-209	1500 ohms 2 watt, carbon	23X40X152K
R-215	1000 ohms ½ watt, carbon	23X20X102K
R-225,247	1 megohm/2500 ohms, VOLUME/CONTRAST control	25B1039
R-231	120,000 ohms 1 watt, carbon	23X30X124K
R-232	1.8 megohm 1 watt, carbon	23X30BF185K
R-233	47,000 ohms 1 watt, carbon	23X30BF473K
R-234	820,000 ohms 1 watt, carbon	23X30BF823K
R-236	470,000 ohms 1 watt, carbon	23X30X474K
R-237	39 ohms 2 watts, carbon	23X40X390K
R-238	18,000 ohms 2 watts, carbon	23X40X183K
R-239,240	47,000 ohms 2 watts, carbon	23X40X473K
R-241	8200 ohms 2 watts, carbon	23X40X822K
R-242	150 ohms 5 watts, WW	24A972
R-243	1000 ohms 10 watt, WW	24BG102D
R-244	750 ohms, VERTICAL LINEARITY control	25B999
R-245,248	50,000 ohms/1 megohm, HORIZONTAL/VERTICAL HOLD control	25B1036
R-246	50,000 ohms, BRIGHTNESS control	25A1037
R-249	22,000 ohms ½ watt, carbon	23X20X223K
R-250	470 ohms 1 watt, carbon	23X30X471K

* USE EXACT REPLACEMENT PARTS ONLY.

MISCELLANEOUS PARTS FOR TV CHASSIS

Schematic Symbol	Description	Hallicrafters Part Number
PL-105	Anode Lead	10A538
	Bearing, phenolic, tuner shaft mtg.	8B1141
	Bracket, rear control guard	67B1438
F-103	Fuse, 4 amp., slow blow	39A383
F-104	Fuse, .3 amp., slow blow	39A382
PL-101 & PL-102	Line cord assembly, includes plug at each end	87A1668-1
PL-103	Plug, speaker	10A372
	Shield, miniature tube, i-f strip	69A232
	Shield, tube; V-107	69A356
	Shield, high voltage supply (less cover)	69-548
	Shield, cover, high voltage supply	66-888
	Socket assembly, high voltage rectifier tube	6A355
SO-101	Socket, a-c power	10A286
	Socket, miniature 7 pin tube; wafer (1 5/8" mtg. center)	6B314
	Socket, miniature 7 pin tube; wafer (1 1/4" mtg. center)	6A340
	Socket, miniature 9 pin tube; wafer (1 5/16" mtg. center)	6A388
	Socket, miniature 9 pin tube; moulded; mica filled	6A360
	Socket, octal; moulded	6B296
SO-106	Socket, octal; moulded; mica filled (pins 4 & 6 deleted)	6A373
	Socket, pix tube; includes leads	6-462
SO-103	Socket, speaker	10A373
S-101	Switch, OFF-ON; part of R-225	---------
TS-101	Terminal strip, antenna	88A020 or 88A679
	VHF TUNING UNIT ASSEMBLY, complete; includes tubes	1E1441

V-1 & V-2 (REFER TO PART NUMBER STAMPED ON SIDE OF TUNER CHASSIS)

PICTURE TUBE AND MOUNTING COMPONENTS

Schematic Symbol	Description	Hallicrafters Part Number
	Picture Tube, 27 inch rectangular; glass	90X27EP4
	Board, pix tube mtg.	78D990
	Bracket, deflection yoke mtg.; upper	67C2124
	Bracket, deflection yoke support	67-2126
	Bracket, yoke mtg. & rear pix tube support (mounts on board)	67D2125
	Bracket, PM focus and centering assembly mtg.	67C2123
	Bracket, pix tube mtg., front	67C2122
	Bracket, pix tube stop	67-2133
	Channel, rubber, pix tube stop	16A297
	Collar, rubber, pix tube mtg.	16-323
	Cushion, rubber, pix tube mtg. strap	16-325
L-120	Deflection yoke assembly (includes leads & plug, PL-104)	53-277
	Focus (PM) & centering assembly	51-1638
	Ion Trap	21-151
	Keeper, anode lead	8A1375
	Pad, rubber; front pix tube mtg. bracket	16-324
	Rod, round steel, bracket support	74-585
	Spring, anode keeper, 3¼" long	75A203
	Spring, anode keeper, 1½" long	75A202
	Spring, flat; pix tube ground	75B246
	Strap, pix tube mtg., with end brackets	76A1043
	Screw, pix tube mtg. strap	3BRCH/A
	Screw, wing, deflection yoke adj.	3A1610
	Spacer, deflection yoke adj.	73A580

1E1441 TV TUNER SERVICE PARTS LIST

MISCELLANEOUS PARTS

Schematic Symbol	*	Description	Cross Reference	Hallicrafters Part Number
V-1	1.	Tube, R.F	6BK7 or 6BQ7	90X6BK7 90X6BQ7
V-2	2.	Tube, Oscillator/Mixer	6J6	90X6J6
	3.	Shield, R.F. Tube	16S-004	69-604
	4.	Shield, Osc./Mixer Tube	16S-006	69-605
	5.	Shield, Side	31B-143	121A046
	6.	Shield, Bottom Cover	31B-103	121A045
	7.	Roller, Detent	31B-016	121A027
	8.	Spring, Detent	31B-005	121A031
	9.	Spring, Shaft Retaining Front	31B-030	121A030
	10.	Spring, Shaft Retaining Rear	31A-109	75-279
	11.	Spring, Fine Tuner Ground	31B-008	121A029

	12. Plate, Fine Tuner Ground	31B-012	121A036
	13. Strap, Fine Tuner Mounting	31B-021	76-1096
	14. Washer, Fibre	11D-022	121A028
	15. Fine Tuner Hot Plate & Lead	31B-252	87-4174
	16. Trimmer, Ceramic & Lead; Ant.	31A-079	121A063
	17. Trimmer, Ceramic & Lead; R-F	31A-056	121A060
	19. Nut, Trimmer Spring	10E-401	121A257
	20. Screw, Trimmer ...	9A-410-7	121A061
	21. Contact Bracket Assembly	31B-278	121A044
	25. Slug, Oscillator Tuning	31B-015	121A033
	26. Spring, Slug Retaining	31A-010	121A034
	28. Fine Tuner Shaft & Blade	31A-115-106	74-603
	29. Drum Assembly without Coils	31B-203-106	1-1707
	38. Core, I.F. Tuning	20C-055	77-631
L-52	40. I.F. Coil & Core Assembly	31B-275-5	51-1707
L-1,2	41. Antenna Strip, Channel 2	31F-522Q	88A853
	42. " " " 3	31F-523Q	88A854
	43. " " " 4	31F-524Q	88A855
	44. " " " 5	31F-525Q	88A856
	45. " " " 6	31F-526Q	88A857
	46. " " " 7	31F-527Q	88A858
	47. " " " 8	31F-528Q	88A859
	48. " " " 9	31F-529Q	88A860
	49. " " " 10	31F-530Q	88A861
	50. " " " 11	31F-531Q	88A862
	51. " " " 12	31F-532Q	88A863
	52. " " " 13	31F-533Q	88A864
L-3,4,5	53. Oscillator Strip, Channel 2	31F-622Q	88A865
	54. " " " 3	31F-623Q	88A866
	55. " " " 4	31F-624Q	88A867
	56. " " " 5	31F-625Q	88A868
	57. " " " 6	31F-626Q	88A869
	58. " " " 7	31F-627Q	88A870
	59. " " " 8	31F-628Q	88A871
	60. " " " 9	31F-629Q	88A872
	61. " " " 10	31F-630Q	88A873
	62. " " " 11	31F-631Q	88A874
	63. " " " 12	31F-632Q	88A875
	64. " " " 13	31F-633Q	88A876

* This number refers to the corresponding number in figure 71A.

RESISTORS

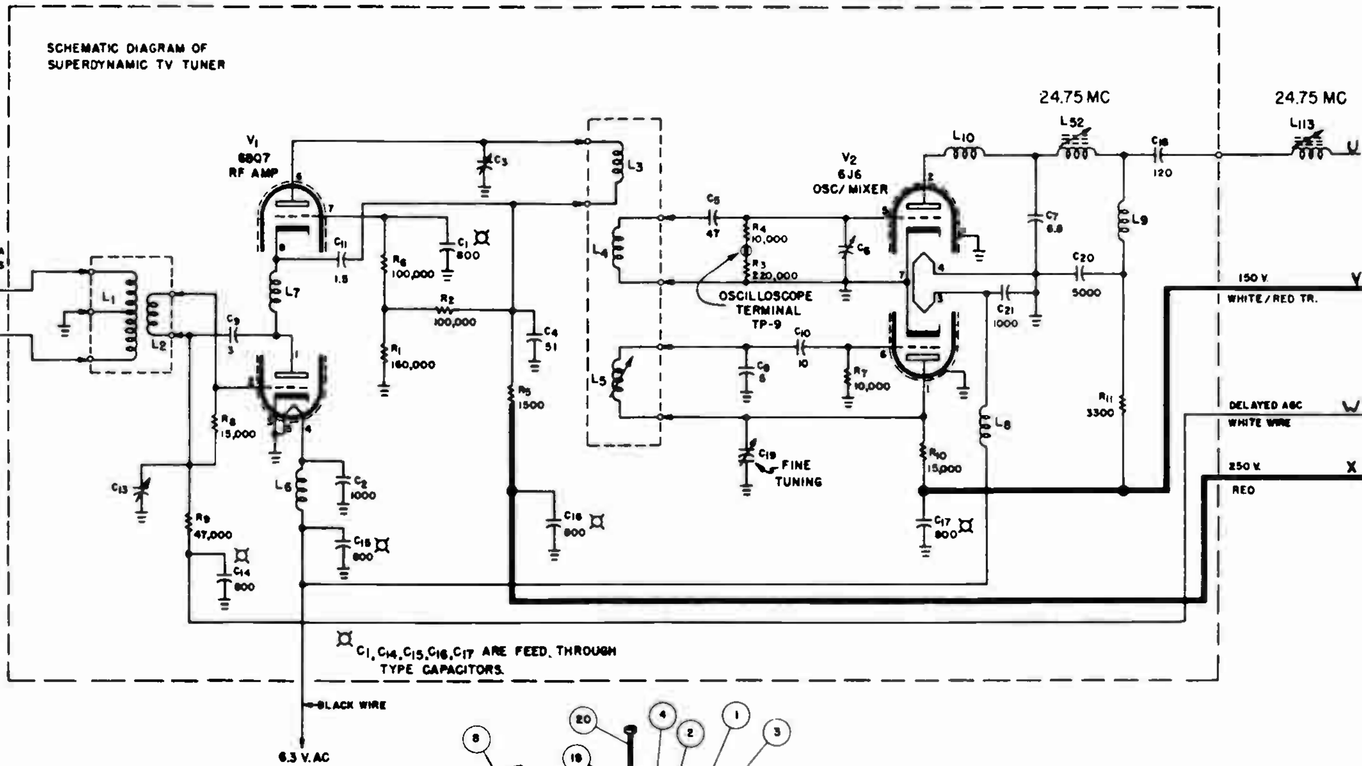
Schematic Symbol	Description	Cross Reference	Hallicrafter Part Number
R-1	160,000 ohms, ½ watt, carbon	12A-167	23X20X164J
R-2	100,000 ohms, ½ watt, carbon	12A-160	23X20X104J
R-3	220,000 ohms, ½ watt, carbon	12A-094	23X20X224K
R-4,7	10,000 ohms, ½ watt, carbon	12A-040	23X20X103K
R-5	1500 ohms, ½ watt, carbon	12A-027	23X20X152J
R-6	100,000 ohms, ½ watt, carbon	12A-047	23X20X104K
R-8,10	15,000 ohms, ½ watt, carbon	12A-004	23X20X153K
R-9	47,000 ohms, ½ watt, carbon	12A-039	23X20X473K
R-11	3300 ohms, ½ watt, carbon	12A-150	23X20X332K

CAPACITORS

Schematic Symbol	Description	Cross Reference	Hallicrafters Part Number
C-1,14,15,16,17	800 mmf. GMV. ceramic feed through	13D-153	121A048
C-2,21	1000 mmf. GMV. ceramic disc	CD8X-102A	47-383
C-3,6	Trimmer, Ceramic & Lead-R.F. & Osc. -.5-3 mmf.	31A-056	44-433
C-4	51 mmf. ceramic disc	CD8Q-510J	47-384
C-5	47 mmf. ceramic disc	CD8Q-470K	121A047
C-7	6.8 mmf. NPO ceramic disc	CD8C-6R8C	47-385
C-8	5 mmf. N750, ceramic disc	CD8U-050C	47-386
C-9	3 mmf. NPO, ceramic disc	CD8C-030C	47-387
C-10	10 mmf. NPO, ceramic disc	CD10C-100K	47-388
C-11	1.5 mmf. NPO, ceramic disc	CD8C-1R5M	47-389
C-13	Trimmer, ceramic & lead-ant.	31A-079	44-434
C-18	120 mmf. ceramic tubular	CD8D-121K	47-390
C-19	Fine Tuning Control	See Miscellaneous Parts	
C-20	5000 mmf. ceramic disc		47-391

COILS

Schematic Symbol		Cross Reference	Hallicrafters Part Number
L-1,2,3,4,5,52	See Page 1953-70		
L-6	Choke, r-f heater	34A-546	121A049
L-7	Choke, cascode coupling	31B-629	121A050
L-8	Choke, osc. heater	34A-575	121A051
L-9	Choke, mixer plate feed	31B-230	53-300
L-10	Choke, mixer plate	31B-638	53-301



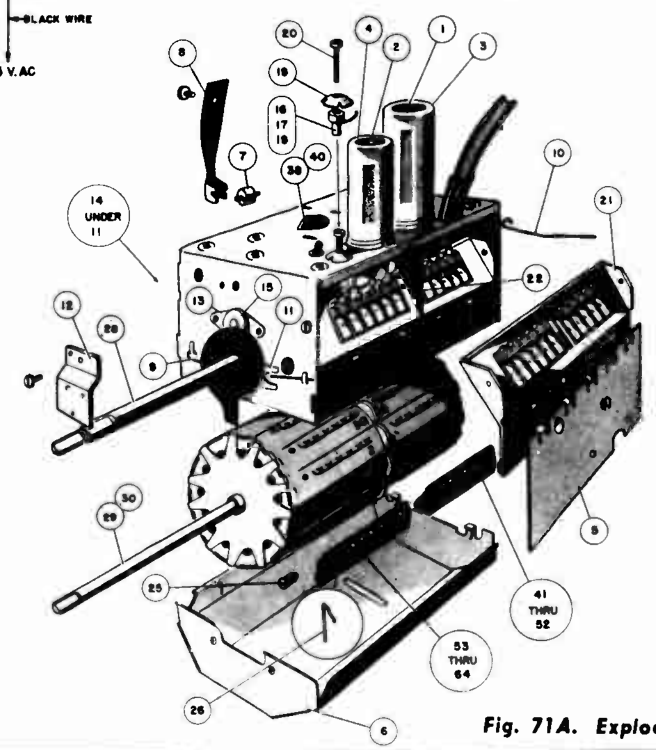
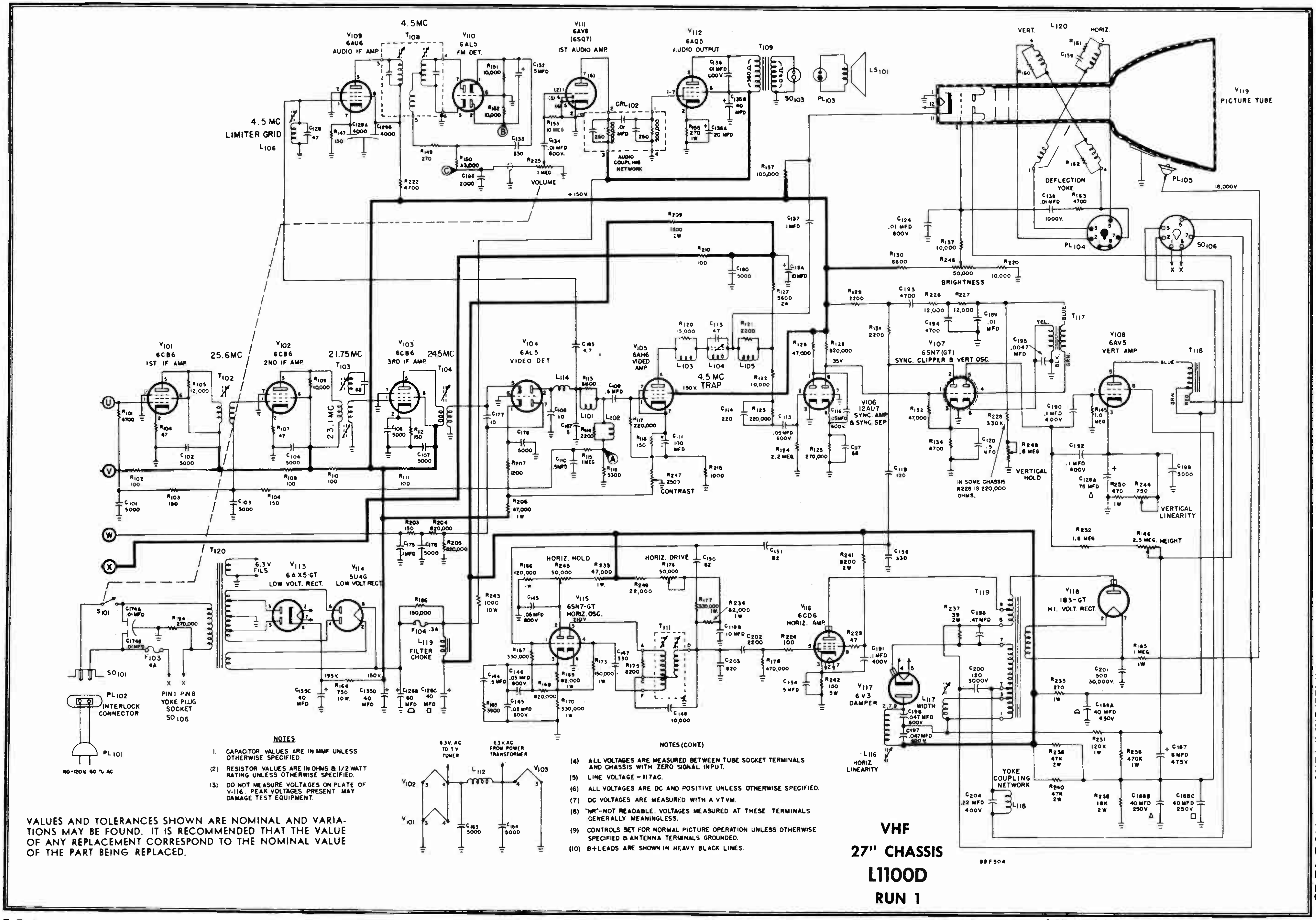


Fig. 71A. Exploded View of TV Tuner 1E1441



NOTES

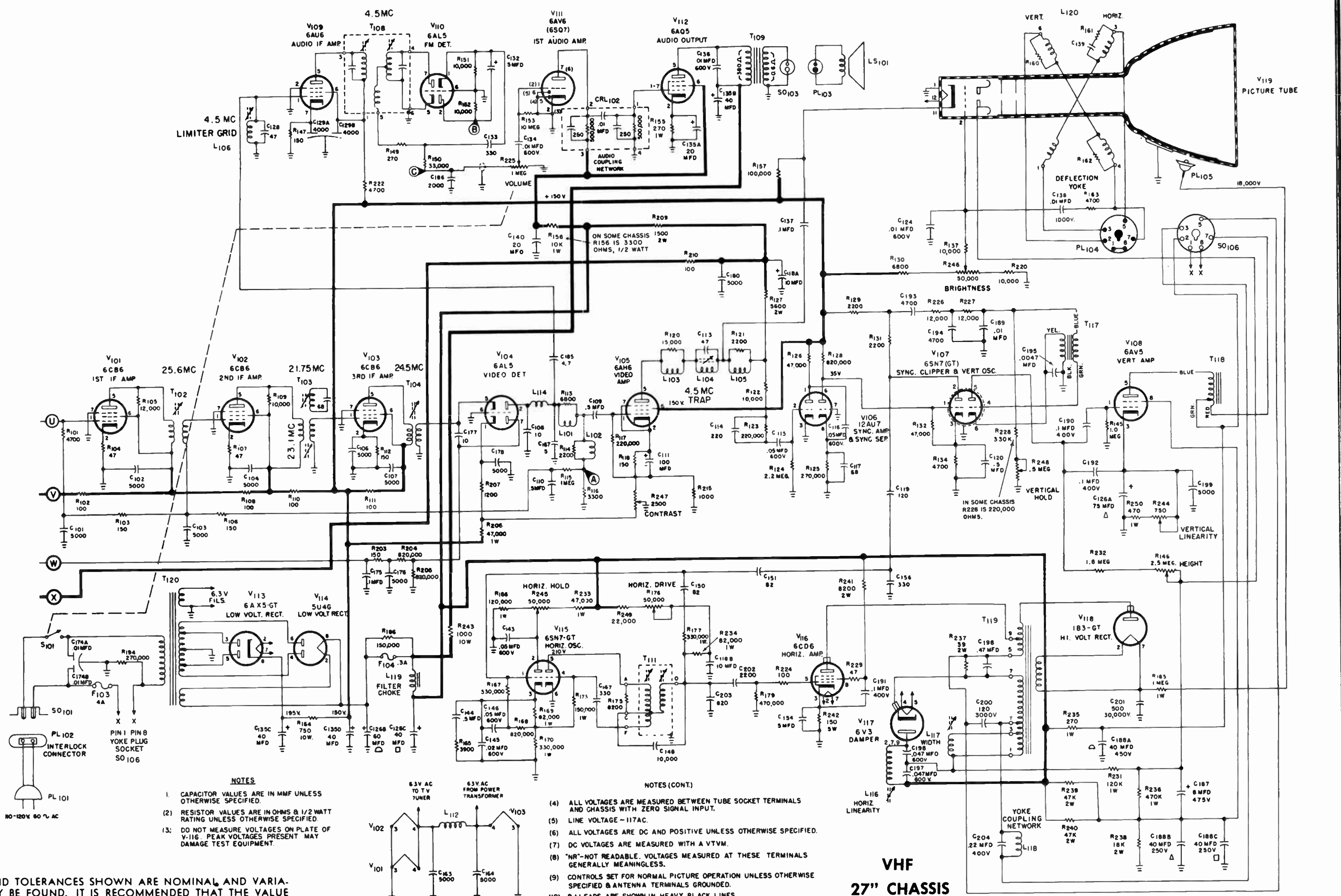
1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
(2) RESISTOR VALUES ARE IN OHMS & 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
(3) DO NOT MEASURE VOLTAGES ON PLATE OF V-116. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

NOTES (CONT.)

(4) ALL VOLTAGES ARE MEASURED BETWEEN TUBE SOCKET TERMINALS AND CHASSIS WITH ZERO SIGNAL INPUT.
(5) LINE VOLTAGE - 117AC.
(6) ALL VOLTAGES ARE DC AND POSITIVE UNLESS OTHERWISE SPECIFIED.
(7) DC VOLTAGES ARE MEASURED WITH A VTVM.
(8) "NR"-NOT READABLE. VOLTAGES MEASURED AT THESE TERMINALS GENERALLY MEANINGLESS.
(9) CONTROLS SET FOR NORMAL PICTURE OPERATION UNLESS OTHERWISE SPECIFIED & ANTENNA TERMINALS GROUNDED.
(10) B+LEADS ARE SHOWN IN HEAVY BLACK LINES.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF
27" CHASSIS
L1100D
RUN 1



NOTES

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
(2) RESISTOR VALUES ARE IN OHMS & 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
(3) DO NOT MEASURE VOLTAGES ON PLATE OF V-116. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

NOTES (CONT.)

(4) ALL VOLTAGES ARE MEASURED BETWEEN TUBE SOCKET TERMINALS AND CHASSIS WITH ZERO SIGNAL INPUT.
(5) LINE VOLTAGE – 117AC.
(6) ALL VOLTAGES ARE DC AND POSITIVE UNLESS OTHERWISE SPECIFIED.
(7) DC VOLTAGES ARE MEASURED WITH A VTVM.
(8) "NR"–NOT READABLE. VOLTAGES MEASURED AT THESE TERMINALS GENERALLY MEANINGLESS.
(9) CONTROLS SET FOR NORMAL PICTURE OPERATION UNLESS OTHERWISE SPECIFIED & ANTENNA TERMINALS GROUNDED.
(10) B+LEADS ARE SHOWN IN HEAVY BLACK LINES.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF
27" CHASSIS
L1100D
RUN 2

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92X1803

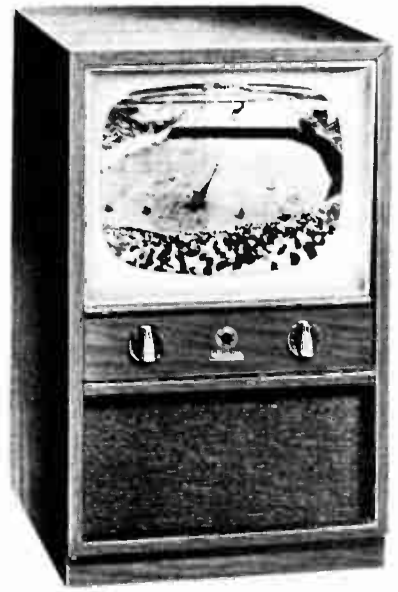
Fig. 109A. Model 1010P, Mahogany

92X1806

Fig. 111A. Model 1012P, Mahogany

92X1807

Fig. 113A. Model 1021P, Mahogany



92X1816

Fig. 115A. Model 1026P, Mahogany

CHASSIS .... A, K OR W1200D

RUN NUMBER ..... 1 FOR ALL CHASSIS

GENERAL SPECIFICATIONS

ANTENNA............ EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE .... 300 OHMS
TUNING .... 12 CHANNELS, 2-13
POWER SUPPLY .... 110-120 V., 60 CYCLES
POWER INPUT .... 145 WATTS
TUBES............... 18, INCLUDING PIX TUBE
SPEAKER.............. 6½" ELECTRODYNAMIC
PICTURE CARRIER IF .... 26.25 MC
SOUND CARRIER IF................. 21.75 MC
INTERCARRIER SOUND SYSTEM .... 4.5 MC
CABINET FINISH .... MAHOGANY
PICTURE TUBE ...... 17" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
TV TUNER .... 1C1345 PENTODE

TUBE COMPLEMENT

V-1	6BC5	R-F AMPLIFIER
V-2	6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	12SN7GT or •6SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	25BQ6GT or •6BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4	DAMPER
V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	25L6GT/G or •6W6	AUDIO OUTPUT AMPLIFIER
V-116	17HP4	PICTURE TUBE

* The 1B3GT tube may be replaced by removing the cabinet bottom and the high voltage compartment shield without removing the chassis from the cabinet.
• Used only in K1200D Chassis.

CHASSIS .... L, D or X1200D

RUN NUMBER 1

GENERAL SPECIFICATIONS

ANTENNA............ EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE .... 300 OHMS
TUNING .... 12 CHANNELS, 2-13
POWER SUPPLY .... 110-120 V., 60 CYCLES
POWER INPUT .... 145 WATTS
TUBES............... 18, INCLUDING PIX TUBE
SPEAKER... 1021P ...... 6½" ELECTRODYNAMIC
SPEAKER... 1026P ...... 8" ELECTRODYNAMIC
PICTURE CARRIER IF .... 26.25 MC
SOUND CARRIER IF................. 21.75 MC
INTERCARRIER SOUND SYSTEM .... 4.5 MC
CABINET FINISH .... MAHOGANY
PICTURE TUBE ...... 20" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
TV TUNER .... 1C1345 PENTODE

Model 1021P TUBE COMPLEMENT

V-1	6BC5	R-F AMPLIFIER
V-2	6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	12SN7GT or •6SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	25BQ6GT or •6BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4	DAMPER
V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	25L6GT/G or •6W6	AUDIO OUTPUT AMPLIFIER
V-116	17HP4	PICTURE TUBE

* The 1B3GT tube may be replaced by removing the cabinet bottom and the high voltage compartment shield without removing the chassis from the cabinet.
• Used only in L1200D Chassis.

Model 1026P TUBE COMPLEMENT

V-1	*6BC5	R-F AMPLIFIER	V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-2	*6J6	OSCILLATOR/MIXER	V-109	6BQ6GT	HORIZONTAL OUTPUT
V-101	6CB6	FIRST I-F AMPLIFIER	V-110	12AX4	DAMPER
V-102	6CB6	SECOND I-F AMPLIFIER	V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-103	6CB6	THIRD I-F AMPLIFIER	V-112	6AU6	SOUND I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER	V-113	6AL5	RATIO DETECTOR
V-105	6SN7GT	SYNC CLIPPER	V-114	6C4	AUDIO AMPLIFIER
V-106	12BH7	VERT. OSC. & OUTPUT	V-115	6W6	AUDIO OUTPUT AMPLIFIER
V-107	6AL5	HORIZONTAL A.F.C.	V-116	20HP4	PICTURE TUBE

* These tubes may be replaced by removing the cabinet bottom without removing the chassis from the cabinet. Remove the high voltage compartment shield to replace V-111.

92X1849

Fig. 117A. Model 1013C, Mahogany

CHASSIS F1200D

RUN NUMBER 1

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	8" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	MAHOGANY
PICTURE TUBE	17" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
TV TUNER	1C1376 CASCODE

TUBE COMPLEMENT

V-1	*6BZ7 or 6BQ7	R-F AMPLIFIER	V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-2	*6J6	OSCILLATOR/MIXER	V-109	6BQ6GT	HORIZONTAL OUTPUT
V-101	6CB6	FIRST I-F AMPLIFIER	V-110	12AX4	DAMPER
V-102	6CB6	SECOND I-F AMPLIFIER	V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-103	6CB6	THIRD I-F AMPLIFIER	V-112	6AU6	SOUND I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER	V-113	6AL5	RATIO DETECTOR
V-105	6SN7GT	SYNC CLIPPER	V-114	6C4	AUDIO AMPLIFIER
V-106	12BH7	VERT. OSC. & OUTPUT	V-115	6W6	AUDIO OUTPUT AMPLIFIER
V-107	6AL5	HORIZONTAL A.F.C.	V-116	17HP4	PICTURE TUBE

* These tubes may be replaced by removing the cabinet bottom without removing the chassis from the cabinet. Remove the high voltage compartment shield to replace V-111.

92X1850

Fig. 119A. Model 1022C, Mahogany

TUBE COMPLEMENT

V-1	*6BZ7 or 6BQ7	R-F AMPLIFIER
V-2	*6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	6SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	6BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4	DAMPER
V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	6W6	AUDIO OUTPUT AMPLIFIER
V-116	20HP4	PICTURE TUBE

* These tubes may be replaced by removing the cabinet bottom without removing the chassis from the cabinet. Remove the high voltage compartment shield to replace V-111.

92X1851

Fig. 121A. Model 1027C, Mahogany

CHASSIS G1200D

RUN NUMBER 1

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER . 1027C	8" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	MAHOGANY
PICTURE TUBE	20" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
TV TUNER	1C1376 CASCODE
SPEAKER . 1022C	6½" ELECTRODYNAMIC

TUBE COMPLEMENT

V-1	*6BZ7 or 6BQ7	R-F AMPLIFIER	V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-2	*6J6	OSCILLATOR/MIXER	V-109	25BQ6GT	HORIZONTAL OUTPUT
V-101	6CB6	FIRST I-F AMPLIFIER	V-110	12AX4	DAMPER
V-102	6CB6	SECOND I-F AMPLIFIER	V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-103	6CB6	THIRD I-F AMPLIFIER	V-112	6AU6	SOUND I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER	V-113	6AL5	RATIO DETECTOR
V-105	12SN7GT	SYNC CLIPPER	V-114	6C4	AUDIO AMPLIFIER
V-106	12BH7	VERT. OSC. & OUTPUT	V-115	25L6GT/G.	AUDIO OUTPUT AMPLIFIER
V-107	6AL5	HORIZONTAL A.F.C.	V-116	20HP4	PICTURE TUBE

* The 1B3GT tube may be replaced by removing the cabinet bottom and the high voltage compartment shield without removing the chassis from the cabinet.

92X1880

Fig. 139A. Model 1062C, Mahogany

92X1881

Fig. 141A. Model 1063C, Mahogany

CHASSIS J1200D
RUN NUMBER 1

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	8" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	MAHOGANY
PICTURE TUBE	21" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
TV TUNER	1E1380 CASCODE

TUBE COMPLEMENT

V-1	*6BQ7	R-F AMPLIFIER
V-2	*6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	6SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	6BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4	DAMPER
V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	6W6	AUDIO OUTPUT AMPLIFIER
V-116	21MP4	PICTURE TUBE

* These tubes may be replaced by removing the cabinet bottom without removing the chassis from the cabinet. Remove the high voltage compartment shield to replace V-111.

CHASSIS P1200D
RUN NUMBER 1

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	6½" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	BROWN ,EBONY PLASTIC
PICTURE TUBE	17" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
TV TUNER	1C1345 PENTODE

92X1873

Fig. 123A. Model 1051P, Ebony

TUBE COMPLEMENT

V-1	6BC5	R-F AMPLIFIER
V-2	6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	12SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	25BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4	DAMPER
V-111	1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	25L6GT/G	AUDIO OUTPUT AMPLIFIER
V-116	17HP4	PICTURE TUBE

CHASSIS R1200D
RUN NUMBER 1

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	6½" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	BLONDE , MAHOGANY
PICTURE TUBE	21" RECTANGULAR GLASS OR METAL WITH ELECTROSTATIC FOCUS
TV TUNER	1C1345 PENTODE

92X1874

Fig. 127A. Model 1053P, Mahogany

92X1875

Fig. 129A. Model 1054P, Blonde

TUBE COMPLEMENT

V-1	6BC5	R-F AMPLIFIER
V-2	6J6	OSCILLATOR/MIXER
V-101	6CB6	FIRST I-F AMPLIFIER
V-102	6CB6	SECOND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER
V-105	12SN7GT	SYNC CLIPPER
V-106	12BH7	VERT. OSC. & OUTPUT
V-107	6AL5	HORIZONTAL A.F.C.
V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-109	25BQ6GT	HORIZONTAL OUTPUT
V-110	12AX4	DAMPER
V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-112	6AU6	SOUND I-F AMPLIFIER
V-113	6AL5	RATIO DETECTOR
V-114	6C4	AUDIO AMPLIFIER
V-115	25L6GT/G	AUDIO OUTPUT AMPLIFIER
V-116	21FP4A or 21MP4	PICTURE TUBE

* These tubes may be replaced by removing the cabinet bottom without removing the chassis from the cabinet. Remove the high voltage compartment shield to replace V-111.

Fig. 131A. Model 1055C, Mahogany

92X1876

CHASSIS T1200D

RUN NUMBER 1

GENERAL SPECIFICATIONS

ANTENNA	EXTERNAL OR BUILT IN SILVER VORTEX
ANTENNA INPUT IMPEDANCE	300 OHMS
TUNING	12 CHANNELS, 2-13
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	18, INCLUDING PIX TUBE
SPEAKER	8", 6½" ELECTRODYNAMIC
PICTURE CARRIER IF	26.25 MC
SOUND CARRIER IF	21.75 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	BLONDE . MAHOGANY
PICTURE TUBE	21" RECTANGULAR METAL WITH ELECTROSTATIC FOCUS
TV TUNER	1C1376 CASCODE

Fig. 135A. Model 1060C, Mahogany

92X1878

Fig. 133A. Model 1056C, Blonde

92X1877

Fig. 137A. Model 1061C, Blonde

TUBE COMPLEMENT

V-1	*6BZ7 or 6BQ7	R-F AMPLIFIER	V-108	6SN7GT	HORIZONTAL OSCILLATOR
V-2	*6J6	OSCILLATOR/MIXER	V-109	6BQ6GT	HORIZONTAL OUTPUT
V-101	6CB6	FIRST I-F AMPLIFIER	V-110	12AX4	DAMPER
V-102	6CB6	SECOND I-F AMPLIFIER	V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-103	6CB6	THIRD I-F AMPLIFIER	V-112	6AU6	SOUND I-F AMPLIFIER
V-104	6AH6	VIDEO AMPLIFIER	V-113	6AL5	RATIO DETECTOR
V-105	6SN7GT	SYNC CLIPPER	V-114	6C4	AUDIO AMPLIFIER
V-106	12BH7	VERT. OSC. & OUTPUT	V-115	6W6	AUDIO OUTPUT AMPLIFIER
V-107	6AL5	HORIZONTAL A.F.C.	V-116	21MP4	PICTURE TUBE

* These tubes may be replaced by removing the cabinet bottom without removing the chassis from the cabinet. Remove the high voltage compartment shield to replace V-111.

92X1935

Fig. 145A. Model 1058U, Mahogany Brown.

CHASSIS Y1200D

RUN NUMBERS . . . . . . 1, 2, 3, 4, & 5

GENERAL SPECIFICATIONS

VHF & UHF ANTENNAS	EXTERNAL OR BUILT IN
VHF & UHF ANT. INPUT IMPEDANCE	300 OHMS
VHF TUNING	12 CHANNELS, 2-13
UHF TUNING	69 CHANNELS, 14-83
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	19 INCLUDING PIX TUBE
SPEAKER	6½" ELECTRODYNAMIC
PICTURE CARRIER IF	45.75 MC
SOUND CARRIER IF	41.25 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	MAHOGANY BROWN PLASTIC
PICTURE TUBE	17" RECTANGULAR GLASS WITH ELECTROSTATIC FOCUS
VHF TUNER	1E1483 CASCODE 16 POSITION
UHF TUNER	1E1484 WITH SILICON DIODE MIXER

TUBE COMPLEMENT

V-1	6BZ7	VHF R-F AMPLIFIER	V-109	6BQ6GT	HORIZONTAL OUTPUT
V-2	6X8	VHF OSCILLATOR/MIXER	V-110	12AX4	DAMPER
V-101	6CB6	FIRST I-F AMPLIFIER	V-111	1B3GT	HIGH VOLTAGE RECTIFIER
V-102	6CB6	SECOND I-F AMPLIFIER	V-112	6AU6	SOUND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER	V-113	6AL5	RATIO DETECTOR
V-104	6AH6	VIDEO AMPLIFIER	V-114	6C4	AUDIO AMPLIFIER
V-105	6SN7GT	SYNC CLIPPER	V-115	6W6	AUDIO OUTPUT AMPLIFIER
V-106	12BH7	VERT. OSC. & OUTPUT	V-116	17HP4	PICTURE TUBE
V-107	6AL5	HORIZONTAL A.F.C.	V-301	6AF4	UHF OSCILLATOR
V-108	6SN7GT	HORIZONTAL OSCILLATOR			

92X1879

92X1934

Fig. 143A. Model 1057U, Mahogany.

CHASSIS Z1200D

RUN NUMBERS . . . . . . 1, 1A, 2, 3, 4, & 5

GENERAL SPECIFICATIONS

VHF & UHF ANTENNAS	EXTERNAL OR BUILT IN
VHF & UHF ANT. INPUT IMPEDANCE	300 OHMS
VHF TUNING	12 CHANNELS, 2-13
UHF TUNING	69 CHANNELS, 14-83
POWER SUPPLY	110-120 V., 60 CYCLES
POWER INPUT	145 WATTS
TUBES	19 INCLUDING PIX TUBE
SPEAKER	6½" ELECTRODYNAMIC
PICTURE CARRIER IF	45.75 MC
SOUND CARRIER IF	41.25 MC
INTERCARRIER SOUND SYSTEM	4.5 MC
CABINET FINISH	WOOD MAHOGANY
PICTURE TUBE	21" RECTANGULAR METAL WITH ELECTROSTATIC FOCUS
VHF TUNER	1E1483 CASCODE 16 POSITION
UHF TUNER	1E1484 WITH SILICON DIODE MIXER

TUBE COMPLEMENT

V-1	*6BZ7	R-F AMPLIFIER	V-109	6BQ6GT	HORIZONTAL OUTPUT
V-2	*6X8	OSCILLATOR/MIXER	V-110	12AX4	DAMPER
V-101	6CB6	FIRST I-F AMPLIFIER	V-111	*1B3GT	HIGH VOLTAGE RECTIFIER
V-102	6CB6	SECOND I-F AMPLIFIER	V-112	6AU6	SOUND I-F AMPLIFIER
V-103	6CB6	THIRD I-F AMPLIFIER	V-113	6AL5	RATIO DETECTOR
V-104	6AH6	VIDEO AMPLIFIER	V-114	6C4	AUDIO AMPLIFIER
V-105	6SN7GT	SYNC CLIPPER	V-115	6W6	AUDIO OUTPUT AMPLIFIER
V-106	12BH7	VERT. OSC. & OUTPUT	V-116	21MP4	PICTURE TUBE
V-107	6AL5	HORIZONTAL A.F.C.	V-301	6AF4	UHF OSCILLATOR
V-108	6SN7GT	HORIZONTAL OSCILLATOR			

* These tubes may be replaced by removing the cabinet bottom without removing the chassis from the cabinet. Remove the high voltage compartment shield to replace V-111.

CHASSIS IDENTIFICATION

A chassis stamp, located on the right side of the rear apron of the chassis, provides the necessary information to identify the chassis and thereby determine the applicable service data and schematic diagram. The first letter of this chassis stamp indicates the chassis type and the number with letter suffix designates the chassis series. A production run number is stamped directly below or to one side of the chassis identification stamp. At the start of production, chassis are stamped RUN 1. Whenever a major production change is made in the chassis, the run number changes to the next higher number.

CHASSIS NO.	MODELS CHASSIS MAY BE USED IN
A1200D, K1200D or W1200D	1010P, 1012P
D1200D, L1200D or X1200D	1021P, 1026P
F1200D	1013C
G1200D	1022C, 1027C
J1200D	1062C, 1063C
P1200D	1051P, 1052P
R1200D	1053P, 1054P
T1200D	1055C, 1056C, 1060C, 1061C
Y1200D (with UHF)	1058-U
Z1200D (with UHF)	1057-U

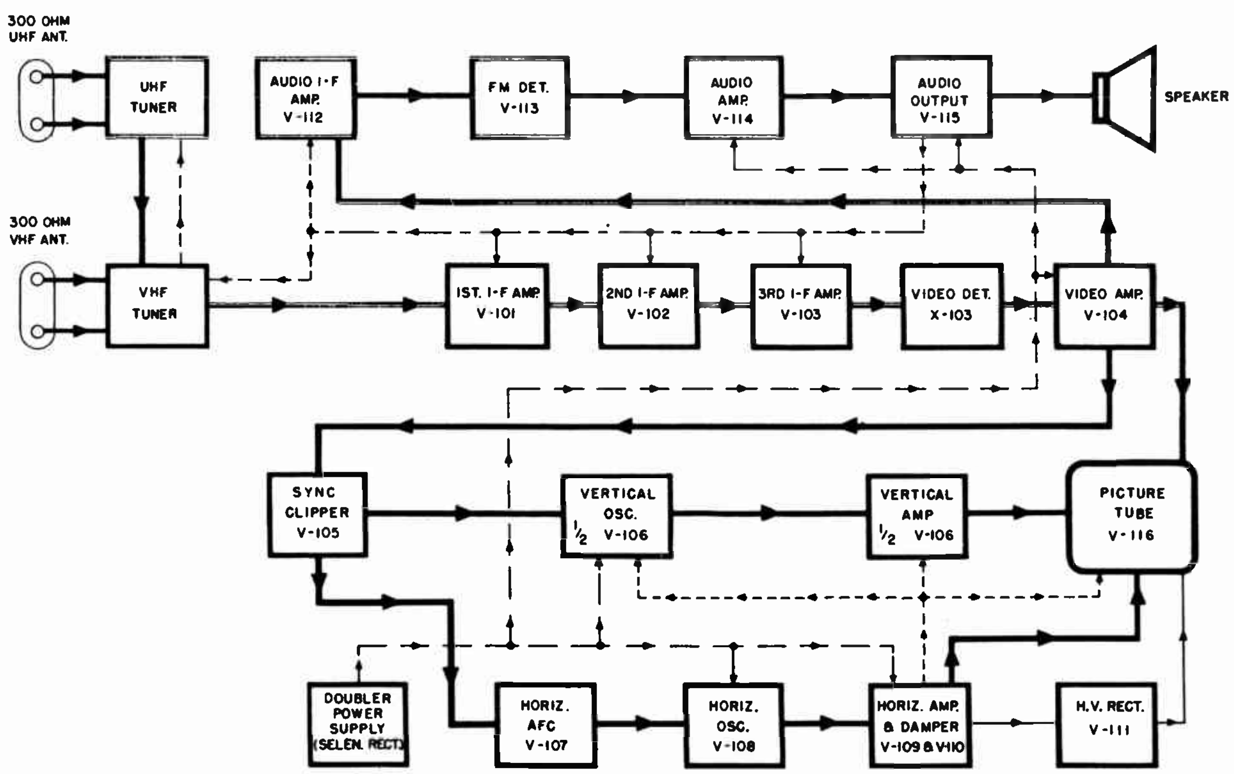


Fig. 72A. Block Diagram of a Typical Chassis

COMPARISON OF 1200 SERIES CHASSIS

The A1200D may be considered the basic chassis in the series 1200 chassis. The D, F, G, J, K, L, P, R, T, W, X, Y and Z1200D chassis are all based on the A1200D chassis with any one or more of the modifications shown on the following pages. See chart below for modifications used in any particular chassis.

COMPARISON CHART FOR 1200 SERIES

CHASSIS	PIX TUBE SIZE See Modification I	HEATER CIRCUIT See Modification IV	TUNER TYPE See Modification VII	MODIFICATIONS USED and/or NOTES FOR RUN 1
A1200D	17" glass	Series-parallel	1C1345 Pentode	Basic 1200 series chassis.
D1200D	20" glass	Series-parallel	1C1345 Pentode	I except step D & II
F1200D	17" glass	Transformer	1C1376 Cascode	II, III, IV, VI & VII
G1200D	20" glass	Transformer	1C1376 Cascode	I, II, IV, VI & VII On some chassis, R-181 is 270,000 ohms and R-194 value is 100,000 or 120,000 ohms.
J1200D	21" metal	Transformer	1E1380 Cascode	I, IV, VI, VII, IX, X, XI, XII & XIV*
K1200D	17" glass	Transformer	1C1345 Pentode	IV & V
L1200D	20" glass	Transformer	1C1345 Pentode	I except step D, II, IV & V
P1200D	17" glass	Series-parallel	1C1345 Pentode	VI, IX & X
R1200D	21" metal or glass	Series-parallel	1C1345 Pentode	I, VI, VIII, IX, X, & XIV*
T1200D	21" metal	Transformer	1C1376 Cascode	I, IV, VI, VII, VIII, IX, X, XII & XIV*
W1200D	17" glass	Series-parallel	1C1345 Pentode	II & VI
X1200D	20" glass	Series-parallel	1C1345 Pentode	I, II & VI
Y1200D	17" glass	Transformer	1E1483 VHF Cascode & 1E1484 UHF	IV, VI, IX, X, XIII & XIV ★
Z1200D	21" metal	Transformer	1E1483 VHF Cascode & 1E1484 UHF	I, IV, VI, VIII, IX, X,• XII, XIII & XIV• ★

* Modification XIV will be found only in J, R, & T1200D chassis which have a RUN 1A chassis stamp.
• Only Run 1A and later Z1200D chassis have modifications X and XIV.
★ See page 33 for changes in Runs 2, 3, 4 and 5 of the Y1200D and Z1200D UHF chassis.

COMPARISON OF 1200 SERIES CHASSIS (Cont.)

LIST OF MODIFICATIONS

MODIFICATION I

To change from a 17 inch to a 20 or 21 inch picture tube the following changes are made:

LOCATION OF CHANGE	CHANGE MADE
A. High side of Horizontal Hold control	82,000 ohms, $\frac{1}{2}$ watt resistor (R-178) added.
B. Plate (pin 2) circuit of Horizontal Oscillator	220,000 ohms, $\frac{1}{2}$ watt resistor (R-179) added.
C. Plate supply decoupling of Horizontal Oscillator (pin 2)	.1 mfd., 600 v. paper capacitor (C-162) added.
D. Plate supply decoupling of Horizontal Oscillator (pin 2)	120,000 ohms, $\frac{1}{2}$ watt resistor (R-156) replaced by 180,000 ohms, $\frac{1}{2}$ watt resistor (R-194). The bottom of R-194 is returned to terminal 1 of T-109.
E. Plate (pin 2) circuit of Horizontal Oscillator	4700 ohms, $\frac{1}{2}$ watt resistor (R-157) replaced by 8200 ohms, $\frac{1}{2}$ watt resistor (R-180).
F. Plate (pin 2) circuit of Horizontal Oscillator	470 mmf. silver mica capacitor (C-145) replaced by 390 mmf. silver mica capacitor (C-163).
G. Horizontal Output stage grid coupling	5000 mmf. disc ceramic capacitor (C-146) replaced by 560 mmf. silver mica capacitor (C-164).
H. Horizontal Output stage grid leak	330,000 ohms, $\frac{1}{2}$ watt resistor (R-158) replaced by 390,000 ohms, $\frac{1}{2}$ watt resistor (R-181).
I. Horizontal Output stage screen bypass	.047 mfd., 400 v. paper capacitor (C-165) added
J. Horizontal Output stage screen resistor	10,000 ohms, 2 watts resistor (R-182) added.
K. Horizontal Output stage output transformer	Horizontal output transformer T-106 (55D193) replaced by T-109 (55D197).
L. Servo Loop feedback from Horizontal Output to AFC tube	Two 150,000 ohms, 1 watt resistors (R-151 & R-152) series connected replaced by 33,000 ohms, 1 watt resistor (R-177).
M. Series capacitor in doubler power supply	140 mfd., 150 v. electrolytic capacitor (C-135) replaced by 200 mfd., 150 v. electrolytic capacitor (C-161).
N. Audio voltage amplifier cathode resistor	1500 ohms, $\frac{1}{2}$ watt resistor (R-169) replaced by 1200 ohms, $\frac{1}{2}$ watt resistor (R-176)
O. Speaker	Speaker with field coil resistance of 85 ohms replaced by speaker with field coil resistance of 61 ohms

MODIFICATION II

The 75 mmf., 500 V. ceramic capacitor (C-142) connected from plate pin 5 to ground of the Horizontal Oscillator, V-108, is replaced by a 100 mmf., 500 v. silver mica capacitor (C-170). Some chassis have neither C-142 or C-170. The 100 mmf. capacitor, C-170, is the preferred capacitor.

MODIFICATION III

The horizontal integrating network in the grid circuit (pin 4) of the Horizontal Oscillator is changed as follows:

A. 4.7 megohms, $\frac{1}{2}$ watt resistor (R-149) is replaced by 470,000 ohms, $\frac{1}{2}$ watt resistor (R-189).
B. .003 mfd., 400 v. paper capacitor (C-139) is replaced by .005 mfd., 400 v. paper capacitor (C-167).
C. .01 mfd., 400 v. paper capacitor (C-141) is replaced by .05 mfd., 400 v. paper capacitor (C-168).

MODIFICATION IV

To replace series parallel heater arrangement with a heater transformer the following changes are made:

LOCATION OF CHANGE	CHANGE MADE
A. Between power line and Damper heater pin 8	190 ohms cold/19 ohms hot, 5 watts negative temperature coefficient resistor (R-143) deleted.
B. Heater string shunt	80 ohms, 10 watts, 5% resistor (R-144) deleted.
C. Heater string shunt	42 ohms, 3 watts, 5% resistor (R-145) deleted.
D. Heater string choke	Air core r-f choke (L-113) deleted.
E. First I.F. Amplifier heater bypass	4000 mmf. dual disc ceramic capacitor (C-104) deleted.
F. Ratio Detector heater bypass	5000 mmf. disc ceramic capacitor (C-106) deleted.
G. Video Amplifier heater bypass	5000 mmf. disc ceramic capacitor (C-158) deleted.
H. 4.5 MC Amplifier heater bypass	5000 mmf. disc ceramic capacitor (C-159) deleted.
I. Heater transformer	Auto transformer T-110 (52C258) added.
J. Sync. Clipper V-105	12SN7GT tube replaced by 6SN7GT tube.
K. Horizontal Output V-109	25BQ6GT tube replaced by 6BQ6GT tube.
L. Audio Output V-115	25L6GT tube replaced by 6W6 tube.
M. Audio Output tube socket wiring	Cathode pin 8 connected directly to heater pin 7 to place both heater and cathode at the same potential.

MODIFICATION V

LOCATION OF CHANGE	CHANGE MADE
A. Integrating network in Vert. Osc. grid circuit	22,000 ohms, $\frac{1}{2}$ watt resistor (R-133) replaced by 47,000 ohms, $\frac{1}{2}$ watt resistor (R-183).
B. AGC divider network in Sync. Clip. plate circuit	3300 ohms, $\frac{1}{2}$ watt resistor (R-132) replaced by 2200 ohms, $\frac{1}{2}$ watt resistor (R-184).
C. Horizontal Oscillator cathode resistor	1200 ohms, $\frac{1}{2}$ watt resistor (R-153) replaced by 1500 ohms, $\frac{1}{2}$ watt resistor (R-185).
D. Horizontal Oscillator plate circuit (pin 2)	4700 ohms, $\frac{1}{2}$ watt resistor (R-157) replaced by 8200 ohms, $\frac{1}{2}$ watt resistor (R-180).
E. Horizontal Oscillator plate circuit (pin 2)	470 mmf. silver mica capacitor (C-145) replaced by 390 mmf. silver mica capacitor (C-163).
F. Horizontal Oscillator Adjustment	Test point (A) removed and the Horizontal Oscillator Adjustment procedure changed. See page 1952-78.

MODIFICATION VI

This modification is composed of MODIFICATION V plus the following changes:

LOCATION OF CHANGE	CHANGE MADE
A. Sync. Clipper plate circuit (pin 2)	680,000 ohms, $\frac{1}{2}$ watt resistor (R-127) replaced by 1.2 megohms, $\frac{1}{2}$ watt resistor (R-190).
B. Sync. Clipper grid leak (pin 4)	22,000 ohms, $\frac{1}{2}$ watt resistor (R-130) replaced by 47,000 ohms, $\frac{1}{2}$ watt resistor (R-191).
C. High side of Horizontal Hold control	82,000 ohms, $\frac{1}{2}$ watt resistor (R-178) added.
D. Sync. Clipper plate (pin 5) circuit supply	10,000 ohms, 1 watt resistor (R-192) added.
E. Sync. clipper plate (pin 5) circuit supply	22,000 ohms, 1 watt resistor (R-193) added.
F. Sync. Clipper plate (pin 5) circuit supply	10 mfd., 150 v. electrolytic capacitor (C-169) added.
G. AGC Control Switch	Switch S-102 (60B500) replaced by S-103 (60B507).
H. AGC Control Switching	22,000 ohms, 1 watt resistor (R-188) added.

MODIFICATION VII

To use a 1C1376 Cascode tuner in place of the 1C1345 Pentode tuner the following changes are made:

A. The 1C1345 Pentode tuner is removed and replaced by the 1C1376 Cascode tuner. These two tuners do not have the same terminal connections. Refer to schematic diagram. The 1C1376 Cascode tuner may be used only with chassis which have a heater transformer.
B. A wire to supply 260 volts d-c is added between tuner terminal 4 of the Cascode tuner and the junction of R-120 (33,000 ohms, 1 watt, the video amplifier screen resistor) and the 260 volt "B" supply.

MODIFICATION VIII

Whenever the picture tube used has a metal cone which eliminates the high voltage filter capacitor built into tubes with an outer aquadag coating, C-166 (500 mmf. 20,000 volts) is required between pin 7 and ground of the 1B3GT high voltage rectifier. Resistor R-210 (1 megohm 1 watt) was added in series with the anode lead on some chassis with metal cone picture tubes.

MODIFICATION IX

A. A deeper chassis with a depth of 3 3/4" instead of 3" is used.
B. The tuner, three i-f amplifiers, video detector, video amplifier, 4.5 MC amplifier and the ratio detector are mounted on a separate sub-chassis.
C. Test socket SO-101 is deleted.
D. The 6C4 audio amplifier tube, V-114, is moved to a new location slightly forward and to one side of the vertical output transformer.

MODIFICATION X

The horizontal stabilizer coil L-108 (55B1536) is replaced by coil 51B1642 and its mounting plate 63A902. When coil 51B1642 is used for L-108, plate 63A902 must also be used and either C-142 (75 mmf.) or C-170 (100 mmf.) connected between pin 5 of the horizontal oscillator and ground is deleted. Coil 51B1642 is preferred. However, the 55B1536 coil will be found in some chassis. Use coil 51B1642 and plate 63A902 for replacement purposes.

MODIFICATION XI

To use a 1E1380 Cascode tuner in place of the 1C1345 Pentode tuner the following changes are made:

A. The 1C1345 Pentode tuner is removed and replaced by the 1C1380 Cascode tuner. The 1E1380 tuner does not have terminal lugs on the back. The wire leads from this tuner must be connected to the correct points in the chassis as shown in the schematic diagram. The 1E1380 tuner also requires a supply voltage of approximately 250 volts as shown in the schematic diagram. The 1E1380 tuner may be used only with 3 3/4" deep chassis which have a heater transformer.
B. Resistor R-101 (100,000 ohms, ½ watt) in the A.G.C. bus is not required.

MODIFICATION XII

The vertical and horizontal hold controls are moved from the rear apron of the chassis to a removable plate mounted on the front apron of the chassis.

MODIFICATION XIII

A 16 position VHF Cascode tuner (1E1483) is used along with the 1E1484 UHF tuner. At the same time, the i-f frequency is shifted to a higher frequency covering 41.25 MC to 45.75 MC instead of 21.75 MC to 26.25 MC. The associated circuit changes are easily identified in the schematic diagram by the schematic symbols in the 200 catagory which were assigned to those components required to make this change in i-f frequency.

MODIFICATION XIV

To improve vertical and horizontal sync particularly under extreme fringe area receiving conditions the following changes will be found in chassis which have a RUN 1A chassis stamp except the Y1200D which has this change in RUN 1.

A. 10,000 ohms, ½ watt resistor (R-124) replaced by 22,000 ohms, ½ watt resistor (R-195).
B. 470,000 ohms, ½ watt resistor (R-125) replaced by 220,000 ohms, ½ watt resistor (R-196).
C. 47,000 ohms, ½ watt resistor (R-183) replaced by 33,000 ohms, ½ watt resistor (R-197).
D. 22 mmf. 500 V., ceramic tubular capacitor (C-124) replaced by 47 mmf. 500 V., ceramic tubular capacitor (C-172).
E. 1000 mmf. 500 V., ceramic disc capacitor (C-171) added between pin 5 and ground of the 12AX4 damper tube V-110.

CHANGES FOR RUN 2 OF THE Y1200D & Z1200D CHASSIS

1. A 100 ohm ½ watt resistor (R-211) was added in series with the +B bus feeding V-101 and the tuner.

2. A 1000 mmf. ceramic disc capacitor (C-176) was added between the power supply side of R-211 and ground.

3. A 1000 mmf. ceramic disc capacitor (C-175) was added between the power supply side of R-209 and ground. The other side of R-209 is connected to pin 10 of the VHF tuner.

4. The UHF input coil in the VHF tuner (L-1 in the schamctics) was made adjustable by either one of two methods. The first method used was to insert a small self-supporting coil in series with the co-axial cable from the UHF tuner where it connects to pin 7 of the VHF tuner. This coil was adjusted by spreading or squeezing the turns. The next method used consisted of replacing L-1 in the VHF tuner with a coil having an adjustable iron core.

5. Capacitor C-308 (100 mmf. ceramic tubular) at the UHF tuner end of the co-axial cable between the UHF and VHF tuners had an additional 120 mmf. ceramic tubular capacitor connected in parallel with it. The value of this additional parallel capacitor was varied in some chassis in order to obtain the desired bandwidth in this coupling circuit. If replacement is necessary be sure to use a capacitor with the same value as the one found in the chassis.

CHANGES FOR RUN 3 OF THE Y1200D & Z1200D CHASSIS

1. Changes 1 through 5 shown above for the Run 2 changes were incorporated except that in change 4 the only coil used for L-1 had an adjustable iron core.

2. Heater choke (L-205) was inserted in series with the brown heater lead to the UHF tuner.

3. Pin 9 of the VHF tuner was by-passed by a 1000 mmf. ceramic disc capacitor C-178.

4. The position of R-207 (100 ohms 1 watt) was changed so that the plate current for the VHF tuner, V-101 and V-102 flows through it instead of the plate current for V-103 plus the VHF tuner, V-101 and V-102.

5. The junction of R-207 (100 ohms 1 watt moved in the above step) and R-205 (470 ohms ½ watt) was by-passed by the addition of capacitor C-177 (1000 mmf. ceramic disc).

6. In the Video Detector circuit the junction of R-116 and R-117 was moved from the junction of C-114, L-102 and L-103 to the junction of R-114 and L-103.

7. Resistor R-212 (10,000 ohms ½ watt) was added to the AGC circuit for V-101 and V-102.

CHANGES FOR RUN 4 OF THE Y1200D & Z1200D CHASSIS

1. Run 4 for both of these chassis is the same as the Run 3 chassis except that the video peaking coil L-107 and resistor R-123 on which L-107 is wound are replaced by a wire jumper.

CHANGES FOR RUN 5 OF THE Y1200D & Z1200D CHASSIS

A. In the grid circuit (pin 1) of V-105 resistor R-195 (22,000 ohms, ½ watt) is replaced by R-124 (10,000 ohms, ½ watt) and R-196 (220,000 ohms, ½ watt) is replaced by R-125 (470,000 ohms, ½ watt).

B. In the plate circuit (pin 2) of V-105 resistor R-190 (1.2 megohms, ½ watt) is replaced by R-213 (820,000 ohms, ½ watt).

C. In the grid and cathode circuits of V-105 (pins 1 & 3) capacitor C-172 (47 mmf.) is replaced by C-124 (22 mmf.).

D. In the plate circuit of V-106A (pin 1) resistors R-136 (3300 ohms, ½ watt) and R-137 (1800 ohms, ½ watt) are transposed so that R-136 goes to ground and R-137 connects to C-130 and C-131. The junction of the two resistors connects as before.

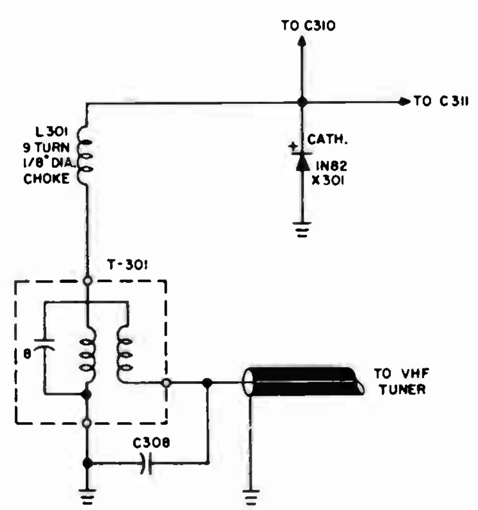
E. In the plate circuit of V-104 (video amp.) peaking coil L-107 and resistor R-123 on which it is wound is added to the circuit in series with the power supply and R-121.

F. In the Servo Loop feedback from the horizontal output to the AFC tube (V-107 pins 5 & 7), capacitor C-140 (.001 mfd. 1000 V. molded tubular) is replaced by two .01 mfd. ceramic disc capacitors (C-179 & C-180).

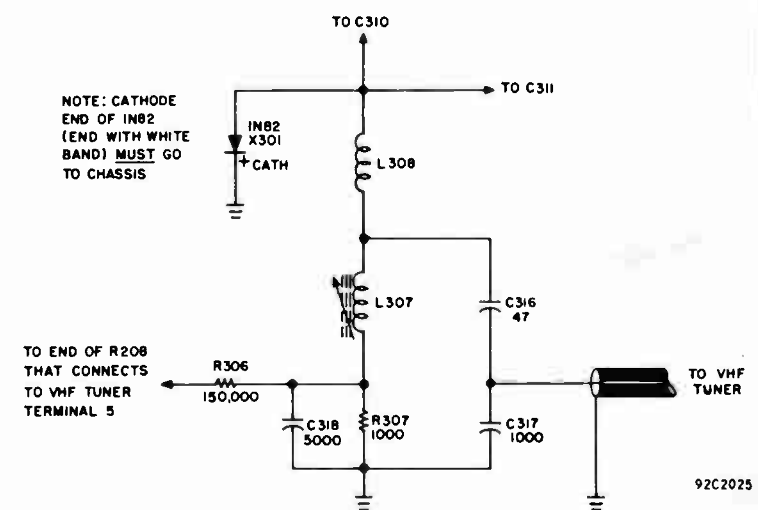
G. Capacitor C-181 (1000 mmf. 500 V., ceramic disc) was added between the positive terminal of C-119A (200 mfd. 150 V., electrolytic) and ground.

H. A shield was placed over the bottom of the video detector transformer T-203.

I. The i-f output coupling circuit of the 1E1484 or 1E1659 UHF tuner was changed at the factory as shown in the following partial schematics:



CIRCUIT BEFORE MODIFICATION



CIRCUIT AFTER MODIFICATION

T-301	I-F coupling tranformer	50A600
L-301	r.f. choke	53A290
C-308	100 mmf. ceramic (1E1484)	47A351
C-308	150 mmf. ceramic (1E1659)	47A394

L-307	I-F coupling coil	51-1708
L-308	r.f. choke	53-302
C-316	47 mmf. tubular ceramic	47B20470K5
C-317	100 mmf. tubular ceramic	47B20101K5
C-318	5000 mmf. disc ceramic	47A168
R-306	150,000 ohms ½ watt	23X20X154K
R-307	1000 ohms ½ watt	23X20X102K

SERVICE ADJUSTMENTS

Note: The controls whose adjustment is outlined below are all located on the rear apron of the chassis with the exception of the centering device which is located on the neck of the picture tube. The sequence of "SERVICE ADJUSTMENTS" outlined herein is suggested as a convenient method of approach and is not an arbitrary procedure. Variations of the procedure are permitted to obtain the desired final results. The operating controls, located on the front panel, should be set for as good a pattern as possible before making any of the following adjustments.

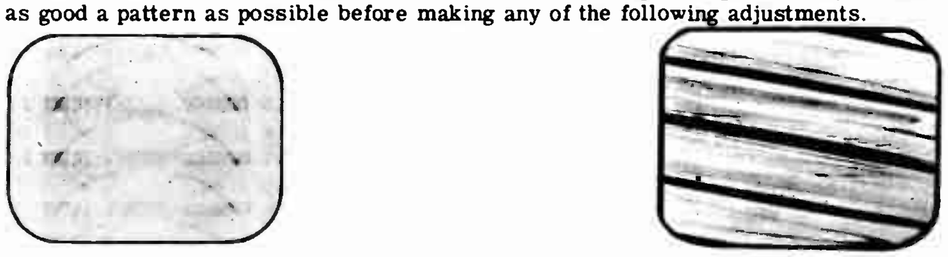


Fig. 73A. Improper Hold Control Adjustments

VERTICAL AND HORIZONTAL HOLD CONTROLS - These two controls should be adjusted until a single steady picture is obtained. With average signal strength it should be possible to switch from one active channel to another without losing sync when these two controls are properly adjusted. These two controls will be found on the front apron of some chassis.

Fig. 73B. Improper Centering Adjustments

CENTERING - Place the horizontal centering control, located on the rear apron of the chassis, in the approximate center of the range over which it may be rotated. Rotate the two ring magnets of the centering device around the neck of the picture tube until the picture is properly centered. Each ring magnet is provided with an ear for making this adjustment. The centering device should contact the rear of the deflection yoke. A slight readjustment of the ion trap may be necessary after adjusting the centering device. The horizontal centering control may now be adjusted as required for a fine adjustment of the horizontal picture centering.

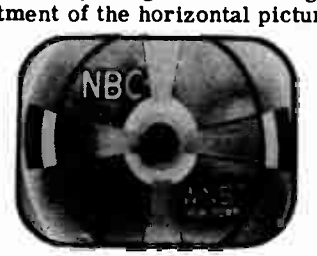


Fig. 73C. Improper Height Control Setting

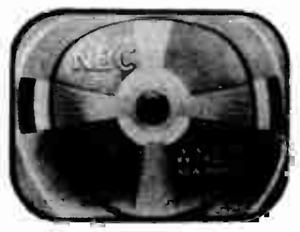


Fig. 73D. Improper Vertical Linearity Control Setting

HEIGHT CONTROL AND VERTICAL LINEARITY ADJUSTMENT - A test pattern will be required for the proper adjustment of these two controls. The height control has a pronounced effect on the overall picture height and at the same time the adjustment of this control will expand or contract the top of the picture more than the bottom. The vertical linearity control will affect the height somewhat but will have a more pronounced effect on the bottom portion of the picture. The interaction between these two controls makes it necessary to adjust both for proper picture height and vertical linearity.

A.G.C. CONTROL SWITCH - The A.G.C. control switch should be adjusted for the best average performance on all active channels.

With this switch set in the 0-10 MILE position (counterclockwise) maximum AGC voltage is applied to the tuner. The video amplifier will not be overloaded by strong signals.

With this switch set in the OVER 30 MILES position (clockwise) minimum AGC voltage is applied to the tuner. Snow in the picture will be at minimum when the switch is in this position under weak signal or fringe area receiving conditions. If the AGC control switch is left in this position in areas where strong signals are received, poor picture quality will result along with a probable intercarrier buzz in the speaker. In some cases the sync pulses will be clipped and trouble will be encountered which will appear like a loss of sync unless this switch is properly adjusted.

WIDTH CONTROL - The width control should be adjusted until the picture fills the screen horizontally. Rotating this control in the clockwise direction will increase picture width while counterclockwise rotation will decrease picture width.

BRIGHTNESS CONTROL - This control should be adjusted in any given location for the best average picture from the various active channels which may be received.

FOCUS CONTROL - Adjust this control until the fine horizontal lines which make up the picture are clearly visible. Use the lines in the center portion of the picture for this adjustment.

HUM ADJUSTMENT - A small rheostat will be found mounted on the frame of some of the speakers. Adjust this rheostat with a small screw driver for minimum audible hum in the speaker.

PICTURE TUBE REMOVAL

1. Remove the chassis from the cabinet. Note that on chassis with the horizontal and vertical hold controls on the rear apron the knobs on the control shafts and the A.G.C. control switch must be removed before the cabinet back may be removed. These are push-on type knobs.
2. Insure the discharge of the high voltage power supply by disconnecting the anode plug and shorting it to the chassis. Also short the anode socket or metal cone of the picture tube to the chassis.
3. Remove the picture tube socket from the base of the tube.
4. Slip the ion trap and the centering device from the neck of the tube. On some chassis, the centering device is an integral part of the deflection yoke assembly.
5. Carefully remove the rear support tension spring on each side of the picture tube. If a glass cone picture tube is involved, remove the metalized paper picture tube shield and ground by unhooking the springs on each side and the hook on the top center of the picture tube mounting strap.
6. Remove the mounting strap from the front rim of the picture tube.
7. Lift the front of the picture tube just far enough to clear the front mounting brackets and slip the tube forward until the neck is clear of the deflection yoke and the rubber collar. Use a slight twisting pull to break the cone of the tube from the rubber collar if the two are stuck together. Loosen the deflection yoke adjustment screw if required for clearance when raising the front of the picture tube over the front mounting brackets.

CAUTION - IF THE TUBE FAILS TO SLIP OUT EASILY, INVESTIGATE AND REMOVE THE CAUSE OF TROUBLE. DO NOT USE FORCE AS THE NECK OF THE PICTURE TUBE IS EASILY BROKEN.

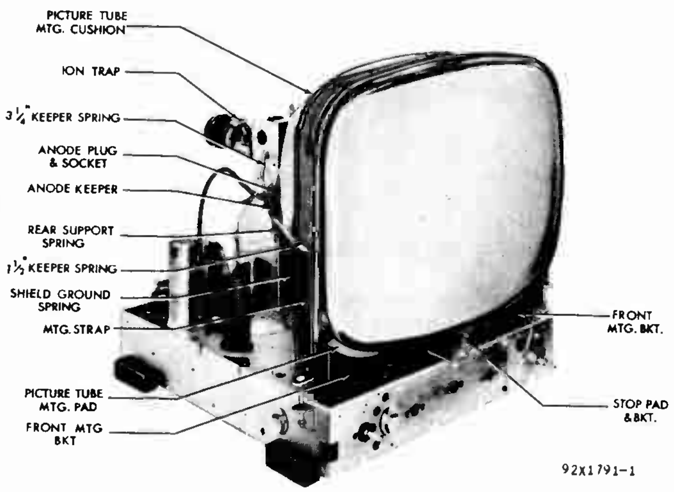


Fig. 75A. 17" Glass Pix Tube Mounting

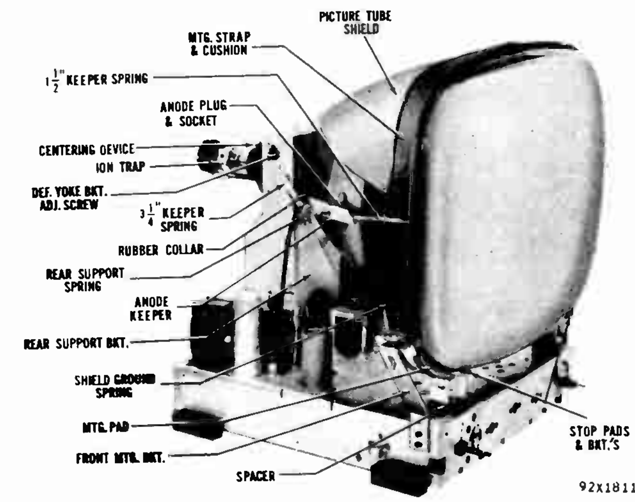


Fig. 75B. 20 or 21" Glass Pix Tube Mounting

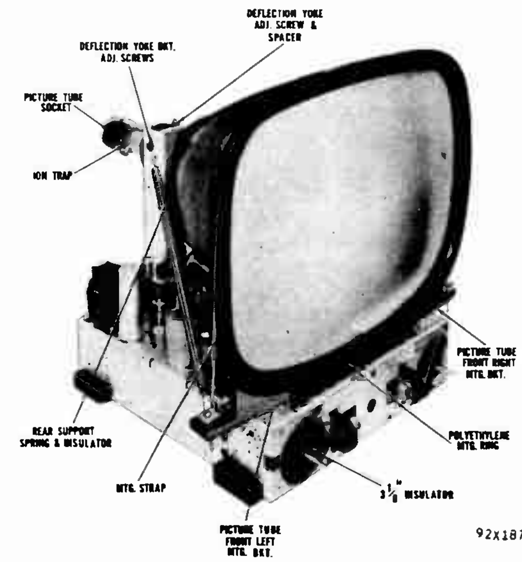


Fig. 75C. 21" Metal Pix Tube Mounting

PICTURE TUBE INSTALLATION AND ADJUSTMENT

1. Position the tube so that the anode socket is located at the left side of the tube when viewed from the front face. A metal cone tube will not have an anode socket but will require the polyethylene mounting ring around the front rim of the tube with the joint in the ring on the bottom center of the tube.

2. Insert the neck of the tube through the rubber collar and the deflection yoke. Seat the front of the tube on the front mounting brackets. The groove in the polyethylene mounting ring fitting over the front mounting brackets or the picture tube face resting against the front stop pad will determine the forward position of the tube. Be sure that the face of the picture tube rests against the stop pad and not against the bracket for this pad which is provided on chassis which use glass cone picture tubes.

3. Place the mounting strap around the front of the tube. On metal cone tubes place the 4" rubber strip in the top center of the groove in the polyethylene mounting ring. At the same time be sure that the copper anode connector strap is inserted under the polyethylene mounting ring on the left side of the tube when viewed from the front. Be sure the picture tube mounting cushion is placed under the mounting strap for glass cone tubes.

4. Tighten the screws on each end of the mounting strap and replace the rear support tension spring on each side of the picture tube. On glass cone picture tubes replace the metalized paper picture tube shield and ground with the metalized surface next to the tube. The hook in the center of this shield should be hooked over the top center of the picture tube mounting strap and the springs on each end should be hooked around the screws on each end of the mounting strap. If the replacement glass pix tube does not have an outer aquadag coating it will be necessary to install C-166 (500 mmf. 20 KV.). See schematic. This capacitor will already be installed in chassis with metal cone picture tubes.

5. Press the deflection yoke firmly forward against the cone of the picture tube and tighten the deflection yoke adjusting screw.

6. The picture tube neck should pass through the approximate center of the deflection yoke. If it does not, loosen the deflection yoke bracket adjustment screws and reposition the yoke.

7. Slide the centering device over the neck of the tube. This device should be installed directly behind and contacting the deflection yoke with the adjusting ears for the two ring magnets as near to the deflection yoke as possible. On some chassis the centering device is an integral part of the deflection yoke assembly.

8. Check the ion trap for any marking and slip the trap over the neck of the tube. If the trap is marked with an arrow, the arrow should point towards the face of the tube.

9. Connect the picture tube anode plug and replace the anode keeper and springs if a glass pix tube is being installed.

10. Connect the picture tube socket and turn the receiver on. Don't forget the chassis is "hot" - use an isolation transformer.

11. Turn up the brightness control and set the ion trap for maximum raster brilliance, backing off the brightness control as the maximum point is approached. The ion trap must be rotated about the axis of the tube as well as shifted along the neck to obtain the proper setting.

12. Tune in a test pattern and set the focus, brightness and contrast controls for as good a picture as possible.

13. Check the position and appearance of the test pattern. If it is off center or shadowed at the corners, adjust the ears of the centering device by rotating them about the axis of the picture tube until proper centering is obtained. An additional horizontal centering control is located on the rear apron of the chassis. This control should be in the approximate center of the range over which it may be rotated before adjusting the centering device.

14. If the lines of the raster are not horizontal or square with respect to the escutcheon, loosen the deflection yoke adjustment screw and rotate the deflection yoke until the proper raster position is obtained. Press the deflection yoke firmly against the cone of the picture tube and tighten the adjustment screw.

15. Follow the procedure under "SERVICE ADJUSTMENTS" and make any minor adjustments necessary to obtain a properly adjusted pattern.

HIGH VOLTAGE WARNING

OPERATION OF THE RECEIVER CHASSIS OUTSIDE OF THE CABINET INVOLVES DANGER OF ELECTRICAL SHOCK. USE A POWER LINE ISOLATION TRANSFORMER AND EXERCISE ALL NORMAL HIGH VOLTAGE PRECAUTIONS WHEN WORKING WITH THIS RECEIVER.

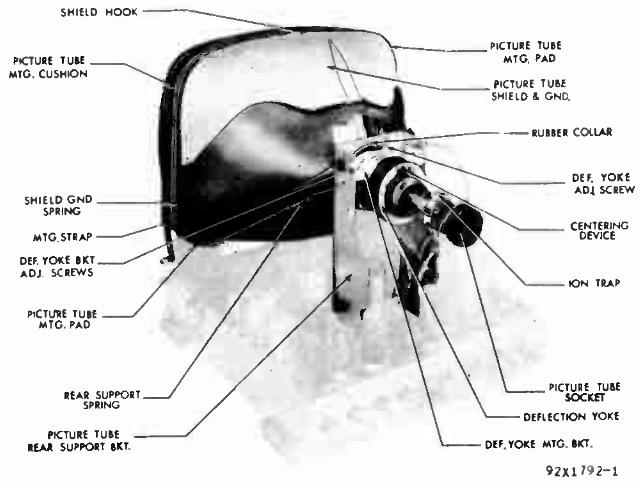


Fig. 77A. 17" Glass Pix Tube Mounting

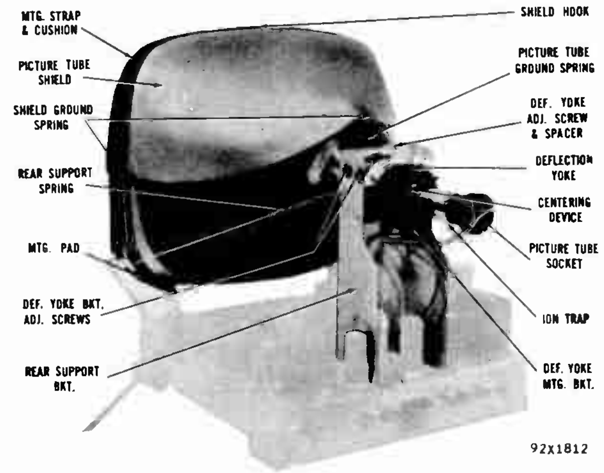


Fig. 77B. 20 or 21" Glass Pix Tube Mounting

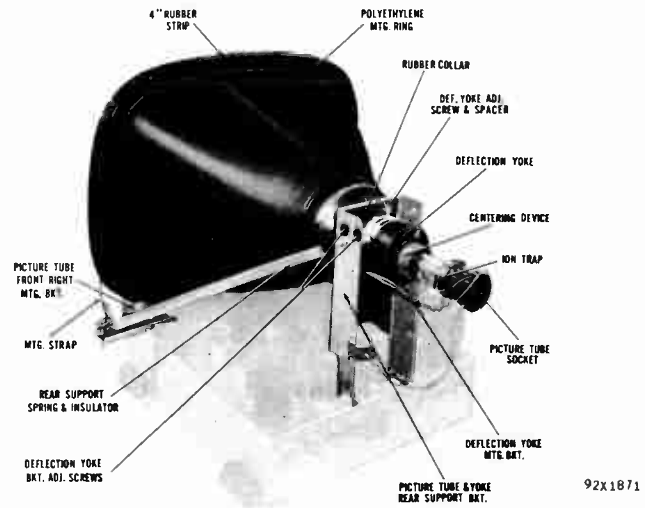


Fig. 77C.! 21" Metal Pix Tube Mounting.

PICTURE TUBE ANODE HIGH VOLTAGE MEASUREMENT

The second anode potential for a 17 inch tube will be approximately 11,500 volts and approximately 14,000 volts for a 20 or 21 inch tube. If it is possible to obtain good picture brilliance, the second anode potential is correct and need not be measured.

The setting of the width control will affect the high voltage on the second anode. If the width control is set for excessive width, the second anode potential will be low.

If it is necessary to measure the voltage present on the second anode, a meter specifically designed for high voltage measurements should be used. The contrast and brightness controls should be rotated to the minimum position and the anode plug should be connected to the tube. Under these conditions the test meter will load the high voltage power supply approximately the same amount as the picture tube would during normal operation.

SAFETY FIRST

DO NOT USE HAND HELD FLEXIBLE TEST LEADS WHEN MAKING SECOND ANODE HIGH VOLTAGE MEASUREMENTS. ANY ACCIDENTAL CONTACT WITH THE HIGH VOLTAGE PRESENT IN THIS CIRCUIT MAY CAUSE A SEVERE BURN OR IN SOME CASES BE FATAL.

HORIZONTAL OSCILLATOR ADJUSTMENT FOR CHASSIS A1200D & X1200D

If the horizontal hold control fails to restore synchronization, the horizontal stabilizer coil (L-108) should be adjusted. Procedure for this adjustment is as follows:

1. Set the brightness control for normal picture brightness and turn the contrast control as low as possible with a picture still visible on the screen.
2. Turn the horizontal centering control, located on the rear apron of the chassis, full clockwise. The right side of the raster should now be visible. If not, reduce the width of the picture by turning the width control counterclockwise until the right edge of the raster does become visible.
3. Connect a .1 mfd. 600 V. tubular capacitor between test point (A) and the chassis. See Fig. 78B.
4. Adjust the horizontal hold control for a single steady picture whose right edge is approximately ¼ inch to the left of the right edge of the raster. See Fig. 78A.
5. Remove the .1 mfd. 600 V. capacitor installed in step 3.
6. Adjust the horizontal stabilizer coil, (L-108) until the right edges of the picture and the raster are the same distance apart as they were set in step 4. See Fig. 78A.
7. Readjust the horizontal centering control and the width control for normal operation.

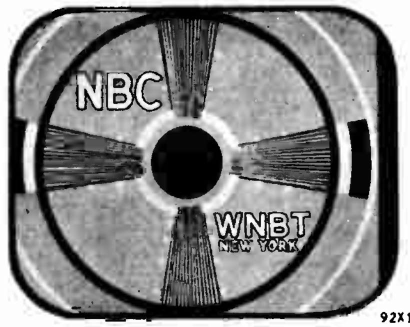


Fig. 78A. Test Pattern for Horizontal Stabilizer Adjustment

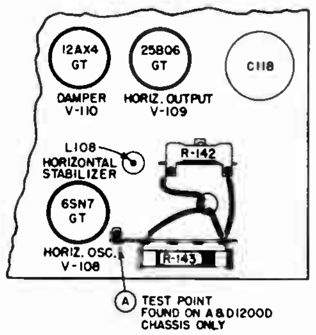


Fig. 78B. Horizontal Oscillator Adjustment Point for Chassis with Series—Parallel Heaters

HORIZONTAL OSCILLATOR ADJUSTMENT FOR CHASSIS F, G, J, K, L, P, R, T, W, X, Y AND Z1200D

If the horizontal hold control fails to restore synchronization, the horizontal stabilizer coil (L-108) should be adjusted. Procedure for this adjustment is as follows:

1. Set the horizontal hold control in the approximate center of the range over which it may be rotated.
2. Set the channel selector to an active channel and adjust the horizontal stabilizer for a single steady picture. See Fig. 78B or 78C.
3. Rotate the horizontal hold control full clockwise. The picture may or may not remain in sync. If it does, momentarily switch the channel selector to another channel and return it to the original channel. The picture should now be slightly out of sync.
4. Rotate the horizontal hold control full counterclockwise. The picture may or may not remain in sync. If it does, momentaril switch the channel selector to another channel and return it to the original channel. The picture should now be slightly out of sync.

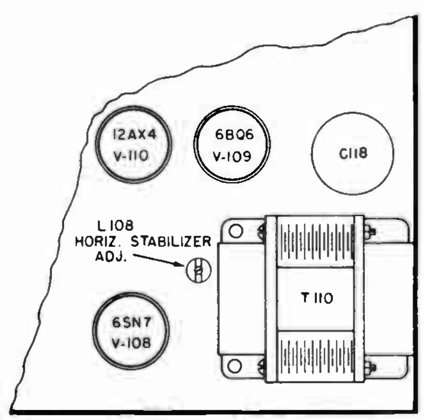
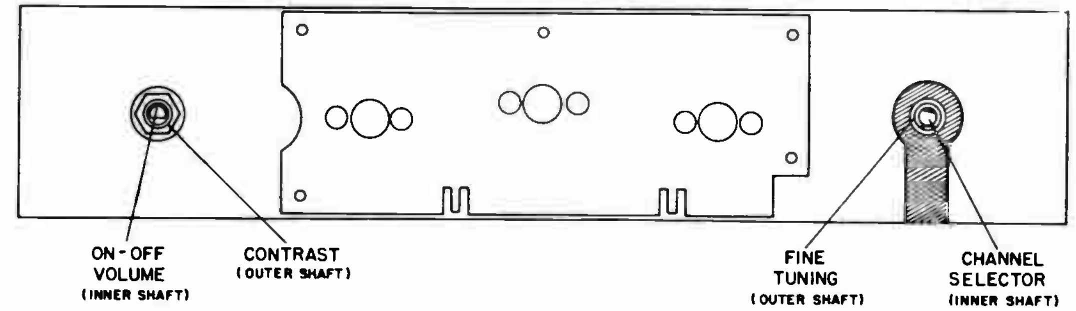


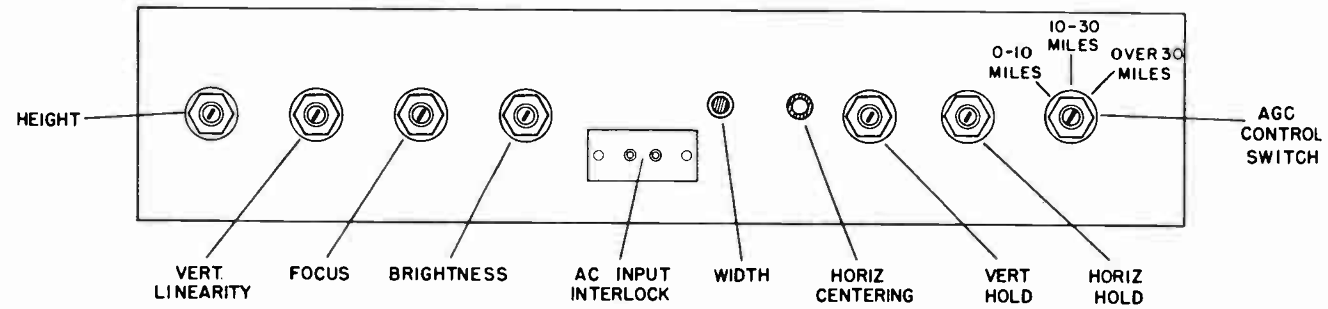
Fig. 78C. Horizontal Oscillator Adjustment Point for Chassis with Heater Transformer

When the horizontal stabilizer coil is properly adjusted the results outlined in steps 3 and 4 will be obtained. If the correct results are not obtained, repeat steps 2, 3 and 4 until they are.



THE P & R1200D ARE DEEP CHASSIS. SEE MODIFICATION IX ON PAGE 1952-72D.

Fig. 79A. Front Controls for Chassis A, D, F, G, K, L, P, R, W, and X1200D



THE P & R1200D ARE DEEP CHASSIS. SEE MODIFICATION IX ON PAGE 1952-72D.

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Fig. 79B. Rear Controls for Chassis A, D, F, G, K, L, P, R, W and X1200D

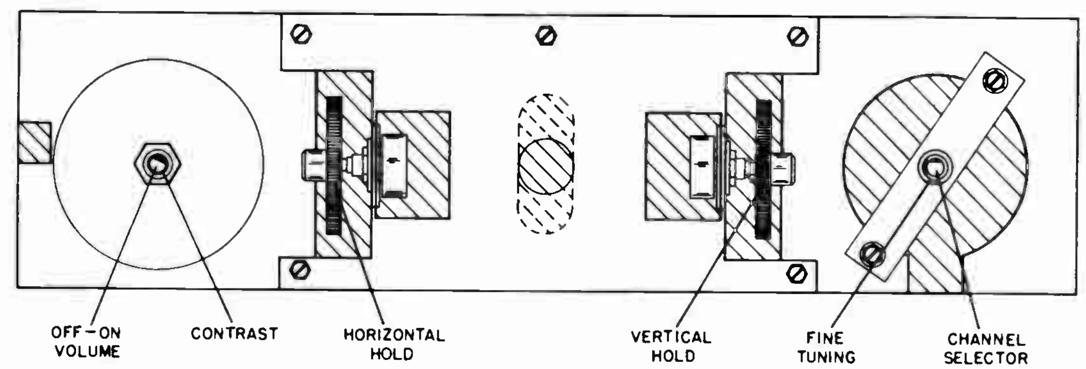

Fig. 79C. Front Controls for Chassis J1200D and T1200D

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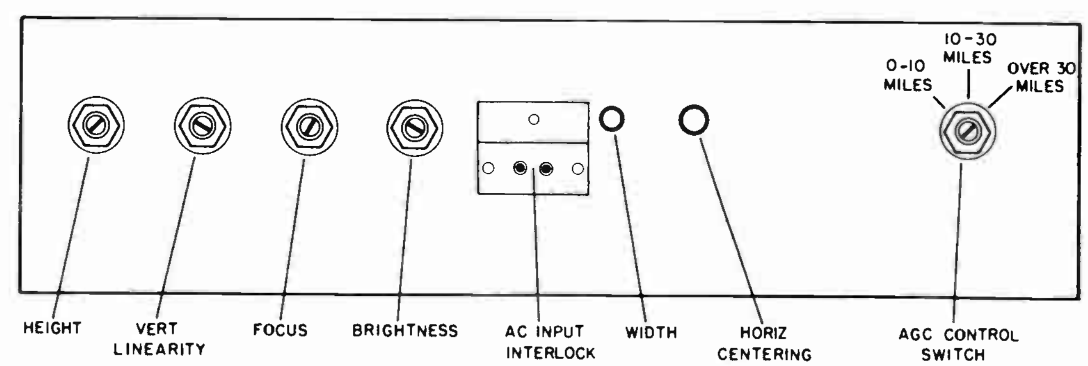


Fig. 79D. Rear Controls for Chassis J1200D and T1200D

FM SOUND CHANNEL ALIGNMENT FOR 1200 SERIES CHASSIS

EQUIPMENT REQUIRED

Signal generator covering 4 to 30 mc. unmodulated.

Vacuum tube voltmeter (VTVM).

Sound alignment test circuit shown in Fig. 80A.

Power line isolation transformer.

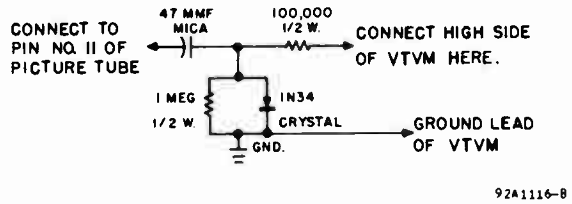


Fig. 80A. Sound Alignment Test Circuit

PROCEDURE

1. Connect all test equipment to a common ground. Connect the TV chassis to this same ground after installing an isolation transformer between the power line and the TV chassis. One side of the line cord connects directly to the TV chassis and an isolation transformer must be used for safety.

2. Set the channel selector to any vacant channel and the contrast control at minimum.

3. Connect the signal generator output through a .005 mfd. capacitor to terminal 2 of test socket SO-101 shown in Figs. 79AA, 79AB, 81A & 81B or test point (D) shown in schematic diagram. Ground the shield of the generator output cable to terminal 1 of the test socket or the chassis.

4. Connect the sound alignment detector circuit and VTVM as shown in Fig. 80A. Adjust the 4.5 mc. generator output (unmodulated) to give a 1 volt reading on the VTVM.

5. Adjust the 4.5 mc. trap adjustment (L-105) at 4.5 mc. for a minimum VTVM reading.

6. Disconnect the test circuit and connect the VTVM to test terminal (B) (Pin 2 of FM detector, V-113). See schematic diagram.

7. Adjust the 4.5 mc. amplifier grid adjustment (L-110) and the primary of T-107 (bottom core) at 4.5 mc. for a maximum VTVM reading.

8. Connect the VTVM to test terminal (C), shown in the schematic diagram. Adjust the secondary of T-107 (top core) at 4.5 mc. for the zero reading which occurs between the positive and negative peaks. If the zero reading occurs at more than one setting, use the position nearest the top limit of the core.

9. Shift the signal generator an equal amount on either side of 4.5 mc. and touch up the primary of T-107 (bottom core) for approximately equal peaks. Use just enough signal output to obtain one volt peaks for best results.

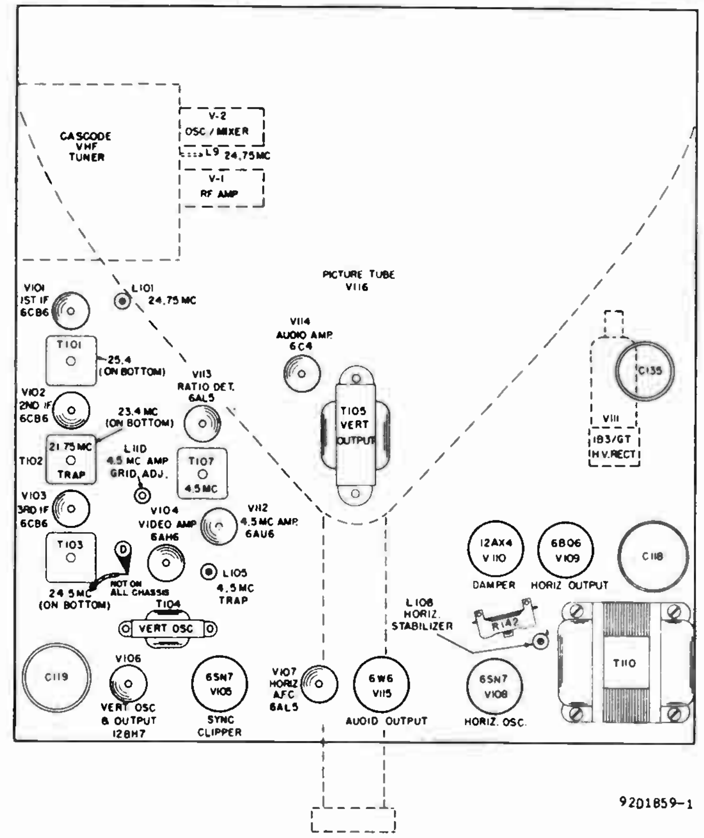


Fig. 79AB. Top View Alignment Locations for Chassis J & T1200D

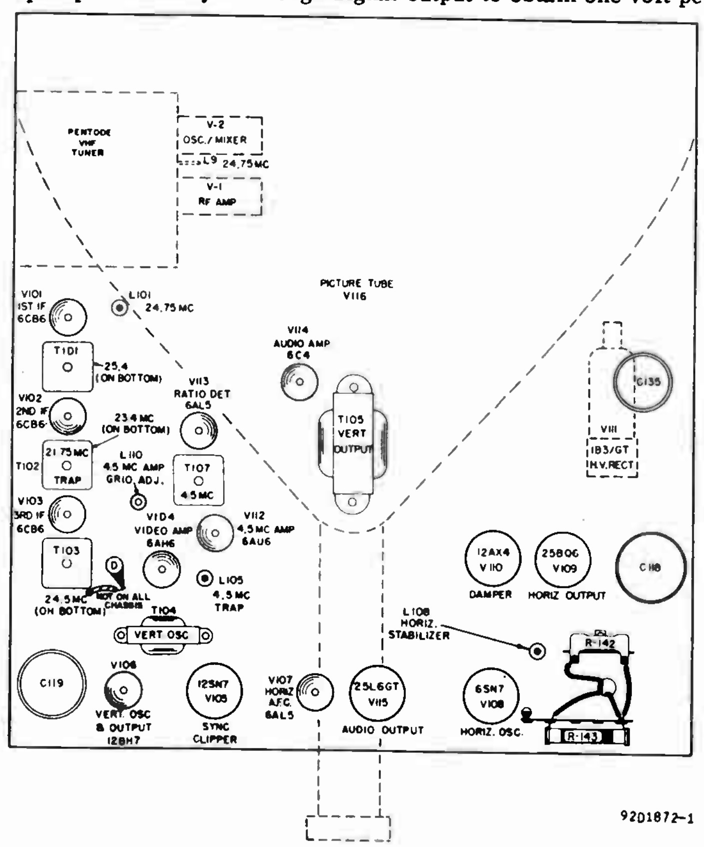


Fig. 79AA. Top View Chassis Alignment Locations for Chassis P & R1200D

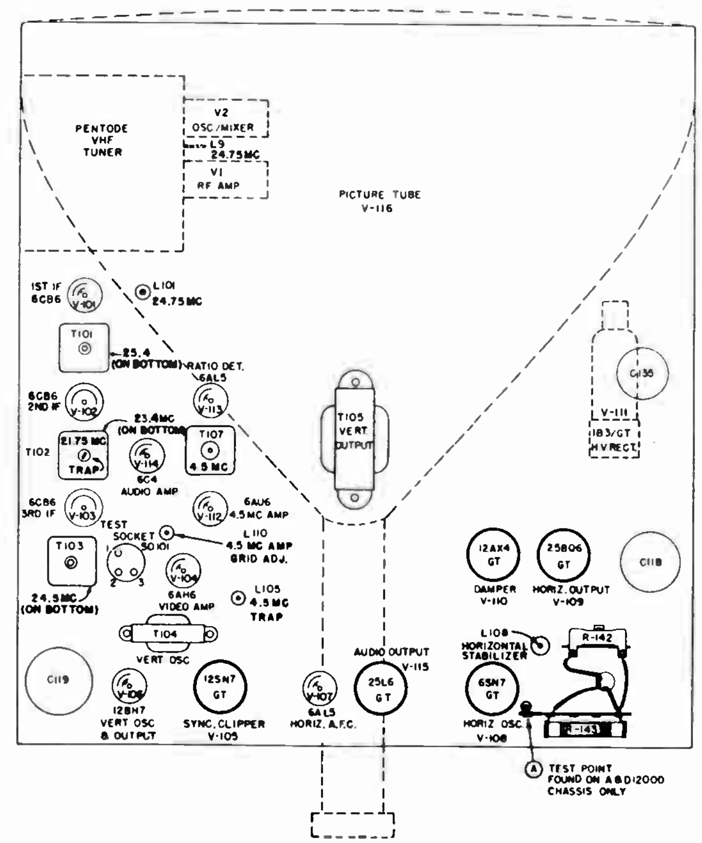


Fig. 81A. Top View Chassis Alignment Location for Chassis A, D, W & X1200D

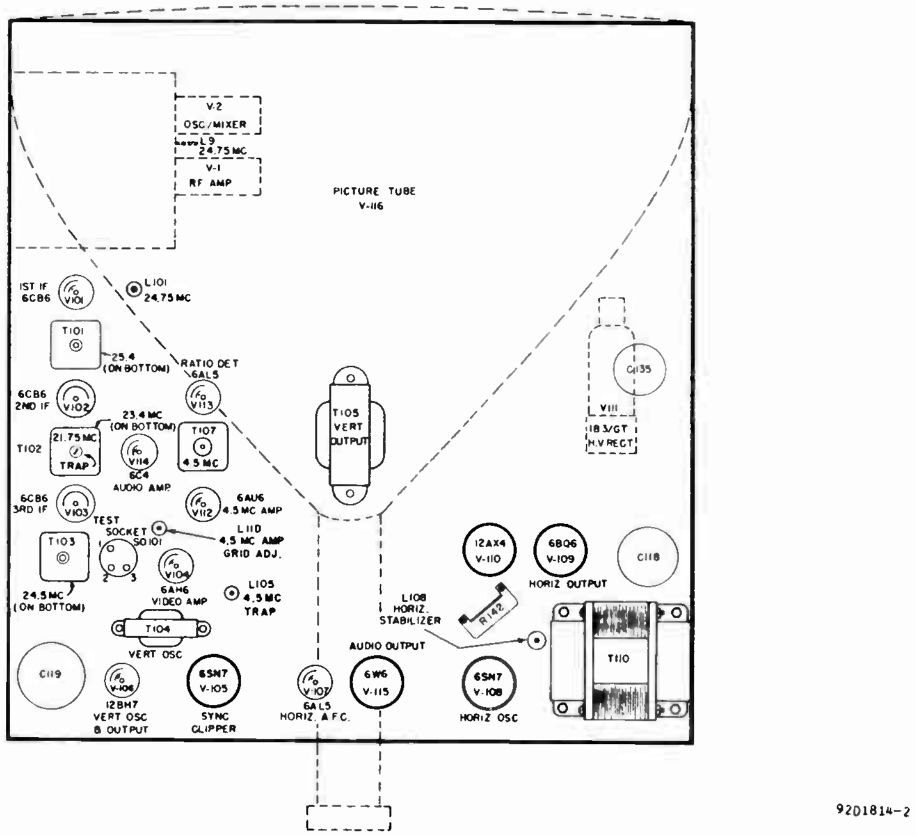


Fig. 81B. Top View Alignment Locations for Chassis F, G, K & L 1200D

I-F AMPLIFIER ALIGNMENT FOR 1200 SERIES CHASSIS EXCEPT Y & Z1200D (See Page 48.)

EQUIPMENT REQUIRED

SWEEP GENERATOR	RCA type WR-59B or equivalent.
MARKER GENERATOR	RCA type WR-39C Television Calibrator or equivalent.
OSCILLOSCOPE	RCA type WO-56A or equivalent.
VACUUM TUBE VOLTMETER (VTVM)	RCA type WV-97A or equivalent.
BIAS SOURCE	Three volt battery.
TEST CIRCUIT	Shown in Fig. 82A.
ISOLATION TRANSFORMER	150 watt rating or higher.

PROCEDURE

1. Connect all test equipment to a common ground. Connect the TV chassis to this same ground after installing an isolation transformer between the power line and the TV chassis. One side of the line cord connects directly to the TV chassis and an isolation transformer must be used for safety. Allow a 15 minute warm up period.

2. Set the AVC switch on the rear chassis apron to the 0-10 MILE (counterclockwise) position.

3. Connect the negative side of a 3 volt battery supply to pin 3 of test socket SO-101 or test point Ⓔ. Connect the positive side of the supply to the TV chassis.

4. Connect a VTVM to pin 2 of test socket SO-101 or test point Ⓓ through a 47,000 ohm carbon resistor. Connect the ground side of the meter to the TV chassis.

5. Connect the high side of a marker generator to the shield of the osc./mixer tube. This connection will capacitively couple the generator output to the tube. Make sure the shield is ungrounded by raising it above the grounded clips that hold it in place.

6. Set the channel selector to any vacant channel.

7. Set the marker generator output (unmodulated) for a two volt negative dc reading on the VTVM and adjust the three i-f transformers, L-9, and L-101 according to the I-F AMPLIFIER ALIGNMENT CHART shown below. Readjust the signal generator output as required to maintain the two volt VTVM reading.

I-F AMPLIFIER ALIGNMENT CHART

Signal Generator Frequency (No Modulation)	Adjustment	Location	VTVM Indication
25.4 MC	T-101 (bottom)	See Fig. 81A	Maximum
23.4 MC	T-102 (bottom)	Under Chassis	Maximum
24.5 MC	T-103 (bottom)	See Fig. 81A	Maximum
21.75 MC	T-102 (top)	See Fig. 81A	Minimum
23.4 MC	T-102 (bottom)	See Fig. 81A	Maximum
24.75 MC	*L-101	See Fig. 81A	Maximum
24.75 MC	#L-9	See Fig. 81A	Maximum

IMPORTANT — The wax in the end of the coil forms holding the iron core in position may be softened for adjustment of the core by means of a heated screwdriver or a small pencil type soldering iron inserted into the wax. Remelt wax after adjustment.

* NOTE: On chassis with the 1E1345 Pentode and 1E1376 Cascode tuners, temporarily connect the series resistor-capacitor combination shown in Fig. 82A to the tuner test point TP-2 when making this adjustment. On chassis with the 1E1380 Cascode tuner, hold the channel selector between channels when making this adjustment.

#NOTE: Temporarily connect the series resistor-capacitor combination shown in Fig. 82A to the grid (pin 1) of V-101 the 6CB6 first i-f amplifier when making this adjustment.

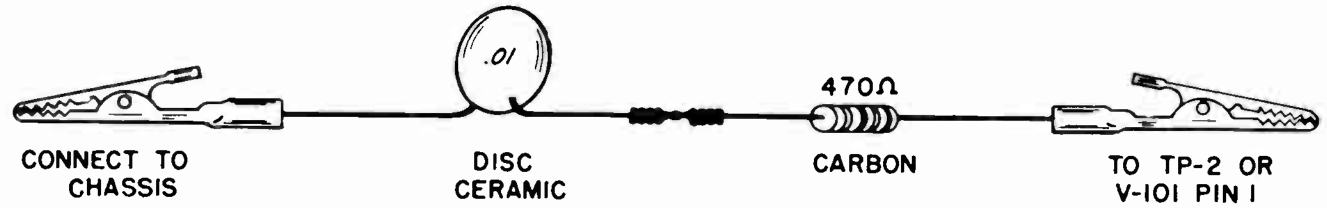


Fig. 82A. Test Circuit for I-F Amplifier Alignment

8. Disconnect the VTVM and marker generator connected in steps 4 and 5. The balance of the set-up should be as directed in steps 1, 2, 3 and 6.

9. Capacitively couple the high side of the sweep generator r-f output to the osc./mixer tube by connecting to the tube shield which has been raised above its grounding clips. The ground side of the sweep generator should be connected to the receiver chassis. Adjust the generator to sweep from 19 to 29 MC.

10. Loosely couple the high side of the marker generator to the high side of the sweep generator by clipping the marker generator r-f lead over the insulation of the sweep generator r-f lead. The ground side of the marker generator should be connected to the receiver chassis.

IMPORTANT - To prevent overloading of the i-f amplifier keep the output of the sweep and marker generators as low as possible. The marker generator output should be just high enough to produce visible pips on the pattern. In some cases the 21.75 MC pip will not be visible unless the r-f. output of the marker generator is increased to overcome the attenuation of the 21.75 MC signal by the trap in the top of T-102.

11. Connect the sweep output terminals on the sweep generator to the input of the horizontal amplifier in the oscilloscope.

12. Connect one side of a 47,000 ohm 1/2 watt resistor to test socket, SO-101, pin 2 or to test point Ⓓ shown in the schematic diagrams for chassis which do not have the test socket. Connect the other end of the resistor to the high side of the input terminals for the vertical amplifier in the oscilloscope. The scope ground terminal connects to the receiver chassis. Keep the scope leads away from the internal chassis wiring, particularly the horizontal output section.

13. Reduce the r-f output of the sweep generator and increase the gain of the vertical amplifier in the oscilloscope as much as possible without introducing an excessive amount of noise on the test pattern. This will prevent overloading of the i-f system.

14. Check the position of the markers shown in Fig. 84A. Adjust only the bottom cores of T-101, T-102 and T-103 for a response curve of maximum amplitude with a slightly tilted flat topped appearance as shown in Fig. 84A. This tilt is required to compensate for the capacitive coupling used for the signal generators. The actual response obtained will be flat when the pattern viewed on the oscilloscope has this tilt. The bottom core of T-103 will primarily control the tilt of this central portion of the curve.

The bottom core of T-101 should be adjusted to position the 26.25 MC marker in the 50% position shown in Fig. 84A.

The bottom core of T-102 should be adjusted to determine the slope of the curve between 21.75 MC and 23.4 MC with the 22.75 MC marker down 50% on the curve as shown in Fig. 84A.

Under no circumstances should an attempt be made to adjust L-9, L-101 and the 21.75 MC trap in the top of T-102 by means of an oscilloscope and sweep generator. Maladjustment of these coils does not give a noticeable indication on the oscilloscope. Align these coils by following the procedure given in steps 1 through 7 only.

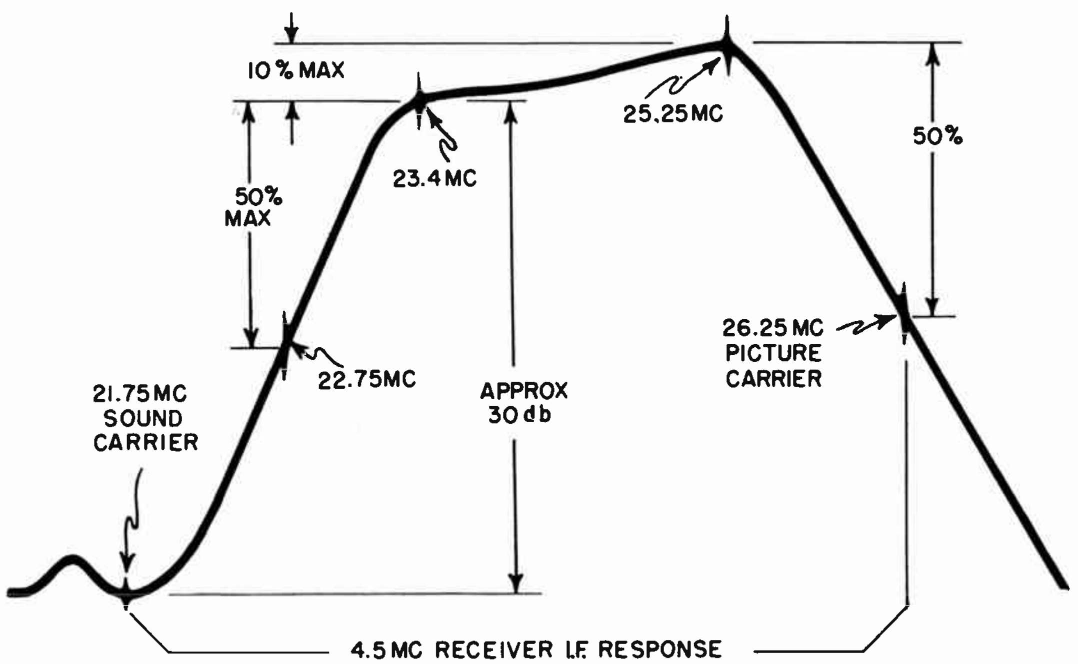
MEASUREMENT OF I-F AMPLIFIER SENSITIVITY

To determine the i-f amplifier sensitivity, disconnect the r-f output lead from the tuner where it connects to L-101. Temporarily connect one side of a .005 mfd. ceramic or mica capacitor to grid pin 1 of the 6CB6 first i-f amplifier tube V-101. Connect the unmodulated r-f output of a marker generator to the other side of the capacitor and the ground side of the generator to the TV chassis. Set the marker generator to 24.75 MC. Connect a VTVM as directed in step 4 of the alignment procedure. The three volt battery must be removed. If a generator output of 200 to 400 microvolts produces a 1 volt reading on the VTVM, the i-f amplifier sensitivity is normal.

TELEVISION CHANNELS vs. CARRIER, OSCILLATOR AND I-F FREQUENCIES

Channel No.	Channel Freq. (mc)	Picture Carrier Freq. (mc)	Sound Carrier Freq. (mc)	Receiver Osc. Freq. (mc)	Picture I-F Freq. (mc)	Sound I-F Freq. (mc)	Picture I-F less Sound I-F (mc)
2	54-60	55.25	59.75	81.5	26.25	21.75	4.5
3	60-66	61.25	65.75	87.5	26.25	21.75	4.5
4	66-72	67.25	71.75	93.5	26.25	21.75	4.5
5	76-82	77.25	81.75	103.5	26.25	21.75	4.5
6	82-88	83.25	87.75	109.5	26.25	21.75	4.5
7	174-180	175.25	179.75	201.5	26.25	21.75	4.5
8	180-186	181.25	185.75	207.5	26.25	21.75	4.5
9	186-192	187.25	191.75	213.5	26.25	21.75	4.5
10	192-198	193.25	197.75	219.5	26.25	21.75	4.5
11	198-204	199.25	203.75	225.5	26.25	21.75	4.5
12	204-210	205.25	209.75	231.5	26.25	21.75	4.5
13	210-216	211.25	215.75	237.5	26.25	21.75	4.5

Fig. 84A. Typical Response for 21.75 to 26.25 MC I-F Amplifier



ALIGNMENT FOR 1C1345 PENTODE & 1C1376 CASCODE TV TUNERS

These tuners have been carefully aligned at the factory by personnel using precision equipment. Minor alignment adjustments of the tuner may be necessary after making tube or part replacements. When replacing tubes in a tuner use the same tube type as the original tube which was removed from the tuner and also try several different tubes and select the one which gives best performance. Realignment of the tuner probably will not be required if a selected tube is used for replacement. Use of an alternate tube may require a complete realignment of the TV tuner. For those service engineers who are properly equipped as specified, the following alignment procedure is included. Balance of TV receiver must be functioning properly before aligning tuner.

EQUIPMENT REQUIRED FOR TV TUNER ALIGNMENT

1. Sweep generator ______ RCA type WR-59B or equiv.
2. Marker Generator ______ RCA type WR-39C Television Calibrator or equivalent.
3. Oscilloscope ______ RCA type WO-56A or equiv.
4. Bias Source ______ 1.5 volt battery.
5. Isolation Transformer ______ 150 watt rating or higher

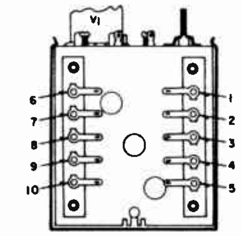


Fig. 85A. Numbering of Tuner Terminals

SET-UP PROCEDURE FOR TUNER ALIGNMENT

1. Check to be sure that the tube shields and the bottom cover for the tuner are in place.
2. Connect all test equipment and the television chassis to a common ground. Be sure to use an isolation transformer for the receiver chassis. Allow at least a 5 minute warm-up period for the receiver chassis.
3. Connect the negative terminal of a 1.5 volt bias source to terminal 8 of the TV tuner. See Fig. 85A for terminal numbering. Connect the positive side of the bias source to any convenient ground point on the chassis.
4. Connect the hot lead from the oscilloscope through a 10,000 ohm carbon resistor to test point T.P.-1 (See page 1952-86). Connect the ground lead from the oscilloscope to any convenient ground point on the TV tuner chassis. Set the scope sweep oscillator to roughly 120 cycles.

OSCILLATOR ADJUSTMENT

1. Turn the channel selector to channel 13.
2. Set the marker generator to 237.5 mc. and connect generator leads to the antenna terminals.
3. Rotate the fine tuning control until a zero beat is indicated on the scope. When the fine tuning control is rotated a band will appear across the face of the scope. As the point of zero beat is approached this band will increase in amplitude and then decrease sharply until a minimum is reached which is the point of zero beat. If the fine tuning control is rotated farther in the same direction the amplitude of the band will increase sharply and then decrease. The point of zero beat should fall in the approximate center of the range over which the fine tuning control may be rotated. If it does not, set the fine tuning control at the approximate center of its range and adjust L-7 (Channel 13 Oscillator Adjustment) for the zero beat. Do not disturb the setting of the fine tuning control after this adjustment.
4. Set the channel selector to channel 6.
5. Set the marker generator to 109.5 mc.
6. Adjust L-8 (Channel 6 Oscillator Adjustment) for the zero beat indication on the scope.

NOTE: Adjustment of the channel 13 and channel 6 oscillator coils automatically brings all other channel into adjustment. The adjustment screws cover their entire electrical range within eight full revolutions counterclockwise from the tight position. Any further rotation of these screws may cause them to fall out. Counterclockwise rotation of the screws will decrease the oscillator frequency. Best results will be obtained if a non-metallic screwdriver is used.

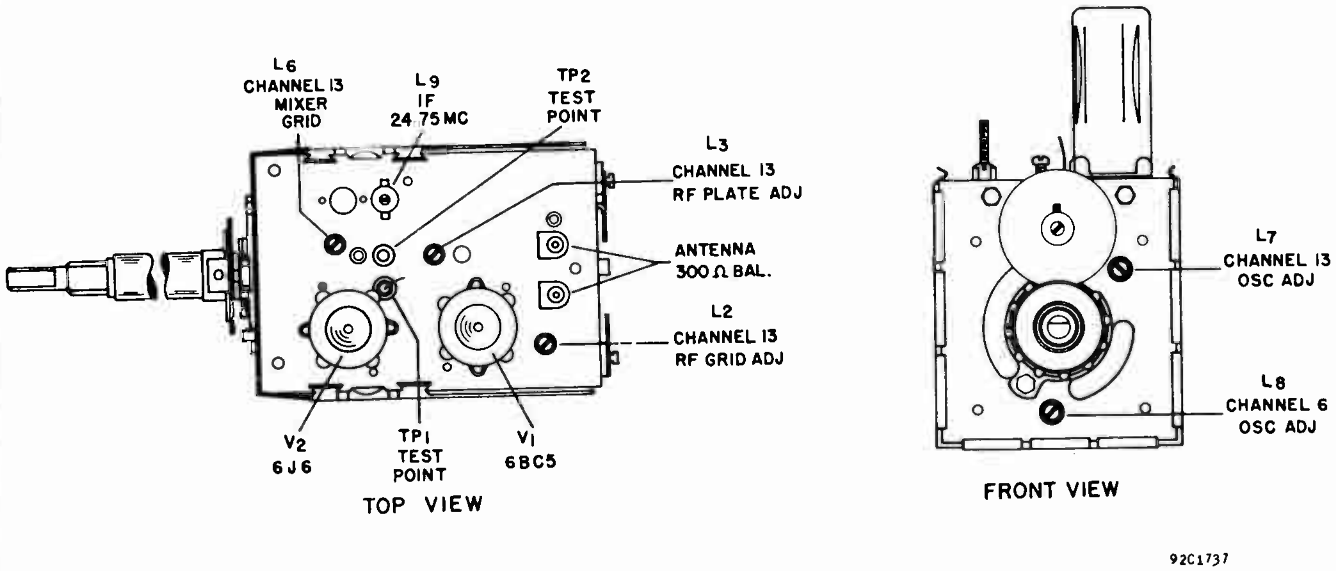


Fig. 86A. 1C1345 Pentode TV Tuner Alignment Adjustments

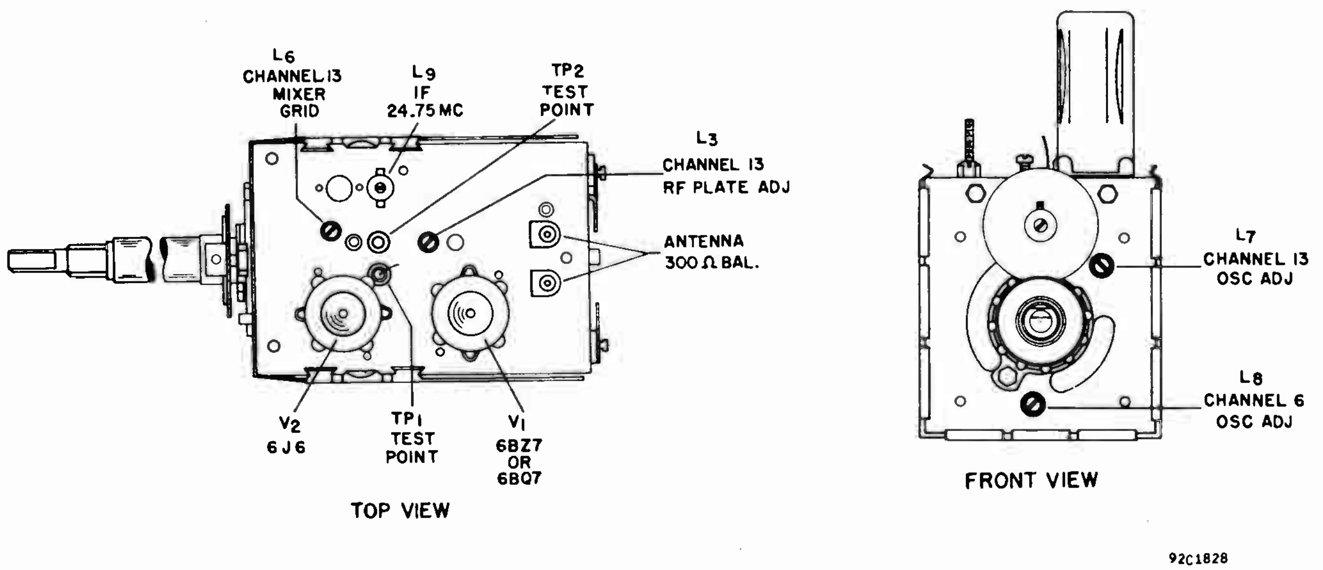


Fig. 86B. 1C1376 Cascode TV Tuner Alignment Adjustments

BAND PASS ALIGNMENT OF 1C1345 & 1C1376 TV TUNERS

CAUTION: Band pass alignment is carefully made at the factory. Attempt this alignment only with proper equipment and set-up. The tube shields and the bottom cover for the tuner must be in place. The oscillator adjustment given on page 39 must be completed before the band pass alignment is started.

1. Complete the set-up procedure given on page 39.
2. Connect the leads from the sweep and marker generators to the tuner antenna terminals.
3. Turn the channel selector to channel 13. Adjust the generators to the correct frequencies for channel 13 as shown in the chart on page 39.
4. Adjust L-3 (channel 13 rf plate), L-2 (channel 13 rf grid), and L-6 (channel 13 mixer grid) adjusting screws (see Fig. 86A or 86B for a band pass characteristic containing both carriers with steep sides and maximum gain. The 1C1376 cascode tuners do not require adjustment of the channel 13 rf grid coil (L-2) and hence a screw for this adjustment will not be found on the top of these tuners.

If the factory adjustment of the incremental loops and coils has not been disturbed, alignment of the rf plate, rf grid, and mixer grid should be complete after the completion of step 4 unless extensive repairs have been made on the tuner. Check the other channels for a similar band pass characteristic as shown in Fig. 87A. If they have the correct characteristics further alignment is not necessary. If they do not, procede with step 5. When aligning the 1C1376 cascode tuners it will first be necessary to repeat step 4 and adjust L-2 by spreading or compressing the turns of the coil before continuing with steps 5 and 6.

5. Adjust the coils of the rf plate, rf grid, and mixer grid for channels 12 through 7 starting with channel 12. Adjust the signal generators for each channel to the frequencies given in the chart on page 39. Pushing the half turn coil loops towards the center of the switch so that they are closer to the switch wafer will increase the frequency while pulling them out and away from the switch wafer will decrease the frequency. Adjust for a band pass characteristic containing both carriers with steep sides and maximum gain.
6. Adjust the coils of the rf plate, rf grid, and mixer grid for channels 6 through 2 starting with channel 6. Adjust the signal generators for each channel to the frequencies given in the chart on page 39. Spreading the turns of the coils will increase the frequency while squeezing the turns together will decrease the frequency. Adjust for a band pass characteristic containing both carriers with steep sides and maximum gain. A tuning wand may be used to determine what change is necessary.

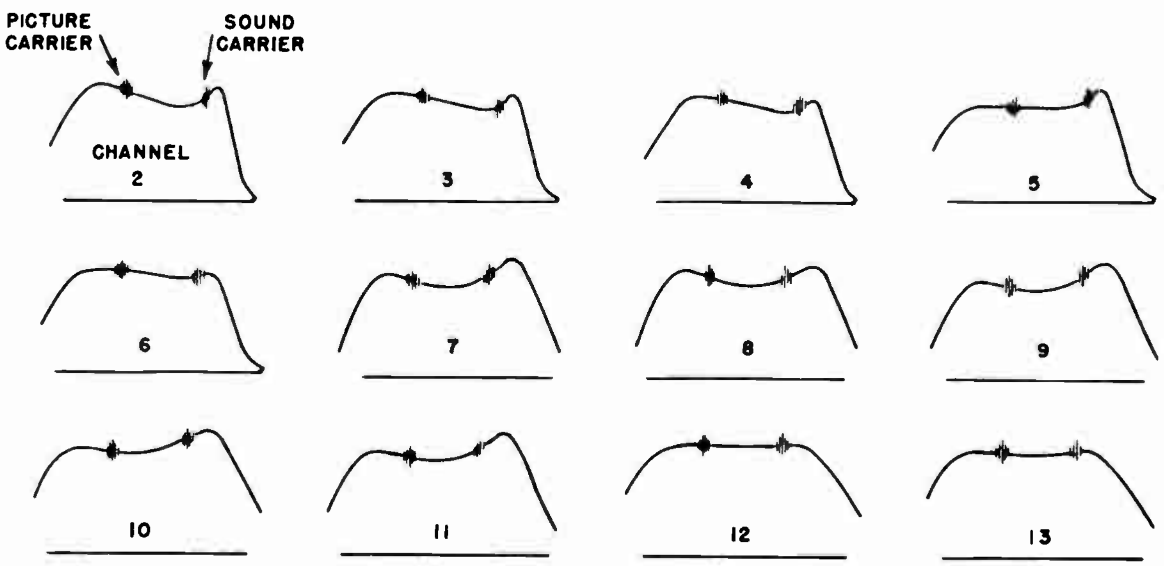
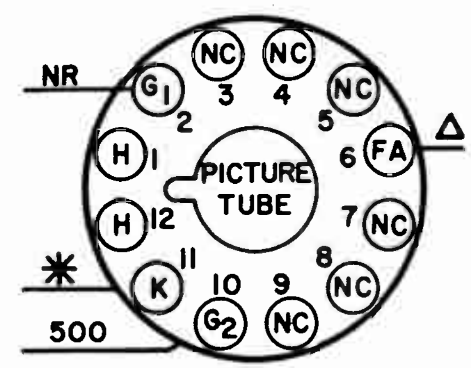


Fig. 87A. Typical Channel Response Curves for TV Tuners 92B1166



✳ 30 BRIGHTNESS MAX
150 BRIGHTNESS MIN

Δ 0 FOCUS CONTROL MIN
500 FOCUS CONTROL MAX

PICTURE TUBE LEAD COLOR CODE

PIN NO	COLOR	ELEMENT
1	BLACK	HEATER & GND.
2	GREEN	GRID
6	BLUE	FOCUS GRID
10	RED	ANODE GRID
11	YELLOW	CATHODE
12	BROWN	HEATER

Fig. 88A. Picture Tube Socket Voltages 92B1769

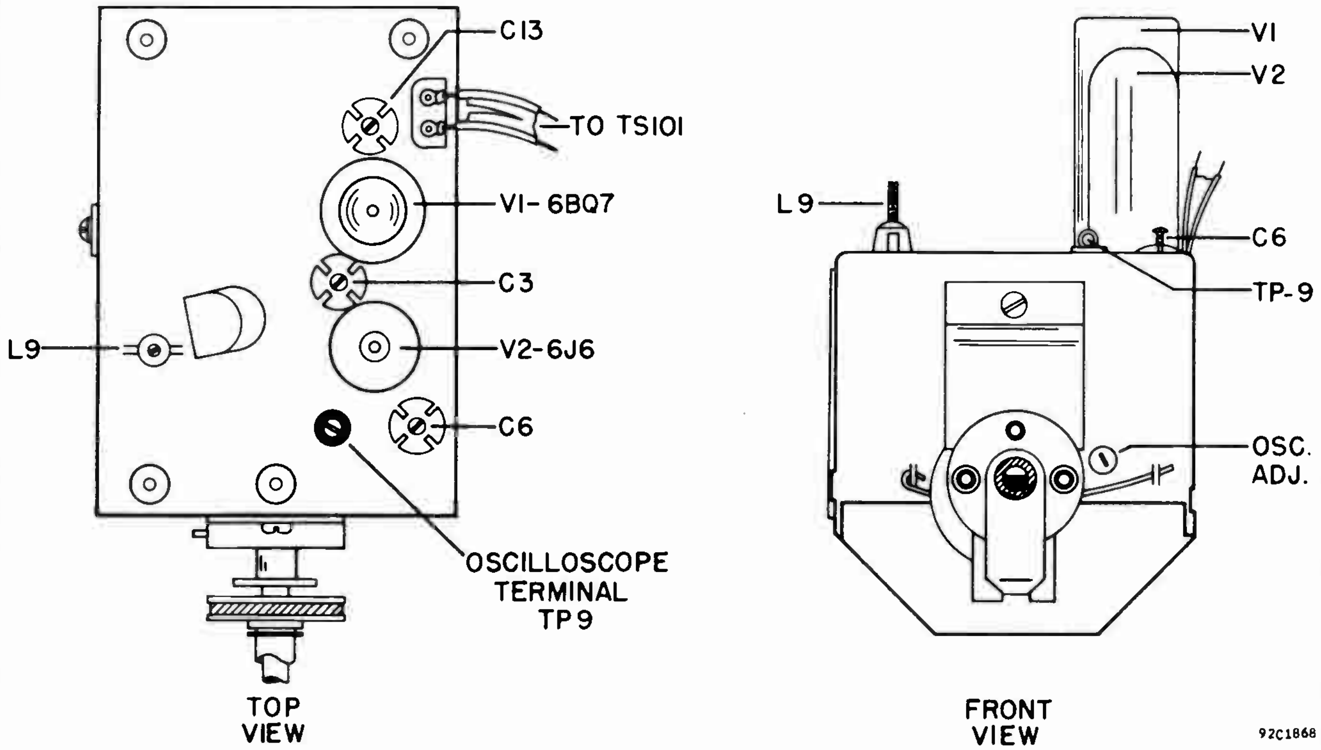


Fig. 88B. 1E1380 Cascode TV Tuner Alignment Adjustments

1E1380 CASCODE TV TUNER ALIGNMENT (ANT. & RF CIRCUITS)

The tuner was carefully aligned at the factory and should not require complete realignment under normal operating conditions. A slight readjustment of the individual oscillator slugs may be required as the tubes in the tuner age or are replaced. In some rare cases it will be necessary to realign the tuner after replacing either of the two tubes. If any service work is performed on the tuner, realignment may or may not be required. NO ATTEMPT TO REALIGN THE TUNER SHOULD BE MADE UNTIL THE BALANCE OF THE TV RECEIVER IS KNOWN TO BE IN PROPER OPERATING CONDITION AND IS PROPERLY ALIGNED.

EQUIPMENT REQUIRED

1. Sweep generator covering all 12 television channels.
2. Marker generator covering the same range as the sweep generator.
3. Oscilloscope.
4. Vacuum tube voltmeter (VTVM).

SET-UP PROCEDURE

1. Set the CHANNEL SELECTOR switch to channel 12.
2. Connect the vertical amplifier input of the oscilloscope through a 10,000 ohm resistor to test point TP-9 on the tuner. (See Schematic Diagram and Fig. 88B). The horizontal amplifier in the oscilloscope should be connected to the oscilloscope sweep voltage output from the sweep generator.
3. Connect the negative pole of a 1.5 volt dry cell to the terminal where the AGC lead (white wire) from the tuner is connected. (Connect the positive pole of the dry cell to the receiver chassis. (See Schematic Diagram).
4. Set the FINE TUNING control at the approximate midpoint of its tuning range.
5. Connect the sweep generator to the antenna terminals and adjust to sweep channel 12. Keep the output of the sweep generator as low as possible to prevent overloading the r-f stage.
6. Loosely couple the r-f output from the marker generator to the antenna terminals. Use the minimum amount of coupling and signal from the marker generator required to give a good marker on pipe on the oscilloscope pattern.

ANTENNA AND RF CIRCUIT ALIGNMENT

7. Adjust C-13, C-3 and C-6 for a flat-top response curve and maximum gain. Check markers on all channels. They should fall in automatically on each channel. Correct marker frequencies for each channel are given in the Picture Carrier and Sound Carrier columns of the chart on page 39. Refer to Fig. 87.
8. Disconnect the battery used to obtain negative bias.
9. Disconnect the test equipment and air check the receiver on all active channels. If it is possible to receive a normal picture on all active channels by adjusting the FINE TUNING control, further alignment will not be necessary.

1E1380 CASCODE TV TUNER ALIGNMENT (OSC. CIRCUIT)

1. Set the FINE TUNING control at the approximate midpoint of its tuning range.
2. Place a non-metallic screwdriver through the openings provided in the front of the chassis and the tuner assembly and adjust the oscillator coil slug for each active channel to give the best possible picture.

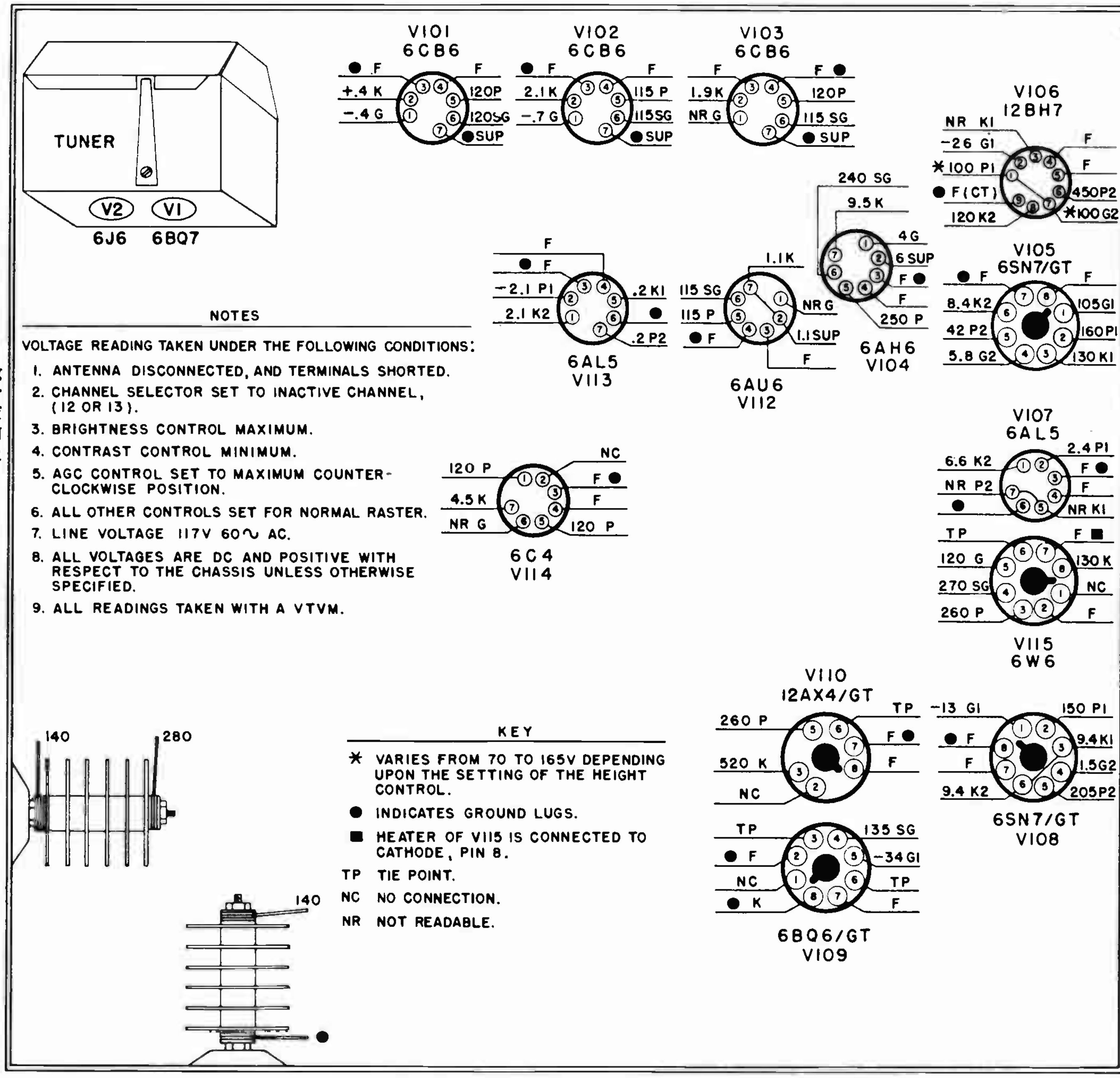


Fig. 88BA. Voltage Chart for 21" J1200D Chassis with 1E1380 Cascode Tuner

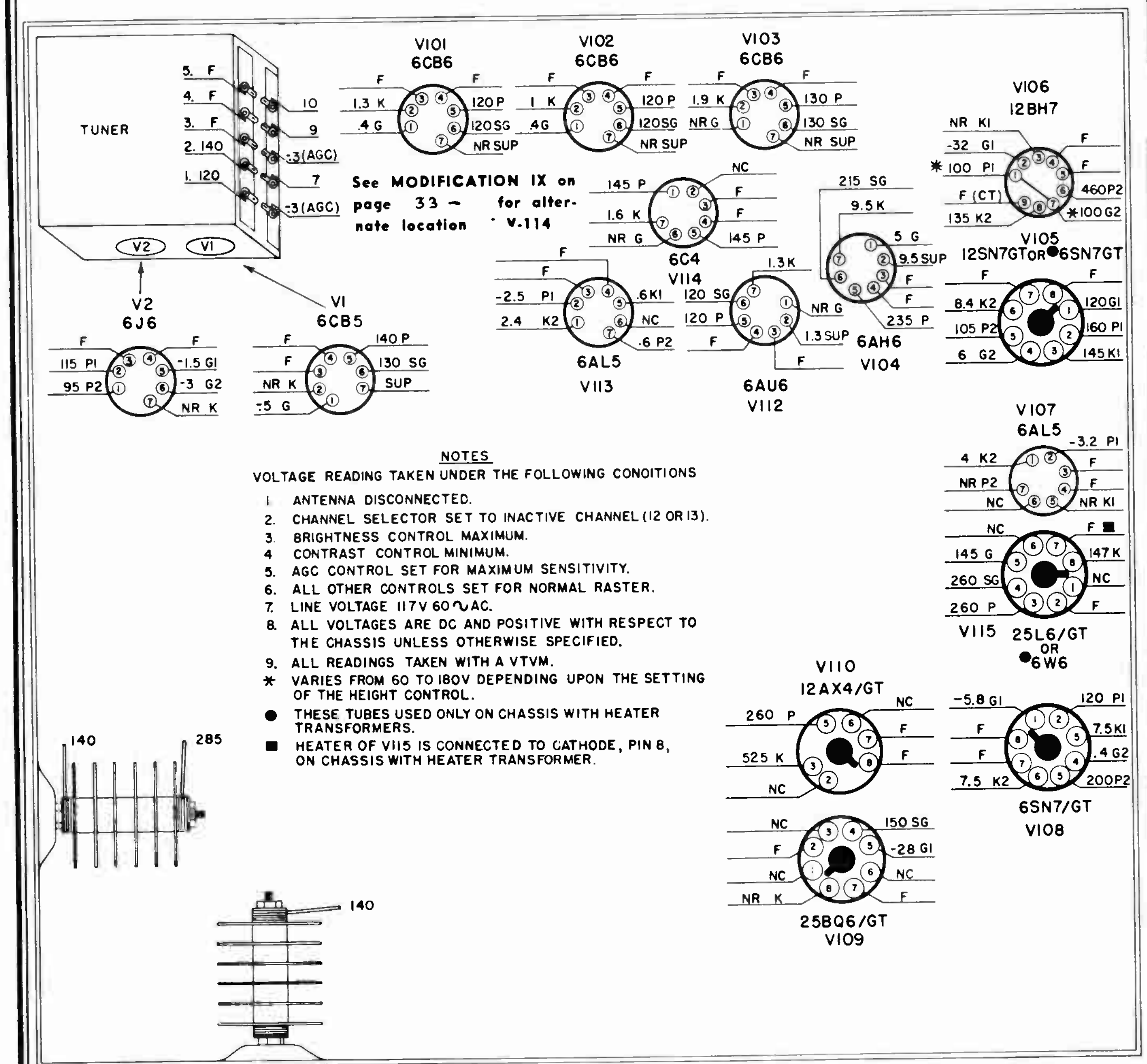


Fig. 89A. Voltage Chart for 17" A, K, P & W1200D Chassis with 1C1345 Pentode Tuner

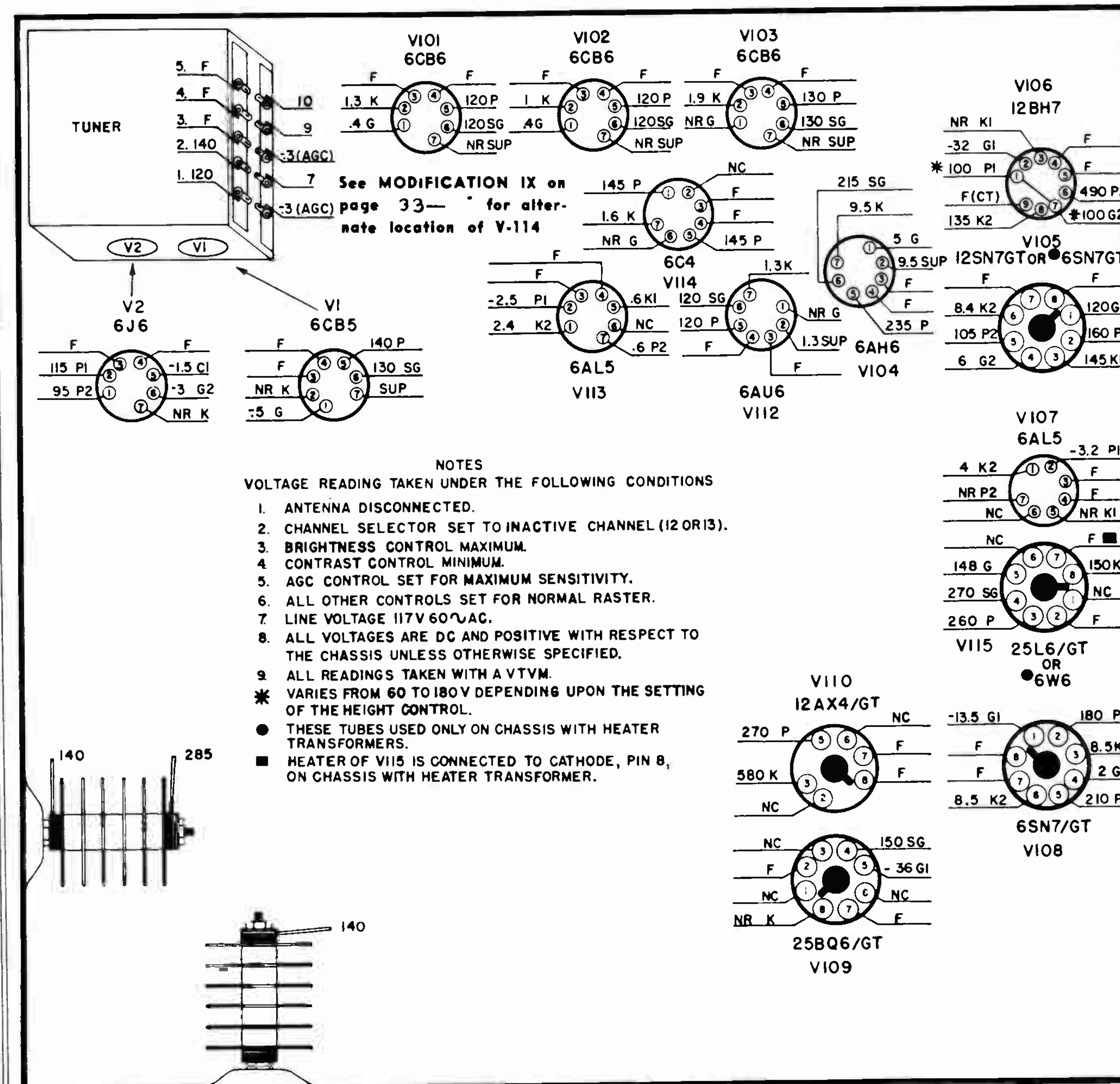


Fig. 90A. Voltage Chart for 20" D, L & X1200D or 21" R1200 D Chassis with 1C1345 Pentode Tuner

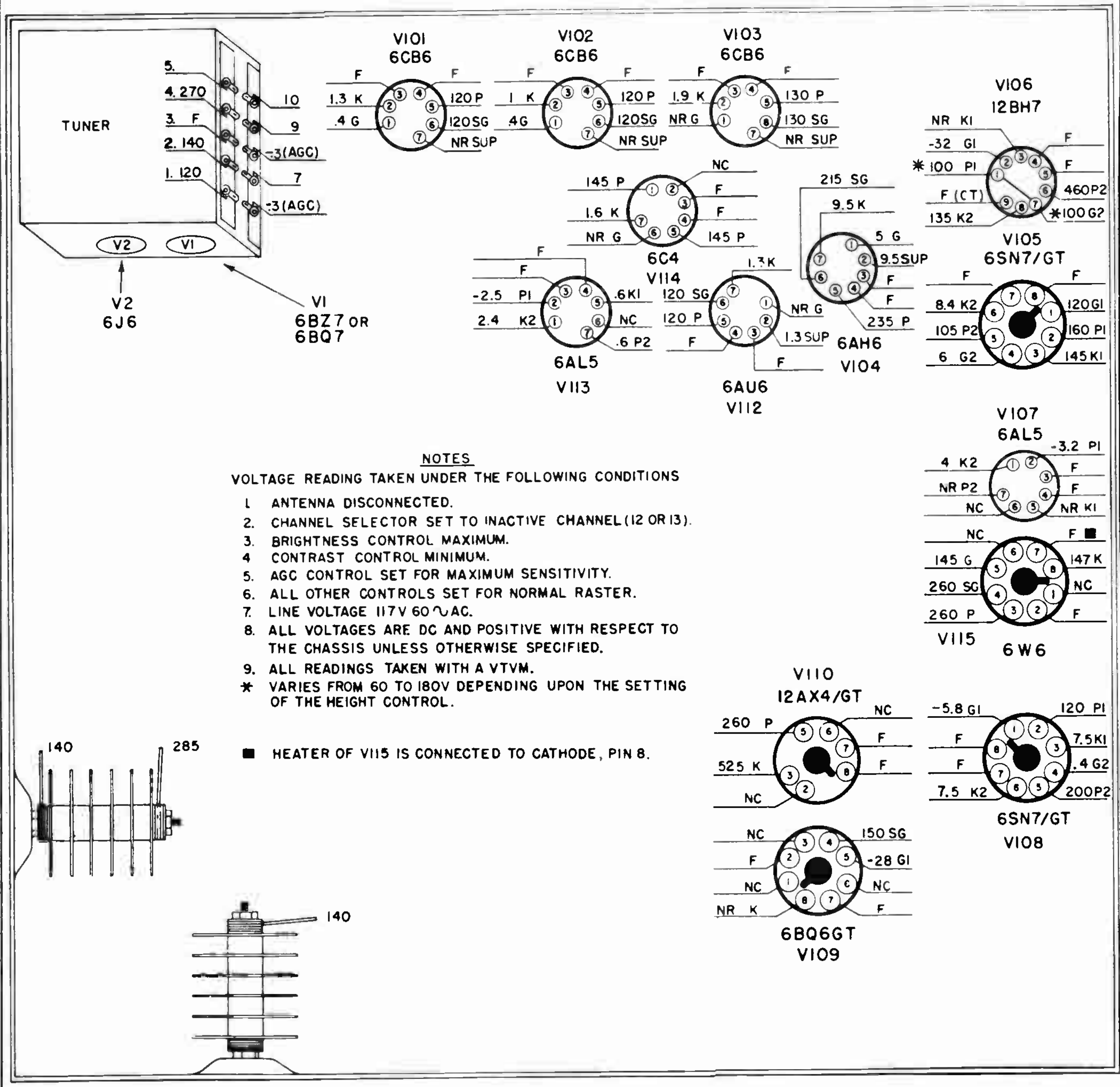


Fig. 89AA. Voltage Chart for 17" F1200D Chassis with 1C1376 Cascode Tuner

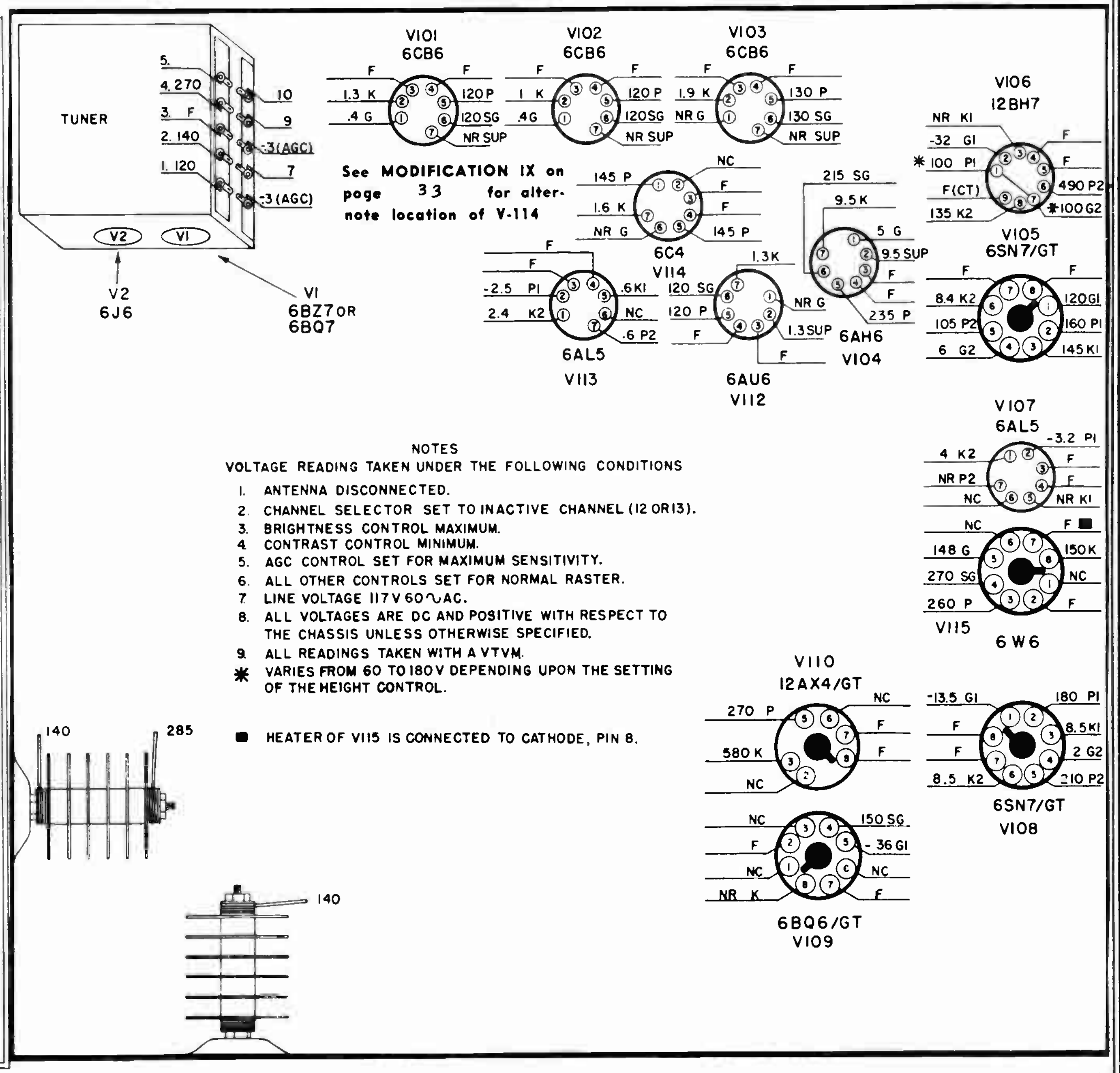


Fig. 90AA. Voltage Chart for 20" G1200D or 21" T1200D Chassis with 1C1376 Cascode Tuner

92C1839-1A

TYPICAL OSCILLOSCOPE PATTERNS

The patterns given on the following pages are presented as a guide when using an oscilloscope to locate trouble in the video amplifier, sync., horizontal oscillator, horizontal output, vertical oscillator, and vertical output stages of the television receiver.

Considerable variation may be noted in the amplitude and shape of some of the various waveforms from one receiver to the next. As long as the waveform obtained from the receiver under test contains the same general characteristics as those shown in the illustrations and the relative amplitude is within approximately 25% of the peak to peak voltage or relative amplitude shown below each waveform the pattern obtained may be assumed to be correct. The patterns are observed with the tv receiver tuned to an active channel and the controls adjusted for the best possible picture. The line voltage should be set to 117 volts.

The waveforms shown in the illustrations were obtained on a Dumont type 304 oscilloscope which was used in conjunction with a low capacity 10 to 1 probe such as the Tel-Instrument Co. type 1610. Other types of oscilloscopes will account for a certain amount of variation in the amplitude and shape of the patterns obtained from the actual receiver under test. A low capacity probe must be used in order to obtain satisfactory results. A power line isolation transformer should also be used for safety since the chassis is "hot".

With the exception of the test patterns obtained across the vertical yoke and horizontal yoke all patterns are taken with the ground side of the oscilloscope connected to the ground or chassis of the tv receiver and the 10 to 1 probe connected to the specific points in the tv chassis as specified by each pattern.

The patterns obtained from the horizontal amplifier plate, damper cathode, horizontal deflection yoke, and the high voltage rectifier tube must be observed by means of the high voltage probe which is made from a type 1X2-A tube as shown in Fig. 94A. The tube is used as a high voltage coupling capacitor. Use a new tube for this application because the loose filament of a burned out one may touch the plate and damage the probe or input circuit of the scope. These patterns are shown with their relative amplitudes indicated with respect to the pattern obtained at pin 3 (cathode) of the damper tube (V-110) which is given a unit value of one.

At certain points throughout the tv receiver the oscilloscope pattern obtained will be dependent upon the frequency of the horizontal sweep oscillator in the oscilloscope. The oscilloscope sweep frequency must be either 30 cps (1/2 of the tv vertical oscillator frequency) or 7875 cps (1/2 of the tv horizontal oscillator frequency) depending upon the pattern desired. The sweep frequency required to obtain the patterns shown is given with each pattern.

VIDEO AMPLIFIER

92X1783-A

V-104
Video Amp.

Plate pin 5

Sweep Freq.
7875 cps

Voltage P/P
set 60 volts

Adjust the contrast control to give a 60 volt peak to peak reading. Do not change this setting when taking other waveforms.

SYNC. CLIPPER

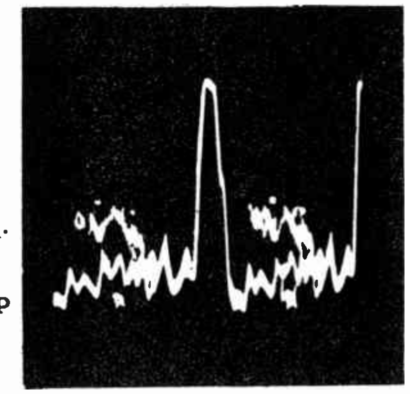
Before viewing the following waveforms set the contrast control for the 60 volt peak to peak reading and the pattern shown on page

V-105
Sync. Clip.

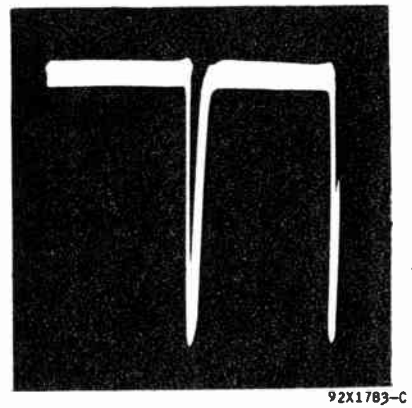
Grid Pin 1

Sweep Freq.
7875 cps

Voltage P/P
43 volts



92X1783-B



92X1783-C

V-105
Sync. Clip.

Plate Pin 2

Sweep Freq.
7875 cps

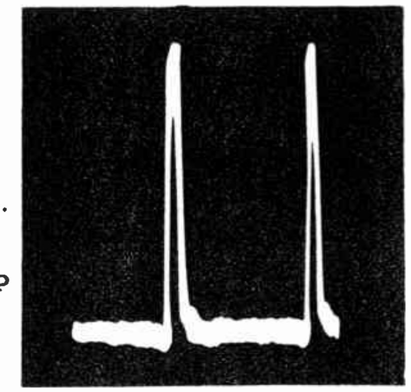
Voltage P/P
34 volts

V-105
Sync. Clip.

Plate Pin 5

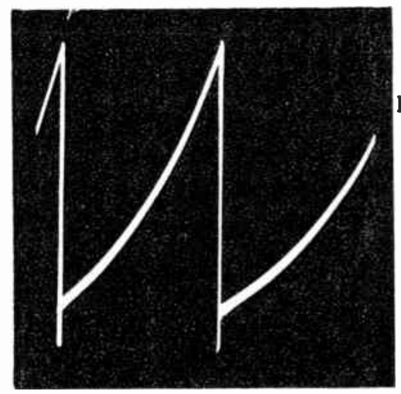
Sweep Freq.
7875 cps

Voltage P/P
40 volts



92X1783-D

VERTICAL OSCILLATOR AND VERTICAL AMPLIFIER



92X1783-E

Junction of
R-133, R-134
& C-126

Sweep Freq.
30 cps

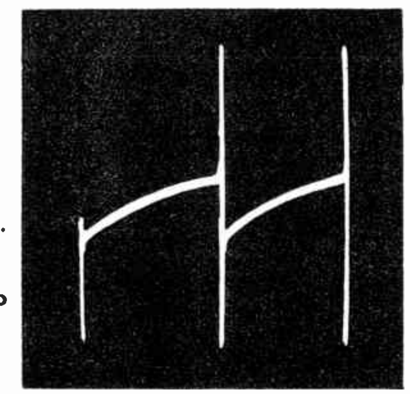
Voltage P/P
47 volts

V-106A
Vert. Osc.

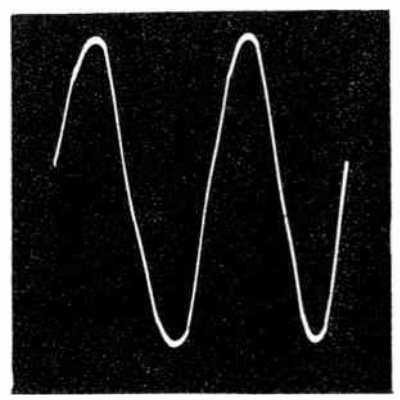
Grid Pin 2

Sweep Freq.
30 cps

Voltage P/P
180 volts



92X1783-F



92X1783-G

V-106A
Vert. Osc.

Cath. Pin 4

Sweep Freq.
30 cps

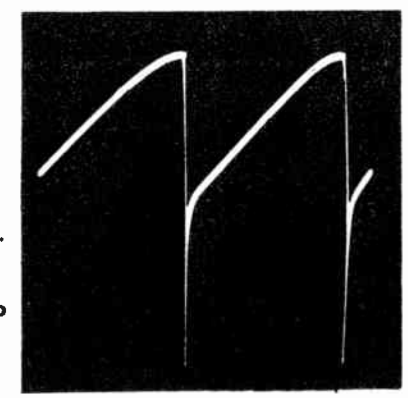
Voltage P/P
110 volts

V-106B
Vert. Out.

Grid Pin 7

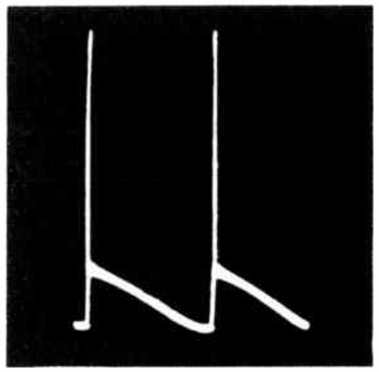
Sweep Freq.
30 cps

Voltage P/P
90 volts.



92X1783-H

VERTICAL OSCILLATOR AND VERTICAL AMPLIFIER (Cont.)



92X1783-I

V-106B
Vert. Out.

Plate Pin 6

Sweep Freq.
30 cps

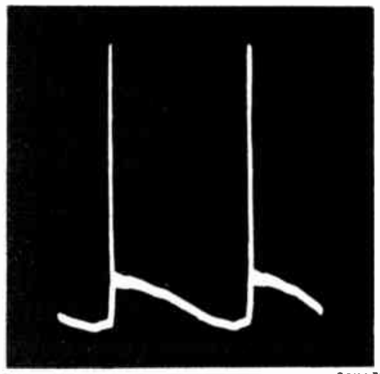
Voltage P/P
1500 volts

V-116
Pix Tube

Grid Pin 2
Green Lead
Sweep Freq.
30 cps

Voltage P/P
14 volts

92X1783-K



92X1783-J

Across Vert.
Yoke

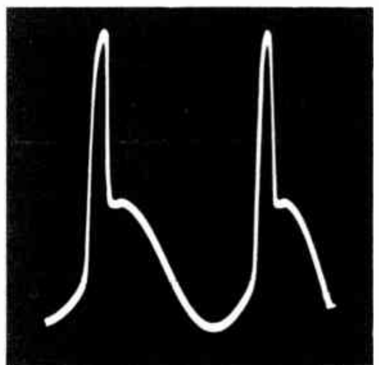
Green Leads

Sweep Freq.
30 cps

Voltage P/P
30 volts

NOTE: When observing this test pattern the oscilloscope must not be grounded since the ground side of the scope is connected to B+ of the power supply. Do not touch the tv chassis and the scope during this observation as a severe shock will result. The "hot" lead of the scope should be connected to the green wire and the other scope lead should be connected to the green wire with black tracer.

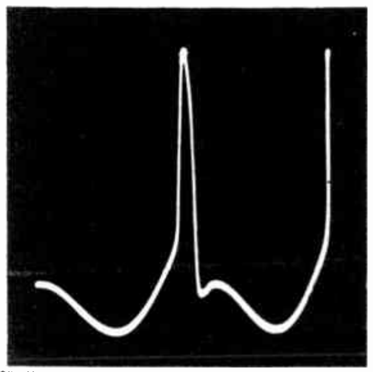
HORIZONTAL OSCILLATOR AND HORIZONTAL AMPLIFIER DRIVE



92X1784-L

V-108
Horiz. Osc.
Plate Pin 5
Sweep Freq.
7875 cps
Voltage P/P
For 17" chassis
34 volts
20" & 21" chassis
45 volts

V-108
Horiz. Osc.
Grid Pin 1
Sweep Freq.
7875 cps
Voltage P/P
For 17" chassis
28 volts
20" & 21" chassis
45 volts



92X1784-M

92X1784-N

V-108
Horiz. Osc.
Plate Pin 2
Sweep Freq.
7875 cps
Voltage P/P
For 17" chassis
95 volts
20" & 21" chassis
145 volts

V-109
Horiz. Out.
Grid Pin 5
Sweep Freq.
7875 cps
Voltage P/P
For 17" chassis
95 volts
20" & 21" chassis
140 volts

92X1784-O

HORIZONTAL AMPLIFIER, DAMPER AND HIGH VOLTAGE RECTIFIER

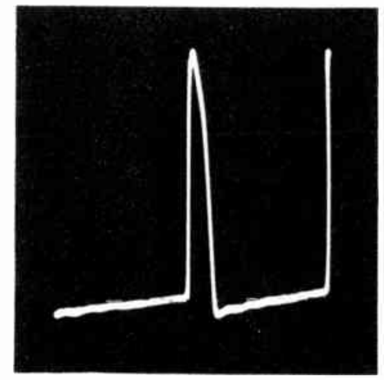
Before endeavoring to view the following waveforms read the notes and instructions at the beginning of this section pertaining to waveforms. The high voltage probe shown below must be used to prevent damage to the test equipment being used.

V-110
Damper

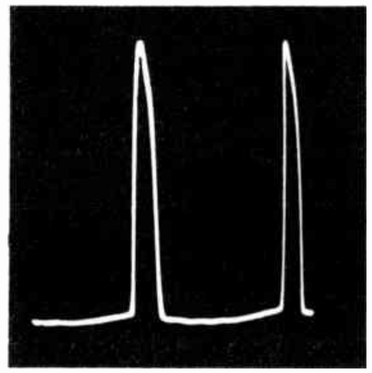
Cath. Pin 3

Sweep Freq.
7875 cps

Voltage Ratio
1 time



94X1784-Q



92X1784-S

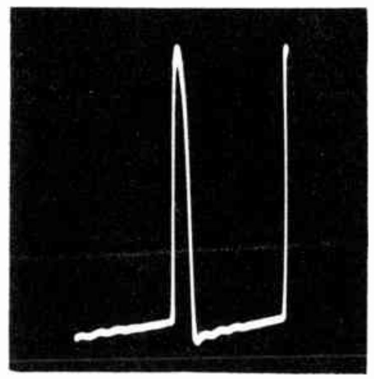
Across Horiz.
Yoke

Red Wires

Sweep Freq.
7875 cps

Voltage Ratio
1 time

NOTE: When observing this test pattern the oscilloscope must not be grounded since the ground side of the scope is connected to B+ of the power supply. Do not touch the tv chassis and the scope during this observation as a severe shock will result. The "hot" lead of the scope should be connected to the red wire and the other scope lead should be connected to the red wire with black tracer.



92X1784-P

V-109
Horiz. Out.

Plate Cap

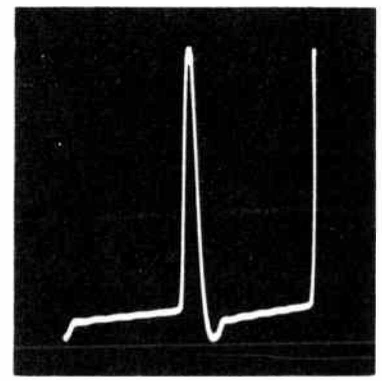
Sweep Freq.
7875 cps

Voltage Ratio
1.7 times

V-111
High Volt.
Rectifier
Plate Cap

Sweep Freq.
7875 cps

Voltage Ratio
5.5 times



92X1784-R

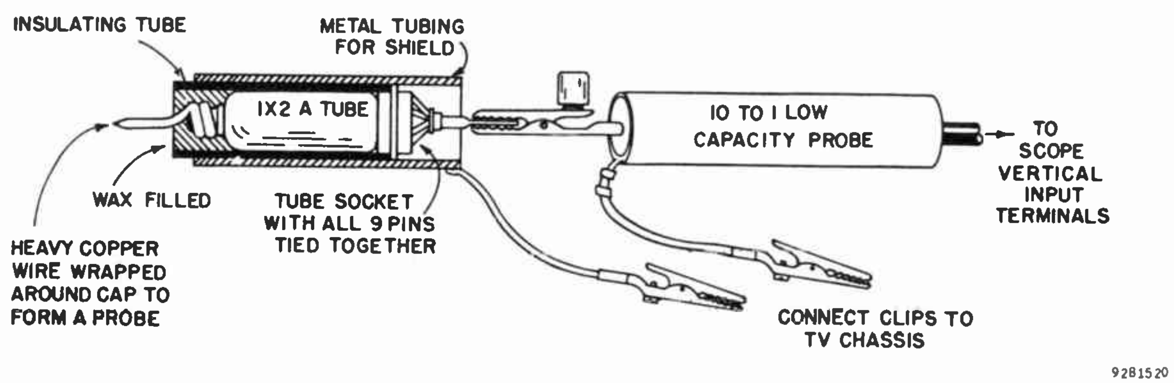


Fig. 94A. High Voltage Probe for Waveform Observations

PICTURE TUBE AND MOUNTING COMPONENTS FOR A, D, F, G, J, K, L, P, R, T, W, X, Y AND Z1200D CHASSIS

Schematic Symbol	Description	Hallicrafters Part Number: For Glass 17" Rect. plastic cab.	For Glass 17" Rect. wood cab.	For Glass 20" Rect. wood cab.	For Metal 21" Rect. wood cab.	For Glass 21" Rect. wood cab.
V-116	Picture tube	90X17HP4	90X17HP4	90X20HP4	90X21MP4	90X21FP4A
	Bracket, deflection yoke mtg.	67C1244	67C1244	67C1244	67C1244	67C1244
	Bracket, front pix tube support	67B2219	8B1808	67C1993	-------	-------
	Bracket, front right pix tube support	-------	-------	-------	67C2030	67D2248
	Bracket, front left pix tube support	-------	-------	-------	67C2031	67D2249
	Bracket, rear pix tube and yoke support	*67B2040	*67D1948	67A1979	67A2035	67D2024
	Bracket, bottom extension for above	None	None	None	None	67A2156
	Bracket, stop pad; center mtg.	*67B2082	*67A1968	None	None	None
	Bracket, stop pad; right mtg.	None	None	67C1992	None	67C2175
	Bracket, stop pad; left mtg.	None	None	67C1991	None	67C2174
	Centering device; electrostatic tubes	21B138	21B138	21B138	21B138	21B138
	Collar, picture tube mtg.; rubber	16A295	16A295	16A295	16A295	16A295
	Cushion, pix tube mtg.; sponge rubber	16A316	16A316	16A316	None	16C162
	Deflection yoke	See		Page	54	
	Ground and shield, pix tube; metalized paper	69C493	69C493	69C506	None	69C506
	Hook, pix tube ground and shield	76A967	76A967	76A967	None	76A967
	Ion trap	21A145	21A145	21A146	21A146	21A146
	Keeper, pix tube anode	8A1375	8A1375	8A1375	None	8A1375
	Pad, pix tube mtg.; 3" rubber channel	16A294	16A294	16A294	16A237	16A294
	Pad, stop; rubber channel	16A314	16A297	16A309	None	16A309
PL-101	Plug, pix tube anode	10A500	10A500	10A500	None	10A500
	Polyethylene mtg. ring; metal pix tube	None	None	None	7E313	None
	Screw, deflection yoke adj.	3A1610	3A1610	3A1610	3A1610	3A1610
	Sleeve, insulating; rear pix tube support springs	None	None	None	8A1926	None
	Sleeve, 12" insulating; anode lead	None	None	None	65A542	None
	Socket assembly, pix tube	6A465	*6A465	6A465	6A465	6A465
	Spacer, deflection yoke adj. screw	73A580	73A580	73A580	73A580	73A580
	Spacer, front pix tube support	None	63A851	8A1943	None	None
	Spring, anode keeper; $1\frac{1}{2}$" long	75A202	75A202	75A202	None	75A202
	Spring, anode keeper, $3\frac{1}{4}$" long	75A203	75A203	75A203	None	75A203
	Spring, pix tube ground and shield	75A257	75A257	75A257	None	75A257
	Spring, pix tube ground	None	None	75B246	None	75B246
	Spring, pix tube rear support	75A268	75B258	75A262	75A269	75A267
	Strap, pix tube mtg.; with end brackets	76B1025	76A1042	76B1026	76A848	76B1027
	Strap, copper; anode connector	None	None	None	76A371	None
	Strip, rubber	None	None	None	16A291	None

*On some 17" chassis the picture tube is mounted with a forward tilt of approximately four degrees. This tilt causes the bottom of the rear picture tube and yoke support bracket to raise up and at the same time move toward the rear of the chassis. The odd shape of the bracket used to mount the rear support bracket in this position is easily recognized. An additional spacer is also placed under the front picture tube mounting brackets on some chassis as indicated below.

The following parts are used when the picture tube is tilted:

	CHASSIS A,F,K & W1200D	CHASSIS P1200D & Y1200D
Socket assembly, pix tube	6A454	None
Spacer, extra; front pix tube support	8A1985	None
Bracket, right rear support	67C2081	67C2081
Bracket, left rear support	67C2080	67C2080
Bracket, rear pix tube & yoke support	No change	67A2083
Bracket, stop pad; center mounting	No change	None

When a chassis with a tilted picture tube is installed in a cabinet a different mask, cabinet back and sometimes safety glass are used. These different cabinet parts are listed on the model data sheets for each individual model when applicable.

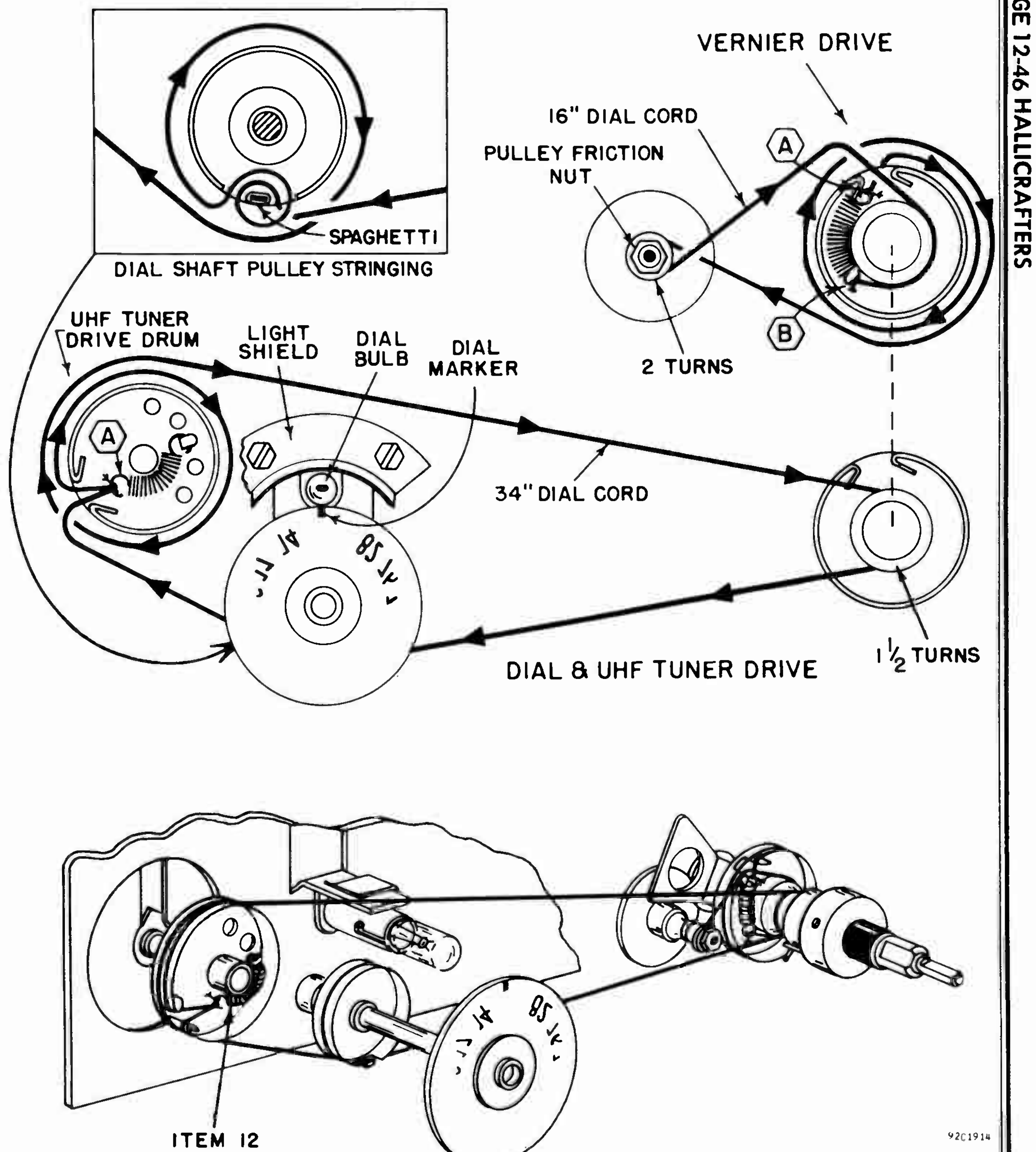


Fig. 104A. 1E1484 UHF Tuner Drive Mechanism Stringing

STRINGING & ADJUSTMENT OF VERNIER DRIVE, DIAL & UHF TUNER DRIVE

STRINGING VERNIER DRIVE

Tie one end of a 16" or longer dial cord to tension spring at "A" and position the spring as shown in Fig. 104A so that a slight tension on the dial cord will hold the spring in place.

Pass cord around pulleys as shown in Fig. 104A in the direction indicated by the arrows. Maintain a slight tension on the free end of the cord and rotate the large pulley counterclockwise to the position shown in Fig. 104A.

Tie the free end of the dial cord to the tension spring at "B" after stretching the spring.

Place a drop of quick drying cement on the knots to prevent them from working loose.

STRINGING UHF TUNER DRIVE AND DIAL

Set UHF tuner drive drum and vernier drive fully counterclockwise as shown in Fig. 104A.

Tie one end of a 34" or longer dial cord to tension spring at "A" and hook other end of spring on the pulley, stretch the spring and pass the cord around pulleys as shown in Fig. 104A in the direction indicated by the arrows until the dial shaft pulley is reached.

Carefully set the position of the dial so that the dial marker is directly above the center of the shaft as shown in Fig. 104A. Pass dial cord around spaghetti covered pin through notches in pulley rim and take one turn around pulley before passing free end of cord through notch in drive drum pulley and tying to the tension spring at "A". Cement knots to prevent them from working loose.

ADJUSTMENT OF PULLEY FRICTION NUT

The vernier drive is designed with a fast and slow tuning speed. During slow speed tuning the friction nut must be tightened so that the friction developed by the spring washer will not allow the idler pulley (Item 6, Fig. 104AA) to slip. If it does slip, it will not be possible to accurately tune in a UHF station.

During high speed tuning the idler pulley must slip. If the friction nut is set too tight the dial cord will slip on the idler pulley causing excessive cord wear necessitating frequent cord replacement. The dial will also be hard to turn.

SERVICE PARTS LIST FOR UHF TUNER VERNIER DRIVE MECHANISM

The items in the following parts list are identified in Fig. 104AA, except item 12 shown in Fig. 104A, by means of the item numbers. WHEN ORDERING REPLACEMENT PARTS ORDER BY PART NUMBER ONLY.

ITEM	DESCRIPTION	PART NO.	ITEM	DESCRIPTION	PART NO.
1	Collar	77A615	7	Screw, set; 6-32 x ½" bristol	3A1803
2	Dial shaft & pulley assembly	28B142	8	Spring, drive string tension	75A163
3	Nut, friction	2A2182	9	Stop, pulley	67A2144
4	Pin, stop	74A586	10	Washer, flat	4A140
5	Pulley and idler assembly	28B141	11	Washer, spring	4A1557
6	Pulley, idler	28A139	12	Spring, drive string tension	75A173

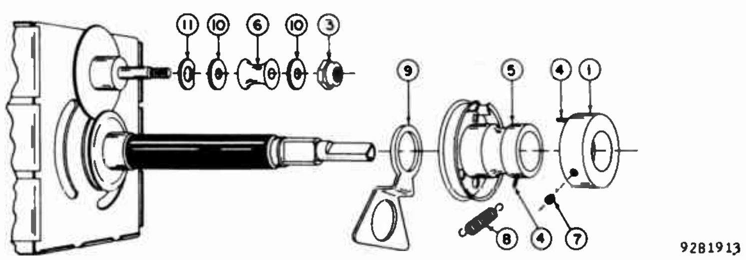


Fig. 104AA. Drive Mechanism Exploded View

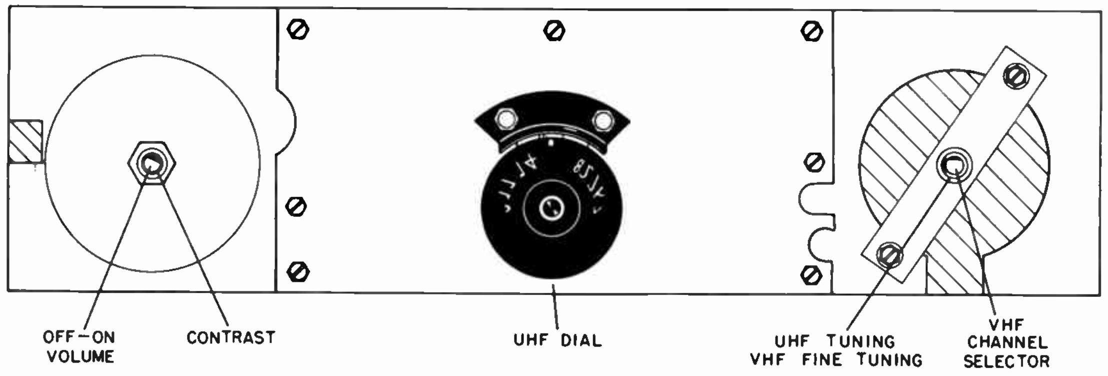


Fig. 104BA. Front Controls for Chassis Y1200D

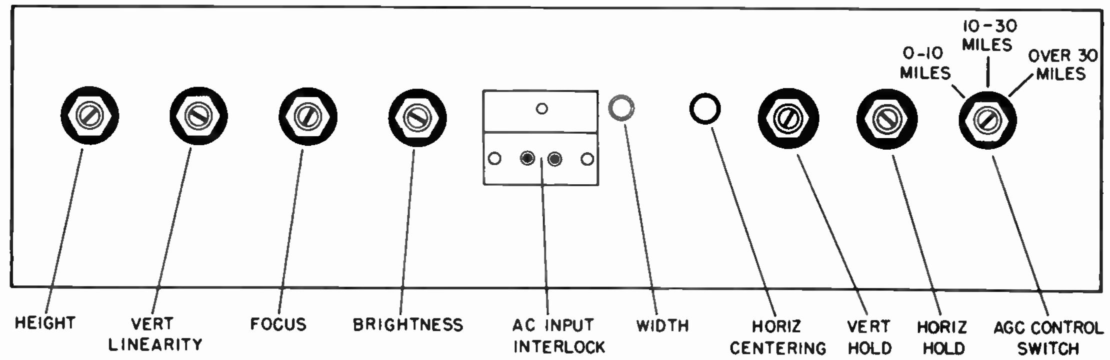


Fig. 104BB. Rear Controls for Chassis Y1200D

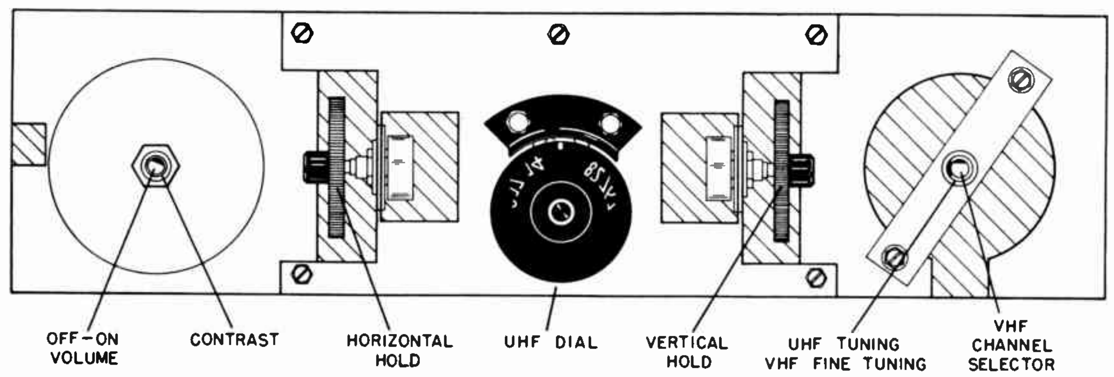


Fig. 104BC. Front Controls for Chassis Z1200D

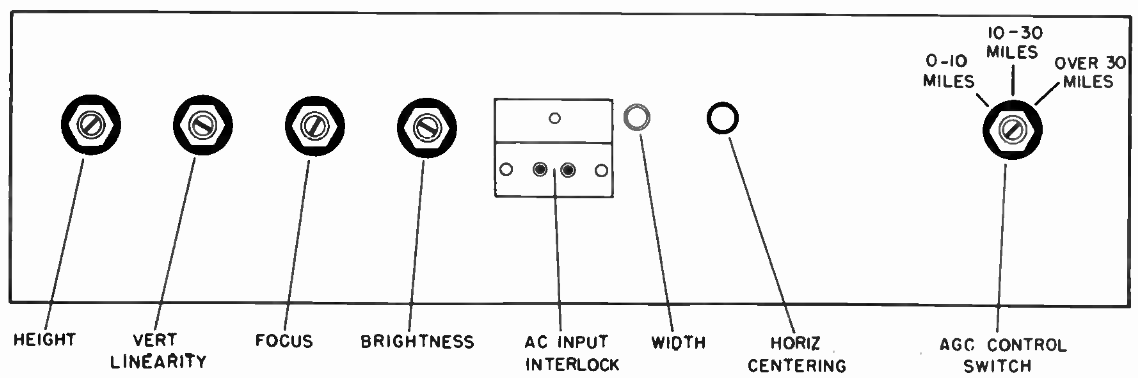


Fig. 104BD. Rear Controls for Chassis Z1200D

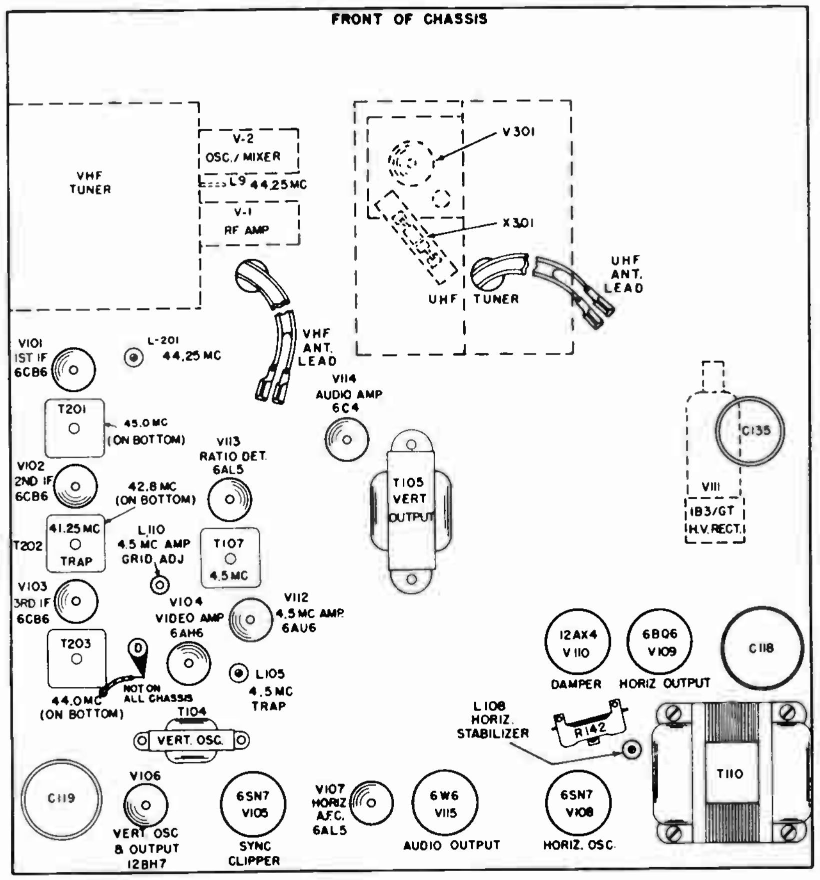


Fig. 104CA. Top View Chassis Alignment Location for Chassis Y & Z1200D

VHF & UHF CHANNELS vs. CARRIER & OSCILLATOR FREQUENCIES FOR 45.75 TO 41.25 MC I.F. SYSTEMS

Channel Number	Channel Freq. (mc)	Picture Carrier Freq. (mc)	Sound Carrier Freq. (mc)	Receiver Oscillator Freq. (mc)
VERY HIGH FREQUENCIES				
2	54-60	55.25	59.75	101
3	60-66	61.25	65.75	107
4	66-72	67.25	71.75	113
5	76-82	77.25	81.75	123
6	82-88	83.25	87.75	129
7	174-180	175.25	179.75	221
8	180-186	181.25	185.75	227
9	186-192	187.25	191.75	233
10	192-198	193.25	197.75	239
11	198-204	199.25	203.75	245
12	204-210	205.25	209.75	251
13	210-216	211.25	215.75	257
ULTRA HIGH FREQUENCIES				
14	470-476	471.25	475.25	517
15	476-482	477.25	481.25	523
16	482-488	483.25	487.75	529
17	488-494	489.25	493.75	535
18	494-500	495.25	499.75	541
19	500-506	501.25	505.75	547
20	506-512	507.25	511.75	553
21	512-518	513.25	517.75	559
22	518-524	519.25	523.75	565
23	524-530	525.25	529.75	571
24	530-536	531.25	535.75	577
25	536-542	537.25	541.75	583
26	542-548	543.25	547.75	589
27	548-554	549.25	553.75	595
28	554-560	555.25	559.75	601
29	560-566	561.25	565.75	607
30	566-572	567.25	571.75	613
31	572-578	573.25	577.75	619
32	578-584	579.25	583.75	625
33	584-590	585.25	589.75	631
34	590-596	591.25	595.75	637
35	596-602	597.25	601.75	643
36	602-608	603.25	607.75	649
37	608-614	609.25	613.75	655
38	614-620	615.25	619.75	661
39	620-626	621.25	625.75	667
40	626-632	627.25	631.75	673

Channel Number	Channel Freq. (mc)	Picture Carrier Freq. (mc)	Sound Carrier Freq. (mc)	Receiver Oscillator Freq. (mc)
41	632-638	633.25	637.75	679
42	638-644	639.25	643.75	685
43	644-650	645.25	649.75	691
44	650-656	651.25	655.75	697
45	656-662	657.25	661.75	703
46	662-668	663.25	667.75	709
47	668-674	669.25	673.75	715
48	674-680	675.25	679.75	721
49	680-686	681.25	685.75	727
50	686-692	687.25	691.75	733
51	692-698	693.25	697.75	739
52	698-704	699.25	703.75	745
53	704-710	705.25	709.75	751
54	710-716	711.25	715.75	757
55	716-722	717.25	721.75	763
56	722-728	723.25	727.75	769
57	728-734	729.25	733.75	775
58	734-740	735.25	739.75	781
59	740-746	741.25	745.75	787
60	746-752	747.25	751.75	793
61	752-758	753.25	757.75	799
62	758-764	759.25	763.75	805
63	764-770	765.25	769.75	811
64	770-776	771.25	775.75	817
65	776-782	777.25	781.75	823
66	782-788	783.25	787.75	829
67	788-794	789.25	793.75	835
68	794-800	795.25	899.75	841
69	800-806	801.25	805.75	847
70	806-812	807.25	811.75	853
71	812-818	813.25	817.75	859
72	818-824	819.25	823.75	865
73	824-830	825.25	829.75	871
74	830-836	831.25	835.75	877
75	836-842	837.25	841.75	883
76	842-848	843.25	847.75	889
77	848-854	849.25	853.75	895
78	854-860	855.25	859.75	801
79	860-866	861.25	865.75	807
80	866-872	867.25	871.75	813
81	872-878	873.25	877.75	819
82	878-884	879.25	883.75	825
83	884-890	885.25	889.75	931

On all channels the Picture I-F frequency is 45.75 MC and the Sound I-F frequency is 41.25 MC which gives a difference between these two frequencies of 4.5 MC for the inter-carrier sound system.

I-F AMPLIFIER ALIGNMENT FOR Y AND Z1200D CHASSIS

EQUIPMENT REQUIRED

SWEEP GENERATOR	RCA type WR-59B or equivalent.
MARKER GENERATOR	RCA type WR-39C Television Calibrator or equivalent.
OSCILLOSCOPE	RCA type WO-56A or equivalent.
VACUUM TUBE VOLTMETER (VTVM)	RCA type WV-97A or equivalent.
BIAS SOURCE	Three volt battery.
TEST CIRCUIT	Shown in Fig. 104DA
ISOLATION TRANSFORMER	150 watt rating or higher.

PROCEDURE

1. Connect all test equipment to a common ground. Connect the TV chassis to this same ground after installing an isolation transformer between the power line and the TV chassis. One side of the line cord connects directly to the TV chassis and an isolation transformer must be used for safety. Allow a 15 minute warm up period.

2. Set the AVC switch on the rear chassis apron to the 0-10 MILE (counterclockwise) position.

3. Connect the negative side of a 3 volt battery supply to test point Ⓔ. Connect the positive side of the supply to the TV chassis. See schematic diagram.

4. Connect a VTVM to test point Ⓓ through a 47,000 ohm carbon resistor. Connect the ground side of the meter to the TV chassis. See Fig. 104CA.

5. Connect the high side of a marker generator to the shield of the osc./mixer tube. This connection will capacitively couple the generator output to the tube. Make sure the shield is ungrounded by raising it above the grounded clips that hold it in place.

6. Set the channel selector to channel 3 or 4, whichever is vacant.

7. Set the marker generator output (unmodulated) for a two volt negative dc reading on the VTVM and adjust the three i-f transformers, L-9, and L-201 according to the I-F AMPLIFIER ALIGNMENT CHART shown below. Readjust the signal generator output as required to maintain the two volt VTVM reading.

I-F AMPLIFIER ALIGNMENT CHART

Signal Generator Frequency (No Modulation)	Adjustment	Transformer or Coil Location	VTVM Indication
45.0 MC	T-201 (bottom)	See Fig. 104CA	Maximum
42.8 MC	T-202 (bottom)	Under Chassis	Maximum
44.0 MC	T-203 (bottom)	See Fig. 104CA	Maximum
41.25 MC	T-202 (top)	See Fig. 104CA	Minimum
42.8 MC	T-202 (bottom)	See Fig. 104CA	Maximum
44.25 MC	*L-201	See Fig. 104CA	Maximum
44.25 MC	#L-9	See Fig. 104CA	Maximum

IMPORTANT — The wax in the end of the coil forms holding the iron core in position may be softened for adjustment of the core by means of a heated screwdriver or a small pencil type soldering iron inserted into the wax. Remelt wax after adjustment.

* NOTE: Temporarily connect the series resistor-capacitor combination shown in Fig. 104DA to the tuner test point TP-2 when making this adjustment.

\# NOTE: Temporarily connect the series resistor-capacitor combination shown in Fig. 104DA to the grid (pin 1) of V-101 the 6CB6 first i-f amplifier when making this adjustment.

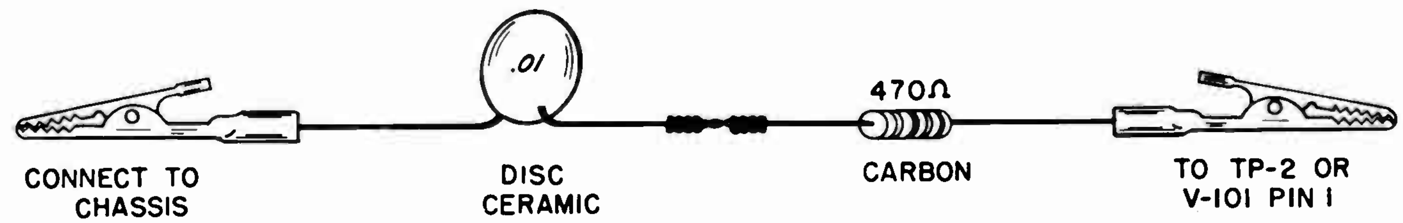


Fig. 104DA. Test Circuit for I-F Amplifier Alignment

8. Disconnect the VTVM and marker generator connected in steps 4 and 5. The balance of the set-up should be as directed in steps 1, 2, 3 and 6.

9. Capacitively couple the high side of the sweep generator r-f output to the osc./mixer tube by connecting to the tube shield which has been raised above its grounding clips. The ground side of the sweep generator should be connected to the receiver chassis. Adjust the generator to sweep from 40.5 to 46.5 MC.

10. Loosely couple the high side of the marker generator to the high side of the sweep generator by clipping the marker generator r-f lead over the insulation of the sweep generator r-f lead. The ground side of the marker generator should be connected to the receiver chassis.

IMPORTANT — To prevent overloading of the i-f amplifier keep the output of the sweep and marker generators as low as possible. The marker generator output should be just high enough to produce visible pips on the pattern. In some cases the 41.25 MC pip will not be visible unless the r-f output of the marker generator is increased to overcome the attenuation of the 41.25 MC signal by the trap in the top of T-202.

11. Connect the sweep output terminals on the sweep generator to the input of the horizontal amplifier in the oscilloscope.

12. Connect one side of a 47,000 ohm 1/2 watt resistor to test point (D) shown in the schematic diagrams. Connect the other end of the resistor to the high side of the input terminals for the vertical amplifier in the oscilloscope. The scope ground terminal connects to the receiver chassis. Keep the scope leads away from the internal chassis wiring, particularly the horizontal output section.

13. Reduce the r-f output of the sweep generator and increase the gain of the vertical amplifier in the oscilloscope as much as possible without introducing an excessive amount of noise on the test pattern. This will prevent overloading of the i-f system.

14. Check the position of the markers shown in Fig. 104EA. Adjust only the bottom cores of T-201, T-202 and T-203 for a response curve of maximum amplitude with a slightly tilted flat topped appearance as shown in Fig. 104EA. This tilt is required to compensate for the capacitive coupling used for the signal generators. The actual response obtained will be flat when the pattern viewed on the oscilloscope has this tilt. The bottom core of T-203 will primarily control the tilt of this central portion of the curve.

The bottom core of T-201 should be adjusted to position the 45.75 MC marker in the 50% position shown in Fig. 104EA.

The bottom core of T-202 should be adjusted to determine the slope of the curve between 41.25 MC and 42.8 MC with the 42.25 MC marker down 50% on the curve as shown in Fig. 104EA.

Under no circumstances should an attempt be made to adjust L-9, L-201 and the 41.25 MC trap in the top of T-202 by means of an oscilloscope and sweep generator. Maladjustment of these coils does not give a noticeable indication on the oscilloscope. Align these coils by following the procedure given in steps 1 through 7 only.

I-F AMPLIFIER SENSITIVITY MEASUREMENT

To determine the i-f amplifier sensitivity, disconnect the r-f output lead from the tuner where it connects to L-201. Temporarily connect one side of a .005 mfd. mica or ceramic capacitor to grid pin 1 of the first 6CB6 i-f amplifier tube V-101. Connect the unmodulated r-f output of a marker generator to the other side of the capacitor and the ground side of the generator to the TV chassis. Set the marker generator to 43.75 MC. Connect a VTVM as directed in step 4 of the alignment procedure. The 3 volt battery must be removed. If a generator output of 200 to 400 microvolts produces a 1 volt reading on the VTVM, the i-f amplifier sensitivity is normal.

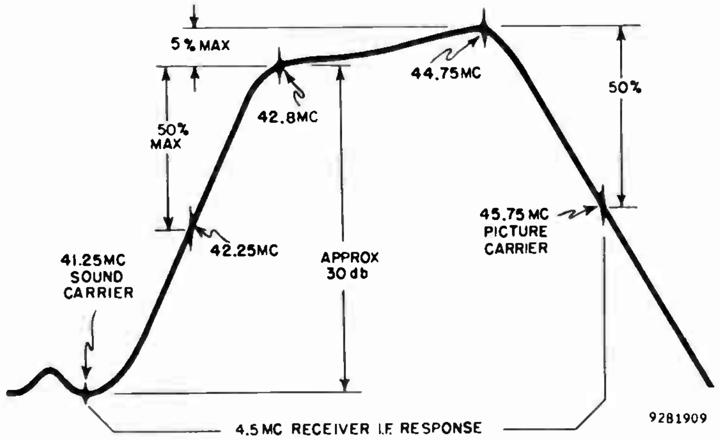
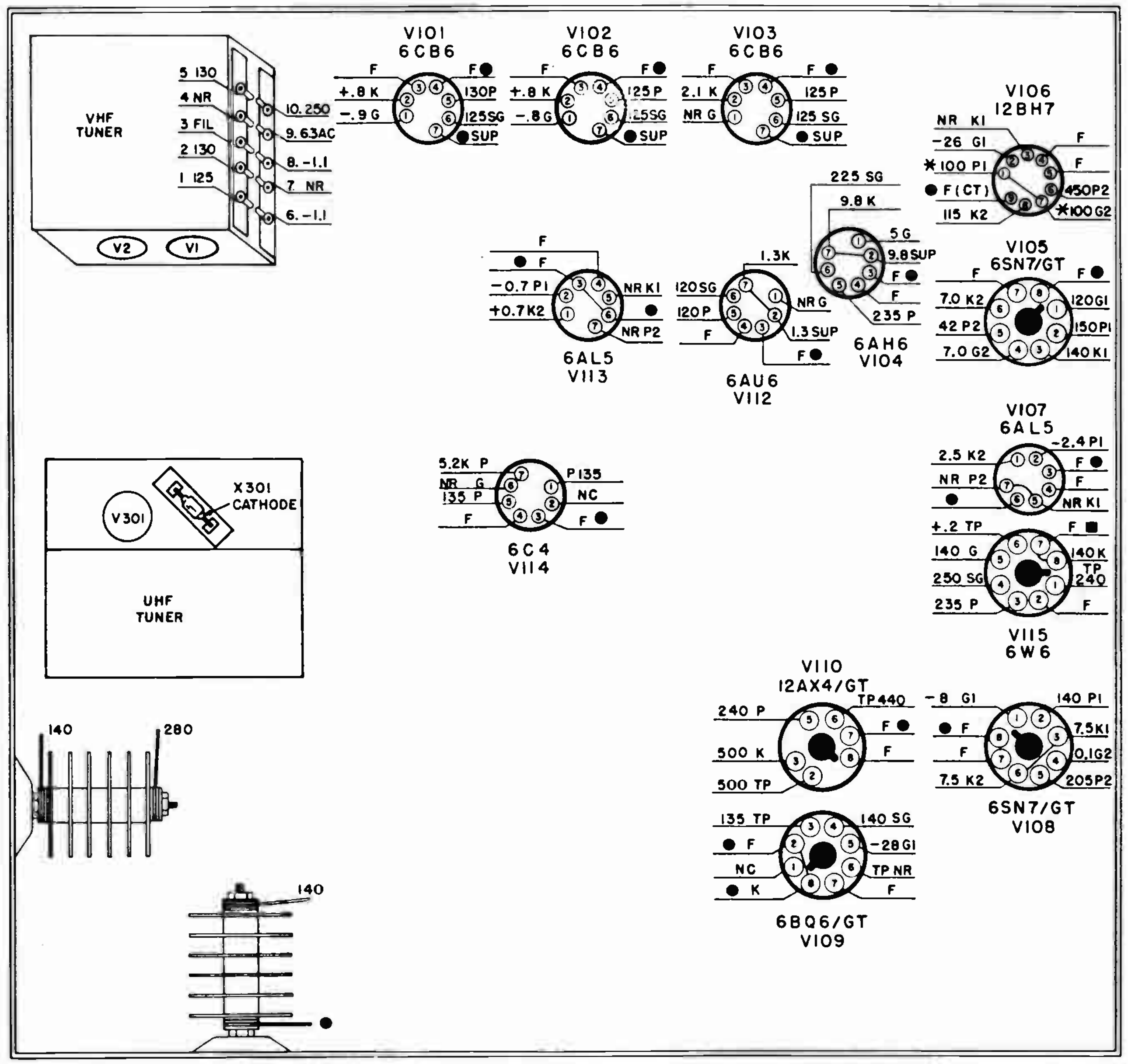


Fig. 104EA. Typical Response for 41.25 to 45.75 MC I-F Amplifiers



92C1911

Fig. 104FA. Voltage Chart for Chassis Y1200D

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS:

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. CHANNEL SELECTOR SET TO UHF POSITION.
3. BRIGHTNESS CONTROL MAXIMUM.
4. CONTRAST CONTROL MINIMUM.
5. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE POSITION.
6. ALL OTHER CONTROLS SET FOR NORMAL RASTER.
7. LINE VOLTAGE 117V 60 ∿ AC.
8. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.
9. ALL READINGS TAKEN WITH A VTVM.

KEY

*	VARIES FROM 65 TO 155V. DEPENDING UPON THE SETTING OF THE HEIGHT CONTROL.
●	INDICATES GROUND LUGS
■	HEATER OF V115 IS CONNECTED TO CATHODE, PIN 8
TP	TIE POINT.
NC	NO CONNECTION.
NR	NOT READABLE.

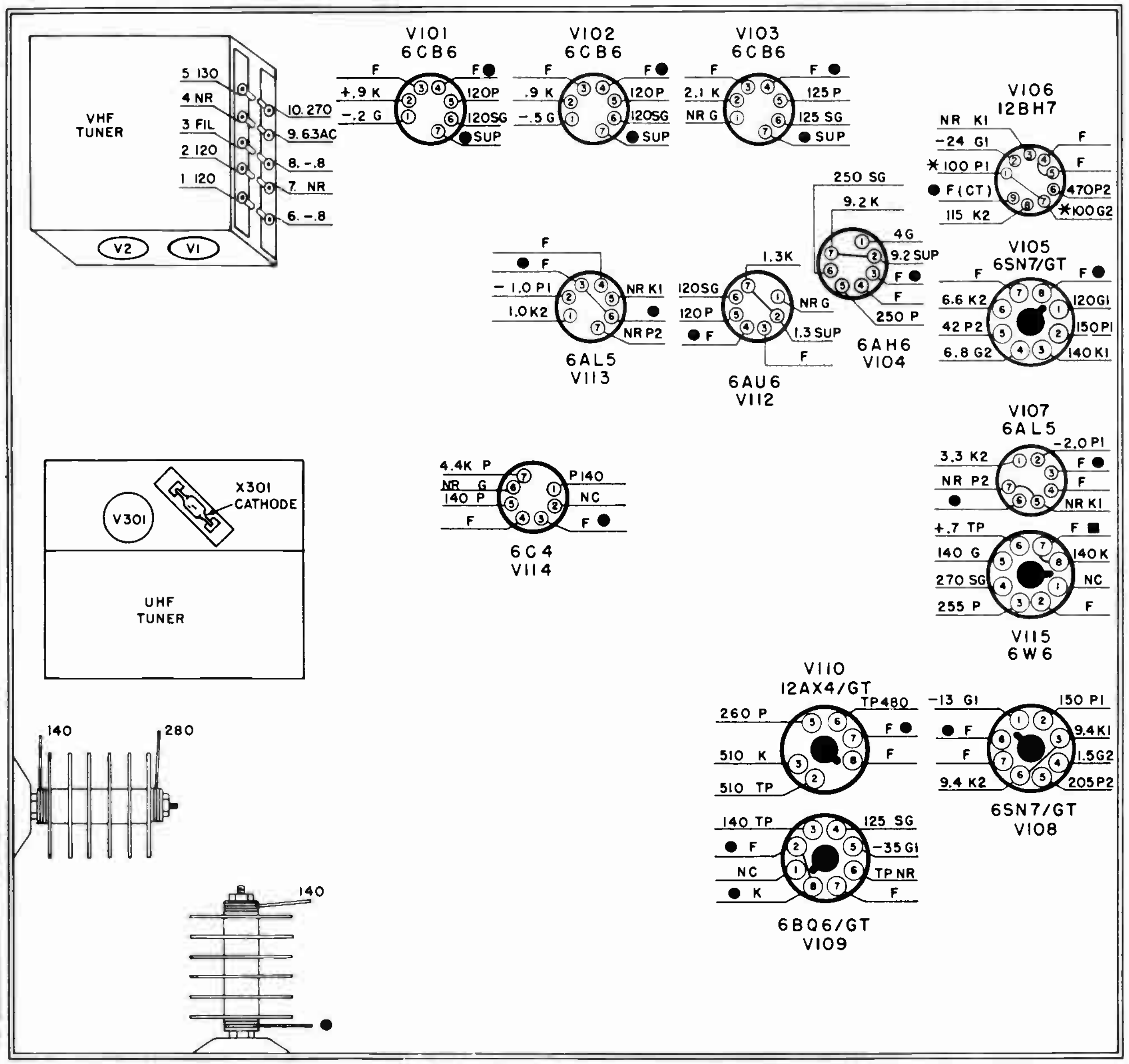


Fig. 104GA. Voltage Chart for Chassis Z1200D

NOTES

VOLTAGE READING TAKEN UNDER THE FOLLOWING CONDITIONS:

1. ANTENNAS DISCONNECTED, AND TERMINALS SHORTED.
2. CHANNEL SELECTOR SET TO UHF POSITION.
3. BRIGHTNESS CONTROL MAXIMUM.
4. CONTRAST CONTROL MINIMUM.
5. AGC CONTROL SET TO MAXIMUM COUNTER CLOCKWISE POSITION.
6. ALL OTHER CONTROLS SET FOR NORMAL RASTER.
7. LINE VOLTAGE 117V 60 ∿ AC.
8. ALL VOLTAGES ARE DC AND POSITIVE WITH RESPECT TO THE CHASSIS UNLESS OTHERWISE SPECIFIED.
9. ALL READINGS TAKEN WITH A VTVM.

KEY

*	VARIES FROM 70 TO 180V. DEPENDING UPON THE SETTING OF THE HEIGHT CONTROL.
●	INDICATES GROUND LUGS
■	HEATER OF V115 IS CONNECTED TO CATHODE, PIN 8.
TP	TIE POINT.
NC	NO CONNECTION.
NR	NOT READABLE.

I-F ALIGNMENT OF THE COUPLING BETWEEN THE 1E1483, 1E1582, OR 1E1670 VHF AND 1E1484 OR 1E1659 UHF TUNERS.

The following alignment procedure is suitable for use with any series 1200D chassis equipped with the 1E1483, 1E1582 or 1E1670 sixteen position cascode VHF tuner and a 1E1484 or 1E1659 UHF tuner.

NO ATTEMPT SHOULD BE MADE TO PERFORM THE FOLLOWING ALIGNMENT PROCEDURE UNTIL THE VHF TUNER AND THE BALANCE OF THE TV RECEIVER IS KNOWN TO BE IN PROPER OPERATING CONDITION.

EQUIPMENT REQUIRED

Sweep Generator	RCA type WR-59B or equiv.
Marker Generator	RCA type WR-39C or equiv.
Oscilloscope	RCA type WO-56A or equiv.
Bias Source	$1\frac{1}{2}$ volt battery or equiv.
Detector Circuit	See Fig. 104HA.
Isolation Transformer	150 watt rating or higher

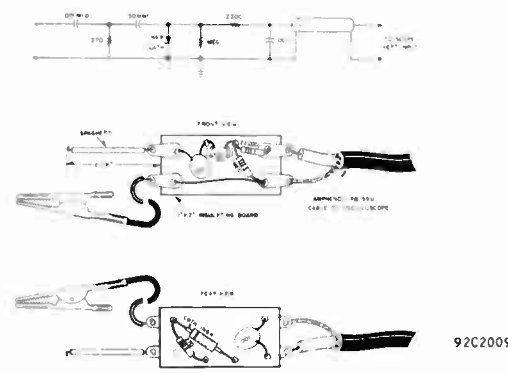


Fig. 104HA. Detector Circuit for UHF-VHF Coupling I-F Alignment

SET-UP PROCEDURE & ADJUSTMENT

1. Check to be sure that all tube shields are in place on both tuners. Open the bottom shield cover of the 16 position VHF tuner and connect the test circuit of Fig. 104HA to the plate pin 1 of the 6BZ7 r-f amplifier in the VHF tuner.
2. Connect all test equipment and the television chassis to a common ground. Be sure to use an isolation transformer for the receiver chassis. Allow at least a 5 minute warm up period for the receiver chassis with the channel selector in the UHF position.
3. Connect the negative side of the bias source to terminal 8 of the VHF tuner and the positive side to the chassis.
4. Connect the vertical input terminals of the oscilloscope to the test circuit as shown in Fig. 104HA.
5. Set the sweep generator to sweep an 8 MC band from 40 to 48 MC. Connect the r-f output hot lead through a .005 mfd. disc ceramic capacitor to the junction of the diode X-301, L-301, C-310 and C-311 in the UHF tuner. This point is the 1N82 diode clip which is farthest away from the 6AF4 oscillator tube in the UHF tuner. The ground lead from the sweep generator should be connected to the UHF tuner chassis. See Fig. 104IA.
6. Loosely couple the high side of the marker generator r-f lead to the high side of the sweep generator by connecting the marker generator r-f lead to the sweep generator r-f lead through a 22 mmf. capacitor. The ground side of the marker generator should be connected to the receiver chassis.
7. Connect the sweep output terminals on the sweep generator to the input of the horizontal amplifier in the oscilloscope.

IMPORTANT—To prevent possible overloading of the tuned circuits and the r-f amplifier tube in the VHF tuner keep the output of the sweep generator as low as possible with a useable pattern remaining on the oscilloscope. The oscilloscope vertical gain should be close to maximum. The marker generator output should be set just high enough to produce visible pips on the pattern viewed on the oscilloscope.

8. Adjust the I.F. output coil (T-301) in the UHF tuner and the I.F. input coil (L-1) (*) in the VHF tuner for peaks of equal amplitude with the 45.75 MC picture carrier marker appearing exactly on one peak of the curve. The 42.25 MC marker should appear somewhere within the 10% limits on the other peak of the curve shown in Fig. 104IB. The coil adjustments must be made so that the two peaks are of the same amplitude regardless of the 42.25 MC marker position.

(*) In some of the early versions of the 1E1483 sixteen position VHF tuner, the I.F. input coil is not adjustable by means of an iron core. On these tuners it will be necessary to spread or compress the turns of this coil within tuner. Some tuners had an additional coil on the outside of the tuner connected in series with the co-axial link from the UHF tuner. This coil may be adjusted as well as the coil inside the VHF tuner.

SPECIAL NOTE: The capacitor (C-308) connected across the r-f output terminals of the UHF tuner determines the bandwidth of the coupling circuits between the UHF and VHF tuners. If this capacitor is increased in value the bandwidth will decrease while a decrease in the value of this capacitor will increase the bandwidth. In some of the 1E1484 tuners C-308 will have a ceramic tubular capacitor connected in parallel with it so that the total effective value will range from 100 to 220 mmf. Some 1E1484 tuners have a variable capacitor (Part No. 44A347) connected in parallel with a 150 mmf. ceramic capacitor (Part No. 47B20151M5) across C-308. This variable capacitor is factory set to give the desired bandwidth. If the bandwidth determined in step 8 is found to be not correct this capacitor may be adjusted. Determine from step 8 whether the bandwidth should be increased or decreased and adjust the variable capacitor accordingly. Repeat step 8. If the bandwidth requires further adjustment, again change the setting of the variable capacitor and repeat step 8. Repeat this procedure until the desired bandwidth is obtained. The value of C-308 is 150 mmf. in the 1E1659 tuners.

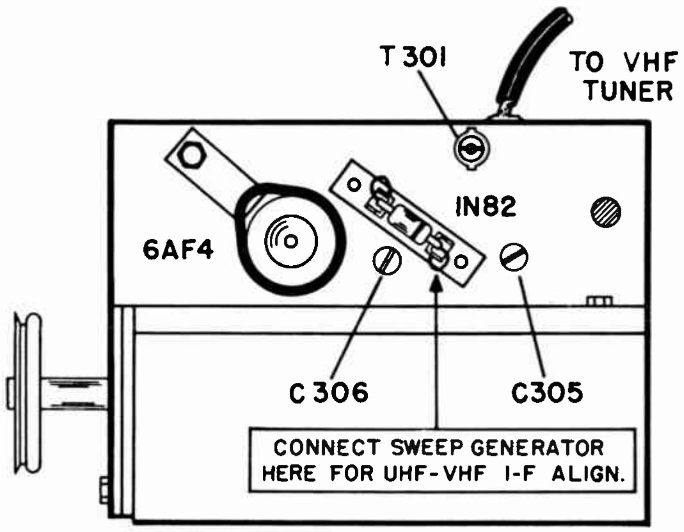


Fig. 104IA. Alignment Adjustments for 1E1484 & 1E1659 UHF Tuners

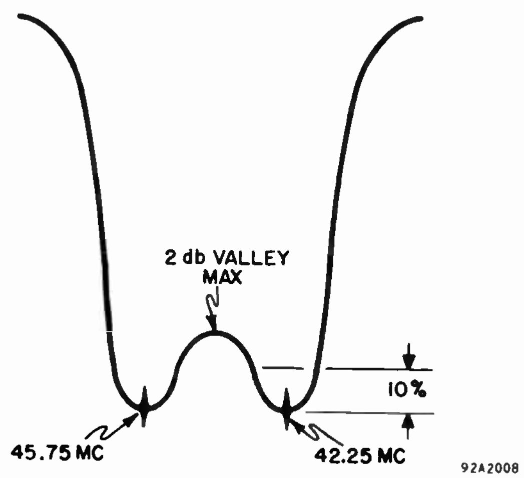


Fig. 104IB. Response Curve for VHF-UHF I-F Coupling Alignment

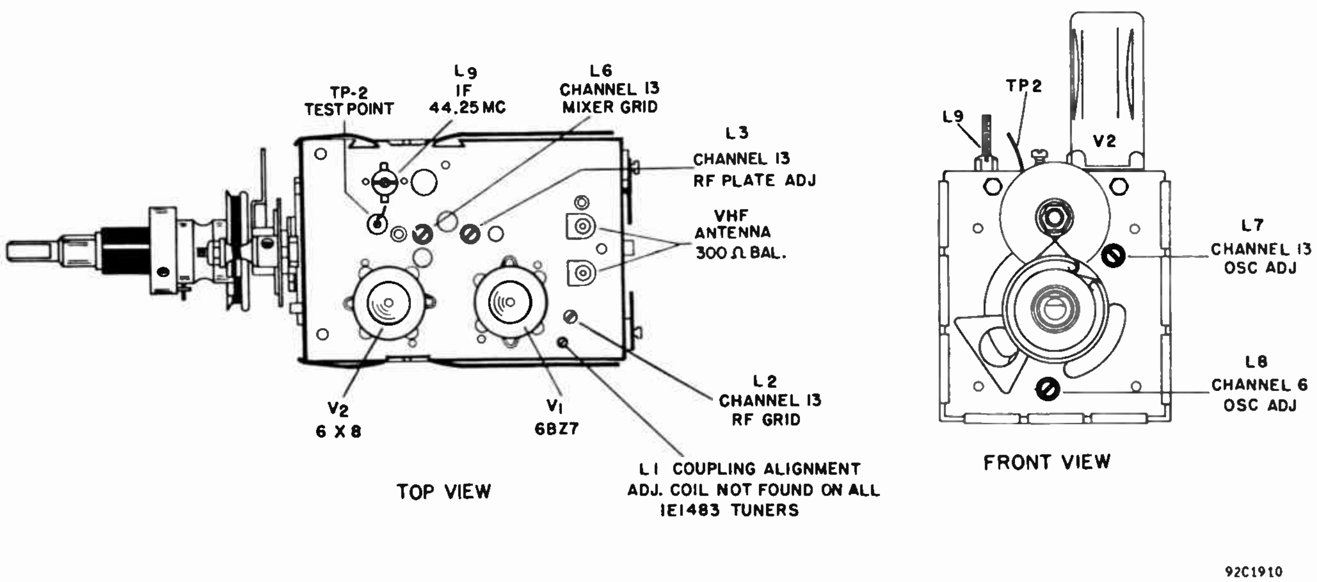


Fig. 104IC. Alignment Adjustments for 1E1483, 1E1582 or 1E1670 VHF Tuners

ALIGNMENT FOR 1E1483, 1E1582 OR 1E1670 VHF 16 POSITION CASCODE TUNERS

These tuners have been carefully aligned at the factory by personnel using precision equipment. Minor adjustments of the tuner may be necessary after making tube or part replacement. When replacing tubes in a tuner use the same tube type as the original tube which was removed from the tuner and also try several different tubes and select the one which gives best performance. Realignment of the tuner probably will not be required if a selected tube is used for replacement. For those service engineers who are properly equipped as specified, the following alignment procedure is included. DO NOT ATTEMPT TUNER ALIGNMENT UNTIL THE TV RECEIVER IS KNOWN TO BE FUNCTIONING PROPERLY AND THE I-F ALIGNMENT OF THE RECEIVER IS CORRECT.

EQUIPMENT REQUIRED FOR VHF TUNER ALIGNMENT

Sweep Generator	RCA type WR-59B or equiv.
Marker Generator	RCA type WR-39C or equiv.
Oscilloscope	RCA type WO-56A or equiv.
Bias Source	$1\frac{1}{2}$ volt battery or equiv.
Detector Circuit	See Fig. 104HA.
Isolation Transformer	150 watt rating or higher.

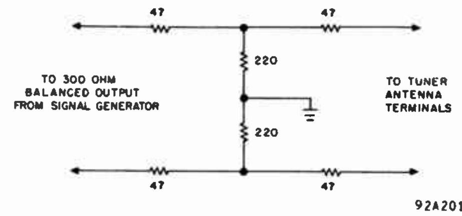


Fig. 104JA. Sweep Generator 300 Ohm Pad

OSCILLATOR ADJUSTMENT FOR 16 POSITION TUNERS

1. Connect the balanced sweep output from a signal generator to the VHF tuner antenna terminals through the 300 ohm pad shown in Fig. 104JA. Set sweep generator for 10 MC sweep.
2. Connect the negative side of $1\frac{1}{2}$ volt bias supply to terminal 8 of the VHF tuner. Connect the positive side of the bias supply to the chassis.
3. Connect the oscilloscope and band-pass detector circuit shown in Fig. 104HA to Test Point TP-2 shown in Fig. 104IC.
4. Set the VHF tuner channel selector to channel 13.
5. Loosely couple the high side of the marker generator to the antenna input terminals by clipping the lead over the insulation of one sweep generator lead. Connect the ground side of the generator to the chassis of the VHF tuner. Set the marker generator to the channel 13 picture carrier frequency of 211.25 MC.
6. Carefully note the position of the marker pip on the response curve. Use a grease pencil if necessary to mark the position on the face of the cathode ray tube.
7. Loosely couple the high side of the marker generator to the band-pass detector circuit by clipping the lead over the germanium diode in the detector circuit. Connect the ground side of the generator to the chassis of the VHF tuner. Set the marker generator to 45.75 MC.
8. Rotate the fine tuning control of the VHF tuner until the 45.75 MC marker is in the same spot as the marker in steps 5 and 6. If this cannot be accomplished by adjustment of the fine tuning control, adjust the channel 13 oscillator adjustment (L-7) to position the 45.75 MC marker. DO NOT DISTURB THE SETTING OF THE FINE TUNING CONTROL AFTER THIS ADJUSTMENT.
9. Switch the VHF tuner channel selector and sweep generator to channel 12.
10. Repeat steps 5 and 6 except use the picture carrier frequency for channel 12 (205.25 MC) in step 5.
11. Repeat step 7 using the same marker frequency of 45.75 MC.
12. Adjust the incremental oscillator coil for the channel until the 45.75 MC marker pip is in the same position on the curve as the marker pip for the picture carrier was in step 10.
13. Repeat steps 9, 5, 6, 7 and 12 for channels 11, 10, 9, 8 and 7 in that order. In each case switch the channel selector and sweep generator to the channel being aligned. The marker generator frequency for step 5 will be the picture carrier frequency for the channel being aligned. See the chart on page 39 for the picture carrier frequency of each channel.
14. Switch the channel selector and sweep generator to channel 6 and repeat steps 5 and 6 except use the picture carrier frequency for channel 6 (83.25 MC) in step 5.

15. Repeat step 7 using the same marker frequency of 45.75 MC.

16. Adjust the channel 6 oscillator adjustment until the 45.75 MC marker pip is in the same position on the curve as the marker pip in Step 14. See Fig. 104IC.

17. Repeat steps 9, 5, 6, 7 and 12 for channels 5, 4, 3 and 2 in that order. In each case switch the channel selector and sweep generator to the channel being aligned. The marker generator frequency for step 10 will be the picture carrier frequency for the channel being aligned. See the chart on page 39 for the picture carrier frequency of each channel.

NOTE: If two marker generators are available the alignment can be greatly simplified by using one generator for the picture carrier marker and the other for the 45.75 MC marker. Both generators are connected to the receiver at all times as directed in the above instructions. The use of two generators will produce two pips on the pattern. The adjustments outlined above will make these two pips coincide on the oscilloscope pattern.

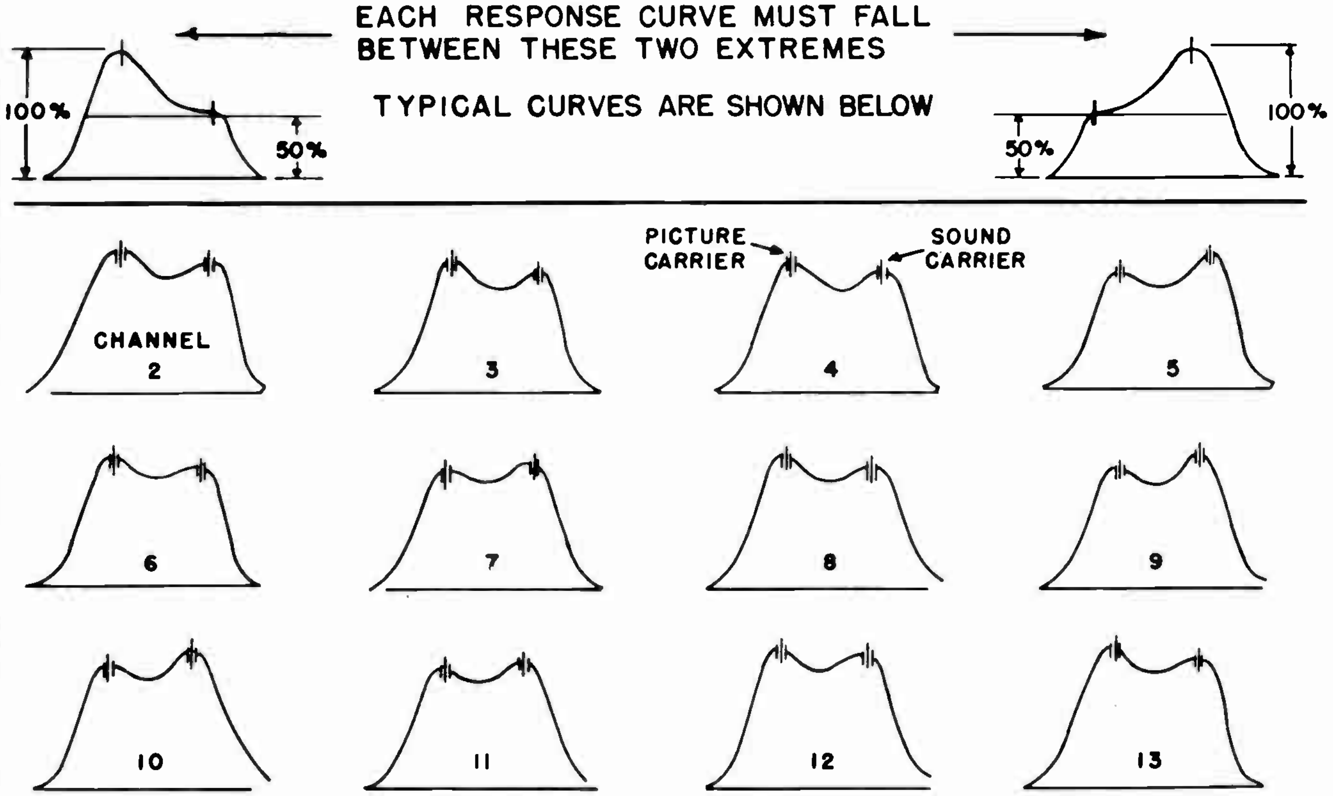


Fig. 104KA. Typical Channel Response Curves 9281956

BAND-PASS ALIGNMENT FOR 16 POSITION VHF TUNERS 1E1483, 1E1582 & 1E1670

DO NOT ATTEMPT THIS ALIGNMENT UNTIL THE I-F ALIGNMENT OF THE RECEIVER HAS BEEN CHECKED AND IS KNOWN TO BE CORRECT. THE OSCILLATOR ADJUSTMENT PROCEDURE GIVEN ON PAGE 39 MUST ALSO BE COMPLETED BEFORE STARTING THIS ALIGNMENT.

1. Connect the balanced sweep output from a signal generator to the VHF tuner antenna terminals through the 300 ohm pad shown in Fig. 104JA. Set the sweep generator for 10 MC sweep.

2. Connect the negative side of the 1½ volt bias supply to terminal 8 of the VHF tuner. Connect the positive side of the bias supply to the chassis.

3. Connect the oscilloscope and band-pass detector circuit shown in Fig. 104HA to Test Point TP-2 shown in Fig. 104IC.

4. Set the VHF tuner channel selector to channel 13.

5. Loosely couple the high side of the marker generator to the band-pass detector circuit by clipping the lead over the germanium diode in the detector circuit. Connect the ground side of the generator to the chassis of the VHF tuner.

6. Set the sweep generator for channel 13 and turn the VHF tuner channel selector to channel 13.

7. Adjust L-2 (channel 13 r-f grid), L-3 (channel 13 r-f plate), and L-6 (channel 13 mixer grid) adjusting screws (see Fig. 104IC) for a band pass characteristic containing both carriers with steep sides and maximum gain. See curves shown on page • The mixer grid adjustment (L-6) must be adjusted for maximum mid-band gain regardless of the shape of the skirts. The slope and position of the skirts are primarily controlled by the r-f plate adjustment (L-3) while the r-f grid adjustment (L-2) controls the slope of the flat topped portion of the curve. Always adjust to place the picture carrier marker on a peak of the curve.

If the factory adjustment of the incremental loops and coils has not been disturbed, alignment of the r-f plate, r-f grid and mixer grid should be complete after the completion of step 7, unless extensive repairs have been made on the tuner. Check the other channels for a similar band-pass characteristic as shown in Fig. 104KA. If they have the correct characteristics further alignment is not necessary. If they do not, proceed with the following steps.

8. Adjust the coils of the r-f plate, r-f grid and mixer grid for channels 12 through 7 starting with channel 12. Adjust the signal generators for each channel to the frequencies given in the chart on page 39. Pushing the half turn incremental loops toward the center of the switch so that they are closer to the switch wafer will increase the frequency while pulling them out and away from the switch wafer will decrease the frequency. Always adjust the mixer grid coils for maximum mid-band gain and the r-f plate and r-f grid coil loops as outlined in step 7.

9. Adjust the coils of the r-f plate, r-f grid and mixer grid for channels 6 through 2 starting with channel 6. Adjust the signal generators for each channel to the frequencies given in the chart on page 39. Spreading the turns of the coils will increase the frequency while squeezing the turns together will decrease the frequency. Always adjust the mixer grid coils for maximum mid-band gain and the r-f plate and r-f grid coils as outlined in step 7.

10. Repeat step 7 as a final adjustment for channel 13.

ALIGNMENT OF UHF POSITION IN 16 POSITION VHF TUNERS

1. Complete the oscillator and band-pass alignment given on pages 51 and 52.

2. Turn the channel selector switch in the VHF tuner to the UHF position which will turn on the UHF dial light.

3. Complete the I-F Amplifier Coupling Alignment given on page 50 and 51 and leave the sweep and marker generators connected as for the coupling alignment.

4. Connect the oscilloscope and band-pass detector shown in Fig. 104HA, to Test Point TP-2 on the VHF tuner as shown in Fig. 104IC.

5. Adjust the incremental coils on S-1C and S-1D in the VHF tuner for the same general characteristics obtained for the I-F coupling alignment between the VHF and UHF tuners. The two peaks of the curve should be adjusted so that they are of equal amplitude with the picture carrier marker on one peak of the curve as shown in Fig. 104IB. Only a slight adjustment of these coils is required to produce considerable change. Adjust the coils with a non-metallic instrument and replace the cover on the VHF tuner before viewing the waveform on the oscilloscope.

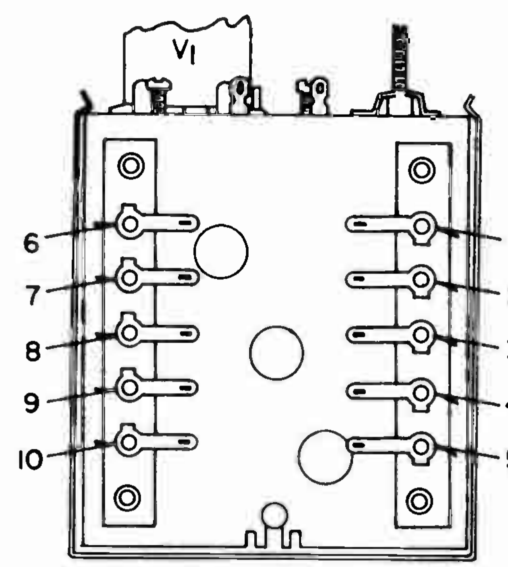
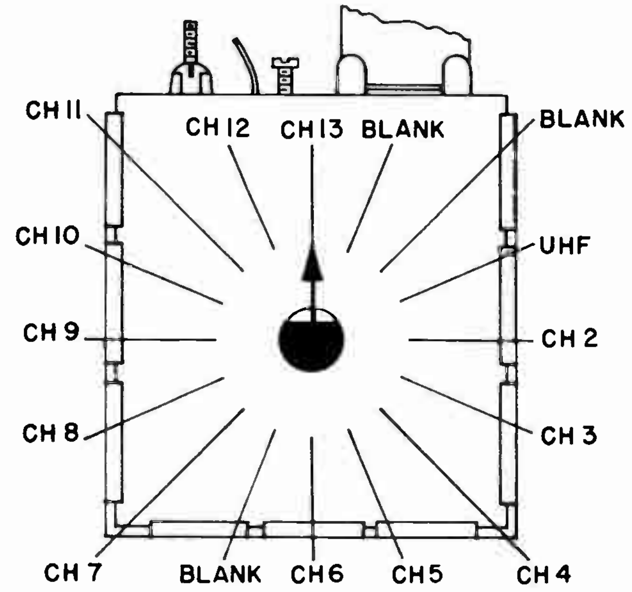


Fig. 104MA. Numbering of Tuner Terminals 9281794-1



CHANNEL SELECTOR SHOWN ON CHANNEL 13 AS INDICATED BY FLAT ON SHAFT.

9281933

Fig. 104MB. Channel Selector Switch Positions

ALIGNMENT OF THE 1E1484 AND 1E1659 UHF TUNERS

It is recommended that the alignment of the 1E1484 and 1E1659 UHF tuners not be disturbed in the field. If it is definitely established that realignment of the tuner is absolutely necessary the UHF tuner will have to be removed from the main TV chassis in order to get at the adjustments. Electrical connections to the main TV chassis will have to be maintained in order to use amplifiers in the TV chassis to obtain a useable oscilloscope indication and prevent loading of the UHF tuner output circuit by the necessary test equipment. A heavy ground braid must also be connected between the UHF tuner chassis and the main TV chassis.

THE HALLICRAFTERS SERVICE DEPARTMENT PROVIDES A TUNER EXCHANGE SERVICE FOR A NOMINAL FEE. THE SERVICE TECHNICIAN IS URGED TO AVAIL HIMSELF OF THIS SERVICE RATHER THAN TO ATTEMPT FIELD ALIGNMENT OF THESE TUNERS.

SET-UP PROCEDURE

1. Complete the I-F coupling alignment given on page 1952-104H.
2. Connect the band-pass detector circuit given in Fig. 104HA to an oscilloscope and the plate (6BZ7 pin 1) of the r-f amplifier in the VHF tuner.
3. Connect the output of a UHF sweep generator to the UHF tuner antenna terminals through the 300 ohm resistor network shown in Fig. 104JA.
4. Loosely couple the r-f output of a UHF marker generator to the leads from the sweep generator.

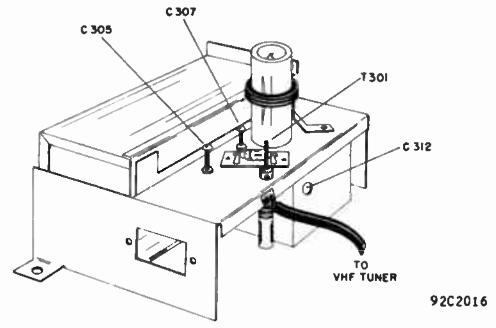


Fig. 104NA. UHF Tuner Adjustment Points

OSCILLATOR ADJUSTMENT

1. Rotate the UHF tuning control to the full counterclockwise position.
2. Set the marker and sweep generators to 465 MC.
3. Adjust the oscillator trimmer capacitor (C-312 shown in Fig. 104NA) until the marker appears on the top portion of the curve.
4. Rotate the UHF tuning control to the full clockwise position.
5. Set the marker and sweep generators to 900 MC.
6. Carefully spread or pinch together the legs of the oscillator end inductor (LI-3 shown in Fig. 104OA) until the marker appears on the top portion of the curve.
7. Repeat the above steps until no further improvement is apparent. The oscillator adjustment figures of 465 and 900 megacycles are approximate only, and may not fall precisely at the dial settings specified; in every case, however, the oscillator must be aligned so that both frequencies can be tuned by normal manipulation of the tuning control.

R-F ALIGNMENT

1. Rotate the UHF tuning control to the full counterclockwise position.
2. Set the marker and sweep generators to 465 MC.
3. Adjust the r-f trimmer (C-305 & C-307 shown in Fig. 104NA) for maximum gain and a flat top response curve. The marker should be in the top center portion of the curve.
4. Rotate the UHF tuning control to the full clockwise position.
5. Carefully spread or pinch together the legs of the r-f end inductors (LI-1 & LI-2 shown in Fig. 104OA) for maximum gain and a flat top response curve. The marker should appear in the top center portion of the curve.
6. Repeat the above steps until no further improvement is apparent.

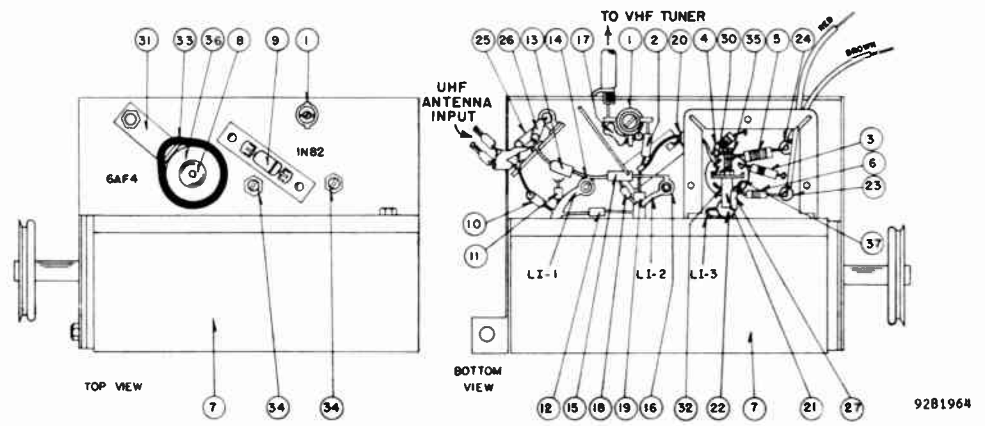


Fig. 104O. Parts Identification for 1E1484 & 1E1659 UHF Tuners

SERVICE PARTS LIST FOR 1E1484 & 1E1659 UHF TUNERS

The parts in the following list may be identified by reference symbols shown in the above figure.

Schematic Symbol	Description	Reference Symbol	Mfgrs. Cross Reference	Hallicrafters Part Number
	TRANSFORMERS & COILS			
T-301	r-f output transformer	1	B-630160-1	50-600
L-301	Choke; 9 turns, 1/8" diameter	2	A-600407-1	53-290
L-302	0.38 uh. cathode choke	3	A-600240-3	53-285
L-303	0.47 uh. heater choke	4	A-600033-1	53-293
L-304	0.47 uh. heater choke	5	A-600033-1	53-293
L-305	0.38 uh. plate choke	6	A-600240-3	53-285
L-306A,B,C	UHF Inductuner complete with R-304 & R-305	7	A-600414-1	1-1645
	TUBES & RECTIFIERS			
V-301	6AF4 triode, UHF oscillator	8	A-600210-1	90X6AF4
X-301	1N82 silicon diode	9	A-600413	19A1883
	CAPACITORS			
C-301	1.0 mmf. ceramic gimmick	10	A-600025-6	47-339
C-302	2.5 mmf. ceramic gimmick	11	A-600389-7	47-350
C-303	0.25 mmf. ceramic gimmick	12	A-600025-12	47-345
C-304	1.0 mmf. ceramic gimmick	13	A-600025-6	47-339
C-305	0.8 to 6.5 mmf. tubular ceramic trimmer	14	A 600220-1	44-428
C-306	0.25 mmf. ceramic gimmick	15	A-600025-12	47-345
C-307	0.8 to 6.5 mmf tubular ceramic trimmer	16	A-600220-1	44-428
C-308	100 mmf. tubular ceramic (1E1484 tuner)	17	A-600026-6	47-351
C-308	150 mmf. tubular ceramic (1E1659 tuner)	17	A-600026-12	47-394
C-309	2.5 mmf. ceramic gimmick	18	A-600025-17	47-353
C-310	2.2 mmf. ceramic gimmick	19	A-600025-10	47-338
C-311	0.4 mmf. ceramic gimmick	20	A-600389-2	47-346
C-312	3.0 to 10 mmf. tubular ceramic trimmer	21	A-600282-3	44-427
C-313	6.0 mmf. ceramic disc	22	A-600463-2	47-352
C-314	68 mmf. ceramic gimmick	23	A-600281-1	47-336
C-315	68 mmf. ceramic gimmick	24	A-600281-1	47-336
	RESISTORS			
R-301	470,000 ohms 1/2 watt, carbon	25	A-6000029-9	23X20X474K
R-302	470,000 ohms 1/2 watt, carbon	26	A-6000029-9	23X20X474K
R-303	12,000 ohms 1/2 watt, carbon	27	A-200116-12	23X20X123K
R-304	22,000 ohms 1/2 watt, carbon	28	None	23X20X223K
R-305	22,000 ohms 1/2 watt, carbon	29	None	23X20X223K
	MISCELLANEOUS PARTS			
	Bracket, mounting for C-312	30	A-600280-1	67-2220
	Bracket, oscillator tube clamp	31	A-600465-1	67-2221
	Connector, oscillator plate	32	A-600446-1	76-1073
	Grommet, oscillator tube clamp	33	A-600466-1	16-336
	Screw, adj.; for C-305 and C-307	34	A-11511-62	3-3136
	Screw, adj.; for C-312	35	A-15717-12	3-3137
	Shield, 7 pin tube	36	A-600035-1	69-577
	Socket, 7 pin molded mica filled	37	A-600215-1	6-471

SERVICE PARTS LIST

The following combined parts list may be used to determine replacement parts for the 1200 series TV chassis. To determine the correct replacement part, first refer to the correct schematic for the particular chassis involved and determine the correct schematic symbol for the part. Refer to the Service Parts List for the part number and description of the component with the same schematic symbol. Some components with the same schematic symbol vary from one type of chassis to another due to mechanical changes. These exceptions are also shown in the Service Parts List.

The part number will be found stamped on most components with the exception of carbon resistors, capacitors, tube sockets, and other small components not large enough to be stamped.

Picture tubes and their associated mounting components are listed in a separate parts list. Cabinet parts may be determined by referring to the pages devoted to individual models.

TRANSFORMERS AND COILS

Schematic Symbol	Description	Hallicrafters Part Number
T-101	Transformer, first i-f amplifier	50B561
T-102	Transformer, second i-f amplifier	50B568
T-103	Transformer, diode detector	50B562
T-104	Transformer, vertical blocking oscillator	55B190
T-105	Transformer, vertical output	55C192
T-106	Transformer, horizontal output (for 17" chassis)	55D193
T-107	Transformer, ratio detector	50C473
T-108	Transformer, audio output	55C191
T-109	Transformer, horizontal output (for 20" chassis)	55D197
T-110	Transformer, Heater	52C258
T-201	Transformer, first i-f amplifier	50B573
T-202	Transformer, second i-f amplifier	50B574
T-203	Transformer, diode detector	50B575
L-101	Coil, converter i-f	51B1301
L-102	Coil, video peaking	51A1578
L-103	Coil, video peaking	51A1579
L-104	Coil, video peaking (wound on R-119)	51A1580
L-105	Coil, 4.5 MC trap	51B1541
L-106	Coil, video peaking (wound on R-122)	51A1581
L-107	Coil, video peaking (wound on R-123)	51A1582
§L-108	Coil, horizontal stabilizer	51B1642 or 51B1536
L-109	Coil, yoke coupling (wound on C-148)	53B264
L-110	Coil, 4.5 MC amplifier grid adjustment	51B1542
L-111	Coil, speaker field (part of speaker)	---------
L-112	Deflection yoke (for 17" chassis)	53A271 or 53C263
L-112	Deflection yoke (for 20" chassis)	53A271 or 53A268
L-112	Deflection yoke (for 21" chassis)	53A271
L-113	Choke, heater	53A266
L-114	Choke, r-f (channel 5 tweet filter)	53B008
L-201	Coil, converter i-f	51C1643
L-202	Choke, heater	53A282
L-203	Choke, heater	53A282
L-204	Choke, heater	53A282
L-205	Choke, heater	53B266

§Either one of the two different horizontal stabilizer coils listed above for L-108 may be found in the 1200 series chassis. The 51B1642 coil is easily identified by the 63A902 aluminum plate which must be used for mounting this coil. Neither C-142 (75 mmf) nor C-170 (100 mmf) are required between pin 5 and ground of the horizontal oscillator when the 51B1642 coil is used.

SERVICE PARTS LIST (Cont.)

TUBES & RECTIFIER COMPLEMENT

Schematic Symbol	Description	Hallicrafters Part Number: CHASSIS WITH HEATER TRANSFORMER	Hallicrafters Part Number: CHASSIS WITH SERIES-PARALLEL HEATER CIRCUIT
V-1	R-F amplifier (part of VHF tuner)	---------	---------
V-2	Oscillator/mixer (part of VHF tuner)	---------	---------
V-101	First i-f amplifier	90X6CB6	90X6CB6
V-102	Second i-f amplifier	90X6CB6	90X6CB6
V-103	Third i-f amplifier	90X6CB6	90X6CB6
V-104	Video amplifier	90X6AH6	90X6AH6
V-105	Sync clipper	90X6SN7GT	90X12SN7GT
V-106	Vertical oscillator and output	90X12BH7	90X12BH7
V-107	Horizontal A.F.C.	90X6AL5	90X6AL5
V-108	Horizontal oscillator	90X6SN7GT	90X6SN7GT
V-109	Horizontal output	90X6BQ6GT	90X25BQ6GT
V-110	Damper	90X12AX4	90X12AX4
V-111	High voltage rectifier	90X1B3GT	90X1B3GT
V-112	Sound i-f amplifier (4.5 MC)	90X6AU6	90X6AU6
V-113	Ratio detector	90X6AL5	90X6AL5
V-114	Audio amplifier	90X6C4	90X6C4
V-115	Audio output amplifier	90X6W6	90X25L6GT/G
V-116	Picture tube	----------	----------
X-101	Selenium rectifier (300 ma.)	27A173	27A173
X-102	Selenium rectifier (300 ma.)	27A173	27A173
X-103	Video detector (1N60 germanium diode) or Video detector (1N64 germanium diode)	19B1246	19B1246
V-301	UHF Oscillator (part of UHF tuner)	----------	----------

VHF & UHF TUNING UNITS

	A, D, K, L, P, R, W & X1200D CHASSIS	F, G & T1200D CHASSIS	J1200D CHASSIS	Y & Z 1200D CHASSIS
VHF tuning unit assembly, complete with tubes. Refer to part number stamped on top of tuner chassis.	1C1345 Pentode type with 90X6BC5 r-f amplifier and 90X6J6 oscillator/mixer.	1C1376 Cascode type with 90X6BZ7 or 90X6BQ7 r-f amplifier and 90X6J6 oscillator/mixer.	1E1380 Cascode type with 90X6BQ7 r-f amplifier and 90X6J6 oscillator/mixer.	1E1483, 1E1582 or 1E1670 Cascode 16 position type with 90X6BZ7 r-f amplifier and 90X6X8 oscillator/mixer.
UHF tuning unit assembly, complete with tube and crystal diode.	None	None	None	1E1484 or 1E1659 with 6AF4 oscillator and 1N82 crystal mixer.

CAPACITORS

Schematic Symbol	Description	Hallicrafters Part Number
C-100	330 mmf. 500 V., ceramic tubular	47BUL20331M5
C-101	330 mmf. 500 V., ceramic tubular	47BUL20331M5
C-102	330 mmf. 500 V., ceramic tubular	47B20331M5
C-103	5000 mmf. 500 V., ceramic disc	47A168
C-104	Dual 4000 mmf. 500 v., ceramic disc	47A218
C-105	1000 mmf. 500 V., ceramic disc	47A230
C-106	5000 mmf. 500 V., ceramic disc	47A168
C-107	5000 mmf. 500 V., ceramic disc	47A168
C-108	1000 mmf. 500 V., ceramic disc	47A230
C-109	5000 mmf. 500 V., ceramic disc	47A168
C-110	5000 mmf. 500 V., ceramic disc	47A168
C-111	1000 mmf. 500 V., ceramic disc	47A230
C-112	10 mmf. 500 V., ceramic tubular	47B20100K5
*C-113	4.7 mmf. 500 V., 10% ceramic tubular	47A160-6
C-114	0.1 mfd. 200 V., paper tubular	46AU104J
C-115	.5 mfd. 25 V., paper tubular	46A177
*C-116	2.2 mmf. 500 V., 10% ceramic tubular	47A160-4

SERVICE PARTS LIST (Cont.)

CAPACITORS (Cont.)

Schematic Symbol	Description	Hallicrafters Part Number
*C-117	30 mmf. 500 V., 10% ceramic tubular	47X25PG300K
C-118	100-10 mfd. 300 V., 200-30 mfd. 150 V., electrolytic	45C209
C-119	200-5 mfd. 150 V., electrolytic	45C210
C-120	5000 mmf. 500 V., ceramic disc	47A168
C-121	.1 mfd. 400 V., paper tubular	46AV104J
*C-122	220 mmf. 500 V., 10% ceramic tubular	47B20221K5
C-123	.005 mfd. 600 V., paper tubular	46AY502J
C-124	22 mmf. 500 V., ceramic tubular	47B20220M5
C-125	.05 mfd. 400 V., paper tubular	46AW503J
C-126	.0047 mfd. 400 V., molded paper tubular	46BS472L4
C-127	.0047 mfd. 400 V., molded paper tubular	46BS472L4
C-128	.01 mfd. 400 V., molded paper tubular	46BS103L4
C-129	0.0047 mfd. 400 V., molded paper tubular	46BS472L4
C-130	.047 mfd. 400 V., molded paper tubular	46BS473L4
C-131	.047 mfd. 400 V., molded paper tubular	46BS473L4
C-132	5000 mmf. 500 V., ceramic disc	47A168
C-133	20 mfd. 450 V., electrolytic	45B208
C-134	0.05 mfd. 200 V., paper tubular	46AU503J
C-135	140 mfd. 150 V., electrolytic	45B207
*C-136	1000 mmf. 500 V., ceramic tubular	47B20A102M5
*C-137	1000 mmf. 500 V., ceramic tubular	47B20A102M5
C-138	.006 mfd. 600 V., paper tubular	46AZ602F
*C-139	0.003 mfd. 400 V., paper tubular	46AW302J
*C-140	.001 mfd. 1000 V., molded paper tubular	46BS102L10
C-141	.01 mfd. 400 V., paper tubular	46AW103J
§*C-142	75 mmf. 500 V., 10% ceramic tubular	47B20750K5
*C-143	3900 mmf. 500 V., 10% silver mica	47X30D392K
*C-144	390 mmf. 500 V., 10% silver mica	47X20D391K
*C-145	470 mmf. 500 V., 10% silver mica	47X20D471K
C-146	5000 mmf. 500 V., ceramic disc	47A168
*C-147	120 mmf. 3000 V., ceramic disc	47A296
C-148	.1 mfd. 200 V., paper tubular (part of L-109)	---------
*C-149	68 mmf. 500 V., 10% ceramic tubular	47X30TH680K
C-150	Dual 4000 mmf. 500 V., ceramic disc	47A218
C-151	5 mfd. 50 V., electrolytic	45B175
C-152	330 mmf. 500 V., ceramic tubular	47B20331M5
C-153	1000 mmf. 500 V., ceramic disc	47A230
C-154	5000 mmf. 500 V., ceramic disc	47A168
C-155	10 mfd. 50 V., electrolytic	45B211
C-156	.01 mfd. 400 V., paper tubular	46AW103J
C-157	.02 mfd. 600 V., paper tubular	46AY203J
C-158	5000 mmf. 500 V., ceramic disc	47A168
C-159	5000 mmf. 500 V., ceramic disc	47A168
C-160	47 mmf. 2000 V., (part of L-112)	---------
*C-161	200 mfd. 150 V., electrolytic	45B217
C-162	.1 mfd. 600 V., paper tubular	46AY104J
*C-163	390 mmf. 500 V., 10% silver mica	47X20D391K
*C-164	560 mmf. 500 V., 10% silver mica	47X20D561K
C-165	.047 mfd. 400 V., paper tubular	46BS473L4
C-166	500 mmf. 20,000 V., ceramic	47A223
C-167	.005 mfd. 400 V., paper tubular	46AW502H
C-168	.05 mfd. 400 V., paper tubular	46AW503H
C-169	10 mfd. 150 V., electrolytic	45A097
§*C-170	100 mmf. 500 V., silver mica	47X20D101K
C-171	1000 mmf. 500 V., ceramic disc	47A230
C-172	47 mmf. 500 V., ceramic tubular	47B20470M5
C-173	.05 mfd. 600 V., paper tubular	46AY503J
C-174	.01 mfd. 600 V., paper tubular	46AY103J
C-175	1000 mmf. 500 V., ceramic disc	47A230
C-176	1000 mmf. 500 V., ceramic disc	47A230
C-177	1000 mmf. 500 V., ceramic disc	47A230
C-178	1000 mmf. 500 V., ceramic disc	47A230
C-179	.01 mfd. 500 V., ceramic disc.	47A217
C-180	.01 mfd. 500 V., ceramic disc	47A217
C-181	1000 mmf. 500 V., ceramic disc	17A230
C-200	5000 mmf. 500 V., ceramic disc	47A168
C-201	1000 mmf. 500 V., ceramic disc	47A230
C-202	1000 mmf. 500 V., ceramic disc	47A230
C-203	1000 mmf. 500 V., ceramic disc	47A230
C-204	1000 mmf. 500 V., ceramic disc	47A230
C-205	1000 mmf. 500 V., ceramic disc	47A230
C-206	1000 mmf. 500 V., ceramic disc	47A230
*C-207	680 mmf. 500 V., 5%, ceramic tubular	47A319
*C-208	820 mmf. 500 V. 5%, ceramic tubular	47A320
*C-209	820 mmf. 500 V. 5%, ceramic tubular	47A320
C-210	24 mmf. 500 V., ceramic tubular	47B20A240K5
C-211	24 mmf. 500 V., ceramic tubular	47B20A240K5
C-212	330 mmf. 500 V., ceramic tubular	47B20331M5
C-213	330 mmf. 500 V., ceramic tubular	47B20331M5

* USE EXACT REPLACEMENT PART ONLY
§ SEE NOTE ON BOTTOM OF PAGE 54.

RESISTORS

Schematic Symbol	Description	Hallicrafters Part Number
R-100	5 ohm hum balance rheostat (part of speaker)	---------
R-101	100,000 ohms ½ watt, carbon	23X20X104K
R-102	4700 ohm ½ watt, carbon	23X20X472K
R-103	1000 ohms ½ watt, carbon	23X20X102K
R-104	47 ohms ½ watt, carbon	23X20X470K
R-105	1000 ohms ½ watt, carbon	23X20X102K
R-106	10,000 ohms ½ watt, carbon	23X20X103K
R-107	47 ohms ½ watt, carbon	23X20X470K
R-108	1000 ohms ½ watt, carbon	23X20X102K
R-109	8200 ohms ½ watt, carbon	23X20X822K
R-110	150 ohms ½ watt, carbon	23X20X151K
R-111	1000 ohms ½ watt, carbon	23X20X102K
R-112	390,000 ohms ½ watt, carbon	23X20X394K
R-113	1.5 megohms ½ watt, carbon	23X20X155K
R-114	5600 ohms ½ watt, carbon	23X20X562K
R-115	1 megohm ½ watt, carbon	23X20X105K
R-116	1.5 megohms ½ watt, carbon	23X20X155K
R-117	2.2 megohms ½ watt, carbon	23X20X225K
R-118/168	2500/1,000,000 ohms; dual contrast/volume control	25B997
R-119	8200 ohms ½ watt, carbon (part of L-104)	---------
R-120	33,000 ohms 1 watt, carbon	23X30X333K
R-121	4700 ohms 2 watt, carbon	23X40X472K
R-122	6800 ohms ½ watt, carbon (part of L-106)	---------
R-123	3300 ohms ½ watt, carbon (part of L-107)	---------
R-124	10,000 ohms ½ watt, carbon	23X20X103K
R-125	470,000 ohms ½ watt, carbon	23X20X474K
R-126	2.2 megohms ½ watt, carbon	23X20X225K
R-127	680,000 ohms ½ watt, carbon	23X20X684K
R-128	2200 ohms ½ watt, carbon	23X20X222K
R-129	560,000 ohms 1 watt, carbon	23X30X564K
R-130	22,000 ohms ½ watt, carbon	23X20X223K
R-131	6800 ohms ½ watt, carbon	23X20X682K
R-132	3300 ohms ½ watt, carbon	23X20X332K
R-133	22,000 ohms ½ watt, carbon	23X20X223K
R-134	10,000 ohms ½ watt, carbon	23X20X103K
R-135	850,000 ohms; vertical hold control: for mtg. on rear apron	25B1001
R-135	850,000 ohms; vertical hold control: for mtg. on front apron	25B1013
R-136	3300 ohms ½ watt, carbon	23X20X332K
R-137	1800 ohms ½ watt, carbon	23X20X182K
R-138	5 megohms; height control	25B998
R-139	120 ohms ½ watt, carbon	23X20X121K
R-140	750 ohms; vertical linearity control	25B999
*R-141	8700 ohms 3 watts, 5% wire wound	24A971
*R-142	7.5 ohms 5 watts, fuse type wire wound	25B1004
*R-143	190 ohms cold - 19 ohms hot, 5 watts; neg. temp. coeff.	25A1008
*R-144	80 ohms 10 watts, 5% wire wound	24A955
*R-145	42 ohms 3 watts, 5% wire wound	24A957
R-146	100,000 ohms ½ watt, carbon	23X20X104K

SERVICE PARTS LIST (Cont.)

RESISTORS (Cont.)

Schematic Symbol	Description	Hallicrafters Part Number
R-147	100,000 ohms ½ watt, carbon	23X20X104K
R-148	22,000 ohms ½ watt, carbon	23X20X223K
R-149	4.7 megohms ½ watt, carbon	23X20X475K
R-150	4.7 megohms ½ watt, carbon	23X20X475K
R-151	150,000 ohms 1 watt, carbon	23X30X154K
R-152	150,000 ohms 1 watt, carbon	23X30X154K
R-153	1200 ohms ½ watt, carbon	23X20X122K
R-154	5600 ohms ½ watt, carbon	23X20X562K
R-155	120,000 ohms; horizontal hold control; for mtg. on rear apron	25B1002
R-155	120,000 ohms; horizontal hold control; for mtg. on front apron	25B1014
R-156	120,000 ohms 1/2 watt, carbon	23X20X124K
R-157	4700 ohms ½ watt, carbon	23X20X472K
R-158	330,000 ohms ½ watt, carbon	23X20X334K
R-159	4700 ohms 1 watt, carbon	23X30X472K
R-160	50 ohms rheostat; horizontal centering (part of horiz. output trans.)	---------
R-161	2.2 ohms ½ watt, carbon (part of horiz. output trans.)	23X20X022K
R-162	150 ohms ½ watt, carbon	23X20X151K
R-163	2200 ohms ½ watt, carbon	23X20X222K
R-164	270 ohms ½ watt, carbon	23X20X271K
*R-165	10,000 ohms ½ watt, 5% carbon	23X20X103J
*R-166	10,000 ohms ½ watt, 5% carbon	23X20X103J
R-167	33,000 ohms ½ watt, carbon	23X20X333K
R-168/118	1,000,000/2500 ohms; dual volume/contrast control	25B997
R-169	1500 ohms ½ watt, carbon	23X20X152K
R-170	33,000 ohms ½ watt, carbon	23X20X333K
R-171	5 megohms; brightness control	25B1000
R-172	1.5 megohms; focus control	25A1003
R-173	220 ohms ½ watt, carbon	23X20X221K
R-174	1000 ohms ½ watt, carbon	23X20X102K
R-175	470,000 ohms ½ watt, carbon	23X20X474K
R-176	1200 ohms ½ watt, carbon	23X20X122K
R-177	33,000 ohms 1 watt, carbon	23X30X333K
R-178	82,000 ohms ½ watt, carbon	23X20X823K
R-179	220,000 ohms ½ watt, carbon	23X20X224K
R-180	8200 ohms ½ watt, carbon	23X20X822K
R-181	390,000 ohms ½ watt, carbon	23X20X394K
R-182	10,000 ohms 2 watts, carbon	23X40X103K
R-183	47,000 ohms ½ watt, carbon	23X20X473K
R-184	2200 ohms ½ watt, carbon	23X20X222K
R-185	1500 ohms ½ watt, carbon	23X20X152K
R-186	470,000 ohms ½ watt, carbon	23X20X474K
R-187	470,000 ohms ½ watt, carbon	23X20X474K
R-188	22,000 ohms 1 watt, carbon	23X30X223K
R-189	470,000 ohms ½ watt, carbon	23X20X474K
R-190	1.2 megohms ½ watt, carbon	23X20X125K
R-191	47,000 ohms ½ watt, carbon	23X20X473K
R-192	10,000 ohms 1 watt, carbon	23X30X103K
R-193	22,000 ohms 1 watt, carbon	23X30X223K
R-194	180,000 ohms ½ watt, carbon	23X20X184K
R-195	22,000 ohms ½ watt carbon	23X20X223K
R-196	220,000 ohms ½ watt carbon	23X20X224K
R-197	33,000 ohms ½ watt, carbon	23X20X333K
R-198	220 ohms ½ watt, carbon	23X20X221K
R-199	220,000 ohms ½ watt, carbon	23X20X224K
R-200	2.2 ohms ½ watt, carbon	23X20X022K
R-201	22,000 ohms ½ watt, carbon	23X20X223K
R-202	15,000 ohms ½ watt, carbon	23X20X153K
R-203	470 ohms ½ watt, carbon	23X20X471K
R-204	470 ohms ½ watt, carbon	23X20X471K
R-205	470 ohms ½ watt, carbon	23X20X471K
R-206	6800 ohms ½ watt, carbon	23X20X682K
R-207	100 ohms 1 watt, carbon	23X30X101K
R-208	3300 ohms 2 watts, carbon	23X40X332K
R-209	220 ohms ½ watt, carbon	23X20X221K
R-210	1 megohm 1 watt, carbon	23X30X105K
R-211	100 ohms ½ watt, carbon	23X20X101K
R-212	10,000 ohms ½ watt, carbon	23X20X103K
R-213	820,000 ohms ½ watt, carbon	23X20X824K

SPEAKERS

DESCRIPTION		HALLICRAFTERS PART NUMBER
Speaker, 6½" Electrodynamic; 85 Ohms Field (Cold Resistance)	1010P	85C128
Speaker, 8" Electrodynamic; 61 ohms field (cold resistance)	1012P	85C136
Speaker, 8" Electrodynamic; 85 ohms field (cold resistance)	1013C	85C136
Speaker, 8" Electrodynamic; 61 ohms field (cold resistance)	1026P, 1027P	85A133
Speaker, 6-1/2" Electrodynamic; 85 Ohms Field (Cold Resistance)	1051P 1052P	85C128
Speaker, 6-1/2" Electrodynamic; 61 ohms field (cold resistance)	1053P 1054P	85A135
Speaker, 6-1/2" Electrodynamic; 61 ohms field (cold resistance)	1055C, 1056C, 1060C, 1061C	85C135
Speaker, 8" Electrodynamic; 61 ohms field (cold resistance)	1055C, 1056C, 1060C, 1061C	85A133
Speaker, 8" Electrodynamic; 61 ohms field (cold resistance)	1062C, 1063C	85A133

* USE EXACT REPLACEMENT PART ONLY

CABINET SERVICE PARTS FOR MODEL 1058U

For parts other than those listed below refer to the appropriate chassis and picture tube mounting parts list and any supplementary material that has been added thereto.

DESCRIPTION	HALLICRAFTERS PART NUMBER
Antenna, Built-in VHF Silver Vortex	57D171
Antenna, Built-in UHF	57C182
VHF or UHF Antenna Terminal strip	88A456
Board, Speaker Baffle	32C625
Bolt, Ornamental Head; Speaker Mounting	3B1790
Bracket, Built In Antenna Support	67A2121
Bracket, Glass & Mask Retainer; Top and Bottom	67A2138
Bracket, Glass & Mask Retainer; Left Side	67B2139
Bracket, Glass & Mask Retainer; Right Side	67B2140
Bracket, Cabinet Back Upper Corner Support	67B2009
Bracket, UHF Prism Mounting	67B2147
Cabinet, Table; Mahogany Brown Plastic	116F029
*Cabinet Back Only	8E2040
*Cabinet Back Assembly	41A15453
Cabinet Foot	16A315
Dust Seal	16B343
*Glass, Safety	22A371
Grille, Speaker	7C424
¶Knob, Channel Selector	15C578
¶Knob, Contrast Control	15C517
¶Knob, VHF Fine Tuning & UHF Tuning	15C573
¶Knob, Off-On-Volume Control	15C577
Line Cord and Plugs	87B1668-1
*Mask, Picture Tube	7D395
Nameplate	13A1046
Pad, Glass and Mask Retainer Brackets	16A313
Plug, Speaker, With Leads	6A442
Prism, UHF Dial Indicator	83D434
Prism Mounting clips	76A415
Shield, Picture Tube; Mounted On Cabinet Back	69A411
•Speaker, 6-1/2" Electrodynamic; 85 Ohms Field (Cold Resistance)	85C128
Screw, Plastic; For Mounting Cabinet Back, Safety Glass and Mask	3A266

*When the chassis has a tilted picture tube all of the following parts are used in place of the components listed in the above parts list:

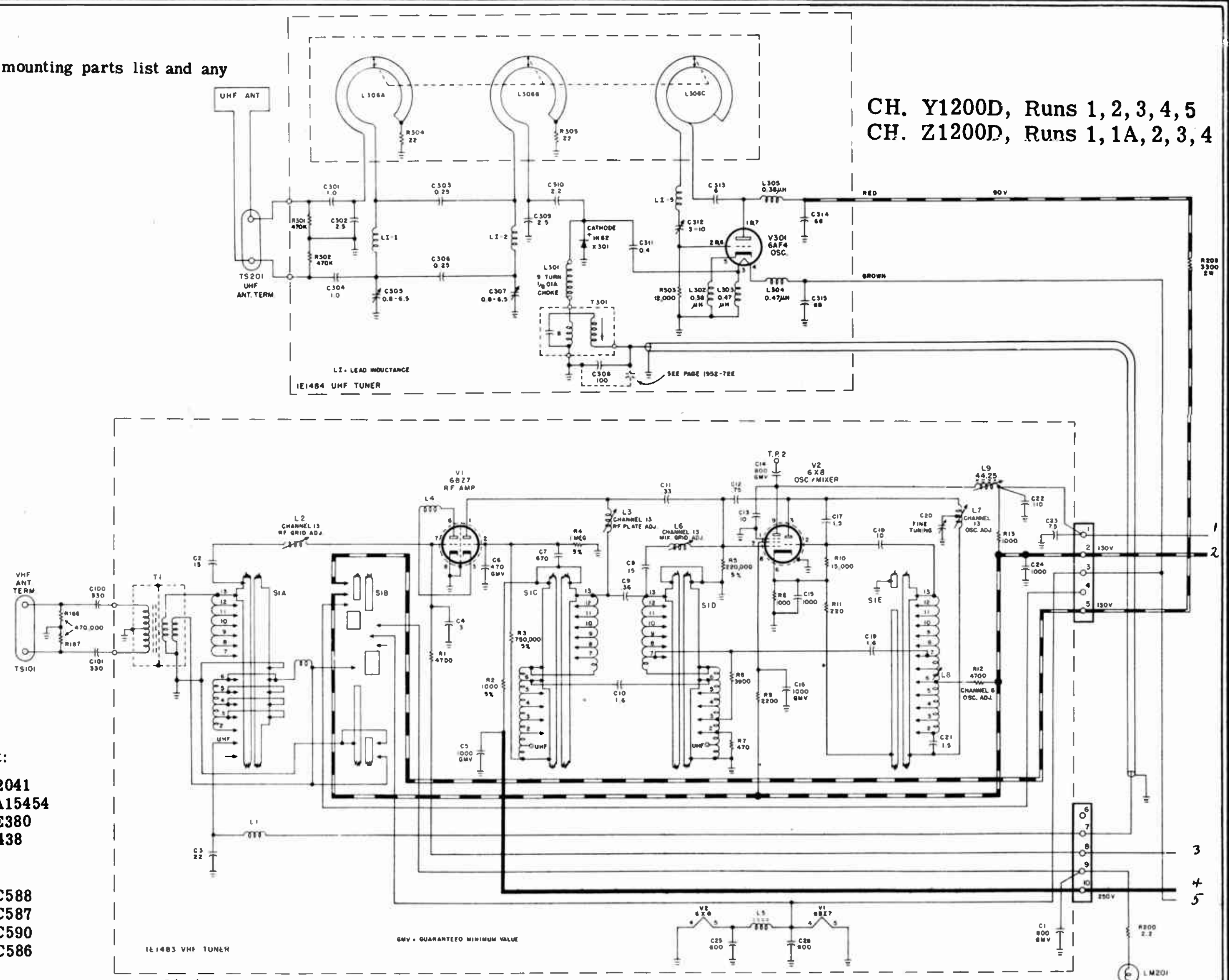
Cabinet Back Only	8B2041
Cabinet Back Assembly	41A15454
Glass, Safety	22E380
Mask, Picture Tube	7D438

¶The following knobs may be used for replacement provided they are replaced as a set:

Knob, Channel Selector	15C588
Knob, Contrast Control	15C587
Knob, VHF Fine Tuning & UHF Tuning	15C590
Knob, Off-On-Volume Control	15C586

• In some models the speaker used is part number 85A135 with a 61 ohms field. When this speaker is used a 20 ohms, 10 watt, flat wirewound resistor 24-927 is connected in series between the red speaker field cable lead and the point from which field voltage is obtained.

CH. Y1200D, Runs 1, 2, 3, 4, 5
CH. Z1200D, Runs 1, 1A, 2, 3, 4



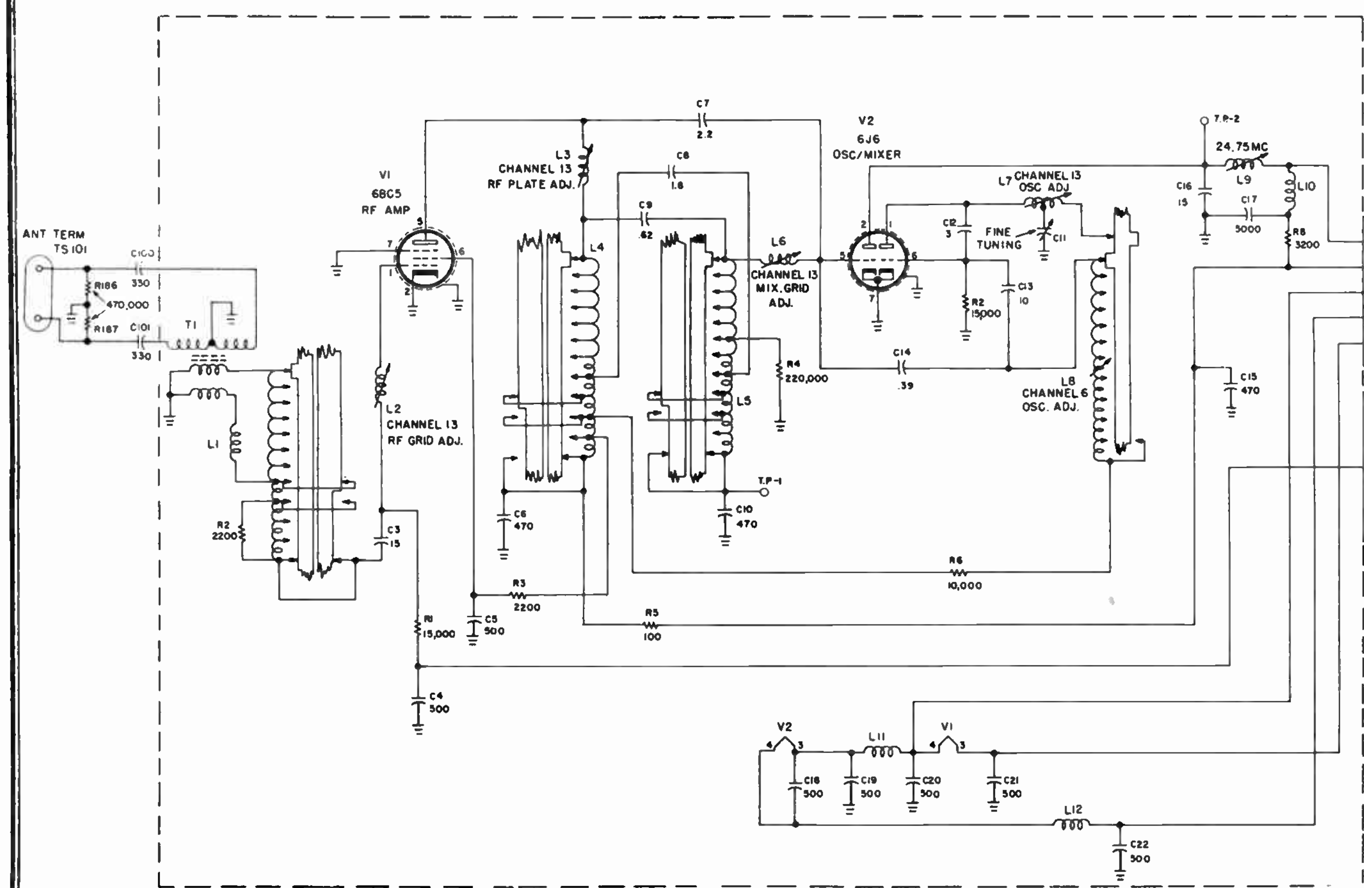
CABINET SERVICE PARTS FOR MODEL 1057U

For parts other than those listed below refer to the appropriate chassis and picture tube mounting parts list and any supplementary material that has been added thereto.

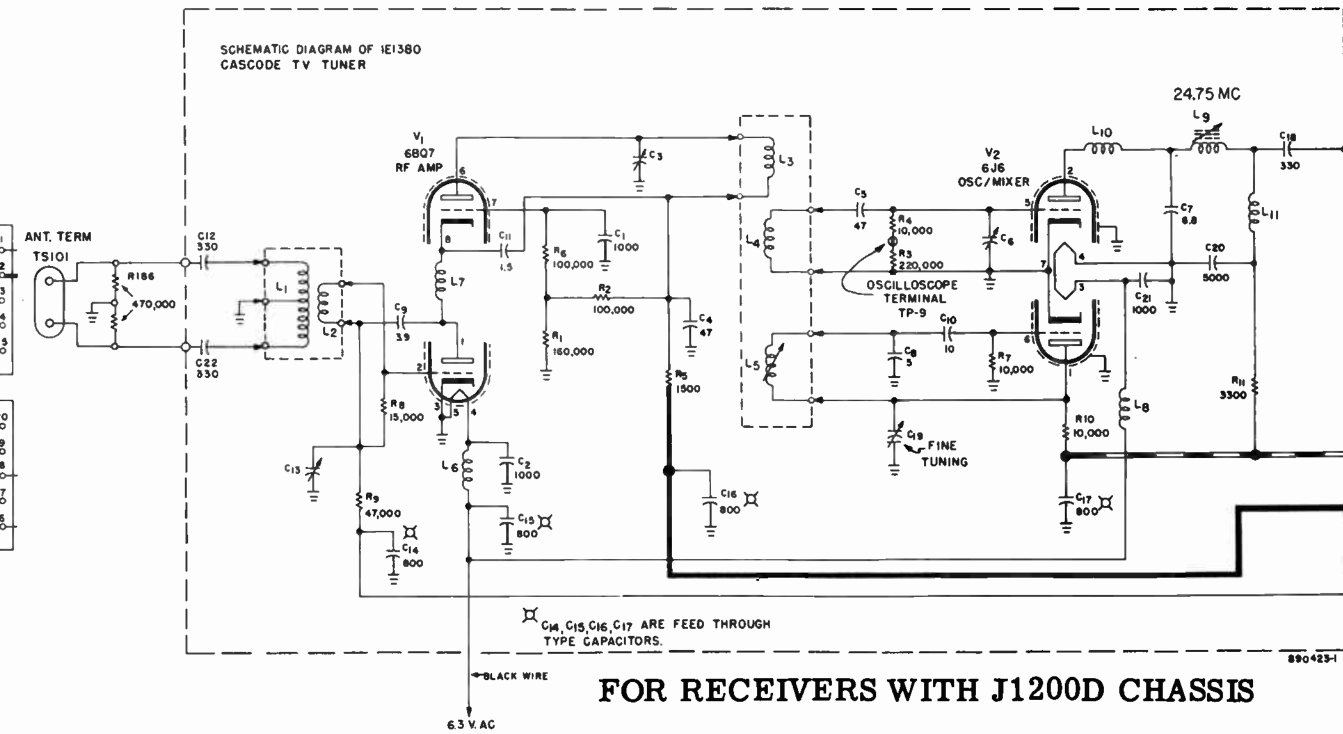
DESCRIPTION	HALLICRAFTERS PART NUMBER
Antenna, Built-in VHF Silver Vortex	57D147
Antenna, Built-in UHF	57C182
VHF or UHF Antenna Terminal Strip	88A456
Baffle, Speaker	32C613
Bolt, Ornamental Head; Speaker Mounting	3A1665
Cabinet, Table; Mahogany	78F942
Cabinet Back Only	8E2039
Cabinet Back Assembly	41A15455
Cabinet Bottom	8D1921
Dust Seal	16B344
Escutcheon, Knob	7D398
Glass, Safety	22D375
¶Knob, Channel Selector	15C578
¶Knob, Contrast Control	15C517
¶Knob, VHF Fine Tuning & UHF Tuning	15C573
¶Knob, Off-On-Volume Control	15C577
Line Cord and Plugs	87B1668-1
Mask, Picture Tube	7D405
Prism, UHF Dial Indicator	83D434
Prism Mounting Bracket	67B2148
Prism, Mounting Clip	76A415
Plug Speaker, With Leads	6A442
Shield, Picture Tube; Mounted On Cabinet Back	69A476
Speaker, 6½" Electrodynamic; 61 ohms field (cold resistance)	85A135

¶The following knobs may be used for replacement provided they are replaced as a set:

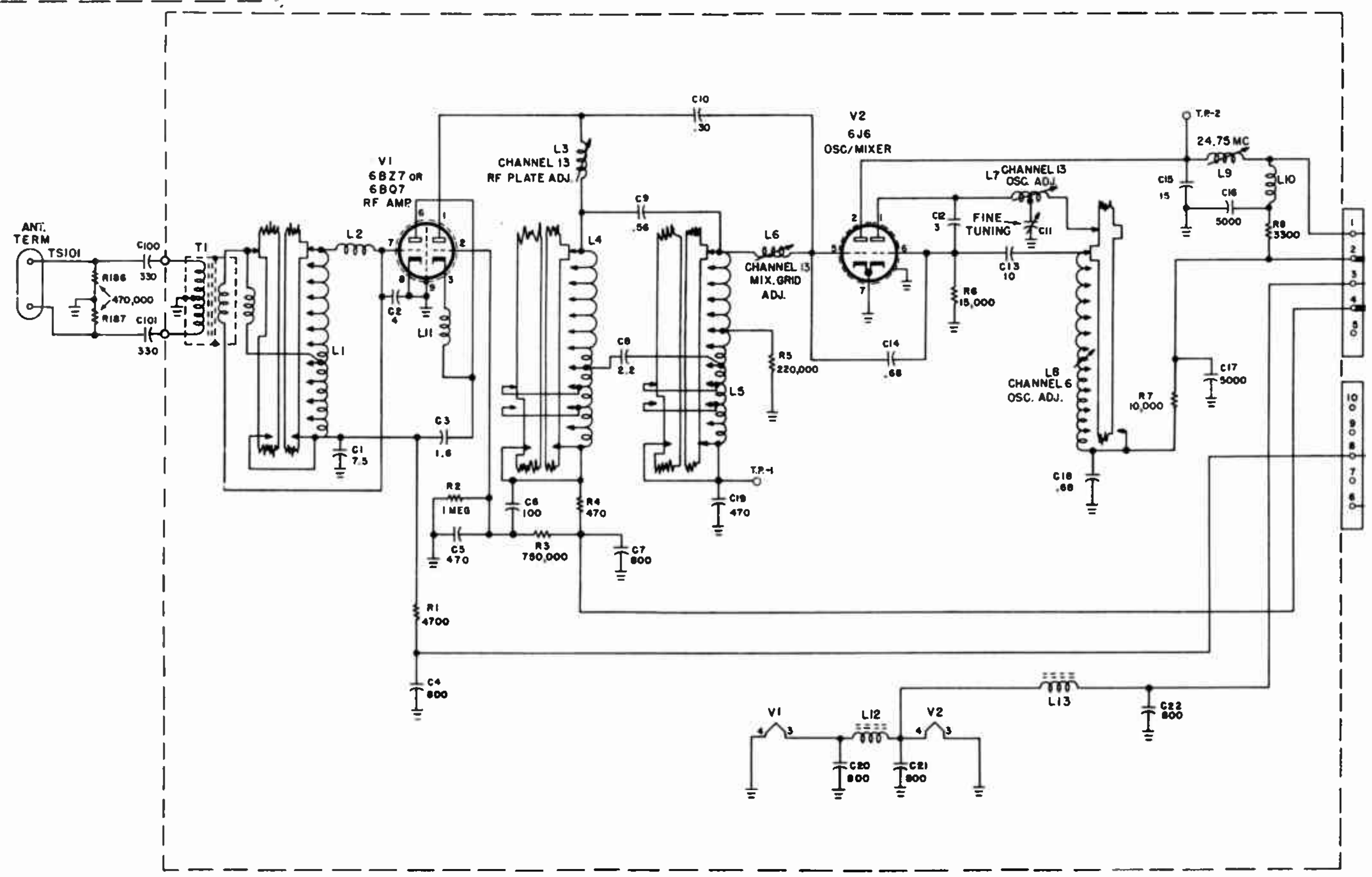
Knob, Channel Selector	15C588
Knob, Contrast Control	15C587
Knob, VHF Fine Tuning & UHF Tuning	15C590
Knob, Off-On-Volume Control	15C586



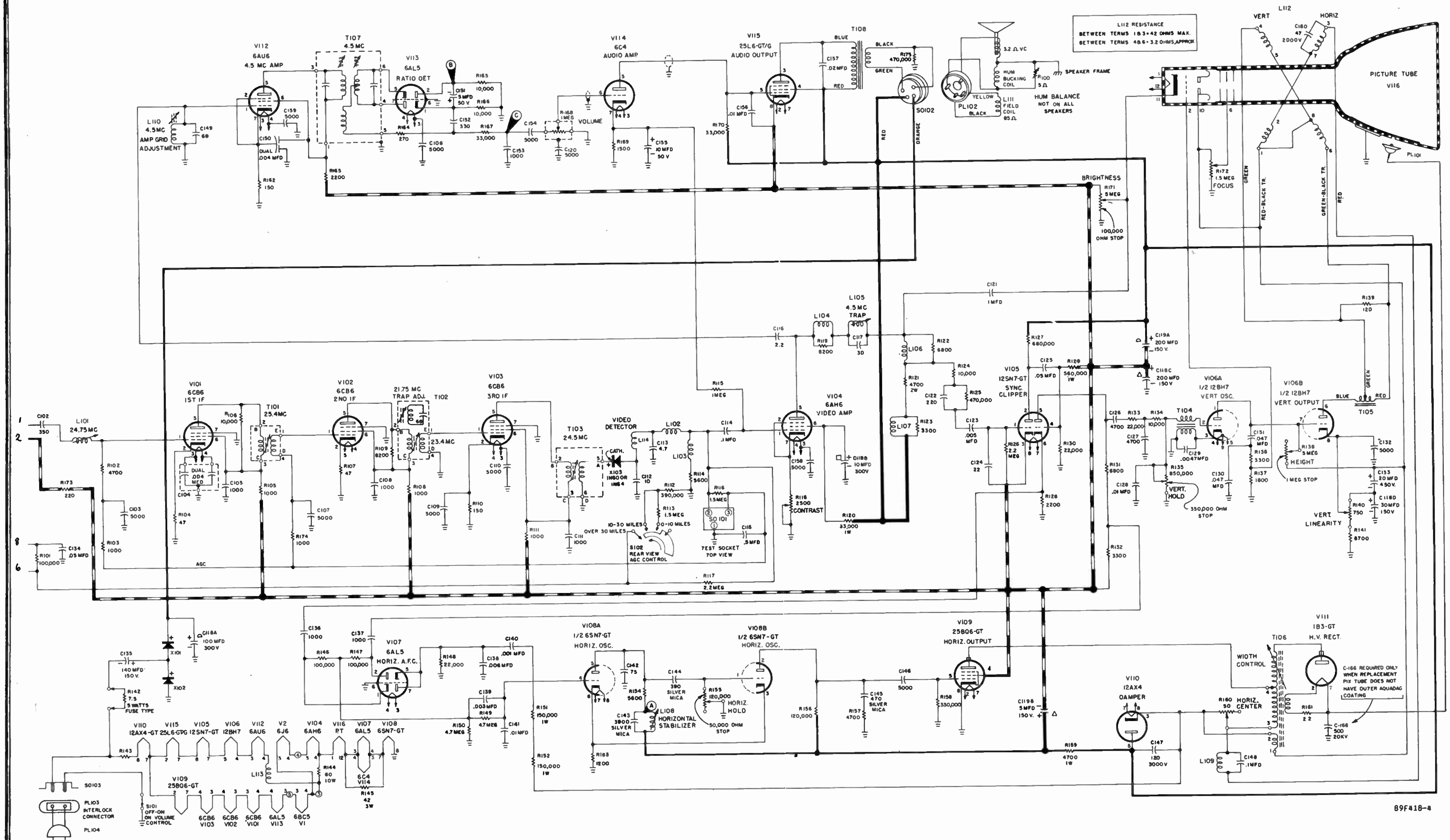
FOR RECEIVERS WITH A1200D, D1200D, K1200D, L1200D, P1200D, R1200D, W1200D, AND X1200D CHASSIS



FOR RECEIVERS WITH J1200D CHASSIS



FOR RECEIVERS WITH F1200D, G1200D, AND T1200D CHASSIS



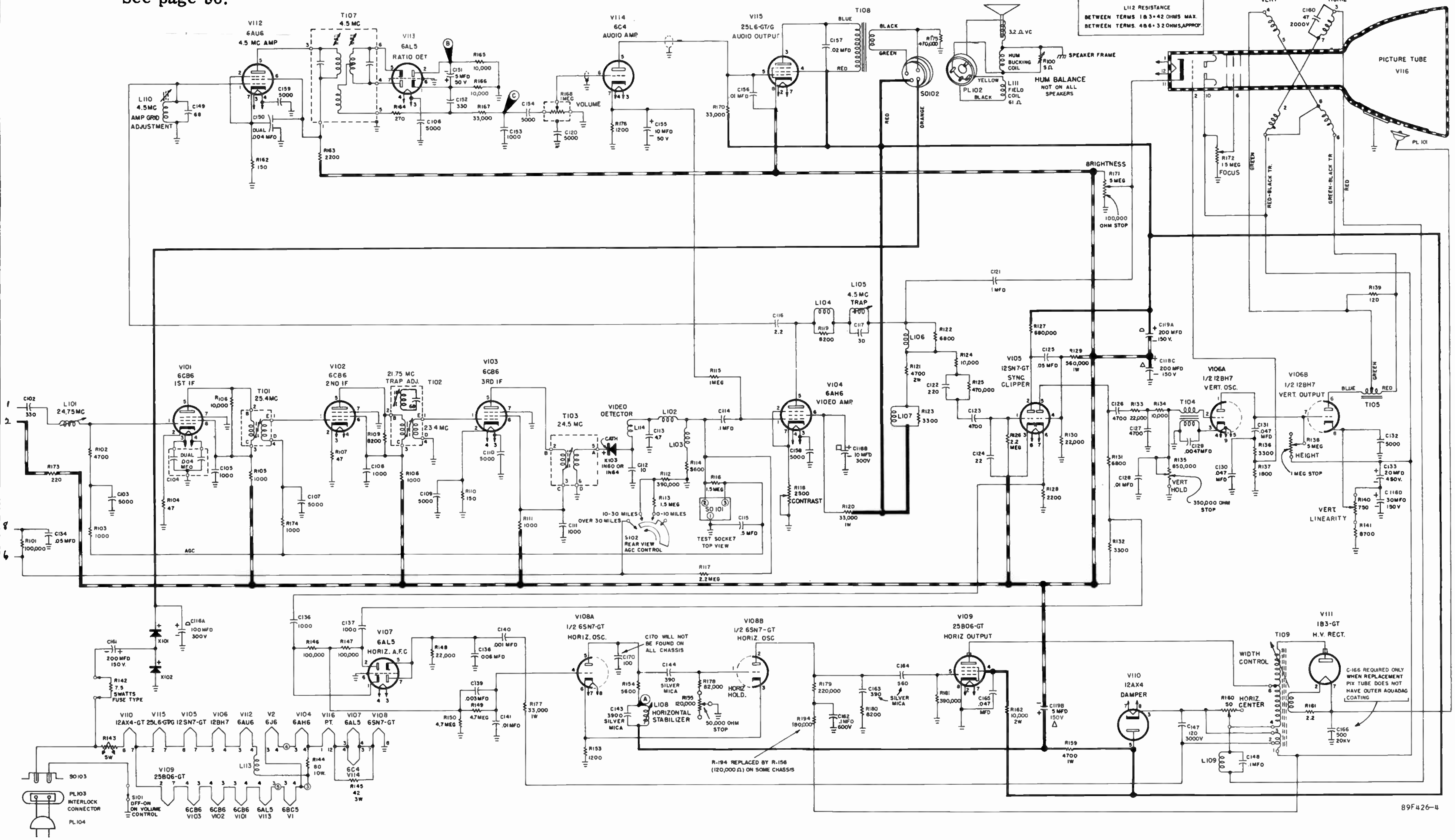
NOTE: For tuner schematic, see page 58.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES.
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES.
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

VHF
17" CHASSIS
A1200D
RUN 1

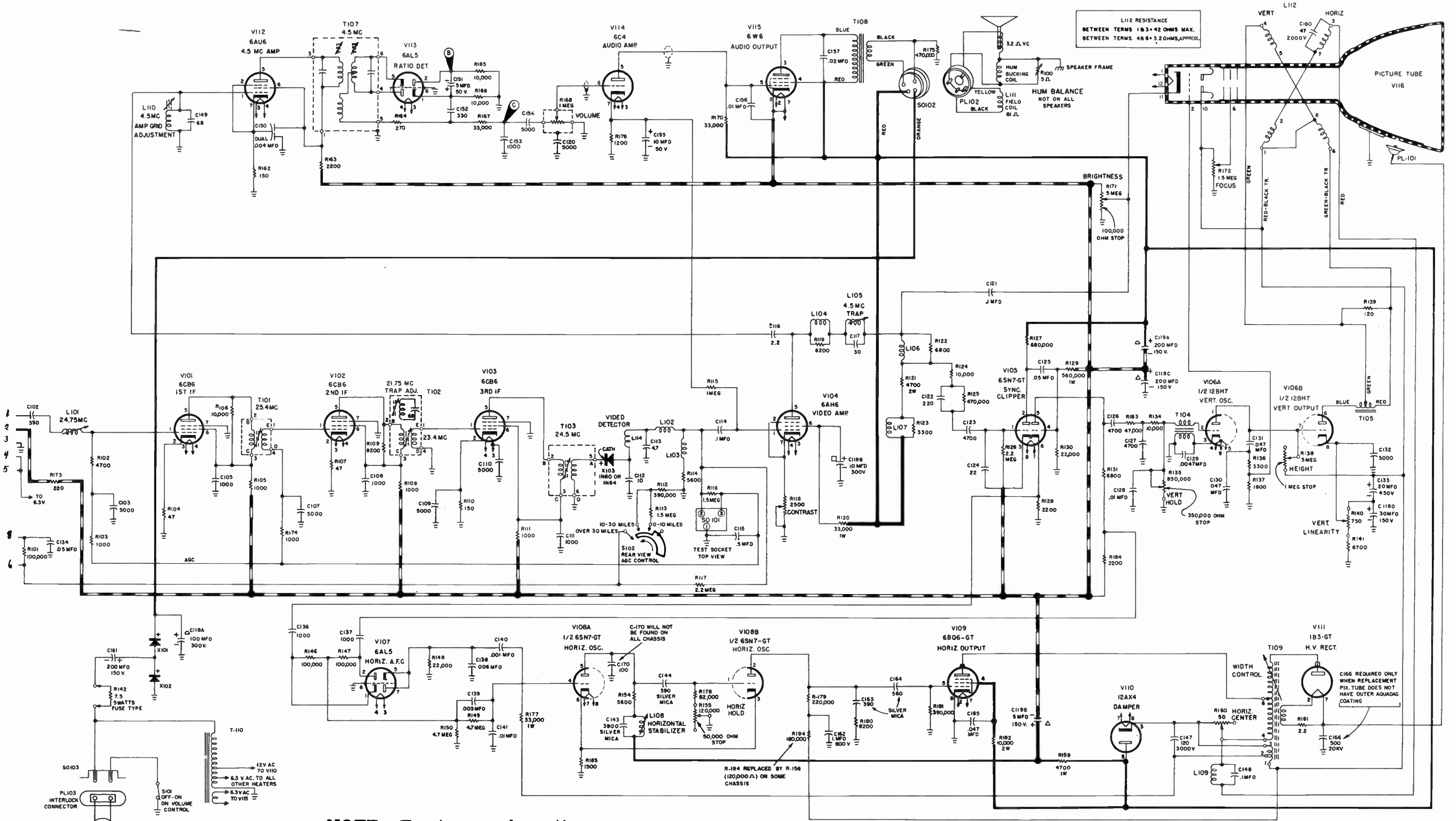
NOTE: For tuner schematic, see page 58.



VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES.
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES.
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109 PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

VHF
20" CHASSIS
D1200D
RUN 1



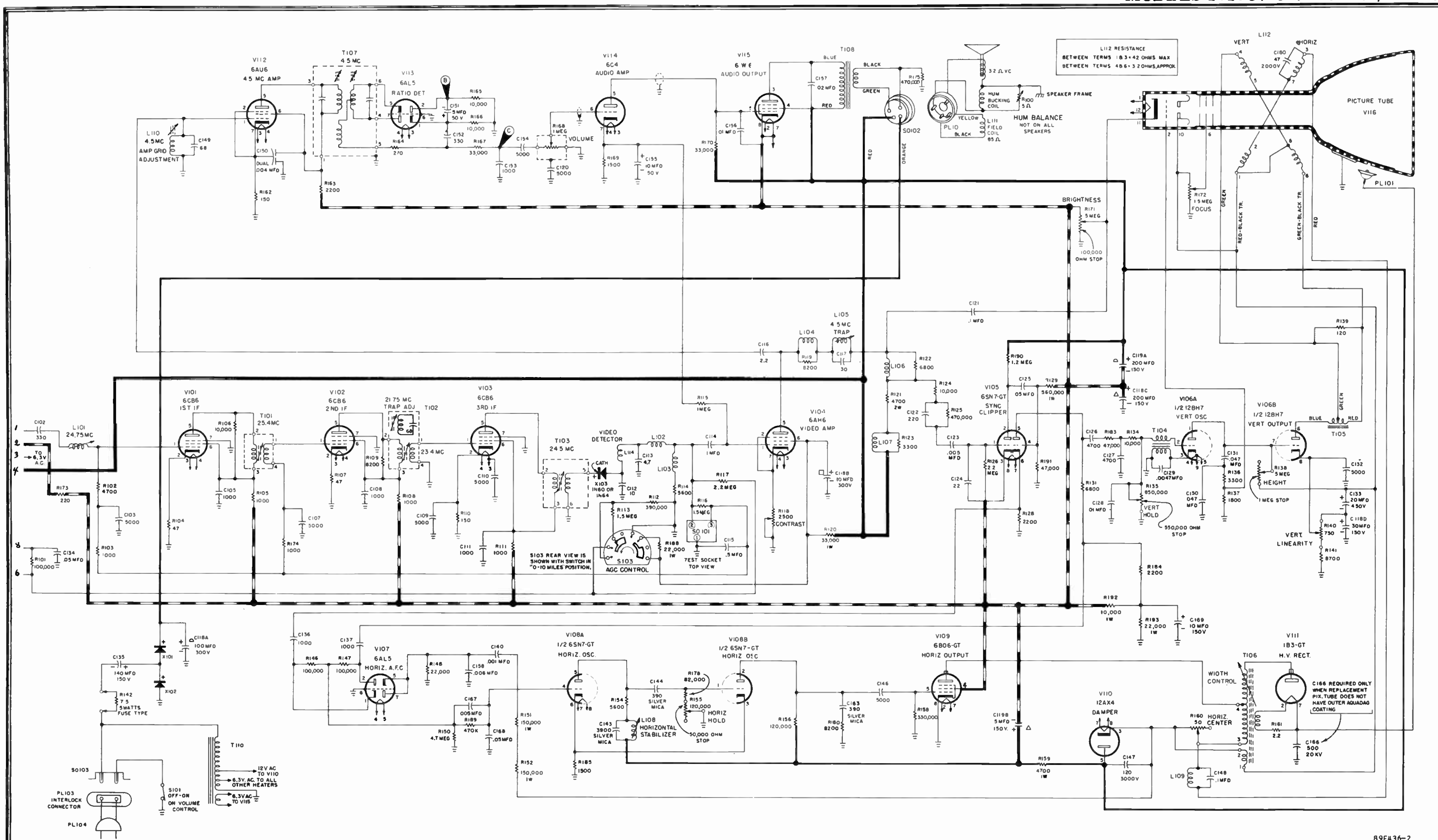
NOTE: For tuner schematic, see page 58.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES.
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES.
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

89F429-4

VHF
20" CHASSIS
L1200D
RUN 1

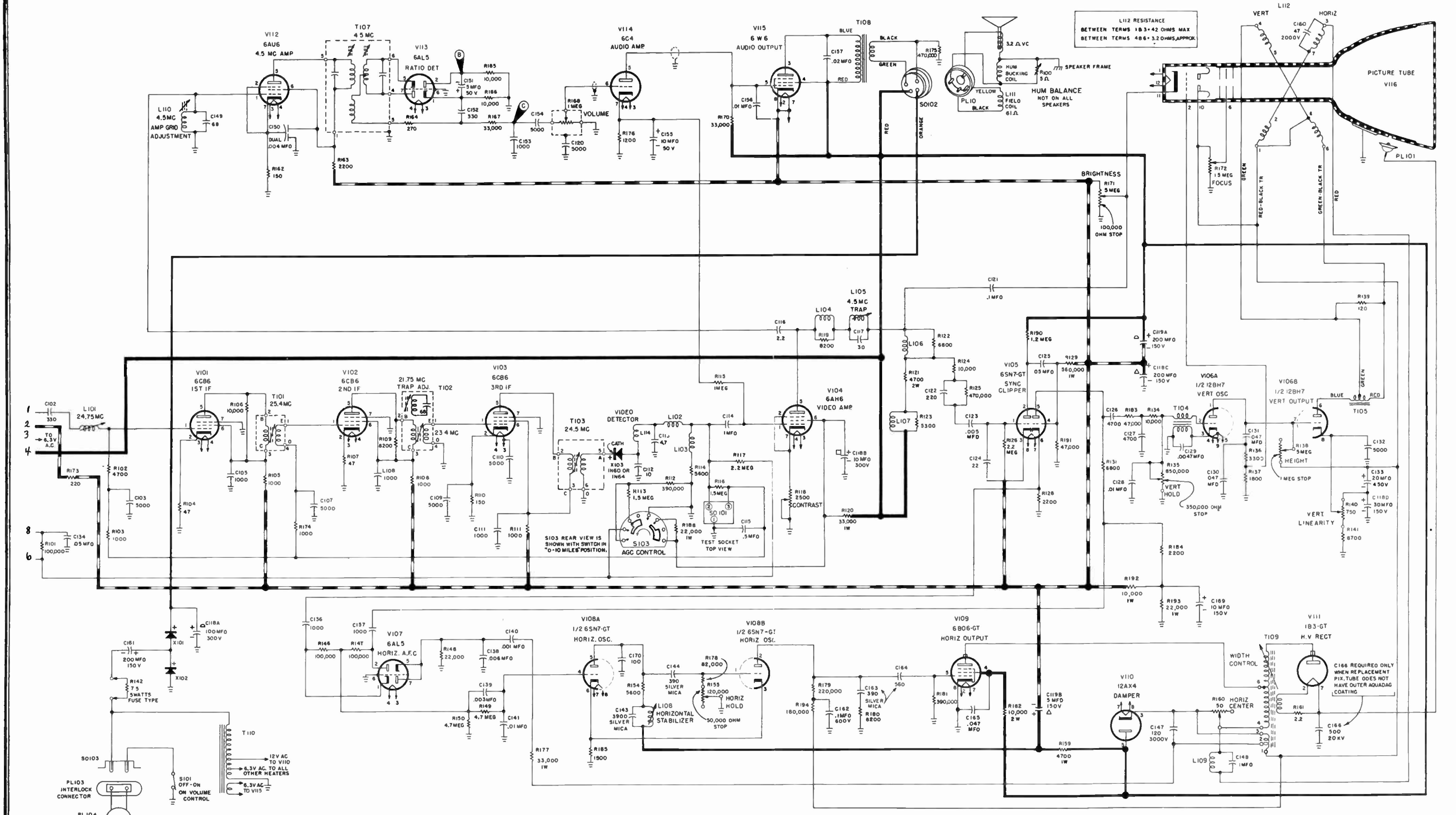


NOTE: For tuner schematic, see page 58.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109 PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF
17" CHASSIS
F1200D
RUN 1



NOTE: For tuner schematic, see page 58.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

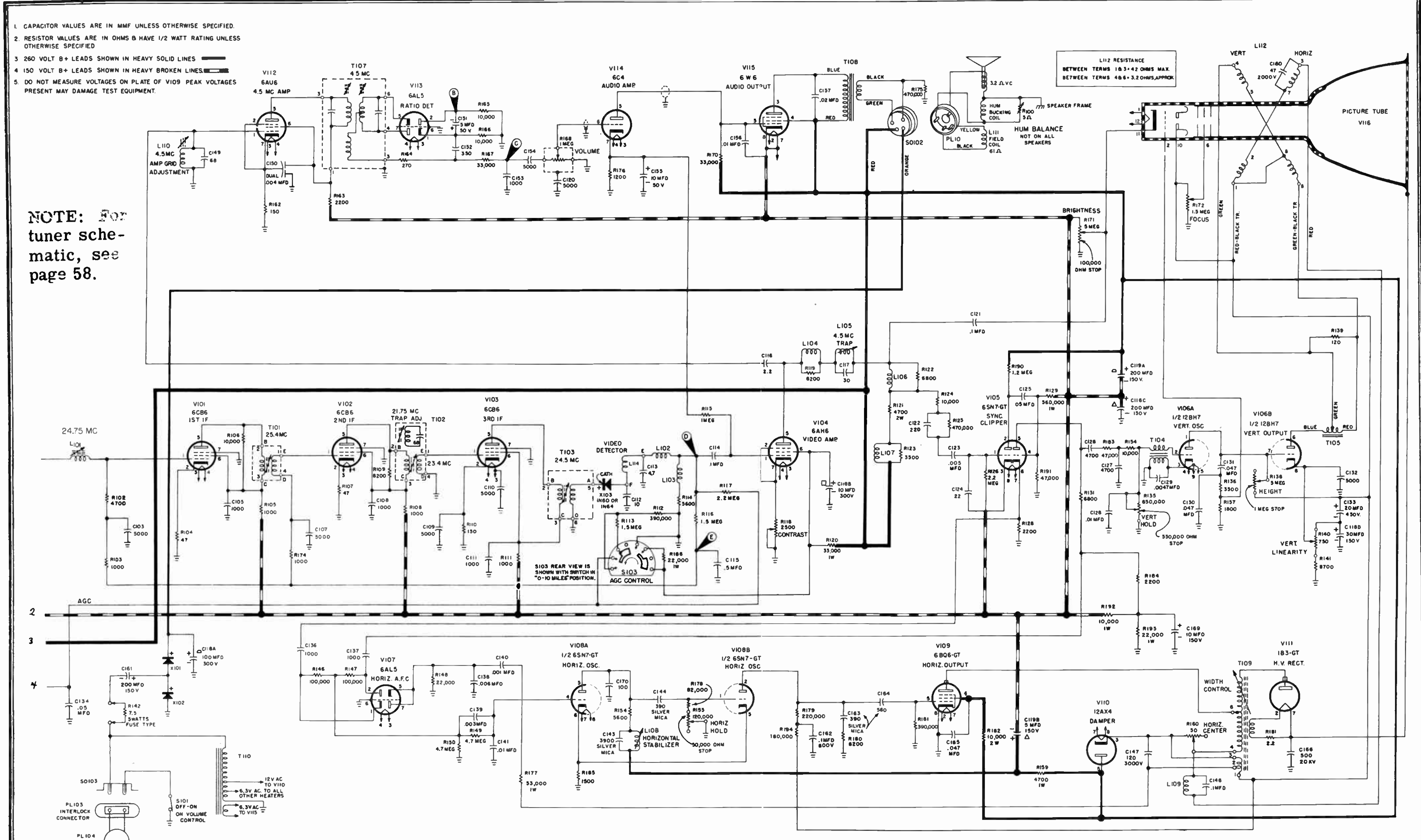
1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 160 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109 PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

89F437-3

VHF
20" CHASSIS
G1200D
RUN 1

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109 PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

NOTE: For tuner schematic, see page 58.

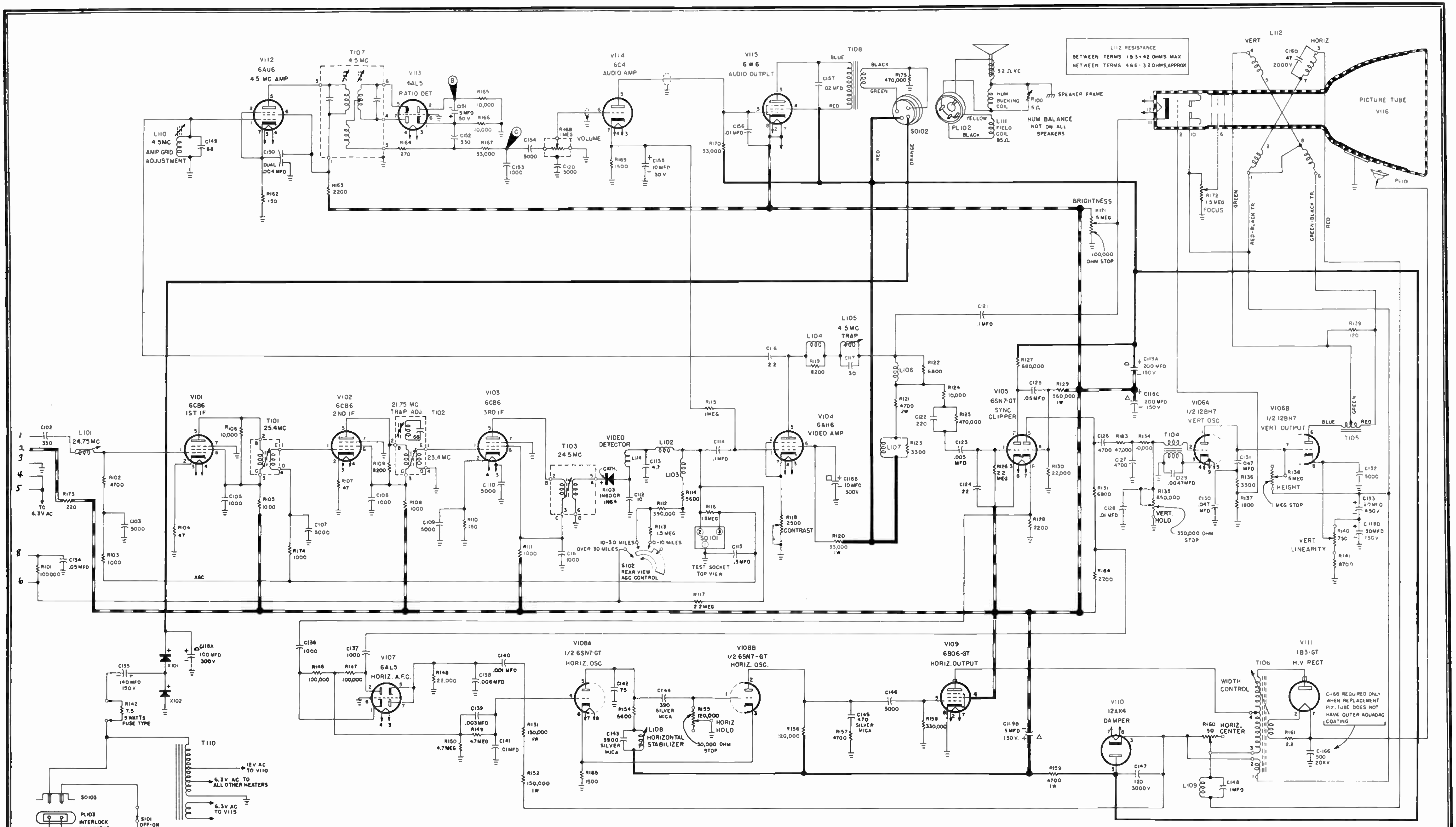


TO IMPROVE VERTICAL AND HORIZONTAL SYNC PARTICULARLY UNDER EXTREME FRINGE AREA RECEIVING CONDITIONS THE FOLLOWING CHANGES WILL BE FOUND ON CHASSIS WHICH HAVE A RUN 1A CHASSIS STAMP:

A. 10,000 OHMS, 1/2 WATT RESISTOR (R-124) REPLACED BY 22,000 OHMS, 1/2 WATT RESISTOR (R-195).
B. 470,000 OHMS, 1/2 WATT RESISTOR (R-125) REPLACED BY 220,000 OHMS, 1/2 WATT RESISTOR (R-196).
C. 47,000 OHMS, 1/2 WATT RESISTOR (R-183) REPLACED BY 33,000 OHMS, 1/2 WATT RESISTOR (R-197).
D. 22 MMF. 500 V., CERAMIC TUBULAR CAPACITOR (C-124) REPLACED BY 47 MMF. 500 V., CERAMIC TUBULAR CAPACITOR (C-172).
E. 1,000 MMF. 500 V., CERAMIC DISC CAPACITOR (C-171) ADDED BETWEEN PIN 5 AND GROUND OF THE 12AX4 DAMPER TUBE V-110.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF
21" CHASSIS
J1200D
RUNS 1 & 1A

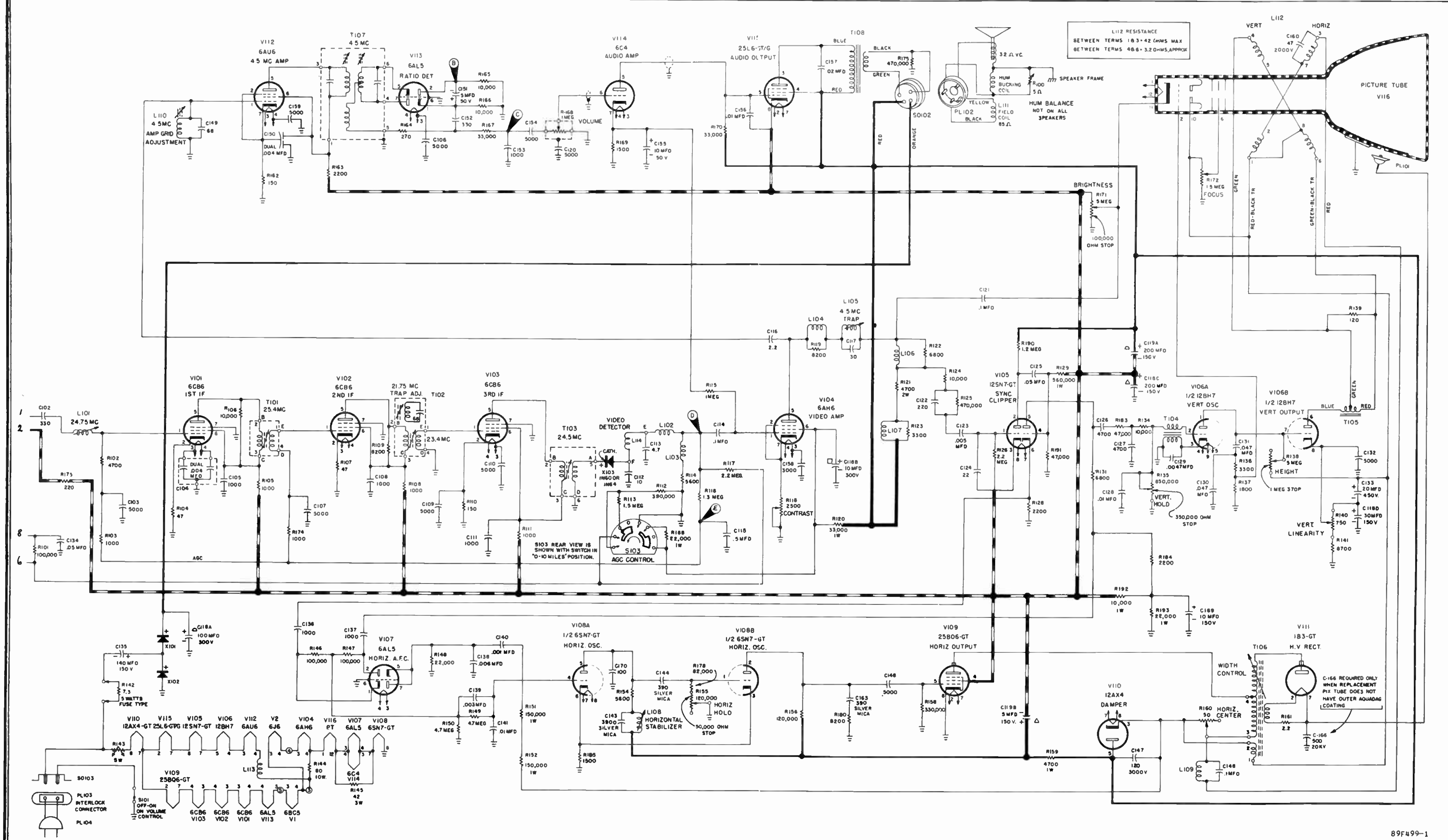


NOTE: For tuner schematic, see page 58.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109 PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT

VHF
17" CHASSIS
K1200D
RUN 1



NOTE: For tuner schematic, see page 58.

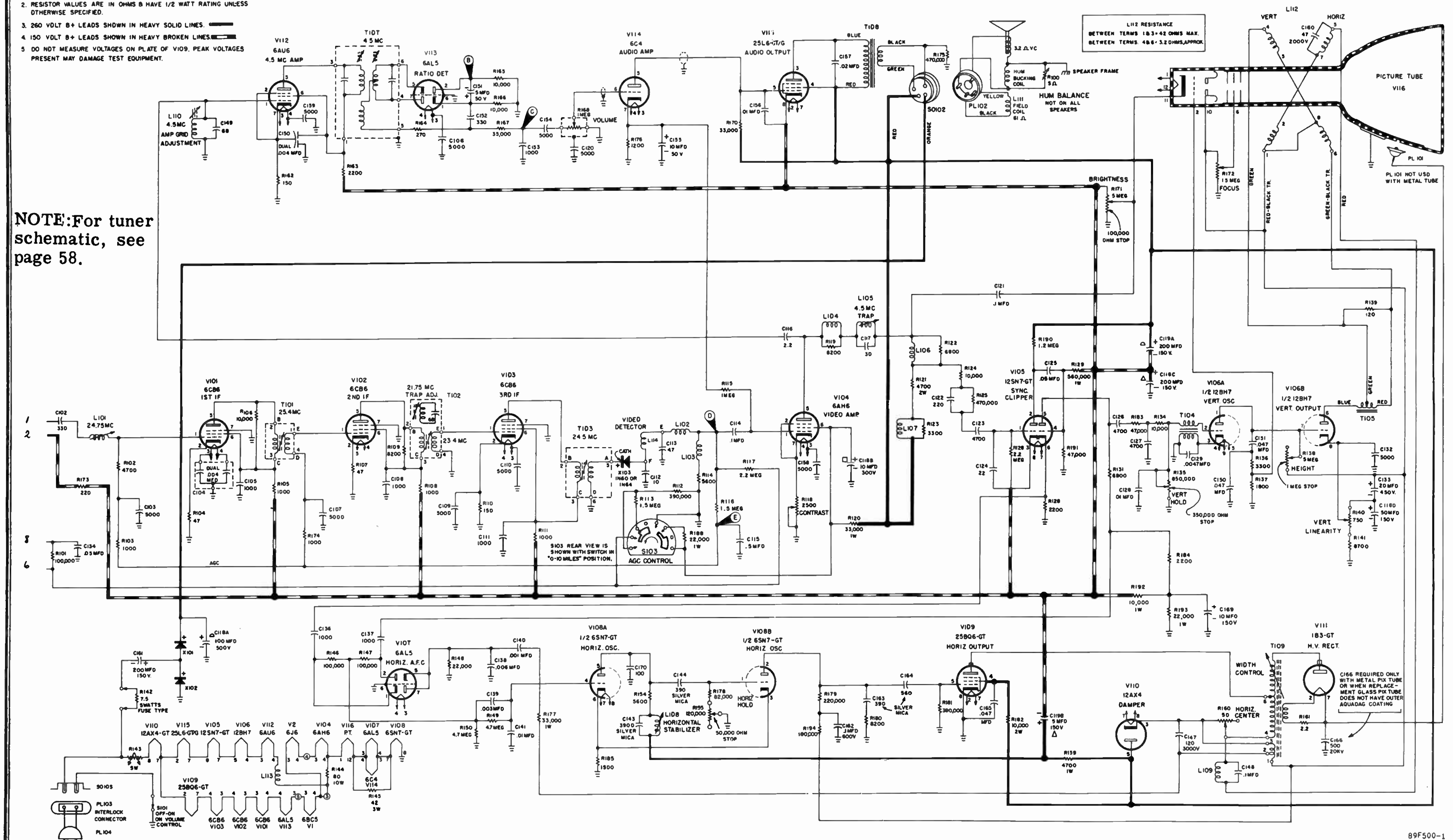
1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109 PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT

VHF
17" CHASSIS
P1200D
RUN 1

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES.
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES.
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

NOTE: For tuner schematic, see page 58.



TO IMPROVE VERTICAL AND HORIZONTAL SYNC PARTICULARLY UNDER EXTREME FRINGE AREA RECEIVING CONDITIONS THE FOLLOWING CHANGES WILL BE FOUND ON CHASSIS WHICH HAVE A RUN 1A CHASSIS STAMP:

A. 10,000 OHMS, 1/2 WATT RESISTOR (R-124) REPLACED BY 22,000 OHMS, 1/2 WATT RESISTOR (R-195).
B. 470,000 OHMS, 1/2 WATT RESISTOR (R-125) REPLACED BY 220,000 OHMS, 1/2 WATT RESISTOR (R-196).
C. 47,000 OHMS, 1/2 WATT RESISTOR (R-183) REPLACED BY 33,000 OHMS, 1/2 WATT RESISTOR (R-197).
D. 22 MMF. 500 V., CERAMIC TUBULAR CAPACITOR (C-124) REPLACED BY 47 MMF. 500 V., CERAMIC TUBULAR CAPACITOR (C-172).
E. 1,000 MMF. 500 V., CERAMIC DISC CAPACITOR (C-171) ADDED BETWEEN PIN 5 AND GROUND OF THE 12AX4 DAMPER TUBE V-110.

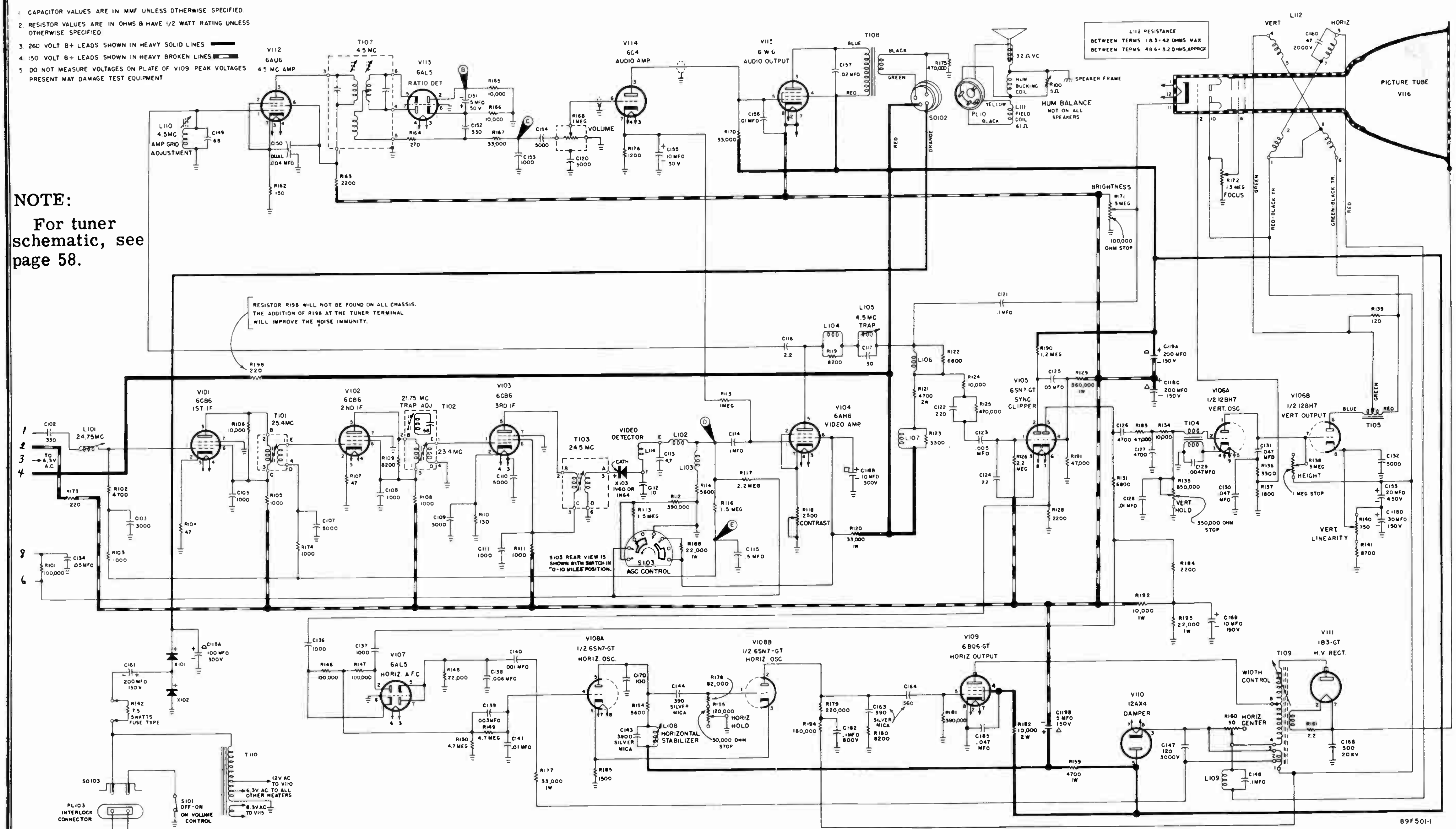
VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF
21" CHASSIS
R1200D
RUNS 1 & 1A

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109 PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT

NOTE:

For tuner schematic, see page 58.



TO IMPROVE VERTICAL AND HORIZONTAL SYNC PARTICULARLY UNDER EXTREME FRINGE AREA RECEIVING CONDITIONS THE FOLLOWING CHANGES WILL BE FOUND ON CHASSIS WHICH HAVE A RUN 1A CHASSIS STAMP:

A. 10,000 OHMS, 1/2 WATT RESISTOR (R-124) REPLACED BY 22,000 OHMS, 1/2 WATT RESISTOR (R-195).
B. 470,000 OHMS, 1/2 WATT RESISTOR (R-125) REPLACED BY 220,000 OHMS, 1/2 WATT RESISTOR (R-196).
C. 47,000 OHMS, 1/2 WATT RESISTOR (R-183) REPLACED BY 33,000 OHMS, 1/2 WATT RESISTOR (R-197).
D. 22 MMF. 500 V., CERAMIC TUBULAR CAPACITOR (C-124) REPLACED BY 47 MMF. 500 V., CERAMIC TUBULAR CAPACITOR (C-172).
E. 1,000 MMF. 500 V., CERAMIC DISC CAPACITOR (C-171) ADDED BETWEEN PIN 5 AND GROUND OF THE 12AX4 DAMPER TUBE V-110.

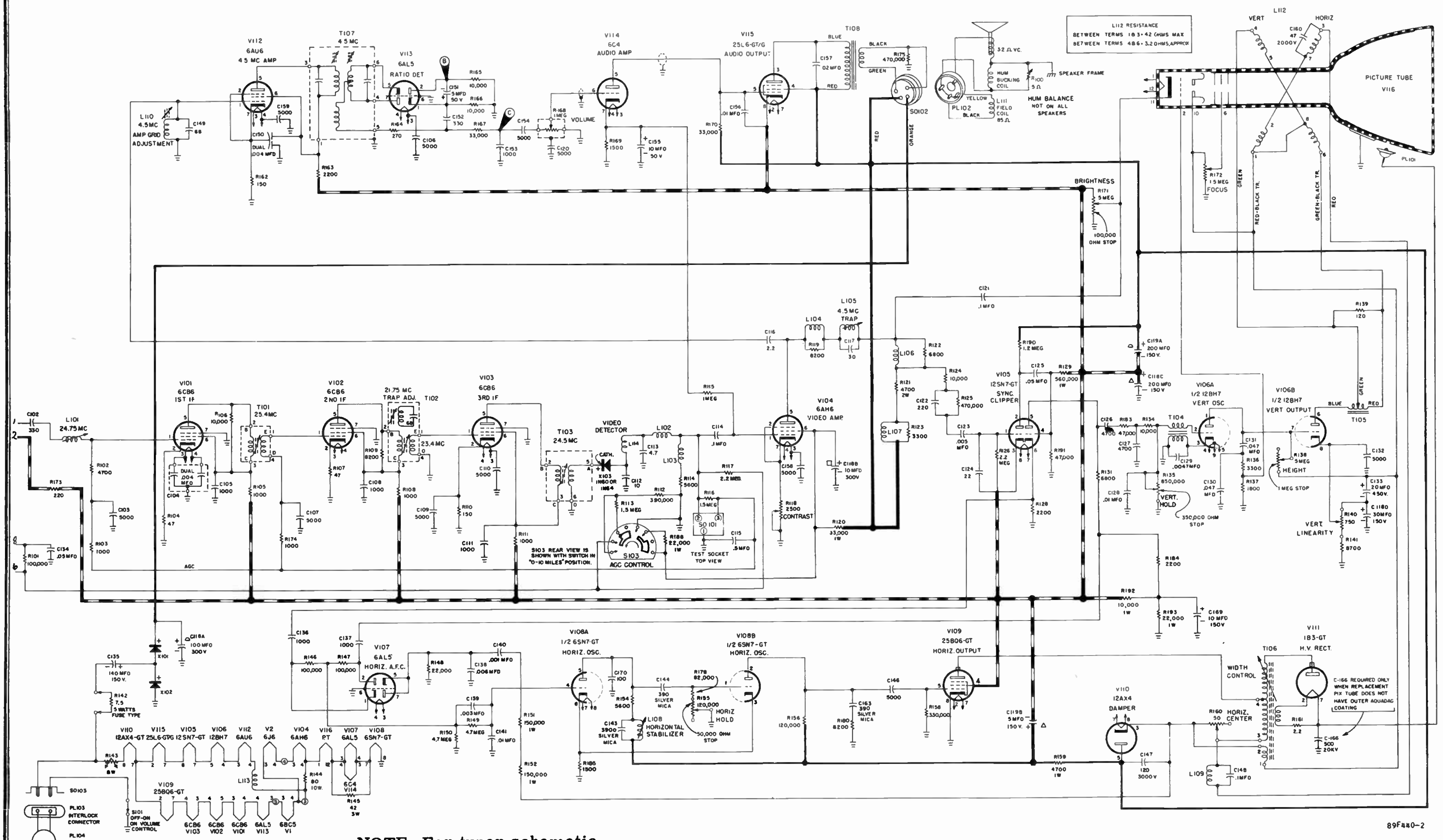
VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF

21" CHASSIS

T1200D

RUNS 1 & 1A

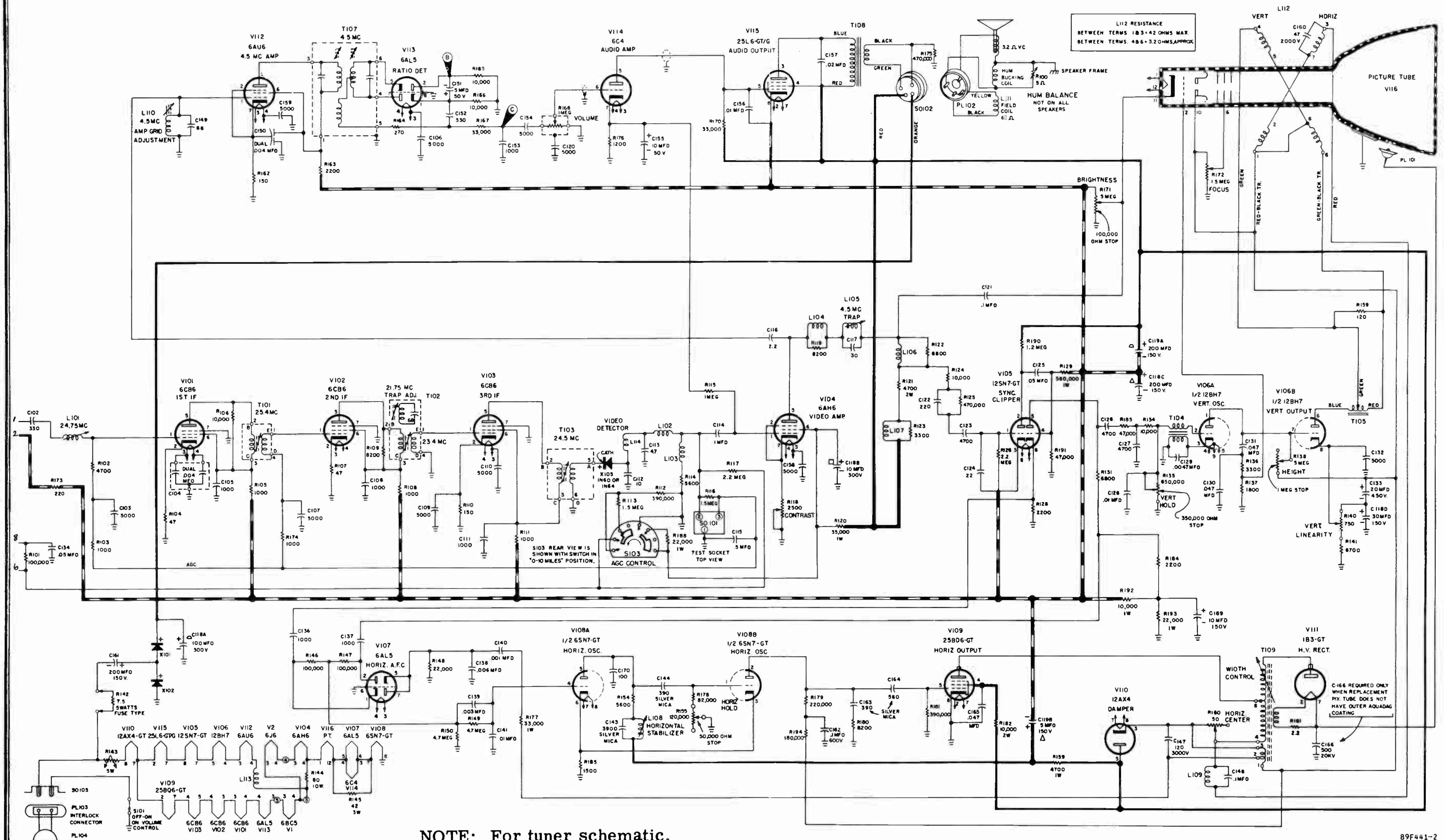


NOTE: For tuner schematic, see page 58.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109 PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

VHF
17" CHASSIS
W1200D
RUN 1

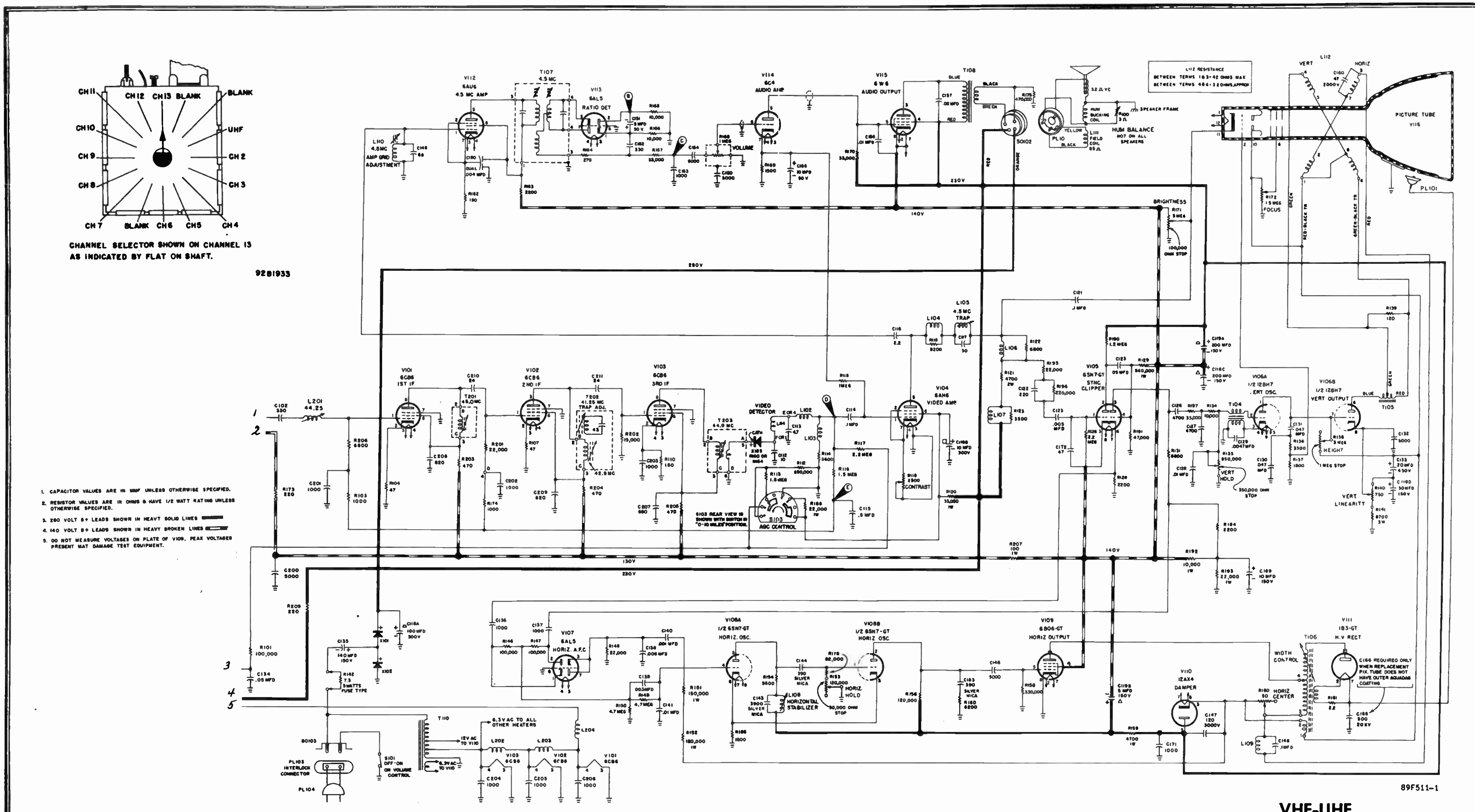


NOTE: For tuner schematic, see page 58.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 260 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES.
4. 150 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES.
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109, PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

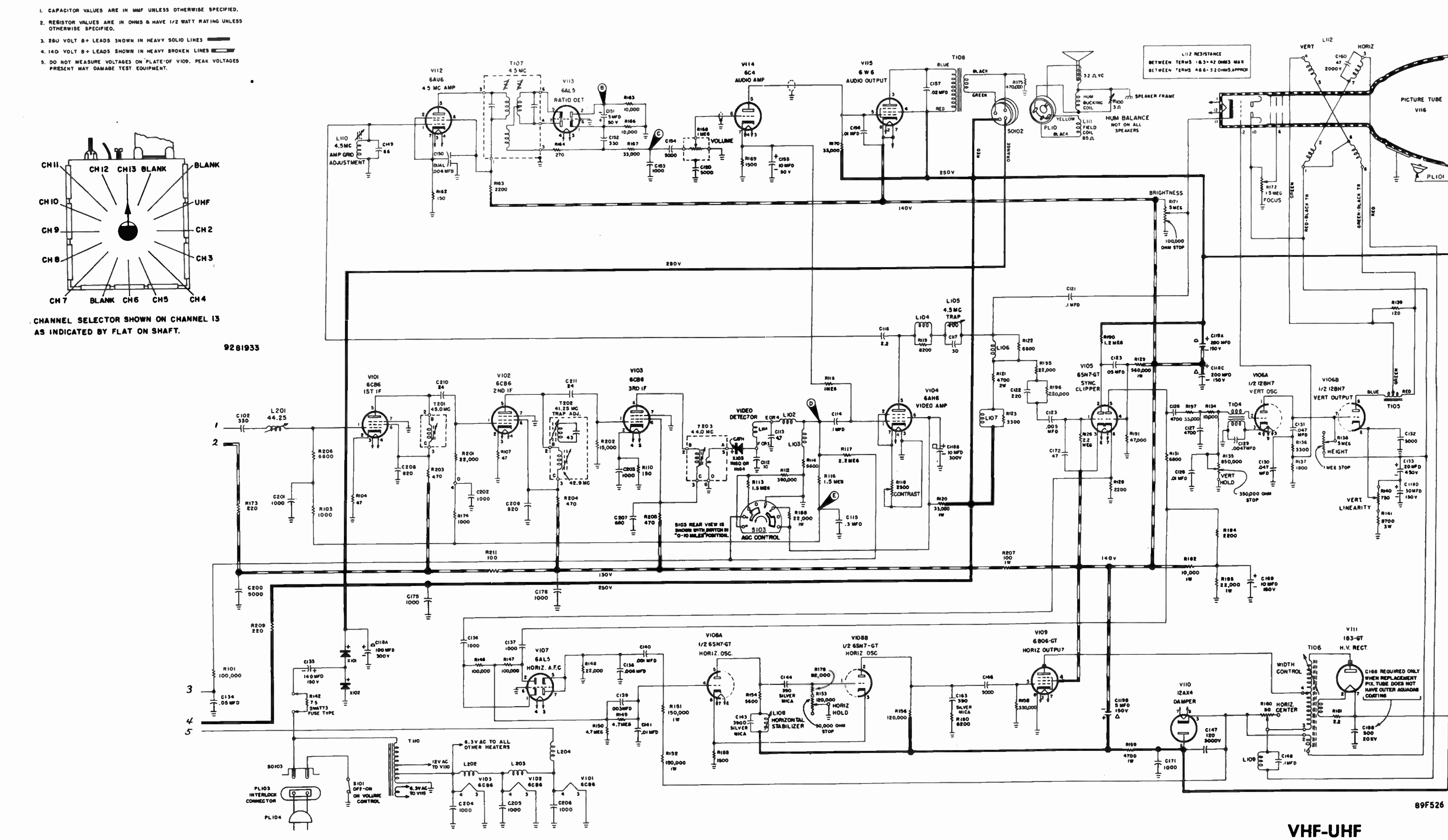
VHF
20" CHASSIS
X1200D
RUN 1



VHF-UHF
17" CHASSIS
Y1200D
RUN 1

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

NOTE: For tuner schematic, see page 57.



VHF-UHF

17" CHASSIS

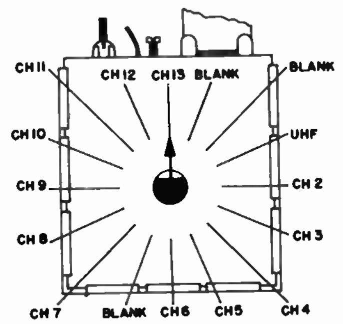
Y1200D

RUN 2

NOTE: For tuner schematic, see page 57.

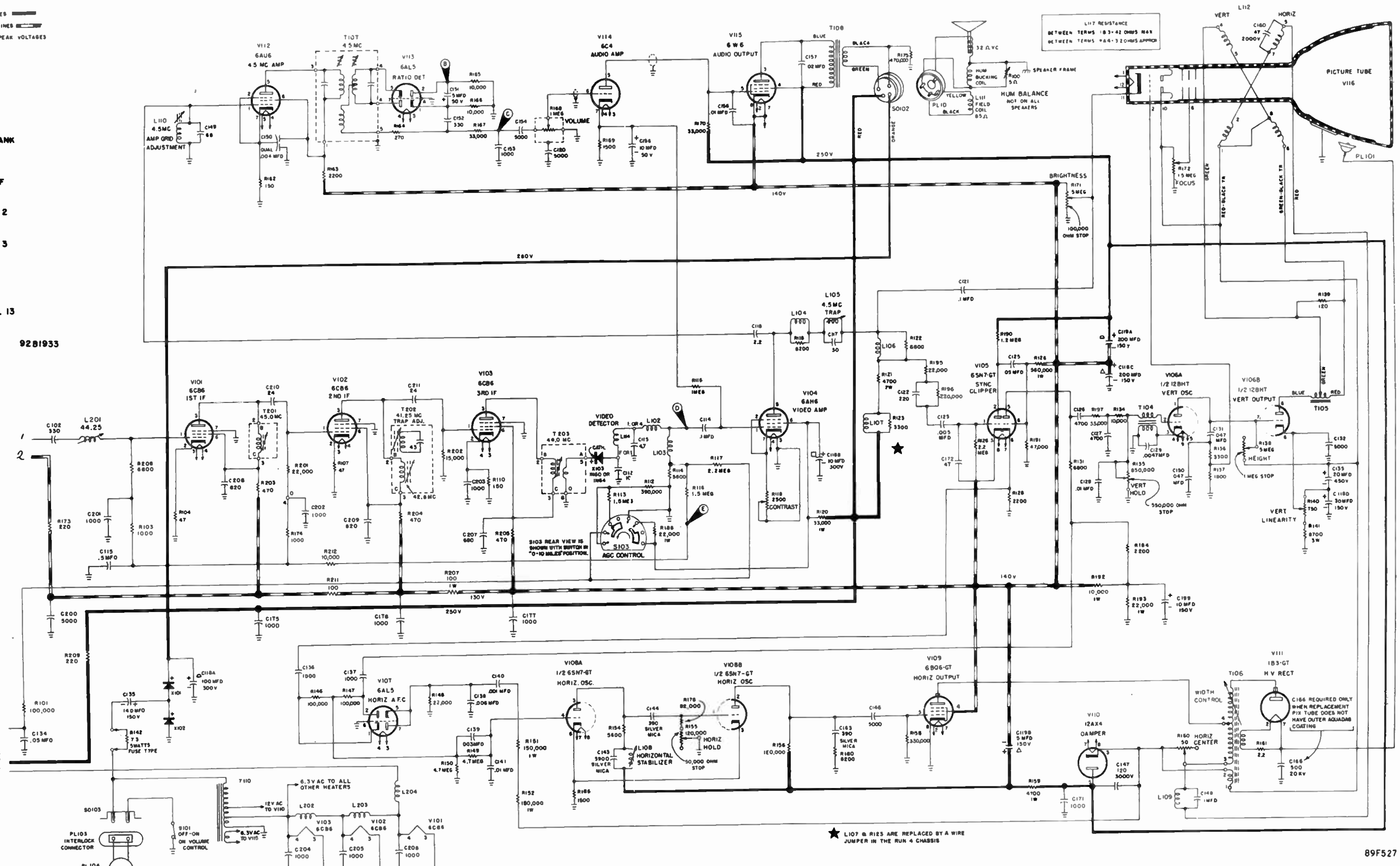
VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 280 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 140 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.



CHANNEL SELECTOR SHOWN ON CHANNEL 13 AS INDICATED BY FLAT ON SHAFT.

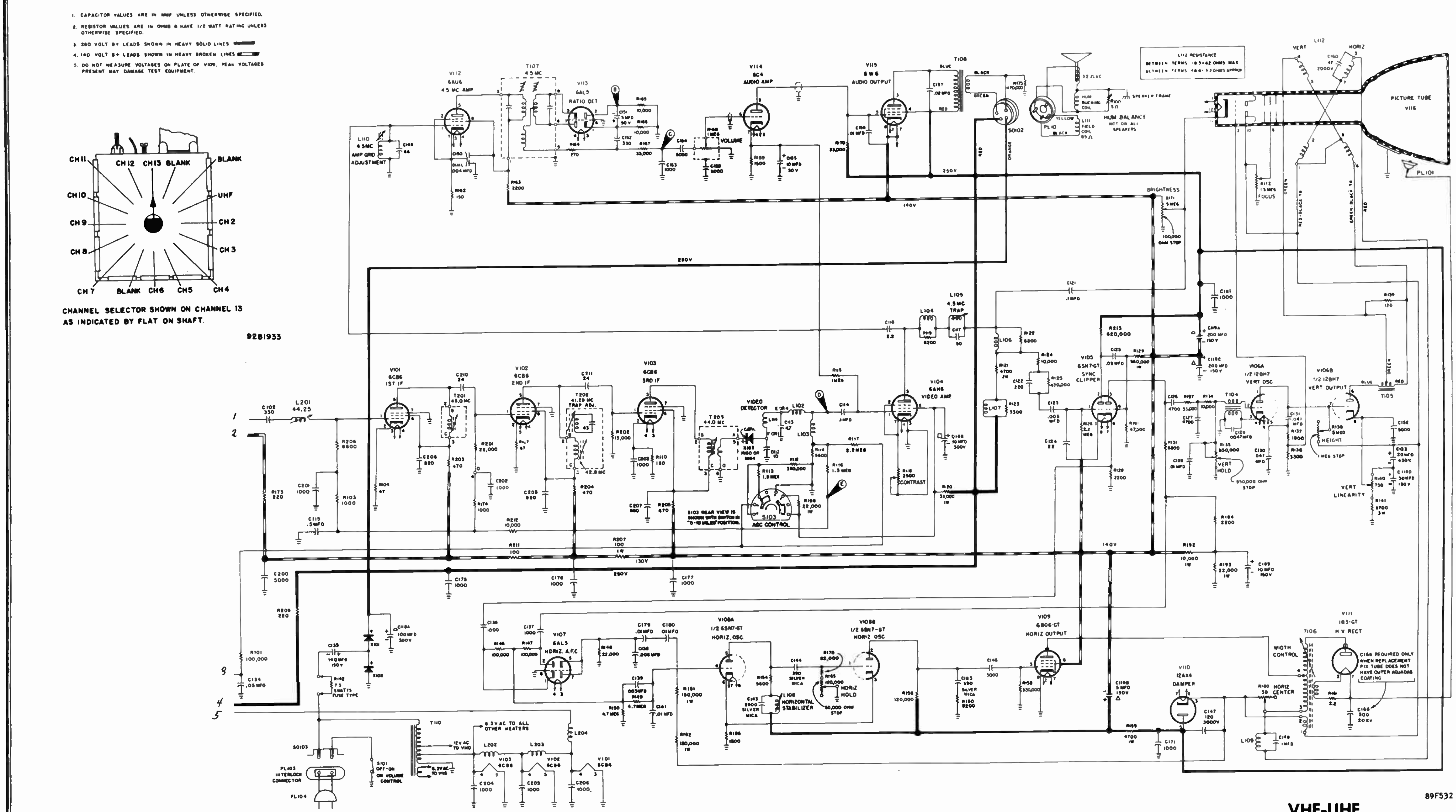
9281933



NOTE: For tuner schematic, see page 57.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

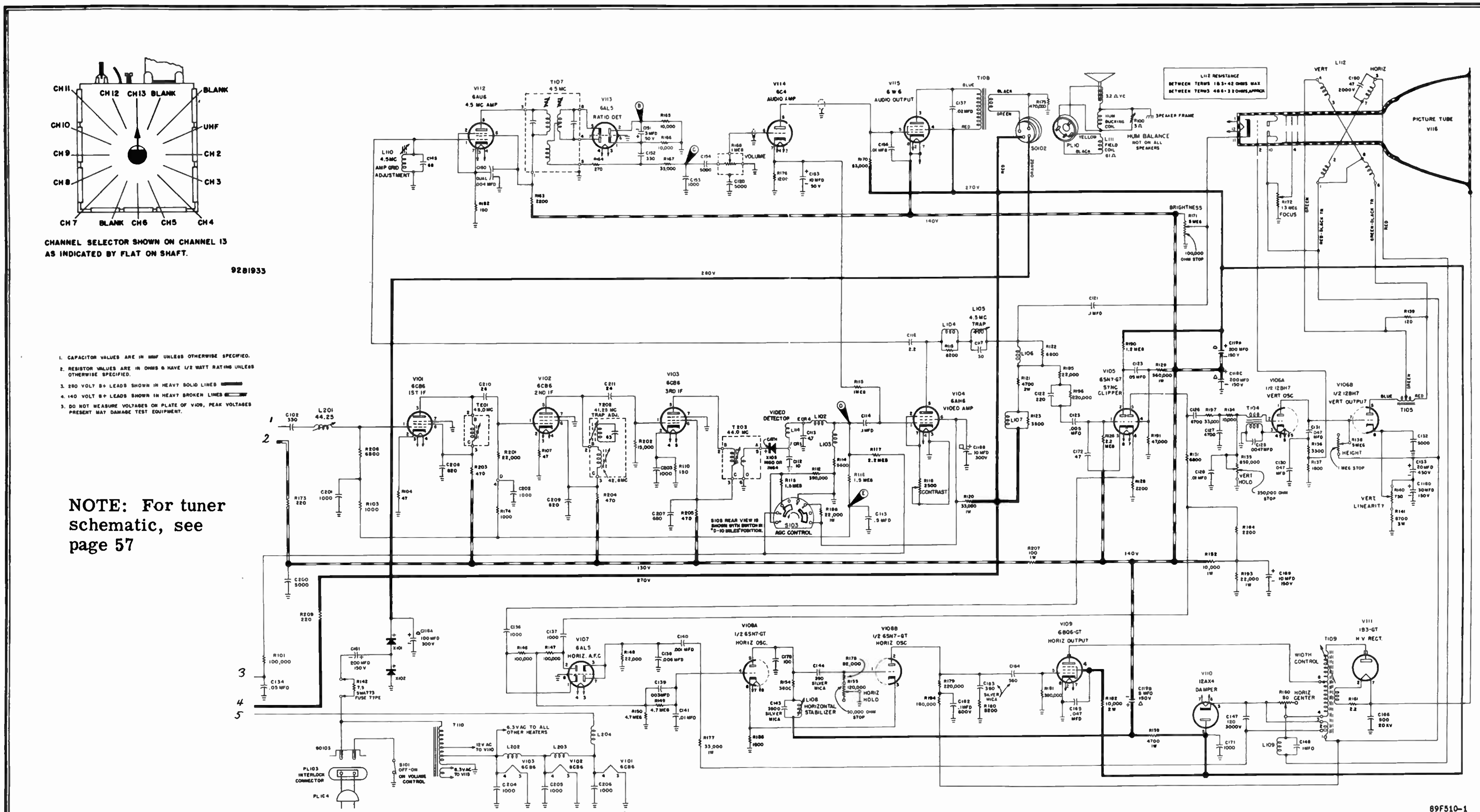
VHF-UHF
17" CHASSIS
Y1200D
RUNS 3 & 4



VHF-UHF
17" CHASSIS
Y1200D
RUN 5

NOTE: For tuner schematic, see page 57.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.



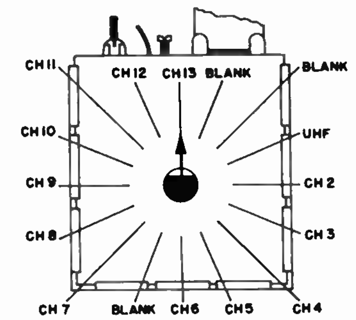
TO IMPROVE VERTICAL AND HORIZONTAL SYNC PARTICULARLY UNDER EXTREME FRINGE AREA RECEIVING CONDITIONS THE FOLLOWING CHANGES WILL BE FOUND ON CHASSIS WHICH HAVE A RUN 1A CHASSIS STAMP:

A. 10,000 OHMS, 1/2 WATT RESISTOR (R-124) REPLACED BY 22,000 OHMS, 1/2 WATT RESISTOR (R-195).
B. 470,000 OHMS, 1/2 WATT RESISTOR (R-125) REPLACED BY 220,000 OHMS, 1/2 WATT RESISTOR (R-196).
C. 47,000 OHMS, 1/2 WATT RESISTOR (R-183) REPLACED BY 33,000 OHMS, 1/2 WATT RESISTOR (R-197).
D. 22 MMF. 500 V., CERAMIC TUBULAR CAPACITOR (C-124) REPLACED BY 47 MMF. 500 V., CERAMIC TUBULAR CAPACITOR (C-172).
E. 1,000 MMF. 500 V., CERAMIC DISC CAPACITOR (C-171) ADDED BETWEEN PIN 5 AND GROUND OF THE 12AX4 DAMPER TUBE V-110.

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

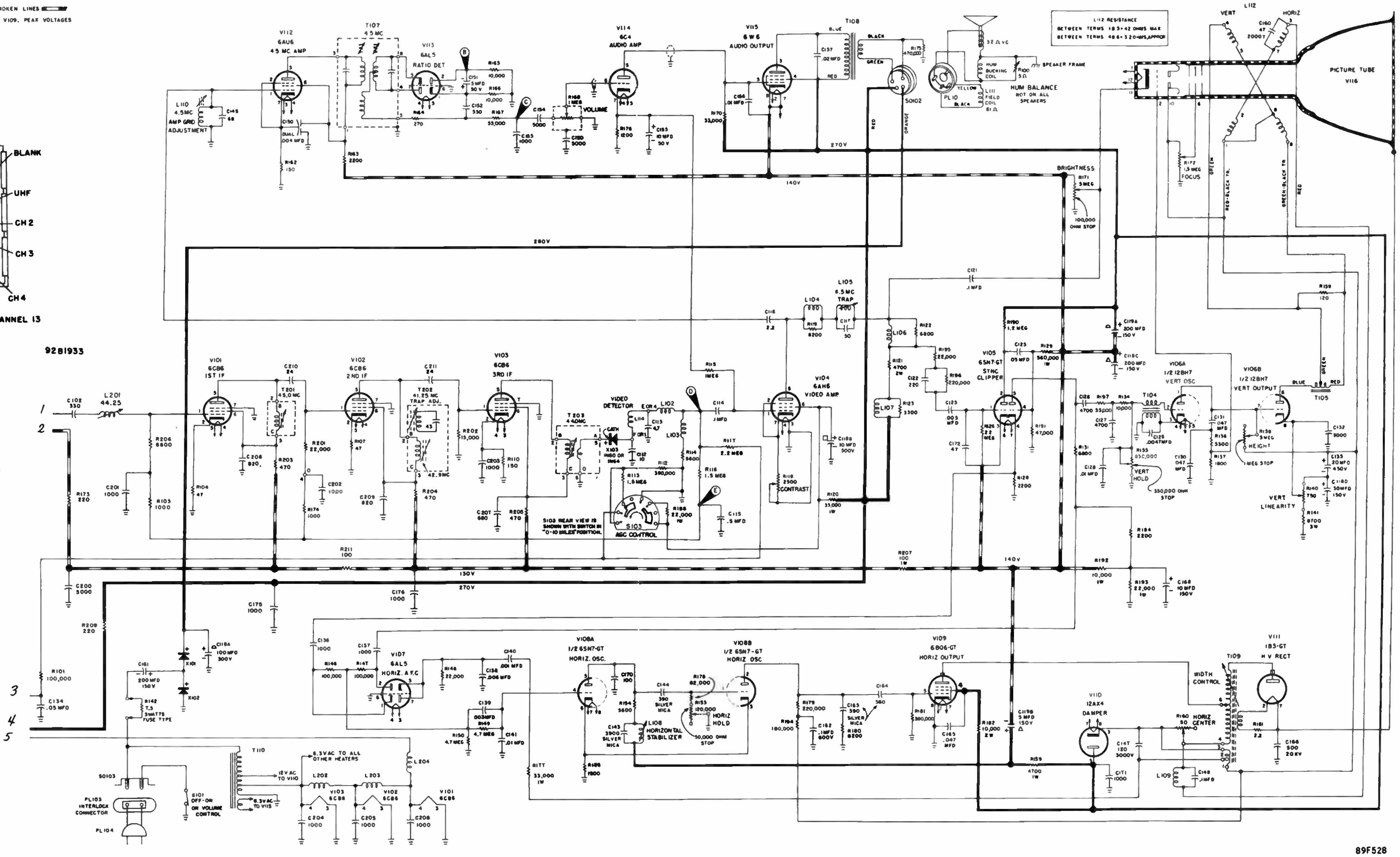
VHF-UHF
21" CHASSIS
Z1200D
RUNS 1 & 1A

1 CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 280 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4 140 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.



CHANNEL SELECTOR SHOWN ON CHANNEL 13 AS INDICATED BY FLAT ON SHAFT.

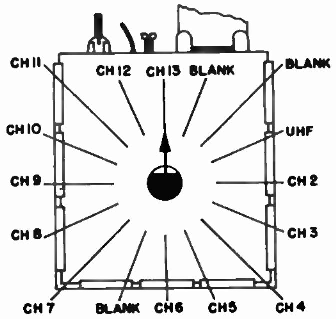
NOTE: For tuner schematic, see page 57.



VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

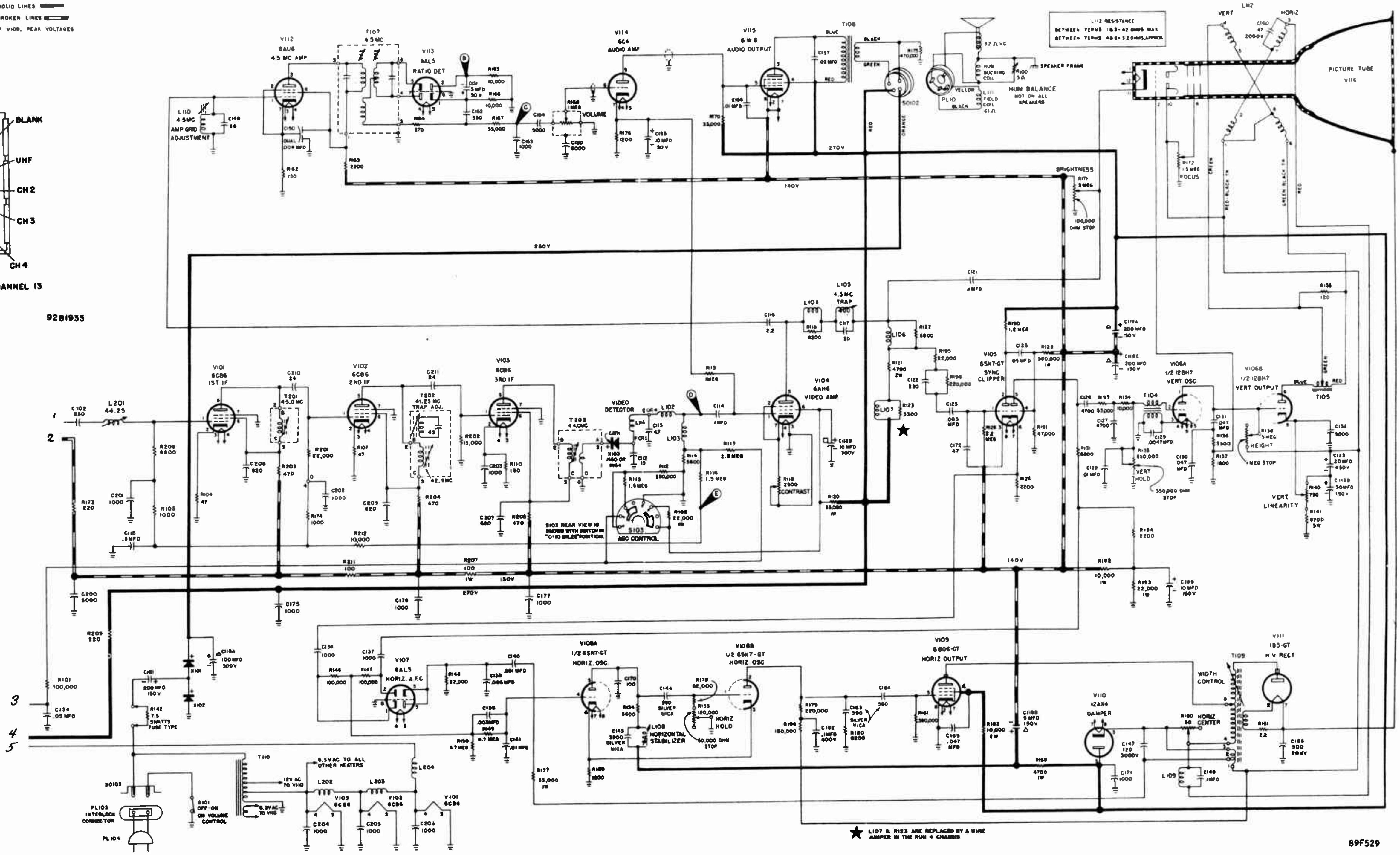
VHF-UHF
21" CHASSIS
Z1200D
RUN 2

1. CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 280 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4. 140 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5. DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.



CHANNEL SELECTOR SHOWN ON CHANNEL 13 AS INDICATED BY FLAT ON SHAFT.

9281933

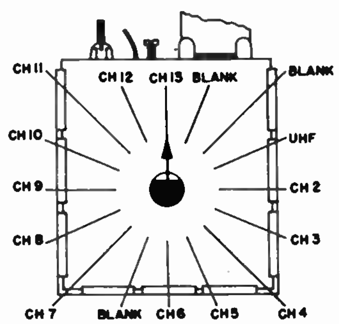


NOTE: For tuner schematic, see page 57.

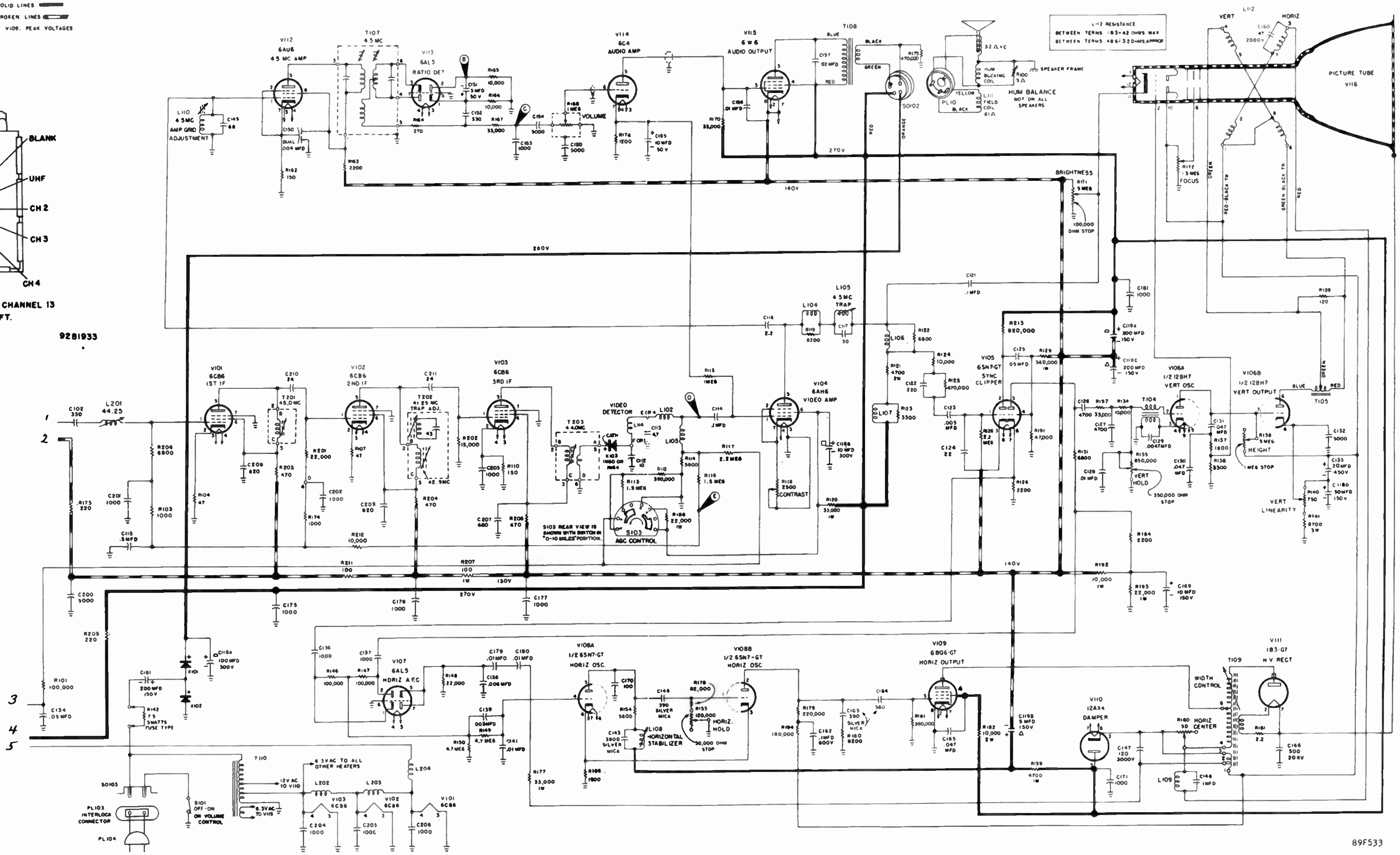
VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

VHF-UHF
21" CHASSIS
Z1200D
RUNS 3 & 4

1 CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.
2 RESISTOR VALUES ARE IN OHMS & HAVE 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.
3. 280 VOLT B+ LEADS SHOWN IN HEAVY SOLID LINES
4 140 VOLT B+ LEADS SHOWN IN HEAVY BROKEN LINES
5 DO NOT MEASURE VOLTAGES ON PLATE OF V109. PEAK VOLTAGES PRESENT MAY DAMAGE TEST EQUIPMENT.



CHANNEL SELECTOR SHOWN ON CHANNEL 13 AS INDICATED BY FLAT ON SHAFT.



VHF-UHF
21" CHASSIS
Z1200D
RUN 5

VALUES AND TOLERANCES SHOWN ARE NOMINAL AND VARIATIONS MAY BE FOUND. IT IS RECOMMENDED THAT THE VALUE OF ANY REPLACEMENT CORRESPOND TO THE NOMINAL VALUE OF THE PART BEING REPLACED.

NOTE: For tuner schematic, see page 57.

THE FOLLOWING INFORMATION IS INTENDED TO BE USED IN CONJUNCTION WITH ANY TELEVISION CHASSIS INCORPORATING THIS TYPE OF UHF TUNING UNIT.

IDENTIFICATION

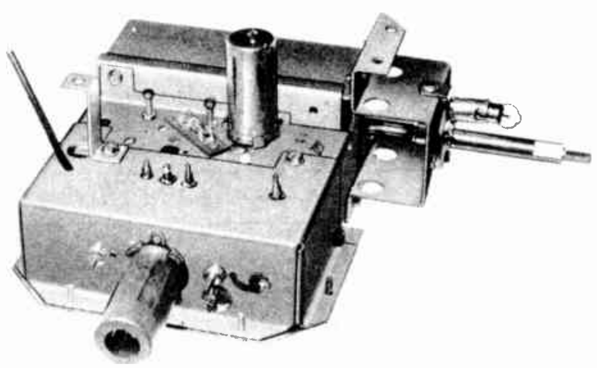


Figure 1. UHF Tuner Assembly

INTRODUCTION

This UHF tuner is of continuous design. In other words, tuning for a UHF channel is not unlike tuning a radio for a radio station. The tuning range is from channel 14 through 83. There are two parts to the tuner; the R-F Section (Mallory Tuning Unit) and the Pre-Amp Section. The tuner is located under the chassis pan and is accessible only by removing the chassis from the cabinet. Circuit operation is described below.

CIRCUIT OPERATION OF THE UHF TUNER

The method of operation may be best understood by referring to the block diagram of the UHF Tuner Assembly, Figure 2. As shown in the upper left of the diagram, the antenna, a UHF-VHF combination type, is connected to the input of the preselector when function switch is in the UHF position. The line connecting the antenna has a normal impedance of 300 ohms.

ELECTRICAL AND MECHANICAL DATA

Antenna Input Impedance	300 Ohms balanced
Output	Single output for sound and picture
R-F Amplifier	6BQ7 or 6BZ7
Mixer-Oscillator	6AF4
Tuning Range	Channels 14 - 83
Tuning Mechanism	Continuous

The signal may be traced to the first tuned circuit, which is resonated to the channel to be received. It is then coupled capacitively to the second tuned circuit, which has the same resonant frequency. The coupling between the circuits is such that a bandpass of 6 mc or more is obtained. The output of the second tuned circuit is matched to the Xtal which is also fed by a voltage from the oscillator shown to the right. The oscillator frequency is so arranged that it is higher than the signal by the I-F frequency and by being connected to the tuning shaft, remains spaced by this amount throughout the band.

A connection from the Xtal circuit to the cascode I-F section contains a filter which passes the difference in frequency of the I-F but rejects the signal frequency.

This I-F signal is now amplified through the cascode stage approximately twenty-five times. However, in the mixing process, the resulting I-F signal is three times down as compared to the R-F signal. This then gives an overall gain of eight times or slightly more.

Lastly, the output of the cascode stage is link-coupled to the first I-F grid coil of the main video I-F amplifier and from there on, the usual circuit actions take place as in the VHF television receiver.

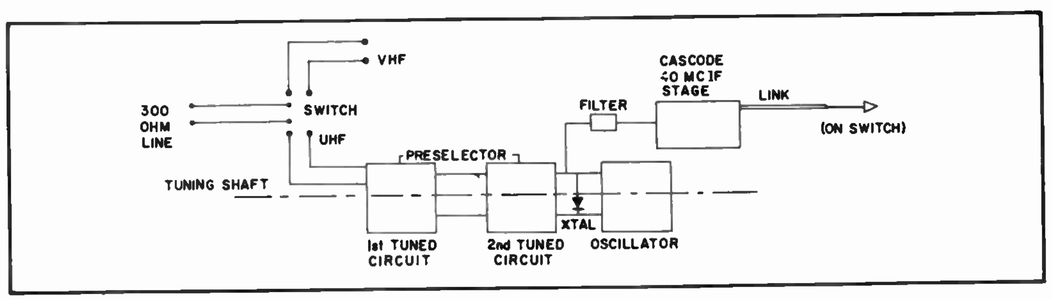


Figure 2. Block Diagram, UHF Tuner Assembly

ALIGNMENT PROCEDURE:

1. Perform the usual VHF alignment of the set with the function switch control shaft turned to the counter-clockwise position (VHF position). Use the standard alignment procedure. Be sure that the four inter-stage video I-F coils and the traps are tuned accurately to the fixed frequencies specified so that a minimum amount of staggering of the mixer plate coil and 1st grid I-F coil is required to obtain a flat I-F response curve.

2. Throw the function switch to its UHF position by turning control shaft in a clockwise direction. Attach a signal generator to ground (make ground lead as short as possible) and to UHF test point lead through a 120 ohm resistor. Shunt a 10 ohm resistor to ground off test point (see Figure 5). Turn the neutralizing trimmer approximately 3 turns out from its maximum clockwise position, using a center frequency of approximately 44 mc. Adjust the two UHF I-F transformers so as to obtain a flat response between the frequency limits given for the VHF bandwidth.

   When necessary, turn the neutralizing trimmer to broaden the response curve of the first circuit.

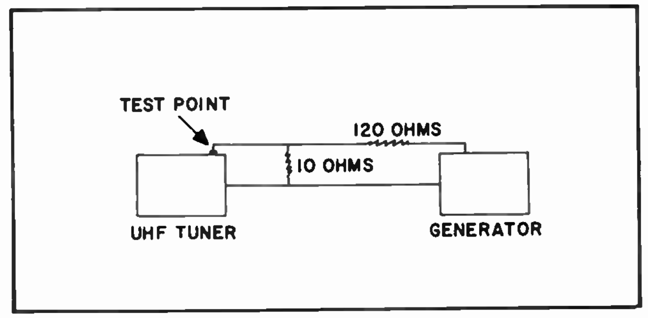


Figure 5. Alignment Test Set-up

NOTE

Each time the neutralizing trimmer is turned, it changes the tuning of the adjacent coil which must be recentered.

3. Close the test point through a meter (0-10) ma dc and check to see that the injection current runs 1 to 2 ma over the band. This should be approximately 1.5 ma over 500 to 750 mc.

4. Solder test point lead to chassis and check to see that shields are fastened tightly.

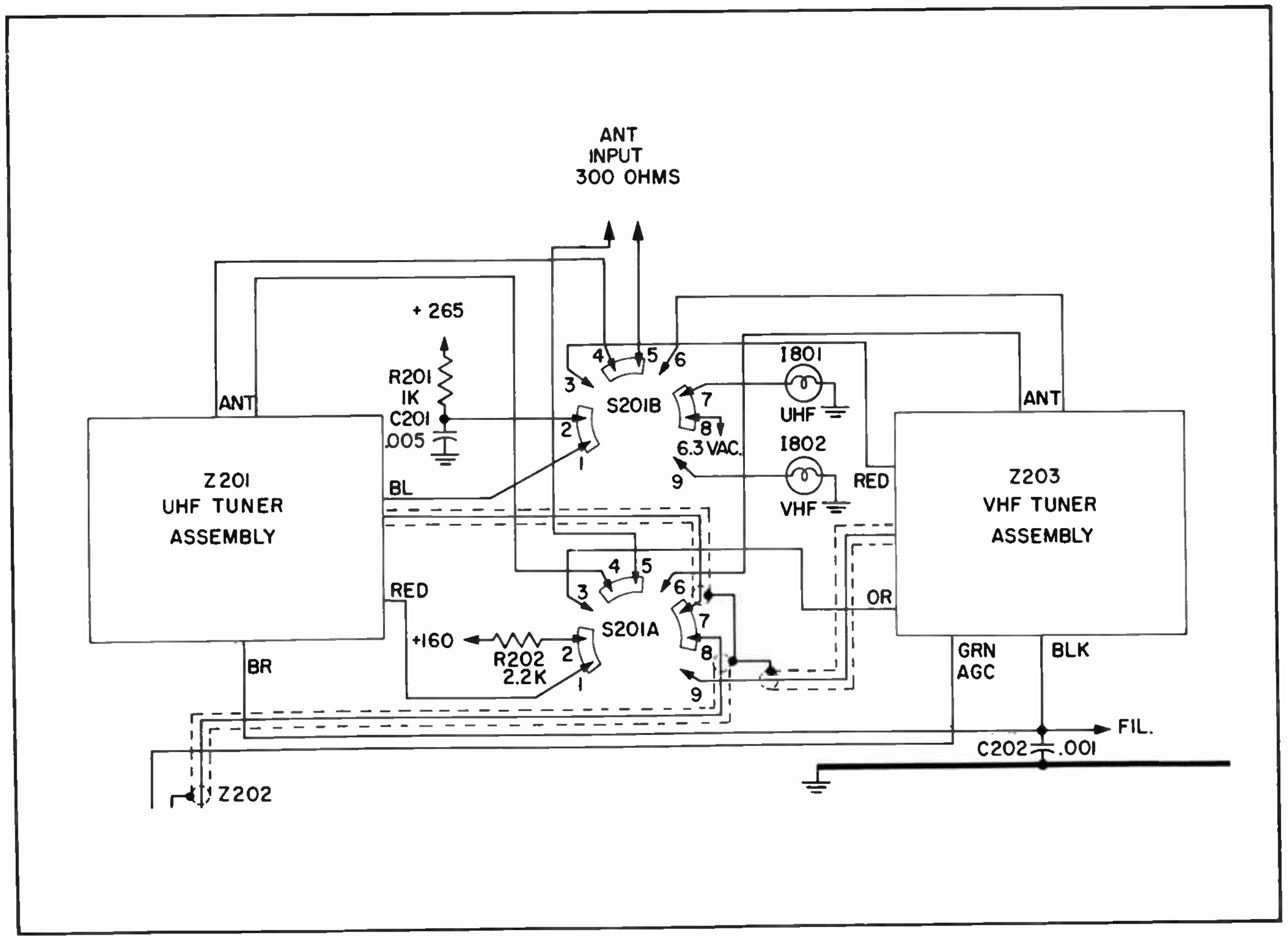
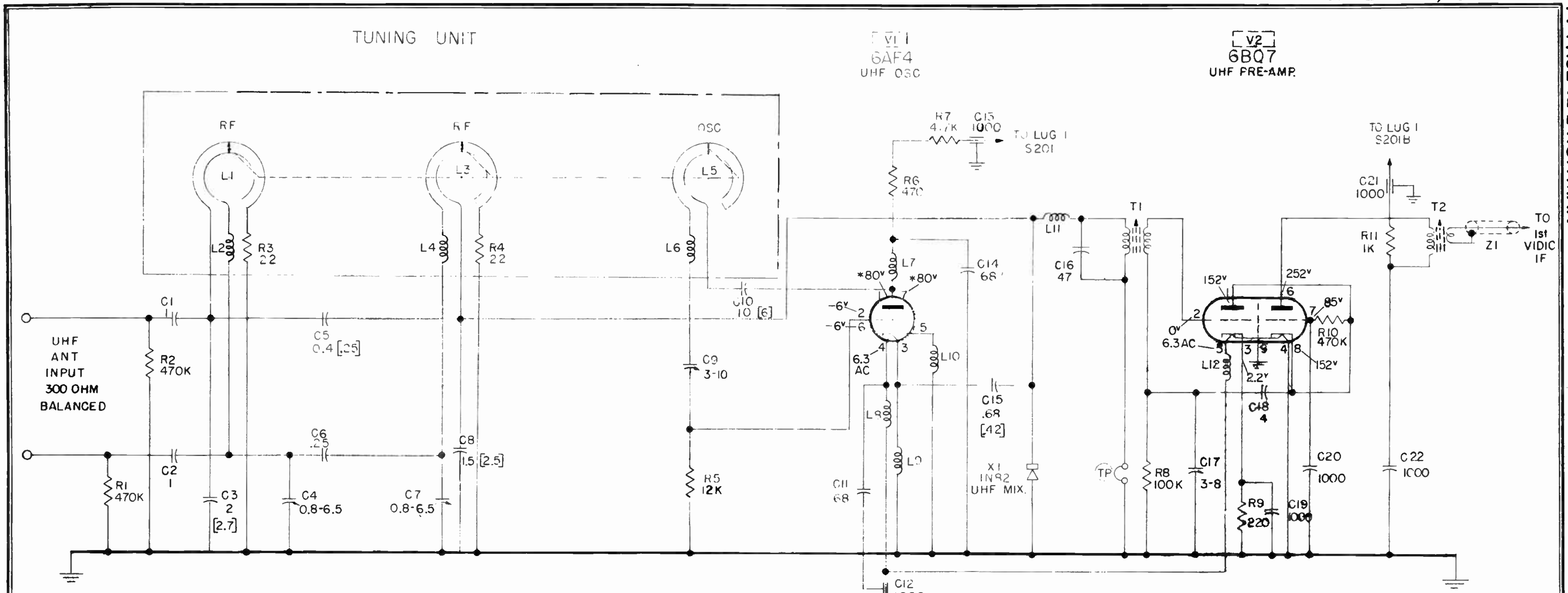


Figure 6. Switching Arrangement, UHF Tuner Assembly



C12 1000

6.3 V AC

NOTES:

1. ALL CAPACITIES ARE GIVEN IN MICROMICROFARADS.
2. ALL RESISTANCES ARE GIVEN IN OHMS; K=1000.
3. DASHED LINE AROUND V-NUMBER INDICATES EXTERNAL TUBE SHIELD.
4. BRACKET NOTATIONS ARE ALTERNATE VALUES OF FIRST RUN.
5. * MEASURED WITH 10K ISOLATING RESISTOR AT END OF LEAD.

Figure 3. Circuit Diagram for UHF Tuner Assembly

PARTS LIST

SYMBOL	PART NO.	VALUE	TOTAL	WATTS
R7	4570	4.7K	10%	1
R8	4511	100K	20%	1/2
R9	4563	220Ohms	10%	1/2
R10	4506	470K	20%	1/2
R11	4542	1K	20%	1/2
C12	14046	1000Mmf	5%	
C13	14046	1000Mmf	5%	
C16	14046	1000Mmf	5%	
C21	14046	1000Mmf	5%	
C19	14045	1000Mmf	5%	
C20	14045	1000Mmf	5%	
C22	14045	1000Mmf	5%	

SYMBOL	PART NO.	VALUE	TOTAL	WATTS
C18	14047 Variable	4Mmf	±5%	
C17	4329	3-8Mmf		

MISCELLANEOUS		
L12	5133	Filament Choke
T1		I-F
T2	5534	Coupling
Mallory	9778	UHF Tuner (R-F Section)

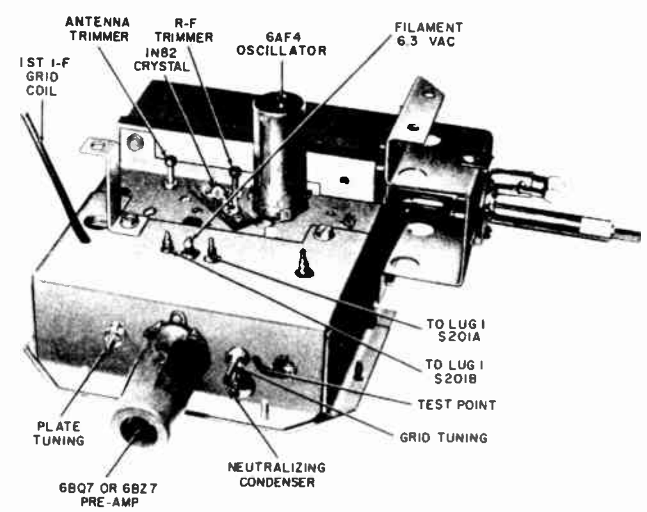


Figure 4. UHF Tuner Assembly

IDENTIFICATION

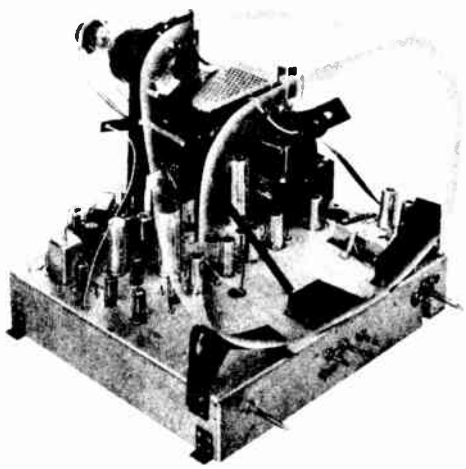


Figure 1. Chassis 195 TV Chassis

Chassis 195 receiver incorporates a low radiation "40 megacycle" cascode type tuner, the RF-11, that comprises the R-F stages.

Both picture and sound output from the tuner is fed to the first of four stages of stagger-tuned I-F amplification. The picture carrier frequency is 45.75 mc. An intercarrier type sound system is employed, the 4.5 mc sound take-off occuring at the output of the video detector. The sound is fed into the first of two 4.5 mc sound I-F stages. A 39.75 mc adjacent channel picture trap, a 41.25 mc co-sound trap, and a 47.25 mc adjacent channel sound trap are employed in the video I-F stages.

A ratio detector is used as the sound second detector. This stage is followed by a stage of voltage amplification which drives a stage of power amplification. The beam power output tube is coupled to the speaker through an audio output transformer which is located on top of the receiver chassis.

The video detector is one-half of a miniature dual diode vacuum tube. The output from this detector is coupled directly to the video amplifier through high frequency compensating shunt and series peaking coils. The single stage of video amplification is directly coupled to the cathode of the picture tube through high frequency compensating shunt and series peaking coils. Since direct coupling is employed, no DC restoration circuit is needed in the receiver.

ELECTRICAL AND MECHANICAL DATA

TABLE I - ELECTRICAL AND MECHANICAL DATA

Operating Voltage	115 Volts AC, 60 cps
Power Consumption	200 Watts
Tuning Range	Channels 2-13
Maximum Audio Power Output	3 Watts
Audio Output Impedance	6.4 Ohms tapped at 3.2 Ohms at 400 cps
Intermediate Frequencies	
Picture Carrier	45.75 Mc
Sound Carrier	4.5 Mc
Antenna Input Impedance	300 Ohms, balanced
Picture Tube Size	17" Rectangular

TABLE II - TUBE COMPLEMENT

TUBE	TYPE	FUNCTION
V1	6BZ7 or 6BQ7	R-F Amplifier
V2	6J6	Oscillator-Mixer
V101	6AU6	1st Sound I.F.
V102	6AU6	2nd Sound I.F.
V103	6AL5	Ratio Detector
V104	1/2-6SQ7	Audio Amplifier
V105	6K6GT	Audio Output
V201	6CB6	1st Picture I.F.
V202	6CB6	2nd Picture I.F.
V203	6CB6	3rd Picture I.F.
V204	6CB6	4th Picture I.F.
V205	1/2-6AL5	Video Detector
V301	6AH6	Video Amplifier
V302	17HP4 (Chassis 195)	Picture Tube
V401	6AU6	AGC Keyer
V402	1/2-6SQ7	Delayed AGC
V501	6AU6	1st Sync Separator
V502	1/2-6SN7GT	2nd Sync Separator
V601	6SN7GT	Vertical Oscillator
V602	6S4	Vertical Output
V701	1/2-6AL5	Horiz. Phase Det.
V702	1/2-6SN7GT	
V703	6SN7GT	Horiz. Oscillator
V704	6BQ6GT	Horiz. Output
V705	6W4GT	Damper
V706	1B3GT	H.V. Rectifier
V801	5U4G	L.V. Rectifier

Two stages of sync separation are designed into the receiver. They receive the composite video signal from a tap on the video amplifier load resistor.

The second sync separator serves the additional function of a phase splitter for feeding approximately equal and opposite sync pulses to the balanced horizontal phase detector. A negative sync pulse is taken from a tap on cathode resistor, and this pulse is fed to the vertical integrating network, Z501, for the purpose of synchronizing the vertical oscillator.

The vertical oscillator is the cathode-coupled multivibrator type. It drives a single power triode output stage which is coupled to the vertical deflection coils through an output transformer. The positive pulse of the retrace portion of the vertical sweep output voltage is reversed in phase by the transformer action of the output transformer, and the resulting negative voltage pulse is coupled to the picture tube control grid through a .022 uf condenser which also serves to sharpen the pulse so that it is only effective during the retrace portion of the sweep. The negative voltage pulse biases the picture tube beyond cut-off during the retrace portion of the vertical sweep, and the bright retrace lines are blanked out.

The horizontal oscillator is a cathode-coupled type of multivibrator. The stabilizing influence of a parallel tuned L-C circuit is used as part of the plate load of one of the triodes in the multivibrator circuit. The natural frequency of the tuned circuit is made very close to the horizontal sweep frequency. The frequency of the horizontal multivibrator is further stabilized by a balanced horizontal phase detector circuit which consists of one-half of a dual diode and one-half of a dual triode which has its plate and grid tied together so that the triode serves as a diode. The horizontal oscillator drives a stage of power amplification that is coupled to the horizontal deflection coils through an output transformer. The horizontal output transformer is also an active member of the high voltage supply. In addition the horizontal output transformer supplies positive keyer pulses to the plate of the keyed AGC tube and it furnishes a reference saw-tooth voltage in conjunction with the horizontal deflection coil circuit for the horizontal phase detector.

The high voltage section is a high efficiency fly-back type which uses a single half-wave rectifier. The approximately 200 volts that results from the rectification of the fly-back potential across the damper tube is

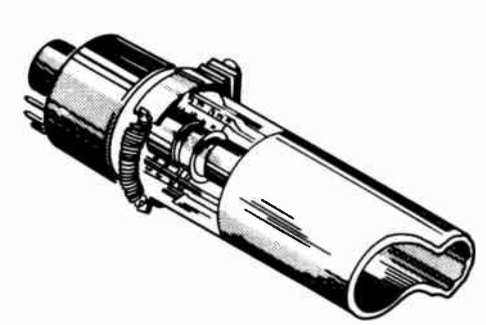


Figure 2. Ion Trap Position

added to the 280 volt bus potential, and this boost voltage of approximately 480 volts is applied to the vertical sweep circuits and electrostatic focus circuit through voltage divider networks which supply the necessary voltage to their respective circuits.

The low voltage power supply is the conventional full-wave rectifier type which delivers power into a condenser input RC filter voltage divider network that supplies the required bus voltage for the circuits throughout the receiver.

Chassis 195 is a 24-tube TV receiver, including the rectangular picture tube.

The picture tube is seated in a support bracket which mounts directly on the receiver chassis of all three chassis types.

Provision is made for phono input on Chassis 195. The phono reproduction may be selected by the use of a double-pole double-throw switch once a record player has been connected to the TV chassis. The selector switch performs the functions of switching the audio amplifier from the ratio detector output to phono input and switching the picture tube control grid from the brightness control circuit to ground, cutting off the picture tube raster when the phonograph is being played. Phono motor power is provided through an AC outlet at the rear of the receiver chassis. A color converter receptacle is also available at the rear apron of the chassis. When the converter is not being utilized, a five-pin plug is inserted in the receptacle. Pins 1 and 5 of the plug are jumpered together, and it is essential that the plug be inserted in the receptacle in order that the B+ circuit to the brightness control be complete.

FUSE PROTECTION

Two sources of fuse protection are provided in the chassis. The entire receiver is protected against over-loading due to short circuiting that results in excessive input current being drawn by the power transformer. The fuse used for this purpose is a 3-ampere Slo-Blo type that is housed in a fuse holder mounted on the chassis rear apron. The second source of fuse protection is in the horizontal output screen circuit and damper circuit. A 1/4-ampere fuse is held in a fuse clip located inside of the high voltage cage at the left rear corner.

MAINTENANCE

The 195 chassis and its complete model assembly is designed to facilitate receiver servicing. The chassis is mounted in a horizontal position within the cabinet. It is held in position within the cabinet by four bolts which thread into four mounting brackets located at the corners of the chassis. The four bolts are inserted from below the mounting shelf in the cabinet. Removal of the backboard exposes the top of the chassis. The removal of one screw from the bottom rear of the high voltage cage allows the back and top of the cage to be rotated away for servicing inside of the cage. The bottom of the chassis is made accessible by removing the bottom cover board which is held in place by several wood screws. Tuner oscillator adjustments may be made by removing the channel selector knob and inserting a non-metallic screw-driver through the access hole located at the right-hand side of the tuner shaft.

OPERATING INSTRUCTIONS

Front Panel Controls

Refer to Figure 3 for location of front panel controls.

OFF-ON VOLUME CONTROL

The VOLUMF control is part of a dual type potentiometer being associated with the CONTRAST control. The chassis power switch is mechanically linked to the volume potentiometer. This switch opens the 115V power line to the receiver power transformer and AC RECEPTACLF when the VOLUME control shaft is turned to the extreme counterclockwise position. The initial rotation of the shaft in the clockwise direction closes the AC switch and causes the sound level to start increasing toward maximum audio power output. The smaller, outer, left-hand knob is the one that turns the VOLUME control shaft when the knobs are in place.

CONTRAST CONTROL

The CONTRAST control varies the gain of the video amplifier. With the AGC system used for maintaining constant signal level, the CONTRAST control becomes primarily useful in setting background level for best viewing under various room lighting levels or different average program contrast levels. To increase picture contrast turn the CONTRAST control clockwise. The large, inner, left-hand knob is the one that turns the CONTRAST control shaft when the knobs are in place.

TUNING CONTROLS

The tuning controls are the dual type. To select a desired channel, turn the CHANNEL SFLECTOR shaft in either direction until the desired channel's coils are in operating position in the tuner. Once a channel has been chosen, tune the FINE TUNING control shaft counterclockwise until the picture starts to become wavy and variable dark horizontal lines and bars appear in the picture. Turn the shaft clockwise until the lines and bars just disappear and the picture appears clear and sharp. Do not turn too far in the clockwise direction or definition will start to decrease. Picture and sound tuning are synchronized so that the best picture will come in with best sound when alignment is correct.

The remaining three front panel controls are located behind the front controls cover plate when the chassis is in position in its cabinet. Pull the cover plate down from the front panel to reach these controls.

BRIGHTNESS CONTROL

The BRIGHTNESS control sets the average background illumination of the picture.

1. Temporarily turn the CONTRAST control to minimum setting (extreme counterclockwise).
2. Turn the BRIGHTNESS control so that a medium illumination is visible on the screen.

This setting produces a picture with average background characteristics at about three-quarters contrast setting. For individual tastes that vary from this recommendation, the BRIGHTNESS control may be set so that the picture is most pleasing to the customer.

VFRTICAL HOLD CONTROL

The Vertical Hold control has a hold-in range over which the picture will stay in vertical sync. Turn the control so that the picture is brought from a downward moving picture into sync and best interlace of the sweep lines is observed.

TONE CONTROL AND TV-PHONO SWITCH

The control is dual control. A double pole double throw switch is mounted at the rear of the tone potentiometer. The switch is activated when the tone control shaft is turned to either the extreme clockwise position or the extreme counterclockwise position. Extreme counterclockwise rotation of the tone control switches the receiver for TV operation and provides maximum bass response. Clockwise rotation of the control provides continuous increase in treble response. Maximum clockwise rotation switches the receiver to PHONO operation. When changing from one function to the other, turn the control in the appropriate direction until a click is heard. Then turn the control until the desired tone is obtained.

Rear Adjustments

The rear chassis controls are intended to be adjusted by the dealer or his service representative at the time of installation in the customer's home or during a service call. Once adjusted correctly, these controls need not be changed over long periods of time or unless a specific service problem develops. Refer to Figure 3 for location of rear controls.

ION TRAP

The effects of the FOCUS control, ion trap, and centering magnet orientation are slightly interdependent and one or two sequential adjustments of each may be necessary for optimum setting of these controls. Always set the ion trap for maximum raster brightness.

CAUTION

Never attempt to center the picture by misadjustment of the ion trap.

Set the BRIGHTNESS and CONTRAST controls about midrange, never at maximum setting, to avoid damaging the picture tube. Move the ion trap over the "flags" of the picture tube first anode. Refer to Figure 2. Rotate the ion trap on the picture tube neck until light appears on the screen. After initial light has been obtained, move the ion trap back and forth and further rotate it to obtain the brightest raster. If the receiver is equipped with a Rauland picture tube, the optimum ion trap setting is indicated by minimum green glow inside the tube neck.

FOCUS ADJUSTMENT

Electrostatic focusing is used. The picture tube is designed for optimum focus at some fixed potential relative to its cathode, the potential value depending chiefly upon tube type, but the variation of focus with several hundred volts change in focus potential is very slight. The FOCUS control is a 2 megohm potentiometer connected between boost voltage (approx. 480 volts) and ground. The arm of the potentiometer is connected to the focusing electrode in the picture tube.

With a picture on the picture tube screen, turn the FOCUS control until the sharpest picture is obtained at the center of the picture.

HORIZONTAL DRIVE ADJUSTMENT

1. Turn the HORIZ. DRIVE control counterclockwise until a drive bar (thin, light vertical line) appears.
2. Turn the control clockwise until the drive bar just disappears. If no drive bar is obtained, set the control at the maximum counterclockwise position.

HORIZONTAL HOLD CONTROL

The HORIZONTAL HOLD control provides a vernier adjustment for the horizontal multivibrator operating frequency. Proper setting depends on correct adjustment of the HORIZ. FREQ. and HORIZ. DRIVE controls.

Turn the Horizontal Hold control until bending of the top portion of the picture is eliminated. This is best determined by noting the vertical lines in the picture.

HORIZONTAL FREQUENCY CONTROL

1. Turn the Horizontal Hold control to mid-range.
2. Turn the HORIZ. FREQ. control counterclockwise while switching the CHANNEL SELECTOR on and off channel until sync is lost.
3. Turn the control clockwise and check the number of bars which appear just before pull-in of the picture. Check circuit for abnormal operation if less than two bar pull-in occurs.
4. Continue turning control clockwise while switching the CHANNEL SELECTOR on and off channel until sync is lost.
5. Turn the control counterclockwise and check the point where picture pull-in occurs.
6. Turn the control an additional 1/2 turn counterclockwise.

HORIZONTAL LINEARITY

Adjust for best Horiz. Linearity with a test pattern. This is generally obtained when the slug is nearly all the way in.

WIDTH ADJUSTMENT

To adjust picture width, turn WIDTH control, L705 clockwise to increase width, counterclockwise to decrease width. When adjusting picture width, remember to take line voltage into consideration if it differs by more than several volts from the value usually existing when and/or where the receiver is to be operated. Make allowance for voltage difference when adjusting width. Width increases with increase in line voltage.

VERTICAL SIZE AND LINEARITY ADJUSTMENTS

The VERT. SIZE and VERT. LINEARITY controls adjust the height and vertical proportion of the picture. The VERT. SIZE control affects the height of the entire picture but not in a linear manner. The bottom portion of the picture is expanded at a greater rate than the top portion, and the picture center tends to move toward the top of the picture tube.

1. Turn the VERT. SIZE control counterclockwise to increase the height of the picture and clockwise to decrease the picture height.

The VERT. LINEARITY control affects the upper portion of the picture and compensates for non-linearity created by changes made by the VERT. SIZE control.

2. Turn the VERT. LINEARITY control clockwise to expand the upper portion of the picture and counterclockwise to compress the upper portion of the picture.

After adjustment of the picture height and/or vertical linearity, check the VERT. HOLD adjustment; the three controls are interdependent. The same caution that was given for picture width and line voltage applies equally well to vertical picture size.

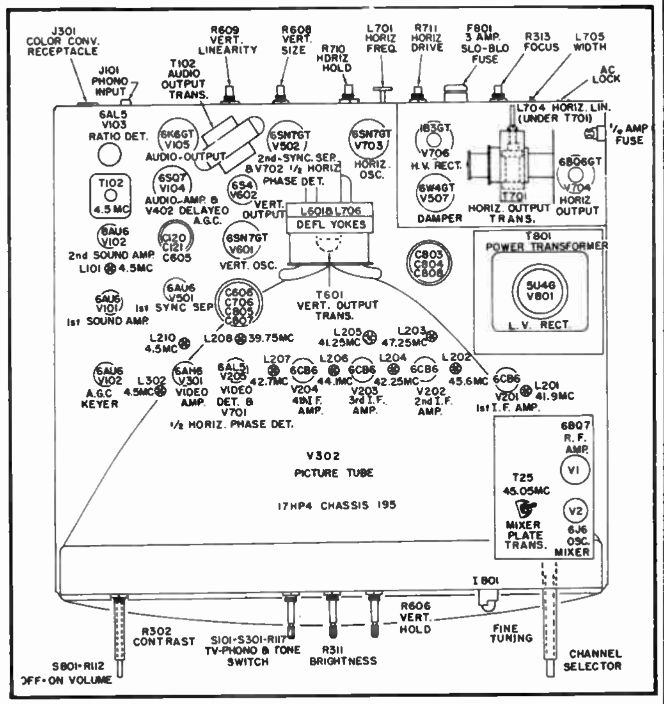


Figure 3. Top View Parts Layout

RASTER CENTERING

It is best to adjust the picture linearity and size, using a test pattern, before centering the picture. If picture tilt exists, temporarily loosen the wing screw at the top of the deflection yoke and rotate the yoke until the tilt is eliminated. Make certain that the deflection yoke is seated as far forward on the picture tube neck as it is possible to move the yoke.

Raster centering is accomplished by adjusting two permanent magnet rings on the neck of the picture tube just behind the deflection yoke. The centering assembly should be positioned very near the deflection yoke (never more than an inch behind). Due to inter-action it will be necessary to rotate both magnets to obtain correct centering in most instances.

MAXIMUM PERFORMANCE SELECTOR

This control and its associated circuits regulate R-F and I-F AGC voltages (within the limits of the AGC system). When the AGC control is turned full clockwise the greatest bias appears on the I-F AGC bus and the lowest bias appears on the R-F AGC bus for a given signal. When the control is reversed the I-F AGC bias voltage is minimum and the R-F AGC bias is maximum for a given signal. This source of high R-F bias is very useful when strong signals cause the video stages to overload, clipping the sync pulses. In very strong signal areas turn the AGC control counterclockwise until loss of sync is eliminated. Do not turn more than necessary because increase bias on the R-F amplifier with simultaneous decrease in I-F bias will lead to excessive noise in the picture after a certain point. Conversely, in weaker signal areas the control should be turned clockwise so that the R-F bias is reduced and the I-F bias is increased. This condition will improve the signal to noise ratio, minimizing "snow", in the picture. Again, do not over control or the I-F stages may be overdriven. The optimum point is a function of signal strength. Use picture quality as an indicating device and adjust for optimum performance.

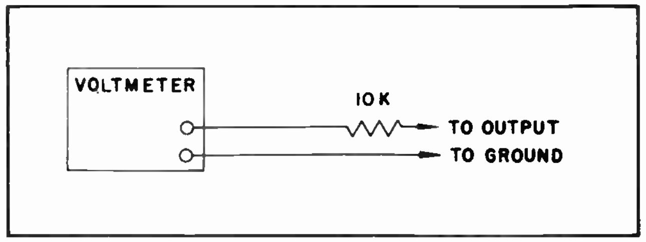


Figure 6. Voltmeter Isolation

Ratio Detector Alignment

Equipment: Generator input remains unchanged from the level that produced 6.5 to 7 volts in the preceding step. Connect the voltmeter across the junction of R111 and R112 and the switch side of R110; polarity will depend upon which side of resonance the secondary winding of T101 is tuned. If a VTVM is being used, set the zero voltage point up scale so that plus and minus readings may be observed without changing the polarity selector switch on the VTVM. Start with one of the higher scales of the VTVM and decrease the scale setting as the null point is obtained.

Procedure: Tune the secondary (top) of T101 for a zero reading on the voltmeter. Do not change the generator output level from that which produced the 6.5 to 7 volts in the first step. Repeat tuning of T101 primary and secondary until adjustments do not change.

Trap and Picture I-F Alignment

TUNING 4.5 MC TRAP

Equipment: Connect the CW generator through the .005 uf isolating condenser, to pin 7 of V205 (plate of video detector) and tune the generator to 4.5 mc. Connect the detector network and voltmeter between ground and the cathode of the picture tube as shown in Figure 7.

Procedure: Tune L302 (4.5 mc trap in plate circuit of video amplifier) for minimum indication on voltmeter.

TUNING 39.75 MC, 41.25 MC, AND 47.25 MC TRAPS

Equipment: Couple the CW generator "hot" lead to the tuner mixer grid. This may be done in several ways. The .5-3 uuf trimmer condenser (C12 in Bulletin 301) located in front of the 6J6 and nearest the contact side of the tuner is connected to pin 5 of the 6J6, the mixer grid. This plate of the trimmer condenser is accessible through a hole in the side cover plate. The "hot" generator lead may be coupled to this point through a .005 uf isolating condenser, the condenser pigtail being clipped to the trimmer by some convenient means. Another method of coupling the generator is to remove the 6J6, wrap the isolating condenser pigtail around pin 5 of this tube, and replace it in its socket. In either method take care that the pigtail lead does not short to ground. A third method of coupling is to pull the 6J6 tube shield up on the tube until it is not grounded. Clip the "hot" lead of the generator directly to the tube shield. The tube shield and the tube electrodes form a condenser which capacitively couples the signal to the mixer grid. The capacity is much less than .005 uf, and a much higher level of generator output will be required if this method is utilized.

Connect the negative lead of the voltmeter to pin 1 of V301, the video amplifier grid, using the 10K ohm isolating resistor at the end of the lead; connect the voltmeter positive lead to ground. Connect the negative terminal of the 3 volt bias source to the AGC bus; connect the bias source positive lead to ground.

Procedure: Turn the CONTRAST control to its maximum position (extreme clockwise) for remainder of alignment. Tune the traps by setting the trap frequency on the CW generator and adjusting the trap slug for a minimum voltmeter reading. The order of tuning the traps is given in Table III. Keep signal low to avoid overloading I-F circuits.

TUNING PICTURE I-F COILS

Equipment: Instruments and set-up remain the same as for trap alignment during the first part of the procedure. For final adjustment the sweep frequency generator is also used and the voltmeter should be replaced by the oscilloscope. See Figure 8 for oscilloscope isolation details.

Procedure: Tune the I-F coils by setting the coil frequency on the CW generator and adjusting the coil for maximum voltmeter reading. The CW generator output must be attenuated so that the DC output voltage of the video detector (indicated on the voltmeter), remains at 1 volt as the I-F coils are tuned. The order of tuning is from the last I-F stage toward the tuner. Before tuning the grid coil of the 1st I-F stage, temporarily tune the tuner mixer plate coil for a minimum reading on the voltmeter at 41.90 mc. After the 1st picture I-F grid coil has been tuned, tune the mixer plate coil to 45.05 mc and repeat the trap and I-F alignment procedure until no additional change in adjustments is necessary.

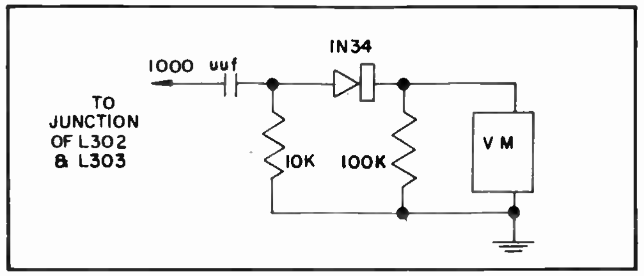


Figure 7. Detector Network

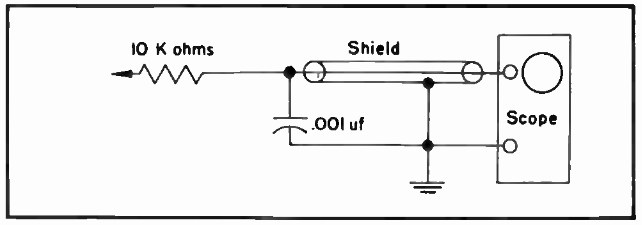


Figure 8. Oscilloscope Isolation

When no further change takes place, replace the voltmeter with the oscilloscope and replace the CW generator with the sweep frequency generator. Use the same isolating condenser and input connection to the mixer grid. Loosely couple the CW generator (marker) to the input by clipping or touching the CW generator "hot" lead to the unshielded insulated end of the sweep generator "hot" lead. This will afford a small amount of capacitive coupling. If the CW and sweep generators are contained in the same instrument, it will only be necessary to switch on the sweep frequency generator in order to continue the procedure. Tune the sweep frequency generator to a center frequency of approximately 43.8 mc. Use a sweep width of approximately 10 mc so that the base of each of the two response curve skirts is well within the ends of the oscilloscope trace. Check the overall bandwidth, position of the picture carrier, dip in bandpass, and trappage by using the marker pip to locate frequency points on the response curve. See Figure 9. Tune the CW generator to 45.75 mc. The marker pip should appear at approximately the 50% point on the response curve skirt. Adjust the 1st I-F grid coil, L201, to eliminate any tilt of the response curve and adjust the mixer plate transformer T25 to set the picture carrier at the 50% response point. It should not be necessary to readjust the other picture I-F coils. Once the picture carrier has been correctly positioned, tune the CW generator so that the marker pip moves to the 50% response point on the opposite skirt. Note the frequency calibration of the CW generator dial and subtract this value from 45.75 mc. The difference should be between 3.6 mc and 3.8

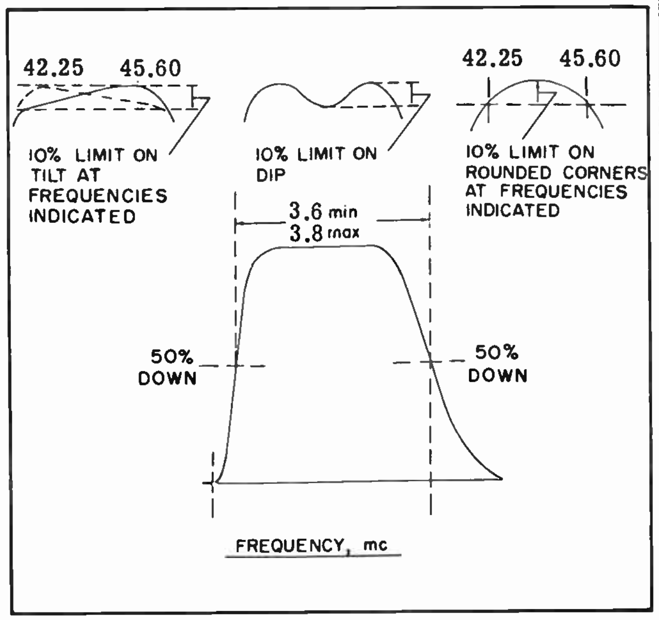


Figure 9. Picture I-F Response Curve

mc, the bandpass limits taken between 50% point of picture carrier and 50% point of opposite skirt. If the bandpass does not lie within these limits, touch up the other I-F coils until the correct curve is obtained. Any appreciable touch-up requirement should be taken as an indication that the I-F Section is not operating normally and should be checked for abnormalities.

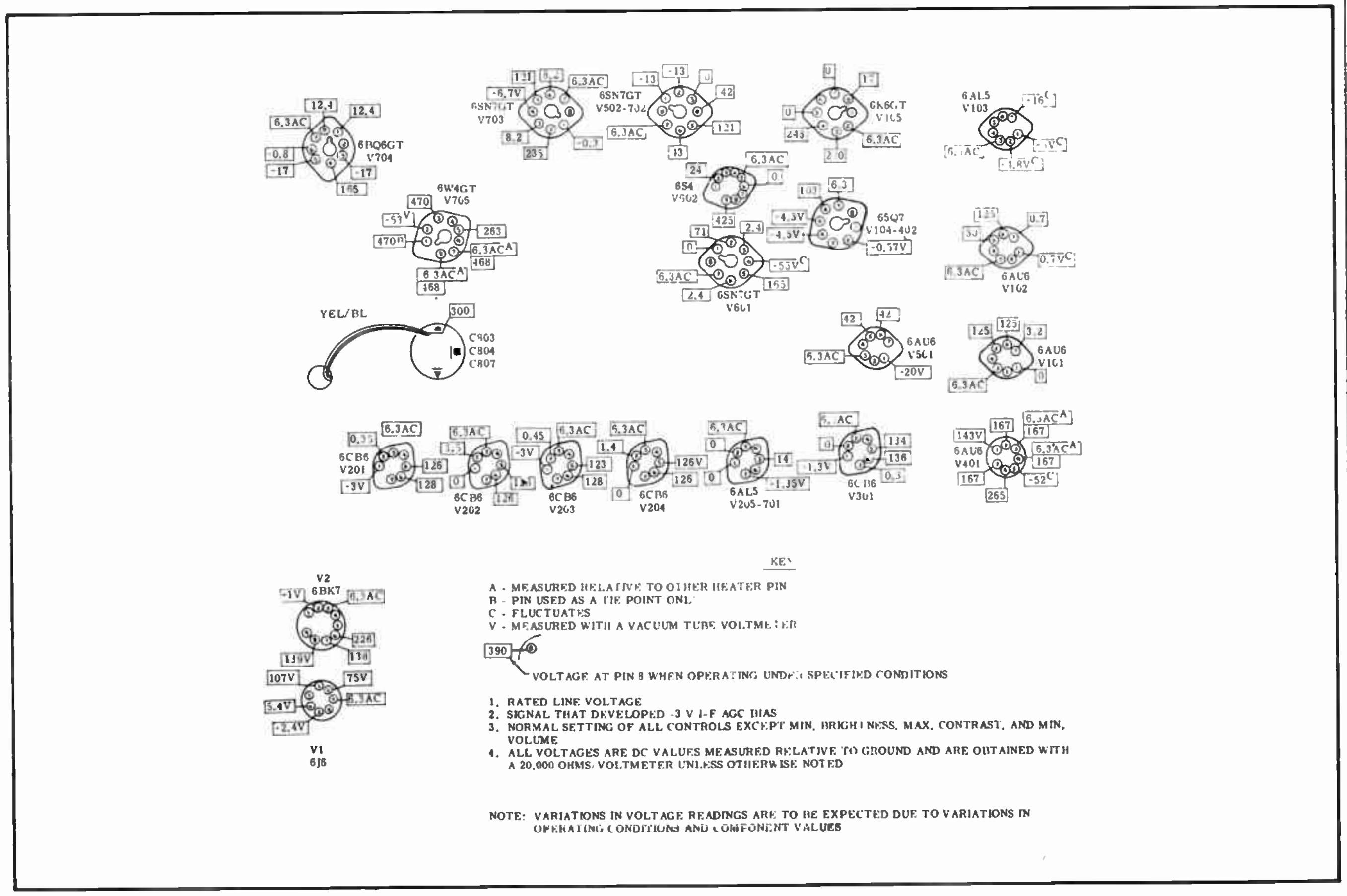


TABLE III - TV ALIGNMENT PROCEDURE

STEP NO.	SIGNAL GENERATOR FREQUENCY, MC	CONNECT SIGNAL TO	OUTPUT INDICATOR	ADJUST	INSTRUCTIONS	SPECIAL CONNECTIONS AND SETTINGS
			SOUND I-F AND RATIO DETECTOR			
1	4.5 CW	Pin 7 of V205	Meter across pin 7 of V103 and ground.	T101 Pri. (bottom) L101 L210	Tune for maximum reading on meter.	Signal level should be low enough to obtain approximately 6.5 to 7 volts on meter. Use isolation networks shown in Figures 5 and 6.
2	4.5 CW	"	Meter across junction of R111 and R112 and switch side of R110.	T101 Sec. (top)	Tune for zero meter reading; use same signal level as in step 1.	Repeat tuning of T101 primary and secondary until adjustments do not change.
			TRAPS AND PICTURE I-F			
3	4.5 CW	Pin 7 of V205	Meter connected through detector network to picture tube cathode lead.	L302	Tune for minimum reading on meter.	Detector and isolating networks shown in Figures 5 and 7. Temporarily detune L210.
4	39.75 CW	Mixer grid	Voltmeter across pin 1 of V301 and ground.	L208	Tune for maximum reading on meter.	Apply -3V bias to AGC bus. See text for connection to mixer grid. Use isolating resistor between negative voltmeter lead and pin 1 of V301. Keep generator output low. Remove 1/4 amp. fuse or bias V704 with -60V for remainder of procedure.
5	41.25 CW	"	"	L205	"	
6	47.25 CW	"	"	L203	"	
7	42.70 CW	Mixer grid	"	L207	Tune for maximum reading on meter.	Set CONTRAST control for maximum contrast. Adjust signal level throughout I-F alignment so that a 1 volt DC output is maintained at pin 1 of V301.
8	44.10 CW	"	"	L206	"	
9	41.25 CW	"	"	L204	"	
10	45.60 CW	"	"	L202	"	
11	41.90 CW	"	"	L201	"	Temporarily tune mixer plate transformer for minimum voltmeter reading at 41.90 mc.
12	45.05 Cw	"	"	Mixer Plate Coil, L4	"	
13		Repeat steps 4 through 12 until adjustments do not change.				
14	Approximately 43.8 with 10-mc sweep. Marker required.	Mixer grid	High gain scope to pin 1 of V301.	Mixer Plate Coil and L201 1st. Other coils if necessary.	Set 45.75 mc marker at 50% point with Mixer Plate transformer T25. Eliminate tilt with L201	See Figure 8 for isolation network. Use markers to determine bandpass between picture carrier and 50% point on opposite skirt. Bandpass should be between 3.8 mc and 3.6 mc. Adjust other I-F coils to obtain proper curve only when absolutely necessary.

ALIGNMENT

The following alignment procedure describes alignment of the stagger-tuned video I-F amplifier stages and the 4.5 mc sound I-F amplifier stages.

The following discussion describes recommended methods and equipment to be used and precautions to be observed during the alignment procedure. Table III offers a ready reference alignment guide to be followed after the more detailed procedure has been studied.

For best results it is important that alignment be performed on a metal topped bench with all instruments and equipment securely bonded together and to ground. All leads should be as short as is practicable, particularly in the input grid circuits. Allow about fifteen minutes for the test equipment and receiver to warm before beginning the alignment. Isolation circuits will be required for both the input and output connections. It is important that composition resistors, preferably the half-watt size, and disc type ceramic condensers be used in making up these isolation networks so that a minimum amount of external inductance is added to the tuned circuits being adjusted.

The following equipment* will be required in order to align the picture and sound I-F stages of the receiver properly.

1. Accurate CW signal generator covering the following frequencies:

4.5 mc	44.10 mc
39.75 mc	45.60 mc
41.25 mc	45.75 mc
42.25 mc	47.25 mc
42.70 mc	

The generator must have an attenuation control which can be used to vary its output signal level.

2. Sweep frequency generator with a sweep center frequency of approximately 43.8 mc and a 10 mc sweep width.
3. Cathode Ray Oscilloscope with at least a moderately high vertical gain. Must have external sweep input or internal sweep frequency equal to the sweep generator sweep frequency and capable of phase control.
4. DC voltmeter with sensitivity of 20,000 ohms per volt or higher and voltage scale ranges which include approximately 10 volts and 3 volts (full scale deflection). VTVM with zero center scale adjustment is an ideal type.
5. 3 volt bias source such as a battery.
6. Detector network shown in Figure 7.
7. .005 uf isolating condenser.
8. 10K ohm, 1/2 watt composition resistor.
9. .001 uf condenser for shunting oscilloscope input.

*Several instrument manufacturers combine the first three items of the equipment list into one compact instrument assembly.

Before alignment is begun, tune the tuner off-channel by turning the tuner CHANNEL SELECTOR shaft so that the detent roller rests on one of the high points of the drum disc. Remove the 1/4 amp. fuse or bias pin 5 of V704 with -60 volts, in order to eliminate spurious signals and possibility of high voltage shock hazard.

ORDER OF ALIGNMENT

1. Sound I-F and Ratio Detector Primary
2. Ratio Detector Secondary
3. 4.5 mc Sound Take-off
4. 4.5 mc Beat Trap
5. 39.75 mc Adj. Channel Picture Trap
6. 41.25 Co-channel Sound Trap
7. 47.25 Adj. Channel Sound Trap
8. 42.70 mc 4th Picture I-F Coil
9. 44.10 mc 3rd Picture I-F Coil
10. 41.25 mc 2nd Picture I-F Coil
11. 45.6 mc 1st Picture I-F Coil
12. 41.9 mc 1st Picture I-F Grid Coil
13. 45.05 mc Mixer Plate Coil

It is important that the alignment be performed in order listed, with the exception of items 1 and 2, because there is some interaction within the various stages. It is for this reason that step 13 is included in the alignment table.

Sound I-F Alignment

Equipment: Connect the "hot" lead of the CW signal generator to the grid, pin 1, of V101, the 1st sound I-F tube, through a .005 uf isolating condenser as shown in Figure 5. Tune the generator frequency to 4.5 mc, unmodulated. Connect the voltmeter negative lead in series with a 10K isolating resistor to pin 7 of V103, one plate of the ratio detector, as shown in Figure 6. It is important that the 10K ohm isolating resistor be at the very end of the meter lead to avoid regeneration. Connect the positive voltmeter lead to ground.

Procedure: Adjust L101, L210 and T101 primary (bottom), to obtain a maximum voltmeter reading. The maximum voltage reading should be held at about 6.5 to 7 volts by decreasing the generator output as the transformer windings are turned to resonance.

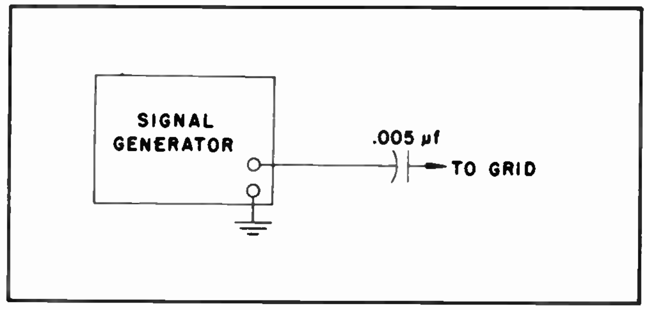


Figure 5. Signal Generator Isolation

PARTS LIST

NOTE: Unless otherwise noted all resistors are 1/2 watt, composition type, ±10% tolerance with values given in ohms.

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
		RESISTORS			
R1	-	47K	20%		
R2	-	15K			
R3	-	330K			
R4	-	180K			
R5	-	470			
R6	-	100K			
R7	-	15K			
R8	-	220K			
R9	-	4.7K			
R10	-	10K			
R11	-	15K			
R101	4511	100K	20%		
R102	4549	390			
R103	4542	1K	20%		
R104	4504	47K	20%		
R105	4598	82			
R106	4542	1K	20%		
R107	4608	6.8K		1 Watt	
R108	4644	10K		1 Watt	
R109	4638	470			
R110	4521	15K	20%		
R111	4597	10K			
R112	4597	10K			
R113	24627	33K	20%		
R114	See Controls				
R115	4505	10 M	20%		
R116	34612	1.8M	5%		
R117	See Controls				
R118	4506	470K	20%		
R119	4618	220K			
R120	4621	560		1 Watt	
R121	14698	1K		2 Watt	
R201	4659	1K			
R202	4512	2.2K	20%		
R203	4537	47K	5%		
R204	4639	47			
R205	4546	120			
R206	4664	470	20%		
R207	4537	47K	5%		
R208	4546	120			
R209	4664	470	20%		
R210	4654	3.9K	5%		
R211	4639	47			
R212	4546	120			
R213	4664	470	20%		
R214	4641	8.2K	5%		
R215	4546	120			
R216	4664	470	20%		
R217	4656	12K	5%		
R218	Part of L211	39K	20%		
R219	4501	22K	20%		
R220	4649	4.7K	5%		
R301	4514	680			
R302	See Controls				
R303	Part of L301	39K	20%		
R304	Part of L303	10M			
R305	4619	15K			
R306	4504	47K	20%		
R307	4610	1.5K	5%		
R308	24543	3.3K	5%	1 Watt	
R309	4638	470			
R310	See Controls				
R311	4559	47K			
R312	See Controls				
R313	4548	120K			
R314	4501	22K	20%		
R401	4664	470	20%		
R402	4521	15K	20%		
R403	See Controls				
R404	4664	470	20%		
R405	4607	3.3K			
R406	34550	470K	5%		
R407	4677	330K	20%		
R408	34532	330K	5%		
R409	34659	4.7M			
R410	4628	22K			
R501	4544	4.7M	20%		
R502	4622	470K			
R503	34531	330K			
R504	24670	82K			
R505	4662	18K			
R506	24525	2.2K	5%		
R507	24525	2.2K	5%		
R508	25417	1.8K	5%		
R509	24517	1.8K	5%		
R510	4549	390			
R511	Part of Z501	22K	20%		
R512	Part of Z501	8.2K	20%		
R513	Part of Z501	8.2K	20%		
R601	4544	4.7M	20%		
R602	34507	180K		1 Watt	
R603	4659	1K			
R604	34571	680K		1 Watt	
R605	34593	1.2M			
R606	See Controls				
R607	4629	5.6K			
R608	See Controls				
R609	See Controls				
R610	4664	470	20%		

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
R611	24697	150K	20%	1 Watt	
R612	4581	1.5K		1 Watt	
R613	4507	560			
R614	4507	560			
R701	4571	100K			
R702	4571	100K			
R703	4506	470K	20%		
R704	4659	1K			
R705	4651	8.2K			
R706	4544	4.7M	20%		
R707	4634	180K			
R708	4610	1.5K	5%		
R709	24670	82K			
R710	See Controls				
R711	See Controls				
R712	4590	560K			
R713	4566	100			
R714	4651	8.2K			
R715	4657	120		2 Watt	
R716	24574	6.8K		2 Watt	
R717	4751	3.9			
R718	14529	22		2 Watt	
R719	4659	1K			(Part of Deflection Yoke Assy #99682)
R801	4730	150		10 Watt	Wire Wound
R802	4730	150		10 Watt	Wire Wound
R803 R804	4731	1.9K Tapped at 800		10 Watt	Wire Wound
		CAPACITORS			
C1	Not Used				
C2	-	3-8	-	-	Ceramic Padder
C3	-	.001	-	-	Ceramic Feed-Thru
C4	-	.001	-	-	Ceramic Button
C5	-	.001	-	-	Ceramic Feed-Thru
C6	-	3	-	-	Ceramic
C7	-	.001	-	-	Ceramic
C8	-	120	-	-	Ceramic
C9	-	.5-3 Uuf	-	-	Ceramic Padder
C10	-	.001	-	-	Ceramic Feed-Thru
C11	-	47	-	-	
C12	-	.5-3 Uuf	-	-	Ceramic Padder
C13	-	.001	-	-	Ceramic
C14	-	5	-	-	
C15	-	10	-	-	
C16	Not Used				
C17	-	3-5	(Fine Tuning)		
C18	-	.001	-	-	Ceramic Feed-Thru
C19	-	6.8	-	-	
C20	-	.001	-	-	Ceramic
C21	-	68	-	-	
C22	-	68	-	-	
C23	-	3-8	-	-	Ceramic Padder
C24	Not Used				
C25	Not Used				
C26	-	.001	-	-	Ceramic
C101	4174	.001 Uf		400 V	
C102	4029	.005 Uf			Ceramic
C103	4029	.005 Uf			Ceramic
C104	Part of L101	47 Uuf	10%		Ceramic NPO
C105	14005	47 Uuf			Ceramic GP
C106 C107	4036	2 x .004 Uf			Ceramic
C108	4029	.005 Uf			Ceramic
C109	4029	.005 Uf			Ceramic
C110	Part of T101	200 Uuf	5%		Ceramic NPO
C111	14010	390 Uuf	5%		Ceramic NPO
C112	4029	.005 Uf			Ceramic
C113	See Electrolytic				
C114	4127	.0047 Uf		400 V	
C115	4127	.0047 Uf		400 V	
C116	4029	.005 Uf			Ceramic
C117	4029	.005 Uf			Ceramic
C118	4128	.0047 Uf			
C119	4105	.01 Uf			
C120	4105	.01 Uf			
C121	See Electrolytic				
C122	See Electrolytic				
C201	4029	.005 Uf			Ceramic
C202	4029	.005 Uf			Ceramic
C203 C204	14029	2 x .005 Uf			Ceramic
C205	14027	470 Uuf			Ceramic
C206	4082	1.5 Uuf	10%		Stackpole GA-3
C207	Part of L203	20 Uuf	10%		Ceramic NPO
C208	14027	470 Uuf			Ceramic
C209	14027	470 Uuf			Ceramic
C210	See Capacitor				Dual Ceramic
C211	4081	5 Uuf	10%		Ceramic NPO
C212	Part of L205	100 Uuf	10%		Ceramic NPO
C213	See Capacitor				Dual Ceramic
C214	14027	470 Uuf			Ceramic
C215	4082	1.5 Uuf	10%		Stackpole GA-3
C216	Part of L207	100 Uuf	10%		Ceramic NPO
C217	14030	.0015 Uf			Ceramic
C218	14027	470 Uuf			Ceramic
C219	4082	1.5 Uuf	10%		Stackpole GA-3
C220	Part of L209	20 Uuf	10%		Ceramic NPO
C221	14030	.0015 Uf			Ceramic
C222	4081	5 Uuf	10%		Ceramic NPO
C223	4081	5 Uuf	10%		Ceramic NPO

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
C301	4029	.005 Uf			Ceramic
C302	Part of L302	47 Uuf	10%		Ceramic NPO
C303	4131	.22 Uf		200 V	
C401	4131	.22 Uf		200 V	
C402	14200	1.0 Uf		100 V	
C403	4029	.005 Uf			Ceramic
C404	4029	.005 Uf			Ceramic
C501	4136	.0022 Uf	10%	400 V	
C502	4026	220 Uuf			Mica or Ceramic
C503	4127	.0047 Uf		400 V	
C504		.002 Uf	+50% -20%	450 V	
C505	Part of Z501	.005 Uf	+50% -20%	450 V	
C506		.005 Uf	+50% -20%	450 V	
C601	14113	.0039 Uf	10%		
C602	4158	.047 Uf	10%	200 V	
C603	14133	0.1 Uf	10%		
C604	4144	0.1 Uf			
C605	See Electrolytic				
C606	See Electrolytic				
C607	4133	.047 Uf			
C608	4124	.022 Uf			
C701	14030	.0015 Uf			Ceramic Hi-K
C702	4175	.001 Uf	10%	400 V	
C703	4175	.001 Uf	10%	400 V	
C704	4127	.0047 Uf		400 V	
C705	4147	.047 Uf		200 V	
C706	See Electrolytic				
C707	4085	.0039 Uuf	10%	500 V	Silver Mica
C708	14009	470 Uuf	10%		Mica
C709	14104	.001 Uf	10%		
C710	4128	.0047 Uf			
C711	14010	390 Uuf	10%		Mica
C712	4144	0.1 Uf			
C713	4173	.47 Uf	10%	200 V	
C714	14103	.22 Uf		400 V	
C715	14127	.033 Uf	10%		
C716	4067	47 Uuf	10%	1500 V	Ceramic
C717	14128	.039 Uf	10%		
C718	4056	500 Uuf		20 KV	Ceramic
C719	14133	0.1 Uf	10%		
C720	4067	47 Uuf	10%	1500 V	(Part of Deflection Yoke Assembly #99682)
C801	4105	.01 Uf			
C802	4105	.01 Uf			
C803	See Capacitors, Electrolytic				
C804	See Electrolytic				
C805	See Electrolytic				
C806	4144	0.1 Uf			
C807	See Electrolytic				
C808	See Electrolytic				
		CAPACITOR - DUAL CERAMIC			
C210 C213	14029	2 x 1500 Uuf			Ceramic Hi-K
		CAPACITORS - ELECTROLYTIC			
C112	4209	5 Uf	-	50 V	-
C120	4230	20 Uf	-	25 V	-
C121		20 Uf	-	475 V	-
C605		50 Uf	-	50 V	-
C606		20 Uf	-	525 V	-
C706	4247	10 Uf	-	350 V	-
C805		60 Uf	-	350 V	-
C807		40 Uf	-	350 V	-
C803		40 Uf	-	475 V	-
C804	4232	30 Uf	-	475 V	-
C808		30 Uf	-	475 V	-

SYMBOL	PART NO.	DESCRIPTION
		COILS
L1	-	5 Turns 1/4" O.D., Coupling Coil
L2	-	16 Turns 1/4" O.D., Filament Choke
L3	-	16 Turns 1/4" O.D., Filament Choke
L4	Not Used	
L5	Not Used	
L6	-	Coil - Neutralizing
L7	-	Coil - Plate Impedance
L8	-	Coil - Absorption Trap
L10	Part of R.F. Tuner Z201	
L101	5437	Coil - Interstage (Sound I-F, 4.5 MC)
L201	5441	Coil - Input (Video I-F Input, 41.9 MC)
L202	5442	Coil - Interstage (1st Video I-F, 45.6 MC)
L203	5440	Coil - Trap (47.25 MC)
L204	5439	Coil - Interstage (2nd Video I-F, 42.25 MC)
L205	5438	Coil - Trap (41.25 MC)
L206	5439	Coil - Interstage (3rd Video I-F, 44.1 MC)
L207	5438	Coil - Trap (41.25 MC)
L208	5439	Coil - Interstage (4th Video I-F 42.7 MC)
L209	5440	Coil - Trap (39.75 MC)
L210	5430	Coil - Sound I-F Take-Off (4.5 MC)
L211	5433	Coil - Peaking (Detector Series, 150 uh)
L212	5434	Coil - Peaking (Detector Shunt, 970 uh)
L301	5433	Coil - Peaking (Video Output Series, 150 uh)
L302	5402	Coil - Trap (4.5 MC)
L303	5340	Coil - Peaking (Video Output, Shunt, 350 uh)
L601	See "Miscellaneous"	
L701	5300	Coil - Horizontal Frequency
L702	5266	Coil - Damper Choke
L703	5266	Coil - Damper Choke
L704	5422	Coil - Horizontal Linearity
L705	5457	Coil - Width Control
L706	See "Miscellaneous"	
L801	5133	Coil - R-F Filament Choke
L802	5133	Coil - R-F Filament Choke
		TRANSFORMERS
T1	5360R	Channel 2 Antenna Coil Assembly
T2	5361R	Channel 3 Antenna Coil Assembly
T3	5362R	Channel 4 Antenna Coil Assembly
T4	5363R	Channel 5 Antenna Coil Assembly
T5	5364R	Channel 6 Antenna Coil Assembly
T6	5365R	Channel 7 Antenna Coil Assembly
T7	5366R	Channel 8 Antenna Coil Assembly
T8	5367R	Channel 9 Antenna Coil Assembly
T9	5368R	Channel 10 Antenna Coil Assembly
T10	5369R	Channel 11 Antenna Coil Assembly
T11	5370R	Channel 12 Antenna Coil Assembly
T12	5371R	Channel 13 Antenna Coil Assembly
T13	5348R	Channel 2 Oscillator-Mixer Coil Assembly
T14	5349R	Channel 3 Oscillator-Mixer Coil Assembly
T15	5350R	Channel 4 Oscillator-Mixer Coil Assembly
T16	5351R	Channel 5 Oscillator-Mixer Coil Assembly
T17	5352R	Channel 6 Oscillator-Mixer Coil Assembly
T18	5353R	Channel 7 Oscillator-Mixer Coil Assembly
T19	5354R	Channel 8 Oscillator-Mixer Coil Assembly
T20	5355R	Channel 9 Oscillator-Mixer Coil Assembly
T21	5356R	Channel 10 Oscillator-Mixer Coil Assembly
T22	5357R	Channel 11 Oscillator-Mixer Coil Assembly
T23	5358R	Channel 12 Oscillator-Mixer Coil Assembly
T24	5359R	Channel 13 Oscillator-Mixer Coil Assembly
T25	-	Transformer - Mixer Plate 45.05 MC
T101	5429	Transformer - Ratio Detector 4.5 MC
T102	5169	Transformer - Audio Output
T601	5157	Transformer - Vertical Output
T701	5160	Transformer - Horizontal Output
T801	5030	Transformer - Power
		CONTROL - SWITCHES
R114		Control - Volumn, 500K ohms Tapped at 150K ohms
R302	4879	Control - Contrast, 1.5K ohm
S801		Switch - On-Off
R117		Control - Tone, 1 M
S101 S301	4890	Switch - D.P.D.T. T.V. - Phono / Raster - On-Off
R310	4867	Control - Brightness 50K ohm
R312	4864	Control - Focus 2M
R403	4853	Control - A.G.C. Threshold 50K ohm
R606	4868	Control - Vertical Hold 1 M
R608	4864	Control - Vertical Size 2 M
R609	4865	Control - Vertical Linearity 5K ohm
R710	4859	Control - Horizontal Hold 25K ohm
R711	4859	Control - Horizontal Drive 25K ohm
		MISCELLANEOUS
F701	9615	Fuse - 1/4 Ampere
F801	9648	Fuse - 3.2 Ampere, Slo-Blo
I801	9505	Pilot Light - Mazda #44
J101	6121	Receptacle - Phono Input
J201	Part of Z201	Receptacle - Intercarrier I-F Output
J301	6119	Receptacle - Color Converter
L601 L706	9729	Yoke - Deflection 42 M / 18.5 M
LS101	9067-1	Speaker - 5-1/4" P.M.
M301	9713	Ion Trap - 35 gauss
M302	9722	Magnet - Centering
P201	6203	Plug - Phono
P301	6211	Plug - Color Converter
P801	6126	Receptacle - Power
Z201	9758	Tuner - R-F Standard Coil
Z202	3195	Cable - Co-axial Intercarrier I-F Take-Off (Used with item P201)
Z203	3208	Cable - Co-axial Sound I-F Take-Off
Z301	6163	Socket - Kinescope (with leads)
Z501	9695	Network - Vertical Integrator
Z701	3209	Cable - Keyer Pulse
Z702	6225	Plug - Anode Connector (with lead)

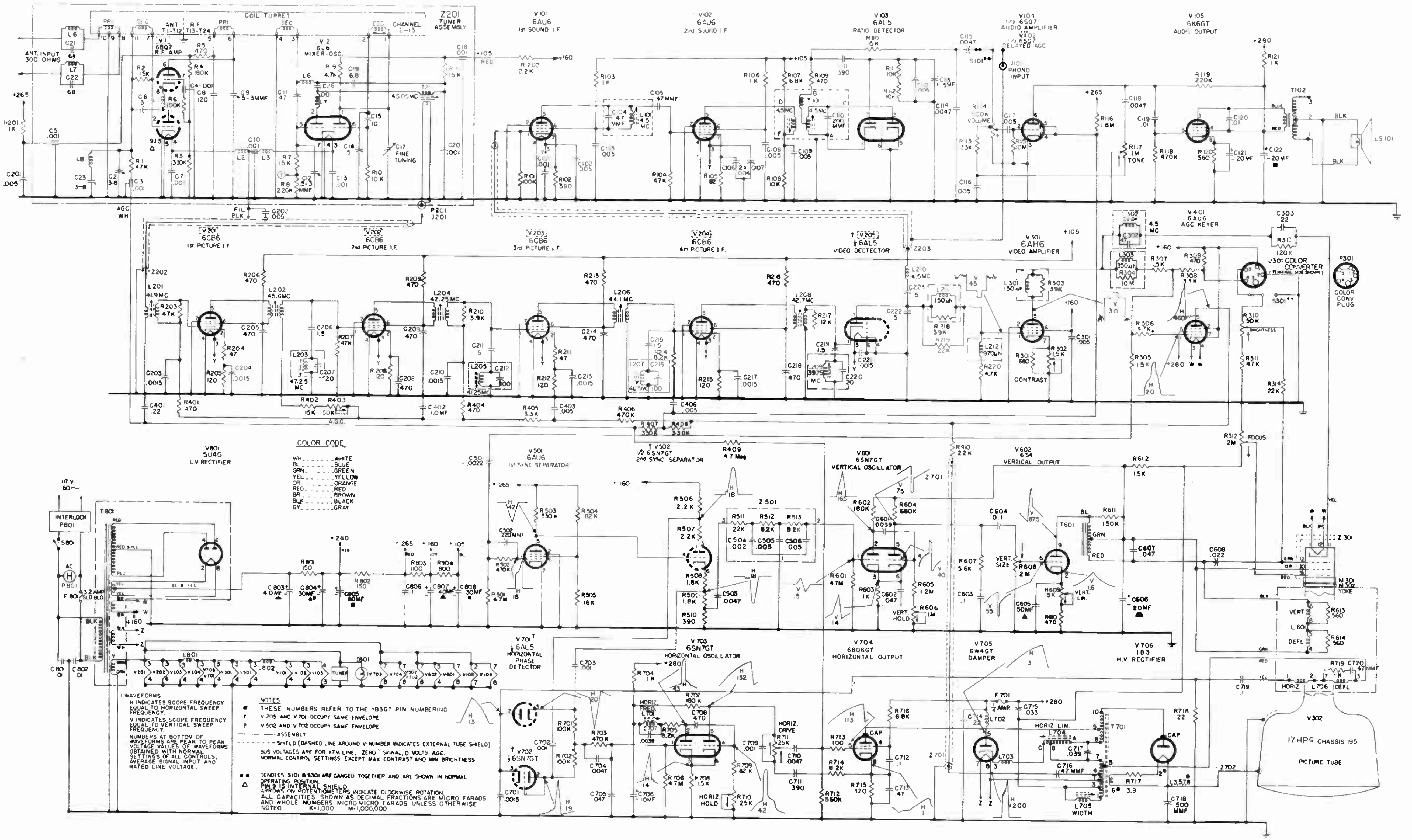


Figure 4. Schematic Diagram for Chassis 195.

CHASSIS 300-17
MODELS 7M140, 7B141
CHASSIS 300-21
MODELS 21M143, 21B144, 21P145, 21M317, 21B318, 21M718, 21B719, 21P720

NOTE

This information also covers the 300 series chassis, incorporating the "All-Wave Tuner".
Chassis incorporating the "All-Wave Tuner" can be identified by a "U" following the model number. (Example 7M140U)

IDENTIFICATION

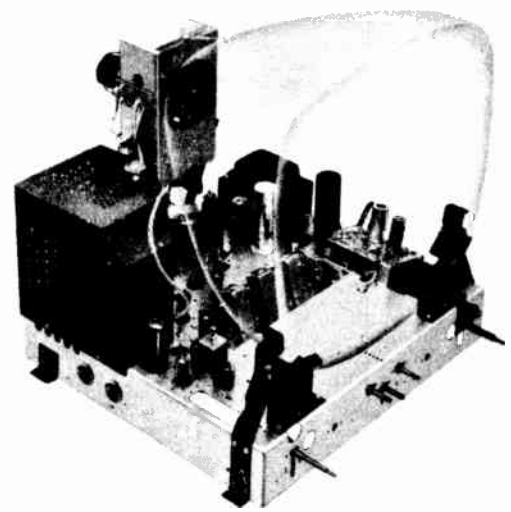


Figure 1. Chassis 300 TV Chassis

Chassis 300-17 and 300-21 will come under the collective heading of the 300 series chassis.

The 300 series chassis will incorporate either a 9786 VHF tuner or a 9795 All-Wave tuner which comprises the RF stages of the receiver.

This tuner is identical to the 9758 tuner except that the coupling is changed. If a 9795 All-Wave tuner is used refer to this bulletin. Both picture and sound output from the tuner is fed to the first of three stages of stagger-tuned I-F amplification. The picture carrier frequency is 45.75 mc. An intercarrier type sound system is employed, the 4.5 mc sound takeoff occurring at the output of the video amplifier. The sound is fed into a single 4.5 mc sound I-F stage.

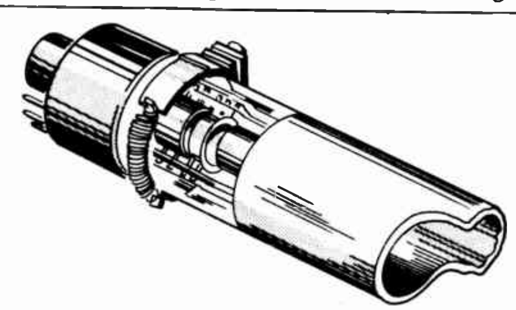


Figure 2. Ion Trap Position

ELECTRICAL AND MECHANICAL DATA

TABLE I - ELECTRICAL AND MECHANICAL DATA

Operating Voltage	115 Volts AC, 60 cps
Power Consumption	155 Watts
VHF Tuning Range	Channels 2-13
Maximum Audio Power Output	1.6 Watts
Audio Output Impedance	3.2 Ohms at 400 cps
Intermediate Frequencies Picture Carrier Sound Carrier	 45.75 mc 4.5 mc
Antenna Input Impedance	300 Ohms, balanced
Picture Tube Size	17" and 21" Rectangular

TABLE II - TUBE COMPLEMENT

TUBE	TYPE	FUNCTION
V1	6BQ7A, 6BQ7 or 6BZ7	R-F Amplifier
V2	6J6	Oscillator Mixer
V101	6AU6	Sound I-F
V102	6AL5	Ratio Detector
V103	6AV6	Audio Amplifier
V104	6W6GT	Audio Output
V201	6CB6	1st Picture I-F
V202	6CB6	2nd Picture I-F
V203	6CB6	3rd Picture I-F
V204	1/2 6AL5	Video Detector
V301	12BY7	Video Amplifier
V302	21YP4, 17HP4	Picture Tube
V401	1/2 12AU7	AGC Keyer
V501	1/2 12AU7	1st Sync Separator
V502	1/2 12AU7	2nd Sync Separator
V601	6SN7GT	Vertical Oscillator
V602	6S4	Vertical Output
V701	1/2 6AL5	Horiz. Phase Det.
V702	1/2 12AU7	Horiz. Phase Det.
V703	6SN7GT	Horiz. Oscillator
V704	6BQ6GT	Horiz. Output
V705	6W4GT	Damper
V706	1B3	H. V. Rectifier
X801	SEL. RECT.	L.V. Rectifier
X802	SEL. RECT.	L.V. Rectifier

HORIZONTAL DRIVE ADJUSTMENT

1. Turn the HORIZ. DRIVE control counterclockwise until a drive bar (thin, light vertical line) appears.
2. Turn the control clockwise until the drive bar just disappears. If no drive bar is obtained, set the control at the maximum counterclockwise position.

HORIZONTAL FREQUENCY CONTROL

1. Turn the Horizontal Hold control to mid-range.
2. Turn the HORIZ. FREQ. control counterclockwise while switching the CHANNEL SELECTOR on and off channel until sync is lost.
3. Turn the control clockwise and check the number of bars which appear just before pull-in of the picture. Check circuit for abnormal operation if less than two bar pull-in occurs.
4. Continue turning control clockwise while switching the CHANNEL SELECTOR on and off channel until sync is lost.
5. Turn the control counterclockwise and check the point where picture pull-in occurs.
6. Turn the control an additional 1/2 turn counterclockwise.

WIDTH ADJUSTMENT

To adjust picture width, turn WIDTH control, L705 clockwise to increase width, counterclockwise to decrease width. When adjusting picture width, remember to take line voltage into consideration if it differs by more than several volts from the value usually existing when and/or where the receiver is to be operated. Make allowance for voltage difference when adjusting width. Width increases with increase in line voltage.

VERTICAL SIZE AND LINEARITY ADJUSTMENTS

The VERT. SIZE and VERT. LINEARITY controls adjust the height and vertical proportion of the picture. The VERT. SIZE control affects the height of the entire picture but not in a linear manner. The bottom portion of the picture is expanded at a greater rate than the top portion, and the picture center tends to move toward the top of the picture tube.

1. Turn the VERT. SIZE control counterclockwise to increase the height of the picture and clockwise to decrease the picture height.

The VERT. LINEARITY control affects the upper portion of the picture and compensates for non-linearity created by changes made by the VERT. SIZE control.

2. Turn the VERT. LINEARITY control clockwise to expand the upper portion of the picture and counterclockwise to compress the upper portion of the picture.

After adjustment of the picture height and/or vertical linearity, check the VERT. HOLD adjustment; the three controls are interdependent. The same caution that was given for picture width and line voltage applies equally well to vertical picture size.

RASTER CENTERING

It is best to adjust the picture linearity and size, using a test pattern, before centering the picture. If picture tilt exists, temporarily loosen the wing screw at the top of the deflection yoke and rotate the yoke until the tilt is eliminated. Make certain that the deflection yoke is seated as far forward on the picture tube neck as it is possible to move the yoke.

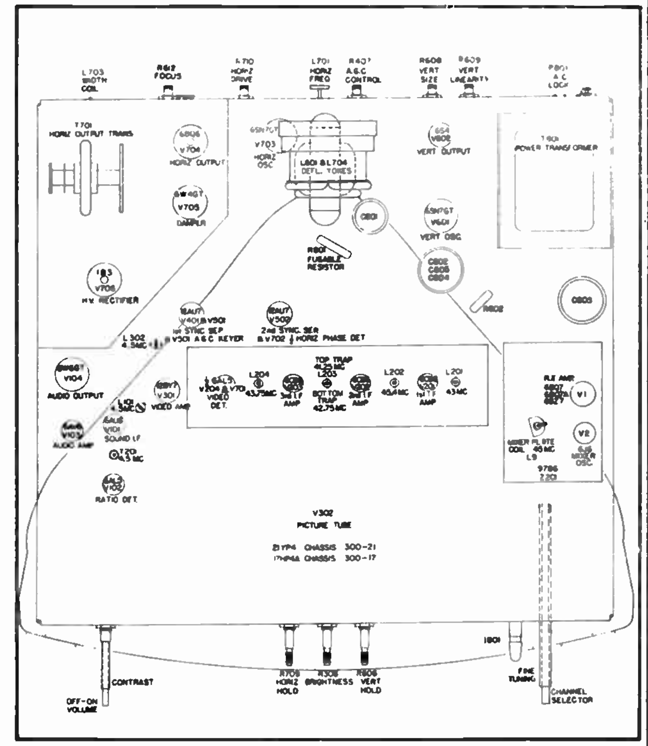


Figure 3. Top View Parts Layout

Raster centering is accomplished by adjusting two permanent magnet rings on the neck of the picture tube just behind the deflection yoke. The centering assembly should be positioned very near the deflection yoke (never more than an inch behind). Due to inter-action it will be necessary to rotate both magnets to obtain correct centering in most instances.

AUTOMATIC GAIN CONTROL

This control and its associated circuits regulate R-F and I-F AGC voltages (within the limits of the AGC system). When the AGC control is turned full clockwise the greatest bias appears on the I-F AGC bus and the lowest bias appears on the R-F AGC bus for a given signal. When the control is reversed the I-F AGC bias voltage is minimum and the R-F AGC bias is maximum for a given signal. This source of high R-F bias is very useful when strong signals cause the video stages to overload, clipping the sync pulses. In very strong signal areas turn the AGC control counterclockwise until loss of sync is eliminated. Do not turn more than necessary because increase bias on the R-F amplifier with simultaneous decrease in I-F bias will lead to excessive noise in the picture after a certain point. Conversely, in weaker signal areas the control should be turned clockwise so that the R-F bias is reduced and the I-F bias is increased. This condition will improve the signal to noise ratio, minimizing "snow", in the picture. Again, do not over control or the I-F stages may be overdriven. The optimum point is a function of signal strength. Use picture quality as an indicating device and adjust for optimum performance.

TABLE III - TV ALIGNMENT PROCEDURE

STEP NO.	SIGNAL GENERATOR FREQUENCY, MC	CONNECT SIGNAL TO	OUTPUT INDICATOR	ADJUST	INSTRUCTIONS	SPECIAL CONNECTIONS AND SETTINGS
			SOUND I-F AND RATIO DETECTOR			
1	4.5 CW	Pin 2 of V301	Meter across pin 7 of V102 and ground.	T101 Pri. (bottom) L101	Tune for maximum reading on meter	Signal level should be low enough to obtain approximately 4 to 7 volts on meter. Use isolation networks shown in Figures 4 and 5.
2	4.5 CW	"	Meter across ground and junction of R105 and C108.	T101 Sec. (top)	Tune for zero meter reading; use same signal level as in step 1.	Repeat tuning of T101 primary and secondary until adjustments do not change.
			TRAPS AND PICTURE I-F			
3	4.5 CW	Pin 2 of V301	Meter connected through detector network to picture tube cathode lead.	L302	Tune for minimum reading on meter.	Detector and isolating networks shown in Figures 4 and 6.
4	41.25 CW	Mixer grid	Voltmeter across R215.	Top of L203	Tune for minimum reading on meter.	Apply -3V bias to AGC bus. See text for connection to mixer grid. Use isolating resistor between negative voltmeter lead and R213. Keep generator output low. Either bias V704 with A-60 volts or remove tube. Set CONTRAST control for maximum contrast. Adjust signal level throughout I-F alignment so that a 1 volt DC output is maintained across R215.
5	43.75 CW	"	"	L204	Tune for maximum.	
6	42.75 CW	"	"	L203	"	
7	45.4 CW	Mixer grid	"	L202	Tune for maximum reading on meter.	
8	43 CW	"	"	L9	Tune for minimum reading on meter.	
9	43 CW	"	"	L201	Tune for maximum.	
10	45 CW	"	"	L9	Tune for maximum.	
11	Repeat steps 4 through 10 until adjustments do not change.					
12	Approximately 43.5 with 10-mc sweep. Marker required.	Mixer grid	High gain scope across R215	Adjust L202, L203 and L204 if necessary.	Set 45.75 mc marker at 50% point with L202. Eliminate tilt with L204.	See Figure 7 for isolation network. Use markers to determine bandpass between picture carrier and 50% point on opposite skirt. Bandpass should be between 3.4 mc and 3.6 mc. Adjust L9 and L201 only when absolutely necessary.

ALIGNMENT

The following alignment procedure describes alignment of the stagger-tuned video I-F amplifier stages and the 4.5 mc sound I-F amplifier stages. The alignment procedure for the VHF TV tuner is described in the 1952 Service Manual. Bulletin No. 301 and 301A covers the tuner. The following discussion describes recommended methods and equipment to be used and precautions to be observed during the alignment procedure. Table III offers a ready reference alignment guide to be followed after the more detailed procedure has been studied.

For best results it is important that alignment be performed on a metal topped bench with all instruments and equipment securely bonded together and to ground. All leads should be as short as is practicable, particularly in the input grid circuits. Allow about fifteen minutes for the test equipment and receiver to warm before beginning the alignment. Isolation circuits will be required for both the input and output connections. It is important that composition resistors, preferably the half-watt size, and disc type ceramic condensers be used in making up these isolation networks so that a minimum amount of external inductance is added to the tuned circuits being adjusted.

The following equipment* will be required in order to align the picture and sound I-F stages of the receiver properly.

1. Accurate CW signal generator covering the following frequencies:

4.5 mc	43.75 mc
41.25 mc	45 mc
42.25 marker freq	45.4 mc
42.75 mc	47.25 marker freq
43 mc	

The generator must have an attenuation control which can be used to vary its output signal level.

2. Sweep frequency generator with a sweep center frequency of approximately 43.5 mc and a 10 mc sweep width.
3. Cathode Ray Oscilloscope with at least a moderately high vertical gain. Must have external sweep input or internal sweep frequency equal to the sweep generator sweep frequency and capable of phase control.
4. DC voltmeter with sensitivity of 20,000 ohms per volt or higher and voltage scale ranges which include approximately 10 volts and 3 volts (full scale deflection). VTVM with zero center scale adjustment is an ideal type.
5. 3 volt bias source such as a battery.
6. Detector network shown in Figure 7.
7. .005 uf isolating condenser.
8. 10K ohm, 1/2 watt composition resistor.
9. .001 uf condenser for shunting oscilloscope input.

*Several instrument manufacturers combine the first three items of the equipment list into one compact instrument assembly.

Before alignment is begun, tune the tuner off-channel by turning the tuner CHANNEL SELECTOR shaft so that the detent roller rests on one of the high points of the drum disc. Bias the grid of V704 with a -60 volts or remove the tube. This is done in order to eliminate spurious signals and the possibility of high shock hazard.

ORDER OF ALIGNMENT. (Use a non-metallic alignment tool or one with a small metal insert.)

1. Ratio Detector Primary
2. 4.5 mc Sound Take-Off
3. Ratio Detector Secondary
4. 4.5 mc Video Trap
5. Tune Co-Sound Trap (L203) for minimum output indication at 41.25 mc
6. Tune 3rd I-F Coil (L204) for maximum output indication at 43.75 mc
7. Tune 2nd I-F Coil (L202) for maximum output indication at 42.75 mc
8. Tune 1st I-F Coil (L202) for maximum output indication at 45.4 mc
9. Tune Converter Coil (L9) for minimum output indication at 43 mc
10. Tune Input Coil (L201) for maximum output indication at 43 mc
11. Tune Converter Coil (L9) for maximum output indication at 45 mc

Repeat steps (5) to (11) until adjustments do not change.

NOTE

In all steps of video I-F alignment, the input signal should be maintained to a level of approximately one (1) volt DC output across video detector load. This is to insure against false tuning due to overloading.

It is important that the alignment be performed in order listed, with the exception of items 1 and 2, because there is some interaction within the various stages.

Sound I-F Alignment

Equipment: Connect the "hot" lead of the CW signal generator to the grid, pin 2, of V301, the video amplifier tube, through a .005 uf isolating condenser as shown in Figure 4. Tune the generator frequency to 4.5 mc, unmodulated. Connect the voltmeter negative lead in series with a 10K isolating resistor to pin 7 of V102, one plate of the ratio detector, as shown in Figure 5. It is important that the 10K ohm isolating resistor be at the very end of the meter lead to avoid regeneration. Connect the positive voltmeter lead to ground.

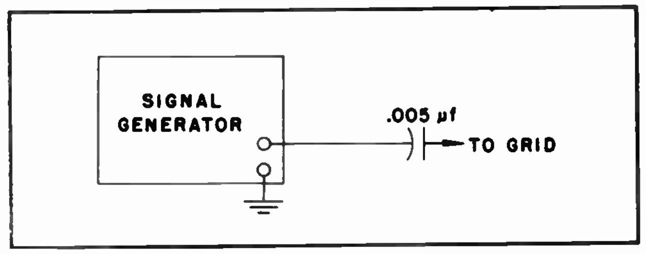


Figure 4. Signal Generator Isolation

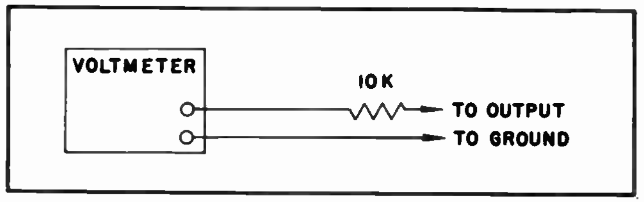


Figure 5. Voltmeter Isolation

Procedure: Adjust L101 and T101 primary (bottom), to obtain a maximum voltmeter reading. The maximum voltage reading should be held at about 4 to 7 volts by decreasing the generator output as the transformer windings are turned to resonance.

Ratio Detector Alignment

Equipment: Generator input remains unchanged from the level that produced 4 to 7 volts in the preceding step. Connect the voltmeter across the junction of R105 and C108; polarity will depend upon which side of resonance the secondary winding of T101 is tuned. If a VTVM is being used, set the zero voltage point up scale so that plus and minus readings may be observed without changing the polarity selector switch on the VTVM. Start with one of the higher scales of the VTVM and decrease the scale setting as the null point is obtained.

Procedure: Tune the secondary (top) of T101 for a zero reading on the voltmeter. Do not change the generator output level from that which produced the 4 to 7 volts in the first step. Repeat tuning of T101 primary and secondary until adjustments do not change.

Trap and Picture I-F Alignment

TUNING 4.5 MC TRAP

Equipment: Connect the CW generator through the .005 uf isolating condenser, to pin 2 of V301 (plate of video detector) and tune the generator to 4.5 mc. Connect the detector network and voltmeter between ground and the cathode of the picture tube as shown in Figure 6.

Procedure: Tune L302 (4.5 mc trap in plate circuit of video amplifier) for minimum indication on voltmeter.

TUNING 41.25 MC TRAP

Equipment: Couple the CW generator "hot" lead to the tuner mixer grid. This may be done in several ways. The .5-3 uuf trimmer condenser (C12 in 1952 Bulletin 301) located in front of the 6J6 and nearest the contact side of the tuner is connected to pin 5 of the 6J6, the mixer grid. This plate of the trimmer condenser is accessible through a hole in the side cover plate. The "hot" generator lead may be coupled to this point through a .005 uf isolating condenser, the condenser pigtail being clipped to the trimmer by some convenient means. Another method of coupling the generator is to remove the 6J6, wrap the isolating condenser pigtail around pin 5 of this tube, and replace it in its socket. In either method take care that the pigtail lead does not short to ground. A third method of coupling is to pull the 6J6 tube shield up on the tube until it is not grounded. Clip the "hot" lead of the generator directly to the tube shield. The tube shield and the tube electrodes form a condenser which capacitively couples the signal to the mixer grid. The capacity is much less than .005 uf, and a much higher level of generator output will be required if this method is utilized.

Connect the negative lead of the voltmeter across R215, the video amplifier load, using the 10K ohm isolating resistor at the end of the lead; connect the voltmeter positive lead to ground. Connect the negative terminal of the 3 volt bias source to the AGC bus; connect the bias source positive lead to ground.

Procedure: Turn the CONTRAST control to its maximum position (extreme clockwise) for remainder of alignment. Tune the traps by setting the trap frequency on the CW generator and adjusting the trap slug for a minimum voltmeter reading. The order of tuning the traps is given in Table III. Keep signal low to avoid overloading I-F circuits.

TUNING PICTURE I-F COILS

Equipment: Instruments and set-up remain the same as for trap alignment during the first part of the procedure. For final adjustment the sweep frequency generator is also used and the voltmeter should be replaced by the oscilloscope. See Figure 7 for oscilloscope isolation details.

Procedure: Tune the I-F coils by setting the coil frequency on the CW generator and adjusting the coil for maximum voltmeter reading. The CW generator output must be attenuated so that the DC output voltage of the video detector (indicated on the voltmeter), remains at 1 volt as the I-F coils are tuned. The order of tuning is from the last I-F stage toward the tuner. Before tuning the grid coil of the 1st I-F stage, temporarily tune the tuner mixer plate coil for a minimum reading on the voltmeter at 43 mc. After the 1st picture I-F grid coil has been tuned, tune the mixer plate coil to 45 mc and repeat the trap and I-F alignment procedure until no additional change in adjustments is necessary.

When no further change takes place, replace the voltmeter with the oscilloscope and replace the CW generator with the sweep frequency generator. Use the same isolating condenser and input connection to the mixer grid. Loosely couple the CW generator (marker) to the input by clipping or touching the CW generator "hot" lead to the unshielded insulated end of the sweep generator "hot" lead. This will afford a small amount of capacitive coupling. If the CW and sweep generators are contained in the same instrument, it will only be necessary to switch on the sweep frequency generator in order to continue the procedure. Tune the sweep frequency generator to a center frequency of approximately 43.5 mc. Use a sweep width of approximately 10 mc so that the base of each of the two response curve skirts is well within the ends of the oscilloscope trace. Check the overall bandwidth, position of the picture carrier, dip in bandpass, and trappage by using the marker pip to locate frequency points on the response curve. See Figure 8. Tune the CW generator to 45.75 mc. The marker pip should appear at approximately the 50% point on the response curve skirt. Readjust individual coils to give proper band pass. Adjust 1st I-F coil to set video carrier (45.75 mc) at 50% (6db) response point. Adjust 2nd I-F coil to set the 50% (6db) bandwidth point (42.25 mc) on sound side. Adjust 3rd I-F coil to eliminate any tilt in the response shape. It should not be necessary to adjust converter or input coil. Once the picture carrier has been correctly positioned at the 50% response point, tune the CW generator to 42.25 mc, which should be the 50% point on the sound side. This will give the proper bandwidth of 3.5 mc. The second I-F coil, L202, may be adjusted slightly to achieve the correct bandwidth.

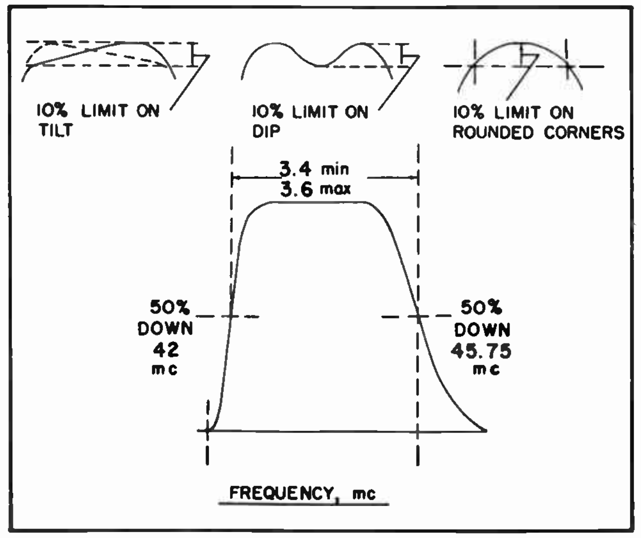


Figure 8. Picture I-F Response Curve

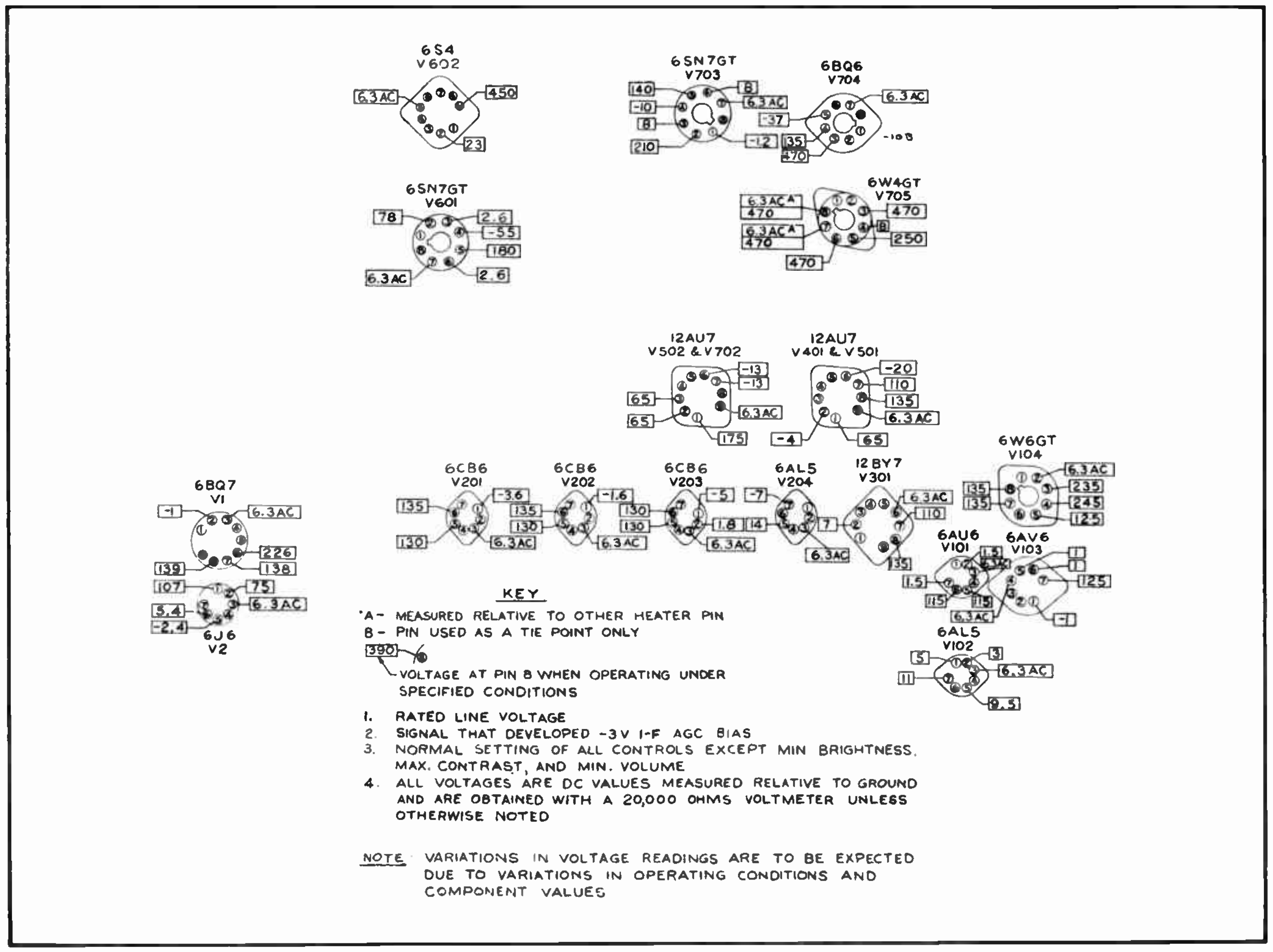


Figure 9. Bottom View Parts Tube Layout

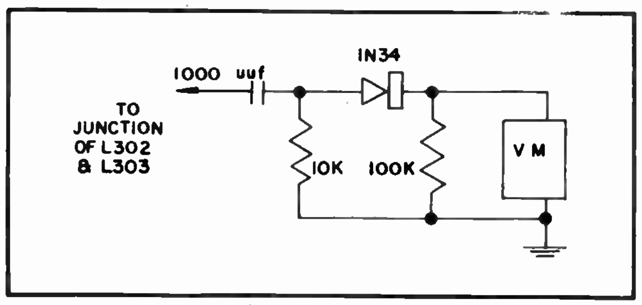


Figure 6. Detector Network

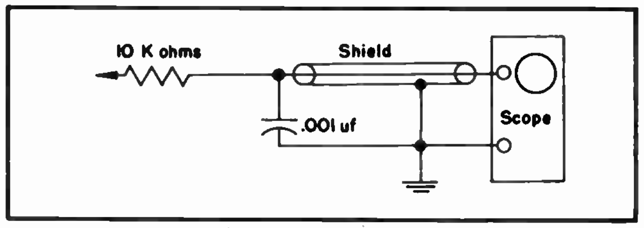


Figure 7. Oscilloscope Isolation

ALL WAVE TUNER

The 9795 is the All-Wave tuner. This tuner incorporates a 6BQ7, a 6BQ7A or a 6BZ7 for an RF amplifier; a 6T4 or 6AF4 as a UHF oscillator with a 6U8 acting as a mixer and VHF oscillator. Refer to Figure 12 for a complete diagram of the 9795.

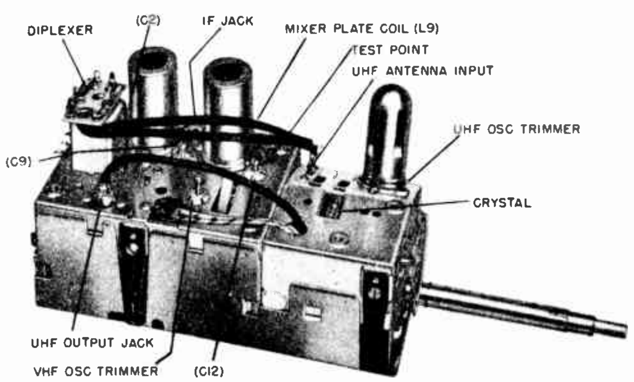


Figure 10. All Wave Tuner

In general, the combination tuner consists of two major units, as noted in the block diagram; the UHF subassembly, and VHF subassembly.

Referring to the block diagram, Figure 11, the antenna is seen to be connected to a diplexer which provides separation of signals above 470 mc for the UHF tuner, and signals below 300 mc for the VHF tuner.

The operation may best be followed by tracing the path of the signal from the antenna through the corresponding tuner and then to the I-F amplifier at its output. When the combination tuner is in UHF position, the signal from the common antenna passes down the twin-lead to the diplexer and continues on to the UHF tuner. Here it goes through two preselector circuits and into a Xtal mixer. The Xtal is supplied with a local oscillator voltage, differing by 40 mc above the signal frequency. After mixing, it becomes a 40 mc signal (I-F frequency) and passes into the VHF tuner. Since the combination tuner has been set for UHF operation, the 40 mc amplifier, which is noted in a block below the VHF tuner, is now in place of one of the VHF channels. In this manner, the signal is amplified again at 40 mc and passes on through the output to the I-F stage.

When the combination tuner is in the VHF position, the following path of signal may be traced: as previously noted, the signal travels from the common antenna to the diplexer, but now, since its frequency is below 300 mc, it is diverted directly to the VHF tuner input. At this point, it is connected to one of the channels (2 - 13) as in the usual TV band, and is amplified at this corresponding frequency. At the end of this amplification, it is mixed (in the VHF tuner) by a 6U8 stage. This provides the local oscillator, again 40 mc above the signal, and the result in output is then the 40 mc signal which is coupled by the output plate coil to the I-F strip.

The various components of the major subassemblies may be seen from the circuit diagram (figure). In the UHF tuner, L22 and L23 are the preselector circuits. L24 and L25 make up the oscillator inductance. The oscillator tube is either a 6AF4 or 6T4, as shown. It should be noted that the coils, L20 and L21, along with C30, C31 and C32, comprise the high-pass filter portion of the diplexer. The low-pass filter, consisting of coils La and Lb, along with the two 1.5 mmfd condenser, is the other portion of the diplexer which diverts signals lower than 300 mc to the VHF tuner.

Shaft Function

1. FINE TUNING - Outer shaft for VHF and UHF oscillators fine tuning.

2. SWITCHING - Center shaft includes nine detent positions, eight for UHF decade coil board strips covering frequency channels 14 to 19; 20 to 29; 30 to 39; 40 to 49; 50 to 59; 60 to 69; 70 to 79 and 80 to 83. VHF channels 10 through 13 may be received on first UHF decade position. The ninth position allows VHF reception.

3. SWITCHING - Inner shaft includes twelve detent positions, ten for UHF unit digits (individual channel selection included within the above eight decades), twelve positions for VHF channels 2 to 13.

4. VHF TUNING - To receive VHF channels 2 through 13, set middle section of tuning knob assembly so that "VHF" and channel numbers are directly in front of pilot light. These VHF channel numbers will be found on the inner circles of numbers. To switch VHF channels, rotate front crown control knob only.

5. UHF TUNING - To receive UHF channels, rotate middle section either right or left from VHF position. First half of UHF channel number is controlled by middle knob. Second half of UHF channel number is controlled by front crown knob; example, channel 56 - the middle knob will place the first half of the UHF channel number (5) in front of the pilot light. The front crown knob will place the second half of this UHF channel number (6) in front of the pilot light, thus reducing UHF channel 56.

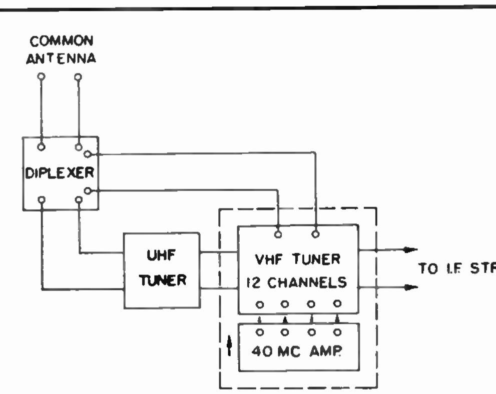


Figure 11. All Wave Tuner Block Diagram

ALL-WAVE I-F ALIGNMENT PROCEDURE - GENERAL

The combination All-Wave tuner contains two sections - the first (front section) contains the UHF portion. The second (rear section) is the usual 12-channel VHF turret tuner. There is one difference in the VHF section, in that it contains a contact board or cascode strip. This provides the equivalent of a 13th position, and is held out when the decade knob is in the VHF position. The units front knob then operates the rear turret from channel 2 to 13. It is also held out when the decade knob is in the 10's position for channels 10, 11, 12 and 13. UHF operation is obtained when the decade center knob is in the 10's position for channels 14 to 19 and for all succeeding decade positions, up to 83.

I-F ALIGNMENT

Set the tuner in the VHF position (on channel 10) and insert a signal at the test point (refer to Figure 10) through a .005 capacitor with the proper termination for the generator being used. Use a -3 volts for the AGC bias. Observe the output of the video detector with a 10K resistor and a .001 capacitor isolation network which is connected to the oscilloscope vertical terminals or a voltmeter.

A. Apply a 43 mc signal and align the 1st I-F grid coil until a maximum indication is observed.

B. Apply a 45 mc signal and align the output plate coil (L9) of the tuner for maximum indication. A sweep may then be applied and the I-F touched up for proper response. It is preferable to adjust coils in the I-F strip slightly, rather than accommodate discrepancies in the curve with changes in the settings of the adjustments mentioned in A and B.

R-F ALIGNMENT - CHECK VHF

Set the tuner to the VHF position on the decade center knob and the units front knob on channel 10. Connect a sweep to the VHF or the antenna point of the diplexer. Note overall wave shape and position of sound in video carrier. Adjust local oscillator slug to proper frequency with fine tuning in center of scale. A bias of 3 volts is applied to AGC during the above operation.

R-F ALIGNMENT - CHECK UHF

With the tuner at channel 19, with three or four volts of bias on the I-F AGC and three volts of R-F AGC. Connect a UHF sweep to the antenna terminals with the proper dummy termination (300 ohms total). Observe the output on the video detector with proper isolation network. (10K resistor and a .001 capacitor on scope.) Use a 60 cycle sweep that is phased properly.

A. Check wave shape and operation of channels 14, 21, 31, 41, 51, 61, 71 and 81. These should operate positively and not be intermittent.

B. Note above operation to be made with fine tuner in center of fine tuning range.

NOTE

To adjust VHF local oscillators, place tuner in VHF position, remove knobs, place fine tuner in middle of range so VHF local oscillators can be reached with proper alignment tool through UHF unit.

To adjust UHF local oscillator, place tuner in UHF position, remove knobs, place fine tuner in middle of range. Rotate units front knob. Adjust front screw head.

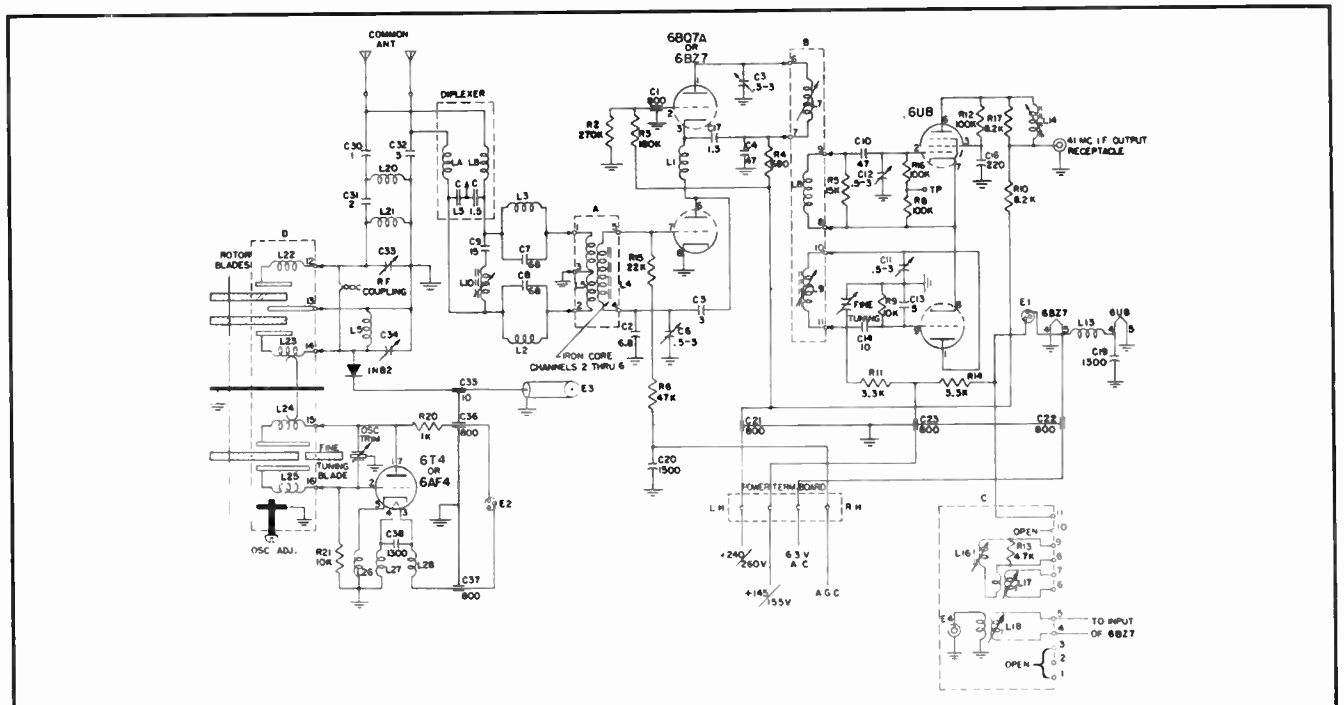


Figure 12. All Wave Tuner Schematic

PARTS LIST

NOTE: Unless otherwise noted all resistors are 1/2 watt, composition type, ±10% tolerance with values given in ohms.

NOTE: Unless otherwise noted all condensers are 600 volt, molded phenolic type, ±20% tolerance with whole number values given in micromicrofarads and decimal fraction values given in microfarads. GMC - guaranteed minimum capacity.

SYMBOL	PART NO.	VALUE	TOL.	VOLTS	TYPE
	CAPACITORS				
C100	Not Used				
C101	4046	68	10%	500	C.T.
C102 C103	4036	2X.004		500	C.D.
C104 C105	5443	10 100			
C106	4065	330			C.T.
C107	See Electrolytic				
C108	14031	.001		500	C.D.
C109	4029	.005		500	C.D.
C110	4029	.005		500	C.D.
C111	4142	.01		400	
C112	4124	.022		600	
C200	Not Used				
C201	4029	.005		500	C.D.
C202	14031	.001		500	C.D.
C203	14031	.001			C.D.
C204	14031	.001		500	C.D.
C205	14054	820	10%	500	C.T.
C206	14056	24	10%	500	Q.C.
C207	14031	.001		500	C.D.
C208	14031	.001		500	C.D.
C209	14054	820	10%	500	C.T.
C210	14056	24	10%	500	Q.C.
C211	Part of L203	47		Part of L203	
C212	14031	.001		500	C.D.
C213	14031	.001		500	C.D.
C214	14031	.001		500	C.D.
C215	14054	820	10%	500	C.T.
C216	14031	.001		500	
C217	14058	10	10%	500	Q.C.
C300	Not Used				
C301	4069	2.2		500	Q.C.
C302	4029	.005		500	C.D.
C303	Part of L302	47			
C304	4131	.22		200	
C400	Not Used				
C401	4131	.22		200	
C402 C403	Not Used				
C404	4172	.47		200	
C405	4029	.005		500	C.D.
C406	4029	.005		500	C.D.
C500	Not Used				
C501	4136	.0022	10%	400	
C502	4026	220			Mica or Ceramic
C503	4127	.0047		400	
C504 C505 C506	Part of 2501 #9695				
C600	Not Used				
C601	14113	.0039	10%	600	
C602	4158	.047	10%	200	
C603	4144	.1		600	
C604	4144	.1		600	
C605	See Electrolytic				
C606	4133	.047		600	
C607	4124	.022		600	
C608	See Electrolytic				
C700	Not Used				
C701	14031	.001		500	C.D.
C702	4175	.001	10%	400	
C703	4175	.001	10%	400	
C704	4185	.0047	10%	400	
C705	4158	.047	10%	200	
C706	4085	3900	10%	500	Silver Mica
C707	14009	470	10%		Mica
C708	4175	.001	10%	400	
C709	14009	470	10%		Mica
C710	4029	.005		500	C.D.
C711	14053	100	10%	3000	C.D.
C712	14048	47	10%	3000	C.D. or Mica
C713	4144	.1		600	
C714	14048	47	10%	3000	C.D. or Ceramic
C800	Not Used				
C801	See Electrolytic				
C802	See Electrolytic				
C803	See Electrolytic				
C804	See Electrolytic				
C805	14069	.01		1500	G.P. Disc
C806	14069	.01		1500	G.P. Disc
	CAPACITORS - ELECTROLYTIC				
C107	4209	5 mfd	-	50	-
C605	4261	30 mfd	-	50	-
C608	4253	10 mfd	-	600	-
C801	4245	140 mfd	-	150	-
C802	4261	140 mfd	-	150	-
C803	4257	200 mfd	-	150	-
C804	4261	200 mfd	-	150	-

SYMBOL	PART NO.	VALUE	TOL.	WATTS	TYPE
	RESISTORS				
R100	Not Used				
R101	4616	150			
R102	4650	2.2K			
R103	4663	270			
R104	4597	10K			
R105	4586	33K			
R106	4597	10K			
R107	See Controls				
R108	4505	10M	20%		
R109	24616	24K	5%		
R110	24610	20K	5%		
R200	Not Used				
R201	4542	1K	20%		
R202	4616	150			
R203	4559	47K			
R204	4597	10K			
R205	4639	47			
R206	4664	470	20%		
R207	4628	22K			
R208	4639	47			
R209	4664	470	20%		
R210	4619	15K			
R211	4616	150			
R212	4664	470	20%		
R213	4619	15K			
R214	Part of L206	10M			
R215	4576	4.7K			
R300	Not Used				
R301	Not Used				
R302	4666	33			
R303	See Controls				
R304	5547	8.2K			
R305	4610	1.5K	5%		
R306	4612	3.3K			
R307	4677	330K	20%		
R308	See Controls				
R309	4501	22K	20%		
R400	Not Used				
R401	4542	1K	20%		
R402	4542	1K	20%		
R403	34620	2.2M	5%		
R404	34532	330K	5%		
R405	4619	15K			
R406	4506	470K	20%		
R407	See Controls				
R408	4521	15K	20%		
R409	24541	3.3K	20%		
R410	4543	120K			
R411	34659	4.7M			
R500	Not Used				
R501	4544	4.7M	20%		
R502	4622	470K			
R503	4677	330K	20%		
R504	24525	2.2K	5%		
R505	24525	2.2K	5%		
R506	24517	1.8K	5%		
R507	24517	1.8K	5%		
R508	4549	270			
R509 R510 R511	Part of 2501 #9695				
R600	Not Used				
R601	4544	4.7M	20%		
R602	34507	180K			1
R603	4659	1K			
R604	34571	680K			1
R605	34593	1.2M			
R606	See Controls				
R607	4629	5.6K			
R608	See Controls				
R609	See Controls				
R610	4664	470	20%		
R611	24697	1501	20%		1
R612	See Controls				
R613 R614	56052 56052			Part of Yoke Assembly	
R700	Not Used				
R701	4571	100K			
R702	4571	100K			
R703	4622	470K			
R704	4544	4.7M	20%		
R705	4651	8.2K			
R706	4548	120K			
R707	4610	1.5K			
R708	24670	82K			
R709	See Controls				
R710	See Controls				
R711	4629	5.6K			
R712	4722	470K			
R713	24580	8.2K			
R714	4735	2.2			
R715	14529	22			
R716		1K		Part of Yoke Assembly	
R800	Not Used				
R801	4762	7.5	10%	5	
R802	4774	120	10%	10	

SYMBOL	PART NO.	DESCRIPTION
	CONTROL - SWITCHES	
R107	4910	Control - Volume, 500K
R303	4910	Control - Contrast, 500K
R308	4867	Control - Brightness, 50K
R407	4853	Control - AGC, 50K
R606	4868	Control - Vertical Hold, 1M
R608	4864	Control - Vertical Size, 2M
R609	4865	Control - Vertical Linearity, 5K
R612	4864	Control - Focus, 2M
R709	4869	Control - Horizontal Hold, 25K
R710	4859	Control - Horizontal Drive, 25K
	TRANSFORMERS	
T101	5443	Transformer - Ratio Detector
T102	5170	Transformer - Audio Output
T601	5157	Transformer - Vertical Output
T701	5184	Transformer - Horizontal Output
T801	5039	Transformer -Isolation Power
	COILS	
L1	-	Coil - I-F Trap
L2	-	Coil - I-F Trap
L3	-	Coil - Series Trap (I-F Band)
L4	-	Coil - 5 Turns 1/4 O.D., Cascode Coupling
L5	-	Coil - 16 Turns 1/4 O.D., Heater
L6	-	Coil - 16 Turns 1/4 O.D., Heater
L7	-	Coil - Neutralizing
L8	-	Coil - Mixer Plate (Compensating Inductance)
L9	-	Coil - Mixer Plate
L101	5454	Coil - 4.5 Mc Sound Take-Off
L201	5562	Coil - I-F Input
L202	5541	Coil - 1st I-F
L203	5542	Coil - 2nd I-F
L204	5543	Coil - 3rd I-F
L205	5545	Coil - Peaking Series (Video Detector)
L206	5340	Coil - Peaking Shunt (Video Detector)
L301	5547	Coil - Peaking series (Video Amp.)
L302	5402	Coil - 4.5 Mc Video Trap
L303	5548	Coil - Peaking Shunt (Video Amp.)
L701	5447	Coil - Horizontal Frequency
L702	5266	Coil - Damper Choke
L703	5464	Coil - Width Control
	MISCELLANEOUS	
I801	9505	Light - Pilot
J100	6198	Socket - Speaker
J600	6101A	Yoke
M301	9702	Trap - Ion
M302	9722	Magnet - Centering
P100	6235	Plug - Speaker
P600	-	Plug - Yoke
P801	6126	Receptacle
S801	4910	Switch - On-Off
X801 X802	9735	Rectifiers - Selenium
Z201	9786 or 9795	Tuner - VHF 40 Mc Standard Coil Tuner - UHF, VHF 40 Mc Standard Coil
Z202	3195	Tuner output 22 Mmf + or - 10% which is equiv. to 9-1/2 in. of cable
Z301	6108A	Socket - Kinescope
Z702	6227	Plug - Anode Connector with Lead

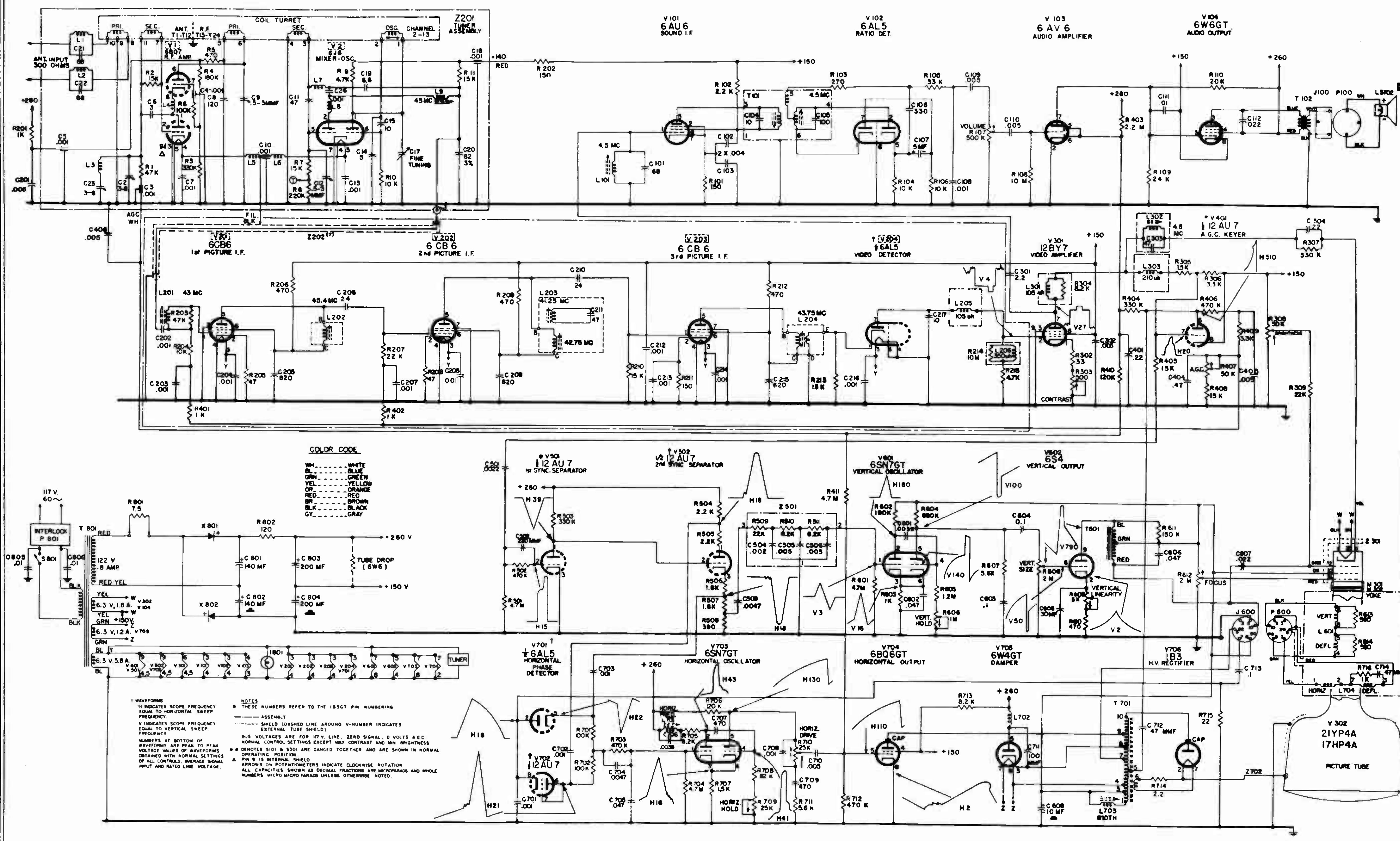


Figure 13. Schematic Diagram for Chassis 300

CHASSIS 375-21

MODELS 21M910, 21B911, 21P912

IDENTIFICATION

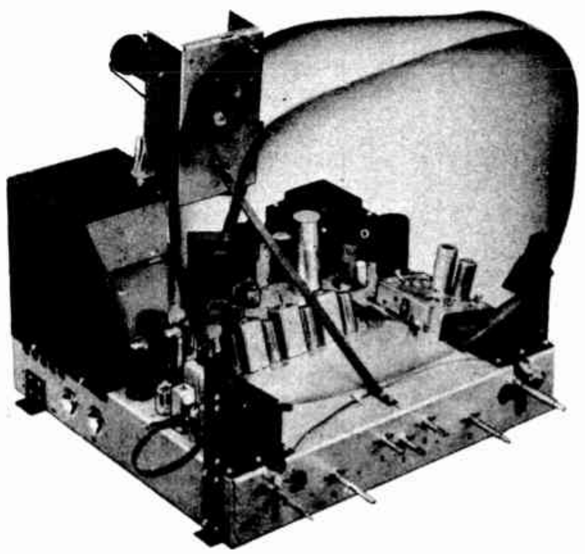


Figure 1. Chassis 375

Chassis 375 is similar to the 300 chassis. The chassis are identical with the exceptions to be pointed out in this bulletin. Chassis 375 includes an AM Radio Tuner. This Tuner employs two tubes; a 6BE6 as a converter and a 6BA6 as an I-F amplifier. In conjunction with the radio, there is an ENTERTAINMENT SELECTOR SWITCH. This switch is used for program selection, RADIO, TV and PHONO. When the switch is in TV position, the chassis operates as would Chassis 300. When the switch is in RADIO-PHONO, parts of the TV CIRCUIT cease to operate, due to an electrical difference which is caused by the switching action. The horizontal oscillator and horizontal output circuit is made inoperative, due to the removal of B+, thus removing the second anode voltage, etc.

ELECTRICAL AND MECHANICAL DATA

TABLE I - ELECTRICAL AND MECHANICAL DATA

Operating Voltage	115 Volts AC, 60 cps
Power Consumption	140 Watts
Tuning Range	
TV	Channels 2-13
AM Radio	535 KC to 1620 KC
Maximum Audio Power Output	3.25 Watts
Audio Output Impedance	3.2 Ohms at 400 cps.
Intermediate Frequencies	
Picture Carrier	45.75 MC
TV Sound Carrier	4.5 MC
AM Sound Carrier	455 KC
TV Antenna Input Impedance	300 Ohms Balanced
Radio Antenna	Broadcast Band Loop
Picture Tube Size	21" Rectangular

TABLE II - TUBE* COMPLEMENT

TUBE	TYPE	FUNCTION
V1	6BZ7 or 6BQ7	R-F Amplifier
V2	6J6	Oscillator-Mixer
V101	6AU6	Sound I-F
V102	6AL5	Ratio Detector
V103	12AX7	1st Audio
V104	6V6	Audio Output
V105	6V6	Audio Output
V201	6CB6	1st Picture I-F
V202	6CB6	2nd Picture I-F
V203	6CB6	3rd Picture I-F
V204	1/2 6AL5	Video Detector
V301	12BY7	Video Amplifier
V302	21YP4	Picture Tube
V401	1/2 6AL5	Delayed AGC
V402	1/2 12AU7	AGC Keyer
V501	1/2 12AU7	1st Sync Sep.
V502	1/2 12AU7	2nd Sync Sep.
V601	6SN7	Vertical Oscillator
V602	6S4	Vertical Output
V701	1/2 6AL5	Horiz. Phase Detec.
V702	1/2 12AU7	Horiz. Phase Detec.
V703	6SN7	Horiz. Oscillator
V704	6BQ6	Horiz. Output
V705	6W4	Damper
V706	1B3	H.V. Rectifier
X801	Sel. Rect.	L.V. Rectifier
X802	Sel. Rect.	L.V. Doubler

*Including crystal and selenium rectifiers.

TABLE III - AM ALIGNMENT PROCEDURE*

Step No.	CW Signal Freq.	Connect Signal To	Condenser Setting	Adjust	Instructions
1	455 KC	Pin 1 of V1	Full open	T2 Primary and Secondary T1 Primary and Secondary	Use a modulated signal. Maintain generators signal level so as to obtain .4 volts reading on output meter. (Meter across audio disconnect speaker output transformer secondary).
2	1620 KC	Radiate into loop	"	Trimmer C2A	Connect radiating loop consisting of several turns (having same shape as AM loop) about 4 inches from AM loop. Maintain same output reading as above by attenuating input signal.
3	1400 KC	"	Tune condenser gang for signal	Trimmer C1A	Tune for maximum output. Maintain same output as above.
4	600 KC	"	"	Bend end plates of C1	Maintain same output as above.

*Refer to Bulletin 403 for TV ALIGNMENT TABLE.

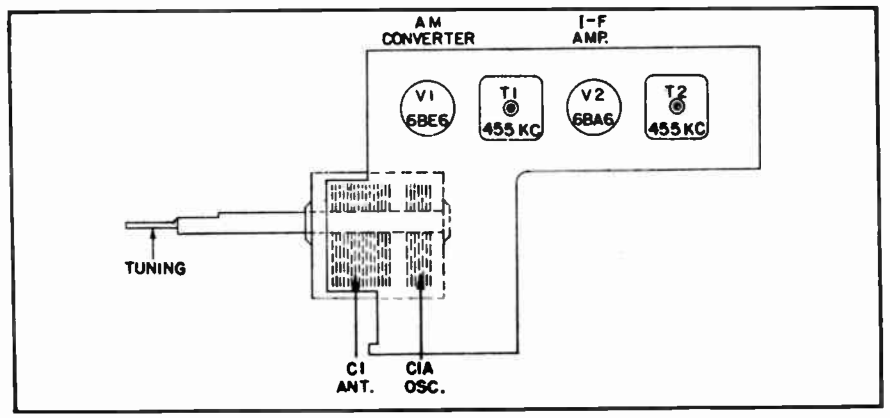


Figure 2. Top View Parts Layout

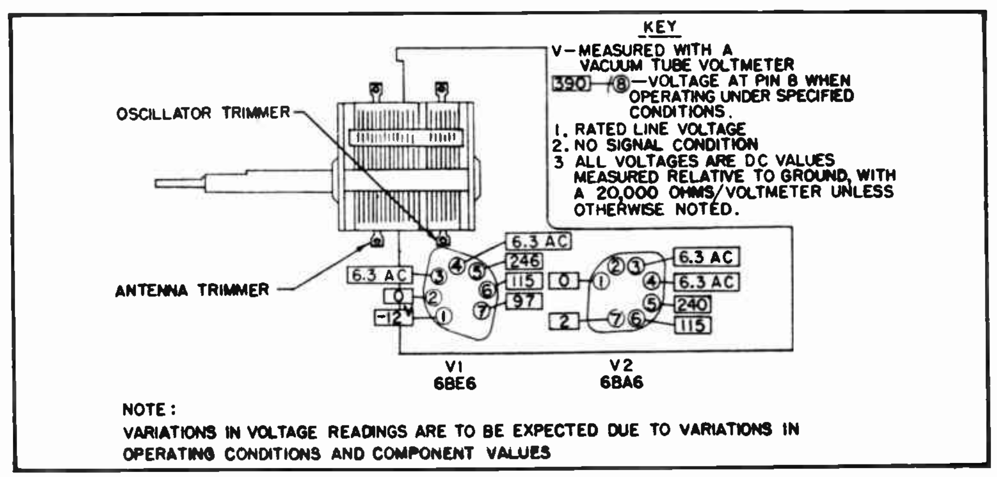


Figure 3. Bottom View Tube Layout and Pin Voltage Information

PARTS LIST

NOTE: Unless otherwise noted all resistors are 1/2 watt, composition type, ±10% tolerance with values given in ohms.

NOTE: Unless otherwise noted all condensers are 600 volt, molded phenolic type, ±20% tolerance with whole number values given in micromicrofarads and decimal fraction values given in microfarads. GMC - guaranteed minimum capacity.

SYMBOL	PART NO.	VALUE	TOL.	VOLTS	TYPE
CAPACITORS					
C101	4046	68	10%	500	C.T.
C102, C103	4036	2X.004		500	C.D.
C104, C105	5443	10, 100			
C106	4065	330			C.T.
C107	See Electrolytic				
C108	14031	.001		500	C.D.
C109	4029	.005		500	C.D.
C110	4029	.005		500	C.D.
C111	4142	.01		400	Tub. Paper
C112	4124	.022			Tub. Paper
C113	4148	.047		400	T.P.
C114	4127	.0047		400	T.P.
C115	4152	.033		400	T.P.
C116	4148	.047		400	T.P.
C117	4148	.047		400	T.P.
C118	4152	.033		400	T.P.
C119	See Electrolytic				
C120	4150	.1		400	T.P.
C201	4029	.005		500	C.D.
C202	14031	.001		500	C.D.
C203	14031	.001		500	C.D.
C204	14031	.001			C.D.
C205	14054	820	10%	500	C.T.
C206	14056	24	10%	500	Q.C
C207	14031	.001		500	C.D.
C208	14031	.001		500	C.D.
C209	14054	820	10%	500	C.T.
C210	14056	24	10%	500	Q.C.
C211	Part of L203	47		Part of L203	
C212	14031	.001		500	C.D.
C213	14031	.001		500	C.D.
C214	14031	.001		500	C.D.
C215	14054	820	10%	500	C.T.
C216	14031	.001		500	
C217	14058	10	10%	500	Q.C.
C301	4069			500	Q.C.
C302	4029	.005		500	C.D.
C303	Part of L302	47			
C304	4131	.22		200	T.P.
C401	4131	.22		200	T.P.
C402, C403	Not Used				
C404	4172	.47		200	T.P.
C405	4029	.005		500	C.D.
C406	4029	.005		500	C.D.
C501	4136	.0022	10%	400	T.P.
C502	4028	220			Mica or Ceramic
C503	4127	.0047		400	T.P.
C504, C505, C506	Part of 2501 9695				
C601	14113	.0039	10%		T.P.
C602	4158	.047	10%	200	T.P.
C603	4144	.1			T.P.
C604	4144	.1			T.P.
C605	See Electrolytic				
C606	4133	.047			T.P.
C607	4124	.022			T.P.
C608	See Electrolytic				
C701	14031	.001		500	C.D.
C702	4175	.001	10%	400	T.P.
C703	4175	.001	10%	400	T.P.
C704	4185	.0047	10%	400	T.P.
C705	4158	.047	10%	200	T.P.
C706	4085	3900	10%	500	Silver Mica
C707	14009	470	10%		Mica
C708	4175	.001	10%	400	T.P.
C709	14009	470	10%		Mica
C710	4029	.005		500	C.D.
C711	14053	100	10%	3000	
C712	14048	47	10%	3000	C.D. or Mica
C713	4144	.1			T.P.
C714	14048	47	10%	3000	C.D. or Mica
C801	See Electrolytic				
C802	Part of 4261	140		150	See Electrolytic
C803	4257	200		150	See Electrolytic

SYMBOL	PART NO.	VALUE	TOL.	VOLTS	TYPE
C804	Part of 4261	200		150	See Electrolytic
C805	14089	.01		1500V AC	G.P. Disc
C806	14069	.01		1500V AC	G.P. Disc
CAPACITORS - ELECTROLYTIC					
C107	4209	5 mfd	-	50	-
C119	4258	50 mfd	-	50	-
C605	4261	30 mfd	-	50	-
C608	4253	10 mfd	-	600	-
C801	4245	140 mfd	-	150	-

SYMBOL	PART NO.	VALUE	TOL.	WATTS	TYPE
RESISTORS					
R101	4816	150			
R102	4650	2.2K			
R103	4663	270			
R104	4597	10K			
R105	4586	33K			
R106	4597	10K			
R107	See Control				
R108	24670	82K			
R109	See Control				
R110	4555	680K	20%		
R111	4504	47K	20%		
R112	See Control				
R113	4505	10M	20%		
R114	4506	470K	20%		
R115	4506	470K	20%		
R116	4505	10M	20%		
R117	4506	470K			
R118	4634	180K			
R119	14639	270		2	
R120	4506	470K	20%		
R121	4586	33K			
R201	4616	150			
R202	4542	1K	20%		
R203	4559	47K			
R204	4597	10K			
R205	4639	47			
R206	4864	470	20%		
R207	4628	22K			
R208	4639	47			
R209	4664	470	20%		
R210	4619	15K			
R211	4618	150			
R212	4664	470	20%		
R213	4619	15K			
R214	Part of L206	10M			
R215	4576	4.7K	10%		
R302	4666	33	10%		
R303	See Control				
R304	Part of 5547	8.2K			
R305	4610	1.5K	5%		
R306	4612	3.3K			
R307	4677	330K	20%		
R308	See Control				
R309	4501	22K	20%		
R401	4542	1K	20%		
R402	4542	1K	20%		
R403	34620	2.2M	5%		
R404	34532	330K	5%		
R405	4619	15K			
R406	4506	470K	20%		
R407	See Control				
R408	4521	15K	20%		
R409	24541	3.3K	20%		
R410	4548	120K			
R411	34659	4.7M			
R501	4544	4.7M	20%		
R502	4822	470K			
R503	4677	330K	20%		
R504	24525	2.2K	5%		
R505	24525	2.2K	5%		
R506	24517	1.8K	5%		
R507	24517	1.8K	5%		
R508	4549	270			
R509, R510, R511	Part of Z501 9695				

SYMBOL	PART NO.	VALUE	TOL.	WATTS	TYPE
R601	4544	4.7M	20%		
R602	34507	180K		1	
R603	4659	1K			
R604	34571	680K		1	
R605	34593	1.2M			
R606	See Control				
R607	4629	5.6K			
R608	See Control				
R609	See Control				
R610	4864	470	20%		
R611	24697	1501	20%	1	
R612	4864	(2M) Focus			
R613	580	Part of			
R614	560	Yoke Assembly			
R701	4571	100K			
R702	4571	100K			
R703	4622	470K			
R704	4544	4.7M	20%		
R705	4651	8.2K			
R706	4548	120K			
R707	4810	1.5K			
R708	24670	82K			
R709	See Control				
R710		(25K) Horiz. Driv			
R711	4629	5.6K			
R712	4722	470K			
R713	24580	8.2K		2	
R714	4735	2.2			
R715	14529	22		2	
R716		Part of Yoke Assembly			
R801	4762	7.5		5	
R802	4774	120		10	
R803	4772	1500		10	

SYMBOL	PART NO.	DESCRIPTION
CONTROL - SWITCHES		
R107	4914	Control - Treble, 2M
R109	4914	Control - Bass, 2M
R112	4912	Control - Volume, 2M
R303	4912	Control - Contrast, 500
R308	4915	Control - Brightness, 50K
R407	4853	Control - AGC, 50K
R606	4832	Control - Vertical Hold, 1M
R608	4864	Control - Vertical Size, 2M
R609	4865	Control - Vertical Linearity, 5K
R709	4859	Control - Horizontal Hold, 25K
R710	4859	Control - Horizontal Drive, 25K
TRANSFORMERS		
T101	5443	Transformer - Ratio Detector
T102	5170	Transformer - Audio Output
T601	5157	Transformer - Vertical Output
T701	5184	Transformer - Horizontal Output
T801	5039	Transformer - Isolation Power
COILS		
L101	5454	Coil - 4.5 Mc Sound Take-Off
L201	5562	Coil - I-F Input
L202	5541	Coil - 1st I-F
L203	5542	Coil - 2nd I-F
L204	5543	Coil - 3rd I-F
L205	5545	Coil - Peaking Series (Video Detector)
L206	5340	Coil - Peaking Shunt (Video Detector)
L301	5547	Coil - Peaking Series (Video Amp.)
L302	5402	Coil - 4.5 Mc Video Trap
L303	5548	Coil - Peaking Shunt (Video Amp.)
L701	5447	Coil - Horizontal Frequency
L702	5266	Coil - Damper-Choke

SYMBOL	PART NO.	DESCRIPTION
L703	5464	Coil - Width Control
MISCELLANEOUS		
I801	9505	Light - Pilot
J100	6198	Socket - Speaker
J101	8121	Receptacle - Phono
J600	6101A	Yoke
LS101	9103	Speaker - 10" Low Frequency
LS102	9091	Speaker - 5-1/4" High Frequency
M301	9702	Trap - Ion
M302	9722	Magnet - Centering
P100	6235	Plug - Speaker
P600	6234	Plug - Yoke
P801	6126	Receptacle - Power Interlock
S901, A,B,C,D	6037	Switch - Rotary
X801, X802	9735	Rectifiers - Selenium
Z201	9788 or 9795	Tuner - VHF 40 Mc Standard Coil Tuner - UHF-VHF 40 Mc Standard Coil
Z202		Tuner - Output cable 22 mmf ±10% which is equiv. to 9-1/2" of cable #3195
Z301	8108A	Socket - Kinescope
Z702	6227	Plug - Anode Connector with Lead

AM RADIO

SYMBOL	PART NO.	DESCRIPTION
CAPACITOR		
C1, C1A, C2, C2A	4418	Variable Section, Loop Antenna Trimmer, Loop Section Variable Section, Oscillator Trimmer, Oscillator Section
C3	14081	100 mmf 20%, G/P. Tubular
C4	14084	.02 Hi-Cap Ceramic Disc
C5	14064	.02 Hi-Cap Ceramic Disc
C6	4097	.01 Hi-Cap Ceramic Disc
C7	4097	.01 Hi-Cap Ceramic Disc
C8		125 mmf (Part of Item T2)
C9	14057	47 mmf 20% G.P. Tubular
RESISTORS		
R1	4506	470K 20%, 1/2 Watt
R2	4628	22K 10%, 1/2 Watt
R3	4511	100K 20%, 1/2 Watt
R4	14615	160 5%, 1/2 Watt
R5	24600	15K 10%, 2 Watt
R6	4502	2.2 Megohm 20%, 1/2 Watt
R7	4504	47K 20%, 1/2 Watt
TRANSFORMERS		
T1	5171	I-F Input, 455 KC
T2	5172	I-F Output, 455 KC
COILS		
L1	5465	Loop Antenna
L2	5549	AM Oscillator
MISCELLANEOUS		
Z1	9757	Diode Crystal (1N65)
TUBES		
V1	6BE6	
V2	6BA6	

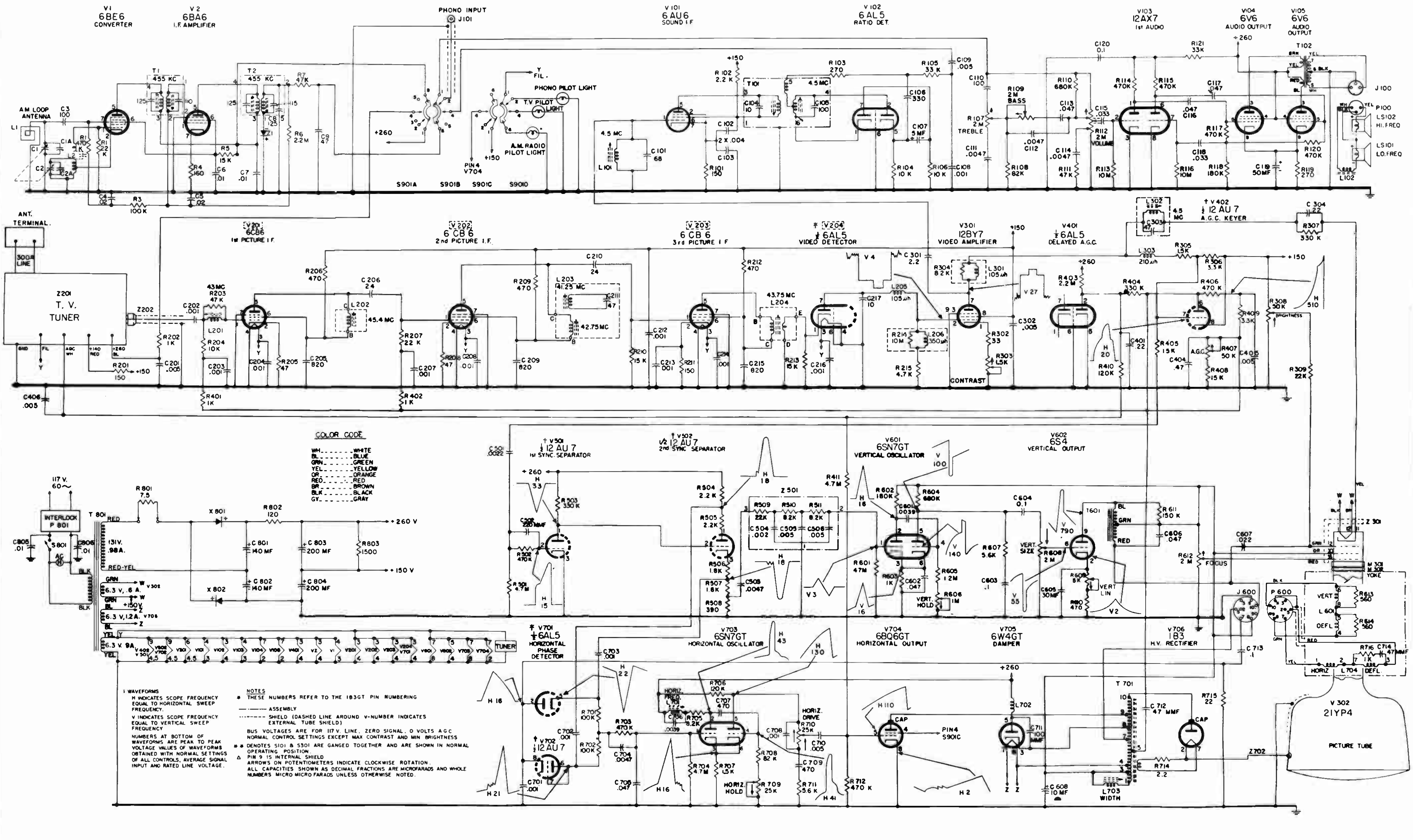


Figure 4. Schematic Diagram for Chassis 375.

CHASSIS 400-21
MODELS 21M721, 21M722, 21B723, 21P724

CHASSIS 401-21
MODELS 21M146, 21B147, 21P148, 21M320, 21B321, 21P322

CHASSIS 402-24
MODELS 24M150, 24B151, 24P152

CHASSIS 403-24
MODELS 24M725, 24B726, 24P727

NOTE

This information also covers the 400 series chassis, incorporating the "All-Wave Tuner".
Chassis incorporating the "All-Wave Tuner" can be identified by a "U" following the model number. (Example 21M721U)

IDENTIFICATION

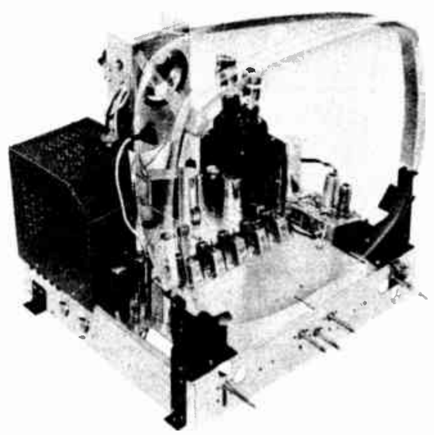


Figure 1. Chassis 401-21

INTRODUCTION

Chassis 400-21, 401-21, 402-24 and 403-24 will come under the collective heading of the 400 series chassis. The 400 series chassis contain all of the outstanding Hoffman features, plus new electrical and mechanical modifications. The same fine workmanship and excellent performance that was typical of the Mark V chassis have been incorporated. All changes, both mechanical and electrical, were made with the service man in mind.

Chassis 400 and 401 are identical in every respect except for the power supply and audio portion of Chassis 400 which incorporates a Push-Pull, Hi-Fi audio circuit.

Chassis 402 and Chassis 403 are identical except for the audio portion of Chassis 403 which incorporates a Push-Pull, Hi-Fi audio circuit. Chassis 400-401 and 402-403 are similar except for the following: Chassis 402 and 403 drive a 24 inch picture tube, whereas Chassis 400 and 401 drive a 21 inch picture tube. The increase in picture tube size on Chassis 402 and 403 require an increase in the amount of energy needed to sweep the larger tube. Therefore the major electrical difference will be found in the high voltage and sweep circuits.

The major mechanical difference, besides the increase in picture tube size, is the use of a 90° deflection yoke assembly.

ELECTRICAL AND MECHANICAL DATA

TABLE I - ELECTRICAL AND MECHANICAL DATA

Operating Voltage	All Chassis	115 Volts AC, 60 CPS
Power Consumption	Chassis 400 Chassis 401 Chassis 402 Chassis 403	265 Watts 240 Watts 260 Watts 275 Watts
VHF Tuning Range	All Chassis	Channels 2-13
Maximum Audio Power Output	Chassis 400 Chassis 401 Chassis 402 Chassis 403	10 Watts 3 Watts 3 Watts 10 Watts
Audio Output Impedance	Chassis 400 Chassis 401 Chassis 402 Chassis 403	6.4 Ohms 6.4 Ohms 6.4 Ohms 6.4 Ohms
Intermediate Frequencies Picture Carrier Sound Carrier	 All Chassis All Chassis	 45.75 Mc 4.5 Mc
Antenna Input Impedance	All Chassis	300 Ohms
Picture Tube Size	Chassis 400 Chassis 401 Chassis 402 Chassis 403	21" 21" 24" 24"

TABLE II - TUBE COMPLEMENT

CHASSIS	TUBE	TYPE	FUNCTION
All	V1	6BZ7 or 6BQ7	R-F Amplifier
All	V2	6J6	OSC - Mixer
All	V101	6AU6	1st Sound IF
All	V102	6AU6	2nd Sound IF
All	V103	6AL5	Ratio Detector
401-402	V104	6AV6	Audio Amp
400-403	V104	1/2 12AX7	Audio Amp
400-403	V104	1/2 12AX7	1st Audio Driver
401-402	V105	6K6GT	Audio Output
400-403	V105	6V6	Audio Output
400-403	V106	6V6	Audio Output
All	V201	6CB6	1st Picture IF
All	V202	6CB6	2nd Picture IF
All	V203	6CB6	3rd Picture IF
All	V204	6CB6	4th Picture IF
All	V205	1/2 6AL5	Video Detector
All	V205	1/2 6AL5	Delayed AGC Clamp
All	V301	6AH6	Video Amp
400-401	V302	21ZP4A	Picture Tube
402-403	V302	24CP4A	Picture Tube
All	V401	6AU6	AGC Keyer
All	V501A	1/2 12AT7	1st Sync Sep.
All	V501B	1/2 12AT7	2nd Sync Sep. Phase Splitter
All	V601	6SN7GT	Vertical OSC
400-401	V602	6S4	Vertical Output
402-403	V602	6W6	Vertical Output
All	V701	6AL5	Horiz. Phase Detector
All	V702	6SN7	Horiz. Oscillator
All	V703	6CD6	Horiz. Oscillator
All	V704	6W4	Damper
All	V705	1B3	H.V. Rectifier
All	V801	5U4	L.V. Rectifier
All	V802	5U4	L.V. Rectifier

Chassis 400 401 402 and 403 will incorporate either a low radiation "40 megacycle" VHF cascode type tuner (Part #9786 RF-14) or an All-Wave tuner (Part #9795 RF-15) that will comprise the R-F stages.

This tuner is identical to the 9758 tuner, except that the coupling is changed. If a 9795 All Wave tuner is used, refer to this bulletin. Both picture and sound output from the tuner is fed to the first of four stages of stagger-tuned I-F amplification. The picture carrier frequency is 45.75 mc. An intercarrier type sound system is employed, the 4.5 mc sound take-off occurring at the output of the video detector. The sound is fed into the first of two 4.5 mc I-F stages. A 39.75 mc adjacent channel picture trap, two 41.25 mc co-sound traps, and a 47.25 mc adjacent channel sound trap are employed in the video I-F stages.

A ratio detector is used as a second sound detector. This stage is followed by a stage of audio amplification (a dual diode triode on Chassis 401-402 and dual triode on Chassis 400-403 with the second half of the dual triode acting as an audio driver) which drives a single stage of power amplification on Chassis 401-402 and a push-pull network in Chassis 400-403. On Chassis 401-402 the audio amplifier is coupled to the audio output by means of a printed circuit, Z201. The audio output tube or tubes is coupled to the speakers through an audio output transformer. On all chassis, plug-type speaker connection is used. Chassis 400-403 uses a Hi-Fi, push-pull type audio circuit, which incorporates two tetrodes. You will note that a unique phase inversion scheme is being used in that one of the push-pull tubes receives its driving voltage from the audio amplifier in the conventional manner, whereas the second tube receives its equal and opposite phase voltage from a tertiary winding on the audio output transformer, thus eliminating the need for a vacuum tube phase inverter. The video detector is 1/2 of a miniature dual diode vacuum tube, with the second half providing the clamping voltage for the delayed AGC. The output from this video detector is coupled directly to the video amplifier, through high frequency compensating shunt and series peaking coils. The single stage of video amplification is directly coupled to the cathode of the picture tube through high frequency compensating shunt and series peaking coils. Since direct coupling is employed, no DC restoration circuit is needed in the receiver. The keyer tube provides the necessary AGC bias for the first and third I-F stages.

Two stages of sync separation are designed into the receiver. They receive the composite video signal from a tap on the video amplifier load resistor.

The second sync separator serves the additional function of a phase splitter for feeding approximately equal and opposite sync pulses to the balanced horizontal phase detector. A negative sync pulse is taken from a tap on cathode resistor, and this pulse is fed to the vertical integrating network, Z501, for the purpose of synchronizing the vertical oscillator.

The vertical oscillator is the cathode coupled multivibrator type. It drives a single power output stage which is coupled to the vertical deflection coils through an output transformer. The positive pulse of the retrace portion of the vertical sweep output voltage is reversed in phase by the transformer action of the output transformer, and the resulting negative voltage pulse is coupled to the picture tube control grid through a .022 uf condenser which also serves to sharpen the pulse so that it is only effective during the retrace portion of the sweep. The negative voltage pulse biases the picture tube beyond cut-off during the retrace portion of the vertical sweep, and the bright retrace lines are blanked out.

The horizontal oscillator is a cathode-coupled type of multivibrator. The stabilizing influence of a parallel tuned L-C circuit is used as part of the plate load of one of the triodes in the multivibrator circuit. The natural frequency of the tuned circuit is made very close to the horizontal sweep frequency. The frequency of the horizontal multivibrator is further stabilized by a balanced horizontal phase detector circuit which consists of a dual diode. The horizontal oscillator drives a stage of power amplification that is coupled to the horizontal deflection coils through an output transformer. The horizontal output transformer is also an active member of the high voltage supply. In addition the horizontal output transformer supplies positive keyer pulses to the place of the keyed AGC tube and it furnishes a reference saw-tooth voltage in conjunction with the horizontal deflection coil circuit for the horizontal phase detector.

The high voltage section is a high efficiency fly-back type which uses a single half-wave rectifier. The approximately 200 volts that results from the rectification of the fly-back potential across the damper tube is added to the 280 volt bus potential, and this boost voltage of approximately 480 volts (630 volts on Chassis 402-403) is applied to the vertical sweep circuit.

The low voltage power supply is a dual, full wave rectifier type, which delivers power into a condenser input RC filter voltage divider network that supplies the required bus voltage for the circuits throughout the receiver. The picture tube is seated in a support bracket which mounts directly on the receiver's chassis. Chassis 401-402 is a 25 tube television receiver, including the rectangular picture tube. Chassis 400-403 is a 26 tube television receiver, including the rectangular picture tube. Provision is made for a phono input on the 400 series chassis. The phono reproduction may be selected by the use of a double pull, double throw switch. On Chassis 401-402, this is accomplished by 1/2 of the treble tone control switch, where on Chassis 400-403, this is accomplished by 1/2 of the brightness control switch. This selector switch performs the function of switching the audio amplifier from the ratio detector output to the phono input and switching the picture tube control grid from the brightness control circuit to ground, cutting off the picture tube raster when the phonograph is being played. Phono motor power is provided through an AC outlet at the rear of the receiver's chassis.

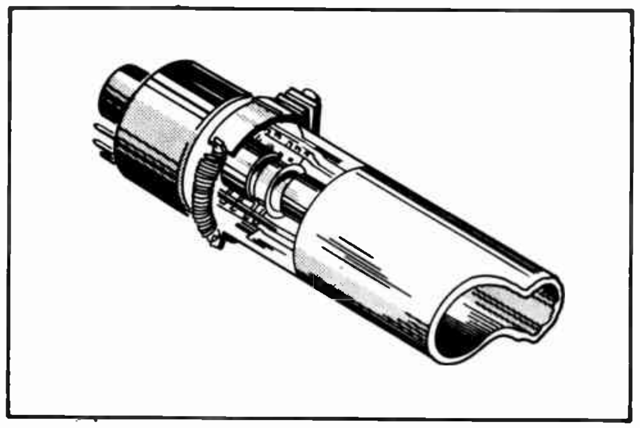


Figure 2. Ion Trap Position

OPERATING INSTRUCTIONS

Front Panel Controls

Refer to Figure 9 for location of front panel controls.

OFF-ON VOLUME CONTROL

The VOLUME control is part of a dual type potentiometer, being associated with a CONTRAST control. The chassis power switch is mechanically linked to the volume potentiometer. This switch opens the 115 volt power line to the receiver's power transformer and AC RECEPTACLE when the VOLUME control shaft is turned to the extreme counterclockwise position. The initial rotation of the shaft in the clockwise direction closes the AC switch and causes the sound level to start increasing toward maximum audio power output. The smaller, outer, left-hand knob is the one that turns the volume control shaft when the knobs are in place. This control also performs the function of automatically removing the bias from the picture tube when the control is in OFF POSITION. (Refer to Focus Operation.)

CONTRAST CONTROL

The CONTRAST control varies the gain of the video amplifier. With the AGC system used for maintaining constant signal level, the CONTRAST control becomes primarily useful in setting background level for best viewing under various room lighting levels or different average program contrast levels. To increase picture contrast turn the CONTRAST control clockwise. The large, inner, left-hand knob is the one that turns the CONTRAST control shaft when the knobs are in place.

TUNING CONTROLS

The tuning controls are the dual type. To select a desired channel, turn the CHANNEL SELECTOR shaft in either direction until the desired channel's coils are in operating position in the tuner. Once a channel has been chosen, tune the FINE TUNING control shaft counterclockwise until the picture starts to become wavy and variable dark horizontal lines and bars appear in the picture. Turn the shaft clockwise until the lines and bars just disappear and the picture appears clear and sharp. Do not turn too far in the clockwise direction or definition will start to decrease. Picture and sound tuning are synchronized so that the best picture will come in with best sound when alignment is correct.

The remaining three front panel controls are located in the middle of the front chassis panel. On chassis 400-403, these controls are visable. On chassis 401-402, the front cover plate must be pulled down in order to view controls.

BRIGHTNESS CONTROL AND PHONO SWITCH (For Chassis 400 and 403 Only)

The BRIGHTNESS control sets the average background illumination of the picture.

1. Temporarily turn the CONTRAST control to minimum setting (extreme counterclockwise).

2. Turn the BRIGHTNESS control so that a medium illumination is visible on the screen.

This setting produces a picture with average background characteristics at about 3/4 contrast setting. For individual tastes that vary from this recommendation, the BRIGHTNESS control may be set so that the picture is most pleasing to the customer.

On chassis 400 and chassis 403 this control performs a dual function. A double pole, double throw switch is mounted at the rear of the brightness potentiometer. This switch is activated when the BRIGHTNESS control shaft is turned either to the extreme clockwise position or the counterclockwise position. Extreme counterclockwise rotation of the BRIGHTNESS control switches the receiver for phono operation and provides minimum brightness. Clockwise rotation of the control provides continuous increase in brightness intensity.

BASS (Chassis 400-403)

As BASS control is turned clockwise, the frequency range is spread to increase reproduction of the lower frequencies, as indicated on the dial. Maximum bass response is achieved when BASS control is in the extreme clockwise position.

VERTICAL HOLD CONTROL (For Chassis 401 and Chassis 402 Only)

The VERTICAL HOLD CONTROL has a hold-in range over which the picture will stay in vertical sync. Turn the control so that the picture is brought from a downward moving picture into sync and best interlace of the sweep lines is observed. Chassis 400 and Chassis 403 utilize a BASE control in place of the VERTICAL HOLD CONTROL.

TREBLE (Chassis 400-403)

As control is turned clockwise, the frequency range is spread to increase the reproduction of the high frequencies, as indicated on the dial. Maximum treble response is achieved when TREBLE control is in the extreme clockwise position.

TONE CONTROL AND PHONO SWITCH (For Chassis 401 and 402 Only)

This control is a dual control on Chassis 401 and 402 only. A double pull, double throw switch is mounted at the rear of the tone potentiometer. The switch is activated when the tone control shaft is turned to either the extreme clockwise position or the extreme counterclockwise position. Extreme counterclockwise rotation of the tone control switches the receiver for PHONO operation and provides maximum base response. Clockwise rotation of the control provides continuous increase in treble response. Maximum clockwise rotation switches the receiver to PHONO operation. When changing from one function to the other, turn the control in the appropriate direction until a click is heard. Then turn the control until the desired tone is obtained.

Rear Adjustments

The rear chassis controls are intended to be adjusted by the dealer or his service representative at the time of installation in the customer's home or during a service call. Once adjusted correctly, these controls need not be changed over long periods of time or unless a specific service problem develops. Refer to Figure 3 for location of rear controls.

ION TRAP

The effects of the FOCUS ADJ, ion trap, and centering control orientation are slightly interdependent and one or two sequential adjustments of each may be necessary for optimum setting of these controls. Always set the ion trap for maximum raster brightness.

CAUTION

Never attempt to center the picture by misadjustment of the ion trap.

Set the BRIGHTNESS and CONTRAST controls about midrange, never at maximum setting, to avoid damaging the picture tube. Move the ion trap over the "flags" of the picture tube first anode. Refer to Figure 2. Rotate the ion trap on the picture tube neck until light appears on the screen. After initial light has been obtained, move the ion trap back and forth and further rotate it to obtain the brightest raster. If the receiver is equipped with a Rauland picture tube, the optimum ion trap setting is indicated by minimum green glow inside the tube neck.

FOCUS ADJUSTMENTS (Refer to Figure 3)

Magnetic focusing is being employed in the 400 series chassis. For correct focus adjustment, adjust focus control for maximum focus range. Readjust ion trap after making the initial focus adjustment. Check neck of picture tube, making sure it is in center of focus coil. Because magnetic focusing is being used, the off-on control switch now performs the function of removing the bias from the picture tube so that when the set is turned off, the small electron beam that is present will be out of focus, therefore preventing damage to the face of the picture tube.

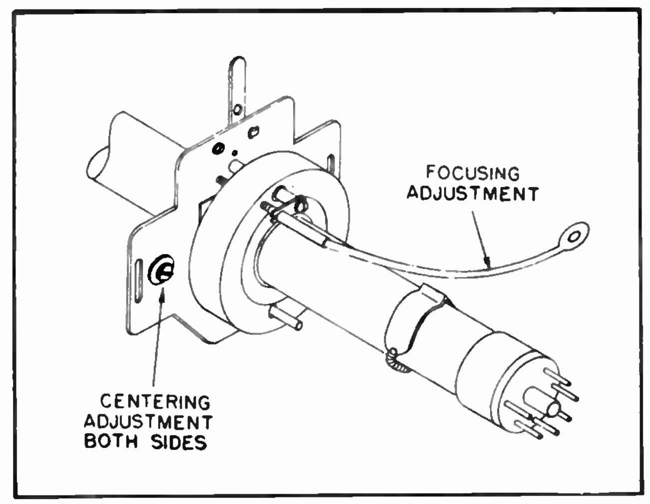


Figure 3. Focus and Centering Adjustment

HORIZONTAL DRIVE ADJUSTMENT

1. Turn the HORIZ. DRIVE control counterclockwise until a drive bar (thin, light vertical line) appears.

2. Turn the control clockwise until the drive bar just disappears. If no drive bar is obtained, set the control at the maximum counterclockwise position.

HORIZONTAL HOLD CONTROL

The HORIZONTAL HOLD control provides a vernier adjustment for the horizontal multivibrator operating frequency. Proper setting depends on correct adjustment of the HORIZ. FREQ. and HORIZ. DRIVE controls.

Turn the Horizontal Hold control until bending of the top portion of the picture is eliminated. This is best determined by noting the vertical lines in the picture.

HORIZONTAL FREQUENCY CONTROL

1. Turn the Horizontal Hold control to mid-range.

2. Turn the HORIZ. FREQ. control counterclockwise while switching the CHANNEL SELECTOR on and off channel until sync is lost.

3. Turn the control clockwise and check the number of bars which appear just before pull-in of the picture. Check circuit for abnormal operation if less than two bar pull-in occurs.

4. Continue turning control clockwise while switching the CHANNEL SELECTOR on and off channel until sync is lost.

5. Turn the control counterclockwise and check the point where picture pull-in occurs.

6. Turn the control an additional 1/2 turn counterclockwise.

WIDTH ADJUSTMENT

To adjust picture width, turn WIDTH control L703 clockwise to increase width, counterclockwise to decrease width. When adjusting picture width, remember to take line voltage into consideration if it differs by more than several volts from the value usually existing when and/or where the receiver is to be operated. Make allowance for voltage difference when adjusting width. Width increases with increase in line voltage.

VERTICAL SIZE AND LINEARITY ADJUSTMENTS

The VERT. SIZE and VERT. LINEARITY controls adjust the height and vertical proportion of the picture. The VERT. SIZE control affects the height of the entire picture but not in a linear manner. The bottom portion of the picture is expanded at a greater rate than the top portion, and the picture center tends to move toward the top of the picture tube.

1. Turn the VERT. SIZE control counterclockwise to increase the height of the picture and clockwise to decrease the picture height.

The VERT. LINEARITY control affects the upper portion of the picture and compensates for non-linearity created by changes made by the VERT. SIZE control.

2. Turn the VERT. LINEARITY control clockwise to expand the upper portion of the picture and counterclockwise to compress the upper portion of the picture.

After adjustment of the picture height and/or vertical linearity, check the VERT. HOLD adjustment; the three controls are interdependent. The same caution that was given for picture width and line voltage applies equally well to vertical picture size.

RASTER CENTERING

It is best to adjust the picture linearity and size, using a test pattern, before centering the picture. If picture tilt exists, temporarily loosen the wing screw at the top of the deflection yoke and rotate the yoke until the tilt is eliminated. Make certain that the deflection yoke is seated as far forward on the picture tube neck as it is possible to move the yoke.

Raster centering is accomplished by adjusting the center control. Refer to Figure 3. By moving the centering control up and down, the raster moves from left to right. By moving the control from left to right, the raster moves up and down.

AUTOMATIC GAIN CONTROL

This control and its associated circuits regulate R-F and I-F AGC voltages (within the limits of the AGC system). When the AGC control is turned full clockwise the greatest bias appears on the I-F AGC bus and the lowest bias appears on the R-F AGC bus for a given signal. When the control is reversed the I-F AGC bias voltage is minimum and the R-F AGC bias is maximum for a given signal. This source of high R-F bias is very useful when strong signals cause the video stages to overload, clipping the sync pulses. In very strong signal areas turn the AGC control counterclockwise until loss of sync is eliminated. Do not turn more than necessary because increase bias on the R-F amplifier with simultaneous decrease in I-F bias will lead to excessive noise in the picture after a certain point. Conversely, in weaker signal areas the control should be turned clockwise so that the R-F bias is reduced and the I-F bias is increased. This condition will improve the signal to noise ratio, minimizing "snow", in the picture. Again, do not over control or I-F stages may be overdriven. The optimum point is a function of signal strength. Use picture quality as an indicating device and adjust for optimum performance.

FUSE PROTECTION

The source of fuse protection is in the horizontal output screen circuit and damper circuit. A 1/4-ampere fuse is held in a fuse clip located inside of the high voltage cage.

ALIGNMENT

The following alignment procedure describes alignment of the stagger-tuned video I-F amplifier stages and the 4.5 mc sound I-F amplifier stages. The alignment procedure for the TV tuner is described in a separate bulletin. Bulletin No. 301 and 301A of the 1952 Service Manual covers the tuner. The following discussion describes recommended methods and equipment to be used and precautions to be observed during the alignment procedure. Table III offers a ready reference alignment guide to be followed after the more detailed procedure has been studied.

For best results it is important that alignment be performed on a metal topped bench with all instruments and equipment securely bonded together and to ground. All leads should be as short as is practicable, particularly in the input grid circuits. Allow about fifteen minutes for the test equipment and receiver to warm before beginning the alignment. Isolation circuits will be required for both the input and output connections. It is important that composition resistors, preferably the half-watt size, and disc type ceramic condensers be used in making up these isolation networks so that a minimum amount of external inductance is added to the tuned circuits being adjusted.

The following equipment* will be required in order to align the picture and sound I-F stages of the receiver properly.

1. Accurate CW signal generator covering the following frequencies:

4.5 mc	44.2 mc
39.75 mc	42.25 mc
41.25 mc	45.5 mc
47.25 mc	43 mc
42.5 mc	45 mc

The generator must have an attenuation control which can be used to vary its output signal level.

2. Sweep frequency generator with a sweep center frequency of approximately 43.5 mc and a 10 mc sweep width.

3. Cathode Ray Oscilloscope with at least a moderately high vertical gain. Must have external sweep input or internal sweep frequency equal to the sweep generator sweep frequency and capable of phase control.

4. DC voltmeter with sensitivity of 20,000 ohms per volt or higher and voltage scale ranges which include approximately 10 volts and 3 volts (full scale deflection). VTVM with zero center scale adjustment is an ideal type.

5. 3 volt bias source such as a battery.

6. Detector network shown in Figure 6.

7. .005 uf isolating condenser.

*Several instrument manufacturers combine the first three items of the equipment list into one compact instrument assembly.

8. 10K ohm, 1/2 watt composition resistor.

9. .001 uf condenser for shunting oscilloscope input.

Before alignment is begun, tune the tuner off-channel by turning the tuner CHANNEL SELECTOR shaft so that the detent roller rests on one of the high points of the drum disc. Bias pin 1 of V703 with -60 volts, in order to eliminate spurious signals and possibility of high voltage shock hazard, or remove high voltage tube.

ORDER OF ALIGNMENT

1. Sound I-F and Ratio Detector Primary
2. Ratio Detector Secondary
3. 4.5 mc Sound Take-off
4. 4.5 mc Beat Trap
5. 39.75 mc Adj. Channel Picture Trap
6. 41.25 Co-channel Sound Traps
7. 47.25 Adj. Channel Sound Trap
8. 42.75 mc 4th Picture I-F Coil
9. 44.2 mc 3rd Picture I-F Coil
10. 42.25 mc 2nd Picture I-F Coil
11. 45.5 mc 1st Picture I-F Coil
12. 43 mc Converter Coil (min)
13. 43 mc Input Coil (max)
14. 45 mc Converter Coil (max)

It is important that the alignment be performed in order listed, with the exception of items 1 and 2, because there is some interaction within the various stages.

Sound I-F Alignment

Equipment: Connect the "hot" lead of the CW signal generator to the grid, pin 1, of V101, the 1st sound I-F tube, through a .005 uf isolating condenser as shown in Figure 5. Tune the generator frequency to 4.5 mc, unmodulated. Connect the voltmeter negative lead in series with a 10K isolating resistor to pin 7 of V103, one plate of the ratio detector, as shown in Figure 5. It is important that the 10K ohm isolating resistor be at the very end of the meter lead to avoid regeneration. Connect the positive voltmeter lead to ground.

Procedure: Adjust L101, L210 and T101 primary (bottom), to obtain a maximum voltmeter reading. The maximum voltage reading should be held at about 4 to 7 volts by decreasing the generator output as the transformer windings are turned to resonance.

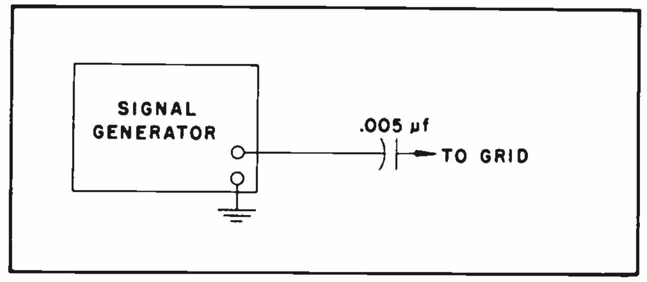


Figure 4. Signal Generator Isolation

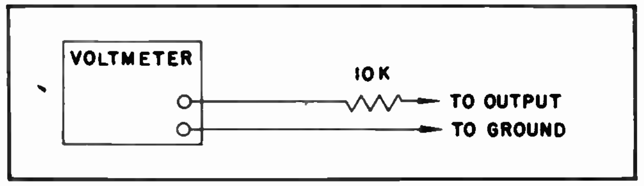


Figure 5. Voltmeter Isolation

Ratio Detector Alignment

Equipment: Generator input remains unchanged from the level that produced 4 to 7 volts in the preceding step. Connect the voltmeter across the junction of R111 and R112 and the switch side of R110; polarity will depend upon which side of resonance the secondary winding of T101 is tuned. If VTVM is being used, set the zero voltage point up scale so that plus and minus readings may be observed without changing the polarity selector switch on the VTVM. Start with one of the higher scales of the VTVM and decrease the scale setting as the null point is obtained.

Procedure: Tune the secondary (top) of T101 for a zero reading on the voltmeter. Do not change the generator output level from that which produced the 4 to 7 volts in the first step. Repeat tuning of T101 primary and secondary until adjustments do not change.

Trap and Picture I-F Alignment

TUNING 4.5 MC TRAP

Equipment: Connect the CW generator through the .005 uf isolating condenser, to pin 7 of V205 (plate of video detector) and tune the generator to 4.5 mc. Connect the detector network and voltmeter between ground and the cathode of the picture tube as shown in Figure 6.

Procedure: Tune L302 (4.5 mc trap in plate circuit of video amplifier) for minimum indication on voltmeter.

TUNING 39.75 MC, 41.25 MC, AND 47.25 MC TRAPS

Equipment: Couple the CW generator "hot" lead to the tuner mixer grid. This may be done in several ways. The .5-3 uuf trimmer condenser (C12 in Bulletin 301 of the 1952 Service Manual) located in front of the 6J6 and nearest the contact side of the tuner is connected to pin 5 of the 6J6, the mixer grid. This plate of the trimmer condenser is accessible through a hole in the side cover plate. The "hot" generator lead may be coupled to this point through a .005 uf isolating condenser, the condenser pigtail being clipped to the trimmer by some convenient means. Another method of coupling the generator is to remove the 6J6, wrap the isolating condenser pigtail around pin 5 of this tube, and replace it in its socket. In either method take care that the pigtail lead does not short to ground. A third method of coupling is to pull the 6J6 tube shield up on the tube until it is not grounded. Clip the "hot" lead of the generator directly to the tube shield. The tube shield and the tube electrodes form a condenser which capacitively couples the signal to the mixer grid. The capacity is much less than .005 uf, and a much higher level of generator output will be required if this method is utilized.

Connect the negative lead of the voltmeter to pin 1 of V301, the video amplifier grid, using the 10K ohm isolating resistor at the end of the lead; connect the voltmeter positive lead to ground. Connect the negative terminal of the 3 volt bias source to the AGC bus; connect the bias source positive lead to ground.

Procedure: Turn the CONTRAST control to its maximum position (extreme clockwise) for remainder of alignment. Tune the traps by setting the trap frequency on the CW generator and adjusting the trap slug for a minimum voltmeter reading. The order of tuning the traps is given in Table III. Keep signal low to avoid overloading I-F circuits.

TUNING PICTURE I-F COILS

Equipment: Instruments and set-up remain the same as for trap alignment during the first part of the procedure. For final adjustment the sweep frequency generator is also used and the voltmeter should be replaced by the oscilloscope. See Figure 7 for oscilloscope isolation details.

Procedure: Tune the I-F coils by setting the coil frequency on the CW generator and adjusting the coil for maximum voltmeter reading. The CW generator output must be attenuated so that the DC output voltage of the video detector (indicated on the voltmeter), remains at 1 volt as the I-F coils are tuned. The order of tuning is from the last I-F stage toward the tuner. Before tuning the grid coil of the 1st I-F stage, temporarily tune the tuner mixer plate coil for a minimum reading on the voltmeter at 43 mc. After the 1st picture I-F grid coil has been tuned, tune the mixer plate coil to 45 mc and repeat the trap and I-F alignment procedure until no additional change in adjustments is necessary.

When no further change takes place, replace the voltmeter with the oscilloscope and replace the CW generator with the sweep frequency generator. Use the same isolating condenser and input connection to the mixer grid. Loosely couple the CW generator (marker) to the input by clipping or touching the CW generator "hot" lead to the unshielded insulated end of the sweep generator "hot" lead. This will afford a small amount of capacitive coupling. If the CW and sweep generators are contained in the same instrument, it will only be necessary to switch on the sweep frequency generator in order to continue the procedure. Tune the sweep frequency generator to a center frequency of approximately 43.5 mc. Use a sweep width of approximately 10 mc so that the base of each of the two response curve skirts is well within the ends of the oscilloscope trace. Check the overall bandwidth, position of the picture carrier, dip in bandpass, and trappage by using the marker pip to locate frequency points on the response curve. See Figure 8. Tune the CW generator to 45.75 mc. The marker pip should appear at approximately the 50% point on the response curve skirt. Adjust individual coils to give proper bandpass. Adjust 1st I-F to set video carrier (45.75 mc) at 50% (6db) response point. Adjust 2nd I-F to set the 50% (6db) bandwidth point (42 mc) on sound side. Adjust 3rd and 4th I-F coils to eliminate any tilt in the response shape. It should not be necessary to adjust converter or input coil.

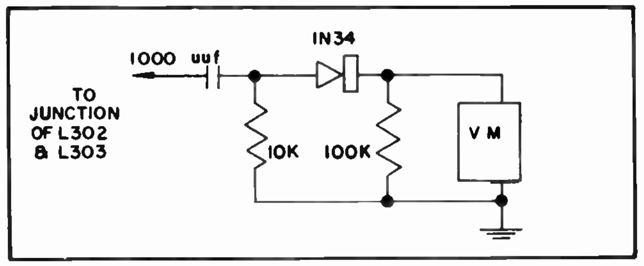


Figure 6. Detector Network

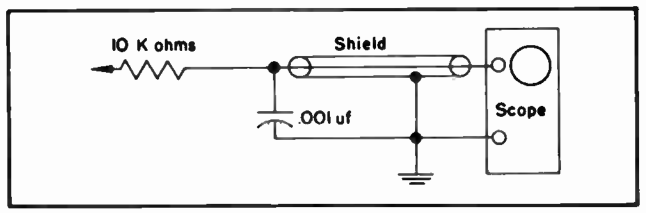


Figure 7. Oscilloscope Isolation

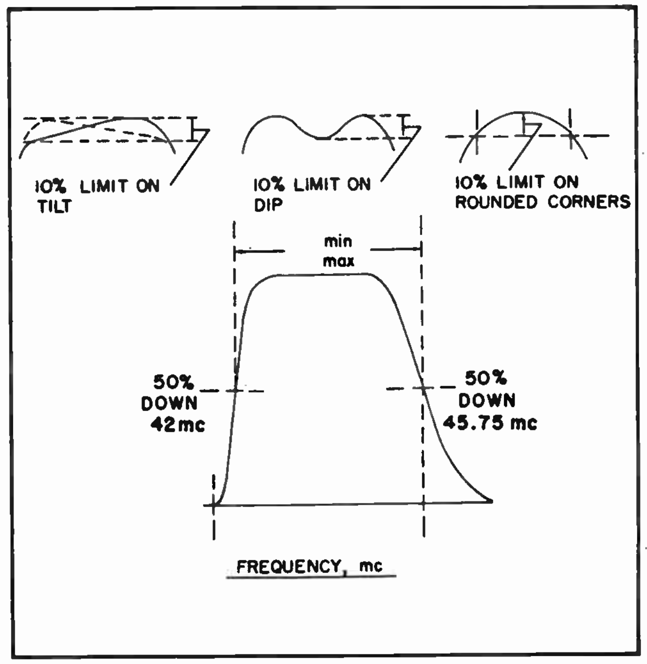


Figure 8. Picture I-F Response Curve

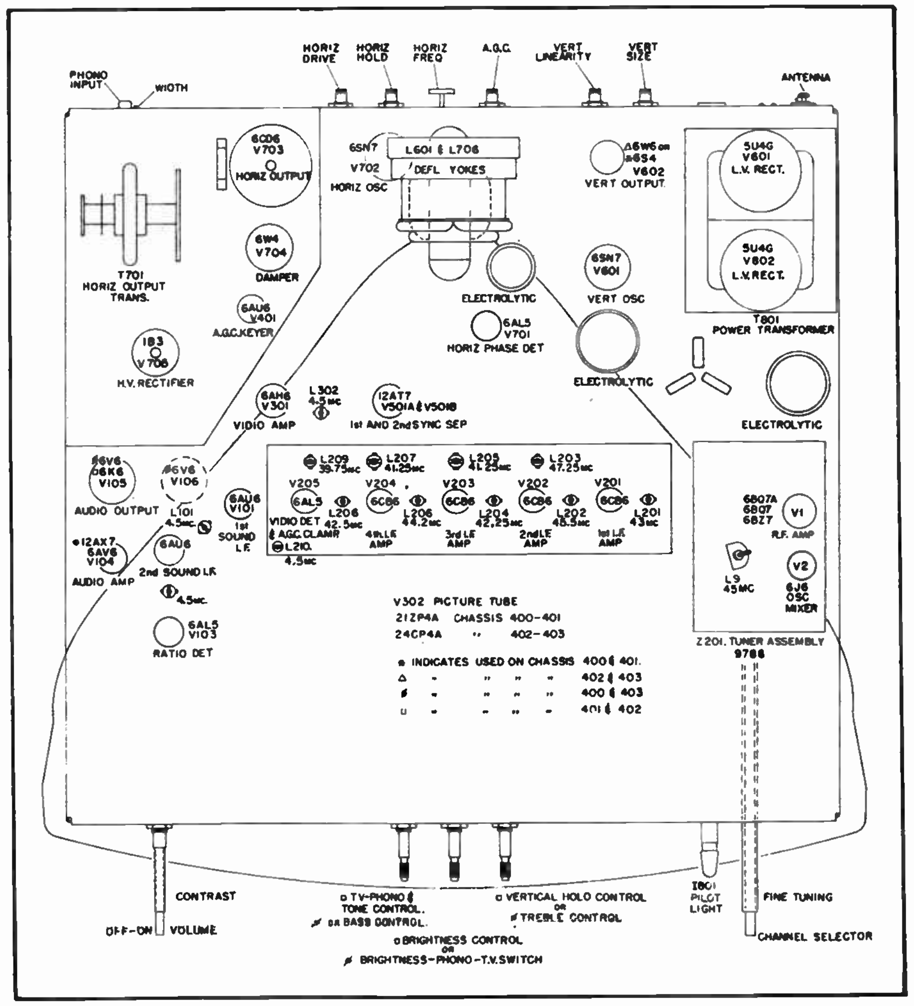


Figure 9. Top View Parts Layout

TABLE III - TV ALIGNMENT PROCEDURE

STEP NO.	SIGNAL GENERATOR FREQUENCY, MC	CONNECT SIGNAL TO	OUTPUT INDICATOR	ADJUST	INSTRUCTIONS	SPECIAL CONNECTIONS AND SETTINGS
SOUND I-F AND RATIO DETECTOR						
1	4.5 CW	Pin 1 of V301	Meter between pin 7 of V103 and ground.	T101 Pri. (bottom) L101 L210	Tune for maximum reading on meter.	Signal level should be low enough to obtain approximately 4 to 7 volts on meter. Use isolation networks shown in Figures 5 and 6.
2	4.5 CW	"	Meter across junction of R111 and R112 and switch side of R110.	T101 Sec. (top)	Tune for zero meter reading; use same signal level as in step 1.	Repeat tuning of T101 primary and secondary until adjustments do not change.
TRAPS AND PICTURE I-F						
3	4.5 CW	Pin 1 of V301	Meter connected through detector network to picture tube cathode lead.	L302	Tune for minimum reading on meter.	Detector and isolating networks shown in Figures 5 and 7.
4	39.75 CW	Mixer grid	Voltmeter across pin 1 of V301 and ground	L209	Tune for minimum reading on meter.	Apply -3V bias to AGC bus. See text for connection to mixer grid. Use isolating resistor between negative voltmeter lead and pin 1 of V301. Keep generator output low. Bias V703 with -60V for remainder of procedure or remove high voltage fuse.
5	41.25 CW	"	"	"	"	
6	41.25 CW	"	"	L205	"	
7	47.25 CW	"	"	L203	"	
8	42.5 CW	Mixer grid	"	L208	Tune for maximum reading on meter.	Set CONTRAST control for maximum contrast. Adjust signal level throughout I-F alignment so that a 1 volt DC output is maintained at pin 1 of V301.
9	44.2 CW	"	"	L206	"	
10	42 25 CW	"	"	L204	"	
11	45.5 CW	"	"	L202	"	

TABLE III - TV ALIGNMENT PROCEDURE (Cont)

STEP NO.	SIGNAL GENERATOR FREQUENCY, MC	CONNECT SIGNAL TO	OUTPUT INDICATOR	ADJUST	INSTRUCTIONS	SPECIAL CONNECTIONS AND SETTINGS
12	43 CW	Mixer grid	Voltmeter across pin 1 of V301 and ground.	L201		Temporarily tune mixer plate coil for minimum voltmeter reading at 43 mc.
13	45 CW	"	"	Mixer Plate L9		
14		Repeat steps 4 through 12 until adjustments do not change.				
15	Approximately 43.5 with 10-mc sweep. Marker required.	Mixer grid	High gain scope to pin 1 of V301.	Mixer Plate Coil and L201 1st. Other coils if necessary.	Adjust 1st I-F to set video carrier (47.75 mc) at 50% point. Adjust 3rd and 4th I-F to eliminate any tilt.	See Figure 7 for isolation network. Use markers to determine bandpass between picture carrier and 50% point on opposite skirt. Bandpass should be between 3.8 mc and 3.6 mc. Adjust other I-F coils to obtain proper curve only when absolutely necessary.

ALL-WAVE TUNER

The 9795 is the All-Wave Tuner. This tuner incorporates a 6BQ7, 6BQ7A or a 6BZ7 for an R-F amplifier; a 6T4 or 6AF4 as a UHF oscillator with a 6U8 acting as a mixer and VHF oscillator. Refer to Figure 12 for complete schematic of the 9795.

SHAFT FUNCTION

1. FINE TUNING - Outer shaft for VHF and UHF oscillators fine tuning.

2. SWITCHING - Center shaft includes nine detent positions, eight for UHF decade coil board strips covering frequency channels 14 to 19; 20; 29; 30 to 39; 40 to 49; 50 to 59; 60 to 69; 70 to 79 and 80 to 83. VHF channels 10 through 13 may be received on first UHF decade position. The ninth position allows VHF reception.

3. SWITCHING - Inner shaft includes twelve detent positions, ten for UHF unit digits (individual channel selection included within the above eight decades), twelve positions for VHF channels 2 to 13.

4. VHF TUNING - To receive VHF channels 2 through 13, set middle section of tuning knob assembly so that "VHF" and channel numbers are directly in front of pilot light. These VHF channel numbers will be found on the inner circle of numbers. To switch VHF channels, rotate front crown control knob only.

5. UHF TUNING - To receive UHF channels, rotate middle section either right or left from VHF position. First half of UHF channel number is controlled by middle knob. Second half of UHF channel number is controlled by front crown knob; example, channel 56 - the middle knob will place the first half of the UHF channel number (5) in front of the pilot light. The front crown knob will place the second half of this UHF channel number (6) in front of the pilot light, thus producing UHF channel 56.

Theory of Operation

In general, the combination tuner consists of two major units as noted in the block diagram; the UHF subassembly, and VHF subassembly.

Referring to the block diagram, the antenna is seen to be connected to a diplexer which provides separation of signals above 470 mc for the UHF tuner, and signals below 300 mc for the VHF tuner.

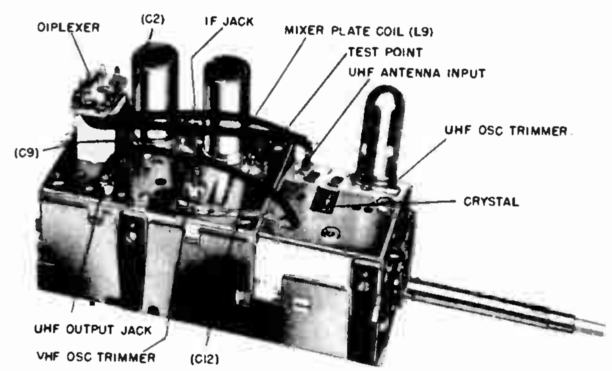


Figure 10. All-Wave Tuner

The operation may best be followed by tracing the path of the signal from the antenna through the corresponding tuner and then to the I-F amplifier at its output. When the combination tuner is in UHF position, the signal from the common antenna passes down the twin-lead to the diplexer and continues on to the UHF tuner. Here it goes through two preselector circuits and into a Xtal mixer. The Xtal is supplied with a local oscillator voltage. differing by 40 mc above the signal frequency. After mixing, it becomes a 40 mc signal (I-F frequency) and passes into the VHF tuner. Since the combination tuner has been set for UHF operation, the 40 mc amplifier, which is noted in a block below the VHF tuner, is now in place of one of the VHF channels. In this manner, the signal is amplified again at 40 mc and passes on through the output to the I-F stage.

When the combination tuner is in the VHF position, the following path of signal may be traced: As previously noted, the signal travels from the common antenna to the diplexer, but now, since its frequency is below 300 mc, it is diverted directly to the VHF tuner input. At this point, it is connected to one of the channels (2 - 13) as in the usual TV band, and is amplified at this corresponding frequency. At the end of this amplification, it is mixed (in the VHF tuner) by a 6U8 stage. This provides the local oscillator, again 40 mc above the signal, and the result in output is then the 40 mc signal which is coupled by the output plate coil to the I-F strip.

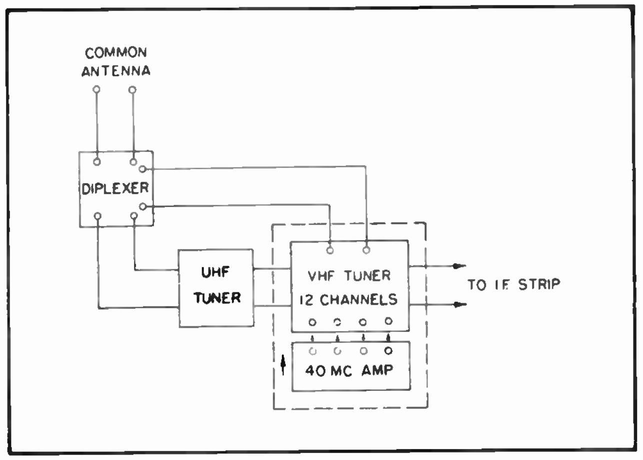


Figure 11. Block Diagram, All-Wave Tuner

The various components of the major subassemblies may be seen from the circuit diagram (figure 12). In the UHF tuner, L22 and L23 are the preselector circuits. L24 and L25 make up the oscillator inductance. The oscillator tube is either a 6AF4 or 6T4, as shown. It should be noted that the coils, L20 and L21, along with C30, C31 and C32, comprise the high-pass filter portion of the diplexer. The low-pass filter, consisting of coils La and Lb, along with the two 1.5 mmfd condensers, is the other portion of the diplexer which diverts signals lower than 300 mc to the VHF tuner.

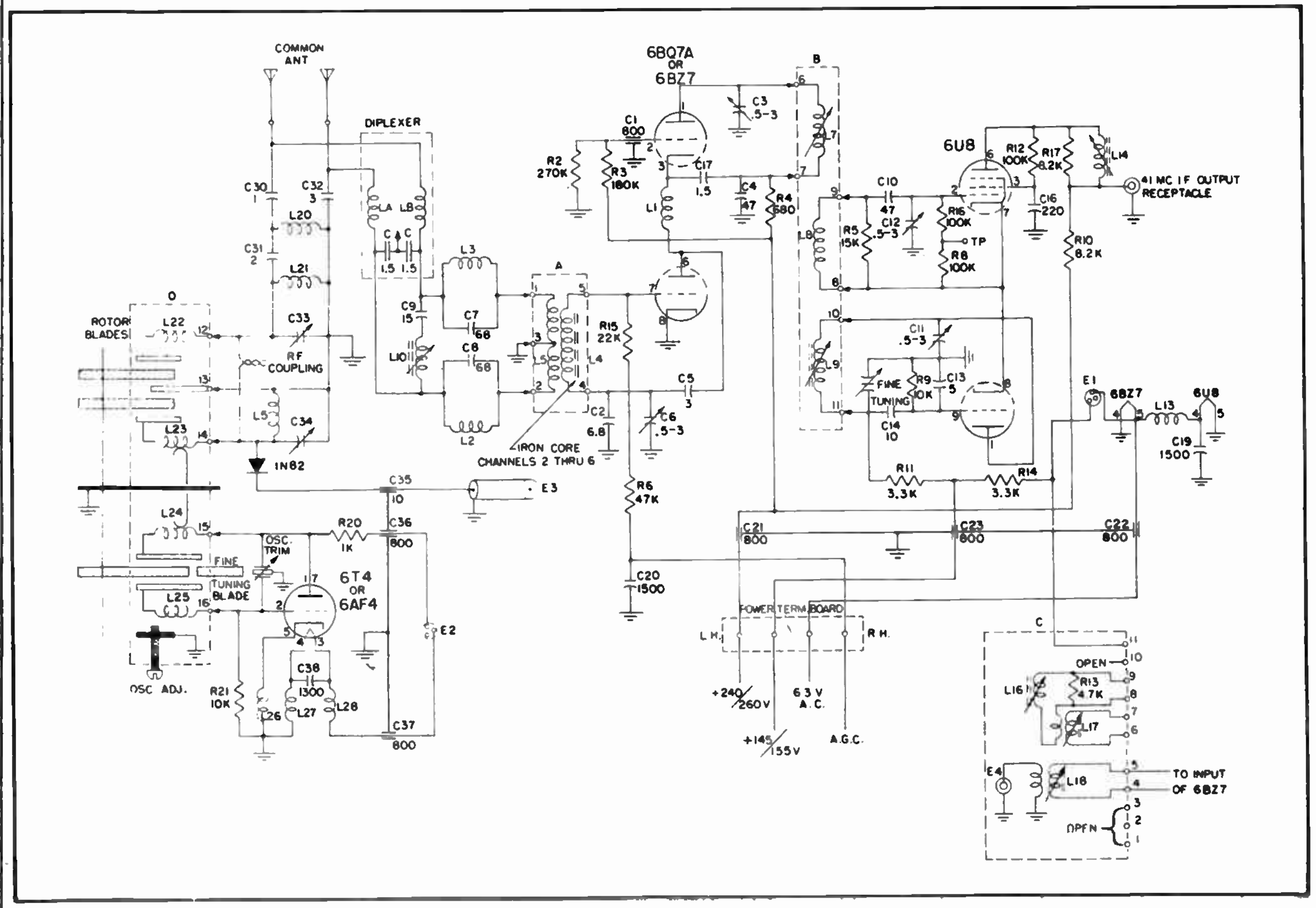


Figure 12. Schematic, All-Wave Tuner

ALIGNMENT

ALL-WAVE I-F ALIGNMENT PROCEDURE - GENERAL

The combination All-Wave tuner contains two sections - the first (front section) contains the UHF portion. The second (rear section) is the usual 12-channel VHF turret tuner. There is one difference in the VHF section, in that it contains a contact board or cascode strip. This provides the equivalent of a 13th position, and is held out when the decade knob is in the VHF position. The units front knob then operates the rear turret from channel 2 to 13. It is also held out when the decade knob is in the 10's position for channels 10, 11, 12 and 13. UHF operation is obtained when the decade center knob is in the 10's position for channels 14 to 19 and for all succeeding decade positions, up to 83.

I-F ALIGNMENT

Set the tuner in the VHF position (on channel 10) and insert a signal at the test point (refer to figure 10) through a .005 capacitor with the proper termination for the generator being used. Use a -3 volts for the AGC bias. Observe the output of the video detector with a 10K resistor and a .001 capacitor isolation network which is connected to the oscilloscope vertical terminals or a voltmeter.

A. Apply a 43 mc signal and align the 1st I-F grid coil until a maximum indication is observed.

B. Apply a 45 mc signal and align the output plate coil (L9) of the tuner for maximum indication. A sweep may then be applied and the I-F touched up for proper response. It is preferable to adjust coils in the I-F strip slightly, rather than accommodate discrepancies in the curve with changes in the settings of the adjustments mentioned in A and B.

R-F ALIGNMENT - Check VHF

Set the tuner to the VHF position on the decade center knob and the units front knob on channel 10. Connect a sweep to the VHF or the antenna point of the diplexer. Note overall wave shape and position of sound in video carrier. Adjust local oscillator slug to proper frequency with fine tuning in center of scale. A bias of 3 volts is applied to AGC during the above operation.

R-F ALIGNMENT - Check UHF

With the tuner at channel 19, with three or four volts of bias on the I-F AGC and three volts of R-F AGC. Connect a UHF sweep to the antenna terminals with the proper dummy termination (300 ohms total.) Observe the output on the video detector with proper isolation network. (10K resistor and a .001 capacitor on scope.) Use a 60 cycle sweep that is phased properly.

A. Check wave shape and operation of channels 14, 21, 31, 41, 51, 61, 71 and 81. These should operate positively and not be intermittent.

B. Note above operation to be made with fine tuner in center of fine tuning range.

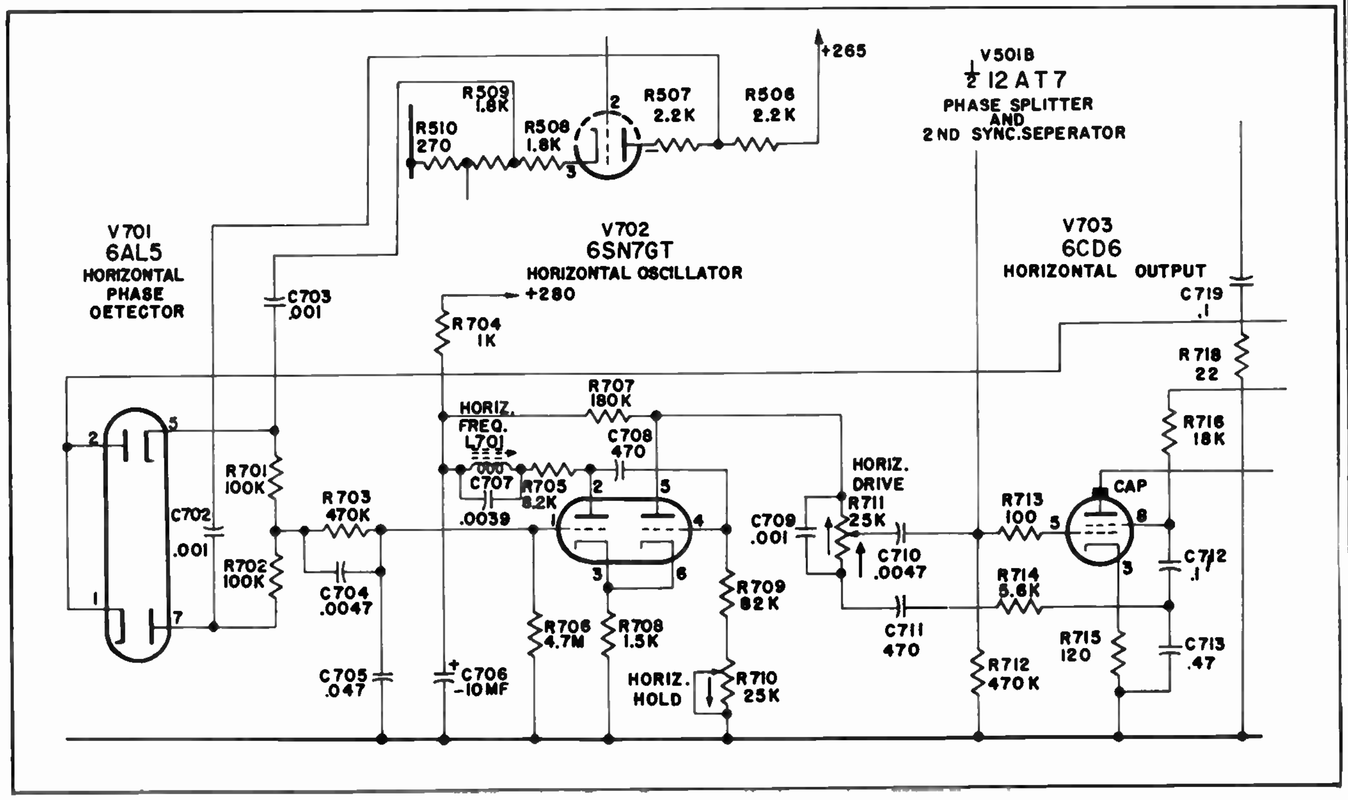


Figure 13. Horizontal Phase Detector

NOTE

To adjust VHF local oscillators, place tuner in VHF position, remove knobs, place fine tuner in middle of range so VHF local oscillators can be reached with proper alignment tool through UHF unit.

To adjust UHF local oscillator, place tuner in UHF position, remove knobs, place fine tuner in middle of range. Rotate units front knob. Adjust front screw head.

Horizontal Phase Detector

It has not been the general policy to include a discussion on circuit theory and operation in the service bulletins. A large number of text books and magazine articles have covered the field quite thoroughly. However, there have been a number of questions submitted by service personnel regarding the operation of the balanced horizontal phase detector.

Figure 13 shows the horizontal sweep section. Without a control voltage on the grid of the horizontal multivibrator, it operates at a free-running frequency which is determined by the inductance of L701 and the resistance of R710, all other factors remaining constant. These other factors are R and C component values, B+ supply voltage, and control voltage at grid No. 1, which at the moment is assumed to be zero. The nature of the frequency vs DC control voltage characteristic of

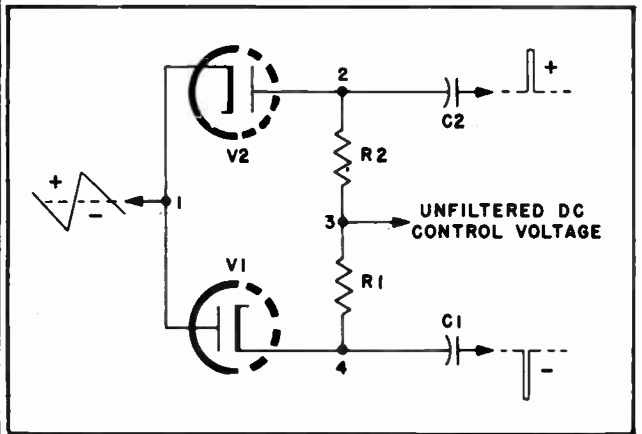


Figure 14. Basic Phase Detector

the common cathode type of multivibrator used in the 400 series chassis is such that a positive change in DC voltage on grid No. 1 produces a decrease in frequency and a negative change produces an increase in frequency, all other factors remaining constant. Since B+ supply voltage changes with line voltage variations and signal strength changes, and the R, L, and C component values change slightly with temperature and humidity, these frequency determining factors do not remain constant. It remains necessary to hold the multivibrator to a constant frequency by employing some factor which does remain constant for all practical purposes. This factor is the horizontal sync pulse frequency which originates at the transmitting source. This source is not used directly because of its poor immunity from random noise pulses, but it is used as a reference standard from which the correct value of DC control voltage is derived.

It remains to be shown how the DC control voltage is made to vary in such a manner as to counteract changes in the other factors so that the frequency will remain constant. Fundamentally, this is accomplished by comparing a sampling of the instantaneous frequency of the multivibrator output with the standard frequency source.

The difference between the two frequencies is made to generate a DC control voltage of such magnitude and polarity that the difference tends to remain zero for all practical purposes. Figure 14 is a simplified drawing of Figure 13 with all but the essential components deleted. V1 represents V701A, V2 represents V701B, R1 represents R701 and R2 represents R702. C719 and R718 complete the high deflection current path to ground, and the saw-tooth current produces a saw-tooth voltage across R718. The saw-tooth potential at 1, Figure 14 has an AC axis since DC is blocked by C712. The saw-tooth current frequency is the same as the horizontal multivibrator frequency so that the derived saw tooth is used as a sampling voltage. C1 and C2 represent C702 and C703 respectively. They serve to couple the sync pulses to the phase detector and to block DC as well as to serve as an active part of the phase detector circuit. R706 is used only as a grid leak for the horizontal multivibrator grid #1 Without this grid leak, a failure in the horizontal control tube would leave grid #1 with insufficient bias. Therefore plate and screen dissipation of the 6CD6 would exceed the rated values. R703, C704 and C705 form a low pass filter to the voltage at point 3, Figure 14. This filter offers a low impedance path to ground for the AC component of voltage that appears at point 3. In addition this filter performs the important function of making the DC control voltage at the multivibrator grid No. 1 relatively free from random noise pulses which "ride in" with the sync pulses. The time constant of the filter is very long compared to the change in circuit conditions that take place when several noise pulses get through, but the time constant is relatively short as far as DC change brought on by phase change is concerned.

The analysis is simplified by assuming an ideal saw-tooth voltage waveform (symmetrical about the AC axis) ideal diodes (equal conducting characteristics) and ideal sync pulses (equal shape and amplitude).

Each diode in conjunction with its respective coupling condenser forms a rectifier circuit. The condenser charges during the conduction period of the diode by an amount which is a function of the voltage applied between the diode electrodes.

Case I Multivibrator in Synchronization.

Consider the case when the multivibrator is in synchronization. Figure 15a shows graphically that the zero voltage point of the saw-tooth occurs at the same point in time that the middle of the sync pulses occur. When the system is in equilibrium, the sync pulses must occur sometime during the return line or

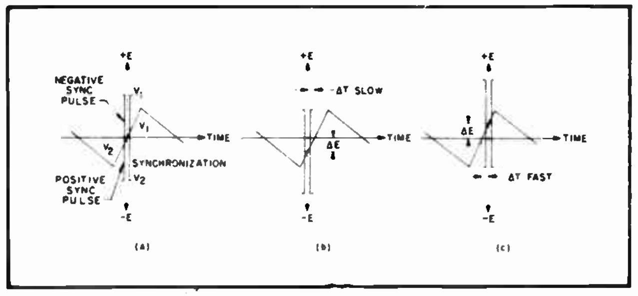


Figure 15. Waveform Analysis of Phase Detector

fly-back; that is, during the steep portion of the saw-tooth wave. This restriction is necessary for viewing of the picture in correct frame position. It is the positive half of the saw tooth at the plate of V1 and the negative sync pulse at the cathode of V1 that cause diode V1 to conduct current. It is the negative half of the saw tooth at the cathode of V2 and positive sync pulse at the plate of V2 that cause diode V2 to conduct current. This situation is shown graphically by flipping the sync pulses with respect to the zero potential axis. The waveforms are labeled in Figure 15a to indicate these facts. The two potentials acting at either diode are series aiding, and the amount of diode conduction depends on the sum of the two potentials applied across the diode at any instant. For the present case, the potential variation across each diode is the same over one cycle, so each condenser charges an equal amount. The instantaneous rate of charge is not the same for each condenser. This gives rise to pulsating output. A pulsating voltage is equivalent to an AC voltage component superimposed on a DC voltage component. The low-pass filter attenuates the AC component to a negligible value. Since each condenser charges by the same amount, points 2 and 4 are at potentials of equal amplitude and opposite polarity if C1 equals C2. The potential at point 3 is the algebraic sum of these two potentials, so it is zero.

Case II Multivibrator Too Slow.

Figure 15b shows that the saw-tooth zero potential point occurs ΔT seconds (a few millionths of a second in order of magnitude) later than the middle of the sync pulses. For this case V2 has a greater potential difference across its electrodes and V1 has a smaller potential difference across its electrodes during the time that the sync pulses are applied than for the same interval of time in Case I. The difference is represented by ΔE volts. This means that the C2 will charge more and C1 charge less, relative to Case I. The potentials at points 2 and 4 are no longer of equal magnitude. The charge on C2 tends to equalize the charge on C1 by transferring electrons through R2 and R1. The potential at point 3 is the algebraic or net potential between 2 and 4, relative to ground; and it is several volts negative with respect to ground. The decrease in potential causes the multivibrator to speed up, and as its phase difference with the sync pulses decreases, the corrective voltage decrease toward zero.

Case III Multivibrator Too Fast.

Figure 15c shows that the saw-tooth zero potential point occurs ΔT seconds (a few millionths of a second in order of magnitude) before the middle of the sync pulses. For this case the potential relationships acting on the two diodes are reversed. C1 charges more than C2, and there is a net positive potential at point 3. This positive potential causes the multivibrator to slow down. The phase difference between saw-tooth and sync voltages tends toward zero, causing the correcting voltage to do the same.

The most stable state of equilibrium and the one that produces the correct picture frame phase relative to the blanking bar is the zero voltage state. The multivibrator will operate in a state of equilibrium for which the DC output of the phase detector is either slightly positive or negative, but this state is less stable. The picture frame phase is wrong, and the multivibrator is likely to lose sync (equilibrium) when switching channels or interrupting the horizontal sync pulse in some other manner.

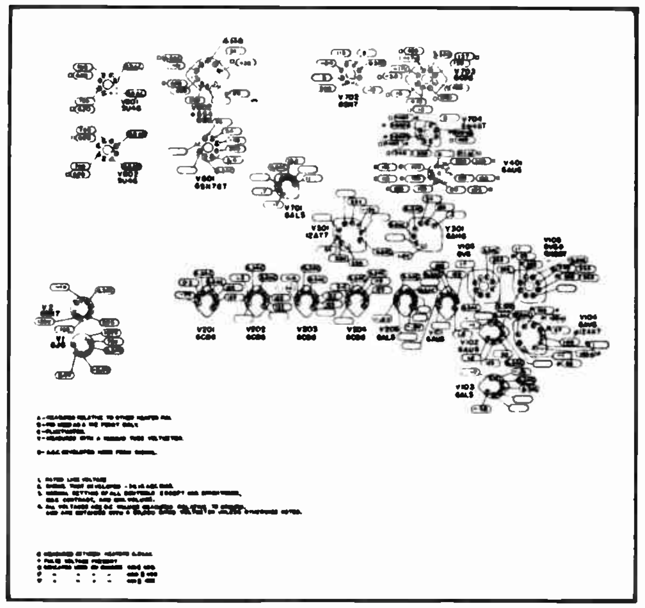


Figure 16. Bottom View Parts Tube Layout

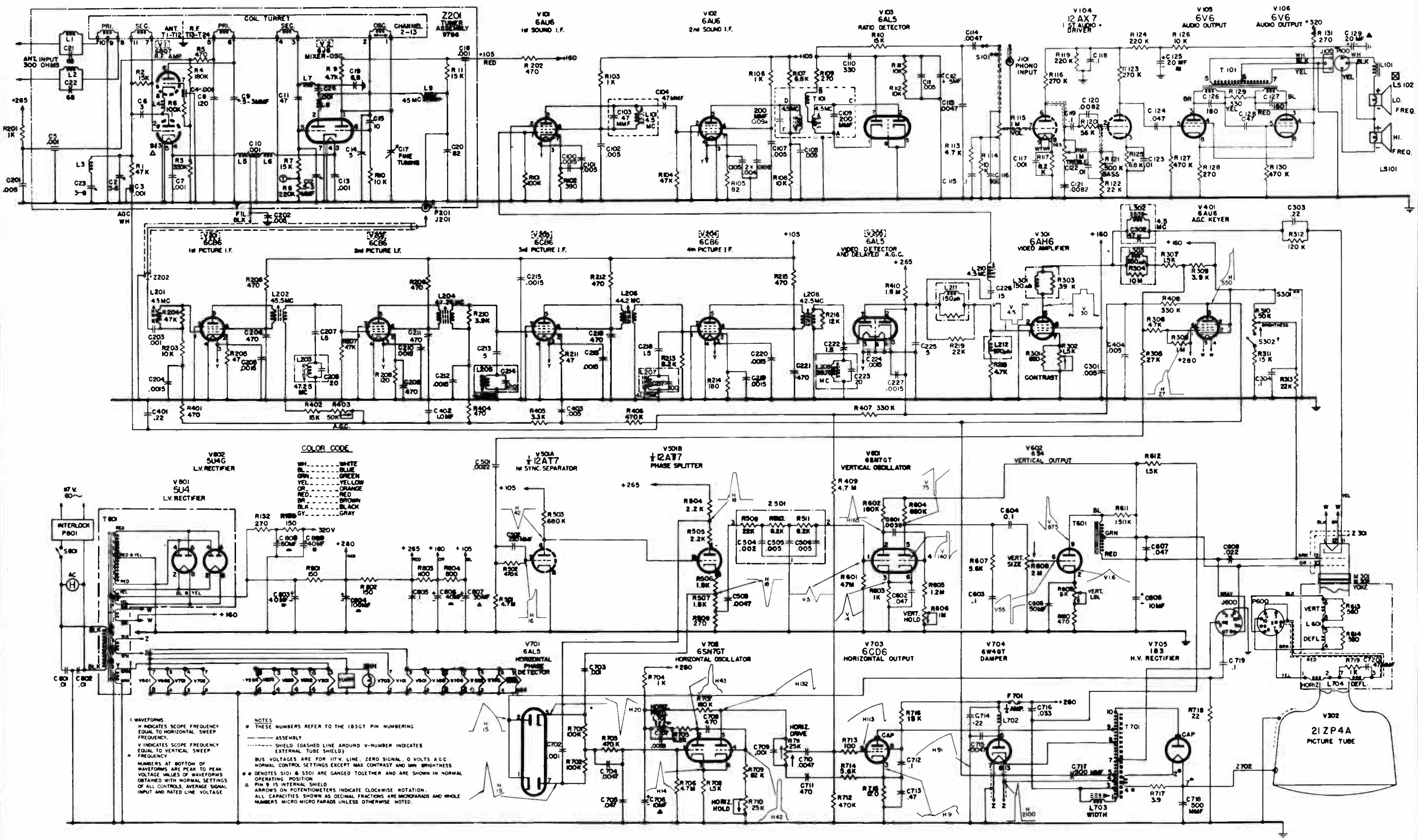


Figure 17. Schematic Diagram for Chassis 400

PARTS LIST

NOTE: Unless other wise noted all resistors are 1/2 watt composition type, ±10% tolerance with values given in ohms.

NOTE: Unless otherwise noted all condensers are 600 volt, molded phenolic type, ±20% tolerance with whole number values given in micromicrofarads and decimal fraction values given in microfarads. GMC - guaranteed minimum capacity.

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
	RESISTORS				
R100	Not Used				
R101	4511	100K	20%		
R102	4549	390			
R103	4542	1K	20%		
R104	4504	47K	20%		
R105	4598	82			
R106	4542	1K	20%		
R107	4608	6.8K		1 Watt	
R108	4644	10K		1 Watt	
R109	4663	270			
R110	4521	15K	20%		
R111	4597	10K			
R112	4597	10K			
R113	4576	4.7K	20%		
R114	4597	10K			
R115	See Controls				
R116	4602	270K			
R117	4651	8.2K			
R118	See Controls				
R119	4618	220K			
R120	24652	56K			
R121	See Controls				
R122	4628	22K			
R123	4602	270K			
R124	4618	220K			
R125	4557	6.8K			
R126	4597	10K			
R127	4622	.47M			
R128	14639	270		2 Watts	
R129	4528	330		1 Watt	
R130	4622	470K			
R131	14639	270		2 Watts	
R132	14639	270		2 Watts	
R133	14613	150		2 Watts	
R200	Not Used				
R201	4659	1K	20%		
R202	4664	470	20%		
R203	4597	10K			
R204	4537	47K			
R205	4639	47			
R206	4664	470			
R207	4537	47K			
R208	4546	120			
R209	4664	470			
R210	4654	3.9K			
R211	4639	47			
R212	4664	470			
R213	Part of L207	8.2K			
R214	14618	180			
R215	4664	470			
R216	4656	12K			
R217	Part of L211	39K	20%		
R218	4649	4.7K			
R219	4628	22K			
R220	Part of L212	39K			
R300	Not Used				
R301	4514	680	20%		
R302	See Controls				
R303	Part of L301	39K			
R304	Part of L303	10M			
R305	24618	27K			
R306	4504	47K	20%		
R307	4610	1.5K	5%		
R308	4614	1M	20%		
R309	24550	3.9K	5%		
R310	See Controls				
R311	4521	15K	20%		
R312	4548	120K			
R313	4501	22K	20%		
R400	Not Used				
R401	4664	470	20%		
R402	4521	15K	20%		
R403	See Controls				
R404	4664	470	20%		
R405	4607	3.3K			
R406	34550	470K	5%		
R407	4677	330K	20%		
R408	34532	330K	5%		
R409	34659	4.7M			
R410	34612	1.8M	5%		
R500	Not Used				
R501	4544	4.7M	20%		
R502	4622	470K			
R503	34568	680K			
R504	24525	2.2K	5%		
R505	24525	2.2K	5%		
R506	24517	1.8K	5%		
R507	24517	1.8K	5%		

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
R508	4549	390			
R509	Part of Z501	22K			
R510	Part of Z501	8.2K			
R511	Part of Z501	8.2K			
R600	Not Used				
R601	4544	4.7M	20%		
R602	34507	180K		1 Watt	
R603	4659	1K			
R604	34571	680K		1 Watt	
R605	34593	1.2M			
R606	See Controls				
R607	4629	5.6K			
R608	See Controls				
R609	See Controls				
R610	4664	470	20%		
R611	24697	150K	20%	1 Watt	
R612	4552	1.5K	20%	1 Watt	
R613	Part of L601	560			
R614	Part of L601	560			
R700	Not Used				
R701	4571	100K			
R702	4571	100K			
R703	4506	470K	20%		
R704	4659	1K			
R705	4651	8.2K			
R706	4544	4.7M	20%		
R707	4634	180K			
R708	4610	1.5K	5%		
R709	24670	82K			
R710	See Controls				
R711	See Controls				
R712	4622	470K			
R713	4566	100			
R714	4629	5.6K			
R715	4657	120		2 Watts	
R716	4631	18K		2 Watts	
R717	4751	3.9			
R718	14529	22		2 Watts	
R719	Part of L706	1K			
R800	Not Used				
R801	4771	150		10 Watts	
R802	4771	150		10 Watts	
R803	4773	1100		10 Watts	
R804	4773	800		10 Watts	
		CAPACITORS			
C100	14030	.0015			
C101	4029	.005			Hi-K Ceramic
C102	4029	.005			Hi-K Ceramic
C103	Part of L101	47			
C104	14057	47	20%	500 V	G.P. Quality Components Type ZC
C105	4036	.004			Hi-K Ceramic
C106	4036	.004			Hi-K Ceramic
C107	4029	.005			Hi-K Ceramic
C108	4029	.005			Hi-K Ceramic
C109	Part of T101	200			
C109A	Part of T101	200			
C110	4065	330			Ceramic Tubular
C111	4029	.005			Hi-K Ceramic
C112	See Electrolytics				
C113	4127	.0047	20%	400 V	
C114	4127	.0047	20%	400 V	
C115	4163	.1	10%	200 V	
C116	4079	100			Ceramic
C117	4175	.001			
C118	4143	.1		200 V	
C119	4143	.1		200 V	
C120	4189	.0082	10%	400 V	
C121	4189	.0082	10%	400 V	
C122	4134	.01	10%	400 V	
C123	4134	.01	10%	400 V	
C124	4147	.047		200 V	
C125	See Electrolytics				
C126	4070	180		500 V	Mica
C127	4070	180		500 V	Mica
C128	4148	.047		400 V	
C129	See Electrolytics				
C200	Not Used				
C201	4029	.005		500 V	
C202	4029	.005		500 V	
C203	14031	.001		500 V	
C204	14030	.0015			
C205	14030	.0015			
C206	14050	470		500 V	
C207	4082	1.5			
C208	Part of L203	20			
C209	14050	470			
C210	14030	.0015			

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
C211	14050	470		500 V	
C212	14030	.0015			
C213	14051	5	10%		
C214	Part of L205	100			
C215	14030	.0015			
C215A	14030	.0015			
C216	14050	470	10%	500 V	
C217	Part of L207	100			
C218	4082	1.5	10%		
C219	14030	.0015			
C220	14030	.0015			
C221	14050	470	10%	500 V	
C222	4082	1.5	10%		
C223	Part of L209	20			
C224	14030	.0015			
C225	14051	5	10%		
C226	14052	15			
C227	14030	.0015			
C300	Not Used				
C301	4029	.005			Hi-K Ceramic
C302	Part of L302	47			
C303	4131	.22		200 V	
C304	4163	.1			
C400	Not Used				
C401	4131	.22		200 V	
C402	14200	1.0		100 V	
C403	4029	.005			Hi-K Ceramic
C404	4029	.005			Hi-K Ceramic
C500	Not Used				
C501	4136	.0022	10%		
C502	4026	220			Mica or Ceramic
C503	4127	.0047		400 V	
C504	Part of Z501	.002			
C505	Part of Z501	.005			
C506	Part of Z501	.005			
C600	Not Used				
C601	14113	.0039	10%		
C602	4158	.047	10%	200 V	
C603	14133	.1	10%		
C604	4144	.1			
C605	See Electrolytics	50			
C606	See Electrolytics	10			
C607	4133	.047			
C608	4124	.022			
C700	Not Used				
C701	Not Used				
C702	4175	.001	10%	400 V	
C703	4175	.001			
C704	4127	.0047		400 V	
C705	4147	.047		200 V	
C706	See Electrolytics	10			
C707	4085	.0039			Silver Mica
C708	14009	470	10%		Mica
C709	14104	.001			
C710	4128	.0047			
C711	14009	470	10%		Mica
C712	4144	.1			
C713	4173	.47	10%	200 V	
C714	14103	.22		400 V	
C715	4128	.0047			
C716	14127	.033	10%		Mica
C717	4056	500		20 KV	Hi-K Ceramic
C718	4056	500		20 KV	Hi-K Ceramic
C719	14133	.1			
C720	Part of L706	47			
C800	Not Used				
C801	4105	.01			
C802	4105	.01			
C803	See Electrolytics	40			
C804	See Electrolytics	100			
C805	4144	.1			
C806	See Electrolytics	40			
C807	See Electrolytics	30			
C808	See Electrolytics	60			
C809	See Electrolytics	40			
		CAPACITORS - ELECTROLYTIC			
C112	4209	5 mfd	-	50 V	-
C125	4259	20 mfd	-	350 V	-
C129	4259	20 mfd	-	350 V	-
C605	4251	50 mfd	-	50 V	-
C606	4253	10 mfd	-	600 V	-
C706	4252	10 mfd	-	350 V	-
C803	4251	40 mfd	-	350 V	-
C804	4251	100 mfd	-	350 V	-
C806	4252	40 mfd	-	350 V	-
C807	4251	30 mfd	-	350 V	-

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
C808	4259	60 mfd	-	350 V	-
C809	4259	40 mfd	-	350 V	-

SYMBOL	PART NO.	DESCRIPTION
		COILS
L1	-	Coil - I-F Trap
L2	-	Coil - I-F Trap
L3	-	Coil - Series Trap (I-F Band)
L4	-	Coil - 5 Turns 1/4 O.D., Cascode Coupling
L5	-	Coil - 16 Turns 1/4 O.D., Heater
L6	-	Coil - 16 Turns 1/4 O.D., Heater
L7	-	Coil - Neutralizing
L8	-	Coil - Mixer Plate (Compensating Inductance)
L9	-	Coil - Mixer Plate
L101	5437	Coil - Interstage (Sound I-F - 4.5 Mc)
L201	5539	Coil - I-F Input (43 Mc)
L202	5538	Coil - 1st I-F (45.5 Mc)
L203	5440	Coil - Adjacent Channel Sound Trap (47.25)
L204	5537	Coil - 2nd I-F (42.25 Mc)
L205	5438	Coil - (41.25 Mc Trap)
L206	5538	Coil - 3rd I-F (44.2 Mc)
L207	5438	Coil - (41.25 Mc Trap)
L208	5537	Coil - 4th I-F (42.5 Mc)
L209	5440	Coil - Adjacent Channel Picture Trap (39.75)
L210	5430	Coil - Sound Take Off (4.5 Mc)
L211	5433	Coil - Peaking (Detector Series 150 UH)
L212	5434	Coil - Peaking (Detector Shunt 970 UH)
L301	5433	Coil - Peaking (Video Output Series 150 UH)
L302	5402	Coil - Trap (4.5 Mc)
L303	5340	Coil - Peaking (Video Output Shunt 350 UH)
L601	See Miscellaneous	
L701	5447	Coil - Horizontal Frequency
L702	5266	Coil - Damper Choke
L703	5464	Coil - Width Control
L704	See Miscellaneous	
		TRANSFORMERS
T101	5443	Transformer - Ratio Detector - 4.5 Mc
T102	5170	Transformer - Audio Output
T601	5157	Transformer - Vertical Output
T701	5184	Transformer - Horizontal Output
T801	5036	Transformer - Power
		CONTROL - SWITCHES
R115	4903	Control - Volume, 1M
R118	4913	Control - Treble, 1M
R121	4905	Control - Bass, 500K
R302	4903	Control - Contrast, 1.5K
R310	4906	Control - Brightness, 50K
R403	4853	Control - AGC, 50K
R606	4832	Control - Vertical Hold, 1M
R608	4864	Control - Vertical Size, 2M
R609	4865	Control - Vertical Linearity, 5K
R710	4859	Control - Horizontal Hold, 25K
R711	4859	Control - Horizontal Drive, 25K
		MISCELLANEOUS
L601	9729	Yoke - Deflection 70°
L704	9729	Yoke - Deflection 70°
F701	9782	Fuse - 1/4 Amp, Slo-Blo
I801	9505	Light - Pilot (#44 Mazda)
J101	6121	Receptacle - Phono Input
LS101	9091	Speaker - 5-1/4"
LS102	9099	Speaker - 10"
M301	9702	Ion Trap - 45 Gauss
M302	9789	Focuser
P801	6126	Receptacle - Power
Z201	9786 or 9795	Tuner - Cascode R-F - UHF-VHF, 40 Mc, Standard Coil
Z301	6107A	Socket - Kinescope with Leads
Z501	9695	Network - Vertical Integrater
Z702	6227	Plug - Anode Connector with Lead

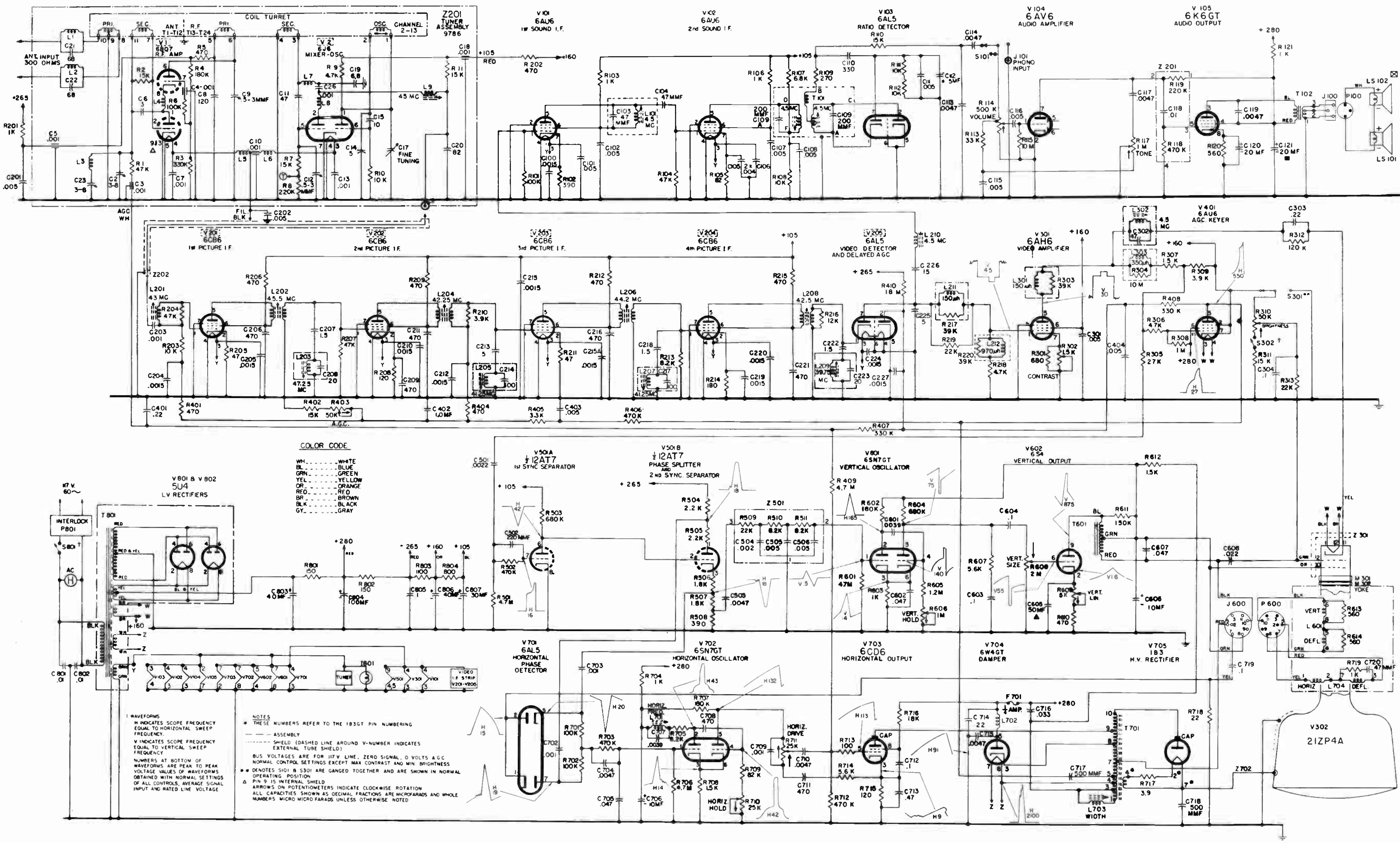


Figure 18. Schematic Diagram for Chassis 401

PARTS LIST

NOTE: Unless otherwise noted all resistors are 1/2 watt, composition type, ±10% tolerance with values given in ohms.

NOTE: Unless otherwise noted all condensers are 600 volt, molded phenolic type, ±20% tolerance with whole number values given in micromicrofarads and decimal fraction values given in microfarads. GMC - guaranteed minimum capacity.

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
		RESISTORS			
R100	Not Used				
R101	4511	100K	20%		
R102	4549	390	10%		
R103	4542	1K	20%		
R104	4504	47K	20%		
R105	4598	82			
R106	4542	1K	20%		
R107	4608	6.8K		1 Watt	
R108	4644	10K		1 Watt	
R109	4663	270			
R110	4521	15K	20%		
R111	4597	10K			
R112	4597	10K			
R113	24627	33K	20%		
R114	See Controls				
R115	4505	10M	20%		
R116	Not Used				
R117	See Controls				
R118	Part of Z201	470M			
R119	Part of Z201	220K			
R120	4621	560		1 Watt	
R121	14698	1K		2 Watt	
R200	Not Used				
R201	4659	1K	20%		
R202	4664	470	20%		
R203	4597	10K			
R204	4537	47K			
R205	4639	47			
R206	4664	470			
R207	4537	47K			
R208	4546	120			
R209	4664	470			
R210	4654	3.9K			
R211	4639	47			
R212	4664	470			
R213	Part of L207	8.2K			
R214	14618	180			
R215	4664	470			
R216	4656	12K			
R217	Part of L211	39K	20%		
R218	4649	4.7K			
R219	4628	22K			
R220	Part of L212	39K			
R300	Not Used				
R301	4514	680	20%	2 Watts	
R302	See Controls				
R303	Part of L301				
R304	Part of L303	10M			
R305	24618	27K			
R306	4504	47K	20%		
R307	4610	1.5K	5%		
R308	4614	1M	20%		
R309	24550	3.9K	5%	1 Watt	
R310	See Controls				
R311	4521	15K	20%		
R312	4548	120K			
R313	4501	22K	20%		
R400	Not Used				
R401	4664	470	20%		
R402	4521	15K	20%		
R403	See Controls				
R404	4664	470	20%		
R405	4607	3.3K			
R406	34550	470K	5%		
R407	4677	330K	20%		
R408	34532	330K	5%		
R409	34659	4.7M			
R410	34612	1.8M	5%		
R500	Not Used				
R501	4544	4.7M	20%		
R502	4622	470K			
R503	34568	680K	10%		
R504	24525	2.2K	5%		
R505	24525	2.2K	5%		
R506	24517	1.8K	5%		
R507	24517	1.8K	5%		
R508	4549	390			
R509	Part of Z501	22K			
R510	Part of Z501	8.2K			
R511	Part of Z501	8.2K			
R600	Not Used				
R601	4544	4.7M	20%		

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
R602	34507	180K		1 Watt	
R603	4659	1K			
R604	34571	680K		1 Watt	
R605	34593	1.2M			
R606	See Controls				
R607	4629	5.6K			
R608	See Controls				
R609	See Controls				
R610	4664	470	20%		
R611	24697	150K	20%	1 Watt	
R612	4552	1.5K	20%	1 Watt	
R613	Part of L601	560			Yoke
R614	Part of L601	560			Yoke
R700	Not Used				
R701	4571	100K			
R702	4571	100K			
R703	4506	470K	20%		
R704	4659	1K			
R705	4651	8.2K			
R706	4544	4.7M	20%		
R707	4634	180K			
R708	4610	1.5K	5%		
R709	24670	82K			
R710	See Controls				
R711	See Controls				
R712	4622	470K			
R713	4566	100			
R714	4629	5.6K			
R715	4657	120		2 Watts	
R716	4631	18K		2 Watts	
R717	4751	3.9			
R718	14529	22		2 Watts	
R719	Part of L706	1K			
R800	Not Used				
R801	4771	150		10 Watts	
R802	4771	150		10 Watts	
R803	4773	1100			
R804	4773	800			
		CAPACITORS			
C100	14030	.0015			
C101	4029	.005			
C102	4029	.005			
C103	Part of L101	47			
C104	14057	47	GP		
C105	4036	.004			Dual Ceramic
C106	4036	.004			Dual Ceramic
C107	4029	.005			
C108	4029	.005			
C109	Part of T101	200			Ratio Detector
C109A	Part of T101	200			
C110	4065	330			
C111	4029	.005			
C112	See Electrolytics				
C113	4127	.0047		400 V	
C114	4127	.0047		400 V	
C115	4029	.005			
C116	4029	.005			
C117	4127	.0047		400 V	
C118	Part of Z201				
C119	4128	.0047			
C120	See Electrolytics				
C121	See Electrolytics				
C200	Not Used				
C201	4029	.005		500 V	
C202	4029	.005		500 V	
C203	14031	.001		500 V	
C204	14030	.0015			
C205	14030	.0015			
C206	14050	470		500 V	
C207	4082	1.5			
C208	Part of L203	20			
C209	14050	470			
C210	14030	.0015			
C211	14050	470		500 V	
C212	14030	.0015			
C213	14051	5	10%		
C214	Part of L205	100			
C215	14030	.0015			
C215A	14030	.0015			
C216	14050	470	10%	500 V	
C217	Part of L207	100			
C218	4082	1.5	10%		
C219	14030	.0015			
C220	14030	.0015			

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
C221	14050	470	10%	500 V	
C222	4082	1.5	10%		
C223	Part of L209	20			
C224	14030	.0015			
C225	14051	5	10%		
C226	14052	15			
C227	14030	.0015			
C300	Not Used				
C301	4029	.005			
C302	Part of L302	47			
C303	4131	.22		200 V	
C304	4163	.1			
C400	Not Used				
C401	4131	.22		200 V	
C402	14200	1.0		100 V	
C403	4029	.005			
C404	4029	.005			
C500	Not Used				
C501	4136	.0022	10%	400 V	
C502	4026	220			Ceramic
C503	4127	.0047		400 V	
C504	Part of Z501	.002			
C505	Part of Z501	.005			
C506	Part of Z501	.005			
C600	Not Used				
C601	14113	.0039	10%		
C602	4158	.047	10%	200 V	
C603	14133	.1	10%		
C604	4144	.1			
C605	See Electrolytics				
C606	See Electrolytics				
C607	4133	.047			
C608	4124	.022			
C700	Not Used				
C701	Not Used				
C702	4175	.001	10%	400 V	
C703	4175	.001	10%	400 V	
C704	4127	.0047		400 V	
C705	4147	.047		200 V	
C706	See Electrolytics				
C707	4085	.0039	10%	500 V	Silver Mica
C708	14009	470	10%	500 V	Mica
C709	14104	.001	10%		
C710	4128	.0047			
C711	14009	470	10%	500 V	Mica
C712	4144	.1			
C713	4173	.47	10%	200 V	
C714	14103	.22		400 V	
C715	4128	.0047			
C716	14127	.033	10%		
C717	4056	500		20 KV	
C718	4056	500		20 KV	
C719	14133	.1	10%		
C720	Part ofL706	47	10%	1500 V	
C800	Not Used				
C801	4105	.01			
C802	4105	.01			
C803	See Electrolytics				
C804	See Electrolytics				
C805	4144	.1			
C806	See Electrolytics				
C807	See Electrolytics				
		CAPACITORS - ELECTROLYTIC			
C112	4209	5 mfd	-	50 V	-
C120	4252	20 mfd	-	350 V	-
C121	4252	20 mfd	-	350 V	-
C605	4251	50 mfd	-	50 V	-
C606	4253	10 mfd	-	600 V	-
C706	4252	10 mfd	-	350 V	-
C803	4251	40 mfd	-	350 V	-
C804	4251	100 mfd	-	350 V	-
C806	4252	40 mfd	-	350 V	-
C807	4251	30 mfd	-	350 V	-

SYMBOL	PART NO.	DESCRIPTION
		COILS
L1	-	Coil - I-F Trap
L2	-	Coil - I-F Trap
L3	-	Coil - Series Trap (I-F Band)
L4	-	Coil - 5 Turns 1/4 O.D., Cascode Coupling
L5	-	Coil - 16 Turns 1/4 O.D., Heater
L6	-	Coil - 16 Turns 1/4 O.D., Heater
L7	-	Coil - Neutralizing
L8	-	Coil - Mixer Plate (Compensating Inductance)
L9	-	Coil - Mixer Plate
L101	5437	Coil - Interstage (Sound I-F - 4.5 Mc)
L201	5539	Coil - I-F Input (43 Mc)
L202	5538	Coil - 1st I-F (45.5 Mc)
L203	5440	Coil - Adjacent Channel Sound Trap (47.25)
L204	5537	Coil - 2nd I-F (42.25 Mc)
L205	5438	Coil - (41.25 Mc Trap)
L206	5538	Coil - 3rd I-F (44.2 Mc)
L207	5438	Coil - (41.25 Mc Trap)
L208	5537	Coil - 4th I-F (42.5 Mc)
L209	5440	Coil - Adjacent Channel Picture Trap (39.75)
L210	5430	Coil - Sound Take Off (4.5 Mc)
L211	5433	Coil - Peaking (Detector Series 150 UH)
L212	5434	Coil - Peaking (Detector Shunt 970 UH)
L301	5433	Coil - Peaking (Video Output Series 150 UH)
L302	5402	Coil - Trap (4.5 Mc)
L303	5340	Coil - Peaking (Video Output Shunt 350 UH)
L601	See Miscellaneous	
L701	5447	Coil - Horizontal Frequency
L702	5266	Coil - Damper Choke
L703	5464	Coil - Width Control
L704	See Miscellaneous	
		TRANSFORMERS
T101	5443	Transformer - Ratio Detector - 4.5 Mc
T102	5192	Transformer - Audio Output
T601	5157	Transformer - Vertical Output
T701	5184	Transformer - Horizontal Output
T801	5038	Transformer - Power
		CONTROL - SWITCHES
R114	4907	Control - Volume, 500K
R117	4890	Control - Tone, 1M
R302	4907	Control - Contrast Valve, 1.5K
R310	4867	Control - Brightness, 50K
R403	4853	Control - AGC, 50K
R606	4868	Control - Vertical Hold, 1M
R608	4864	Control - Vertical Size, 2M
R609	4865	Control - Vertical Linearity, 5K
R710	4859	Control - Horizontal Hold, 25K
R711	4859	Control - Horizontal Drive, 25K
		MISCELLANEOUS
F701	9782	Fuse - 1/4 Amp, Slo-Blo
I801	9505	Light - Pilot (#44 Mazda)
L601	9729	Yoke - Deflection 70°
L704	9729	Yoke - Deflection 70°
J101	6121	Receptacle - Phono Input
LS101	9091	Speaker - 5-1/4"
LS102	9074	Speaker - 11-1/2"
M301	9702	Ion Trap - 45 Gauss
M302	9789	Focuser
P801	6126	Receptacle - Power
Z201	9786 or 9795	Tuner - Cascode R-F - UHF-VHF, 40 Mc Standard Coil
Z301	6107-A	Socket - Kinescope with Leads
Z501	9695	Network - Vertical Integrator
Z702	6227	Plug - Anode Connector with Lead

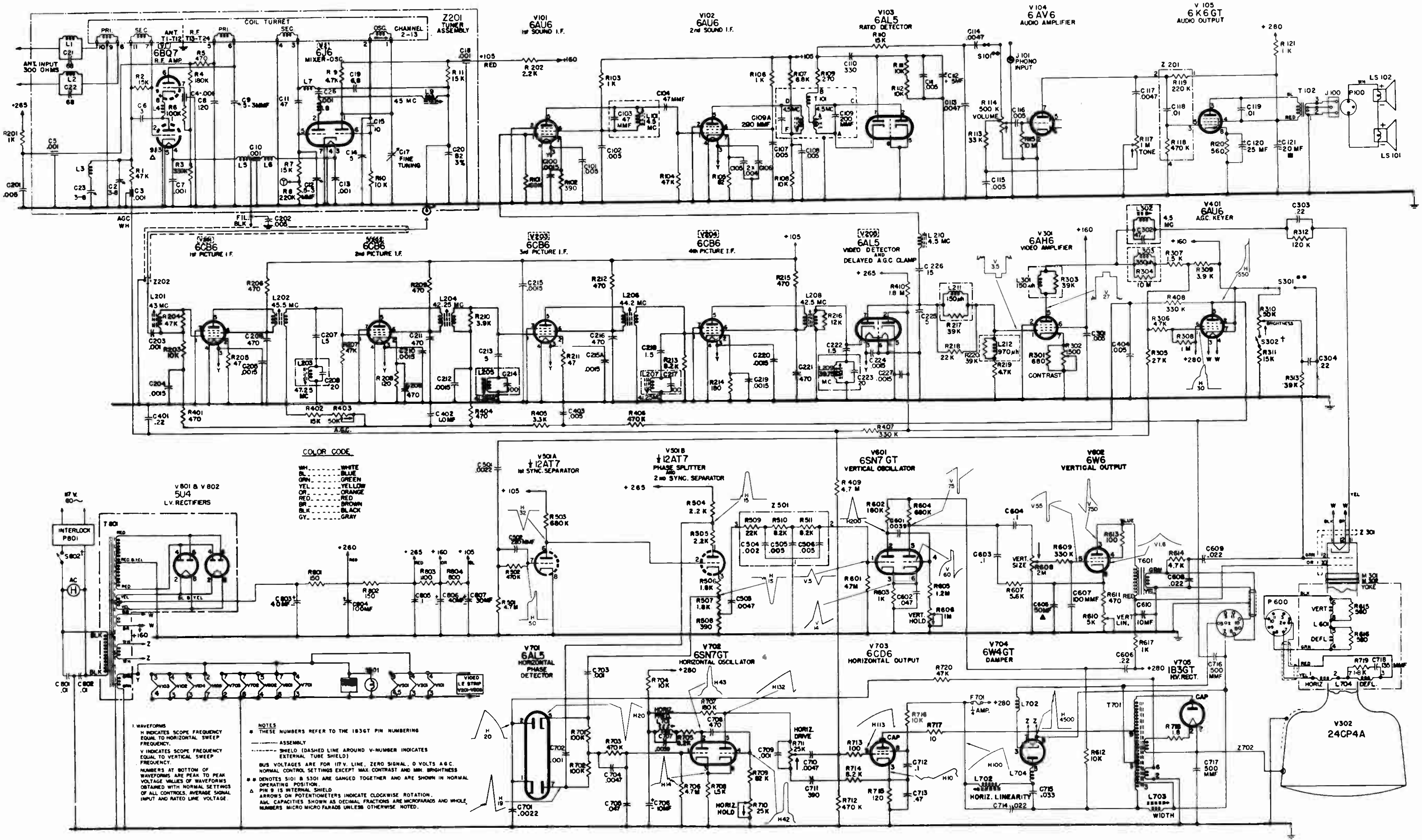


Figure 19. Schematic Diagram for Chassis 402

PARTS LIST

NOTE: Unless otherwise noted all resistors are 1/2 watt, composition type, ±10% tolerance with values given in ohms.

NOTE: Unless otherwise noted all condensers are 600 volt, molded phenolic type, ±20% tolerance with whole number values given in micromicrofarads and decimal fraction values given in microfarads. GMC - guaranteed minimum capacity.

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
	RESISTORS				
R100	Not Used				
R101	4511	100K	20%		
R102	4549	390			
R103	4542	1K	20%		
R104	4504	47K	20%		
R105	4598	82			
R106	4542	1K	20%		
R107	4608	6.8K		1 Watt	
R108	4644	10K		1 Watt	
R109	4663	270			
R110	4521	15K	20%		
R111	4597	10K			
R112	4597	10K			
R113	24627	33K	20%		
R114	See Controls				
R115	4505	10M	20%		
R116	Not Used				
R117	See Controls				
R118	Part of Z201	470K			
R119	Part of Z201	220K			
R120	4621	560		1 Watt	
R121	14698	1K		2 Watts	
R200	Not Used				
R201	4659	1K	20%		
R202	4512	2.2K	20%		
R203	4597	10K			
R204	4537	47K			
R205	4639	47			
R206	4664	470			
R207	4537	47K			
R208	4546	120			
R209	4664	470			
R210	4654	3.9K			
R211	4639	47			
R212	4664	470			
R213	Part of L207	8.2K			
R214	14618	180			
R215	4664	470			
R216	4656	12K			
R217	Part of L211	39K	20%		
R218	4649	4.7K			
R219	4628	22K			
R220	Part of L212	39K			
R300	Not Used				
R301	4514	680	20%	1 Watt	
R302	See Controls				
R303	Part of L301	39K			
R304	Part of L303	10M			
R305	24618	27K			
R306	4504	47K	20%	1 Watt	
R307	4610	1.5K	5%		
R308	4614	1M			
R309	24550	3.9K	5%	1 Watt	
R310	See Controls				
R311	4521	15K	20%		
R312	4548	120K			
R313	44566	39K	20%		
R400	Not Used				
R401	4664	470	20%		
R402	4521	15K	20%		
R403	See Controls				
R404	4664	470	20%		
R405	4607	3.3K			
R406	34550	470K	5%		
R407	4677	330K	20%		
R408	34532	330K	5%		
R409	34659	4.7M			
R410	34612	1.8M	5%		
R500	Not Used				
R501	4544	4.7M	20%		
R502	4622	470K			
R503	34568	680K	10%		
R504	24525	2.2K	5%		
R505	24525	2.2K	5%		
R506	24517	1.8K	5%		
R507	24517	1.8K	5%		
R508	4549	390			
R509	Part of Z501	22K			
R510	Part of Z501	8.2K			
R511	Part of Z501	8.2K			
R600	Not Used				
R601	4544	4.7M	20%		
R602	34507	180K		1 Watt	
R603	4659	1K			
R604	34571	680K		1 Watt	
R605	34593	1.2M			
R606	See Controls				
R607	4629	5.6K			
R608	See Controls				
R609	4677	330K	20%		
R610	See Controls				
R611	4664	470			
R612	4625	10K		1 Watt	
R613	4547	100			
R614	4543	47K			
R615	Part of L601	560			
R616	Part of L601	560			
R617	4522	1K	20%	1 Watt	
R700	Not Used				
R701	4571	100K			
R702	4571	100K			
R703	4506	470K	20%		
R704	4644	10K		1 Watt	
R705	4651	8.2K			
R706	4544	4.7M	20%		
R707	4634	180K			
R708	4610	1.5K	5%		
R709	24670	82K			
R710	See Controls				
R711	See Controls				
R712	4622	470K			
R713	4547	100			
R714	4651	8.2K			
R715	4657	120		2 Watts	
R716	4503	10K		2 Watts	
R717	4685	10	20%	1 Watt	
R718	4776	1.8			
R719	Part of L706	1.8K			
R800	Not Used				
R801	4771	150		10 Watts	
R802	4771	150		10 Watts	
R803	4773	1100		10 Watts	
R804	4773	800		10 Watts	
	CAPACITORS				
C100	14030	.0015			
C101	4029	.005			
C102	4029	.005			
C103	Part of L101	47			
C104	14057	47			
C105	4036	.004			Dual Ceramic
C106	4036	.004			Dual Ceramic
C107	4029	.005			
C108	4029	.005			
C109	Part of T101	200			Ratio Detector
C109A	Part of T101	200			
C110	4065	330			
C111	4029	.005			
C112	See Electrolytics				
C113	4127	.0047		400 V	
C114	4127	.0047		400 V	
C115	4029	.005			
C116	4029	.005			
C117	4127	.0047		400 V	
C118	Part of Z201	.01			
C119	4105	.01			
C120	See Electrolytics				
C121	See Electrolytics				
C200	Not Used				
C201	4029	.005		500 V	
C202	4029	.005		500 V	
C203	14031	.001		500 V	
C204	14030	.0015			
C205	14030	.0015			
C206	14050	470		500 V	
C207	4082	1.5			
C208	Part of L203	20			
C209	14050	470			
C210	14030	.0015			
C211	14050	470		500 V	
C212	14030	.0015			
C213	14051	5	10%		
C214	Part of L205	100			
C215	14030	.0015			
C215A	14030	.0015			
C216	14050	470	10%	500 V	
C217	Part of L207	100			
C218	4082	1.5	10%		
C219	14030	.0015			
C220	14030	.0015			
C221	14050	470	10%	500 V	
C222	4082	1.5	10%		
C223	Part of L209	20			
C224	14030	.0015			
C225	14051	5	10%		
C226	14052	15			
C227	14030	.0015			
C300	Not Used				
C301	4029	.005			
C302	Part of L302	47			
C303	4131	.22		200 V	
C304	4131	.22		200 V	
C400	Not Used				
C401	4131	.22		200 V	
C402	14200	1.0		100 V	
C403	4029	.005			
C404	4029	.005			
C500	Not Used				
C501	4136	.0022	10%	400 V	
C502	4026	220			Ceramic
C503	4127	.0047		400 V	
C504	Part of Z501	.002			
C505	Part of Z501	.005			
C506	Part of Z501	.005			
C600	Not Used				
C601	14113	.0039	10%		
C602	4158	.047	10%	200 V	
C603	14133	.1	10%		
C604	4144	.1			
C605	See Electrolytics				
C606	4129	.22	10%		
C607	4079	100	10%		
C608	4124	.022			
C609	4124	.022			
C610	See Electrolytics				
C700	Not Used				
C701	4136	.0022	10%	400 V	
C702	4175	.001	10%	400 V	
C703	4175	.001	10%	400 V	
C704	4127	.0047		400 V	
C705	4147	.047		200 V	
C706	See Electrolytics				
C707	4085	.0039	10%	500 V	Silver Mica
C708	14009	470	10%		Mica
C709	14104	.001	10%		
C710	4128	.0047			
C711	14010	390	10%		Mica
C712	4144	.1			
C713	4173	.47	10%	200 V	
C714	4124	.022			
C715	14127	.033	10%		
C716	4076	500		1500 V	Mica
C717	14037	500		30 KV	Ceramic
C718	Part of L706	135	10%	3000 V	Ceramic
C800	Not Used				
C801	4105	.01			
C802	4105	.01			
C803	See Electrolytics				
C804	See Electrolytics				
C805	4144	.1			
C806	See Electrolytics				
C807	See Electrolytics				
	CAPACITORS - ELECTROLYTIC				
C112	4209	5 mfd	-	50 V	-
C120	4252	25 mfd	-	25 V	-
C121	4252	20 mfd	-	350 V	-
C605	4251	50 mfd	-	50 V	-
C610	4253	10 mfd	-	600 V	-
C706	4252	10 mfd	-	350 V	-
C803	4251	40 mfd	-	350 V	-
C804	4251	100 mfd	-	350 V	-
C806	4252	40 mfd	-	350 V	-
C807	4251	30 mfd	-	350 V	-

SYMBOL	PART NO.	DESCRIPTION
	COILS	
L1	-	Coil - I-F Trap
L2	-	Coil - I-F Trap
L3	-	Coil - Series Trap (I-F Band)
L4	-	Coil - 5 Turns 1/4 O.D., Cascode Coupling
L5	-	Coil - 16 Turns 1/4 O.D., Heater
L6	-	Coil - 16 Turns 1/4 O.D., Heater
L7	-	Coil - Neutralizing
L8	-	Coil - Mixer Plate (Compensating Inductance)
L9	-	Coil - Mixer Plate
L101	5437	Coil - Interstage (Sound I-F - 4.5 Mc)
L201	5539	Coil - I-F Input (43 Mc)
L202	5538	Coil - 1st I-F (45.5 Mc)
L203	5440	Coil - Adjacent Channel Sound Trap (47.25)
L204	5537	Coil - 2nd I-F (42.25 Mc)
L205	5438	Coil - (41.25 Mc Trap)
L206	5538	Coil - 3rd I-F (44.2 Mc)
L207	5438	Coil - (41.25 Mc Trap)
L208	5537	Coil - 4th I-F (42.5 Mc)
L209	5440	Coil - Adjacent Channel Picture Trap (39.75)
L210	5430	Coil - Sound Take Off (4.5 Mc)
L211	5433	Coil - Peaking (Detector Series 150 UH)
L212	5434	Coil - Peaking (Detector Shunt 970 UH)
L301	5433	Coil - Peaking (Video Output Series 150 UH)
L302	5402	Coil - Trap (4.5 Mc)
L303	5340	Coil - Peaking (Video Output Shunt 350 UH)
L601	See Miscellaneous	
L701	5447	Coil - Horizontal Frequency
L702	5266	Coil - Damper Choke
L703	5464	Coil - Width Control
L704	See Miscellaneous	
	TRANSFORMERS	
T101	5443	Transformer - Ratio Detector
T102	5192	Transformer - Audio Output
T601	5188	Transformer - Vertical Output
T701	5187	Transformer - Horizontal Output
T801	5042	Transformer - Power
	CONTROL - SWITCHES	
R114	4907	Control - Volume, 500K
R117	4890	Control - Tone, 1M
R302	4907	Control - Contrast, 1.5K
R310	4867	Control - Brightness, 50K
R403	4853	Control - AGC, 50K
R606	4868	Control - Vertical Hold, 1M
R608	4864	Control - Vertical Size, 2M
R610	4865	Control - Vertical Linearity, 5K
R710	4859	Control - Horizontal Hold, 25K
R711	4859	Control - Horizontal Drive, 25K
	MISCELLANEOUS	
R701	9782	Fuse - 1/4 Amp, Slo-Blo
I801	9505	Light - Pilot (#44 Mazda)
L601	5189	Yoke - Deflection - 90°
L704	5189	Yoke - Deflection - 90°
J101	6121	Receptacle - Phono Input
LS101	9091	Speaker - 5-1/4"
LS102	9074	Speaker - 11-1/2"
M301		Ion Trap - 55 Gauss
M302	9789	Focuser
P801	6126	Receptacle - Power
Z201	9786 or 9795	Tuner - Cascode R-F - UHF-VHF, 40 Mc, Standard Coil
Z301	6107-A	Socket - Kinescope with Leads
Z501	9695	Network - Vertical Integrator
Z702	6239	Plug - Anode Connector with Lead

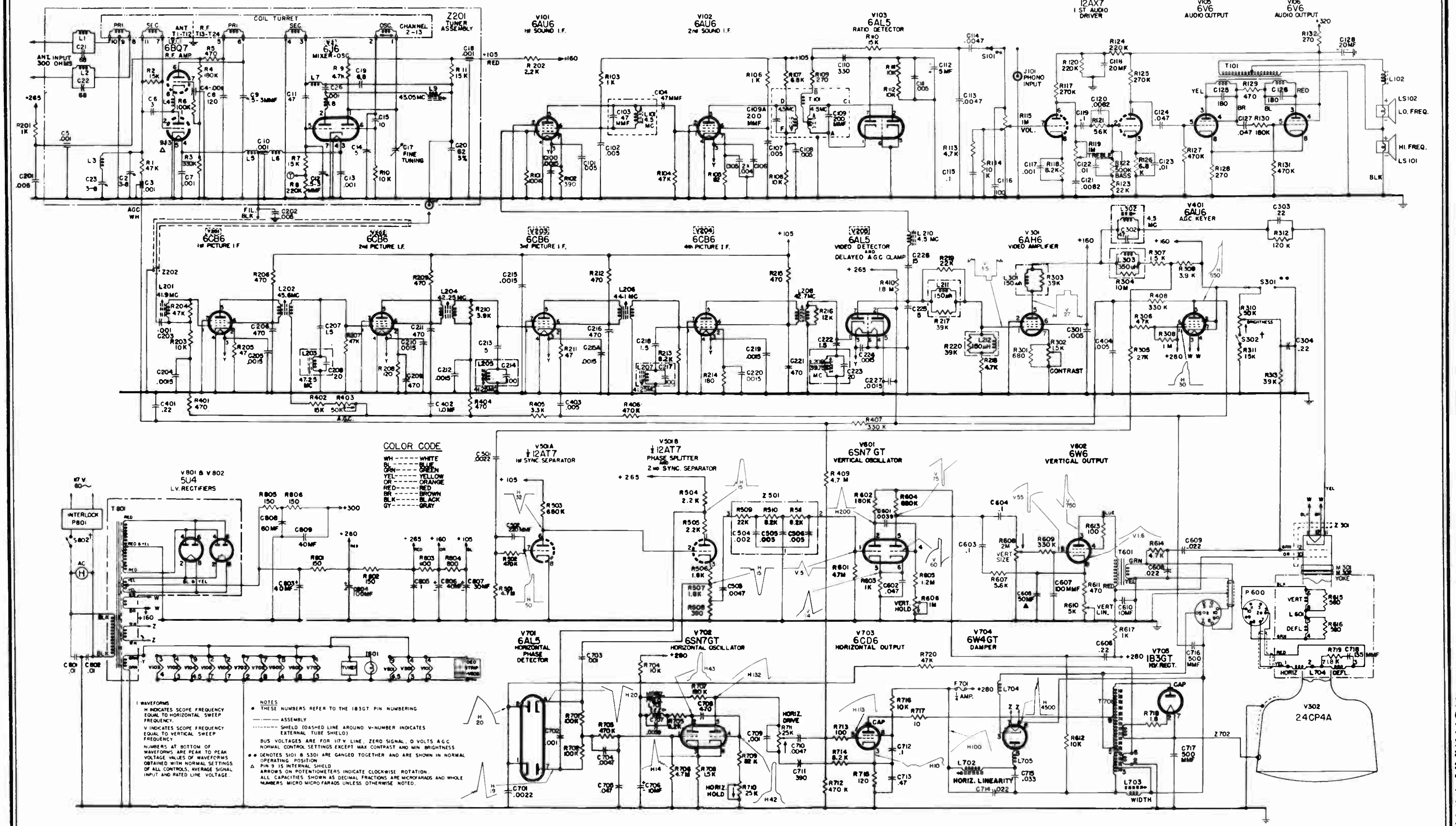


Figure 20. Schematic Diagram for Chassis 403

PARTS LIST

NOTE: Unless otherwise noted all resistors are 1/2 watt, composition type, ±10% tolerance with values given in ohms.

NOTE: Unless otherwise noted all condensers are 600 volt, molded phenolic type, ±20% tolerance with whole number values given in micromicrofarads and decimal fraction values given in microfarads. GMC - guaranteed minimum capacity.

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
	RESISTORS				
R100	Not Used				
R101	4511	100K	20%		
R102	4549	390			
R103	4542	1K	20%		
R104	4504	47K	20%		
R105	4598	82			
R106	4542	1K	20%		
R107	4608	6.8K		1 Watt	
R108	4644	10K		1 Watt	
R109	4663	270			
R110	4521	15K	20%		
R111	4597	10K			
R112	4597	10K			
R113	4576	4.7K	20%		
R114	4597	10K			
R115	See Controls				
R116	Not Used				
R117	4602	270K			
R118	4651	8.2K			
R119	See Controls				
R120	4618	220K			
R121	24652	56K			
R122	See Controls				
R123	4628	22K			
R124	4618	220K			
R125	4602	270K			
R126	4557	6.8K			
R127	4622	470K			
R128	14639	270		2 Watts	
R129	4531	470			
R130	4634	180K			
R131	4622	470K			
R132	14639	270		2 Watts	
R200	Not Used				
R201	4659	1K	20%		
R202	4512	2.2K	20%		
R203	4597	10K			
R204	4537	47K			
R205	4639	47			
R206	4664	470			
R207	4537	47K			
R208	4546	120			
R209	4664	470			
R210	4654	3.9K			
R211	4639	47			
R212	4664	470			
R213	Part of L207	8.2K			
R214	14618	180			
R215	4664	470			
R216	4656	12K			
R217	Part of L211	39K	20%		
R218	4649	4.7K			
R219	4628	22K			
R220	Part of L212	39K			
R300	Not Used				
R301	4514	680	20%		
R302	See Controls				
R303	Part of L301	39K			
R304	Part of L303	10M			
R305	24618	27K			
R306	4504	47K	20%		
R307	4610	1.5K	5%		
R308	4614	1M	20%		
R309	24550	3.9K	5%		
R310	See Controls				
R311	4521	15K	20%		
R312	4548	120K			
R313	44566	39K	20%		
R400	Not Used				
R401	4664	470	20%		
R402	4521	15K	20%		
R403	See Controls				
R404	4664	470	20%		
R405	4607	3.3K			
R406	34550	470K	5%		
R407	4677	330K	20%		
R408	34532	330K	5%		
R409	34659	4.7M			
R410	34612	1.8M	5%		
R500	Not Used				
R501	4544	4.7M	20%		
R502	4622	470K			
R503	34568	680K			
R504	24525	2.2K	5%		
R505	24525	2.2K	5%		
R506	24517	1.8K	5%		
R507	24517	1.8K	5%		
R508	4549	390			
R509	Part of Z501	22K			

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
R510	Part of Z501	8.2K			
R511	Part of Z501	8.2K			
R600	Not Used				
R601	4544	4.7M	20%		
R602	34507	180K		1 Watt	
R603	4659	1K			
R604	34571	680K		1 Watt	
R605	34593	1.2M			
R606	See Controls				
R607	4629	5.6K			
R608	See Controls				
R609	4677	330K	20%		
R610	See Controls				
R611	4664	470			
R612	4625	10K		1 Watt	
R613	4547	100			
R614	4543	4.7K			
R615	Part of L601	560			
R616	Part of L601	560			
R617	4522	1K	20%	1 Watt	
R700	Not Used				
R701	4571	100K			
R702	4571	100K			
R703	4506	470K	20%		
R704	4644	10K		1 Watt	
R705	4651	8.2K			
R706	4544	4.7M	20%		
R707	4634	180K			
R708	4610	1.5K	5%		
R709	24870	82K			
R710	See Controls				
R711	See Controls				
R712	4622	470K			
R713	4547	100			
R714	4651	8.2K			
R715	4657	120		2 Watts	
R716	4503	10K		2 Watts	
R717	4685	10	20%	1 Watt	
R718	4776	1.8			
R719	Part of L706	1.8K			
R800	Not Used				
R801	4771	150		10 Watts	
R802	4771	150		10 Watts	
R803	4773	1100		10 Watts	
R804	4773	800		10 Watts	
R805	14613	150		2 Watts	
R806	14613	150		2 Watts	
		CAPACITORS			
C100	14030	.0015			
C101	4029	.005			Hi-K Ceramic
C102	4029	.005			Hi-K Ceramic
C103	Part of L101	47			
C104	14057	47	20%	500 V	G.P. Quality Components Type ZC
C105	4036	.004			Hi-K Ceramic
C106	4036	.004			Hi-K Ceramic
C107	4029	.005			Hi-K Ceramic
C108	4029	.005			Hi-K Ceramic
C109	Part of T101	200			
C109A	Part of T101	200			
C110	4065	330			Ceramic Tubular
C111	4029	.005			Hi-K Ceramic
C112	See Electrolytics				
C113	4127	.0047	20%	400 V	
C114	4127	.0047	20%	400 V	
C115	4163	.1	10%	200 V	
C116	4079	100			Ceramic
C117	4175	.001			
C118	See Electrolytics				
C119	4143	.1		200 V	
C120	4189	.0082	10%	400 V	
C121	4189	.0082	10%	400 V	
C122	4134	.01	10%	400 V	
C123	4134	.01	10%	400 V	
C124	4147	.047		200 V	
C125	4070	180		500 V	Mica
C126	4070	180		500 V	Mica
C127	4148	.047		400 V	
C128	See Electrolytics				
C200	Not Used				
C201	4029	.005		500 V	
C202	4029	.005		500 V	
C203	14031	.001		500 V	
C204	14030	.0015			
C205	14030	.0015			
C206	14050	470		500 V	
C207	4082	1.5			
C208	Part of L203	20			
C209	14050	470			

SYMBOL	PART NO.	VALUE	TOL.	WATTS OR VOLTS	TYPE
C210	14030	.0015			
C211	14050	470		500 V	
C212	14030	.0015			
C213	14051	5	10%		
C214	Part of L205	100			
C215	14030	.0015			
C215A	14030	.0015			
C216	14050	470	10%	500 V	
C217	Part of L207	100			
C218	4082	1.5	10%		
C219	14030	.0015			
C220	14030	.0015			
C221	14050	470	10%	500 V	
C222	4082	1.5	10%		
C223	Part of L209	20			
C224	14030	.0015			
C225	14051	5	10%		
C226	14052	15			
C227	14030	.0015			
C300	Not Used				
C301	4029	.005			Hi-K Ceramic
C302	Part of L302	47			
C303	4131	.22		200 V	
C304	4131	.22			
C400	Not Used				
C401	4131	.22		200 V	
C402	14200	1.0		100 V	
C403	4029	.005			Hi-K Ceramic
C404	4029	.005			Hi-K Ceramic
C500	Not Used				
C501	4138	.0022	10%		
C502	4026	220			Mica or Ceramic
C503	4127	.0047		400 V	
C504	Part of Z501	.002			
C505	Part of Z501	.005			
C506	Part of Z501	.005			
C600	Not Used				
C601	14113	.0039	10%		
C602	4158	.047	10%	200 V	
C603	14133	.1	10%		
C604	4144	.1			
C605	See Electrolytics				
C606	4129	.22	10%		
C607	4079	100	10%		
C608	4124	.022			
C609	4124	.022			
C610	See Electrolytics				
C700	Not Used				
C701	4136	.0022	10%	400 V	
C702	4175	.001	10%	400 V	
C703	4175	.001	10%	400 V	
C704	4127	.0047		400 V	
C705	4147	.047		200 V	
C706	See Electrolytics				
C707	4085	.0039	10%	500 V	Silver Mica
C708	14009	470	10%		Mica
C709	14104	.001	10%		
C710	4128	.0047			
C711	14010	390	10%		Mica
C712	4144	.1			
C713	4173	.47	10%	200 V	
C714	4124	.022			
C715	14127	.033	10%		
C716	4076	500		1500 V	Mica
C717	14037	500		30 KV	Ceramic
C718	Part of L706	135	10%	3000 V	Ceramic
C800	Not Used				
C801	4105	.01			
C802	4105	.01			
C803	See Electrolytics				
C804	See Electrolytics				
C805	4144	.1			
C806	See Electrolytics				
C807	See Electrolytics				
C808	See Electrolytics				
C809	See Electrolytics				
		CAPACITORS - ELECTROLYTIC			
C112	4209	5 mfd	-	50 V	-
C118	4259	20 mfd	-	350 V	-
C128	4259	20 mfd	-	350 V	-
C605	4251	50 mfd	-	50 V	-
C610	4253	10 mfd	-	600 V	-
C706	4252	10 mfd	-	350 V	-
C803	4251	40 mfd	-	350 V	-
C804	4251	100 mfd	-	350 V	-
C806	4252	40 mfd	-	350 V	-
C807	4251	30 mfd	-	350 V	-

SYMBOL	PART NO.	DESCRIPTION
		COILS
L1	-	Coil - I-F Trap
L2	-	Coil - I-F Trap
L3	-	Coil - Series Trap (I-F Band)
L4	-	Coil - 5 Turns 1/4 O.D., Cascode Coupling
L5	-	Coil - 16 Turns 1/4 O.D., Heater
L6	-	Coil - 16 Turns 1/4 O.D., Heater
L7	-	Coil - Neutralizing
L8	-	Coil - Mixer Plate (Compensating Inductance)
L9	-	Coil - Mixer Plate
L101	5437	Coil - Interstage (Sound I-F - 4.5 Mc)
L201	5539	Coil - I-F Input (43 Mc)
L202	5538	Coil - 1st I-F (45.5 Mc)
L203	5440	Coil - Adjacent Channel Sound Trap (47.25)
L204	5537	Coil - 2nd I-F (42.25 Mc)
L205	5438	Coil - (41.25 Mc Trap)
L206	5538	Coil - 3rd I-F (44.2 Mc)
L207	5438	Coil - (41.25 Mc Trap)
L208	5537	Coil - 4th I-F (42.5 Mc)
L209	5440	Coil - Adjacent Channel Picture Trap (39.75)
L210	5430	Coil - Sound Take Off (4.5 Mc)
L211	5433	Coil - Peaking (Detector Series 150 UH)
L212	5434	Coil - Peaking (Detector Shunt 970 UH)
L301	5433	Coil - Peaking (Video Output Series 150 UH)
L302	5402	Coil - Trap (4.5 Mc)
L303	5340	Coil - Peaking (Video Output Shunt 350 UH)
L601	See Miscellaneous	
L701	5447	Coil - Horizontal Frequency
L702	5286	Coil - Damper Choke
L703	5464	Coil - Width Control
L704	See Miscellaneous	
		TRANSFORMERS
T101	5443	Transformer - Ratio Detector
T102	5170	Transformer - Audio Output
T601	5188	Transformer - Vertical Output
T701	5187	Transformer - Horizontal Output
T801	5043	Transformer - Power
		CONTROL - SWITCHES
R115	4907	Control - Volume, 500K
R117	4913	Control - Treble, 1M
R122	4905	Control - Bass, 500K
R302	4907	Control - Contrast, 1.5K
R310	4867	Control - Brightness, 50K
R403	4853	Control - AGC, 50K
R606	4832	Control - Vertical Hold, 1M
R608	4864	Control - Vertical Size, 2M
R610	4865	Control - Vertical Linearity, 5K
R710	4859	Control - Horizontal Hold, 25K
R711	4859	Control - Horizontal Drive, 25K
		MISCELLANEOUS
F701	9782	Fuse - 1/4 Amp, Slo-Blo
I801	9505	Light - Pilot (#44 Mazda)
J101	8121	Receptacle - Phono Input
L601	5189	Yoke - Deflection - 90°
L704	5189	Yoke - Deflection - 90°
LS101	9091	Speaker - 5-1/4"
LS102	9099	Speaker - 11-1/2"
M301	9702	Ion Trap - 45 Gauss
M302	9789	Focuser
P801	6126	Receptacle - Power
Z201	9786 or 9795	Tuner - Cascode R-F - UHF-VHF, 40 Mc, Standard Coil
Z301	6107-A	Socket - Kinescope with Leads
Z501	9695	Network - Vertical Integrator
Z402	6239	Plug - Anode Connector with Lead

DESCRIPTION

The Regency Model RC-600 UHF (Ultra High Frequency) Television Converter is designed to permit reception of UHF television signals on receivers designed for VHF channels 2 through 13.

The frequency coverage of the UHF television band is from 470 to 890 megacycles. Seventy UHF channels make up this band and are numbered 14 through 83. As adjusted at the factory, the RC-600 converts any of the UHF channels for reception on channel 10 on your VHF television receiver. If a signal on channel 10 makes this channel unusable, an easily performed adjustment will permit reception of the UHF signals on any channel from 8 to 13.

Two front panel control knobs are used on the Regency Model RC-600. (See figure 1.) The large control knob is used for tuning UHF stations with tuning indicated by the large slide rule type dial. The other front panel control actuates the selector switch. Switch positions are marked OFF-VHF-UHF. If the television receiver's AC plug is inserted into the receptacle on the back of the converter (see figure 2), the selector switch also controls power to the television receiver.

The action of the selector switch is as follows:

1. OFF POSITION—Power to both converter and receiver is turned off.
2. VHF POSITION—Power to the receiver and to the converter tube filaments is turned on, and the VHF antenna is connected through the switch to the receiver antenna input terminals. The receiver may now tune in any available VHF station from Channel 2 through 13.
3. UHF POSITION—Power to both receiver and converter is on. The VHF antenna is disconnected by the switch, and the converter output (channel 10 frequency) is fed to the antenna input terminals of the receiver. With the channel selector of the receiver in channel 10 position, the converter is tuned to an available UHF signal for best picture and sound.

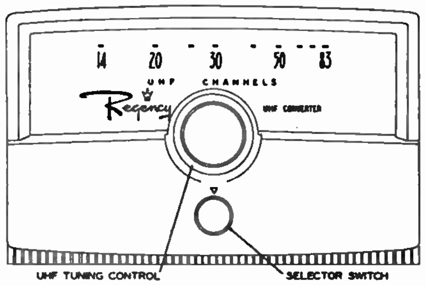


Figure 1.

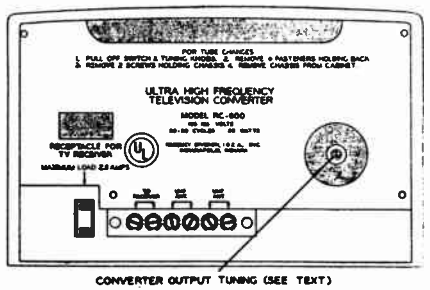


Figure 2.

INSTALLATION

1. Locate the converter as close to the television receiver as is convenient. Disconnect the VHF antenna lead from the receiver and connect it to the converter terminal strip marked VHF ANTENNA at the back of the unit.

2. Connect a short piece of 300 ohm twin lead from the receiver antenna input terminals to the converter terminals marked VHF SET.

3. Connect the UHF antenna lead-in to the converter terminals marked UHF ANTENNA. If a combination UHF and VHF antenna is employed, connect a short piece of 300 ohm twin lead from the converter terminals marked UHF ANTENNA to terminals marked VHF ANTENNA.

4. If it is desired to have the television receiver turned on and off by the converter selector switch, plug the receiver AC plug into the AC receptacle on the back of the converter.

5. Plug the converter power cord into a convenient outlet that provides 105-125 volts AC, 50 to 60 cycles. DO NOT CONNECT TO A DC SOURCE.

6. Select a clear VHF channel (8 to 13) for UHF reception, preferably channel 10, if available, and tune in a UHF station as described in OPERATION below. Adjust the converter output by means of the small fiber knob at the back of the converter (see figure 2) for best reception of the UHF television signal.

OPERATION

With the television receiver line cord plugged into the back of the converter, as previously described, the power switch of the television receiver should be left in "On" position at all times. The lower knob on the converter then turns the converter and receiver off and on simultaneously, thereby employing only one control for this operation.

To place your television receiver in operation, rotate the lower knob on the front of the converter cabinet to VHF position. In this position the television receiver may be used to tune in available VHF stations between channels 2 and 13 in the normal fashion. Since the filaments of the converter tubes are supplied with power in VHF position, a warm-up period is not required when switching to UHF position.

To receive UHF stations, turn the lower knob on the converter to the position marked UHF, and set the receiver channel selector knob to channel 10 position (or such other channel as may have been selected for UHF reception). The receiver is now set to receive signals from the UHF converter. Turn the large knob on the converter until the desired UHF channel is tuned as indicated by the pointer on the tuning dial. This setting of the tuning knob should always be adjusted for best picture and sound from the received UHF signal. Tuning may be touched up with the fine tuning control on the receiver.

In areas where only UHF stations are available, the converter is turned to UHF position and tuned to the desired channel. This requires a warm-up period to allow the tubes to reach their required operating temperature, thus insuring stable operation. Usually it is found that the normal warm-up period of the television receiver is sufficient. For some receivers it may be necessary to allow an additional minute or two of warm-up time to insure efficient operation.

SERVICING PROCEDURES

The Regency Model RC-600 converter employs a tuning drum unit consisting of a pre-selector circuit, crystal mixer, oscillator, and intermediate frequency amplifier. Both oscillator and converter tubes, type 6AF4 and 6BK7, are contained inside the tuning drum. A power transformer supplies filament voltages and provides voltage to the half wave selenium rectifier in the B plus circuit.

When servicing the converter, any components may be replaced with the exception of those contained in the tuning drum. Should difficulties occur in the tuning drum or if alignment is required, it is suggested that the entire converter unit be returned to the factory for service. To aid in locating the various converter components, the top and bottom chassis views are shown in figures 3 and 4.

TUBE REPLACEMENT—A tube puller is supplied with each tube in the tuning drum. If tube replacement is required, perform the following steps:

1. Remove knobs from front of cabinet.
2. Remove back cover.
3. Remove hex head screws holding chassis in.
4. Remove chassis.
5. Remove the 6BK7 tube (located at center of tuning drum, nearest the front of chassis).
6. Remove screw holding shield plate near top of tuning drum.
7. Remove the 6AF4 tube.
8. Remove tube pullers from old tubes and replace on new tubes.
9. Re-assemble the chassis into the cabinet.

Normally, a tube replacement will not necessitate converter alignment. However, if the unit does not track properly or if converter operation is not up to standard after tube replacement, it is suggested that a number of tubes (particularly the 6AF4 oscillator) be tried. In this way, it will be possible to select a tube whose characteristics more nearly approach those of the original tube.

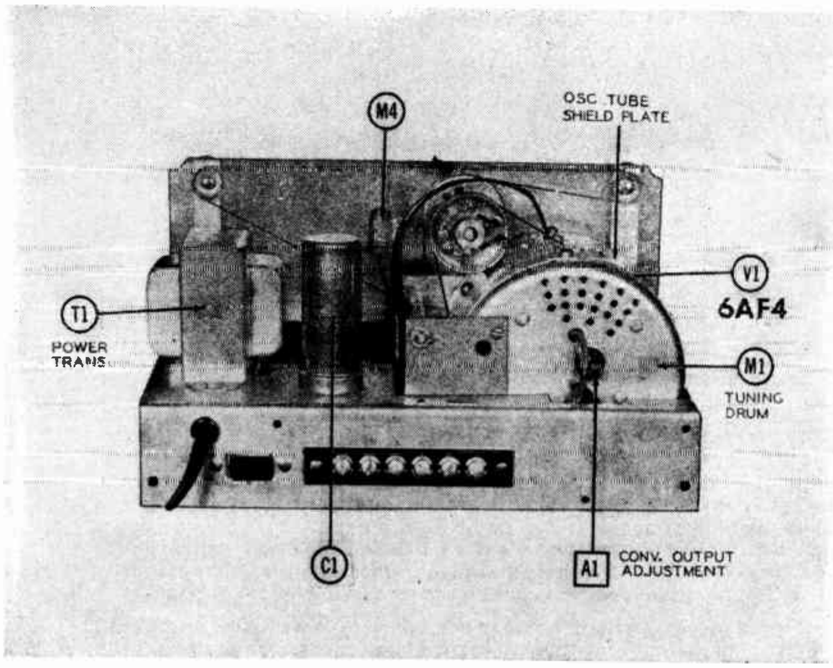


Figure 3. Chassis Rear View

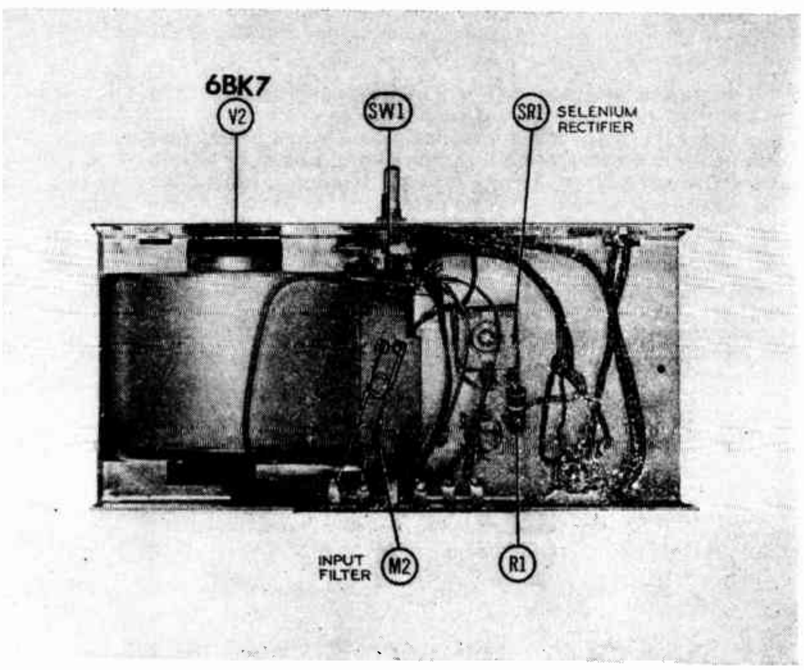


Figure 4. Chassis Bottom View

REPLACEMENT PARTS

In ordering replacement parts from the factory, always give part number (and number printed on the part, if different from number shown on parts list) and name or description of part.

All parts on which adjustments or replacements are desired must be returned to REGENCY DIVISION, I. D. E. A. INC., 7900 Pendleton Pike, Indianapolis 26, Indiana, with a letter specifying the reason for the return and giving the model and serial number of the converter in which the parts are to be used. This converter is manufactured according to standard specifications, and any competent serviceman should be able to correct faults locally with the information in this instruction manual.

The following list is for identification of parts and may be referred to figures 3 and 4 for locations of these parts. Most resistors, capacitors, etc. can be supplied by your parts dealer from the description or by comparison with old parts. If you are unable to locate parts, we will be glad to supply additional information if required.

PARTS LIST

TUBES		
V1	6AF4	
V2	6BK7	
CAPACITOR		
C1	300-082-7	50-50MFD@150 volts
RESISTOR		
R1		Carbon 390Ω, 2 watt, 10%
TRANSFORMER		
T1	300-272	Power transformer

MISCELLANEOUS PARTS

SR-1		Selenium rectifier 65MA@ 130 volts
M1	300-296-2	Tuner drum complete with tubes
M4		Dial lamp #47
SW1	300-286	Selector switch
	300-079-6	Terminal board, antenna
	600-016	Plastic cabinet
	300-289	Glass dial
	100-458	Dial light shield
	100-450	Dial Pointer
	100-448-2	Knob, selector switch
	100-375-2	Knob, tuning
	20010-2	Spring, dial drive
	300-281	Dial plate, metal

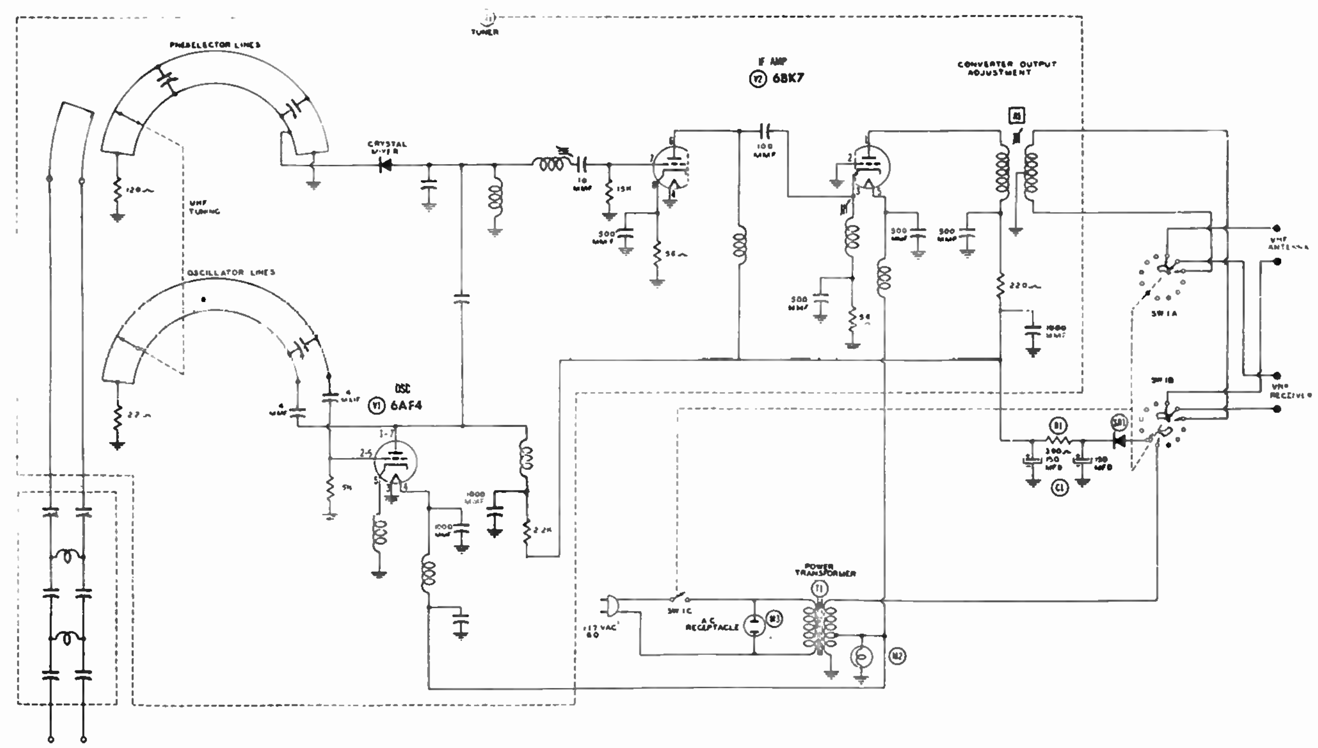


Figure 5. Schematic

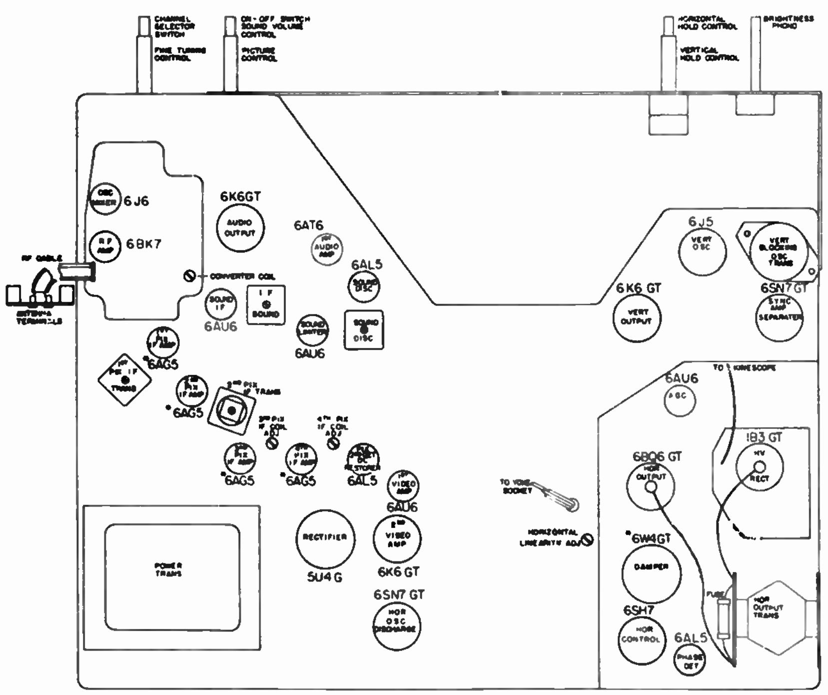
I GENERAL DESCRIPTION

The following Series of Television Receivers are distinguished by related chassis types.

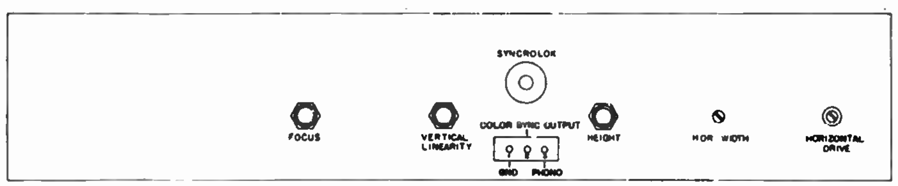
Models 5620, 5620-1: 26-tube receiver (including picture tube and two rectifiers). Features include: full 12 channel coverage; latest Standard Coil Cascode Circuit RF tuner, with high signal to noise ratio, UHF adaptable; limiter-discriminator FM sound system; high second anode potential for full picture brilliance and definition; automatic frequency control of the horizontal oscillator (Syncrolok); full 4 mc. bandwidth of the picture channel; noise saturation circuits; keyed A.G.C.; a connection is provided for adaptation to color reception; and a phonograph input connector by means of which the sound section may be used as an audio amplifier. Reference is made to the overall circuit diagram.

Models 2400, 2426, 2426B: These sets have a chassis especially adapted for use with a 24" picture size, and is otherwise the same as Model 5620.

TUBE LAYOUT



✻TUBES SHOWN	ALTERNATES
6AG5	6CB6 6BC5
6W4GT	5V4G
6SH7	6AU6
6BQ6 GT	6BG6G
6BK7	6AG5 6BC5



REAR CHASSIS CONTROLS

FIGURE 3

II ELECTRICAL SPECIFICATIONS

R.F. Frequency Range:	Channels 2 to 13 in 12 steps
Power Supply Rating:	117 Volts, 60 Cycles, 275 Watts
Audio Power Rating:	Undistorted - 2.5 Watts
	Maximum - 4 Watts

Antenna Input Impedance: 300 ohms

III TUBE COMPLEMENT

CIRCUIT SYMBOL	TUBE TYPE	FUNCTION	ALTERNATE
V 101	6AG5	1st Video I.F.	(6CB6) (6BC5)*
V 102	6AG5	2nd Video I.F.	(6CB6) (6BC5)*
V 103	6AG5	3rd Video I.F.	(6CB6) (6BC5)*
V 104	6AG5	4th Video I.F.	(6CB6) (6BC5)*
V 105	6AL5	A-Video Detector B-D.C. Restorer	
V 106	6AU6	1st Video Amplifier	
V 107	6K6GT	2nd Video Amplifier	
V 108	6SN7GT	A- Sync Limiter B- Sync Amplifier	
V 109	6AU6	AGC Keying Tube	
V 110	6J5	Vertical Oscillator & Discharge	
V 111	6K6GT	Vertical Amplifier	
V 112	6SN7GT	A- Horizontal Discharge B- Horizontal Oscillator	
V 113	6BQ6GT	Horizontal Amplifier	(6BG6G)
V 114	1B3GT	High Voltage Rectifier	
V 115	6W4GT	Damper	
V 116	5U4G	Power Supply Rectifier	
V 117	6AU6	Sound I.F.	
V 118	6AU6	Sound Limiter	
V 119	6AL5	Sound Discriminator	
V 120	6AT6	1st Audio Amplifier	
V 121	6K6	Audio Output	
V 122	6 SH7	Horiz. Oscillator Control	
V 123	6AL5	Horiz. Syne Discriminator	

RF amplifier, RF Oscillator-Mixer tubes are also supplied. These are 6J6 oscillator and Mixer, and 6 BK7 RF amplifier in the tuner.

IV CIRCUIT DESCRIPTION

1. VIDEO I.F.

The video I.F. section is composed of the 4 amplifier stages V-101, V-102, V-103, and V-104. This video I.F. section provides ample gain and gives very satisfactory pictures in all TV signal reception areas. The I.F. sound is taken off at the plate of the 2nd I.F. video amplifier(V-102) taking advantage of the extra gain afforded by the 1st two video I.F. stages. The video I.F. section is equipped with adjacent traps to eliminate interference from channels on either side of the station being received. The video I.F. picture carrier frequency is 26.25 megacycles. Also, a 4.5 mc trap (T114) is incorporated to eliminate sound "pebble" from the picture.

2. VIDEO DETECTOR AND AMPLIFIERS

All Models employ a 6AL5 half-wave detector (V-105A); and a 6AU6 first video amplifier (V-106). A 6K6 (V-107) is employed as the second Video amplifier. The gain of the video is controlled in the cathode of this stage by degeneration with high frequency compensation.

3. SOUND SECTION

The sound section consists of one 6AU6 (V-117) sound I.F. amplifier and one 6AU6 limiter (V-118) tuned to 21.75 megacycles; a phase discriminator using a 6AL5 duodiode (V-119); a 6AT6 (V-120) first audio amplifier and a 6K6 (V-121) audio output tube.

Provision has been made to allow the audio section to be used as a phonograph amplifier. Phono input is located on the rear of the chassis, the picture tube and video amplifier are inactivated by turning the brightness control to the extreme counter-clockwise position until phono-switch shape into position.

4. SYNCHRONIZING CIRCUITS

The vertical and horizontal synchronizing pulses are taken off in the plate circuit of the 1st video amplifier. They are then fed through two 6SN7 (V-108A, V-108B) triode stages for shaping and amplification. The vertical sync pulse is removed after the second stage of amplification and is applied to the grid of a 6J5 (V-110) triode functioning as the vertical blocking oscillator. The resulting saw-tooth wave form is fed through a 6K6 (V-111) vertical amplifier which drives the vertical deflection coils.

The horizontal sync pulse is clipped and amplified by the 6SN7 (V-108A, V-108B) and then fed to the horizontal discriminator described below. The horizontal sweep voltage is applied to the grid of a 6BQ6 (V-113) horizontal amplifier which drives the horizontal deflection coils.

5. HORIZONTAL OSCILLATOR AND FREQUENCY CONTROL CIRCUIT

The Horizontal oscillator and frequency control system is essentially a modified Syncrolok circuit. This system retains all the advantages of the Syncrolok circuit including noise immunity and phasing control.

The circuit uses three tubes, a horizontal oscillator (1/2 6SN7 - V-112B), a horizontal oscillator control tube (6SH7 - V-122), and a horizontal sync discriminator (6AL5 - V-123). The discriminator compares the frequency and phase of the sine wave output of the oscillator with that of the incoming horizontal sync pulses. If there is a difference between the two, the discriminator circuit acts through the oscillator control circuit to correct the oscillator frequency.

Since the control tube circuit is designed to react only to changes in the average level of discriminator output, noise pulses have little effect on the circuit, their duration usually being too short to affect the average output level.

6. COLOR ADAPTABILITY

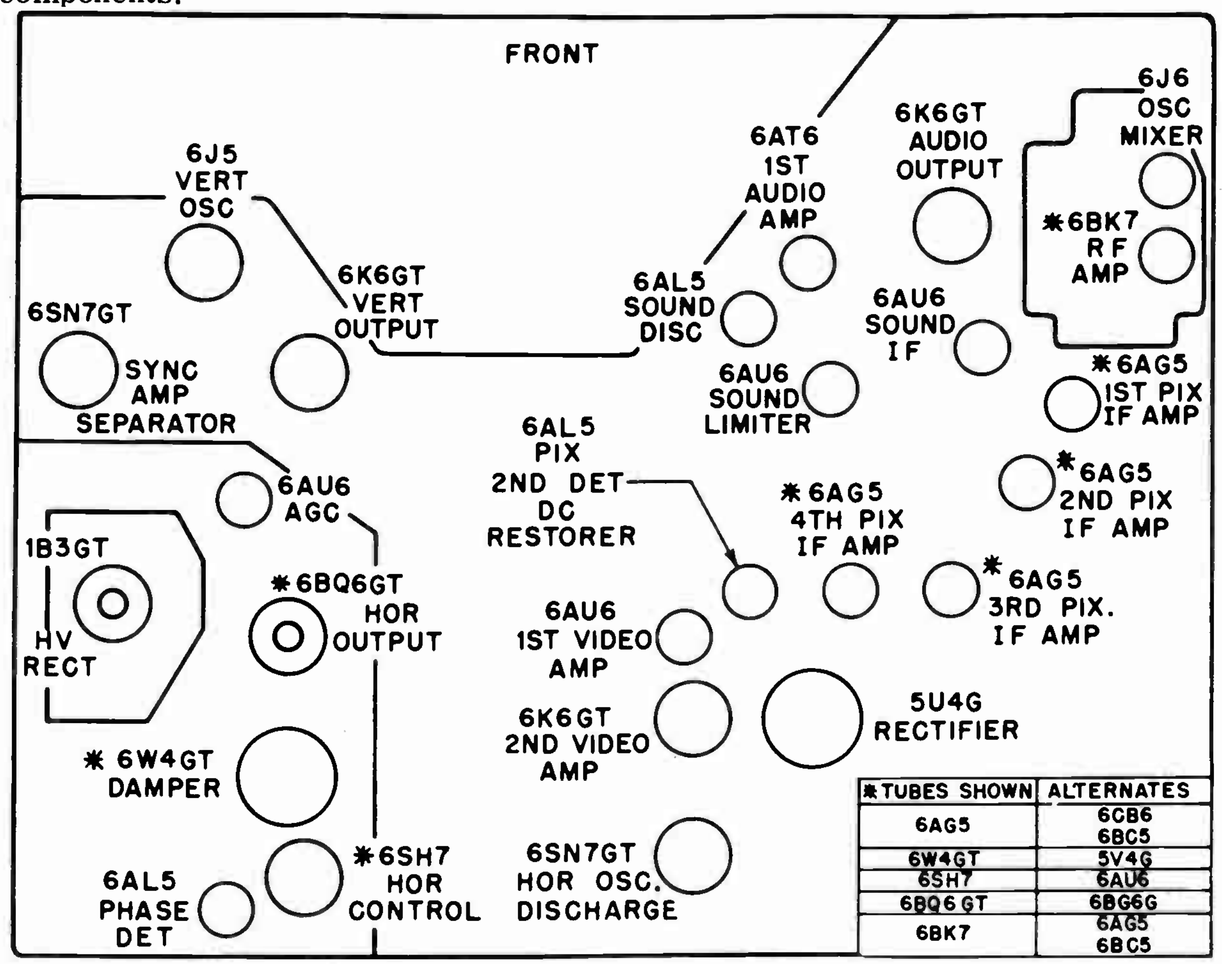
All receivers are provided with a terminal on the rear apron of the chassis for ready connection to an adapter for color reception. This connection is indicated in Fig III as the center lug on the terminal connection; the same connection containing the phono connection. This color lug is directly connected to the 60-cycle color sync pulse, from the vertical circuit, within the chassis.

7. HIGH VOLTAGE CIRCUIT

The high voltage supply consists of a "flyback" high voltage system, a 6W4 (V-115) damper tube, and a single 1B3 (V-114) high voltage rectifier. By employing an extremely efficient high voltage transformer, 15 KV anode voltage is consistently obtained on the picture tube.

8. LOW VOLTAGE SUPPLY

The low voltage supply is of the conventional type and consists of a 115V, 60-cycle power transformer, a 5U4G (V-116) full wave rectifier, plus its associated filter components.



✱TUBES SHOWN	ALTERNATES
6AG5	6CB6 6BC5
6W4GT	5V4G
6SH7	6AU6
6BQ6 GT	6BG6G
6BK7	6AG5 6BC5

BOTTOM VIEW

V INSTALLATION NOTES

When the set is ready for installation, subject it to a thorough visual inspection to be sure that no damage has occurred in shipment.

The set should be used in conjunction with a suitable 300 ohm antenna. When the antenna has been installed and connected to the chassis, connect the set to a 115V 60-cycle AC outlet.

1. In some cases, it may not be possible, as a result of shipping, to first off obtain a satisfactory picture by means of the front panel controls. If this happens, it will be necessary to readjust the rear panel controls. The names and locations of these controls are shown on the accompanying diagram, Fig. III.

2. If the picture or raster is off-center with respect to the mask, to the right or left, or too high or too low, it may readily be repositioned by adjustment of the FOCUS COIL. The FOCUS COIL is located on the neck of the picture tube. This adjustment is accomplished by simply loosening the wing nuts holding the FOCUS COIL, repositioning the FOCUS COIL so that the picture is properly centered in the mask with no neck shadow, and then re-tightening the wing nuts. This adjustment is done while viewing the picture with the aid of a mirror placed in front of the television set.

3. If the picture has a slightly blurred or fuzzy appearance, this may be cleared up by adjustment of the FOCUS control.

4. When the height of the picture is not sufficient to fill the mask, or if vertical non-linearity is present (evinced by unequal heights of the vertical wedges in the test pattern, or heads and bodies being out of proportion in a picture), the VERTICAL LINEARITY AND HEIGHT controls must be adjusted. These two controls affect each other, and when one is adjusted, it is usually necessary to readjust the other to obtain a satisfactory picture. The HEIGHT CONTROL has its greatest effect on the bottom half of the picture, while the LINEARITY CONTROL mostly affects the top half. If the picture width is not right, or if horizontal non-linearity is present, (i.e. one side of the picture expanded and the other side squeezed in), adjustment of the HORIZONTAL WIDTH, HORIZONTAL LINEARITY and/or HORIZONTAL DRIVE controls will be necessary (See Fig. III).

5. If the picture does not hold in sync throughout the range of the HORIZONTAL HOLD control, it may be possible to make it do so by adjusting the SYNCROLOK control on the rear panel. If this cannot be done, a detailed adjustment of the sync system, as described in the following: Service, Section VI, must made.

VI SERVICE INFORMATION

Each television set is pre-aligned and pre-adjusted before being shipped from the factory, and should give satisfactory performance upon installation. However, should it become necessary to re-align either the Sound or Video I.F. stages, or re-adjust the horizontal synchronizing circuits, it is suggested that the following procedures be used as guides.

HIGH VOLTAGE WARNING: OPERATION OF THE TELEVISION RECEIVER OUTSIDE THE CABINET, OR WITH COVERS REMOVED INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WHEN WORKING ON THE CHASSIS, ALL PRECAUTIONS SHOULD BE TAKEN TO PREVENT CONTACT WITH HIGH VOLTAGE POINTS. DO NOT OPERATE THE CHASSIS WITH THE HIGH VOLTAGE COMPARTMENT SHIELD REMOVED.

1. ADJUSTMENT OF HORIZONTAL OSCILLATOR

Connect a suitable antenna to the receiver and tune to an operating television station. A picture or test pattern should appear on the screen. The picture should remain in horizontal sync with the HORIZONTAL HOLD control in both the extreme clockwise and extreme counter-clockwise positions. The picture should also pull into sync with the hold control in either of these positions when the signal is momentarily removed.

If the above check reveals a lack of sync in the set, make the following adjustments:

(a) Tune in a television station and adjust the fine tuning control for best sound quality.
(b) Turn the syncrolok frequency control (on the rear of the chassis) until the picture is synchronized.
(c) If the blanking bar appears in the picture turn the "phase adjustment" (rear slug of syncrolok transformer under the chassis) until the blanking bar moves to the right and off the raster.
(d) Turn horizontal hold to extreme counter-clockwise position and turn "syncrolok frequency adjustment" (located on rear apron of the chassis) clockwise until the picture falls out of sync. Then turn the adjustment slowly counter-clockwise to the point where the picture falls into sync again.
(e) Readjust the phase adjustment so that the left side of the picture is close to to the left side of the raster, but does not begin to fold over.

(f) Turn HORIZONTAL HOLD to its extreme clockwise position. The right side of the picture should be close to the right side of the raster, but should not begin to fold over. If it does, readjust the phase.
(g) Momentarily remove the signal by tuning station selector off channel and then re-tuning. When the signal is restored, the picture should fall into sync. If it doesn't turn the sync frequency adjustment counter-clockwise until it does.
(h) Turn horizontal hold to extreme counter-clockwise position. Remove the signal momentarily. When the signal is restored, the picture should fall into sync.

2A. VIDEO I.F. ALIGNMENT

The following procedures should be followed when aligning the Video I.F. sections:

Connect the focus coil and deflection yokes to the set. Speaker and picture tube connections need not be made for I.F. alignment.

(a) Plug set into 115V, 60 cycle line; turn set on.
(b) Disable AGC by shorting Pin #1 of 6AU6 (V-109) keying tube to ground.
(c) Connect -1.5 volt bias between chassis and AGC strip. (Junction of R128 and C131).
(d) Connect a calibrated signal generator to the tuner by connecting the "hot" lead to the tuner mixer tube shield, and the ground lead to the chassis. Shield must be disconnected from ground so that signals can be coupled into the mixer through the shield to tube capacity.
(e) Connect one lead of a vacum tube voltmeter to the plate side of the 3900 ohm video detector load resistor, the other lead to ground, using lowest voltage range on meter.

(f) Adjust traps first. Inject trap frequencies of 20.25 mc; 21.75 mc; 27.75 mc; and 4.5 mc into tuner and adjust the respective traps for minimum deflection on meter. When adjusting 4.5 mc trap, a voltmeter with crystal probe should be connected between R141 and ground.
(g) Inject video I.F. amplifier frequencies of 25.8 mc; 22.8 mc; 22.3 mc; 25.7 mc and 23.9 mc. into the tuner, adjust each stagger tuned stage at its respective frequency for maximum deflection on vacuum tube voltmeter.
(h) Repeat Step (f).

Note: In all alignment procedures, use as low a signal input as possible to prevent overload.

3. SOUND I.F. ALIGNMENT

The following procedures should be followed when aligning the Sound I.F. sections of all the 260 Models.

The Sound I.F. carrier frequency is 21.75 mc. Inject a 21.75 mc. signal on the grid of the first sound I.F. amplifier. Connect a d.c. voltmeter in series with a 1. meg. resistor between ground and the high side of the second I.F. amplifier grid lead resistor (R-103). Adjust I.F. transformer (T-101) to obtain a maximum reading on the voltmeter (the voltage should be between -1 and -3 volts).

Now connect the voltmeter and the 1 meg. resistor between ground and the junction of the discriminator load resistors. Adjust the discriminator transfer primary for maximum deflection on the meter.

Connect the voltmeter across the total discriminator load and adjust the discriminator secondary for zero reading on the meter. Make sure that the meter goes positive as the secondary is adjusted to one side of the balance point and negative as it is moved to the other side.

4. USE OF OSCILLOSCOPE TO CHECK ALIGNMENT

In all cases it is desirable to check the alignment of both the Sound and Video I.F. sections as outlined above by using an oscilloscope in conjunction with suitable sweep equipment. This procedure is outlined herewith:

To check both Video and Sound I.F. alignment, attach a sweep generator to the antenna terminal and inject I.F. markers from the crystal controlled source between the chassis and the ground side of the cathode resistor of the first Video I.F. amplifier.

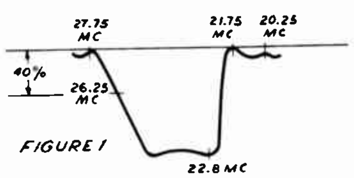


FIGURE 1

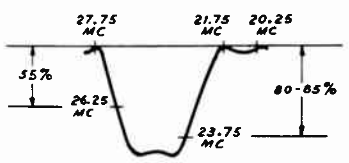


FIGURE 2

(a) Switch channel selector on set to Channel Six (6) and adjust the sweep generator to sweep Channel Six.
(b) Connect horizontal input of oscilloscope to "Scope" terminal of sweep generator.
(c) Connect vertical input of oscilloscope across the video detector load resistor (R-138).
(d) Slight adjustment of the video I.F. coils should bring the I.F. curve into proper shape. Check trap frequencies and half voltage point frequencies with crystal markers only.

The curves that should be obtained from a properly aligned I.F. are shown in Fig. I and II, depending on the set Model.

The sound I.F. curves can be observed by connecting the vertical input of the oscilloscope in series with a 50K resistor between the grid resistor of the 6AU6 limiter tube and ground series resistor. The discriminator curve can be observed by connecting the vertical input of the oscilloscope across the discriminator diode load resistors (Junction R-106 and R-108).

5. TUNER CHANNEL SLUG ADJUSTMENT

Individual channel tuner oscillator adjustments of the television receiver should be checked, upon its installation or servicing. If such adjustments are properly made, it is possible to on-tune from one station to another by merely turning the CHANNEL Selector and, if necessary, slightly readjusting the fine TUNING control. With correct oscillator channel adjustment, best picture and satisfactory sound will be located at the approximate center (half rotation) of the range of the FINE TUNING control.

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.
b. Set the CHANNEL SELECTOR knob for a station; set other controls for normal picture and sound.
c. Set FINE TUNING control at center of its range by rotating it approximately half way.
d. Remove the CHANNEL Selector and FINE TUNING knobs.
e. Insert a 1/8" blade, non-metallic screwdriver in the 1/4" hole (to the right of the channel tuning shaft). For each channel in operation, carefully adjust its channel slug for best picture with clear detail and best sound. Be sure that the FINE TUNING control is set at the center of its range before adjusting each channel slug. Generally, only a slight rotation of the slug will be required; turning the slug in too far will cause it to fall into its coil. (If the slug falls into the coil, remove the coil strip from the tuner, move the retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace the slug and re-set retaining spring.)

6. TROUBLE SHOOTING DATA

Reference is made to "Resistance Measurement Chart", and "Voltage Measurement Chart" These charts are useful in detailing which section of the chassis may be inoperative. Any resistance or voltage measurements which do not correspond to these charts will point up the circuit breakdown as to resistor, condenser, etc.

RESISTANCE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V101	100K	82	0	0.2	10K	10K	82		
V 102	100K	82	0.2	0	9.5K	9.5K	82		
V 103	100K	39	0.2	0	12.5K	9.5K	39		
V 104	0.4	150	0.2	0	14.5K	8.5K	150		
V 105	0.2	22K	0.2	0	1meg	0	4K		
V 106	3.9K	0	0	0.2	10K	9.5K	0		
V 107	1meg	0	10K	8K	800K	1.0meg	0.2	290	
V 108	20K	37K	3.9meg	300K	25K	0	0.2	0	
V 109	40K	8K	0	0.2	100K	25K	8K		
V 110	0	0	900K	60K	2.2meg	60K	0.2	750	
V 111	11K	0.2	11K	11K	2.2meg	2.8K	0	4.5K	
V 112	2.3meg	100K	750	100K	10K	800	0.2	0	
V 113	NC	0.2	NC	15K	500K	NC	0	850	
V 114		Inf			110K		Inf		
V 115	9K	NC	23K	9K	9K	9K	23K	23K	
V 116	NC	9K	NC	750	NC	750	NC	9K	
V 117	470K	0	0	0.2	9K	9K	100		
V 118	22K	0	0.2	0	9K	9K	0		
V 119	200K	100K	0	0.2	0	0	100K		
V 120	10meg	0	0.2	0	22K	22K	340K		
V 121	180	0.2	10.5K	10K	270K	320K	0	0	
V 122	0	0	0	1.45meg	0	8K	0.2	32K	
V 123	30	500K	0	0.2	1meg	0	500K		

All measurements in ohms taken with reference to chassis ground.
Permissible resistance variation ±10%.
Readings taken with Senior Voltohmist.
Measurements taken with all front panel controls in max. CW position.
K=1000 ohms

VOLTAGE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 101	-.12	0.64	0	6.3AC	85	85	0.64		
V 102	-.10	0.68	6.3AC	0	84	84	0.68		
V 103	-.08	0.54	6.3AC	0	60	80	0.54		
V 104	0	1.1	6.3AC	0	60	90	1.1		
V 105	0	0	6.3AC	0	1.8	0	-.5		
V 106	-.5	0	0	6.3AC	77	100	0		
V 107	0	0	42	100	0.4	2.5	6.3AC		
V 108	80	250	90	0	43	0	6.3AC		
V 109	80	101	0	6.3AC	0.42	260	101		
V 110	0	0	138	-89	-150	-89	6.3AC	-89	
V 111	0	6.3AC	245	245	-70	-56	0	-43	
V 112	-140	120	-86	-106	230	-86	6.3AC	0	
V 113	0	6.3AC	0	180	-90	0	0	-76	
V 114	*	*	*	*	*	*	*	*	
V 115	260	NC	500	250	250	260	500	500	
V 116	NC	280	NC	350AC	NC	350AC	NC	280	
V 117	-.08	0	0	6.3AC	98	98	0.74		
V 118	-.4	0	6.3AC	0	96	94	0		
V 119	1	-3	0	6.3AC	0	0	-2.5		
V 120	-.7	0	6.3AC	0	-.3	-.3	60		
V 121	-25	6.3AC	235	240	-25	0	0	0	
V 122	0	0	0	-3.8	NC	104	6.3AC	240	
V 123	-4	-9.5	0	6.3AC	-4	-	-9		

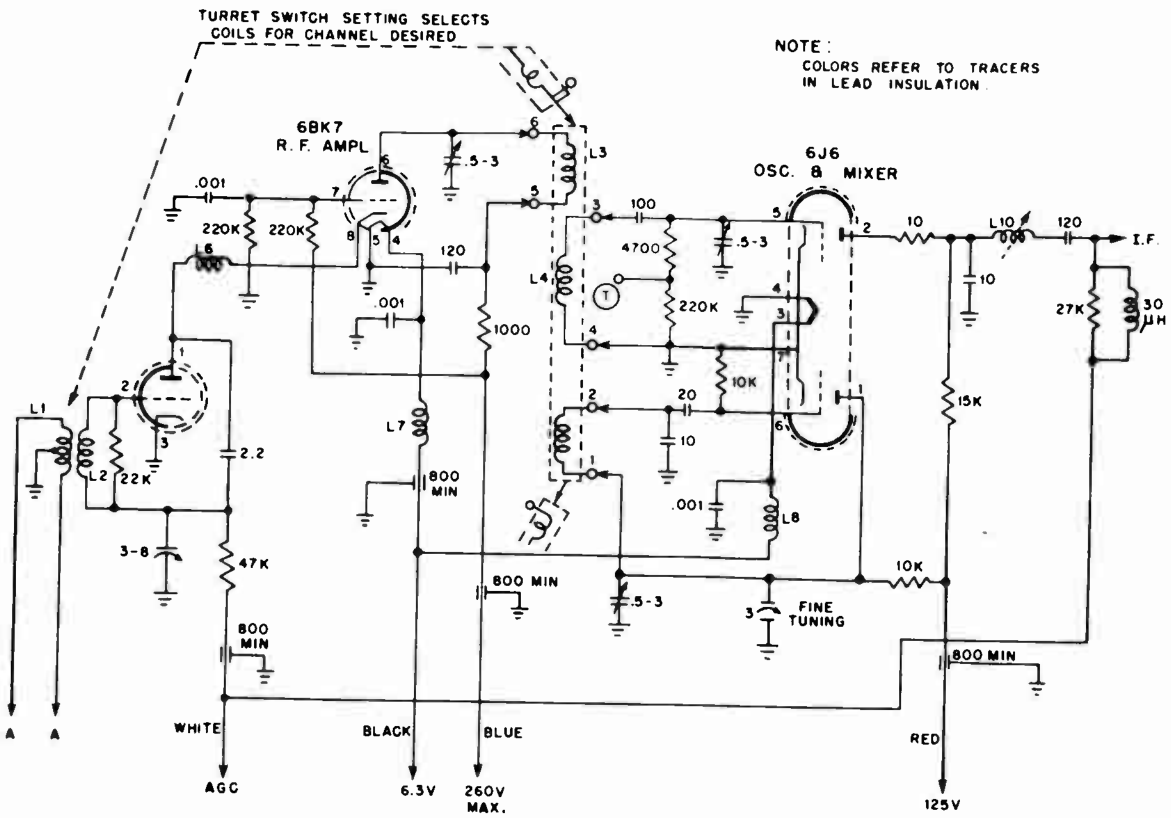
*Do not measure these voltages with ordinary meters - DANGER - Extremely high potentials.

AC line voltage 115 volts.
Measurements in volts taken with reference to chassis ground.
All voltages D. C. unless otherwise specified.
All voltages positive unless otherwise specified.

All measurements taken with Senior Voltohmist with picture tube and antenna disconnected.
Permissible voltage variation ±20%.

VII TUNER DESCRIPTION

A new Cascode type Standard Coil tuner is used in all models It is a rugged, sensitive 12-position turret tuner. Each channel has its individual set of coils, connected into the television circuit, when selected. The cascode circuit of this tuner provides higher gain and greater signal-to-noise reception ratios than ever before practicable. The fine tuning control permits crisp, sharp pictures to be brought in individually for each channel, at the point of best and truest sound reception. Standard Coil Products, Inc., will make available UHF coil sets, for simple insertion in place of any unused VHF channel, for direct reception through this receiver of any ultra high frequency (UHF) channels that will be authorized by the F.C.C.



RESISTORS, Carbon, 1/2w

Symbol No.	Part No.	Description
R209	ERA-33GJ	3.3Ω
R182	ERA-3005	30Ω 10%
R129	ERA-3901	39Ω 10%
R118, R123	ERA-8201	82Ω 10%
R101, R193	ERA-1011	100Ω 10%
R116, R121, R127, R132, R134	ERA-1511	150Ω 10%
R144	ERA-3311	330Ω 10%
R175, R176	ERA-5611	560Ω 10%
R102, R105, R189, R119, R124, R130, R136, R120, R125	ERA-1021	1000Ω 10%
R172	ERA-1821	1.8KΩ 10%
R131	ERA-2725	2.7KΩ 5%
R128	ERA-3325	3.3KΩ 5%
R141	ERA-3321	3.3KΩ 10%
R138	ERA-3925	3.9KΩ 5%
R122, R135	ERA-5625	5.6KΩ 5%
R171	ERA-8221	8.2KΩ 10%
R150, R154, R159, R140	ERA-1031	10KΩ 10%
R153, R158	ERA-1531	15KΩ 10%
R103, R108, R181	ERA-2231	22KΩ 10%
R149, R206, R190	ERA-2731	27KΩ 10%
R109, R152	ERA-8231	82KΩ 10%
R106, R107, R133, R166, R187, R191, R198	ERA-1041	100KΩ 10%
R168	ERA-2241	220KΩ 10%
R113	ERA-2741	270KΩ 10%
R112	ERA-3341	330KΩ 10%
R156	ERA-3941	390KΩ 10%
R126, R185, R186, R183, R194	ERA-4741	470KΩ 10%
R142	ERA-8241	820KΩ 10%
R207	ERA-1051	1megΩ 10%
R165	ERA-1555	1.5megΩ 5%
R155, R169, R170	ERA-2251	2.2megΩ 10%
R147, R157	ERA-3951	3.9megΩ 10%
R111	ERA-1061	10megΩ 10%

RESISTORS, Carbon, 1w 1KΩ.

R174	ERB-1022	3.3KΩ 10%
R148	ERB-3321	15KΩ 10%
R208	ERB-1531	47KΩ 10%
R160, R180	ERB-4731	470KΩ 10% (used on
Allen Bradley	ERB-4741	260K24 only)

RESISTORS, Carbon, 2w

R195	ERC-1011	100Ω 10%
R184	ERC-1511	150Ω 10%
R203	ERC-4711	470Ω 10%
R143	ERC-1231	12KΩ 10%

RESISTORS, Wire Wound, High Wattage

R115	ERD-104	600Ω 10% 10w
R114	ERD-105	1KΩ 10% 5w
R196	ERD-110	3KΩ 10% 5w (used in 260K24 only)
R196, R202	ERD-107	15KΩ 10% 10w (used in 260C & 260 DXC only)
R202	ERD-109	25KΩ 10% 10w (used in 260K24 only)
	ERD-113	Bleeder assembly-6450Ω total Tapped at 1450 and 5000Ω

CONTROLS

Symbol No.	Part No.	Description
R197	EP-101	Height 2.5megΩ
R167, R188	EP-105	Vert. & Horiz. hold 50KΩ, 1megΩ, dual control
R151	EP-106	Brightness, 50KΩ w/SPST switch
R110, R146	EP-107	Power on-off, sound, contrast, 1megΩ 10KΩ, dual control
R204	EP-108	Focus, w.w. 5KΩ 5w
R173	EP-111	Vert. lin., w.w. 5KΩ 2w

CAPACITORS, Ceramic

C142	ECC-100	10mmf 10% 500V
C105	ECC-101	51mmf 10% 500V
C185, C186	ECC-103	5000mmf 500V, Dual GMV
C181	ECC-105B	500mmf Titanium - oxide 20KV
C191-122, C127-190, C188-140, C120-125, C133-189, C137-138, C121-126, C132-138	ECC-107	1500mmf 10%, Dual GMV 500V
C187, C101, C130, C103	ECC-108	1500mmf 10% 500V, Single GMV
C160	ECC-114	56mmf 10% 1000V
C106	ECC-110	5000mmf 10% 500V, Single GMV

CAPACITORS, Mica

C168	ECM-100A	82mmf 10% 600V
C110, C124, C129, C134, C139, C149	ECM-101	270mmf 10% 600V
C155	ECM-102	4700mmf 10% 600V
C150	ECM-107	100mmf 10% 600V
C175	ECM-112	Padder w/mtg. assy. 20-270mmf
C147	ECM-113	390mmf 10% 600V
C119, C145, C170	ECM-114	470mmf 10% 600V

CAPACITORS, Molded Paper

C173	ECP-100	.001mf 600V
C111, C115, C116, C166, C172	ECP-105	.0047mf 400V
C169	ECP-106	.0047mf 600V
C113, C196	ECP-107	.01mf 400V
C144, C195, C146, C148	ECP-110	.047mf 400V
C157, C178	ECP-111	.047mf 600V
C192, C176, C177, C104	ECP-113	.1mf 400V
C156	ECP-114	.1mf 600V
C197	ECP-115	.27mf 400V
C112, C114	ECP-116	.0022mf 400V
C183	ECP-117	.15mf 600V
C165	ECP-119	.022mf 400V
C167, C171 Sprague	ECP-123	.015mf 10% 400V
C180	ECP-124	.27mf 600V
C136	ECP-125	1.0mf 200V

CAPACITORS, Electrolytic

C117, C163	ECE-100	20mf/450V, 80mf/350V, 2 sec.
C193, C179, C174	ECE-101	40mf/450V, 10mf/450V, 10mf/350V; 3 sec.
C184, C143, C159	ECE-102	40mf/450V, 80mf/150V, 10mf/450V; 3 sec.
C182, C158	ECE-104	80mf/450V, 50mf/50V, 2 sec.

COILS AND TRANSFORMERS

T104	EL-101	1st Video IF, 20.25mc trap
T114	EL-102	4.5mc trap
T101	EL-104	Sound IF
L103	EL-106	Peaking coil 250 μh, green
L102, L105, L107	EL-107	Peaking coil 120 μh, blue (w/22K res)
L106, L108	EL-108	Peaking coil 93 μh, red
L118, L119, L120, L121, L122	EL-111	Filament choke
L117	EL-113	Power Supply choke
L116	EL-114C	Focus coil 1000Ω
T105	EL-120	2nd Video IF 21.75mc sound take-off
T106	EL-121	3rd Video IF 27.75mc trap
T107	EL-122	4th Video IF 21.75mc trap
L123	EL-123	Syncrolok
T102	EL-124	Sound discriminator
L114	EL-126	Linearity coil
L115	EL-127	Width coil
T110	ET-100	Syncrolok
T112	ET-101C	Power
T108	ET-102	Vertical Blocking Oscillator
T109	ET-103	Vertical Output
T103	ET-105	Audio Output
T111	ET-106	High Voltage w/AGC winding

TUBES

V101, V102, V103, V104	EVT-100	6AG5
V105, V119, V123	EVT-101	6AL5
V110	EVT-102	6J5
V107, V111, V121	EVT-103	6K6
V108, V112	EVT-104	6SN7
V113	EVT-121	6BQ6
V114	EVT-106	1B3
V116	EVT-108	5U4G
V122	EVT-110	6SH7
V106, V109, V117, V118	EVT-111	6AU6
V120	EVT-112	6AT6
V115	EVT-120	6W4

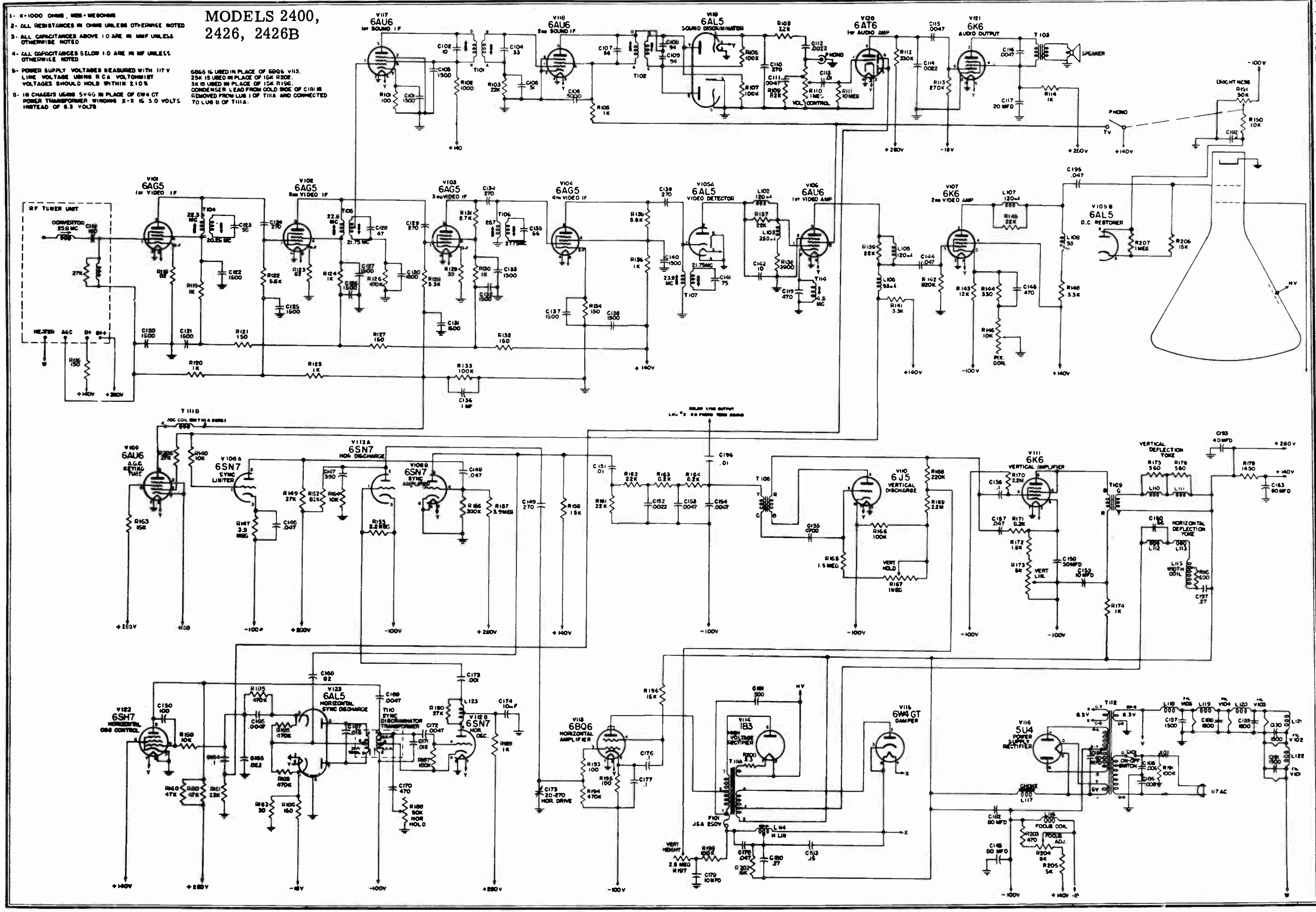
ELECTRICAL COMPONENTS

F101	EF-101	Fuse-pigtail, .15amp-delayed action
	EFE-105	Tuner-complete with tubes and shields
	ENW-100	Vertical Integrating network

MODELS 2400, 2426, 2426B

1- K=1000 OHMS, MEG=MEGOHMS
2- ALL RESISTANCES IN OHMS UNLESS OTHERWISE NOTED
3- ALL CAPACITANCES ABOVE 1.0 ARE IN MMF UNLESS OTHERWISE NOTED
4- ALL CAPACITANCES BELOW 1.0 ARE IN MF UNLESS OTHERWISE NOTED
5- POWER SUPPLY VOLTAGES MEASURED WITH 117 V LINE VOLTAGE USING R C A VOLTOHMYST VOLTAGES SHOULD HOLD WITHIN ±10%
6- IN CHASSIS USING 5V4G IN PLACE OF 6W4 GT POWER TRANSFORMER WINDING X-X IS 5.0 VOLTS INSTEAD OF 6.3 VOLTS

6BG6 IS USED IN PLACE OF 6BQ6 V113.
25K IS USED IN PLACE OF 15K R202.
3K IS USED IN PLACE OF 15K R196.
CONDENSER LEAD FROM COLD SIDE OF C181 IS REMOVED FROM LUG 1 OF T111A AND CONNECTED TO LUG B OF T111A.



General Information

POWER SUPPLY—These receivers are designed to operate from a power source of 117 volts at 60 cycles A.C. It will, however, operate satisfactorily from a line whose voltage is no lower than 105 volts, or no greater than 125 volts at 60 cycles A.C. Always measure the voltage of the line with a dependable a-c voltmeter if it is suspected that the line voltage is beyond the above acceptable limits.

TUBES—In all receivers, all tubes, including the picture tube, are shipped properly mounted in their sockets. Check to see that all tubes are firmly seated since some may have worked loose during shipment. See Picture Tube Handling Precautions below.

ANTENNA—The installation and orientation of an antenna is one of the most important single factors in realizing optimum performance from a television receiver. An improperly oriented, or poorly matched, or unwisely chosen antenna can completely offset the good design engineered into these television receivers. For these reasons, choose, locate and install your antenna carefully, especially in poor signal areas. All receivers in these series are equipped with a built-in antenna which performs satisfactorily in locations where good signal strength is available, and where a minimum of noise is present.

When an outdoor antenna must be installed, use a standard, approved antenna, having a 300 ohm impedance, and match it with a balanced 300 ohm transmission line. Orient the antenna for maximum signal strength from the greatest number of stations, and for the minimum amount of interference and reflection. Where the receiver is to be installed beyond the range of good signal strength (about 30 miles) use a stacked array, being careful to match the impedance of the antenna, transmission line, and receiver (300 ohms). If additional gain is required, try a "booster" for improvement of signal-to-noise ratio.

In critical locations, where the receiver is surrounded by several stations, most of which are located beyond the 30 mile radius, a careful appraisal of the terrain and the measurement of field strength will usually yield acceptable television operation where a haphazard installation might have failed. To make full use of the directional and "gain" properties of a stacked array and booster, the following procedure is recommended:

1. Measure the field-strength of the transmitted signal from each of the desired stations on a calibrated field-strength meter.
2. Tabulate your results and conclude which stations are within reasonable quality distance. A field-strength of 300 microvolts-per-meter or higher will give acceptable results. A field-strength measurement of 100 microvolts-per-meter or lower may not be satisfactory without the use of a "booster."
3. Let the consumer decide which of the acceptable channels he desires, and orient the antenna to receive maximum signal from those desired stations.
4. Always twist the 300 ohm lead-in about once for every foot of length to minimize transmission line noise pick-up.

PICTURE TUBE HANDLING PRECAUTIONS

Extreme care should be used in handling the picture tube. The picture tube bulb encloses a high vacuum and, due to its large surface area is subjected to considerable air pressure. The front of the picture tube, particularly the rim of the viewing surface, must not be struck, scratched, or subjected to more than moderate pressure at any time. If the yoke sticks or fails to slip smoothly over the tube or its socket, check and remove the cause of the trouble. Do not under any circumstances force the yoke.

HIGH VOLTAGE WARNING

OPERATION OF THIS RECEIVER WITH INTERLOCKED BACK COVER REMOVED INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THIS RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT.

IMPORTANT—**With the exception of the next paragraph, all information in this folder pertains to 16", 17", 20" and 21"** screen receivers.

FOCUS AND YOKE ASSEMBLY INSTALLATION INSTRUCTIONS (FOR RECEIVERS WITH 20" AND 21" SCREEN ONLY)

1. Remove the slotted head P.K. screws retaining the back, and release the interlocked line cord.
2. Remove the Focus Coil from its shipping position against the side of the tube support bracket by removing the long machine screw and nut and retaining bracket. This bracket and hardware may be thrown away. Remove the 2 wingscrews located on the Focus Coil Mounting Bracket.
3. Remove the beam bender from the neck of the picture tube and carefully slide the Focus Coil, smooth side forward, over the neck of the C.R. tube until there is about $\frac{1}{4}$" separation between the Focus Coil and the rear of the Deflection Yoke.
4. Fasten the Focus Coil in place by means of the wingscrews removed in Step 2.
5. Slide the beam bender over the neck of the picture tube.
6. Connect the picture tube socket to the picture tube base.
7. The male octal plug from the Deflection Yoke and Focus Coil Assembly is already plugged into its female socket on the chassis.

BUILT-IN ANTENNA INSTALLATION

This receiver is shipped with the built-in antenna completely connected. A few precautions should be observed, upon installing this receiver, if optimum performance is to be obtained.

1. Try to locate the receiver in such a position so that:
   a) All requirements for good viewing position and ventilation are satisfied.
   b) It is near a 105-125 volt 60 cycle A.C. power outlet.
   c) The back of the receiver is parallel and close to a window which faces in the general direction of the transmitters.
   d) It is not adjacent to a street having heavy automobile traffic which may cause ignition interference.
2. After performing the Service Adjustments outlined on the following pages, try a few stations and observe if their signals are received with sufficiently good quality so that the receiver may be left in this position.
3. If signal strength and noise conditions are known to be good and operation is not satisfactory, it may be best to try a new receiver location, choosing one where the receiver will be rotated 90 degrees relative to its former position.

If, however, it is found that the receiver is not permitted to perform at its best because of limitations of the built-in antenna in a noisy or weak-signal area, an outdoor antenna should be installed.

To connect an outdoor antenna to this receiver:

1. Loosen the two screws on the antenna terminal strip.
2. Disconnect the existing built-in antenna wires.
3. Connect the 300 ohm lead-in from the external antenna to the terminals and tighten the screws.

SERVICE ADJUSTMENTS

Below is given a description of the steps required in adjustment of the Beam Bender and Deflection Yoke and the adjustment of the Focus, Vertical Size and Linearity and Horizontal Size, Linearity, Drive and A.F.C. controls. However, it should be remembered that these adjustments are to be made only when picture quality is such that service adjustment is warranted. Use this description as a check-list and if a particular phase of quality is good, leave it alone and go on to the next operation. Refer to figure 1 for location of front panel controls, and to figure 7 for location of rear panel controls.

IMPORTANT—The adjustment of the Beam Bender (Ion Trap magnet) must be performed immediately after the receiver warms up. If any length of time is permitted to elapse while the receiver is on, and while the Beam Bender is misadjusted, serious damage to the internal structure of the cathode-ray gun may result.

A. PREPARATION FOR SERVICE ADJUSTMENTS

1. Remove the three slotted-head P.K. screws on the back of the receiver (located one in each corner, and one closest to the center of the cabinet top), disengage the interlock, and remove the back with the line cord.
2. Drop hinged door on front panel for access to the auxiliary controls as illustrated in Fig. 1. The lower set of these controls is adjusted by means of a narrow shanked screwdriver.
3. Connect a substitute interlock line cord between receiver and suitable power outlet and turn on the receiver allowing about 30 seconds of warm-up period before proceeding.

B. BEAM BENDER (ION TRAP) ADJUSTMENT

1. Advance the BRIGHTNESS control almost fully clockwise.
2. Position the beam bender on the glass neck approximately $\frac{1}{2}$" from the picture tube base.
3. Starting from this position, adjust the Beam Bender by moving it forward or backward, and at the same time rotating it slightly around the neck of the tube until the brightest raster appears on the screen. If two maximum brightness positions are found, the one nearest the tube base is the correct setting. This adjustment should be done quickly to avoid damaging the gun structure.
4. Adjust the BRIGHTNESS control setting until the raster is slightly above average brilliance.
5. Re-adjust the Beam Bender carefully for maximum raster brilliance.

C. DEFLECTION YOKE ADJUSTMENT

1. Loosen the wing thumb screw located at the top of the deflection yoke frame.
2. Check to see that the deflection yoke mounting bracket rubber cushions press firmly against the flare of the tube.
3. Press the yoke firmly against the flare of the tube.
4. Rotate the yoke until the lines of the raster are horizontal and squared with the picture mask, and tighten the wing screw.

SERVICE ADJUSTMENTS *(Continued)*

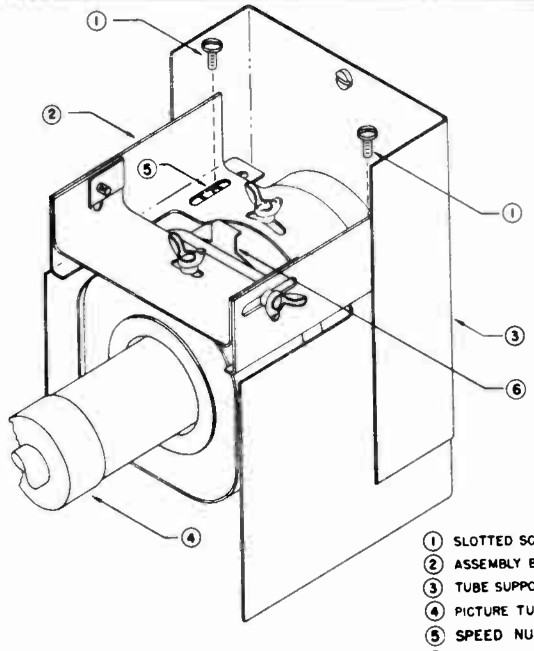
D. FOCUSING ADJUSTMENTS

1. Adjust BRIGHTNESS and CONTRAST controls so that the raster brilliance corresponds to that of an average picture.
2. If a corner of the raster is shadowed, it indicates that the electron beam is striking the neck of the tube. Loosen the Focus Coil Wing Screws and rotate the coil about its horizontal and vertical axis until the entire raster is visible, approximately centered, and with no shadowed corners. The Focus Coil should be kept close to, but not necessarily touching, the rear of the deflection coil for optimum range of the focus control. A slight readjustment of the Beam Bender may now be required.
3. Adjust the focus control (see Fig. 1) so that the lines of the raster are sharp and distinct over the greatest screen area.

E. HORIZONTAL A.F.C. ADJUSTMENT

In order to check this adjustment tune in a station, preferably one that is transmitting a test pattern. If difficulty is encountered in locking the picture horizontally or if it locks-in only when the Horizontal Hold Control is at either end of its rotation, adjust the Horizontal A.F.C. Control as follows:

1. Turn CONTRAST down about half way.
2. Turn HORIZONTAL HOLD CONTROL fully counterclockwise.
3. If the picture is not locked in, turn the HORIZONTAL A.F.C. control till it does lock-in. (See Fig. 7)
4. Momentarily interrupt the signal by switching the channel selecter off channel and then back. The picture should just fall out of sync. If it does not, turn the Horizontal A.F.C. adjustment screw slightly clockwise and again momentarily interrupt the signal. Continue this procedure until the picture just falls out of sync. only when the signal is interrupted.
5. Rotate the Horizontal Hold Control clockwise until the picture falls into sync. The picture should now stay in sync. throughout most of the range of the Horizontal Hold Control.
6. If the picture cannot be made to hold sync., carefully repeat the above procedure. If difficulty is still encountered, it may be necessary to make a complete alignment of the horizontal oscillator transformer using an oscilloscope, as described on page 3.



① SLOTTED SCREW
② ASSEMBLY BRACKET
③ TUBE SUPPORT BRACKET
④ PICTURE TUBE
⑤ SPEED NUT
⑥ CENTERING DISC

FIG. 2. DEFLECTION YOKE AND FOCUS COIL ASSEMBLY (20" and 21" RECEIVERS ONLY)

F. PICTURE CENTERING, SIZE AND LINEARITY

1. Horizontal or Vertical Centering is accomplished mechanically. To center the picture, loosen the Focus Coil Wing Nuts sufficiently to twist the Focus Coil slightly about its horizontal or vertical axis. Make sure the corners of the raster are not shadowed. See step D.2. Note: Some 20" receivers are equipped with a magnetic centering disc, located between the focus coil and the deflection yoke. To center the picture in the mask, rotate and slightly vary the position of the disc in its vertical plane. This adjustment should be made in conjunction with positioning of Focus Coil (described above).
2. Adjust the VERTICAL SIZE and VERTICAL LINEARITY controls until the test pattern is vertically linear and symmetrical from top to bottom, and fills the mask. Adjustment of either control may require readjustment of the other. If vertical synchronization "falls-out," readjust the VERTICAL HOLD control. (Refer to Fig. 1)
3. Adjust the HORIZONTAL SIZE control slotted screw, located at the rear of the High Voltage cage at the rear of the chassis, for correction of horizontal width. The large outer arcs of the test pattern should coincide with the edge of the picture mask. (Refer to fig 7)
4. Adjust the HORIZONTAL DRIVE control trimmer for horizontally symmetrical pattern, and elimination of any existing vertical bars in left center of picture. The final adjustment should have the control at least ½ turn counterclockwise from the maximum clockwise position. (See Fig. 7)
5. The readjustment of the HORIZONTAL A.F.C. control may now be necessary.
6. Adjust the HORIZONTAL LINEARITY control slotted screw, located at the rear of the High Voltage cage, for central alignment of the inner circles of the test pattern.

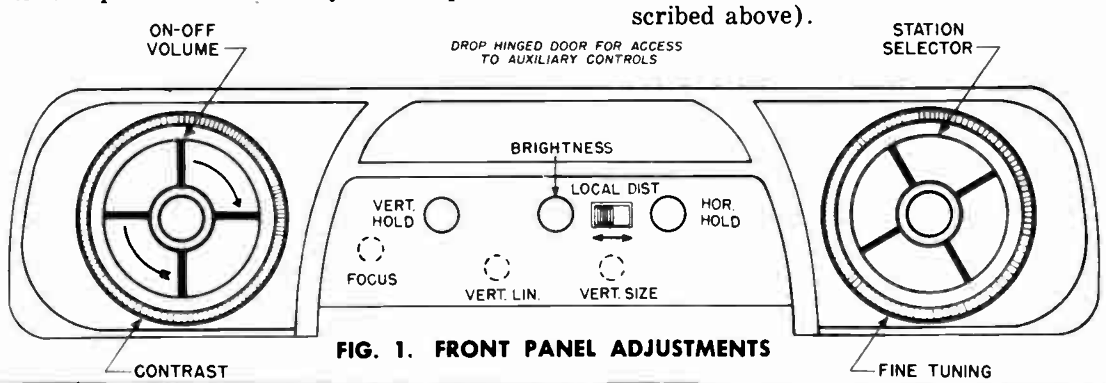


FIG. 1. FRONT PANEL ADJUSTMENTS

Alignment Instructions

Video I-F and Sound Alignment Procedure

TV I-F ALIGNMENT

1. Tune receiver to quiet portion of TV High Band.
2. Set contrast control fully counterclockwise.
3. Apply 3 v. negative bias between the A.G.C. bus (at C22A) and ground. (Use 2—1½ v. cells.)
4. Connect TV I-F Signal Generator through a 1500 MMF condenser to Test Point (A) of tuner unit; low side to ground. (See schematic diagram.)
5. Connect negative lead of V.T.V.M. (or meter of 20,000 ohms-per-volt, or better) to 4.7K diode load resistor TEST POINT (B); positive lead to ground. (See schematic diagram.)
6. Feed 23.2 MC [23.3]* (±.05 MC) from Signal Generator and adjust T4 for maximum deflection on meter. Maintain Signal Generator output so low that meter reads no more than 1.5 volts at peak.
7. Feed 21.8 MC [21.8]* (±.05 MC) from Signal Generator, and adjust T3 as above.
8. Feed 24.0 MC [23.9]* (±.05 MC) from Signal Generator, and adjust T2 as above.
9. Feed 24.7 MC [24.5]* (±.05 MC) from Signal Generator, and adjust T1 as above.
10. Replace the meter with the vertical input of an Oscilloscope through a 10K isolating resistor, low side to ground.
11. Remove Signal Generator. Feed a video I-F Sweep Generator (20 to 28MC) through loosely coupled shield of 6J6 converter tube, making sure shield is not grounded. (Refer to Fig. 3.)
12. Loosely couple high side of a TV I-F Marker Generator to the high Sweep Generator Lead; low side to ground.
13. Feed I-F Sweep, and observe response on 'scope. (See Fig. 5.) Use marker frequencies 20.25, 21.75 and 24.75 MC.
14. If response does not approximate that shown in Fig. 5, repeat steps 3 to 9, making sure that frequencies are precise, and that the Signal Generator output voltage is kept low. Continue with steps 10 to 13. A slight touch-up of individual slugs may be required to approximate the recommended curve of Fig. 5.

*NOTE: If 3v fixed bias is unavailable and zero fixed bias is used, set signal generator at [ ] bracketed frequencies values.

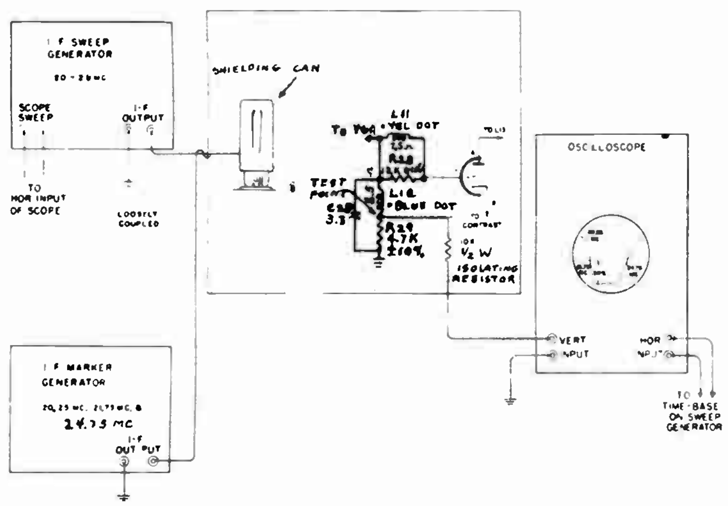


FIG. 3. IF ALIGNMENT BLOCK DIAGRAM

TV SOUND ALIGNMENT

NOTE: TV-phono switch must be in TV position.

1. Connect a 4.5 MC Signal Generator (±.01 MC) through a 1500 MMF condenser to the 4.7K video diode load resistor TESTPOINT (B); low side to ground. See schematic diagram.
2. Obtain two resistors of approximately 100,000 ohms each, whose resistances have been matched accurately with an ohmmeter. Connect them in series across the 18K resistor (R107) at the 6T8 tube socket (V9A).
3. Connect negative lead of V.T.V.M. to junction of matched resistors of step 2; positive lead to ground.
4. Feed 4.5MC (±.01 MC) from signal generator, and adjust L22, sound take-off coil, for maximum deflection on V.T.V.M. Two points of maximum deflection may be found when making this adjustment. Correct adjustment is attained when screw is at most outward maximum reading position.
5. Adjust the bottom slug of T10 for maximum deflection on V.T.V.M.
6. Connect positive lead of V.T.V.M. to junction of C96, and R106 TEST POINT (C), leaving negative lead of V.T.V.M. connected as in step 3. See schematic diagram.
7. Adjust top of T10 for zero output on V.T.V.M. between two opposite polarity peaks.

IMPORTANT: Keep the sweep generator and marker generator outputs at minimum to avoid curve distortion. Marker pips should be kept barely visible.

TABLE I RF ALIGNMENT FREQUENCIES

CHANNEL NUMBER	SWEEP GEN. CENTER FREQ. (10MC.SWEEP)	MARKER GENERATOR FREQUENCIES VIDEO CARRIER	SOUND CARRIER
2	57 MC.	55.25 MC.	59.75 MC.
3	63 MC.	61.25 MC.	65.75 MC.
4	69 MC.	67.25 MC.	71.75 MC.
5	79 MC.	77.25 MC.	81.75 MC.
6	85 MC.	83.25 MC.	87.75 MC.
7	177 MC.	175.25 MC.	179.75 MC.
8	183 MC.	181.25 MC.	185.75 MC.
9	189 MC.	187.25 MC.	191.75 MC.
10	195 MC.	193.25 MC.	197.75 MC.
11	201 MC.	199.25 MC.	203.75 MC.
12	207 MC.	205.25 MC.	209.75 MC.
13	213 MC.	211.25 MC.	215.75 MC.

R.F. and Oscillator Alignment

(STANDARD COIL TUNER)

R.F. ALIGNMENT

1. Connect TV Sweep Generator to Antenna Terminals.
2. Connect R.F. Marker Generator loosely to Antenna Terminals.
3. Connect vertical amplifier of Oscilloscope through a 10,000 ohm ½w. resistor to Test Point (A) fig 6.
4. Short A.G.C. Bus to ground on TV chassis (across C22A 5000 MMF Discap condenser).
5. Set Station Selector switch to Channel 12.
6. Feed 207 mc at 10 mc sweep from Sweep Generator, and 205.25 mc and 209.75 mc fixed frequencies from R.F. Marker Generator.
7. Observe response curve on Scope. If necessary adjust C2, C4, or C7 (See fig. 6) so that response curve corresponds approximately to that shown in fig. 5 and has maximum gain.
8. Check markers on response curve of all remaining channels, setting Sweep and Marker Generators at corresponding frequencies for each channel. See Table I for convenient tabulation of proper frequencies. If the R.F. Markers do not fall in automatically in their proper places on all channels, a compromise must be made by slight readjustment of C2, C4, or C7.

OSCILLATOR ALIGNMENT

1. Connect TV R.F. Sweep Generator to Antenna Terminals.
2. Couple R.F. Marker Generator loosely to Antenna Terminals.
3. Connect vertical amplifier of Oscilloscope across the video amplifier grid and ground (Pin 7 of 12BH7, V7A).
4. Couple 24.75 mc video I.F. Marker Generator loosely to first I.F. grid (Pin 1 of 6CB6, V3).
5. Rotate Fine Tuning control to center of range.
6. Set Station Selector switch to Channel 12.
7. Set Sweep Generator to 207 mc at 10 mc sweep and Marker Generator to 205.25 mc (video carrier).
8. Observe response curve and adjust C10 (fig. 6) for Zero-beat with 24.75 marker. Zero-beat is indicated by an unmistakable break-up of the observed response curve.

   NOTE: Quality of response curve does not affect accuracy of oscillator alignment, so long as a zero-beat is obtained.
9. Check for zero-beat on all channels in this manner, setting the Station Selector, Sweep Generator and Marker Generator at corresponding frequencies. (See Table I.) It is not usually necessary to make any further adjustments. However, if the individual oscillator coils must be touched-up, the following procedure should be employed:
   a) Rotate Fine Tuning control to center of range.
   b) Set Station Selector to desired channel, Sweep Generator to its center frequency with 10 mc sweep, R.F. Marker Generator to the corresponding video carrier frequency (See Table I), and I.F. Marker Generator at 24.75 mc.
   c) Place a non-metallic screwdriver through the opening marked 'Recessed Individual Osc. Adjustment', fig. 6, and adjust oscillator coil zero-beat with 24.75 mc marker on response curve.
   d) This adjustment can be repeated on any single channel, or, if necessary, on all channels.
   e) If difficulty is encountered in tuning any particular channel well within limits of Fine Tuning control after these adjustments are made, readjust C10 slightly (as in Step 8) shifting the whole range of frequencies in the desired direction.

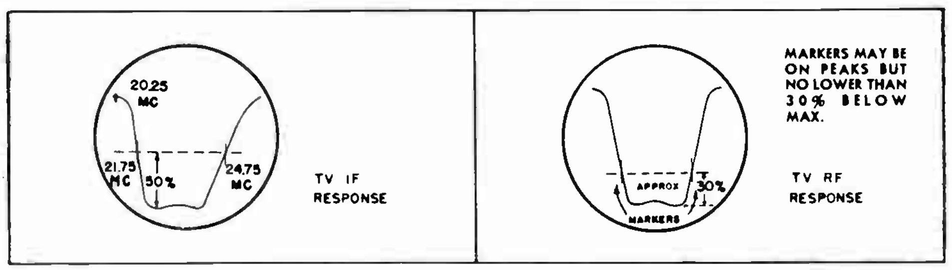


FIG. 5. RECOMMENDED RESPONSE CURVES.

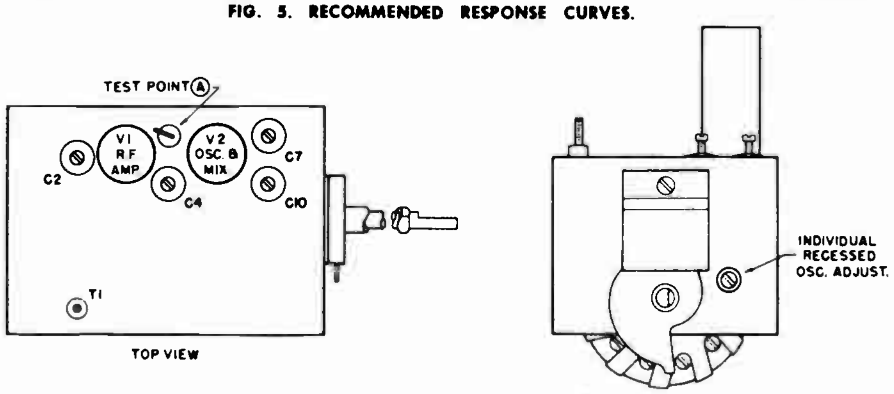


FIG. 6. R.F. TUNER ADJUSTMENT POINTS (STANDARD COIL TUNER)

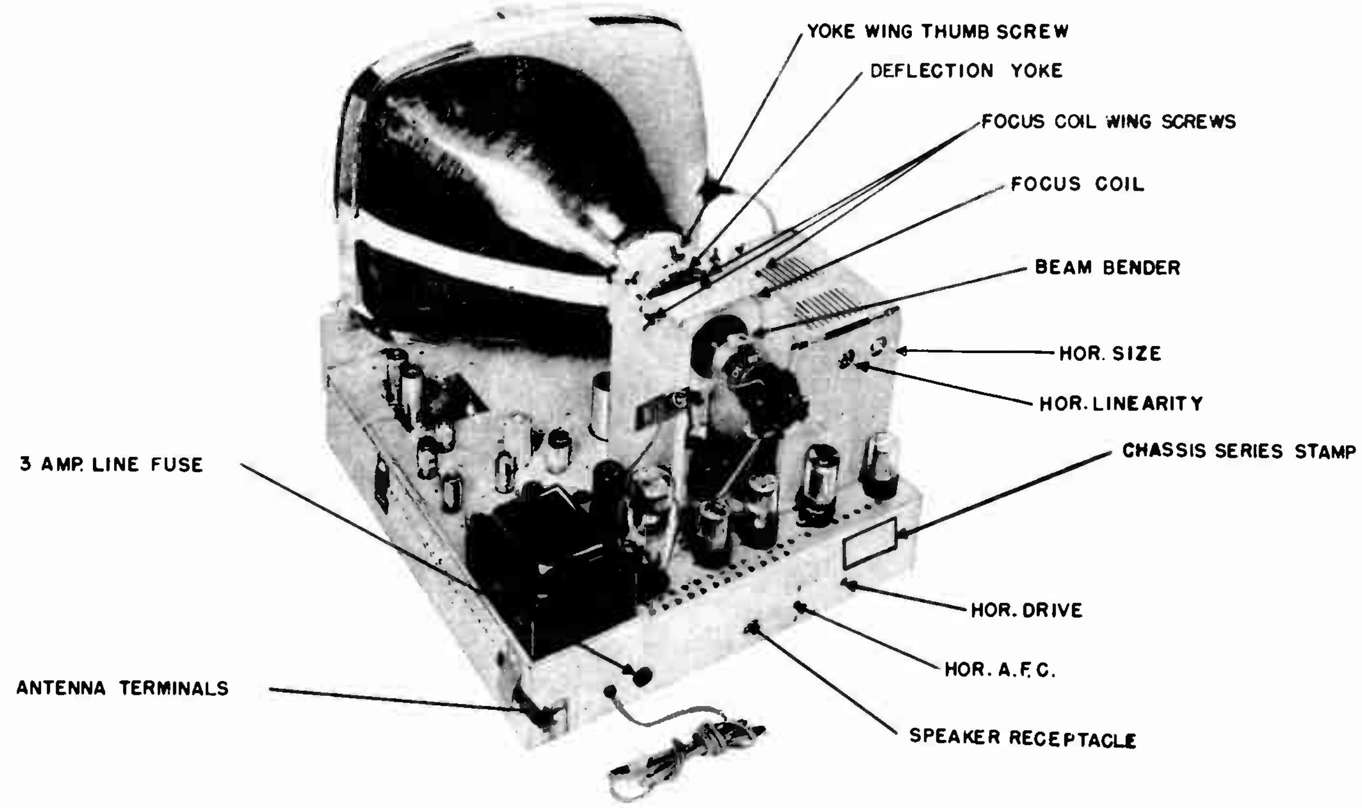
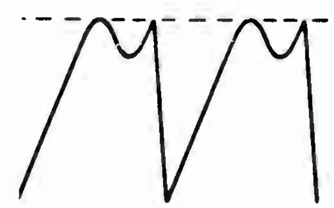


FIG. 7. PICTURE OF TV CHASSIS (REFER TO FIG. 2 FOR 20" & 21" YOKE & FOCUS ASSEMBLY)

HORIZONTAL OSCILLATOR TRANSFORMER ALIGNMENT

Refer to Service Adjustment "E" before proceeding with this alignment.

1. Tune in a TV station, preferably one that is transmitting a test pattern.
2. If after attempting the Horizontal A.F.C. Service Adjustment, described above, the picture cannot be made to sync. pre-set the Horizontal Stabilizing adjustment (inner slug of T8, beneath chassis) 5 turns in from its maximum out position.
3. Set the Horizontal Hold control to the center of its range and adjust the Horizontal A.F.C. adjustment until the picture is in sync.
4. Connect a low capacity probe of an oscilloscope to terminal "C" of the Horizontal oscillator transformer, T8; low side to ground. Set horizontal sweep to 7875 C.P.S. If a low capacity probe is unavailable, connect a 10K resistor in series with the vertical scope lead.
5. Adjust the Horizontal Stabilizing brass slotted screw until the broad and narrow peaks of the pattern on the oscilloscope are of equal height. (See illustration.) During Horizontal Stab. adjustment, picture must be kept in sync. by adjusting the Horizontal A.F.C. adjustment, if necessary.
6. Disconnect oscilloscope and follow Service Adjustment E above.



PARTS LIST

CAPACITORS

SYMBOL	Part No.	DESCRIPTION
C1-C15	Part of Tuner Unit D-36.137-2 (Standard)	
C17	B-4.115-1	5000 MMF, 450V. Cer. Disc.
C18	C-4.109-10	100 MMF, Cer.
C19A, C19B	B-4.125-1	5000 MMF, 5000 MMF 450V. Dual Cer. Disc.
C20	B-4.115-1	5000 MMF, 450V. Cer. Disc.
C21A, C21B	B-4.125-1	5000 MMF, 5000 MMF 450V. Dual Cer. Disc.
C22A, C22B	B-4.125-1	5000 MMF, 5000 MMF 450V. Dual Cer. Disc.
C24	D-3.105-23	.22 MF, 400V. Molded
C25A, C25B	B-4.125-1	5000 MMF, 5000 MMF 450V. Dual Cer. Disc.
C26	B-4.115-1	5000 MMF, 450V. Cer. Disc.
C27	C-4.109-10	100 MMF, Cer. Tub.
C28	C-4.111-5	3.3 MMF, Cer.
*C29		40 MF, 450V. Elect.
C30	D-3.105-23	.22, 400 V. Molded
*C31		4 MF, 450V. Elect.
C32	D-3.105-23	.22 MF, 400V. Molded

CAPACITORS—*Continued*

SYMBOL	Part No.	DESCRIPTION
C34	B-4.115-1	5000 MMF, 450 V. Cer. Disc.
C39	D-3.105-23	.22 MF, 400V. Molded
C40	C-4.109-11	220 MMF, Cer. Tub.
C41	D-3.105-12	.0022 MF, 400V. Molded
C42	D-3.105-17	.022 MF, 400V. Molded
C43	D-4.104-93	68 MMF, ±5%, Silver Mica
C44	10.101	2000 MMF Printed Circuit
C45	10.101	5000 MMF Printed Circuit
C46	10.101	5000 MMF Printed Circuit
C47	D-4.105-24	4700 MMF, ±10%, Mica
C48	D-3.105-34	.047 MF, 600V. Molded
C49	D-3.105-21	.1 MF, 400V. Molded
•C50		100 MF, 50V. Elect.
C51	D-3.100-32	.25 MF, 600V. Paper Tub.
C52	D-3.105-21	.1 MF, 400V. Molded
C53	D-3.105-36	.1 MF, 600V. Molded
C54	D-3.105-34	.047 MF, 600V. Molded
C59	C-4.109-14	47 MMF, ±5%, Cer.
C60	B-4.115-1	5000 MMF, 450V. Cer. Disc.
C61	B-4.115-1	5000 MMF, 450V. Cer. Disc.
•C62		40 MF, 450V. Elect.
•C63		40 MF, 450V. Elect.
•C64		40 MF, 450V. Elect.
C65	D-3.105-26	.0022 MF, 600V. Molded
C66	D-3.105-19	.047 MF, 400V. Molded
C67	D-3.105-17	.022 MF, 400V. Molded
C68	D-3.100-30	.25 MF, 200 V. Paper Tub.
C69	D-4.104-59	330 MMF, ±10%, Mica
C70	D-3.106-1	.01 MF, 600V. Molded
C71	D-4.105-9	1200 MMF, ±10%, Mica
•C72		8 MF, 450V. Elect.
C73	D-4.104-70	560 MMF, ±10%, Mica
C74	B-4.119-2	40-370 MMF, Trimmer
C75	D-4.109-14	47 MMF, Cer. ± 5%
C76	B-3.105-34	.047 MF, 600V. Molded
C77	B-4.129-3	47 MMF, ±5%, 2000V. Cer.
C78	D-3.100-30	.25 MF, 200 V. Paper Tub.
C79	B-4.128	500 MMF, 20KV. Mold. Barrel
C80	B-4.129-2	39 MMF. ±10%, 2000V. Cer.
C81	D-3.105-34	.047 MMF, 600V. Molded
C82	D-3.100-46	.035 MMF, 600V. ±10%, Pa. Tub.
C83	B-4.129-4	68 MMF, 2000V. ±10%, Cer.
C91	C-4.104-38	100 MMF, Cer. ± 10% Mica
C92	D-4.104-21	39 MMF, ±10%, Mica
C93A	B-4.125-1	5000 MMF 450V. Dual Cer. Disc.
C93B	B-4.125-1	5000 MMF 450V. Dual Cer. Disc.
C94	B-4.115-1	5000 MMF, 450V. Cer. Disc.
C95	D-4.108-12	1500 MMF, 500V. Cer.
C96	D-4.108-12	1500 MMF, 500V. Cer.
C97	C-5.430-1	4 MF, 50V. Paper Elect.
C98	D-3.105-19	.047 MF, 400V. Molded
C99	B-4.115-1	5000 MMF, 450V. Cer. Disc.
C100	C-4.109-5	680 MMF, Cer.
✱✱C101		.01 MF, Part of triode couplate
•C102		20 MF. 25V. Elect.
C103	B-4.115-1	5000 MMF, 450V. Cer. Disc.
•C104		4 MF. 450V. Elect.
C105	D-4.108-12	1500 MMF, 500 V. Cer.

•Refer to note on schematic for this series receivers.

✱✱ 10.102 TRIODE COUPLATE

RESISTORS

SYMBOL	Part No.	DESCRIPTION	TYPE
R1-R9	Part of Tuner Unit D-36.137-2 (Standard)		
R12	D-7.103-128	10K ±10%	2 w. carbon
R13	D-7.103-128	10K ±10%	2 w. carbon
θR14	D-7.101-237	330	½ w. carbon
R16	D-7.101-44	4.7K ±10%	½ w. carbon
R17	D-7.101-250	47 ± 10%	½ w. carbon
R18	D-7.101-227	330	½ w. carbon
R19	D-7.101-55	8.2K ±10%	½ w. carbon
R20	D-7.101-250	47 ± 10%	½ w. carbon
R21	D-7.101-226	100	½ w. carbon
R22	D-7.101-62	12K ± 10%	½ w. carbon
R23	D-7.101-248	150 ± 10%	½ w. carbon
R24	D-7.101-138	820K ±10%	½ w. carbon

RESISTORS—*Continued*

SYMBOL	Part No.	DESCRIPTION	TYPE
R25	D-7.101-226	100	½ w. carbon
R27	D-7.101-226	100	½ w. carbon
R28	D-7.101-62	12K ±10%	½ w. carbon
R29	D-7.101-44	4.7K ±10%	½ w. carbon
R30	C-8.230-1	1.5K Pot. ±30%	
R31	D-7.101-37	3.3K ±10%	½ w. carbon
R32	D-7.101-55	8.2K ±10%	½ w. carbon
R33	D-7.101-80	33K	½ w. carbon
R34	D-7.101-83	39K ±10%	½ w. carbon
R35	B-6.211-4	2750 ±10%	10 w. Wire wnd.
R36	D-7.101-55	8.2K ±10%	½ w. carbon
R38	D-7.102-34	1.8K ±10%	1 w. carbon
R39	D-7.103-108	3.3K	2 w. carbon
R40	C-7.101-38	3.3K	½ w. carbon
R41	D-8.229-9	100K Pot.	comp.
R42	D-7.101-80	33K	½ w. carbon
R43	D-7.101-121	330K	½ w. carbon
R44	D-7.101-226	100Ω	½ w. carbon
R45	D-7.101-114	220K ±10%	½ w. carbon
R46	D-7.101-114	220K ±10%	½ w. carbon
R48	D-7.101-148	1.5M ±10%	½ w. carbon
R49	D-7.101-121	330K ±10%	½ w. carbon
R50	D-7.101-90	56K ±10%	½ w. carbon
R51	D-7.101-48	5.6K ±10%	½ w. carbon
R52	D-7.101-27	1.8K ±10%	½ w. carbon
R53	D-7.101-38	3.3K	½ w. carbon
R54	10.101	22K	Printed Circuit
R55	10.101	8.2K	Printed Circuit
R56	10.101	8.2K	Printed Circuit
R57	D-7.101-145	1.2M ±10%	½ w. carbon
R58	C-8.229-8	1.5M Pot. ±30%	comp.
R60	D-7.101-129	470K	½ w. carbon
R61	C-8.219-5	2.5M Pot. ±30%	comp.
R62	D-7.101-185	6.8M	½ w. carbon
R63	D-7.101-234	220	½ w. carbon
R64	C-8.206-6	5K Pot. ±15%	2 w. carbon
R65	D-7.102-94	47K ±10%	1 w. carbon
R66	D-7.101-6	560 ±10%	½ w. carbon
R67	D-7.101-6	560 ±10%	½ w. carbon
R68	D-7.101-59	10K	½ w. carbon
R70	D-7.101-122	330K	½ w. carbon
R71	D-7.101-62	12K ±10%	½ w. carbon
R73	D-7.103-97	1800Ω ± 10%	2 w. carbon
R74	D-7.101-100	100K ±10%	½ w. carbon
R75	C-8.221	2250 Pot. ±10%	4 w. carbon
R76	C-6.215-5	470	7 w. Wire wnd.
R77	D-7.102-108	100K ±10%	1 w. carbon
R78	C-8.229-7	50K Pot.	comp.
R79	D-7.101-171	3.3M ±10%	½ w. carbon
R80	D-7.101-138	820K ±10%	½ w. carbon
R81	D-7.101-55	8.2K ±10%	½ w. carbon
R82	D-7.101-107	150K ±10%	½ w. carbon
R83	D-7.101-99	100K ±5%	½ w. carbon
R84	D-7.101-111	180K ± 10%	½ w. carbon
R85	D-7.102-94	47K ±10%	1 w. carbon
R86	D-7.101-55	8.2K ±10%	½ w. carbon
R87	D-7.102-24	1K	1 w. carbon
R88	D-7.102-94	47K ±10%	1 w. carbon
R89	D-7.101-129	470K	½ w. carbon
R90	D-7.101-142	1M	½ w. carbon
R91	D-7.101-226	100	½ w. carbon
R92	D-7.103-118	5.6K ±10%	2 w. carbon
R93	C-6.212-1	3.3	½ w. Wire wnd.
R94	D-7.102-137	470K	1 w. carbon
R95	D-7.101-128	470K ±10%	½ w. carbon
R96	D-7.101-204	150	½ w. carbon
R100	D-7.101-87	47K	½ w. carbon
R101	D-7.101-226	100	½ w. carbon
R102	D-7.102-94	47K ±10%	1 w. carbon
R103	D-7.101-87	47K	½ w. carbon
R104	D-7.101-17	1K	½ w. carbon
•R105	D-7.101-234	220	½ w. carbon
R106	D-7.101-66	15K	½ w. carbon
R107	D-7.101-69	18K ±10%	½ w. carbon
R108	C-8.230-1	IM Pot. ±30%	
R109	D-7.101-192	10M	½ w. carbon
✱✱R110		470K	Part of triode
✱✱R111		470K	couplate
R112	D-7.102-13	560 ±10%	1 w. carbon
R113	D-7.102-10	470	1 w. carbon
R114	D-7.101-100	100K	½ w. carbon

COILS AND CHOKES

SYMBOL	PART NO.	DESCRIPTION	D.C. RESIST.
L1-L7	Part of Tuner Unit D-36.137-2 (Standard)		
L11	C-1.522-4	Video Peaking Coil	Refer to Schematic
L12	C-1.522-3	Video Peaking Coil	Refer to Schematic
L13	C-1.522-4	Video Peaking Coil	Refer to Schematic
L14	C-1.522-4	Video Peaking Coil	Refer to Schematic
L15	C-1.522-4	Video Peaking Coil	Refer to Schematic
L16A	C-9.254-3	Vert. Deflect. Yoke	Refer to Schematic
L16B	C-9.254-3	Horiz. Deflect. Yoke	Refer to Schematic
L17	C-9.237-3	Filter Choke	Refer to Schematic
L18	C-9.234-4	Focus Coil	Refer to Schematic
L19	B-1.533-1	Horiz. Size	Refer to Schematic
L20	B-1.531	Horiz. Lin.	Refer to Schematic
L22	C-1.554	Audio Take-off	Refer to Schematic
L1-L2 Coil Units	B-36.141-2	Ant. Coils Ch.-2	
	B-36.141-3	Ant. Coils Ch.-3	
	B-36.141-4	Ant. Coils Ch.-4	
	B36.141-5	Ant. Coils Ch.-5	
	B-36.141-6	Ant. Coils Ch.-6	
	B-36.141-7	Ant. Coils Ch.-7	
	B-36.141-8	Ant. Coils Ch.-8	
	B-36.141-9	Ant. Coils Ch.-9	
	B-36.141-10	Ant. Coils Ch.-10	
	B-36.141-11	Ant. Coils Ch.-11	
	B-36.141-12	Ant. Coils. Ch.-12	
	B-36.141-13	Ant. Coils Ch.-13	
L4, L5, L6 Coil Units	B-36.141-102	RF & Osc. Coils Ch.-2	
	B-36.141-103	RF & Osc. Coils Ch.-3	
	B-36.141-104	RF & Osc. Coils Ch.-4	
	B-36.141-105	RF & Osc. Coils Ch.-5	
	B-36.141-106	RF & Osc. Coils Ch.-6	
	B-36.141-107	RF & Osc. Coils Ch.-7	
	B-36.141-108	RF & Osc. Coils Ch.-8	
	B-36.141-109	RF & Osc. Coils Ch.-9	
	B-36.141-110	RF & Osc. Coils Ch.-10	
	B-36.141-111	RF & Osc. Coils Ch.-11	
	B-36.141-112	RF & Osc. Coils Ch.-12	
	B-36.141-113	RF & Osc. Coils Ch.-13	

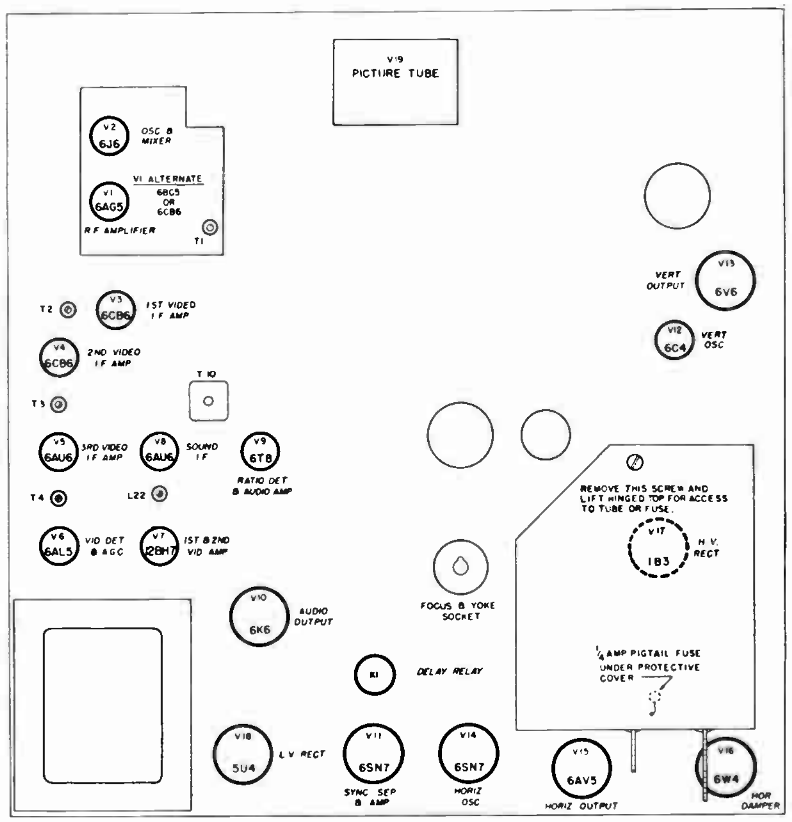
TRANSFORMERS

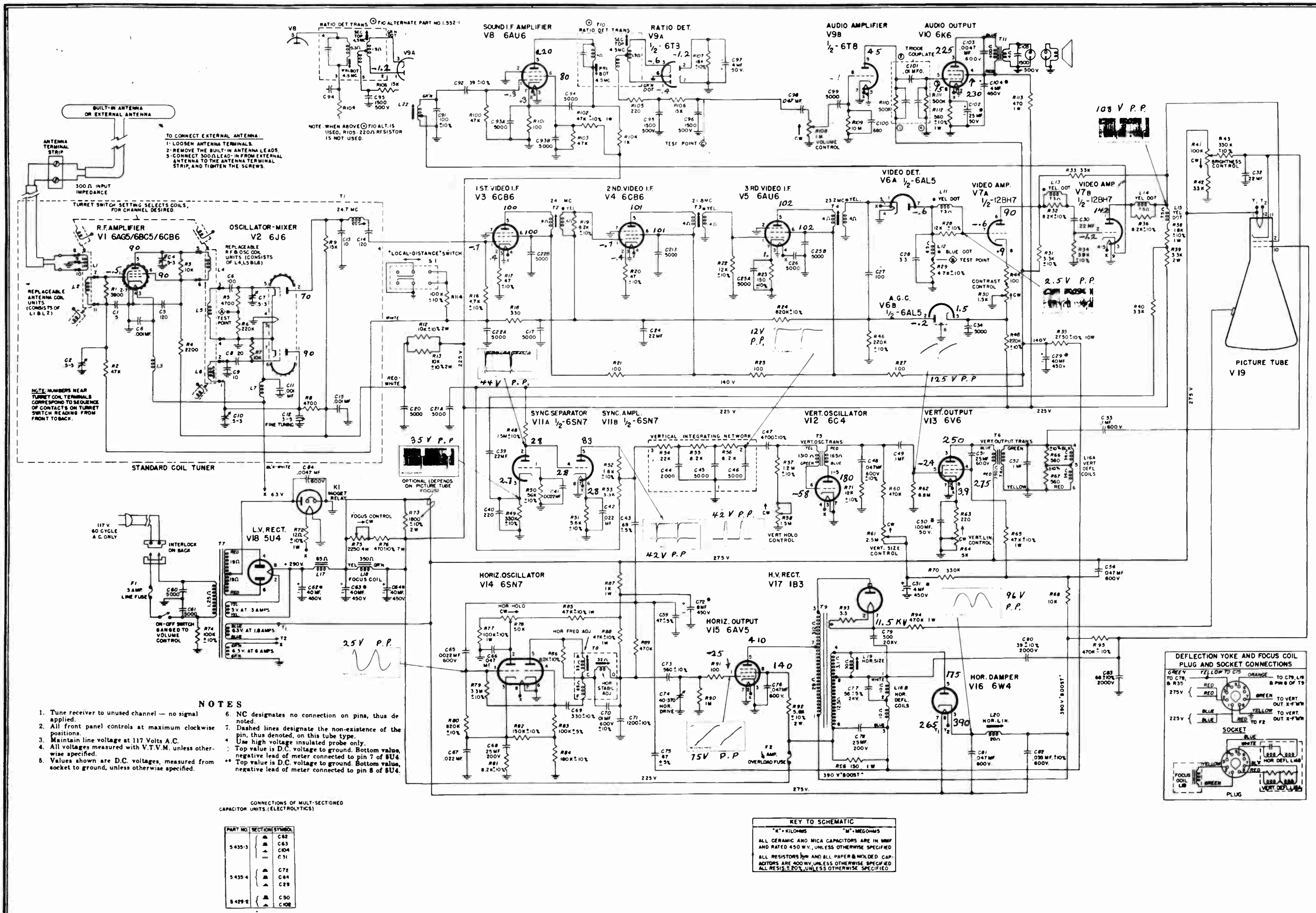
SYMBOL		DESCRIPTION	D.C. RESIST.
S1	B-11.210	Local-Distance Switch	
T1	Part of Tuner Unit D-36.137-2 (Standard)		Refer to Schematic
T2	C-1.553	I-F Trans.	Refer to Schematic
T3	C-1.553	I-F Trans.	Refer to Schematic
T4	C-1.553	I-F Trans.	Refer to Schematic
T5	C-9.230-4	Vert. Bl. Osc. Trans.	Refer to Schematic
T6	C-9.228-5	Vert. Out. Trans.	Refer to Schematic
T7	D-9.252	Power Trans.	Refer to Schematic
T8	B-1.549	Hor. Osc. Trans.	Refer to Schematic
T9	C-9.259	Hor. Out Trans.	Refer to Schematic
θT10	C-1.528-1	Ratio Detect. Trans.	Refer to Schematic
T11	C-9.225-4	Audio Out. Trans.	Refer to Schematic

θT10 Alt. C-1.552-1 Ratio Det. Trans.
See Schematic for Connections
*R105 Not Used When T10 is C-1.552-1

MISCELLANEOUS

PART No.	DESCRIPTION
D-36.137-2	Tuner (Standard)
E-30.326	Speaker (Table Models)
E-30.328	Speaker (Consoles)
C-24.225-4	Pix Tube Socket (20" & 21" Pix)
C-24.225-8	Pix Tube Socket (16" & 17" Pix)
B-36.131	Line Fuse Holder
20.223	Line Cord





PART NO.	SECTION	SYMBOL
5435-3		C62
		C63
		C104
		C31
5435-4		C72
		C84
		C29
5429-2		C50
		C102

MACY'S TV PAGE 12-13

PART I

DESCRIPTION & SPECIFICATIONS

The Magnavox 105 Series TV Chassis are 21 tube receivers including a direct view picture tube. It is constructed on a single chassis and so designed as to accommodate 17″ rectangular, 20″ rectangular or 21″ rectangular picture tubes without any change in circuitry.

Features of this Series include:

- Capacity coupled video amplifier
- Intercarrier I-F Amplifiers for ease of alignment, increased stability and freedom from the effect of oscillator drift
- Keyed automatic gain control
- Magnalok type horizontal frequency control
- Cathode modulation of picture tube
- Vertical multivibrator circuit
- Noise inverter circuit for noise immunity

IMPEDANCE

300 ohm input..................Speaker Voice Coil 3.2 ohms

POWER REQUIREMENTS

TV with Audio..........205 watts, 117V, 60CPS
TV without Audio..........190 watts, 117V, 60CPS
TV with Audio & AM Tuner (Radio-TV Switch in Radio Position)..........170 watts, 117V, 60CPS

TUBE COMPLEMENT

Symbol	Tube	Function	Symbol	Tube	Function
V1	6BC5	R-F Ampl.	V207	(See List)	Picture tube
V2A	½12AT7	Mixer	V301A	½12AX7	Noise invertor
V2B	½12AT7	Oscillator	V301B	½12AX7	Sync separator
V101	6AU6	Limiter	V302A	½6SN7	Sync ampl.
V102A	½6T8	Discriminator	V302B	½6SN7	Sync clipper
V102B	½6T8	1st Audio ampl.	V303	6SN7	Vertical MV
V103	6V6GT	Audio output	V304	6W6GT	Vertical output
V201	6CB6	1st Video I-F	V401A	½6SN7GT	Hor. AFC
V202	6CB6	2nd Video I-F	V401B	½6SN7GT	Hor. osc.
V203	6BC5/6AG5	3rd Video I-F	V402	6BQ6	Hor. output
V204	6AU6	Video det. 1st Audio I-F	V403	1B3	H. V. Rectifier
			V404	6W4	Damper
V205	6CB6	Video ampl.	V501	5U4G	L. V. Rectifier
V206	6AU6	AGC ampl.			

CHASSIS DIFFERENCES

Chassis No.	Audio	Picture Tube	Control Panel No.#
CT 331A, B	Internal	20CP4A	1
CT 331C, E	Internal	20CP4A	3
CT 332A, B	External	20CP4A	2
CT 332C, E	External	20CP4A	4
CT 333A, B	Internal	17BP4A	1
CT 333C, E	Internal	17BP4A	3
CT 334A, B	External	17BP4A	2
CT 334C, E	External	17BP4A	4
CT 335A, B	Internal*	17BP4A	1
CT 335C, E	Internal*	17BP4A	3
CT 336A, B	External	17BP4A	2
CT 336C, E	External	17BP4A	4
CT 337A, B	Internal**	20CP4A	1
CT 337C, E	Internal**	20CP4A	3
CT 338A, B	External	16TP4	2
CT 338C, E, J	External	16TP4	4
CT 339C, E	Internal*	20CP4A	3
CT 340A, B	External	20CP4A	2
CT 340C, E	External	20CP4A	4
CT 341D	Internal	21FP4A	3
CT 341K	Internal	21FP4A	6
CT 342D	External	21FP4A	4
CT 343D, K	Internal	17HP4	3
CT 344D, K	Internal	17HP4	4
CT 345D, K	Internal*	17HP4	3
CT 346D	Internal	21FP4A	3
CT 347D, K	Internal*	20HP4A	3
CT 348D, K	External	20HP4A	4
CT 349D, K	Internal*	20HP4A	3
CT 350D, K	Internal**	20HP4A	3
CT 350H	Internal**	20HP4A	5
CT 351E	Internal	21EP4A	3
CT 351F	Internal	21EP4A	5
CT 351J	Internal	21EP4A	6
CT 352E, J	External	21EP4A	4
CT 353E, J	Internal*	21EP4A	3
CT 354D, K	External	17HP4	4
CT 355D, K	External	20HP4A	4
CT 356K	Internal	17HP4	3
CT 357K	Internal	20HP4A	3

*Connections for radio tuner.
**Vertical Mounting.
#See chart on opposite page.

FRONT PANEL CONTROL CHART

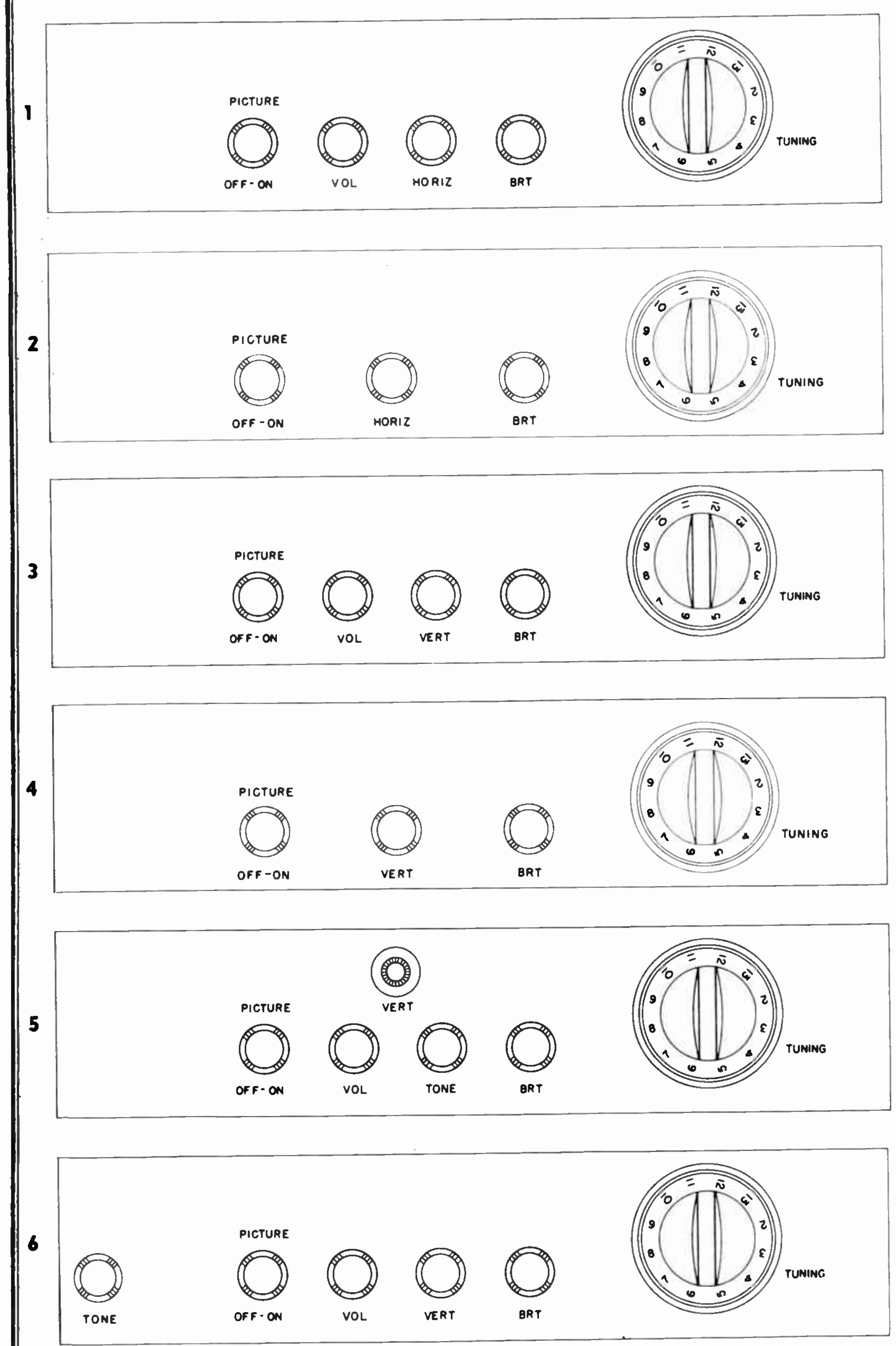
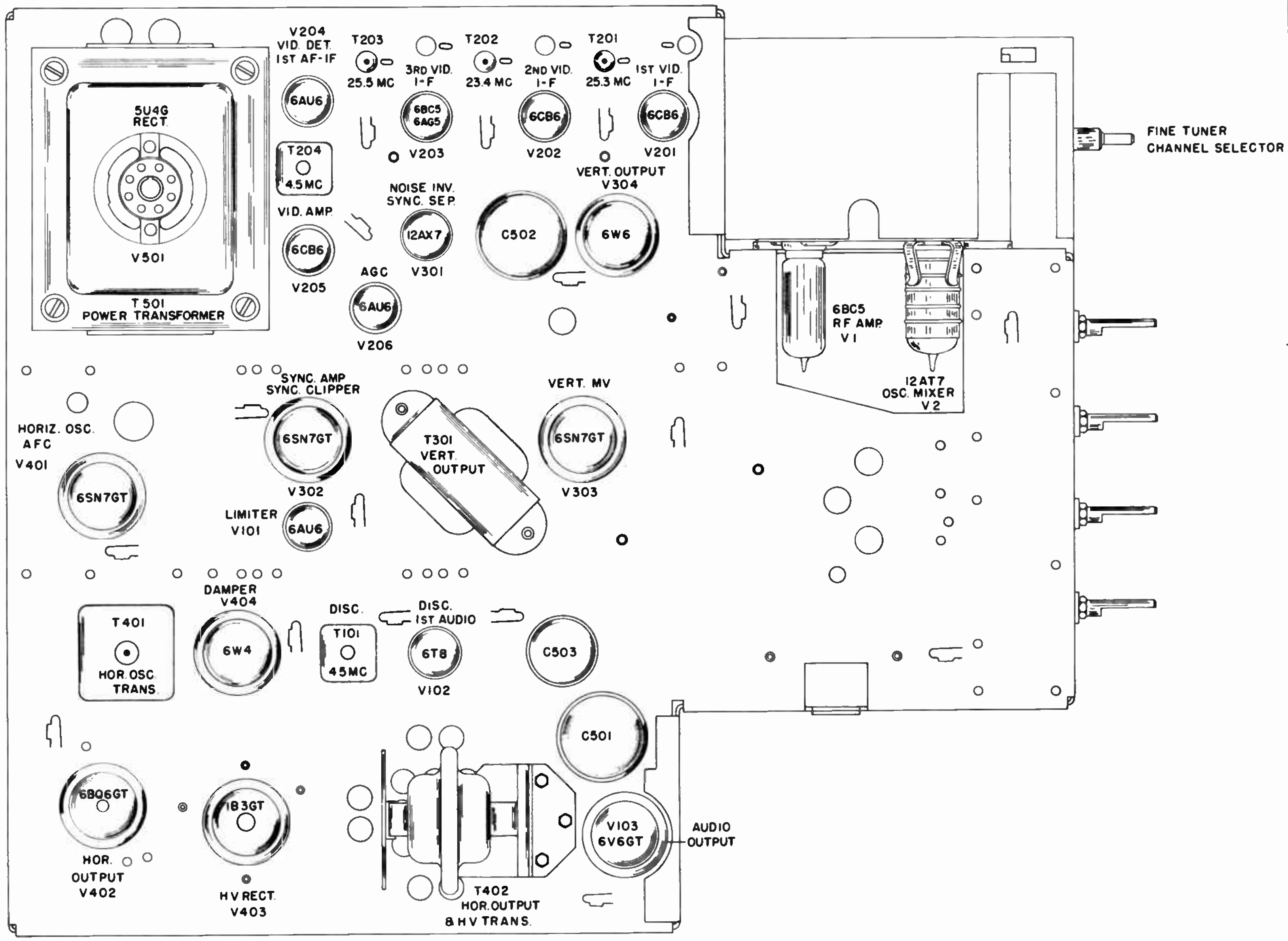
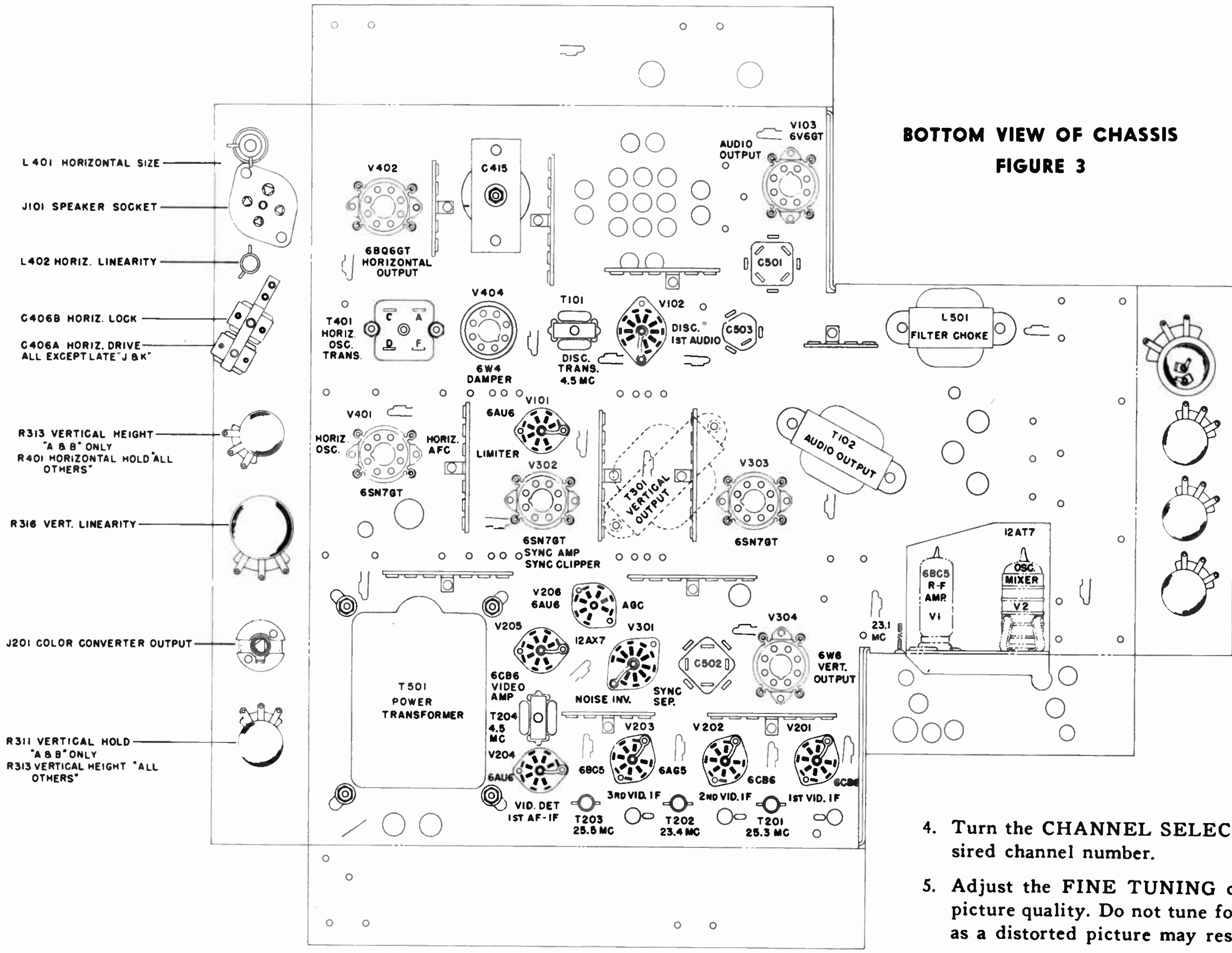


FIGURE 1

PART II
PARTS, IDENTIFICATION



TOP VIEW OF CHASSIS
FIGURE 2



BOTTOM VIEW OF CHASSIS

FIGURE 3

PART III

OPERATION AND INSTALLATION

1. Plug the receiver into the AC outlet.
2. Turn the receiver on by turning the PICTURE OFF-ON control to the right about ½ turn.
3. Adjust the BRIGHTNESS control for suitable picture brilliance. If no light appears, it may be limited by incorrect adjustment of the ion trap. Adjustment of this trap is as follows:

Turn the brightness control fully clockwise and adjust the ion trap until light appears on the screen. Reduce the brilliance to a point near extinction by turning the brightness control counter-clockwise. Readjust the ion trap for maximum brilliance.

It may be necessary to reduce the brilliance still further and readjust the ion trap for maximum brilliance.

The final adjustment should now be made for maximum brightness with the brightness control in full clockwise position.

4. Turn the CHANNEL SELECTOR to the desired channel number.
5. Adjust the FINE TUNING control for best picture quality. Do not tune for loudest sound as a distorted picture may result.
6. Adjust the PICTURE control for the proper degree of black, gray and white. With the brilliance at a point near extinction advance the control until sufficient picture detail appears without over-shading the light areas of the picture.
7. Adjust the VERTICAL HOLD control so the picture holds in vertical sync. If the picture rolls up or down, turn the control knob so the roll is downward, then turn it in the opposite direction until the picture locks in frame.
8. If the picture pulls out of horizontal sync, it can be brought back by adjustment of the HORIZONTAL HOLD control.
9. Adjust the FOCUS control so the lines making up the raster are clear and distinct.
10. Adjust the HEIGHT and VERTICAL LINEARITY controls so the picture just fills the mask and the linearity is uniform from top to bottom. Adjustment of either the vertical hold, vertical linearity or vertical height controls will slightly affect the other controls and readjustments may be necessary.
11. Adjust the HORIZONTAL DRIVE trimmer for the most drive consistent with good linearity. Turn it to the point where compression at the middle of the picture occurs, and then reduce it slightly.
12. Adjust the HORIZONTAL LINEARITY control for the most linear picture. Caution: There may be two positions of the slug which seem to provide horizontal linearity. Use the one which places the slug nearest all the way in.
13. Adjust the HORIZONTAL SIZE slug for proper width.
14. HORIZONTAL and VERTICAL CENTERING of the picture is accomplished by moving the centering lever on the front side of the focus magnet. Readjustment of the ion trap may be necessary after this plate has been adjusted. On receivers using electrostatic focus picture tubes, HORIZONTAL and VERTICAL CENTERING is accomplished by adjusting the CENTERING DEVICE located on the neck of the tube immediately behind the deflection coil. Properly adjusted, the ears of the CENTERING DEVICE will be to the right side when facing the back of the unit.
15. If it is necessary to make any large adjustments (greater than a fraction of a turn) of the horizontal drive trimmer, a check should be made of the range of the horizontal hold control. The following sequence should be used.
    a. Rotate the horizontal hold control fully clockwise and the picture should show a vertical blanking bar just emerging from the left side.
    b. Rotate the horizontal hold control full counter-clockwise. The picture should remain in sync.

c. Switch off channel and then back on channel. Picture may come in immediately or diagonal bars may appear.

d. If diagonal bars are present, turn the horizontal hold control clockwise slowly. The number of diagonal bars will reduce, and after three bars are reached a slight additional rotation of the control in a clockwise direction should result in the picture locking in sync. If the picture does not lock in until after two bars are reached, the horizontal lock trimmer needs to be adjusted. When less than two bars are present, adjust the trimmer slightly in a counter-clockwise direction. In the J and K versions, the LOCK trimmer was replaced with a fixed capacitor.

e. After making this adjustment check the pull in range again. With the horizontal hold control full counter-clockwise, switch off channel then back on. If diagonal bars appear, rotate the hold control clockwise slowly. The picture should lock in sync, with a slight rotation of the control, after three bars are reached. If necessary repeat the lock trimmer adjustment and then check until correct adjustment is attained. If this condition can not be obtained, check horizontal alignment, as outlined in alignment section.

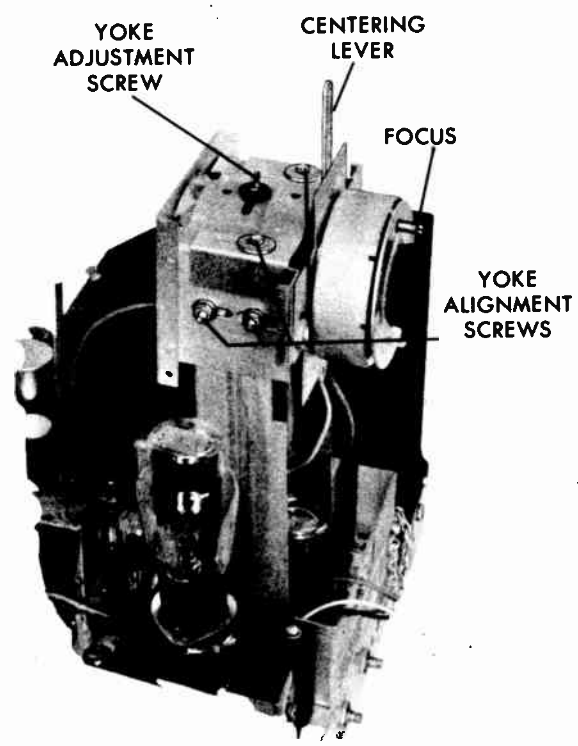


FIGURE 4

PICTURE TUBE ADJUSTMENTS

Note—On sets with electrostatic focus picture tubes, the focus coil is omitted. Focusing is accomplished by adjusting the focus control on rear apron of chassis and to the left of the high voltage compartment.

PART IV

CIRCUIT DESCRIPTION

R-F TUNER

The R-F tuner is a separate assembly and mounts at the right front of the receiver. It consists of an R-F amplifier V1 (6BC5) and mixer-oscillator V2 (12AT7). A 12-position channel selector rotary switch is used with a concentric shaft which operates the variable dielectric type fine tuner. For ease of alignment, inductances, adjustable by bending or spreading, are provided on every channel.

The antenna input transformer T1 is designed for optimum antenna coupling on all channels (2-13). An electrostatic shield is used between the primary and secondary to reduce the amount of man-made interference appearing on the R-F grid. As shown in the schematic, Fig. 10 the secondary of the antenna transformer T1 is tuned for each channel by shunting it with the proper value of inductance (S1, Section 4) to make it resonate with the R-F tube V1. (6BC5) input capacity.

Tuning of the R-F plate and mixer grid is accomplished by wafer sections 3 and 2, which are identical to the R-F grid wafer and have similar series strings of channel coils associated with them to resonate with the R-F plate capacity and mixer grid capacity, respectively. Coupling capacitors C7, C9, and C10 connected between appropriate points on the R-F plate and mixer grid coil strings provide the necessary coupling for the proper bandpass on all channels. Shields between the R-F grid, R-F plate, and mixer grid wafers reduce stray coupling.

The triode mixer V2A (½12AT7) is used because of its low noise characteristic. The triode mixer also has relatively low plate resistance compared to a pentode so that it furnishes a large portion of the damping needed for proper bandwidth in the mixer plate—I-F grid circuit. The mixer coil L4 is connected in series between the converter plate and 1st I-F grid to prevent the oscillator voltage appearing on the mixer plate from getting to the 1st I-F grid capacity in series. C22 (10 mmf.) eliminates the high channel mixer regeneration due to resonance of the lead from the mixer plate to the I-F coil L4 with the total stray and tube capacities. A test point is provided in the mixer grid circuit (junction of R14 and R6), to which a scope may be connected for observing the R-F band-pass curves. This is grounded when not in use in order to provide a short enough time constant to avoid white noise under very strong impulse noise conditions.

The local oscillator V2B (½12AT7) is of the Colpitts type. The circuit is conventional with the inductance (S1, Section 1) connected from grid to plate. Series coil switching is used for ease of alignment and wafer assembly. A variable dielectric type fine tuner (C19) is used. The tuning range obtained is about 4 mc on Channel 13 and 2 mc on Channel 2.

To reduce high band radiation from the main TV chassis, the choke L7 was added in the output lead to the 1st I-F tube grid and the tuner chassis was connected to the main chassis only at the tuner rear apron. To reduce high and low band radiation from the antenna, the tuner shield cover was shortened so that it extends only to the shield partition located between the R-F grid and plate switch wafers. To reduce all types of radiation, a metal shield to cover the fine tuning assembly, and an additional outside shield cover were added. This, in conjunction with the walls of the tuner well in the main TV chassis, provides a complete additional enclosure around the tuner. The shield is grounded at a number of points on the main TV chassis.

VIDEO I-F

The picture I-F amplifier consists of four single tuned circuits, stagger tuned to specific frequencies. Series tuning is used between the mixer plate and first I-F grid in order to reduce the amount of oscillator voltage appearing on the first I-F grid. Bifilar coils are used in the 1st and 2nd I-F stages, whereas a more conventional inter-stage coil is used to couple the 3rd I-F to the detector stage. The first and second I-F stages are stacked with AGC applied to the 1st I-F only. Because of the stacking arrangement the second I-F bias change will be proportional to the applied bias. The 3rd I-F and detector are also stacked. See power distribution block diagram, Figure 5.

The use of Bifilar coils provides the necessary low impedance in the grid and plate circuits of the three stages so that I-F bias is not developed by noise pulses that are of sufficient amplitude to draw grid current. L206 (36 microhenries), wound on the 18K converter circuit load resistor, provides a low impedance in the 1st I-F grid return.

In the 1st and 2nd I-F stages, V201 and V202, 6CB6 tubes are used to provide maximum stable gain. To compensate for variation in input capacity with change of gain, the cathode resistors R203 and R207 (47 ohms) are un-bypassed. A 6BC5 (V203) is used in the 3rd video I-F stage, and since this stage is not provided with gain control, the cathode is bypassed.

VIDEO DETECTOR AND 1ST SOUND I-F

Detection is accomplished by the diode action of the grid and cathode of V204. The 4.5 mc component is recovered from the plate of the tube after amplification. The video component is recovered at the detector load. The effect is identical to having a diode directly coupled to a pentode. However, since the grid and cathode of the pentode act as a detector and produce the same results, the diode is eliminated.

The video frequency voltage developed across the diode load resistor (R213) is of negative polarity. This signal is amplified by the direct coupled video amplifier V205, (6CB6), and coupled to the kinescope. In order to obtain the proper video response, the total stray and circuit capacity had to be kept to a minimum. It was for this reason that the 3rd video I-F coil had to be modified, since a standard Bifilar coil would contribute about 70 mmf. of capacity. L203, L201, and R213 provide the necessary peaking for the video amplifier, whereas C208 and L201 are so adjusted as to resonate at 4.5 mc, thus attenuating the 4.5 mc beat at the video amplifier and increasing the amplitude of the 4.5 mc carrier to the 1st Sound I-F amplifier. L202 (an R-F choke) and C207 attenuate the I-F carrier and its components.

The 4.5 mc FM modulated carrier generated in the diode action is amplified and transformer coupled through T-204 to the sound limiter V101, (6AU6). A double tuned circuit is used to provide good selectivity since a large portion of the demodulated video frequencies also exist in the plate circuit.

SOUND LIMITER AND DISCRIMINATOR

The sound limiter V101 (6AU6) is stacked with the sync amplifier V302A, sync clipper V302B, sync separator V301B and the R-F screen. This portion of the stacked arrangement is possible because of the relatively constant plate current characteristic of the sound limiter.

The limiter was designed on the basis of plate limiting and grid limiting. Plate limiting is accomplished by using a low screen potential and grid limiting is obtained by using grid leak bias. In this combination, the tube initially has zero bias with no signal at the grid. As soon as a signal is applied, the grid is driven slightly positive and charges C101 (56 mmf.). The capacitor attempts to discharge through R101 (220K), but due to the relatively long time constant, the discharge will occur slowly. Because of the current flow through R101, a voltage is developed, with the grid becoming negative. This bias varies with the amplitude of the incoming signal, in this way tending to keep the plate current constant within wide limits of input voltage.

Since substantially no AM rejection exists below the threshold of limiting, the circuit parameters were adjusted so that limiting occurs when the developed bias is approximately 1.2 V. across R101. Because of this action of the limiter, there is an F-M signal of constant amplitude applied to the discriminator transformer T101.

The 4.5 mc discriminator circuit uses the diodes (No. 1 and No. 2) section of V102A (½6T8) for detection. The discriminator is used because of the relative greater gain over the ratio detector. However, unlike the ratio detector, the discriminator is sensitive to both amplitude and frequency modulation. The AM output is zero at center frequency and is proportional to the frequency deviation from balance, but with limiter action, suppression of AM to either side of center frequency is accomplished.

The DC load for the discriminator is composed of R102 and R107. The audio output is modified by R108 and C106, the de-emphasis network; then coupled to the grid of the 1st audio amplifier V102B (½6T8).

AUDIO AMPLIFIER

The audio amplifier is a two-stage amplifier using ½6T8, (V102A) and 6V6, (V103). The triode in the 6T8 gives comparatively high gain. This makes it possible to use inverse feedback. The feedback is from the voice coil winding of the audio output transformer to the cathode of the 1st AF amplifier. By this method, the distortions introduced by V102, V103 and T102 can be greatly reduced. Such a connection also gives better speaker damping.

VIDEO AMPLIFIER

In addition to the notes on the detector, as given in the paragraph on the video detector and 1st sound I-F, the 4.5 mc trap serves to greatly reduce the amount of inter-carrier beat that may be present in the signal. As far as the video signal is concerned, the detector is compensated to approximately 4 mc. This is more than necessary, but is done for the reasons stated in the paragraph on the video detector and sound I-F.

The detector is DC coupled to the video amplifier V205, (6CB6). The DC level is retained for better picture quality, and AGC reference. The video amplifier is compensated for 3 mc response, this being the definition obtainable from the I-F. The video amplifier is AC coupled to the kinescope. The coupling time constant is long enough that vertical shading is minimized.

An external color converter connection is provided. It is connected to the cathode of the video amplifier and takes advantage of the cathode follower action when the contrast control is set to minimum.

NOISE INVERTER

The noise inverter, one half 12AX7 (V301A), is a grounded grid amplifier that forms a parallel signal path around the video amplifier tube. Since it is cathode driven, the noise inverter signal output is in phase with the detector signal while the video amplifier output is 180° out of phase.

The signals from these two sources are applied to common load resistors. For sync circuits, the gain through the noise inverter, due to its plate load (R215 and R218), is greater than that through the video amplifier plate load (R218), resulting in driving the noise into the white region and leaving the sync pulses free of noise bursts. This will result in a minor amount of low amplitude white noise in the picture. The noise inverter is biased beyond cutoff, enabling it to conduct only on noise signals which exceed the sync tips at the detector.

Bias for the noise inverter is obtained from the grid bias voltage of the horizontal output tube by means of a voltage divider in the output tube grid return. A filter network, R320 and C302, removes the horizontal sawtooth that exists in this circuit. Since bias on the horizontal output tube is determined by the signal amplitude on its grid, the horizontal drive control (C406) will affect the bias voltage of the noise inverter. The voltage divider has been set up to avoid any difficulty with the noise inverter when the horizontal drive is correctly adjusted.

AGC

The 105 chassis uses keyed AGC. Since peak type of AGC references on the sync tips only, it would be highly desirable to make the AGC system inoperative during the interval of time between sync pulses. This is accomplished by supplying a pulse from the horizontal output system to the plate of the AGC tube V206 (6AU6). The time constants used in this system are very short. This makes it very adaptable to reducing airplane flutter. A series fed pulse to the AGC amplifier was chosen because of the ease of filtering the derived AGC voltage. A more rapidly acting AGC is therefore possible.

The R-F AGC voltage is considerably delayed to reduce the medium signal noise content of the picture. The I-F gain is high enough that it is at the threshold of the noise level of the converter. If R-F and I-F bias were always equal, then the converter noise would appear in the picture at considerably higher signal level than necessary. To prevent this, the R-F bias is delayed until the I-F gain is reduced to where no converter noise appears in the picture. At this level the R-F bias starts increasing at a rate faster than the I-F bias. The result is that the R-F and I-F bias are equal at approximately —5.5 volts. This gives the set its best strong signal handling capabilities. At full sensitivity the noise at the R-F input masks out the converter noise.

The threshold of the R-F bias is adjusted so that when it has increased to —0.5V, the I-F bias is in the order of —2.7 to —3.0 volts. The crossover of R-F and I-F biases is approximately —5.5 volts. The R-F amplifier grid to cathode is used as a clamp for R-F bias delay in the AGC system.

The double time constant filtering, formed by C213, C214 and R212 at the AGC plate, is for eliminating a low frequency transient in the AGC bus following the vertical sync pulse.

SYNC SEPARATORS

The sync separators consist of three triode sections, one half 12AX7 (V301B) and a 6SN7 (V302A, V302B), which are, sync separator, sync amplifier, and sync clipper, respectively.

The grid of the sync separator has a double time constant (R304, C309, and R302, C303) that provides a faster recovery time under noise conditions. Having grid leak biasing, the sync separator will only accept a certain peak to peak portion of the positive peak of the signal. At low contrast levels this includes some of the video signal; therefore, another stage of separation is required. The first stage inverts the signal, making it necessary to cathode drive the sync amplifier, which operates in much the same manner as the sync separator. The sync tip amplitude, in particular the vertical serrated pulses, have become quite irregular due to successive stages of amplification, making it necessary to have another stage which will level off this side of the sync signal. A negative signal fed to the grid of the sync clipper accomplishes this purpose, and supplies a negative sync signal at the cathode for the vertical multivibrator and a positive sync signal at the plate for the horizontal AFC.

VERTICAL SWEEP OSCILLATOR

The vertical sweep oscillator V303 is a cross-coupled multivibrator. In the A and B versions a bridged T filter is used for feed back coupling to the grid of the first tube. This filter removes horizontal frequencies which would prevent proper interlace. Later versions have the bridged T network eliminated. The output is taken from the plate of the second triode. Trapezoidal wave shape is obtained by the peaking circuit composed of C307 and R315, and R316 in A and B versions. The resistance of the peaking circuit is divided to obtain retrace blanking for the kinescope. All other versions use C307 and R315 for peaking. The multivibrator circuit feeds the 6W6GT vertical output tube V304.

HORIZONTAL OSCILLATOR AND FREQUENCY CONTROL

The horizontal oscillator, discharge, and AFC circuits utilize a double triode tube 6SN7, (V401). The frequency of the blocking oscillator, V401B, can be adjusted by the top slug of T401. The frequency of oscillation is stabilized by a tuned circuit. The inductance for the tuned circuit is in T401 and the capacitor is C407. The generated sawtooth reaches the grid of the output tube V402 through the capacity divider C410-C406. The latter, marked horizontal drive, is variable and controls the amount of drive on the grid of V402 (6BQ6). This adjustment will affect the horizontal linearity, high voltage, and noise inverter tube bias.

Synchronization is accomplished by means of the AFC, V401A, as follows: A complex wave consisting of the sync pulse and a parabola is fed to the grid of this triode. The sync pulse rides at the peak of the complex wave. The tube is biased from the oscillator grid to such a value that plate current flows only during the positive peak portions of the complex wave. A portion of the cathode voltage is applied to the oscillator grid. Its magnitude affects the frequency of the oscillator in such a way as to automatically lock it in synchronism.

The plate voltage for the AFC as supplied through R412, R402, and R401, is obtained from the boost supply. This is to neutralize the horizontal oscillator frequency change due to the inherent regulation characteristics of the boost voltage at different brightness levels.

HORIZONTAL OUTPUT AND DAMPER

The function of the horizontal output tube V402 is to supply sufficient current of the proper waveform to the horizontal deflection coils to provide horizontal scanning for the kinescope. The function of the damper tube, V404, (6W4) is to stop oscillation of components at certain times and thus help provide a linear trace. Other functions of this circuit are to provide a high amplitude pulse for high voltage and to recover a good part of the energy in the system. The energy recovery appears in the form of a boost voltage at the damper cathode.

The inductance and distributed capacity of the system are controlled so that the self-resonant frequency will be in the order of 72 KC so that the retrace time will be sufficiently short.

THE RECTIFIED HIGH VOLTAGE SUPPLY

The high voltage is supplied by part of the energy stored in the horizontal system. When the 6BQ6 plate current is cut off by the horizontal sawtooth, a high positive pulse of voltage appears on the tertiary of T402 due to the rapidly collapsing field in the system. This high positive pulse is rectified by the high voltage rectifier V403 (1B3). This pulse charges the H. V. condenser C415. This condenser is returned to the plate of the damper tube so that the negative pulse that exists there simultaneously with the tertiary pulse will add to the available high voltage. This added high voltage is approximately 1500 V. The total high voltage applied to the picture tube is 14 KV.

The filament power is obtained from a one-turn coil around the horizontal output transformer core. Width is controlled by L401 and linearity is controlled mainly by L402; the drive control influences linearity to some extent.

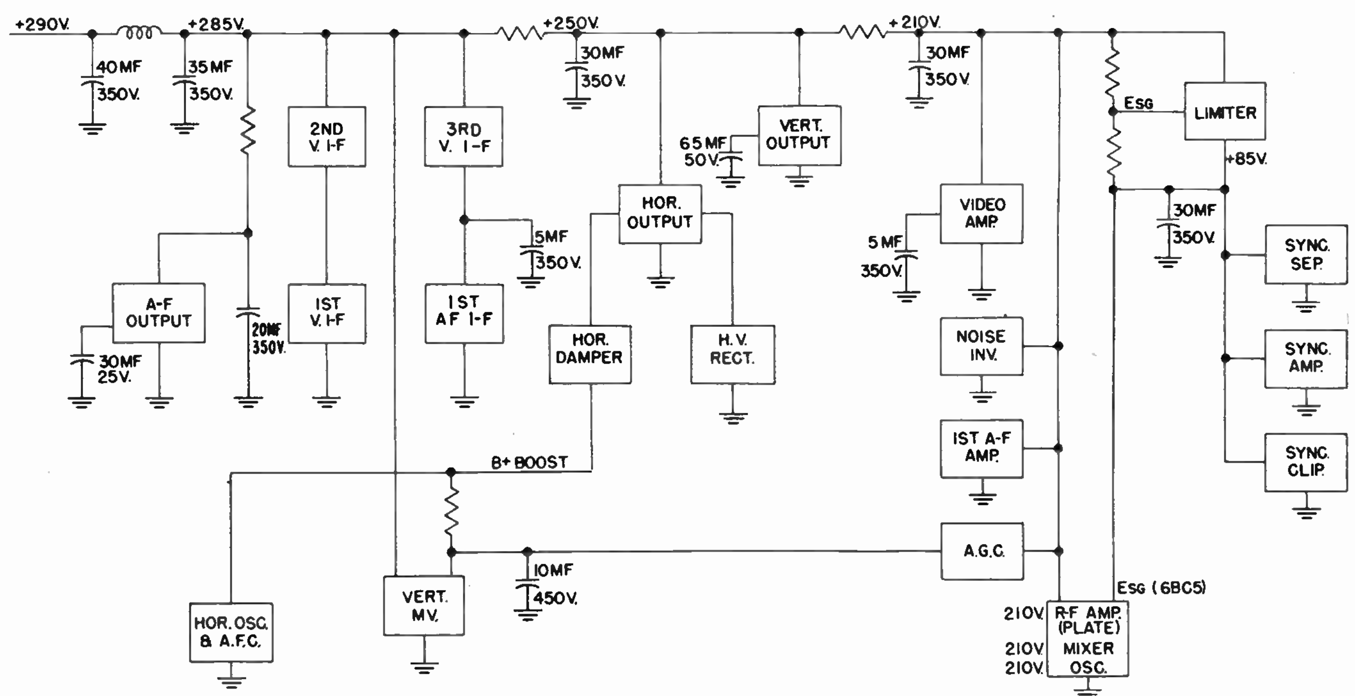
The capacitor and resistor in series across the upper half of the horizontal deflection coils cancel out the crosstalk transients. The resistor in series with the capacitor makes the value of the capacitor less critical. The resistors across the vertical windings damp out vertical transients.

LOW VOLTAGE SUPPLY

The low voltage power supply provides the filament and plate voltages for the receiver. A 5U4G (V501) rectifier tube is used to supply 290 volts DC input to the filter at approximately 230 ma. The power transformer has two 6.3 volt filament windings. One winding is grounded and supplies 11.4 amperes for all of the tubes except V202, V203, and V206. These three tubes are supplied by the second winding and draw 0.9 amperes. This winding is connected to the 140 volt bus so that the filament to cathode rating of the three tubes is not exceeded.

FOCUSING

Both permanent magnet and electrostatic focusing is employed in this series. On chassis having the permanent magnet focus unit, there is a centering plate on the front of the focus unit and a focus adjusting screw on the rear. Adjustment of the focus adjusting screw varies the flux density through which the electron beam passes. Ion trap and centering adjustments may be required after the beam is properly focused. The electrostatic focused units vary from the above in that the focus control is a potentiometer located on the rear apron of the chassis and centering is accomplished by means of a centering device located on the neck of the tube between the deflection coil and ion trap.



POWER DISTRIBUTION BLOCK DIAGRAM

FIGURE 5

PART V
ALIGNMENT

HORIZONTAL AFC

Horizontal frequency adjustment (T401 top slug).

1. Short out Terminals C-D of horizontal oscillator and AFC transformer. Set horizontal lock (if used) and horizontal drive trimmers 1½ turn from tight.
2. Turn horizontal hold control full clockwise, and adjust frequency slug (top of T401) until picture locks in.
3. Before further frequency adjustments are made, set up horizontal width and horizontal linearity, making any final adjustment necessary to horizontal drive trimmer. If the horizontal drive trimmer is changed at any time, the frequency adjustment will have to be checked.

Horizontal Oscillator waveform adjustment, (T401 bottom slug).

1. Remove short from terminals C-D of T401.
2. Connect oscilloscope, through series capacitor of approximately 15 mmf, to terminal C of T401. The pattern should be a sine wave, superimposed on a sawtooth. Adjust bottom slug of T109 for proper waveform, i.e. peak of sawtooth and sine waves should be nearly equal.
3. Remove the oscilloscope from T109. Turn the "horizontal hold" control full clockwise. Adjust frequency slug (top of T401) until picture is just out of sync. as indicated by blanking bar appearing at left of picture. Back off frequency slug slightly until picture again locks in sync. This adjustment is made with BRIGHTNESS control in full clockwise position.

VIDEO I-F ALIGNMENT

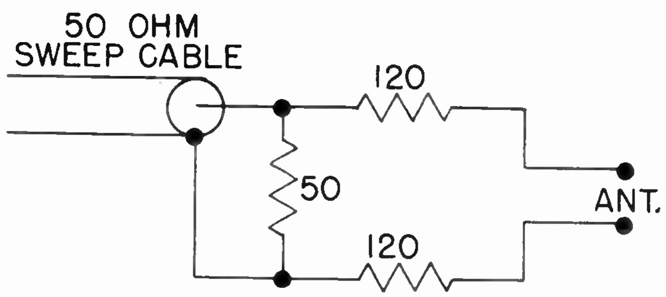
Test equipment needed:

A.M. Signal generator 21.25 to 25.75 MC
Sweep Generator
Cathode Ray Oscilloscope
Electronic Voltmeter

1. A low impedance voltage source, such as a tapped "C" battery must be used to apply fixed bias during alignment. Connect —1.5 volts to the R-F AGC bus and —4.5 volts to the I-F AGC bus. It is not necessary to remove the AGC tube during alignment.
2. Connect modulated signal generator to convertor grid wafer through hole in tuner shield.
3. Connect scope or VTVM across detector load resistor (R213). The scope is preferable as overload is more easily detected.
4. Tune the signal generator to the following frequencies and adjust the corresponding slugs for maximum indication.

Frequency	Adjust
23.1 MC	Converter Coil
25.3 MC	(T201) 1st I-F
23.4 MC	(T202) 2nd I-F
25.5 MC	(T203) 3rd I-F

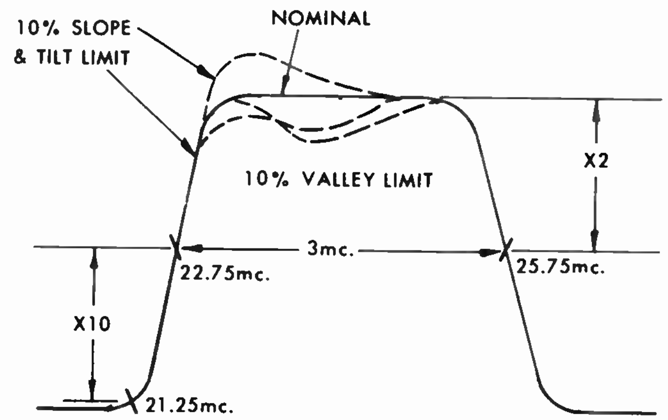
5. Remove signal generator and connect sweep generator to antenna terminals through proper impedance matching network, see Figure 6. Loosely couple marker generator to I-F chassis.



ANTENNA IMPEDANCE MATCHING NET

FIGURE 6

6. Tune sweep generator and television chassis to channel 6.
7. Retouch I-F coils if necessary for proper curve as shown on following page.



OVERALL I-F CURVE
FIGURE 7

NOTE: The converter (23.1 mc) will have most effect on the low frequency side of the curve, the 1st I-F transformer (25.3 mc) on the high frequency side. Tilt may be corrected by adjusting the 2nd or 3rd I-F transformer. Proper positioning of the markers is important, as no traps are used.

SOUND I-F ALIGNMENT

1. Connect VTVM through 1 meg. isolating resistor, across R101 (220K) limiter grid resistor. CAUTION: Case of VTVM will be at +85 volts.
2. Connect 4.5 MC signal to pin 1 (V204) and chassis ground.
3. Adjust primary (top slug) and secondary (bottom slug) of T204, for maximum reading. Keep output of signal generator low, so that this maximum reading does not exceed —5 volts.
4. Remove VTVM and connect from junction of R108 and C106 to ground.
5. Adjust primary (bottom slug) of T101 discriminator transformer for maximum output, and secondary (top slug) for zero reading.

NOTE: For accurate alignment do not change level of signal input after Step 3 above. Discriminator adjustments should be repeated until no improvement can be made.

OSCILLATOR ALIGNMENT

Oscillator alignment should be made only when the fine tuning control tunes in the extreme clockwise or counter-clockwise position, or if it will not tune at all within its tuning range.

TOUCH UP OSCILLATOR ALIGNMENT

If some channels do not tune at all, or not near enough to the center of the fine tuning range, adjust the oscillator trimmer for the best compromise tuning on all channels. If, for example all channels tune near one side of the control, adjustment of the trimmer will bring them all near the center. However if some channels tune near one end and others tune at the other end of the control, adjustment will move some to the center and move the others beyond the range of the control. In this case the oscillator coils will have to be adjusted individually as follows:

COMPLETE OSCILLATOR ALIGNMENT

Connect a sweep generator to the antenna terminals of the receiver. Connect an unmodulated signal generator to the antenna terminals and tune it to the channel 13 video carrier frequency. TV signals may be used.

Loosely couple an unmodulated signal generator to the first I-F grid and tune it to 25.75 MC. Connect an oscilloscope across the video detector load resistor through a 10K ohm resistor.

Turn on the receiver and set the vernier to the mid range position. When the receiver has warmed up, if there are two markers on the scope, determine which rotation of the vernier causes the markers to move closer together. If it is clockwise, reset the vernier to the midrange position and close the channel 13 oscillator coil. If it is counter-clockwise open the coil. Adjust for a zero beat. The channel 13 coil moves all high band channels. The channel 6 coil moves all low band channels.

Tune the sweep generator to channel 12. The signal generator to the channel 12 video carrier frequency. Set channel selector to 12. Adjust the channel 12 oscillator coil for a zero beat of the markers.

Repeat the procedure for channels 11 through 2. Recheck channels 13 through 7. The high channel coils are adjusted by moving them up or down and the low channel coils by spreading or pushing together.

TV CHANNEL FREQUENCIES

Channel No.	Band Width (MC)	Picture Carrier	Sound Carrier	Local Oscillator
2	54-60	52.25	59.75	81
3	60-66	61.25	66.75	87
4	66-72	67.25	71.75	93
5	76-82	77.25	81.75	103
6	82-88	83.25	87.75	109
7	174-180	175.25	179.75	201
8	180-186	181.25	185.75	207
9	186-192	187.25	191.75	213
10	192-198	193.25	197.75	219
11	198-204	199.25	203.75	225
12	204-210	205.25	209.75	231
13	210-216	211.25	215.75	237

ANTENNA, R-F AMPLIFIER AND CONVERTER ALIGNMENT

The desired pattern to be applied to the I-F amplifiers is the result of three variables. These three variables are the ANTENNA COIL (rear wafer), the R-F COIL (second wafer from rear) and the CONVERTER COIL (third wafer from rear).

These coils must be very carefully adjusted with only a slight movement. It is imperative that the following sequence of adjustment is followed to obtain the desired pattern. Antenna coils first, R-F coils second, and the converter coil last. The R-F wafer has B+ on it and should not be touched with the hand or a metal tool. Adjustment of the converter coil is critical. The oscillator coils (fourth wafer from rear) are properly adjusted and should not be touched.

The R-F tuner has been properly aligned at the factory and should not require any additional adjustment except when tubes are replaced in the tuner. Proper selection of the replacement tube will eliminate the necessity of making these coil adjustments. Try several tubes while observing their effects on the pattern. Use the one that gives the desired pattern. It is important that the tuner cover be in place when observing the pattern.

PART VI
SERVICE INFORMATION

HIGH VOLTAGE WARNING

The danger accompanying shock is always present when the receiver is operated outside the cabinet or when the rear cover is removed from the cabinet. Only a person familiar with the precautions to be observed when working with high-voltage equipment should service this receiver.

CATHODE RAY TUBE HANDLING

Shatterproof goggles and heavy gloves should be worn at all times when handling a cathode ray tube. The tube should not be handled in the vicinity of any person not so equipped. When handling the tube, always keep it away from the body.

Due to the large surface area of the tube and the high vacuum contained within, more than ordinary care is required to prevent shattering the tube. The large end of the bulb, particularly the rim of the viewing surface, must not be struck, scratched, or subjected to more than moderate pressure. If the tube binds during removal or replacement, determine the cause of the trouble. DO NOT FORCE THE TUBE.

PICTURE TUBE REPLACEMENT (HORIZONTAL CHASSIS)

If it becomes necessary to replace the picture tube, it should be done in the following manner.

1. Remove the tube socket from the rear of the picture tube, then remove the ion trap.
2. Remove the safety glass assembly by taking out the screws which hold the glass rail in position.
3. Loosen the nuts that secure the tube strap over the rim of the tube, and remove the strap.
4. Remove the high voltage anode connector and lift out the tube.
5. Install the replacement picture tube being careful not to force the neck when inserting thru the deflection coil.
6. Install the HV connector, replace the support strap, and fasten it down securely with the nuts removed in Step 3.
7. Loosen the thumbscrew on top of the deflection yoke, so the yoke moves freely. Loosen the two hex-head screws on each side of the deflection yoke mounting bracket, and push the top section forward until the rubber bumper fits against the bell of the tube, all the way around. Make sure tube face is vertical and neck of tube is parallel with chassis base. Then tighten the screws. Then press the deflection yoke forward as far as possible, and tighten the thumbscrew.
8. Loosen the two screws which secure the focus magnet, and move it so the neck of the tube is properly centered in it. Then tighten the screws and adjust the ion trap.
9. On chassis using "magnetic focus picture tubes" HORIZONTAL and VERTICAL CENTERING ¾ of the picture is accomplished by moving the "centering device" on the front side of the focus magnet. Readjustment of the ion trap may be necessary after this plate has been adjusted.

   On chassis using "electrostatic focus picture tubes", HORIZONTAL and VERTICAL CENTERING is accomplished by adjusting the "centering ring" located on the neck of the tube behind the deflection coil.

(VERTICAL CHASSIS)

In models where the chassis is mounted in a vertical position, the following procedure is recommended.

1. Remove the safety glass and mask assembly by taking out the screws which hold the glass rail in place.
2. Lay the cabinet on its side on a clean piece of felt or other soft material, with the chassis side down.
3. Remove the two metal wedges that brace the rim of the picture tube top and side. Two wood screws hold each in place.
4. Two ¼-20 screws secure each side of the chassis to the mounting rails of the cabinet. Remove these screws, and pull the chassis out of the cabinet. Proceed through steps 1 to 9 in the preceding section. Then replace the chassis.

REVISIONS

A comparison of the schematic diagrams for the A & B and the C chassis will show that a number of components were rearranged in the vertical multivibrator circuit. This was done to reduce the number of components requiring close tolerances, thereby simplifying service problems.

The vertical output stage was changed so that the 6W6 tube operates as a beam power tube rather than a triode as previously employed. This makes the selection of tubes less critical, as there are many 6W6's which will oscillate when triode connected, resulting in alternate light and dark horizontal bars on the screen. Two capacitors (C408 and C410) were changed in value, so that proper adjustment of the associated controls would be nearer the center of their range.

The "E" revision is similar to "C", with the following differences: R232 and R233 were added, and the value of C209 was changed to eliminate the possibility of intercarrier "buzz" and audio hum. R215 and R308 were changed to improve sync separation.

A focus control has been added in the "D" revision for use with electro-statically focused tubes. Otherwise, the circuit is the same as the "E".

A tone control has been added to some chassis. When the tone control is installed at the left of the control panel, the "D" becomes an "H" and the "E" becomes an "F"

On the J & K revisions, resistor R202 was changed to 8200 ohms. The horizontal lock trimmer C411 was changed from a variable to a fixed capacitor. R239 and C222 have been added to eliminate vertical sweep modulation at maximum settings of contrast and brilliance controls. R215 was changed in value to reduce twist at top of picture.

SERVICE HINTS ON THE 105 SERIES TV CHASSIS

Intercarrier Buzz

1. Check alignment of secondary (top slug) of discriminator transformer. Adjust for minimum buzz on transmitted signal.
2. Check 4.5 MC sound alignment as outlined in service manual.
3. Check response curve on video I-F. Align if necessary.
4. Buzz may be due to overmodulation at the transmitter. If more than one station is available, try all stations. Buzz on only one station will confirm this condition.
5. See revision "E", page 18.

White Raster, No Picture or Sound

1. Check AGC amplifier (6AU6).
2. Check keyer coil and width coil.
3. Check tuner and I-F tubes.
   Several tubes should be tried in the I-F amplifier. Because of the voltage stacking, these tubes must have nearly equal mutual conductances.
4. Check video amplifier tube.

Overall Focus

1. Make sure proper ion trap is installed.
   20″ and 21″ magnetic focus tubes use part number 360492-2 or 4 (yellow dot).
   20″ and 21″ electrostatic focus tubes use part number 360492-5 or 6 (green dot).
2. Check ion trap adjustment. Slight adjustment may be necessary to obtain maximum brightness at full clockwise position of brightness control.
3. Check focus adjustment. Adjust for best focus at normal brightness.
   A. On magnetic focus units the focus control is a screw-driver adjustment at the rear of the focus magnet. If good focus cannot be obtained, and picture changes position considerably with rotation of focus control, install a new focus magnet, part number 360504-1.
   B. On electrostatic focus units, the focus control is a potentiometer adjustment on the rear chassis apron.
4. On magnetic focus tubes make sure the focus magnet is placed ¼″ to ⅜″ in back of the deflection yoke.
5. If poor overall focus is noted replace deflection yoke. Use part number 360526-1 as replacement.
6. Try a picture tube which is known to give good focus in another instrument.

Picture Resolution and Contrast

1. Try known good tubes (6CB6) in I-F and video amplifiers. CAUTION: If it is necessary to change tubes in the I-F amplifier, check the alignment.
2. Check range of fine tuning control.
   The 4.5 mc. beat pattern should begin to appear in the picture at the left center of the fine tuning control range. If this cannot be accomplished, try adjusting the oscillator trimmer located on the front of the tuner. If further oscillator adjustment is necessary, proceed as outlined in the alignment instructions.
3. Check I-F alignment.

Background Noise

1. To reduce background noise in picture, change R223 from 4.7 megohm to 3.9 megohm.
2. Remove 10K ohm resistor, R231, in the 2nd I-F grid return.

NOTE: R231 not used in A and B models.

Vertical Sync

1. In weak signal areas, R215 in AGC grid circuit should be 27K ohm. In some chassis 10K ohms has been used.
2. If proper height and vertical linearity cannot be attained without "foldover" at bottom of raster, replace vertical output transformer, part number 320060-1.

Horizontal Sync

1. If horizontal circuit will not stay in adjustment, replace horizontal oscillator transformer, part number 360499-1.
2. If horizontal drive adjustment appears too critical, or if horizontal and vertical sync "motorboats," install noise inverter bias control as shown. This control can be installed in place of "color converter" jack.

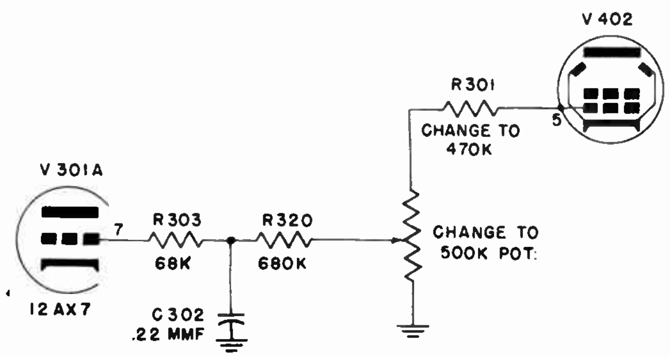


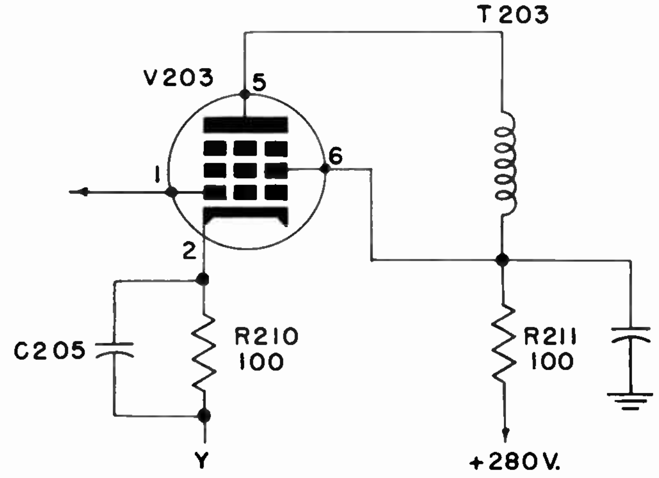
FIGURE 8

Adjust "noise bias" control for most stable sync.

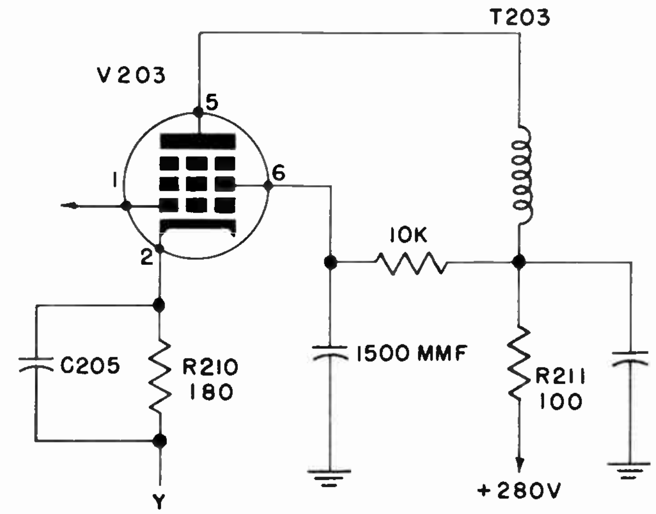
3. Align horizontal oscillator and AFC.

Signal Blocking (Strong Signal Areas Only)

1. If signal blocks when tuning from weak to strong signal check noise inverter bias. This should be approximately—11V, and may be raised by adjustment of the horizontal drive control or "noise bias" control if used.
2. Replace V206, AGC amplifier tube.
3. Blocking may be due to excessive grid current in V203, the 3rd video I-F amplifier. This circuit may be modified as shown below.



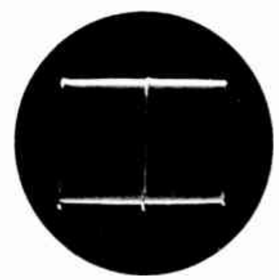
ORIGINAL CIRCUIT
FIGURE 9



MODIFIED CIRCUIT
FIGURE 10

Detector load resistor, 2.6 V. p/p, 'scope at 30 c.p.s.

Grid of sync clipper, 25 V. p/p, 'scope at 30 c.p.s.



Cathode of sync clipper, 2.5 V. p/p, 'scope at 30 c.p.s.

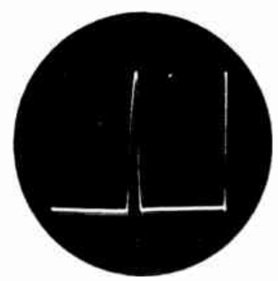


Plate of sync clipper, 22 V. p/p, 'scope at 7875 c.p.s.

Grid of vertical output, 18 V. p/p, 'scope at 30 c.p.s.

Plate of vertical output, 750 V. p/p, 'scope at 30 c.p.s.

(Yellow lead) deflection yoke, 120 V. p/p, 'scope at 30 c.p.s.

Vertical retrace blanking, 12 V. p/p, 'scope at 30 c.p.s.

Junction of C405 & R409 through capacitor, 25 V. p/p, 'scope at 7875 c.p.s.

Grid of 6BQ6, 55 V. p/p, 'scope at 7875 c.p.s.

Cathode of damper, 50 V. p/p, 'scope at 7875 c.p.s.

Output of horizontal linearity, 40 V. p/p, 'scope at 7875 c.p.s.

A.G.C. plate, 450 V. p/p, 'scope at 7875 c.p.s.

Pin 5 (horizontal) output, 140 V. p/p, 'scope at 7875 c.p.s.

VOLTAGE CHART 105 SERIES J AND K SERIES

			Plate		Screen		Cathode		Grid	
Tube No.	Tube Type	Function	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts
V-1	6BC5	R-F Ampl.	5	210	6	85			1	0
V-2	12AT7	Mixer Osc.	6 1	80 170					7 2	−2.5* −7*
V-201	6CB6	1st Video I-F	5	130	6	130	2	.8	1	0
V-202	6CB6	2nd Video I-F	5	275	6	275	2	135	1	135
V-203	6BC5/6AG5	3rd Video I-F	5	280	6	280	2 & 7	140	1	140
V-204	6AU6	Vid. Det. 1st Sound I-F	5	135	6	40	7	0	1	−.9†
V-205	6CB6	Video Ampl.	5	140†	6	140†	2	0	1	−.9†
V-206	6AU6	AGC Ampl.	5	−.4	6	415	7	210	1	170†
V-207	See List	Picture Tube	Cap	14KV	10	400	11	100°	2	15
V-101	6AU6	Limiter	5	185	6	120	7	80	1	75
V-102	6T8	Disc. 1st Audio	9	55					8	−.2
V-103	6V6	Audio Output	3	240	4	265	8	16	5	0
V-301	12AX7	Noise Inverter Sync. Sep.	6 1	165 78			8 3	−.9 0	7 2	−11 −3†
V-302	6SN7GT	Sync. Ampl. Sync. Clipper	5 2	20 55			6 1	3 3.3	4 3	0 3.7
V-303	6SN7GT	Vertical MV	2 5	35 30			3 6	15† 15†	1 4	15† −12
V-304	6W6GT	Vert. Output	3	220	4	140	8	15†	5	0
V-401	6SN7GT	Hor. AFC Hor. OSC	5 2	185† 290			6 3	−15 0	4 1	−35 −90
V-402	6BQ6GT	Hor. Output	Cap	Do Not Measure	4	150	8	0	5	−30
V-403	1B3GT	H. V. Rectifier	Cap	Do Not Measure			2	14KV		
V-404	6W4GT	Damper	5	Do Not Measure			3	410		

*Varies with channel selector switch position.

†Varies with control settings.

WHY THE WAVEFORMS VARY

Assuming normal operation of the television receiver, voltage waveforms often do not appear as shown. This is a function of the type of oscilloscope used, and its input cable.

These waveforms are as reproduced on a Dumont 208B instrument but another, having greater or lesser frequency fidelity, may show a waveform quite different in shape and/or size. Therefore, the service technician must be familiar with his oscilloscope, must recognize its limitations and must make mental correction if waveforms do not appear to be "normal."

The same logic applies to the measure of D-C voltages. Measurements shown here are on an RCA Voltohymist, Jr. and the use of a 20,000 ohm per volt movement will indicate some D-C voltages to differ greatly from those shown. Again, logic and reasoning must be applied, realizing that in a high impedance circuit, the indicated voltage will be less than the actual operating voltage.

Allowances for scope waveforms and D-C meter readings may be computed if all pertinent factors are known, but the experienced technician makes mental correction and allowances to the end that high fidelity instruments are not required.

PARTS LIST FOR THE 105 SERIES

Ref. No.	DESCRIPTION	Part No.
T 101	Transformer, discriminator, 4.5 mc.	360512-1
T 102	Transformer, audio output, omit on "without audio"	320063-1
T 201	Transformer, 1st video I-F (J & K only)	360529-1
	Transformer, 1st video I-F, all others	360461-1
T 202	Transformer, 2nd video I-F	360461-1
T 203	Transformer, 3rd video I-F	360511-1
T 204	Transformer, sound, 4.5 mc.	360519-1
T 301	Transformer, V. O.	320060-1
T 401	Transformer, horizontal blocking oscillator	360499-1
T 402	Transformer, H. V.	320061-1
T 501	Transformer, power	300064-1
L 201	Coil, peaking, blue-blue	360443-17
L 202	Coil, peaking, black-black	360443-15
L 203	Coil, peaking, violet	360443-6
L 204	Coil, peaking, brown	360443-13
L 205	Coil, peaking, green-green	360443-14
L 206	Coil, peaking, white-white	360443-16
L 301	Coil, deflection	360515-2
L 301	Coil, deflection (side mounted chassis)	360516-1
L 301	Coil, deflection (electrostatic focus tube)	360526-1
L 401	Coil, keyer & horizontal size	360521-1
L 402	Coil, horizontal linearity	360517-1
L 501	Filter reactor	320058-1
	Focus magnet	360504-1
	Centering device (electrostatic focus tubes)	360525-1
C 101	Capacitor, mica, 56 mmf, 500 V.	250179-79
C 102	Capacitor, ceramic, dual, 4000 mmf, 450 V.	250195-2
C 103	Capacitor, ceramic, 5000 mmf, 450 V.	250175-1
C 104	Capacitor, ceramic, 5000 mmf, 450 V.	250175-1
C 105	Capacitor, ceramic, 100 mmf, 450 V.	250207-46
C 106	Capacitor, ceramic, 470 mmf, 500 V. (CT 350J, CT 351K only)	250206-5
	Capacitor, ceramic, 1000 mmf, 350 V., used on all except above	250088-46
C 107	Capacitor, ceramic, .01 mfd, 450 V.	250175-2
C 108	Capacitor, paper, .01 mfd, 600 V., omit on "without audio"	250201-7
C 109	Capacitor, paper, .01 mfd, 600 V., omit on "without audio"	250201-7
C 110	Capacitor, mica, 56 mmf, 500 V.	250159-79
C 111	Capacitor, paper, .02 mfd, used with "radio tuner" only	250129-3
	Capacitor, ceramic, .01 mfd, preferred replacement	250217-2
C 112	Capacitor, paper, .0015 mfd, 400 V. (CT 350J, CT 351K only)	250211-2
C 201	Capacitor, ceramic, 1500 mmf, 450 V.	250175-3
C 202	Capacitor, dual, ceramic, 1500 mmf, 450 V.	250195-1
C 203	Capacitor, ceramic, 5000 mmf, 450 V.	250175-1
C 204	Capacitor, ceramic, dual, 1500 mmf, 450 V.	250195-1
C 205	Capacitor, ceramic, 5000 mmf, 450 V.	250175-1
C 206	Capacitor, ceramic, dual, 4000 mmf, 450 V.	250195-2
C 207	Capacitor, ceramic, 10 mmf, 450 V.	250207-3
C 208	Capacitor, ceramic, 12 mmf, ±5%, 450 V.	250088-73
C 209	Capacitor, ceramic, 5000 mmf, 450 V. (A, B & C only)	250175-1
C 209A	Capacitor, ceramic, dual, 4000 mmf, 450 V., in all except A, B & C	250195-2
C 209B	Capacitor, ceramic, dual, 4000 mmf, 450 V., in all except A, B & C	250195-2

Ref. No.	DESCRIPTION	Part No.
C 210	Capacitor, paper, .1 mfd, 600 V.	250203-13
C 211	Capacitor, paper, .22 mfd, 200 V.	250202-15
C 212	Capacitor, paper, .1 mfd, 200 V.	250202-13
C 213	Capacitor, paper, .01 mfd, 600 V.	250201-7
C 214	Capacitor, paper, .047 mfd, 200 V.	250202-11
C 215	Capacitor, ceramic, 1500 mmf, 450 V.	250175-3
C 216	Capacitor, paper, .01 mfd, 600 V.	250201-7
C 217	Capacitor, paper, .22 mfd, 400 V.	250204-15
C 218	Capacitor, ceramic, 1500 mmf, 450 V.	250175-3
C 219	Capacitor, ceramic, 1500 mmf, 450 V.	250175-3
C 222	Capacitor, ceramic, 220 mmf (J & K only)	250218-5
C 301	Capacitor, paper, .047 mfd, 200 V. (A & B only)	250205-11
	Capacitor, paper, .022 mfd, 200 V. (C, D, E, F & H only)	250202-9
C 302	Capacitor, paper, .22 mfd, 200 V.	250202-15
C 303	Capacitor, mica, 240 mmf, ±5%, 500 V.	250159-56
C 304	Capacitor, mica, 47 mmf, 500 V.	250159-78
C 305	Capacitor, mica, 4700 mmf, ±5%, 500 V.	250161-24
C 306	Capacitor, paper, .0068 mfd, 600 V.	250203-6
C 307	Capacitor, paper, .047 mfd, 600 V. (A & B only)	250203-11
	Capacitor, paper, .1 mfd, 400 V. (all except above)	250211-13
C 308	Capacitor, paper, .047 mfd, 600 V.	250203-11
C 309	Capacitor, ceramic, 1500 mmf, 450 V.	250175-3
C 310	Capacitor, paper, .047 mfd, 600 V.	250203-11
C 311	Capacitor, ceramic, 10,000 mmf, 450 V.	250175-2
C 312	Capacitor, paper, .001 mfd, 600 V.	250203-1
C 313	Capacitor, paper, .001 mfd, 600 V.	250203-1
C 314	Capacitor, paper, .001 mfd, 600 V.	250203-1
C 401	Capacitor, paper, .047 mfd, 600 V.	250203-11
C 402	Capacitor, paper, .47 mfd, 250 V.	250205-17
C 403	Capacitor, paper, .022 mfd, 200 V.	250202-9
C 404	Capacitor, paper, .047 mfd, 600 V.	250203-11
C 405	Capacitor, mica, 82 mmf, 500 V.	250159-81
C 406	Capacitor, trimmer	260116-1
C 407	Capacitor, mica, .01 mfd, 300 V.	250161-47
C 408	Capacitor, mica, 180 mmf, ±5%, 500 V. (A & B only)	250159-53
	Capacitor, mica, 150 mmf, ±5%, 500 V. (all except above)	250159-51
C 409	Capacitor, mica, 1000 mmf, ±10%, 500 V.	250160-64
C 410	Capacitor, mica, 560 mmf, ±10%, 500 V. (A & B only)	250159-130
	Capacitor, mica, 470 mmf, ±10%, 500 V. (all except above)	250159-90
C 411	Capacitor, mica, 68 mmf, 500 V.	250159-80
C 412	Capacitor, paper, .047 mfd, 600 V.	250203-11
C 413	Capacitor, paper, .047 mfd, 600 V.	250203-11
C 414	Capacitor, paper, .1 mfd, 600 V.	250203-13
C 415	Capacitor, hi voltage	250189-1
C 416	Capacitor, paper, .22 mfd, 400 V.	250211-15
C 417	Capacitor, paper, .0068 mfd, 600 V.	250201-6
C 418	Capacitor, paper, .047 mfd, 600 V.	250211-11
C 501	Capacitor, electrolytic, 40-35-30-30 mfd, 350 V.	270021-43
C 502	Capacitor, electrolytic, 10-30-5 mfd, 350 V.—80 mfd, 50 V. (A & B only)	270021-45
	Capacitor, electrolytic, 10-30-5 mfd, 350 V.—200 mfd, 25 V. (all except above)	270021-46

Ref. No.	DESCRIPTION	Part No.
C 503	Capacitor, electrolytic, 20-5 mfd, 350 V.—30 mfd, 25 V. (used "with audio" and "with audio for AM" only)	270023-17
	Capacitor, electrolytic, 10 mfd, 350 V. ("without audio" only)	270023-18
R 101	Resistor, carbon, 220,000 ohms, ½ W.	230104-90
R 102	Resistor, carbon, 470 ohms, ½ W.	230104-58
R 103	Resistor, carbon, 5600 ohms, ½ W.	230104-71
R 104	Resistor, carbon, 10,000 ohms, 2 W.	230106-74
R 105	Resistor, carbon, 470 ohms, ½ W.	230104-58
R 106	Resistor, carbon, 100,000 ohms, ½ W.	230104-86
R 107	Resistor, carbon, 100,000 ohms, ½ W.	230104-86
R 108	Resistor, carbon, 68,000 ohms, ½ W.	230104-84
R 109	Potentiometer, volume control, 1 megohm, ½ W. ("with audio" only)	220076-19
	Potentiometer, volume control with switch ("with radio tuner" only)	220118-1
	Potentiometer, volume control, (long shaft) CT 356-CT 357	220126-19
	Potentiometer, volume control, 1 megohm, ½ W., JE & F, KE & F ("with audio" only)	220126-25
	Potentiometer, volume control, with switch, JE & F, KE & F ("with radio tuner" only)	220118-2
R 110	Resistor, carbon, 4.7 megohm, ±5%, ½ W., omit on "without audio"	230104-106
R 111	Resistor, carbon, 470,000 ohms, ½ W., omit on "without audio"	230104-94
R 112	Resistor, carbon, 10 ohms, ½ W., omit on "without audio"	230104-38
R 113	Resistor, carbon, 100 ohms, ½ W., omit on "without audio"	230104-50
R 114	Resistor, carbon, 470,000 ohms, ½ W., omit on "without audio"	230104-94
R 115	Resistor, carbon, 390 ohms, 1 W., omit on "without audio"	230105-57
R 116	Resistor, carbon, 390 ohms, 1 W., omit on "without audio"	230105-57
R 117	Resistor, carbon, 100,000 ohms, ½ W.	230104-86
R 118	Potentiometer, tone control, 500,000 ohms, ¼ W. (CT 350 & CT 351 only)	220126-17
	Potentiometer, tone control, CT 350, CT 351, JE & F, KE & F only	220126-28
R 201	Potentiometer, focus, 2.5 megohm (electrostatic focus tubes)	220076-5
R 202	Resistor, carbon, 82,000 ohms, ½ W. (used with "360529-1 I-F trans." only)	230104-73
	Resistor, carbon, 12,000 ohms, ½ W. (used with all except above)	230104-75
R 203	Resistor, carbon, 47 ohms, ½ W.	230104-46
R 204	Resistor, carbon, 470 ohms, ½ W.	230104-58
R 205	Resistor, carbon, 100 ohms, ½ W. (A only)	230104-50
	Resistor, carbon, 470,000 ohms, ±5%, ½ W. (all except A, J & K)	230094-223
	Resistor, carbon, 330,000 ohms, ½ W. (J & K only)	230104-92
R 206	Resistor, carbon, 240,000 ohms, ±5%, ½ W. (all except A, J & K)	230094-216
	Resistor, carbon, 180,000 ohms, ½ W. (J & K only)	230104-89
R 207	Resistor, carbon, 47 ohms, ½ W.	230104-46
R 208	Resistor, carbon, 3300 ohms, ½ W.	230104-68
R 209	Resistor, carbon, 470 ohms, ½ W.	230104-58
R 210	Resistor, carbon, 100 ohms, ½ W.	230104-50
R 211	Resistor, carbon, 100 ohms, ½ W.	230104-50
R 212	Resistor, carbon, 39,000 ohms, ½ W.	230104-81
R 213	Resistor, carbon, 5600 ohms, ½ W.	230104-71

Ref. No.	DESCRIPTION	Part No.
R 214	Resistor, carbon, 100 ohms, ½ W.	230104-50
R 215	Resistor, carbon, 27,000 ohms, ½ W.	230204-79
	Resistor, carbon, 10,000 ohms, ½ W., ±10%	230104-74
R 216	Potentiometer, contrast, 600 ohms, ½ W. (JE & K, CE & F only)	220126-26
	Potentiometer, contrast, 600 ohms, ½ W., (long shaft) CT 356-357	220126-20
	Potentiometer, contrast, 600 ohms, ½ W. (all except above)	220126-7
R 217	Resistor, carbon, 22,000 ohms, 1 W.	230105-78
R 218	Resistor, carbon, 2200 ohms, 1 W.	230105-66
R 219	Resistor, carbon, 3300 ohms, 1 W.	230105-68
R 220	Resistor, carbon, 120,000 ohms, ½ W. (J & K only)	230104-87
	Resistor, carbon, 180,000 ohms, ½ W. (all except above)	230094-213
R 221	Resistor, carbon, 330,000 ohms, ½ W., ±10% (J & K only)	230104-92
	Resistor, carbon, 240,000 ohms, ½ W. (all except above)	230094-216
R 222	Resistor, carbon, 470,000 ohms, ½ W.	230104-94
R 223	Resistor, carbon, 4.7 megohm, ½ W.	230104-106
R 224	Resistor, carbon, 100,000 ohms, ½ W.	230094-207
R 225	Resistor, carbon, 330,000 ohms, ½ W.	230094-219
R 226	Resistor, carbon, 220,000 ohms, ½ W.	230104-90
R 227	Potentiometer, brightness, 100,000 ohms, ¼ W., (long shaft) CT 356-357	220126-18
	Potentiometer, brightness, 100,000 ohms, ¼ W. (JE & F and KE & F only)	220126-24
	Potentiometer, brightness, 100,000 ohms, ¼ W. (all except above)	220126-5
R 228	Resistor, carbon, 82,000 ohms, ½ W.	230104-85
R 229	Resistor, carbon, 180,000 ohms, ½ W.	230104-89
R 230	Resistor, carbon, 33,000 ohms, ½ W.	230104-80
R 231	Resistor, carbon, 10,000 ohms, ½ W., ±10%	230104-74
R 232	Resistor, carbon, 10,000 ohms, 2 W.	230096-74
R 233	Resistor, carbon, 3900 ohms, ½ W.	230104-69
R 239	Resistor, carbon, 82,000 ohms, ½ W., ±10%	230104-85
R 301	Resistor, carbon, 680,000 ohms, ½ W.	230104-96
R 302	Resistor, carbon, 270,000 ohms, ½ W.	230104-91
R 303	Resistor, carbon, 68,000 ohms. ½ W.	230104-84
R 304	Resistor, carbon, 4.7 megohm, ½ W.	230104-106
R 305	Resistor, carbon, 33,000 ohms, ½ W.	230104-80
R 306	Resistor, carbon, 390,000 ohms, ½ W. (A only)	230104-93
	Resistor, carbon, 470,000 ohms, ½ W.	230104-94
R 307	Resistor, carbon, 1 megohm, ½ W.	230104-98
R 308	Resistor, carbon, 560 ohms, ½ W.	230104-59
R 309	Resistor, carbon, 100,000 ohms, 1 W.	230105-86
R 310	Resistor, carbon, 1.5 megohm, ½ W. (A & B only)	230104-100
	Resistor, carbon, 680,000 ohms, ½ W. (all except above)	230104-96
R 311	Potentiometer, vertical hold, 1 megohm, ¼ W. (A & B only)	220076-28
	Potentiometer, vertical hold, 1 megohm, ¼ W. (JE & F and KE & F only)	220126-29
	Potentiometer, vertical hold, 1 megohm, ¼ W., (long shaft) CT 356-357	220126-21
	Potentiometer, vertical hold, 1 megohm, ¼ W. (all except above)	220076-12
R 312	Resistor, carbon, 3300 ohms, ½ W.	230104-68
R 313	Potentiometer, vertical height, 1.5 megohm (A & B only)	220076-28
	Potentiometer, vertical height, 1 megohm	220076-5

Ref. No.	DESCRIPTION	Part No.
R 314	Resistor, carbon, 1 megohm, ½ W. (A & B only)	230104-98
	Resistor, carbon, 1.5 megohm, ½ W. (J & K only)	230104-100
	Resistor, carbon, 2.2 megohm, ½ W. (all except above)	230104-102
R 315	Resistor, carbon, 5600 ohms, ½ W. (A & B only)	230104-71
	Resistor, carbon, 2200 ohms, ½ W. (all except above)	230104-66
R 316	Resistor, carbon, 4700 ohms, ½ W. (A & B only)	230104-70
	Resistor, carbon, 22,000 ohms, ½ W. (all others)	230104-78
R 317	Resistor, carbon, 2.2 megohm, ½ W. (A & B only)	230104-102
	Resistor, carbon, 1.5 megohm, ½ W. (all others)	230104-100
R 318	Potentiometer, vertical linearity, 1500 ohms (A & B only)	220126-4
	Potentiometer, vertical linearity, 1000 ohms (all others)	220126-10
R 319	Resistor, carbon, 560 ohms, 1 W. (A & B only)	230105-59
	Resistor, carbon, 47 ohms, ½ W. (all others)	230104-46
R 320	Resistor, carbon, 680,000 ohms, ½ W.	230104-96
R 321	Resistor, carbon, 22,000 ohms, ½ W.	230104-78
R 322	Resistor, carbon, 47,000 ohms, ½ W.	230104-82
R 323	Resistor, carbon, 120,000 ohms, ½ W.	230104-87
R 324	Resistor, carbon, 47,000 ohms, ½ W.	230104-82
R 325	Resistor, carbon, 3900 ohms, ½ W.	230104-69
R 326	Resistor, carbon, 10,000 ohms, ½ W.	230104-74
R 327	Resistor, carbon, 27,000 ohms, 1 W.	230105-79
R 328	Resistor, carbon, 47,000 ohms, ½ W.	230104-82
R 401	Potentiometer, 50,000 ohms (A & B only)	220076-44
	Potentiometer, 50,000 ohms (all others)	220126-9
R 402	Resistor, carbon, 120,000 ohms, ½ W.	230104-87
R 403	Resistor, carbon, 3900 ohms, ½ W.	230104-69
R 404	Resistor, carbon, 330,000 ohms, ½ W.	230104-92
R 405	Resistor, carbon, 82,000 ohms, ½ W.	230104-85
R 406	Resistor, carbon, 330,000 ohms, ½ W.	230104-92
R 407	Resistor, carbon, 820,000 ohms, ½ W.	230104-97
R 408	Resistor, carbon, 150,000 ohms, ½ W.	230104-88
R 409	Resistor, carbon, 150,000 ohms, ½ W.	230104-88
R 410	Resistor, carbon, 8200 ohms, ½ W.	230104-73
R 411	Resistor, carbon, 47,000 ohms, 1 W.	230105-82
R 412	Resistor, carbon, 120,000 ohms, ½ W.	230104-87
R 413	Resistor, carbon, 47 ohms, ½ W.	230104-46
R 414	Resistor, carbon, 3900 ohms, ±10%, 2 W. (J & K only)	230096-69
	Resistor, carbon, 7500 ohms, 2 W. (all others)	230096-180
R 415	Resistor, carbon, 68,000 ohms, ½ W.	230104-84
R 416	Resistor, carbon, 1 megohm, 1 W.	230105-98
R 417	Resistor, carbon, 2200 ohms, ½ W.	230104-66
R 418	Resistor, carbon, 47,000 ohms, ½ W. (used "with radio tuner" only)	230104-82

Ref. No.	DESCRIPTION	Part No.
R 419	Resistor, carbon, 4.7 ohms, ½ W.	230094-26
R 420	Resistor, carbon, 3900 ohms, ±10%, 2 W.	230096-69
R 501	Resistor, wire wound, 210 ohms, 10 W. (A, B & C only)	240021-29
	Resistor, wire wound, 125 ohms, 10 W. (all others)	240021-11
R 502	Resistor, wire wound, 1300 ohms, 3 W.	240021-30
R 503	Resistor, carbon, 220,000 ohms, 1 W.	230105-90
RC 301	Printed circuit	250186-1
F 501	Fuse, 150 MA	180475-4
J 101	Socket, speaker	180504-11
J 102	Socket, radio, (used "with radio tuner" only) 6 hole	189798-5
	Socket, radio, (used "with radio tuner" only) 5 hole	189798-4
J 103	Socket, phono motor, (used "with radio tuner" only)	180520-4
J 201	Receptacle, color converter	180466-1
	Ion trap—order for picture tube	
	R-F tuner unit, CT 356 & CT 357 (long shaft)	700357-21
	R-F tuner unit (JE & F and KE & F)	700357-22
	R-F tuner unit (all except above)	700357-20

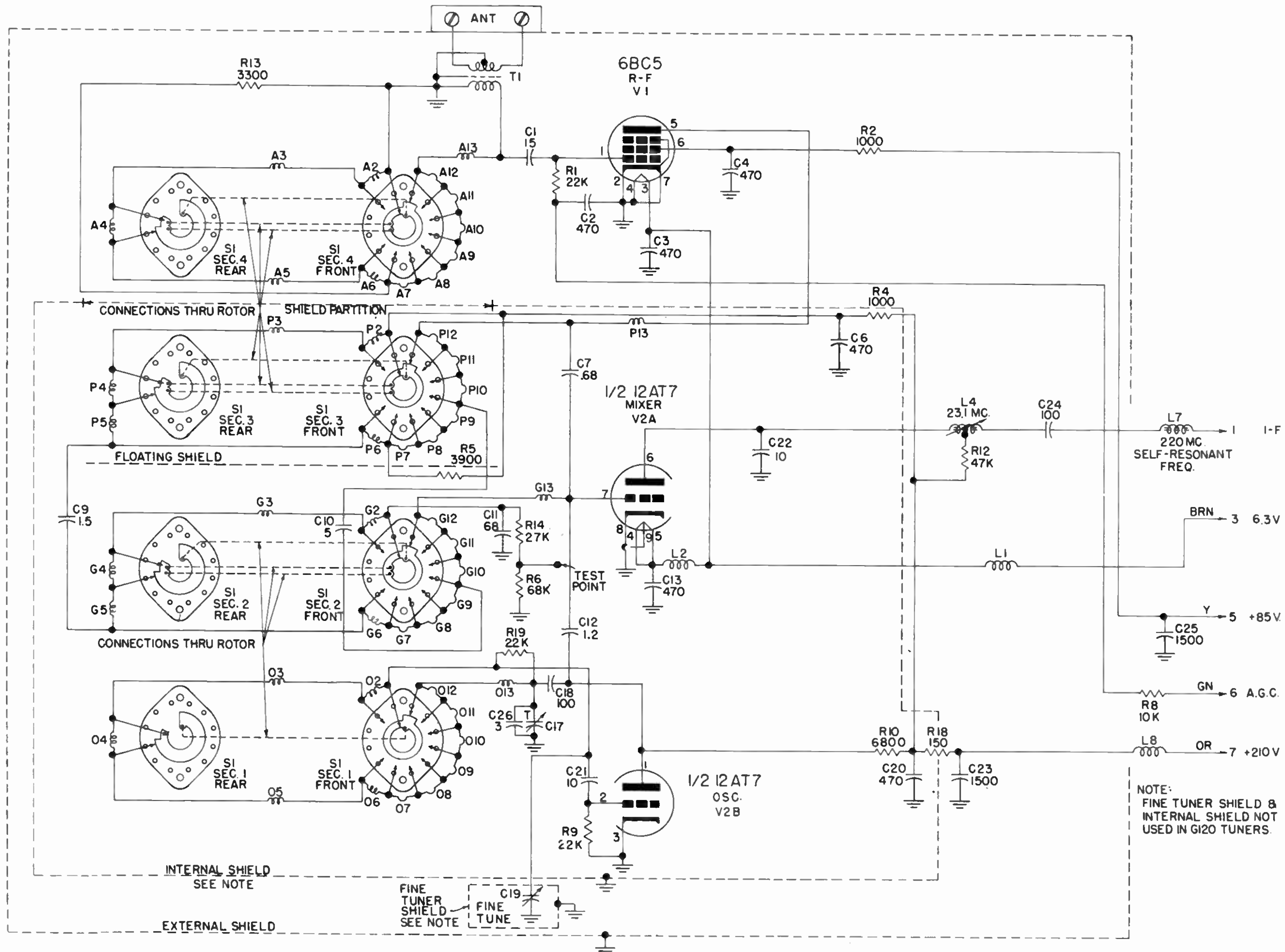


FIGURE 11—SCHEMATIC DIAGRAM, 700357 TUNER

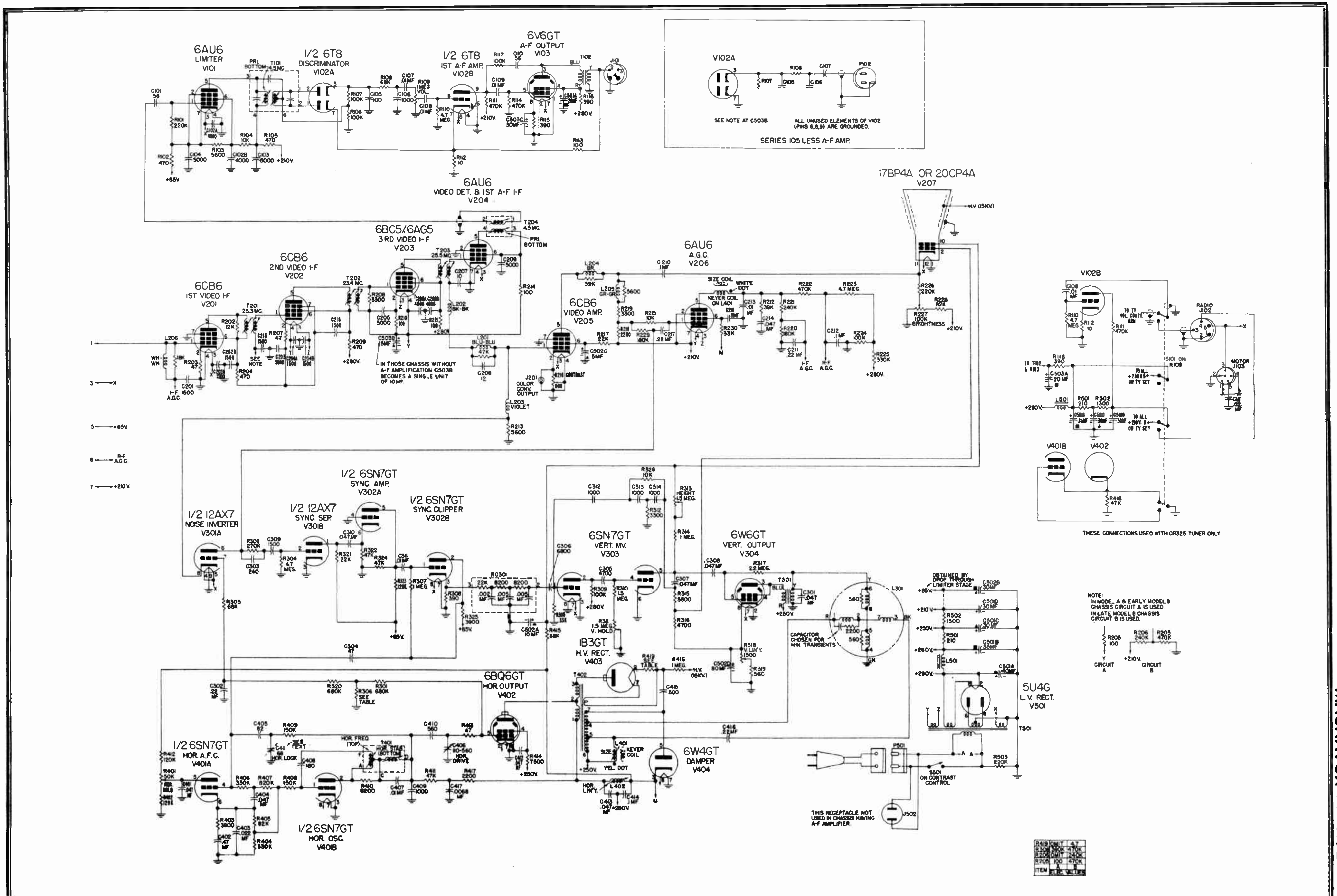
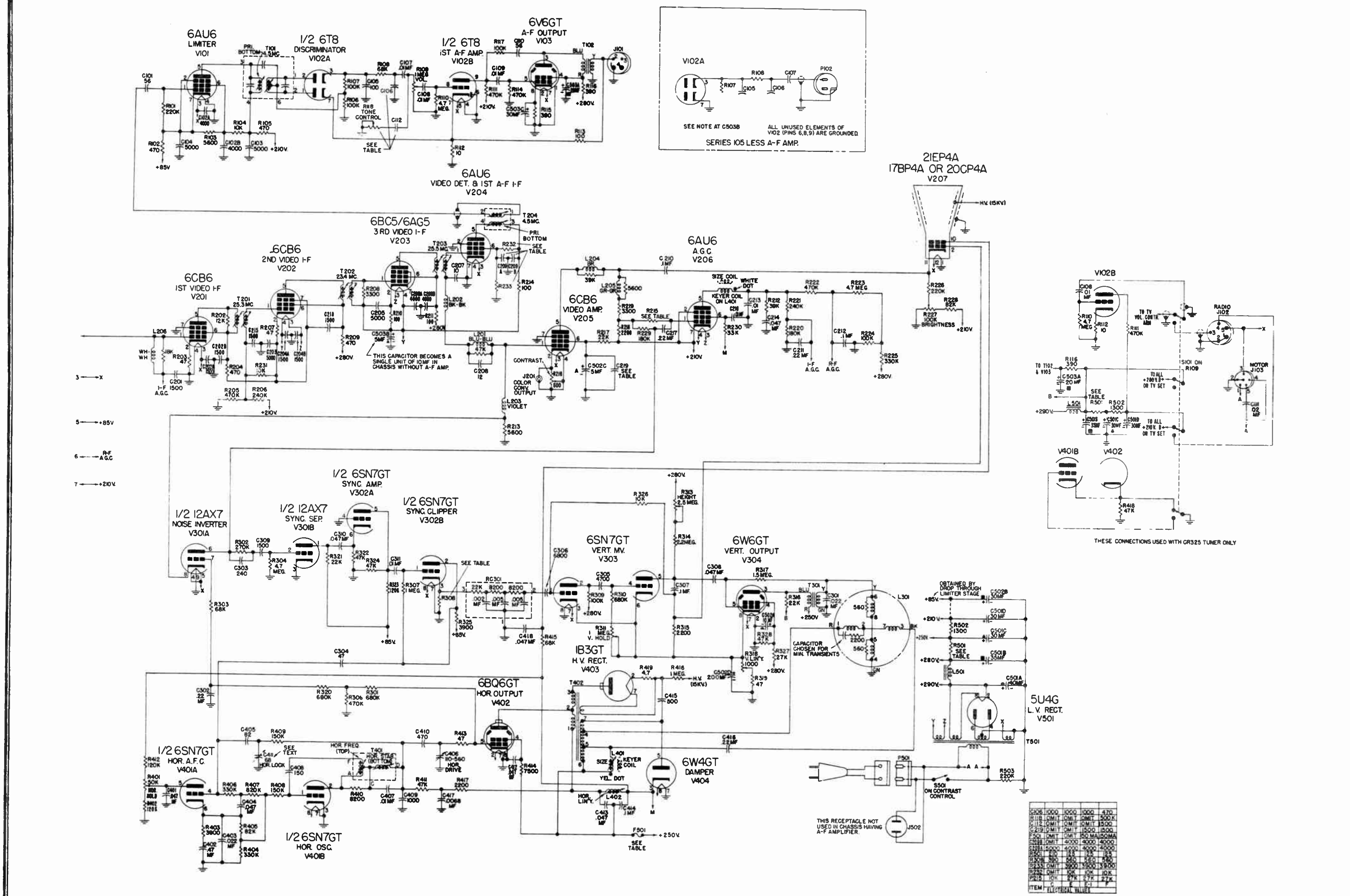


FIGURE 12—SCHEMATIC DIAGRAM, 105 SERIES A AND B



ITEM	C	E	E-1	F
C106	1000	1000	1000	470
R118	OMIT	OMIT	OMIT	500K
C112	OMIT	OMIT	OMIT	1500
C219	OMIT	OMIT	1500	1500
F501	OMIT	OMIT	150 MA	150MA
C208B	OMIT	4000	4000	4000
C208A	5000	4000	4000	4000
R501	210	125	125	125
R308	390	560	560	560
R233	OMIT	3900	3900	3900
R232	OMIT	10K	10K	10K
R215	10K	27K	27K	27K

ELECTRICAL VALUES

FIGURE 13—SCHEMATIC DIAGRAM, 105 SERIES C, E AND F

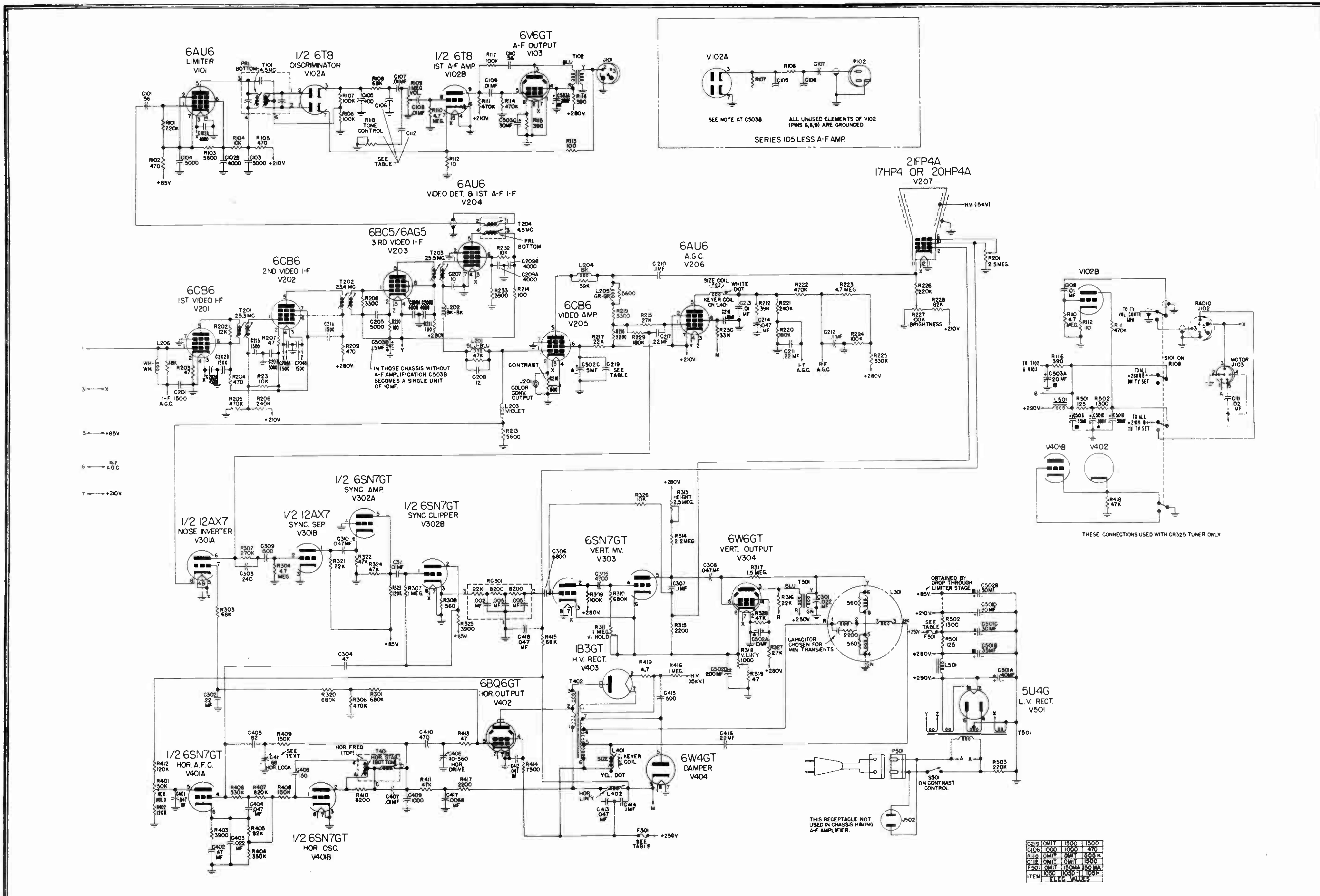


FIGURE 14—SCHEMATIC DIAGRAM, 105 SERIES D AND H

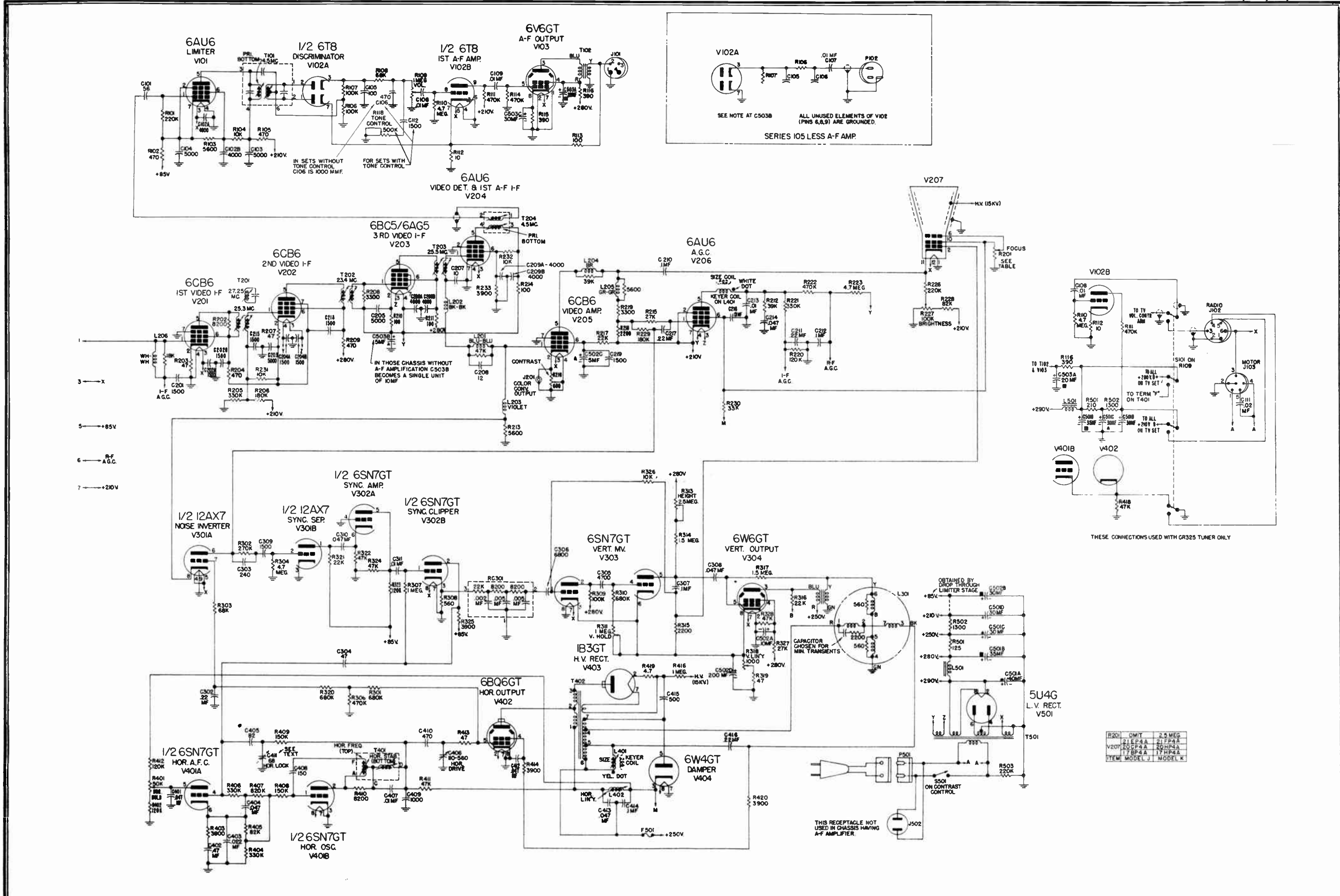


FIGURE 15—SCHEMATIC DIAGRAM, 105 SERIES J AND K

POWER REQUIREMENTS

All chassis are rated 117 volts AC 60 cycles. Power consumptions listed are for 117 volt line.

TV with audio	205 Watts max.
TV without audio	190 watts max.

The addition of the UHF converter will increase the power consumption approximately 10 watts, the UHF tuner about 4 watts.

TUBE COMPLEMENT

Function	Tube Type	Symbol	Function	Tube Type	Symbol
Cascode RF Amplifier	6BQ7	V1	Sync Separator	1/2 12AX7	V301B
RF Mixer	1/2 6U8	V2A	Sync Amplifier	1/2 6SN7GT	V302A
Oscillator	1/2 6U8	V2B	Sync Clipper	1/2 6SN7GT	V302B
1st Video IF	6CB6	V201	Vertical Oscillator	6SN7GT	V303
2nd Video IF	6CB6	V202	Vertical Output	6W6GT	V304
3rd Video IF	6CB6	V203	Horizontal AFC	1/2 6SN7GT	V401A
Video Detector	IN64	Crystal	Horizontal Oscillator	1/2 6SN7GT	V401B
Sound IF Amplifier	6AU6	V204	Horizontal Output	6BQ6GT	V402
Limiter	6AU6	V101	Damper	6W4GT	V404
Discriminator	1/2 6T8	V102A	HV Rectifier	1B3GT	V403
1st AF Amplifier	1/2 6T8	V102B	LV Rectifier	5U4G	V501
Audio Output	6V6GT	V103	Picture Tube	20" or 21" rectangular	V207
Video Amplifier	6CB6	V205			
AGC Amplifier	6AU6	V206			
Noise Inverter	1/2 12AX7	V301A			

CIRCUIT DESCRIPTION

General

This receiver is basically designed to accommodate either a UHF tuner or a UHF converter. The converter can be added when the UHF transmissions start and the customer wishes it.

The TV receiver is constructed on a single chassis which may be used in conjunction with an AM tuner or a separate audio amplifier or record player. It is so designed that it will accommodate either 21-inch rectangular or 20-inch rectangular tubes without any changes in circuitry.

Cascode RF Tuner

The cascode RF tuner consists of an RF amplifier V1 (6BQ7) and mixer-oscillator V2 (6U8). A 12-position channel selector rotary switch is used with a concentric shaft which operates the variable type fine tuner. For ease of alignment, inductances adjustable by bending or spreading are provided on every channel.

As shown in the schematic diagram, the secondary of the antenna transformer T1 is tuned for each channel by shunting it with the proper value of inductance (S1, Section 4) to make it resonate with the RF tube V1 (6BQ7) input capacity. L1 and C1 form an IF trap, which is tuned to 44.5 MC for best average IF rejection on all channels. To further minimize IF interference an external IF trap assembly is available for those few areas where the overall IF interference is severe. These traps are series-connected in the receiver antenna lead-in and should be tuned to give maximum rejection at the undesired IF frequency.

Tuning of the RF plate and mixer grid is accomplished by wafer sections 2 and 3, which are identical to the RF grid wafer. Coupling capacitors C6, C9 and C10, connected between appropriate points, provide the necessary coupling for the proper bandpass on all channels. Shields between the RF grid, RF plate and mixer grid wafers reduce stray coupling. The 6BQ7 RF tube is used in a cascode circuit (triode 1 grounded cathode, triode 2 grounded grid) to minimize triode feedback so that the superior signal-to-noise ratio of a triode is realized with good stability.

The pentode mixer V2A (1/2 6U8) is used because of its low feedback characteristic with 41 MC IF.

To reduce high band radiation from the main TV chassis, common low side capacity coupling was used to the 1st IF tube grid circuit and the tuner chassis was connected to the main chassis only at the tuner rear apron.

Video IF

The video IF amplifier operates at a picture carrier frequency of 45.75 MC, with a 6 db design bandwidth of 3.0 MC and consists of a double-tuned circuit (low-side capacity coupled), followed by three stagger tuned I-F transformers. The double-tuned circuit consists of two similar coils that are physically separated, one in the tuner (converter plate coil), and one in the grid circuit of the 1st IF amplifier (T201).

The remainder of the IF amplifier consists of three stagger-tuned stages, using 6CB6's for maximum stable gain. A trap similar to that on the IF input coil is inductively coupled to the 1st IF plate coil (T202) and tuned to 47.25 MC adjacent channel sound carrier.

This chassis employs intercarrier sound IF (4.5 MC) produced by the beat between sound and picture carriers. The video detector is comprised of a crystal diode (IN64)located accessibly within shield can (T204), also containing the final IF bifilar coil, bypass capacitor and IF stabilizing filter choke.

The 4.5 MC intercarrier sound IF signal is applied to the single tuned 1st sound IF amplifier (V204) and in turn fed to the limiter stage (V101).

The limiter was designed on the basis of plate limiting and grid limiting. Plate limiting is accomplished by using a low screen potential and grid limiting is obtained by using grid leak bias.

The 4.5 MC discriminator circuit uses the diodes (#1 and #2) section of V102A (1/2 6T8) for detection. The AM output is zero at center frequency and is proportional to the frequency deviation from balance, and with limiter action, suppression of AM to either side of center frequency is accomplished.

Audio Amplifier

The audio amplifier is a two-stage amplifier using 1/2 6T8 (V102A) and 6V6 (V103). The triode in the 6T8 gives comparatively high gain. This makes it possible to use inverse feedback. The feedback is an overall feedback from the voice coil winding of the audio output transformer to the cathode of the 1st AF amplifier.

Video Detector, Video Amplifier

The detector is DC coupled to the video amplifier V205 (6CB6). The DC level is retained for better picture quality, and AGC reference. The video amplifier is compensated for 3 MC response, this being the definition obtainable from the IF. The video amplifier is AC coupled to the picture tube.

Noise Inverter

The noise inverter is for the purpose of removing noise bursts that exceed the sync pulse level from the signal that is fed to the AGC and the sync circuits. The noise inverter (one-half 12AX7 V301A) is a grounded grid amplifier that forms a parallel signal path around the video amplifier tube. Since it is cathode driven, the noise inverter signal output is in phase with the detector signal while the video amplifier out put is 180° out of phase.

The noise inverter is biased beyond cutoff, enabling it to conduct only on noise signals which exceed the sync tips at the detector.

Bias for the noise inverter is obtained from the grid bias voltage of the horizontal output by means of a voltage divider in the output tube grid return. Since bias on the horizontal output tube is determined by the signal amplitude on its grid, the horizontal drive control (C406) will affect the bias voltage of the noise inverter. A potentiometer (R304) provides for independent adjustment of noise inverter bias and horizontal drive. The voltage divider has been set up to avoid any difficulty with the noise inverter when the horizontal drive is correctly adjusted. The noise inverter bias usually is between -9V and -13V as measured with VTVM.

AGC

The 105-41 MC chassis uses keyed AGC for improved noise immunity and reduction of airplane flutter. A series-fed pulse to the AGC amplifier was chosen because of the ease of filtering the derived AGC voltage. A more rapidly acting AGC is therefore possible.

Sync Separators

The sync separators consist of three triode sections, one-half 12AX7 (V301B) and a 6SN7 (V302A, V302B), which are sync separator, sync amplifier and sync clipper, respectively.

Having grid leak bias, the sync separator will only accept a certain peak-to-peak portion of the positive peak of the signal. At low contrast levels this includes some of the video signal; therefore, another stage of separation is required. The first stage inverts the signal, making it necessary to cathode drive the sync amplifier, which operates in much the same manner as the sync separator. A negative signal fed to the grid of the sync clipper supplies a negative sync signal at the cathode for the vertical multivibrator and a positive sync signal at the plate for the horizontal AFC.

Vertical Sweep Oscillator

The vertical sweep oscillator is a plate-to-grid multivibrator using a 6SN7 dual triode. The integrated vertical sync is fed to the grid of the first triode section and the output wave is taken from the plate of the second triode. The pulse across the resistance R315 of the peaking circuit is also used for obtaining vertical retrace blanking of the picture tube.

The feedback circuit in the multivibrator is from the peaking resistor to the grid of the first triode. RC301 is a printed circuit integrating network for deriving the vertical synchronizing pulse.

Vertical Output Circuit

The vertical output amplifier is a type 6W6, pentode connected and transformer coupled to the yoke. Improvement in linearity is obtained by feedback from the transformer secondary to the grid.

Horizontal Oscillator and Frequency Control

The horizontal oscillator, discharge and AFC circuits utilize a double triode tube 6SN7 (V401). The frequency of the blocking oscillator (V401B) can be adjusted by the top slug of T401. The frequency of oscillation is stabilized by a tuned circuit. The inductance for the tuned circuit is in T401 and the capacitor is C407. The generated sawtooth reaches the grid of the output tube V402 through the capacity divider C410 - C406. The latter, marked HORIZONTAL DRIVE, is variable and controls the amount of drive on the grid of V402 (6BQ6). THIS ADJUSTMENT WILL AFFECT THE HORIZONTAL LINEARITY, HIGH VOLTAGE AND INVERTER TUBE BIAS.

Horizontal Output and Damper

The function of the output tube V402 is to supply sufficient current of the proper waveform to the horizontal deflection coils in order to provide horizontal scanning for the picture tube. The function of the damper tube, V404 (6W4) is to stop oscillation of the yoke current at retrace time and thus help provide a linear trace. Other functions of this circuit are to provide a high amplitude pulse for high voltage and to recover a good part of the energy in the system. Part of the energy recovered appears in the form of a boost voltage at the damper cathode, and part in actual deflection current in the yoke.

High Voltage Supply

The high voltage is supplied by part of the energy stored in the horizontal system. When the 6BQ6 plate current is cut-off by the horizontal sawtooth, a high positive pulse of voltage appears on the tertiary of T402 due to the rapidly collapsing field in the system. This high positive pulse is rectified by the H.V. rectifier V403 (1B3).

Anastigmatic Deflection Yoke

The anastigmatic deflection yoke has the windings spaced in a manner that gives very little deflection spot defocusing.

Low Voltage Supply

The low voltage power supply provides the filament and plate voltages for the receiver. A 5U4G (V501) rectifier tube is used to supply 290 volts DC input to the filter at approximately 230 MA. The power transformer has two 6.3 volt filament windings. One winding is grounded and supplies 11.4 amperes for all of the tubes except V202, V204 and V206. These three tubes are supplied by the second winding and draw 0.9 amperes. This winding is connected to the 140 volt bus so that the filament to cathode rating of the three tubes is not exceeded.

ALIGNMENT INSTRUCTIONS

HORIZONTAL OSC. AND AFC

1. Horizontal frequency adjustment (Top slug, T401).
   a. Short out terminals C and D of the horizontal oscillator and AFC transformer. Set HORIZONTAL DRIVE trimmer to 1½ turns from tight.
   b. Turn HORIZONTAL HOLD control to full clockwise position and adjust the top slug of T401 until picture locks in.
   c. Adjust HORIZONTAL DRIVE, LINEARITY, and WIDTH controls for proper size and linearity of picture. If it is necessary to change the HORIZONTAL DRIVE control, readjustment of the frequency slug will be necessary.

   NOTE: If proper frequency adjustment cannot be obtained
   1. Check the grid voltage on the noise invertor tube, Pin 7, V301 (12AX7). It should be between -9 and -13.5 V., (Measure with VTVM only).
   2. Recheck Horizontal Linearity adjustment.

   d. Repeat WIDTH, LINEARITY and FREQUENCY adjustments.

2. Horizontal Waveform adjustment (bottom slug T401).
   a. Remove short from terminals C and D of T401.
   b. Connect oscilloscope probe in series with 15 mmf. capacitor to terminal C. Set scope at horizontal frequency and adjust bottom slug of T401 so that the rounded and sharp peaks of the curve are of equal amplitude.
   c. Remove scope. With HORIZONTAL HOLD control in full clockwise position, adjust frequency slug (top of T401) until picture is just out of sync as indicated by blanking bar appearing at left of picture. Back off frequency slug slightly until picture again locks in sync. This adjustment is made with BRIGHTNESS control in full clockwise position.

VIDEO I-F ALIGNMENT

Test equipment needed:
A.M. Signal generator 41.25 to 47.25 MC
RF Sweep Generator
Cathode Ray Oscilloscope
Electronic Voltmeter
4.5 V "C" battery with tap at 1.5 volts

1. Connect positive (+) terminal of "C" battery to chassis ground. Connect -1.5 V Tap to RF grid return (junction R222 and R223). Connect -4.5 V Tap to IF grid return (junction R235 and C201).
2. Connect modulated signal generator to convertor grid wafer through hole in tuner shield.
3. Connect scope or VTVM across detector load resistor (R213).
4. Tune the signal generator to the following frequencies and adjust the corresponding slugs for as indicated in table below:

FREQUENCY	ADJUST	INDICATION
47.25MC	T203 (Top) 2nd IF	Minimum
47.25MC	T201 (Top) IF Input	Minimum
43.5 MC	T201 (Bottom) Input IF	Maximum
45.6 MC	Convertor Coil	Maximum
43.3 MC	T202 (Bottom) 1st, IF	Maximum
45.2 MC	T203 (Bottom) 2nd IF	Maximum
44.1 MC	T204 (Bottom) 3rd IF & Det	Maximum

NOTE: Do not readjust IF input coil after peaking converter coil.

5. Remove signal generator and connect sweep generator to antenna terminals through proper impedance matching network, see Fig. 1. (If generator output is unbalanced) loosely couple marker generator to IF chassis.

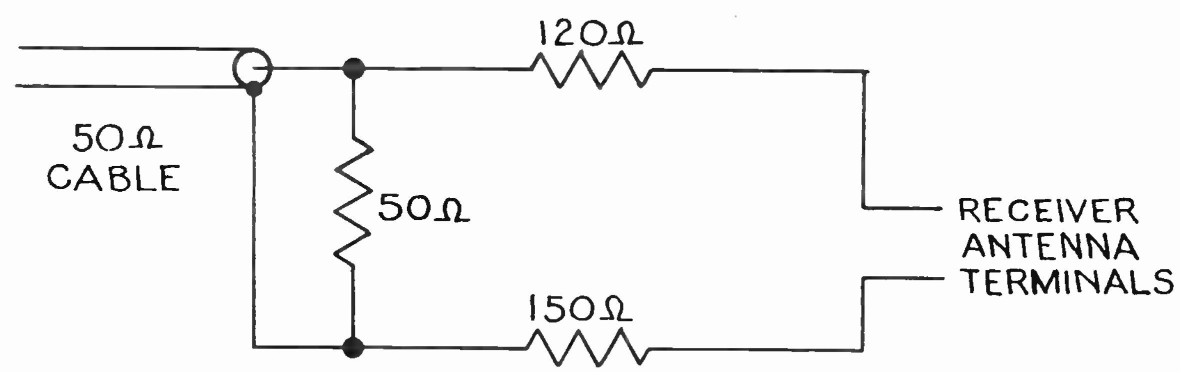
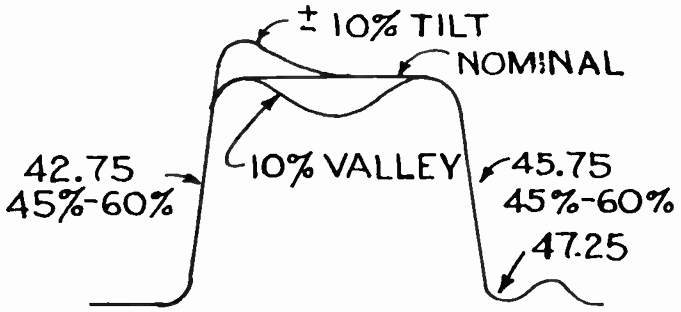


FIG. 1

6. Tune sweep generator and television chassis to channel 4.
7. Retouch IF coils only if overall RF-IF curve does not fall within the limits shown. The RF oscillator must be on frequency when making this check.



OVERALL I-F CURVE

Note: To correct tilt, the 3rd IF (44.1MC should be adjusted. For correct marker-setting, the 1st IF (43.3MC) or 2nd IF (45.2MC) should be adjusted.

SOUND I-F ALIGNMENT

1. Connect VTVM through 1 mg. isolating resistor, across R101 (39K) limiter grid resistor. CAUTION: Case of VTVM will be at + 85 volts.
2. Connect 4.5 MC signal to terminal D (T204) and chassis ground.
3. Adjust L206 sound take-off coil and L101, sound IF coil for maximum reading. Keep output of signal generator low, so that this maximum reading does not exceed -2 volts.
4. Remove VTVM and connect from junction of R108 and C106 to ground.
5. Adjust primary (bottom slug) of T101 discriminator transformer for maximum output, and secondary (top slug) for zero reading.
   NOTE: For accurate alignment do not change level of signal input after Step 3 above. It may be necessary to detune secondary of T101 before peaking of the primary can be accomplished.

RF TUNER ALIGNMENT

Oscillator alignment should be made only when the fine tuning control tunes in the extreme clockwise or counter-clockwise position or if it will not tune at all within its tuning range.

TOUCH UP OSCILLATOR ALIGNMENT

If some channels do not tune at all, or not near enough to the center of the fine tuning range, adjust the oscillator trimmer for the best compromise tuning on all channels. If, for example all channels tune near one side of the control, adjustment of the trimmer will bring them all near the center. If the range of the trimmer is not sufficient to accomplish this, check the space between the "hot" plate of the fine tuner and the fine tuner cam. This space should not be greater than .015". If it is necessary to change the space it can be adjusted by carefully bending the "hot" plate. CAUTION: Do not decrease the space to the point of excessive rubbing. If some channels tune near one end and others tune at the other end of the control, adjustment will move some to the center and move the others beyond the range of the control. In this case the oscillator coils will have to be adjusted individually as follows:

COMPLETE OSCILLATOR ALIGNMENT

Connect a sweep generator to the antenna terminals of the receiver. Connect an unmodulated signal generator to the antenna terminals and tune it to the Channel 13 video carrier frequency. TV signals may be used.

Loosely couple an unmodulated signal generator to the first IF grid and tune it to 45.75MC. Connect an oscilloscope across the video detector load resistor.

Turn on the receiver and set the vernier to the mid range position. When the receiver has warmed up, if there are two markers on the scope, determine which rotation of the vernier causes the markers to coincide. If it is clockwise, reset the vernier to the midrange position and close the Channel 13 oscillator coil. If it is counter-clockwise, open the coil. Adjust for a zero beat. The Channel 13 coil moves all high band channels. The Channel 6 coil moves all low band channels.

CHANNEL NO.	BANDWIDTH (MC)	PICTURE CARRIER	SOUND CARRIER	LOCAL OSCILLATOR
2	54-60	55.25	59.75	101
3	60-66	61.25	65.75	107
4	66-72	67.25	71.75	113
5	76-82	77.25	81.75	123
6	82-88	83.25	87.75	129
7	174-180	175.25	179.75	221
8	180-186	181.25	185.75	227
9	186-192	187.25	191.75	233
10	192-198	193.25	197.75	239
11	198-204	199.25	203.75	245
12	204-210	205.25	209.75	251
13	210-216	211.25	215.75	257

Tune the sweep generator to Channel 12. The signal generator to the Channel 12 video carrier frequency. Set CHANNEL SELECTOR to 12. Adjust the Channel 12 oscillator coil for a zero beat of the markers.

Repeat the procedure for Channels 11 through 2. Recheck Channels 13 through 7. The high channel coils are adjusted by moving them up or down and the low channel coils by spreading or pushing together.

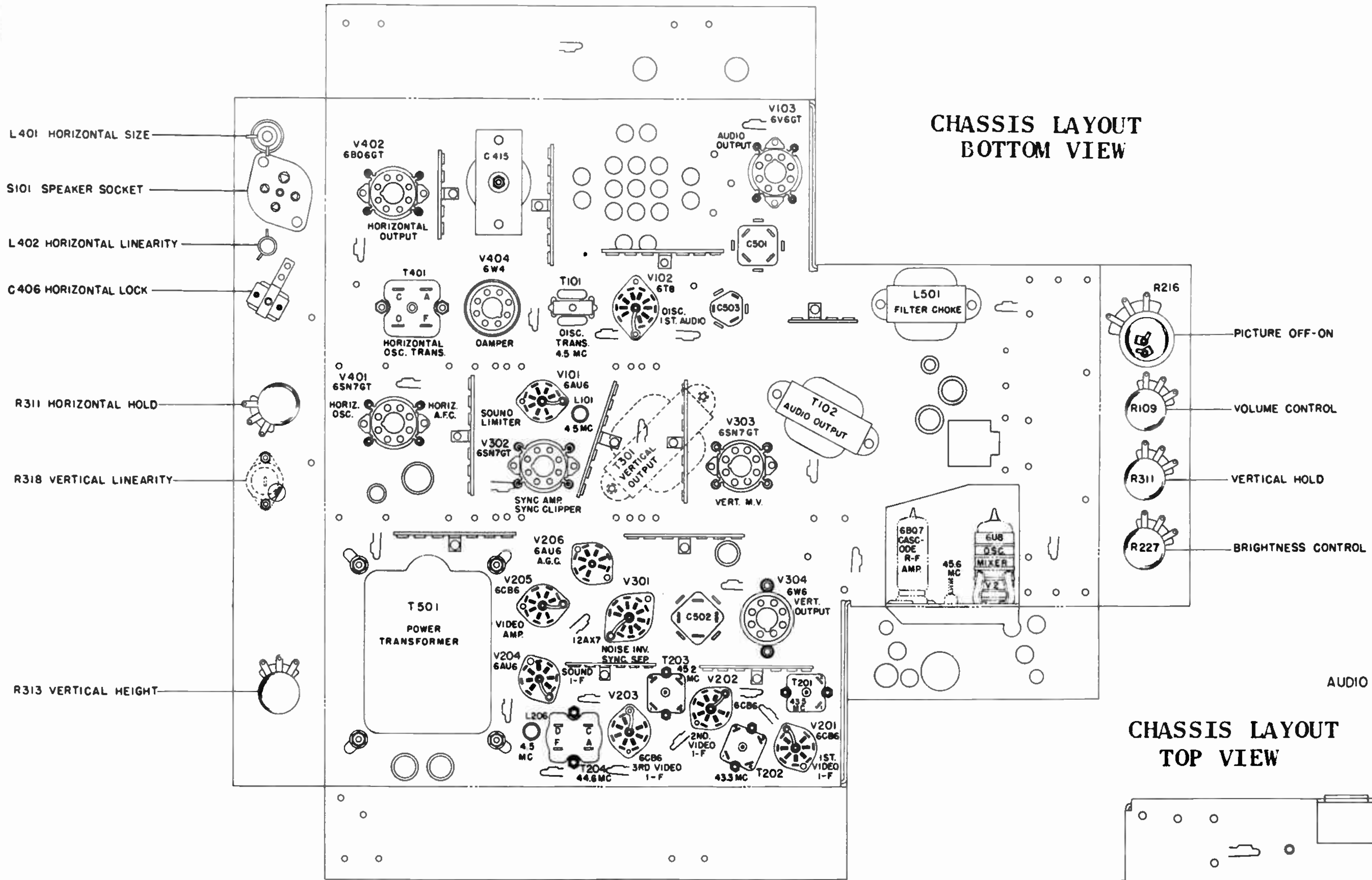
ANTENNA, RF AMPLIFIER AND CONVERTER ALIGNMENT

The desired pattern to be applied to the IF amplifiers is the result of three variables. These three variables are the ANTENNA COIL (rear wafer), the RF COIL (second wafer from rear) and the CONVERTER COIL (third wafer from rear).

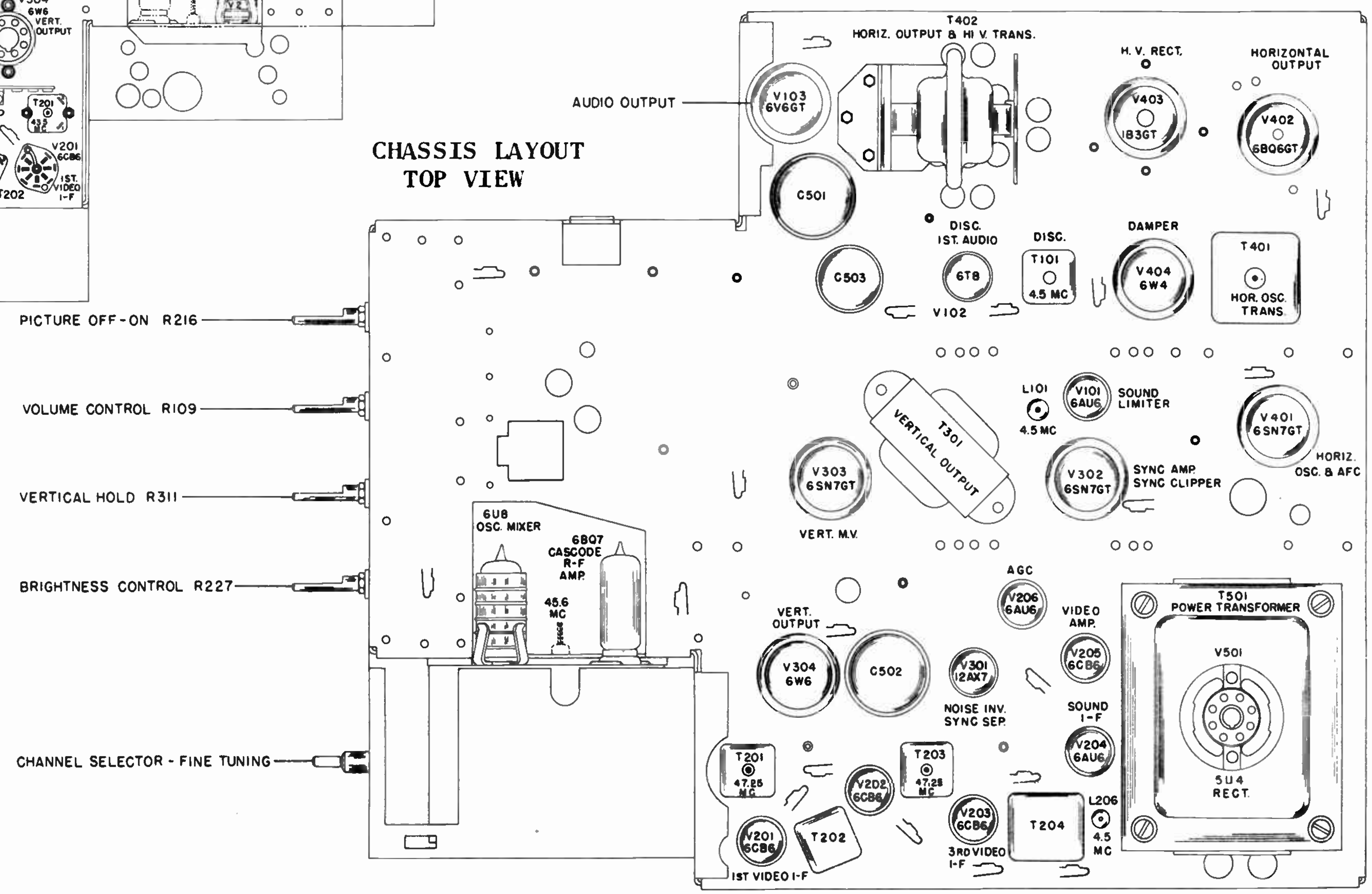
These coils must be very carefully adjusted with only a slight movement. It is imperative that the following sequence of adjustment is followed to obtain the desired pattern. Antenna coils first, RF coils second, and the converter coil last. The RF wafer has B+ on it and should not be touched with the hand or a metal tool. Adjustment of the converter coil is critical. The oscillator coils (fourth wafer from rear) are properly adjusted and should not be touched.

The RF tuner has been properly aligned at the factory and should not require any additional adjustment except when tubes are replaced in the tuner. Proper selection of the replacement tube will eliminate the necessity of making these coil adjustments. Try several tubes while observing their effects on the pattern. Use the one that gives the desired pattern. It is important that the tuner cover be in place when observing the pattern.

CHASSIS LAYOUT BOTTOM VIEW



CHASSIS LAYOUT TOP VIEW



PARTS LIST FOR THE 105L & M SERIES

SYMBOL	DESCRIPTION	PART NO.
T101	Transformer, Discriminator, 4.5 M.C.	360512-2
T102	Transformer, Audio Output, Omit on "Without Audio"	320063-1
T201	Coil & Trap I.F. Input	360545-1
T202	Coil, 1st I.F.	360548-1
T203	Coil & Trap, 2nd I.F.	360546-1
T204	Coil & Video Det. 3rd I.F.	360549-1
T301	Transformer, V.O.	320060-1
T401	Transformer, Horizontal Blocking Oscillator	360499-1
T402	Transformer, H.V.	320061-1
T501	Transformer, Power	300064-1
L101	Coil, Sound I.F.	360481-1
L201	Coil, Peaking, Resistor Color Code 6 uh	360443-23
L202	Coil, Peaking, White	360443-13
L203	Coil, Peaking, Black-Black-Black	360443-27
L204	Coil, Peaking, Brown	360443-13
L205	Coil, Peaking, Green-Green	360443-14
L206	Coil, Sound Takeoff	360535-1
L301	Coil, Deflection	360526-1
L401	Coil, Keyer & Horizontal Width	360521-1
L402	Coil, Horizontal Linearity	360517-1
L501	Filter Reactor	320058-1
	Focus Magnet	360504-1
	Centering Device (Electrostatic Focus Tube)	360525-1
C101	Capacitor, Mica, 56 mmf, 500 V	250159-79
C102	Capacitor, Ceramic, Dual, 4000 mmf, 450 V	250195-2
C104	Capacitor, Ceramic, 5000 mmf, 450 V	250175-1
C105	Capacitor, Ceramic, 100 mmf, 450 V	250207-46
C106	Capacitor, Ceramic, 470 mmf, 500 V "Electrostatic Tube With Audio"	250207-50
	Capacitor, Ceramic, 1000 mmf, 350 V "With Audio" & Radio Tuner	250088-46
C108	Capacitor, Paper, .01 mfd, 200 V, Omit on "Without Audio"	250202-7
C109	Capacitor, Paper, .01 mfd, 400 V, Omit on "Without Audio"	250211-7
C111	Capacitor, Paper, .02 mfd, Used on "Audio for A.M. Only"	250129-3
C112	Capacitor, Paper, .0015 mfd, 400 V Electrostatic Tube "With Audio"	250211-2
C113	Capacitor, Mica, 68 mmf, 500 V	250159-80
C201	Capacitor, Ceramic, 470 mmf, 450 V	250175-9
C202	Capacitor, Ceramic, 470 mmf, 450 V	250175-9
C203	Capacitor, Ceramic, 470 mmf, 450 V	250175-9
C204	Capacitor, Ceramic, 470 mmf, 450 V	250175-9
C205	Capacitor, Ceramic, 680 mmf, 500 V	250218-4
C206	Capacitor, Ceramic, 680 mmf, 500 V	250218-4
C207	Capacitor, 10 mmf, 450 V	250207-3
C208	Capacitor, Ceramic, 5000 mmf, 450 V	250175-1
C209	Capacitor, Ceramic, 5000 mmf, 450 V	250175-1
C210	Capacitor, Paper, .1 mfd, 400 V	250211-13
C211	Capacitor, Paper, .22 mfd, 200 V	250202-15
C212	Capacitor, Paper, .1 mfd, 200 V	250202-13
C213	Capacitor, Paper, .01 mfd, 200 V	250202-7
C214	Capacitor, Paper, .047 mfd, 200 V	250202-11
C215	Capacitor, Ceramic, 470 mmf, 450 V	250175-9
C216	Capacitor, Paper, .01 mfd, 600 V	250201-7
C217	Capacitor, Paper, .22 mfd, 200 V	250202-15
C218	Capacitor, Ceramic, 470 mmf, 450 V	250175-9
C220	Capacitor, Ceramic, 470 mmf, 450 V	250175-9
C221	Capacitor, Ceramic, 5000 mmf, 450 V	250175-1
C222	Capacitor, Ceramic, 220 mmf, 500 V	250218-5
C223	Capacitor, Ceramic, 470 mmf, 450 V	250175-9
C224	Capacitor, Ceramic, 680 mmf, 500 V	250218-4
C302	Capacitor, Paper, .22 mfd, 200 V	250202-15
C303	Capacitor, Mica, 240 mmf, ± 5%, 500 V	250159-56
C304	Capacitor, Mica, 47 mmf, 500 V	250159-78
C305	Capacitor, Mica, 4700 mmf, ± 5%, 500 V	250161-24
C306	Capacitor, Paper, .0068 mfd, 200 V	250202-6
C307	Capacitor, Paper, .1 mfd, 400 V	250211-13
C308	Capacitor, Paper, .047 mfd, 400 V	250211-11
C309	Capacitor, Ceramic, 1500 mmf, 450 V	250175-3
C310	Capacitor, Paper, .047 mfd, 400 V	250211-11
C311	Capacitor, Ceramic, 10K mmf, 450 V	250175-2
C401	Capacitor, Paper, .047 mfd, 400 V	250211-11
C402	Capacitor, Paper, .47 mfd, 200 V	250202-17
C403	Capacitor, Paper, .022 mfd, 200 V	250202-9
C404	Capacitor, Paper, .047 mfd, 200 V	250202-11
C405	Capacitor, Mica, 82 mmf, 500 V	250159-81
C406	Capacitor, Trimmer	260116-1
C407	Capacitor, Mica, 10K mmf, 300 V	250161-47
C408	Capacitor, Mica, 150 mmf, ± 5%, 500 V	250159-51
C409	Capacitor, Mica, 1000 mmf, ± 1%, 500 V	250160-64
C410	Capacitor, Mica, 470 mmf, ± 10%, 500 V	250159-90
C411	Capacitor, Mica, 68 mmf, 500 V	250159-80
C412	Capacitor, Paper, .047 mfd, 400 V	250211-11
C413	Capacitor, Paper, .047 mfd, 400 V	250211-11
C414	Capacitor, Paper, .1 mfd, 400 V	250211-13
C415	Capacitor, Hi Voltage	250189-1
C416	Capacitor, Paper, .22 mfd, 400 V	250211-15
C501	Capacitor, Electrolytic, 40-35-30-30 mfd, 350 V	270021-43
C502	Capacitor, Electrolytic, 10-30-5 mfd, 350 V 200 mfd, 25 V	270021-46
C503	Capacitor, Electrolytic, 20 mfd, 350 V 30 mfd, 25 V	270023-19
R101	Resistor, Carbon, 39K Ohms, ½ W	230104-81
R102	Resistor, Carbon, 470 Ohms, ½ W	230104-58
R103	Resistor, Carbon, 8200 Ohms, ½ W	230104-73
R104	Resistor, Carbon, 15K Ohms, 1 W	230105-76
R106	Resistor, Carbon, 100K Ohms, ½ W	230104-86
R107	Resistor, Carbon, 100K Ohms, ½ W	230104-86
R108	Resistor, Carbon, 68K Ohms, ½ W	230104-84
R109	Potentiometer, Vol. Control, 1 Megohm, ¼ W "With Audio" only	220126-25
	Potentiometer, Vol. Control With Switch With "Radio Tuner"	220118-2
R110	Resistor, Carbon, 4.7 Megohm, ± 5%, ½ W Omit on "Without Audio"	230104-106

SYMBOL	DESCRIPTION	PART NO.
R111	Resistor, Carbon, 470K Ohms, ½ W Omit on "Without Audio"	230104-94
R112	Resistor, Carbon, 10 Ohms, ½ W Omit on "Without Audio"	230104-38
R113	Resistor, Carbon, 100 Ohms, ½ W Omit on "Without Audio"	230104-50
R114	Resistor, Carobn, 470K Ohms, ½ W Omit on "Without Audio"	230104-94
R115	Resistor, Carbon, 390 Ohms, 1 W Omit on "Without Audio"	230105-57
R116	Resistor, Carbon, 390 Ohms, 1 W Omit on "Without Audio"	230105-57
R118	Potentiometer, Tone Control, 500K Ohms, ¼ W	220126-28
R201	Potentiometer, Vertical Ht. & Focus	220076-5
R202	Resistor, Carbon, 22K Ohms, ½ W	230104-78
R203	Resistor, Carbon, 47 Ohms, ½ W	230104-46
R204	Resistor, Carbon, 470 Ohms, ½ W	230104-58
R205	Resistor, Carbon, 330K Ohms, ½ W	230104-92
R206	Resistor, Carbon, 180K Ohms, ½ W	230104-89
R207	Resistor, Carbon, 47 Ohms, ½ W	230104-46
R208	Resistor, Carbon, 22K Ohms, ½ W	230104-78
R209	Resistor, Carbon 470 Ohms, ½ W	230104-58
R210	Resistor, Carbon, 220 Ohms, ½ W	230104-54
R211	Resistor, Carbon, 470 Ohms, ½ W	230104-58
R212	Resistor, Carbon, 39K Ohms, ½ W	230104-81
R213	Resistor, Carbon, 5600 Ohms, ½ W	230104-71
R214	Resistor, Carbon, 470 Ohms, ½ W	230104-58
R215	Resistor, Carbon, 10K Ohms, ½ W	230104-74
R216	Potentiometer, Contrast, 600 Ohms, ½ W	220126-26
R217	Resistor, Carbon, 22K Ohms, 1 W	230105-78
R218	Resistor, Carbon, 2200 Ohms, 1 W	230105-66
R219	Resistor, Carbon, 3300 Ohms, 1 W	230105-68
R220	Resistor, Carbon, 120K Ohms, ½ W	230104-87
R221	Resistor, Carbon, 330K Ohms, ½ W	230104-92
R222	Resistor, Carbon, 470 Ohms, ½ W	230104-94
R223	Resistor, Carbon, 4.7 Megohm, ½ W	230104-106
R226	Resistor, Carbon, 220K Ohms, ½ W	230104-90
R227	Potentiometer, Brightness, 100K Ohms, ¼ W	220126-24
R228	Resistor, Carbon, 82K Ohms, ½ W	230104-85
R229	Resistor, Carbon, 180K Ohms, ½ W	230104-89
R230	Resistor, Carbon, 33K Ohms, ½ W	230104-80
R231	Resistor, Carbon, 10K Ohms, ½ W	230104-74
R234	Resistor, Carbon, 39K Ohms, ½ W	230104-81
R235	Resistor, Carbon, 1000 Ohms, ½ W	230104-62
R236	Resistor, Carbon, 6800 Ohms, ½ W	230104-72
R237	Resistor, Carbon, 470K Ohms, ½ W	230104-94
R238	Resistor, Carbon, 470 Ohms, ½ W	230104-58
R239	Resistor, Carbon, 82K Ohms, ½ W	230104-85
R240	Resistor, Carbon, 22K Ohms, ½ W	230104-78
R301	Resistor, Carbon, 680K Ohms, ½ W	230104-96
R302	Resistor, Carbon, 270K Ohms, ½ W	230104-91
R303	Resistor, Carbon, 68K Ohms, ½ W	230104-84
R304	Resistor, Carbon, 4.7 Megohm, ½ W	230104-106

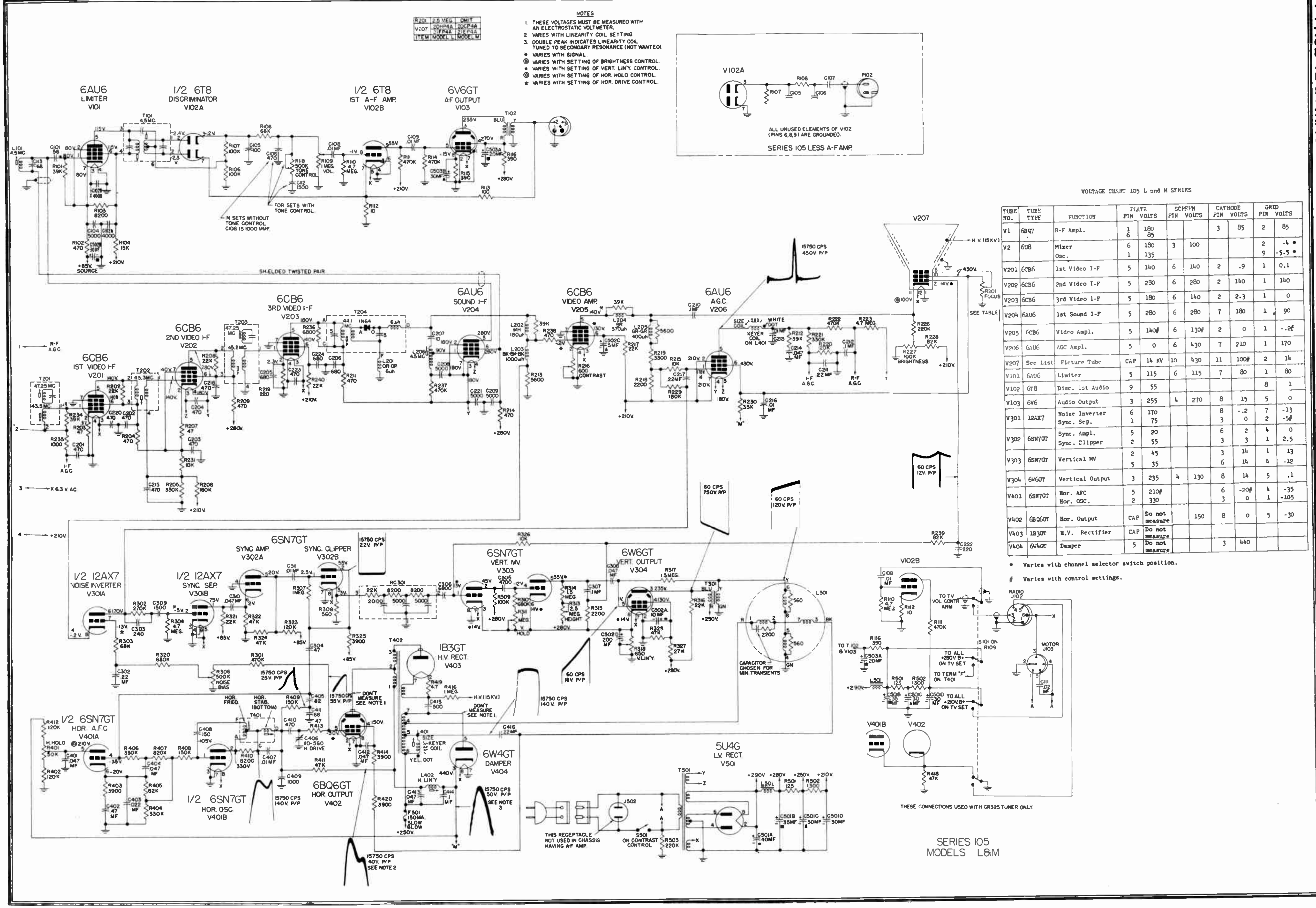
SYMBOL	DESCRIPTION	PART NO.
R306	Resistor, Carbon, 470K Ohms, ½ W	230104-94
R307	Resistor, Carbon, 1 Megohm, ½ W	230104-98
R308	Resistor, Carbon, 560 Ohms, ½ W	230104-59
R309	Resistor, Carbon, 100K Ohms, 1 W	230105-86
R310	Resistor, Carbon, 680K Ohms, ½ W	230104-96
R311	Potentiometer, Vertical Hold, 1 Megohm, ¼ W Electrostatic Tube With Audio	220126-27
	Potentiometer, Vert Hold Radio Tuner & Without Audio	220126-29
R312	Potentiometer, Vert. Ht., 2.5 Megohm, ¼ W	220076-5
R314	Resistor, Carbon, 1.5 Megohm, ½ W	230104-100
R315	Resistor, Carbon, 2200 Ohms, ½ W	230104-66
R316	Resistor, Carbon, 22K Ohms, 1 W	230105-78
R317	Resistor, Carbon, 1.5 Megohm, ½ W	230104-100
R318	Potentiometer, Vertical Linearity, 650 Ohms, 1½ W	220120-1
R320	Resistor, Carbon, 680K Ohms, ½ W	230104-96
R321	Resistor, Carbon, 22K Ohms, ½ W	230104-78
R322	Resistor, Carbon, 47K Ohms, ½ W	230104-82
R323	Resistor, Carbon, 120K Ohms, ½ W	230104-87
R324	Resistor, Carbon, 47K Ohms, ½ W	230104-82
R325	Resistor, Carbon, 3900 Ohms, ½ W	230104-69
R326	Resistor, Carbon, 10K Ohms, ½ W	230104-74
R327	Resistor, Carbon, 27K Ohms, 1 W	230105-79
R328	Resistor, Carbon, 47K Ohms, ½ W	230104-82
R401	Potentiometer, Horizontal Hold, 50K Ohms, ¼ W	220126-9
R402	Resistor, Carbon, 120K Ohms, ½ W	230104-87
R403	Resistor, Carbon, 3900 Ohms, ½ W	230104-69
R404	Resistor, Carbon, 330K Ohms, ½ W	230104-92
R405	Resistor, Carbon, 82K Ohms, ½ W	230104-85
R406	Resistor, Carbon, 330K Ohms, ½ W	230104-92
R407	Resistor, Carbon, 820K Ohms, ½ W	230104-97
R408	Resistor, Carbon, 150K Ohms, ½ W	230104-88
R409	Resistor, Carbon, 150K Ohms, ½ W	230104-88
R410	Resistor, Carbon, 8200 Ohms, ½ W	230104-73
R411	Resistor, Carbon, 47K Ohms, 1 W	230105-82
R412	Resistor, Carbon, 120K Ohms, ½ W	230104-87
R413	Resistor, Carbon, 47 Ohms, ½ W	230104-46
R414	Resistor, Carbon, 3900 Ohms, ± 10%, 2 W	230106-69
R416	Resistor, Carbon, 1 Megohm, 1 W	230105-98
R418	Resistor, Carbon, 47K Ohms, ½ W	230104-82
R419	Resistor, Carbon, 4.7 Ohms, 1 W	230107-1
R420	Resistor, Carbon, 3900 Ohms, ± 10%, 2 W	230106-69
R501	Resistor, Wire Wound, 125 Ohms, 10 W	240021-11
R502	Resistor, Wire Wound, 1300 Ohms, 3 W	240021-30
R503	Resistor, Carbon, 220K Ohms, 1 W	230105-90
RC301	Printed Circuit	250186-1
F501	Fuse, 150 MA	180475-4
J101	Socket, Speaker	180476-1
J104	Socket, A.C.	180504-11
	Socket, A.C., "Without Audio" Only	180428-1
	R.F. Tuner Unit	700379-20

R201	2.5 MEG.	OMIT
V207	20HP4A 21FP4A	20CP4A 21EP4A
ITEM	MODEL L	MODEL M

NOTES

1. THESE VOLTAGES MUST BE MEASURED WITH AN ELECTROSTATIC VOLTMETER.
2. VARIES WITH LINEARITY COIL SETTING
3. DOUBLE PEAK INDICATES LINEARITY COIL TUNED TO SECONDARY RESONANCE (NOT WANTED).

* VARIES WITH SIGNAL.
◎ VARIES WITH SETTING OF BRIGHTNESS CONTROL.
• VARIES WITH SETTING OF VERT. LIN'Y. CONTROL.
◎ VARIES WITH SETTING OF HOR. HOLD CONTROL.
★ VARIES WITH SETTING OF HOR. DRIVE CONTROL.



VOLTAGE CHART 105 L and M SERIES

TUBE NO.	TUBE TYPE	FUNCTION	PLATE PIN	PLATE VOLTS	SCREEN PIN	SCREEN VOLTS	CATHODE PIN	CATHODE VOLTS	GRID PIN	GRID VOLTS
V1	6BQ7	R-F Ampl.	1 6	180 85			3	85	2	85
V2	6U8	Mixer Osc.	6 1	180 135	3	100			2 9	-4 * -5.5 *
V201	6CB6	1st Video I-F	5	140	6	140	2	.9	1	0.1
V202	6CB6	2nd Video I-F	5	280	6	280	2	140	1	140
V203	6CB6	3rd Video I-F	5	180	6	140	2	2.3	1	0
V204	6AU6	1st Sound I-F	5	280	6	280	7	180	1	90
V205	6CB6	Video Ampl.	5	140#	6	130#	2	0	1	-.2#
V206	6AU6	AGC Ampl.	5	0	6	430	7	210	1	170
V207	See List	Picture Tube	CAP	14 KV	10	430	11	100#	2	14
V101	6AU6	Limiter	5	115	6	115	7	80	1	80
V102	6T8	Disc. 1st Audio	9	55					8	1
V103	6V6	Audio Output	3	255	4	270	8	15	5	0
V301	12AX7	Noise Inverter Sync. Sep.	6 1	170 75			8 3	-.2 0	7 2	-13 -5#
V302	6SN7GT	Sync. Ampl. Sync. Clipper	5 2	20 55			6 3	2 3	4 1	0 2.5
V303	6SN7GT	Vertical MV	2 5	45 35			3 6	14 14	1 4	13 -12
V304	6W6GT	Vertical Output	3	235	4	130	8	14	5	.1
V401	6SN7GT	Hor. AFC Hor. OSC.	5 2	210# 330			6 3	-20# 0	4 1	-35 -105
V402	6BQ6GT	Hor. Output	CAP	Do not measure		150	8	0	5	-30
V403	1B3GT	H.V. Rectifier	CAP	Do not measure						
V404	6W4GT	Damper	5	Do not measure			3	440		

* Varies with channel selector switch position.

\# Varies with control settings.

PART I
DESCRIPTION AND SPECIFICATIONS

The Magnavox 103 series television chassis are all 24 tube receivers, including rectifiers and a direct view picture tube. All chassis of this series require an external audio amplifier either in an associated radio chassis in the combination models or the 127 amplifier for television only. Features of the 103 series include:

- R-F Tuner with tuned input to give improved signal to noise ratio, increased sensitivity, and improved image rejection.
- Four stages of stagger-tuned video I-F for reduced phase distortion, increased stability and ease of alignment.
- Three stages of sound I-F, plus the first video I-F, which amplifies both video and sound I-F frequencies.
- Direct coupled video amplifiers eliminating the necessity for a DC restorer.
- Separate audio amplifier chassis, to be omitted when the TV chassis is used with a radio in combination models. In models having TV only, the audio amplifier may be operated alone, for use with a record player.
- MAGNALOK horizontal AFC system, which controls the frequency by comparing the sine wave oscillator frequency with the frequency of the sync pulses. The result is applied to a reactance tube that controls the oscillator frequency.
- Amplified AGC affords maximum uniformity of performance when changing stations and reduces fading.
- De-energizing circuit eliminates bright spot on picture tube when the power is turned off.

TUBE COMPLEMENT

V-1—R-F Amplifier 6BC5
V-2—Mixer . . . . . ½ 12AT7
V-3—Oscillator . . . . . ½ 12AT7
V-101—1st Sound I-F . . . . . 6BA6 or 6AU6
V-102—2nd Sound I-F . . . . . 6BA6 or 6AU6
V-103—3rd Sound I-F 6AU6
V-104—Sound Discriminator 6AL5
V-105A—AGC Amplifier . . . . . ½ 6SN7
V-105B—AGC Rectifier . . . . . ½ 6SN7
V-106—1st Video I-F (Composite) 6CB6
V-107—2nd Video I-F 6CB6
V-108—3rd Video I-F 6CB6
V-109—4th Video I-F 6CB6
V-110A—1st Video Amplifier . . . . . ½ 6SN7
V-110B—AGC Clamp . . . . . ½ 6SN7
V-111—2nd Video Amplifier 6AQ5
V-112A—1st Sync Amplifier . . . . . ½ 6SN7
V-112B—2nd Sync Amplifier . . . . . ½ 6SN7
V-113A—Sync Clipper . . . . . ½ 6SN7
V-113B—Vertical Oscillator . . . . . ½ 6SN7
V-114—Vertical Output 6V6
V-115—Horizontal Control 6AU6
V-116—Horizontal Discriminator 6AL5
V-117A—Horizontal Oscillator . . . . . ½ 12AU7
V-117B—Horizontal Discharge . . . . . ½ 12AU7
V-118—Horizontal Output 6BG6
V-119—HV Rectifier 1B3
V-120—Damper 6W4
V-121—LV Rectifier 5U4
V-122—Picture Tube . . . . . (See Chart)

• 127 AMPLIFIER

Rectifier 5Y3
1st Audio Amplifier 6SJ7
Audio Output 6V6

IMPEDANCE AND POWER RATINGS

300 Ohms—Antenna Input . . . . . IMPEDANCE . . . . . Speaker Voice Coil 3.2 Ohms
275 W. at 117 V., 60 C. P. S. . . . . . POWER . . . . . Audio—2.5 W. Undistorted, 4 W. Max.

CHASSIS DIFFERENCES

CT Number	Audio Amp.	Picture Tube	Picture Tube Center Height	CT Number	Audio Amp.	Picture Tube	Picture Tube Center Height
262	127 Amp.	16TP4	9½	288	Radio	17AP4	10⅞
263	127 Amp.	16GP4	11¼			17BP4	
264	127 Amp.	19EP4	12	289	127 Amp.	17AP4	11¼
265	127 Amp.	19AP4	12			17BP4	
266	Radio	16TP4	9½	290	Radio	17AP4	11¼
267	Radio	16TP4	11¼			17BP4	
268	Radio	19EP4	12	291	127 Amp.	19EP4	11¼
269	Radio	19AP4	12			19AP4	
283	127 Amp.	16TP4	11¼	292	Radio	19EP4	11¼
284	Radio	16TP4	11¼			19AP4	
285	Radio	16TP4	10⅞	293	127 Amp.	20CP4	11¼
286	127 Amp.	17AP4	10⅛	294	Radio	20CP4	11¼
		17BP4		297	127 Amp.	19AP4	13
287	Radio	17AP4	10⅛	299	127 Amp.	20CP4	13
		17BP4		316	Radio	20CP4	12

RECEIVER OPERATING INSTRUCTIONS

1. Plug the receiver power cord into the power outlet.

2. Set the TV-PHONO switch on the rear of the TV chassis to TV.

3. Turn on the radio chassis and set the band selector switch to TV in combination models. On TV models only, turn the PICTURE OFF-ON control to the right about ½ turn.

4. Set the STATION SELECTOR switch to the desired channel number.

5. Adjust the FINE TUNING control for the best quality sound. Set the desired sound volume with the VOLUME control.

6. Advance the BRIGHTNESS control to slightly illuminate the picture tube screen. If no light appears, it may be due to incorrect ion trap adjustment. The proper procedure for adjusting the ion trap follows:

   With the brightness control full on, adjust the ion trap until light appears on the screen. Reduce the brightness to a point near extinction by turning the brightness control counterclockwise. Readjust the ion trap for maximum brightness. It may be necessary to reduce brightness still farthur and readjust the ion trap.

7. Adjust the PICTURE control for the desired contrast.

8. If the picture "rolls" up or down, turn the VERTICAL control knob so the "roll" is downward, then turn it in the opposite direction until the picture moves up to lock in frame. Switching from channel to channel will not cause the picture to lose sync if the control is properly set.

9. If the picture does not snap into horizontal sync immediately on being switched to a picture channel, but instead shows diagonal bars that slowly reduce in number until the picture snaps in, the following adjustments should be made. Remove the Horizontal Discriminator tube (V-116, 6AL5) and adjust the HORIZONTAL HOLD SCREW until the picture slowly moves back and forth with the blanking bar vertical. Replace the AFC discriminator tube. After allowing time for the tube to warm up, the picture should fall into sync immediately upon switching from channel to channel.

10. If horizontal linearity is unsatisfactory, adjust the Drive control for maximum width. This point may be determined by observing the height, as minimum height occurs simultaneously. Then adjust linearity control for linear pattern.

11. Adjust the HEIGHT control until the picture just fills the mask vertically. Adjust the VERTICAL LINEARITY until the test pattern is

symmetrical from top to bottom. These two controls are interacting and should be adjusted together.

12. The FOCUS MAGNET has an adjustable shunt ring that governs the amount of magnetic flux controlling the size of the electron stream. Set the FOCUS CONTROL at about mid-range, and adjust the shunt ring so proper focus appears at this point. This ring is adjusted by loosening the "Shunt Ring Adjusting Screw" shown in Figure 1, and moving the ring parallel to the neck of the tube. Any further focusing can be accomplished with the focus control.

It will probably be necessary to readjust the ion trap after the shunt ring has been moved.

13. To center the picture, loosen the screw on each side of the focus coil and move the coil about the neck of the tube until proper centering is accomplished. Tighten the screws with the coil in this position.

14. If shadows appear in the corners of the picture, adjust the spring loaded screws holding the focus magnet support plate to tilt the focus magnet in the direction to eliminate the shadows.

PART II
PARTS IDENTIFICATION

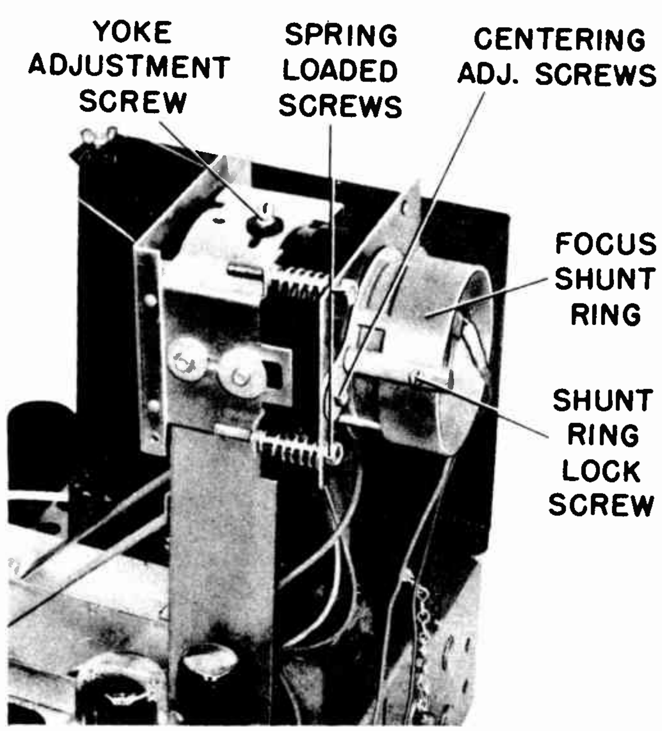


FIGURE 1

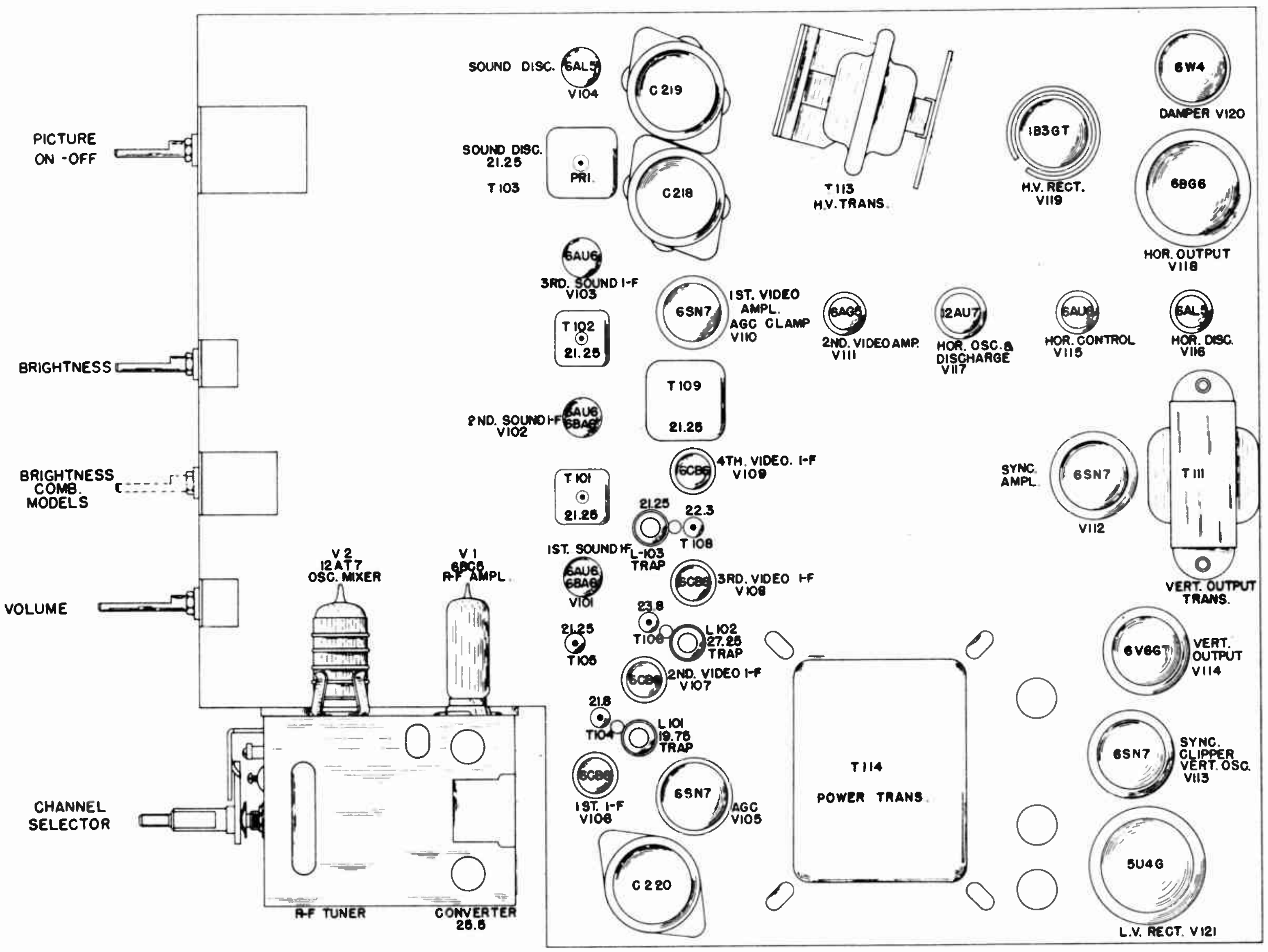


FIGURE 2

TOP VIEW OF CHASSIS

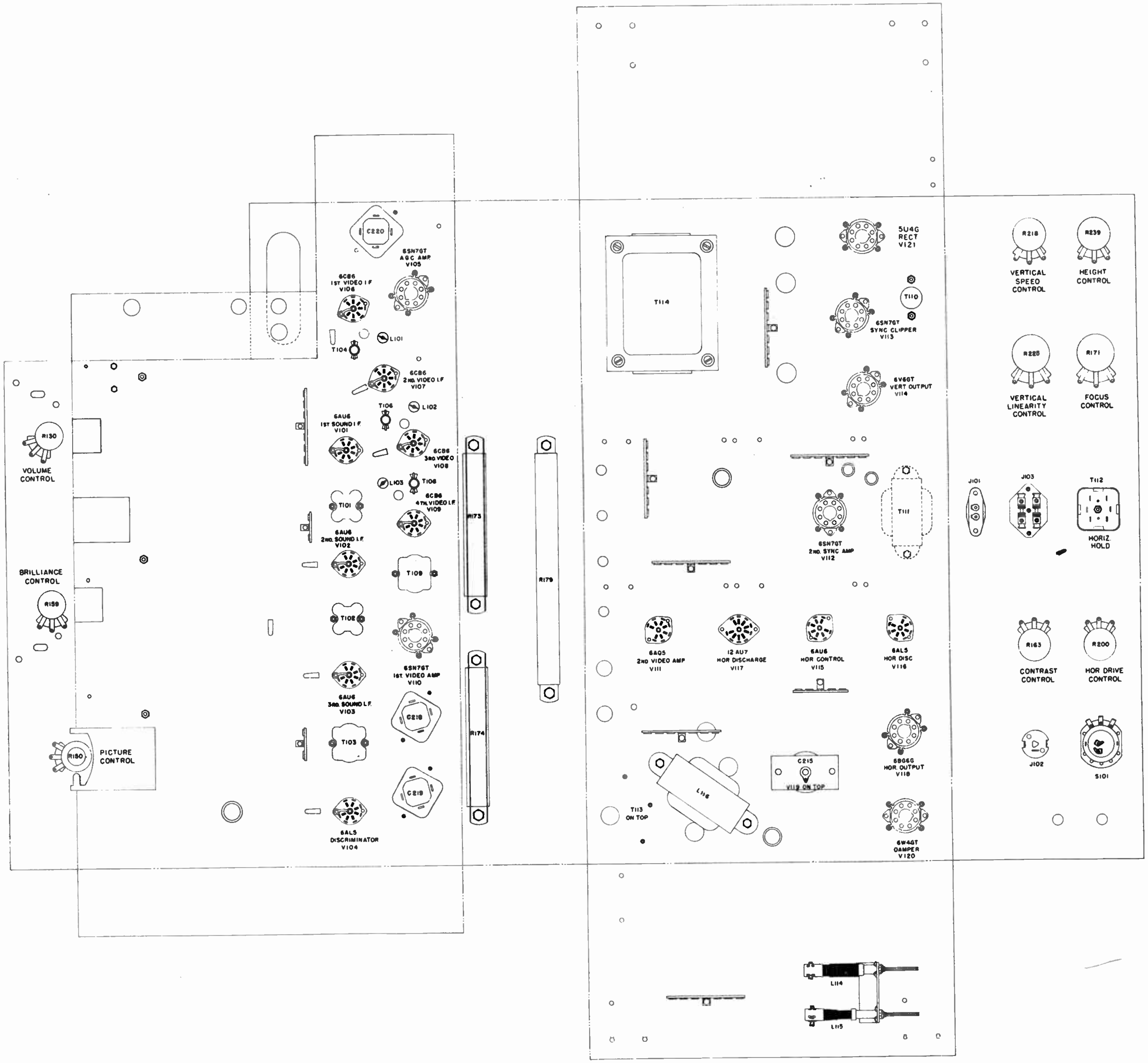


FIGURE 3

BOTTOM VIEW OF CHASSIS

PART III
CIRCUIT DESCRIPTION

The tuner is a two tube unit with tuned input, providing good sensitivity, image rejection and signal to noise ratio. It consists of a 6BC5 pentode R-F amplifier and a 12AT7 twin-triode as oscillator-mixer. The antenna input transformer matches a 300-ohm balanced antenna to the tuner input, and has an electrostatic shield between primary and secondary. The channel selector is a positive acting, twelve position switch, connecting individual inductances for each channel. One oscillator adjustment suffices for all channels, and fine tuning is accomplished by a smooth operating, variable dielectric capacitor. The schematic diagram is shown in Fig. 12.

The video I-F amplifier is of the latest design incorporating adequate gain and band width. It consists of four 6CB6 tubes coupled by I-F transformers. I-F transformers are bi-filar wound, and coupling between stages is by the capacitive and inductive coupling between windings. The transformers are tuned by an adjustable iron core. The I-F passband is 3.75 Mc. wide, with a response of 50% at 22.0 Mc.

The converter coil and four transformers are stagger-tuned. The first stage includes a 19.75 Mc. adjacent channel picture trap. The second stage includes a 27.25 Mc. adjacent channel sound trap. A 21.25 Mc. sound trap is included in the third stage. These traps insure a minimum of interference from adjacent channels and the sound channel.

The first stage accommodates both the sound and video I-F signals. The sound portion is removed by the sound take-off transformer T105.

AGC bias is applied to the first three stages, and controls their gain inversely proportional to the applied signal strength. The last stage operates at cathode bias. The output of the I-F amplifier strip is essentially constant despite variations of input signal level.

The IN60 crystal detector conducts on negative cycles. Current flowing through its load resistor develops a voltage that varies with the modulation of the I-F carrier. The high frequency I-F component is bypassed to ground through a 10 mmf. capacitor and C137, .0015.

The first video amplifier is conventional and is direct coupled to the next stage, presenting a positive signal to the second video amplifier. The picture control governs the cathode degeneration of the second video amplifier.

The peaking network between the second video amplifier and the picture tube is conventional, except for the 4.5 Mc. trap, that is included to eliminate any beat between the sound and picture carriers.

The picture tube is grid modulated with a negative signal. Its brilliance is variable by means of the brightness control in the cathode circuit. The picture control has the AC switch on it, and also a switch that opens, putting −100 volts on the picture tube cathode thus decreasing the grid bias to zero when the power is turned off, quickly discharging the high voltage supply. This eliminates the bright spot noticeable on the picture tube of some receivers.

The sound I-F take-off transformer is tuned to 21.25 Mc. and removes the frequency modulated sound I-F signal from the video I-F strip. The three transformer coupled sound I-F amplifiers are all conventional. This highly efficient circuit applies an adequate signal to the FM discriminator. The resultant audio signal is applied to the amplifier section of the associated radio chassis when used in combination models.

Models featuring TV only use a high fidelity audio amplifier Amp. 127A. This amplifier chassis has its own power supply, a 6SJ7 audio amplifier and a 6V6 power output. It also contains the audio cable socket and speaker socket. Its line cord plugs into the AC socket on the TV chassis.

A Phono-TV switch and a phono jack are located on the rear apron of the TV chassis in models featuring TV only. For TV reception the switch must be turned to TV. When an external record player is used, its output is plugged into the phono jack and the switch must be in the Phono position. In the Phono position, 117V AC is applied to the Amp. 127 but not to the TV chassis. Thus the amplifier may be used independently.

The vertical and horizontal sync pulses appear on the video carrier, through the I-F amplifiers, detector and video amplifiers, between scanning lines of video modulation. Their appearance at the picture tube grid is always during retrace time, and cuts the beam to blanking level at those intervals.

The positive going signal, Fig. 4 (a), is sampled at the plate of the first video amplifier, and applied to the grid of the first sync amplifier V-112A. This tube is biased so the video portion of the signal falls below the knee of its characteristic curve, and receives but little amplification, and the sync pulses appear on the linear portion of the curve, and are amplified, as shown in Fig. 4 (b).

The negative signal that is fed to the second sync amplifier grid V-112B is again amplified. This tube is also biased so that any noise on the crest of the pulses is removed, and any noise between the sync pulses is reduced to their amplitude. The resulting wave form is shown in Fig. 4 (c).

The signal is in a positive direction at the sync clipper grid V-113A, and in that stage the lower half of the signal is removed, leaving only clean, square sync pulses, as shown in Fig. 4 (d).

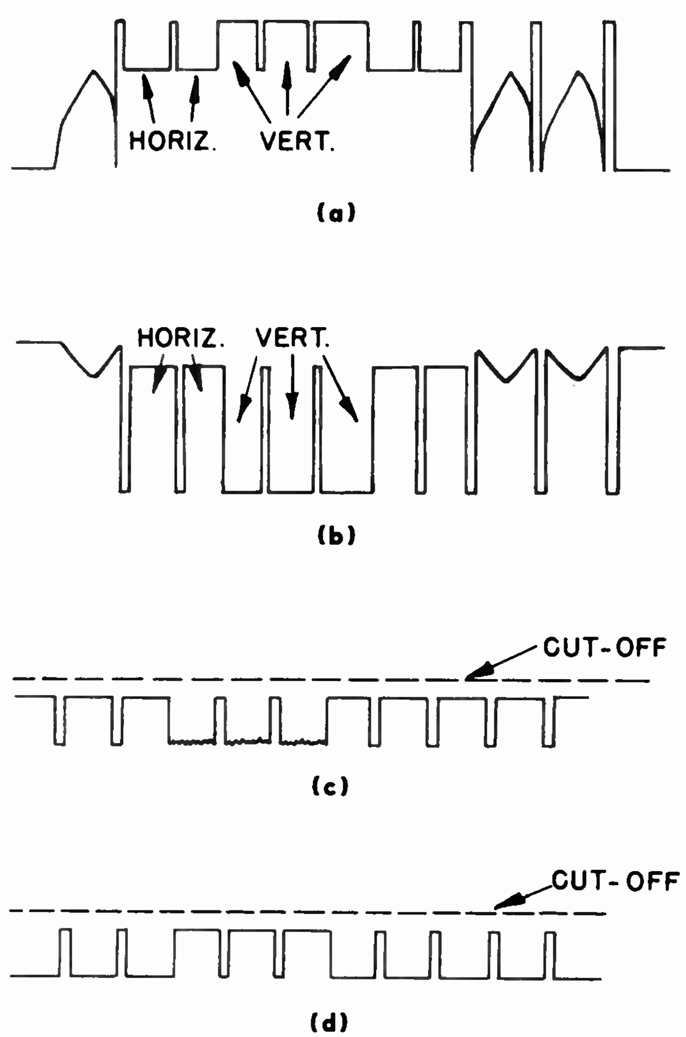


FIGURE 4

These are applied to the vertical oscillator stage V-113B, through RC-101, a filter network which passes only the low frequency vertical pulses. The vertical blocking oscillator and discharge stage, V-113B, is ½ of a 6SN7. During non-conduction, the grid voltage is negative with respect to the cathode. The plate draws current during discharge at a rate determined by the setting of the height control R-239. Due to the coupling of the oscillator transformer, there is a corresponding voltage rise on the grid, A to B in Fig. 5. When the grid becomes more positive than the cathode, it draws grid current. This quickly charges C-205, which drives the grid negative and cuts off the plate current, see B to C. Then the charge on C-205 is slowly discharged through the vertical speed control, R-218 and R-216, which allows the grid voltage to slowly rise to its normal bias, see C to A. Then plate current begins to flow again and the cycle is repeated at a frequency depending on the rate of C-205 discharge, which is controlled by the setting of R-218.

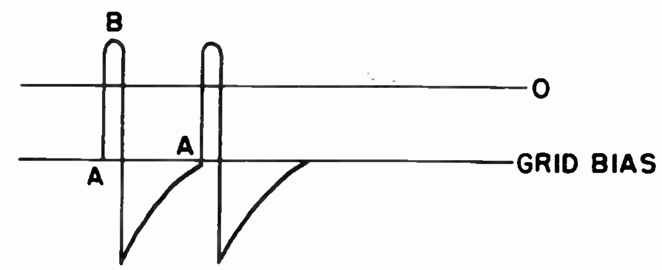


FIGURE 5

The frequency is adjusted at slightly slower than 60 cps. During the charging period of C-205 (C to A), the vertical sync pulse is applied just before it would "trip" in its free-running cycle. The magnitude of the sync pulse is sufficient to drive the tube into conduction, and therefore controls the frequency of the blocking oscillator.

The sync clipper output signal is also used to synchronize horizontal scanning. When free running, the Horizontal Oscillator V-117A operates at a frequency approximately correct for horizontal scanning. The resultant sine wave output is applied through T-112 to the plates of the Horizontal Discriminator V-116 *180° out of phase*. The horizontal sync pulses are applied to the center tap of the plate winding of the transformer, and appears at the plates of the Discriminator *in phase*. When the oscillator operates in synchronism with the transmitter, the pulses appear on the sine waves as one plate goes through zero voltage in a negative direction and as the other plate goes through zero voltage in a positive direction.

This may be seen in Fig. 6 (a).

Because the pulses appear when both plates are at zero voltage, there is no change in the operation of the circuit. However if the oscillator changes in frequency, the sync pulses at the detector plates do not appear when the oscillator voltage is zero, but at a point on each sine wave either before or after it goes through zero, as shown in Fig. 6 (b).

As the sine wave on one plate is of opposite polarity from the other, and as the sync pulse on one plate is of the same polarity as the other, the sync pulse will add to the sine wave that is positive, and subtract from the one that is negative. This condition will produce a voltage unbalance in the cathode circuit of the Discriminator.

This voltage difference, applied to the grid of V-115, the 6AU6 Horizontal Control stage, controls the variable reactance in shunt with the horizontal oscillator tank circuit, and causes the oscillator to change frequency in such a direction so as to come back into exact synchronism with the sync pulses.

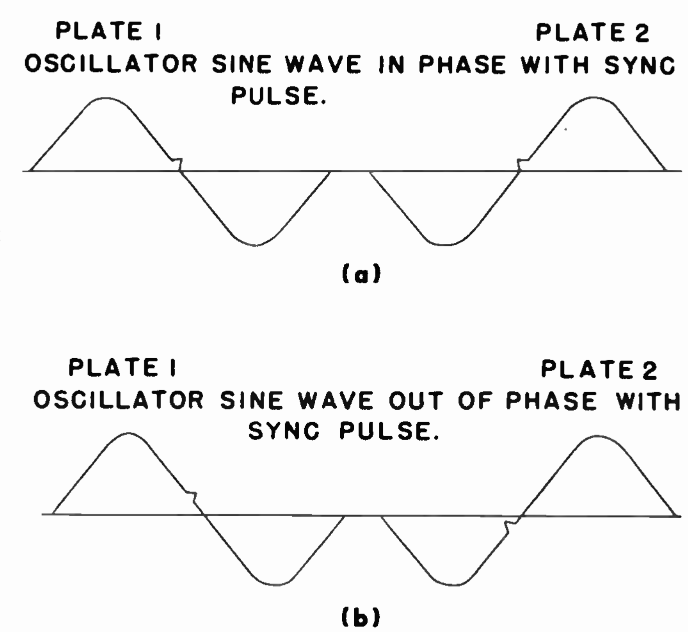
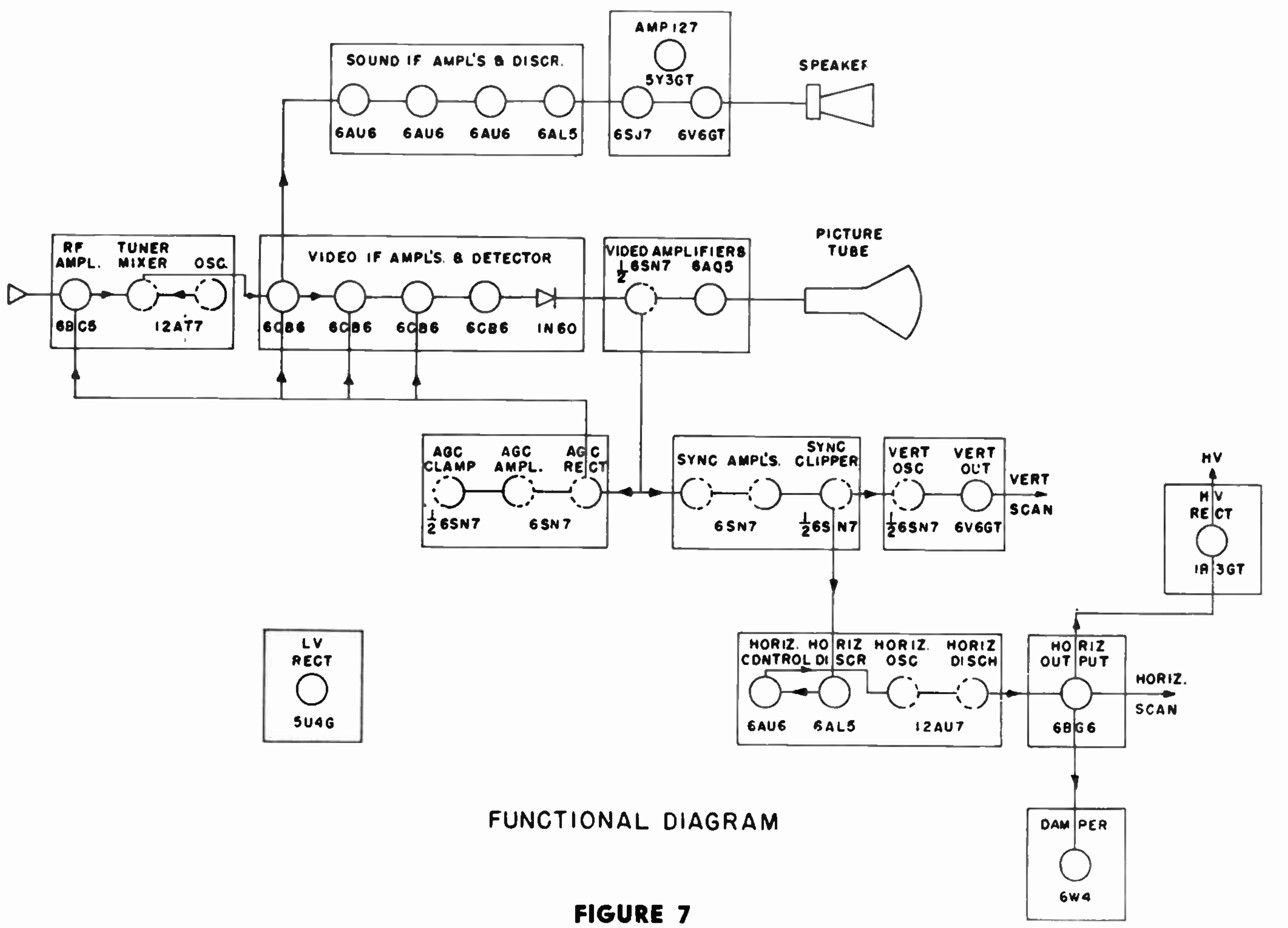
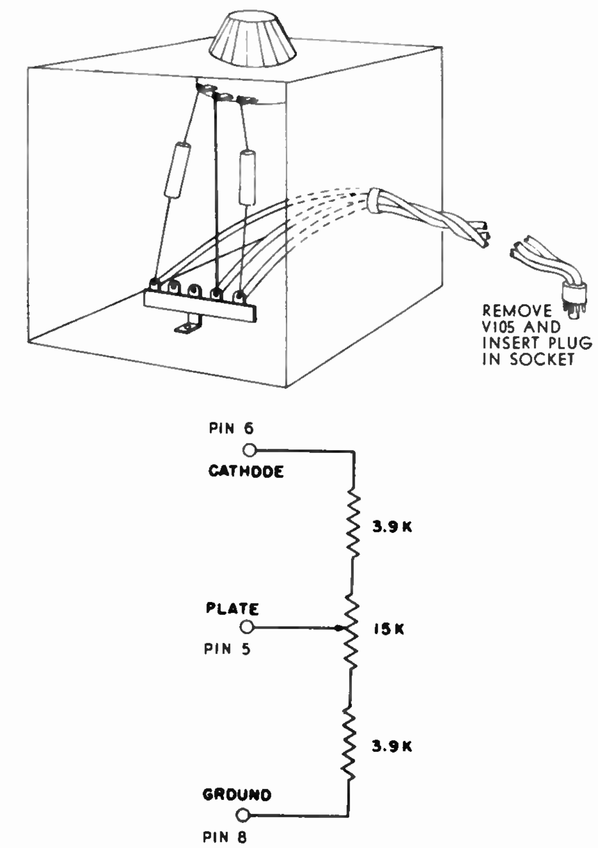


FIGURE 6



FUNCTIONAL DIAGRAM

FIGURE 7



Control for setting R-F bias. Use Plug Adaptor to plug into AGC tube socket, V105, AGC tube is removed.

FIGURE 8

PART IV
ALIGNMENT

DEFLECTION CIRCUIT ALIGNMENT

The horizontal AFC circuits are to be adjusted as follows:

1. Set station selector to a channel with a station.
2. Lock the picture in with the vertical control.
3. Remove the horizontal discriminator tube (V-116, 6AL5).
4. Adjust HORIZONTAL HOLD screw (rear of chassis) until diagonal bars disappear and the picture moves slowly across the screen with the blanking bar vertical.
5. Replace the 6AL5 tube and wait for it to warm up.
6. Adjust oscillator PHASING slug (inside chassis on oscillator transformer) to center the picture in the raster.
7. Adjust the HORIZONTAL DRIVE control counterclockwise until a bright vertical stripe is visible in the picture. Turn the control clockwise until the stripe disappears.
8. Adjust the HORIZONTAL LINEARITY screw for best linearity.
9. Adjust the WIDTH so the picture fills the mask.

VIDEO I-F ALIGNMENT

1. Adjust the bias on the tuner AGC lead to -2 volts by using the variable resistor and plug assembly (illustrated in Fig. 8) substituted for the AGC tube.
2. Connect the I-F signal generator to the converter grid wafer (through the hole provided in the bottom of the tuner shield) and chassis ground.
3. Connect the oscilloscope to the first video plate through a 10,000 ohm isolating resistor. The purpose of the oscilloscope is to observe the demodulated signal and make sure no overload develops. Overload is detected by no increase in output for an increase in input, and a distorted waveform.
4. Set the modulated signal generator to 19.75 Mc. and adjust the trap coil L-101 for minimum response.
5. Set the signal generator to 21.25 Mc. and adjust the trap coil L-103 and the sound pick-off coil T-105 for minimum response.
6. Set the signal generator to 27.25 Mc. and adjust trap coil L-102 for minimum response.
7. Set the signal generator to 25.5 Mc. Be sure the signal does not overload the receiver. Align the converter coil on the R-F tuner for maximum response.
8. Set the signal generator to 21.8 Mc. and adjust the first I-F transformer T-104 for maximum response.
9. Set the signal generator to 23.8 Mc. and adjust the second I-F transformer T-106 for maximum response.
10. Set the signal generator to 22.3 Mc. and adjust the third I-F transformer T-108 for maximum response.

To check the overall alignment, set the bias on the tuner AGC lead to −2 volts. Connect the sweep generator to the receiver antenna terminals. Connect the oscilloscope to the first video amplifier plate through a 10,000 ohm isolating resistor. Tune the receiver and the sweep generator to channel 13.

The video I-F can now be retouched if necessary to obtain the overall frequency response curve, Fig. 9, with the picture carrier at approximately 40% of maximum response as shown in the curve drawing. In making the final touch up adjustments, it should be remembered that the converter stage and the first video I-F stage are high Q circuits and tend to control the response at the high and low frequency ends of the pass band. The third and fourth video I-F's are relatively low Q circuits and they control the response over the center of the passband. The second video I-F controls the tilt. All twelve channels should be checked for alignment.

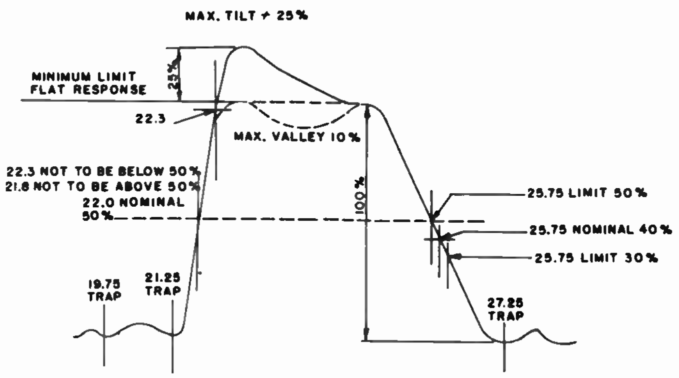


FIGURE 9

OSCILLATOR ADJUSTMENT

Set channel selector on channel 13. Apply a crystal controlled, amplitude modulated sound carrier to the receiver antenna terminals. Set the fine tuner to the mid-range position. Tune the oscillator trimmer for the null in the sound output. Each channel should be checked for proper tuning, the null should be more than 30 degrees rotation from either end of the fine tuner rotation.

NOTE: Complete alignment of the R-F Tuner is covered in other manuals and will not be repeated here. The schematic diagram of the tuner is shown in Fig. 12.

SOUND I-F ALIGNMENT

1. Adjust the bias on the tuner AGC lead to −2 volts by using the variable resistor and plug assembly. Set the modulated signal generator to 21.25 Mc. Connect the output cable of the generator to the grid of the first sound I-F (Pin 1 of V-101) and chassis ground. Connect an oscilloscope or VTVM to terminal 1 of T-102 through a 470,000 ohm isolating resistor. Align both slugs of T-101 and T-102 for maximum output.
2. Connect the oscilloscope to the junction of C-126 and R-116. Align the bottom slug of the discriminator transformer (T-103) for minimum output. Disconnect the signal generator.
3. Connect the sweep generator to Pin 1 of V-101 and chassis ground. Connect the oscilloscope to terminal 1 of T-102 through a 470,000 ohm isolating resistor. Check for symmetrical response about 21.25 Mc.
4. Connect the oscilloscope to junction of R-116 and C-126, and check the discriminator (T-103) for symmetrical output.

4.5 MC. TRAP ALIGNMENT

Connect the modulated signal generator to the first video amplifier grid. Tune the generator to 4.5 Mc. Connect a crystal detector to the picture tube grid lead. Turn the contrast control fully counterclockwise. Observe the signal at the crystal detector load resistor on an oscilloscope and adjust the 4.5 Mc. trap for minimum output at the scope.

I-F ALIGNMENT CHARTS

1. VIDEO I-F

This chart was prepared from the preceding detailed information, and is condensed in chart form for your convenience.
Caution: Set R-F bias to −2 volts as outlined in text before proceeding.

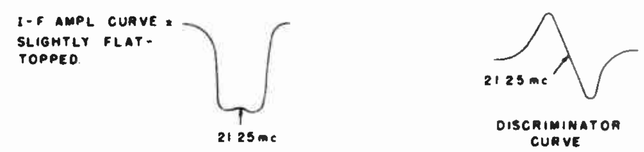
Connect Signal Gen.	Mod.	Connect Sweep Gen.	Freq. Mc.	Connect Scope	Adjust	For	Remarks
(1) Convertor Grid Wafer On Tuner	AM		19.75	Plate, Pin 2 Video Amp.	Trap L-101	Min.	Adjacent Channel Picture
(2)			21.25	V-110A Through	Trap L-103	Min.	Co-Channel Sound
(3)			21.25	10,000 ohm Isolating	T-105	Min.	Sound Takeoff Coil
(4)			27.25	Resistor	Trap L-102	Min.	Adjacent Channel Sound
(5)			21.8		T-104	Max.	1st I-F Trans.
(6)			23.8		T-106	Max.	2nd I-F Trans.
(7)			22.3		T-108	Max.	3rd I-F Trans.
(8)			25.2		T-109	Max.	4th I-F Trans.
(9)			25.5		Convertor		On Tuner
(10)		Antenna Terminals Through Proper Matching Network	Check All Channels	Same As Above	All I-F Coils Except Traps	Correct Waveform	See Notes Below

Notes:

Slug	Freq.	Tunes	Most Affects
Conv.	25.5	Sharp	H. F. End of Curve
T-104	21.8	Sharp	L. F. End of Curve
T-106	23.8	Broad	Tilt
T-108	22.3	Broad	Center of Curve
T-109	25.2	Broad	Center of Curve

2. SOUND I-F

Connect Signal Gen.	Mod.	Connect Sweep Gen.	Mc. Freq.	Connect Scope	Connect VTVM	Adjust	For	Remarks
(1) Grid of 1st Sound I-F	AM		21.25	Terminal of T-102 Through 470,000 ohms	Term. 1 of T-102	Both Top and Bottom Slugs of T-101 and T-102	Max.	
(2) Pin 1, V-101			21.25	Junction of 6126, R-116		Bottom Slug T-103	Min.	
(3)		Pin 1, V-101 1st Sound I-F	21.25	Term. 1 of T-102 Through 470,000 ohms		Top and Bottom Slugs of T-101, T-102	Symmetrical Curve	
(4)		Pin 1, V-101 1st Sound I-F	21.25	Junction of R-116, C-126		Top and Bottom Slugs of T-103	Good Disc. Curve	



PART V
SERVICE INFORMATION

PICTURE TUBE REPLACEMENT (HORIZONTAL CHASSIS)

If it becomes necessary to replace the picture tube, it should be done in the following manner.

1. Remove the tube socket from the rear of the picture tube, then remove the ion trap.
2. Remove the safety glass assembly by taking out the screws which hold the glass rail in position.
3. Loosen the nuts that secure the tube strap over the rim of the tube, and remove the strap.
4. Remove the high voltage anode connector and lift out the tube.
5. If metal tube, transfer the insulating ring to the replacement tube.
6. Install the HV connector, replace the support strap, and fasten it down securely with the nuts removed in step 3.
7. Loosen the thumbscrew on top of the deflection yoke, so the yoke moves freely. Loosen the two hex-head screws on each side of the deflection yoke mounting bracket, and push the top section forward until the rubber bumper fits against the bell of the tube, all the way around. Make sure tube face is vertical and neck of tube is parallel with chassis base. Then tighten the screws. If the screw heads on the left side are difficult to reach, use a right-angle spintite, an end wrench, or remove the HV compartment cover. Then press the deflection yoke forward as far as possible, and tighten the thumbscrew.
8. Tighten the three focus coil plate adjustment screws until the plate is near the deflection yoke, perpendicular to the neck of the tube.
9. Loosen the two screws which secure the focus coil, and move it so the neck of the tube is properly centered in it. Then tighten the screws and adjust the ion trap.
10. If centering is not satisfactory, move the focus coil around the neck of the tube until the picture is properly centered in the mask. It may be necessary to readjust the ion trap each time the focus coil is moved.

PICTURE TUBE REPLACEMENT (VERTICAL CHASSIS)

In models where the chassis is mounted in a vertical position, the following procedure is recommended.

1. Remove the safety glass and mask assembly by taking out the screws which hold the glass rail in place.
2. Lay the cabinet on its side on a clean piece of felt or other soft material, with the chassis side down.
3. Remove the two metal wedges that brace the rim of the picture tube top and side. Two wood screws hold each in place.
4. Two ¼-20 screws secure each side of the chassis to the mounting rails of the cabinet. Remove these screws, all connections to the amplifier, and pull the chassis out of the cabinet. Then proceed through steps 1 to 10 in the preceding section. Then replace the chassis.

NOTICE: In the event that proper centering cannot be accomplished, remove the ion trap, turn the front edge to the rear, install and readjust it. Then proceed with the centering adjustment. If proper centering still cannot be accomplished, remove the focus coil and rotate 180°.

MODIFICATIONS AND SERVICE SUGGESTIONS

SOUND DRIFT

The 103 series chassis is mounted vertically in some cabinets, and the heat rising to the tuner may cause some oscillator drift. The changes outlined below were made to compensate for this, and, if found necessary in early chassis, may be incorporated in the field.

Refer to Fig. 10 in making these modifications.

a. Replace C-21, 10 mmf. (black, brown, black, black, white) with 10 mmf. N-750 (violet, brown, black, black, white) Magnavox Part No. 250088G63. C-21 is the condenser connected from the oscillator socket to the front lug at the base of the front wafer.

b. Remove C-16, 3 mmf. N-750 (violet, black, orange, black) from oscillator socket.

c. Add 3 mmf. N-1800 (orange, orange, black, orange, black, green) Magnavox Part No. 250088G57 from rear lug at bottom of front wafer (connection point for C-17 oscillator trimmer) to chassis ground in front of oscillator socket (connection point for C-22). *Keep leads as short as possible.*

Check oscillator alignment on channel 13 (or on highest channel station) to see if oscillator tunes in with fine tuner not too close to either end of its rotation. If not, adjust oscillator trimmer C-17 (in front apron of tuner) with screwdriver.

Check oscillator alignment on all other channels (or on all available stations) to see if all other channels tune in with fine tuner not too close to either end of its rotation. If any channel does not tune in or tunes too close to either end of fine tuner rotation, adjust the inductance of the oscillator coil for that channel. Then check all lower channels, adjusting their coils also, if necessary. Re-check tuning of all channels after last coil is adjusted.

Although the above changes should correct this difficulty, in persistent cases change C-18, 100 mmf. condenser to part No. 250088-13, 100 mmf. N-750. It is also advisable to check the 22,000 ohm oscillator grid resistor R9, as this will sometimes change value with temperature increases. Changing C-18 and R-9 may also help in curing a similar complaint on the horizontally mounted chassis, but C-16 and C-21 should not be changed in this case.

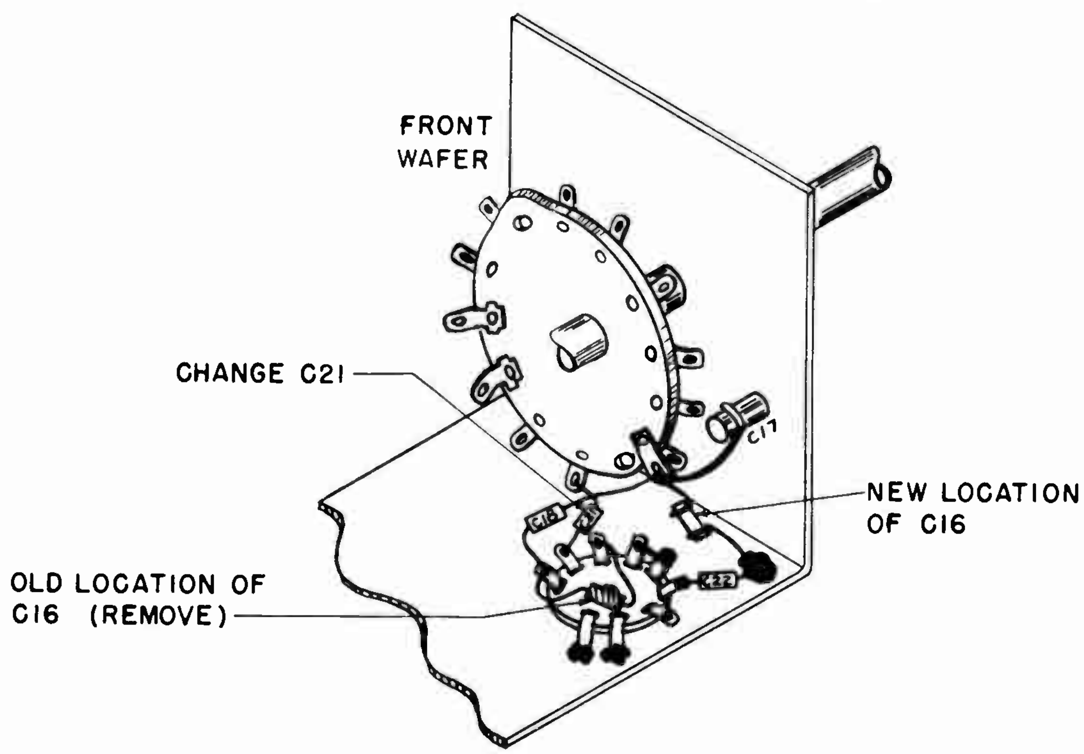


FIGURE 10

POOR RESOLUTION

Note that the overall video response curve shown in this manual differs from that of the preliminary manual. In cases of poor resolution, it is advisable to check the I-F alignment, making sure that the curve is within the limits shown in Fig. 9.

SIGNAL OVERLOAD

In very strong signal areas, some overload may be experienced on this chassis. This condition may be corrected by changing R-164 in the AGC clamp circuit to 2.7 megohms.

VOLTAGE CHART

Measurements made with receiver operating at 117 volts, 60 cycles AC, with a strong signal input. Measurements made with "Voltohmist" type VTVM, between indicated terminal and chassis ground, unless otherwise noted.

Tube No.	Tube Type	Function	Plate		Screen		Cathode		Grid	
			Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts
V-101	6BA6 6AU6	1st Sound I-F	5	120	6	120	7	1.5	1	0
V-102	6BA6 6AU6	2nd Sound I-F	5	120	6	120	7	1.6	1	0
V-103	6AU6	3rd Sound I-F	5	60	6	60	7	0	1	−5.8
V-104	6AL5	Discriminator	7 2	−4.5 −3.5			1 5	1.42 0		
V-105A	½6SN7GT	AGC Ampl.	5	−18			6	−38	4	−39
V-105B	½6SN7GT	AGC Rect.	2	92			3	4.7	1	−3.7
V-106	6CB6	1st Video I-F	5	140	6	140	2	.22	1	−4.8
V-107	6CB6	2nd Video I-F	5	140	6	140	2	.22	1	−4.2
V-108	6CB6	3rd Video I-F	5	140	6	140	2	.36	1	−4.2
V-109	6CB6	4th Video I-F	5	140	6	140	2	2.3	1	0
V-110A	½6SN7GT	1st Video Ampl.	2	−16			3	−80	1	−88
V-110B	½6SN7GT	AGC Clamp	5	0			6	0	4	−2.2
V-111	6AQ5	2nd Video Ampl.	5	170	6	200	2	2.7	7	−16
V-112A	½6SN7GT	1st Sync Ampl.	2	100			3	4.8	1	−3.7
V-112B	½6SN7GT	2nd Sync Ampl.	5	96			6	1.12	4	−.9
V-113A	½6SN7GT	Sync Clipper	2	+200			3	8.3	1	−17
V-113B	½6SN7GT	Vertical Osc.	5	+140			6	−80	4	−138
V-114	6V6GT	Vertical Output	3	+280	4	280	8	−47	5	−65
V-115	6AU6	Horiz. Control	5	+200	6	150	7	+3.6	1	.24
V-116	6AL5	Horiz. Discr.	1 5	0 .1			7 2	−27 −28		
V-117A	½12AU7	Horiz. Osc.	1	170			3	.1	2	−8.6
V-117B	½12AU7	Horiz. Disch.	6	142			8	−80	7	−110
V-118	6BG6G	Horiz. Output	Cap	Do not meas.	8	205	3	−80	5	−110
V-120	6W4GT	Damper	5	Do not meas.			3	450		
V-121	5U4G	LV Rectifier	4/6	*365			8/2	300		
V-122	(See Chart Picture Tube)			‡13KV	10	400	11	70-120	2	−5 to +50

*AC voltage, measured from −100 volt tap.

‡Measured with electrostatic voltmeter.

Do not measure Horizontal Output plate or Damper plate with VTVM.

Pulses cause grid rectification in meter so reading is meaningless, and HV pulses may damage meter.

103 SERIES TELEVISION CHASSIS

Grid of 1st Video Ampl., pin 1, V-110A, 'scope at 30 c.p.s. 5 V. p/p.*

Control grid of picture tube, 'scope at 30 c.p.s. 50 V. p/p.**

Grid of 1st Sync Ampl., pin 1, V-112A, 'scope at 30 c.p.s. 18 V. p/p.

Cathode of Sync Clipper, pin 3, V-113A, 'scope at 30 c.p.s. vert. osc. unsynchronized. 50 V. p/p.

Cathode of Sync Clipper, pin 3, V-113A, 'scope at 7875 c.p.s. 48 V. p/p.

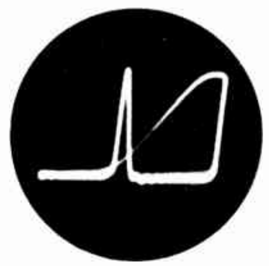
Output of integrating network, term. 2, 'scope at 30 c.p.s. vert. osc. unsynchronized. Sync pulse 8 V. p/p. osc. pulse 55 V. p/p.

Secondary of Vert. Output trans., yellow lead, 'scope at 30 c.p.s. 105 V. p/p.

Plate of Hor. Control, pin 5, V-115, 'scope at 7875 c.p.s. 50 V. p/p.

Plate of Hor. Disc., pin 7, V-116, 'scope at 7875 c.p.s. 25 V. p/p.

Grid of Hor. Output (junction of R-202, R-203), 'scope at 7875 c.p.s. 150 V. p/p.



Term. 6, Hor. Output trans., 'scope at 7875 c.p.s. 130 V. p/p.

Cathode of Damper, pin 3, V-120, 'scope at 7875 c.p.s. 40 V. p/p.

WHY THE WAVEFORMS VARY

Assuming normal operation of the television receiver, voltage waveforms often do not appear as shown. This is a function of the type of oscilloscope used, and its input cable.

These waveforms are as reproduced on a Dumont 208B instrument but another, having greater or lesser frequency fidelity, may show a waveform quite different in shape and/or size. Therefore, the service technician must be familiar with his oscilloscope, must recognize its limitations and must make mental correction if waveforms do not appear to be "normal."

The same logic applies to the measure of D-C voltages. Measurements shown here are on an RCA Voltohymist, Jr. and the use of a 20,000 ohm per volt movement will indicate some D-C voltages to differ greatly from those shown. Again, logic and reasoning must be applied, realizing that in a high impedance circuit, the indicated voltage will be less than the actual operating voltage.

Allowances for scope waveforms and D-C meter readings may be computed if all pertinent factors are known, but the experienced technician makes mental correction and allowances to the end that high fidelity instruments are not required.

PART VI
PARTS LIST

Plate of 1st Sync Ampl., pin 2, V-112A, 'scope at 30 c.p.s. 18 V. p/p.

Plate of 2nd Sync Ampl., pin 5, V-112B, 'scope at 30 c.p.s. 115 V. p/p.

Grid of Vert. Output, pin 5, V-114, 'scope at 30 c.p.s. 50 V. p/p.

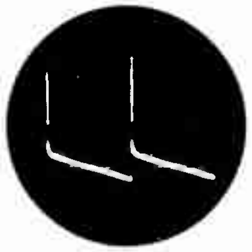


Plate of Vert. Output, pin 3, V-117, 'scope at 30 c.p.s. 1200 V. p/p.

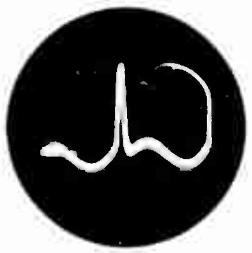
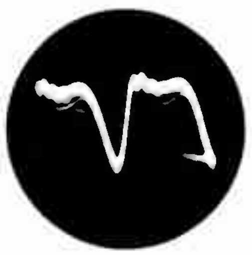


Plate of Hor. Disc., pin 2, V-116, 'scope at 7875 c.p.s. 28 V. p/p.

Plate of Hor. Osc., pin 1, V-117A, 'scope at 7875 c.p.s. 28 V. p/p.



Term. 1, Hor. Output trans., 'scope at 7875 c.p.s. 25 V. p/p.

*Use 10,000 ohms in series with probe. Voltage varies with signal input.

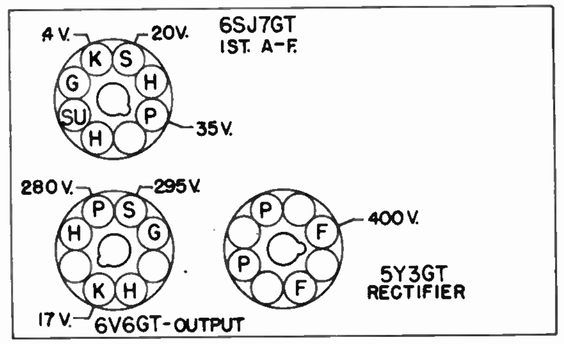
**Varies with contrast control.

Ref. No.	DESCRIPTION	Part No.	List Price
T 101	Transformer, sound I-F	360498-1	$1.40
	Use R 103 & R 110 with this transformer	360332-12	2.00
T 102	Transformer, sound I-F	360498-1	1.40
	Use R 103 & R 110 with this transformer	360332-12	2.00
T 103	Transformer, sound discriminator	360332-13	2.50
T 104	Transformer, 1st video I-F	360461-2	.80
T 105	Transformer, 4th video I-F	360461-2	.80
T 106	Transformer, 2nd video I-F	360461-2	.80
T 108	Transformer, 3rd video I-F	360461-2	.80
T 109	Video detector assembly	360476-1	3.20
T 110	Transformer, vertical blocking oscillator	320030-6	1.95
T 111	Transformer, vertical output	320056-3	2.35
T 112	Transformer, horizontal oscillator	360435-1	2.55
T 113	Transformer, hi voltage	320055-1	7.75
T 114	Transformer, power	300060-1	17.50
L 101	Video I-F trap	360484-1	1.40
L 102	Video I-F trap	360484-1	1.40
L 103	Video I-F trap	360484-1	1.40
L 104	Choke, R-F, 6.8 uh.	360372-4	.15
L 106	Coil, peaking—green	360443-9	.30
L 107	Coil, 4.5 mc. trap	360483-1	.95
L 108	Coil, peaking—red (AA, BA only)	360443-7	.30
	Coil, peaking—yellow (CA only)	360443-12	.30
L 109	Coil, peaking—yellow	360443-12	.30
L 110	Coil, peaking—orange	360443-11	.30
L 111	Coil, deflection	360462-5	8.80
	CT297-299 only	360496-1	8.80
L 112	Coil, focus	360477-2	6.40
L 113	Coil, peaking	360451-1	.50
L 114	Coil, horizontal size	360357-1	.75
L 115	Coil, horizontal linearity	360358-1	.55
L 116	Filter reactor	320041-2	.80
C 101	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 102	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 103	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 104	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 105	Capacitor, ceramic, 47 mmf. 500 V.	250207-11	.15
C 107	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 108	Capacitor, ceramic, 270 mmf. 500 V.	250207-20	.15
C 111	Capacitor, ceramic, 5 mmf. 500 V.	250206-1	.15
C 112	Capacitor, paper, .001 mfd. 600 V.	250201-1	.20
C 113	Capacitor, ceramic, 2.2 mmf. 500 V.	250164-13	.10
C 114	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 115	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 116	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 117	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 118	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 119	Capacitor, ceramic, 5 mmf. ±10%, 500 V.	250206-1	.15
C 120	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 121	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 122	Capacitor, ceramic, 15 mmf. ±10%, 500 V.	250206-5	.15
C 123	Capacitor, ceramic, 10 mmf. ±10%, 500 V.	250206-3	.15
C 125	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 126	Capacitor, ceramic, .01 mfd. 450 V.	250175-2	.20
C 128	Capacitor, ceramic, 5 mmf. ±10%, 500 V.	250206-1	.15
C 129	Capacitor, ceramic, 10 mmf. ±10%, 500 V.	250206-3	.15
C 130	Capacitor, ceramic, 15 mmf. ±10%, 500 V.	250206-5	$ .15
C 131	Capacitor, paper, .001 mfd. 600 V.	250201-1	.15
C 132	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 133	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 134	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 135	Capacitor, ceramic, .01 mfd. 450 V.	250175-2	.15
C 136	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 137	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 138	Capacitor, ceramic, 1500 mmf. 450 V.	250175-3	.15
C 150	Capacitor, paper, .047 mfd. 600 V.	250201-11	.25
C 151	Capacitor, paper, .047 mfd. 600 V.	250201-11	.25
C 152	Capacitor, paper, .047 mfd. 600 V.	250201-11	.25
C 153	Capacitor, paper, .047 mfd. 600 V.	250201-11	.25
C 154	Capacitor, electrolytic, 25 mfd. 50 V.	270027-7	.65
C 155	Capacitor, paper, .01 mfd. 600 V.	250201-7	.20
C 157	Capacitor, paper, .05 mfd. 400 V.	250129-15	.20
C 158	Capacitor, paper, .05 mfd. 400 V.	250129-15	.20
C 180	Capacitor, paper, .25 mfd. 400 V.	250151-21	.35
C 181	Capacitor, paper, .047 mfd. 600 V.	250201-11	.25
C 182	Capacitor, mica, 100 mmf. 500 V.	250159-98	.15
C 183	Capacitor, mica, 100 mmf. 500 V.	250159-98	.15
C 184	Capacitor, paper, .0047 mfd. 600 V.	250201-5	.20
C 185	Capacitor, paper, .005 mfd. 600 V.	250185-9	.20
C 186	Capacitor, paper, .015 mfd. 600 V.	250185-10	.20
C 187	Capacitor, paper, .0047 mfd. 600 V.	250201-5	.20
C 188	Capacitor, paper, .047 mfd. 600 V.	250201-11	.25
C 189	Capacitor, paper, .01 mfd. 600 V.	250201-7	.20
C 190	Capacitor, paper, .1 mfd. 600 V.	250201-13	.35
C 191	Capacitor, paper, .01 mfd. 600 V.	250201-7	.20
C 192	Capacitor, mica, 1000 mmf. 500 V.	250160-64	.25
C 193	Capacitor, paper, .047 mfd. 600 V.	250201-11	.25
C 194	Capacitor, electrolytic, 10 mfd. 350 V.	270027-9	.70
C 195	Capacitor, paper, .033 mfd. 600 V.	250201-10	.20
C 196	Capacitor, paper, .1 mfd. 600 V.	250201-13	.35
C 198	Capacitor, paper, .25 mfd. 400 V.	250151-21	.35
C 199	Capacitor, paper, .1 mfd. 600 V.	250201-13	.35
C 201	Capacitor, mica, 100 mmf. 500 V.	250159-98	.15
C 202	Capacitor, ceramic, 3.3 mmf. ±10% (CA only)	250164-14	.10
C 205	Capacitor, mica, 4700 mmf. ±5%, 500 V.	250161-24	.60
C 207	Capacitor, paper, .1 mfd. 600 V.	250201-13	.35
C 209	Capacitor, paper, .068 mfd. 600 V.	250201-12	.35
C 215	Capacitor, hi voltage	250189-1	1.15
C 216	Capacitor, paper, .047 mfd. 600 V. (AA, BA only)	250201-11	.25
C 217	Capacitor, paper, .1 mfd. 600 V. (CA only)	250201-13	.35
C 218	Capacitor, electrolytic, 45-40 mfd. 475 V.	270021-33	2.35
C 219	Capacitor, electrolytic, 40-30-10 mfd. 475 V.	270021-24	1.95
C 220	Capacitor, electrolytic, 40 mfd. 350V.—50-20 mfd. 150V.—80 mfd. 50 V.	270021-40	1.50
RC 101	Printed Circuit	250186-1	.80
R 102	Resistor, carbon, 270 ohms, ½ W.	230104-55	.05
R 103	Resistor, carbon, 22,000 ohms, ½ W. Used only with 360332-12 trans.	230104-78	.05
R 104	Resistor, carbon, 1000 ohms, ½ W.	230104-62	.05
R 105	Resistor, carbon, 100 ohms, ½ W.	230104-50	$ .05
R 106	Resistor, carbon, 1000 ohms, ½ W.	230104-62	.05
R 107	Resistor, carbon, 100,000 ohms, ½ W.	230104-86	.05
R 108	Resistor, carbon, 10,000 ohms, 1 W.	230105-74	.05
R 109	Resistor, carbon, 10,000 ohms, 1 W.	230105-74	.05
R 110	Resistor, carbon, 39,000 ohms, ½ W. Used only with 360332-12 trans.	230104-81	.05
R 111	Resistor, carbon, 100,000 ohms, ½ W.	230104-86	.05
R 114	Resistor, carbon, 100,000 ohms, ½ W.	230104-86	.05
R 116	Resistor, carbon, 68,000 ohms, ½ W.	230104-84	.05
R 117	Resistor, carbon, 22,000 ohms, ½ W. Used on the AA only	230104-78	.05
	Resistor, carbon, 100,000 ohms, ½ W. Used on the BA, CA only	230104-86	.05
R 118	Resistor, carbon, 68 ohms, ½ W.	230104-48	.05
R 119	Resistor, carbon, 1000 ohms, ½ W.	230104-62	.05
R 120	Resistor, carbon, 10,000 ohms, ½ W.	230104-74	.05
R 121	Resistor, carbon, 68 ohms, ½ W.	210104-48	.05
R 122	Resistor, carbon, 100 ohms, ½ W.	230104-50	.05
R 123	Resistor, carbon, 3300 ohms, ½ W.	230104-68	.05
R 124	Resistor, carbon, 68 ohms, ½ W.	230104-48	.05
R 125	Resistor, carbon, 100 ohms, ½ W.	230104-50	.05
R 126	Resistor, carbon, 3900 ohms, ½ W.	230104-69	.05
R 127	Resistor, carbon, 150 ohms, ½ W.	230104-52	.05
R 128	Resistor, carbon, 100 ohms, ½ W.	230104-50	.05
R 129	Resistor, carbon, 100 ohms, ½ W.	230104-50	.05
R 130	Potentiometer, volume	220076-19	.50
R 132	Resistor, carbon, 33 ohms, ½ W.	230104-44	.05
R 133	Resistor, carbon, 39,000 ohms, ½ W. (CA only)	230104-81	.05
R 149	Resistor, carbon, 18,000 ohms, 2 W.	230106-77	.20
R 150	Potentiometer, picture, 10,000 ohms	220076-43	.85
R 151	Resistor, carbon, 3900 ohms, ½ W.	230104-69	.05
R 152	Resistor, carbon, 270 ohms, ½ W.	230104-55	.05
R 153	Resistor, carbon, 10,000 ohms, ½ W. (AA, BA only)	230104-74	.05
	Resistor, carbon, 3300 ohms, ½ W. (CA, DA only)	230104-68	.05
R 154	Resistor, carbon, 5600 ohms, 1 W.	230105-71	.10
R 155	Resistor, carbon, 5600 ohms, 1 W.	230105-71	.10
R 156	Resistor, carbon, 2.2 megohm, ½ W. (AA, BA only)	230104-102	.05
	Resistor, carbon, 1 megohm, ½ W. (CA, DA only)	230104-98	.05
R 157	Resistor, carbon, 2.2 megohm, ½ W. (AA, BA only)	230104-102	.05
	Resistor, carbon, 1 megohm, ½ W. (CA, DA only)	230104-98	.05
R 158	Resistor, carbon, 39,000 ohms, ½ W.	230104-81	.05
R 159	Potentiometer, brightness	220076-44	.50
R 160	Resistor, carbon, 82,000 ohms, 1 W.	230105-85	.05
R 161	Resistor, carbon, 560,000 ohms, ½ W.	230104-95	.05
R 162	Resistor, carbon, 470,000 ohms, ½ W.	230104-94	.05
R 163	Potentiometer, contrast	220076-39	.45
R 164	Resistor, carbon, 1.8 megohm, ½ W.	230104-101	.05
R 165	Resistor, carbon, 100,000 ohms, ½ W.	230104-86	.05
R 167	Resistor, carbon, 18,000 ohms, ½ W.	230104-77	.05
R 168	Resistor, carbon, 1000 ohms, ½ W.	230104-62	.05
R 171	Potentiometer, focus	220076-38	1.10
R 173	Resistor, strip, 800 ohms, 10.9 W.	240035-8	.55
R 174	Resistor, strip, 900 ohms, 7 W.	240035-13	.50
R 175	Resistor, carbon, 4700 ohms, 1 W.	230105-70	.10

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Ref. No.	DESCRIPTION	Part No.	List Price
R 176	Resistor, carbon, 8200 ohms, 2 W.	230106-73	$ .10
R 178	Resistor, carbon, 270 ohms, ½ W.	230104-55	.05
R 179	Resistor, strip, 400 ohms, 50 V.— 400 ohms, 50 V.	240069-1	.75
R 180	Resistor, carbon, 10,000 ohms, ½ W.	230104-74	.05
R 181	Resistor, carbon, 6800 ohms, ½ W.	230104-72	.05
R 182	Resistor, carbon, 680,000 ohms, ½ W.	230104-96	.05
R 183	Resistor, carbon, 27,000 ohms, ½ W.	230104-79	.05
R 184	Resistor, carbon, 1 megohm, ½ W.	230104-98	.05
R 185	Resistor, carbon, 220 ohms, ½ W.	230104-54	.05
R 186	Resistor, carbon, 22,000 ohms, 1 W.	230105-78	.10
R 187	Resistor, carbon, 3.9 megohm, ½ W.	230104-105	.05
R 188	Resistor, carbon, 2200 ohms, ½ W.	230104-66	.05
R 189	Resistor, carbon, 1000 ohms, ½ W.	230104-62	.05
R 190	Resistor, carbon, 10,000 ohms, ½ W.	230104-74	.05
R 191	Resistor, carbon, 470,000 ohms, ½ W.	230104-94	.05
R 192	Resistor, carbon, 470,000 ohms, ½ W.	230104-94	.05
R 193	Resistor, carbon, 1 megohm, ½ W.	230104-98	.05
R 194	Resistor, carbon, 470,000 ohms, ½ W.	230104-94	.05
R 195	Resistor, carbon, 47,000 ohms, ½ W.	230104-82	.05
R 196	Resistor, carbon, 22,000 ohms, ½ W.	230104-78	.05
R 197	Resistor, carbon, 3900 ohms, 1 W.	230105-69	.05
R 198	Resistor, carbon, 2.2 megohm, ½ W.	230104-102	.05
R 199	Resistor, carbon, 100,000 ohms, ½ W. (AA, BA, CA only)	230104-86	.05
	Resistor, carbon, 120,000 ohms, ½ W. (DA only)	230104-87	.05
R 200	Potentiometer, horizontal drive (AA, BA, CA only)	220076-35	.50
	Potentiometer, horizontal drive (DA only)	220126-3	.50
R 202	Resistor, carbon, 1 megohm, ½ W.	230104-98	.05
R 203	Resistor, carbon, 100 ohms, ½ W.	230104-50	.05
R 214	Resistor, carbon, 15,000 ohms, ½ W.	230104-76	.05
R 215	Resistor, carbon, 4.7 megohm, ½ W.	230104-106	.05
R 216	Resistor, carbon, 100,000 ohms, ½ W.	230104-86	.05
R 217	Resistor, carbon, 1 megohm, ½ W.	230104-98	.05
R 218	Potentiometer, vertical speed	220076-12	.55
R 223	Resistor, carbon, 2.2 megohm, ½ W.	230104-102	.05
R 224	Resistor, carbon, 820 ohms, 1 W.	230105-61	.10
R 225	Potentiometer, linearity	220076-20	1.00
R 228	Resistor, carbon, 1 megohm, 1 W.	230105-98	.10
R 232	Resistor, carbon, 10,000 ohms, ½ W.	230104-74	.05
R 233	Resistor, wire wound, 38,000 ohms, 10 W.	240021-19	.60
R 234	Resistor, carbon, 220,000 ohms, ½ W.	230104-90	.05
R 237	Resistor, carbon, 3900 ohms, ½ W.	230104-69	.05
R 238	Resistor, carbon, 270,000 ohms, ½ W.	230104-91	.05
R 239	Potentiometer, vertical height	220076-5	.55
J 102	Socket, interlock	180476-1	.20
J 103	AC socket	180428-1	.20
J 104	Socket, phono	180466-1	.05
J 105	Socket, color converter (CA only)	180466-1	.05
S 101	Switch, audio	160223-1	1.35
F 101	Fuse, ¼ amp.	180475-1	.20
F 102	Fuse, 5 amp.	180475-2	.20
	R-F tuner (AA only)	700351-1	57.50
	R-F tuner (CA, BA only)	700348-1	57.50
	R-F tuner, CT297 & CT299 (CA only)	700354-23	57.50
	R-F tuner, (316)	700354-25	57.50
P 101	Plug, sound—Shell 180310-1 plus plug	180311-2	.05
P 102	Plug, interlock	467702-1	.60

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE



ALL ELECTRICAL VALUES SHOWN ARE IN OHMS OR MMF UNLESS OTHERWISE SPECIFIED.

MEASURE HEATER (H) AND FIL. (F) VOLTAGES ACROSS SOCKET TERMINALS.

ALL OTHER VOLTAGES MEASURED FROM SOCKET TERMINAL TO GROUND WITH A 20,000 OHMS PER VOLT VOLTMETER.

LINE VOLTAGE-117 V. A.C.

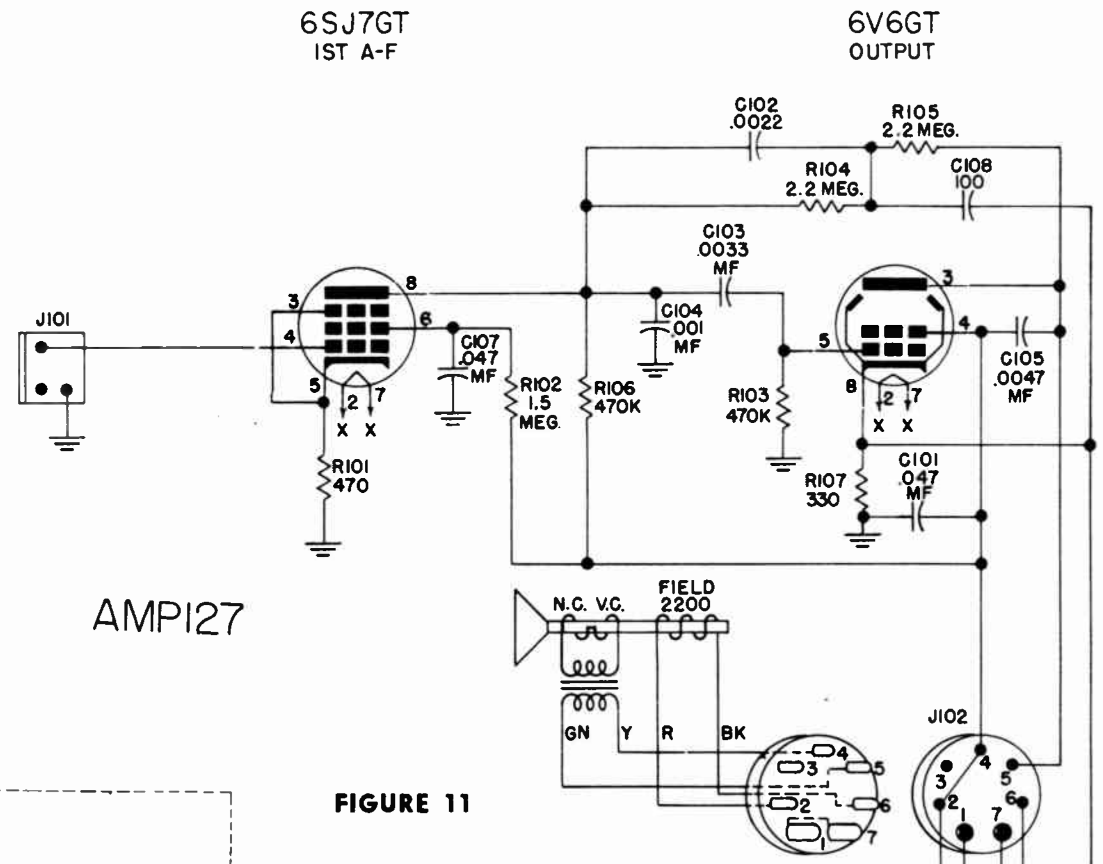
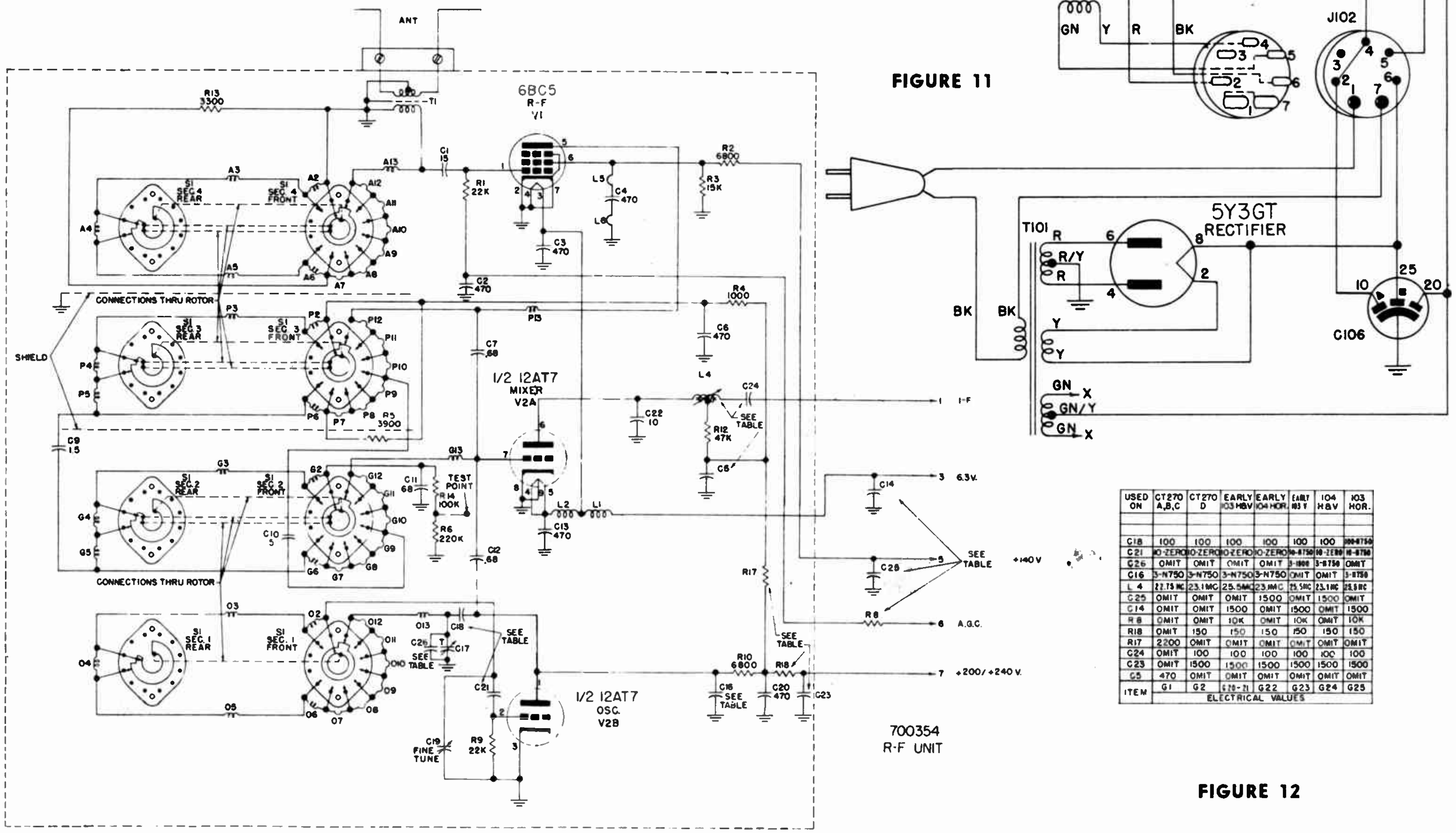


FIGURE 11



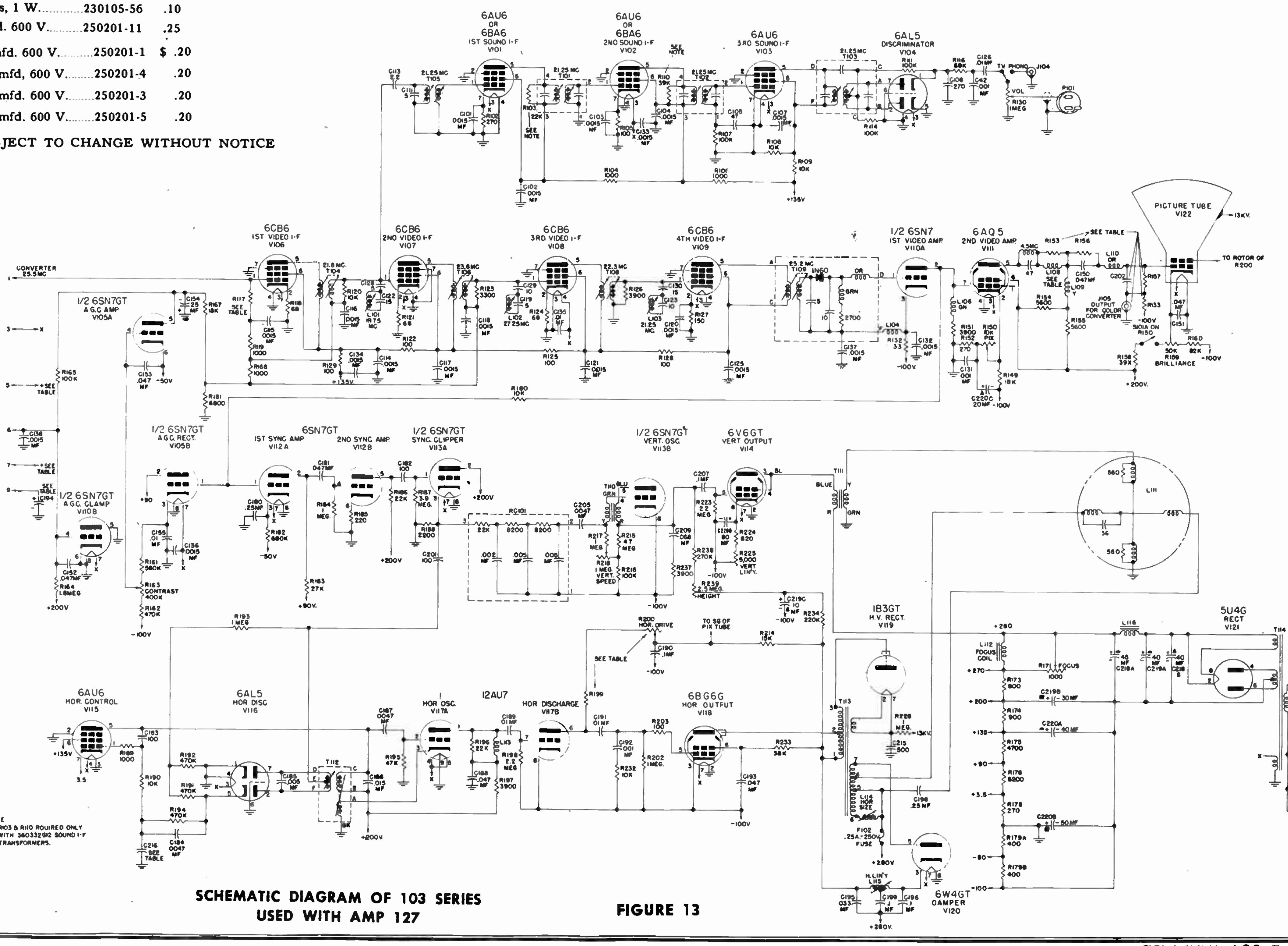
USED ON	CT270 A,B,C	CT270 D	EARLY 103 H&V	EARLY 104 HOR.	EARLY 103 V	104 H&V	103 HOR.
C18	100	100	100	100	100	100	100-N750
C21	10-ZERO	10-ZERO	10-ZERO	10-ZERO	10-N750	10-ZERO	10-N750
C26	OMIT	OMIT	OMIT	OMIT	3-N1500	3-N750	OMIT
C16	3-N750	3-N750	3-N750	3-N750	OMIT	OMIT	3-N750
L 4	22.75 MC	23.1 MC	25.5 MC	23.1 MC	25.5 MC	23.1 MC	25.5 MC
C25	OMIT	OMIT	OMIT	1500	OMIT	1500	OMIT
C14	OMIT	OMIT	1500	OMIT	1500	OMIT	1500
R 8	OMIT	OMIT	10K	OMIT	10K	OMIT	10K
R18	OMIT	150	150	150	150	150	150
R17	2200	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT
C24	OMIT	100	100	100	100	100	100
C23	OMIT	1500	1500	1500	1500	1500	1500
C5	470	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT
ITEM	G1	G2	G20-21	G22	G23	G24	G25
	ELECTRICAL VALUES						

FIGURE 12

PARTS LIST FOR AMP 127AA AUDIO AMPLIFIER

Ref. No.	DESCRIPTION	Part No.	List Price
T 101	Power transformer	300062-1	$6.90
R 101	Resistor, carbon, 470 ohms, ½ W.	230104-58	.05
R 102	Resistor, carbon, 1.5 megohm, 1 W.	230105-100	.10
R 103	Resistor, carbon, 470,000 ohms, ½ W.	230104-94	.05
R 104	Resistor, carbon, 2.2 megohm, ½ W.	230104-102	.05
R 105	Resistor, carbon, 2.2 megohm, ½ W.	230104-102	.05
R 106	Resistor, carbon, 470,000 ohms, 1 W.	230105-94	.10
R 107	Resistor, carbon, 330 ohms, 1 W.	230105-56	.10
C 101	Capacitor, paper, .047 mfd. 600 V.	250201-11	.25
C 102	Capacitor, paper, .001 mfd. 600 V.	250201-1	$ .20
C 103	Capacitor, paper, .0033 mfd, 600 V.	250201-4	.20
C 104	Capacitor, paper, .0022 mfd. 600 V.	250201-3	.20
C 105	Capacitor, paper, .0047 mfd. 600 V.	250201-5	.20
C 106	Capacitor, electrolytic	270023-12	1.65
C 107	Capacitor, paper, .047 mfd. 600 V.	250201-11	.25
J 101	Socket, external	180060-1	.10
J 102	Socket, speaker	180504-16	.15

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE



NOTE
R103 & R110 REQUIRED ONLY WITH 360332G12 SOUND I-F TRANSFORMERS.

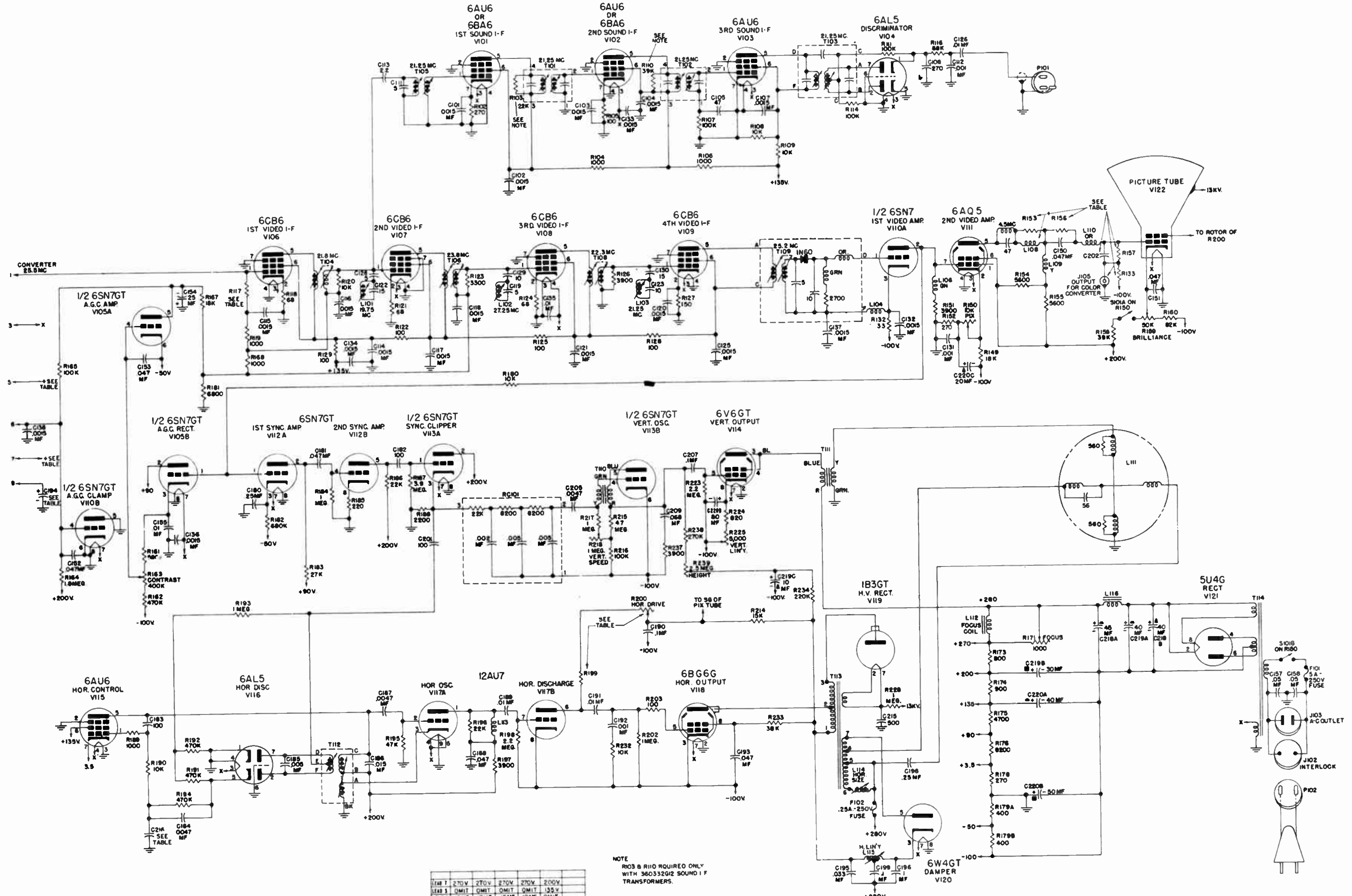
ITEM	A	B	C	D	E	H
LEAD 1	270V	270V	270V	270V	200V	200V
LEAD 3	OMIT	OMIT	OMIT	OMIT	135V	135V
C194	10 MF	10 MF	10 MF	10 MF	OMIT	OMIT
R200	500K	500K	500K	300K	300K	300K
R199	100K	100K	100K	120K	120K	120K
L108	RED	RED	YEL	YEL	YEL.	YEL.
J105	OMIT	OMIT	USE	USE	USE	USE
C216	.047 MF	.047 MF	.1 MF	.1 MF	.1 MF	.1
C202	OMIT	OMIT	3.3	3.3	3.3	3.3
R157	2.2 MEG	2.2 MEG	1 MEG	1 MEG	1 MEG.	1 MEG.
R156	2.2 MEG	2.2 MEG	1 MEG	1 MEG	1 MEG.	1 MEG
R153	10K	10K	3300	3300	3300	3300
R133	OMIT	OMIT	39K	39K	39K	39K
R17	22K	100K	100K	100K	100K	100K

ELEC. VALUE

SCHEMATIC DIAGRAM OF 103 SERIES
USED WITH AMP 127

FIGURE 13

MAGNAVOX TV PAGE 12-35



NOTE
R103 & R110 RQUIRED ONLY WITH 360332G12 SOUND I F TRANSFORMERS.

ITEM	A	B	C	D	E & H	
LEAD 1	270V	270V	270V	270V	200V	
LEAD 3	OMIT	OMIT	OMIT	OMIT	135V	
C194	10MF	10MF	10MF	10MF	OMIT	
R200	500K	500K	500K	300K	300K	
R199	100K	100K	100K	120K	120K	
L108	RED	RED	YEL	YEL	YEL	
J105	OMIT	OMIT	USE	USE	USE	
C216	.047MF	.047MF	.1MF	.1MF	.1MF	
C202	OMIT	OMIT	3.3	3.3	3.3	
R157	2.2MEG	2.2MEG	1MEG	1MEG	1MEG	
R156	2.2MEG	2.2MEG	1MEG	1MEG	1MEG	
R153	10K	10K	3300	3300	3300	
R133	OMIT	OMIT	39K	39K	39K	
R117	22K	100K	100K	100K	100K	
	ELEC VALUE					

FIGURE 14

SCHEMATIC DIAGRAM OF 103 SERIES USED WITH RADIO

TUBE COMPLEMENT

Function	Tube Type	Symbol	Function	Tube Type	Symbol
RF Amplifier	6BQ7	V1	Sync Amplifier	1/2 6SN7GT	V302A
RF Mixer	1/2 6U8	V2A	Sync Clipper	1/2 6SN7GT	V302B
Oscillator	1/2 6U8	V2B	Vertical Oscillator	6SN7GT	V303
1st Video IF	6CB6	V201	Vertical Output	6AU5GT	V304
2nd Video IF	6CB6	V202	Horizontal AFC	1/2 6SN7GT	V401A
3rd Video IF	6CB6	V203	Horizontal Oscillator	1/2 6SN7GT	V401B
4th Video IF	6CB6	V204	Horizontal Output	6CD6G	V402
Sound IF Amplifier	6AU6	V101	HV Rectifier	1B3GT	V403
Limiter	6AU6	V102	Damper	6AX4GT	V404
Ratio Detector	6AL5	V103	2nd Detector	IN64	
AF Amplifier & Phase Inverter	12AX7	V104	Damper	6AX4GT	V405
Audio Output	6V6GT	V105	LV Rectifier	5U4G	V501
Audio Output	6V6GT	V106	LV Rectifier	5U4G	V502
Video Amplifier	6CB6	V205	Picture Tube	27" glass rectangular	V207
AGC Amplifier	6AU6	V208			
Noise Inverter	1/2 12AX7	V301A			
Sync Separator	1/2 12AX7	V301B			

CIRCUIT DESCRIPTION

General

This chassis is designed to power a 27", 90 degree picture tube and supplies full sweep at a maximum high voltage consistent with the tube rating. Light output (using the aluminized tube) is comparable to or greater than that of the smaller screen chassis. A total of 27 tubes (including picture tube and rectifiers) plus a crystal detector is used.

The design features a cascode RF tuner, an increased sensitivity full bandwidth video IF amplifier, and wide band video amplifier to provide a high contrast, high definition picture. Other special features include a high gain intercarrier—sound IF amplifier with limiter and ratio detector, and a 10 watt push-pull audio amplifier. There are direct provisions for a UHF tuner, which can be added when needed.

The horizontal output system is of the new efficient auto transformer type, providing greater high voltage with full 90 degree deflection. The vertical deflection system provides full sweep with positive interlace.

Further features employed in the 107 design are, keyed AGC and noise inverter for optimum fringe area performance, and the "synchroguide" horizontal oscillator and AFC system.

The 107 design employs a single shallow-pan chassis for ease of service. The plug-in deflection yoke and 27" picture tube mount separately in the cabinet. The chassis is designed for any mounting position including side mounting.

The 107 chassis is rated for 117 volts 60 cycles AC line potential with power consumption of 315 watts. Sufficient additional power capacity for the UHF tuner has been included in the design of the power supply.

Cascode RF Tuner

The cascode RF tuner consists of an RF amplifier V1 (6BQ7) and mixer-oscillator V2 (6U8). A 12-position channel selector rotary switch is used with a concentric shaft which operates the variable fine tuner. For ease of alignment, inductances adjustable by bending or spreading are provided on every channel.

As shown in the schematic diagram, the secondary of the antenna transformer T1 is tuned for each channel by shunting it with the proper value of inductance (S1, Section 4) to make it resonate with the RF tube V1 (6BQ7) input capacity. L1 and C1 form an IF trap, which is tuned to 44.5 MC for best average IF rejection on all channels. To further minimize IF interference an external IF trap assembly is available for those few areas where the overall IF interference is severe. These traps are series-connected in the receiver antenna lead-in and should be tuned to give maximum rejection at the undesired IF frequency.

Tuning of the RF plate and mixer grid is accomplished by wafer sections 3 and 2, which are identical to the RF grid wafer. Coupling capacitors C6, C9 and C10, connected between appropriate points provide the necessary coupling for the proper bandpass on all channels. Shields between the RF grid, RF plate and mixer grid wafers reduce stray coupling. The 6BQ7 RF tube is used in a cascode circuit (triode 1 grounded cathode, triode 2 grounded grid) to minimize triode feedback so that the superior signal-to-noise ratio of a triode is realized with good stability.

The pentode mixer V2A (1/2 6U8) is used because of its low feedback characteristic with 41 MC IF.

To reduce high band radiation from the main TV chassis, common low side capacity coupling was used to the 1st IF tube grid circuit and the tuner chassis was connected to the main chassis only at the tuner rear apron.

Video IF

The video IF amplifier operates at a picture carrier frequency of 45.75 MC, with a design bandwidth of 4.0 MC at -6 db and consists of a double-tuned circuit (low-side capacity coupled), followed by a staggered quadruple. This double-tuned circuit consists of two similar coils that are physically separated, one in the tuner (converter plate coil,) and one in the grid circuit of the 1st IF amplifier (T201).

The remainder of the IF amplifier consists of four stagger-tuned stages, using 6CB6's for maximum stable gain. Inductively coupled to the 1st, 2nd and 3rd IF plate coils are three traps, similar to that on the IF input coil. Two of these traps are tuned to 47.25 MC (adjacent channel sound), and one to 39.75 MC (adjacent channel picture). An additional 41.25 MC trap is capacity-coupled to the plate of the 2nd IF tube to provide additional co-channel sound rejection.

The 1st and 2nd IF stages are in series, thus reducing the drain on the low voltage supply and at the same time providing a relatively "Stiff" effective "B" voltage for better AGC action. Similarly, the 4th IF tube is in series with the sound IF amplifier.

To provide stability, all IF coils and traps, with the exception of the capacity-coupled 41.25 MC trap, are completely shielded and the detector IN64 is enclosed in the 4th IF can. Two RF chokes (L201 and the RFC in 4th IF assembly) with a self-resonant frequency of 43 MC provide isolation of the IF amplifier and prevent stray coupling of the RF component.

Video Detector & Sound IF System

The 107 chassis employs intercarrier sound IF (4.5 MC) produced by the video detector. The latter comprises a crystal diode (IN64) located accessibly within shield can (T-205) also containing the final IF bifilar coil, bypass condenser and IF stabilizing filter choke.

The 4.5 MC intercarrier sound IF signal is amplified by the single tuned 1st sound IF amplifier (V101) and in turn fed to the limiter stage (V102). The limiter stage drives a conventional ratio detector circuit which provides additional AM rejection resulting in high quality FM sound performance in the recovered audio. It is to be noted that both grid and plate limiting occur in the limiter stage.

The audio amplifier comprises a resistance coupled voltage amplifier phase inverter stage (V104) driving a pair of 6V6GT push-pull output tubes giving 10 watts of high quality audio output. A phono switch and input jack is provided at the rear of the chassis for convenient use with an external phono. Provision is also made for connecting an external radio tuner to feed the TV audio amplifier.

Video Amplifier

The video amplifier employs two stages in order to provide full bandwidth with a good margin of drive voltage (up to 130 V.P-P) for the picture tube. The first stage is a 6CB6 (V205) direct coupled to the video detector for constant level noise clipping. Sync and AGC takeoff is from the plate side of V205, the AGC tube (V208) being DC coupled to this point.

The video signal is AC coupled to the grid of the video output tube (V206). By means of grid current DC restoration takes place at this point. The combined tube characteristics of the two stages are such that good contrast in the vicinity of "white" is achieved and DC restoration on the output tube grid maintains this condition with relative black/white content changes in the signal. Partial AC coupling from the output peaking circuit (L205 and R223) to the picture tube grid is employed in order to render less critical the variation in background (DC) component when switching between channels. THE LOAD RESISTOR (R223) IS WIRE WOUND AND HAS AN AMOUNT OF INDUCTANCE WHICH IS A PART OF THE COMPENSATION EMPLOYED AND SHOULD NOT BE REPLACED BY A NON-INDUCTIVE RESISTOR.

Noise Inverter

The noise inverter is for the purpose of removing noise bursts that exceed the sync pulse level, from the signal that is fed to the AGC and sync circuits. The noise inverter (one-half 12AX7, V301A) is a grounded grid amplifier that forms a parallel signal path around the video amplifier tube. Since it is cathode driven, the noise inverter signal output is in phase with the detector signal while the video amplifier output is 180° out of phase.

The noise inverter is biased beyond cutoff, enabling it to conduct only on noise signals which exceed the sync tips at the detector.

Bias for the noise inverter is obtained from the grid bias voltage of the horizontal output tube by means of a voltage divider in the output tube grid return. A potentiometer (R304) provides for independent adjustment of noise inverter bias and horizontal drive. The noise inverter bias usually is between -9V and -13V as measured with a VTVM.

This chassis uses keyed AGC for improved noise immunity and reduction of airplane flutter effects. A series fed pulse to the AGC amplifier was chosen because of the ease of filtering the derived AGC voltage. A more rapidly acting AGC is therefore possible.

The RF AGC voltage is considerably delayed to reduce the medium signal noise content of the picture. The RF amplifier grid to cathode conduction is used as a clamp for RF bias delay in the AGC system.

Sync Separators

The sync separator consists of three triode sections (V301B), V302A, V302B) which are, respectively, the sync separator, sync amplifier, and sync clipper.

The sync separator is direct coupled to the sync amplifier operating in its positive grid region. The sync clipper is AC coupled to the sync amplifier and levels off sync tips at a uniform level. The sync clipper also serves as a phase-splitter and supplies a negative sync signal at the cathode for the vertical system, and a positive sync signal at the plate for the horizontal system.

Vertical Sweep Oscillator

The vertical sweep oscillator is a plate to grid multivibrator using a 6SN7 dual triode. The integrated vertical sync is fed to the grid of the first triode section and the output wave is taken from the plate of the second triode (vertical discharge V303B).

The feedback circuit in the multivibrator is from the peaking resistor to the grid of the first triode. PC301 is a printed circuit integrating network and this together with an additional integrating section (R312 and C307) for improved interlace provides the vertical sync pulse.

Vertical Output

The vertical output amplifier is a type 6AU5GT (V304) pentode connected, and transformer coupled to the yoke.

The capacitor across the transformer secondary reduces horizontal pulses on the vertical yoke winding and improves interlace.

Retrace blanking is obtained by superimposing part of the vertical retrace pulse on the picture tube bias so that the picture tube is biased beyond cut-off during retrace.

Horizontal Oscillator and Frequency Control

The horizontal oscillator, discharge and AFC circuits utilize a double triode tube 6SN7, (V401). The frequency of the blocking oscillator, V401B, can be adjusted by the slug of L401 (accessible at rear of chassis). The frequency of oscillation is stabilized by a tuned circuit. The inductance for the tuned circuit is L401 and the capacity is composed of C410, C411 and C412. The generated sawtooth reaches the grid of the output tube V402 through the capacity divider C410 - C411. The latter, marked horizontal drive, is variable and controls the amount of drive on the grid of V402 (6CD6G). This adjustment will affect the horizontal linearity, high voltage and inverter tube bias and to a slight degree the frequency. Feedback capacitor (C408) affects the frequency slightly.

Synchronization is accomplished by means of the AFC, V401A, as follows: A complex wave consisting of the sync pulse and a parabola is fed to the grid of this triode. The sync pulse rides near the peak of the complex wave. The tube is biased from the oscillator grid to such a value that plate current flows only during the positive peak portions of the complex wave. A portion of the integrated cathode voltage is applied to the oscillator grid. Its magnitude controls the frequency of the oscillator in such a way as to automatically lock it in synchronism.

Horizontal Output and Damper

The function of the output tube V402 is to supply sufficient current of the proper waveform to the horizontal deflection coils for normal horizontal scanning of the picture tube. The function of the damper tubes (V404 and V405) is to damp oscillations of the yoke current following retrace time and thus help provide a linear trace. Two dampers are used due to the greater current requirement for 90° deflection. Because the output transformer is the auto transformer type, "inverted" damper tubes are required, and for this reason such tubes must withstand high heater-to-cathode potentials. Other functions of this circuit are to provide a high amplitude pulse for high voltage and to recover a substantial part of the energy in the system. Part of the energy recovered appears in the form of a boost voltage at the damper cathode and part in actual deflection current in the yoke.

The output transformer is a highly efficient auto transformer, and special insulation is used to protect it against H.V. breakdown. Normal retrace time in the system is 9 to 10 microseconds. Width is controlled by L402 and linearity is controlled mainly by L403; the drive control influences linearity to some extent.

High Voltage Supply

The high voltage is supplied by part of the energy stored in the horizontal system. When the 6CD6G plate current is cutoff by the horizontal oscillator pulse, a high positive pulse of voltage appears on the high voltage winding of T401 due to the rapidly collapsing field in the system. This high positive pulse is rectified by the H.V. rectifier V403 (1B3). The total high voltage applied to the picture tube is 20 KV.

Anastigmatic Deflection Yoke & Focusing

The anastigmatic deflection yoke has the windings distributed in a manner that gives very little deflection spot defocusing. This also produces a slight amount of raster distortion. Beam straighteners are used to correct this slight distortion. Otherwise the yoke is conventional in electrical characteristics.

The 90° deflection requires that the yoke be designed physically shorter than 70° systems in order to minimize neck shadows. This makes the yoke less sensitive, thus requiring greater deflection power and consequently more current.

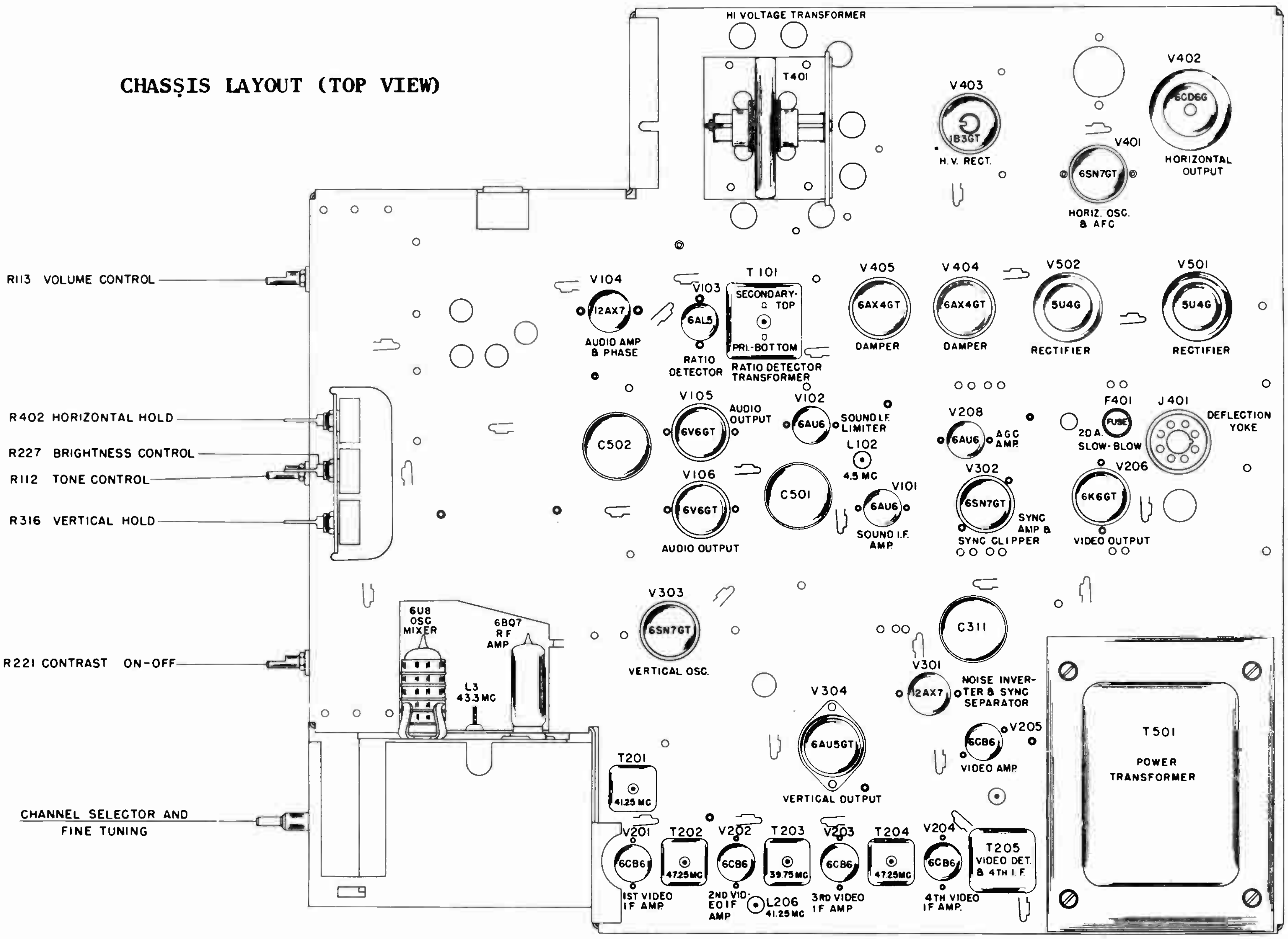
A permanent magnet focus unit which has a centering plate on the front and the focus adjusting screw at the rear of the assembly is used.

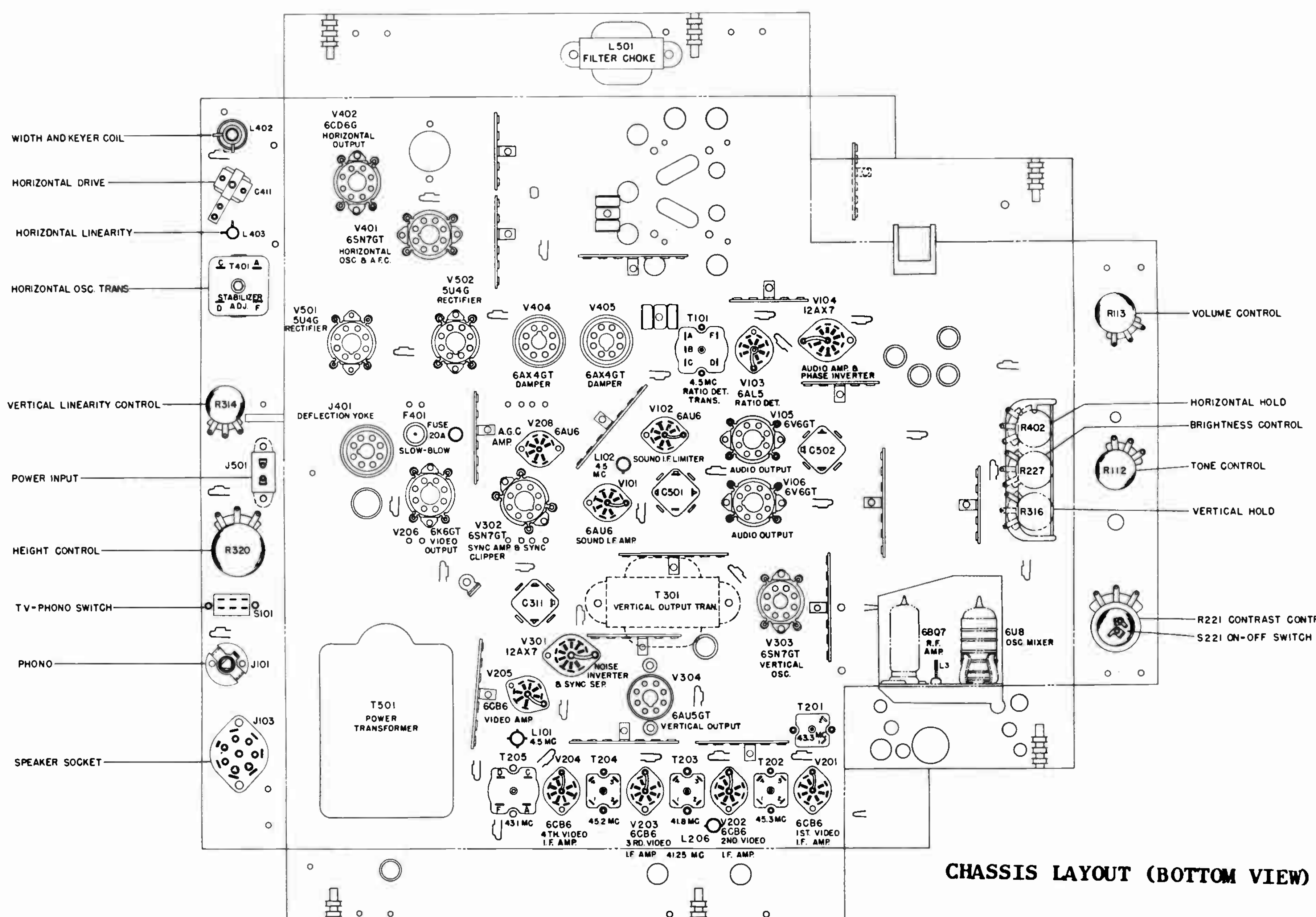
Low Voltage Supply

The low voltage power supply provides the filament and plate voltages for the receiver. Two 5U4G (V501 and V502) rectifier tubes are used to supply nominal 300 volts DC input to the filter at approximately 435 ma. The power transformer has one 6.3 volt and one 12.6 volt center tapped filament winding. The 12.6 volt winding is normally grounded at midpoint and supplies filament current for all of the tubes except V207, V101, V202, and V208. These four tubes are supplied by the second winding. This winding is connected to a 140 volt point so that the filament to cathode rating of the tubes is not exceeded.

MODEL MV 110M1, Ch. CT358, 107 Series, Prelim.

CHASSIS LAYOUT (TOP VIEW)





CHASSIS LAYOUT (BOTTOM VIEW)

ALIGNMENT INSTRUCTIONS

1. I-F ALIGNMENT

a. Using a 4.5 V "C" battery with a tap at 1.5 V, connect the positive terminal to ground. Connect the -1.5 V tap to the junction of R234 and R235, the R. F. grid return. Connect the -4.5 V terminal to the junction of R201 and C201, the I.F. grid return.

b. Connect oscilloscope and/or VTVM across R216, the video detector load resistor. The oscilloscope is preferable as overload is more easily detected.

c. Connect an AM signal generator to the convertor grid circuit. This connection can be made to convertor grid wafer of tuner through hole in bottom of tuner shield.

d. Align the following slugs for indicated output.

FREQUENCY	ADJUST	FOR
41.25 MC	T201 (Top)	Minimum Output
41.25 MC	L206 (Top)	Minimum Output
47.25 MC	T202 (Top)	Minimum Output
47.25 MC	T204 (Top)	Minimum Output
39.75 MC	T203 (Top)	Minimum Output
# * 43.3 MC	T201 (Bottom)	Maximum Output
* 43.3 MC	Convertor Coil (on tuner)	Maximum Output
# 45.3 MC	T202 (Bottom)	Maximum Output
# 41.8 MC	T203 (Bottom)	Maximum Output
# 45.2 MC	T204 (Bottom)	Maximum Output
43.1 MC	T205 (Bottom)	Maximum Output

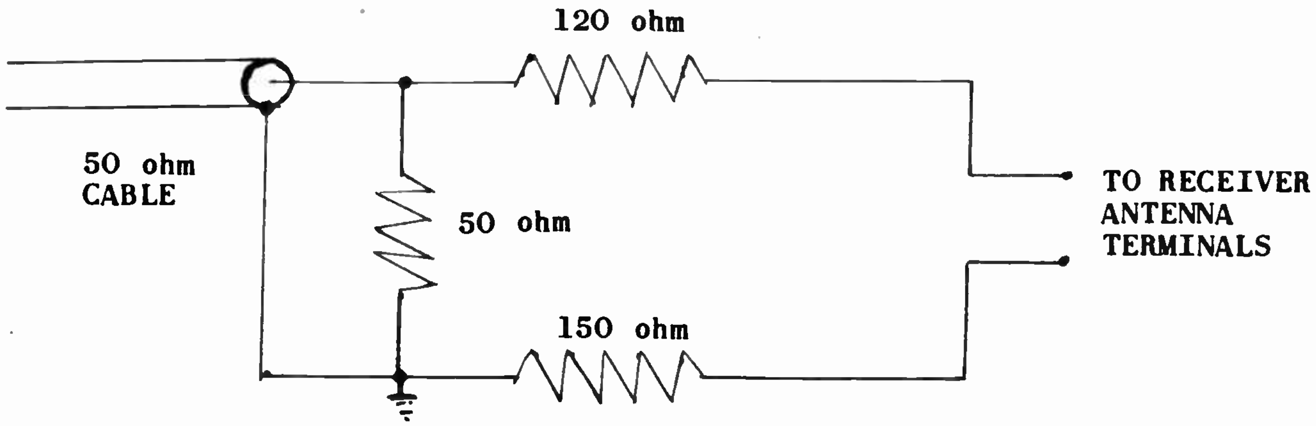
* The convertor coil and the bottom slug of T201 form a double tuned circuit and should be adjusted as follows:

(1) Detune convertor coil.
(2) Adjust T201 for maximum output.
(3) Adjust convertor coil for maximum output.
(4) Do not reset T201.

If any of these slugs require more than 3 turns readjust associated trap (top slug).

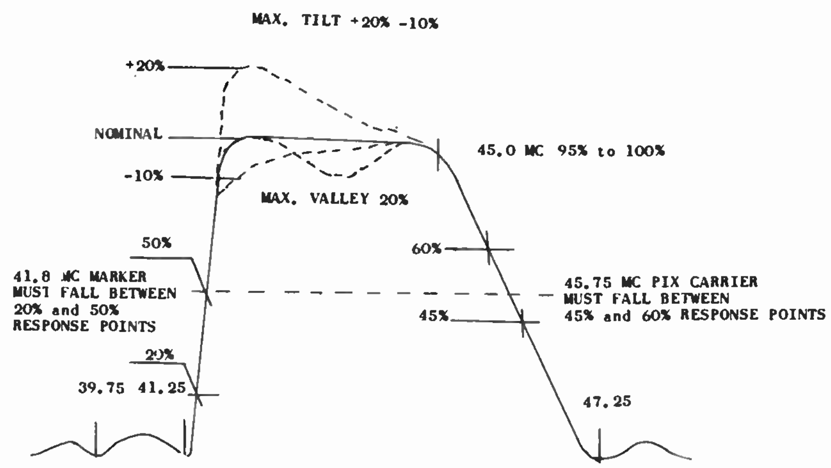
e. Remove signal from convertor grid and loosely couple signal generator for marker injection.

f. Set receiver and R-F sweep generator to channel 4 and connect R-F sweep generator to antenna terminals of receiver. Note: If balanced output cable for sweep generator is not available, the impedance matching network shown below should be used.



g. Retouch I-F slugs (bottom), if necessary, to obtain curve shown. If curve falls within prescribed limits do not readjust.

h. Check all channels for symmetry and bandwidth. If it is necessary to retouch any of the I-F adjustments, only the following should be adjusted.



To correct for excessive tilt, adjust 4th I-F (43.1 MC) coil. To adjust low frequency side of curve, adjust 2nd I-F (41.8 MC) coil. For high frequency correction, adjust the 1st & 3rd I-F coils (45.2 MC) and (45.3 MC).

2. 4.5 MC TRAP (L101) ADJUSTMENT

a. Remove V203, 3rd video I-F amplifier to prevent noise from masking output indication.

b. Connect 4.5 MC AM signal to terminal "D" of T205, video detector. Signal Input must not exceed 0.2 V. RMS.

c. Connect VTVM with crystal probe to grid lead of picture tube. (Pin 2, V207)

d. Turn contrast control to full clockwise position and adjust core of L101 for minimum output.

3. SOUND I-F ALIGNMENT

a. Connect 4.5 MC signal to terminal "D" of T205 as in 4.5 MC trap adjustment.

b. Connect VTVM from pin 7 of V103, 6AL5 to ground.

c. Adjust L102, Sound I-F coil, and primary of ratio detector transformer (bottom of T101) for maximum output. Reduce signal to maintain output below -5.0 volts to prevent overload.

d. Remove VTVM and connect negative lead to the junction of R109 and R110, and probe to junction of R108 and C112.

e. Adjust secondary (top) of ratio detector transformer for zero reading.
If secondary should require more than 3 or 4 turns for proper adjustment, repeat primary adjustment, as in (b) and (c).

4. HORIZONTAL OSCILLATOR AND AFC ALIGNMENT:

a. Tune set to weakest channel available.

b. Set noise bias control fully clockwise. Then set horizontal drive trimmer about 1/2 turn from full clockwise position as a preliminary setting.

c. Short terminals "C" and "D" of horizontal stabilizing coil (L401), and turn horizontal hold control to full clockwise position.

d. Adjust Horizontal Frequency coil (on rear chassis apron) until picture locks horizontally.

e. Adjust Horizontal Width, Drive and Linearity as follows:

1. Adjust Horizontal Drive trimmer for maximum sweep. Turn counterclockwise until compression appears at center (drive lines), then clockwise until compression is just eliminated.
2. Adjust Horizontal Linearity coil (L403) on rear chassis apron for proper linearity. Two positions may be found which appear correct. The proper adjustment is that with the core further out (counter-clockwise position).
3. Adjust Horizontal Width control (L402) on rear chassis apron for proper picture size.

f. Remove short from terminals "C" and "D" of stabilizing coil and connect oscilloscope through approximately 15 MMF capacitor to terminal "C" above.

g. Adjust stabilizing coil (L401) inside chassis so that sharp and rounded peaks of the pattern on the oscilloscope are of equal amplitude. If necessary, horizontal hold control may be adjusted to maintain sync.

h. Remove oscilloscope lead and turn horizontal hold to full clockwise position.

i. Turn Brightness Control to full clockwise position and adjust Horizontal Frequency control until blanking bar appears at left side of picture. Then back off until blanking bar and wiggle at top of picture is not present.

VOLTAGE CHART 107 SERIES

TUBE NO.	TUBE TYPE	FUNCTION	PLATE PIN	PLATE VOLTS	SCREEN PIN	SCREEN VOLTS	CATHODE PIN	CATHODE VOLTS	GRID PIN	GRID VOLTS
V1	6BQ7	R-F Amp	1 6	180 85			3	85	2	85
V2	6U8	Mixer Osc.	6 1	180 135	3	100			2 9	-4 * -5.5 *
V101	6AU6	Sound I-F Amplifier	5	290	6	290	7	150	1	145
V102	6AU6	Limiter	5	180	6	180	7	110	1	105
V103	6AL5	Ratio Det.	7	-25						
V104	12AX7	Audio Amp & Phase Inverter	1 6	170 170			3 8	2 2		
V105	6V6GT	Audio Output	3	295	4	290	8	20	5	0
V106	6V6GT	Audio Output	3	295	4	290	8	20	5	0
V201	6CB6	1st Video I-F	5	150	6	150	2	.25	1	-5
V202	6CB6	2nd Video I-F	5	285	6	285	2	175	1	170
V203	6CB6	3rd Video I-F	5	140	6	140	2	.25	1	-5
V204	6CB6	4th Video I-F	5	145	6	140	2	2.5		
V205	6CB6	Video Amp.	5	180#	6	110#			1	-1.0 #
V206	6K6GT	Video Output	3	160*	4	145				
V207	See List	Picture Tube	Cap	20KV	10	570	11	105#	2	45
V208	6AU6	AGC Amp.	5	-.5	6	615	7	210	1	180
V301	12AX7	Noise Inv. Sync Sep.	1 6	25 110			3	-1	2 7	-8.5 -14
V302	6SN7GT	Sync Amp. Sync Clipper	5 2	185 80			6 3	110 3	4 1	100 -1
V303	6SN7GT	Vertical Osc.	2 5	60 80			3 6	25 25		
V304	6AU5GT	Vertical Output	5	255	8	190	3	25	1	0
V401	6SN7GT	Horizontal AFC. Horizontal OSC.	5 2	250 450			6	-9.5#	4 1	-45 -125
V402	6CD6G	Hor. Output	Cap	Do not measure	8	160			5	-40
V403	1B3GT	H.V. Rectifier	Cap	Do not measure						
V404	6AX4GT	Damper	5	260			3	620		
V405	6AX4GT	Damper	5	260			3	620		

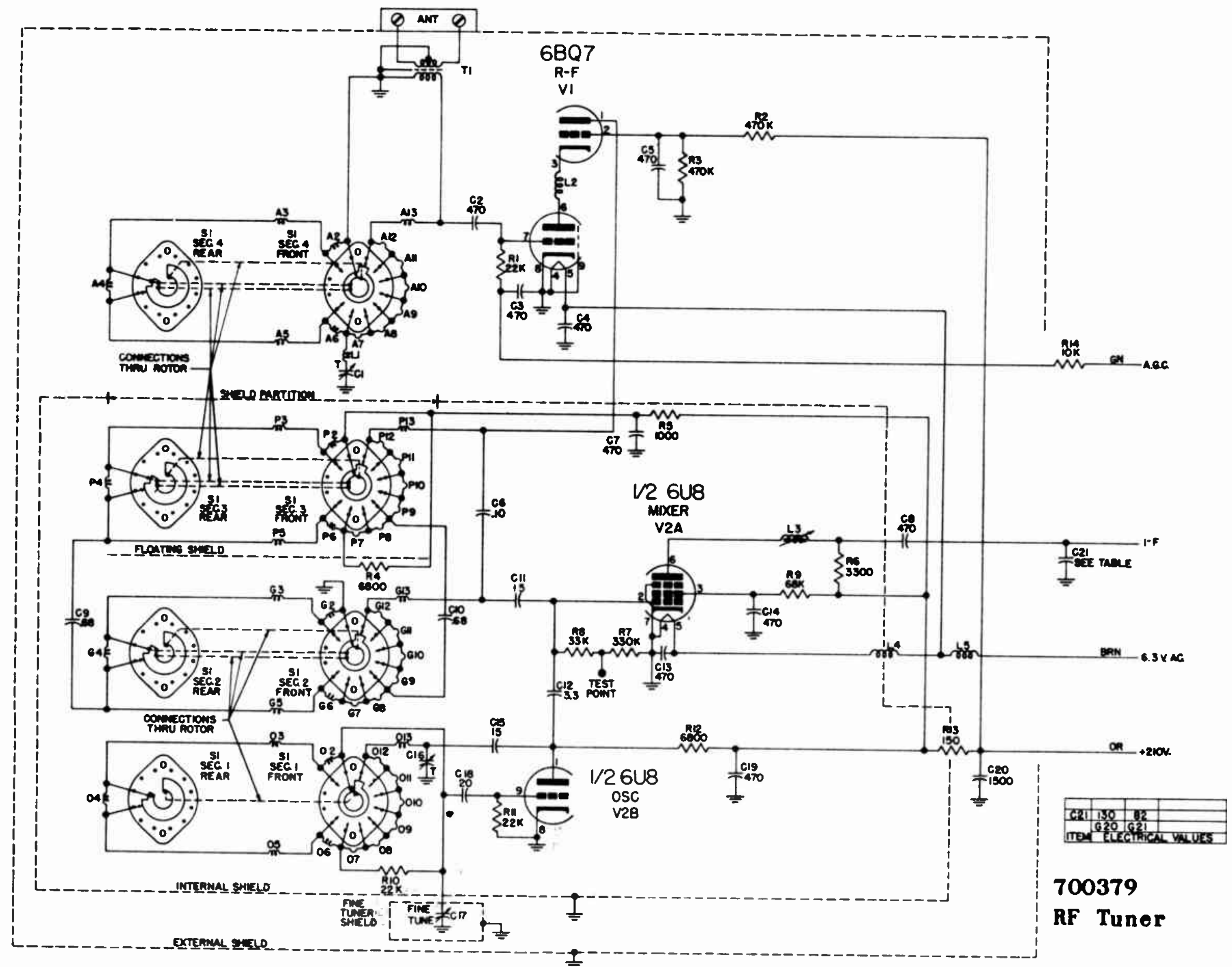
* Varies with channel selector switch position.
\# Varies with control setups.

PARTS LIST FOR THE 107 SERIES

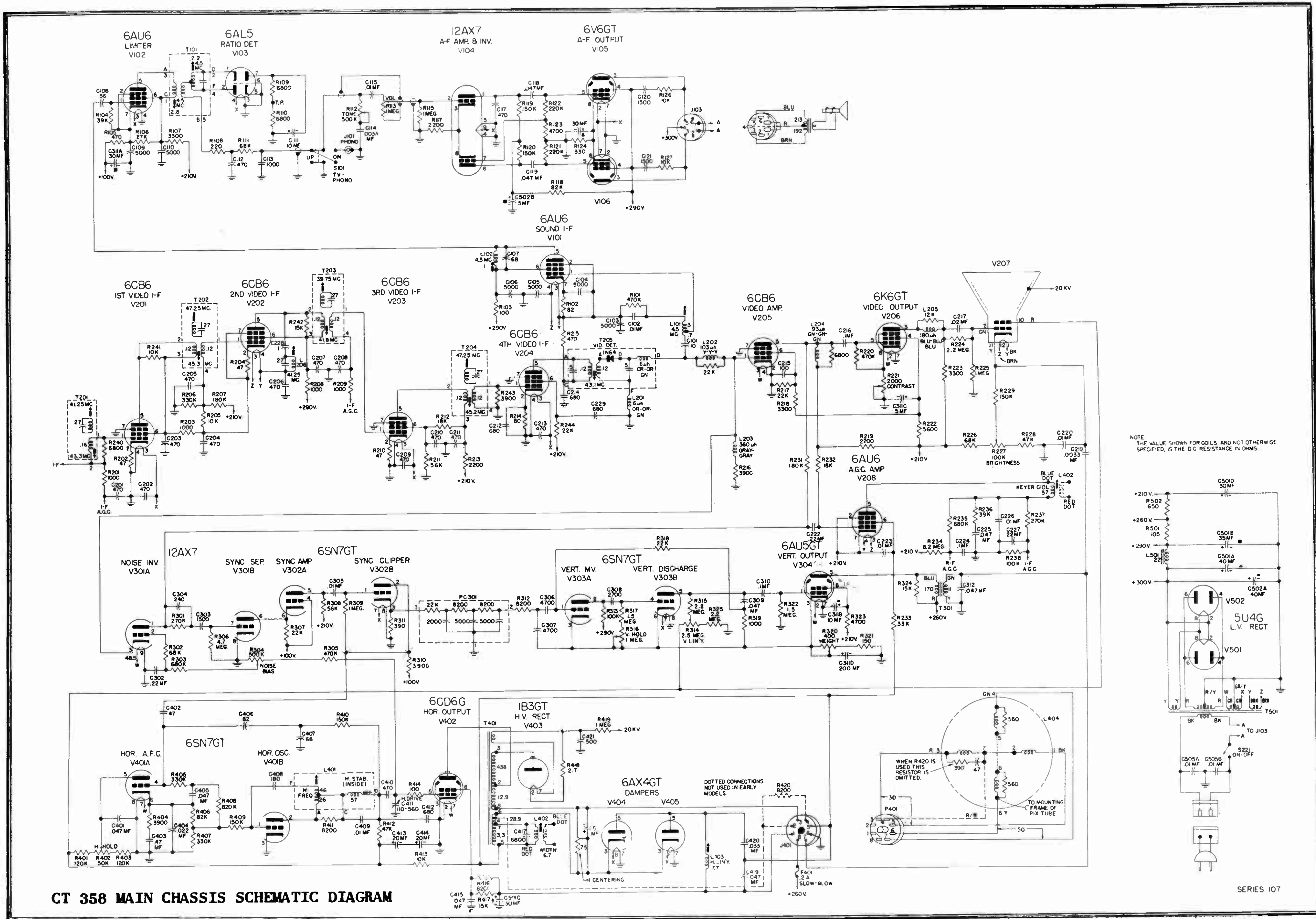
SYMBOL	DESCRIPTION	PART NO.
T101	Transformer, Ratio Detector	360482-1
T201	Coil & Trap, I.F. Input	360545-1
T202	Coil & Trap, 1st I.F.	360546-1
T203	Coil & Trap, 2nd I.F.	360546-1
T204	Coil & Trap, 3rd I.F.	360546-1
T205	Coil & Video Det. I.F.	360549-1
T301	Transformer, Vertical Output	330035-1
T401	Transformer, Horizontal Output & Hi Voltage used with 360556-1 Deflection Yoke	360552-1
	Transformer, Horizontal Output & Hi Voltage used with 360556-2 Deflection Yoke	360552-2
T501	Transformer, Power	300068-1
L101	Coil, 4.5 MC Sound Takeoff	360535-1
L102	Coil, 4.5 MC Sound I.F.	360481-1
L201	Coil, Peaking, 6 uh, Orange-Orange-Green	360443-23
L202	Coil, Peaking, 103 uh, Yellow-Yellow-Yellow	360443-24
L203	Coil, Peaking, 360 uh, Gray-Gray	360443-19
L204	Coil, Peaking, 93 uh, Green-Green-Green	360443-25
L205	Coil, Peaking, 180 uh, Blue-Blue-Blue	360443-26
L206	Trap Coil Assembly	360554-1
L401A,B	Transformer, Horizontal Oscillator	360499-3
L402A,B	Transformer, Keyer & Horizontal Width	360534-1
L403	Coil, Horizontal Linearity	360533-1
L404	Deflection Yoke used with 360552-1 Hi Voltage Transformer	360556-1
	Deflection Yoke used with 360552-2 Hi Voltage Transformer	360556-2
L501	Reactor Filter	320064-1
C101	Capacitor, Ceramic, 10 mmf., ± 10%, 500V	250207-3
C102	Capacitor, Ceramic, 10K mmf., GMV, 500V	250175-2
C103	Capacitor, Ceramic, 5000 mmf, GMV, 500V	250175-1
C104	Capacitor, Ceramic, 5000 mmf, GMV, 500V	250175-1
C105	Capacitor, Ceramic, 5000 mmf, GMV, 500V	250175-1
C106	Capacitor, Ceramic, 5000 mmf, GMV, 500V	250175-1
C107	Capacitor, Mica, 68 mmf, ± 10%, 500V	250159-80
C108	Capacitor, Mica, 56 mmf, ± 10%, 500V	250159-79
C109	Capacitor, Ceramic, 5000 mmf, GMV, 500V	250175-1
C110	Capacitor, Ceramic, 5000 mmf, GMV, 500V	250175-1
C111	Capacitor, Electrolytic, 10 mfd, 50V	270027-4
C112	Capacitor, Mica, 470 mmf, ± 10%, 500V	250159-90
C113	Capacitor, Ceramic, 1000 mmf, 350V	250088-46
C114	Capacitor, Paper, .0033 mfd, 600V	250201-4
C115	Capacitor, Paper, .01 mfd, 600V	250201-7
C117	Capacitor, Mica, 470 mmf, ± 10%, 500V	250159-90
C118	Capacitor, Paper, .047 mfd, 600V	250201-11
C119	Capacitor, Paper, .047 mfd, 600V	250201-11
C120	Capacitor, Paper, .0015 mfd, 600V	250201-2
C121	Capacitor, Paper, .0015 mfd, 600V	250201-2
C201	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C202	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C203	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C204	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C205	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C206	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C207	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C208	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C209	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C210	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C211	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C212	Capacitor, Ceramic, 680 mmf, 450V	250218-4
C213	Capacitor, Ceramic, 470 mmf, 450V	250175-9
C214	Capacitor, Ceramic, 680 mmf, 450V	250218-4
C215	Capacitor, Ceramic, 100 mmf, 500V	250207-46
C216	Capacitor, Paper, .1 mfd, 400V	250211-13
C217	Capacitor, Ceramic, 20K mmf, +80%, -20%, 450V	250175-7
C219	Capacitor, Paper, .0033 mfd, 600V	250201-4
C220	Capacitor, Paper, .01 mfd, 600V	250201-7
C222	Capacitor, Paper, .22 mfd, 200V	250202-15
C223	Capacitor, Paper, .01 mfd, 600V	250201-7
C224	Capacitor, Paper, .1 mfd, 200V	250202-13
C225	Capacitor, Paper, .047 mfd, 200V	250202-11
C226	Capacitor, Paper, .01 mfd, 600V	250201-7
C227	Capacitor, Paper, .22 mfd, 200V	250202-15
C228	Capacitor, Ceramic, 1 mmf, ± 10%, 500V	250209-114
C229	Capacitor, Ceramic, 680 mmf, 450V	250218-4
C302	Capacitor, Paper, .22 mfd, 200V	250202-15
C303	Capacitor, Ceramic, 1500 mmf, GMV, 500V	250175-3

SYMBOL	DESCRIPTION	PART NO.
C304	Capacitor, Mica, 240 mmf, ± 5%, 500V	250159-56
C305	Capacitor, Ceramic, 10K mmf, GMV, 500V	250175-2
C306	Capacitor, Paper, .0047 mfd, 600V	250201-5
C307	Capacitor, Paper, .0047 mfd, 600V	250201-5
C308	Capacitor, Mica, 2700 mmf, ± 5%, 500V	250160-48
C309	Capacitor, Paper, .047 mfd, 600V	250201-11
C310	Capacitor, Paper, .1 mfd, 600V	250201-13
C311	Capacitor, Electrolytic, 10-30-5 mfd, 350V -200 mfd, 25V	270021-46
C312	Capacitor, Paper, .047 mfd, 600V	250201-11
C401	Capacitor, Paper, .047 mfd, 600V	250201-11
C402	Capacitor, Mica, 47 mmf, 500V	250159-78
C403	Capacitor, Paper, .47 mfd, 200V	250202-17
C404	Capacitor, Paper, .022 mfd, 200V	250202-9
C405	Capacitor, Paper, .047 mfd, 200V	250202-11
C406	Capacitor, Mica, 82 mmf, ± 10%, 500V	250159-81
C407	Capacitor, Mica, 68 mmf, ± 10%, 500V	250159-80
C408	Capacitor, Mica, 150 mmf, ± 5%, 500V	250159-51
C409	Capacitor, Mica, .01 mfd, 300V	250161-47
C410	Capacitor, Mica, 470 mmf, ± 10%, 500V	250159-90
C411	Capacitor, Variable, Mica Dielectric 110-560	260116-1
C412	Capacitor, Mica, 680 mmf, ± 10%, 500V	250159-131
C413	Capacitor, Electrolytic, 20 mfd, 350V	270027-20
C414	Capacitor, Electrolytic, 20 mfd, 350V	270027-20
C415	Capacitor, Paper, .047 mfd, 600V	250201-11
C417	Capacitor, Paper, .0068 mfd, 600V	250201-6
C418	Capacitor, Paper, .033 mfd, 600V	250201-10
C419	Capacitor, Paper, .047 mfd, 600V	250201-11
C420	Capacitor, Paper, .033 mfd, 600V	250201-10
C421	Capacitor, Hi Voltage, 500 mmf, +50%, -20%, 30KV	250189-2
C501	Capacitor, Electrolytic, 40-35-30-30 mfd, 350V	270021-43
C502	Capacitor, Electrolytic, 40-5 mfd, 350V 30 mfd, 25V	270021-49
C505	Capacitor, Ceramic, Dual, 10K mmf, GMV, 500V	250217-3
R101	Resistor, Carbon, 470K ohms, 1/2W	230104-94
R102	Resistor, Carbon, 82 ohms, 1/2W	230104-49
R103	Resistor, Carbon, 100 ohms, 1/2W	230104-50
R104	Resistor, Carbon, 39K ohms, 1/2W	230104-81
R105	Resistor, Carbon, 470 ohms, 1/2W	230104-58
R106	Resistor, Carbon, 27K ohms, 1/2W	230104-79
R107	Resistor, Carbon, 3300 Ohms, 1/2W	230104-68
R108	Resistor, Carbon, 220 Ohms, 1/2W	230104-54
R109	Resistor, Carbon, 6800 ohms, 1/2W	230104-72
R110	Resistor, Carbon, 6800 ohms, 1/2W	230104-72
R111	Resistor, Carbon, 68K ohms, 1/2W	230104-84
R112	Potentiometer, Variable (Tone) 500K ohms, 1/4W	220126-28
R113	Potentiometer, Variable (Vol.) 1 Meg. 1/4W	220126-25
R115	Resistor, Carbon, 1 Megohm, 1/2W	230104-98
R117	Resistor, Carbon, 2200 ohms, 1/2W	230104-66
R118	Resistor, Carbon, 82K ohms, 1/2W	230104-85
R119	Resistor, Carbon, 150K ohms, 1/2W	230104-88
R120	Resistor, Carbon, 150K ohms, 1/2W	230104-88
R121	Resistor, Carbon, 220K ohms, 1/2W	230104-90
R122	Resistor, Carbon, 220K ohms, 1/2W	230104-90
R123	Resistor, Carbon, 4700 ohms, 1/2W	230104-70
R124	Resistor, Carbon, 330 ohms, 2W	230106-56
R126	Resistor, Carbon, 10K ohms, 1W	230105-74
R127	Resistor, Carbon, 10K ohms, 1W	230105-74
R201	Resistor, Carbon, 1000 ohms, 1/2W	230104-62
R202	Resistor, Carbon, 47 ohms, 1/2W	230104-46
R203	Resistor, Carbon, 1000 ohms, 1/2W	230104-62
R204	Resistor, Carbon, 47 ohms, 1/2W	230104-46
R205	Resistor, Carbon, 10K ohms, 1/2W	230104-74
R206	Resistor, Carbon, 330K ohms, 1/2W	230104-92
R207	Resistor, Carbon, 180K ohms, 1/2W	230104-89
R208	Resistor, Carbon, 1000 ohms, 1/2W	230104-62
R209	Resistor, Carbon, 1000 ohms, 1/2W	230104-62
R210	Resistor, Carbon, 47 ohms, 1/2W	230104-46
R211	Resistor, Carbon, 56K ohms, 1/2W	230104-83
R212	Resistor, Carbon, 18K ohms, 1/2W	230105-66
R214	Resistor, Carbon, 180 ohms, 1/2W	230104-53
R215	Resistor, Carbon, 470 Ohms, 1/2W	230104-58
R216	Resistor, Carbon, 3900 ohms, 1/2W	230104-69
R217	Resistor, Carbon, 22K ohms, 1W	230105-78
R218	Resistor, Carbon, 3300 ohms, 1/2W	230104-68
R219	Resistor, Carbon, 2200 ohms, 1W	230105-66
R220	Resistor, Carbon, 470K ohms, 1/2W	230104-94
R221	Potentiometer, (Contrast With Switch) 2000 ohms, 2W	220126-30

SYMBOL	DESCRIPTION	PART NO.
R222	Resistor, Carbon, 5600 ohms, 2W	230106-71
R223	Resistor, Wire Wound, 3300 ohms, ± 5%, 10W	240021-31
R224	Resistor, Carbon, 2.2 Megohm, 1/2W	230104-102
R225	Resistor, Carbon, 1 Megohm, 1/2W	230104-98
R226	Resistor, Carbon, 68 ohms, 1/2W	230104-84
R227	Potentiometer, (Brightness) 100K ohms, 1/4W	220126-31
R228	Resistor, Carbon, 47K ohms, 1/2W	230104-82
R229	Resistor, Carbon, 150K ohms, 1/2W	230104-88
R231	Resistor, Carbon, 180K ohms, 1/2W	230104-89
R232	Resistor, Carbon, 18K ohms, 1/2W	230104-77
R233	Resistor, Carbon, 33K ohms, 1/2W	230104-80
R234	Resistor, Carbon, 8.2 Megohm, 1/2W	230104-109
R235	Resistor, Carbon, 680K ohms, 1/2W	230104-96
R236	Resistor, Carbon, 39K ohms, 1/2W	230104-81
R237	Resistor, Carbon, 270K ohms, 1/2W	230104-91
R238	Resistor, Carbon, 100K ohms, 1/2W	230104-86
R240	Resistor, Carbon, 6800 ohms, 1/2W	230104-72
R241	Resistor, Carbon, 10K ohms, 1/2W	230104-74
R242	Resistor, Carbon, 15K ohms, 1/2W	230104-76
R243	Resistor, Carbon, 3900 ohms, 1/2W	230104-69
R244	Resistor, Carbon, 22K ohms, ± 10%, 1/2W	230104-78
R301	Resistor, Carbon, 270K ohms, 1/2W	230104-91
R302	Resistor, Carbon, 68K ohms, 1/2W	230104-84
R303	Resistor, Carbon, 680K ohms, 1/2W	230104-96
R304	Potentiometer, (Noise Bias) 500K, 1/4W	220126-35
R305	Resistor, Carbon, 470K ohms, 1/2W	230104-94
R306	Resistor, Carbon, 4.7 Megohm, 1/2W	230104-106
R307	Resistor, Carbon, 22K ohms, 1/2W	230104-78
R308	Resistor, Carbon, 56K ohms, 1/2W	230104-83
R309	Resistor, Carbon, 1 Megohm, 1/2W	230104-98
R310	Resistor, Carbon, 3900 ohms, 1/2W	230104-69
R311	Resistor, Carbon, 390 ohms, 1/2W	230104-57
R312	Resistor, Carbon, 8200 ohms, 1/2W	230104-73
R313	Resistor, Carbon, 100K ohms, 1W	230105-86
R314	Potentiometer, (Vertical Linearity) 2.5 Megohm, 1/4W	220076-5
R315	Resistor, Carbon, 2.2 Megohm, 1/2W	230104-102
R316	Potentiometer, (Vertical Hold) 1 Megohm, 1/4W	220126-32
R317	Resistor, Carbon, 1.5 Megohm, 1/2W	230104-100
R318	Resistor, Carbon, 22K ohms, 1/2W	230104-78
R319	Resistor, Carbon, 1000 ohms, 1/2W	230104-62
R320	Potentiometer, (Vertical Height) 400 ohms, 2W	220126-34
R321	Resistor, Carbon, 150 ohms, 1W	230105-52
R322	Resistor, Carbon, 1.5 Megohm, 1/2W	230104-100
R323	Resistor, Carbon, 4700 ohms, 1W	230105-70
R324	Resistor, Carbon, 15K ohms, 1W	230105-76
R325	Resistor, Carbon, 2.2 Megohm, 1/2W	230104-102
R401	Resistor, Carbon, 120K ohms, 1/2W	230104-87
R402	Potentiometer, (Horizontal Hold) 50K ohms, 1/4W	220126-33
R403	Resistor, Carbon, 120K ohms, 1/2W	230104-87
R404	Resistor, Carbon, 3900 ohms, 1/2W	230104-69
R405	Resistor, Carbon, 330K ohms, 1/2W	230104-92
R406	Resistor, Carbon, 82K ohms, 1/2W	230104-85
R407	Resistor, Carbon, 330K ohms, 1/2W	230104-92
R408	Resistor, Carbon, 820K ohms, 1/2W	230104-97
R409	Resistor, Carbon, 150K ohms, 1/2W	230104-88
R410	Resistor, Carbon, 150K ohms, 1/2W	230104-88
R411	Resistor, Carbon, 8200 ohms, 1/2W	230104-73
R412	Resistor, Carbon, 47K ohms, 1W	230105-82
R413	Resistor, Carbon, 10K ohms, 1W	230105-74
R414	Resistor, Carbon, 100 ohms, 1/2W	230104-50
R416	Resistor, Carbon, 8200 ohms, 2W	230106-73
R417	Resistor, Carbon, 15K ohms, 1W	230105-76
R418	Resistor, Carbon, 2.7 ohms, ± 10%, 1W	230107-2
R419	Resistor, Carbon, 1 Megohm, 1W	230105-98
R420	Resistor, Carbon, 8200 ohms, 1/2W	230104-73
R501	Resistor, Wire Wound, 105 ohms, ± 5%, 15W	240021-34
R502	Resistor, Wire Wound, 650 ohms, ± 5%, 10W	240021-33
PC301	Printed Circuit	250186-1
J101	Socket, Phono	180466-1
J103	Socket, Speaker, 7 Pin	180504-16
J401	Socket, Yoke	
J501	Socket, A.C.	180476-1
F401	Fuse, 20A, Slow-Blow	180530-1
S101	Switch, Phono	160229-1
	Beam Corrector	360557-1
	Tuner, R.F.	700379-21
	Ion Trap	360492-2
	Acceptable substitute	360492-4



700379
RF Tuner



CT 358 MAIN CHASSIS SCHEMATIC DIAGRAM

General Information

POWER SUPPLY—These receivers are designed to operate from a power source of 117 volts at 60 cycles A.C. It will, however, operate satisfactorily from a line whose voltage is no lower than 105 volts, or no greater than 125 volts at 60 cycles A.C. Always measure the voltage of the line with a dependable a-c voltmeter if it is suspected that the line voltage is beyond the above acceptable limits.

TUBES—In all receivers, all tubes, including the picture tube, are shipped properly mounted in their sockets. Check to see that all tubes are firmly seated since some may have worked loose during shipment. See Picture Tube Handling Precautions below.

ANTENNA—The installation and orientation of an antenna is one of the most important single factors in realizing optimum performance from a television receiver. An improperly oriented, or poorly matched, or unwisely chosen antenna can completely offset the good design engineered into these television receivers. For these reasons, choose, locate and install your antenna carefully, especially in poor signal areas. All receivers in these series are equipped with a built-in antenna which performs satisfactorily in locations where good signal strength is available, and where a minimum of noise is present.

When an outdoor antenna must be installed, use a standard, approved antenna, having a 300 ohm impedance, and match it with a balanced 300 ohm transmission line. Orient the antenna for maximum signal strength from the greatest number of stations, and for the minimum amount of interference and reflection. Where the receiver is tc be installed beyond the range of good signal strength (about 30 miles) use a stacked array, being careful to match the impedance of the antenna, transmission line, and receiver (300 ohms). If additional gain is required, try a "booster" for improvement of signal-to-noise ratio.

In critical locations, where the receiver is surrounded by several stations, most of which are located beyond the 30 mile radius, a careful appraisal of the terrain and the measurement of field strength will usually yield acceptable television operation where a haphazard installation might have failed. To make full use of the directional and "gain" properties of a stacked array and booster, the following procedure is recommended:

1. Measure the field-strength of the transmitted signal from each of the desired stations on a calibrated field-strength meter.
2. Tabulate your results and conclude which stations are within reasonable quality distance. A field-strength of 300 microvolts-per-meter or higher will give acceptable results. A field-strength measurement of 100 microvolts-per-meter or lower may not be satisfactory without the use of a "booster."
3. Let the consumer decide which of the acceptable channels he desires, and orient the antenna to receive maximum signal from those desired stations.
4. Always twist the 300 ohm lead-in about once for every foot of length to minimize transmission line noise pick-up.

PICTURE TUBE HANDLING PRECAUTIONS

Extreme care should be used in handling the picture tube. The picture tube bulb encloses a high vacuum and, due to its large surface area is subjected to considerable air pressure. The front of the picture tube, particularly the rim of the viewing surface, must not be struck, scratched, or subjected to more than moderate pressure at any time. If the yoke sticks or fails to slip smoothly over the tube or its socket, check and remove the cause of the trouble. Do not under any circumstances force the yoke.

HIGH VOLTAGE WARNING

OPERATION OF THIS RECEIVER WITH INTERLOCKED BACK COVER REMOVED INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THIS RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT.

IMPORTANT—With the exception of the next paragraph, all information pertains to 16", 17", 20" and 21" screen receivers.

IMPORTANT

The Series 112 and 113 Television Receivers are shipped with the ion trap (beam bender) and centering magnet taped to the neck of the electrostatic-focus picture tube. These components are very carefully adjusted and then taped to prevent accidental movement during shipment. The adjustment of the ion trap is especially critical in the electrostatic-focus type of picture tube. The electron gun of the picture tube can be damaged within seconds as a result of a misadjusted ion trap. **DO NOT READJUST THE ION TRAP UNLESS ABSOLUTELY NECESSARY.** If adjustment is required read the instructions in paragraph B of the Service Adjustments on page 3 before turning the receiver on.

BUILT-IN ANTENNA INSTALLATION

This receiver is shipped with the built-in antenna completely connected. A few precautions should be observed, upon installing this receiver, if optimum performance is to be obtained.

1. Try to locate the receiver in such a position so that:
   a) All requirements for good viewing position and ventilation are satisfied.
   b) It is near a 105-125 volt 60 cycle A.C. power outlet.
   c) The back of the receiver is parallel and close to a window which faces in the general direction of the transmitters.
   d) It is not adjacent to a street having heavy automobile traffic which may cause ignition interference.
2. After performing the Service Adjustments outlined on the following pages, try a few stations and observe if their signals are received with sufficiently good quality so that the receiver may be left in this position.
3. If signal strength and noise conditions are known to be good and operation is not satisfactory, it may be best to try a new receiver location, choosing one where the receiver will be rotated 90 degrees relative to its former position.

If, however, it is found that the receiver is not permitted to perform at its best because of limitations of the built-in antenna in a noisy or weak-signal area, an outdoor antenna should be installed.

To connect an outdoor antenna to this receiver:

1. Loosen the two screws on the antenna terminal strip.
2. Disconnect the existing built-in antenna wires.
3. Connect the 300 ohm lead-in from the external antenna to the terminals and tighten the screws.

SERVICE ADJUSTMENTS

Below is given a description of the steps required in adjustment of the Beam Bender and Deflection Yoke and the adjustment of the Focus, Vertical Size and Linearity and Horizontal Size, Linearity, Drive and A.F.C. controls. However, it should be remembered that these adjustments are to be made only when picture quality is such that service adjustment is warranted. Use this description as a check-list and if a particular phase of quality is good, leave it alone and go on to the next operation. Refer to figure 1 for location of front panel controls, and to figure 7 on the schematic diagram for location of rear panel controls.

IMPORTANT—The adjustment of the Beam Bender (Ion Trap magnet) must be performed immediately after the receiver warms up. If any length of time is permitted to elapse while the receiver is on, and while the Beam Bender is misadjusted, serious damage to the internal structure of the cathode-ray gun may result.

A. PREPARATION FOR SERVICE ADJUSTMENTS

1. Remove the eight slotted-head wood screws and the one hex-head P.K. screw adjacent the line cord bracket, disengage the interlock, and remove the back and the line cord.
2. Drop hinged door on front panel for access to the auxiliary controls as illustrated in Fig. 1. The lower set of these controls is adjusted by means of a narrow shanked screwdriver.
3. Connect a substitute interlock line cord between receiver and suitable power outlet and turn on the receiver allowing about 30 seconds of warm-up period before proceeding. Keep the BRIGHTNESS control turned fully counter-clockwise.

B. BEAM BENDER (ION TRAP) ADJUSTMENT

1. Position the beam bender on the glass neck approximately ½" from the picture tube base.
2. Advance the BRIGHTNESS control almost fully clockwise.
3. Starting from this position, adjust the Beam Bender by moving it forward or backward, and at the same time rotating it slightly around the neck of the tube until the brightest raster appears on the screen. If two maximum brightness positions are found, the one nearest the tube base is the correct setting. This adjustment should be done quickly to avoid damaging the gun structure.
4. Adjust the BRIGHTNESS control to maximum, fully clockwise.
5. Re-adjust the Beam Bender carefully for maximum raster brilliance.
6. The Beam Bender must be adjusted at all times for maximum brightness. A misadjusted Beam Bender can damage the picture tube in a matter of seconds and it is of utmost importance to make this the first adjustment when the set is turned on and the last adjustment before the cabinet back is reinstalled.

C. DEFLECTION YOKE AND PICTURE CENTERING ADJUSTMENT

1. Loosen the wing thumb screw located at the top of the deflection yoke frame.
2. Check to see that the deflection yoke mounting bracket rubber cushions press firmly against the flare of the tube.
3. Press the yoke firmly against the flare of the tube. An improperly positioned yoke will cause shadows on the corners of the raster. This indicates that the electron beam is striking the neck of the picture tube.
4. Rotate the yoke until the lines of the raster are horizontal and squared with the picture mask, and tighten the wing screw.
5. Position the centering magnet assembly approximately ½" to ¾" behind the yoke. Centering is accomplished by rotating the small horizontal shaft. When the shaft of the magnet is above the tube vertical centering results, if the entire magnet assembly is rotated on the picture tube neck. until the shaft is on either side of the neck, it will center horizontally. When both vertical and horizontal centering is necessary, rotate the magnet assembly while rotating the small magnet shaft. Improper adjustment may cause neck shadow. Check the yoke position as described in 3 above. Then readjust the centering magnet for proper centering without neckshadow. Readjust the Beam Bender for maximum brightness.

4. Adjust the focus control (see Fig. 1) so that the lines of the raster are sharp and distinct over the greatest screen area.

E. HORIZONTAL A.F.C. ADJUSTMENT

In order to check this adjustment tune in a station, preferably one that is transmitting a test pattern. If difficulty is encountered in locking the picture horizontally or if it locks-in only when the Horizontal Hold Control is at either end of its rotation, adjust the Horizontal A.F.C. Control as follows:

1. Turn CONTRAST down about half way.
2. Turn HORIZONTAL HOLD CONTROL fully counterclockwise.
3. If the picture is not locked in, turn the HORIZONTAL A.F.C. control till it does lock-in. (See Fig. 7)
4. Momentarily interrupt the signal by switching the channel selecter off channel and then back. The picture should just fall out of sync. If it does not, turn the Horizontal A.F.C. adjustment screw slightly clockwise and again momentarily interrupt the signal. Continue this procedure until the picture just falls out of sync. only when the signal is interrupted.
5. Rotate the Horizontal Hold Control clockwise until the picture falls into sync. The picture should now stay in sync. throughout most of the range of the Horizontal Hold Control.
6. If the picture cannot be made to hold sync., carefully repeat the above procedure. If difficulty is still encountered, it may be necessary to make a complete alignment of the horizontal oscillator transformer using an oscilloscope, as described on page .

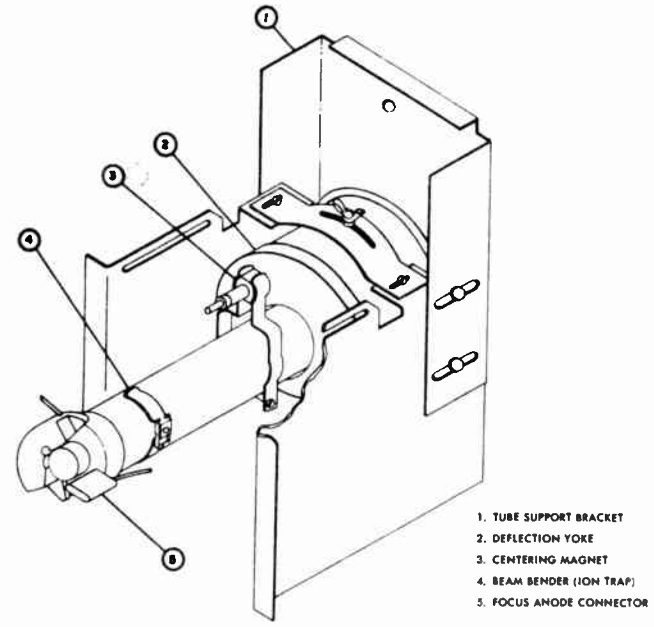


FIG. 2. DEFLECTION YOKE AND CENTERING MAGNET ASSEMBLY

F. PICTURE, SIZE AND LINEARITY

1. Adjust the VERTICAL SIZE and VERTICAL LINEARITY controls until the test pattern is vertically linear and symmetrical from top to bottom, and fills the mask. Adjustment of either control may require readjustment of the other. If vertical synchronization "falls-out," readjust the VERTICAL HOLD control. (Refer to Fig. 1)
2. Adjust the HORIZONTAL SIZE control slotted screw, located at the rear of the High Voltage cage at the rear of the chassis, for correction of horizontal width. The large outer arcs of the test pattern should coincide with the edge of the picture mask. (Refer to fig 7)
3. Adjust the HORIZONTAL DRIVE control trimmer for horizontally symmetrical pattern, and elimination of any existing vertical bars in left center of picture. The final adjustment should have the control at least ½ turn counterclockwise from the maximum clockwise position. (See Fig. 7)
4. The readjustment of the HORIZONTAL A.F.C. control may now be necessary.
5. Adjust the HORIZONTAL LINEARITY control slotted screw, located at the rear of the High Voltage cage, for central alignment of the inner circles of the test pattern.

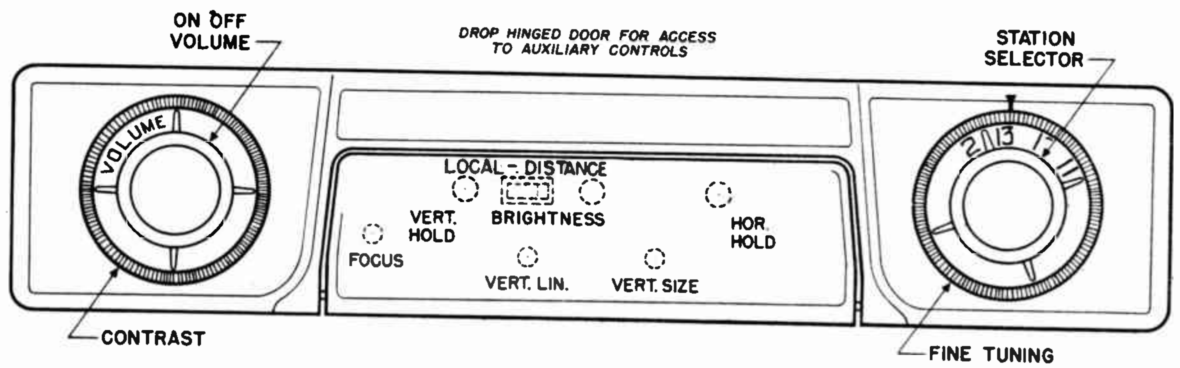


FIG. 1. FRONT PANEL ADJUSTMENTS

D. FOCUSING ADJUSTMENTS

1. Adjust BRIGHTNESS and CONTRAST controls so that the raster brilliance corresponds to that of an average picture.
2. Adjust focus control for best focus. Some electrostatic tubes will focus properly over the entire range of the focus control. This is no defect, it merely indicates an exceptionally well balanced gun structure.
3. Readjust the Beam Bender for maximum brightness.

Alignment Instructions

Video I-F and Sound Alignment Procedure

TV I-F ALIGNMENT

1. Tune receiver to quiet portion of TV High Band.
2. Set contrast control fully counterclockwise.
3. Apply 3 v. negative bias between the A.G.C. bus (at C22A) and ground. (Use 2—1½ v. cells.)
4. Connect TV I-F Signal Generator through a 1500 MMF condenser to Test Point (A) of tuner unit; low side to ground. (See schematic diagram.)
5. Connect negative lead of V.T.V.M. (or meter of 20,000 ohms-per-volt, or better) to 4.7K diode load resistor TEST POINT (B); positive lead to ground. (See schematic diagram.)
6. Feed 23.2 MC [23.3]* (±.05 MC) from Signal Generator and adjust T4 for maximum deflection on meter. Maintain Signal Generator output so low that meter reads no more than 1.5 volts at peak.
7. Feed 21.8 MC [21.8]* (±.05 MC) from Signal Generator, and adjust T3 as above.
8. Feed 24.0 MC [23.9]* (±.05 MC) from Signal Generator, and adjust T2 as above.
9. Feed 24.7 MC [24.5]* (±.05 MC) from Signal Generator, and adjust T1 as above.
10. Replace the meter with the vertical input of an Oscilloscope through a 10K isolating resistor, low side to ground.
11. Remove Signal Generator. Feed a video I-F Sweep Generator (20 to 28MC) through loosely coupled shield of 6J6 converter tube, making sure shield is not grounded. (Refer to Fig. 3.)
12. Loosely couple high side of a TV I-F Marker Generator to the high Sweep Generator Lead; low side to ground.
13. Feed I-F Sweep, and observe response on 'scope. (See Fig. 5.) Use marker frequencies 20.25, 21.75 and 24.75 MC.
14. If response does not approximate that shown in Fig. 5, repeat steps 3 to 9, making sure that frequencies are precise, and that the Signal Generator output voltage is kept low. Continue with steps 10 to 13. A slight touch-up of individual slugs may be required to approximate the recommended curve of Fig. 5.

*NOTE: If 3v fixed bias is unavailable and zero fixed bias is used, set signal generator at [ ] bracketed frequencies values.

TV SOUND ALIGNMENT

1. Connect a 4.5 MC Signal Generator (±.01 MC) through a 1500 MMF condenser to the 4.7K video diode load resistor TESTPOINT (B); low side to ground. See schematic diagram.

2. Obtain two resistors of approximately 100,000 ohms each, whose resistances have been matched accurately with an ohmmeter. Connect them in series across the 18K resistor (R107) at the 6T8 tube socket (V9A).

3. Connect negative lead of V.T.V.M. to junction of matched resistors of step 2; positive lead to ground.

4. Feed 4.5MC (±.01 MC) from signal generator, and adjust L22, sound take-off coil, for maximum deflection on V.T.V.M. Two points of maximum deflection may be found when making this adjustment. Correct adjustment is attained when screw is at most outward maximum reading position.

5. Adjust the bottom slug of T10 for maximum deflection on V.T.V.M.

6. Connect positive lead of V.T.V.M. to junction of C96, and R106 TEST POINT (C), leaving negative lead of V.T.V.M. connected as in step 3. See schematic diagram.

7. Adjust top of T10 for zero output on V.T.V.M. between two opposite polarity peaks.

IMPORTANT: Keep the sweep generator and marker generator outputs at minimum to avoid curve distortion. Marker pips should be kept barely visible.

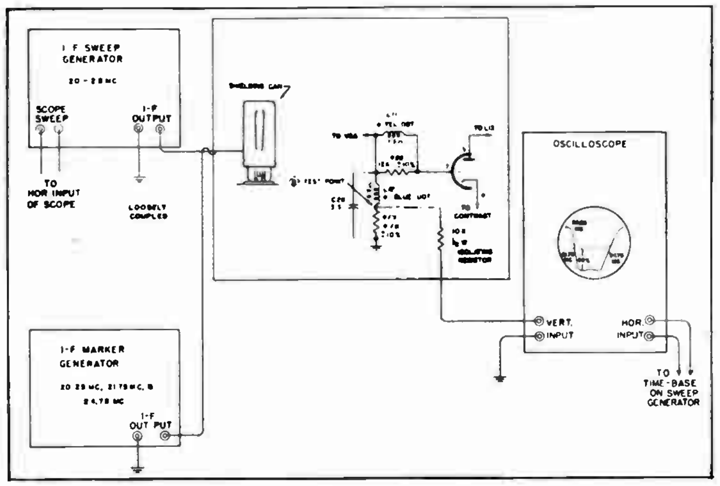


FIG. 3. IF ALIGNMENT BLOCK DIAGRAM

TABLE I RF ALIGNMENT FREQUENCIES			
CHANNEL NUMBER	SWEEP GEN. CENTER FREQ. (10MC.SWEEP)	MARKER GENERATOR FREQUENCIES	
		VIDEO CARRIER	SOUND CARRIER
2	57 MC.	55.25 MC.	59.75 MC.
3	63 MC.	61.25 MC.	65.75 MC.
4	69 MC.	67.25 MC.	71.75 MC.
5	79 MC.	77.25 MC.	81.75 MC.
6	85 MC.	83.25 MC	87.75 MC.
7	177 MC.	175.25 MC.	179.75 MC.
8	183 MC.	181·25 MC.	185.75 MC.
9	189 MC.	187.25 MC.	191.75 MC.
10	195 MC.	193·25 MC.	197.75 MC.
11	201 MC.	199·25 MC.	203.75 MC.
12	207 MC.	205.25 MC.	209.75 MC.
13	213 MC.	211,25 MC.	215.75 MC.

R.F. and Oscillator Alignment

(STANDARD COIL TUNER)

R.F. ALIGNMENT

1. Connect TV Sweep Generator to Antenna Terminals.
2. Connect R.F. Marker Generator loosely to Antenna Terminals.
3. Connect vertical amplifier of Oscilloscope through a 10,000 ohm ½w. resistor to Test Point (A) fig 6.
4. Short A.G.C. Bus to ground on TV chassis (across C22A 5000 MMF Discap condenser).
5. Set Station Selector switch to Channel 12.
6. Feed 207 mc at 10 mc sweep from Sweep Generator, and 205.25 mc and 209.75 mc fixed frequencies from R.F. Marker Generator.
7. Observe response curve on Scope. If necessary adjust C2, C4, or C7 (See fig. 6) so that response curve corresponds approximately to that shown in fig. 5 and has maximum gain.
8. Check markers on response curve of all remaining channels, setting Sweep and Marker Generators at corresponding frequencies for each channel. See Table I for convenient tabulation of proper frequencies. If the R.F. Markers do not fall in automatically in their proper places on all channels, a compromise must be made by slight readjustment of C2, C4, or C7.

OSCILLATOR ALIGNMENT

1. Connect TV R.F. Sweep Generator to Antenna Terminals.
2. Couple R.F. Marker Generator loosely to Antenna Terminals.
3. Connect vertical amplifier of Oscilloscope across the video amplifier grid and ground (Pin 7 of 12BH7, V7A).
4. Couple 24.75 mc video I.F. Marker Generator loosely to first I.F. grid (Pin 1 of 6CB6, V3).
5. Rotate Fine Tuning control to center of range.
6. Set Station Selector switch to Channel 12.
7. Set Sweep Generator to 207 mc at 10 mc sweep and Marker Generator to 205.25 mc (video carrier).
8. Observe response curve and adjust C10 (fig. 6) for Zero-beat with 24.75 marker. Zero-beat is indicated by an unmistakable break-up of the observed response curve.

   NOTE: Quality of response curve does not affect accuracy of oscillator alignment, so long as a zero-beat is obtained.

9. Check for zero-beat on all channels in this manner, setting the Station Selector, Sweep Generator and Marker Generator at corresponding frequencies. (See Table I.) It is not usually necessary to make any further adjustments. However, if the individual oscillator coils must be touched-up, the following procedure should be employed:
   a) Rotate Fine Tuning control to center of range.
   b) Set Station Selector to desired channel, Sweep Generator to its center frequency with 10 mc sweep, R.F. Marker Generator to the corresponding video carrier frequency (See Table I), and I.F. Marker Generator at 24.75 mc.
   c) Place a non-metallic screwdriver through the opening marked 'Recessed Individual Osc. Adjustment', fig. 6, and adjust oscillator coil zero-beat with 24.75 mc marker on response curve.
   d) This adjustment can be repeated on any single channel, or, if necessary, on all channels.
   e) If difficulty is encountered in tuning any particular channel well within limits of Fine Tuning control after these adjustments are made, readjust C10 slightly (as in Step 8) shifting the whole range of frequencies in the desired direction.

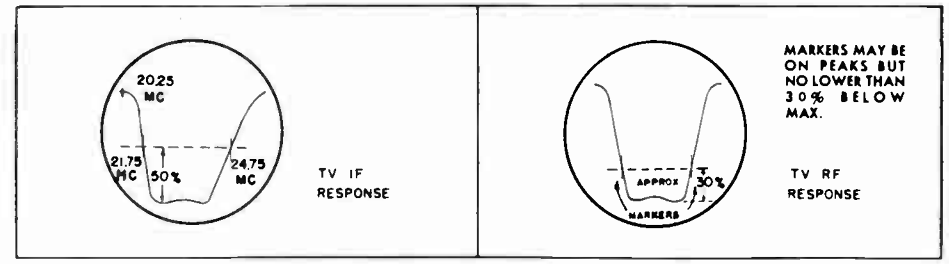


FIG. 5. RECOMMENDED RESPONSE CURVES.

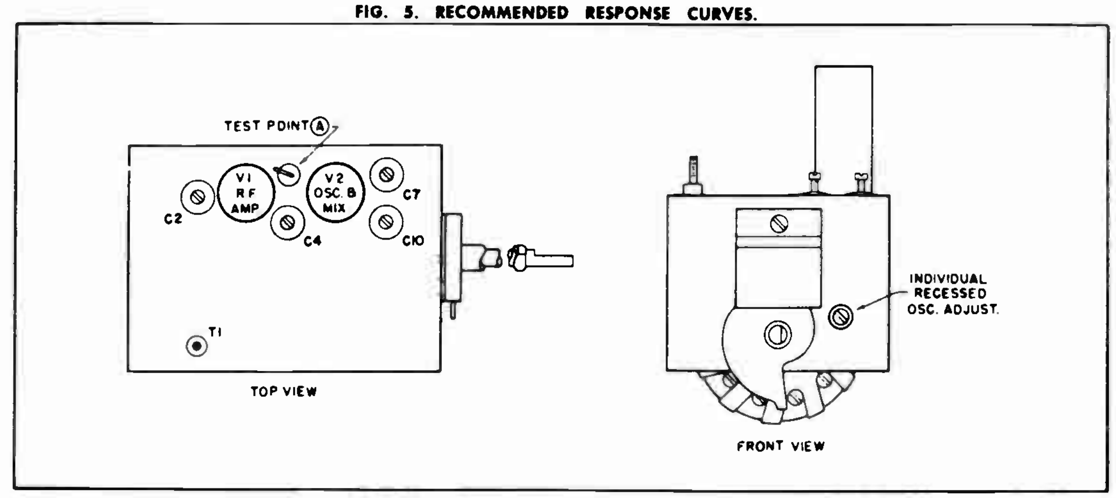
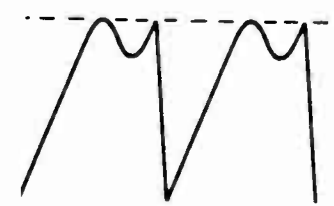


FIG. 6. R.F. TUNER ADJUSTMENT POINTS (STANDARD COIL TUNER)

HORIZONTAL OSCILLATOR TRANSFORMER ALIGNMENT

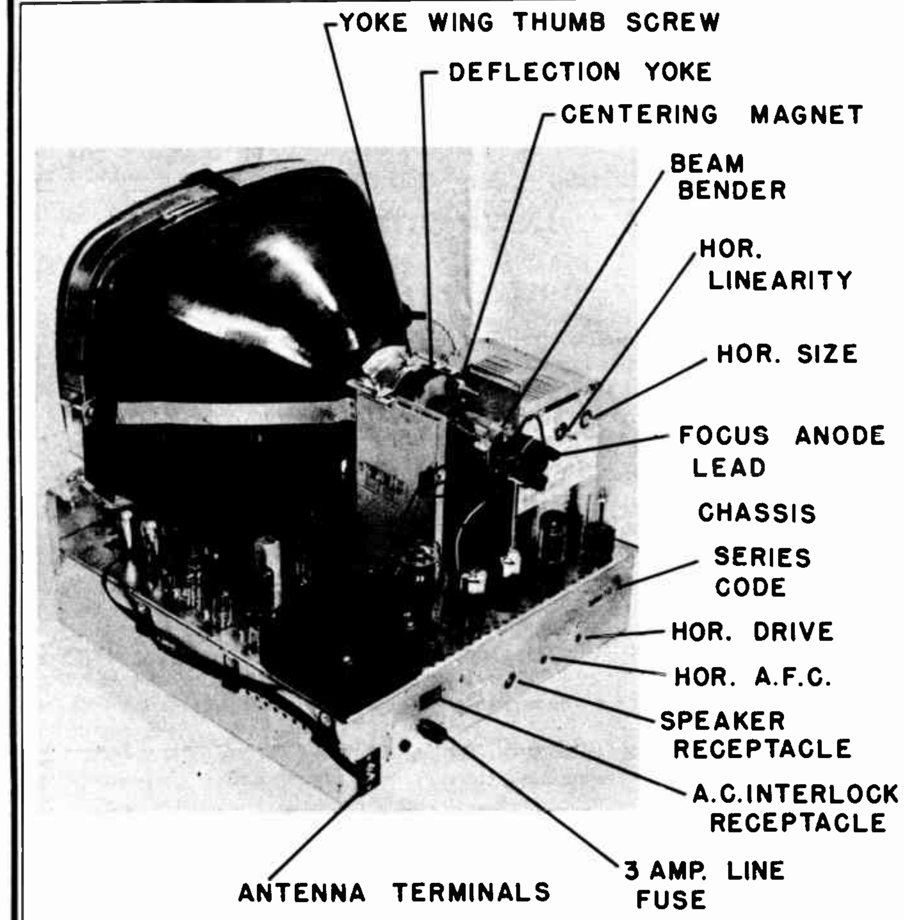
Refer to Service Adjustment "E" before proceeding with this alignment.

1. Tune in a TV station, preferably one that is transmitting a test pattern.
2. If after attempting the Horizontal A.F.C. Service Adjustment, described above, the picture cannot be made to sync. pre-set the Horizontal Stabilizing adjustment (inner slug of T8, beneath chassis) 5 turns in from its maximum out position.
3. Set the Horizontal Hold control to the center of its range and adjust the Horizontal A.F.C. adjustment until the picture is in sync.
4. Connect a low capacity probe of an oscilloscope to terminal "C" of the Horizontal oscillator transformer, T8; low side to ground. Set horizontal sweep to 7875 C.P.S. If a low capacity probe is unavailable, connect a 10K resistor in series with the vertical scope lead.
5. Adjust the Horizontal Stabilizing brass slotted screw until the broad and narrow peaks of the pattern on the oscilloscope are of equal height. (See illustration.) During Horizontal Stab. adjustment, picture must be kept in sync. by adjusting the Horizontal A.F.C. adjustment, if necessary.
6. Disconnect oscilloscope and follow Service Adjustment E above.



TUBE COMPLEMENT AND VOLTAGE CHART — SERIES 112-113

Symbol	Function	Tube Type	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	RF Amp.	6AG5/6BC5/6CB6	−.75	0	6.3AC	0	75	72	0	—	—
V2	Osc.-Mixer	6J6	64	49	6.3AC	0	−1.7	−3.6	0	—	—
V3	1st Video IF.	6CB6	−.9	.4	0	6.3AC	93	96	0	—	—
V4	2nd Video IF.	6CB6	−.8	.37	0	6.3AC	94	97	0	—	—
V5	3rd Video IF.	6AU6	0	0	0	6.3AC	95	98	.9	—	—
V6	AGC and Video Det.	6AL5	0	−.8	6.3AC	0	0	0	−.4	—	—
V7	Video Amp.	12BH7	98	−.2	0	6.3AC	6.3AC	78	−.4	.8	0
V8	Sound IF Amp.	6AU6	0	0	0	6.3AC	94	94.5	.6	—	—
V9	Ratio Det. and AF Amp.	6T8	−.5	−.8	−.5	6.3AC	0	0	0	−.6	40
V10	Audio Output	6K6	NC	0	208	224	0	224	6.3AC	14	—
V11	Sync Sep.-Amp.	6SN7	0	28	2.8	28	75	28	6.3AC	0	—
V12	Vertical Osc.	6C4	200	0	0	6.3AC	200	−43	0	—	—
V13	Vertical Output	6V6	NC	6.3AC	240	345	0	NC	0	28V	—
V14	Horizontal Osc.-Control	6SN7	−7	190	6.2	−62	183	0	0	6.3AC	—
V15	Horizontal Output	6AV5	−27	6.3AC	0	NC	Do not measure	NC	0	140	—
V16	Horizontal Damper	6W4	245	NC	465	NC	245	NC	248 †6.3AC	248 †6.3AC	—
V17	High Voltage Rect.	*1B3	—	14KV	—	14KV	—	14KV	14KV	NC	—
V18	Low Voltage Rect.	5U4	NC	302 5.0AC**	NC	295AC	248	295AC	248	302 5.0AC**	—
V19	Picture Tube		0	2.6	—	—	—	0-425	Pin 10: 440	Pin 11: 40	Pin 12: 6.3AC
	Yoke Socket		245	410	245	—	245	—	47AC	0	—



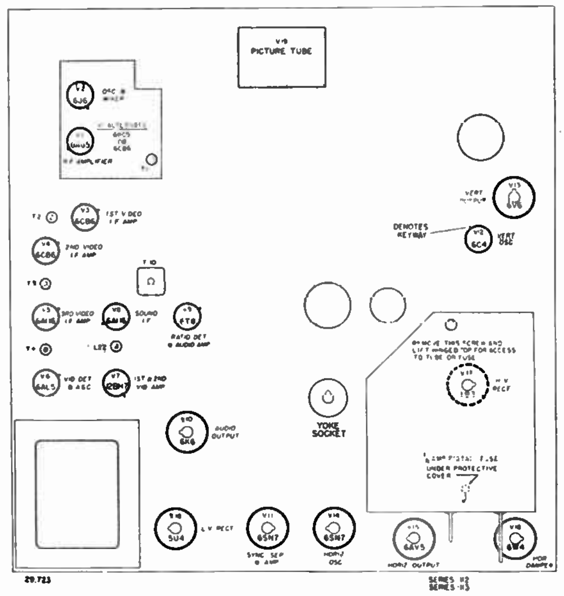
NOTES

1. Tune receiver to unused channel—no signal applied.
2. All front panel controls at maximum clockwise positions.
3. Screwdriver service adjustments, adjusted for normal raster.
4. All voltages measured with V.T.V.M. at 117 volts A.C. line.
5. Values shown are D.C. voltages measured from socket to ground unless otherwise specified.
6. N.C. designates no connection.
7. A dash designates the non existence of socket connections.

* Use high voltage insulated probe only.

† Top value is D.C. voltage to ground. Bottom value connect A.C. meter across socket connections 7 and 8.

** Top value is D.C. voltage to ground. Bottom value connect A.C. meter across socket connections 2 and 8.



PARTS LIST

CAPACITORS

SYMBOL	Part No.	DESCRIPTION
C1-C15	Part of Tuner Unit D-36.137-2 (Standard)	
C17	B-4.115-1	5000 MMF, 450V. Cer. Disc.
C21A	B-4.125-1	5000 MMF 450V. Dual Cer. Disc.
C21B	B-4.125-1	5000 MMF 450V. Dual Cer. Disc.
C22A	B-4.125-1	5000 MMF 450V. Dual Cer. Disc.
C22B	B-4.125-1	5000 MMF 450V. Dual Cer. Disc.
C24	D-3.105-23	.22 MF, 400V. Molded
C25A	B-4.125-1	5000 MMF 450V. Dual Cer. Disc.
C25B	B-4.125-1	5000 MMF 450V. Dual Cer. Disc.
C26	B-4.115-1	5000 MMF, 450V. Cer. Disc.
C27	C-4.109-11	220 MMF, Cer. Tub.
C28	C-4.111-5	3.3 MMF, Cer.
*C29	C-5.435-2	4 MF, 450V. Elect.
C30	D-3.105-23	.22, 400V. Molded
*C31	C-5.435-3	4 MF, 450V. Elect.
C32	D-3.105-21	.1 MF, 400V. Molded
C39	D-3.105-23	.22 MF, 400V. Molded
C40	C-4.109-11	220 MMF, Cer. Tub.
C41	D-3.105-12	.0022 MF, 400V. Molded
C42	D-3.105-17	.022 MF, 400V. Molded
C43	D-4.104-93	68 MMF, ±5%, Silver Mica
C44	B-10.101	2000 MMF Printed Circuit
C45	B-10.101	5000 MMF Printed Circuit
C46	B-10.101	5000 MMF Printed Circuit
C47	D-4.105-24	4700 MMF, ±10%, Mica
C48	D-3.105-34	.047 MF, 600V. Molded
C49	D-3.105-21	.1 MF, 400V. Molded
*C50		100 MF, 50V. Elect.
C51	D-3.100-32	.25 MF, 600V. Paper Tub.
C52	D-3.105-21	.1 MF, 400V. Molded
C53	D-3.105-19	.047 MF, 400V. Molded
C54	D-3.105-34	.047 MF, 600V. Molded
C59	C-4.109-14	47 MMF, ±5%, Cer.
C60	B-4.115-1	5000 MMF, 450V. Cer. Disc.
C61	B-4.138	5000 MMF, 2000V. Cer. Disc. Heavy Duty
*C62	C-5.435-3	40 MF, 450V. Elect.
*C63	C-5.435-3	4 MF, 450V. Elect.
*C64	C-5.435-3	40 MF, 450V. Elect.

SYMBOL	Part No.	DESCRIPTION
C65	D-3.105-26	.0022 MF, 600V. Molded
C66	D-3.105-19	.047 MF, 400V. Molded
C67	D-3.105-17	.022 MF, 400V. Molded
C68	D-3.100-30	.25 MF, 200V. Paper Tub.
C69	D-4.104-59	330 MMF, ±10%, Mica
C70	D-3.106-1	.01 MF, 600V. Molded Stab.
C71	D-4.105-9	1200 MMF, ±10%, Mica
*C72	C-5.435-3	4 MF, 450V. Elect.
C73	D-4.104-70	560 MMF, ±10%, Mica
C74	B-4.119-2	40-370 MMF, Trimmer
C75	D-4.109-14	47 MMF, Cer. ±5%
C76	B-3.105-34	.047 MF, 600V. Molded
C77	B-4.129-6	56 MMF, ±5%, 2000V. Cer.
C78	D-3.100-30	.25 MF, 200V. Paper Tub.
C79	B-4.128	500 MMF, 20KV. Mold. Barrel
C80	B-4.129-2	39 MMF, ±10%, 2000V. Cer.
C81	D-3.105-34	.047 MMF, 600V. Molded
C82	D-3.100-46	.035 MMF, 600 V. ±10%, Pa. Tub.
C83	B-4.129-4	68 MMF, 2000V. ±10%, Cer.
C91	C-4.104-38	100 MMF, Cer. ±10% Mica
C92	D-4.104-21	39 MMF, ±10%, Mica
C93A	B-4.125-1	5000 MMF 450V. Dual Cer. Disc.
C93B	B-4.125-1	5000 MMF 450V. Dual Cer. Disc.
C94	D-3.105-34	.047 MF, 600V. Molded
C95	D-4.108-12	1500 MMF, 500V. Cer.
C97	C-5.430-1	4 MF, 50V. Paper Elect.
C98	B-4.115-1	5000 MMF, 450V. Cer. Disc.
C99	B-4.115-1	5000 MMF, 450V. Cer. Disc.
C100	C-4.109-5	680 MMF, Cer.
C101	B-10.103	.01 MF, Part of triode couplate
*C102	C-5.429-2	25 MF, 50V. Elect.
C103	D-3.105-28	.0047 MF, 600V. Molded
*C104	C-5.435-3	40 MF, 450V. Elect.
C105	D-4.108-12	1500 MMF, 500V. Cer.
*C106	C-5.435-3	40 MF, 450V. Elec.

*Refer to schematic for connection of multi-sectioned electrolytic capacitors.

RESISTORS

SYMBOL	Part No.	DESCRIPTION	TYPE
R1-R9	Part of Tuner Unit D-36.137-2 (Standard)		
R12	C-6.215-4	250 ±10%	7 w. Wire wnd.
R13	C-6.215-4	250 ±10%	7 w. Wire wnd.
R16	D-7.101-44	4.7K ±10%	½ w. carbon
R17	D-7.101-250	47 ±10%	½ w. carbon
R18	D-7.101-237	330	½ w. carbon
R19	D-7.101-55	8.2K ±10%	½ w. carbon
R20	D-7.101-250	47 ±10%	½ w. carbon
R21	D-7.101-226	100	½ w. carbon
R22	D-7.101-62	12K ±10%	½ w. carbon
R23	D-7.101-248	150 ±10%	½ w. carbon
R24	D-7.101-114	220 ±10%	½ w. carbon
R25	D-7.101-226	100	½ w. carbon
R26	D-7.101-226	100	½ w. carbon
R27	D-7.101-226	100	½ w. carbon
R28	D-7.101-62	12K ±10%	½ w. carbon
R29	D-7.101-44	4.7K ±10%	½ w. carbon
*R30	C-8.230-2	1.5K Pot. ±30%	
R31	D-7.101-37	3.3K ±10%	½ w. carbon
R33	D-7.101-79	33K ±10%	½ w. carbon
R34	D-7.101-83	39K ±10%	½ w. carbon
R36	D-7.101-55	8.2K ±10%	½ w. carbon
R37	D-7.102-34	1.8K ±10%	1 w. carbon
R38	D-7.103-104	2.7K ±10%	½ w. carbon
R39	D-7.103-104	2.7K ±10%	2 w. carbon
R40	C-7.101-17	1K	½ w. carbon
R41	D-8.229-9	100K Pot.	comp.
R42	D-7.101-86	47K ±10%	½ w. carbon
R43	D-7.101-121	330K ±10%	½ w. carbon
R44	D-7.101-226	100Ω	½ w. carbon
R45	C-8.219-6	1M Pot.	comp.
R46	D-7.101-100	100K ±10%	½ w. carbon
R48	D-7.101-148	1.5M ±10%	½ w. carbon
R49	D-7.101-121	330K ±10%	½ w. carbon
R50	D-7.101-90	56K ±10%	½ w. carbon
R51	D-7.101-48	5.6K ±10%	½ w. carbon
R52	D-7.101-30	2.2K ±10%	½ w. carbon
R53	D-7.101-37	3.3K ±10%	½ w. carbon
R54	B-10.101	22K	Printed Circuit
R55	B-10.101	8.2K	Printed Circuit
R56	B-10.101	8.2K	Printed Circuit
R57	D-7.101-148	1.5M ±10%	½ w. carbon
R58	C-8.229-10	1.5M Pot. ±30%	comp.
R60	D-7.101-129	470K	½ w. carbon
R61	C-8.219-5	2.5M Pot. ±30%	comp.
R62	D-7.101-185	6.8M	½ w. carbon
R64	C-8.206-6	5K Pot. ±15%	2 w. Wire wnd.
R65	D-7.102-94	47K ±10%	1 w. carbon
R66	D-7.101-6	560 ±10%	½ w. carbon
R67	D-7.101-6	560 ±10%	½ w. carbon
R68	D-7.101-59	10K	½ w. carbon
R69	D-7.101-148	1.5M ±10%	½ w. carbon
R70	D-7.101-122	330K	½ w. carbon
R71	D-7.101-65	15K ±10%	½ w. carbon
R72	D-7.101-29	470K	½ w. carbon
R73	D-7.102-44	3.3K ±10%	1 w. carbon
R74	D-7.101-100	100K 10%	½ w. carbon
R75	D-7.101-87	47K	½ w. carbon
R77	D-7.102-108	100K ±10%	1 w. carbon
R78	C-8.229-7	50K Pot.	comp.
R79	D-7.101-171	3.3M ±10%	½ w. carbon
R80	D-7.101-138	820K ±10%	½ w. carbon
R81	D-7.101-55	8.2K ±10%	½ w. carbon
R82	D-7.101-107	150K ±10%	½ w. carbon
R83	D-7.101-99	100K ±5%	½ w. carbon
R84	D-7.101-111	180K ±10%	½ w. carbon
R85	D-7.102-94	47K ±10%	1 w. carbon
R86	D-7.101-55	8.2K ±10%	½ w. carbon
R87	D-7.102-69	12K ±10%	1 w. carbon
R88	D-7.102-94	47K ±10%	1 w. carbon
R89	D-7.101-129	470K	½ w. carbon
R90	D-7.101-142	1M	½ w. carbon
R91	D-7.101-226	100	½ w. carbon
R92	D-7.103-125	8.2K ±10%	2 w. carbon
R93	C-6.212-1	3.3	½ w. Wire wnd.
R94	D-7.102-137	470K	1 w. carbon
R95	D-7.101-128	470K ±10%	½ w. carbon
R96	D-7.101-214	150 ±10%	½ w. carbon
R100	D-7.101-87	47K	½ w. carbon
R101	D-7.101-226	100	½ w. carbon
R104	D-7.101-17	1K	½ w. carbon
R105	D-7.101-234	220	½ w. carbon
R106	D-7.101-66	15K	½ w. carbon
R107	D-7.101-69	18K ±10%	½ w. carbon
R108	C-8.230-2	1M Pot. ±30%	
R109	D-7.101-192	10M	½ w. carbon
R110	B-10.103	470K	Part of triode couplate
R111	B-10.103	470K	Part of triode couplate
R112	D-7.102-13	560 ±10%	1 w. carbon
R113	B-6.211-6	1K ±10%	10 w. Wire wnd.
R114	B-6.211-7	2.2K ±10%	10 w. Wire wnd.
R115	D-7.101-93	68K ±10%	½ w. carbon

COILS AND CHOKES

SYMBOL	PART NO.	DESCRIPTION	D.C. RESIST.
L1-L7	Part of Tuner Unit D-36.137-2 (Standard)		
L11	C-1.522-4	Video Peaking Coil	Refer to Schematic
L12	C-1.522-3	Video Peaking Coil	
L14	C-1.522-4	Video Peaking Coil	
L15	C-1.522-4	Video Peaking Coil	
L16A	C-9.254-3	Vert. Deflect. Yoke	
L16B	C-9.254-3	Horiz. Deflect. Yoke	
L19	B-1.533-1	Horiz. Size	
L20	B-1.531	Horiz. Lin.	
L22	C-1.554	Audio Take-off	
L1-L2 Coil Units	B-36.141-2	Ant. Coils Ch.-2	
	B-36.141-3	Ant. Coils Ch.-3	
	B-36.141-4	Ant. Coils Ch.-4	
	B-36.141-5	Ant. Coils Ch.-5	
	B-36.141-6	Ant. Coils Ch.-6	
	B-36.141-7	Ant. Coils Ch.-7	
	B-36.141-8	Ant. Coils Ch.-8	
	B-36.141-9	Ant. Coils Ch.-9	
	B-36.141-10	Ant. Coils Ch.-10	
	B-36.141-11	Ant. Coils Ch.-11	
	B-36.141-12	Ant. Coils Ch.-12	
	B-36.141-13	Ant. Coils Ch.-13	
L4, L5 L6 Coil Units	B-36.141-102	RF & Osc. Coils Ch.-2	
	B-36.141-103	RF & Osc. Coils Ch.-3	
	B-36.141-104	RF & Osc. Coils Ch.-4	
	B-36.141-105	RF & Osc. Coils Ch.-5	
	B-36.141-106	RF & Osc. Coils Ch.-6	
	B-36.141-107	RF & Osc. Coils Ch.-7	
	B-36.141-108	RF & Osc. Coils Ch.-8	
	B-36.141-109	RF & Osc. Coils Ch.-9	
	B-36.141-110	RF & Osc. Coils Ch.-10	
	B-36.141-111	RF & Osc. Coils Ch.-11	
	B-36.141-112	RF & Osc. Coils Ch.-12	
	B-36.141-113	RF & Osc. Coils Ch.-13	

TRANSFORMERS

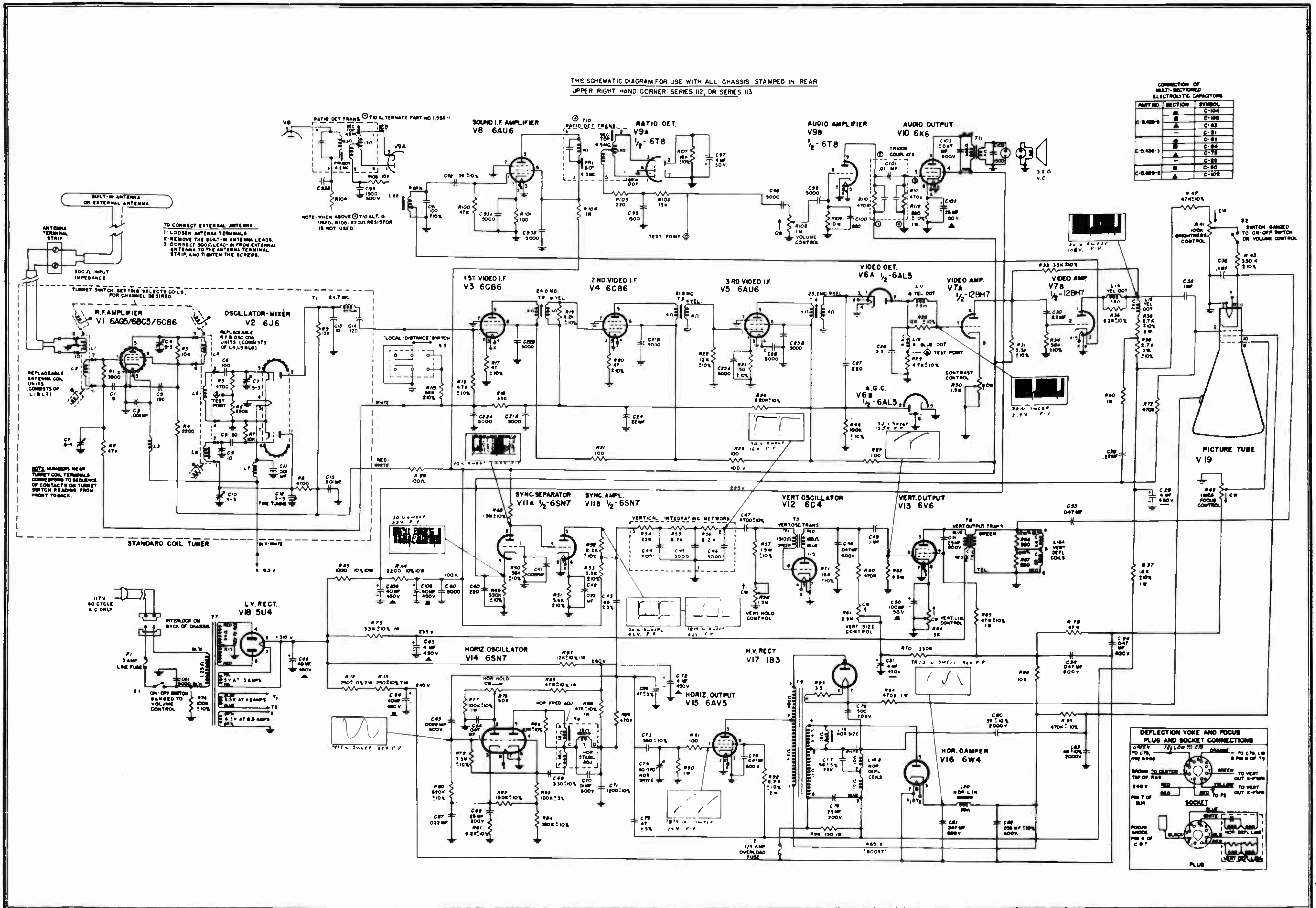
SYMBOL	Part No.	DESCRIPTION	D.C. RESIST.
S1, S2	Part of C-8.230-2		
S3	B-11.210	Local-Distance Switch	
T1	Part of Tuner Unit D-36.137-2 (Standard)		Refer to Schematic
T2	C-1.553	I-F Trans.	
T3	C-1.553	I-F Trans.	
T4	C-1.553	I-F Trans.	
T5	C-9.230-4	Vert. Bl. Osc. Trans.	
T6	C-9.228-5	Vert. Out. Trans.	
T7	D-9.260	Power Trans.	
T8	B-1.549	Hor. Osc. Trans.	
T9	C-9.253-2	Hor. Out Trans.	
0T10	C-1.528-1	Ratio Detect. Trans.	
T11	C-9.225-4	Audio Out. Trans.	

0T10 Alt. C-1.552-1 Ratio Det. Trans.
See Schematic for Connections

MISCELLANEOUS

PART No.	DESCRIPTION
D-36.137-2	Tuner (Standard) Pentode
E-30.326	Speaker (Table Models) 5"
C-30.333 or C-30.334-2	Speaker (Consoles) 10"
C-24.225-10	Pix Tube Socket
20.223	Line Cord

*Refer to schematic for connection of multi-sectioned electrolytic capacitors.


THIS SCHEMATIC DIAGRAM FOR USE WITH ALL CHASSIS STAMPED IN REAR UPPER RIGHT HAND CORNER: SERIES 112, OR SERIES 113
CONNECTION OF MULTI-SECTIONED ELECTROLYTIC CAPACITORS
SOUND I.F. AMPLIFIER V8 6AU6
RATIO DET. V9A 1/2 - 6T8
AUDIO AMPLIFIER V9B 1/2 - 6T8
AUDIO OUTPUT V10 6K6
BUILT-IN ANTENNA OR EXTERNAL ANTENNA
TO CONNECT EXTERNAL ANTENNA:
1 - LOOSEN ANTENNA TERMINALS
2 - REMOVE THE BUILT-IN ANTENNA LEADS.
3 - CONNECT 300Ω LEAD-IN FROM EXTERNAL ANTENNA TO THE ANTENNA TERMINAL STRIP, AND TIGHTEN THE SCREWS.
ANTENNA TERMINAL STRIP
300 Ω INPUT IMPEDANCE
TURRET SWITCH SETTING SELECTS COILS FOR CHANNEL DESIRED
R.F. AMPLIFIER V1 6AG5/6BC5/6CB6
OSCILLATOR-MIXER V2 6J6
REPLACEABLE R.F. & OSC. COIL UNITS (CONSISTS OF L4, L5 & L6)
REPLACEABLE ANTENNA COIL UNITS (CONSISTS OF L1 & L2)
NOTE: NUMBERS NEAR TURRET COIL TERMINALS CORRESPOND TO SEQUENCE OF CONTACTS ON TURRET SWITCH READING FROM FRONT TO BACK.
STANDARD COIL TUNER
"LOCAL-DISTANCE" SWITCH
1ST. VIDEO I.F. V3 6CB6
2ND. VIDEO I.F. V4 6CB6
3RD. VIDEO I.F. V5 6AU6
VIDEO DET. V6A 1/2 - 6AL5
A.G.C. V6B 1/2 - 6AL5
VIDEO AMP. V7A 1/2 - 12BH7
VIDEO AMP. V7B 1/2 - 12BH7
CONTRAST CONTROL
100K BRIGHTNESS CONTROL
SWITCH GANGED TO ON-OFF SWITCH ON VOLUME CONTROL
PICTURE TUBE V19
FOCUS CONTROL
SYNC. SEPARATOR V11A 1/2 - 6SN7
SYNC. AMPL. V11B 1/2 - 6SN7
VERTICAL INTEGRATING NETWORK
VERT. OSCILLATOR V12 6C4
VERT. OUTPUT V13 6V6
VERT. HOLD CONTROL
VERT. SIZE CONTROL
VERT. LIN. CONTROL
117V 60 CYCLE A.C. ONLY
INTERLOCK ON BACK OF CHASSIS
L.V. RECT. V18 5U4
3 AMP LINE FUSE
ON-OFF SWITCH GANGED TO VOLUME CONTROL
HORIZ. OSCILLATOR V14 6SN7
HOR. HOLD
HOR. FREQ. ADJ.
HOR. STABIL. ADJ.
HOR. DRIVE
HORIZ. OUTPUT V15 6AV5
H.V. RECT. V17 1B3
HOR. DAMPER V16 6W4
HOR. SIZE
HOR. LIN.
1/4 AMP OVERLOAD FUSE
"BOOST"
DEFLECTION YOKE AND FOCUS PLUG AND SOCKET CONNECTIONS
SOCKET
PLUG

SPECIFICATIONS

ELECTRICAL INPUT - - - - - - - - - - - - - - - - - - 117 Volts A.C., 60 Cycles

RF FREQUENCY RANGE - - - - - - - - - - - - - - - - - - Channels 2 through 13
54-88 MC, 174-216 MC

INTERMEDIATE FREQUENCY - - - - - - - - - - - - - - - - - - Video 26.1 MC
Sound 21.6 MC
Intercarrier Sound Freq. 4.5 MC

ANTENNA INPUT - 300 ohms, Balanced

CAUTION

The regular B+ voltages are dangerous, and precaution should be taken when the chassis is removed from the cabinet for service. Secondary human reactions to otherwise harmless shocks have been known to cause injury. Always discharge the picture anode to the receiver chassis before handling the tube. The picture tube is highly evacuated, and if broken, glass fragments will be violently expelled.

A.G.C. SYSTEM

This receiver utilizes a type of keyed A.G.C., the 6U8 tube performing dual functions of sound I.F. amplifier and A.G.C. Keyer.

This system requires a D.C. connection from the video detector through the video amplifier, to the A.G.C. Keyer (triode section 6U8). The A.G.C. Keyer is directly connected across a portion of the plate load resistance for the video amplifier. This establishes a bias voltage (-6 to -10 V.) across R-133, due to the current drain in the 12BY7 video amplifier, holding the 6U8 approximately at cutoff, depending on the contrast setting.

The plate circuit of the A.G.C. Keyer has no direct connection to B+, its plate supply voltage consisting entirely of pulses taken from a winding on the horizontal output transformer. This winding will normally supply a positive pulse of approximately 500 volts peak value to the keyer during the horizontal retrace time. This pulse will exceed the cathode voltage by approximately 150 volts, at the same time that the positive horizontal sync pulse will appear at the grid of the 6U8. The conduction of the 6U8 at this time will establish a small negative voltage across R-122, which is then filtered and applied to the controlled I.F. stages as the A.G.C. control voltage. This bias is cut in half by a simple voltage divider and only half is applied to the R.F. circuits (see schematic).

Due to the direct connection between the video amplifier and the A.G.C. Keyer, the A.G.C. voltage developed will depend to a large extent upon current through the video amplifier. Advancing the contrast control, as would be necessary on weak signals, has the effect of increasing the bias on the A.G.C. Keyer and consequently less A.G.C. voltage is developed. Conversely, retarding this control, as would be necessary on strong, local signals, will reduce the bias on the Keyer, and more A.G.C. voltage will be developed, in effect increasing the range of the contrast control.

Since the Keyer is conducting heavily not more than 5% of the time, random noise occuring during the active portion of the horizontal scan cannot charge up the A.G.C. filter system to any large degree, unless the noise is of sufficient amplitude to cause grid current in the controlled stages.

IMPORTANT NOTICE

In previous models, the filament winding on the power transformer which supplied heater voltage to the 6W4 was connected directly to the positive 140 volt supply. This was done to minimize the potential between heater and cathode of the 6W4 damper.

In these models, this heater winding is maintained at a positive 220 volts by means of a voltage divider connected between B+ and ground. The filament winding is bypassed by a .05 mfd 600 volt capacitor to ground.

VOLTAGE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 22	0-1.5	0	0	6.3AC	140	140	+.7-1.2		
V 23	0-1.5	0	0	6.3AC	140	140	+.7-1.2		
V 24	0	1.8	0	6.3AC	140	140	0		
V 25	0	1.9	0	6.3AC	140	140	0		
V 30	+.5 to 3.0	-1.0 to 3.0	0	6.3AC	6.3AC	0	220-290	140	
V 40*	-155	+16	+50	+60	+60	+200	+5.5	+160	+140
V 41	-11	-11	6.3AC	0	0	NC	-22		
V 9	+15	0	+4 to +18	6.3AC	6.3AC	+120	0 to -45	0	0
V 10	+100	-.5	0	6.3AC	6.3AC	+6.5 to 8.2	-1.0 to 3.3	+1.0 to 4.8	0
V 4	-1.0 to +3.3	+275	+10 to +12	-7 to -9	+130	+10 to +12	0	6.3AC	
V 5	+.6	0	0	+6.5 to +8.2	-19 to -36	NC	6.3AC	CAP DO NOT MEASURE	
V 6	NC	NC	+500 to +575	NC	+360	NC	+200	+200	
V 2	-17 to -30	-70 to +150	+1.0	0	+24 to +40	+1	6.3AC	-17 to -30	
V 3	+.2	+290 to +450	0 to +24	+.2	+290 to +450	0 to +24	6.3AC	0	
V 11	NC	+60	+200	+200	-5 to -15	NC	+60	0	
V 1	NC	+400	NC	360AC	NC	360AC	NC	+400	
V 7	DO NOT MEASURE								

*Readings taken from Pin Socket with +140 as common negative reference.

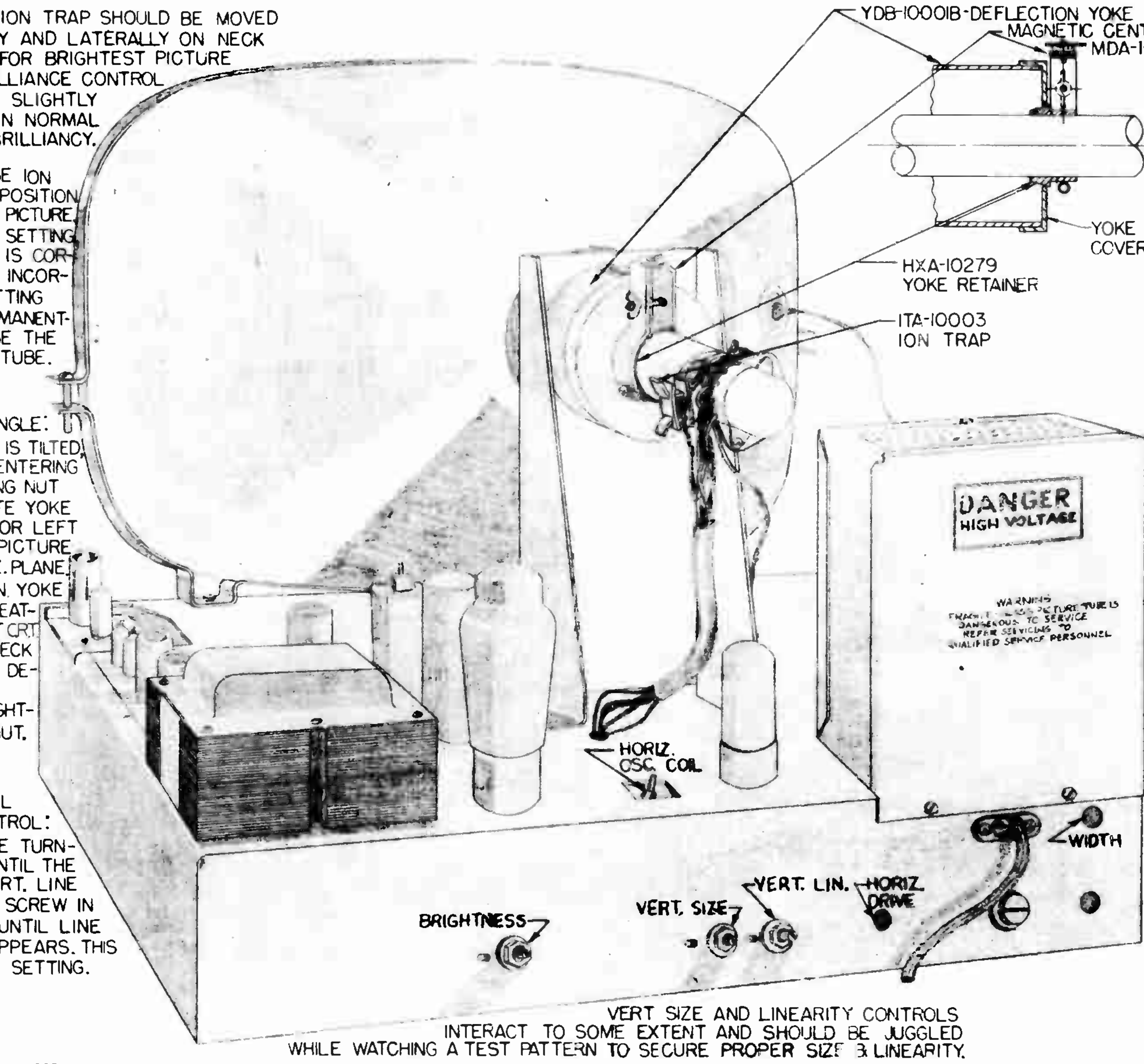
1. Where readings may vary according to control settings, min. & max. readings are given.
2. Measurements are from socket pin to chassis, unless otherwise stated.
3. All measurements taken with line voltage maintained at 117 A. C.

CAUTION: ION TRAP SHOULD BE MOVED CIRCULARLY AND LATERALLY ON NECK OF TUBE FOR BRIGHTEST PICTURE WHEN BRILLIANCE CONTROL IS SET AT SLIGHTLY MORE THAN NORMAL VIEWING BRILLIANCY.

NEVER USE ION TRAP TO POSITION OR FOCUS PICTURE. ONLY ONE SETTING OF TRAP IS CORRECT. AN INCORRECT SETTING WILL PERMANENTLY DAMAGE THE PICTURE TUBE.

PICTURE ANGLE: IF PICTURE IS TILTED LOOSEN CENTERING DEVICE WING NUT AND ROTATE YOKE TO RIGHT OR LEFT TO BRING PICTURE INTO HORIZ. PLANE. BE CERTAIN YOKE REMAINS SEATED AGAINST CRT BELL. RECHECK CENTERING DEVICE & ION TRAP & TIGHTEN WING NUT.

HORIZONTAL DRIVE CONTROL: SHOULD BE TURNED OUT UNTIL THE BRIGHT VERT. LINE APPEARS. SCREW IN CONTROL UNTIL LINE JUST DISAPPEARS. THIS IS PROPER SETTING.



TO PROPERLY ASSEMBLE THE YOKE, CENTERING DEVICE AND ION TRAP ON THE PICTURE TUBE REFER TO ILLUSTRATION.

THE PURPOSE OF THE YOKE RETAINER(RUBBER SLEEVE WITH CONE SHAPED END)IS TO CENTER THE BACK OF THE YOKE ON THE PICTURE TUBE NECK AND HOLD THE YOKE AGAINST THE PICTURE TUBE.

TO ASSEMBLE, HOLD THE YOKE IN POSITION AND SLIP THE PICTURE TUBE NECK THROUGH THE YOKE AND FIRMLY SEAT THE PICTURE TUBE IN ITS HARDWARE.

AFTER THE TUBE IS FASTENED SECURELY, CENTER THE YOKE ON TUBE NECK BY SLIDING THE YOKE RETAINER ON THE NECK WITH THE CONE PORTION TOWARD THE YOKE.

INSERT THE YOKE RETAINER IN THE REAR OF THE YOKE AND CENTER THE YOKE AT THE SAME TIME HOLDING THE YOKE AGAINST THE TUBE BELL. SLIP THE CENTERING DEVICE AROUND THE SLEEVE PORTION OF THE YOKE RETAINER WITH CLAMPING SCREW LOOSENED. INSTALL THE ION TRAP AND PICTURE TUBE SOCKET AND ADJUST THE ION TRAP. CENTER THE PICTURE BY BOTH ADJUSTING THE KNOB ON THE CENTERING DEVICE AND ROTATING THE CENTERING DEVICE AROUND THE SLEEVE PORTION OF THE YOKE RETAINER.

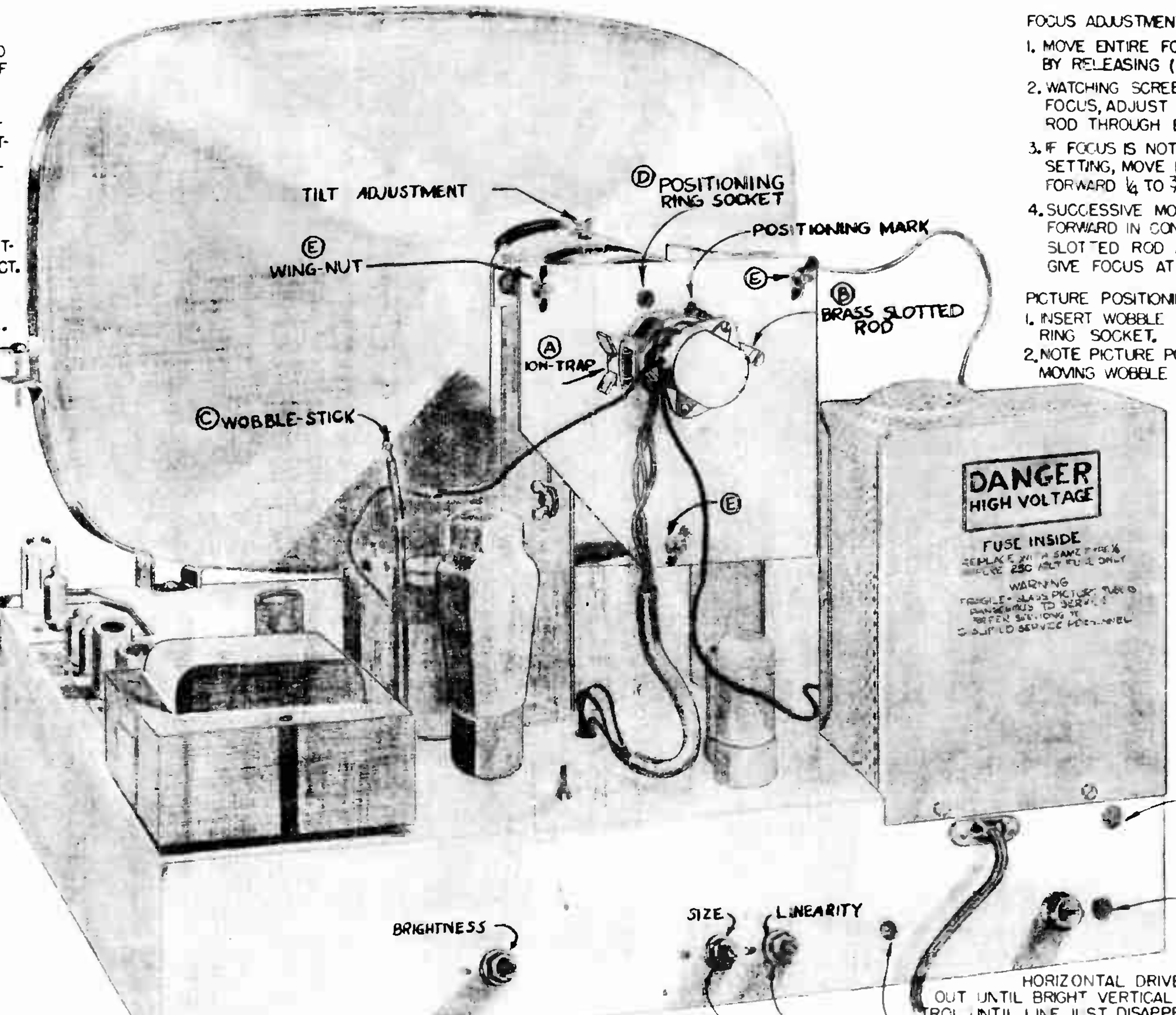
AFTER THE CENTERING HAS BEEN ACCOMPLISHED, TIGHTEN THE WING NUT ON THE CENTERING DEVICE TO HOLD THE YOKE IN PLACE. RECHECK THE ION TRAP ADJUSTMENT.

VERT SIZE AND LINEARITY CONTROLS INTERACT TO SOME EXTENT AND SHOULD BE JUGGLED WHILE WATCHING A TEST PATTERN TO SECURE PROPER SIZE & LINEARITY.

REAR VIEW OF CHASSIS
XXD-10707

CAUTION: ION TRAP SHOULD BE MOVED CIRCULARLY AND LATERALLY ON NECK OF PICTURE TUBE FOR BRIGHTEST PICTURE WHEN BRILLIANCE CONTROL IS SET AT SLIGHTLY MORE THAN NORMAL VIEWING BRILLIANCY.

NEVER USE ION TRAP TO POSITION OR FOCUS PICTURE. ONLY ONE SETTING OF TRAP IS CORRECT. AN INCORRECT SETTING WILL PERMANENTLY DAMAGE PICTURE TUBE.



FOCUS ADJUSTMENT:

1. MOVE ENTIRE FOCUS UNIT TO REAR BY RELEASING (3) WING NUTS.
2. WATCHING SCREEN FOR SHARPEST FOCUS, ADJUST BRASS SLOTTED ROD THROUGH ENTIRE RANGE.
3. IF FOCUS IS NOT REACHED WITH THIS SETTING, MOVE ENTIRE ASSEMBLY FORWARD 1/4 TO 3/8" AND REPEAT STEP 2.
4. SUCCESSIVE MOVING OF THE UNIT FORWARD IN CONJUNCTION WITH BRASS SLOTTED ROD ADJUSTMENT, WILL GIVE FOCUS AT SOME POINT.

PICTURE POSITIONING:

1. INSERT WOBBLE STICK IN POSITIONING RING SOCKET.
2. NOTE PICTURE POSITION IN MIRROR WHILE MOVING WOBBLE STICK FOR PICTURE CENTERING.

HORIZONTAL LINEARITY SHOULD BE ADJUSTED WHILE WATCHING A TEST PATTERN.

HORIZONTAL DRIVE CONTROL SHOULD BE TURNED OUT UNTIL BRIGHT VERTICAL LINE APPEARS. SCREW IN CONTROL UNTIL LINE JUST DISAPPEARS. THIS IS PROPER SETTING.

VERTICAL SIZE & LINEARITY CONTROLS INTERACT TO SOME EXTENT & SHOULD BE JUGGLED WHILE WATCHING A TEST PATTERN TO SECURE PROPER VERTICAL SIZE & LINEARITY.

REAR VIEW OF CHASSIS
XXD-10691

INSTALLATION AND ADJUSTMENT

BUILT-IN-ANTENNA

This receiver is equipped with a built-in antenna which should provide favorable reception of television signals within the primary service area, and where local interferences are not excessive. Do not locate the receiver near a large metal surface such as a radiator or metal partition, or a serious reduction of signal will result.

OUTSIDE ANTENNA

Where reception is weak due to less favorable receiving conditions with the built-in antenna, an outside antenna is recommended. When this external or outdoor antenna is connected to the receiver input terminals, the built-in antenna must be disconnected.

RECEIVER INSTALLATION

The receiver was shipped from the factory with all components preadjusted for normal operation. However, if in checking the receiver performance it becomes evident that one or more of the installation controls are out of adjustment, due to handling, it is necessary to re-adjust the affected controls. A complete adjustment of installation controls is outlined in the step by step procedure which follows. It will be noted that adjustment of some of the controls will interact on one or more of the others. These controls should be adjusted alternately, and in the given sequence of the procedure. Power should never be applied to the receiver for any great length of time, prior to the installation, without checking the ion trap adjustment for best screen illumination.

SEQUENCE OF ADJUSTMENTS

Ion Trap Adjustment

1. Remove the cabinet back cover. (In some cases, this will open circuit the A.C. interlock, and another line cord with appropriate fittings must be used temporarily until the necessary adjustments have been completed.) With power applied to the receiver and after allowing adequate warm-up time, set the brightness control in the center of its range and rotate the ion trap, or beam bender magnet, until light appears on the screen. After initial screen illumination is obtained, move the magnet forward or backward, and further rotate it to obtain the brightest raster. If two positions are noted which seem to give equal screen brightness, the setting closest to the picture tube base should be used. This is the only setting of the ion trap that is correct. NEVER ATTEMPT TO COMPENSATE FOR NECK SHADOWS OR FOCUS WITH THE ION TRAP OR BEAM BENDER ADJUSTMENT, IF BY SUCH ADJUSTMENT THE SCREEN BRIGHTNESS IS DECREASED.

Focus Adjustment

2. Adjust the brass screwdriver slotted rod to the right of the C.R.T. socket until best focus is obtained. The raster may be centered by movement of the positioning ring (inside the focusing ring) with the "Wobble Stick," which is supplied with every unit. This special nonmagnetic rod will be taped to an electrolytic capacitor on top of the chassis in every receiver employing a PM focus unit.

Yoke Positioning

3. Connect an antenna to the set and tune in a station, (test pattern if available). Check to make sure that the deflection yoke is positioned firmly against the "bell" of the picture tube. The yoke may be slightly tilted to the left or right in order to properly frame the picture within the mask.

Horizontal Drive Adjustment

4. Check the horizontal drive setting by turning the drive trimmer several turns counter-clockwise until one or more vertical white lines are observed on the left side of the screen. Then, turn the trimmer just far enough clockwise to eliminate these "drive lines." In the event that no drive lines are observed on the picture tube face, leave the trimmer set to the position of minimum capacity consistent with sufficient trimmer screw pressure and good horizontal linearity.

Vertical Sweep Adjustments

5. Adjust the vertical size and the vertical linearity controls on the rear of the chassis for correct height and best vertical linearity. Do not attempt this adjustment unless a test pattern is available.

Width Adjustment

6. Check the width coil for proper setting, and correct if necessary.

Caution

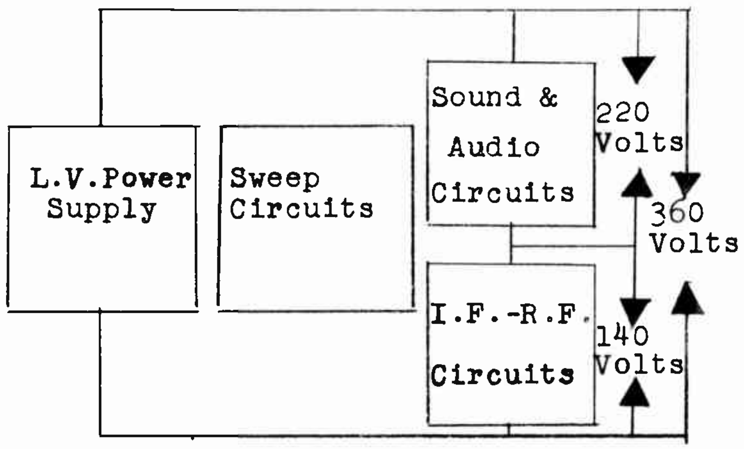
7. Re-Adjust the beam bender or ion trap if necessary.

*Some chassis will contain electrostatically focused picture tubes. These tubes will ordinarily have the focus electrode wired to the 140 volt B+ supply. Due to line voltage variations, however, it may become necessary to raise or lower the voltage on this electrode for best focus. Any well filtered voltage from zero, or ground, to a positive 400 volts is permissable on this electrode. If satisfactory focus is not obtained within this range of voltages, re-check the width and horizontal drive adjustments. If these adjustments are found to have been correctly made, check the second anode voltage on the picture tube. For this measurement, a voltmeter which will range to at least fifteen thousand volts is necessary. The picture tube second anode voltage should range between 11.5 and 13.5 K.V. positive. The picture is centered by means of a centering magnet, located just to the rear of the deflection yoke, in the position formerly occupied by the focus unit. This magnet may be rotated in any direction to correctly center the pattern. When this ring is in a vertical plane, the thumbscrew will adjust vertical centering. When the ring is in a horizontal plane, horizontal centering will be effected by adjustment of the thumbscrew. (See assembly instruction.)

General Circuit Description

The LOW VOLTAGE POWER SUPPLY is conventional, consisting of a center tapped power transformer used on conjunction with a 5U4 full wave rectifier.

This supply provides a filtered output of approximately 360 volts for application to the sweep or deflection circuits. It is interesting to note that the I.F.-R.F. portions and the sound-audio portions of the receiver are in series across the 360 volt supply. This arrangement provides 220 volts for application to the sound and audio circuits, and the remaining 140 volts is available for I.F.-R.F. supply potential. The audio power amplifier tube (6V6) is also used as a series voltage regulator. Its grid is returned to a high impedance voltage divider tapped at approximately 130 volts, while its cathode is wired directly to the 140 volt line. Any change in the 140 volt drain due to A.G.C. fluctuations thus changes the grid to cathode voltage of the 6V6 almost instantaneously, and the resulting cathode current change in this tube acts to maintain the 140 volt supply substantially constant. It should, therefore become apparent that if the 140 volt supply measures considerable higher than 140 volts, a short exists across the sound-audio circuits. If this voltage is considerably lower than the nominal 140 volts, and the 390 ohm resistor (R-80) in the plate supply circuit of the 6V6 is observed to overheat, a short exists across the 140 volt supply. If the 140 volt supply is measured considerably lower than its nominal value, and the 390 ohm resistor does not overheat, an open circuit is indicated in the 200 volt sound-audio portion of the receiver. (See Diagram Below.)



Alignment Procedure

Necessary Equipment:
- Television Sweep Generator
- Marker Frequency Generator
- Vacuum Tube Voltmeter
- 4.5MC Crystal Generator, or equivalent, Oscilloscope

Sound I.F. Alignment

1. Connect a 4.5 MC generator to the grid of the video amplifier tube. Low signal level is important here. Metering may be accomplished at the sound take-off point of the ratio detector (at the juncture of R-155 and C-160) with the meter ground connected to pin eight of the 6V6.

2. Adjust the slug of L-18 (sound take-off coil) for maximum negative meter indication. Attenuate the output of the generator so that not more than five volts is measured on the meter, as the alignment progresses.

3. Adjust the top slug of T-5 (ratio det. primary) for the maximum negative reading.

4. Move the meter ground to the juncture of R-156 and R-157 (6800 ohm resistors) in the sound detector circuit, and adjust the bottom slug of T-5 (Ratio Det.) for zero voltage. The other meter lead remains connected as in Step 1. N. 4.5MC trap adjustment is necessary. The trap consists of a coil L-17 which is self-resonant at 4.5MC.

Video I.F. Alignment

The I.F. amplifier contains five tuned circuits, no traps being necessary. The video carrier is passed through the I.F. at a freq. of 26.1MC, and the sound carrier at 21.6 MC. Extreme care must be taken in alignment to assure that the sound carrier is attenuated substantially below the level of the video carrier. This is necessary to assure that the slight AM modulation on the sound carrier due to picture modulation, will be sufficiently low to be removed by the detector, and not produce spurious phase modulation of the sound I.F. A band width of 3.4MC (6DB down) with a stage gain of from 12 to 15 times is attained. Earlier sets employed a staggered quintuple, which resulted in a different order of stagger of the I.F. coils. (See peaking frequencies below.) These sets may be identified by the values of the grid load resistors on the last two I.F. amplifier tubes, (R-109 and R-113) 6800 ohms. In the later sets, employing a staggered double, the third I.F. grid resistor, R-109, is 10,000 ohms, while the fourth, R-113, remains 6800. Another difference which will serve to help identify the quintuple stagger, lies in the wiring of the A.G.C. to the second I.F. amplifier. In the staggered quintuple alignment, the grid return of the tube is wired directly to the 1. mfd. A.G.C. filter capacitor (C-106). In the staggered triple-staggered double alignment, a 470 ohm resistor (R-106) and a .001 mfd capacitor (C-105) have been added as additional A.G.C. decoupling.

Peaking Frequencies

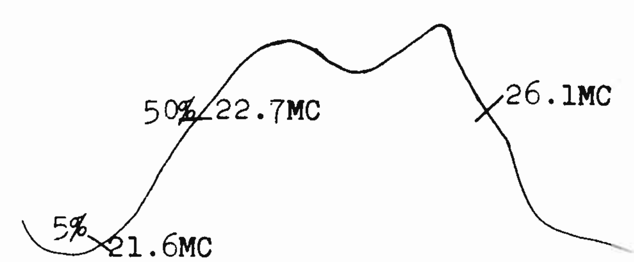
Adjust curve for band width of 3.4MC.

1st IF tuner slug to high side	25.9
2nd IF slug to middle of band	24.3
3rd IF slug to low side	23.1
4th IF slug to low side	22.9
5th IF slug to high side	25.7

Use only sufficient input to give pattern on scope with scope vertical control at maximum gain.

Should AGC be developed with this decreased input apply a D.C. battery of -3V to AGC line and align as before.

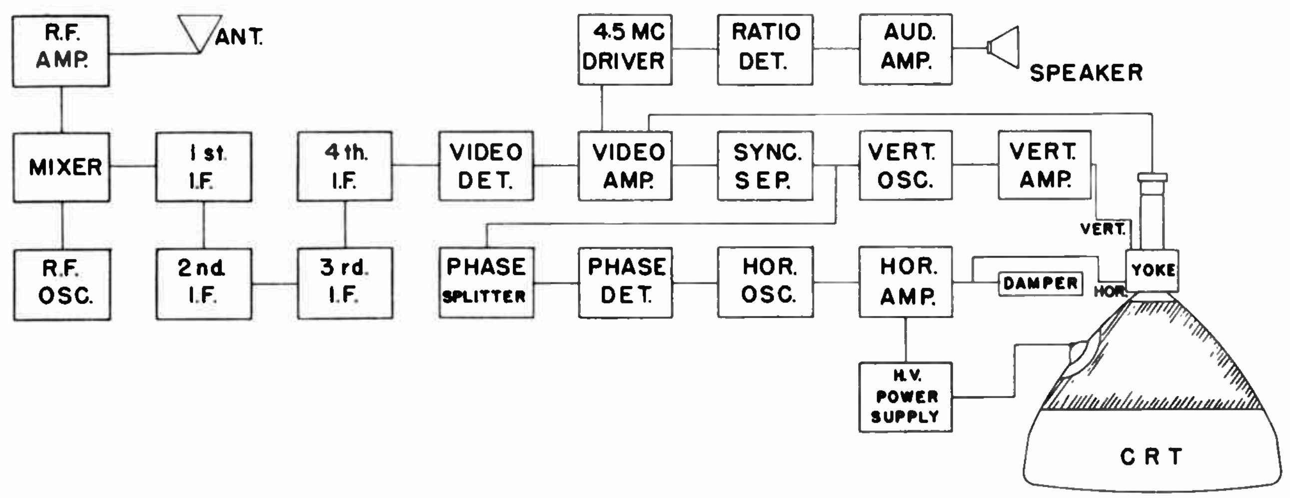
An I.F. alignment signal is best introduced to the chassis by means of a suitable cup, or tube shield floated over the mixer tube to capacity couple the signal to the plate circuit. It may be necessary to disable the local oscillator* to prevent R.F. harmonics from distorting the trace on the scope screen. The oscilloscope is connected to the grid of the video amplifier, through a 100,000 ohm isolating resistor. Metering is done on the AGC line, keeping the input attenuated to produce no more than a negative 1 volt reading. The resulting overall response should coincide with the curve shown below.



* A dummy 6J6 may be substituted for the mixer tube with the #1 pin removed, to facilitate alignment.

R.F. Alignment

The R.F. tuner in the receiver has to be pre-aligned by the manufacturer and adjustment in the field is not recommended. It may be necessary on occasional sets, however, to re-set the local oscillator tuning slug. This may be accomplished without test equipment, if it is possible to receive a signal of good quality, and if the I.F. and R.F. portions of the set are functioning correctly. Simply set the fine tuning in the center of its range and adjust the oscillator slug for best picture detail. The oscillator adjustment is recessed in a hole in the tuner front, directly to the right of the tuner shaft. This adjustment must be checked on each channel to be received. It is important that a non-metallic alignment screwdriver be used to prevent detuning when the adjustment is completed and the screwdriver withdrawn. On sets using a wooden front panel, a small hole is provided under the flanged tuner knob, which will accommodate this alignment tool, and make possible re-setting the osc. slug without removing the set from its cabinet. If a signal of sufficient strength is not available, oscillator adjustment may be made with the sweep generator connected as for I.F. alignment, and the video R.F. carrier frequency applied to the antenna terminals of the receiver from an accurately calibrated signal generator. With the hook-up outlined above, a pip, or marker indicating the video carrier for the particular channel being set will appear on the I.F. response curve. This pip will ride up and down on the curve when the fine tuning control is moved, and the oscillator is correctly set when the pip is passing through the point on the curve marked 26.1 in Fig. 5, with the fine tuning at the center of its rotation.

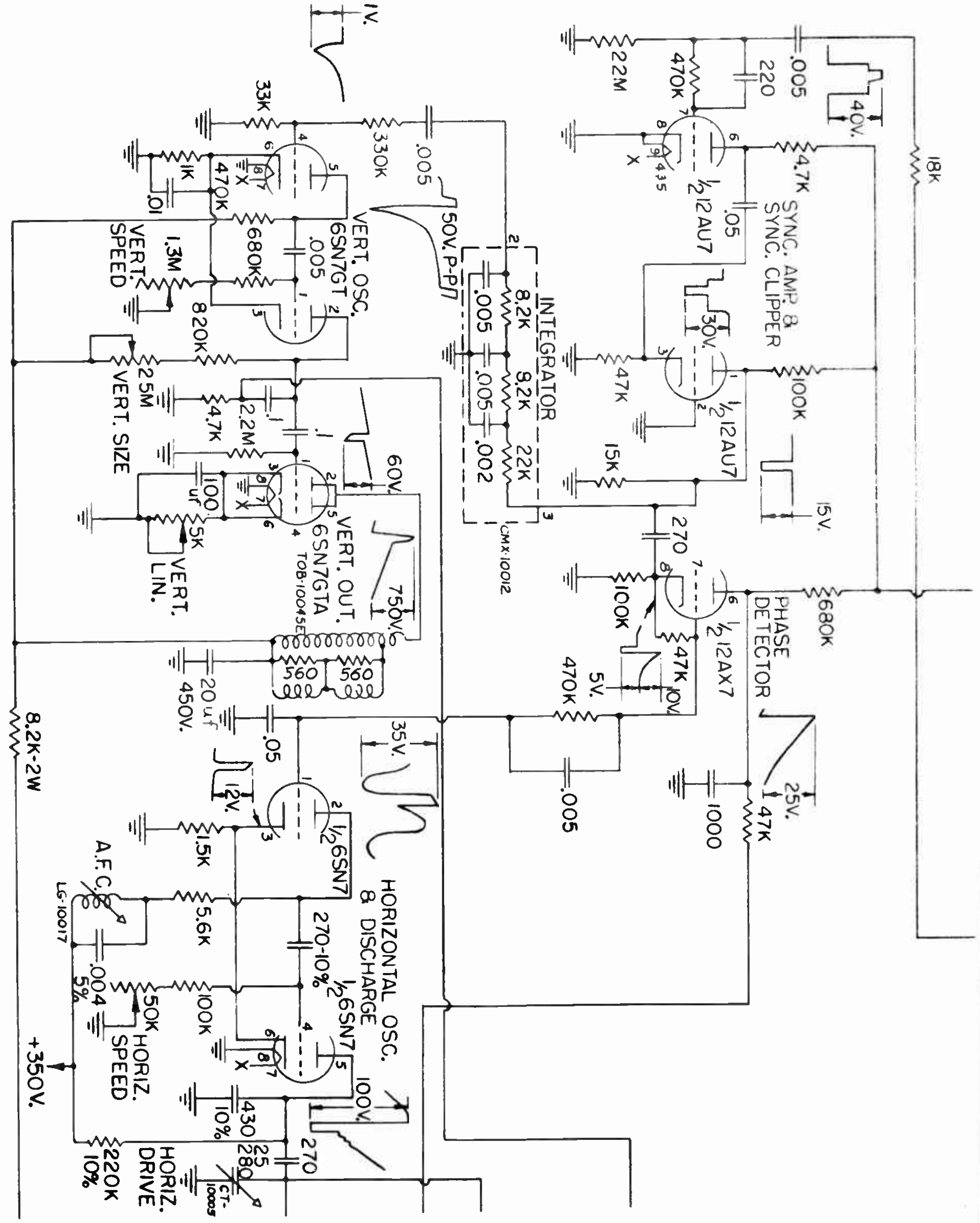


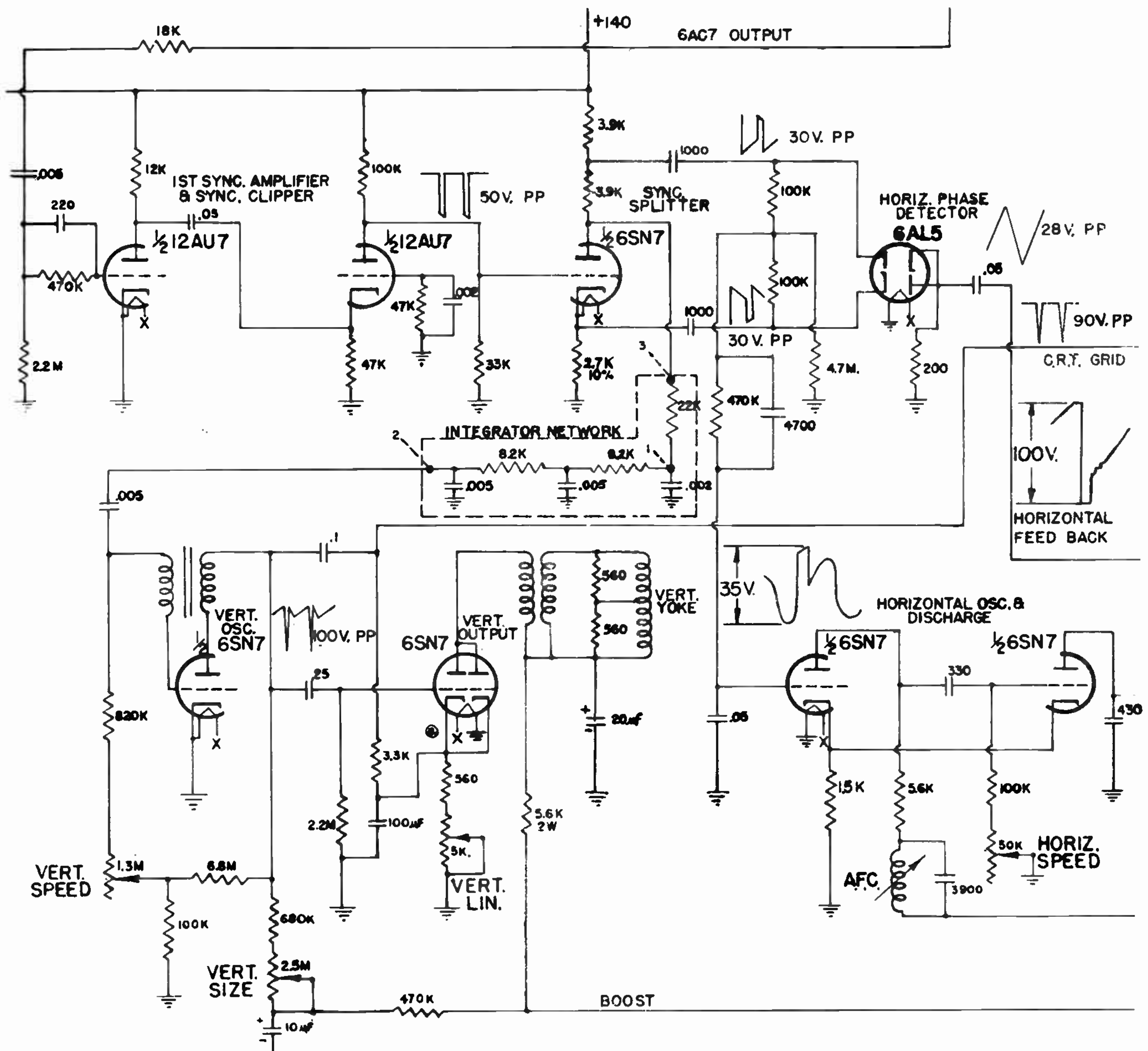
BLOCK DIAGRAM

Printed in U. S. A.

SCHEMATIC - SYNC. SECTION
XXC-10708

WAVE FORMS OBSERVED ON OSCILLOSCOPE
WITH RESPONSE FLAT TO 2 MC.

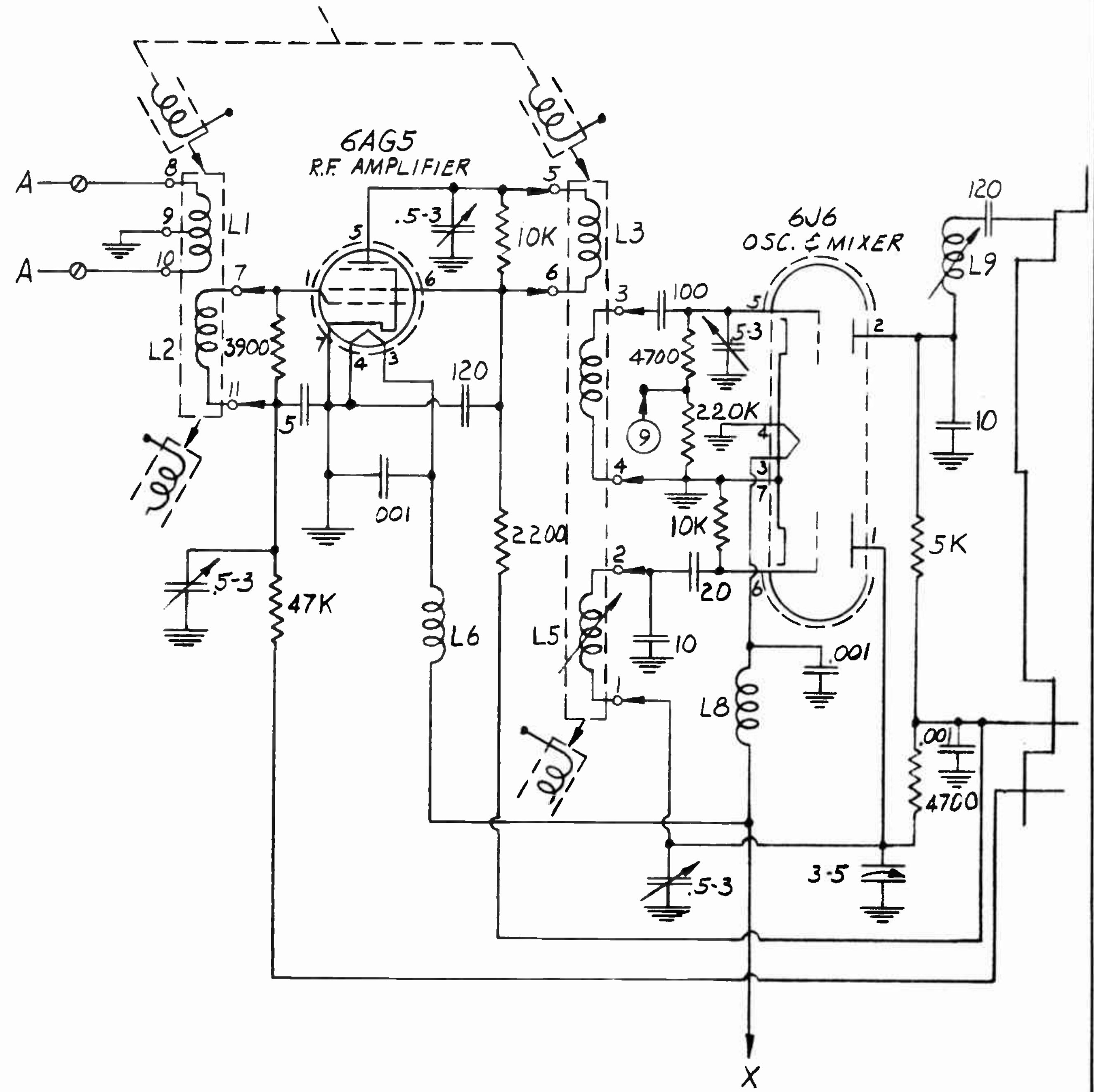




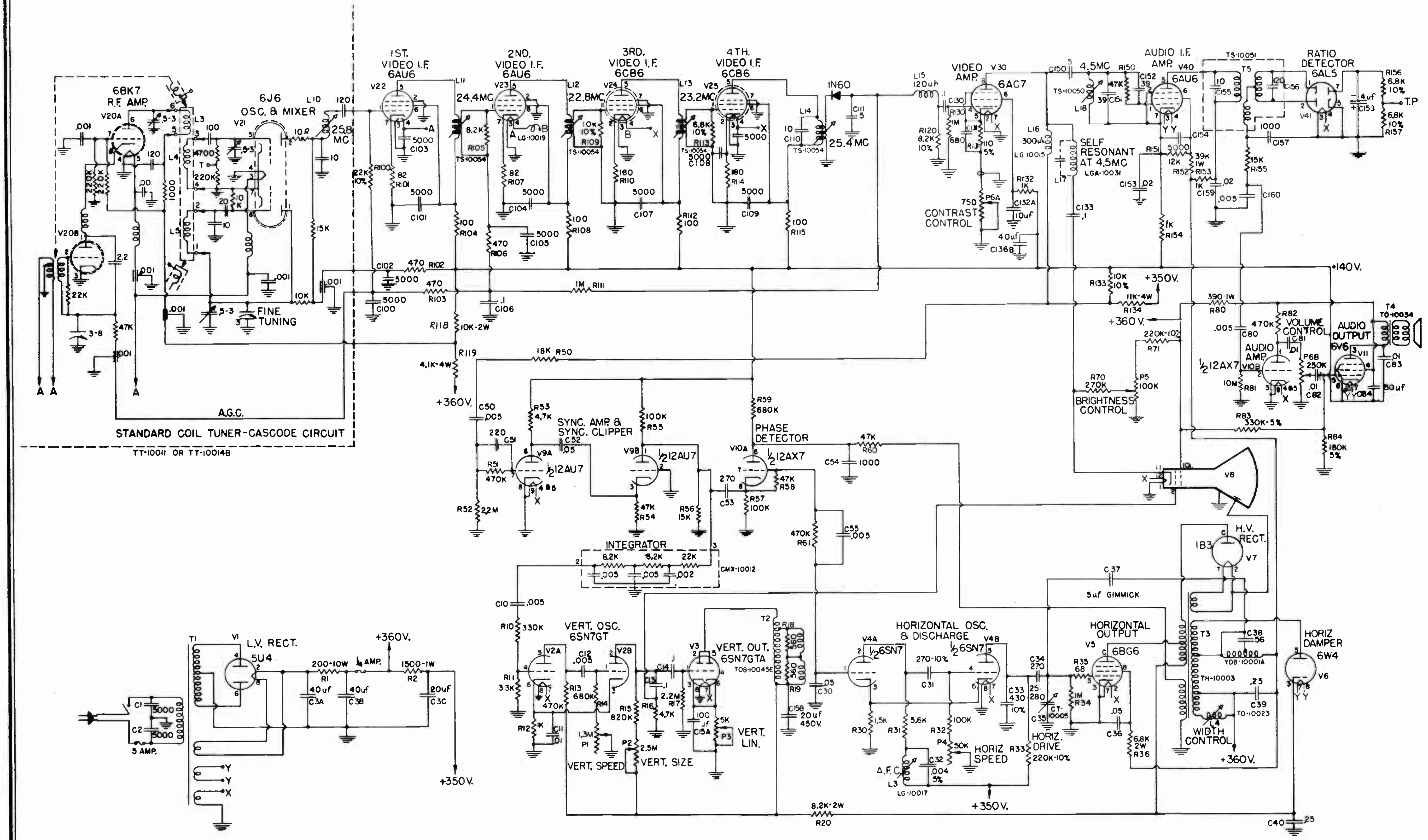
WAVE FORMS OBSERVED ON OSCILLOSCOPE WITH RESPONSE FLAT TO 2MC.

ALL RESISTANCE VALUES IN OHMS
K= 1,000
M= 1,000,000
ALL RESISTOR ARE 1/2 WATT UNLESS OTHERWISE NOTED.
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS & GREATER THAN ONE IN MICRO-MICROFARADS UNLESS OTHERWISE NOTED.

SYNC. STAGE WAVE FORMS



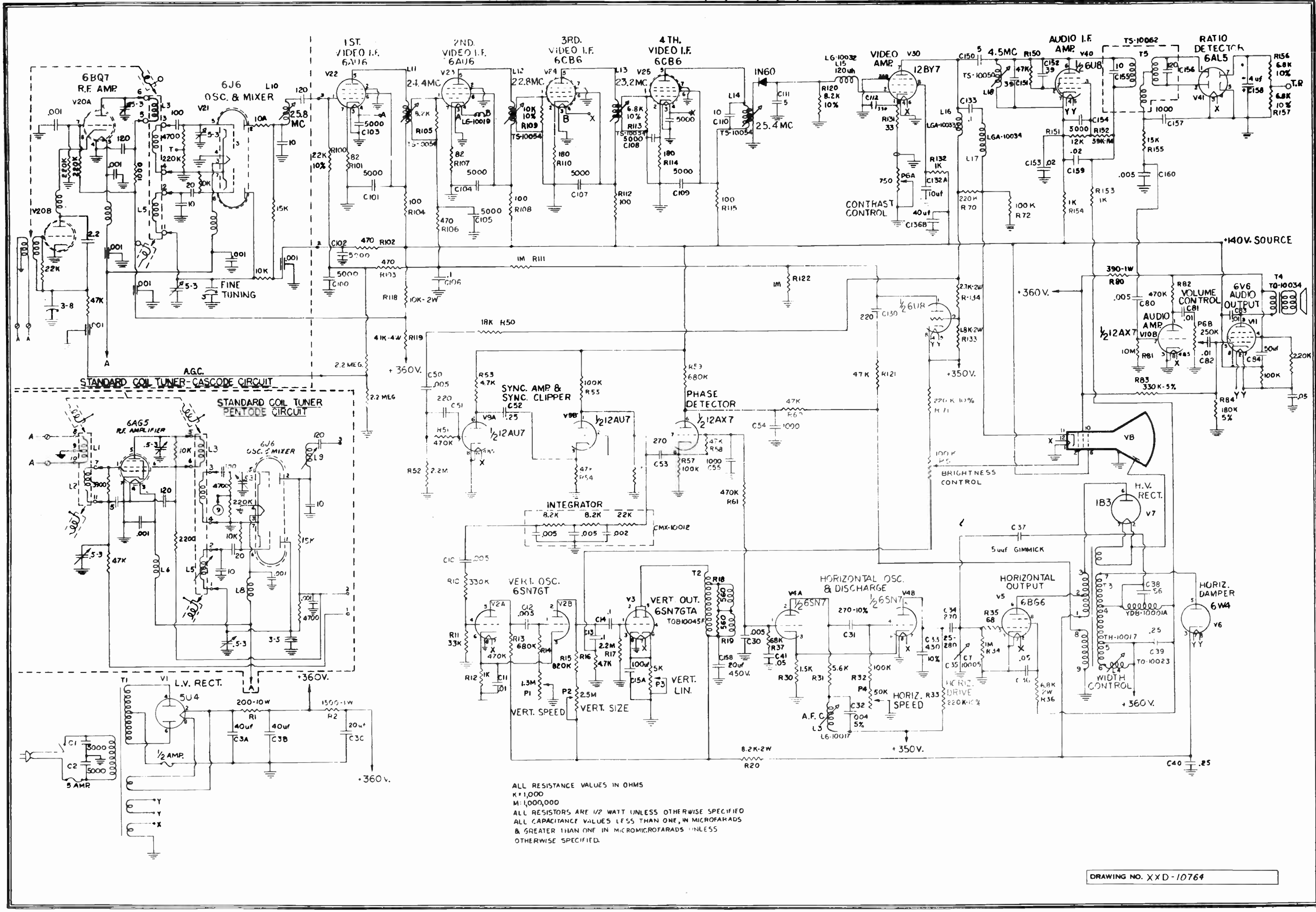
STANDARD COIL
Pentode Circuit
XXB-10663

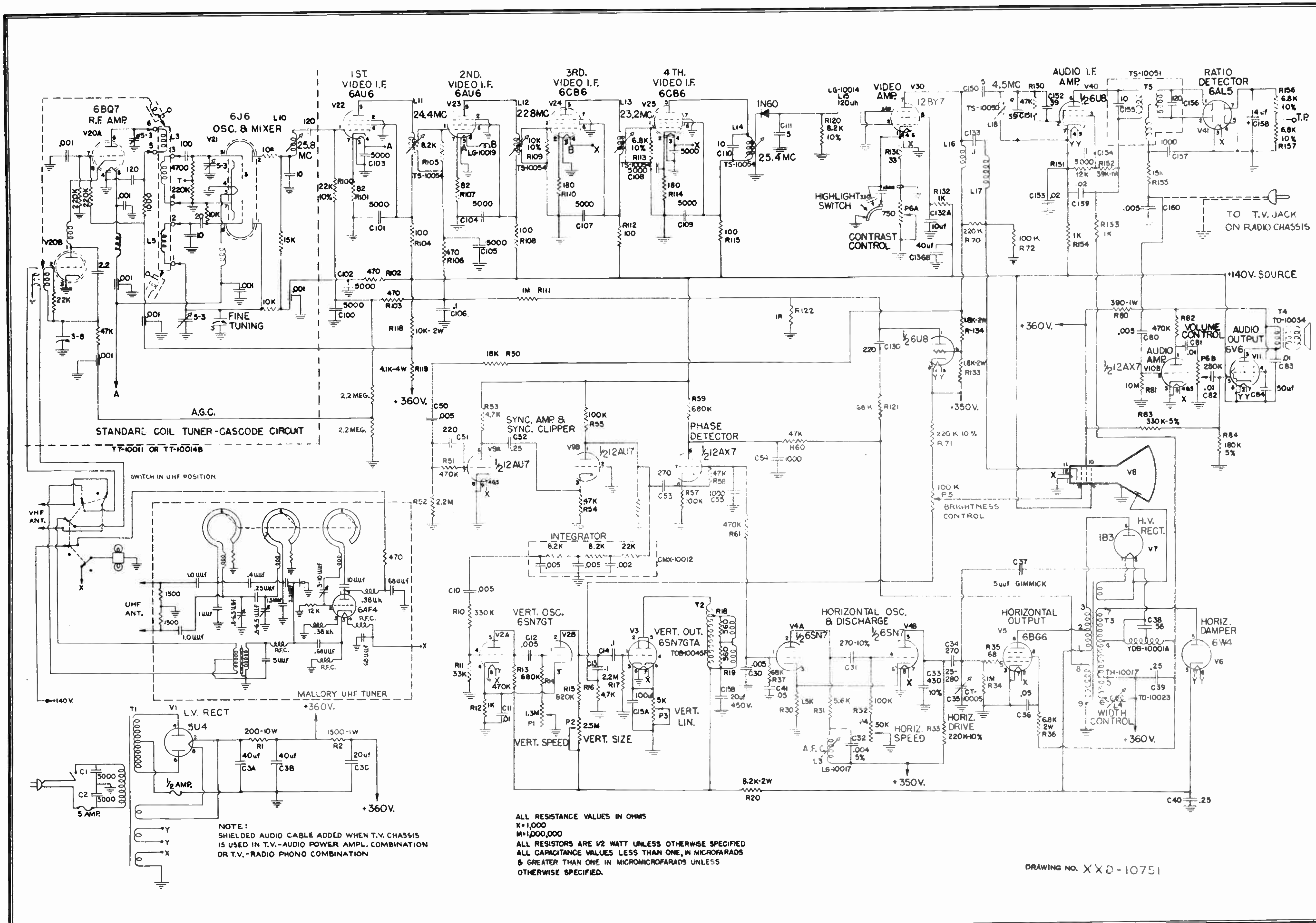


ALL RESISTANCE VALUES IN OHMS
K= 1,000
M= 1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS
& GREATER THAN ONE IN MICROMICROFARADS
UNLESS OTHERWISE SPECIFIED

SCHEMATIC - 9032
Meck Redhead Cascode Tuner
XXD-10703

MODELS JM-717C, T, -721C, D, T, MM-617C, -621C, RPT, RPTB, T, Ch. 9031A, 9032A


6BQ7 R.F. AMP.
6J6 OSC. & MIXER
1ST. VIDEO I.F. 6AU6
2ND. VIDEO I.F. 6AU6
3RD. VIDEO I.F. 6CB6
4 TH. VIDEO I.F. 6CB6
IN60
VIDEO AMP. 12BY7
4.5MC
AUDIO I.F. AMP. 1/2 6U8
RATIO DETECTOR 6AL5
+140V. SOURCE
CONTRAST CONTROL
FINE TUNING
A.G.C.
STANDARD COIL TUNER-CASCODE CIRCUIT
STANDARD COIL TUNER PENTODE CIRCUIT
6AG5 R.F. AMPLIFIER
6J6 OSC. & MIXER
SYNC. AMP. & SYNC. CLIPPER 1/2 12AU7
PHASE DETECTOR 1/2 12AX7
VOLUME CONTROL
AUDIO AMP. 1/2 12AX7
6V6 AUDIO OUTPUT
BRIGHTNESS CONTROL
H.V. RECT. 1B3
INTEGRATOR
VERT. OSC. 6SN7GT
VERT. OUT. 6SN7GTA
HORIZONTAL OSC. & DISCHARGE 1/2 6SN7
HORIZONTAL OUTPUT 6BG6
HORIZ. DAMPER 6W4
WIDTH CONTROL
L.V. RECT. 5U4
VERT. SPEED
VERT. SIZE
VERT. LIN.
HORIZ. SPEED
HORIZ. DRIVE
5uuf GIMMICK
ALL RESISTANCE VALUES IN OHMS
K=1,000
M=1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS & GREATER THAN ONE IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED.
DRAWING NO. XXD-10764


6BQ7 R.F. AMP.
6J6 OSC. & MIXER
1ST. VIDEO I.F. 6AU6
2ND. VIDEO I.F. 6AU6
3RD. VIDEO I.F. 6CB6
4 TH. VIDEO I.F. 6CB6
IN60
VIDEO AMP. 12BY7
AUDIO I.F. AMP. 1/2 6U8
RATIO DETECTOR 6AL5
TO T.V. JACK ON RADIO CHASSIS
+140V. SOURCE
HIGHLIGHT SWITCH
CONTRAST CONTROL
FINE TUNING
A.G.C.
STANDARD COIL TUNER-CASCODE CIRCUIT
TT-10011 OR TT-10014B
SWITCH IN UHF POSITION
VHF ANT.
UHF ANT.
MALLORY UHF TUNER
6AF4
SYNC. AMP. & SYNC. CLIPPER
1/2 12AU7
PHASE DETECTOR
1/2 12AX7
INTEGRATOR
CMX-10012
VOLUME CONTROL
AUDIO AMP.
AUDIO OUTPUT 6V6
BRIGHTNESS CONTROL
H.V. RECT. 1B3
VERT. OSC. 6SN7GT
VERT. OUT. 6SN7GTA
VERT. SPEED
VERT. SIZE
VERT. LIN.
HORIZONTAL OSC. & DISCHARGE
1/2 6SN7
HORIZ. SPEED
HORIZ. DRIVE
HORIZONTAL OUTPUT 6BG6
HORIZ. DAMPER 6W4
WIDTH CONTROL
5uuf GIMMICK
L.V. RECT 5U4
+360V.
+350V.
NOTE: SHIELDED AUDIO CABLE ADDED WHEN T.V. CHASSIS IS USED IN T.V.-AUDIO POWER AMPL. COMBINATION OR T.V.-RADIO PHONO COMBINATION
ALL RESISTANCE VALUES IN OHMS
K=1,000
M=1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED
ALL CAPACITANCE VALUES LESS THAN ONE, IN MICROFARADS & GREATER THAN ONE IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED.
DRAWING NO. XXD-10751

PART NO.	DESCRIPTION	APPLICATION
TT-10012	Standard Coil Pentode Tuner	Tuner
ITA-10003	Ion Trap	Cathode Ray Tube
VSA-10012	Picture Fidelity-Control	24" Sets
VCA-12134A	200 K-Control	Drive 24" Sets
VCA-12121D	2.5 Meg.-Control	Vertical Size
VCA-12120C	5 K Slotted Shaft-Control	Vertical Linearity
VCA-12127D	Dual 750 Tap. 250 S.W.-Control	Video Amp. & Audio
VCA-12131E	50 K	Horizontal Speed
VCA-12132E	1.3 Meg.	Vertical Speed
VCA-12135A	100 K-Brightness	Rear Mounting
MDA-10002	Magnetic Centering Device	Cathode Ray Tube
RXA-10019	200 Ohm 10 Watt Resistor	B+
CLC-10050	20 UF-450 V & 100 UF-25 V	Vertical Sweep
CLC-10074	40-10 UF 350-250 V	B+ Audio-Video & S.G.
CLC-10075	4C-20-40 UF-450 V	Power
CLA-10087C	50 UF-350 V	Audio Output
CMX-10012	Integrator Network	Vertical Sync.
CMX-10002	.005 Ceramic Disc.	Audio & Video
CPA-14402B	.004 UF 400 V 5%	LGA-10017-AFC Coil
CTA-10005	25-280 UUF Trimmer	Horizontal
CLA-10027A	4-10 UF, 50 V	Audio
LVA-10001A	Width coil	24" Sets
LGA-10017B	Horizontal AFC	Horizontal sweep
LGA-10019A	Filament choke	Video IF
LGA-10032	120 UH Coil	Video Amp.
LGA-10033	180 UH Coil	Video Amp.
LGA-10034	100 UH Coil	Video Amp.
LVA-10000	Linearity Coil	24" Sets
THC-10017B	H. V. Transformer	High Voltage
THC-10016	H. V. Transformer	High Voltage
TOB-10045H	Vertical Output Transformer	Vertical

PART NO.	DESCRIPTION	APPLICATION
TOA-10061	Vertical Output Transformer	Vertical 24" Sets
TPC-10010C	6 V Filament Tubes	Power 24" Sets
TPA-10016	Filament	6W4 24" Sets
TPC-10011	Power Transformer	Power
TOA-10023C	Width Control	Horizontal
TOC-10034C	Audio Transformer	Output Transformer
FCB-10001	EM Focus Unit	24" Sets
YDB-10006A	Deflection yoke	Horizontal & Vertical Sweep 24" Sets
YDB-10001C	Deflection yoke	Horizontal & Vertical Sweep
TSB-10062A	Ratio Detector Coil	Sound
TSA-10054B	IF Coil	I.F.
TSA-10050C	Sound Driver Coil	Sound
TT-10014	Standard Coil Cascode Tuner	Tuner

PART NO.	DESCRIPTION	JM 721 T	JM 721 TU	JM 721 D	JM 721 DU	JM 721 C	JM 717 T	JM 717 TU	JM 717 C	JM 717 CU
SRC-10026	5" Round Speaker									
SRC-10025	8" Round Speaker	X	X				X	X		
SRC-10024	10" Round Speaker			X	X	X			X	X

PART NO.	DESCRIPTION	817 C	817 CUL	817 T	817 TU	LIST
SR-10052	Speaker, Jensen 12"					5.95*
SRC-10024	Speaker					6.65*
SRC-10024A	Speaker	X	X			6.65*
SRC-10025	Speaker, Round 8"			X	X	4.45*
SRC-10027	Speaker, Round 12"					7.60*
SRC-10051	Speaker, Jensen 10"					28.77*

PART NO.	DESCRIPTION	817 CU	817 TU	821 TU	821 TH	821 CH	921 WH	924 XW	921 WU	821 CU
SRA-10051	12" Co-Ax. Speaker									
SRA-10055	15" Co-Ax. Speaker									
SRC-10024A	10" Round Speaker	X				X	X		X	
SRC-10025	8" Round Speaker		X	X	X					X
SRC-10027	12" Round Speaker							X		

MODEL	DESCRIPTION
T212 - MZ	Mahogany 21" Consolette
T212 - BZ	Blonde 21" Consolette
T172 - MZ	Mahogany 17" Consolette
T172 - BZ	Blonde 17" Consolette

These models use 19 tubes (Including picture tube and rectifier) plus a crystal diode video detector and employ a intercarrier sound circuit. Picture tube has Electro Static focus which is automatic and permanent.

SAFETY PRECAUTIONS: The kinescope should be handled with extreme care. The person handling this tube should wear gloves and protective goggles as an added precaution.

When power is connected, care must be taken in servicing the HIGH VOLTAGE supply of these receivers. As a safety precaution the AC line is open when the cabinet back is removed. For servicing with chassis out of cabinet a separate line cord must be used.

VOLTAGE READINGS: The voltage readings to be obtained at various locations in the receiver have been indicated on the schematic diagram. These voltages will be very advantageous when "trouble shooting." Check voltages, tubes, fuse and inspect for damaged or burned parts before attempting to re-align receiver. A ¼ amp fuse is located in the low voltage power supply of the receiver.

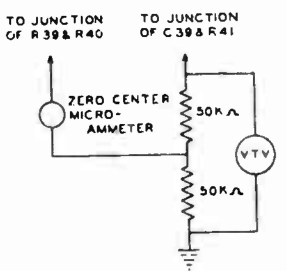
All voltages were taken with a 117.5 V. 60 Cycle line and with no signal input. The contrast control set at the maximum clockwise position; the brightness control at 50% rotation and all other controls in normal operating position. All voltages are positive with respect to ground unless otherwise indicated.

FREQUENCY CHART

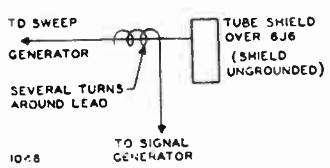
CHANNEL NO.	CHANNEL FREQ. MC.	PICTURE CARRIER M. C.	SOUND CARRIER M. C.	RECEIVER RF. OSC. M. C.	CHANNEL NO.	CHANNEL FREQ. MC.	PICTURE CARRIER M. C.	SOUND CARRIER M. C.	RECEIVER RF. OSC. M. C.
2	54-60	55.25	59.75	81.65	8	180-186	181.25	185.75	207.65
3	60-66	61.25	65.75	87.65	9	186-192	187.25	191.75	213.65
4	66-72	67.25	71.75	93.65	10	192-198	193.25	197.75	219.65
5	76-82	77.25	81.75	103.65	11	198-204	199.25	203.75	225.65
6	82-88	83.25	87.75	109.65	12	204-210	205.25	209.75	231.65
7	174-180	175.25	179.75	201.65	13	210-216	211.25	215.75	237.65

IF. FREQ. M.C.
Picture Carrier 26.4
Sound Carrier 21.9

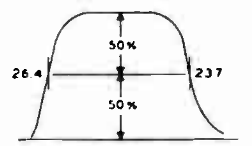
NOTE 1



NOTE 2

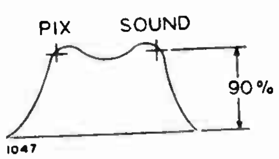


NOTE 3



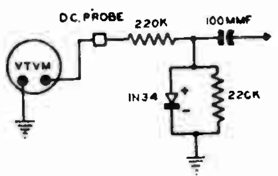
OVERALL IF RESPONSE CURVE
1035

NOTE 4



PIX AND AUDIO MARKERS

NOTE 5



VTVM CONNECTIONS.
1045

CENTERING OF PICTURE: The picture may be centered in relation with the opening of the glass panel at the face of the receiver by shifting the centering magnet at the neck of the picture tube. The centering magnet should be rotated and the control adjusted until the picture is properly framed keeping in mind that the effect of the control is governed by the position of rotation. If the control is above or below the neck of the picture tube, the picture will be moved up or down. To the left or right of the neck of the picture tube, the picture will be moved either to the left or right.

CONTROL ADJUSTMENT

VERTICAL HEIGHT & VERTICAL LINEARITY CONTROLS: The vertical height and linearity controls should both be adjusted at the same time. For best results adjust while a test pattern is being transmitted. The linearity control affects the upper portion of the picture while the height control affects the overall size especially the lower portion of the picture. Adjust both controls simultaneously until the test pattern is symmetrical and fills the entire screen vertically.

WIDTH ADJUSTMENT: Adjust width by turning slug either clockwise or counter-clockwise. A clockwise rotation will decrease width. Proper width is obtained when raster covers entire screen of picture tube.

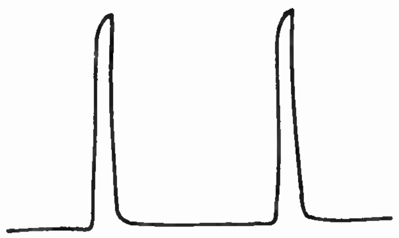
HORIZONTAL FREQ.: Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync. If in the above check the receiver fails to hold sync, reset horizontal hold slightly.

4.5 MC TRAP ALIGNMENT: 1. Connect the signal generator to the grid (pin 1) of the video amplifier tube v-6, through a 1000 MMF. Capacitor. 2. Connect the germanium crystal detector and voltmeter, between the cathode of the kinescope and chassis, as shown in note 5. 3. Set the signal generator at 4.5 MC and maximum output (setting of 4.5 MC must be accurate). Adjust 4.5 MC trap (L10) for minimum reading on the lowest voltage scale of the meter.

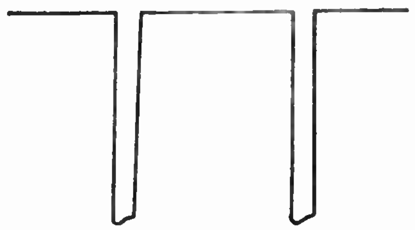
I. F. ALIGNMENT PROCEDURE

STEP NO.	CONNECT SIGNAL GENERATOR TO	SIGNAL GENERATOR FREQUENCY MC	CONNECT SWEEP GENERATOR TO	SWEEP GENERATOR FREQUENCY	CONNECT OSCILLOSCOPE TO	REMARKS	ADJUSTMENTS (Use peak obtained when screw is farthest out of can or coil.)
1. AUDIO IF ALIGNMENT	Grid of Video Amp. (6AH6) Pin No. 1. Contrast control at maximum.	4.5 MC. No Modulation. See Adjustments column.	NOT USED		NOT USED	Connect Vacuum Tube Voltmeter and zero center Microammeter as shown in Note 1 (50,000 ohm resistors shown in Note 1 must match within 5%).	Adjust L12 and T3 (Bottom) for maximum on Vacuum Tube Voltmeter. This adjustment should be made with Voltage on Vacuum Tube Voltmeter under 12 Volts. Adjust T3 (Top) for zero on Microammeter. If the receiver is receiving a signal, the above adjustment can be made off a weak station keeping the reading on the Vacuum Tube Voltmeter under 12 Volts.
2. PRELIMINARY VIDEO IF ALIGNMENT	Tube shield over 6J6. Disengage shield from clip to remove ground.	26.1 MC. No Modulation.	NOT USED		NOT USED	Connect —4.5 V. Battery to Junction of R20 and C24. Connect Vaccum Tube Voltmeter to A. G. C. point. Junction of R20 and R21.	Adjust 1st and 4th I. F. coils (L3 in Tuner and L7) for maximum on Vacuum Tube Voltmeter. Adjust at approximotely one volt.
3. PRELIMINARY VIDEO IF ALIGNMENT	Tube shield over 6J6. Disengage shield from clip to remove ground.	24.0 MC. No Modulation.	NOT USED		NOT USED	Connect —4.5 V. Battery to Junction of R20 and C24. Connect Vaccum Tube Voltmeter to A. G. C. point. Junction of R20 and R21.	Adjust 3rd I. F. coil (L6) for maximum on Vacuum Tube Voltmeter. Adjust at approximately one volt.
4.	Tube shield over 6J6. Disengage shield from clip to remove ground.	24.4 MC. No Modulation.	NOT USED		NOT USED	SAME AS ABOVE	Adjust 2nd I. F. coil (L5) for maximum on VTVM. Adjust at approximately one volt.
5. FINAL VIDEO IF ALIGNMENT	Signal Generator as shown in Note 2.	26.4 and 23.7 MC. No Modulation. See Note 3.	Tube shield over 6J6. Disengage shield from clip to remove ground.	24.3 Center Frequency and at least 6 MC wide.	Junction of R21 and L8.		With signal generator set at 26.4 MC adjust 1st and 4th I. F. coils to give correct marker position as shown in Note 3. Set signal generator at 23.7 MC and adjust 2nd and 3rd I. F. coils for pattern shown in Note 3. A slight readjustment of 1st and 2nd coils may be necessary.

OSCILLOSCOPE PATTERNS

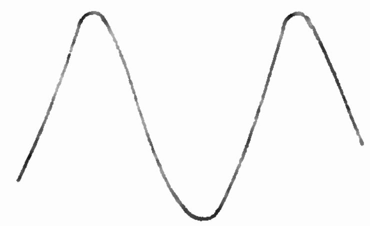


6SN7GT PHASE SPLITTER
PIN 2
15,750 CYCLES
25 VOLTS PP



6SN7GT PHASE SPLITTER
PIN 3
15,750 CYCLES
35 VOLTS PP

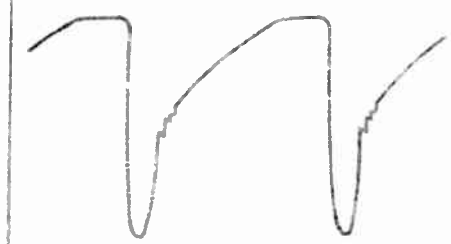
6AL5 HORIZ. PHASE DET.
PIN 1 & 2
15,750 CYCLES
11 VOLTS PP



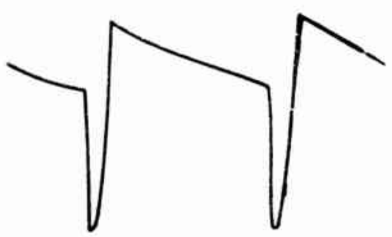
JUNCT R76 & C62
15,750 CYCLES
35 VOLTS PP

1050

6SN7GT HORIZ. OSC
PIN 1
15,750 CYCLES
40 VOLTS PP

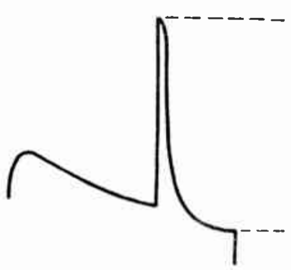


6BQ6GT HORIZ. DRIVER
PIN 5
15,750 CYCLES
130 VOLTS PP

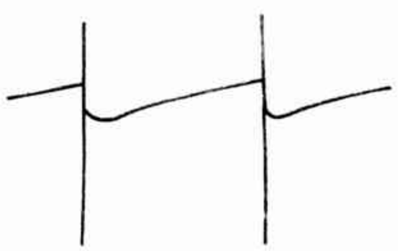


6AL5 HORIZ. PHASE DET.
PIN 5
ON STATION IN SYNC.
11 VOLTS PP

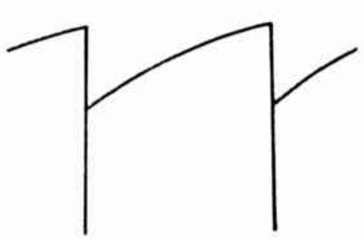
6AL5 HORIZ. PHASE DET.
PIN 7
ON STATION IN SYNC.
8 VOLTS PP



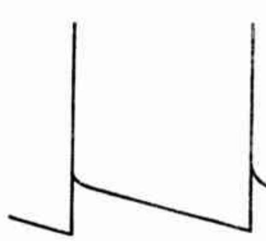
JUNCT. C49 & R65A
ON STATION
OUT OF SYNC.
60 CYCLES
6 VOLTS PP



6SN7GT VERT. OSC.
PIN 5
60 CYCLES
220 VOLTS PP

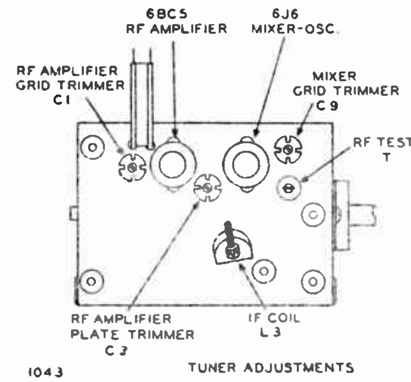


6S4 VERT. OUTPUT
PIN 6
60 CYCLES
130 VOLTS PP



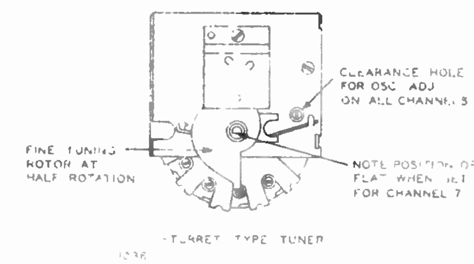
6S4 VERT. OUTPUT
PIN 9
60 CYCLES
1500 VOLTS PP

TUNER ALIGNMENT PROCEDURE



TUNER ADJUSTMENTS

NOTE 6

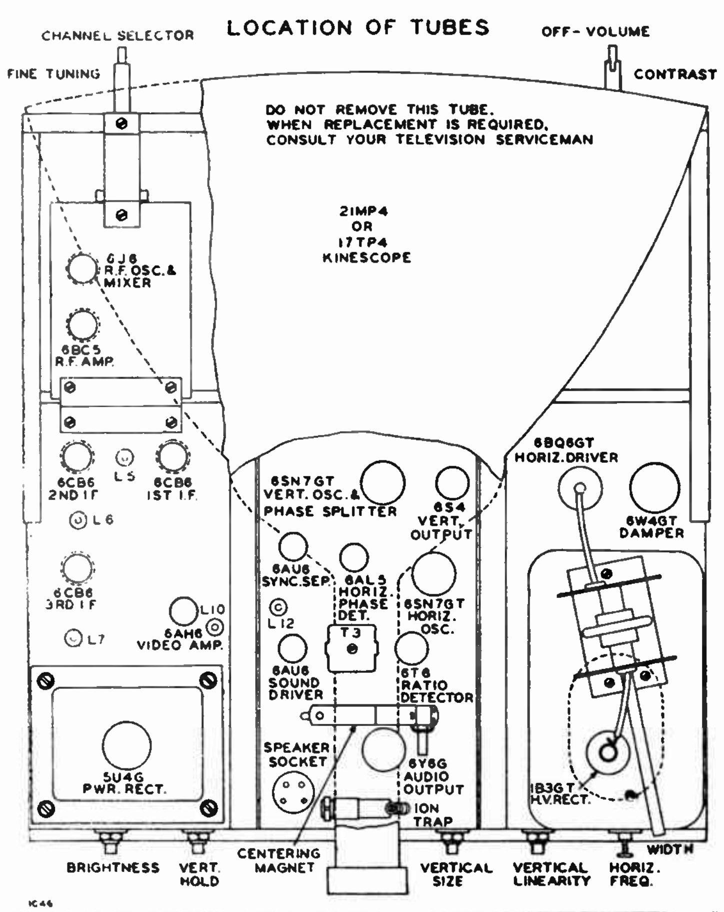


TURRET TYPE TUNER

NOTE 7

STEP NO.	CONNECT SIGNAL GENERATOR TO	SIGNAL GENERATOR FREQUENCY	CONNECT SWEEP GENERATOR TO	SWEEP GENERATOR FREQUENCY	CONNECT OSCILLOSCOPE TO	REMARKS	ADJUSTMENTS
1. RF & MIXER ALIGNMENT	Connect to piece of wire and wrap around 300 Ohm antenna lead.	205.25 MC (Picture Carrier). 209.75 MC (Sound Carrier.)	Antenna lead of receiver. (Generator must terminate in 300 ohms.)	TO SWEEP TV CHANNEL 12.	Through 10,000 Ohm resistor to test point (T) on tuner.	Connect negative of 1½ volt battery to junction of R10 and R12 and positive of battery to chassis ground.	With tuner set to channel 12, adjust Mixer Grid Trimmer (C9), RF Amplifier Plate Trimmer (C3), and RF Amplifier Grid Trimmer (C1) to obtain response curve shown in Note 4. Response curve should have maximum amplitude with proper band width.
2. RF & MIXER ALIGNMENT	SAME AS ABOVE	Correct sound and picture carrier for each channel. (See listing on first page of booklet.)	SAME AS ABOVE	TO SWEEP PROPER TV CHANNEL.	SAME AS ABOVE	Check response curve of each channel without disturbing trimmers.	If satisfactory response is not obtained for some particular channel try replacing coils for that channel or repeat step 1 of tuner alignment favoring weak channel without seriously affecting other channels.
3. OSCILLATOR ALIGNMENT FOR INDIVIDUAL CHANNEL	SAME AS ABOVE	Correct sound and picture carrier for each channel. (See listing on first page of booklet.)	SAME AS ABOVE	TO SWEEP PROPER TV CHANNEL.	JUNCTION OF C25 and [illegible]	All adjustments to oscillator coils (T9 [illegible]) must be made with [illegible] alignment [illegible] blade. If slug "falls in" during adjustment, remove [illegible] from tuner and raise slug retention spring. By tapping coil slightly, slug will return to a position retainable by spring.	For fine oscillator adjustment of channel, set tuner to channel and adjust slug of oscillator coil (T9) through hole in face plate of tuner (See Note 7) to position markers in the exact position on the response curve indicated in Note 3 under I. F. alignment. REPEAT OSC. ALIGNMENT FOR EACH CHANNEL AFTER SETTING TUNER TO PROPER CHANNEL.

N-9197



TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Watts
R1		15,000	½
R2		47,000	½
R3		2,200	½
R4		1,000	½
R5		4,700	½
R6		220,000	½
R7		10,000	½
R8		15,000	½
R9		6,800	½

CONDENSERS

Ref. No.	Description
C1	Amplifier Grid Trimmer 3-8MMFD
C2, 5, 6, C15	800 MMFD. Minimum (Feed thru Capacitors)
C3	Amplifier Plate Trimmer .5-3 MMFD.
C4	150 MMFD. Ceramic
C7, C14	120 MMFD. Ceramic
C8	5 MMFD. Ceramic
C9	Mixer Grid Trimmer .5-3 MMFD.
C10, C13	10 MMFD. Ceramic
C11	Fine Tuning Rotor
C12, C16	1000 MMFD. Ceramic

COILS & TRANSFORMERS

Ref. No.	Part No.	Description	Channel
T8	N-9152	Antenna Coil Strip	2
	N-9153	Antenna Coil Strip	3
	N-9154	Antenna Coil Strip	4
	N-9155	Antenna Coil Strip	5
	N-9156	Antenna Coil Strip	6
	N-9157	Antenna Coil Strip	7
	N-9158	Antenna Coil Strip	8
	N-9159	Antenna Coil Strip	9
	N-9160	Antenna Coil Strip	10
	N-9161	Antenna Coil Strip	11
	N-9162	Antenna Coil Strip	12
	N-9163	Antenna Coil Strip	13
T9	N-9164	Oscillator & Mixer Coil Strip	2
	N-9165	Oscillator & Mixer Coil Strip	3
	N-9166	Oscillator & Mixer Coil Strip	4
	N-9167	Oscillator & Mixer Coil Strip	5
	N-9168	Oscillator & Mixer Coil Strip	6
	N-9169	Oscillator & Mixer Coil Strip	7
	N-9170	Oscillator & Mixer Coil Strip	8
	N-9171	Oscillator & Mixer Coil Strip	9
	N-9172	Oscillator & Mixer Coil Strip	10
	N-9173	Oscillator & Mixer Coil Strip	11
	N-9174	Oscillator & Mixer Coil Strip	12
	N-9175	Oscillator & Mixer Coil Strip	13
L1		Heater Choke RF Amp	
L2		Heater Choke Oscillator & Mixer	
L3		IF Coil (Mixer Plate Coil)	
L15		Plate Choke (Mixer Plate Choke)	

MAIN CHASSIS

RESISTORS

Ref. No.	Part No.	Description
R85	N-8125	4.3 Ohms 0.5 W. 10%
R11, R15, R27	N-6237	47 Ohms 0.5 W. 10%
R61, R62	N-8023	56 Ohms 0.5 W. 10%
R81	N-1349	100 Ohms 0.5 W. 20%
R18	N-3663	150 Ohms 0.5 W. 10%
R42	N-4420	330 Ohms 0.5 W. 10%
R39	N-5159	390 Ohms 0.5 W. 10%
R19, R84	N-4280	560 Ohms 0.5 W. 10%
R75	N-4279	820 Ohms 0.5 W. 10%
R10, R12, R38	N-3341	1,000 Ohms 0.5 W. 10%
R69	N-6793	1,200 Ohms 0.5 W. 10%
R57	N-7398	1,500 Ohms 0.5 W. 10%
R66	N-4281	1,800 Ohms 0.5 W. 10%
R55	N-8103	2,700 Ohms 0.5 W. 10%
R68	N-7399	3,900 Ohms 0.5 W. 10%
R67	N-7000	4,700 Ohms 0.5 W. 20%
R14	N-7400	5,600 Ohms 0.5 W. 10%
R21	N-4630	6,800 Ohms 0.5 W. 10%
R79	N-4897	8,200 Ohms 0.5 W. 10%
R31, R64	N-4895	10,000 Ohms 0.5 W. 10%
R41	N-5690	12,000 Ohms 0.5 W. 10%
R17, R23, R40, 47 R91	N-6424	15,000 Ohms 0.5 W. 10%
R24	N-7124	47,000 Ohms 0.5 W. 10%
R60	N-4823	56,000 Ohms 0.5 W. 10%
R78	N-9015	82,000 Ohms 0.5 W. 10%
R46, R70, 71, 73	N-2973	100,000 Ohms 0.5 W. 10%
R36	N-4468	150,000 Ohms 0.5 W. 10%
R48	N-7401	180,000 Ohms 0.5 W. 5%
R77	N-7003	180,000 Ohms 0.5 W. 10%
R22, 44, 88, 89	N-4899	220,000 Ohms 0.5 W. 10%
R45	N-9041	220,000 Ohms 0.5 W. 5%
R92	N-7004	270,000 Ohms 0.5 W. 10%
R53, R80	N-8026	390,000 Ohms 0.5 W. 10%
R74	N-5694	470,000 Ohms 0.5 W. 10%
R26, R29, R30	N-7790	560,000 Ohms 0.5 W. 10%
R20	N-4469	820,000 Ohms 0.5 W. 10%
R90	N-2976	1.0 Megohms 0.5 W. 10%
R51	N-4470	1.2 Megohms 0.5 W. 10%
R56	N-4420	2.2 Megohms 0.5 W. 10%
R25, R72	N-4061	4.7 Megohms 0.5 W. 20%
R43	N-4028	6.8 Megohms 0.5 W. 20%
R58	N-9016	820 Ohms 1.0 W. 10%
R13, R16	N-7793	3,300 Ohms 1.0 W. 10%
R76	N-7406	5,600 Ohms 1.0 W. 10%
R34, R37	N-7013	39,000 Ohms 1.0 W. 10%
R82, R83	N-9017	150,000 Ohms 1.0 W. 10%
R86	N-8029	470,000 Ohms 1.0 W. 10%
R49	N-9040	220 Ohms 2.0 W. 10%
R63	N-7126	2,700 Ohms 2.0 W. 10%
R33	N-8491	5,600 Ohms 2.0 W. 10%
R28, R50	N-8942	Contrast & On-Off Vol. Variable
	N-9117	Contrast & Off Volume (Combination Models Only)
R52	N-8943	1.0 Megohms, Vertical Hold, Variable
R87	N-8944	100,000 Ohms Brightness, Variable
R54	N-8971	2.5 Megohms Vertical Height—Variable
R59	N-8945	5,000 Ohms Vertical Linearity- Variable

CAPACITORS

Ref. No.	Part No.	Description
C18, C21, C19	N-7774	.004 MFD. Dual Ceramic 500 V.
C72	N-9045	.01 MFD. Dual Ceramic 500 V.
C20, C29	N-9047	4.7 MMFD. Ceramic 500 V. 5%
C23	N-9048	10 MMFD. Ceramic 500 V. 10%
C27, C74	N-9049	22 MMFD. Ceramic 500 V. 10%
C69	N-9052	43 MMFD. Ceramic 2000 V. 5%
C30	N-9050	47 MMFD. Ceramic 500 V. 10%
C31	N-9051	68 MMFD. Ceramic 500 V. 10%
C43	N-9053	100 MMFD. Ceramic 500 V. 20%
C26	N-9055	220 MMFD. Ceramic 500 V. 10%
C37	N-9059	3,900 MMFD. Ceramic 500 V. 20%
C17, 22, 28, 32 C41, 42, 46, 47 C74	N-6272	.005 MFD. Ceramic 500 V. (GMV)
C33, C38	N-9062	.01 MFD. Ceramic 400 V. (GMV)
C60	N-9054	220 MMFD. Silver Mica 500 V. 5%
C61	N-9056	330 MMFD. Silver Mica 500 V. 5%
C64	N-9057	560 MMFD. Mica 500 V. 5%
C36	N-7780	560 MMFD. Mica 500 V. 10%
C66	N-9058	1,000 MMFD. Mica 1000 V. 10%
C55, C56, C63	N-7783	1,100 MMFD. Mica 500 V. 10%
C49	N-6998	4,700 MMFD. Mica 600 V. 10%
C59	N-1344	.01 MFD. Paper 400 V.
C48	N-9046	.015 MFD. Paper 600 V.

CAPACITORS (Continued)

Ref. No.	Part No.	Description
C44	N-1376	.02 MFD. Paper 400 V.
C45, C58	N-1345	.05 MFD. Paper 200 V.
C25, C65, C68	N-1351	.1 MFD. Paper 200 V.
C51, C52, C71	N-1623	.1 MFD. Paper 400 V.
C24	N-1479	.25 MFD. Paper 200 V.
C67	N-2579	.25 MFD. Paper 400 V.
C62	N-9060	3,900 MMFD. Stab. Paper 600 V. 5%
C57	N-9061	4,700 MMFD. Stab. Paper 600 V. 10%
C73	N-8970	100 MFD. Electrolytic 200 V.
C40B, C40A	N-8969	100-40 MFD. Electrolytic 400 V.
C54A, C54B	N-8039	10-10 MFD. Electrolytic 450 V.
C53A, C53B, 53D C53C	N-8967	10 MFD. Electrolytic 400 V. 80-40 MFD. Electrolytic 200 V. 100 MFD. Electrolytic 50 V.
C39	N-6912	16 MFD. Electrolytic 50 V.
C70	N-8041	500 MMFD. High Volt. 20,000 V.

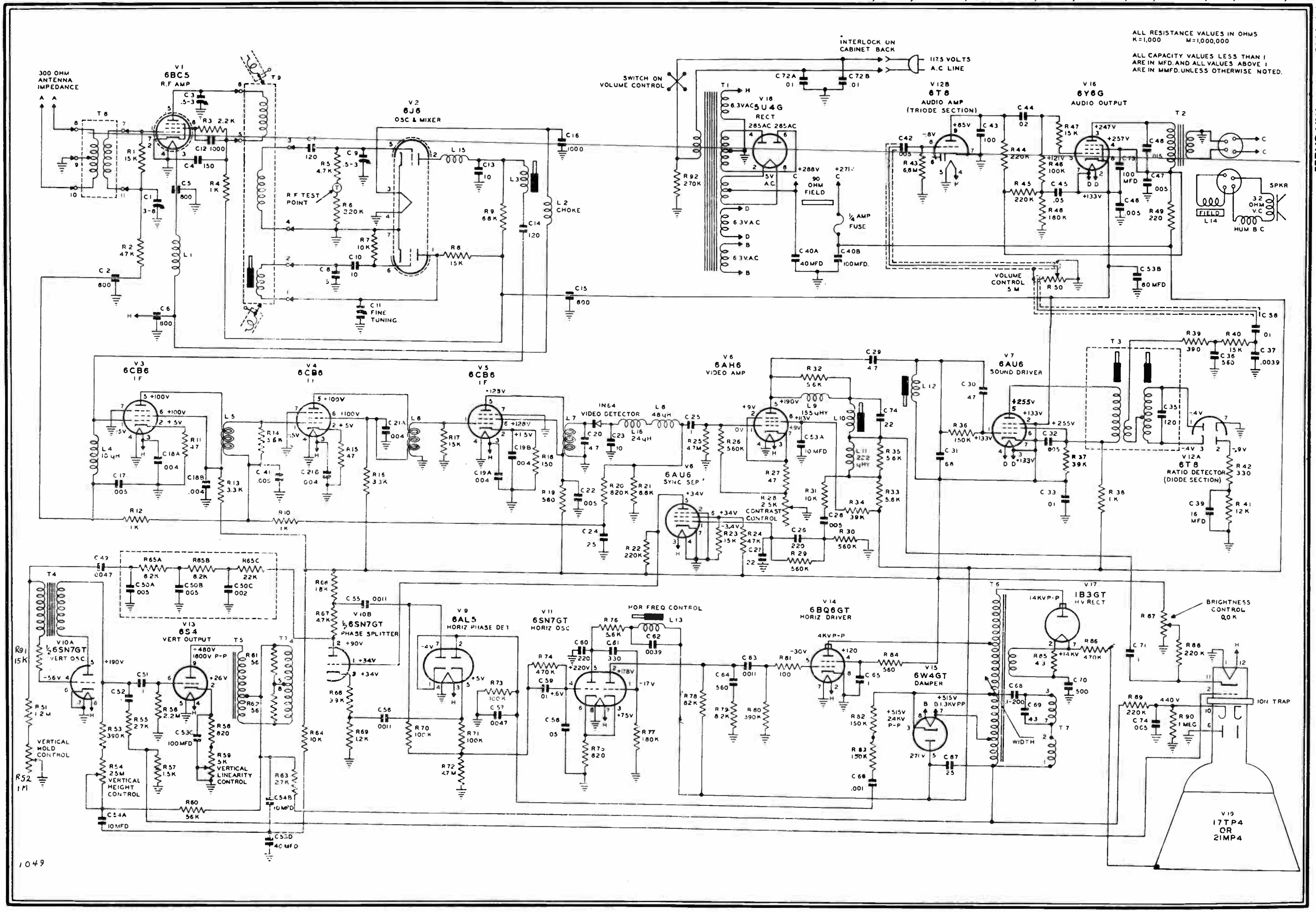
CHOKES, COILS, TRANSFORMERS

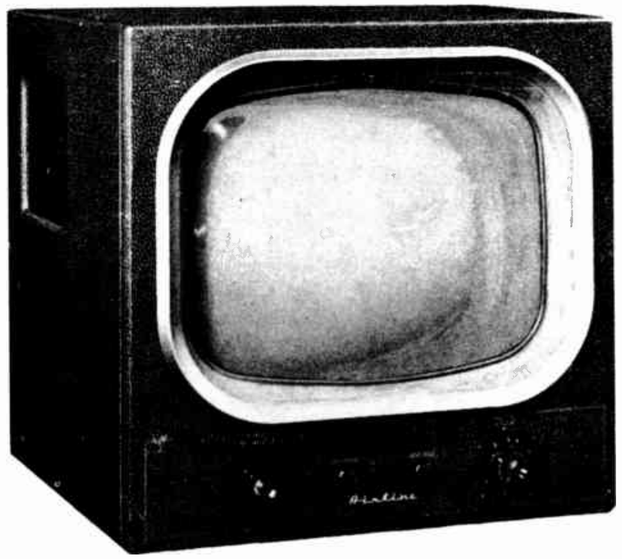
Ref. No.	Part No.	Description
T3	N-8928	Coil, ratio detector includes C35
L5, L6, L7	N-8929	Coil, I. F.
L10	N-9011	Coil, 4.5 MC Sound Trap
L12	N-7746	Coil, Sound Take-off
T7	N-8930	Coil, Deflection Yoke
L13	N-8931	Coil, Horiz. Freq. Control
L8	N-8932	Coil, Video Peaking-Detector
L9	N-8933	Coil, Video Peaking-Amp. — Series Includes No. R-32
L11	N-8934	Coil, Video Peaking-Amp. — Shunt Includes No. R-35
L4	N-7321	Choke, R. F.
L16	N-9250	Choke Coil
T1	N-8935	Transformer, Power
T6	N-8936	Transformer, Horiz. Output
T5	N-8937	Transformer, Vertical Output
T4	N-9002	Transformer, Vertical Osc.
T2	N-8938	Audio Output Transformer
L14		Filter Choke (Part of N-8926 See Miscellaneous)

MISCELLANEOUS

Part No.	Description
N-8926	Speaker 8" Electro Magnet (with cable & Plug)
N-8042	Multiple Resistor Capacitor Assembly (R65 & C50)
N-9012	ION TRAP
N-8939	CENTERING MAGNET
*N-9268	ION TRAP

* 21" Receivers Only.


ALL RESISTANCE VALUES IN OHMS K=1,000 M=1,000,000
ALL CAPACITY VALUES LESS THAN 1 ARE IN MFD. AND ALL VALUES ABOVE 1 ARE IN MMFD. UNLESS OTHERWISE NOTED.
300 OHM ANTENNA IMPEDANCE
V1 6BC5 R.F. AMP
V2 6J6 OSC & MIXER
INTERLOCK ON CABINET BACK
117.5 VOLTS A.C. LINE
SWITCH ON VOLUME CONTROL
V18 5U4G RECT
V12B 6T8 AUDIO AMP (TRIODE SECTION)
V16 6Y6G AUDIO OUTPUT
R.F. TEST POINT
C11 FINE TUNING
VOLUME CONTROL 5 M
V3 6CB6 I.F.
V4 6CB6 I.F.
V5 6CB6 I.F.
1N64 VIDEO DETECTOR
V6 6AH6 VIDEO AMP
V7 6AU6 SOUND DRIVER
V8 6AU6 SYNC SEP.
R28 2.5K CONTRAST CONTROL
V12A 6T8 RATIO DETECTOR (DIODE SECTION)
V10A 1/2 6SN7GT VERT OSC
V13 6S4 VERT OUTPUT
V10B 1/2 6SN7GT PHASE SPLITTER
V9 6AL5 HORIZ PHASE DET
V11 6SN7GT HORIZ OSC
HOR FREQ CONTROL
V14 6BQ6GT HORIZ DRIVER
V15 6W4GT DAMPER
V17 1B3GT H.V. RECT
BRIGHTNESS CONTROL
ION TRAP
VERTICAL HOLD CONTROL
VERTICAL HEIGHT CONTROL
VERTICAL LINEARITY CONTROL
WIDTH
SPKR
HUM B.C.
FIELD
V19 17TP4 OR 21MP4
1049



RADIO FREQUENCY RANGES

Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc	Receiver R-F Osc. Frequency Mc
2	54-60	55.25	59.75	81.45
3	60-66	61.25	65.75	87.45
4	66-72	67.25	71.75	93.45
5	76-82	77.25	81.75	103.45
6	82-88	83.25	87.75	109.45
7	174-180	175.25	179.75	201.45
8	180-186	181.25	185.75	207.45
9	186-192	187.25	191.75	213.45
10	192-198	193.25	197.75	219.45
11	198-204	199.25	203.75	225.45
12	204-210	205.25	209.75	231.45
13	210-216	211.25	215.75	237.45

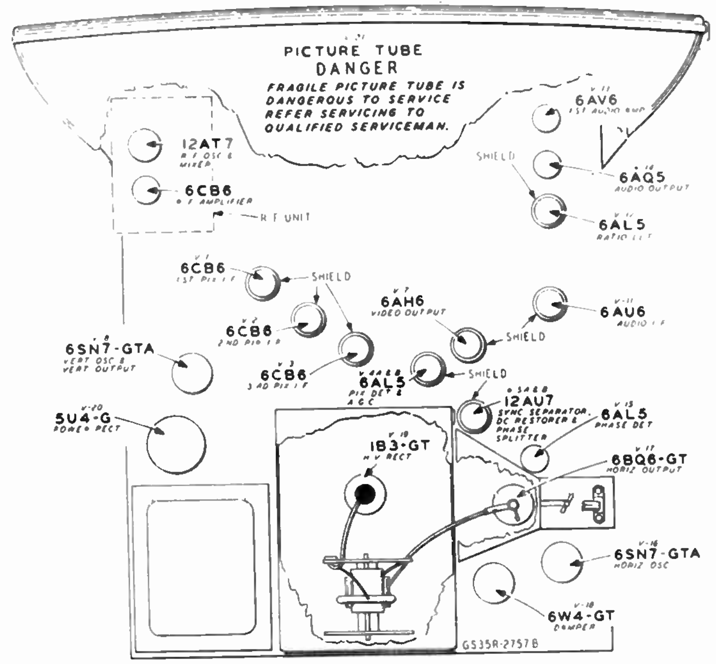


Fig. 1—Tube Layout.

ELECTRICAL SPECIFICATIONS

Power Supply.............105-125 Volts AC
60 Cycles only

Power Consumption........190 Watts

Power Output............2.4 Watts (Max.)
1.8 Watts (10% Distortion)

Tuning Range ....12 Channel

Antenna Input Imp.........300 Ohms balanced

Intermediate
Frequencies............Picture 26.20 MC
Sound 21.70 MC

Intercarrier Sound
System.................4.5 MC

Loud Speaker............5" PM Dynamic

Voice Coil Imp............3.2 Ohms 400 Cycles

TUBE COMPLEMENT

Symbol	Type	Function
Tuner	6CB6	R-F Osc. and Mixer
Tuner	12AT7	R-F Amplifier
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and AGC
V-5 A & B	12AU7	Sync Sep. DC Restorer and Phase Splitter
V-7	6AH6	Video Output
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-11	6AU6	Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6W4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20	5U4-G	Low Voltage Rectifier
V-21	17HP4	Picture Tube 17" Glass Rectangular (Electrostatic)

RECEIVER LOCATION — Advise the owner as to the proper location for the television receiver. The following may be used as a guide:

1. Choose an area in the home where sunlight or light from lamps does not strike the face of the picture tube and cause glare.
2. Remember the necessity of an electrical outlet and the location of the point at which the antenna leads enter the room.
3. The receiver should be placed a short distance from the wall to allow adequate ventilation.
4. The receiver should be placed to permit easy access for operation and comfortable viewing from all angles.

ANTENNA — This receiver has been designed to use an antenna with a 300 ohm balanced transmission line. This line must be as short as possible because the longer the line the greater the chances are for picking up electrical disturbances. Stand-off insulation should be used to keep the line away from the mast, metal or walls. Twist this line about one turn per foot throughout the line to cancel out direct signal and or noise pickup by the transmission line. It should also be securely anchored in place so that a change in weather will not affect its position.

HIGH VOLTAGE WARNING

This television receiver contains high voltages which are dangerous to life. Never operate or service the receiver outside of the cabinet or with the covers removed until all the safety precautions necessary for working with high voltage equipment have been observed.

PICTURE TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves must be worn by individuals while handling the picture tube or installing the picture tube into the receiver.

The picture tube encloses a high vacuum and due to the large surface area, is subjected to very high air pressure. Therefore, care should be taken not to bump or scratch the picture tube accidentally as it may cause the tube to implode resulting in damage to property or injury to an individual.

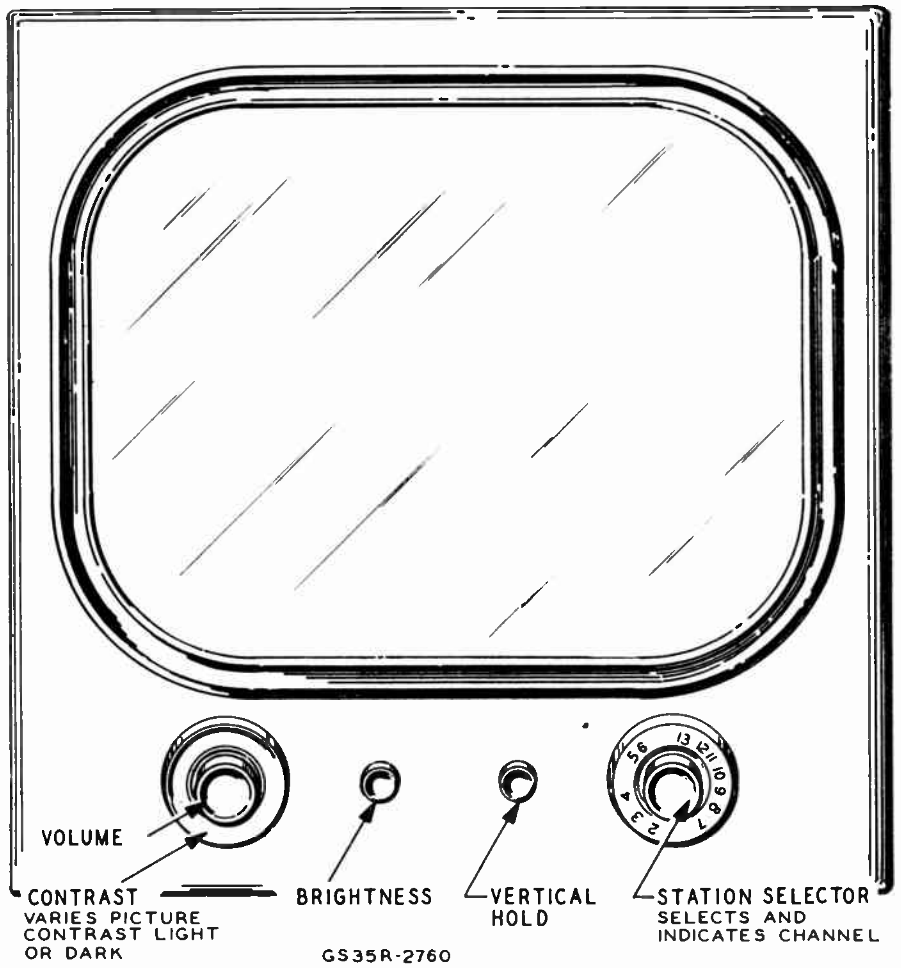


Fig. 2—Front Panel Controls

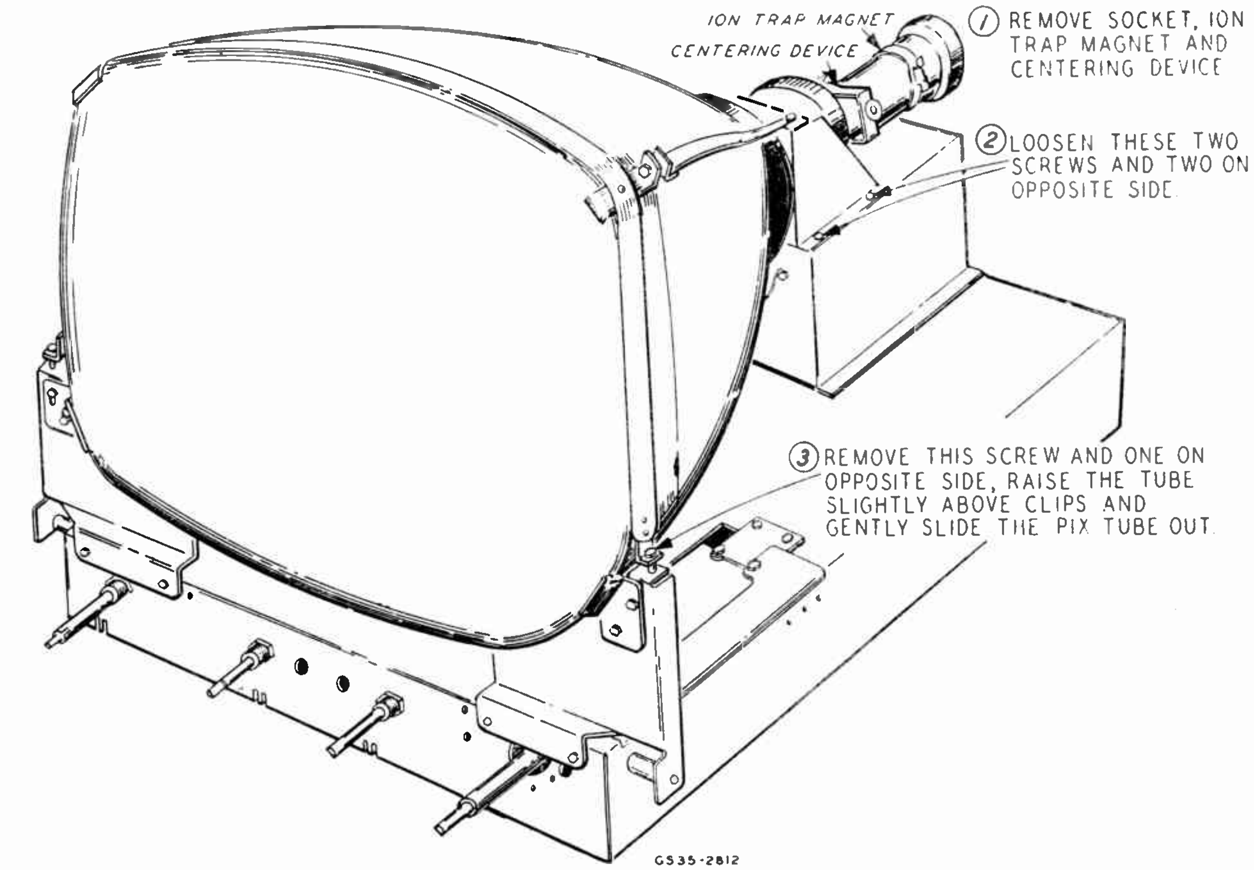


Fig. 3—Removal of Picture Tube.

TUNING PROCEDURE

1. To turn the television receiver on, turn the OFF-ON VOLUME control clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.
2. Turn the STATION SELECTOR control to the desired channel. This control may be turned in either direction.
3. Turn the CONTRAST control clockwise until activity or definite form is noted on the screen.
4. Adjust the STATION SELECTOR control for clearest picture and the VOLUME control for desired volume.
5. To turn off the receiver, turn the OFF-ON VOLUME control counterclockwise until a click is heard.

OCCASIONAL ADJUSTMENTS TO IMPROVE PICTURE RECEPTION

Brightness and Vertical Hold Controls are provided at the front of the receiver. These controls are pre-set at the factory and may occasionally need adjustment due to aging of the components in the receiver and the fluctuating line voltages in different areas. If any adjustments are necessary, follow the instructions under "Controls and Functions."

IMPORTANT — Be sure that the STATION SELECTOR Control has been set for the clearest picture before adjusting any control.

CONTROLS AND FUNCTIONS

HORIZONTAL HOLD—Stops horizontal movement (diagonal bars.) This control is located at the rear of the receiver.

BRIGHTNESS—Adjusts for desired picture brilliance.

VERTICAL HOLD—Stops upward or downward picture movement.

WARNING — Before handling the picture tube, it will be necessary to remove the static charge. In receivers with glass picture tubes, ground the anode lead to chassis, and insert an insulated wire from the well in the tube to chassis. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

PICTURE TUBE REPLACEMENT — To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front control knobs by pulling them straight from their shafts.
2. Remove the cabinet back.
3. Disconnect the leads from the speaker, remove the antenna terminal board at the rear of the cabinet and then the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

FRONT OF CHASSIS

Brightness	R-25
Vertical Hold	R-51

NON-OPERATING CONTROLS
REAR OF CHASSIS

Horizontal Centering	Centering Device
Vertical Centering	Centering Device
Ion Trap Magnet	Wing Nut Adjustment
Deflection Yoke	Wing Screw
Width	L-15
Horizontal Drive	R-80
Horizontal Hold	L-14
Vertical Linearity	R-49
Height	R-54

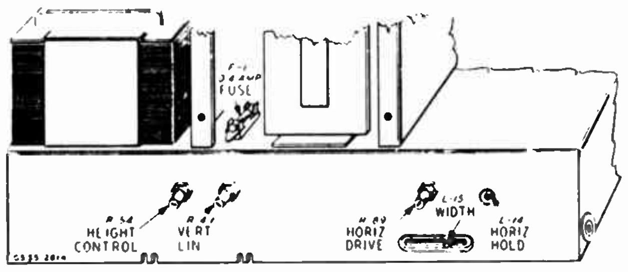


Fig. 4—Adjustments Rear of Chassis

ION TRAP MAGNET ADJUSTMENT—The ion trap magnet should be positioned close to the base of the tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to make sure that the ion trap magnet is correctly adjusted.

DEFLECTION YOKE ADJUSTMENT — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

CENTERING ADJUSTMENT — If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained.

PICTURE ADJUSTMENT — For further adjustments, obtain a test pattern on the receiver, Turn on receiver and follow tuning procedure on page 2. When a test pattern is obtained it may be necessary to slightly re-adjust the station selector control for clearest picture.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync immediately. If in the above check the receiver fails to hold sync or pull-in to sync without hesitation it will be necessary to make a horizontal hold adjustment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT — Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49 until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH AND DRIVE ADJUSTMENTS —While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. If adjustment of the horizontal drive (R-89) is required, it usually will be necessary to recheck the horizontal hold control. Adjust the picture centering device to align the picture with the mask.

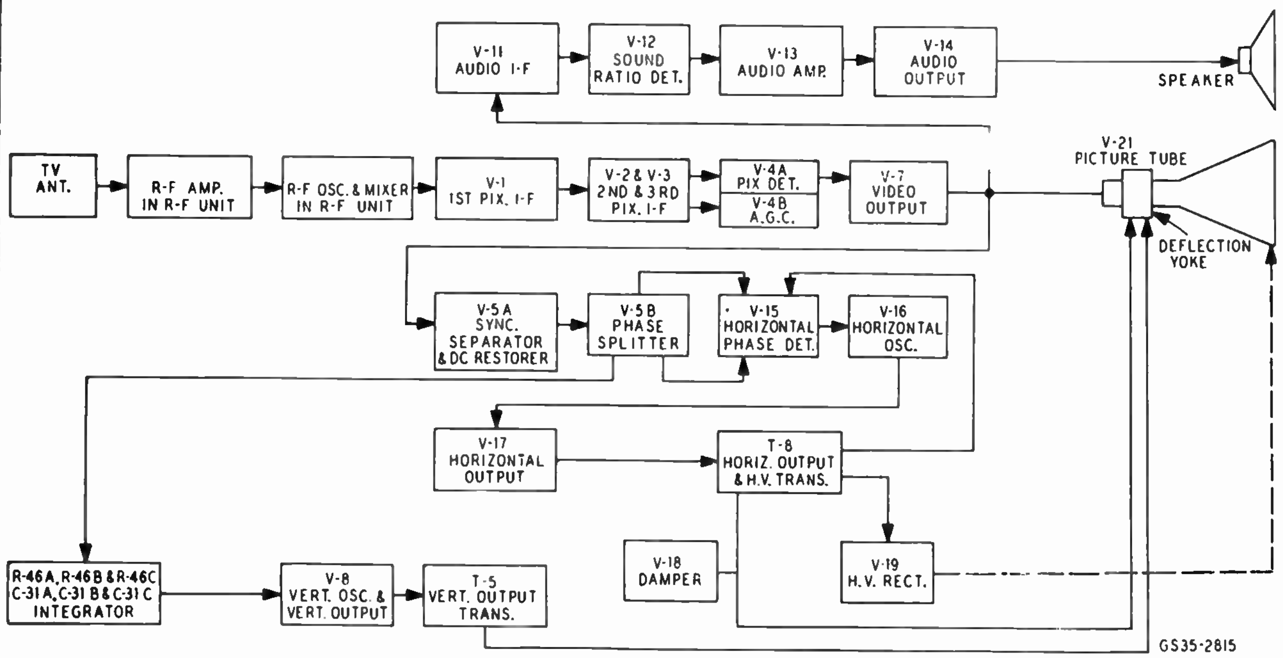


Fig. 5—Block Diagram.

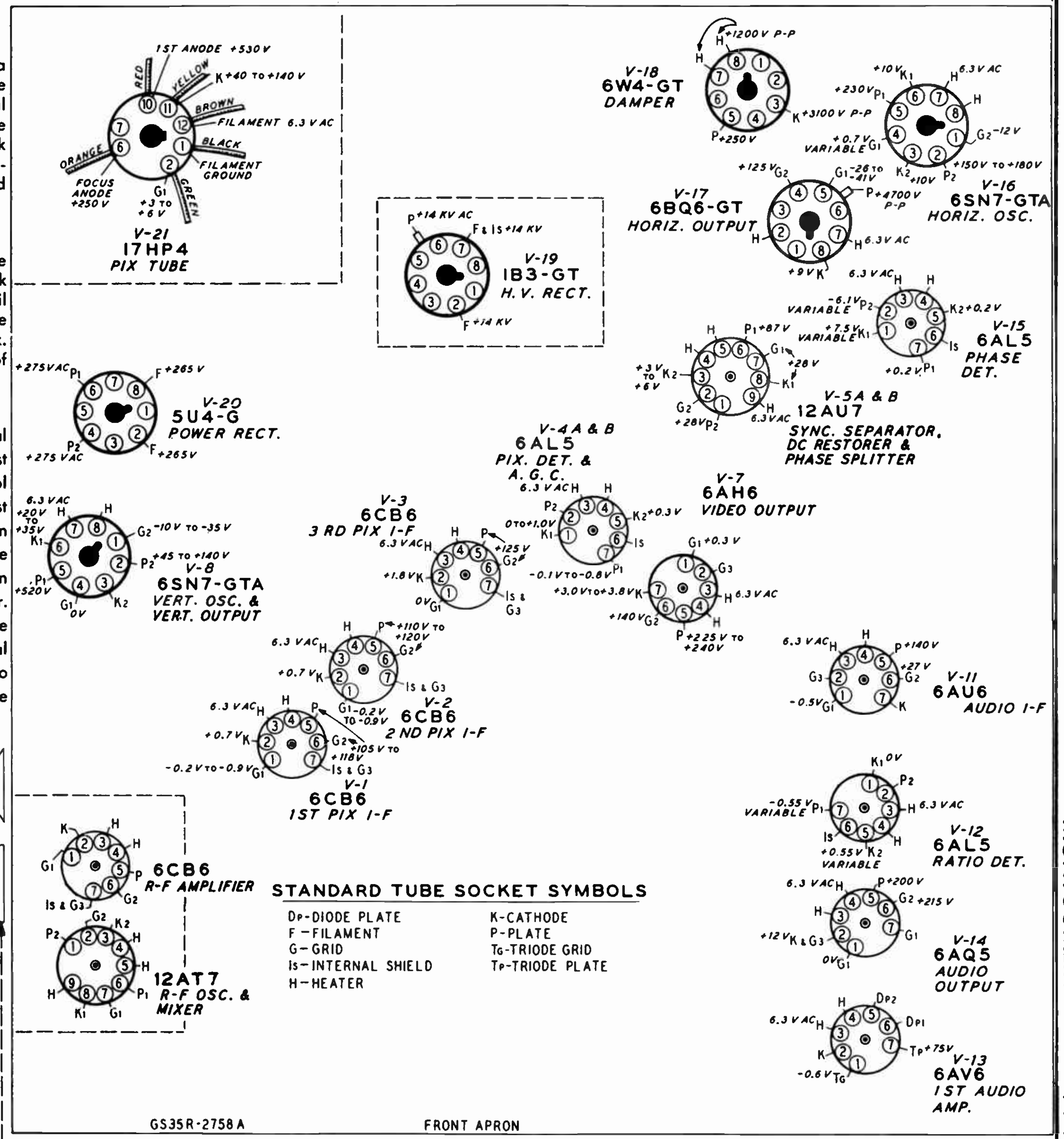


Fig. 6—Bottom Socket Voltages.

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.

1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4 10 ampere fuse. Replace if defective. If fuse continually burns out, check
   (A) Horizontal output tube V-17 (6BQ6-GT)
   (B) Check damper tube V-18 (6W4-GT).
   (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
   (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-8) and the chassis.
   (E) Check DC resistance of T-8.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-8, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-99 and C-78 defective or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:

1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.

1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-35A, or C-70 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitor C-37, or open or incorrect value of resistors R-55 & R-56.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-36 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive control does not correct this condition, check the following:

1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6W4-GT).
3: Check capacitors C-74, C-76, for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER

1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:

1: Defective yoke due to C-75 or R-98 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2: V-18 (6W4-GT) defective.

SMALL RASTER — This condition can be caused by:

1: Low+B or line voltage. Check V-20 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control R-89.
5: V-18 (6W4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND — This condition can be caused by:

1: No signal on picture tube grid. Check V-7 tube and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY — A condition of this nature can be caused by:

1: Defective V-5A sync separator or phase splitter V-5B.
2: If tube is O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-4B (6AL5) AGC tube and associated circuit.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY — If this condition is encountered, check:

1: Vertical integrating network capacitors C-31A, B & C, and resistors R-46 A, B & C.
2: Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY

1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal hold control.
3: Check setting of horizontal drive control.
4: Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:

1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video output (V-7).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-6, L-7, L-8, L-9 and L-10 for continuity. Note that L-6 and L-7 have shunting resistors.
5: Leakage in grid capacitor C-14. If the capacitor is not found to be defective, check the following:
   1: Check all potentials in video circuits.
   2: Check picture tube grid circuit for poor or dirty contact.
   3: Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:

1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-7 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc.)

1: Check sound I-F tubes V-11 & V-12 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S-ING

1: Check capacitors C-35B and C-79B.
2: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
3: Check sync separator tube V-5A (12AU7) and phase splitter V-5B (12AU7).
4: If contrast setting is too high it can cause this trouble.

PICTURE NORMAL—NO SOUND OR WEAK OR DISTORTED SOUND

1: Check sound I-F alignment.
2: Check V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

BUZZ IN SOUND:

1: Contrast setting too high.
2: Check sound I-F Alignment.

POOR FOCUS:

1: Improper setting of Ion Trap magnet.
2: Defective picture tube or picture tube socket.

PICTURE JITTER:

1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AU7) and sync separator V-5A.
6: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
7: Contrast control setting either too high or too low.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:

(a) Frequency ranges:
   18 to 30 mc, 10 mc sweep width
   40 to 90 mc, 10 mc sweep width
   170 to 225 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)

(a) Intermediate alignment frequencies.
   23.1 mc first picture I-F coil.
   24.1 mc third picture I-F coil.
   25.9 mc second picture I-F coil.
   21.7 mc sound trap.
   4.5 mc video trap & sound I-F.
   25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-99.

ALIGNMENT PROCEDURE

PIX I-F

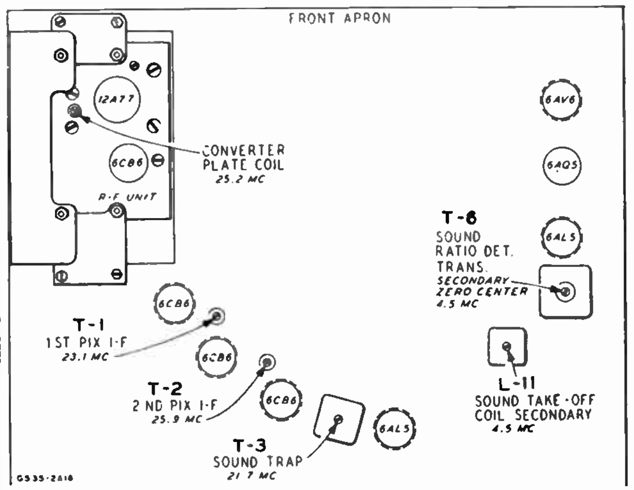


Fig. 7—Top Chassis Video and Audio I-F Adjustments

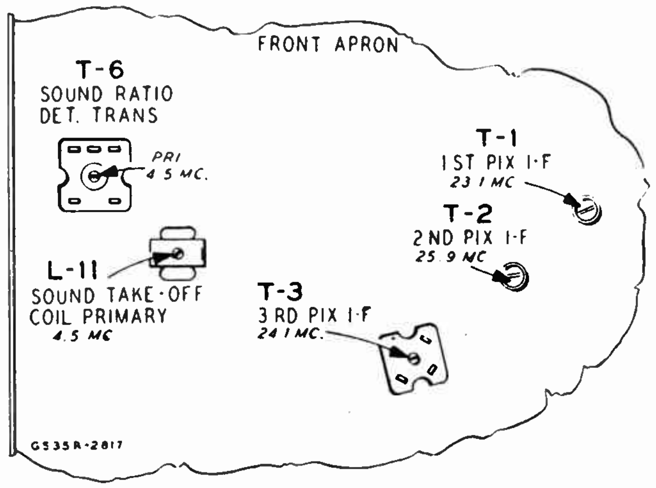


Fig. 8--Bottom Chassis Video and Audio I-F Adjustments

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-14) 4700 ohms, in series with peaking coil (L-7) from Pin 5 of 6AL5. Input signal leval should be such that output is less than 2 volts D.C. Apply -4.5V battery bias on AGC line.

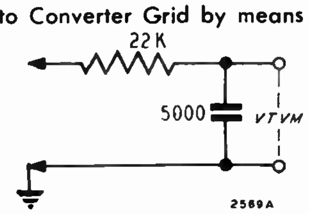


Fig. 9—VTVM Connections

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil (L-4) for maximum dc at picture detector
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I F trap (T-3 in can above chassis) for minimum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-14 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery). Tuner should be turned to dead channel so as not to cause interference.

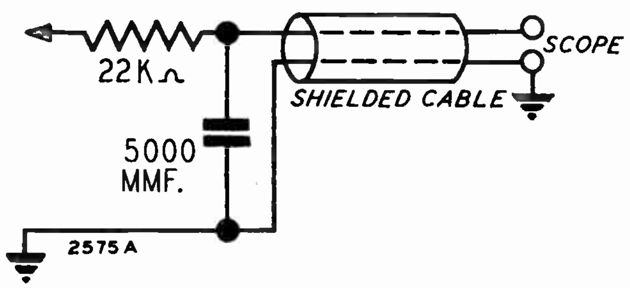


Fig. 10—Oscilloscope Connections.

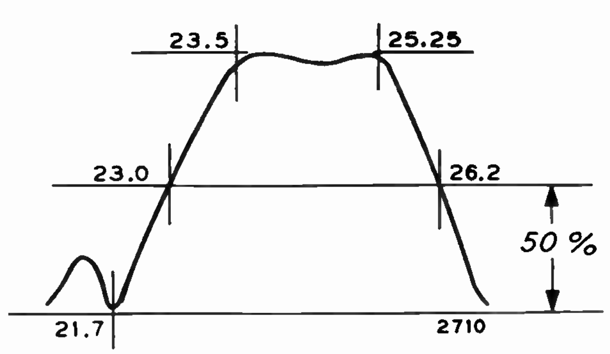


Fig. 11—Overall Response Curve

Observe overall I-F response, which should be as shown above. A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into cathode of the picture detector tube (Pin 5-6AL5) and VTVM on picture tube grid, tune sound take off coil primary (L-11 Bottom) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-17 and C-13, adjust sound take-off coil secondary (L-11 Top) for maximum.
2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-6 Bottom) for maximum.
3: With VTVM connected to junction of R-66, R-69 and C-50, adjust ratio detector secondary (T-6 Top) for cross over (zero voltage) on lowest scale.
NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

CONTINUOUS TUNER ADJUSTMENTS

ALIGNMENT of tuner cannot be accomplished in the field, however, a pictorial of the tuner is shown below to be used ONLY for minor field adjustments. A replacement parts list and schematic diagram are shown on page 14.

NOTE—A FEW RECEIVERS WERE SHIPPED WITH A TURRET TYPE TUNER PART NUMBER 25A1080.

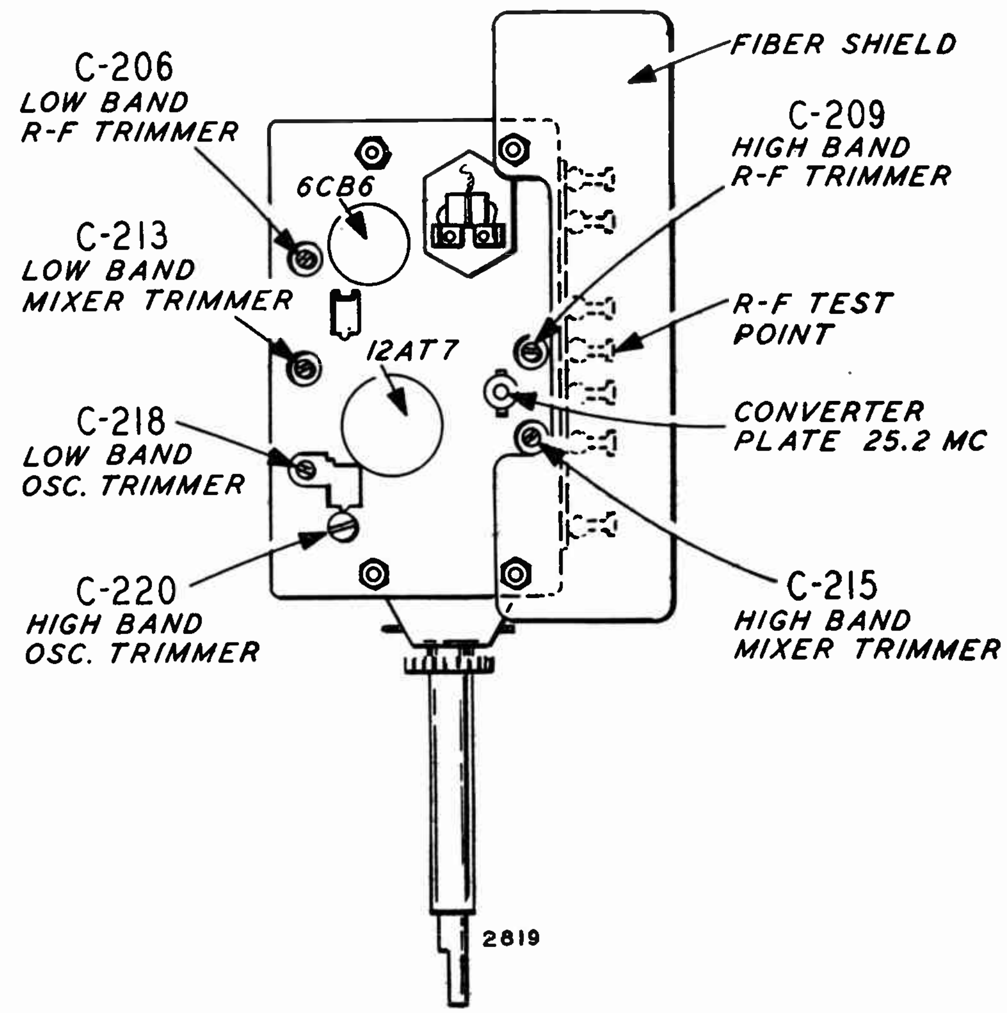


Fig. 12—Tuner Adjustments.

CONTINUOUS TUNER INFORMATION

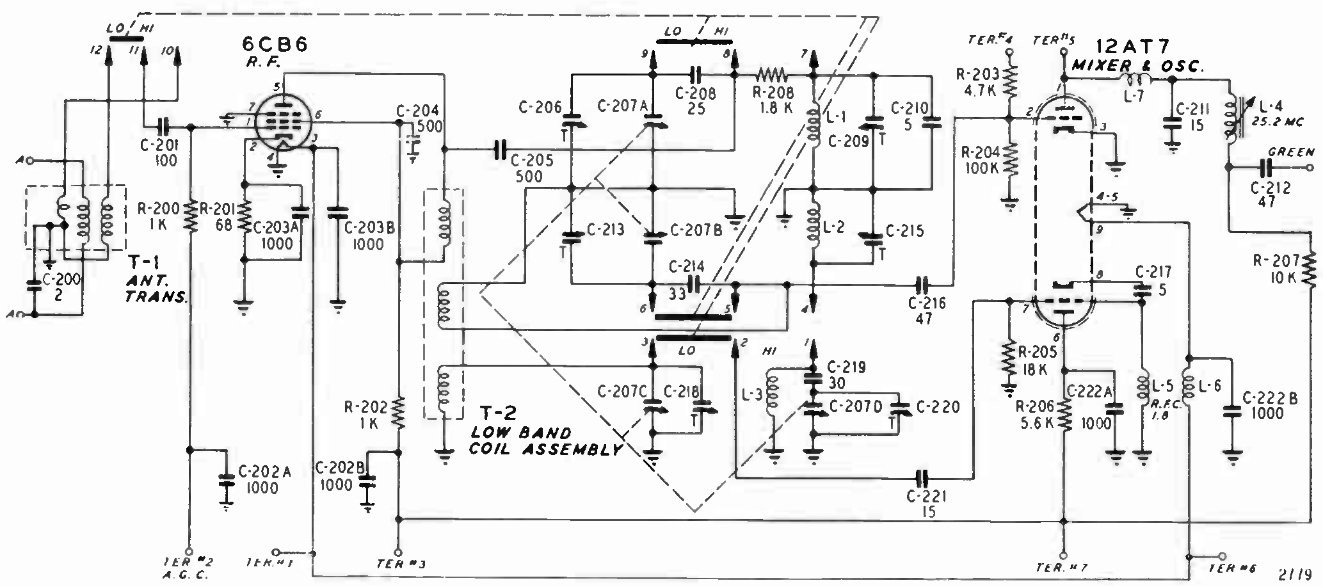


Fig. 13—Tuner Schematic.

TUNER PARTS LIST

Ref. No.	Part No.	Description	
		CAPACITORS	
C-200	RC-690032	2 mmf	Ceramic......
C-201	RC-690009	100 mf	Ceramic......
C-202A, C-202B, C-203A, C-203B, C-222A, C-222B	RC-690016	1000 mmf	Dual Ceramic.
C-204, C-205	RC-690007	500 mf	Ceramic......
C-206		Low Band R-F Trimmer	
C-207A, C-207B, C-207C, C-207D		Gang Condenser Assembly	
C-208	RC-690008	25 mmf	Ceramic......
C-209		High Band R-F Trimmer	
C-210, C-217	RC-690010	5 mmf	Ceramic......
C-211, C-221	RC-690001	15 mmf	Ceramic......
C-212, C-216	RC-690004	47 mmf	Ceramic......
C-213		Low Band Mixer Trimmer	
C-214	RC-690017	33 mmf	Ceramic......
C-215		High Band Mixer Trimmer	
C-218		Low Band Osc. Trimmer	
C-219	RC690003	30 mmf	Ceramic......
C-220	RC-691003	High Band Osc. Trimmer	

NOTE — C-206, C-209, C-213, C-215 and C-218 are part of the Gang Condenser.

Ref. No.	Part No.	Description	
		RESISTORS	
R-200, R-202	RC-680002	1000 Ohms	0.5 W......
R-201	RC-680000	68 Ohms	0.5 W......
R-203	RC-680004	4.7 K Ohms	0.5 W......
R-204	RC-680007	100 K Ohms	0.5 W......
R-205	RC-680006	18 K Ohms	0.5 W......
R-206	RC-680023	5.6 K Ohms	0.5 W......
R-207	RC-680005	10 K Ohms	0.5 W......
R-208	RC-680003	1.8 K Ohms	0.5 W......
		MISCELLANEOUS	
L-1		High Band RF Coil	
L-2		High Band Mixer Coil	
L-3		High Band Oscillator Coil	
L-4	RC-345062	Converter Plate Coil	
L-5		RF Choke (1.8 uh)	
L-6		Filament Choke	
L-7		RF Choke	
T-1	RC-345038	Antenna Transformer	
T-2		Low Band Coil Assembly	
	RC-185112	Drive Assembly Consisting of drive bracket, spindle, gear, spring and washer	
	RC-155117	Gear and Sleeve Assembly consisting of a sleeve and gear........	
	RC-175103	Gear Assembly consisting of three gears and a disc	

OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.
The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.

No. 1—6AH6 Grid
5-10V P-P 60 C.P.S.

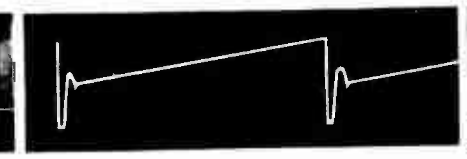
No. 2—Pix Tube Grid
20-100V P-P 60 C.P.S.

No. 3—12AU7 Sync Sep. Plate
20V P-P 60 C.P.S.

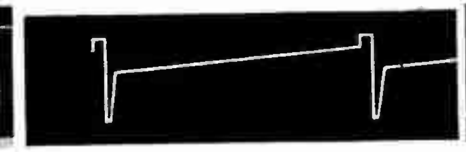
No. 4—12AU7 Phase Splitter Cathode
18V P-P 60 C.P.S.

No. 4—12AU7 Phase Splitter Cathode
18V P-P 15,750 C.P.S.

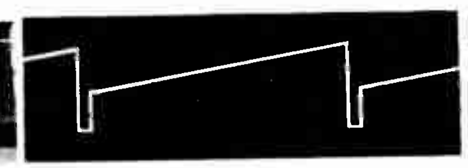
No. 5—12AU7 Phase Splitter Plate
45V P-P 60 C.P.S.



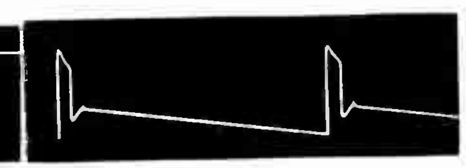
No. 6—6SN7—Vert. Osc. Plate
100V P-P 60 C.P.S.



No 7—6SN7 Vert. Osc. Grid
130V P-P 60 C.P.S.

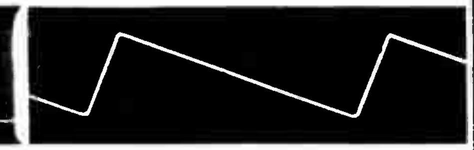


No. 8—6SN7 Vert. Output Grid
120V P-P 60 C.P.S.

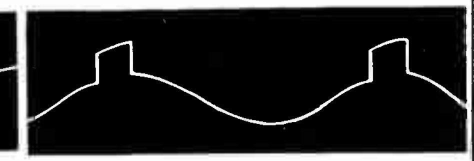


No. 9—Vert. Def. Coil
85V P-P 60 C.P.S.

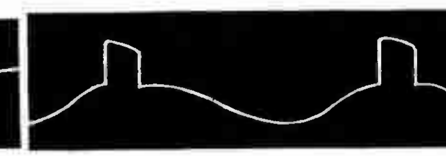
No. 10—Term "A" Hor. Output Transformer
450V P-P 15,750 C.P.S.



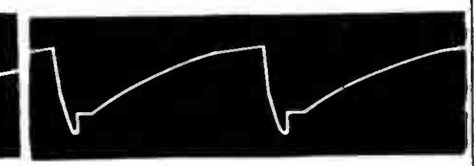
No. 11—6AL5 Phase Det.
18V P-P 15,750 C.P.S.



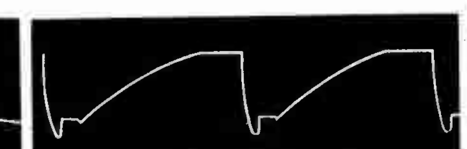
No. 12—6SN7—Hor. Osc. Plate
50V P-P 15,750 C.P.S.



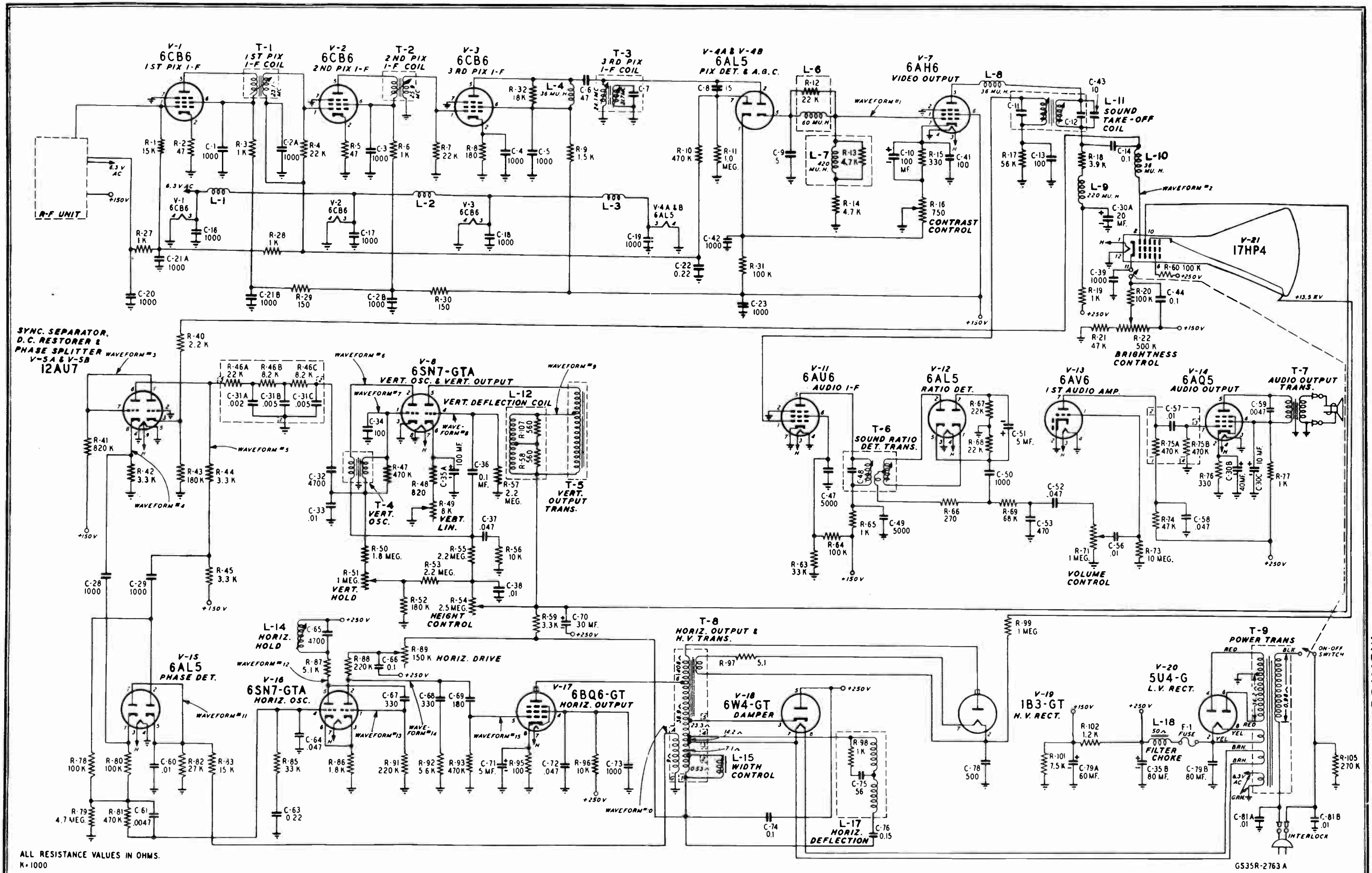
No. 13—6SN7 Hor. Osc. Grid
48V P-P 15,750 C.P.S.



No. 14—6SN7 Hor. Osc. Plate
135V P-P 15,750 C.P.S.



No. 15—6BQ6 Grid
120V P-P 15,750 C.P.S.



ALL RESISTANCE VALUES IN OHMS.
K=1000

ALL CAPACITANCE VALUES LESS THAN 1.0 IN MF. AND ABOVE 1.0 IN MMF., UNLESS OTHERWISE NOTED

COIL RESISTANCE VALUES LESS 1.0 OHM ARE NOT SHOWN.

TELEVISION PARTS LIST

17" GLASS RECTANGULAR PIX TUBE

Use only genuine factory tested parts to insure service jobs you can depend on and to obtain original set performance.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CAPACITORS

Ref. No.	Part No.	Capacity	Voltage	Description	Selling Price
C-1, C-3, C-4, C-5, C-16, C-17, C-18, C-19, C-20, C-23, C-28, C-29, C-39, C-42, C-50, C-73	80X1	1000 mmf		Ceramic	.12
C-2A, C-2B, C-21A, C-21B	80X3	1000 mmf		Dual Ceramic	.18
C-6	47X565	47 mmf	500 V	Molded Mica	.12
C-7	Part of T-3				
C-8	47X605	15 mmf	500 V	Ceramic	.06
C-9	47X562	5 mmf	500 V	Ceramic	.48
C-10	45X401	100 mf	25 W.V.	Dry Electrolytic	.47
C-11, C-12	Part of L-11				
C-13, C-34, C-41	47X604	100 mmf	500 V	Ceramic	.12
C-14, C-66, C-74	RCP10M4104M	0.1 mf	400 V	Tubular	.22
C-22, C-63	RCP10M2224M	.22 mf	200 V	Tubular	.28
C-30A, C-30B, C-30C	45X399	20 mf / 40 mf / 10 mf	300 V / 50 V / 300 V	Dry Electrolytic	1.38
C-31A, C-31B, C-31C	Part of 76X7				
C-32, C-65	47X543	4700 mmf	500 V	Molded Mica	.52
C-33, C-56, C-60	RCP10M4103M	.01 mf	400 V	Tubular	.16
C-35A, C-35B	45X395	100 mf / 80 mf	50 V / 300 V	Dry Electrolytic	1.96
C-36	RCP10M6104M	0.1 mf	600 V	Tubular	.30
C-37	RCP10M6473M	.047 mf	600 V	Tubular	.22
C-38	RCP10M6103M	.01 mf	600 V	Tubular	.18
C-43	47X523	10 mmf	500 V	Ceramic	.16
C-44	RCP10M2104M	0.1 mf	200 V	Tubular	.18
C-47, C-49	47X507	5000 mmf		Ceramic	.18
C-48	Part of T-6				
C-51, C-71	45X378	5 mf	25 W.V.	Dry Electrolytic	.58
C-52, C-64	RCP10M2473M	.047 mf	400 V	Tubular	.18
C-53	47X525	470 mmf	500 V	Molded Mica	.16
C-57	Part of 76X5				
C-58, C-72	RCP10M4473M	.047 mf	400 V	Tubular	.18

CAPACITORS—Continued

Ref. No.	Part No.	Capacity	Voltage	Description	Selling Price
C-59	RCP10M6472M	.0047 mf	600 V	Tubular	.16
C-61	RCP10M4472M	.0047 mf	400 V	Tubular	.16
C-67, C-68	47X570	330 mmf	500 V	Molded Mica	.14
C-69	47X564	180 mmf	500 V	Molded Mica	.12
C-70	45X393	30 mf	400 V	Dry Electrolytic	1.06
C-75	47X598	56 mmf	1500 V	Ceramic	.20
C-76	RCP10M4154M	.15 mf	400 V	Tubular	.24
C-78	47X560	500 mmf	20 K.V.	Ceramic	1.20
C-79A, C-79B	45X397	60 mf	300 V	Dry Electrolytic	2.32
C-81A, C-81B	76X8	.01 mf		Dual Ceramic	.26

RESISTORS

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
R-1	883153	15 K	0.5	Carbon	.10
R-2, R-5	883470	47 K	0.5	Carbon	.10
R-3, R-6, R-27, R-28, R-65, R-98	885102	1 K	0.5	Carbon	.06
R-4, R-7	B83223	22 K	0.5	Carbon	.10
R-8	884181	180	0.5	Carbon	.08
R-9	B84152	1.5 K	0.5	Carbon	.08
R-10, R-47, R-81	B85474	470 K	0.5	Carbon	.06
R-11	B84105	1.0 Meg.	0.5	Carbon	.08
R-12	Part of L-6				
R-13	Part of L-7				
R-14	B83472	4.7 K	0.5	Carbon	.10
R-15	884331	330	0.5	Carbon	.08
R-16, R-71	78X11	750 / 1.0 Meg.		Contrast and Volume Control	1.52
R-17	884563	56 K	0.5	Carbon	.08
R-18	C83392	3.9 K	1.0	Carbon	.12
R-19	C84102	1 K	1.0	Carbon	.10
R-20, R-60	B85104	100 K	0.5	Carbon	.06
R-21, R-74	885473	47 K	0.5	Carbon	.06
R-22	40X365	500 K		Brightness	.25
R-29, R-30	885151	150	0.5	Carbon	.06
R-31, R-64, R-78, R-80	884104	100 K	0.5	Carbon	.08
R-32	B84183	18 K	0.5	Carbon	.08
R-40	884222	2.2 K	0.5	Carbon	.08
R-41	884824	820 K	0.5	Carbon	.08
R-42, R-45	883332	3.3 K	0.5	Carbon	.10

RESISTORS—Continued

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
R-43, R-52	B84184	180 K	0.5	Carbon	.08
R-44	B84332	3.3 K	0.5	Carbon	.08
R-46A, R-46B, R-46C	Port of 76X7				
R-48	B84821	820	0.5	Carbon	.08
R-49	40X362	8 K		Vertical Linearity	.46
R-50	B84185	1.8 Meg.	0.5	Carbon	.08
R-51	40X366	1.0 Meg.		Vertical Hold	.25
R-53, R-55, R-57	884225	2.2 Meg.	0.5	Carbon	.08
R-54	40X364	2.5 Meg.		Height	.42
R-56	884103	10 K	0.5	Carbon	.08
R-58, R-107	B84561	560	0.5	Carbon	.08
R-59	C84332	3.3 K	1.0	Carbon	.10
R-63, R-85	884333	33 K	0.5	Carbon	.08
R-66	B84271	270	0.5	Carbon	.08
R-67, R-68	B84223	22 K	0.5	Carbon	.08
R-69	884683	68 K	0.5	Carbon	.08
R-73	B85106	10.0 Meg.	0.5	Carbon	.06
R-75A, R-75B	Part of 76X5				
R-76	C84331	330	1.0	Carbon	.10
R-77	D84102	1 K	2.0	Carbon	.16
R-79	B85475	4.7 Meg.	0.5	Carbon	.06
R-82	B84273	27 K	0.5	Carbon	.08
R-83	C84153	15 K	1.0	Carbon	.10
R-86	B83182	1.8 K	0.5	Carbon	.10
R-87	C83512	5.1 K	0.5	Carbon	.12
R-88, R-91	B84224	220 K	0.5	Carbon	.08
R-89	40X331	150 K		Horizontal Drive	.44
R-92	B84562	5.6 K	0.5	Carbon	.08
R-93	884474	470 K	0.5	Carbon	.08
R-95	D84101	100	2.0	Carbon	.16
R-96	43X272	10 K	5.0	Wirewound	.50
R-97	43X238	5.1	0.5	Wirewound	.24
R-99	C85105	1.0 Meg.	1.0	Carbon	.08
R-101	43X274	7.5 K	10.0	Wirewound	.32
R-102	43X271	1.2 K	15.0	Wirewound	.29
R-105	B85274	270 K	0.5	Carbon	.06

TRANSFORMERS AND COILS

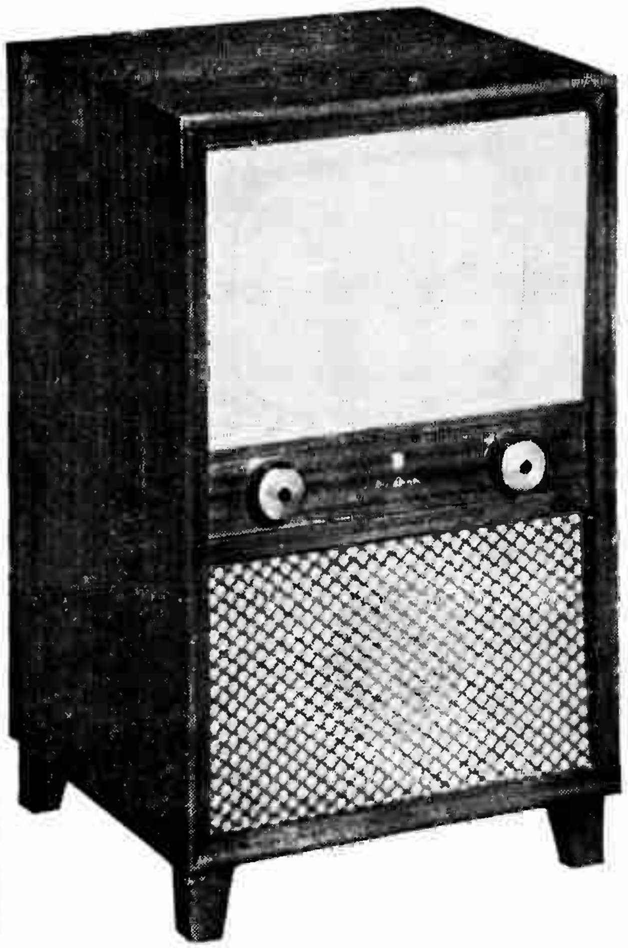
Ref. No.	Part No.	Description	Selling Price
L-1, L-2, L-3	9A2033	R.F. Heater Choke	.12
L-4, L-8, L-10	9A1979	Peaking Coil (36 uh)	.30
L-6	36A10	Peaking Coil (60 uh)	.24
L-7	36A14	Peaking Coil (420 uh)	.28
L-9	36A15	Peaking Coil (220 uh)	.20
L-11	9A2170	Sound Take-Off Coil	.94
L-12, L-17	Part of Deflection Coil		

TRANSFORMERS AND COILS—Continued

Ref. No.	Part No.	Description	Selling Price
L-14	9A2273	Horizontal Hold	.58
L-15	9A2183	Width Control Coil	.96
L-18	52X90	Filter Choke	2.22
T-1, T-2	9A2230	1st and 2nd Pix I-F Coils	.44
T-3	9A2226	3rd Pix I-F Coil	1.06
T-4	54X8	Vertical Osc. Trans.	1.42
T-5	51X156	Vertical Output Trans.	3.04
T-6	9A2269	Ratio Det. Trans.	1.66
T-7	51X150	Audio Output Trans.	1.64
T-8	53X326	Horizontal Output Trans.	7.20
T-9	53X325	Power Trans.	14.88

MISCELLANEOUS

Part No.	Description	Selling Price
3A466	Tube Socket (1B3)	.36
25X1827	Bracket, Pix Tube Rear Mtg.	1.02
8X227	Collar Pix Tube Rear Mtg.	.34
20X1652	Wing Screw	.04
9A2261	Deflection Yoke Assembly	7.60
3A427	Tube Socket (6AL5) (6AQ5)	.16
3A458	Tube Socket (6CB6) (6AU6)	.12
3A463	Tube Socket (12AU7)	.36
3A303	Tube Socket Octal (5U4)	.12
3A464	Tube Socket (6SN7)	.10
3A445	Tube Socket (6W4)	.16
3A470	Tube Socket (Octal)	.10
6A305	Power Cord Receptacle	.16
S-25X69	Tube Mtg. Strap Assembly	.78
S-25X70	Tube Mtg. Strap Assembly (Top)	.12
4A408	Antenna Terminal Strip	.24
25X1844	Pix Tube Front Support (R.H.)	.46
25X1845	Pix Tube Front Support (L.H.)	.46
16X146	Fuse Holder	.16
16X147-3	Fuse 4/10 Amp. 125-250 V.	.22
13X816	Pix Tube Socket	.58
28X596	Ground Spring	.06
32X403	Tube Shield (3A458 Sockets)	.06
32X405	Tube Shield (3A463 Socket)	.12
2A421	Ion Trap Magnet	.48
2A419	Centering Device	.76
76X5	Multiple Resistor-Capacitor	.40
76X7	Multiple Resistor-Capacitor	.54
12A511	5" PM Speaker	3.28
17X169	Pix Crystal	4.06
4X1186	Pix Mask	2.64
4X1185	Pix Escutcheon	3.46
10A813	Knob (Channel Selector)	.62
10A814	Knob (Contrast)	.52
10A815	Knob (Volume)	.50
10A816	Knob (Tuning)	.50
10A817	Knob (Brightness and Horizontal Hold)	.30
6A320	Anode Connector	.34
S-14X57	Cabinet Back Assembly	1.50
S-34X19	Tube Cover & Power Cord Assembly	1.36



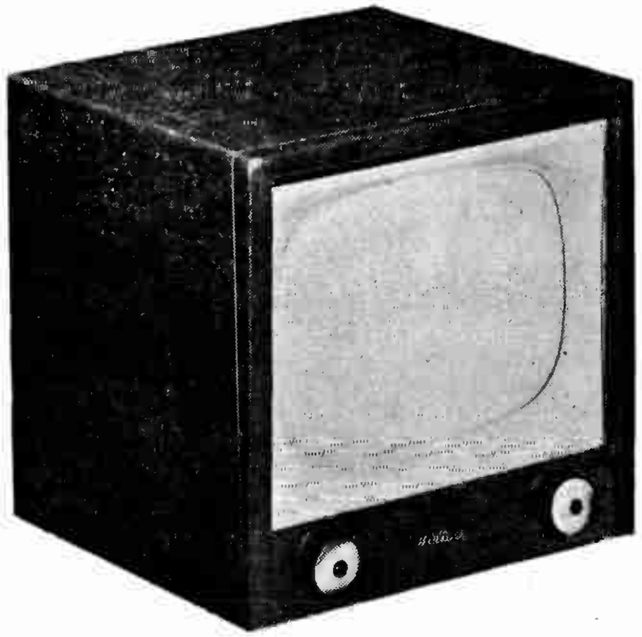


FIGURE 1 FRONT CONTROLS

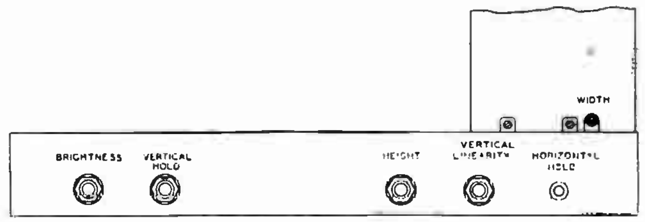


FIGURE 2 REAR CONTROLS

OFF-VOLUME: Turns set on or off and adjusts sound volume.

CONTRAST: Varies contrast between light and dark portions of the television picture.

STATION SELECTOR: Tunes the set to the desired station or channel. It may be turned in either direction.

FINE TUNING: Adjusts set so that both picture and sound are received with maximum clarity.

BRIGHTNESS: Controls brilliance of the picture.

VERTICAL HOLD: Stops picture from moving up or down.

HEIGHT: Changes size of picture vertically.

VERT. LINEARITY: Controls vertical distribution of picture.

HORZ. HOLD: Stops picture from moving.

WIDTH: Changes size of picture horizontally.

GENERAL DESCRIPTION

These models use 19 tubes, (including picture tube and rectifier) have a crystal diode video detector, employ a intercarrier sound circuit, have safety interlock and a fuse in the low voltage power supply. Picture tube has electrostatic focus, which is automatic and permanent.

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles Only
Power Consumption	170 Watts
Power Output	2.7 Watts (Max.) 1.55 Watts (10% Distortion)
Tuning Range	12 Channel
Antenna Input Imp.	300 Ohms balanced
Intermediate Frequencies	Picture 26.4 MC Sound 21.9 MC
Intercarrier Sound System	4.5 MC
Loud Speaker	Electro-Magnetic
Voice Coil Imp.	3.2 Ohms 400 Cycles
Field Coil Resistance	90 Ohms

TUBE COMPLEMENT

Symbol	Type	Function
V1 Tuner	6BC5	R-F Amplifier
V2 Tuner	6J6	R-F Osc. & Mixer
V3	6CB6	1st Pix I-F Amplifier
V4	6CB6	2nd Pix I-F Amplifier
V5	6CB6	3rd Pix I-F Amplifier
V6	6AH6	Video Amp.
V7	6AU6	Sound Driver
V8	6AU6	Sync. Separator
V9	6AL5	Horizontal Phase Det.
V10 A&B	6SN7GT	Vert. Osc. & Phase Splitter
V11	6SN7GT	Horizontal Oscillator
V12 A&B	6T8	Audio Amp. & Ratio Detector
V13	6S4	Vertical Output
V14	6BQ6GT	Horizontal Output
V15	6W4-GT	Damper
V16	6Y6G	Audio Output
V17	1B3-GT	High Voltage Rectifier
V18	5U4-G	Low Voltage Rectifier
V19	17TP4	Pix Tube 17" Metal Rectangular

SERVICE ADJUSTMENTS

ION TRAP MAGNET ADJUSTMENT: The ION trap magnet should be positioned approximately over the diagonal slit in the electron gun. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance.

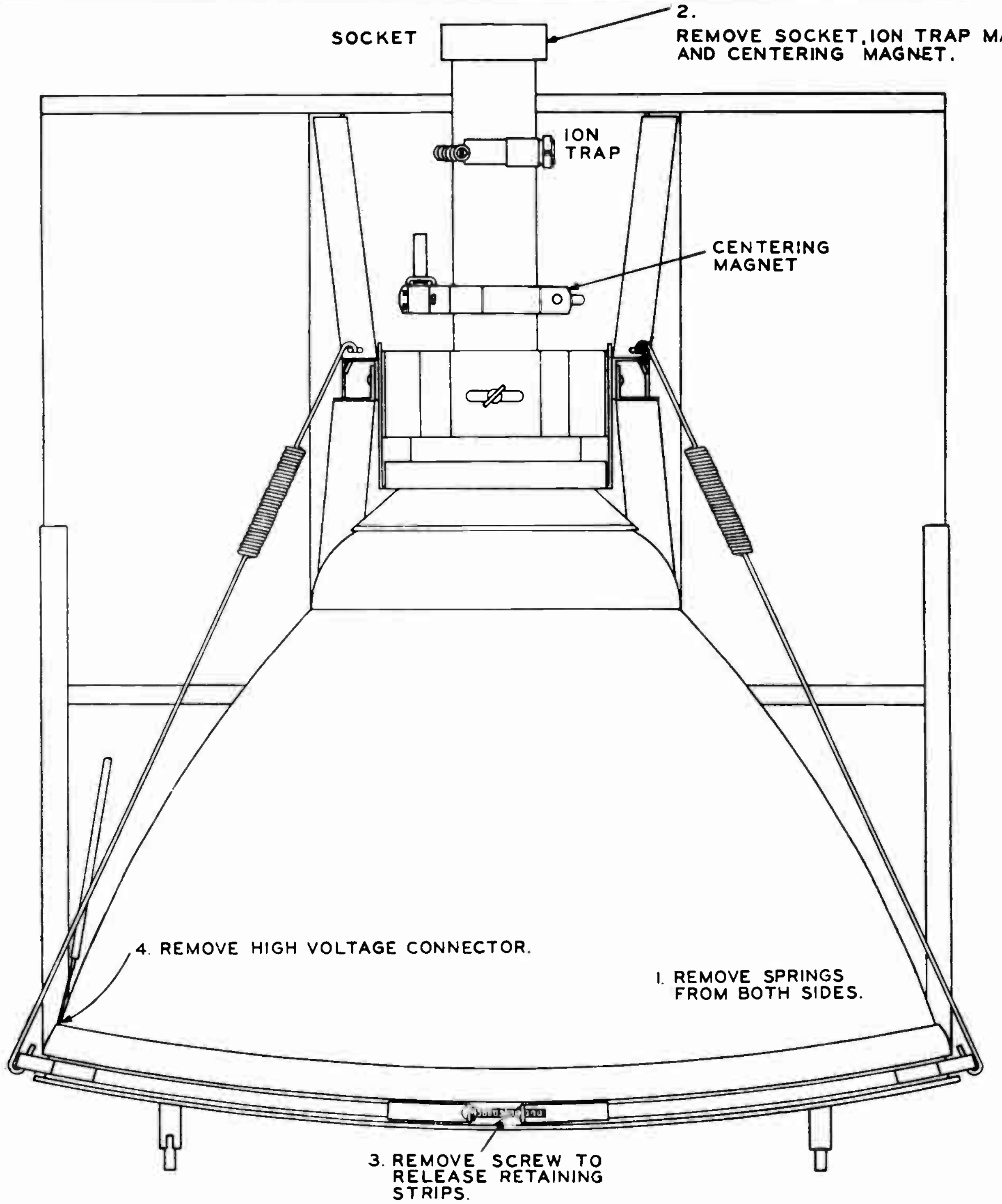
DEFLECTION YOKE ADJUSTMENT: If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. The correct position for the deflection yoke is as far forward on the neck of the picture tube as the shape of the tube will allow. Tighten the yoke adjustment wing screw.

CENTERING MAGNET: The centering magnet should be rotated and the control adjusted until the picture is properly framed keeping in mind that the effect of the control is governed by the position of rotation. If the control is above or below the neck of the picture tube, the picture will be moved up or down. To the left or right of the neck of the picture tube, the picture will be moved either to the left or right.

WIDTH ADJUSTMENTS: Adjust width by turning slug either clockwise or counter clockwise. A clockwise rotation will decrease width. Proper width is obtained when raster covers entire screen of picture tube.

CHECK OF HORIZONTAL OSC. ALIGNMENT: Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync. If in the above check the receiver fails to hold sync. re-set horizontal hold slightly.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS: The vertical size and linearity controls should both be adjusted at the same time while a test pattern is being transmitted. The linearity control affects the upper portion of the picture while the size control affects the overall size especially the lower portion of the picture. Adjust both controls simultaneously until the test pattern is symmetrical and fills the entire screen vertically. Readjust the vertical hold control if necessary.



1037 FIG. 3 PICTURE TUBE ASSEMBLY

PICTURE TUBE REPLACEMENT: To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove the cabinet back. Remove antenna terminal board from cabinet back. You will not that the interlocked line cord disconnects the power when the cabinet back is removed.
3. Disconnect speaker plug from chassis, remove the five chassis mounting bolts. Pull chassis **CAREFULLY** out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

WARNING: Before handling the picture tube, it will be necessary to remove the static charge. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE: If raster cannot be obtained check below for the possible causes.

1. ION trap magnet adjustment is incorrect.
2. No B+ voltage. Check 1/4 ampere fuse. Replace if defective. If fuse continually burns out, check (A) for short of B+ circuit with ohmmeter, check (B) horizontal output tube V-14 (6BQ6-GT), check (C) damper tube V-15 (6W4-GT). (D) Check horizontal oscillator V-11 (6SN7-GT) for proper operation. (E) With an ohmmeter, check for a short between terminal 3 of the horizontal output transformer (T-6) and the chassis.
3. No high voltage. Check V-11, V-14, V-15 and V-17 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage measured on pin 3 of the damper tube (V-15), the trouble can be isolated to the high voltage rectifier V-17 circuit. Either the high voltage winding to the 6BQ6GT plate and 1B3 plate is open, tube V-17 is defective, its filament circuit is open, or the high voltage filter capacitor C-70 is shorted.
4. Defective picture tube. Heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY: If only horizontal deflection is obtained as evidenced by a straight line across face of the picture tube, it can be caused by the following:

1. Vertical oscillator V-10A (6SN7-GT) or vertical output tube V-13 (6S4) inoperative. Check voltages on grid and plate.
2. Vertical oscillator transformer T-4 defective.
3. Vertical output transformer (T-5) open or shorted.
4. Yoke vertical coils open.
5. Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY: If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.

1. Check variable resistors R-54 and R-59.
2. Vertical output transformer (T-5) defective.
3. Capacitors C-54A & B or C-53C & D defective.
4. V-10A (6SN7-GT) or V-13 (6S4) defective, check voltages.
5. Excess leakage or incorrect value of capacitor C-51, C-52, or open or incorrect value of resistors R-55, 56 & R-57.
6. Low plate voltages. Check rectifier tubes and capacitors in B+ supply circuits.
7. Vertical deflection coils defective (part of T-7 yoke).

POOR HORIZONTAL LINEARITY:

1. Check or replace horizontal output tube V-14 (6BQ6-GT).
2. Check or replace damper tube V-15 (6W4-GT).
3. Check capacitor C-67.
4. Horizontal deflection coils defective (part of T-7 yoke).

TRAPEZOIDAL OR NONSYMMETRICAL RASTER:

1. Improper adjustment of ION trap magnet.
2. Defective yoke.

SERVICE SUGGESTIONS (*Continued*)

BARS AND WRINKLES ON LEFT SIDE OF RASTER: This condition can be caused by:

1. Defective yoke due to C-69 or R-61, R-62 (Internal in yoke assembly) being wrong or open. These components are mounted in rear of yoke assembly.
2. V-15 (6W4) defective.

SMALL RASTER: This condition can bė caused by:

1. Low B+ or line voltage. Check V-18 (5U4G).
2. Insufficient output from horizontal output tube V-14. Replace tube.
3. Insufficient output from vertical oscillator tube V-10A or vertical output tube V-13. Replace tubes.
4. V-15 (6W4) defective.

RASTER: NO IMAGE, BUT ACCOMPANYING SOUND: This condition can be caused by:

1. No signal on picture tube grid. Check V-6 (6AH6) tube and associated circuits.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY:

A condition of this nature can be caused by:

1. Defective sync. Sep. V-8 or Horiz. splitter V-10B or Horiz. Phase Detector V-9.
2. If tubes are O.K. check voltages, and associated circuits.
3. AGC system inoperative.
4. Open video peaking coil. Check all coils, L-8, L-9, L-10, L-16 and L-11 for continuity. Note that L-9 and L-11 have shunting resistors.
5. Check all potentials in video circuits.
6. Check and realign, if necessary, the picture 1-F and R-F circuits.

POOR FOCUS:

1. Improper adjustment of ION trap.
2. Defective picture tube.

SNOWY PICTURE:

1. Insufficient signal input.
2. Defective antenna.
3. Weak V-1 (6BC5).
4. Defective Tuner.

PICTURE SMEAR:

1. Normally, smear can be attributed to shift at the low frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6).
2. This trouble can also originate at the transmitter. Check reception from another station.
3. Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE JITTER:

1. Replace the horizontal oscillator tube V-11.
2. Vertical instability may be due to loose connections or noise received with the signal.
3. Horizontal instability may be due to unstable transmitted sync. or to noise.
4. Check receiver AGC system for proper operation.
5. Check phase splitter V-10B (6SN7-GT).

LACK OF CONTRAST:

1. Defective V-3, V-4, V-5, V-6.
2. Defective crystal detector.
3. Defective Control R-28.

NO SOUND PICTURE NORMAL:

1. Defective V-7, V-12, V-16.
2. Speaker leads open.
3. T-2, T-3 defective.
4. Improper sound alignment.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

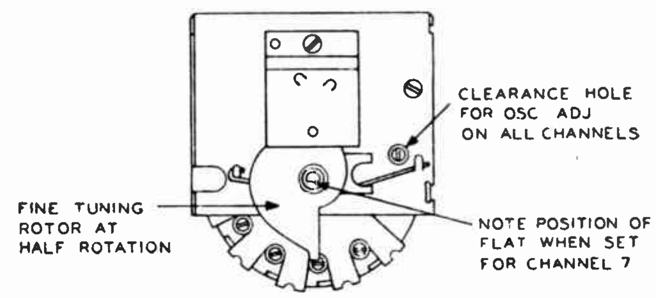
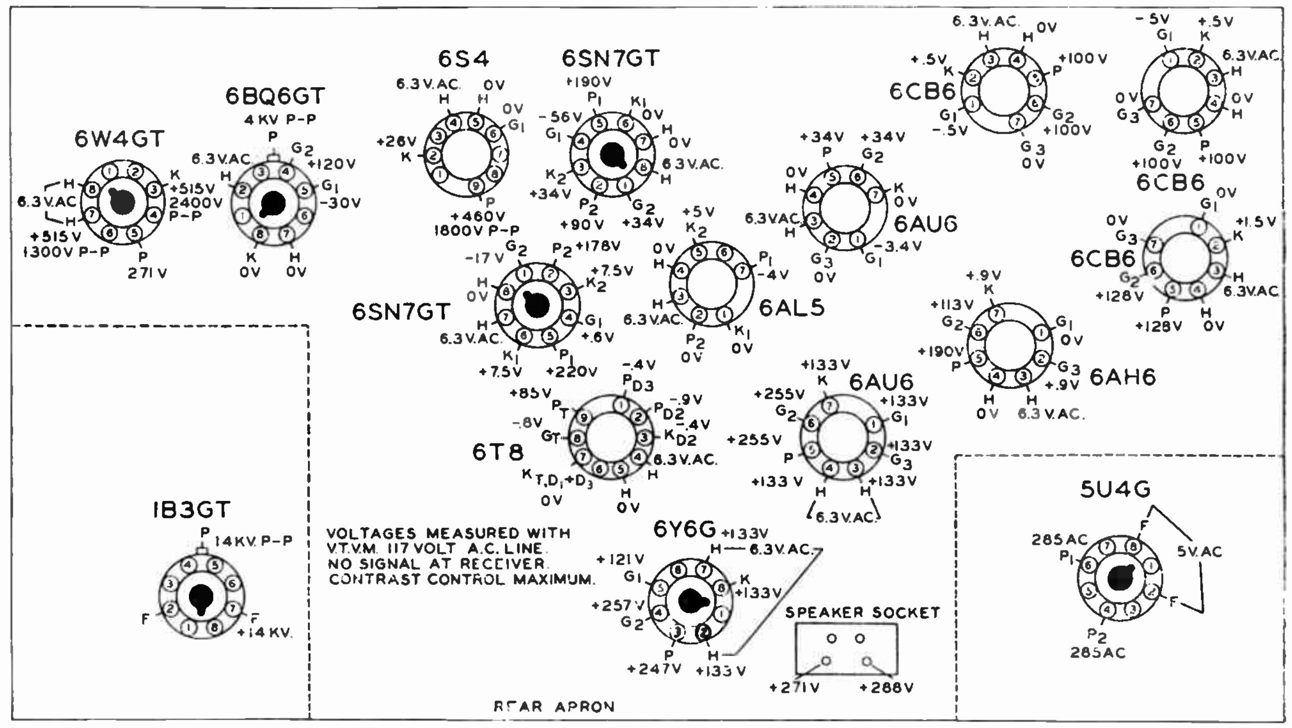
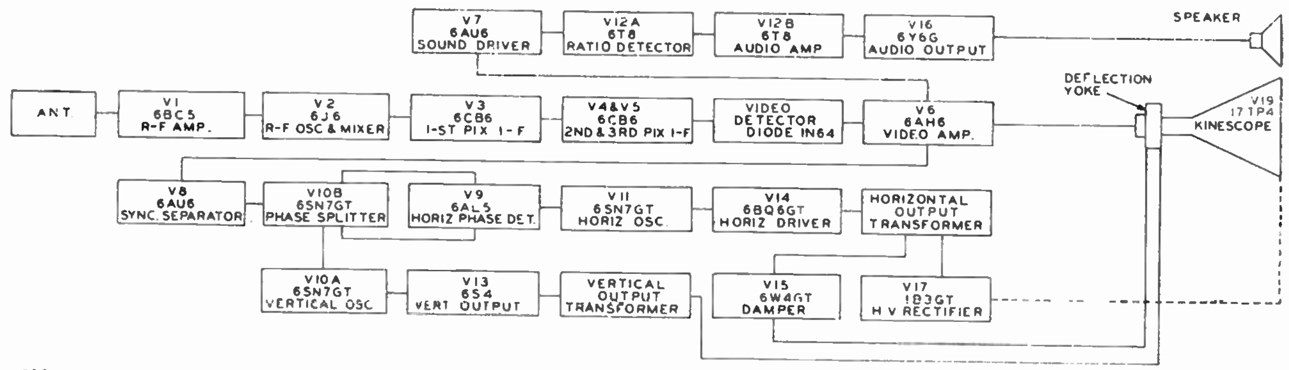


FIG 4 - TURRET TYPE TUNER
1036



BOTTOM SOCKET VOLTAGES
FIG. 5

1044



1033

FIG 6 BLOCK DIAGRAM OF RECEIVER

ALIGNMENT PROCEDURE

TEST EQUIPMENT: To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:

(a) Frequency ranges:

18 to 30 mc, 10 mc sweep width

40 to 90 mc, 10 mc sweep width

170 to 225 mc, 10 mc sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled. Electronic Voltmeter and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

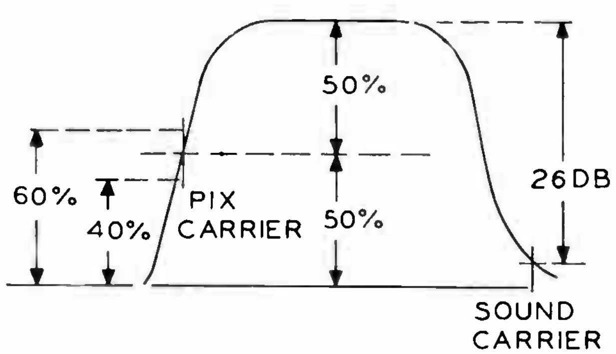


FIG.7 - OVERALL RESPONSE CURVE

1038

SIGNAL GENERATOR to provide the following frequencies; (Output on these ranges should be adjustable and at least .1 volt maximum.)

(a) Intermediate alignment frequencies.

26.1 Plate coil tuner

24.4 1st Pix I.F. Coil

24.0 2nd Pix I.F. Coil

4.5 mc video trap and sound I.F.

26.1 3rd Pix I.F. Coil

(b) Radio frequencies.

Channel No.	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

SERVICE PRECAUTIONS: To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect speaker plug from chassis, remove the antenna terminal board from cabinet back, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the top. The weight of the chassis will be supported against the high voltage housing.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-86.

LOCATION OF TUBES

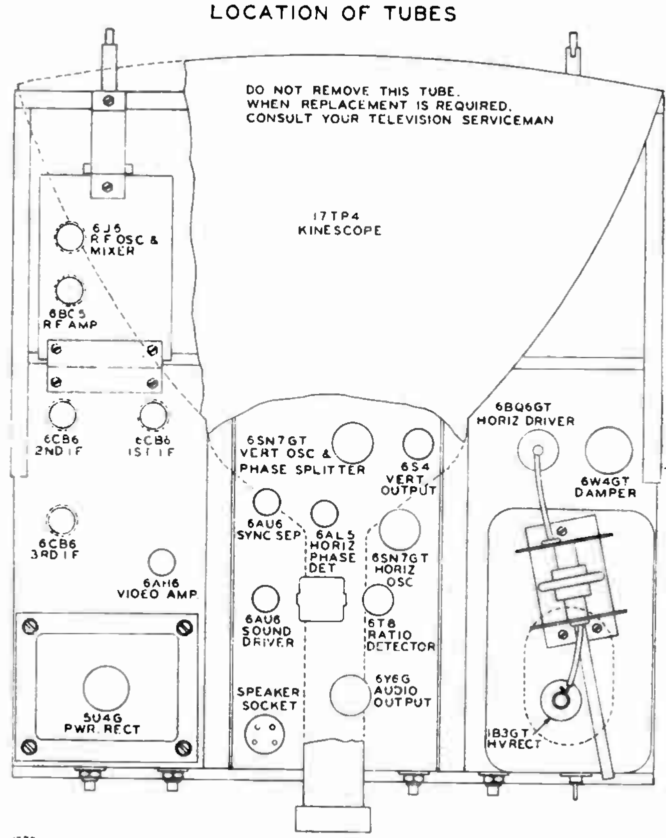


FIG 9

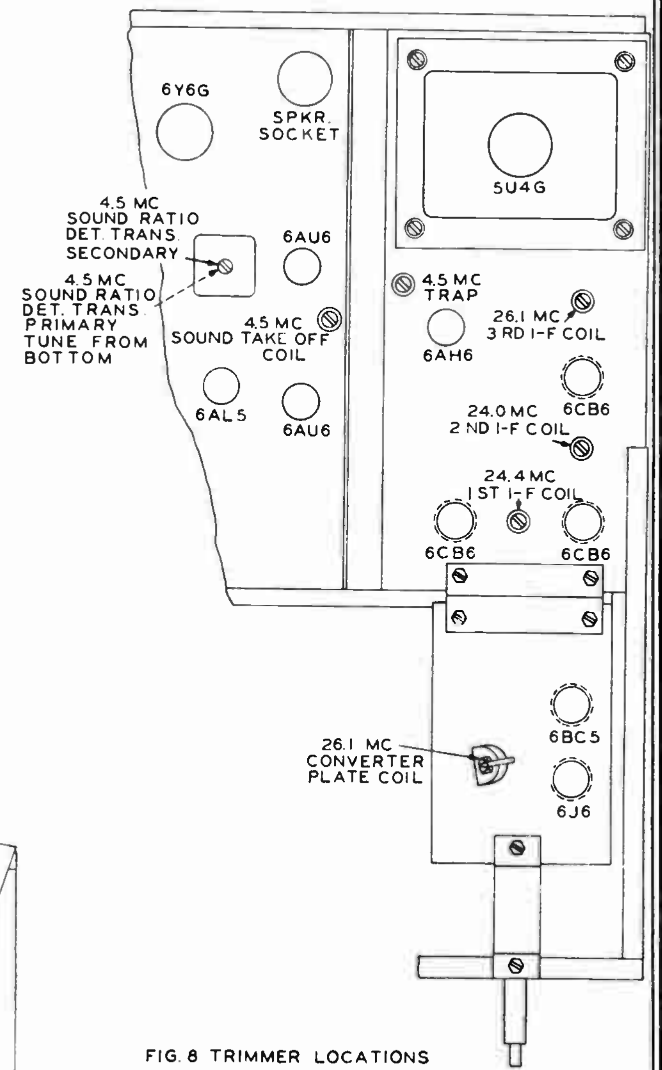


FIG. 8 TRIMMER LOCATIONS

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM connected to junction picture detector load resistor, (R-21) 6800 ohms, and peaking coil (L-8). Input signal level should be such that output is less than 2 volts DC. apply — 4.5 V battery Bias on AGC line.

ALIGNMENT PROCEDURE (*Continued*)

Frequency	Adjust
1. 26.1 MC	Converter plate coil (on top of tuner) for maximum dc at picture detector.
2. 24.4 MC	1st picture I-F coil L-5 (above chassis) for maximum dc at picture detector.
3. 24.0 MC	2nd picture I-F coil L-6 (above chassis) for maximum dc at picture detector.
4. 26.1 MC	3rd picture I-F coil L-7 (above chassis) for maximum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base. Connect oscilloscope across R-21, 6800 Ohms (in place of VTVM). Apply — 4.5 bias (battery) to AGC line.

Tuner should be switched to a channel not being used so as not to cause interference.

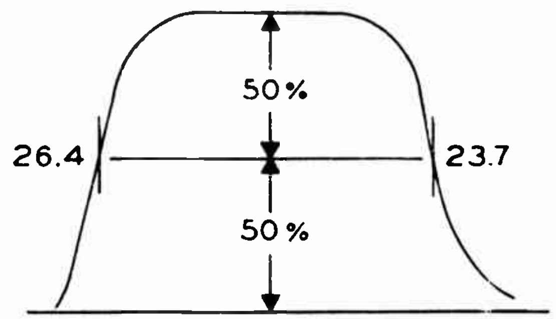


FIG. 10 OVERALL I.F. RESPONSE CURVE

1035

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should it be necessary to turn any of the picture I-F coils more than ½ turn of the slug. The following comments are suggestions only:

1. The height of the 26.4 MC marker is controlled by the (26.1 MC) converter plate coil on tuner and the (26.1 MC) 3rd P.I.F. coils.
2. The 23.7 MC marker position is controlled by the 2nd picture I-F coil (24.0 MC) and the 1st picture I-F coil (24.4 MC).

4.5 MC TRAP ALIGNMENT:

1. Tune in a station.
2. Adjust fine tuning rotar until sound bars just appear in picture.
3. Turn L-10 slug all the way out (counter clockwise).
4. Turn the slug in (clockwise) until the horizontal scanning lines are smooth and continuous.

SOUND I-F ALIGNMENT: Connect signal generator to grid of video amp. (6AH6), adjust contrast control to maximum. Set signal generator to 4.5 MC (no modulation) (setting of 4.5 MC must be accurate). Connect (2) two 50,000 ohm resistors across C-39 (resistors must match within 5%). 1. VTVM is connected across C-39. **See Fig. 12.** Adjust L-12 and T-3 (Bottom) for maximum on VTVM. This adjustment should be made with voltage on VTVM under 12 volts. 2. Connect VTVM between junction of R-39, R-40 and junction of the (2) two 50,000 ohm resistors. **See Fig. 12.** Adjust T-3 (Top) for zero on VTVM. If VTVM reads below zero, reverse leads and again adjust T-3 (Top) for zero reading. Re-check step one.

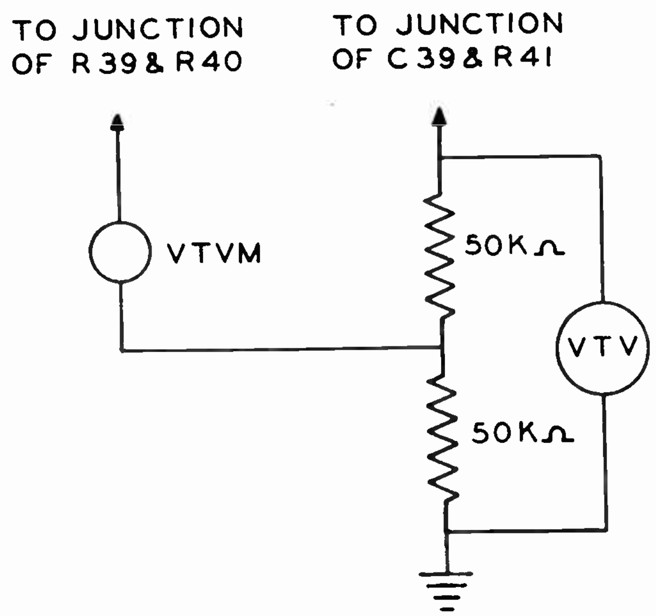
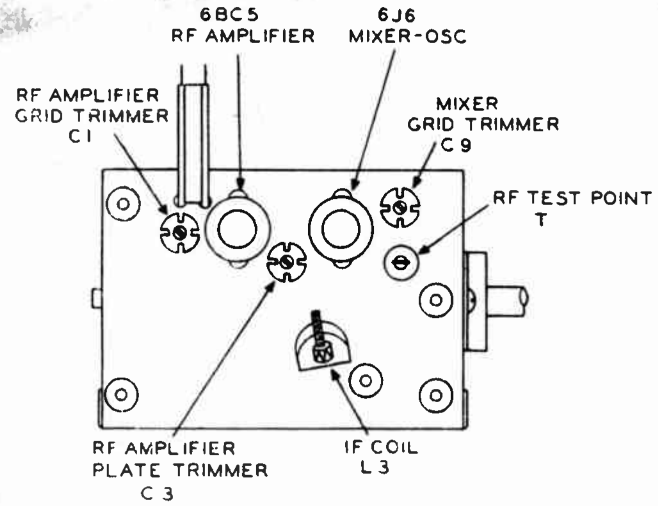


FIG. 12

1039

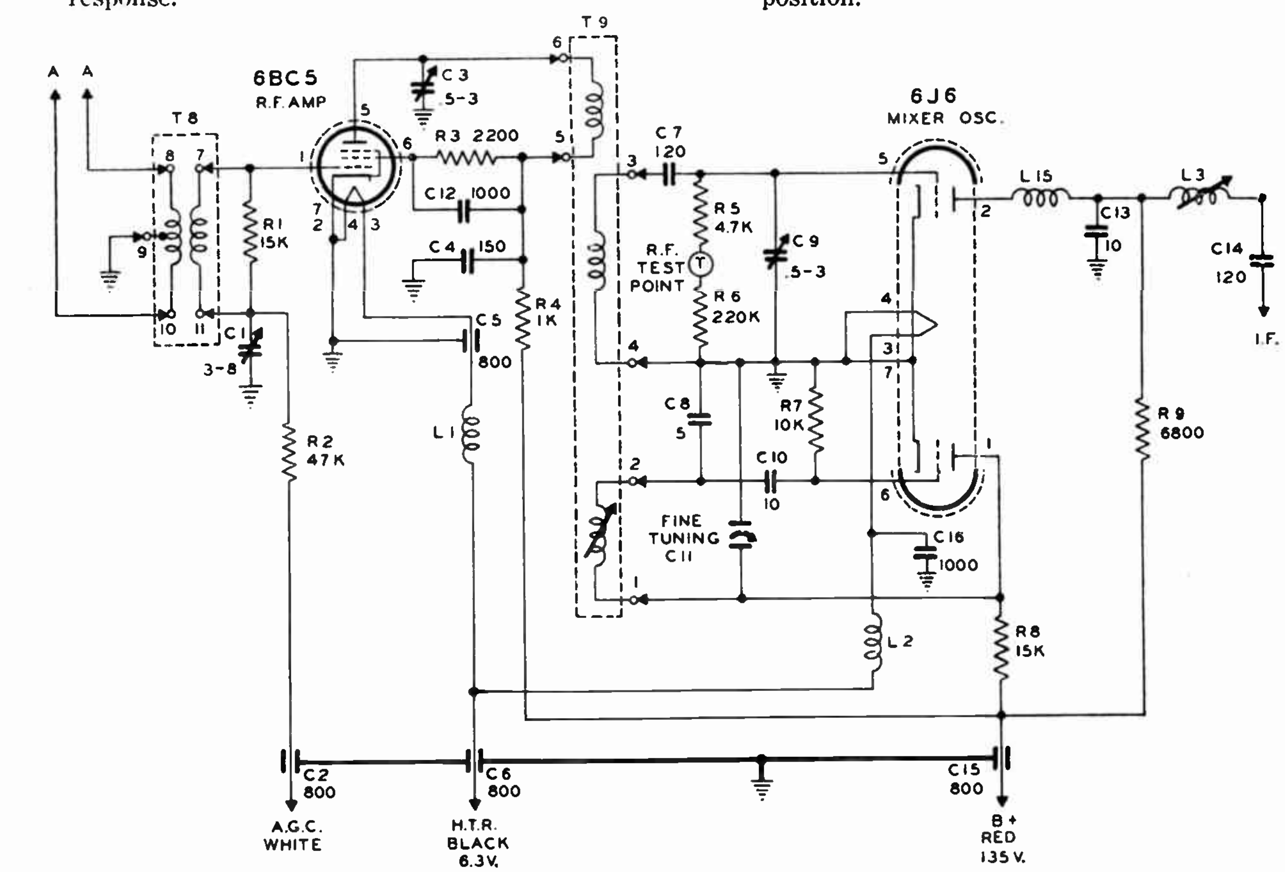
TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "Test Point" on tuner. Ground AGC line at junction of R-12 and C-17.



1043 FIG. 13 TUNER ADJUSTMENTS

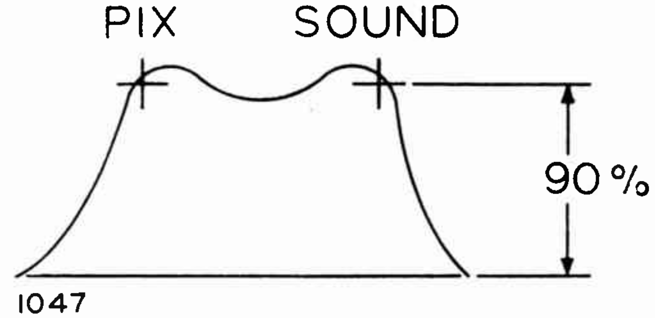
B. RF and converter adjustment:
1. With channel selector on channel 12, adjust C-1, C-9 and C-3 for response as in Figure 14. Picture and Sound markers at 90% maximum response.



I. ALL CAPACITANCE VALUES STATED IN MMF.

TUNER SCHEMATIC

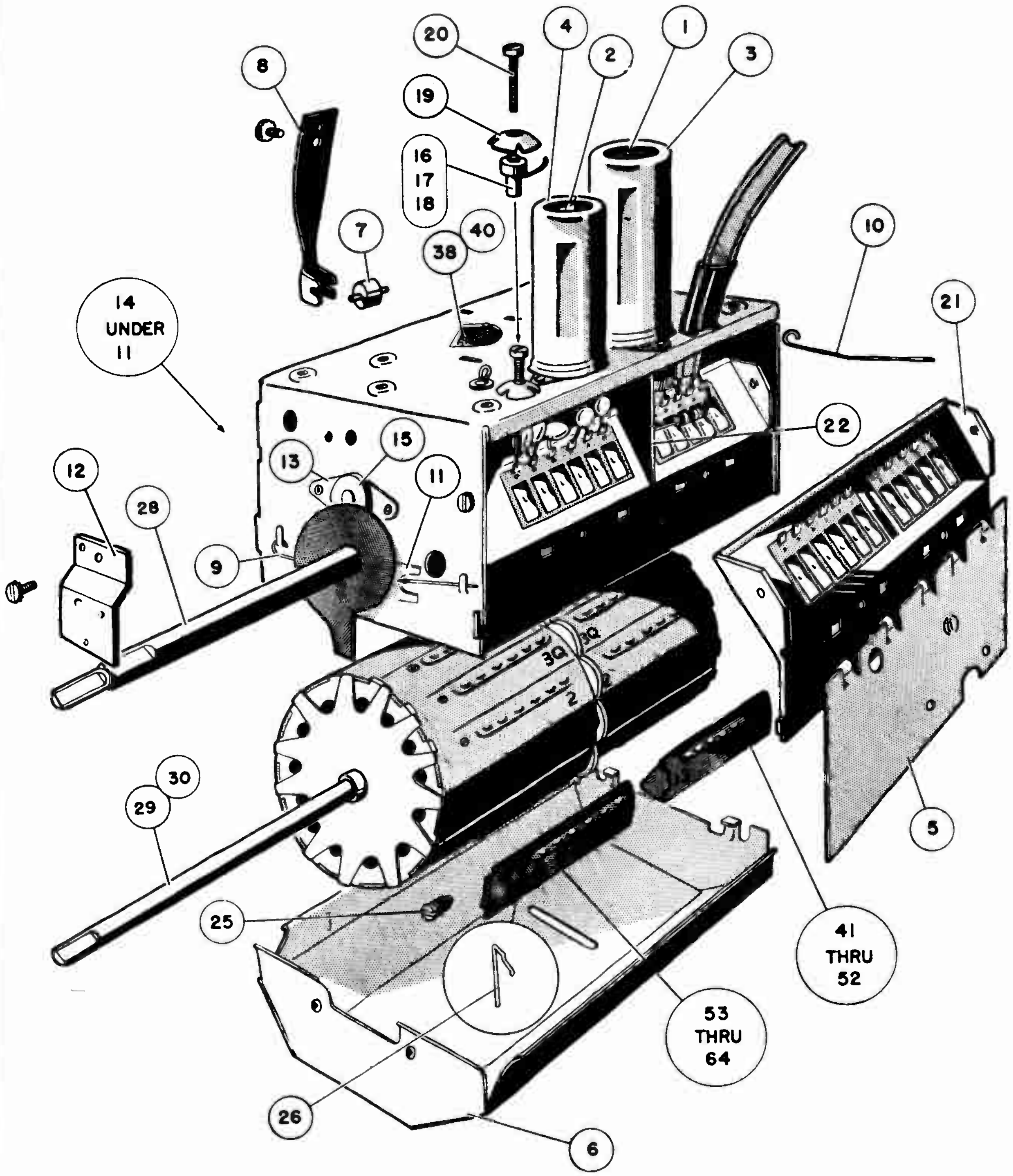
2. Check response on all channels. If markers are below 70% on any channel, readjust C-1, C-9 and C-3. Re-check all channels.



1047

FIG. 14 – PIX AND AUDIO MARKERS

C. Oscillator adjustment:
1. Remove AGC ground. Apply — 4.5 Volts on I-F AGC line.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Picture marker should be at 50%. **See Fig. 7.**
3. If some channels are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring Picture Marker to correct position.



TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Watts	Price Each
R1	N-6424	15,000	½	$0.14
R2	N-7124	47,000	½	.14
R3	N-5090	2,200	½	.14
R4	N-4987	1,000	½	.14
R5	N-5350	4,700	½	.14
R6	N-4899	220,000	½	.14
R7	N-4578	10,000	½	.14
R8	N-6424	15,000	½	.14
R9	N-4630	6,800	½	.14

CONDENSERS

Ref. No.	Part No.	Description	Price Each
C1	N-9395	Amplifier Grid Trimmer 3-8 MMFD.	$0.60
C2, 5, 6, C15	N-9409	800 MMFD. Minimum (Feed thru Capacitors)	.32
C3	N-9396	Amplifier Plate Trimmer .5-3 MMFD.	.60
C4	N-9410	150 MMFD. Ceramic	.28
C7, C14	N-9411	120 MMFD. Ceramic	.24
C8	N-9412	5 MMFD. Ceramic	.24
C9	N-9397	Mixer Grid Trimmer .5-3 MMFD.	.60
C10, C13	N-9413	10 MMFD. Ceramic	.20
C11	N-9394	Fine Tuning Rotor	.38
C12, C16	N-9414	1000 MMFD. Ceramic	.20

COILS & TRANSFORMERS

Ref. No.	Part No.	Coil Strip	Channel	
T8	N-9152	Antenna	2	$1.00
	N-9153	Antenna	3	1.00
	N-9154	Antenna	4	1.00
	N-9155	Antenna	5	1.00
	N-9156	Antenna	6	1.00
	N-9157	Antenna	7	.84
	N-9158	Antenna	8	.84
	N-9159	Antenna	9	.84
	N-9160	Antenna	10	.84
	N-9161	Antenna	11	.84
	N-9162	Antenna	12	.84
	N-9163	Antenna	13	.84
T9	N-9164	Osc. & Mixer	2	1.32
	N-9165	Osc. & Mixer	3	1.32
	N-9166	Osc. & Mixer	4	1.32
	N-9167	Osc. & Mixer	5	1.32
	N-9168	Osc. & Mixer	6	1.32
	N-9169	Osc. & Mixer	7	1.24
	N-9170	Osc. & Mixer	8	1.24
	N-9171	Osc. & Mixer	9	1.24
	N-9172	Osc. & Mixer	10	1.24
	N-9173	Osc. & Mixer	11	1.24
	N-9174	Osc. & Mixer	12	1.24
	N-9175	Osc. & Mixer	13	1.24
L1	N-9415	Heater Choke RF Amp.		.14
L2	N-9416	Heater Choke Osc. & Mixer		.14
L3	N-9408	IF Coil (Mix. Plate Coil)		.50
L15	N-9417	Plate Choke (Mixer Plate Choke)		.60

MECHANICAL PARTS

Ref. No.	Part No.	Description	Price Each
5	N-9384	Shield, Side	$0.16
6	N-9385	Shield, Bottom Cover	1.20
7	N-9386	Roller, Detent	.16
8	N-9387	Spring, Detent	.16
9	N-9388	Spring, Shaft Retaining Front	.16
10	N-9389	Spring, Shaft Retaining Rear	.16
11	N-9390	Spring, Fine Tuner Ground	.16
12	N-9391	Plate, Fine Tuner Ground	.20
13	N-9392	Strap, Fine Tuner Mtg.	.20
14	N-9393	Washer, Fiber	.14
15	N-9394	Fine Tuner Hot Plate & Lead	.38
16	N-9395	Trimmer, Ceramic & Lead-Ant. (C1 Schematic)	.60
17	N-9396	Trimmer, Ceramic & Lead-RF. (C3 Schematic)	.60
18	N-9397	Trimmer, Ceramic & Lead-Osc. (C9 Schematic)	.60
19	N-9398	Nut, Trimmer Spring	.14
20	N-9399	Screw, Trimmer	.14
21	N-9400	Contact Bracket Assembly	3.00
22	N-9401	Shield, Center Assembly	2.80
25	N-9402	Slug, Oscillator Tuning	.14
26	N-9403	Spring, Slug Retaining	.14
28	N-9404	Fine Tuner Shaft & Blade	.52
29	N-9405	Drum Assembly without coils	3.40
38	N-9407	Core, IF. Tuning	.16
40	N-9408	IF. Coil & Core Assembly (L3 Schematic)	.50
41 Thru 52		Antenna Coil Strips (T8 Schematic)	
		See Coils and Transformers for part numbers.	
53 Thru 64		Osc. & Mixer Strips (T9 Schematic)	

MAIN CHASSIS

RESISTORS

Ref. No.	Part No.	Description	Price Each
R85	N-8125	4.3 Ohms 0.5 W. 10%	$0.14
R11, R15, R27	N-6237	47 Ohms 0.5 W. 10%	.14
R61, R62	N-8023	56 Ohms 0.5 W. 10%	.14
R81	N-1349	100 Ohms 0.5 W. 20%	.14
R19	N-3663	150 Ohms 0.5 W. 10%	.14
R42	N-4420	330 Ohms 0.5 W. 10%	.14
R39	N-5159	390 Ohms 0.5 W. 10%	.14
R19, R84	N-4280	560 Ohms 0.5 W. 10%	.14
R75	N-4279	820 Ohms 0.5 W. 10%	.14
R10, R12, R38	N-3341	1000 Ohms 0.5 W. 10%	.14
R69	N-6793	1200 Ohms 0.5 W. 10%	.14
R57	N-7398	1500 Ohms 0.5 W. 10%	.14
R66	N-4281	1,800 Ohms 0.5 W. 10%	.14
R55	N-8103	2,700 Ohms 0.5 W. 10%	.14
R68	N-7399	3,900 Ohms 0.5 W. 10%	.14
R67	N-7000	4,700 Ohms 0.5 W. 20%	.14
R14	N-7400	5,600 Ohms 0.5 W. 10%	.14
R21	N-4630	6,800 Ohms 0.5 W. 10%	.14
R79	N-4897	8,200 Ohms 0.5 W. 10%	.14
R31, R64	N-4895	10,000 Ohms 0.5 W. 10%	.14
R41	N-5690	12,000 Ohms 0.5 W. 10%	.14
R17, R23, R40, 47, R91	N-6424	15,000 Ohms 0.5 W. 10%	.14
R24	N-7124	47,000 Ohms 0.5 W. 10%	.14
R60	N-4823	56,000 Ohms 0.5 W. 10%	.14
R78	N-9015	82,000 Ohms 0.5 W. 10%	.14
R46, R70, 71, 73	N-2973	100,000 Ohms 0.5 W. 10%	.14
R36	N-4468	150,000 Ohms 0.5 W. 10%	.14
R48	N-7401	180,000 Ohms 0.5 W. 5%	.14
R77	N-7003	180,000 Ohms 0.5 W. 10%	.14
R22, 44, 88, 89	N-4899	220,000 Ohms 0.5 W. 10%	.14
R45	N-9041	220,000 Ohms 0.5 W. 5%	.14
R92	N-7004	270,000 Ohms 0.5 W. 10%	.14
R53, R80	N-8026	390,000 Ohms 0.5 W. 10%	.14
R74	N-5694	470,000 Ohms 0.5 W. 10%	.14
R26, R29, R30	N-7790	560,000 Ohms 0.5 W. 10%	.14
R20	N-4469	820,000 Ohms 0.5 W. 10%	.14
R90	N-2976	1.0 Megohms 0.5 W. 10%	.14
R51	N-4470	1.2 Megohms 0.5 W. 10%	.14
R56	N-4420	2.2 Megohms 0.5 W. 10%	.14
R25, R72	N-4061	4.7 Megohms 0.5 W. 20%	.14
R43	N-4028	6.8 Megohms 0.5 W. 20%	.14
R58	N-9016	820 Ohms 1.0 W. 10%	.14
R13, R16	N-7793	3,300 Ohms 1.0 W. 10%	.14
R76	N-7406	5,600 Ohms 1.0 W. 10%	.14
R34, R37	N-7013	39,000 Ohms 1.0 W. 10%	.14
R82, R83	N-9017	150,000 Ohms 1.0 W. 10%	.14
R86	N-8029	470,000 Ohms 1.0 W. 10%	.14
R49	N-9040	220 Ohms 2.0 W. 10%	.18
R63	N-7126	2,700 Ohms 2.0 W. 10%	.18
R33	N-8491	5,600 Ohms 2.0 W. 10%	.18
R28, R50	N-8942	Contrast & On-Off Vol. Variable	1.84
R52	N-8943	1.0 Megohms, Vertical Hold. Variable	.60

RESISTORS

Ref. No.	Part No.	Description	Price Each
R87	N-8944	100,000 Ohms Brightness, Variable	$0.56
R54	N-8971	2.5 Megohms Vertical Height — Variable	.60
R59	N-8945	5,000 Ohms Vertical Linearity — Variable	.60

CAPACITORS

Ref. No.	Part No.	Description	Price Each
C18, C21, C19	N-7774	.004 MFD. Dual Ceramic 500 V.	$0.28
C72	N-9045	.01 MFD. Dual Ceramic 500 V.	.32
C20, C29	N-9047	4.7 MMFD. Ceramic 500 V. 5%	.60
C23	N-9048	10 MMFD. Ceramic 500 V. 10%	.14
C27, C75	N-9049	22 MMFD. Ceramic 500 V. 10%	.14
C69	N-9052	43 MMFD. Ceramic 2000 V. 5%	.38
C30	N-9050	47 MMFD. Ceramic 500 V. 10%	.14
C31	N-9051	68 MMFD. Ceramic 500 V. 10%	.24
C43	N-9053	100 MMFD. Ceramic 500 V. 20%	.14
C26	N-9055	220 MMFD. Ceramic 500 V. 10%	.16
C37	N-9059	3,900 MMFD. Ceramic 500 V. 20%	.18
C17, 22, 28, 32, C41, 42, 46, 47, C74	N-6272	.005 MFD. Ceramic 500 V. (GMV)	.18
C33, C38	N-9062	.01 MFD. Ceramic 400 V. (GMV)	.18
C60	N-9054	220 MMFD. Silver Mica 500 V. 5%	.26
C61	N-9056	330 MMFD. Silver Mica 500 V. 5%	.36
C64	N-9057	560 MMFD. Mica 500 V. 5%	.28
C36	N-7780	560 MMFD. Mica 500 V. 10%	.22
C66	N-9058	1000 MMFD. Mica 1,000 V. 10%	.62
C55, C56, C63	N-7783	1,100 MMFD. Mica 500 V. 10%	.26
C49	N-6893	4,700 MMFD. Mica 600 V. 10%	.50
C59	N-1344	.01 MFD. Paper 400 V.	.16
C48	N-9046	.015 MFD. Paper 600 V.	.16
C44	N-1376	.02 MFD. Paper 400 V.	.18
C45, C58	N-1345	.05 MFD. Paper 200 V.	.16
C25, C65, C68	N-1351	.1 MFD. Paper 200 V.	.20
C51, C52, C71	N-1623	.1 MFD. Paper 400 V.	.20
C24	N-1479	.25 MFD. Paper 200 V.	.28
C67	N-2579	.25 MFD. Paper 400 V.	.30
C62	N-9060	3,900 MMFD. Stab. Paper 600 V. 5%	.54
C57	N-9061	4,700 MMFD. Stab. Paper 600 V. 10%	.40
C73	N-8970	100 MFD. Electrolytic 200 V.	2.26
C40B, C40A	N-8969	100-40 MFD. Electrolytic 400 V.	3.46
C54A, C54B	N-8039	10-10 MFD. Electrolytic 450 V.	1.68
C53A, C53B, 53D, C53C	N-8967	10 MFD. Electrolytic 400 V. 80-40 MFD. Electrolytic 200 V. 100 MFD. Electrolytic 50 V.	2.72
C39	N-6912	16 MFD. Electrolytic 50 V.	.84
C70	N-8041	500 MMFD. High Volt. 20,000 V.	1.60

CHOKES, COILS, TRANSFORMERS

Ref. No.	Part No.	Description	Price Each
T3	N-8928	Coil, ratio detector includes C35	$2.32
L5, L6, L7	N-8929	Coil, I.F.	.52
L10	N-9011	Coil, 4.5 MC Sound Trap	.74
L12	N-7746	Coil, Sound Take-off	.80
T7	N-8930	Coil, Deflection Yoke	7.20
L13	N-8931	Coil, Horiz. Freq. Control	.98
L8	N-8932	Coil, Video Peaking — Detector	.34
L9	N-8933	Coil, Video Peaking — Series Includes No. R-32	.36
L11	N-8934	Coil, Video Peaking — Shunt Includes No. R-35	.40
L4	N-7321	Choke, R.F.	.26
L16	N-9250	Choke, Coil	.40
T1	N-8935	Transformer, Power	13.90
T6	N-8936	Transformer, Horiz. Output	7.86
T5	N-8937	Transformer, Vertical Output	3.12
T4	N-9002	Transformer, Vertical Osc.	2.12
T2	N-8938	Audio Output Transformer	2.08
L14		Filter Choke (Part of N-8926 or N-9184) (See Miscellaneous)	

MISCELLANEOUS

Part No.	Description	Price Each
No. 407	Cabinet — Consolette	**$87.12
N-8926	Speaker, 8" Electro-Magnetic (With cable & plug)	6.54
N-8042	Multiple Resistor Capacitor Assembly (R65 & C50)	.80
N-8915	Channel, Kinescope Support	2.56
N-8916	Support, Kinescope — Front	.16
N-8917	Bracket, Yoke	1.58
N-8918	Bracket, Tuner Mtg. (Front)	.14
N-8919	Bracket, Tuner Mtg. (Rear)	.14
N-8728	Bracket, Cabinet Back, Mtg.	.40
N-9234	Bracket, Tuner Stabilizing	.20
N-8920	Strap, Yoke Mounting	.30
N-8921	Support, Yoke Bracket	.40
N-8922	Enclosure, High Voltage	1.02
N-8924	Strap, Kinescope Retaining (Tapped)	.60
N-8925	Strap, Kinescope Retaining (Untapped)	.60
N-6402	Plate, Bakelite Electrolytic Mtg.	.14
N-9012	Ion trap	.60

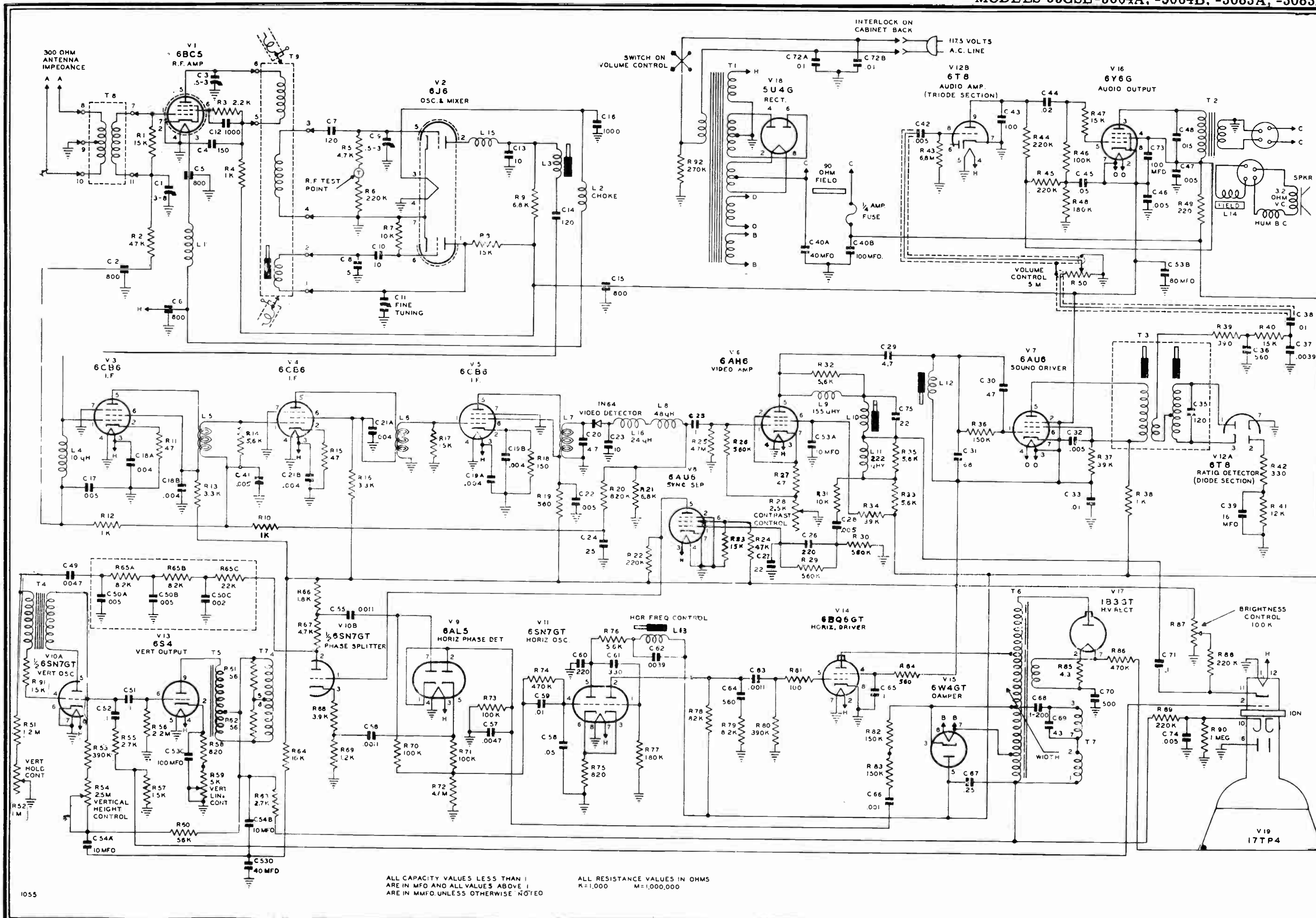
MISCELLANEOUS

Part No.	Description	Price Each
N-8939	Centering Magnet	$1.00
N-8940	Socket, Kinescope — with leads	.72
N-7333	Tube Socket, (6CB6 & 6AH6)	.14
N-7334	Tube Socket (6AU6 Sound Driver)	.14
N-7336	Tube Socket (6AU6 & 6AL5)	.14
N-7335	Tube Socket (6T8)	.14
N-9034	Tube Socket (6S4)	.20
N-7515	Tube Socket (6SN7, 6Y6, 6BQ6)	.14
N-7733	Tube Socket (6W4)	.22
N-8100	Tube Socket (1B3)	.44
N-2227	Socket, Speaker plug	.14
N-6265	Socket, Inter-lock A.C.	.26
N-9087	H. V. Connector & Cable	.40
N-7355	Fuse 1/4 Amp.	.16
N-9018	Knob, Fine Tuning	.30
N-9260	Knob, Tuner	.84
N-9261	Knob, Volume	.64
N-9020	Knob, Contrast	.30
N-9462	Glass, front panel	6.16
N-9023	Mask, Picture tube	4.20
N-9024	Grille Cloth	1.70
N-9006	Strips, rubber, yoke bumper	.14
N-9008	Anode lead support	.14
N-9009	Spring, H. V. Cover retaining	.20
N-8948	Ring, Kinescope Front Insulating	3.60
N-8499	Grommet, Kinescope Support	.36
N-8947	Cabinet Back	1.48
N-8950	Line Cord	.76
N-8949	Springs, Tension — Kinescope Mtg.	.14
N-8020	Shield, Miniature Tube	.14
N-7731	Antenna Terminal Strip	.14
N-8135	Base, Tube Shield	.14
N-9007	Fuse Holder	.22
*N-435	Cabinet Table Model Leatherette	**31.98
*N-9184	Speaker 5" Electro-Magnetic (With Cable & Plug)	6.16
*N-9463	Glass, Front Panel	6.30
*N-9179	Mask, Picture Tube	4.20
*N-9254	Grille Cloth	.40
*N-9182	Cabinet Back	1.44

*Used on Table Model No. 3064A Only

**Excise Tax Included.

IMPORTANT — All prices in this literature are subject to change without notice and are subject to an additional charge to cover any applicable sales tax, use, occupation, or other tax affecting our purchase or sale of merchandise.


300 OHM ANTENNA IMPEDANCE
V1 6BC5 R.F. AMP
V2 6J6 OSC.& MIXER
SWITCH ON VOLUME CONTROL
INTERLOCK ON CABINET BACK
117.5 VOLTS A.C. LINE
V18 5U4G RECT.
V12B 6T8 AUDIO AMP. (TRIODE SECTION)
V16 6Y6G AUDIO OUTPUT
90 OHM FIELD
1/4 AMP FUSE
VOLUME CONTROL 5 M
SPKR
3.2 OHM VC
HUM B C
V3 6CB6 I.F.
V4 6CB6 I.F.
V5 6CB6 I.F.
IN64 VIDEO DETECTOR
V6 6AH6 VIDEO AMP
V7 6AU6 SOUND DRIVER
V8 6AU6 SYNC SEP
CONTRAST CONTROL
V12A 6T8 RATIO DETECTOR (DIODE SECTION)
V10A 1/2 6SN7GT VERT OSC
V13 6S4 VERT OUTPUT
V10B 1/2 6SN7GT PHASE SPLITTER
V9 6AL5 HORIZ PHASE DET
V11 6SN7GT HORIZ OSC
HOR FREQ CONTROL
V14 6BQ6GT HORIZ. DRIVER
V15 6W4GT DAMPER
V17 1B3GT H.V. RECT
BRIGHTNESS CONTROL 100 K
WIDTH
ION
V19 17TP4
VERT HOLD CONT
VERTICAL HEIGHT CONTROL
VERT LIN. CONT
ALL CAPACITY VALUES LESS THAN 1 ARE IN MFD AND ALL VALUES ABOVE 1 ARE IN MMFD. UNLESS OTHERWISE NOTED
ALL RESISTANCE VALUES IN OHMS K=1,000 M=1,000,000
1055

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MODEL
25WG-3060A (MAHOGANY)

MODEL
25WG-3070A (OAK)

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 cycles only
Power Consumption	Television . . . . 245 Watts Radio . . . . 35 Watts Phonograph . . . . . . 55 Watts
Power Output	2.4 Watts (Maximum) 1.8 Watts (10% Distortion)
Tuning Ranges	TV . . . . 12 Channels AM . . . . 540-1600 K.C.
Intermediate Freq. (Tel.)	Picture . . . . 26.20 MC Sound . . . . 21.70 MC
Intermediate Freq. (Radio) . .	AM . . . . 455 KC
Selectivity (Radio)	45 KC Broad at 1000 Times Signal, Measured at 1000 KC
Sensitivity (Radio)	(For .5 Watt Output) 10 Microvolts Average
Tel. Antenna Input Imp.	300 ohms Balanced
Loud Speaker	8" PM Speaker
Voice Coil Impedance	3.2 ohms 400 cycles
Cartridge	Shure P77V (60H17)
Needles — 78 RPM . . . . 33-1/3 & 45 RPM .	Shure 85-16 (61H2) Shure 85-18 (61H13)

4111A

TUBE COMPLEMENT

TV CHASSIS

Symbol	Type	Function
Tuner	6J6	R-F Osc. and Mixer
*Tuner	6BQ7	R-F Amplifier
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V 5 A & B	12AT7	Ist Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6W4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20	5U4-G	Low Voltage Rectifier
V-21	21MP4	Picture Tube 21" Metal Rectangular (Electrostatic)

TUBE COMPLEMENT

RADIO CHASSIS

1	6BA6	R-F Amplifier
1	6BE6	AM Converter
1	6BA6	I-F Amplifier
1	6AV6	Det. & 1st Audio Amplifier
1	6AQ5	Audio Output
1	6X4	Rectifier
2	No. 47	Dial Lamps

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

RADIO FREQUENCY RANGES

Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc	Receiver R-F Osc. Frequency Mc
2	54-60	55.25	59.75	81.45
3	60-66	61.25	65.75	87.45
4	66-72	67.25	71.75	93.45
5	76-82	77.25	81.75	103.45
6	82-88	83.25	87.75	109.45
7	174-180	175.25	179.75	201.45
8	180-186	181.25	185.75	207.45
9	186-192	187.25	191.75	213.45
10	192-198	193.25	197.75	219.45
11	198-204	199.25	203.75	225.45
12	204-210	205.25	209.75	231.45
13	210-216	211.25	215.75	237.45

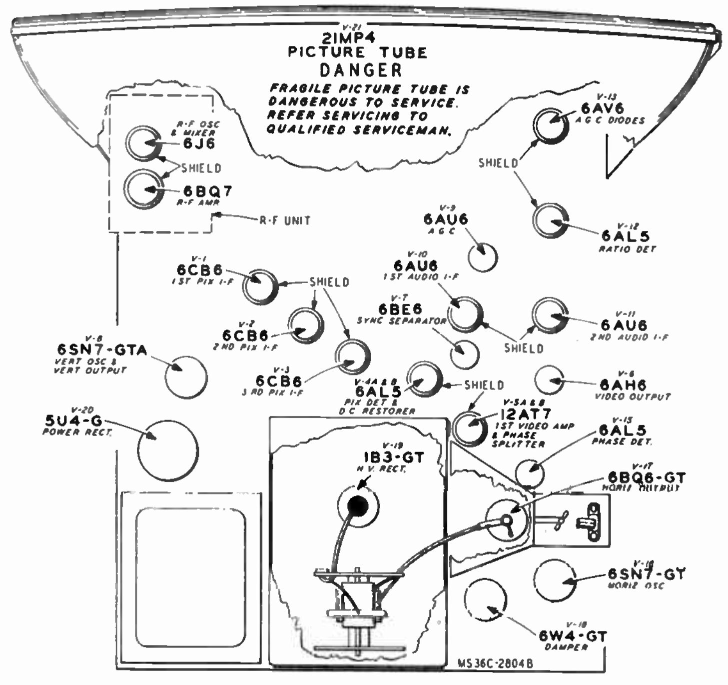
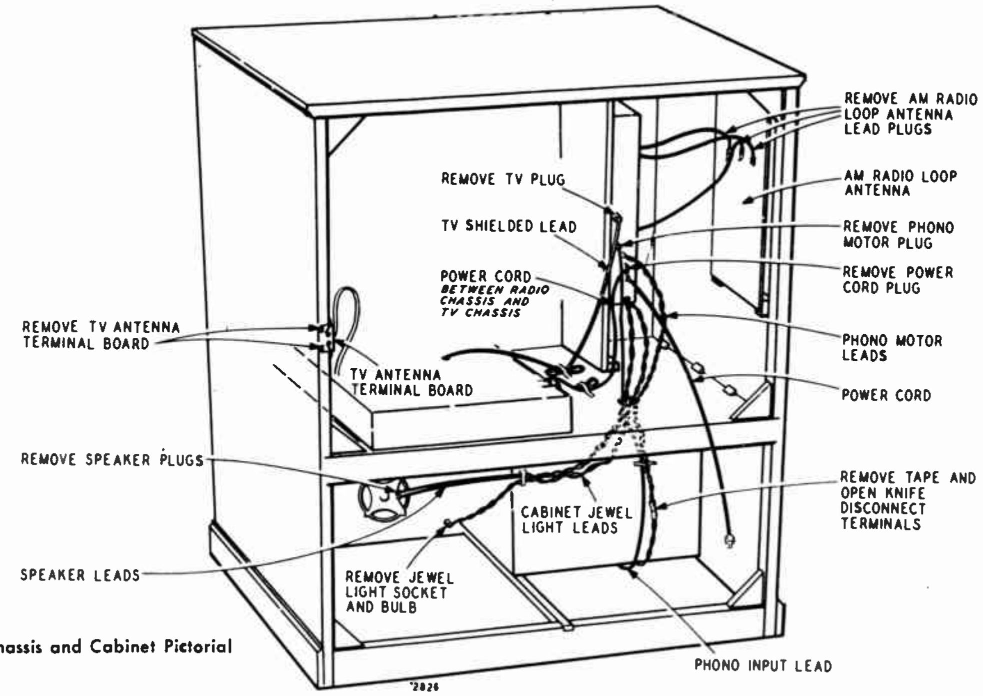


Fig. 1—Tube Layout.



-Chassis and Cabinet Pictorial

PICTURE TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves must be worn by individuals while handling the picture tube or installing the picture tube into the receiver.

The picture tube encloses a high vacuum and due to the large surface area, is subjected to very high air pressure. Therefore, care should be taken not to bump or scratch the picture tube accidentally as it may cause the tube to implode resulting in damage to property or injury to an individual.

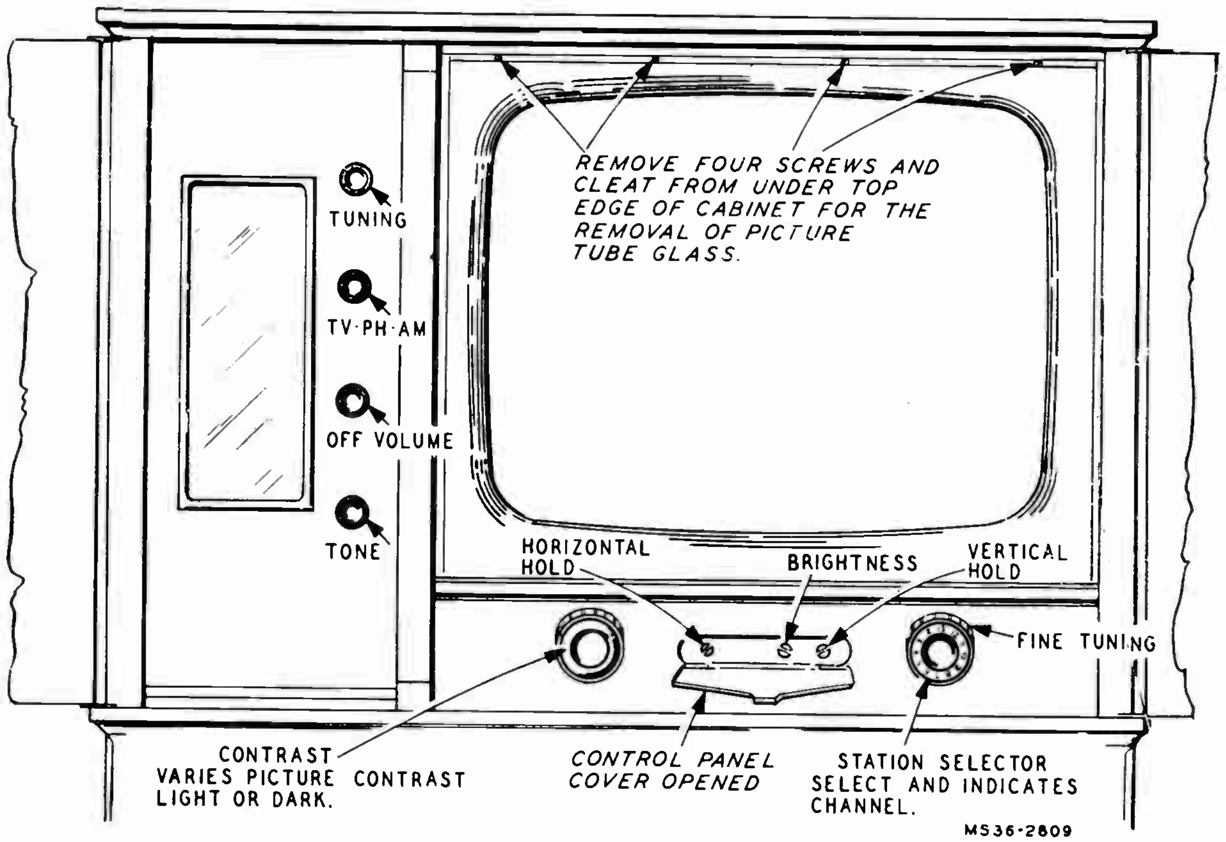


Fig. 2—Front Panel Controls

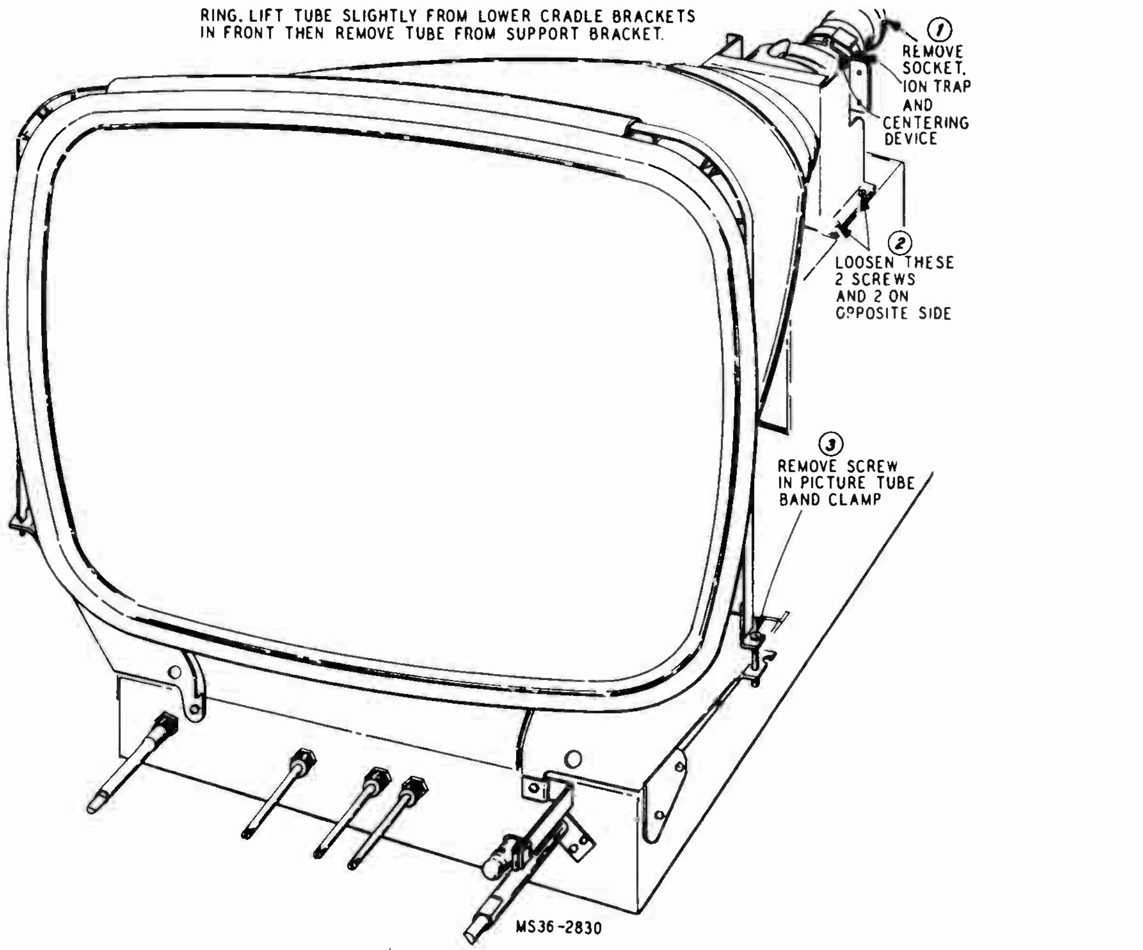


Fig. 3—Removal of Picture Tube

TUNING PROCEDURE

1. To turn the television receiver on, turn the OFF-ON VOLUME control on the radio panel clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.
2. Turn BAND SWITCH control on the radio panel to the TV position.
3. Turn the STATION SELECTOR control to the desired channel. This control may be turned in either direction.
4. Turn the CONTRAST control clockwise until activity or definite form is noted on the screen.
5. Adjust the FINE TUNING control for clearest picture and the VOLUME control for desired volume.
6. To turn off the receiver, turn only the OFF-ON VOLUME control counterclockwise until a click is heard.

OCCASIONAL ADJUSTMENTS TO IMPROVE PICTURE RECEPTION

There are three controls at the front of the chassis which are accessible when the hinged control panel is pulled downward. See illustration. (Figure 2.) These controls are pre-set at the factory and may occasionally need adjustment due to aging of the components in the receiver and the fluctuating line voltages in different areas.

If any adjustments are necessary follow the instructions under 'Controls and Functions."

IMPORTANT — Be sure that the FINE TUNING control has been set for the clearest picture before adjusting any controls.

CONTROLS AND FUNCTIONS

HORIZONTAL HOLD — Stops horizontal movement (diagonal bars.)

BRIGHTNESS—Adjusts for desired picture brilliance.

VERTICAL HOLD — Stops upward or downward picture movement.

PICTURE TUBE SAFETY GLASS

It will be necessary to clean this glass and the face of the picture tube occasionally. Remove the safety glass carefully as outlined in the illustration.

CAUTION—UPON REMOVAL OF THE LAST SCREW AND THE CLEAT THE GLASS WILL FALL FORWARD. SUPPORT THE GLASS WITH ONE HAND AS YOU LIFT IT GENTLY FROM THE CABINET. Clean the safety glass and the face of the picture tube with a soft lint-free cloth dampened with water or mild soapsuds.

WARNING — Before handling the picture tube, it will be necessary to remove the static charge. In receivers with glass picture tubes, ground the anode lead to chassis, and insert an insulated wire from the well in the tube to chassis. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

PICTURE TUBE REPLACEMENT — To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove the cabinet back.
3. Disconnect the leads from the speaker, the radio chassis, remove the antenna terminal board at the rear of the cabinet and then the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

FRONT OF CHASSIS

(Accessible After Opening Front Panel Control Cover)

Horizontal Hold	R-94
Brightness	R-25
Vertical Hold	R-51

NON-OPERATING CONTROLS
REAR OF CHASSIS

Horizontal Centering	Centering Device
Vertical Centering	
Ion Trap Magnet	Wing Nut Adjustment
Deflection Yoke	Wing Screw
Width	L-15
Horizontal Linearity	L-16
Horizontal Drive	R-89
Horizontal Frequency	L-14
Vertical Linearity	R-49
Height	R-54
Sync Stability	R-39
AGC Threshold Control	R-108

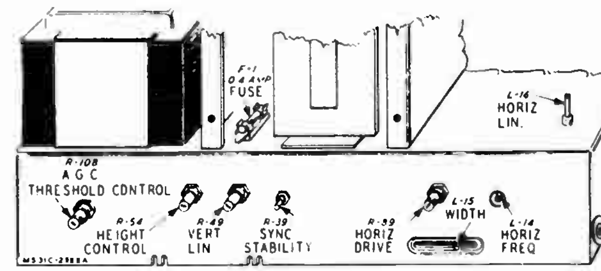


Fig. 4—Adjustments Rear of Chassis

ION TRAP MAGNET ADJUSTMENT—The ion trap magnet should be positioned close to the base of the tube with the magnet of the ion trap on the side where the electron gun is nearest the glass neck of the picture tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to make sure that the ion trap magnet is correctly adjusted.

DEFLECTION YOKE ADJUSTMENT — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

CENTERING ADJUSTMENT — If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained. If a clamp type centering device is used, rotate the device to the left or right and turn the knob located at the top of the device until the picture is centered correctly.

PICTURE ADJUSTMENT — For further adjustments, obtain a test pattern on the receiver. Turn on receiver and follow tuning procedure on page 18. When a test pattern is obtained it may be necessary to slightly re-adjust the fine tuning control for clearest picture.

ADJUSTMENT OF AGC THRESHOLD CONTROL — Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL — When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control fully counter-clockwise, then, while observing the picture, turn the control slowly clockwise until a minimum amount of bending occurs. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.
When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the picture fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT — With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT — Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS— While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (R-89) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (R-89) will be necessary. Adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

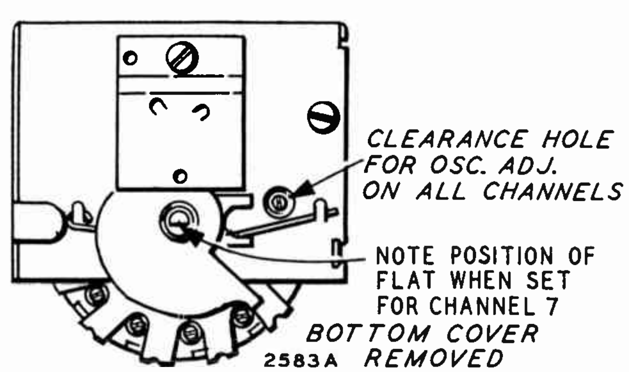


Fig. 5—Tuner Oscillator Adjustments

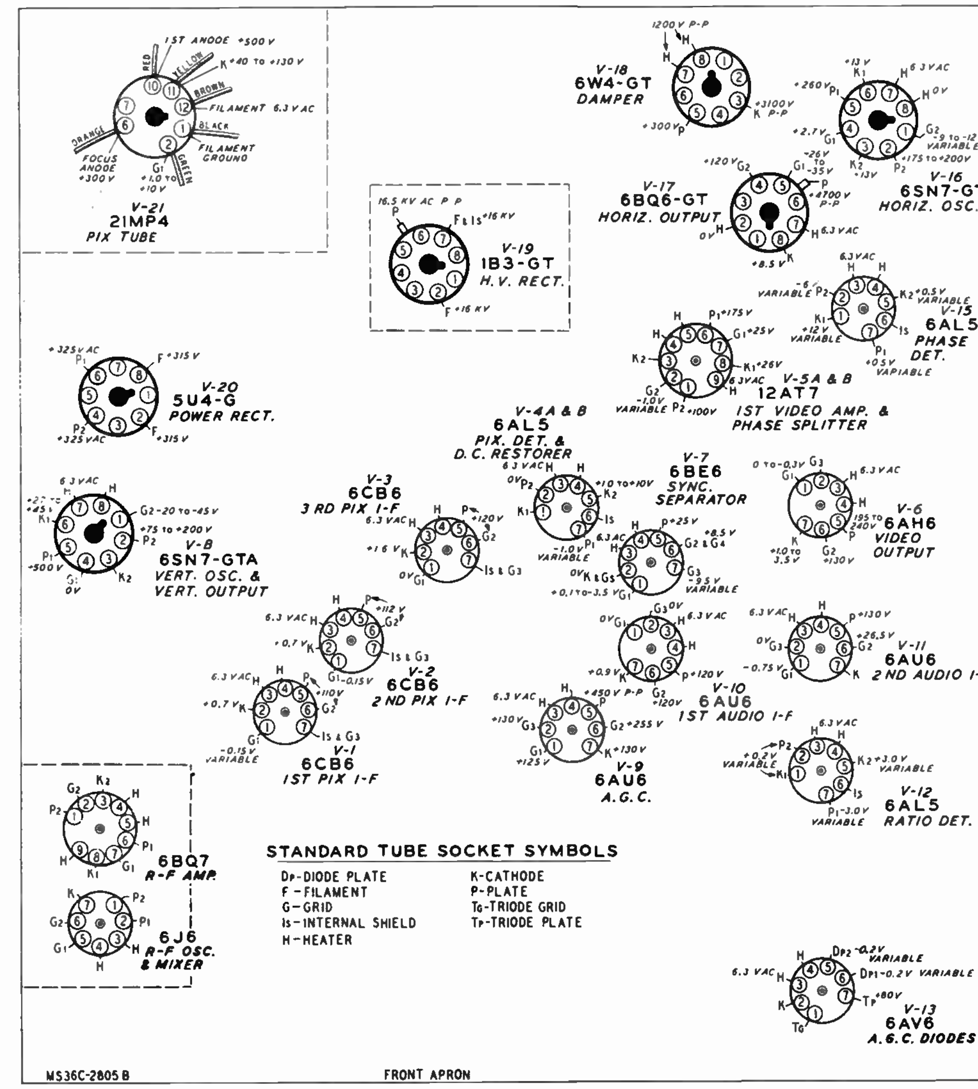


Fig. 6—Bottom Socket Voltages

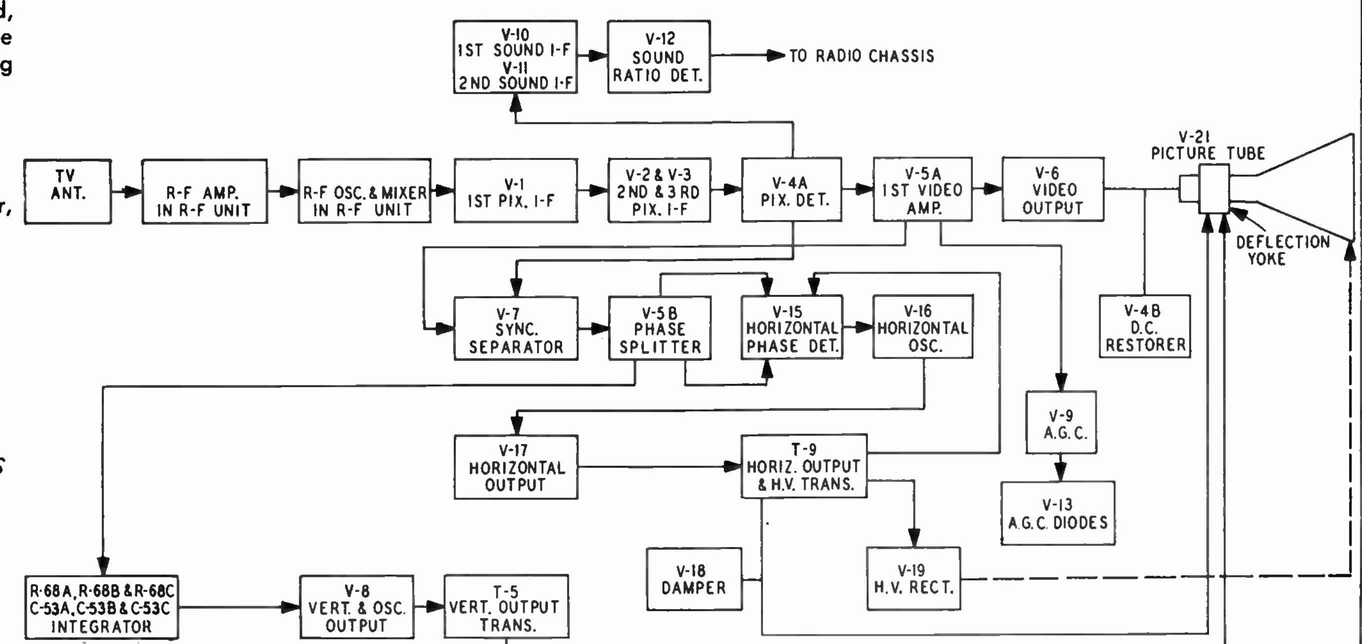


Fig. 7—Block Diagram

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.
1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
(A) Horizontal output tube V-17 (6BQ6-GT)
(B) Check damper tube V-18 (6W4-GT).
(C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
(D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
(E) Check DC resistance of T-9.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-105 and C-75 defective or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:
1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.
1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-47B, C-70 or C-71 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitor C-68, or open or incorrect value of resistors R-90 & R-92.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-67 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:
1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6W4-GT).
3: Check capacitors C-77, C-78, C-79 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER
1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:
1: Defective yoke due to C-76 or R-106 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2: V-18 (6W4-GT) defective.

SMALL RASTER — This condition can be caused by:
1: Low +B or line voltage. Check V-20 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control R-89.
5: V-18 (6W4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND — This condition can be caused by:
1: No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY — A condition of this nature can be caused by:
1: Defective sync separator V-7 or phase splitter V-5B.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY — If this condition is encountered, check:
1: Vertical integrating network capacitors C-53A, B & C, and resistors R-68A, B & C.
2: Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY
1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:
1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (6AH6).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5: Leakage in V-6 (6AH6) grid capacitor C-36. If the capacitor is not found to be defective, check the following:
1: Check all potentials in video circuits.
2: Check picture tube grid circuit for poor or dirty contact.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:
1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc)
1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S-ING
1: Check sync stability control adjustment.
2: Check capacitors C-47A and C-49A.
3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4: Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5: Check AGC threshold control.

PICTURE NORMAL—NO SOUND OR WEAK OR DISTORTED SOUND
1: Check sound I-F alignment.
2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) and associated circuits.

POOR FOCUS
1: Improper setting of Ion Trap magnet.
2: Defective picture tube or picture tube socket.

PICTURE JITTER:
1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).
6: Check for improper setting of sync stability control.
7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8: Check AGC threshold control.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:
(a) Frequency ranges:
18 to 30 mc, 10 mc sweep width
40 to 90 mc, 10 mc sweep width
170 to 225 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)
(a) Intermediate alignment frequencies.
23.1 mc first picture I-F coil.
24.1 mc third picture I-F coil.
25.9 mc second picture I-F coil.
21.7 mc sound trap.
4.5 mc video trap & sound I-F.
25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, the radio chassis, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-105.

ALIGNMENT PROCEDURE
PIX I-F

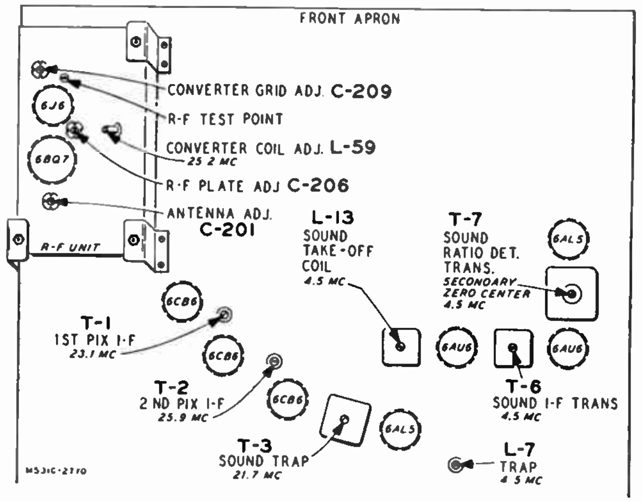


Fig. 8—Top Chassis Video and Audio I-F Adjustments

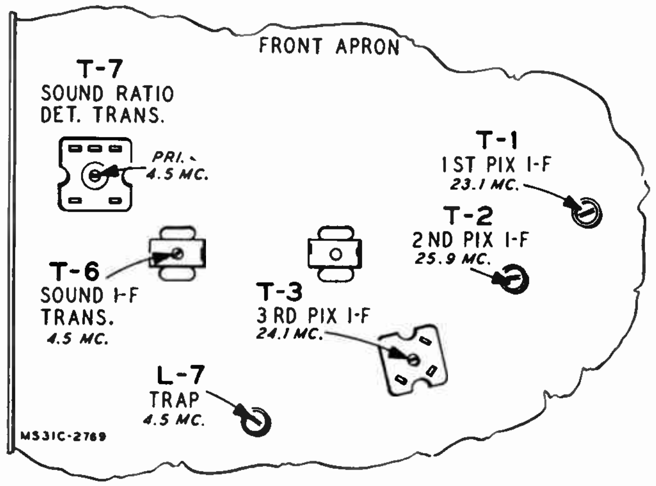


Fig. 9—Bottom Chassis Video and Audio I-F Adjustments.

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-37) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line.

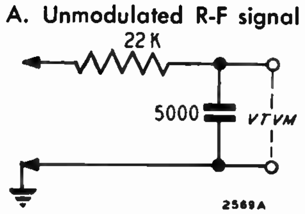


Fig. 10—VTVM Connections

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-37 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery).

Tuner should be switched to dead channel so as not to cause interference.

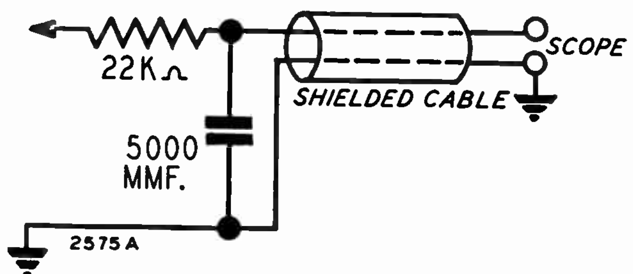


Fig. 11—Oscilloscope Connections

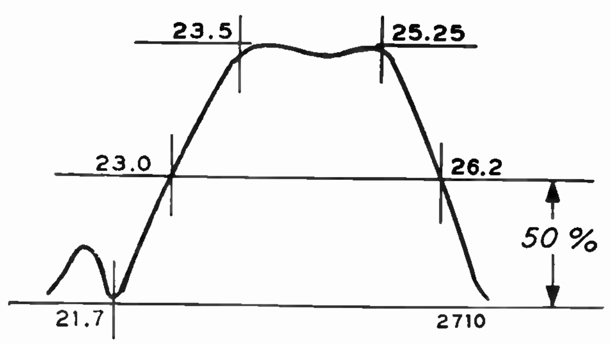


Fig. 12—Overall Response Curve

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

ALIGNMENT PROCEDURE (Continued)

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-13 and C-14, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-17, R-20 and C-18, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect 1½ V bias to AGC line at junction of R-34 and C-29 on the receiver.

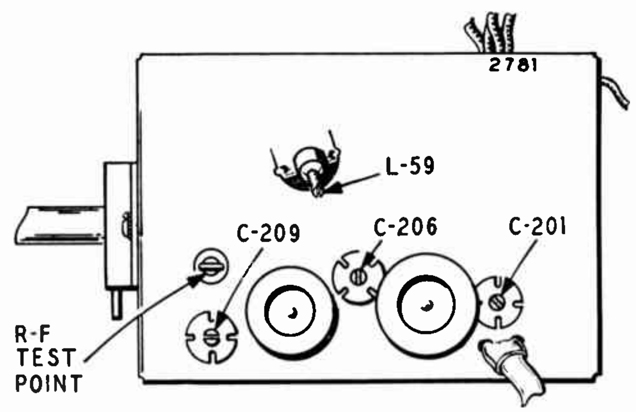


Fig. 13—Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.

2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

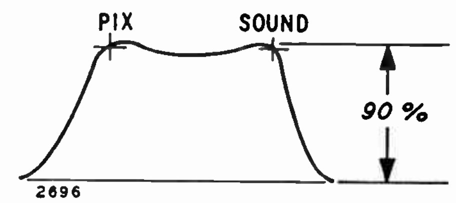


Fig. 14—Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply 4.5 volts on I-F AGC line at junction of R-1 and C-30A.

2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).

3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.

RADIO INFORMATION

ALIGNMENT PROCEDURE
RADIO

The following is required for aligning:
An All Wave Signal Generator Which Will Provide on Accurately Calibrated Signal at the Test Frequencies as Listed.
Output Indicating Meter, Non-Metallic Screwdriver, Dummy Antennas — .1 mf, and 50 mmf.

Volume Control Maximum all Adjustments.
Connect Chassis to Ground Post of Signal Generator with a Short Heavy Lead.
Allow Chassis and Signal Generator to "Heat Up" for Several Minutes.

SIGNAL GENERATOR						
FREQUENCY SETTING	CONNECT GENERATOR OUTPUT TO	THROUGH DUMMY ANTENNA	CONNECT GROUND TO	GANG CONDENSER SETTING	ADJUST	ADJUST FOR
455 KC	Control Grid I-F 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	.1 mf	Chassis Base	Rotor Fully Open	1st I.F. Pri. (4) and Sec. (3)	Maximum Output
455 KC	Control Grid 6BE6 Pin No. 7	.1 mf	Chassis Base	Rotor Fully Open	2nd I.F. Pri. (1) and Sec. (2)	Maximum Output
1620 KC	Control Grid R-F 6BA6 Pin No. 1	.1 mf	Chassis Base	Rotor Fully Open	Oscillator C-8	Maximum Output
1400 KC	Control Grid R-F 6BA6 Pin No. 1	.1 mf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Interstage C-6 See Note B	Maximum Output
1400 KC	External Antenna Terminal	50 mmf	Chassis Base	Turn Rotor to Max. Output. Set Pointer to 1400 KC See Note A	Antenna C-2 See Note B	Maximum Output

NOTE A—If the pointer is not at 1400 KC on the dial, reset pointer to the 1400 KC mark on the dial scale.
NOTE B—Turn the rotor back and forth and adjust the trimmer until the peak of greatest intensity is obtained.

TUBE SOCKET VOLTAGES

Socket voltages are shown on the Bottom Socket diagram at the tube socket terminals. All voltages are between the socket terminals and chassis ground. Plate, screen and cathode voltages were taken with a 1000 ohm-per-volt meter with a 300 volt scale used for plate and screen voltages. Audio grid voltages were read with a vacuum tube volt-meter. Conditions of measurement are:

Line voltage ....117 Volts AC
Signal Input ....None
A Variation of ±10% is usually permissible.

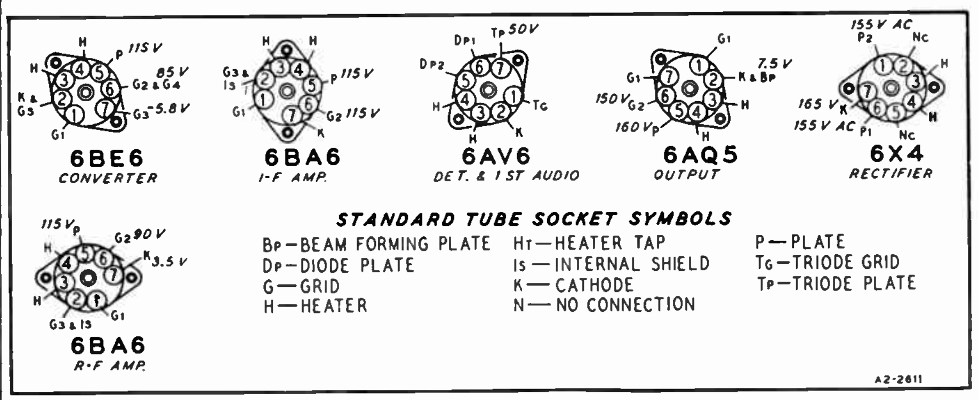


Fig. 21—Bottom Socket Voltages

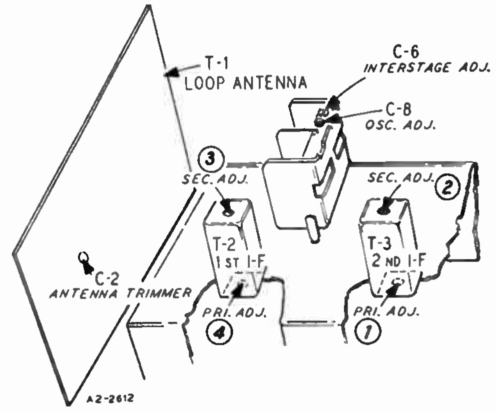


Fig. 17—Trimmer Adjustments

DRIVE CORD REPLACEMENT

DIAL POINTER CORD

Use a new S-10X77 drive cord assembly or a new length of cord 48 inches long for the installation. Install the cord as shown in the illustration, winding three turns counterclockwise around the drive shaft with the turns progressing away from the chassis. After completing the installation rotate the drive shaft a few turns to take up the slack in the cord.

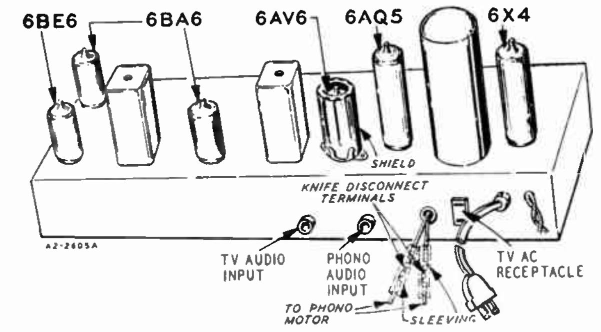


Fig. 18—Tube Layout

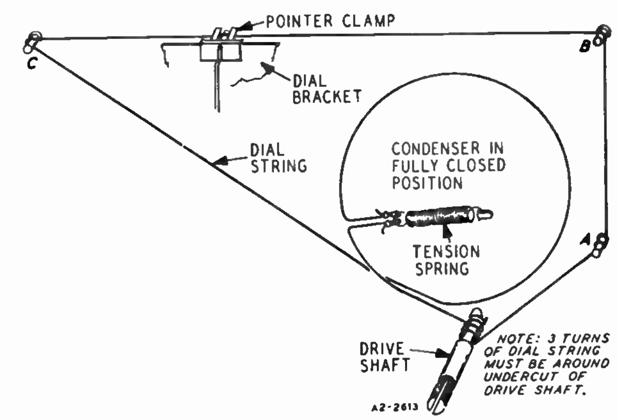


Fig. 19—Drive Cord Stringing.

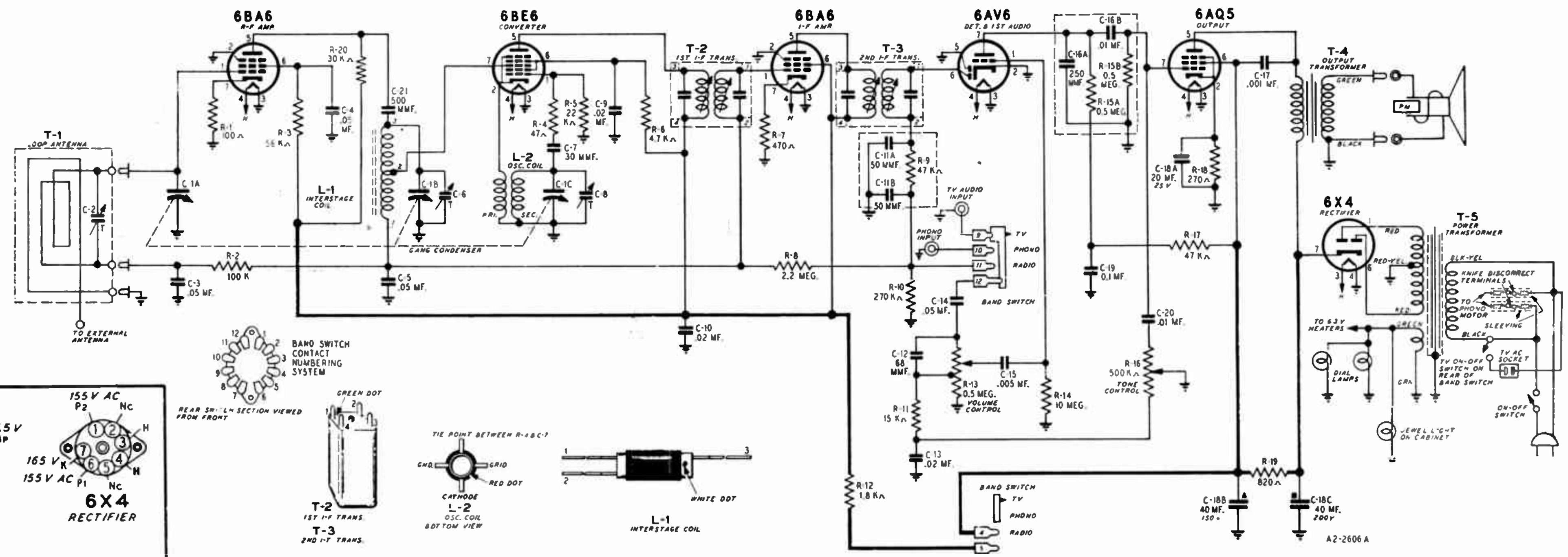
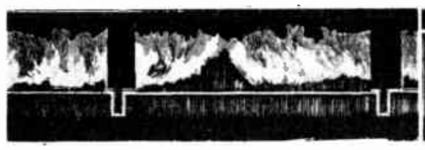


Fig. 20—Radio Schematic Diagram

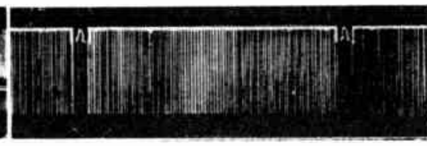
OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.

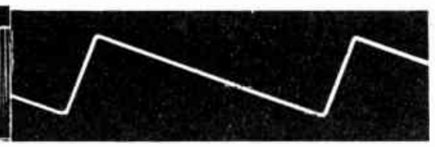
The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.



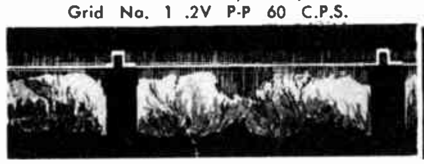
No. 1—6AL5 Pix Det. Plate 3.5V P-P 60 C.P.S.
No. 4—6BE6 Sync Sep. Grid No. 1 .2V P-P 60 C.P.S.



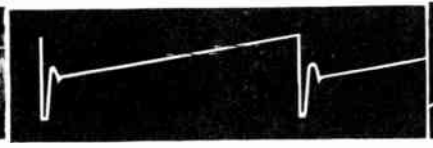
No. 7—12AT7 Phase Splitter Plate 45V P-P 60 C.P.S.



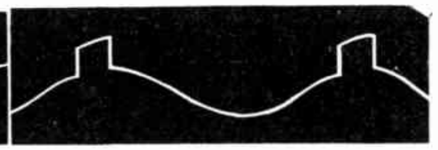
No. 13—6AL5 Phase Det. 18V P-P 15,750 C.P.S.



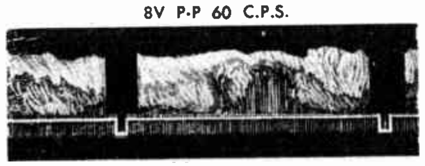
No. 2—12AT7 Plate 35V P-P 60 C.P.S.
No. 2—6AH6 Grid 8V P-P 60 C.P.S.



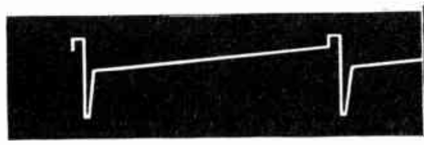
No. 8—6SN7-GTA—Vert. Osc. Plate 125V P-P 60 C.P.S.



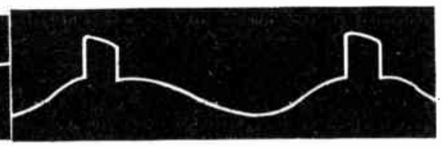
No. 14—6SN7—Hor. Osc. Plate 50V P-P 15,750 C.P.S.



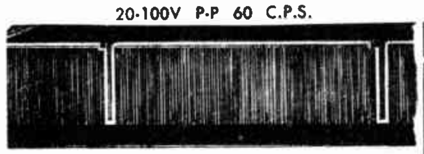
No. 3—Pix Tube Grid 20-100V P-P 60 C.P.S.



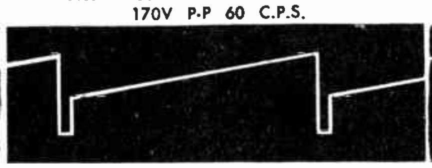
No. 9—6SN7-GTA Vert. Osc. Grid 170V P-P 60 C.P.S.



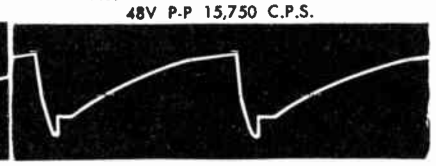
No. 15—6SN7 Hor. Osc. Grid 48V P-P 15,750 C.P.S.



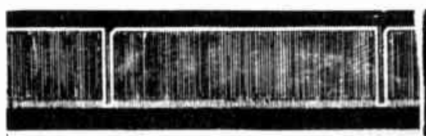
No. 5—6BE6 Sync Sep. Plate 20V P-P 60 C.P.S.



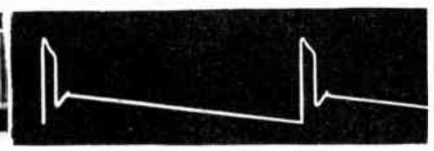
No. 10—6SN7-GTA Vert. Output Grid 150V P-P 60 C.P.S.



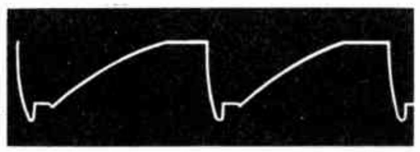
No. 16—6SN7 Hor. Osc. Plate 135V P-P 15,750 C.P.S.



No. 6—12AT7 Phase Splitter Cathode 18V P-P 60 C.P.S.

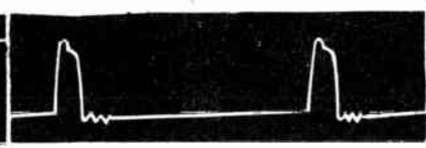


No. 11—Vert. Def. Coil 100V P-P 60 C.P.S.

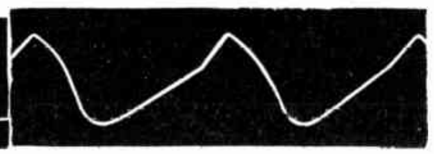


No. 17—6BQ6 Grid 120V P-P 15,750 C.P.S.

No. 6—12AT7 Phase Splitter Cathode 18V P-P 15,750 C.P.S.



No. 12—6AU6 A.G.C. 450V P-P 15,750 C.P.S.



No. 18—6W4 Damper Plate 120V P-P 15,750 C.P.S.

PARTS LIST

RADIO AND RECORD CHANGER

Use only genuine factory tested parts to insure service jobs you can depend on and to obtain original set performance.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Ref. No.	Part No.	DESCRIPTION	Selling Price
		CAPACITORS	
C-1A, C-1B, C-1C	14A213	Gang Condenser Assembly	2.16
C-2	17A235	2-24 mmf Trimmer	.22
C-3, C-5, C-9, C-14	B66503	0.5 mf 200 V Tubular	.16
C-4, C-10, C-13	B66203	0.2 mf 200 V Tubular	.12
C-6, C-8		Part of Gang Condenser Assembly	
C-7	47X558	30 mmf Ceramic	.16
C-11A, C-11B		Part of 76X1 Assembly (See Miscellaneous)	
C-12	47X471	68 mmf Ceramic	.18
C-15	D66502	.005 mf 400 V Tubular	.12
C-16A, C-16B		Part of 76X5 Assembly (See Miscellaneous)	
C-17	F66102	.001 mf 600 V Tubular	.12
C-18A, C-18B, C-18C	45X381	20 mf 25 V, 40 mf 150 V, 40 mf 200 V Dry Electrolytic	1.34
C-19	B66104	.1 mf 200 V Tubular	.18
C-20	B66103	.01 mf 200 V Tubular	.12
C-21	47X508	500 mmf 500 V Ceramic	.16

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
				RESISTORS	
R-1	B84101	100	0.5	Carbon	.08
R-2	B85104	100 K	0.5	Carbon	.06
R-3	B84563	56 K	0.5	Carbon	.08
R-4	B85470	47	0.5	Carbon	.06
R-5	B85223	22 K	0.5	Carbon	.06
R-6	B84472	4.7 K	0.5	Carbon	.08
R-7	B84471	470	0.5	Carbon	.08
R-8	B85225	2.2 Meg.	0.5	Carbon	.06
R-9				Part of 76X1 Assembly (See Miscellaneous)	
R-10	B84274	270 K	0.5	Carbon	.08
R-11	B84153	15 K	0.5	Carbon	.08
R-12	C85182	1.8 K	1.0	Carbon	.08
R-13	36X372	.5 Meg.		Volume Control	.74
R-14	B85106	10 Meg.	0.5	Carbon	.06
R-15A, R-15B				Part of 76X5 Assembly (See Miscellaneous)	
R-16	40X310	500 K		Tone Control	.48
R-17	B85473	47 K	0.5	Carbon	.06
R-18	B84271	270	0.5	Carbon	.08
R-19	D84821	820	2.0	Carbon	.16
R-20	B84303	30 K	0.5	Carbon	.08

Ref. No.	Part No.	DESCRIPTION	Selling Price
		TRANSFORMERS AND COILS	
L-1	9A2283	R. F. Interstage Coil	.88
L-2	9A2113	Oscillator Coil	.30
T-1	9A2114	"B" Range Loop Antenna	1.30
T-2	9A2112	1st I. F. Transformer	.94
T-3	9A2063	2nd I. F. Transformer	.94
T-4	51X134	Output Transformer	1.56
T-5	53X291	Power Transformer	5.52
		DIAL AND DRIVE ASSEMBLY	
	S-10X77	Drive Cord Assembly	.12
	15X251	Pointer	.10
	25X1616	Dial Bracket	.90
	58X764	Dial Glass	.82
	26X524	Drive Shaft	.52
	28X113	Drive Cord Spring	.02
	7A199	Pilot Light Socket Assembly (Radio)	.28
	7A103	No. 47 Pilot Light Bulb (Chassis)	.16
	19X192	"C" Washer (Mtg. Drive Shaft)	.02
		MISCELLANEOUS	
	12A477	8" P.M. Speaker	5.60
	10A759	Knobs (Mah.)	.16
	10A766	Knobs (Blonde)	.14
	4X1162	Escutcheon	.94
	2A403	Band Switch	1.12
	13X546	Line Cord and Plug Assembly	.54
	3A426	Tube Socket	.12
	3A458	Tube Socket	.12
	32X403	Tube Shield	.06
	6A307	TV-AC Receptacle	.16
	30X560	Line Cord Clamp	.06
	3A305	Phono, TV Audio Socket	.06
	76X1	Capacitor-Resistor Combination	.24
	76X5	Capacitor-Resistor Combination	.40
	7A233	Pilot Light Socket Assembly (Cabinet)	.40
	7A32	No. 51 Pilot Light Bulb (Cabinet)	.10
	7A230	Jewel, Pilot Light (Cabinet)	.14

TYPE V-28A189 RECORD CHANGER PARTS

Part No.	Description	Qty.	Selling Price
See Note	Motor Assembly, 60 cycles 105-125 Volts AC	1	
V-2503B	Pickup Arm	1	1.20
P-77V	Crystal Cartridge & Needles (Use 60H17)	1	8.50
85-16	Needle, Regular (Use 61H2)	1	.98
85-18	Needle, Microgroove, Red (Use 61H13)	1	1.50

NOTE — Specify part number stamped on motor assembly.

TELEVISION PARTS LIST

21" METAL RECTANGULAR PIX TUBE

Use only genuine factory tested parts to insure service jobs you can depend on and to obtain original set performance.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

NOTICE: There is a model number label on the chassis. This label identifies the receiver as to chassis and issue letter. When ordering parts or writing, give complete model number.

CAPACITORS

Ref. No.	Part No.	Description	Selling Price
C-1, C-3, C-4, C-5, C-18, C-32, C-35, C-42, C-43, C-44, C-45, C-50, C-55, C-58, C-74	80X1	1000 mmf Ceramic	.12
C-2A, C-2B, C-30A, C-30B	80X3	1000 mmf Dual Ceramic	.18
C-6	47X603	47 mmf 500 V Ceramic	.12
C-7	Part of T-3		
C-8	47X562	5 mmf 500 V Ceramic	.48
C-9	47X584	1.5 mmf Composition	.06
C-10	Part of L-13		
C-11, C-12	Part of T-6		
C-13, C-15, C-17	47X507	5000 mmf Ceramic	.18
C-14, C-66	47X604	100 mmf 500 V Ceramic	.12
C-16	Part of T-7		
C-19, C-72	45X378	5 mf 25W.V. Dry Electrolytic	.58
C-20	47X525	470 mmf 500 V. Molded Mica	.16
C-56, C-81	RCP10M4472M	.0047 mf 400 V Tubular	.16
C-52, C-57	RCP10M4103M	.01 mf 400 V Tubular	16
C-36, C-51, C-73, C-79	RCP10M4473M	.047 mf 400 V Tubular	.18
C-27A, C-27B	45X392	20 mf 400 V, 10 mf 400 V Dry Electrolytic	1.50
C-29, C-31, C-61	RCP10M2224M	.22 mf 200 V Tubular	.28
C-33	45X361	4 mf 100 W.V. Dry Electrolytic	.60
C-34	47X568	360 mmf 500 V Molded Mica	.12
C-37	RCP10M2104M	.1 mf 200 V Tubular	.18
C-38, C-77, C-80	RCP10M4104M	.1 mf 400 V Tubular	.22
C-39	RCP10M6153M	.015 mf 600 V Tubular	.18
C-40, C-68	RCP10M6473M	.047 mf 600 V Tubular	.22
C-46A, C-46B	76X8	.01 mf Dual Ceramic	.26
C-47A, C-47B	45X391	80 mf 400 V, 100 mf 50 V Dry Electrolytic	2.22
C-49A, C-49B	45X390	80 mf 400 V, 60 mf 400 V Dry Electrolytic	2.68

CAPACITORS—Continued

Ref. No.	Part No.	Description	Selling Price
C-53A, C-53B, C-53C	Part of 76X7 (See Miscellaneous)		
C-54, C-60	47X543	4700 mmf 500 V Molded Mica	.52
C-59	RCM20A271K	270 mmf 500 V Molded Mica	.06
C-62	RCP10M2473M	.047 mf 200 V Tubular	.18
C-63	RCM20B431K	430 mmf 500 V Molded Mica	.18
C-64	47X570	330 mmf 500 V Molded Mica	.14
C-65	RCM20A221K	220 mmf 500 V Molded Mica	.16
C-67, C-70	RCP10M6104M	.1 mf 600 V Tubular	.30
C-69	RCP10M6103M	.01 mf 600 V Tubular	.18
C-71	45X393	30 mf 400 V Dry Electrolytic	1.06
C-75	47X560	500 mmf 20 K.V. Ceramic	1.20
C-76	47X598	56 mmf 1500 V Ceramic	.20
C-78	RCP10M4154M	.15 mf 400 V Tubular	.24

RESISTORS

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
R-1	B83822	8.2 K	0.5	Carbon	.10
R-2, R-5	883470	47	0.5	Carbon	.10
R-3, R-6, R-12, R-16, R-30	B85102	1 K	0.5	Carbon	.06
R-4, R-7	B83223	22 K	0.5	Carbon	.10
R-8	B84181	180	0.5	Carbon	.08
R-9, R-42	B84152	1.5 K	0.5	Carbon	.08
R-10	Part of L-5				
R-11, R-44	B84101	100	0.5	Carbon	.08
R-13	B84563	56 K	0.5	Carbon	.08
R-14, R-41, R-80	B84333	33 K	0.5	Carbon	.08
R-15, R-24, R-36, R-74	B84104	100 K	0.5	Carbon	.08
R-17	B84271	270	0.5	Carbon	.08
R-18, R-19, R-86	B84223	22 K	0.5	Carbon	.08
R-20, R-65	B84683	68 K	0.5	Carbon	.08
R-22	40X367	1.5 K		Contrast Control	.66
R-25	40X333	500 K		Brightness Control	.52
R-31, R-32	885151	150	0.5	Carbon	.06

RESISTORS—Continued

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
R-33	B84275	2.7 meg.	0.5	Carbon	.08
R-34, R-100	B84474	470 K	0.5	Carbon	.08
R-35	B83334	330 K	0.5	Carbon	.10
R-37	B83472	4.7 K	0.5	Carbon	.10
R-38, R-63, R-103	B84473	47 K	0.5	Carbon	.08
R-39	40X363	7.5 meg.		Sync Stability Control	.48
R-40	Part of L-9				
R-43, R-50	B84105	1.0 meg.	0.5	Carbon	.12
R-46	Part of L-10				
R-47	C83472	4.7 K	0.5	Carbon	.12
R-49	40X368	4 K		Vertical Linearity Control	.42
R-51	40X334	1.0 meg.		Vertical Hold Control	.52
R-52, R-84	B85104	100 K	0.5	Carbon	.06
R-53	B85472	47 K	0.5	Carbon	.06
R-54	40X364	2.5 meg.		Height Control	.42
R-55	B84222	2.2 K	0.5	Carbon	.08
R-56	B85274	270 K	0.5	Carbon	.06
R-57	43X273	330	10.0	Wirewound	.48
R-58	43X277	2 K	15.0	Wirewound	.60
R-59	43X272	10 K	5.0	Wirewound	.50
R-60	C84562	5.6 K	1.0	Carbon	.10
R-61	B84274	270 K	0.5	Carbon	.08
R-62, R-82	B84155	1.5 meg.	0.5	Carbon	.08
R-64, R-92	B84103	10 K	0.5	Carbon	.08
R-66	B84824	820 K	0.5	Carbon	.08
R-67, R-70, R-96	B83222	2.2 K	0.5	Carbon	.10
R-68A, R-68B, R-68C	Part of 76X7 (See Miscellaneous)				
R-69	B84332	3.3 K	0.5	Carbon	.08
R-73	B85475	4.7 meg.	0.5	Carbon	.06
R-75, R-83	B85474	470 K	0.5	Carbon	.06
R-76	B84273	27 K	0.5	Carbon	.08
R-77, R-78	C84682	6.8 K	0.5	Carbon	.10
R-79	C83562	5.6 K	1.0	Carbon	.12
R-81	B83224	220 K	0.5	Carbon	.10
R-85	B84821	820	0.5	Carbon	.08
R-87, R-93	B84225	2.2 meg.	0.5	Carbon	.08
R-88	B84184	180 K	0.5	Carbon	.08
R-89	40X331	150 K		Horizontal Drive Control	.44
R-90	B84125	1.2 meg	0.5	Carbon	.08
R-91	C84102	1 K	1.0	Carbon	.10
R-94	40X361	50 K		Horizontal Hold Control	.52
R-95	D84682	6.8 K	2.0	Carbon	.16
R-97	B83154	150 K	0.5	Carbon	.10
R-98, R-107	B84561	560	0.5	Carbon	.08
R-99	B84562	5.6 K	0.5	Carbon	.08
R-101	D84101	100	2.0	Carbon	.16
R-102	43X276	12 K	5.0	Wirewound	.62
R-104	43X239	5.1	0.5	Wirewound	.24
R-105	C85105	1.0 meg.	1.0	Carbon	.08
R-106	B85102	1 K	0.5	Carbon	.06
R-108	40X364	2.5 meg.		A.G.C. Control	.42
R-109	43X274	7.5 K	10.0	Wirewound	.64
R-110	D85104	100 K	2.0	Carbon	.12

21" METAL RECTANGULAR PIX TUBE

MISCELLANEOUS

Ref. No.	Part No.	Description		Selling Price
	2A426	Centering Device		.70
	76X7	Multiple Resistor Capacitor Assembly		.54
	9A2274	Deflection Yoke Assembly		7.12
	2A407	Ion Trap Magnet		.50
	4A408	Antenna Terminal Strip		.24
	3A427	Tube Socket Miniature		.16
	3A458	Tube Socket 6CB6-6AU6-6AL5		.12
	3A463	Tube Socket, 12AT7		.24
	3A303	Tube Socket, 5U4		.12
	3A464	Tube Socket 6BQ6-6SN7		.10
	3A445	Tube Socket, 6W4		.16
	3A466	Tube Socket, 1B3		.36
	3A470	Tube Socket, Octal		.10
	13X817	Pix Tube Socket		.58
	7A240	Pilot Light Socket Assy	—Channel Selector	.12
	7A32	No. 51 Pilot Light Bulb	—Channel Selector	.10
	32X403	Tube Shield (3A458 Socket)		.06
	32X405	Tube Shield (3A463 Socket)		.12
	S-6A1	Anode Connector & Lead Assembly		.30
	25X1828	Bracket, Pix Tube Rear Mtg.		1.14
	8X227	Collar Pix Tube Rear Mtg.		.34
	S-25X85	Tube Mtg. Strap Assembly		.52
	S-34X19	Tube Cover and Power Cord Assembly		1.36
	4X1157	Pix Tube Mtg. Ring		3.58
	6X73	Rubber Grommet (6BQ6 Plate Lead)		.04
	25X1815	Bracket, Tube Front Support (R.H.)		.64
	25X1816	Bracket, Tube Front Support (L.H.)		.64
	16X146	Fuse Holder		.16
	16X147-3	Fuse 4/10 Amp. 125-250 V		.22
	17X174	Pix Crystal	Models 3060 & 3070	6.48
	4X1200	Pix Mask	Models 3060 & 3070	3.00
	14X485	Ventilator Grille	Models 3060 & 3070	.18
	S-14X67	Cabinet Back Assembly	Models 3060 & 3070	2.50
	S-4X28-1	Escutcheon Assembly (Control Panel)	Model 3060	2.10
	10A820-1	Knob (Fine Tuning)	Model 3060	.90
	10A821-2	Knob (Contrast)	Model 3060	.22
	10A812-2	Knob (Contrast)	Model 3060	.48
	10A812-1	Knob (Channel Selector)	Model 3060	.72
	S-4X28-2	Escutcheon Assembly (Control Panel)	Model 3070	2.10
	10A820-2	Knob (Fine Tuning)	Model 3070	.34
	10A821-5	Knob (Contrast)	Model 3070	.22
	10A812-7	Knob (Contrast)	Model 3070	.48
	10A812-3	Knob (Channel Selector)	Model 3070	.84

TRANSFORMERS AND COILS

Ref. No.	Part No.	Description	Selling Price
L-1, L-2, L-3	9A2033	R.F. Heater Choke	.12
L-4, L-8	9A1979	Peaking Coil (36 uh)	.30
L-5	36A10	Peaking Coil (60 uh)	.24
L-6	36A11	Peaking Coil (500 uh)	.28
L-7	9A2074	4.5 MC Trap	.36
L-9	36A16	Peaking Coil (80 uh)	.28
L-10	36A12	Peaking Coil (160 uh)	.24
L-11	36A2	Peaking Coil (190 uh)	.30
L-12, L-17	Part of Deflection Coils		
L-13	9A2168	Sound Take Off Coil	.66
L-14	9A2096	Horizontal Frequency Control	.66
L-15	9A2183	Width Control	.96
L-16	9A2262	Horizontal Linearity Control	.46
L-18	52X90	Filter Choke	2.22
T-1, T-2	9A2230	1st and 2nd P.I.F. Transformer	.44
T-3	9A2226	3rd P.I.F. Transformer	1.06
T-4	54X8	Vertical Osc. Transformer	1.42
T-5	51X156	Vertical Output Transformer	3.04
T-6	9A2170	Sound I.F. Transformer	.94
T-7	9A2269	Sound Ratio Det. Transformer	1.66
T-9	53X330	Horizontal Output Transformer	7.20
T-10	53X324	Power Transformer	14.98

TUNER ASSEMBLY PARTS LIST

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204, C-212	CD8X102Z	1000 mmf	
C-205, C-207	CD8Q470K	47 mmf	±10%
C-206, C-209	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Port of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215, C-216, C-217, C-218	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	±10%	0.5
R-202	12A-039	47 K	±20%	0.5
R-203	12A-094	100 K	±10%	0.5
R-204	12A-166	100 K	±5%	0.5
R-205	12A-167	160 K	±5%	0.5
R-206	12A-183	1500	±10%	0.5
R 207, R 209, R 210	12A-040	10 K	±10%	0.5
R 208	12A-041	220 K	±20%	0.5

COILS AND CHOKES

Ref.	Part No.	Description	Channel Code No.
	9A2278-1	Antenna Coil	2-Q......
	9A2278-2	Antenno Coil	3-Q......
	9A2278-3	Antenno Coil	4-Q......
	9A2278-4	Antenno Coil	5-Q......
	9A2278-5	Antenna Coil	6-Q......
	9A2278-6	Antenna Coil	7-Q......
	9A2278-7	Antenna Coil	8-Q......
	9A2278-8	Antenno Coil	9-Q......
	9A2278-9	Antenna Coil	10-Q......
	9A2278-10	Antenna Coil	11-Q......
	9A2278-11	Antenno Coil	12-Q......
	9A2278-12	Antenna Coil	13-Q......
	9A2279-1	Oscillotor Coil	2-Q......
	9A2279-2	Oscillator Coil	3-Q......
	9A2279-3	Oscillotor Coil	4-Q......
	9A2279-4	Oscillator Coil	5-Q......
	9A2279-5	Oscillotor Coil	6-Q......
	9A2279-6	Oscillotor Coil	7-Q......
	9A2279-7	Oscillotor Coil	8-Q......
	9A2279-8	Oscillator Coil	9-Q......
	9A2279-9	Oscillotor Coil	10-Q......
	9A2279-10	Oscillator Coil	11-Q......
	9A2279-11	Oscillator Coil	12-Q......
	9A2279-12	Oscillator Coil	13-Q......
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A575	Choke, Oscillotor Filoment	
L-58	31B-295	Choke, Mixer Plate	
L59	31A-078	Converter Plate Coil	
L-60	31B-239	Choke, Coil	

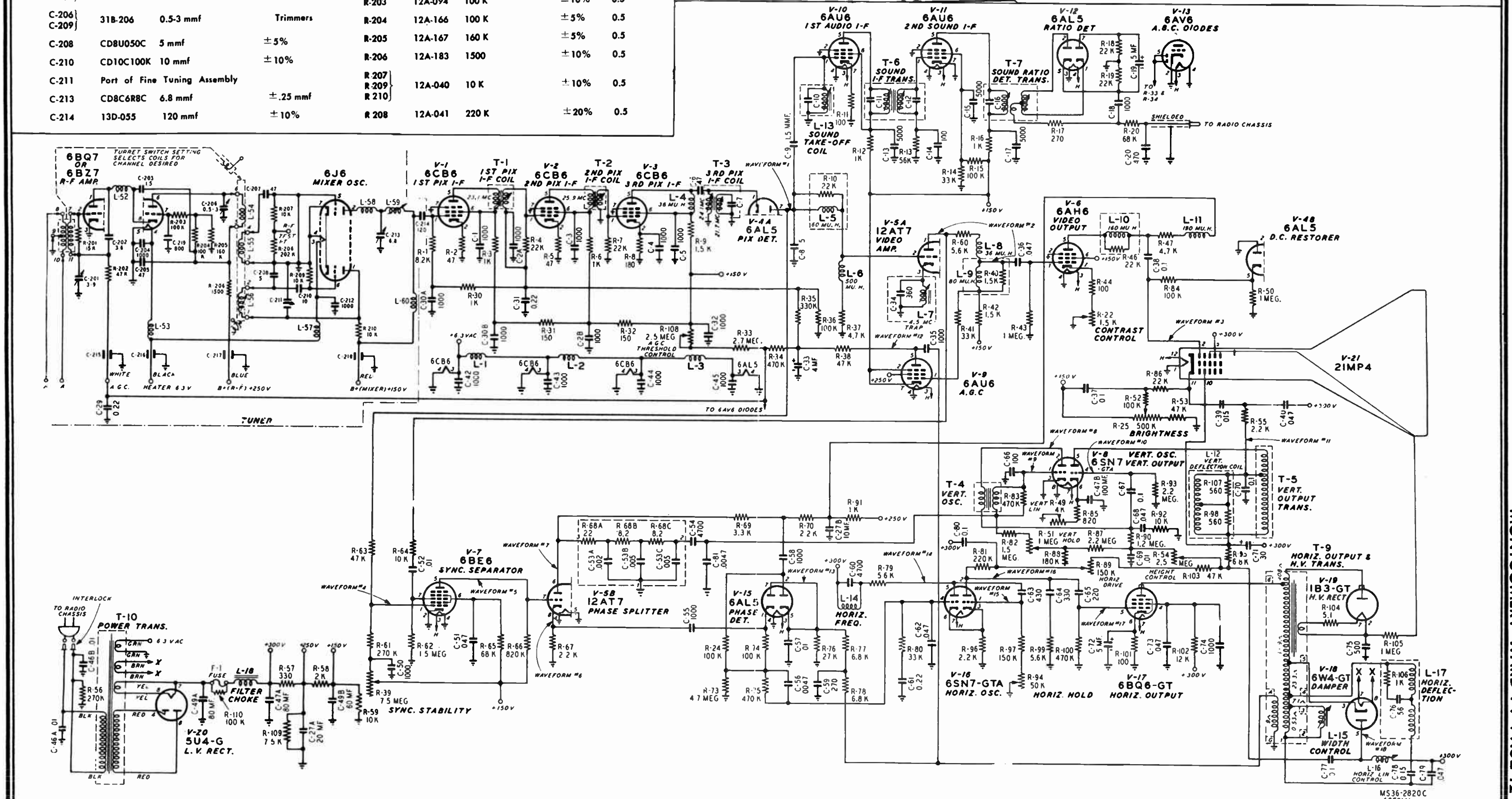


Fig. 23—Television Schematic Diagram.

MODEL
35WG-3060B (MAHOGANY)

MODEL
35WG-3070B (OAK)

SUPPLEMENTARY MANUAL

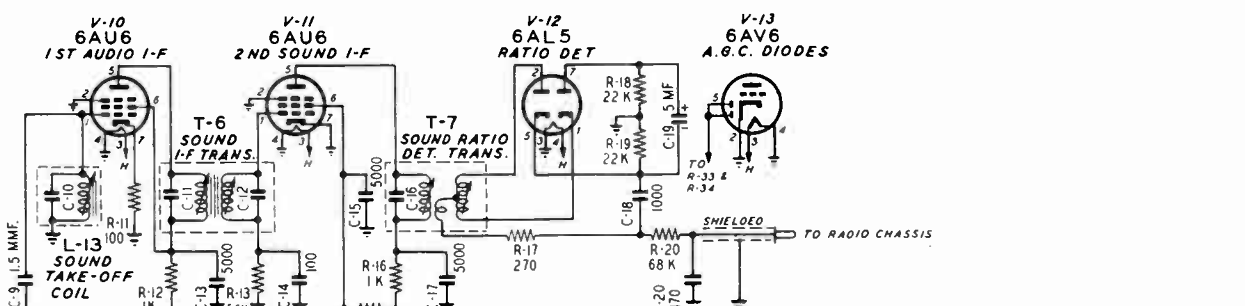
Models 35WG-3060B and 35WG-3070B are identical to models 25WG-3060A and 25WG-3070A except for a change in the V-18 damper tube from a 6W4-GT to a 6AX4-GT and a change in value of resistors R-82 and R-90 from 1.5 megohm and 1.2 megohm respectively to 1.8 megohm. The part number of the resistor is B84185.

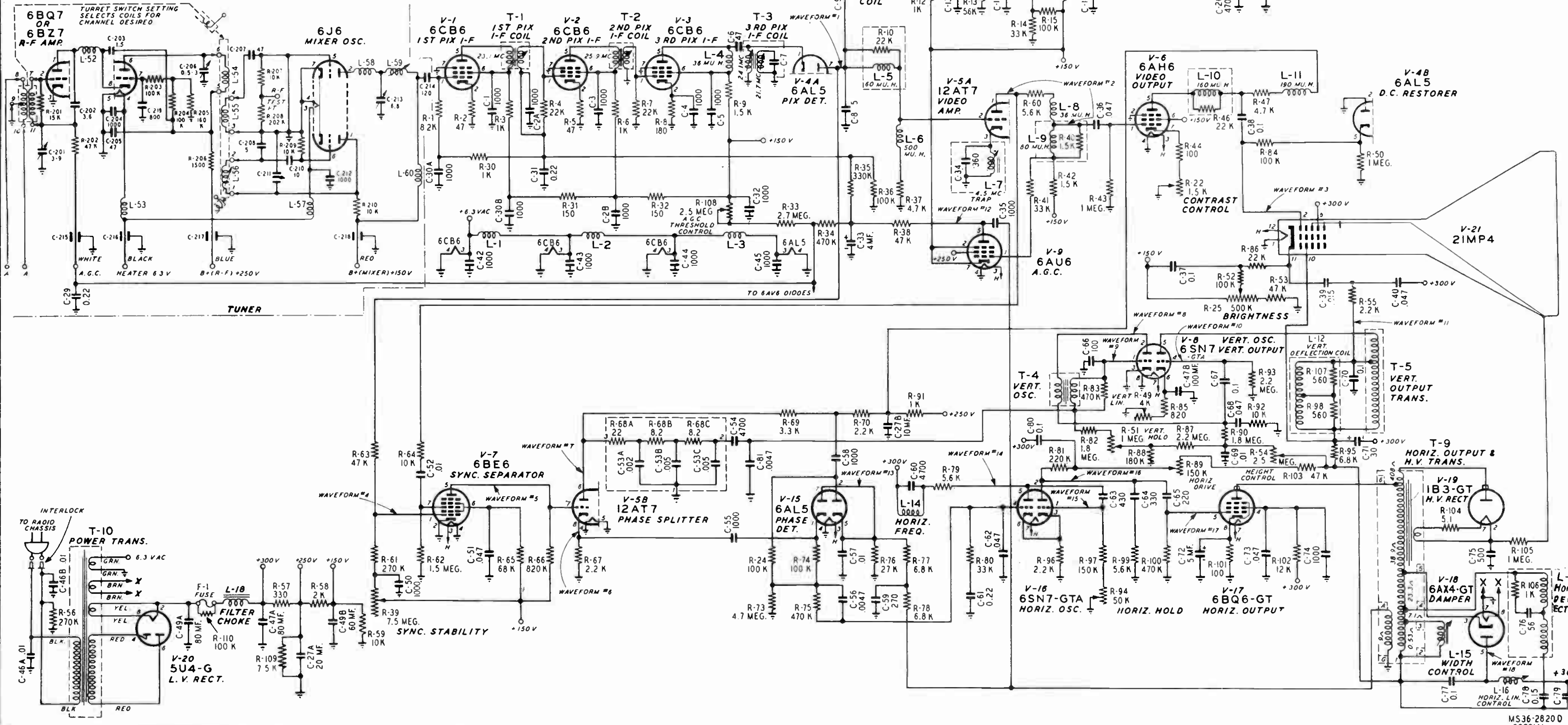
SERVICE INFORMATION

UHF strips may be inserted into the tuner of this receiver without removing the chassis from the cabinet. Turn the cabinet upside down on top of a clean sheet of paper or cloth to avoid marring the finish of the cabinet. You will note an opening in the cabinet located directly below the tuner. Remove the protective cover from the opening and take off the tuner bottom cover. The tuner is now accessible for the removal of any VHF strip and the addition of any UHF strip. After the UHF strip has been inserted into the tuner, the bottom cover on the tuner and the protective cover on the cabinet have been replaced, turn the cabinet right side up.

Because of the addition of the UHF strip, an adjustment of the R-F oscillator will be necessary. Remove the channel selector and fine tuning knobs from the tuning shaft and proceed as follows:

1. Set channel selector to receive the desired UHF station.
2. Set fine tuning control in center of its range.
3. Through the clearance hole in the cabinet adjust the oscillator slug with a bakelite type screwdriver for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.





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MODELS 3171A&B

MODELS 3173A&B

IMPORTANT

Issue "A" &"B" Series of Models 3171 & 3173 are identical except for a few minor changes in cabinet construction and design. For differences between the "A" & "B" models, see the parts list section.

ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles Only
Power Consumption	210 Watts
Power Output	2.4 Watts (Max.) 1.8 Watts (10% Distortion)
Tuning Ranges	VHF — Channels 2 thru 13 UHF — Channels 14 thru 83
Antenna Input Imp.	300 Ohms Balanced
Intermediate Frequencies	Picture 26.20 MC Sound 21.70 MC
I-F (UHF Position Only)	Picture 121.75 Sound 126.25
Intercarrier Sound System	4.5 MC
Loud Speaker	See Parts List
Voice Coil Imp.	3.2 Ohms 400 Cycles

TUBE COMPLEMENT

Symbol	Type	Function
VHF Tuner	6J6	R-F Osc. and Mixer
*VHF Tuner	6BQ7	R-F Amplifier
UHF Tuner	6AF4	R-F Osc.
UHF Tuner	1N72 or 1N82	Crystal Mixer

4115A

TUBE COMPLEMENT (Continued)

Symbol	Type	Function
V-1	6CB6	1st Pix I-F Amplifier
V-2	6CB6	2nd Pix I-F Amplifier
V-3	6CB6	3rd Pix I-F Amplifier
V-4 A & B	6AL5	Pix Det. and DC Restorer
V-5 A & B	12AT7	1st Video Amp. and Phase Splitter
V-6	6AH6	Video Output
V-7	6BE6	Sync. Separator
V-8	6SN7-GTA	Vertical Osc. & Vertical Output
V-9	6AU6	Automatic Gain Control
V-10	6AU6	1st Audio I-F
V-11	6AU6	2nd Audio I-F
V-12	6AL5	Ratio Detector
V-13	6AV6	1st Audio Amplifier
V-14	6AQ5	Audio Output
V-15	6AL5	Phase Detector
V-16	6SN7-GTA	Horizontal Oscillator
V-17	6BQ6-GT	Horizontal Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20 & V-22	5U4-G	Low Voltage Rectifier
V-21	21MP4	Picture Tube 21" Metal Rectangular (Electrostatic)

*For replacement purposes a 6BZ7 tube may be used in place of a 6BQ7 tube.

RADIO FREQUENCY RANGES

Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc	Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc
2	54-60	55.25	59.75	43	644-650	645.25	649.75
3	60-66	61.25	65.75	44	650-656	651.25	655.75
4	66-72	67.25	71.75	45	656-662	657.25	661.75
5	76-82	77.25	81.75	46	662-668	663.25	667.75
6	82-88	83.25	87.75	47	668-674	669.25	673.75
7	174-180	175.25	179.75	48	674-680	675.25	679.75
8	180-186	181.25	185.75	49	680-686	681.25	685.75
9	186-192	187.25	191.75	50	686-692	687.25	691.75
10	192-198	193.25	197.75	51	692-698	693.25	697.75
11	198-204	199.25	203.75	52	698-704	699.25	703.75
12	204-210	205.25	209.75	53	704-710	705.25	709.75
13	210-216	211.25	215.75	54	710-716	711.25	715.75
14	470-476	471.25	475.75	55	716-722	717.25	721.75
15	476-482	477.25	481.75	56	722-728	723.25	727.75
16	482-488	483.25	487.75	57	728-734	729.25	733.75
17	488-494	489.25	493.75	58	734-740	735.25	739.75
18	494-500	495.25	499.75	59	740-746	741.25	745.75
19	500-506	501.25	505.75	60	746-752	747.25	751.75
20	506-512	507.25	511.75	61	752-758	753.25	757.75
21	512-518	513.25	517.75	62	758-764	759.25	763.75
22	518-524	519.25	523.75	63	764-770	765.25	769.75
23	524-530	525.25	529.75	64	770-776	771.25	775.75
24	530-536	531.25	535.75	65	776-782	777.25	781.75
25	536-542	537.25	541.75	66	782-788	783.25	787.75
26	542-548	543.25	547.75	67	788-794	789.25	793.75
27	548-554	549.25	553.75	68	794-800	795.25	799.75
28	554-560	555.25	559.75	69	800-806	801.25	805.75
29	560-566	561.25	565.75	70	806-812	807.25	811.75
30	566-572	567.25	571.75	71	812-818	813.25	817.75
31	572-578	573.25	577.75	72	818-824	819.25	823.75
32	578-584	579.25	583.75	73	824-830	825.25	829.75
33	584-590	585.25	589.75	74	830-836	831.25	835.75
34	590-596	591.25	595.75	75	836-842	837.25	841.75
35	596-602	597.25	601.75	76	842-848	843.25	847.75
36	602-608	603.25	607.75	77	848-854	849.25	853.75
37	608-614	609.25	613.75	78	854-860	855.25	859.75
38	614-620	615.25	619.75	79	860-866	861.25	865.75
39	620-626	621.25	625.75	80	866-872	867.25	871.75
40	626-632	627.25	631.75	81	872-878	873.25	877.75
41	632-638	633.25	637.75	82	878-884	879.25	883.75
42	638-644	639.25	643.75	83	884-890	885.25	889.75

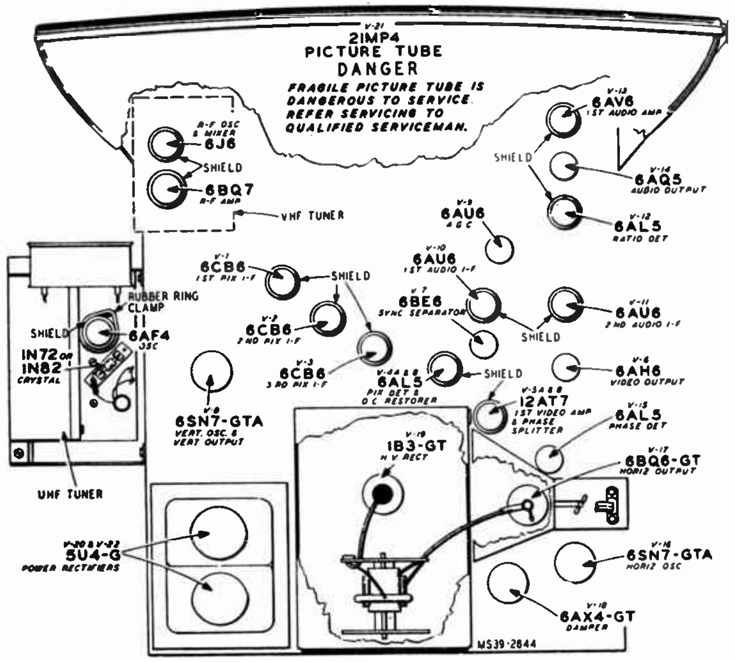


Fig. 1—Tube Layout.

RECEIVER LOCATION — Advise the owner as to the proper location for the television receiver. The following may be used as a guide:

1. Choose an area in the home where sunlight or light from lamps does not strike the face of the picture tube and cause glare.
2. Remember the necessity of an electrical outlet and the location of the point at which the antenna leads enter the room.
3. The receiver should be placed a short distance from the wall to allow adequate ventilation.
4. The receiver should be placed to permit easy access for operation and comfortable viewing from all angles.

ANTENNA — This receiver has been designed to use an antenna with a 300 ohm balanced transmission line. This line must be as short as possible because the longer the line the greater the chances are for picking up electrical disturbances. Stand-off insulation should be used to keep the line away from the mast, metal or walls. Twist this line about one turn per foot throughout the line to cancel out direct signal and/or noise pickup by the transmission line. It should also be securely anchored in place so that a change in weather will not affect its position.

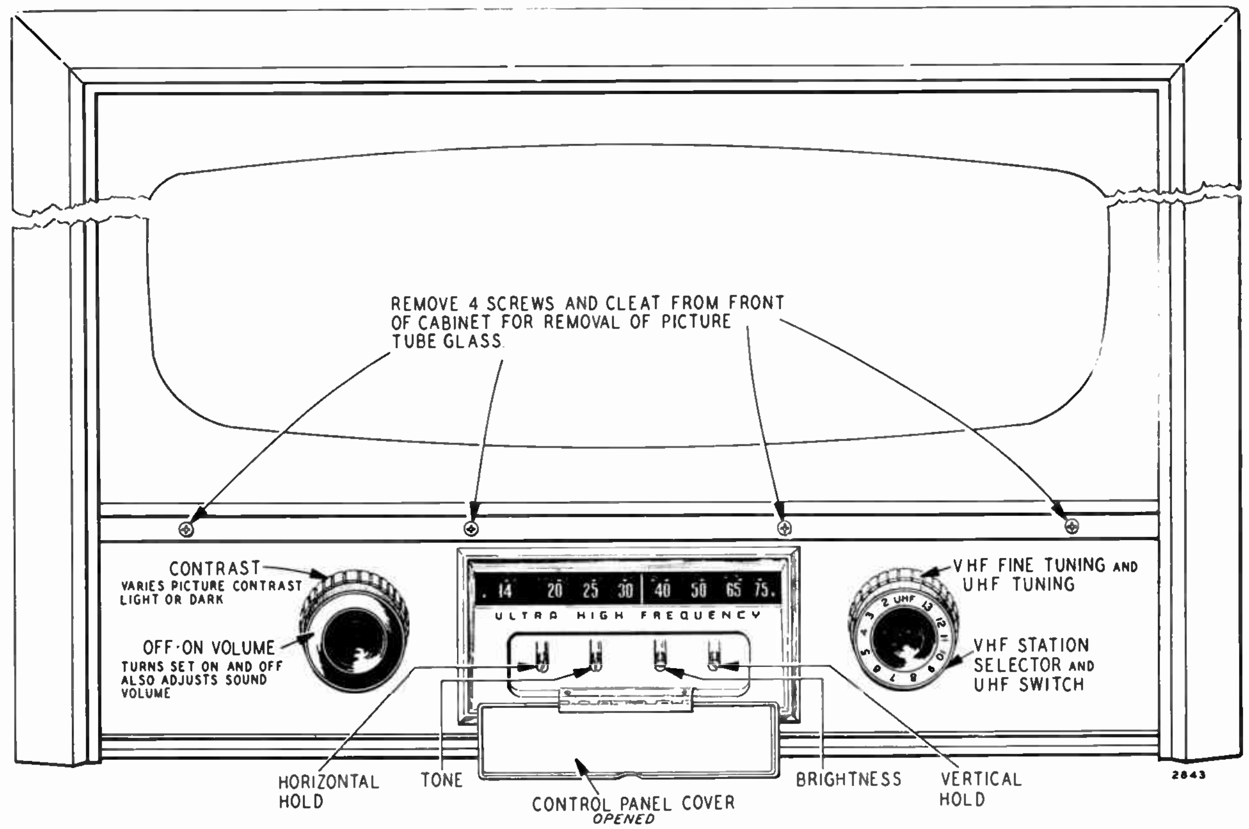
HIGH VOLTAGE WARNING

This television receiver contains high voltages which are dangerous to life. Never operate or service the receiver outside of the cabinet or with the covers removed until all the safety precautions necessary for working with high voltage equipment have been observed.

PICTURE TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves must be worn by individuals while handling the picture tube or installing the picture tube into the receiver.

The picture tube encloses a high vacuum and due to the large surface area, is subjected to very high air pressure. Therefore, care should be taken not to bump or scratch the picture tube accidentally as it may cause the tube to implode resulting in damage to property or injury to an individual.



NOTE — In some receivers it may be necessary to remove 5 screws and cleat from under top edge of cabinet for the removal of picture tube glass.

Fig. 2—Front Panel Controls

TUNING PROCEDURE

1. To turn the television receiver on, turn the OFF-ON VOLUME control clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.
2. Turn the STATION SELECTOR control to the desired channel. This control may be turned in either direction.
3. Turn the CONTRAST control clockwise until activity or definite form is noted on the screen.
4. Adjust the FINE TUNING control for clearest picture and the VOLUME control for desired volume.
5. To turn off the receiver, turn only the OFF-ON VOLUME control counterclockwise until a click is heard.
6. TONE CONTROL — When this Control is turned clockwise, the high notes will predominate and when turned counterclockwise, a deep bass effect will result.
7. In localities where UHF programs are available, turn the STATION SELECTOR control to the UHF position and tune in the desired station with the UHF Tuning Control. The dial scale is calibrated in channel numbers and covers the entire UHF range of channels 14 through 83.

OCCASIONAL ADJUSTMENTS TO IMPROVE PICTURE RECEPTION

There are four controls at the front of the chassis which are accessible when the hinged control panel is pulled downward. See illustration Figure 2. These controls are pre-set at the factory and may occasionally need adjustment due to aging of the components in the receiver and the fluctuating line voltages in different areas.

If any adjustments are necessary follow the instructions under "Controls and Functions."

IMPORTANT — Be sure that the FINE TUNING control has been set for the clearest picture before adjusting any controls.

CONTROLS AND FUNCTIONS

HORIZONTAL HOLD—Stops horizontal movement (diagonal bars.)

TONE—Adjusts for tonal quality bass or treble.

BRIGHTNESS—Adjusts for desired picture brilliance.

VERTICAL HOLD—Stops upward or downward picture movement.

PICTURE TUBE SAFETY GLASS

PICTURE TUBE SAFETY GLASS — It will be necessary to clean the picture tube safety glass and the face of the picture tube occasionally. Remove the screws and cleat as outlined in the illustration. Insert your fingers into the opening at the center of the frame and carefully lift up and pull out the safety glass. Clean the safety glass and the face of the picture tube with a soft lint-free cloth dampened with water or mild soapsuds.

For models that have the cleat and screws at the top of the cabinet the following caution must be observed.

CAUTION — UPON REMOVAL OF THE LAST SCREW AND THE CLEAT THE GLASS MAY FALL FORWARD. SUPPORT THE GLASS WITH ONE HAND AS YOU LIFT IT GENTLY FROM THE CABINET.

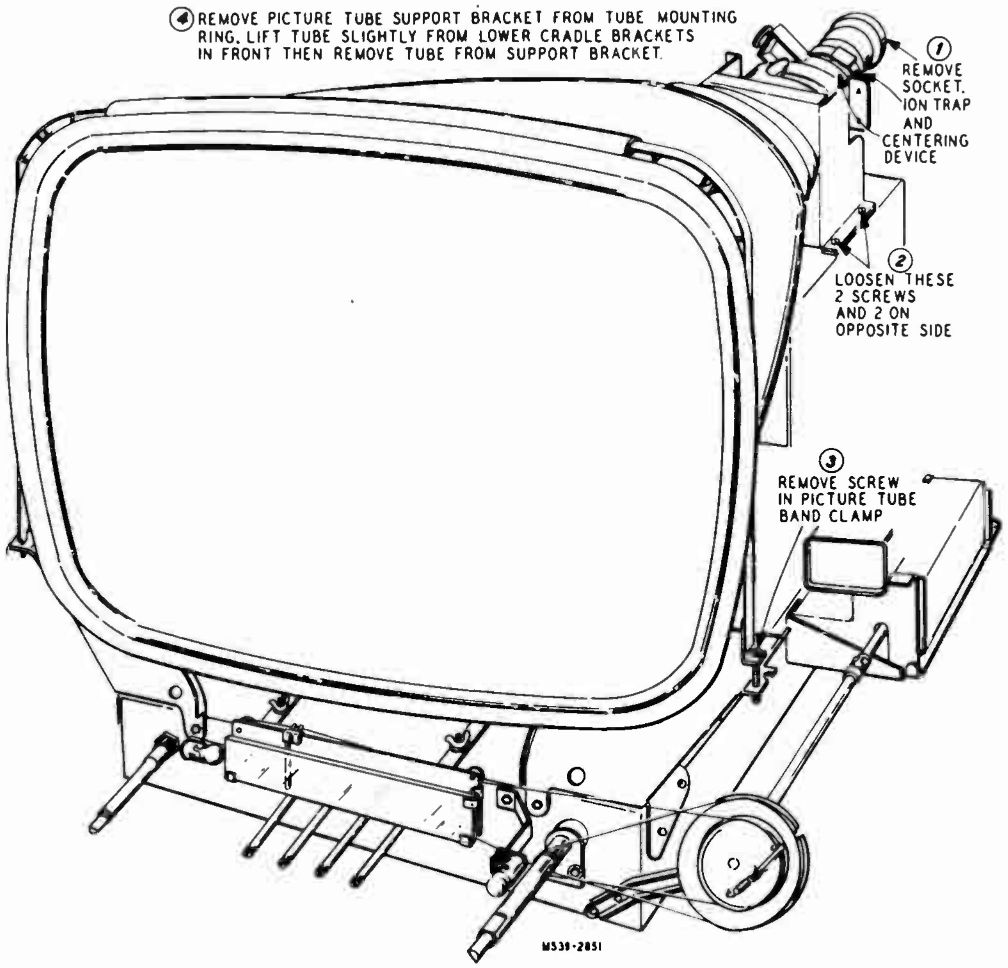


Fig. 3—Removal of Picture Tube

WARNING — Before handling the picture tube, it will be necessary to remove the static charge. In receivers with glass picture tubes, ground the anode lead to chassis, and insert an insulated wire from the well in the tube to chassis. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

PICTURE TUBE REPLACEMENT — To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove the cabinet back.
3. Disconnect the leads from the speaker, remove the antenna terminal boards at the rear of the cabinet and then the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

FRONT OF CHASSIS

(Accessible After Opening Front Panel Control Cover)

Horizontal Hold R-94
Brightness R-25
Vertical Hold R-51
Tone R-72

NON-OPERATING CONTROLS REAR OF CHASSIS

Horizontal Centering .... } Centering
Vertical Centering .... } Device
Ion Trap Magnet .... See paragraph.
Deflection Yoke .... Wing Screw
Width L-15
Horizontal Linearity L-16
Horizontal Drive R-89
Horizontal Frequency L-14
Vertical Linearity R-49
Height R-54
Sync Stability R-39
AGC Threshold Control R-108

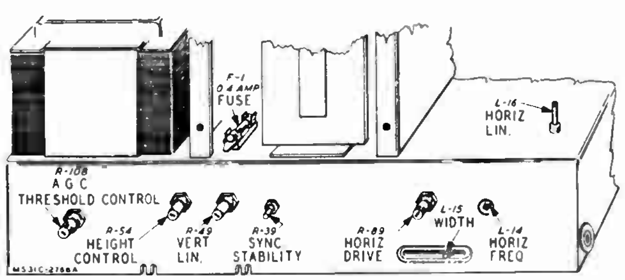


Fig. 4—Adjustments Rear of Chassis

ION TRAP MAGNET ADJUSTMENT—The ion trap magnet should be positioned close to the base of the tube with the magnet of the ion trap on the side where the electron gun is nearest the glass neck of the picture tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Readjust the ion trap magnet for maximum raster brilliance and best focus. MAXIMUM RASTER BRILLIANCE AND BEST FOCUS OCCUR AT THE SAME POINT. Do not sacrifice brilliance for best focus. The ion trap magnet adjustment is a very critical one especially with the electrostatic type zero focus picture tube. Consequently, great care should be taken to make sure that the ion trap magnet is correctly adjusted.

DEFLECTION YOKE ADJUSTMENT — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

CENTERING ADJUSTMENT — If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained. If a clamp type centering device is used, rotate the device to the left or right and turn the knob located at the top of the device until the picture is centered correctly.

PICTURE ADJUSTMENT — For further adjustments, obtain a test pattern on the receiver. Turn on receiver and follow tuning procedure on page 28. When a test pattern is obtained it may be necessary to slightly re-adjust the fine tuning control for clearest picture.

ADJUSTMENT OF AGC THRESHOLD CONTROL — Tune the receiver to the strongest station in the area in which the receiver will be used. While observing the picture and listening to the sound, turn the control clockwise until signs of overloading (buzz in sound, washed-out picture) appear. Then turn the control a few degrees counter-clockwise from the point at which overloading occurs. (The stronger the signal input, the more counter-clockwise this setting will be.) In areas where the strongest signal does not exceed 10,000 uv the setting will usually be maximum clockwise. With the control set correctly, the AGC will automatically adjust the bias on the R.F. and I.F. amplifiers so that the best possible signal to noise ratio (Minimum snow) will be obtained for any signal input to the receiver.

ADJUSTMENT OF SYNC STABILITY CONTROL — When receiving strong (500 MV or more) signals, set hold controls so that the picture is locked in. Turn the sync control slowly clockwise until bending occurs at top of picture. Then turn the control a few degrees counter-clockwise until bending disappears. If the control is set incorrectly bending, tearing, etc., will be present and when switching from channel to channel the picture will not lock in quickly.

In weak signal areas the control should be set for maximum picture stability. In general the weaker the signal the more clockwise the control should be turned.

When the sync stability control is correctly adjusted the receiver will hold sync without tearing or rolling under even the most adverse noise conditions.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT — Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT — With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-14) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENT — Adjust the height control (R-54) until the picture fills the mask vertically. Adjust the vertical linearity control (R-49) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other control.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS— While receiving a signal from a station (with picture locked in sync) turn contrast control fully counter-clockwise, turn the brightness control (R-25) up so that the picture appears washed out. Adjust width control (L-15) until the picture fills the mask. Turn the horizontal drive control (R-89) clockwise until white bars appear in the left center portion of the raster, then turn counter-clockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust horizontal linearity control (L-16) for best linearity. If adjustment of the horizontal drive (R-89) or horizontal linearity (L-16) is required, it usually will be necessary to recheck the horizontal oscillator alignment. If adjustment of the horizontal linearity control (L-16) is required, readjustment of the horizontal drive control (R-89) will be necessary. Adjust the picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

Caution — These adjustments are intended only for VHF Channels. For information regarding UHF alignment, see paragraph "Tuner Alignment" on page 11.

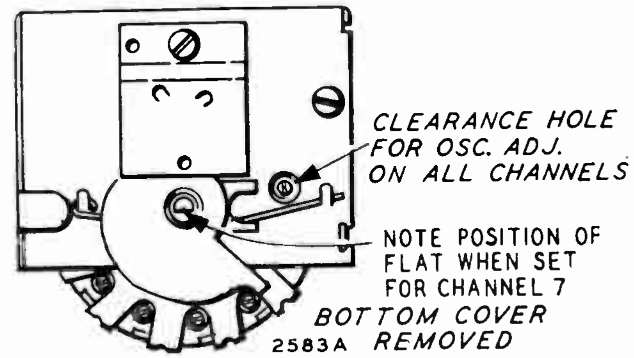


Fig. 5—Tuner Oscillator Adjustments

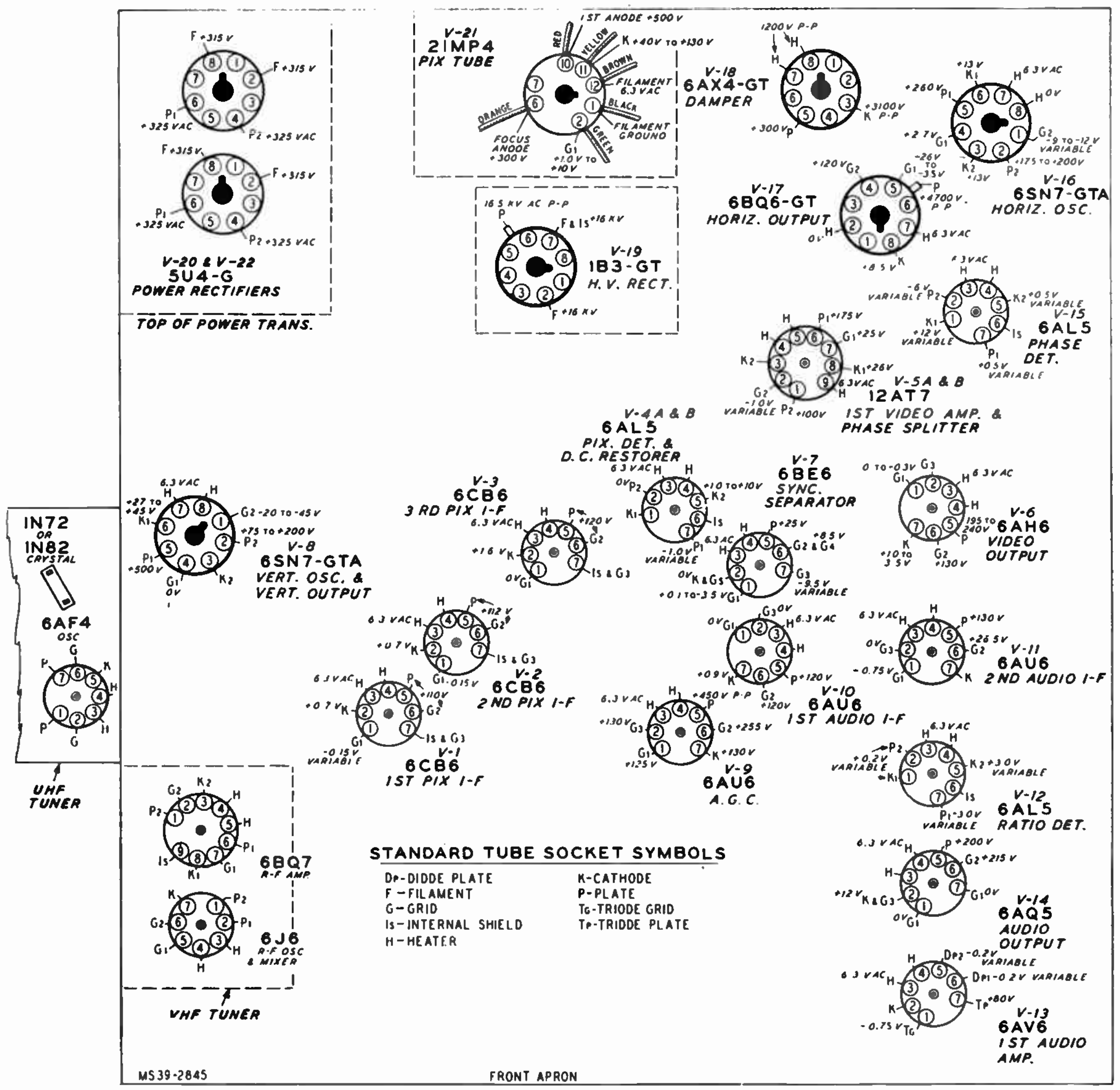


Fig 6—Bottom Socket Voltages

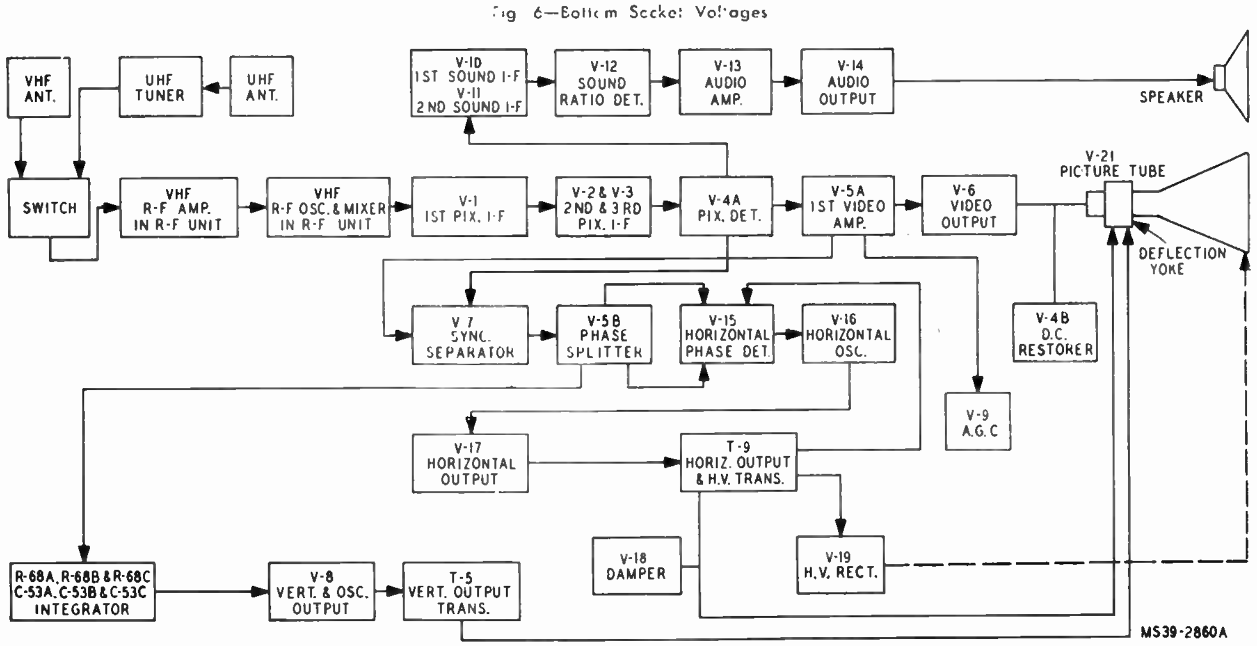


Fig. 7—Block Diagram

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE — If raster cannot be obtained check below for the possible causes.

1: Ion trap magnet adjustment is incorrect.
2: No +B voltage. Check 4/10 ampere fuse. Replace if defective. If fuse continually burns out, check
   (A) Horizontal output tube V-17 (6BQ6-GT)
   (B) Check damper tube V-18 (6AX4-GT).
   (C) Check horizontal oscillator tube V-16 (6SN7-GTA) for proper operation.
   (D) With an ohm meter, check for a short between terminal 1 of the horizontal output transformer (T-9) and the chassis.
   (E) Check DC resistance of T-9.
3: No high voltage. Check V-17, V-18 and V-19 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage (600V) measured on terminal No. 1 of T-9, the trouble can be isolated to the high voltage rectifier circuit. Either the high voltage winding to the 6BQ6-GT plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, R-105 and C-75 defective or pix tube elements shorted internally.
4: Defective picture tube heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:

1: Vertical oscillator and vertical output tube V-8 inoperative. Check socket voltages.
2: Vertical oscillator transformer (T-4) defective.
3: Vertical output transformer (T-5) open or shorted.
4: Yoke vertical coils open or shorted.
5: Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.

1: Check variable resistors R-49 and R-54.
2: Vertical output transformer (T-5) defective.
3: Capacitors C-47B, C-70 or C-71 defective.
4: V-8 defective, check voltages.
5: Excess leakage or incorrect value of capacitor C-68, or open or incorrect value of resistors R-90 & R-92.
6: Low plate voltages. Check rectifier tube and capacitors in +B supply circuits.
7: Capacitor C-67 defective.
8: Vertical deflection coils (L-12) defective.

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:

1: Check or replace horizontal output tube V-17.
2: Check or replace damper tube V-18 (6AX4-GT).
3: Check capacitors C-77, C-78, C-79 and horizontal linearity control (L-16) for defects.
4: Horizontal deflection coils (L-17) defective.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER

1: Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER — This condition can be caused by:

1: Defective yoke due to C-76 or R-106 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2: V-18 (6AX4-GT) defective.

SMALL RASTER — This condition can be caused by:

1: Low +B or line voltage. Check V-20 & V-22 (5U4G).
2: Insufficient output from horizontal output tube V-17. Replace tube.
3: Insufficient output from vertical oscillator and vertical output tube V-8. Replace tube.
4: Incorrect setting of horizontal drive control R-89.
5: V-18 (6AX4-GT) defective.
6: Incorrect setting of (L-15) width control.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND — This condition can be caused by:

1: No signal on picture tube grid. Check V-5A (12AT7) and V-6 (6AH6) tubes and associated circuits.
2: Bad contact to picture tube grid (lead to socket broken).
3: AGC tube (V-9) may be defective. Check tube and its associated circuit.

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY — A condition of this nature can be caused by:

1: Defective sync separator V-7 or phase splitter V-5B.
2: If tubes are O.K. check voltages, and associated circuits.
3: AGC system inoperative. Check V-9 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY — If this condition is encountered, check:

1: Vertical integrating network capacitors C-53A, B & C, and resistors R-68 A, B & C.
2: Vertical hold control (R-51) defective.

SIGNAL ON PICTURE TUBE GRID AND VERTICAL SYNC ONLY

1: V-15 or V-16 defective.
2: Improper setting of (L-14) horizontal frequency control.
3: Check setting of horizontal drive control and horizontal linearity control.
4: Check V-15 and V-16 socket voltages.

PICTURE STABLE BUT WITH POOR RESOLUTION — If the picture resolution is not up to standard, it may be caused by any of the following:

1: Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2: Defective picture detector V-4A, (6AL5) or video amplifier V-5A or video output V-6 (6AH6).
3: Defective picture tube.
4: Open video peaking coil. Check all peaking coils L-5, L-6, L-8, L-9, L-10 and L-11 for continuity. Note that L-5, L-9 and L-10 have shunting resistors.
5: Leakage in V-6 (6AH6) grid capacitor C-36. If the capacitor is not found to be defective, check the following:
   1: Check all potentials in video circuits.
   2: Check picture tube grid circuit for poor or dirty contact.
   3: Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:

1: A smear can be attributed to phase shift at the low or high frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6 (6AH6), open or shorted peaking coils, video amplifier load resistors are of improper value (high).
2: This trouble can also originate at the transmitter. Check reception from another station.
3: Check and realign, if necessary, the picture I-F and R-F circuits.

MAN MADE NOISE IN SOUND (Ignition, etc)

1: Check sound I-F tubes V-10, 11 & 12 and associated circuits.
2: Check sound I-F alignment.

BENDING OR S-ING

1: Check sync stability control adjustment.
2: Check capacitors C-47A and C-49A.
3: V-17 (6BQ6-GT) defective or V-16 (6SN7-GTA) defective.
4: Check sync separator tube V-7 (6BE6) and phase splitter V-5B (12AT7) and V-5A (12AT7) video amplifier.
5: Check AGC threshold control.

PICTURE NORMAL—NO SOUND OR WEAK OR DISTORTED SOUND

1: Check sound I-F alignment.
2: Check V-10 (6AU6) V-11 (6AU6) V-12 (6AL5) V-13 (6AV6) V-14 (6AQ5) and associated circuits.

RASTER ON TUBE BUT NO PICTURE OR SOUND

This condition can be caused by,
1: Defective pix I-F Amplifier tubes V-1, V-2 or V-3
2: Defective pix detector tube V-4A (6AL5). Check tube and its associated circuit.
3: Defective R-F Amplifier or oscillator mixer tubes in the tuner.
4: UHF-VHF switch defective.

POOR FOCUS

1: Improper setting of Ion Trap magnet.
2: Defective picture tube or picture tube socket.

PICTURE JITTER:

1: If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2: Vertical instability may be due to loose connections or noise received with the signal.
3: Horizontal instability may be due to unstable transmitted sync.
4: Check receiver AGC system for proper operation.
5: Check phase splitter V-5B, (12AT7) and sync separator V-7 (6BE6).
6: Check for improper setting of sync stability control.
7: Picture tube grid lead not held in position by support spring, ie: close proximity of grid lead to sync and horizontal tubes will cause picture to jitter at high contrast setting.
8: Check AGC threshold control.

NO PICTURE OR SOUND OR WEAK PICTURE OR SOUND IN UHF POSITION

If this condition is encountered
1: Check to see whether or not a UHF station is operating in the vicinity.
2: The 6AF4 oscillator tube or the IN72 (or IN82) crystal may be defective.
3: Pre-selector in UHF tuner defective.
4: Low pass filter defective.
5: The UHF antenna and oscillator strips in the VHF tuner defective.
6: Defective switch on UHF tuner.

ALIGNMENT PROCEDURE

TEST EQUIPMENT — To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:
(a) Frequency ranges:
18 to 30 mc, 10 mc sweep width
40 to 90 mc, 10 mc sweep width
120 to 130 mc, 10 mc sweep width
170 to 225 mc, 10 mc sweep width
470 to 890 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)
(a) Intermediate alignment frequencies.
23.1 mc first picture I-F coil.
24.1 mc third picture I-F coil.
25.9 mc second picture I-F coil.
21.7 mc sound trap.
4.5 mc video trap & sound I-F.
25.2 mc converter plate coil (Tuner).

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal boards at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the power transformer and pix tube brackets.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-105.

ALIGNMENT PROCEDURE
PIX I-F

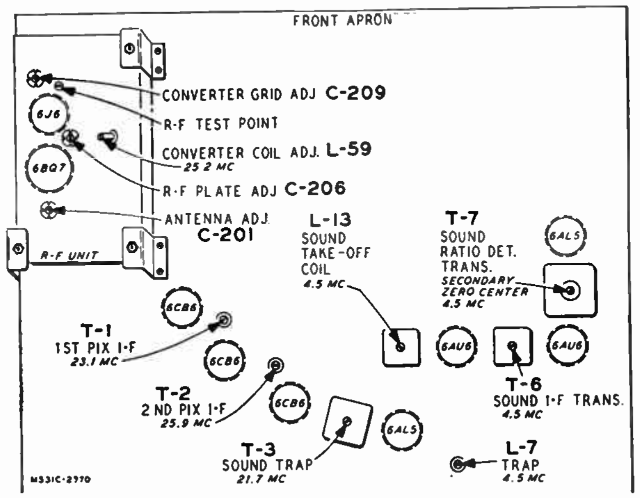


Fig. 8—Top Chassis Video and Audio I-F Adjustments

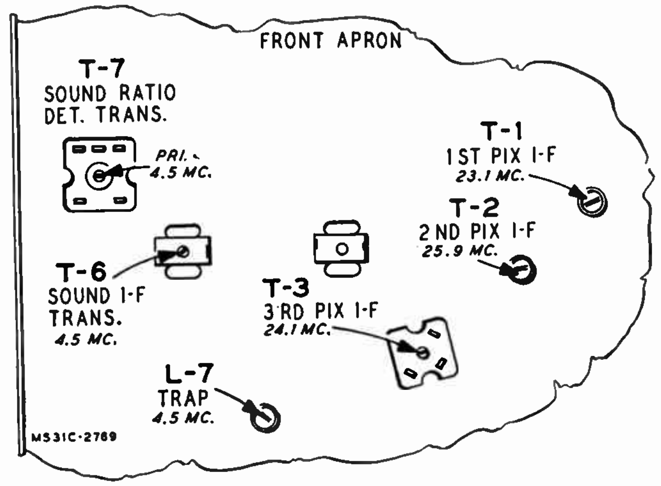


Fig. 9—Bottom Chassis Video and Audio I-F Adjustments.

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 22 K ohms and 5000 mmf connected to pic. det. load resistor, (R-37) 4700 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -4.5V battery bias on AGC line.

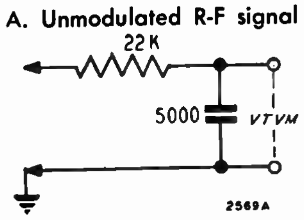


Fig. 10—VTVM Connections

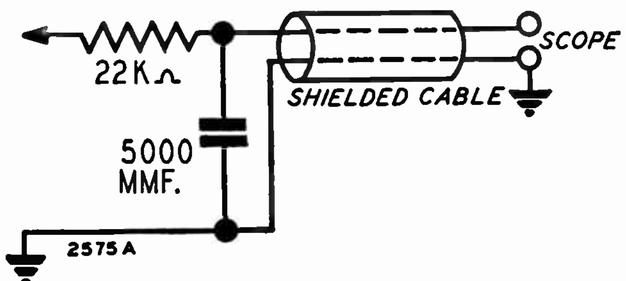


Fig. 11—Oscilloscope Connections

	FREQUENCY	ADJUST
1.	25.2 MC	Converter plate coil on top of tuner for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-1) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-2) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-3 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-3 in can above chassis) for minimum dc at picture detector.

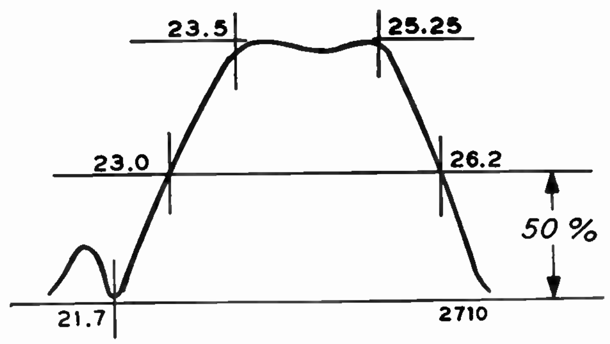


Fig. 12—Overall Response Curve

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base.

Connect oscilloscope across R-37 (in place of VTVM). Apply -4.5V bias (DC) to AGC line (battery).

Tuner should be switched to dead channel so as not to cause interference.

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

ALIGNMENT PROCEDURE (Continued)

1. The height of the 26.2 MC marker is controlled by the 25.2 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with the generator) into plate of the picture detector tube (Pin 7-6AL5) and VTVM on picture tube grid, tune 4.5 MC trap (L-7 Top) for minimum response. VTVM on 0-10 V AC scale. This adjustment can also be made while observing a picture from a station. Tune trap for least 4.5 MC beat in picture.

AUDIO I-F

1: With signal generator set to 4.5 MC and dc VTVM connected to junction of R-13 and C-14, adjust sound take-off coil (L-13 Top) and sound I-F transformer slugs (T-6 Top & Bottom) for maximum.

2: With VTVM connected to pin 7 of V-12 (6AL5) adjust the ratio detector primary (T-7 Bottom) for maximum.

3: With VTVM connected to junction of R-17, R-20 and C-18, adjust ratio detector secondary (T-7 Top) for cross over (zero voltage) on lowest scale.

NOTE — If no signal generator is available, the procedure above may be followed by tuning in a station and using the 4.5 MC beat between picture and sound carrier.

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "test point" (Figure 13) on tuner. Connect 1½ V bias to AGC line at junction of R-34 and C-29 on the receiver.

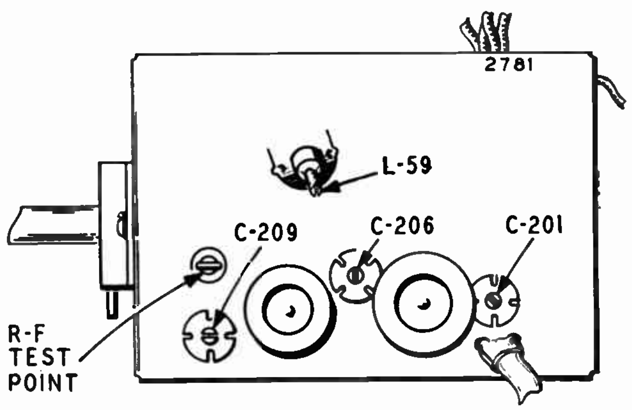


Fig. 13—Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.

1. With channel selector on Channel 12, adjust C-201 slightly favoring the Pix carrier, then adjust C-206 and C-209 for response as in Figure 14. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channels, readjust C-201, C-206, and C-209. Recheck all channels.

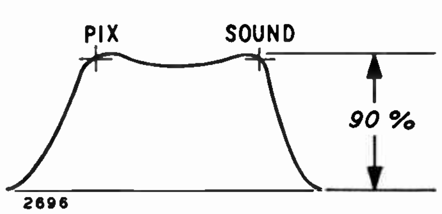


Fig. 14—Pix & Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply -4.5 volts on I-F AGC line at junction of R-1 and C-30A.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 12).
3. If markers are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.
4. To adjust oscillator on UHF position, feed the sweep generator with center frequency of 124 MC and markers at 121.75 and 126.25 into the input of the low pass filter (output of UHF tuner). Adjust oscillator slug in the VHF tuner so that the 121.75 pix carrier marker is at 50% and that 126.25 marker is in the sound notch. If a sweep generator is not available, a single frequency generator set to 126.25 MC and VTVM may be used. Connect VTVM to the pix detector load resistor R-37. Feed generator into the low pass filter. Adjust oscillator slug in the VHF tuner so that the 126.25 marker is in the sound notch of the I-F curve.
5. If the 6AF4 oscillator tube in the UHF tuner is replaced, it may be necessary to adjust the oscillator trimmer C-309 on the UHF tuner located underneath the chassis. (See Figure 15). Adjust this trimmer until the tuner will cover a range of below 470 MC to above 890 MC.

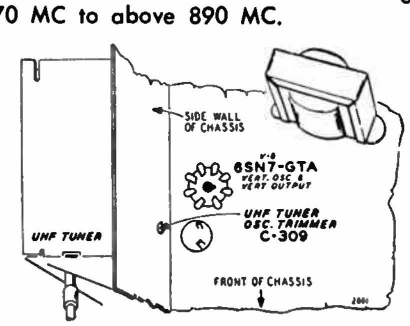


Fig. 15—UHF Tuner Adjustment.

VHF TUNER ASSEMBLY INFORMATION

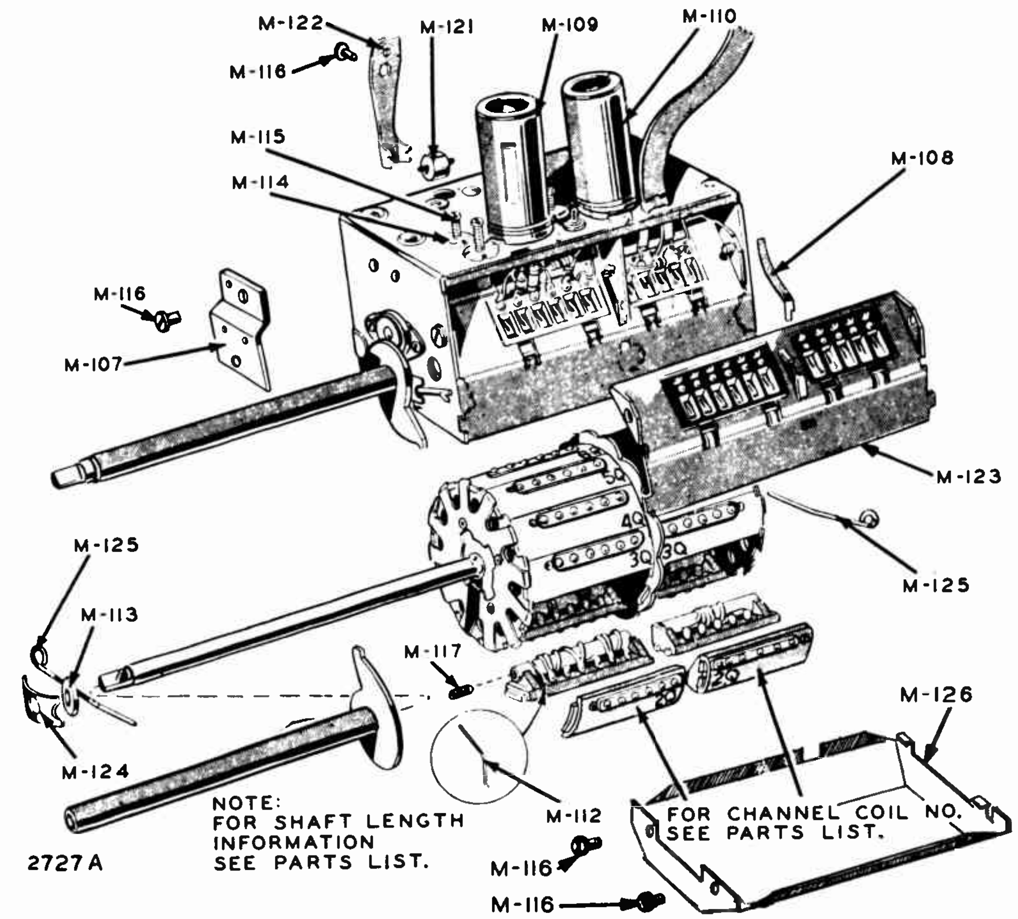


Fig. 16—"Q" Tuner Pictorial.

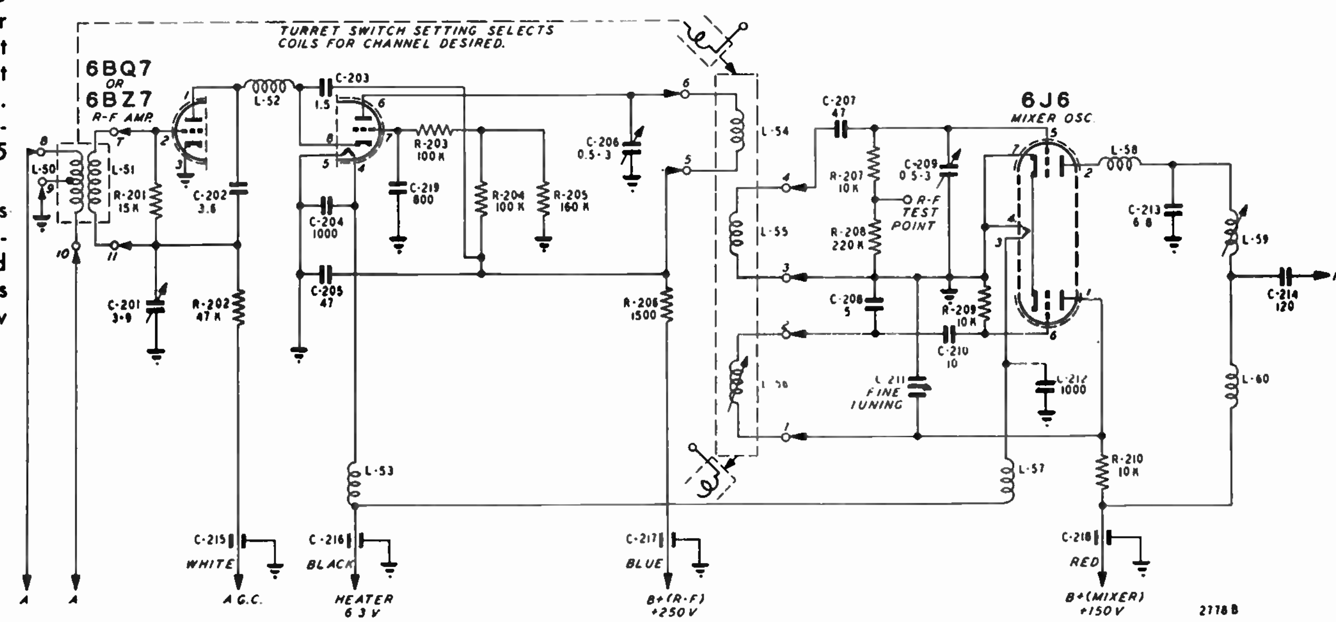


Fig. 17—"Q" Tuner Schematic Diagram.

UHF TUNER INFORMATION

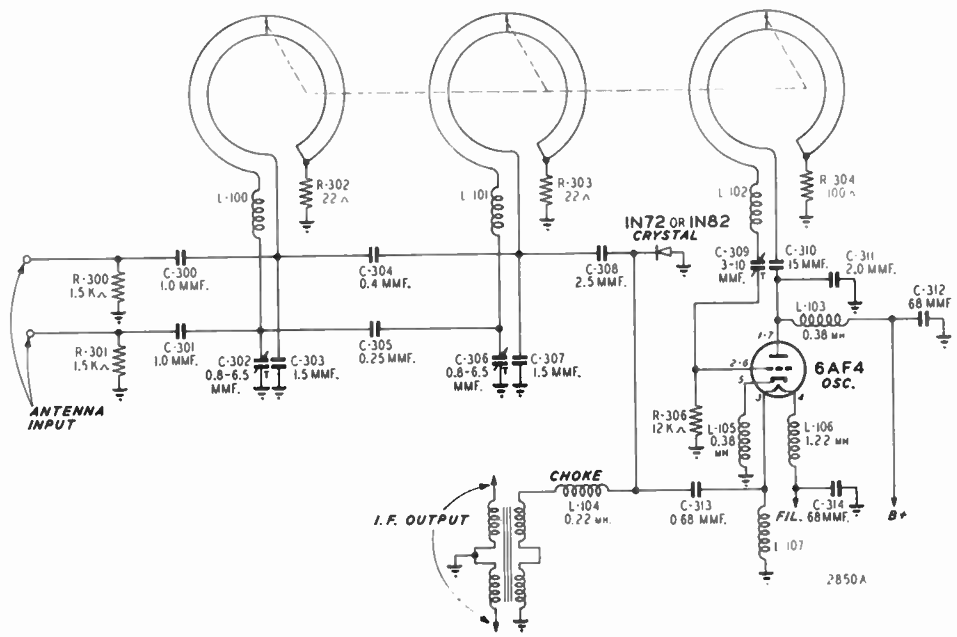


Fig. 18—UHF Tuner Schematic Diagram.

Due to the complexity of the UHF tuner, neither servicing nor aligning is encouraged in the field because replacement of any component within the R-F circuit may disturb the band-pass characteristics of the tuner. However, the 6AF4 tube or the 1N72 (or 1N82) crystal may be replaced in the field if found to be defective. A schematic diagram of this tuner is shown only for the purpose of outlining the circuit used.

If the UHF tuner does not operate satisfactorily after the tube or crystal replacement, disconnect the tuner and return it to the factory for repair.

DRIVE CORD REPLACEMENT

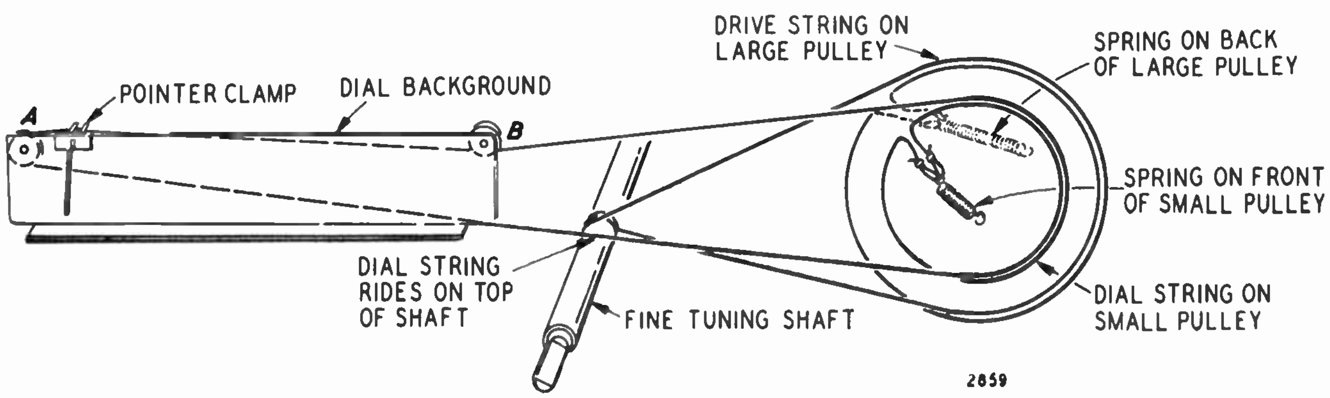
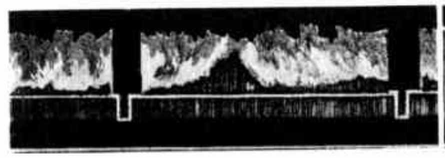


Fig. 19—Drive Cord Stringing.

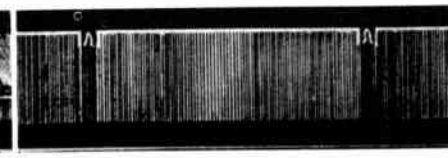
You will note that there are two cords used for the pointer drive system on this receiver. Part number 10X88 Drive Cord assembly and part number 28X603 Spring are used on the tuning shaft and large pulley, while part number 10X89 Drive Cord and a part number 28X603 Spring are used on the small pulley system and the pointer. Install the cords as shown in the illustration. After completing the installation rotate the fine tuning shaft a few turns to take up the slack in the cord.

OSCILLOSCOPE WAVEFORM PATTERNS

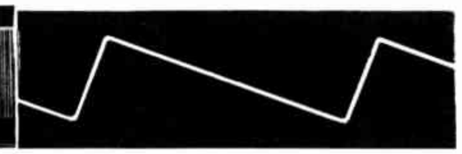
The waveforms on this page were taken with the receiver tuned to a normal picture. The numbers on the waveforms correspond to the numbers on the schematic diagram which identifies each test point.
The voltages shown on each waveform are the approximate peak to peak amplitudes. The frequencies shown indicates the repetition rate of the waveform, not the sweep rate of the oscilloscope. If the waveforms are observed on the oscilloscope with a poor high frequency response, the corners of the pulses will tend to be more rounded than those shown below and the amplitudes of any high frequency pulse will tend to be less.



No. 1—6AL5 Pix Det. Plate
3.5V P-P 60 C.P.S.
No. 4—6BE6 Sync Sep.
Grid No. 1 .2V P-P 60 C.P.S.

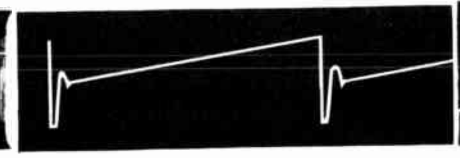


No. 7—12AT7 Phase Splitter Plate
45V P-P 60 C.P.S.

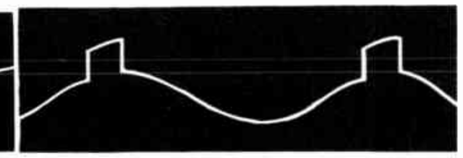


No. 13—6AL5 Phase Det.
18V P-P 15,750 C.P.S.

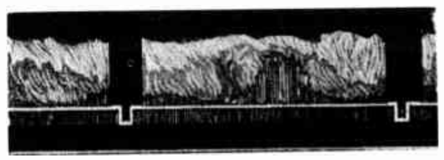
No. 2—12AT7 Plate
35V P-P 60 C.P.S.
No. 2—6AH6 Grid
8V P-P 60 C.P.S.



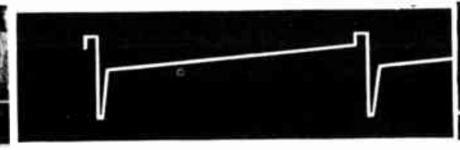
No. 8—6SN7-GTA—Vert. Osc. Plate
125V P-P 60 C.P.S.



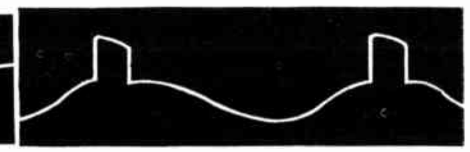
No. 14—6SN7—Hor. Osc. Plate
50V P-P 15,750 C.P.S.



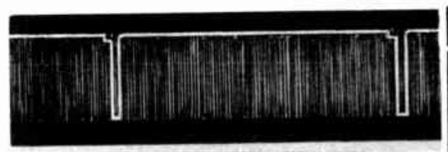
No. 3—Pix Tube Grid
20-100V P-P 60 C.P.S.



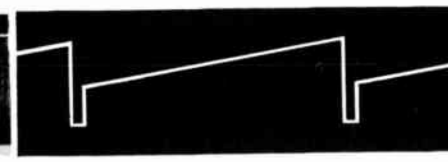
No. 9—6SN7-GTA Vert. Osc. Grid
170V P-P 60 C.P.S.



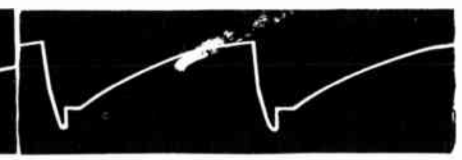
No. 15—6SN7 Hor. Osc. Grid
48V P-P 15,750 C.P.S.



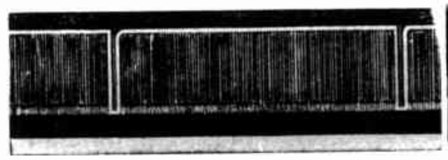
No. 5—6BE6 Sync Sep. Plate
20V P-P 60 C.P.S.



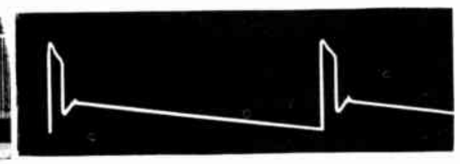
No. 10—6SN7-GTA Vert. Output Grid
150V P-P 60 C.P.S.



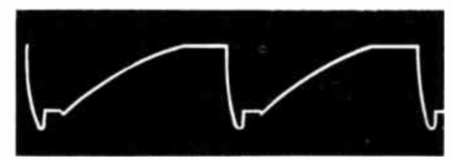
No. 16—6SN7 Hor. Osc. Plate
135V P-P 15,750 C.P.S.



No. 6—12AT7 Phase Splitter Cathode
18V P-P 60 C.P.S.

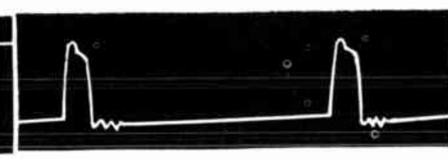


No. 11—Vert. Def. Coil
100V P-P 60 C.P.S.

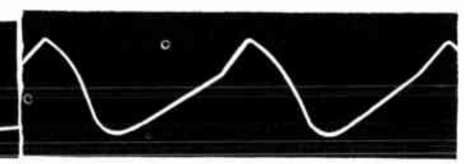


No. 17—6BQ6 Grid
120V P-P 15,750 C.P.S.

No. 6—12AT7 Phase Splitter Cathode
18V P-P 15,750 C.P.S.

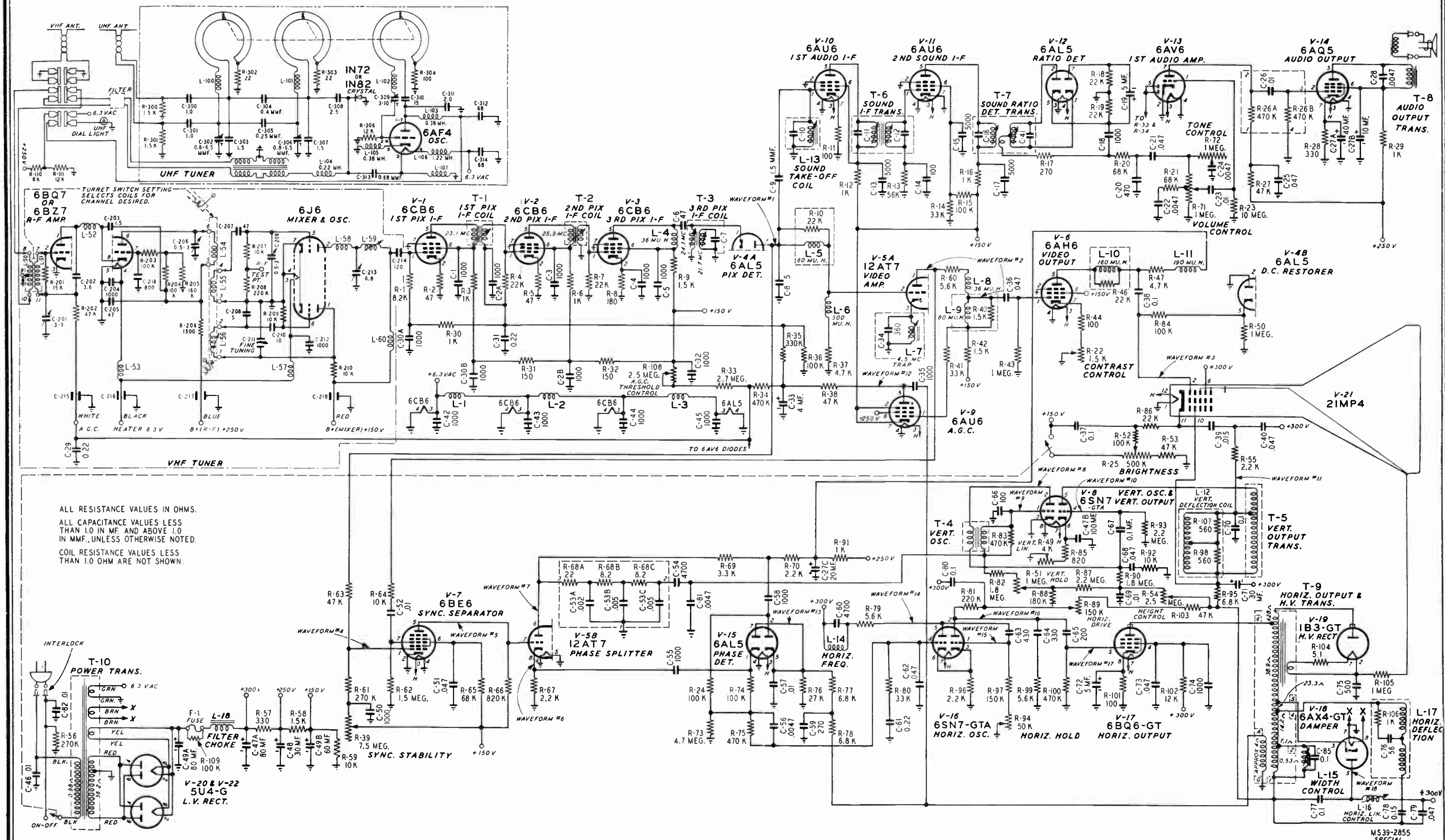


No. 12—6AU6 A.G.C.
450V P-P 15,750 C.P.S.



No. 18—6AX4-GT Damper Plate
120V P-P 15,750 C.P.S.

21" UHF-VHF TELEVISION RECEIVER



PRODUCTION CHANGES

There are two different ratio detector transformers (T-7) used in these receivers, Part Numbers 9A2269 and 9A2295. The T-7 circuit shown in this schematic diagram covers the 9A2269 ratio detector. Receivers using the 9A2295 ratio detector can be identified by the following changes:

C-18 becomes 47X570 330 mmf molded mica condenser

R-15 becomes B84333 33K ohm 0.5 W carbon resistor

R-18, R-19 become B83103 10K ohm 0.5 W carbon resistors

In addition, the 9A2295 ratio detector has terminals with numerical identification (1, 2, 3 etc.) whereas the 9A2269 ratio detector has terminals with alphabetical identification (A, B, C etc.)

VHF TUNER ASSEMBLY PARTS LIST

RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-201	12A-004	15 K	±10%	0.5
R-202	12A-039	47 K	±20%	0.5
R-203	12A-094	100 K	±10%	0.5
R-204	12A-166	100 K	±5%	0.5
R-205	12A-167	160 K	±5%	0.5
R-206	12A-183	1500	±10%	0.5
R 207, R 209, R 210	12A-040	10 K	±10%	0.5
R 208	12A-041	220 K	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-201	31B-207	3-9 mmf	Trimmer
C-202	CD8C3R6C	3.6 mmf	±.25 mmf
C-203	CD8C1R5M	1.5 mmf	±20%
C-204, C-212	CD8X102Z	1000 mmf	
C-205, C-207	CD8Q470K	47 mmf	±10%
C-206, C-209	31B-206	0.5-3 mmf	Trimmers
C-208	CD8U050C	5 mmf	±5%
C-210	CD10C100K	10 mmf	±10%
C-211	Part of Fine Tuning Assembly		
C-213	CD8C6R8C	6.8 mmf	±.25 mmf
C-214	13D-055	120 mmf	±10%
C-215, C-216, C-217, C-218	13D-153	800 mmf	Minimum
C-219	13D-196	800 mmf	Minimum

COILS AND CHOKES

Ref. No.	Part No.	Description	Channel and Code No.
	A9A2297-2	Antenna Coil	2-Q..............
	A9A2297-3	Antenna Coil	3-Q..............
	A9A2297-4	Antenna Coil	4-Q..............
	A9A2297-5	Antenna Coil	5-Q..............
	A9A2297-6	Antenna Coil	6-Q..............
	A9A2297-7	Antenna Coil	7-Q..............
	A9A2297-8	Antenna Coil	8-Q..............
	A9A2297-9	Antenna Coil	9-Q..............
	A9A2297-10	Antenna Coil	10-Q..............
	A9A2297-11	Antenna Coil	11-Q..............
	A9A2297-12	Antenna Coil	12-Q..............
	A9A2297-13	Antenna Coil	13-Q..............

COILS AND CHOKES (Continued)

Ref. No.	Part No.	Description	Channel & Code No.
	A9A2297-91	Antenna Coil	UHF Position........
	A9A2298-2	Oscillator Coil	2-Q..............
	A9A2298-3	Oscillator Coil	3-Q..............
	A9A2298-4	Oscillator Coil	4-Q..............
	A9A2298-5	Oscillator Coil	5-Q..............
	A9A2298-6	Oscillator Coil	6-Q..............
	A9A2298-7	Oscillator Coil	7-Q..............
	A9A2298-8	Oscillator Coil	8-Q..............
	A9A2298-9	Oscillator Coil	9-Q..............
	A9A2298-10	Oscillator Coil	10-Q..............
	A9A2298-11	Oscillator Coil	11-Q..............
	A9A2298-12	Oscillator Coil	12-Q..............
	A9A2298-13	Oscillator Coil	13-Q..............
	A9A2298-91	Oscillator Coil	UHF Position........
L-52	31B-296	Choke, Cathode	
L-53	34A-546	Choke, R-F Filament	
L-57	34A-575	Choke, Oscillator Filament	
L-58	31B-295	Choke, Mixer Plate	
L-59	31A-078	Converter Plate Coil	
L-60	31B-230	Choke, Coil	

MISCELLANEOUS MECHANICAL PARTS

Ref. No.	Part No.	Description
M-107	31B-012	Bracket, Sharp Tuning Rotor Retaining
M-108	31B-048	Spring, Detent Plate Grounding....
M-109	16S-006	Shield, Tube (6J6) ....
M-110	16S-004	Shield, Tube (6BQ7) ....
M-112	31A-010	Spring, Slug Retaining (Oscillator Coil) ....
M-113	11D-022	Washer, Fibre Spacer (¼" ID by ½" OD) ....
M-114	10E-401	Nut, Locking Spring (for trimmers)..
M-115	9A-410-7	Screw, Trimmer ....
M-116	9A-629-3	Screw, Bracket Mounting .... (6/32" by ¼") ....
M-117	31B-029	Osc. Slug Trimmer ....
M-121	31B-016	Roller, Detent (⅜" dia., 3/32" dia. bearing) ....
M-122	31B-005	Spring, Detent (2-5/16" long) ......
M-123	31B-278	Contact Plate and Bracket Assembly
M-124	31B-008	Spring, Sharp Tuning Rotor Contact (Flat Bronze 1-7/16" by ½") ......
M-125	31B-030	Spring, Front and Rear Turret Shaft (Wire 2-3/4" long, 3/64" dia.)....
M-126	31B-103	Shield, Bottom Cover ....
	31B-655-3	Fine Tuning Shaft (Sharp Tuning) used with 25A1104 ....

TELEVISION PARTS LIST

21" METAL RECTANGULAR PIX TUBE

Use only genuine factory tested parts to insure service jobs you can depend on and to obtain original set performance.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

NOTICE: There is a model number label on the chassis. This label identifies the receiver as to chassis and issue letter. When ordering parts or writing, give complete model number.

CAPACITORS

Ref. No.	Part No.	Description			Selling Price
C-1, C-3, C-4, C-5, C-18, C-32, C-35, C-42, C-43, C-44, C-45, C-50, C-55, C-58, C-74	80X1	1000 mmf		Ceramic......	.12
C-2A, C-2B, C-30A, C-30B	80X3	1000 mmf		Dual Ceramic..	.18
C-6	47X603	47 mmf	500 V	Ceramic......	.12
C-7	Part of T-3				
C-8	47X562	5 mmf	500 V	Ceramic......	.48
C-9	47X584	1.5 mmf		Composition ..	.06
C-10	Part of L-13				
C-11, C-12	Part of T-6				
C-13, C-15, C-17	47X507	5000 mmf		Ceramic......	.18
C-14, C-66	47X604	100 mmf	500 V	Ceramic......	.12
C-16, C-41	Part of T-7				
C-19, C-72	45X378	5 mf	25W.V.	Dry Electrolytic	.58
C-20	47X525	470 mmf	500 V.	Molded Mica..	.16
C-21, C-62	RCP10M2473M	.047 mf	200 V	Tubular......	.18
C-22, C-24, C-56, C-81	RCP10M4472M	.0047 mf	400 V	Tubular......	.16
C-23, C-52, C-57	RCP10M4103M	.01 mf	400 V	Tubular......	.16
C-25, C-36, C-51, C-73, C-79	RCP10M4473M	.047 mf	400 V	Tubular......	.18
C-26	Part of 76X5 (See Miscellaneous)				
C-27A, C-27B, C-27C	45X392	40 mf, 10 mf, 20 mf	50 V, 400 V, 400 V	Dry Electrolytic	1.50
C-28	RCP10M6472M	.0047 mf	600 V	Tubular......	.16
C-29, C-31, C-61	RCP10M2224M	.22 mf	200 V	Tubular......	.28
C-33	45X361	4 mf	100 W.V.	Dry Electrolytic	.60
C-34	47X568	360 mmf	500 V	Molded Mica..	.12
C-37	RCP10M2104M	.1 mf	200 V	Tubular......	.18
C-38, C-77, C-80, C-85	RCP10M4104M	.1 mf .	400 V	Tubular......	.22
C-39	RCP10M6153M	.015 mf	600 V	Tubular......	.18
C-40, C-68	RCP10M6473M	.047 mf	600 V	Tubular......	.22
C-46, C-82	47X615	.01 mf		Ceramic......	.26
C-47A, C-47B	45X391	80 mf, 100 mf	400 V, 50 V	Dry Electrolytic	2.22

CAPACITORS—Continued

Ref. No.	Part No.	Description			Selling Price
C-48, C-71	45X393	30 mf	400 V	Dry Electrolytic	1.06
C-49A, C-49B	45X390	80 mf 60 mf	400 V 400 V	Dry Electrolytic	2.68
C-53A, C-53B, C-53C	Part of 76X7 (See Miscellaneous)				
C-54, C-60	47X543	4700 mmf	500 V	Molded Mica..	.52
C-59	RCM20A271K	270 mmf	500 V	Molded Mica..	.16
C-63	RCM20B431K	430 mmf	500 V	Molded Mica..	.18
C-64	47X570	330 mmf	500 V	Molded Mica..	.14
C-65	RCM20A201K	200 mmf	500 V	Molded Mica..	.16
C-67, C-70	RCP10M6104M	.1 mf	600 V	Tubular......	.30
C-69	RCP10M6103M	.01 mf	600 V	Tubular......	.18
C-75	47X560	500 mmf	20 K.V.	Ceramic......	1.20
C-76	47X598	56 mmf	1500 V	Ceramic......	.20
C-78	RCP10M4154M	.15 mf	400 V	Tubular......	.24

RESISTORS

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
R-1	B83822	8.2 K	0.5	Carbon......	.10
R-2, R-5	B83470	47	0.5	Carbon......	.10
R-3, R-6, R-12, R-16, R-30	B85102	1 K	0.5	Carbon......	.06
R-4, R-7	B83223	22 K	0.5	Carbon......	.10
R-8	B84181	180	0.5	Carbon......	.08
R-9, R-42	B84152	1.5 K	0.5	Carbon......	.08
R-10	Part of L-5				
R-11, R-44	B84101	100	0.5	Carbon......	.08
R-13	B84563	56 K	0.5	Carbon......	.08
R-14, R-41, R-80	B84333	33 K	0.5	Carbon......	.08
R-15, R-24, R-36, R-74	B84104	100 K	0.5	Carbon......	.08
R-17	B84271	270	0.5	Carbon......	.08
R-18, R-19, R-86	B84223	22 K	0.5	Carbon......	.08
R-20, R-21, R-65	B84683	68 K	0.5	Carbon......	.08
R-22, R-71	78X12	1.5 K 1.0 meg.		Contrast and Volume Control	1.62
R-23	B85106	10.0 meg	0.5	Carbon......	.06
R-25	40X333	500 K		Brightness Control	.52
R-26A, R-26B	Part of 76X5 (See Miscellaneous)				
R-27, R-53	B85473	47 K	0.5	Carbon......	.06
R-28	C84331	330	1.0	Carbon......	.10
R-29	D84102	1 K	2.0	Carbon......	.16
R-31, R-32	B85151	150	0.5	Carbon......	.06
R-33	B84275	2.7 meg.	0.5	Carbon......	.08
R-34, R-100	B84474	470 K	0.5	Carbon......	.08
R-35	B83334	330 K	0.5	Carbon......	.10
R-37	B83472	4.7 K	0.5	Carbon......	.10
R-38, R-63, R-103	B84473	47 K	0.5	Carbon......	.08

RESISTORS—Continued

Ref. No.	Part No.	Ohms	Watts	Description	Selling Price
R-39	40X363	7.5 meg.		Sync Stability Control	.48
R-40	Part of L-9				
R-43, R-50	B84105	1.0 meg.	0.5	Carbon......	.12
R-46	Part of L-10				
R-47	C83472	4.7 K	1.0	Carbon......	.12
R-49	40X368	4 K		Vertical Linearity Control	.42
R-51	40X334	1.0 meg.		Vertical Hold Control	.52
R-52, R-84	B85104	100 K	0.5	Carbon......	.06
R-54	40X364	2.5 meg.		Height Control	.42
R-55	B84222	2.2 K	0.5	Carbon......	.08
R-56	B85274	270 K	0.5	Carbon......	.06
R-57	43X273	330	10.0	Wirewound...	.48
R-58	43X275	1.5 K	15.0	Wirewound...	.58
R-59	43X272	10 K	5.0	Wirewound...	.50
R-60	C84562	5.6 K	1.0	Carbon......	.10
R-61	B84274	270 K	0.5	Carbon......	.08
R-62	B84155	1.5 meg.	0.5	Carbon......	.08
R-64, R-92	B84103	10 K	0.5	Carbon......	.08
R-66	B84824	820 K	0.5	Carbon......	.08
R-67, R-70, R-96	B83222	2.2 K	0.5	Carbon......	.10
R-68A, R-68B, R-68C	Part of 76X7 (See Miscellaneous)				
R-69	B84332	3.3 K	0.5	Carbon......	.08
R-72	40X334	1.0 meg.		Tone Control.	.52
R-73	B85475	4.7 meg.	0.5	Carbon......	.06
R-75, R-83	B85474	470 K	0.5	Carbon......	.06
R-76	B84273	27 K	0.5	Carbon......	.08
R-77, R-78	C84682	6.8 K	0.5	Carbon......	.10
R-79	C83562	5.6 K	1.0	Carbon......	.12
R-81	B83224	220 K	0.5	Carbon......	.10
R-82, R-90	B84185	1.8 meg.	0.5	Carbon......	.08
R-85	B84821	820	0.5	Carbon......	.08
R-87, R-93	B84225	2.2 meg.	0.5	Carbon......	.08
R-88	B84184	180 K	0.5	Carbon......	.08
R-89	40X331	150 K		Horizontal Drive Control	.44
R-91	C84102	1 K	1.0	Carbon......	.10
R-94	40X361	50 K		Horizontal Hold Control	.52
R-95	D84682	6.8 K	2.0	Carbon......	.16
R-97	B83154	150 K	0.5	Carbon......	.10
R-98, R-107	B84561	560	0.5	Carbon......	.08
R-99	B84562	5.6 K	0.5	Carbon......	.08
R-101	D84101	100	2.0	Carbon......	.16
R-102	43X276	12 K	5.0	Wirewound...	.62
R-104	43X239	5.1	0.5	Wirewound...	.24
R-105	C85105	1.0 meg.	1.0	Carbon......	.08
R-106	B85102	1 K	0.5	Carbon......	.06
R-108	40X364	2.5 meg.		A.G.C. Control	.42
R-109	D85104	100 K	2.0	Carbon......	.12
R-110	43X279	8 K	5.0	Wirewound...	.48
R-111	D84123	12 K	2.0	Carbon......	.16

MISCELLANEOUS

Part No.	Description	Selling Price
76X5	Multiple Resistor Capacitor Assembly	.40
2A426	Centering Device	.70
76X7	Multiple Resistor Capacitor Assembly..........	.54
9A2274	Deflection Yoke Assembly	7.12
2A407	Ion Trap Magnet	.50
4A408	Antenna Terminal Strip	.24
3A427	Tube Socket Miniature	.16
3A458	Tube Socket 6CB6-6AU6-6AL5	.12
3A463	Tube Socket, 12AT7	.24
3A303	Tube Socket, 5U4	.12
3A464	Tube Socket 6BQ6-6SN7	.10
3A445	Tube Socket, 6AX4	.16
3A466	Tube Socket, 1B3	.36
3A470	Tube Socket, Octal	.10
13X817	Pix Tube Socket	.58
32X403	Tube Shield (3A458 Socket)	.06
32X405	Tube Shield (3A463 Socket)	.12

MISCELLANEOUS—Continued

Part No.	Description		Selling Price
S-6A1	Anode Connector & Lead Assembly		.30
25X1828	Bracket, Pix Tube Rear Mtg.		1.14
8X227	Collar Pix Tube Rear Mtg.		.34
S-34X19	Tube Cover and Power Cord Assembly		1.36
6X73	Rubber Grommet (6BQ6 Plate Lead)		.04
25X1815	Bracket, Tube Front Support (R.H.)		.64
25X1816	Bracket, Tube Front Support (L.H.)		.64
16X146	Fuse Holder		.16
16X147-3	Fuse 4/10 Amp. 125-250 V		.22
12A480	10" PM Speaker		6.90
S-14X69	Cabinet Back Assembly		2.32
S-25X85	Tube Mtg. Strap Assembly		.52
25A1105	UHF Tuner R.F. (Mallory)		
25A1104	VHF Tuner R.F. (Standard Coil)		
26X528	Shaft & Pulley Assembly		.64
S-37X4	Shaft Coupling Assembly		.48
S-37X3	Switch Cover Assembly		.48
2A430	Switch Assembly (VHF-UHF)		1.74
11X163	Switch Assembly Cover		.06
25X1887	Dial Bracket		.34
19X108	Flat Washer ....doz.		.06
10X88	UHF Tuner Drive Cord Assembly		.18
10X89	Dial Drive Cord Assembly		.22
28X603	Drive Cord Tension Springs		.04
58X768	Dial Glass		.34
15X277	Pointer		.18
52X92	Filter, Low Pass		2.92
28X564	Spring Clips		.10
28X604	Spring Washer ....doz.		.22
7A246	Pilot Light Socket Assembly (UHF Dial)		.16
7A247	Pilot Light Socket Assembly (Channel Selector) ..		.16
7A32	Pilot Light Bulb		.10
4X1157	Pix Tube Mtg. Ring		3.58
4X1210-1	Escutcheon Plate		1.86
20X1772	Compression Ring (For Fine Tuning Knob) ..doz.		.22
2110-15	Caster, Rubber Wheel		.46
17X175	Pix Crystal ..	Models 3171A—3173A	6.16
4X1212-1	Pix Mask ...	Models 3171A—3173A	3.22
17X179	Pix Crystal ..	Models 3171B—3173B	5.76
4X1220-1	Pix Mask ...	Models 3171B—3173B	2.70
4X1219-1	Plastic Molding (Model 3171B)		.42
4X1219-2	Plastic Molding (Model 3173B)		.42
S-4X28-1	Escutcheon Control (Panel Assembly) .	Models 3171A 3171B	2.10
10A820-1	Knob (Maroon) (Fine Tuning)	Models 3171A 3171B	.90
10A821-1	Knob (") (Contrast)	Models 3171A 3171B	.70
10A822-1	Knob (") (Channel Selector) ..	Models 3171A 3171B	.64
10A779	Knob (") (Volume)	Models 3171A 3171B	.88
S-4X28-2	Escutcheon Control (Panel Assembly) .	Models 3173A 3173B	2.10
10A820-2	Knob (Beige) (Fine Tuning)	Models 3173A 3173B	.34
10A821-3	Knob (Beige) (Contrast)	Models 3173A 3173B	.48
10A822-3	Knob (Beige) (Channel Selector)	Models 3173A 3173B	.76
10A812-4	Knob (Beige) (Volume)	Models 3173A 3173B	.76

TRANSFORMERS AND COILS

Ref. No.	Part No.	Description	Selling Price
L-1, L-2, L-3	9A2033	R.F. Heater Choke	.12
L-4, L-8	9A1979	Peaking Coil (36 uh)	.30
L-5	36A10	Peaking Coil (60 uh)	.24
L-6	36A11	Peaking Coil (500 uh)	.28
L-7	9A2074	4.5 MC Trap	.36
L-9	36A16	Peaking Coil (80 uh)	.28
L-10	36A12	Peaking Coil (160 uh)	.24
L-11	36A2	Peaking Coil (190 uh)	.30
L-12, L-17	Part of Deflection Coils		
L-13	9A2168	Sound Take Off Coil	.66
L-14	9A2096	Horizontal Frequency Control	.66
L-15	9A2183	Width Control	.96
L-16	9A2262	Horizontal Linearity Control.........	.46
L-18	52X91	Filter Choke	2.22
T-1, T-2	9A2230	1st and 2nd P.I.F. Transformer	.44
T-3	9A2226	3rd P.I.F. Transformer	1.06
T-4	54X8	Vertical Osc. Transformer	1.42
T-5	51X156	Vertical Output Transformer	3.04
T-6	9A2170	Sound I.F. Transformer	.94
T-7	9A2269	Sound Ratio Det. Transformer	1.66
T-8	51X150	Audio Output Transformer	1.64
T-9	53X330	Horizontal Output Transformer	7.20
T-10	53X333	Power Transformer 16.56	

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GENERAL DESCRIPTION

The models covered in this manual are a 20 tube, including the picture tube, AC operated, direct view, 17 and 21-inch rectangular television receivers. The receivers are complete in one unit and feature full coverage of 12 V.H.F. and 70 U.H.F. channels, automatic gain control, automatic horizontal frequency control, intercarrier sound system, electrostatic focusing, magnetically deflected picture tube and a sync stabilizer switch and control to adjust the operational characteristics of the receiver for various signal areas.

At the rear of the receivers is a safety interlock to prevent dangerous electrical shock and as an added safety measure, a fusible resistor is located in the low voltage power supply to protect the receiver in case of overloading.

35BR-3167A (21-inch) Mahogany
35BR-3169A (21-inch) Blond

35BR-3158A (17-inch)
35BR-3168A (21-inch)

SPECIFICATIONS

Sensitivity at the Antenna
Video - 150 microvolts
Audio - 150 microvolts
(one volt above noise at detector)

Antenna Impedance Requirements
Balanced 300-ohm

Audio Power Output Rating
2 watts undistorted

Speaker
Permanent magnet type
3.2 ohm voice coil impedance

Power Supply Rating
115 volts 60 Cycles, AC
Power Consumption, 230 watts

Intermediate Frequencies
Video - 26.75 mc.
Audio - 22.25 mc.
Intercarrier Sound- 4.5 mc.

Dimensions
17" Chassis - 16"x 16½"x 2½"
21" Chassis - 19"x 17½"x 2½"

TUBE COMPLEMENT

Schematic Ref. No.	RTMA Type	Tube Function
1	6BQ7A	VHF, RF Amplifier
2	12AT7	VHF Oscillator-Converter
3-4-5	6CB6	IF Amplifiers
6	6AH6V	Video Amplifier
7	17HP4	Cathode-Ray Tube
7	21FP4A	Cathode-Ray Tube
8	6AU6	Audio IF Amplifier
9	6AL5	Audio Detector
10	6AV6	Audio Amplifier
11	25L6GT	Audio Output
12	6BE6	Sync Clipper
13	12SN7GT	Vert. Blocking Osc. and Output.
14	6AL5	A.F.C. Discriminator
15	6SN7GT	Horizontal Multivibrator
16	25BQ6GT	Horizontal Pulse Amplifier
17	6AX4GT	Damper
18	1X2A	High Voltage Rectifier
19	6AF4	UHF Oscillator
20	6BQ7A	UHF Pre-IF Amplifier

CONTROLS

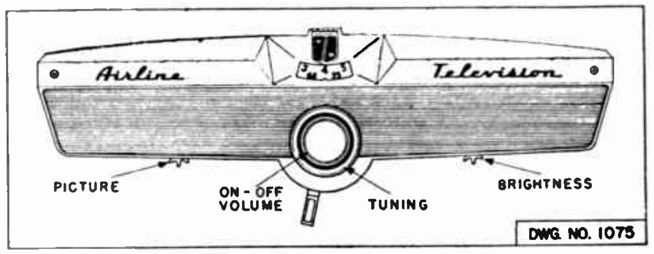


Figure 1. Front Controls

OPERATOR'S CONTROLS

On-Off Volume—Turns the receiver on or off and adjusts the sound volume level.

Contrast or Picture—Varies the contrast between the the light and dark portions of the picture.

Tuning—Tunes the receiver to the desired station or channel. May be turned in either direction.

Selector Switch—Selects the desired unit of the receiver for operation; either VHF or UHF.

Brightness—Controls the brilliance of the picture.

V. Hold—Controls synchronization of the picture vertically.

H. Hold—Controls synchronization of the picture horizontally.

SERVICEMAN'S CONTROLS

V. Size—Controls the size of the picture vertically.

V. Linearity—Controls vertical distribution of picture.

Fringe-Suburban-Local Switch—Three position switch for selection of the proper operational characteristics of the receiver for various signal level areas.

Sync Stabilizer Adjust—Changes the operational characteristics of the receiver for the area in which the receiver is located. Control has no effect in "local" switch position.

H. Size—Controls the size of the picture horizontally. To some extent, affects the vertical size control setting.

H. Linearity Magnet—Controls horizontal distribution of right side of picture.

Anti-Pin Cushion Magnet—(21" only)—Eliminates pin-cushioning and keystoning.

Centering Magnet—Controls positioning of the picture for proper framing.

Ion Trap Magnet—Controls focus and picture tube illumination.

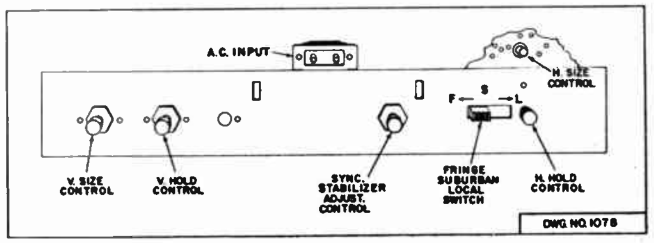


Figure 2. Rear Controls

NOTE: The V. Hold control on the rear flange (figure 2) has a rubber knob for easy identification. The position of all the controls are illustrated in figures 1, 2 and 3. Refer to figure 6 for the position of the vertical linearity control.

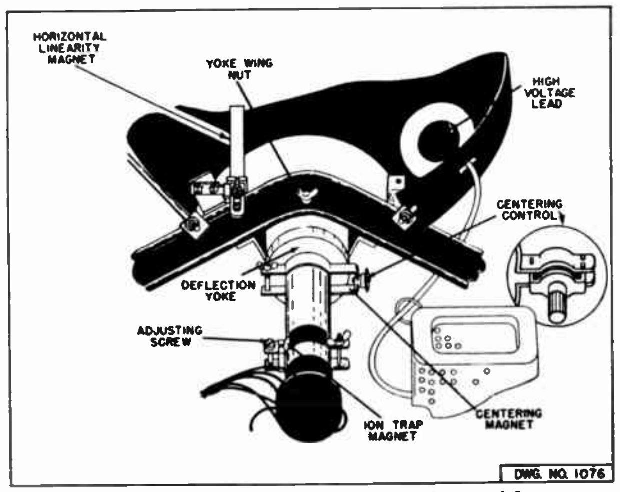


Figure 3A. 17-inch Tube Assembly

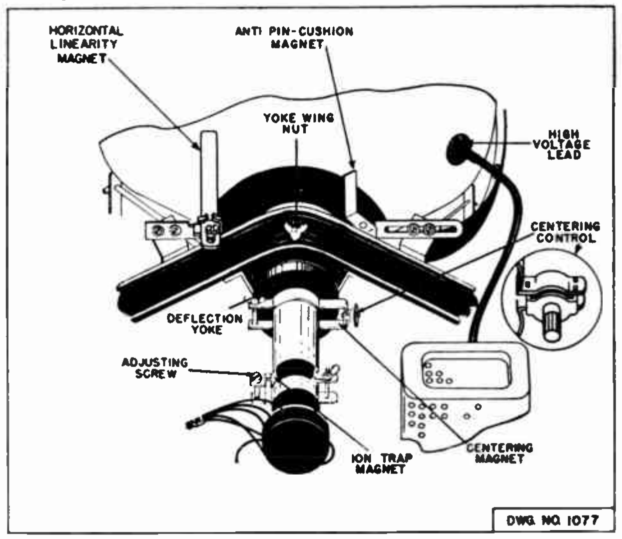


Figure 3B. 21-inch Tube Assembly

SERVICE ADJUSTMENTS

Vertical Size and Vertical Linearity Controls (R-73 and R-75):

The vertical size and linearity controls should both be adjusted at the same time while a test pattern is being transmitted. The linearity control affects the upper portion of the picture while the size control affects the overall size especially the lower portion of the picture. Adjust both controls simultaneously until the test pattern is symmetrical and fills the entire screen vertically. Readjust the vertical hold control if necessary.

CAUTION:

The vertical linearity control is on the top chassis plate, therefore, severe shock may result from contact. If an isolation transformer is unavailable, use an insulated screwdriver for the adjustment to reduce shock hazards. The adjustment can be made from either the top or bottom of the chassis.

Fringe-Suburban-Local Switch (Figure 2):

The three position switch selects the proper operational characteristics of the receiver for the signal strength area in which located. The position of the switch is governed by the signal strength available.

In the Fringe position the A.G.C. voltage is reduced to a bare minimum and the sync stabilizer adjust control affects the sync clipping level to reduce noise affects.

In the Suburban position full A.G.C. is applied and the sync stabilizer adjust control functions as in the fringe position.

In the Local position full A.G.C. is applied and the sync stabilizer adjust control is disabled.

Sync Stabilizer Adjust Control (R-61):

The control varies the operational characteristics of the sync clipper stage to obtain the optimum operation point for the least effect of noise interrupting synchronization. The control should be adjusted for a steady picture.

Ion Trap Magnet (Figure 3):

The position of the ion trap magnet MUST be over the grid of the picture tube (second cylinder from the base identified by a flared forward lip) If the adjustment is necessary, loosen the wing nut and rotate until the position which gives maximum illumination is found. Adjust the screw for maximum illumination. Repeat the above two steps. Rotate and slide magnet until the best focus position is found. Tighten wing nut. Adjustment should be made with brightness and picture controls set for normal viewing.

Horizontal Size Control (Figure 2):

The horizontal size control should be adjusted until the picture fills the entire screen horizontally. A clockwise rotation will decrease size. To some extent the vertical size control setting may be affected by a major horizontal size adjustment.

Horizontal Hold Control (L-30):

The horizontal hold control is located on the rear flange of the chassis and should be adjusted in the following manner.

Set the picture control to its normal operating position. Turn the thumb screw clockwise until it reaches its stop. Turn two complete turns counter-clockwise. The thumb screw is a vernier adjustment and will then be in the center of its range.

Turn the iron core with a small screwdriver or adjusting tool until the picture is steady (no horizontal movement). Set the core to the middle of its range.

After the iron core has been properly adjusted the thumb screw should then be used as a vernier adjustment to control synchronization when necessary.

Centering Magnet (Figure 3):

The centering magnet should be rotated and the control adjusted until the picture is properly framed keeping in mind that the effect of the control is governed by the position of rotation. If the control is above or below the neck of the picture tube, the picture will be moved up or down. To the left or right of the neck of the picture tube, the picture will be moved either to the left or right.

Deflection Yoke (Figure 3):

The correct position for the deflection yoke is as far forward on the neck of the picture tube as the shape of the tube will allow. Tube shadow or a tilted raster may result from an incorrectly positioned yoke. If a positioning adjustment is necessary, loosen the yoke wing nut located at the top of the picture tube assembly (fig 2).

Horizontal Linearity Magnet (Figure 3):

The horizontal linearity magnet affects the linearity of the right side of the picture only. The magnet pulls or stretches the right side and has a greater effect closer to the picture tube.

Anti-Pin Cushion Magnet - 21" only (Figure 3B):

Adjust centering until an edge of the raster is visible. Loosen the positioning screws and slide the magnet backward or forward until the edge of the raster is vertically straight. If keystoning is noticed adjust magnets in vertical plane.

NOTICE: Some receivers may incorporate a 6BK7 tube in place of the 6BQ7A R.F. Amplifier in the VHF tuner. Refer to page 26 for wiring differences.

Some receivers may also incorporate a 12BH7 in place of the 12SN7 Vertical Blocking Oscillator and Output tube. Refer to page 26 for wiring differences.

WARNING

At all times during operation the top chassis plate is at 125 volts DC potential above ground and it also may be at the line-voltage potential depending on how the line cord plug is inserted in the power receptacle.

Extreme caution must be observed when working with the chassis outside the cabinet and when power is applied to the receiver with the cabinet back removed. SEVERE SHOCK may result from contact with chassis.

Use an isolation transformer between the line cord plug and power receptacle when service is required. This removes all shock hazards and is the *ONLY* safeguard. Damage to the receiver and test equipment may result without the use of an isolation transformer.

SERVICE DATA

WARNING:

High voltage on the plate caps of the 1X2A high voltage rectifier and the 25BQ6 horizontal pulse amplifier. DO NOT MEASURE this voltage.

Schematic Diagram:

The schematic diagram located at the rear of this manual shows all the values of resistance and capacitance and gives all the proper voltages at the pins of the tube sockets. The voltage readings were taken with a 20,000 ohm/volt voltmeter with normal operation, no signal input, and line voltage at 115 volts A.C.

Replacing Tubes:

Before replacing the tubes the cabinet back must first be removed. Removing the cabinet back disengages the safety interlock and removes the power to the receiver. Do not tamper with or attempt to defeat the purpose of the safety interlock as severe shock may result.

Before replacing the High Voltage tubes first be sure the power is turned off and then short the corona ring of the 1X2A to the chassis.

WARNING:

Do not remove any tubes while the receiver is in operation as over-loading and component failures may result. Also contact with the top chassis plate during operation may produce a severe shock.

If the receiver has been in operation for some time, the tubes become hot and gloves should be used when replacing tubes to prevent finger burns.

Picture Tube Handling:

Due to the large surface and extreme high vacuum of the picture tube, care should be used when handling the chassis outside the cabinet. Do not subject the tube to excessive pressure of rough handling as an implosion may result causing serious personal injury.

High Voltage Power Supply:

In the process of inspection, repairs, changing of tubes or transformers, or for any other reason where it is necessary to work within the high voltage power supply, the following should be closely observed.

1. Terminals on the 1X2A socket must be dressed toward the inside of the corona ring and be free of sharp protrusions.
2. The corona ring must be dressed in such a way as to make its presence useful; that is, properly centered and about 1/8-inch below the socket terminals.
3. All leads must be dressed as far away as possible from the transformer winding. Excess lead length should be transferred to the top-side of the chassis.

When replacement of the H.V. deflection transformer is necessary, be sure to closely follow the precautions listed above. The transformer can easily be replaced with the chassis in the cabinet by the following procedure.

1. Remove two (2) hex head screws on either side of the H. Size control.
2. Disengage the H.V. lead holder ring. (back side of shield can)
3. Remove 25BQ6 plate cap
4. Remove shield can by pushing back side of shield can toward front and lifting up.

SERVICE DATA

VHF TELEVISION FREQUENCY RANGES

(All figures represent megacycles)

Channel	Channel Frequencies	Picture Carrier Frequency	Sound Carrier Frequency	Receiver RF Oscillator Frequency
Low Band				
2	54-60	55.25	59.75	82
3	60-66	61.25	65.75	88
4	66-72	67.25	71.75	94
5	76-82	77.25	81.75	104
6	82-88	83.25	87.75	110
High Band				
7	174-180	175.25	179.75	202
8	180-186	181.25	185.75	208
9	186-192	187.25	191.75	214
10	192-198	193.25	197.75	220
11	198-204	199.25	203.75	226
12	204-210	205.25	209.75	232
13	210-216	211.25	215.75	238

R. M. A. WIRE COLOR CODE

Listed below is a R.M.A. wire color code chart to aid in circuit tracing.

Wire Color	Where used
Black	B- or Ground leads
Brown	Filament leads
Red	B+ leads
Orange	Screen leads
Yellow	Cathode leads
Green	Grid or Control leads
Blue	Plate leads
Violet	Not used
Gray	A.C. leads
White	Bias leads

COIL DC RESISTANCE CHART

The DC resistance readings shown in the chart below have been taken with a ohmmeter directly across the coil being measured. The coils not listed in the chart have a DC resistance reading of less than one ohm. A tolerance of ±5% is permissible.

COILS	RESISTANCE IN OHMS	COILS	RESISTANCE IN OHMS
L17	1.5	T4 pri.	170
L20	1.5	T5 pri.	960
L22	2.2	sec.	160
L23	2	T6 pri.	1100
L24	2	sec.	6.6
L25	2	T7A	68
L27	8	B	12.5
L28	8	T8 25BQ6 plate to 1X2A plate	180
L29	1.5	25BQ6 plate to term 4	9.5
L30	80	25BQ6 plate to term 3	17.5
L31	2.3	25BQ6 plate to term 1	25.5
L32	72	term 7 to term 8	2.6
L33	8.5	term 7 to term 10	5.4
L34	2.3	T9 pri.	7
T3 pri.	4.7		

SERVICE DATA

REMOVABLE SAFETY GLASS

To clean the inside of the safety glass and the face of the picture tube follow the simple procedure below.

1. Remove the on-off volume and tuning knobs (pull straight out).
2. Remove two (2) phillips head screws at bottom of escutcheon.
3. Remove two (2) gold phillips head screws at top on either side of escutcheon.
4. Remove escutcheon.
5. Remove selector switch.
6. Carefully remove safety glass by pulling out and down from bottom.

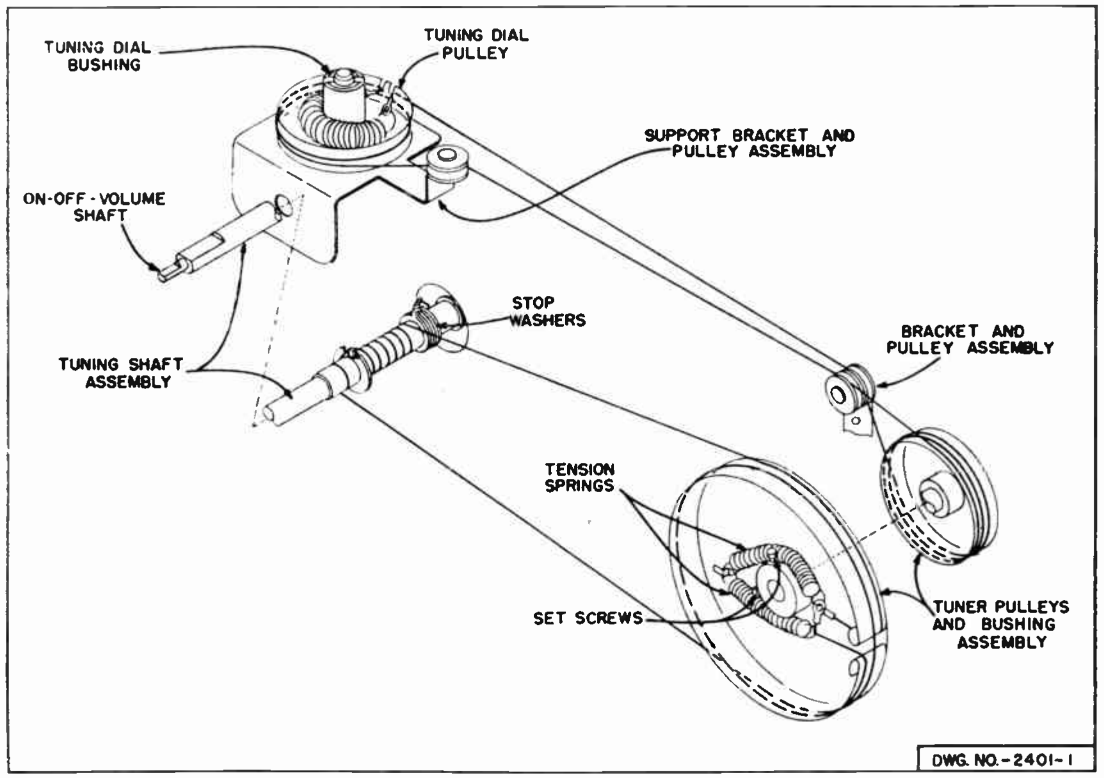


Figure 4. Dial Stringing

DIAL CORD REPLACEMENT

Dial Cord Stringing:
If dial cord replacement is necessary, turn the tuning shaft completely counter-clockwise. Two (2) separate dial cords are used and can be restrung separately.

Large Tuner Pulley Stringing:
Follow the diagram and start by attaching the dial cord to the top tension spring as shown on the large tuner pulley. Route the cord through the opening in the pulley and make a quarter counter-clockwise turn around the pulley and route to the tuning shaft assembly directly in front of the stop washers. Make six (6) counter-clockwise turns around the tuning shaft assembly and then one (1) counter-clockwise turn around the lug on the center washer and continue in the counter-clockwise direction and make one and one-half (1½) turns around the tuner shaft in front of the center washer. Route to the large pulley and make (1) complete turn around the pulley before routing through the opening and then attach to the tension spring. Add second tension spring as shown.

Small Tuner Pulley Stringing:
Follow the diagram and start by attaching the dial cord to the tension spring and route through the opening in the tuner dial pulley. Route over the bracket and pulley assembly (rear pulley) and make two and one-half (2½) counter-clockwise turns around the small tuner pulley and then route over the bracket and pulley assembly (front pulley) and over to the pulley on the support bracket and then make two (2) clockwise turns around the tuning dial pulley before routing through the opening and attaching to the other end of the tension spring.

Mechanical Tracking:

If for any reason the stop washers do not correspond to the stop position of the tuner, loosen the set screws on the tuner pulley and bushing assembly and re-position. Turn the tuning shaft to the extreme counter-clockwise position (stop washers in position shown in diagram) and tuner shaft also to the extreme counter-clockwise position. Retighten set screw.

Dial Calibration:

To correct any error in calibration, turn the tuning knob until the channel number appears in the opening. Press finger on the dial indicator and tune in the corresponding station.

VHF TROUBLE-SHOOTING

Trouble	Probable Location
No Raster No Sound	1. Defective tubes 11-13-16. 2. Defective selenium rectifier. 3. Defective resistors R52-82-101. 4. Defective capacitors C70-72-74-90-91. 5. Defective transformer T9 or choke L32. 6. Defective safety interlock or on-off switch.
No Raster Sound Normal	1. Insufficient or no high voltage, (refer to "No High Voltage" section). 2. Defective picture tube. 3. Second anode lead disconnected. 4. Ion trap magnet misadjusted. 5. Defective C.R.T. socket.
No High Voltage	1. Defective tubes 15-16-17-18. 2. Defective transformer T8, yoke T7 or coil L30-31-34. 3. Defective capacitor C105-106-107-108-110-111-112-113. 4. Defective resistor R92-96-97-98-99-100.
No Picture No Sound Raster Normal	1. Defective antenna or lead-in. 2. Defective tuner tube 1-2 or 19-20 3. Defective tuner (refer to page 43). 4. Defective tubes 3-4-5-6. 5. Improper voltages or resistances at sockets of tubes 3-4-5-6. 6. Improper alignment. 7. Defective crystal detector. 8. UHF power plug not in place.
No Sound Picture Normal	1. Defective tubes 8-9-10-11. 2. Improper voltages or resistances at socket of tube 8-9-10-11. 3. Defective speaker or leads broken or not in place. 4. Defective transformer T3-4 or coil L29. 5. Improper sound alignment.

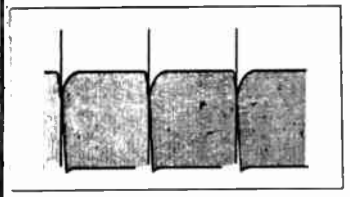
Trouble	Probable Location
No Sync	1. Defective tube 12. 2. Improper voltages or resistances at socket of tube 12. 3. Defective F-S-L switch or in wrong position. 4. Sync stabilizer adjust control misadjusted.
Insufficient or no Vertical Sweep	1. Defective tube 13. 2. Defective transformer T5-6 or yoke T7. 3. Defective capacitor C70-85-86-87. 4. Defective resistor R68-73-74-75-76-77.
Picture Cannot be Centered	1. Defective picture tube. 2. Defective centering magnet. 3. Defective ion trap magnet.
Poor Focus	1. Improper adjustment of Ion trap. 2. Defective picture tube.
Poor Horizontal Linearity	1. Improper adjustment of linearity magnet or anti-pin cushion magnet. 2. Defective tube 16-17. 3. Defective capacitor C105-106-111. 4. Defective transformer T8 or coil L31.
Snow or Poor Picture	1. Insufficient signal input. 2. Defective antenna or lead-in. 3. Improper alignment of C1-A-B. 4. Weak tubes 1-2-3-4-5-20. 5. Improper video IF alignment.
Lack of Contrast	1. Defective tube 6. 2. Defective crystal detector. 3. Improper video IF alignment.
Washed Out or Picture Smear	1. F-S-L switch in wrong position. 2. Defective crystal detector. 3. Gassy tube 1-3-4-20. 4. Improper video IF alignment.

WAVE FORM ANALYSIS

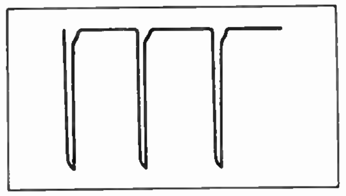
The drawings on this page illustrate the wave forms at various positions within the receiver. The wave forms are not theoretical but exact copies of that shown by an oscilloscope and were taken under normal operating conditions, with a transmitted signal and the picture in sync at all times.

When checking the wave forms, connect the ground lead from the oscilloscope to the top chassis plate and the hot lead to the position indicated. The wave shapes may vary somewhat depending on the strength of the signal, the picture information being transmitted and the adjustments of the various controls.

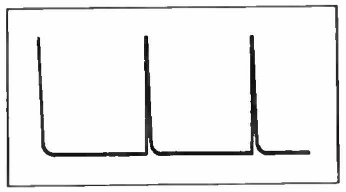
Under each wave form is the schematic reference, position taken at, peak-to-peak voltage and the type of wave form indicated (Vertical -60 cycles and Horizontal -15,750 cycles).



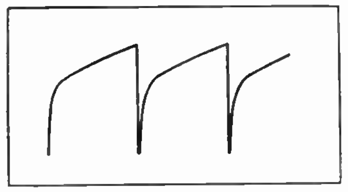
VERTICAL PULSE
Pin 5 of Tube 12.
Plate of Sync Clipper
25 volts Peak-to-Peak



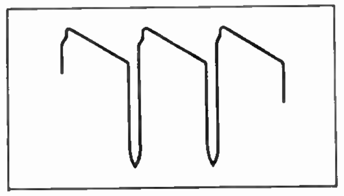
HORIZONTAL PULSE
Pin 5 of Tube 12.
Plate of Sync Clipper
25 volts Peak-to-Peak



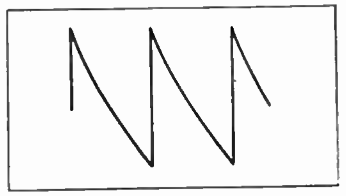
VERTICAL PULSE
Pin 3 of Tube 13
Cathode of V. Blocking Osc.
125 volts Peak-to-Peak



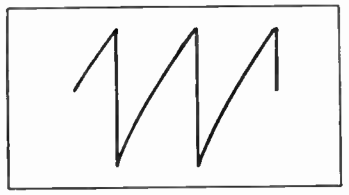
VERTICAL PULSE
Pin 4 of Tube 13
Grid of V. Output
95 volts Peak-to-Peak



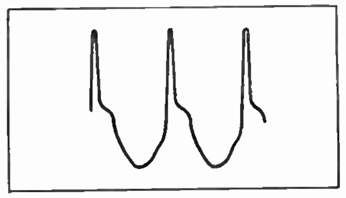
HORIZONTAL PULSE
Pin 1 or 5 of Tube 14
Cathode of A.F.C. Discr.
15 volts Peak-to-Peak



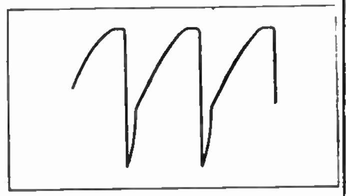
HORIZONTAL PULSE
Pin 2 of Tube 14
Plate of A.F.C. Discr.
4 volts Peak-to-Peak



HORIZONTAL PULSE
Pin 7 of Tube 14
Plate of A.F.C. Discr.
6 volts Peak-to-Peak



HORIZONTAL PULSE
Pin 5 of Tube 15
Plate of H. Mult.
35 volts Peak-to-Peak



HORIZONTAL PULSE
Pin 5 of Tube 16
Grid of H. Pulse Amp.
100 volts Peak-to-Peak

VHF GENERAL DESCRIPTION

VHF Tuner:

The Tuner is composed of a separate sub-chassis consisting of a 6BQ7A (twin triode) cascode RF amplifier and a 12AT7 tube (twin triode) for the oscillator and converter. Separate high and low band coils and trimmers are used with an automatic switching device to change bands. The tuner selects and amplifies the stations signal and converts it to the carrier IF frequency of 26.75 MC for video and 22.25 MC for sound which in turn is then fed to the IF amplifiers for further amplification.

Video IF Amplifier:

The Video IF Amplifiers are mounted on a separate sub-chassis along with a crystal video detector and the A.G.C. network. The IF amplifier section consists of three (3) staggered tuned stages with an over coupled output IF transformer using 6CB6 (pentode) tubes with self resonant core tuned coils. Since the receiver is of the intercarrier type both the video and sound IF frequencies are amplified simultaneously and then detected by a Raytheon CK-706 crystal. The signal is then coupled to the video amplifier and the first grid of the sync clipper. The A.G.C. network of R-59 and C-78 develops a negative bias voltage proportional to the average composite video signal.

Video Amplifier:

The Video Amplifier section consists of a 6AH6V (pentode) tube with a degenerative picture (or contrast) control (R-33) to vary the signal to the cathode of the picture tube. The audio signal is also amplified in this stage and then separated by a 4.5 MC trap (L-29). This trap also serves to separate or keep the audio from appearing in the picture.

Sound Section:

The Sound Section consists of a 6AU6 (pentode) 4.5 MC audio IF amplifier, 6AL5 (twin diode) ratio detector, 6AV6 (triode) audio amplifier and a 25L6 (beam power amplifier) output tube. Due to the hetrodyne action between the video and sound IF frequencies at the video detector a 4.5 MC signal is obtained containing the audio information. After the video detector the audio information is amplified by the video amplifier, separated from the video by the trap (L-29), amplified, detected and further amplified before being coupled to the speaker.

Sync Clipper:

The Sync Clipper stage utilizes a 6BE6 (heptode) tube which functions as a sync separator and noise clipper. The signal from the output of the video amplifier is coupled to pin 7 through R-34 and C-77. With the positive going signal at pin 7 and the low plate voltage sync separation is accomplished. When noise bursts are present the negative going signal from the video detector, coupled through R-58 to pin 1, cuts the tube off and eliminates false sync information in the output. A sync stabilizer adjust control (R-61) is provided to adjust the cut-off or clipping level by varying the bias voltage to pin number 1. A three position F-S-L switch is also provided to change the operational characteristics of the receiver for various signal level areas. The switch disconnects the control (R-61) from the circuit and applies a fixed bias voltage only in the "local" position. In the "fringe" position the A.G.C. source is connected to 240 volt B plus through 20 megohms of resistance (R-56, R-60). No bias voltage to the RF and IF tubes is utilized in this position allowing maximum amplification. In the "suburban" and "local" positions, full A.G.C. is applied. The sync pulses are separated from the video signal without the noise effects and then coupled to the vertical blocking oscillator cathode and horizontal A.F.C.

Vertical Deflection:

The Vertical Deflection section consists of a 12SN7 (twin triode) tube, one-half being used as a blocking oscillator and the other half as an output amplifier. The signal from the plate of the sync clipper is coupled through R-67 and C-81 to the cathode of the blocking oscillator. The vertical hold control (R-69) in the grid circuit varies the oscillator operating frequency, thus providing adjustment for synchronization. The vertical size control (R-73) varies the amplitude of the pulse to the grid of the amplifier and controls the amount of vertical deflection. The vertical linearity control (R-75) varies the cathode resistance, thus adjusting the operating characteristics of the amplifier to provide the proper wave shape to obtain a linear picture vertically. The network of C-84, C-85 and R-70, R-71 is designed to eliminate vertical retrace lines at high brightness levels.

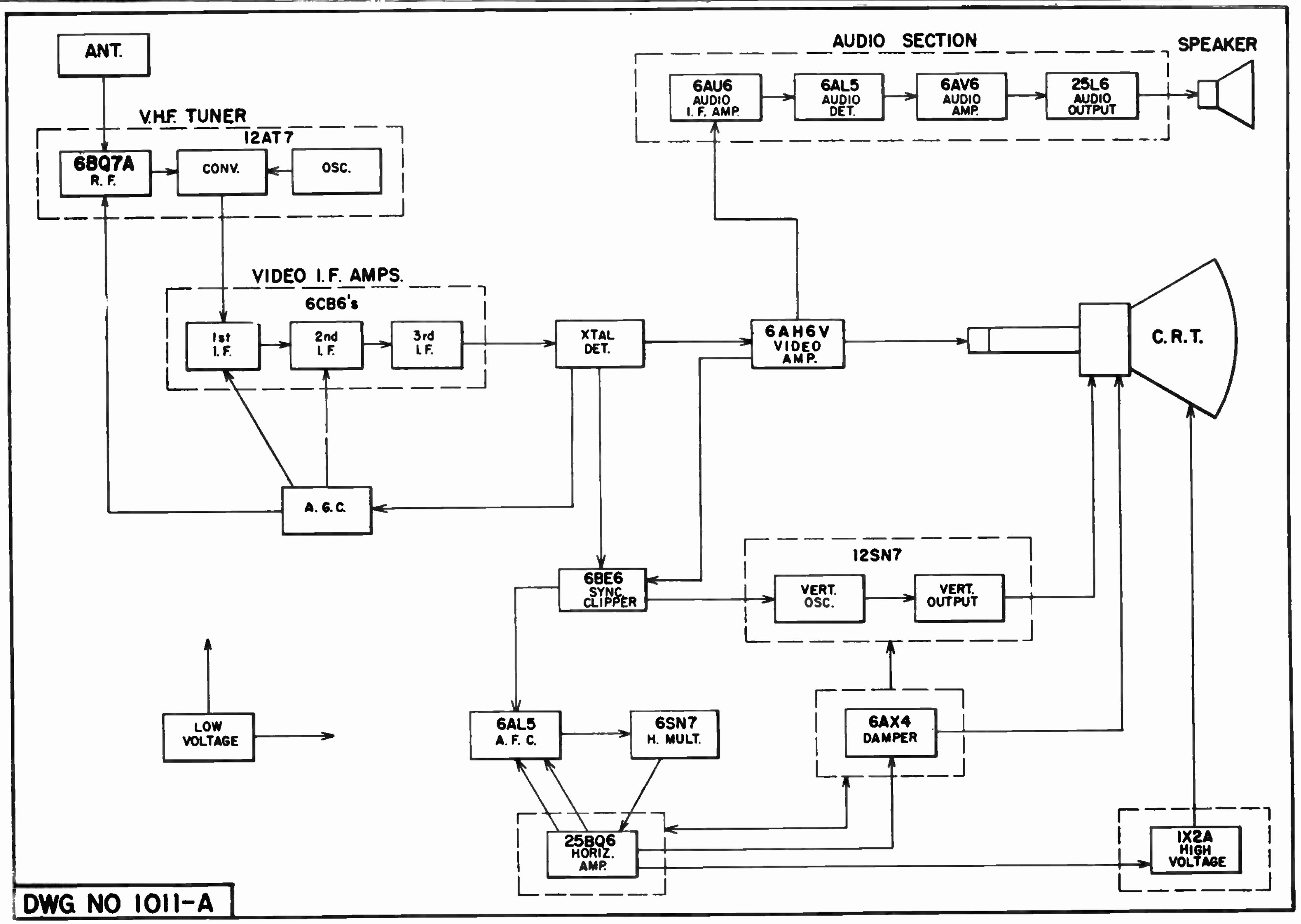


Figure 5. Block Diagram of VHF portion of Receiver

AFC Discriminator:

The Automatic Frequency Control section utilizes a 6AL5 (twin diode) tube which functions as a discriminator. The horizontal sync pulses from the output of the sync clipper are coupled to the AFC tube through capacitor C-79. At the same time two feed back voltages of opposite polarity are intergrated and applied to the plates of the AFC tube. The two feed back voltages are obtained from a separate winding (terminals 7 and 10) of the H V deflection transformer and are of the same frequency as the horizontal multivibrator. Any phase shift between the horizontal sync pulses and the horizontal multivibrator signal will cause one diode section to conduct more than that of the other. This will result in a DC bias voltage applied to the grid of the multivibrator and change the operating frequency. The output of the AFC discriminator thus synchronizes the horizontal multivibrator to the incoming horizontal sync pulse.

Horizontal Multivibrator:

The Horizontal Multivibrator uses a 6SN7 (twin triode) tube and is of the conventional cathode coupled type. The core tuned parallel resonant circuit (L-30 and C-97) is used as a hold adjustment to stabilize the frequency of oscillation. Because of the wide pull-in range of the automatic frequency control tube a fine hold control is not necessary. The output signal of the multivibrator is coupled to the horizontal pulse amplifier through capacitor C-106. Capacitor C-107 is a negative peaking device to aid in cutting off the pulse amplifier tube at the proper time.

Horizontal Pulse Amplifier:

The Horizontal Pulse Amplifier utilizes a 25BQ6 (beam pentode) tube to develop the necessary power for the fly back pulse and the horizontal winding of the deflection yoke.

VHF CIRCUIT DESCRIPTION

Damper:

The Damper tube (6AX4-diode) performs three functions: aids in horizontal scanning, suppresses oscillations which occur over part of the horizontal scanning cycle and gives an increase in plate supply voltage for the vertical blocking oscillator, vertical output amplifier and first anode of the picture tube.

Hi-Voltage Supply:

The High Voltage (second anode) is obtained from the auto-transfomer type primary winding of the H V deflection transformer (T-8). When the plate current of the H pulse amplifier tube is cut off, the field built-up in the primary winding collapses and induces a high voltage surge which is rectified by the 1X2A tube, filtered by the capacity of the aquadag coating of the picture tube and applied to the second anode. The 1X2A is a conventional half-wave high voltage rectifier and obtains its filament power from a separate secondary winding of the H V deflection transformer.

Low Voltage Supply:

The B plus voltage for the receiver is obtained from the voltage doubler arrangement of two selenium rectifiers and filter capacitors C-90 and C-91. The majority of the receivers tubes obtain its filament power from the filament transformer (T-9), however, three tubes are connected in series with resistor R-101 and placed across the 115 volt AC line. A safety interlock is provided to reduce shock hazards and a resistor type fuse is connected in series to protect the receiver in case of overloading.

VHF SERVICE HINTS

V.H.F. Tuner:

Before looking into the tuner for a particular trouble, first make the following observations. Since the receiver is of the intercarrier type both the sound and video information are amplified simultaneously by the tuner, I F and video amplifiers. Therefore, if the sound section is functioning normally it can be assumed that there are no defects in the tuner, I F or video amplifiers. If the receiver is "dead" (no sound or picture-raster normal) first determine whether a signal is being transmitted and then check the antenna, lead-in and connections to the receiver. Next, rotate the contrast or picture control completely to the left (counter-clockwise) and observe the face of the picture tube. Advance the control to the extreme clockwise position and again observe the face of the picture tube. If no "snow" appears check the video amplifier, detector and second and third I F amplifiers. If, however, an increase of "snow" appears check the first I F amplifier before looking into the tuner.

The tuner can easily be serviced by removing the three hex-head nuts on top and the one on the bottom which holds bottom cover in place. Removing the bottom cover makes all the tuner components within easy reach and all parts can be serviced. When working inside the tuner do not move any component a great distance as a change in the distributed capacity may result and offset the alignment. When replacing components be sure to obtain the same lead length and replace them in the same position.

A majority of tuner troubles are often open and high resistance ground or coil solder connections, defective trimmers or coils and defective switch contacts.

Open or high resistance connections can easily be repaired by placing a hot soldering iron at the solder connection.

Defective switch contacts may cause an intermittent condition or the loss of one or both bands. Contact replacement is easily accomplished by removing the two switch plate tension springs, the hex-head bolt and the switch plate bracket. Lift up the switch plate assembly and remove the switch contact holder and replace contacts.

A.G.C.

The A.G.C. is a negative bias voltage proportional to the average composite video signal, developed by the network of R-59 and C-78 and applied to the R F and first and second I F amplifiers. The magnitude of the A.G.C. voltage will vary according to the strength of the signal being received. However, it will closely correspond to the detector output voltage (across R-27). As a fast and simple check to determine whether the A.G.C. voltage is normal, measure both the A.G.C. and detector output voltage. Under normal operating conditions these two voltages will be approximately the same.

Sync Stability:

For optimum sync stability the following points should be considered. A three position F-S-L switch and a sync stabilizer adjust control are provided along with the two hold controls. The position of the switch is governed by the strength of the signal being received and the control should be adjusted for a steady picture. The position of the switch and the adjustment of the control are important for good sync stability (control will not function in "local" switch position).

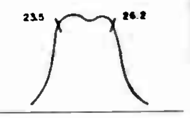
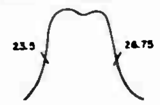
For good horizontal sync stability both the horizontal hold thumb screw and coil core should be set to the center of their respective ranges. (Center position before going out of sync in either direction).

For good vertical sync stability the vertical hold control can be adjusted to reduce the effect of noise that may interrupt synchronization in reception areas where noise conditions exist. Rotate the vertical hold control until the picture is moving upward and just locks into place. At this control setting, the noise will have the least tendency to interrupt vertical synchronization.

Vertical Distribution:

A fast and simple method to check the vertical distribution of a TV picture, without a test pattern, rotate the vertical hold control until the picture is moving slowly downward. Observe the black horizontal bar. If the vertical size and linearity controls are properly adjusted, the bar will not change in thickness as it moves from top to bottom.

VIDEO I-F ALIGNMENT

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	23.5 26.2	25	Pin 1 of tube 5	Scope at junction of L25, R27, C53	Connect short between pin 5 and pin 6 of tube 4	T2 pri. T2 sec. Coupling rod	
2	Calibrate scope for sensitivity of one volt per inch. Adjust peak response for one inch deflection. Marker should fall 10% down. If response curve is not as shown readjust coupling rod (bottom of T2) for proper bandwidth and T2 primary and secondary for flat response and maximum gain.						
3	21.4	——	Converter grid *	VTVM at junction of L25, R27, C58	Remove Short. Adjust generator for output of approx. 2 volts DC	L19-B (top of Chassis)	Maximum Reading
4	26.5	——	Converter grid *	VTVM at junction of L25, R27, C58	Adjust generator for output of approx. 2 volts DC	L19-A (bottom of chassis)	Maximum Reading
5	21.4	——	Converter grid *	VTVM at junction of L25, R27, C58	Remove Short. Adjust generator for output of approx. 2 volts DC	L19-B (top of chassis)	Maximum Reading
6	23.8	——	Converter grid *	VTVM at junction of L25, R27, C58	Adjust generator for output of approx. 2 volts DC	L16	Maximum Reading
7	25.0	——	Converter grid *	VTVM at junction of L25, R27, C58	Adjust generator for output of approx. 2 volts DC	L15	Maximum Reading
8	——	25	Converter grid *	Scope at junction of L25, R27, C58	——	T2 pri. (top of chassis)	Rock for flat response
9	23.5 26.5	25	Converter grid *	Scope at junction of L25, R27, C58	Marker should be 50% down and response curve should be as shown — If not, repeat alignment.	Check point only	

Picture IF frequency 26.75 MC — Sound IF frequency 22.25 MC.

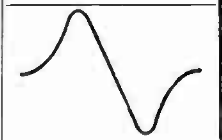
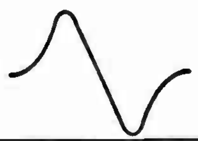
* NOTE: A very short lead from the generator must be used to prevent regeneration.

VIDEO TRAP COIL (L-29) ADJUSTMENT

1. Tune in a station.
2. Adjust the tuner until sound bars just appear.
3. Turn L-29 slug all the way out (counter-clockwise).
4. Turn the slug in (clockwise) until the horizontal scanning lines are smooth and continuous

SOUND I-F ALIGNMENT

Short antenna to ground.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	4.5	——	Junction of L25, R27, C58	VTVM at junction of R44, C65, C67	——	T3 pri. (bottom of chassis)	Maximum Reading
2	——	4.5	Junction of L25, R27, C58	Scope at junction of R44, C65, C67	Sweep approximately ±100 kc—Adjust for maximum linearity	T3 sec. (bottom of chassis)	
3	——	4.5	Junction of L25, R27, C58	Scope at junction of R44, C65, C67	Sweep approximately ±100 kc—Adjust for symmetry of peaks	T3 pri. (bottom of chassis)	

NOTE: L-29 coil should only be adjusted as prescribed. Do not adjust for maximum sound.

PRE-ALIGNMENT PRECAUTIONS

1. If sweep generator does not have a balanced output, connect a 150 ohm resistor in series with the ground lead and 150 ohms minus the internal resistance of the generator in series with the hot lead.
2. Connect a 1000 mmf capacitor across scope terminals and a 10K ohm resistor in series with hot scope lead as close to test point as possible.
3. Connect signal generator through a 1000 mmf capacitor.
4. Set F-S-L switch to "Fringe" position.
5. When aligning the IF Amplifier be sure tuner is turned to high band channel 13.

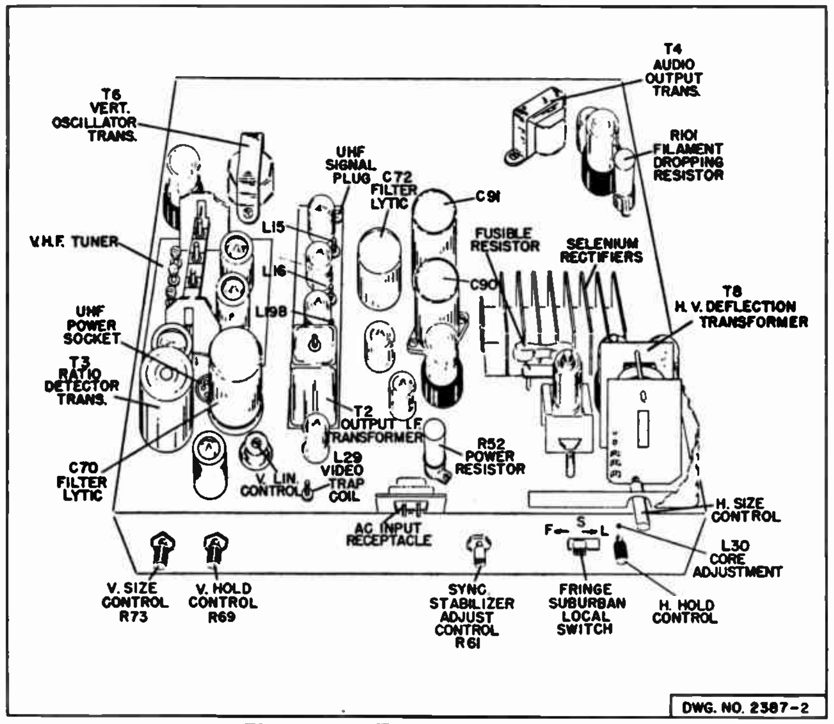


Figure 6. Top Chassis View (Shown with UHF tuner removed)

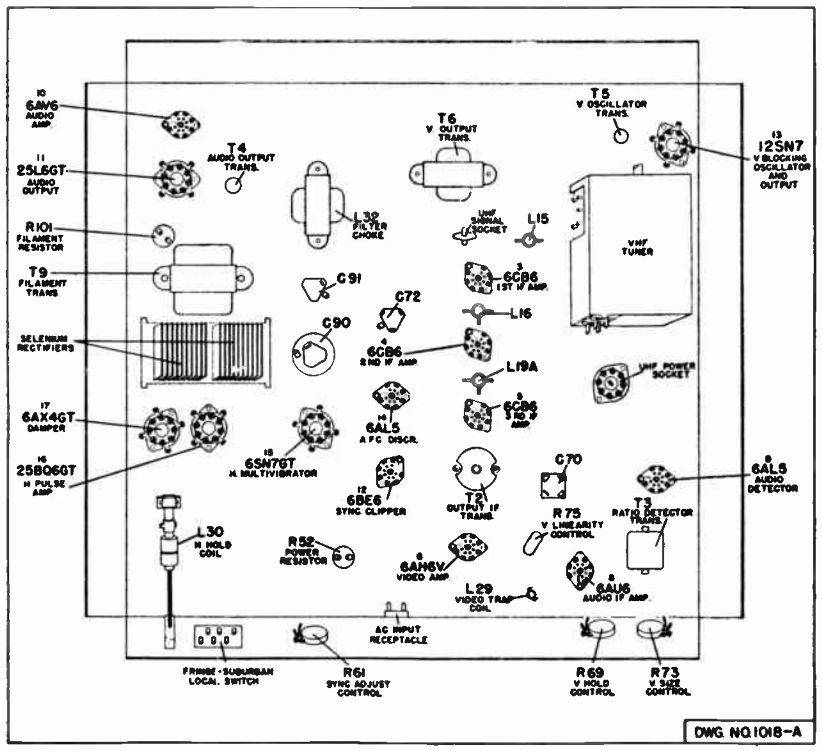


Figure 7. Bottom Chassis View

VHF TUNER ALIGNMENT

1. Preset trimmer screws C11-14-18-22-28-31- to dimensions shown on page 44.
2. Preset coil cores L3-5-7-8-10-11 in the following manner:
   - (a) In low band position, turn tuner to top of stroke (cores furthest out of coil).
   - (b) Switch will be in low band position.
   - (c) Adjust coil cores 1.6 inch from core to end of coil form (use core aligning tool if available).

V-video
S-sound

LOW BAND R F TRACKING Turn Tuner to channel 6.

NOTE: Low Band must be aligned before high band.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	V—83.25 S—87.75	Channel 6	Antenna Terminals	* Test Point (terminal 6)	Adjust for maximum response	C-2B	
2	V—83.25 S—87.75	Channel 6	Antenna Terminals	* Test Point (terminal 6)	Adjust for maximum response	C-18 C-22	
3	V—77.25 S—81.75 V—67.25 S—71.75 V—61.25 S—65.75 V—55.25 S—59.75	Channel 5 Channel 4 Channel 3 Channel 2	Antenna Terminals	* Test Point (terminal 6) * See sketch on schematic	Adjust tuner until response curve appears on scope. Adjust trimmers for compromise which will give the best overall response across band.	C-18 C-22	

HIGH BAND R F TRACKING Turn Tuner to channel 13.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	V—211.25 S—215.75	Channel 13	Antenna Terminals	* Test Point (terminal 6)	Adjust for maximum response	C-2A	
2	V—211.25 S—215.75	Channel 13	Antenna Terminals	* Test Point (terminal 6)	Adjust for maximum response	C-11 C-14	
3	V—205.25 S—209.75 V—199.25 S—203.75 V—193.25 S—197.75 V—187.25 S—191.75 V—181.25 S—185.75 V—175.25 S—179.75	Channel 12 Channel 11 Channel 10 Channel 9 Channel 8 Channel 7	Antenna Terminals	* Test Point (terminal 6) * See sketch on schematic	Adjust tuner until response curve appears on scope. Adjust trimmers for compromise which will give the best overall response across band.	C-11 C-14	

LOW BAND OSCILLATOR TRACKING Turn Tuner to channel 6.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	83.25	Channel 6	Antenna Terminals	Scope at junction of L25, R27, C58	Adjust until marker is 50% down on low frequency slope	C-31	50% VIDEO LOW FREQ.
2	67.25 55.25	Channel 4 Channel 2	Antenna Terminals	Scope at junction of L25, R27, C58	Marker should be 50% down on low frequency slope	——	50% VIDEO LOW FREQ.

HIGH BAND OSCILLATOR TRACKING Turn Tuner to channel 13.

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	211.25	Channel 13	Antenna Terminals	Scope at junction of L25, R27, C58	Adjust until marker is 50% down on low frequency slope	C-28	50% VIDEO LOW FREQ.
2	193.25 175.25	Channel 10 Channel 7	Antenna Terminals	Scope at junction of L25, R27, C58	Marker should be 50% down on low frequency slope	——	50% VIDEO LOW FREQ.

VHF TUNER DIAGRAM

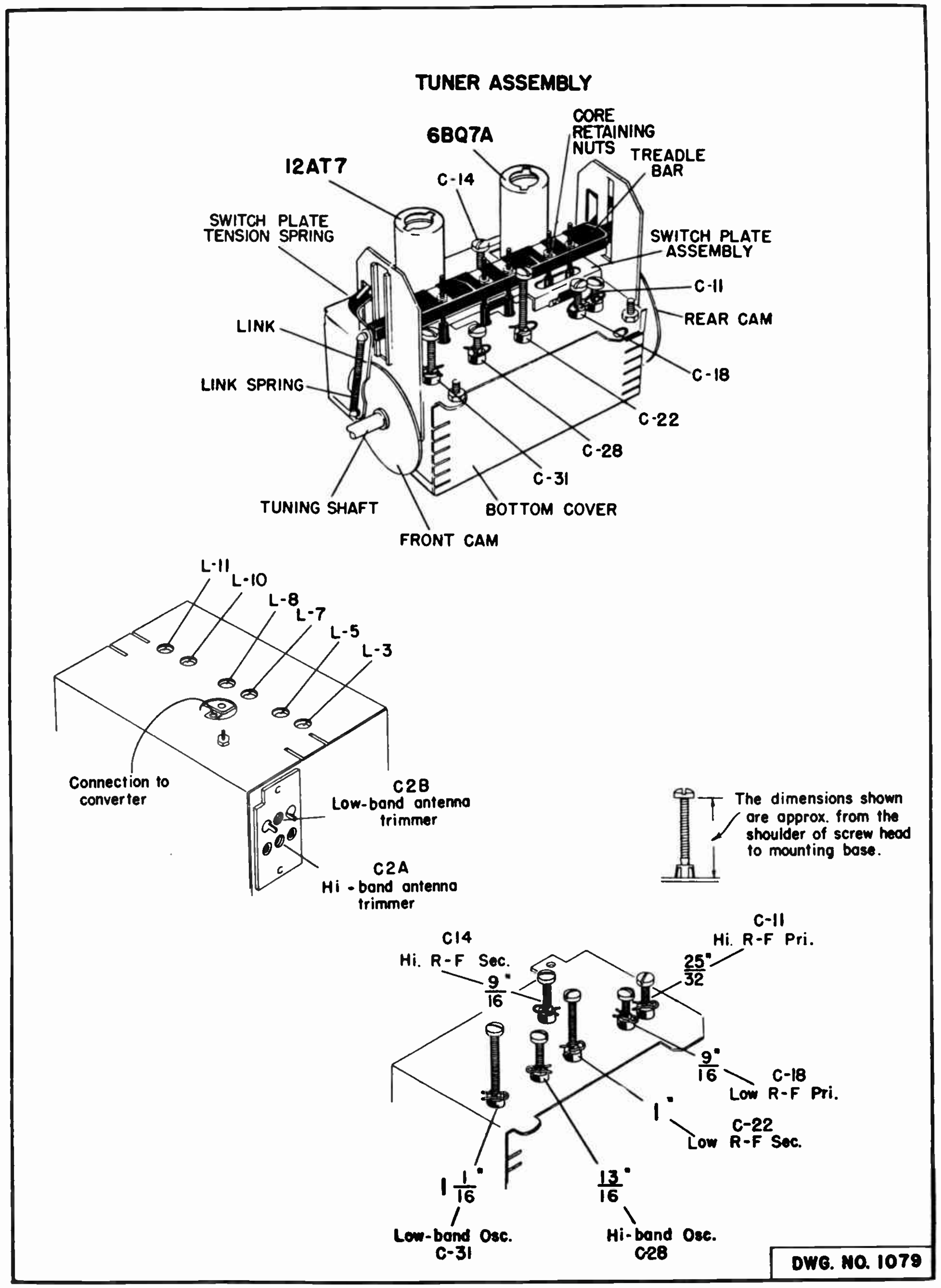


Figure 8. VHF Tuner Diagram

UHF GENERAL DESCRIPTION

The UHF Tuner is a single conversion, continuous tuning device which mechanically mounts directly over the VHF tuner in the receiver. The tuner is coupled to the VHF tuner by drive gears which thus provides tuning of both UHF and VHF by the same tuning knob. The tuner obtains its filament and plate supply voltages from the TV chassis and a switch is provided to select the desired tuner for operation.

The UHF Tuner selects the UHF stations video and sound carriers and converts them to the carrier IF frequency of 26.75 MC for video and 22.25 MC for sound which is coupled to the IF amplifiers in the receiver by 10 inches of RG-62U cable.

Some receivers may incorporate a 6BK7 tube in place of the 6BQ7A cascode pre-IF amplifier. Refer to figure 12 for wiring differences.

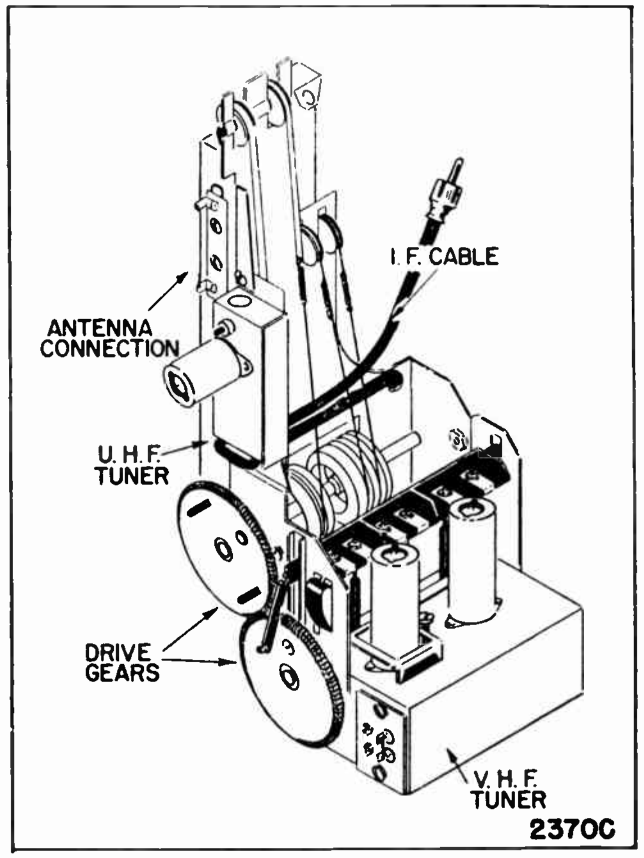


Figure 9

UHF CIRCUIT DESCRIPTION

The UHF Tuner employs a double coaxial line RF cavity pre-selector. The coaxial line arrangement has the advantages of high selectivity, low insertion losses, uniform band-width and good shielding against oscillator radiation. The coaxial cavity is basically a one-quarter wave shorted tuned stub. The electrical length of the cavities is varied by a ribbon which is attached to the dial cord and pulley arrangement. In this manner tuning is accomplished similar to varying the length of a tuned stub which would change the resonant length for various frequencies. The dial cord is of a special material which is not affected by temperature or moisture and is locked to the pulleys which eliminates the possibility of slippage. Tracking screws are provided in the cavities to obtain uniform band width and sensitivity. The tracking screws vary the capacity between the ribbon and the cavity wall and thus vary the electrical length of the ribbon.

The oscillator tube used is a 6AF4 which is similar to the 6F4. Oscillator tuning is accomplished by a one quarter wave shorted parallel wire transmission line arrangement. It differs from the RF cavities, in that a shorting bar is used to vary the electrical length of the lines. This method provides very stable operation.

Inductive or link coupling is employed to transfer the signal between stages. The arrangement of link coupling gives maximum selectivity and constant band-width over the entire UHF band. The signal from the output coupling link is mixed and detected by a CK-710 crystal detector and then applied to the tuned input of the cascode amplifier. A 6BQ7A tube is used as a cascode Pre-IF amplifier which is tuned to a center frequency of 25 MC and has the features of low noise and broad band-width. The signal is amplified by the cascode amplifier and then coupled to the IF amplifier section in the receiver through 10 inches of RG-62U coaxial cable.

UHF CIRCUIT DESCRIPTION

The UHF Tuner maintains a fairly constant antenna input impedance of 300 ohms, has an overall band-width of 6 to 8 megacycles and has an oscillator injection curent ratio of approximately 2 to 1. The only amplification of the signal takes place in the cascode amplifier. The signal is not amplified in the RF cavities, therefore, the sensitivity of the receiver on UHF will not quite equal that of VHF. A receiver equiped with a UHF tuner will have an overall UHF sensitivity of approximately 150 microvolts.

Service features of this tuner provides a convenient check point for measuring the oscillator grid current to determine whether the oscillator is functioning. Also provisions have been made for measuring the oscillator injection current to check both the crystal detector and the oscillator. An opening is also provided for coupling to the input grid coil when alignment of the cascode amplifier is necessary.

SERVICE HINTS

If the receiver is "dead" when attempting to view a UHF program, first check the position of the selector switch, then determine whether a signal is being transmitetd and then check the antenna and lead-in connections before suspecting the tuner for trouble.

Also as a fast check, view the face of the picture tube at minimum contrast or picture control setting and advance the control to maximum. Compare the difference. If there is little or no difference (no "snow") check the video detector and IF amplifiers. If an increase of "snow" appears at maximum control setting, check the first IF stage before looking to the tuner for a defect.

If the UHF tuner is not functioning properly, first substitute the oscillator (6AF4) and cascode amplifier (6BQ7A) tubes. Next check the voltages at the UHF power socket or cable connections in the receiver.

If soldering iron servicing, crystal detector or component parts replacement is necessary, the picture tube must be removed. Removing the picture tube makes the majority of the UHF Tuner components within easy reach and most of the parts can be serviced. The tuner should not be removed from the chassis when service is required, also caution must be observed not to lay the chassis on the tuner side. Damage to the UHF Tuner may result.

CAUTION: When attempting to service the tuner, do not move or rearrange components or mechanical parts as a change in distributed capacity may result and off-set the alignment. When replacing a component, be sure to obtain the same lead lengths and replace in the same physical position.

SERVICE DATA

To determine whether the oscillator section is functioning, a convenient check point has been provided where the oscillator grid current can be measured. To measure the oscillator grid current, place a Simpson Model 260 Multimeter (or equivalent) on the 100 microamp scale across the 22 ohm resistor (R2). See figure 10. A reading of 10 to 30 microamperes should be obtained if the oscillator is functioning normally.

Both the oscillator and crystal detector can easily be checked by measuring the oscillator injection currrent. Place a Simpson Model 260 Multimeter (or equivalent) on the 100 microamp scale across the 22 ohm resistor (R10) at the terminal indicated in Figure 11. A reading of 5 to 40 microamperes should be obtained if both the oscillator and crystal are functioning normally.

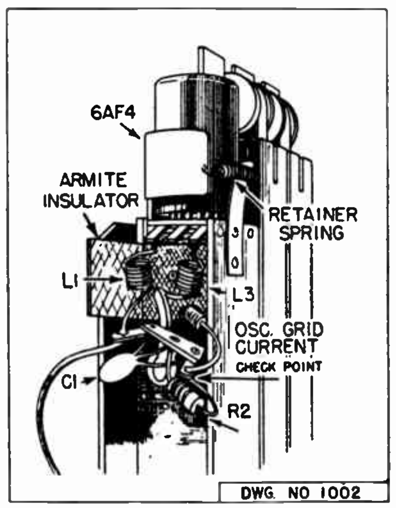


Figure 10

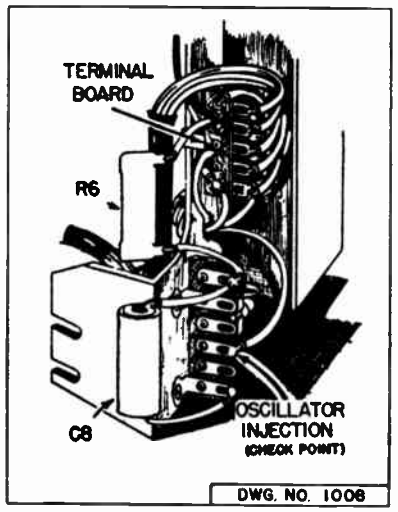


Figure 11

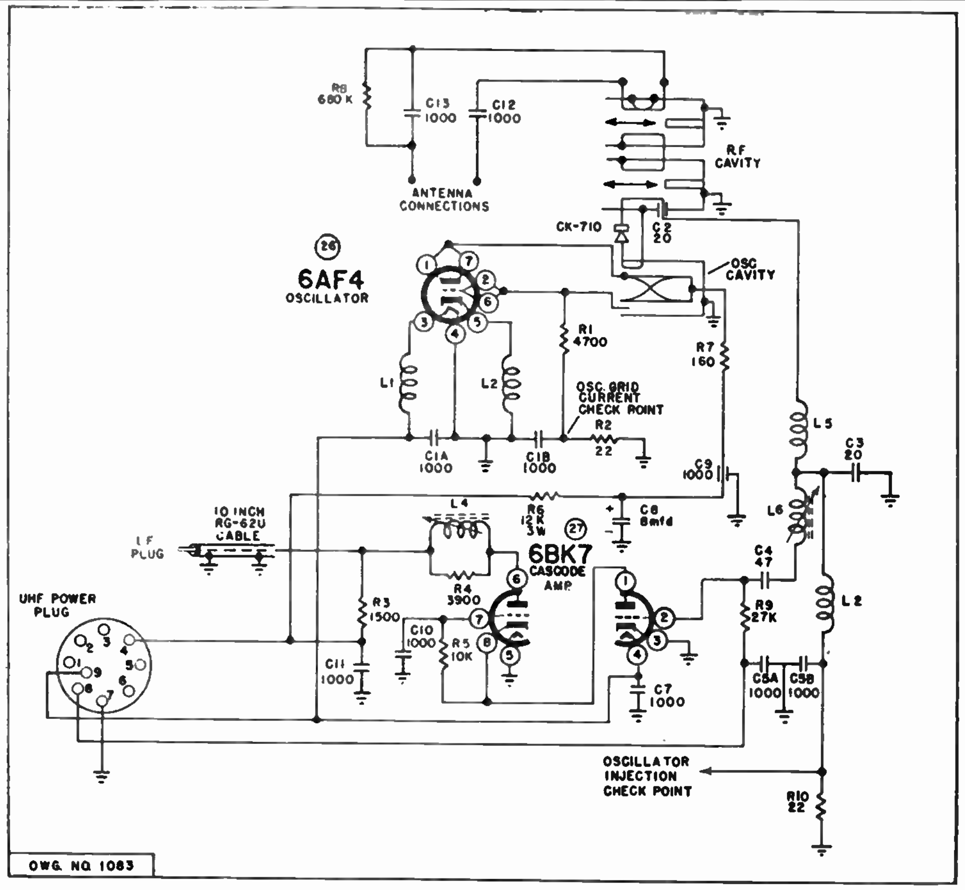


Figure 12 6BK7 UHF TUNER SCHEMATIC

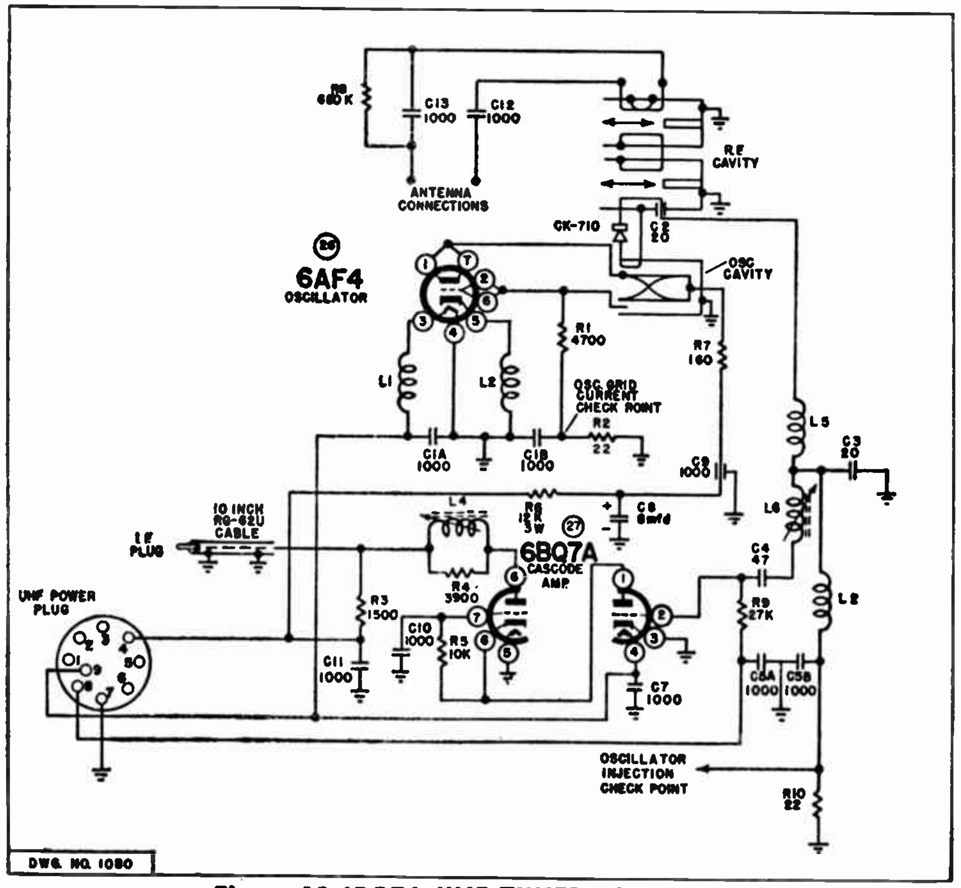


Figure 13 6BQ7A UHF TUNER SCHEMATIC

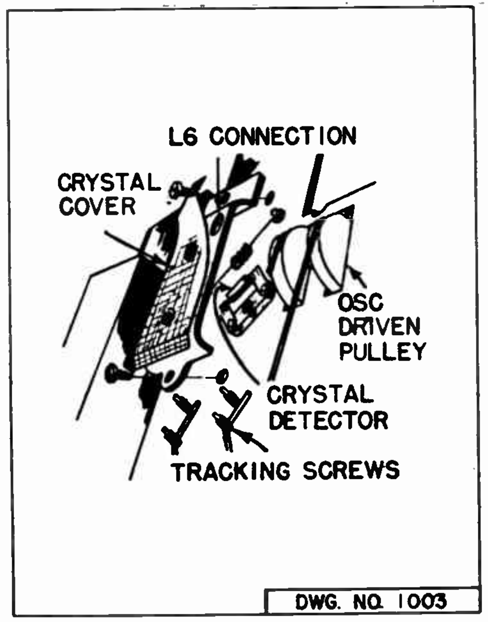


Figure 14

CRYSTAL DETECTOR: If replacement of the CK-710 Crystal Detector is necessary, the picture tube must be removed along with the cyrstal cover (refer to figure 14). The crystal is soldered into place and should be carefully resoldered after replacement. Overheating may damage the crystal. To dissipate the heat, grasp each crystal lead with a pliers when soldering into place.

ALIGNMENT

Since UHF is a relatively new field, test equipment necesary for RF and Oscillator Alignment is highly expensve and not readily available on the market at the present time. Therefore, a complete alignment procedure is not presented in this manual.

The cascode Pre-IF Amplifier can easily be realigned if necessary by connecting a 25 MC unmodulated signal to the junction of Coil L-5 and Capacitor C-2 (see figure 14), and a VTVM at the video IF Detector output of the receiver. Connect generator through a 1 mmf capacitor. Adjust both L4 and L6 for maximum VTVM reading.

If for any reason such as dial cord replacement, component replacement, etc., the RF cavities may be adjusted for peak performance. Before attempting adjustment, note position of ribbons and mark the UHF drive gear so that original positions can be relocated if necessary. Loosen the pulley positioning screw (refer to figure 15) and rotate the RF Drive Pulleys while viewing a UHF program. Rotate the pulleys for the sharpest and clearest picture.

CAUTION: Do not under any circumstances attempt adjustment of the tracking screws, oscillator trimmer screw or oscillator cavity. Precision test equipment is necessary for the adjustment.

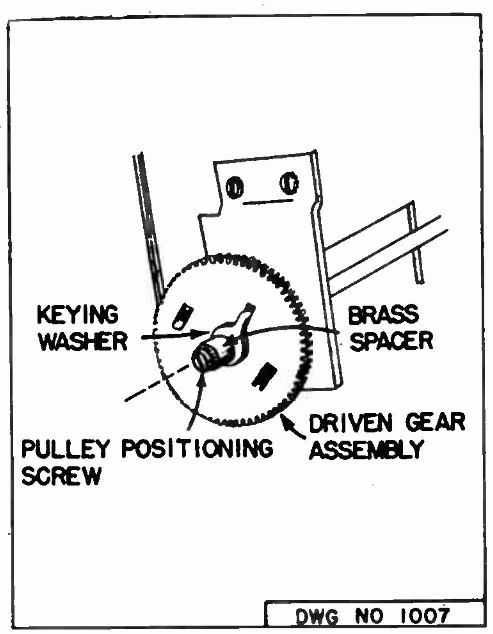


Figure 15

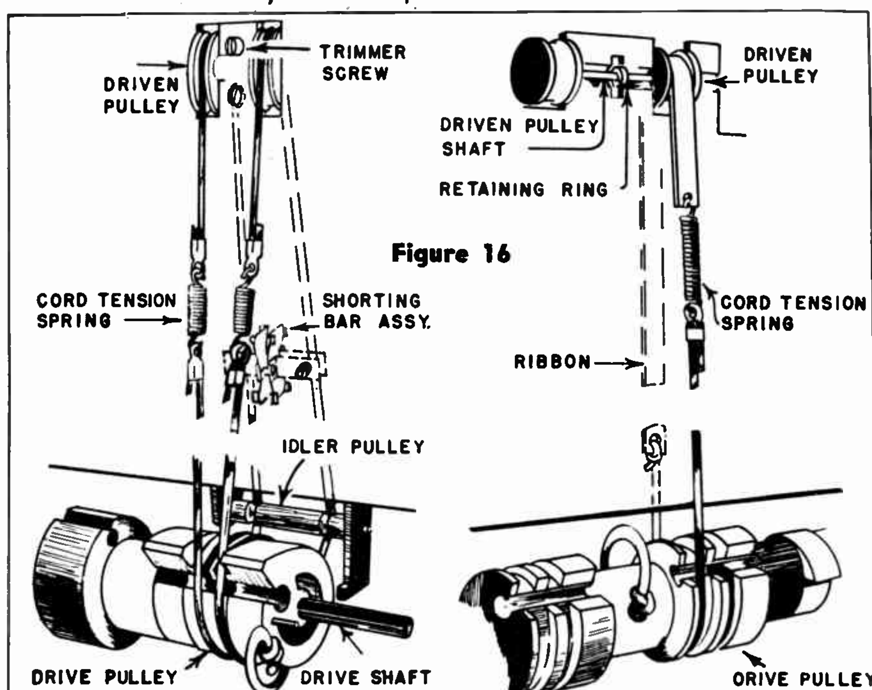


Figure 16

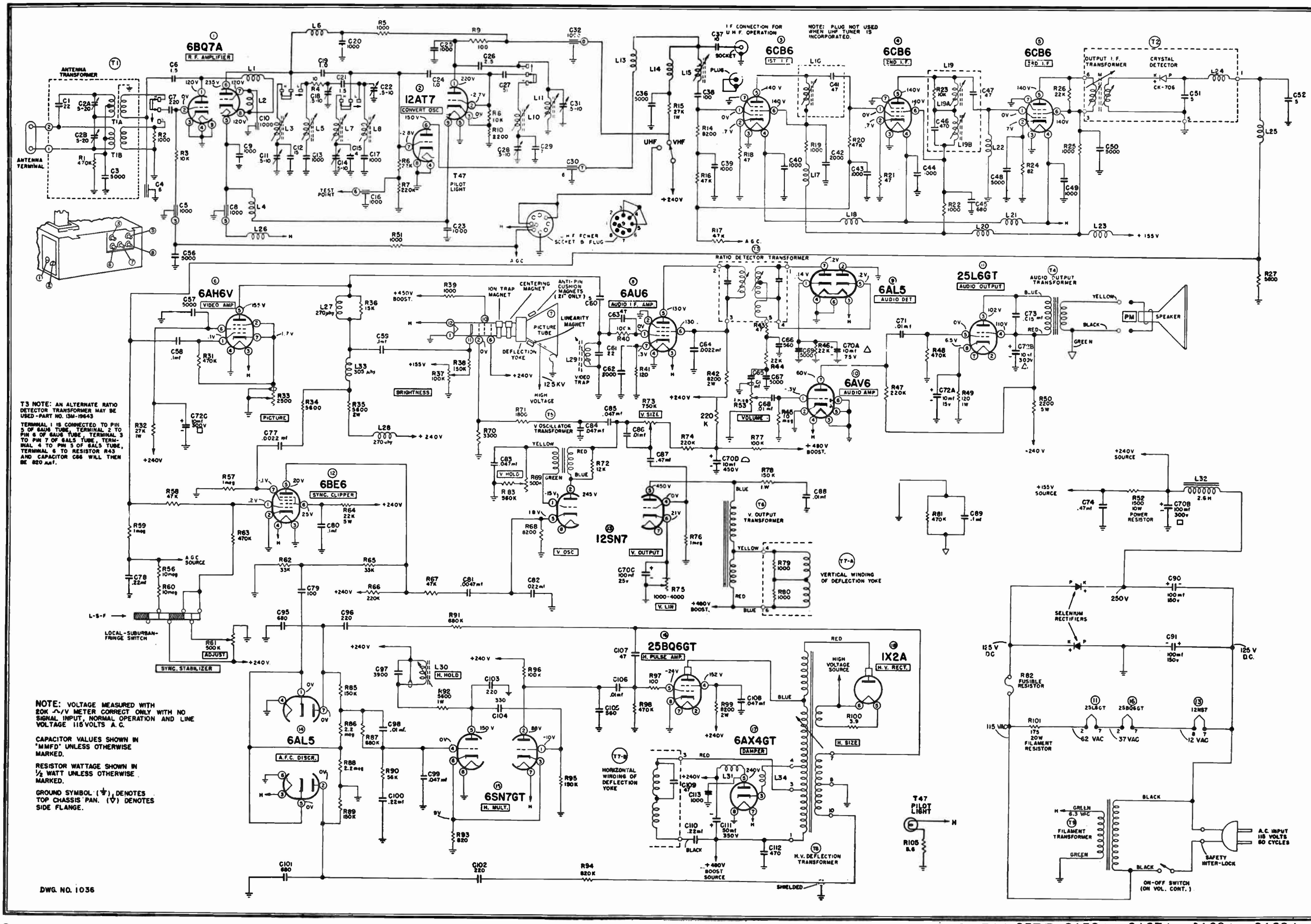
OSCILLATOR CAVITY STRINGING   RF CAVITY STRINGING

U.H.F. TELEVISION FREQUENCY RANGES

(All Figures Represent Megacycles)

Channel	Channel Frequencies	Picture Carrier Frequency	Sound Carrier Frequency	Receiver Oscillator Frequency
14	470-476	471.25	475.75	498
15	476-482	477.25	481.75	504
16	482-488	483.25	487.75	510
17	488-494	489.25	493.75	516
18	494-500	495.25	499.75	522
19	500-506	501.25	505.75	528
20	506-512	507.25	511.75	534
21	512-518	513.25	517.75	540
22	518-524	519.25	523.75	546
23	524-530	525.25	529.75	552
24	530-536	531.25	535.75	558
25	536-542	537.25	541.75	564
26	542-548	543.25	547.75	570
27	548-554	549.25	553.75	576
28	554-560	555.25	559.75	582
29	560-566	561.25	565.75	588
30	566-572	567.25	571.75	594
31	572-578	573.25	577.75	600
32	578-584	579.25	583.75	606
33	584-590	585.25	589.75	612
34	590-596	591.25	595.75	618
35	596-602	597.25	601.75	624
36	602-608	603.25	607.75	630
37	608-614	609.25	613.75	636
38	614-620	615.25	619.75	642
39	620-626	621.25	625.75	648
40	626-632	627.25	631.75	654
41	632-638	633.25	637.75	660
42	638-644	639.25	643.75	666
43	644-650	645.25	649.75	672
44	650-656	651.25	655.75	678
45	656-662	657.25	661.75	684
46	662-668	663.25	667.75	690
47	668-674	669.25	673.75	696
48	674-680	675.25	679.75	702
49	680-686	681.25	685.75	708
50	686-692	687.25	691.75	714
51	692-698	693.25	697.75	720
52	698-704	699.25	703.75	726
53	704-710	705.25	709.75	732
54	710-716	711.25	715.75	738
55	716-722	717.25	721.75	744
56	722-728	723.25	727.75	750
57	728-734	729.25	733.75	756
58	734-740	735.25	739.75	762
59	740-746	741.25	745.75	768
60	746-752	747.25	751.75	774
61	752-758	753.25	757.75	780
62	758-764	759.25	763.75	786
63	764-770	765.25	769.75	792
64	770-776	771.25	775.75	798
65	776-782	777.25	781.75	804
66	782-788	783.25	787.75	810
67	788-794	789.25	793.75	816
68	794-800	795.25	799.75	822
69	800-806	801.25	805.75	828
70	806-812	807.25	811.75	834
71	812-818	813.25	817.75	840
72	818-824	819.25	823.75	846
73	824-830	825.25	829.75	852
74	830-836	831.25	835.75	858
75	836-842	837.25	841.75	864
76	842-848	843.25	847.75	870
77	848-854	849.25	853.75	876
78	854-860	855.25	859.75	882
79	860-866	861.25	865.75	888
80	866-872	867.25	871.75	894
81	872-878	873.25	877.75	900
82	878-884	879.25	883.75	906
83	884-890	885.25	889.75	912

NOTE: The Receiver Oscillator Frequency applies only to those UHF Tuners which employ single conversion and an output IF of approximately 25 MC.


6BQ7A
R.F. AMPLIFIER
12AT7
CONVERT OSC
6CB6
1ST I.F.
6CB6
2ND I.F.
6CB6
3RD I.F.
OUTPUT I.F. TRANSFORMER
CRYSTAL DETECTOR
ANTENNA TRANSFORMER
ANTENNA TERMINAL
6AH6V
VIDEO AMP
6AU6
AUDIO I.F. AMP
RATIO DETECTOR TRANSFORMER
6AL5
AUDIO DET
25L6GT
AUDIO OUTPUT
AUDIO OUTPUT TRANSFORMER
SPEAKER
6AV6
AUDIO AMP
6BE6
SYNC. CLIPPER
12SN7
V. OSC
V. OUTPUT
V. OUTPUT TRANSFORMER
VERTICAL WINDING OF DEFLECTION YOKE
6AL5
A.F.C. DISCR.
6SN7GT
H. MULT.
25BQ6GT
H. PULSE AMP.
1X2A
H. V. RECT.
6AX4GT
DAMPER
H.V. DEFLECTION TRANSFORMER
HORIZONTAL WINDING OF DEFLECTION YOKE
FILAMENT TRANSFORMER
SELENIUM RECTIFIERS
LOCAL-SUBURBAN-FRINGE SWITCH
SYNC. STABILIZER
ON-OFF SWITCH (ON VOL. CONT.)
A.C. INPUT 115 VOLTS 60 CYCLES
SAFETY INTER-LOCK
T3 NOTE: AN ALTERNATE RATIO DETECTOR TRANSFORMER MAY BE USED-PART NO. 13M-19643
TERMINAL 1 IS CONNECTED TO PIN 5 OF 6AU6 TUBE, TERMINAL 2 TO PIN 6 OF 6AU6 TUBE, TERMINAL 3 TO PIN 7 OF 6AL5 TUBE, TERMINAL 4 TO PIN 5 OF 6AL5 TUBE, TERMINAL 6 TO RESISTOR R43 AND CAPACITOR C66 WILL THEN BE 820 mmf.
NOTE: VOLTAGE MEASURED WITH 20K Ω/V METER CORRECT ONLY WITH NO SIGNAL INPUT, NORMAL OPERATION AND LINE VOLTAGE 115 VOLTS A.C.
CAPACITOR VALUES SHOWN IN "MMFD" UNLESS OTHERWISE MARKED.
RESISTOR WATTAGE SHOWN IN 1/2 WATT UNLESS OTHERWISE MARKED.
GROUND SYMBOL (⏚) DENOTES TOP CHASSIS PAN. (▽) DENOTES SIDE FLANGE.
DWG. NO. 1036

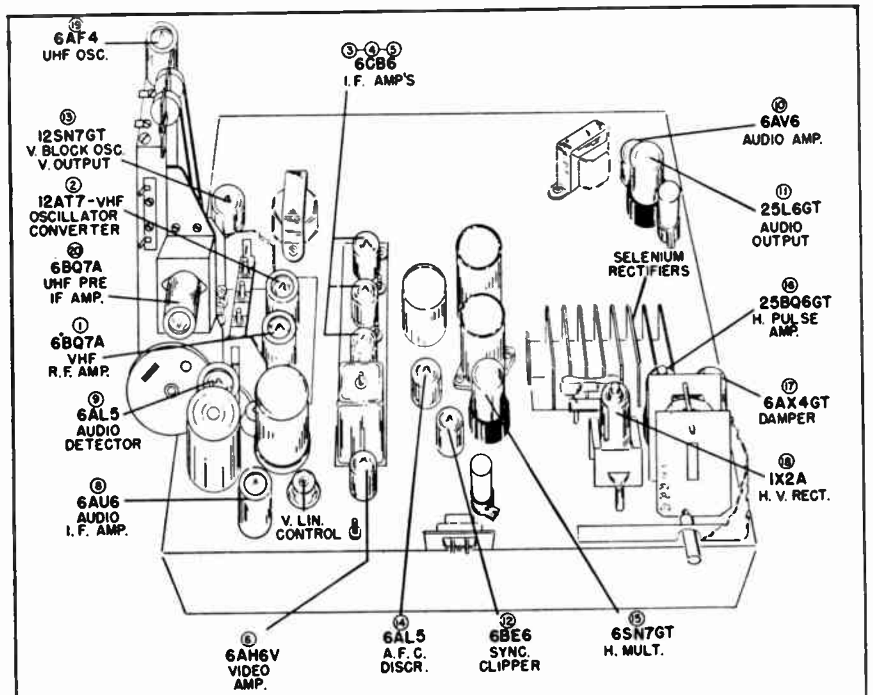
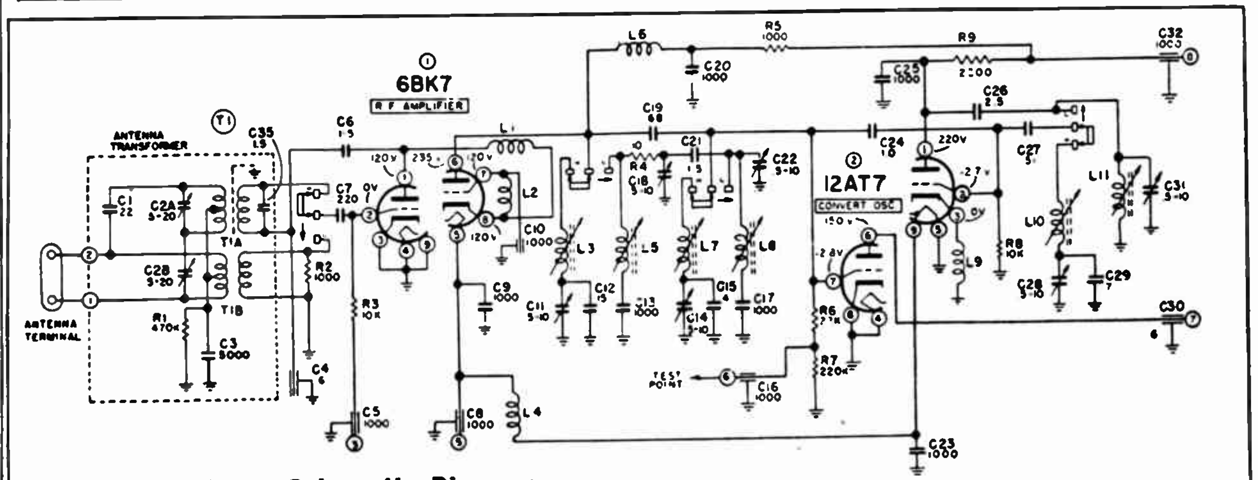


Figure 17. Tube Layout

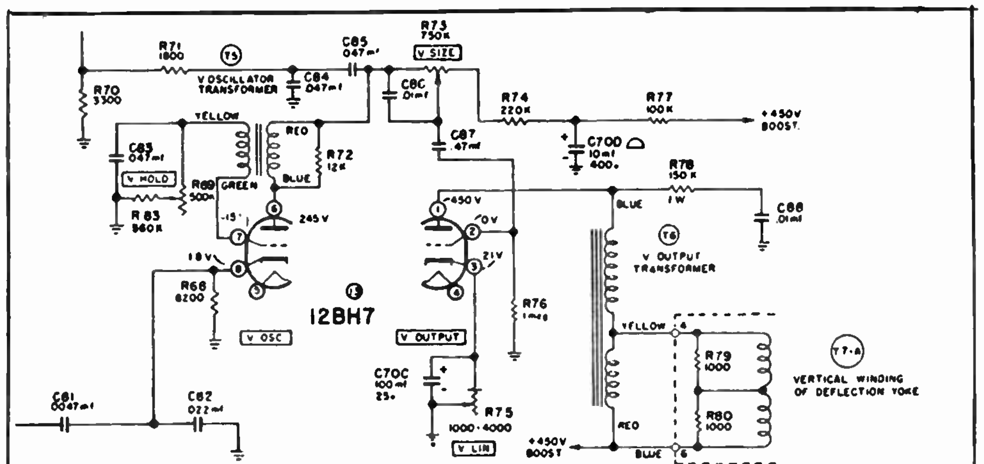
DWG NO 1027-A



6BK7 VHF Tuner Schematic Diagram

(Parts differences noted in parts list by an asterisk-*)

DWG. NO. 1081



12BH7 Vertical Deflection Schematic Diagram

(Parts differences noted in parts list by a double asterisk-**)

DWG. NO. 1082

U.H.F. TUNER

Ref. No.	Part No.	Description	Selling Price
		CAPACITORS	
C1A,B	8G-19506	1000 mmf, dual ceramic	.18
C2	8G-21315	20 mmf, feed thru	.18
C3	8G-21951	20 mmf, ceramic	.12
C4	8G-20740	47 mmf, ceramic	.12
C5A,B	8G-19506	1000 mmf, dual ceramic	.18
C7	8G-13201	1000 mmf, ceramic	.14
C8	8C-13453	8 mfd x 450 volt, lytic	1.00
C9	8G-20878	1000 mmf, feed thru	.34
C10,11	8G-13201	1000 mmf, ceramic	.14
C12,13	8G-19862	1000 mmf, ceramic	.12
		RESISTORS	
R1	9B1-70	4700 ohm, 1/2 watt, 10%	.14
R2	9B1-42	22 ohm, 1/2 watt, 10%	.14
R3	9B1-64	1500 ohm, 1/2 watt, 10%	.14
R4	9B1-69	3900 ohm, 1/2 watt, 10%	.14
R5	9B1-74	10K ohm, 1/2 watt, 10%	.14
R6	9C11-1112	12K ohm, 3 watt, 10%	.30
R7	9B1-140	160 ohm, 1/2 watt, 5%	.14
R8	9B1-96	680K ohm, 1/2 watt, 10%	.14
R9	9B1-79	27K ohm, 1/2 watt, 10%	.14
R10	9B1-42	22 ohm, 1/2 watt, 10%	.14
		COILS	
L1	16A-20469	Filament Choke Coil	.12
L2	201-20265	Choke Coil	.22
L3	16A-20470	Cathode Choke Coil	.12
L4	201-20483	Output IF Coil	.28
L5	16A-21934	Crystal Coupling Coil	.04
L6	201-21933	Input IF Coil	.60
		MISCELLANEOUS	
	201-21283	Ribbon Contact Arm Assembly (bottom)	.18
	201-21954	Ribbon Contact Arm Assy. (top)	.30
	5M-21286	RF Driven Pulley	.22
	3A-21287	Shaft for R.F. Pulley	.06
	5M-21289	Oscillator Driven Pulley	.04
	29C-21288	Retaining Ring (RF Pulley Shaft)	.04
	3A-21290	Oscillator Pulley Shaft	.04
	3A-21292	Oscillator Idler Pulley	.10
	213-21583	Oscillator Cover Assembly	.16
	8M-21655	Crystal (CK-710)	1.96
	200-21295	Crystal Cover	.16
	200-21298	Driven Gear Assembly	.58
	3A-21300	Drive Shaft	.22
	29M-21512	Keying Washer	.04
	3C-11073	Brass Spacers	.02
	3C-21374	Sleeve Spacer	.24
	32F8SE-5882	Pulley Positioning Screw	.02
	5M-21373	R.F. Cavity Drive Pulley	.58
	200-21299	Oscillator Drive Pulley & Pin	.40
	2C-21301	R.F. Cavity Cover	.10
	2B-21304	Cascode Amplifier Cover	.12
	3M-21305	Tracking Screw	.04
	62M-21306	Locking Wire (for above)	.02

V.H.F. TUNER

Ref. No.	Part No.	Description	Selling Price
		Capacitors	
C1	8G-11892	22 mmf, 500 volt, ceramic, (included with T1)	.16
C2A-B	8E-17142	5-20 mmf, dual trimmer	.22
C3	8G-13962	5000 mfd, 500 volt, ceramic	.16
C4	8G-20880	6 mmf, feed thru	.28
C5	8G-20878	1000 mmf, feed thru	.34
C6	8G-12495-8	1.5 mmf, 500 volt, ceramic	.14
C7	8G-16045	220 mmf, 500 volt, ceramic	.14
C8	8G-20878	1000 mmf, feed thru	.34
C9	8G-13201	1000 mmf, 500 volt, ceramic	.14
C10	8G-20850	1000 mmf, feed thru	.24
C11	201-15142	.5-10 mmf, trimmer	.18
C12	8G-13017	15 mmf, 500 volt, ceramic	.14
C13	8G-13201	1000 mmf, 500 volt, ceramic	.14
C14	201-15142	.5-10 mmf, trimmer	.18
C15	8G-19314	4 mmf, 500 volt ceramic	.16
C16	8G-20878	1000 mmf, feed thru	.34
C17	8G-13201	1000 mmf, 500 volt, ceramic	.14
C18	201-15142	.5-10 mmf, trimmer	.18
C19	8G-12495-2	1.0 mmf, 500 volt, ceramic	.14
*C19	8G-12495-1	.68 mmf, 500 volt, ceramic	.14
C20	8G-13201	1000 mmf, 500 volt, ceramic	.14
C21	8G-12495-8	1.5 mmf, 500 volt, ceramic	.14
C22	201-15142	.5-10 mmf, trimmer	.18
C23	8G-13201	1000 mmf, 500 volt, ceramic	.14
C24	8G-12495-2	1.0 mmf, 500 volt, ceramic	.14
C25	8G-13201	1000 mmf, 500 volt, ceramic	.14
C26	8G-19568	2.5 mmf, 500 volt, ceramic	.18
C27	8G-11891	51 mmf, 500 volt, ceramic	.16
C28	201-15142	.5-10 mmf, trimmer	.18
C29	8G-15224	7 mmf, 500 volt, ceramic	.07
C30	8G-20879	6 mmf, feed thru	.34
C31	201-15142	.5-10 mmf, trimmer	.18
C32	8G-20878	1000 mmf, feed thru	.34
*C35	8G-12495-8	1.5 mmf, 500 volt, ceramic	.14
		Resistors	
R1	9B1-29	470K ohm, 1/2 watt, 20% (incl. with T1)	.14
R2	9B1-62	1000 ohm, 1/2 watt, 10%	.14
R3	9B1-74	10K ohm, 1/2 watt, 10%	.14
R4	9B1-38	10 ohm, 1/2 watt, 10%	.14
R5	9B1-13	1000 ohm, 1/2 watt, 20%	.14
R6	9B1-78	22K ohm, 1/2 watt, 10%	.14
R7	9B1-27	220K ohm, 1/2 watt, 20%	.14
R8	9B1-74	10K ohm, 1/2 watt, 10%	.14
R9	9B1-50	100 ohm, 1/2 watt, 10%	.14
R10	9B1-66	2200 ohm, 1/2 watt, 10%	.14
		Chokes, Transformers and Coils	
T1 (Incl. T1A,T1B,C1, C2A,C2B,C3 andR1)	201-21192	Antenna transformer assembly	2.04
T1A	13E-20767	H. B. Antenna transformer (incl. with T1)	.30
T1B	13E-21189	L.B. Antenna transformer (incl. with T1)	.42
L1	13M-20781	Cascode plate-to-cathode coil	.10
L2	13M-20780	Cascode cathode-to-grid coil	.10
L3	13E-17140	H.B. R.F. primary coil	.58
L4	16A-20777	Filament choke	.18
L5	13E-12046	L.B. R.F. primary coil	.22
L6	16A-17128	R.F. choke	.36
L7	13E-17140	H.B. R.F. secondary coil	.58
L8	13E-12046	L.B. R.F. secondary coil	.22
L10	13E-17140	H.B. oscillator coil	.58
L11	13D-12155	L.B. oscillator coil	.54
		Miscellaneous	
	200-20772	T1 shield assembly	.28
	201-20766	Coil alignment strip	.18
	200-20779	Switch lever assembly	.34
	2D-20893	Switch lever bracket	.04
	200-18824	Rear cam	.12
	200-21193	Shaft and front cam	.58
	200-20881	Bottom cover	.30
	201-20769	Capacitor plate assembly (included C5-8-16-30-32)	3.60
	49A-20763	Hair-pin spring (for trimmer)	.02
	5M-18807	Treadle bar	.40
	2M-16276	Core mounting clip	.02
	43A2-5444	Hex nut, 2-56x3/16"	.02
	51A-15713	Iron core (white) for L-10	.22
	51A-17162	Iron core (brown) for L3-7	.18
	51A-21200	Iron core (pink) for L-11	.18
	51A-15715	Iron core (blue) for L-5	.22
	51A-17161	Iron core (orange) for L-8	.22
	2C-21099-1	Front end plate	.12
	2C-18805-1	Rear end plate	.12
	49A-18799	Link spring	.06
	2M-18800	Front link	.06
	2M-21278	Rear link	.06
	2M-19150	Flat spring	.02
	2B-19323	Tube shield (12AT7)	.16
	2B-20864	Tube shield (6BK7)	.10
	2J-16310	Sliding switch contact	02
	5F-16311	Switch contact holder	.05

MAIN CHASSIS

Capacitors

C36	8G-13962	5000 mmf, 500 volt, ceramic	.16
C37	8G-11789	10 mmf, 500 volt, ceramic	.14
C38	8F3-8	100 mmf, 500 volt, mica	.14
C39-40	8G-13201	1000 mmf, 500 volt, ceramic	.14
C41	8G-19731	47 mmf, 500 volt, ceramic (included with L-16)	.12
C42	8G-19522	2000 mmf, 500 volt, ceramic	.18
C43-44	8G-13201	1000 mmf, 500 volt ceramic	.14
C45	8G-21105	680 mmf, 500 volt, ceramic	.12
C46	8G-11732	470 mmf, 500 volt, ceramic (included with L-19)	.16
C47	8G-19731	47 mmf, 500 volt, ceramic (included with L-19)	.12
C48	8G-13962	5000 mmf, 500 volt, ceramic	.16
C49	8G-13201	1000 mmf, 500 volt, ceramic	.14
C50	8G-13962	5000 mmf, 500 volt, ceramic	.16
C51	8G-12166	5 mmf, 500 volt, ceramic (included with T-2)	.16
C52	8G-12166	5 mmf, 500 volt, ceramic	.16
C56-57	8G-13962	5000 mmf, 500 volt, ceramic	.16
C58	8J-16085	.1 mfd, 200 volt, molded	.18
C59	8J-16083	.1 mfd, 400 volt, molded	.24
C60	8G-12166	5 mmf, 500 volt, ceramic	.16
C61	8G-13909	22 mmf, 500 volt, ceramic	.16
C62	8G-13962	5000 mmf, 500 volt, ceramic	.16
C63	8G-12198	47 mmf, 500 volt, ceramic	.16
C64	8J-20634	.0022 mfd, 400 volt, molded	.18
C65	8J-20582	.01 mfd, 200 volt, molded	.16
C66	8F3-122	560 mmf, 500 volt, mica	.16
C67	8G-21207	5000 mmf, 500 volt, ceramic	.18
C68	8J-20582	.01 mfd, 200 volt, molded	.16
C69	8G-13962	5000 mmf, 500 volt, ceramic	.16
C70A-B-C-D	8C-22130	10 mfd, 75 volt—100 mfd, 300 volt—100 mfd, 25 volt—10 mfd, 450 volt filter lytic	2.52
**C70 A,B,C,D	8C-20808	10 mfd, 75 volt-100 mfd, 300 volt-100 mfd, 25 volt-10 mfd, 400 volt, filter lytic	2.50
C71	8J-16084	.01 mfd, 400 volt, molded	.16
C72A-B-C	8C-20954	10 mfd, 15 volt—10 mfd, 300 volt—10 mfd, 300 volt filter lytic	1.24
C73	8J-20594	.015 mfd, 400 volt, molded	.16
C74	8J-21505	.47 mfd, 400 volt, molded	.58
C77	8J-20590	.0022 mfd, 400 volt, molded	.16
C78	8J-16082	.22 mfd, 200 volt, molded	.28
C79	8F3-113	100 mmf, 500 volt, mica	.14
C80	8J-16083	.1 mfd, 400 volt molded	.24
C81	8J-20592	.0047 mfd, 400 volt, molded	.16
C82	8J-16086	.022 mfd, 200 volt, molded	.16
C83-84	8J-16096	.047 mfd, 200 volt, molded	.18
C85	8J-16081	.047 mfd, 400 volt, molded	.18
C86	8J-16084	.01 mfd, 400 volt, molded	.16
C87	8J-21505	.47 mfd, 400 volt, molded	.58
C88	8J-16097	.01 mfd, 600 volt, molded	.18
C89	8J-16083	.1 mfd, 400 volt, molded	.24
C90	8C-20709	100 mfd, 150 volt, lytic	1.18
C91	8C-20684	100 mfd, 150 volt, lytic	1.12
C95	8F3-123	680 mmf, 300 volt, mica	.18
C96	8F3-117	220 mmf, 500 volt, mica	.14
C97	8J-20613	3900 mmf, 600 volt, ceramic	.18
C98	8J-20582	.01 mfd, 200 volt, molded	.16
C99	8J-16096	.047 mfd, 200 volt, molded	.18
C100	8J-16082	.22 mfd, 200 volt, molded	.28
C101	8F3-123	680 mmf, 300 volt, mica	.18
C102-103	8F3-117	220 mmf, 500 volt, mica	.14
C104	8F3-119	330 mmf, 500 volt, mica	.16
C105	8F3-122	560 mmf, 500 volt, mica	.16
C106	8J-16084	.01 mfd, 400 volt, molded	.16
C107	8G-12198	47 mmf, 500 volt, ceramic	.16
C108	8J-16081	.047 mfd, 400 volt, molded	.18
C109	8G-12198	47 mmf, 500 volt, ceramic (included with T-7)	.16
C110	8J-16082	.22 mfd, 200 volt, molded	.28
C111	8C-22111	50 mfd, 300 volts, lytic	1.38
C112	8G-21440	470 mmf, 1000 volt, ceramic	.18
C113	8G-19505	1000 mmf, 500 volt, ceramic	.20

Resistors

R13	9B1-13	1000 ohm, ½ watt, 20%	.14
R14	9B1-73	8200 ohm, ½ watt, 10%	.14
R15	9B2-79	27K ohm, 1 watt, 10%	.14
R16-17	9B1-82	47K ohm, ½ watt, 10%	.14
R18	9B1-46	47 ohm, ½ watt, 10%	.14
R19	9B1-13	1000 ohm, ½ watt, 20%	.14
R20	9B1-82	47K ohm, ½ watt, 10%	.14
R21	9B1-46	47 ohm, ½ watt, 10%	.14
R22	9B1-13	1000 ohm, ½ watt, 20%	.14
R23	9B1-74	10K ohm, ½ watt, 10% (included with L-19)	.14
R24	9B1-49	82 ohm, ½ watt, 10%	.14
R25	9B1-13	1000 ohm, ½ watt, 20%	.14
R26	9B1-78	22K ohm, ½ watt, 10%	.14
R27	9B1-71	5600 ohm, ½ watt, 10%	.14
R31	9B1-94	470K ohm, ½ watt, 10%	.14
R32	9B2-79	27K ohm, 1 watt, 10%	.14
R33	10B-21476	Picture control—2500 ohm	.52
R34	9B1-71	5600 ohm, ½ watt, 10%	.14
R35	9B4-71	5600 ohm, 2 watt, 10%	.24
R36	9B1-76	15K ohm, ½ watt, 10%	.14
R37	10B-17275	Brightness control—100K	.40
R38	9B1-88	150K ohm, ½ watt, 10%	.40
R39	9B1-62	1000 ohm, ½ watt, 10%	.14
R40	9B1-86	100K ohm, ½ watt, 10%	.14
R41	9B1-51	120 ohm, ½ watt, 10%	.14
R42	9B4-73	8200 ohm, 2 watt, 10%	.24
R43	9B1-46	47 ohm, ½ watt, 10%	.14
R44	9B1-78	22K ohm, ½ watt, 10%	.14
R45	9B1-110	10 megohm, ½ watt, 10%	.14
R46	9B1-78	22K ohm, ½ watt, 10%	.14
R47	9B1-90	220K ohm, ½ watt, 10%	.14
R48	9B1-94	470K ohm, ½ watt, 10%	.14
R49	9B2-51	120 ohm, 1 watt, 10%	.24
R50	9C12-1103	2200 ohm, 5 watt, 10%	.26
R51	9B1-62	1000 ohm, ½ watt, 10%	.14
R52	9M-20736	1500 ohm, 10 watt, 10%	.42
R53	10A-21484	Volume Control w/switch - 1 meg.	.82
R56	9B1-110	10 megohms, ½ watt, 10%	.14
R57	9B1-98	1 megohm, ½ watt, 10%	.14
R58	9B1-82	47K ohm, ½ watt, 10%	.14
R59	9B1-98	1 megohm, ½ watt, 10%	.14
R60	9B1-110	10 megohms, ½ watt, 10%	.14
R61	10B-20558	Sync adjust control - 500K	.42
R62	9B1-80	33K ohm, ½ watt, 10%	.14
R63	9B1-94	470K ohm, ½ watt, 10%	.14
R64	9C12-1115	22K ohm, 5 watt, 10%	.24
R65	9B1-80	33K ohm, ½ watt, 10%	.14
R66	9B1-90	220K ohm, ½ watt, 10%	.14
R67	9B1-82	47K ohm, ½ watt, 10%	.14
R68	9B1-73	8200 ohm, ½ watt, 10%	.14
R69	10B-20558	V. Hold control - 500K	.42
R70	9B1-68	3300 ohm, ½ watt, 10%	.14
R71	9B1-65	1800 ohm, ½ watt, 10%	.14
R72	9B1-75	12K ohm, ½ watt, 10%	.14
R73	10B-19220	V. Size control - 750K	.40
R74	9B1-90	220K ohm, ½ watt, 10%	.14
R75	10B-21052	V. Linearity control - 4000	.28
R76	9B1-98	1 megohm, ½ watt, 10%	.14
R77	9B1-86	100K ohm, ½ watt, 10%	.14
R78	9B2-88	150K ohm, 1 watt, 10%	.14
R79-80	9B1-62	1000 ohm, ½ watt, 10% (included with T-7)	.14
R81	9B1-94	470K ohms, ½ watt, 10%	.14
R82	46M-20681	Fusible resistor, 5.6 ohm, 1 amp.	.28
R83	9B1-95	560K ohm, ½ watt, 10%	.14
R84	9B1-90	220K ohm, ½ watt, 10%	.14
R85	9B1-88	150K ohm, ½ watt, 10%	.14
R86	9B1-102	2.2 megohm, ½ watt, 10%	.14
R87	9B1-96	680K ohm, ½ watt, 10%	.14
R88	9B1-102	2.2 megohm, ½ watt, 10%	.14
R89	9B1-88	150K ohm, ½ watt, 10%	.14
R90	9B1-83	56K ohm, ½ watt, 10%	.14
R91	9B1-96	680K ohm, ½ watt, 10%	.14
R92	9B2-71	5600 ohm, 1 watt, 10%	.20
R93	9B1-61	820 ohm, ½ watt, 10%	.14
R94	9B1-97	820K ohm, ½ watt, 10%	.14
R95	9B1-88	150K ohm, ½ watt, 10%	.14
R96	9B1-86	100K ohm, ½ watt, 10%	.14
R97	9B1-50	100 ohm, ½ watt, 10%	.14
R98	9B1-94	470K ohm, ½ watt, 10%	.14
R99	9B4-73	8200 ohm, 2 watt, 10%	.24
R100	9C1-1070	3.9 ohm, ½ watt, 10%	.14
R101	9M-21715	175 ohm, 20 watt, 10% - Filament	.54
R105	9C1-1072	5.6 ohm, ½ watt, 10%	.18

Chokes, Transformers and Coils

T2 (incl. C51, L24 & CK-706)	13B-21167	Output I.F. transformer	2.34
T3 (alternate)	13M-19643	Ratio detector transformer	.72
T3	13M-21644	Ratio detector transformer	1.50
T4	12C-21215	Audio output transformer	1.48
T5	12M-18241-3	Vertical oscillator transformer	1.04
T6	12C-20761-1	Vertical output transformer	2.86
†T7A-B (incl. R79-80 & C109)	201-21130	Deflection yoke assembly	6.00
††T7A-B (incl. R79-80 & C109)	201-21514	Deflection yoke assembly	6.42
T8	201-21025-1	H. V. Deflection transformer	6.90
T9	12D-21160	Filament transformer	3.24
L13	16A-21656	R.F. choke	.28
L14	201-15608	R.F. choke	.34
L15	201-20782	1st I.F. coil assembly	.18
L16 (incl. C41)	201-21111	2nd I.F. coil assembly	.18
L17	16A-18676	B+ choke	.12
L18	16A-17937	Filament choke	.36
L19 (incl. R23, C46-47, L19A, L19B)	201-21494	3rd I.F. coil assembly	1.12
L20	16A-18676	B+ choke	.12
L21	16A-17937	Filament choke	.36
L22-23	201-15608	Choke coil	.34
L24	201-15608	Choke coil (incl. with T-2)	.34
L25	201-20265	Choke coil	.22
L26	16A-17937	Filament choke	.36
L27-28	16A-20970	Peaking coil (270 uhy)	.30
L29	201-21398	Video trap coil	.36
L30	201-20291	H. Hold coil	.48
L31	201-15608	Choke coil	.34
L32	16A-21214	Filter choke (2.6 H)	2.16
L33	16A-21391	Peaking coil (305 uhy)	.34
L34	201-15608	Choke coil	.34

MISCELLANEOUS

15C-16007	7-pin tube socket	.10
15B-10440	8-pin tube socket	.10
15B-20860	6AX4 tube socket	.12
19B-11920	UHF tuner socket	.12
19A-21244	UHF tuner plug	.12
2H-17588	Tube shield	.06
2M-17589	Tube shield base	.04
15B-21186	Lytic mounting plate (C-90)	.06
46M-20681	Fusible resistor	.28
7M-20751	Fuse mounting board	.04
7M-20752	Fuse terminal board	.06
19A-19446	A.C. receptacle	.12
2D-11490	Condenser mounting clip (C-111)	.06
21J-20097	Selenium rectifier	2.44
20B-21506	LSF switch	30
201-21910	1X2A socket assembly (including the five (5) items below)	.78
15C-18735	1X2A tube socket	.12
5M-18733	Standoff insulator	.04
62D-18734	H.V. ring	.04
41M-20092	Tube positioner	.16
9C1-1070	3.9 ohm resistor (R-100)	.14
2B-20646	H.V. shield can	.42
2B-20549	H.V. shield can cover	.06
49A-19389	Ring (3 used)	.04
23M-16744	Yoke wing nut	.04
50A-20783	Felt pad tube protector	.04
16M-19906	Ion Trap magnet	.54
16M-20697	Centering magnet	.60
2M-19378	Flat screw spring (L-30)	.04
32T8-19377	Thumb screw (L-30)	.04
25A-13005	Mounting grommet (L-30)	.02
7B-13050	Antenna terminal board	.10
49A-15857	14½" wire shield	.06
43D-17860	Coil fastener (L-19)	.02
51A-17966	Iron core (L-19)	.06
2D-21118	Tuner shaft support bracket	.04
25M-18177	Red rubber knob	.04
29E-21513	Spring washer	.02
29A-15939	Flat washer	.02
29M-21234	Front stop washer	.02
29M-21235	Center stop washer (3 used)	.02
29M-21236	Rear stop washer	.02
47A-21608	Pilot light and bracket	.34
38A-21436	Pilot light shield	.02
46A-10793	Pilot light bulb (T-47)	.10
200-21242	Tuning shaft assembly	.42
200-21362	Tuner pulley and bushing	.42
52C-14443	Set screw	.06
200-21589	Bracket and pulley assembly	.16
2M-19637	Tuning dial pulley	.04
3B-19651	Pulley bushing	.16
3B-21552	Tuning dial bushing	.24
29C-21590	Retaining ring	.04
200-21587	Support bracket and shaft assem.	.28
49A-10078	Tension spring	.02
49A-11324	Tension spring	.04

†17-INCH MISCELLANEOUS

2M-20695	C.R.T. outer coat contact	.10
14C-19133	H. V. Cable assembly	.36
38A-21096	Anode retainer	.10
2C-20876	R.H. tube holding plate	.18
2C-20877	L.H. tube holding plate	.18
25M-20703	Rubber pad (4 used)	.06
213-21464	Deflection yoke mounting brace	1.78
2M-20705	Tube strap	.10
2D-18542	Tube strap bracket	.04
3M-20689	Support rod	.22
15B-17278-7	C.R.T. socket and cable	.58
16M-21526	Linearity magnet	.60
51A-19322	Iron core (L-30)	.10
49A-21691	Spring (large)	.06
49A-19707	Spring (small)	.06

*21-INCH MISCELLANEOUS

2M-21559	C.R.T. Outer coat contact	.18
41M-21584	H. Size extension shaft	.02
14C-20824	H. V. Cable assembly	.40
38A-21515	Anode retainer	.10
2C-21490	R.H. tube holding plate	.42
2C-21491	L.H. tube holding plate	.42
213-21466	Deflection yoke mounting brace	2.04
200-20109	Tube strap	.16
200-20976	Tube strap	.12
25M-19382	Rubber pad (4 used)	.10
3M-21497	Support rod	.16
15B-17278-8	C.R.T. socket and cable	.66
51A-21426	Iron core (L-30)	.10
16M-21499	Anti-pin-cushion magnet	.46

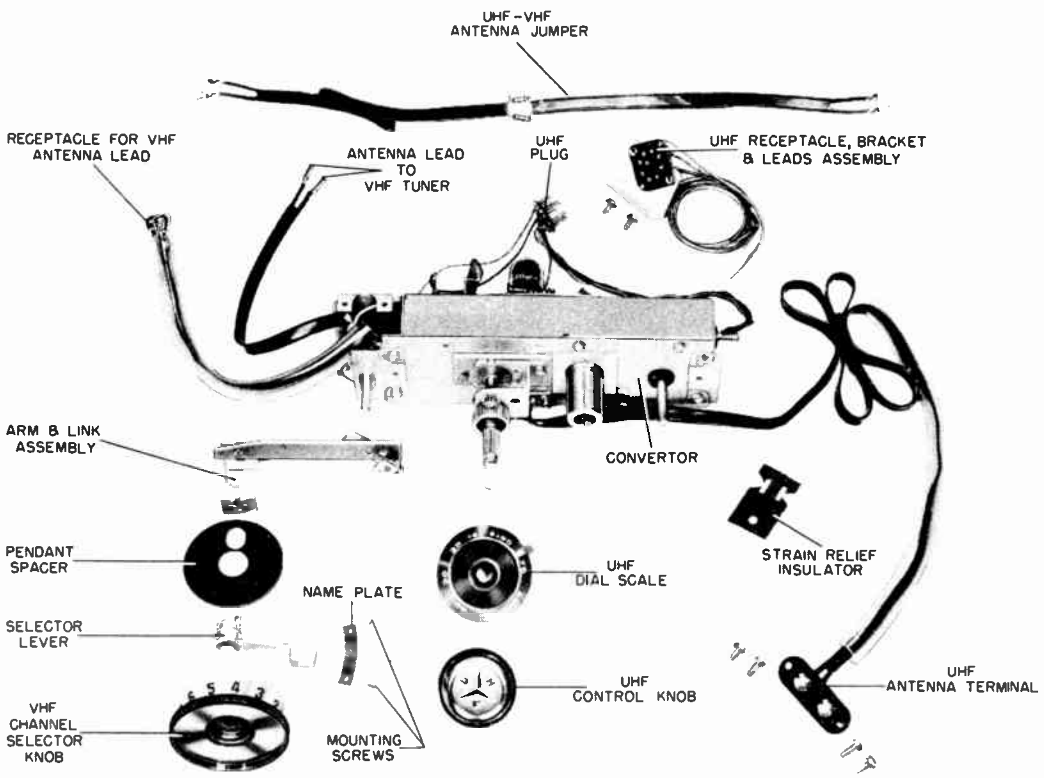
† NOTE: 17-inch Receivers Only.
*NOTE: 21-inch Receivers Only.

CABINET PARTS

25M-21638	Mask (3158)	3.36
25M-21637	Mask (3167-3168-3169)	4.96
30M-21645	Safety glass (3158)	3.90
30M-21647	Safety glass (3167-3168-3169)	6.82
5M-21562	Tuning dial	.40
2D-21582	Escutcheon mtg. bracket (2 used)	.06
56A6-12120	Screw for above (4 used)	.02
2M-21561	Escutcheon (3158-3167-3168)	2.62
2M-21897	Escutcheon (3169)	3.42
32E6-21634	Gold phillips head escutcheon screws (2 used)	.01
56B4-12347	Phillips head escutcheon screws (2 used)	.02
18A-21216	5" PM speaker (3158)	2.28
18A-21433	6" PM speaker (3168)	2.86
18A-21442	10" PM speaker (3167-3169)	4.50
5B-21581-A76	On-off volume knob (3158-3167-3168)	.22
5B-21581-A56	On-off volume knob (3169)	.22
5B-21574-A76	Tuning knob (3158-3167-3168)	.12
5B-21574-A56	Tuning knob (3169)	.12
5B-21273-29	Star knob (2 used)	.06
2M-21665	Switch lever	.82
200-21438-1	Cabinet back assembly (3158)	2.34
200-21578	Cabinet back assembly (3167-3168-3169)	2.76
201-20237-2	TV built-in antenna	1.06
5B-18382-36	Antenna knob	.16

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

MODEL TC-101 SUPER-STRATA-TUNER



TYPICAL UHF CONVERTOR KIT (TK-19M SHOWN)

Part No. 68P730410

GENERAL INFORMATION

The Motorola Super Strata-Tuner is a two-tube UHF convertor which employs continuous tuning over all 70 of the UHF channels. This unit operates in conjunction with a VHF TV receiver as a double superheterodyne, using the RF stage of the VHF tuner as the 1st IF stage. The Super Strata-Tuner is available as a self-contained convertor, in kit form for installation in designated Motorola TV chassis, or factory-installed in Motorola receivers.

SELF-CONTAINED CONVERTOR

The self-contained UHF convertor has its own built-in power supply, and is housed in a wooden cabinet. It may be connected externally to any VHF TV receiver. The convertor models are:

Model	Cabinet Finish	Tuner
TC-101	Mahogany	TT-19
TC-101B	Limed oak	TT-19

CONVERTOR KITS

The UHF convertor kits are designed for installation in all Motorola TV receivers having UHF cut-out cover plates on the front panels of the cabinets. VHF chassis designed for installation of UHF convertor kits are listed in Chart I.

CHART I

UHF KIT		INSTALL IN MOTOROLA TV CHASSIS		CONVERTOR DESCRIPTION					
MODEL	BASIC TUNER	SERIES FILAMENTS	PARALLEL FILAMENTS	FILAMENT TRANSFORMER INCLUDED	TONE CONTROL ON UHF TUNER	CONNECTION TO TV CHASSIS	TUNING SHAFT LENGTH	COLOR OF VHF CHANNEL KNOB INCLUDED	COLOR OF UHF DIAL & KNOB INCLUDED
TK-17M	TT-28M		TS-214	Yes (discard)	No	Soldered	2 5/8"	—	(See Note 2)
			TS-228	Yes (discard)	No	Soldered	2 5/8"	—	(See Note 2)
			TS-236	Yes (discard)	No	Soldered	2 5/8"	—	(See Note 2)
			TS-307	Yes (discard)	No	Soldered	2 5/8"	—	(See Note 2)
		TS-314		Yes (use)	No	Soldered	2 5/8"	—	(See Note 2)
		TS-315		Yes (use)	No	Soldered	2 5/8"	—	(See Note 2)
VTK-17M	VTT-28M		TS-351	Yes (discard)	Yes	Soldered	2 5/8"	—	(See Note 2)
			TS-401	Yes (discard)	Yes	Soldered	2 5/8"	—	(See Note 2)
			TS-395	Yes (discard)	Yes	Soldered	2 5/8"	—	(See Note 2)
		TS-325		Yes (use)	Yes	Soldered	2 5/8"	—	(See Note 2)
		TS-326		Yes (use)	Yes	Soldered	2 5/8"	—	(See Note 2)
		TS-400		Yes (use)	Yes	Soldered	2 5/8"	—	(See Note 2)
VTK-17ME	VTT-28M	TS-325		Yes (discord)	Yes	Soldered	2 5/8"	—	(See Note 3)
		TS-400		Yes (discard)	Yes	Soldered	2 5/8"	—	(See Note 3)
TK-19M	TT-52M		TS-292	No	Yes	Plug-in. (See Note 1)	2 13/16"	Brown	Brown
			WTS-292	No	Yes	Plug-in (See Note 1)	2 13/16"	Brown	Brown
			TS-324	No	Yes	Plug-in (See Note 1)	2 13/16"	Brown	Brown
			WTS-324	No	Yes	Plug-in (See Note 1)	2 13/16"	Brown	Brown
			TS-408	No	Yes	Plug-in (See Note 1)	2 13/16"	Brown	Brown
TK-19ME	TT-52M		TS-292	No	Yes	Plug-in	2 13/16"	Black	Black
			TS-408	No	Yes	Plug-in	2 13/16"	Black	Black
TK-20M	TT-57M	TS-410		Yes	No	Plug-in	2 13/16"	Brown	Brown
TK-22M	TT-27M		TS-119C1,	No	No	Soldered	2 5/8"	—	(See Note 4)
			TS-119D	No	No	Soldered	2 5/8"	—	(See Note 4)
TK-23M	TT-31M	TS-216		Yes	No	Soldered	2 1/8"	—	(See Note 2)
		TS-275		Yes	No	Soldered	2 1/8"	—	(See Note 2)
TK-24M	TT-35M		TS-501	No	No	Plug-in	3 19/32"	Brown	Brown
TK-24ME	TT-35M		TS-501	No	No	Plug-in	3 19/32"	Black	Black
TK-31M	VTT-58M	VTS-410		Yes	No	Plug-in	3 11/32"	Brown	Brown
TK-33M	TT-60M		VTS-292	No	Yes	Plug-in	3 11/32"	Brown	Brown

Note 1: Install receptacle if not in chassis.
Note 2: Gold dial with brown lettering and brown tuning knob. Early models—green dial and green tuning knob.
Note 3: Gold dial with black lettering and black tuning knob.
Note 4: Gold dial with brown lettering and green tuning knob.

The kits vary only by the addition of required hardware, knobs, and filament transformer. The transformer is included for installation of the convertor in series filament TV chassis. Kits TK-17M and VTK-17M, which are designed to cover early series and parallel filament chassis, include a filament transformer which is to be discarded when used in parallel filament TV chassis.

The UHF tuners used in the kits are basically the same and vary only in shaft lengths, mounting brackets, and the addition of a tone control. They receive their B+ and filament power from the VHF chassis.

If the VHF receiver contains a tone control, it is to be replaced, because of space limitations, with the tone control mounted on the appropriate UHF convertor tuner.

Late model TV chassis contain a receptacle for plugging in power connections to the UHF convertor, but early chassis require the convertor connections to be soldered.

Chart I lists convertor kits, the TV chassis with which they may be used, and differences between the convertors.

FACTORY-INSTALLED CONVERTORS

UHF tuners installed in the TV chassis at the factory are, in most cases, identical with the tuners listed in Chart I. The TV chassis containing factory-installed UHF tuners are designated with the suffix "Y". The "Y" version chassis is the same as the corresponding VHF TV chassis with the addition of UHF convertor. Use the VHF TV Service Manual for VHF parts and service information and this manual for UHF convertor information (i. e., TS-292Y UHF information would be found in this manual, while the VHF information would be found in the TS-292 Service Manual).

UHF tuners and the current TV chassis in which they are included from the factory are shown in Chart II.

TUNING RANGE - Channels 14 through 83 (470-890 mc)

CHART II

CHASSIS INSTALLED IN	UHF TUNER
TS-292Y	TT-52M
VTS-292Y	TT-60M
WTS-292Y	TT-52M
TS-324Y	TT-52M
TS-326Y	VTT-28M
TS-408Y	TT-52M
TS-410Y	TT-50M
VTS-410Y	TT-58M
TS-501Y	TT-35M

CONVERTOR OUTPUT FREQUENCY - Channels 5 or 6 (76 to 88 mc)

ANTENNA INPUT IMPEDANCE - 300 ohms.

POWER SUPPLY

1. Convertor - TC-101 117 volts, 60 cycle only
   Filament - 6.3V | B+ 120V
2. Kits (Series Filament Receivers)
   Filament - 6.3V (supplied by filament transformer with 117V 60 cycle primary) | Hi B+ 250 to 280V (from TV receiver)
3. Kits (Parallel Filament Receivers)
   Filament - 6.3V (from TV receiver) | Hi B+ 250 to 280V (from TV receiver)

TUBE COMPLEMENT

Ref. No.	Tube	Function
V-1	6AF4 or 6T4	UHF Oscillator (see Service Notes)
V-2	6BK7	Pre-amplifier
CR-1	CK-710 or equivalent	UHF Mixer Crystal

Discard the antenna jumper connection and connect each antenna to the proper input terminals when two outdoor antennas are being used.

In some areas where the VHF antenna and the jumper are used, it may be necessary to experiment with the length of the leads on the antenna jumper to get the best results.

The installation procedure for the outdoor UHF antenna will, in general, be the same as for the VHF antenna. The lead-in, however, should be the tubular, unshielded 300 ohm line instead of the ribbon type, as the latter attenuates UHF frequencies when damp. As the UHF antenna is more critical in setting up than the VHF, more care should be taken in properly positioning the antenna. Setting the UHF antenna toward the station will not necessarily give the best results, so check the area in order to deliver the maximum signal to the receiver.

When using the tubular lead, it is good practice to form a drainage loop before the lead enters the house, then punch a hole in the polyethylene at the low point. Unless this is done, the condensation formed inside the 300 ohm tubular line, may create a pool of water behind the television set.

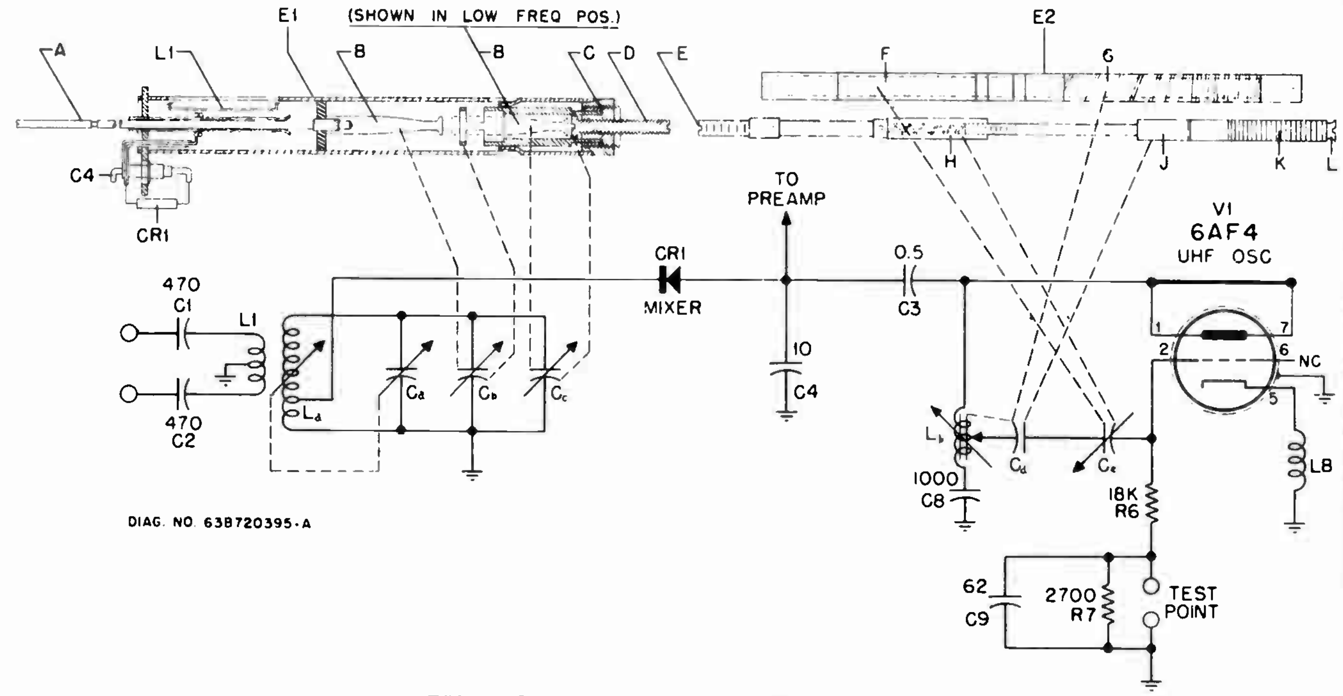


FIGURE 1. UHF TUNER FUNCTIONAL DIAGRAM

INSTALLATION & OPERATING INSTRUCTIONS

MODEL TC-101 SERIES - Refer to TC-101 Installation & Operating Instructions (Motorola Part No. 54P711714)

UHF CONVERTOR KITS - Refer to UHF convertor kit Installation & Operating Instructions (Motorola Part No. 68P720898)

ANTENNA

A separate, special antenna will normally be required for UHF reception.

The Motorola UHF "Bilt-In-Antenna" will give satisfactory UHF reception in "good signal" areas but, if you are located in a "fringe" or weak signal area, it is suggested that an outdoor antenna be used.

In some areas, an outdoor VHF antenna will be satisfactory for both UHF and VHF reception. If you are in such an area, a special jumper connection must be made between the VHF and UHF antenna terminals on the rear of your receiver. This jumper connection (furnished with the convertor) consists of a length of 300 ohm line, with a 150 ohm resistor in each lead.

If the outdoor antenna and antenna jumper connector are used for both VHF and UHF reception, the following precautions must be taken:

1. If the receiver is located in an area where there is a local UHF station and a fringe area VHF signal, connect the antenna to the VHF antenna terminals on the TV receiver (or TC-101 convertor).

2. If the receiver is located in an area where there is a local VHF station and a fringe area UHF signal, connect the antenna to the UHF antenna terminals on the TV receiver (or TC-101 convertor) instead of on the VHF side of the antenna jumper.

The above instructions will make it possible to use a single antenna for both UHF and VHF reception, but extreme caution must be taken when the antenna jumper is used, as this connector does result in a loss of signal. This signal loss cannot be tolerated if there is a very weak VHF signal as there might be too great a deterioration of the picture or, possibly, a complete loss of picture. In this case use separate outdoor antennas for UHF and VHF reception.

CIRCUIT DESCRIPTION

The UHF convertor was designed to operate as a double superheterodyne, in conjunction with a TV receiver, where the RF stage of the VHF tuner is used as the 1st IF. The UHF signal enters the convertor thru the antenna coupling RF coil, then it is loop-coupled to the transmission line, where a UHF mixer (losser type) crystal is tapped on. The incoming signal beats against the output of a series tuned Colpitts oscillator and the resultant frequency is either channel 5 or 6. The output of the crystal mixer is then amplified by a low-noise cascode amplifier and the amplified signal is coupled to the VHF receiver tuner.

The UHF signal enters a 300 ohm balanced input and is loop-coupled into the transmission line by L-1, which is inserted into a slot in the tubing.

Except for the power supply, all tuners are basically the same. The input is tuned by a capacity-loaded, shorted quarter-wave coaxial line. See £-1, Figures 1, 9 & 10. The tube wall, together with the rod & core assembly (A & B, Figure 1), form the inductance L_a. C_a is the distributed capacity between core (B) and the tube wall. As the core moves into the transmission line tube, the line is lengthened and its resonant frequency lowered. The line is capacity-loaded by C_b and C_c to keep the line from becoming too long. C_b, formed by the core (B) and the capacitor tuning, and C_c, formed by the core (B) and screw adjustment (D), are actually part of C_a but are adjusted to set C_a at a particular value at a particular frequency, i. e., C_c is the initial tracking adjustment at the low frequency end, while C_b is the initial mid-band adjustment. C_b is adjusted by threaded bushing (C).

A crystal mixer, CR-1, is tapped onto the transmission line, and the incoming signal beats against the output of a 6AF4 series-tuned, modified Colpitts oscillator. The difference frequency is either channel 5 or 6, depending upon which channel is unoccupied by a VHF station. The oscillator coil L_b consists of a glass coil form with a metallized covering (G, Figure 1) cut to form windings. In addition to the windings, there is also a solid metallized section (F) which, with core (H), form the tuning capacitor C_e. Core (J), in addition to tuning the inductance L_b, combines with the windings to form capacitor C_d. As its capacitance varies only slightly with the position of (J), C_d is effectively a fixed capacitor moving along the coil. Detuning slug (K), a series of copper rings, raises the resonant frequency of the unused portion of the inductance to keep its self-resonance higher than the operating frequency, thus preventing "suck-out" in the tuning range. (E) and (L) are high and low alignment adjustments, respectively.

The crystal, CR-1, is a losser type of mixer. Therefore, its output is fed to a 6BK7 cascode pre-amplifier which is used because of its good signal-to-noise ratio. It is a wide-band amplifier, passing both channel 5 and channel 6 carriers. The output of the pre-amp is 300 ohms balanced, and is coupled into the VHF receiver antenna terminals.

A two-position switch on the Built-In Supér Strata-Tuner allows the VHF antenna to be bypassed during UHF reception settings, while it bypasses the UHF antenna during VHF reception.

The two-position switch also controls the B+ supply. During UHF the B+ is approximately 260V, while during VHF the B+ supply is approximately 20V due to the 180,000 ohm dropping resistor (R-16). The low B+ is necessary to prevent deterioration of the UHF convertor tubes which would occur if no B+ were present while filament voltages were supplied to the tubes. The filaments are lit so that either UHF or VHF stations can be viewed without any "warm-up" period.

The switch on the TT-19 has a third position which acts as an on-off switch for both TV chassis and convertor when the TV receiver is plugged into an AC outlet on the back of the convertor.

Special Tools & Materials Required:

1. Antenna bushing adjusting tool - This adjusting tool can be made by filing off the edges of a 1/4" spintite so that the ridges fit into the slots on the antenna mid-frequency bushing.

2. Insulated screwdriver.

3. Hex alignment tool (3/32" hex - insulated) for iron cores (Motorola Part No. 66A891488).

4. Brass-iron tuning wand.

5. UHF plug and receptacle extension. Extension can be made up by soldering 28" lengths of wire between plug (Motorola Part No. 28K790063) and receptacle (Motorola Part No. 9K721371). See Figure 4.

ALIGNMENT

The built-in convertor chassis, as it is mounted in the TV chassis, does not have the adjustments readily accessible, therefore, the convertor must be removed from the main chassis.

The TT-19 (TC-101) must be removed from its cabinet for alignment.

Plug the convertors into the following sources of supply:

1. TT-19 into a 1:1 isolation transformer receiving 117V AC 60 cycle only.

2. Built-in convertors into a power supply having a B+ of 260V DC and a filament of 6.3V AC.

The B+ and filament voltages can be taken from the TV receiver by means of a plug and receptacle extension listed under "Special Tools Required for Alignment".

In convertors wired directly to the chassis (TT-27M, TT-28M, VTT-28M, and TT-31M), solder an extension to the B+, filament and ground leads.

As proper voltages are important for best alignment, use a variac if it is necessary to obtain 117 volt input.

On the TT-19, it is necessary to shunt a 330 ohm resistor across the "Dummy Load" input, as there is a possibility of standing waves appearing due to the long 300 ohm convertor output lead.

This alignment procedure will differ from those previously used in that it is necessary to adjust the high frequency oscillator and antenna adjustments before the IF can be aligned.

This alignment chart is laid out so that you can make a complete alignment by following all the steps in succession or you can align only one circuit by following the steps listed under the heading of the particular circuit you wish to align i.e., OSC steps #2 and #8.

Turn the selector switch to UHF (full clockwise position).

Connect the output of the UHF signal generator to the input of the UHF convertor (Figure 3).

Connect the output of the convertor to the input of the "Dummy Load". (Full details for construction of the dummy load can be found in Figure 5). Connect a sensitive microammeter to the output of the "Dummy Load" (Figure 3).

In order to properly align the UHF tuner, the following precautions should be taken:

1. Avoid turning the mid-frequency bushing and the low frequency slug in too far, as the high frequency plunger can strike it when the dial is fully counterclockwise.

2. The dial assembly must always stop due to the filled gear and not due to seating of the carriage or the slug on obstructions at either end of carriage travel.

3. Avoid spurious generator responses in the high frequency range. This can be detected by a marked difference in amplitude from the correct response.

4. Avoid making final adjustments with the UHF attenuator above 200K microvolts.

5. Use Figure 2 as a guide in aligning the set.

6. All electrical component references made in the alignment procedure refer to the UHF convertor.

Equipment Required:

1. UHF Signal Generator - Measurements Corp. Model M444, General Radio GR1021, or equivalent.

2. Microammeter - RCA-WV84, Simpson #374, or equivalent.

3. DC Meter - Low range electronic voltmeter (RCA voltohmyst junior or equivalent).

4. Power Supply

a. TC-101
117 volts 60 cycle only (thru isolation transformer)

b. Built-In Convertors

(1) B+ - 260 volts at 50 ma
(2) Fil - 6.3 volts at 0.675 amps

5. Dummy Load

6. Isolation Transformer

7. Variac

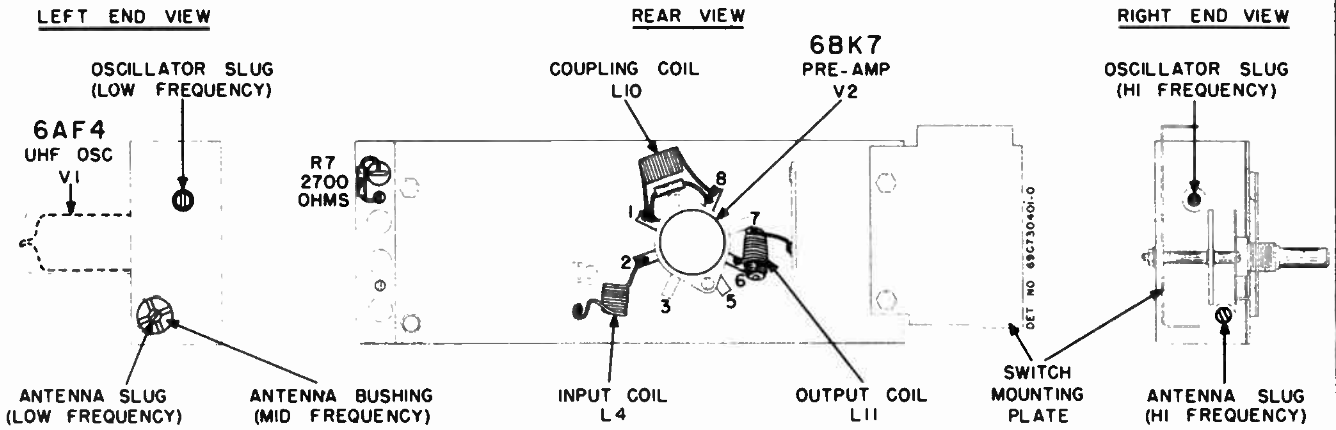


FIGURE 2. ALIGNMENT ADJUSTMENT LOCATIONS

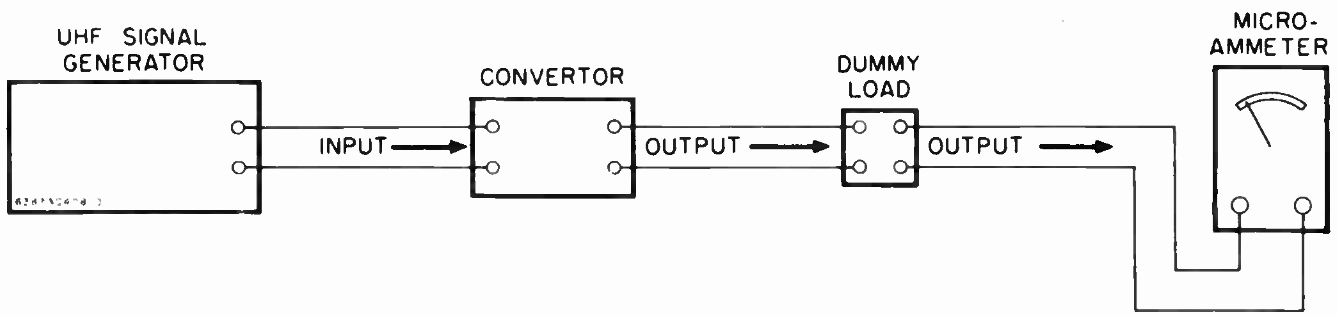


FIGURE 3. UHF TUNER ALIGNMENT CONNECTIONS

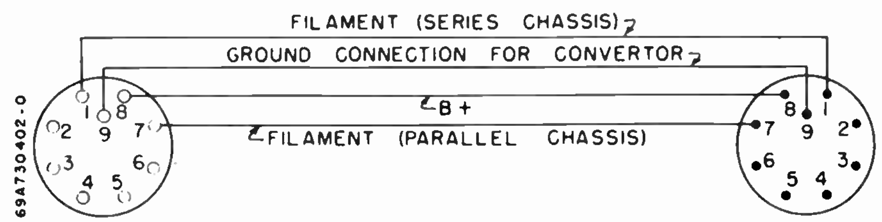


FIGURE 4. UHF PLUG & RECEPTACLE EXTENSION

ALIGNMENT CHART

STEP	UHF GEN. FREQ.	TURN UHF CHANNEL SELECTOR	MISCELLANEOUS INSTRUCTIONS AND CAUTIONS	ADJUST			CHECKS
				OSC.	ANT.	IF	
1.			1) Remove IF core from output coil (L-11). 2) It is absolutely necessary to complete steps #2 & #3 before attempting the IF alignment.				
2.	900 Mc.	Fully Clockwise.	1) Generator output should be set at a point where an approximate midscale reading is obtained on the Microammeter. 2) Avoid spurious responses found in this frequency range.	Hi-freq slug for maximum reading on Micro-ammeter.			
3.	900 Mc.	Fully Clockwise.	1) Avoid spurious responses found in this frequency range. 2) Make final adjustment with the generator attenuator set on or below 200K microvolts.		Hi-freq slug for maximum reading on Micro-ammeter.		
4.	900 Mc.	Fully Clockwise.	1) Re-insert IF Core. 2) It is absolutely necessary to have completed steps #2 & #3 before attempting the IF alignment.			Output coil (L-11) for maximum reading on Micro-ammeter.	
5.	900 Mc.	Fully Clockwise.	1) Use brass-iron wanding tool and spread and compress coils as wand indicates. 2) CAUTION: Do not move or dress IF components after alignment.			Input coil (L-4) for maximum reading on Microammeter.	
6.	900 Mc.	Fully Clockwise.	1) Use brass-iron wanding tool and spread and compress coils as wand indicates. 2) CAUTION: Do not move or dress IF components after alignment.			Coupling coil (L-10) for maximum reading on Micro-ammeter.	
7.							RE-CHECK steps #3 & #4 for maximum response on Micro-ammeter.
8.	528 Mc.	Fully counter-clockwise and then return exactly two turns clockwise.	1) Hold Hi-freq slug while adjusting the Lo-freq slug. 2) The dial assembly must always stop due to the filled gear and not due to the seating of the carriage or the slugs on some obstructions.	Lo-freq slug for maximum reading on Micro-ammeter.			
9.	Adjust for maximum reading on meter.	Fully counter-clockwise.					Reading must be obtained between 457 and 470 Mc.
10.		Slowly from full counter-clockwise to fully clockwise position.	1) Clip VTVM across 2700 ohm res (R-7). 2) Set VTVM on lowest DC voltage range. 3) Be sure cover is on and screwed down.				Observe that meter reading does not go below .3 volt (variation may be 2:1).
11.	Set generator to approximately 900 Mc. Vary gen freq for maximum reading on Microammeter.		1) Disconnect VTVM. 2) If maximum readings do not meet limits, repeat steps #2, 8, 10 & 11.				Peak Microammeter reading must occur at 896 Mc ±5 Mc.
12.	600 Mc.	Turn exactly 7½ turns counter-clockwise from fully clockwise position.					Vary for maximum reading on Micro-ammeter which should occur between 580 to 620 Mc.
13.	600 Mc.	Turn exactly 7½ turns counter-clockwise from fully clockwise position.	1) Use special tool for this adjustment. 2) Avoid turning slug too far as the Hi-freq plunger can strike it when the dial is fully counter-clockwise. 3) Avoid making any adjustments when the UHF Gen. attenuator is above 200K microvolts.		Mid-freq bushing for maximum reading on Micro-ammeter.		
14.	460 Mc.	Fully counter-clockwise.	Make certain that the mid-freq bushing does not turn.		Low-freq slug for maximum reading on Microammeter		

ALTERNATE ALIGNMENT

The Alternate Alignment Procedure is for use only in the event that a UHF signal generator is not available.

This alignment procedure uses a Standard Measurements Corporation Model 80 AM signal generator (or equivalent) and a vacuum tube voltmeter (RCA Voltohmyst or equivalent) instead of the UHF signal generator and the micro-ammeter. The same special tools, as described in the regular alignment procedure, are required.

In this procedure, the signal generator is connected to the input of the UHF convertor (UHF antenna terminal) through a matching resistor network. The output of the convertor (spade lugs on TC-101; antenna terminal pins on all built-in convertors) goes to the VHF TV receiver, where the VTVM records the response at the video detector load resistor.

In this alternate alignment, the accuracy of the signal generator is of utmost importance as 2nd and 3rd harmonics are used throughout the alignment (i.e., a signal generator that is 5 mc "off frequency" would be 15 mc "off frequency" on the 3rd harmonic).

It is suggested that the convertor be aligned under the same conditions that would exist during normal operation, therefore:

1. Align convertor with the same TV chassis in which convertor is to be used.

2. Align convertor on the same VHF channel (5 or 6) that will be used for UHF reception.

3. Align convertor using the same antenna lead lengths that are furnished with the convertor. This might necessitate using a convertor mounting platform in order to connect the convertor output 300 ohm antenna leads to the VHF tuner.

The built-in convertor chassis, as it is mounted in the TV chassis, does not have the adjustments readily accessible, therefore, the convertor must be removed from the main chassis.

The TT-19 (TC-101) must be removed from its cabinet for alignment.

Plug the convertors into the following sources of supply:

1. TT-19 into a 1:1 isolation transformer receiving 117V AC 60 cycle only.

2. Built-in convertors into a power supply having a B+ of 260V DC and a filament of 6.3V AC.

The B+ and filament voltages can be taken from the TV receiver by means of a plug and receptacle extension listed under "Special Tools Required for Alignment".

In convertors wired directly to the chassis (TT-27M, TT-28M, VTT-28M and TT-31M), solder an extension to the B+, filament and ground leads.

As proper voltages are important for best alignment, use a variac, if necessary, to obtain 117 volt input.

This alignment procedure will differ from those previously used in that it is necessary to make the high frequency oscillator and antenna adjustments before the IF can be aligned.

This alignment chart is laid out so that you can make a complete alignment by following all the steps in succession or you can align only one circuit by following the steps listed under the heading of the particular circuit you wish to align (i.e., OSC steps #1 and #7).

Turn the switch to UHF (full clockwise position).

Connect the output of the signal generator to the input of the UHF convertor through a matching resistor network. In the case of the Standard Measurements Model 80, which has an output impedance of 50 ohms, insert a 100 ohm resistor in series with the output terminal, and a 150 ohm resistor in series with the ground terminal.

Connect the VTVM across the video (2nd) detector load resistor using the lowest possible DC range on the VTVM.

In order to properly align the UHF tuner, the following precautions should be taken:

1. Avoid turning the antenna mid-frequency bushing and the low frequency slug in too far, as the high frequency plunger can strike it when the dial is fully counterclockwise.

2. The dial assembly must always stop due to the stop on the dial scale actuating gear and not due to seating of the carriage or the slug on obstructions at either end of carriage travel.

3. Avoid spurious generator responses in the high frequency range. This can be detected by a marked difference in amplitude from the correct response.

4. Avoid making final adjustments when the VTVM reading is more than 2 volts above zero signal.

5. Use Figure 2 as a guide in aligning the set.

6. All electrical component references made in the Alternate Alignment Procedure refer to the UHF convertor.

ALTERNATE ALIGNMENT CHART

STEP	GEN. FREQ.	TURN UHF CHANNEL SELECTOR	MISCELLANEOUS INSTRUCTIONS AND CAUTIONS	ADJUST OSC.	ADJUST ANT.	ADJUST IF	CHECKS
1.	300 Mc. (3rd harmonic)	Fully Clockwise.	1) Generator output should be set at a point where an approximate 2 volt reading is obtained on the VTVM. 2) Avoid spurious responses found in this frequency range. 3) Check to see that the gearing is also at maximum.	Hi-freq slug for maximum reading on VTVM.			
2.	300 Mc. (3rd harmonic)	Fully Clockwise.	1) Avoid spurious responses found in this frequency range. 2) Make final adjustment with a 2 volt (above zero signal level) VTVM reading.		Hi-freq slug for maximum reading on VTVM.		
3.	300 Mc. (3rd harmonic)	Fully Clockwise.	It is absolutely necessary to have completed steps #2 & #3 before attempting the IF alignment.			Output coil (L-11) for maximum reading on VTVM.	
4.	300 Mc. (3rd harmonic)	Fully Clockwise.	1) Use brass-iron wanding tool and spread and compress coils as wand indicates. 2) CAUTION: Do not move or dress IF components after alignment.			Input coil (L-4) for maximum reading on VTVM.	
5.	300 Mc. (3rd harmonic)	Fully Clockwise.	1) Use brass-iron wanding tool and spread and compress coils as wand indicates. 2) CAUTION: Do not move components after alignment.			Coupling coil (L-10) for maximum reading on VTVM.	
6.							RE-CHECK steps #2 & #3 for maximum response on VTVM.
7.	264 Mc. (2nd harmonic)	Fully counter-clockwise and then return exactly two turns clockwise.	1) Hold Hi-freq slug while adjusting the Lo-freq slug. 2) The dial assembly must always stop due to the seating of the filled gear and not due to the seating of the carriage or the slugs on some obstructions. 3) If more than 2 turns were required, it will be necessary to repeat steps #1 & #7. 4) See Service Note regarding oscillator slug.	Lo-freq slug for maximum reading on VTVM.			
8.	Adjust for maximum reading on meter.	Fully counter-clockwise.					Reading must be obtained between 228 and 235 Mc.
9.		Slowly from full counter-clockwise to fully clockwise position.	1) Remove VTVM from video detector load and clip across 2700 ohm res (R-7). 2) Set VTVM on lowest DC voltage range. 3) Be sure cover is on and screwed down.				Observe that meter reading does not go below .3 volt.
10.	300 Mc. (2nd harmonic)	Turn exactly 7½ turns counter-clockwise from fully clockwise position.	1) Replace VTVM to video detector load.				Vary for maximum reading on VTVM which should occur between 290 to 310 Mc.
11.	300 Mc. (2nd harmonic)	Turn exactly 7½ turns counter-clockwise from fully clockwise position.	1) Use special tool for this adjustment. 2) Avoid turning slug too far as the Hi-freq plunger can strike it when the dial is fully counter-clockwise. 3) Avoid making any adjustments when VTVM reading is more than 2 volts above zero signal level.		Mid-freq bushing for maximum reading on VTVM.		
12.	230 Mc. (2nd harmonic)	Fully counter-clockwise.	Make certain that the mid-freq bushing does not turn.		Low-freq slug for maximum reading on VTVM.		

DUMMY LOAD INSTRUCTIONS

The dummy load, a necessity for proper UHF convertor alignment, can be constructed by the serviceman in a short time. All parts should be assembled onto a piece of plastic or bakelite. The schematic (Figure 5) gives a circuit description and lists all parts, electrical and mechanical, necessary for completion of the dummy load.

THE SUGGESTED CONSTRUCTION PROCEDURE IS LISTED BELOW:

1. Put sleeving over antenna impedance matching transformer and twist transformer leads as shown in schematic (Figure 5).

2. Wind 9 turns of #16 enameled wire on 1/4" diameter coil form approximately 1/2" from either end.

3. Remove enamel from both ends of wound coil and also from second turn on coil (Figure 5).

4. Insert core mounting nut and core into coil form so that iron core is capable of cutting across all 9 turns of wire.

5. Solder all connections, remembering to keep all leads, with the exception of the crystal leads, as short as possible. (Figure 5).

6. Add a length of wire to C so that a ground connection can be made to the convertor chassis.

DUMMY LOAD ALIGNMENT INSTRUCTIONS

1. Connect a Standard Measurements Corp. Model 80 signal generator (or equivalent) to dummy load input terminal strip, matching the generator to the receiver with a resistor network. In the case of a generator with a 50 ohm output impedance, insert a 100 ohm resistor in series with the output terminal, and a 150 ohm resistor in series with the ground terminal.

2. Connect sensitive microammeter (Simpson 374 or equivalent) to output terminals of dummy load.

3. Set signal generator to 84 mc.

4. Adjust L iron core for a maximum reading on the microammeter (on X-1 scale).

5. Reduce output of signal generator output as resonance is reached.

6. Check dummy load bandwidth as follows:

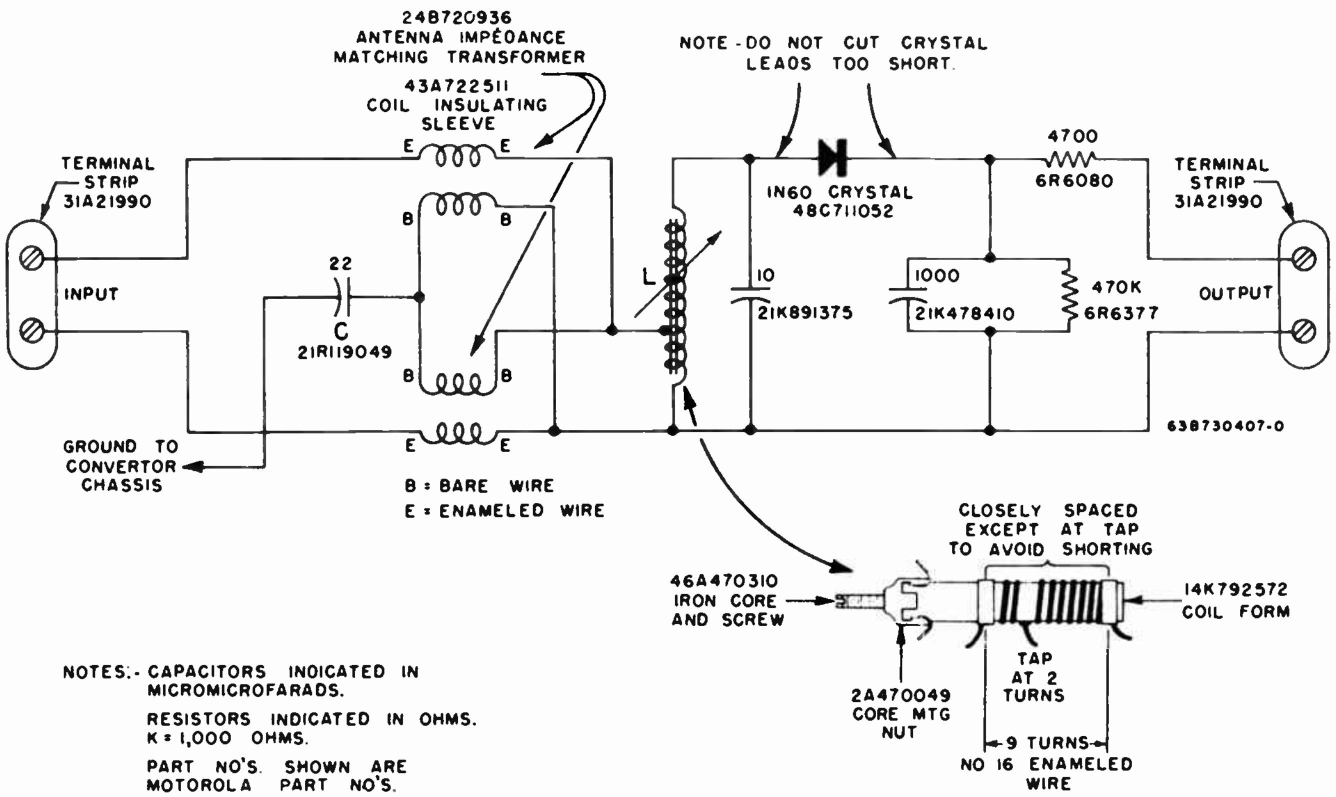
a. Set signal generator frequency to 84 mc.

b. Set output of signal generator to read 100 microamps on microammeter.

c. Lower frequency of signal generator until output reading drops to 70 microamps. Frequency should be in the range of 82 mc.

d. Raise frequency until the output reading drops to 70 microamps. Frequency should be in the range of 86 mc.

e. Relocate tap on coil L if frequency does not fall within the range in steps 3 or 4.



NOTES:- CAPACITORS INDICATED IN MICROMICROFARADS.
RESISTORS INDICATED IN OHMS.
K = 1,000 OHMS.
PART NO'S. SHOWN ARE MOTOROLA PART NO'S.

FIGURE 5. DUMMY LOAD SCHEMATIC DIAGRAM

SERVICE NOTES

Trouble	Remedy
Weak signal -snowy	Replace 6AF4 tube, L-1 shorted; replace crystal; replace C-13; check alignment.
Weak signal (low frequency end won't reach 470 mc)	Replace 6AF4 tube; ribbon broken on oscillator pipe; alignment
IF goes into oscillation at 600 mc	Change crystal
IF goes into oscillation across dial	Change shorted crystal
Oscillator not functioning on upper half	Check C-8 (realign after replacing)
Sudden dip in oscillator grid voltage on low end	Blue lead from C-3 to plates of V-1 dressed too close to oscillator pipe
Meter reading is less than .3 volt on injection check. (Step 10 Alignment Chart or step 9 Alternate Alignment Chart)	Check R-6 and R-7
Change in frequency during repairs	L-6 and L-7 are not parallel; blue lead from C-3 to plates of V-1 has been moved; C-8, L-6, L-7, L-8 and the blue lead from C-3 to plates of V-1 are very critical and should not be moved indiscriminately.
Set does not cover frequency range	Replace 6AF4; if actuating gear assembly has been removed or replaced, a careful check of the frequency range is absolutely necessary.
Difficulty in aligning oscillator on low frequency end	If oscillator is very badly out of alignment, on low frequency slug adjustment, remove oscillator core and adjust separation between slugs to 1-15/16" before attempting alignment operation.

USE OF 6T4 TUBE AS SUBSTITUTE FOR 6AF4

When using a 6T4 tube as a substitute for 6AF4 tube, proceed as follows:

1. Cut off pin #6 from 6T4 tube.
2. Place shorting strap (Motorola Part No. 42A730014) across pins #1 and #7.
3. Never place a used strap across pins #1 and #7.

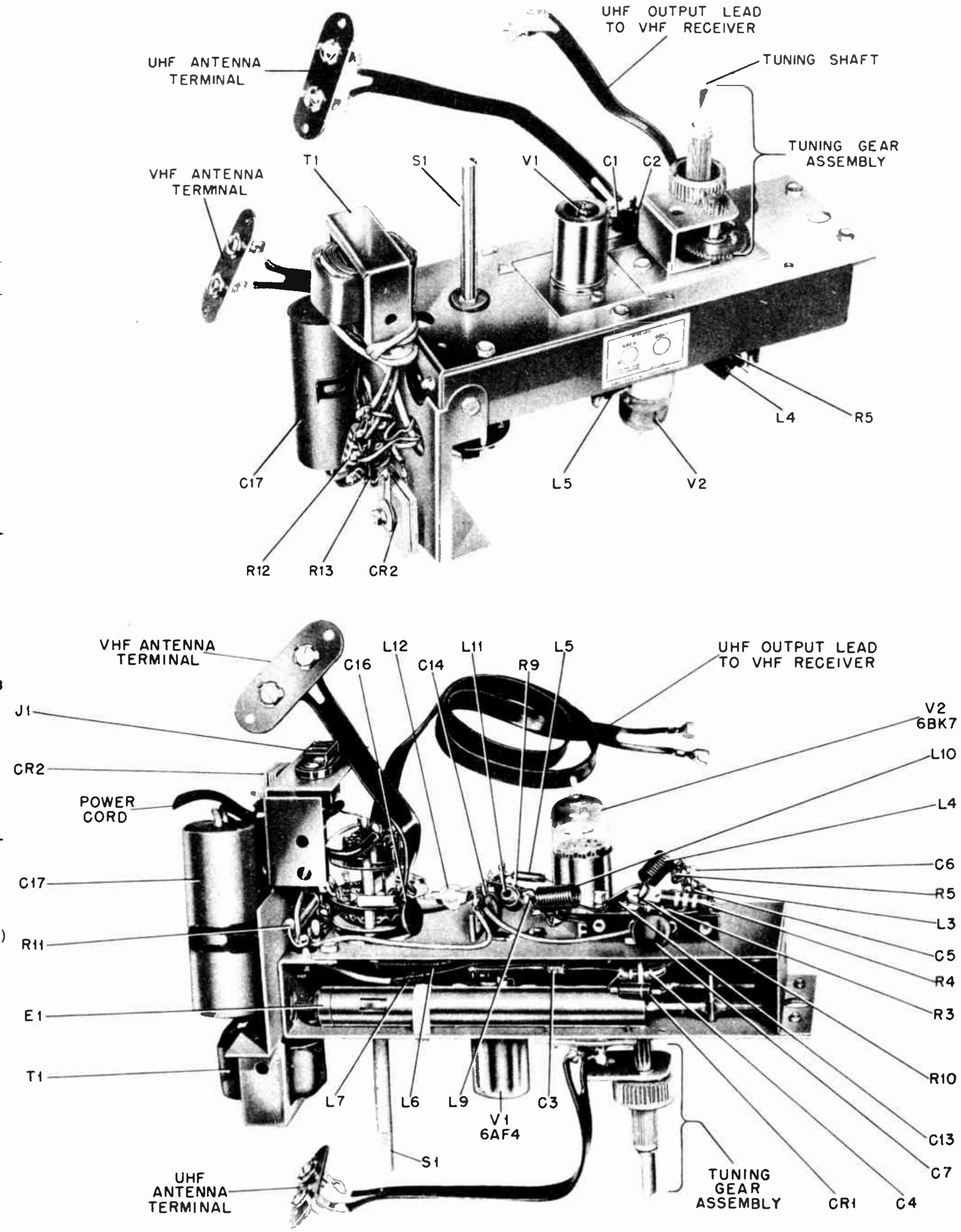


FIGURE 6. TT-19 PARTS LOCATION

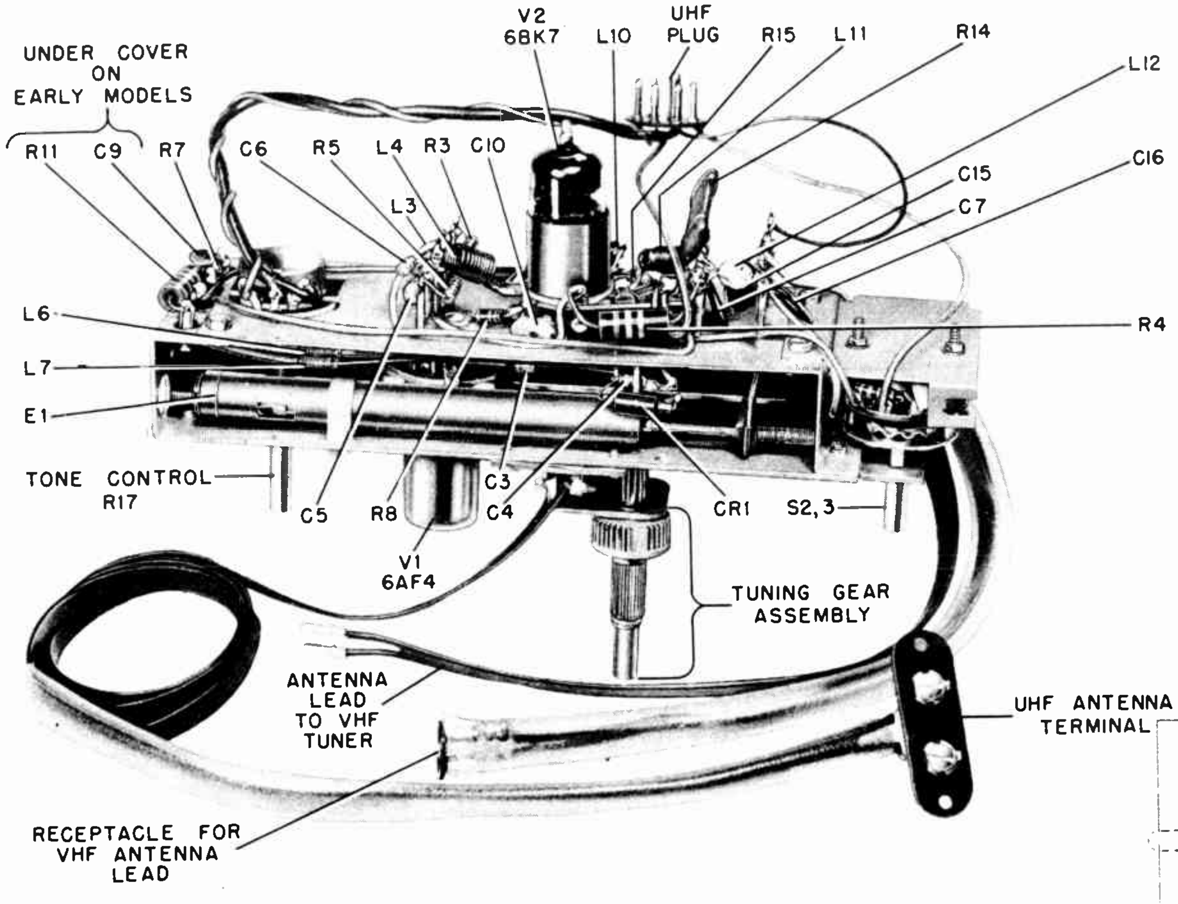


FIGURE 7.
TT-27M, VTT-28M, TT-28M, TT-31M, TT-35M, TT-50M, TT-52M, TT-57M, VTT-58M, TT-60M
PARTS LOCATIONS

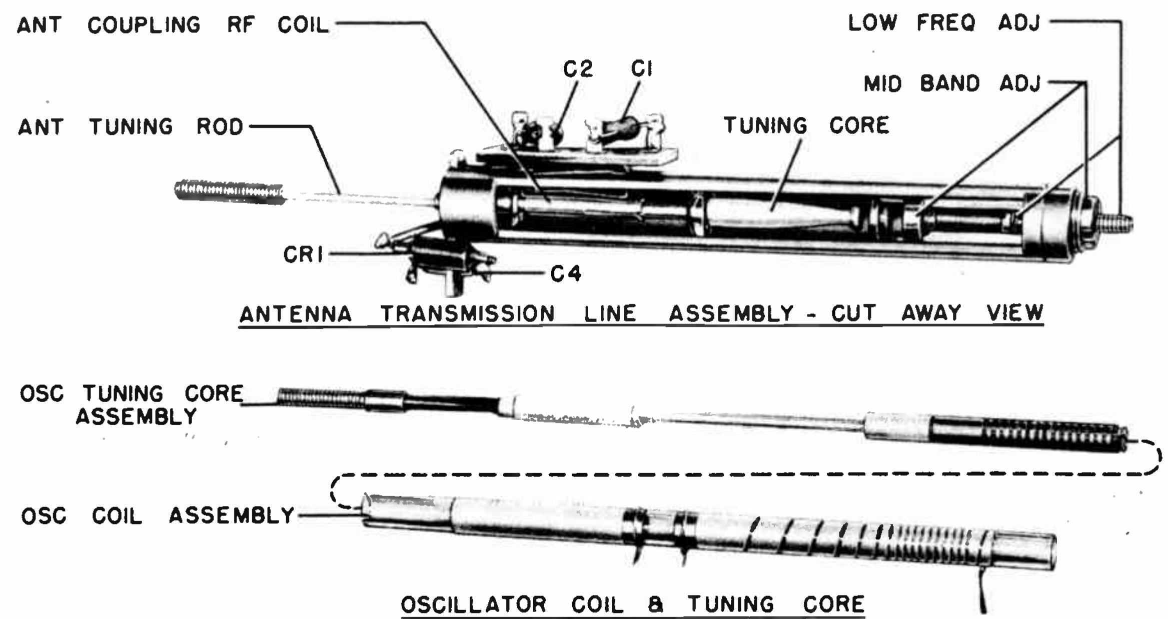
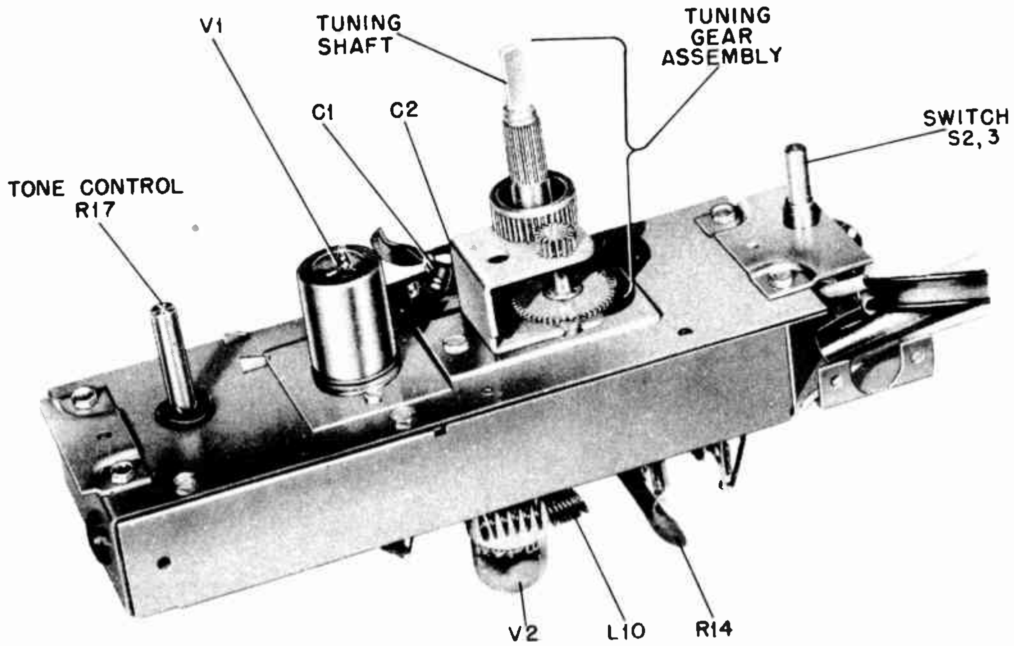


FIGURE 8. ANTENNA TRANSMISSION LINE AND OSCILLATOR TUNING CORE DETAIL



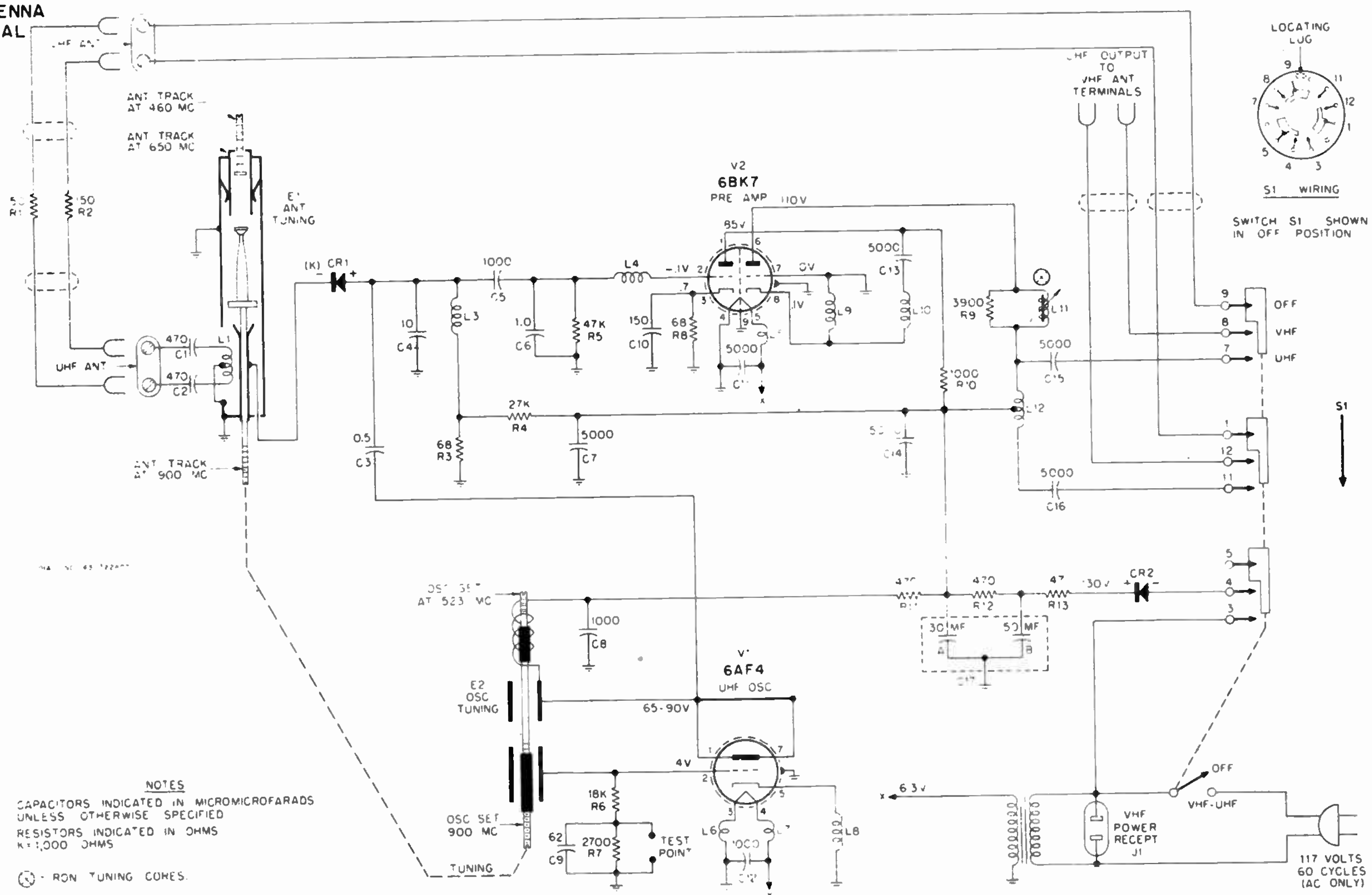


FIGURE 9. SCHEMATIC DIAGRAM TT-19

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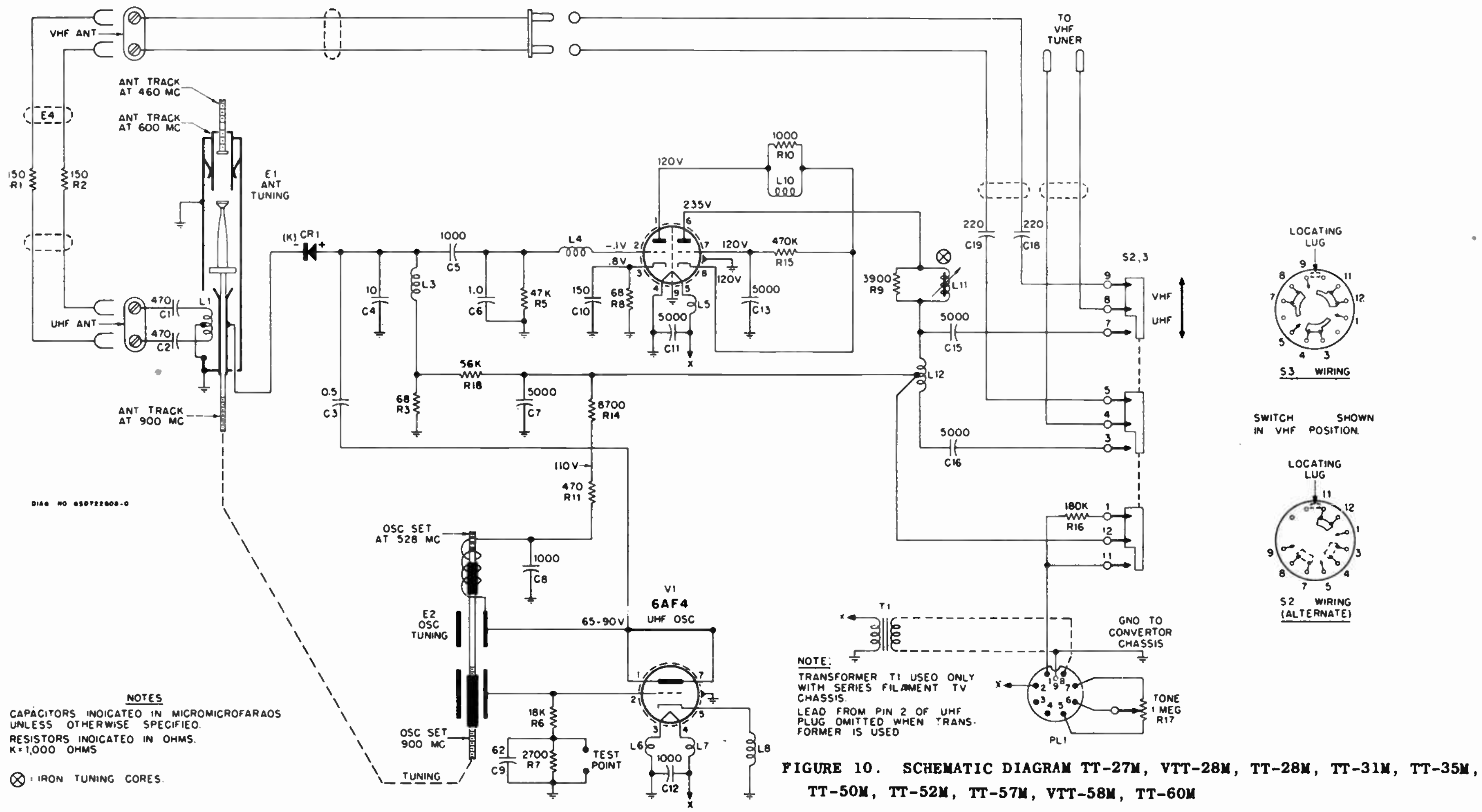


FIGURE 10. SCHEMATIC DIAGRAM TT-27M, VTT-28M, TT-28M, TT-31M, TT-35M, TT-50M, TT-52M, TT-57M, VTT-58M, TT-60M

PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

Ref. No.	Part Number	Description	List Price
CONVERTOR CHASSIS ELECTRICAL PARTS			
Capacitors			
C-1	21K400940	Ceramic tubular: 470 mmf 500V	.25
C-2	21K400940	Ceramic tubular: 470 mmf 500V	.25
C-3	21K83994	Molded phenolic: 0.5 mmf 500V	.10
C-4	21K721710	Ceramic feed-through: 10 mmf 500V (coded brown-black-brown on outer flange of eyelet)	.25
C-5	21K780599	Ceramic tubular: 1000 mmf 500V	.25
C-6	21R115957	Molded phenolic: 1.0 mmf 500V	.10
C-7	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-8	21A712386	Ceramic feed-through: 1000 mmf 500V (coded brown-black-red on outer flange of eyelet)	.25
C-9	21R410028	Ceramic disc: 62 mmf 500V	.25
C-10	21R400932	Ceramic disc: 150 mmf 750V	.25
C-11	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-12	21R115386	Ceramic disc: 1000 mmf 1000V	.25
C-13	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-14	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-15	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-16	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-17A, B	23K722536	Electrolytic: 30 mf 150V 50 mf 150V	2.90
C-18	21R115905	Ceramic disc: 220 mmf 500V	.25
C-19	21R115905	Ceramic disc: 220 mmf 500V	.25
Miscellaneous Electrical Parts			
CR-1	48B711922 or 48B711923 or 48K722456 or 48K722267	Crystal, UHF mixer	3.35
CR-2	48B791092	Rectifier, selenium: 160 ma.	1.80
E-1	1A711524	Antenna Transmission Line Assembly	2.85
E-2	24B711595	Oscillator coil: less tuning core listed below	1.80
	1A711455	Oscillator Core Assembly	1.40
E-3	1A720061	Cable, antenna jumper assembly: includes R-1, R-2, PL-1 & PL-2; 8" long (for use between UHF & VHF antenna terminals when only one antenna is used - TC-101)	.65
E-4	1K721910	Cable, antenna jumper assembly: includes R-1, R-2, PL-1 & PL-2; 26½" long (for use between UHF and VHF antenna terminals when only one antenna is used)	.70
Receptacle			
J-1	9A721182	Receptacle, power (AC supply for TV chassis)	.30
Coils			
L-1	24A711504	Antenna Coupling RF Coil	.30
L-3	24K712103	Compensating Coil: black dot	.45
L-4	24K721777	Input Coil	.10
L-5	24A711337	RF Choke	.45
L-6	24K712254	RF Choke	.45
L-7	24K712254	RF Choke	.45
L-8	24K721430	Cathode Choke Coil	.45
L-9	24K712103	Compensating Coil: black dot	.45
L-10	24K711474	Coupling Coil	.15
L-11	24K721778	Output Coil	.10
L-12	24A790033	Impedance Matching Coil	.80
Plug			
PL-1	28K790063	Plug, UHF: 9-prong	.20
Resistors			
		Note: All resistors are insulated carbon type unless otherwise specified.	
R-1	6R6373	150 10% 1/2W...doz	1.20
R-2	6R6373	150 10% 1/2W...doz	1.20
R-3	6R2039	68 10% 1/2W...doz	1.20
R-4	6R6427	27,000 10% 1W	.20
R-5	6R6056	47,000 20% 1/2W...doz	1.20
R-6	6R5591	18,000 10% 1/2W...doz	1.20
R-7	6R5577	2700 10% 1/2W...doz	1.20
R-8	6R2039	68 10% 1/2W...doz	1.20
R-9	6R5659	3900 10% 1/2W...doz	1.20
R-10	6R6229	1000 10% 1/2W...doz	1.20
R-11	6R3949	470 10% 1/2W (was 2200 2W in some tuners - use 470 when replacing)...doz	1.20
R-12	6R2010	470 10% 2W	.25
R-13	6R5550	47 10% 1/2W...doz	1.20
R-14	17K710950	8700 10% 3W: wire wound	.50
R-15	6R6377	470,000 10% 1/2W...doz	1.20
R-16	6R6444	180,000 10% 1/2W...doz	1.20
R-17	18K712161	Tone control: 1 meg	.75
R-18	6R5592	56,000 10% 2W	.25
Switches			
S-1	40B711556	Switch, 3-position (UHF-VHF-OFF) (TT-19 only)	2.55
S-2	40K721974	Switch, 2-position: 1-3/64" shaft; UHF-VHF selector	1.55
S-3	40B721975	Switch, 2-position: 2" shaft; UHF-VHF selector (TT-27M, TT-28M, VTT-28M only)	1.95
Transformer			
T-1	25K730003	Transformer, filament: 6.3V 0.7 amp	2.00

CONVERTOR CHASSIS MECHANICAL PARTS

Part Number	Description	List Price
7A711315	Bracket, tuner mtg: RH (TT-27M)	.05
7A711546	Bracket, tuner mtg: LH (TT-27M)	.25
7A721184	Bracket, tuner mtg: LH (TT-35M, TT-50M, TT-52M, TT-57M, VTT-58M, TT-60M)	.10

SUPPLEMENT NO. 1

Part Number	Description	List Price
7A721186	Bracket, tuner mtg: RH (TT-35M, VTT-35M, TT-50M, TT-52M, TT-57M, TT-58M, TT-60M)	.10
64A711813	Bracket, switch (TT-27M).......doz	.35
7A721798	Bracket, switch (TT-28M, VTT-28M, TT-31M).......................doz	.35
7A711432	Bracket, switch (TT-35M).......doz	.35
7B721188	Bracket, switch & shield (TT-50M, TT-52M, TT-57M, VTT-58M, TT-60M)...........................	.10
38K722748	Button, plug (covers adjustment hole on chassis cover)..........	.05
38K722472	Button, plug (tone control mtg hole cover on convertors without tone control).......................doz	.40
42A711430	Clamp, "U" (secures E-1).......doz	.15
42A75825	Clip, electrolytic mounting (TT-19 only).................doz	.60
30A470651	Cord, line & plug (TT-19 only)....	.75
46A711360	Core, iron (L-11).................	.10
15B711458	Cover, UHF chassis................	.20
44B711460	Gear, dial actuating: 1-3/32" long (TT-19, TT-27M, TT-28M)..........	.30
44K711461	Gear, dial actuating: 19/32" long (TT-31M)........................	.40
44K720990	Gear, dial actuating: 2-1/16" long (TT-35M)........................	.35
44K720991	Gear, dial actuating: 1-9/32" long (TT-50M, TT-52M, TT-57M)..........	.25
44K730046	Gear, dial actuating: 1-13/16" long (VTT-58M, TT-60M)...............	.25
11M120017	Grease, solidified (tuner lubricant)...........................	
5K792031	Grommet, insulating (for osc core).........................doz	.30
14A711553	Insulator, chassis mounting (TT-19 only)..........................	.50
14A690548	Insulator, control (TT-19 three-position switch)...............	.05
14A711335	Insulator, tuner mtg: LH (TT-28M, VTT-28M, TT-31M)................	.10
14A711506	Insulator, tuner mtg: RH (TT-28M, VTT-28M, TT-31M)................	.10
14K712339	Insulator, tone control..........	.05
2S7051	Nut, hex palnut: 3/8-32 x 9/16 (switch & tone control mounting).........................doz	.15
29K720994	Pin, antenna terminal (to VHF tuner).......................doz	.20
1A711864	Rack, pinion: with drive yoke brkt (for all except TT-31M)..........	.35
1A711911	Rack, pinion: with drive yoke brkt (TT-31M only)..................	.35
9B720103	Receptacle, VHF antenna plug...doz	.20
47A711450	Shaft, tuning: 2-1/8" long (TT-31M)........................	.55
47K711452	Shaft, tuning: 2-5/8" long (TT-19, TT-27M, TT-28M)..................	.55
47K720986	Shaft, tuning: 3-19/32" long (TT-35M)........................	.55
47K720988	Shaft, tuning: 2-13/16" long (TT-50M, TT-52M, TT-57M).................	.55
47K730044	Shaft, tuning: 3-11/32" long (VTT-58M, TT-60M)................	.55
26K722163	Shield, tube: round (V-1).........	.10
	Shield, tube: rectangular (V-1) Order 1 - 7A722161 & 1 - 26K722163 as replacement..................	
26A711336	Shield, tube (V-2)................	.10
9R119875	Socket, tube: miniature; 7-prong (V-1)...........................	.20
9R119880	Socket, tube: noval (V-2).........	.20

Part Number	Description	List Price
35A711438	Strip, drive mounting & insulating: phenolic (gear drive mtg)........	.10
31A711339	Strip, terminal (L-6 & L-7 mtg)...	.20
1A711512	Strip, terminal (L-1 mtg).........	.20
7A722161	Support, tube shield (for round V-1 shield).....................	.05
1B711852	Tuning Gear Assembly: complete; includes 2-5/8" tuning shaft, 1-3/32" dial actuating gear, shaft bearing bracket, pinion gear, rotor gear and drive (TT-19, TT-27M, TT-28M, VTT-28M).........	2.60
1B711909	Tuning Gear Assembly: complete; includes 2-1/8" tuning shaft, 19/32" dial actuating gear, shaft bearing bracket, pinion gear, rotor gear & drive (TT-31M)......	2.60
1K712033	Tuning Gear Assembly: complete; includes 3-19/32" tuning shaft, 2-1/16" dial actuating gear, shaft bearing bracket, pinion gear, rotor gear & drive (TT-35M)	2.60
1K721776	Tuning Gear Assembly: complete; includes 2-13/16" tuning shaft, 1-9/32" dial actuating gear, shaft bearing bracket, pinion gear, rotor gear & drive (TT-50M, TT-52M, TT-57M).........................	2.60
1K730047	Tuning Gear Assembly: complete; includes 3-11/32" tuning shaft, 1-13/16" dial actuating gear, shaft bearing bracket, pinion gear, rotor gear & drive (VTT-58M, TT-60M)...............	2.60
4A11722	Washer, "C" (control shaft & idler shaft retainer)..............doz	.20
4K711487	Washer, shoulder: fibre (tone control mtg)....................doz	.20
4K76598	Washer, spring (between dial actuating gear & brkt)........doz	.25
4K690571	Washer, shoulder: fibre (TT-19 sw mtg).....................doz	.20

MISCELLANEOUS MECHANICAL PARTS

The following parts are used with the kits indicated and also for receivers with factory built-in UHF convertors. Receivers with factory built-in UHF convertors are identified by a "Y" suffix following the model and chassis number. Knobs, and other parts directly connected with the UHF section of the "Y" version receiver are the same as listed in the appropriate convertor kit. Parts and service information for VHF section of "Y" version receivers will be found in the regular VHF service manual. (i.e., TS-292Y UHF information would be found in this manual, while the VHF information would be found in the TS-292 service manual).

Part Number	Description	List Price
1V721979	Arm & Link Assembly (UHF-VHF actuating assembly for all except TK-17M & VTK-17M)...........	.30
1V720456	Arm & Link Assembly (UHF-VHF actuating assembly for TK-17M, VTK-17M).........................	.30
34B711298	Dial scale, UHF: green; gold numerals (TK-17M, VTK-17M, TK-23M).........................	.90
34B711299	Dial scale, UHF: gold; brown numerals (TK-22M)...............	.90
34C720956	Dial scale, UHF: brown; gold numerals (TK-19M, TK-20M, TK-24M, VTK-24M, TK-31M, TK-33M).........	.45
34K720957	Dial scale, UHF: black; gold numerals (TK-19ME, TK-20ME, TK-24ME).........................	.45
34K730038	Dial scale, UHF: gold; black numerals (VTK-17ME).............	.90
34K730037	Dial scale, UHF: gold; brown numerals (TK-17M, VTK-17M, TK-23M).........................	.90
36B711296	Knob, control: UHF; green; gold lettering (TK-17M, VTK-17M, TK-23M)...........................	.35
36B711297	Knob, control: UHF; brown; gold lettering (TK-22M)..............	.75
36C720949	Knob, control: UHF; brown; gold lettering (TK-19M, TK-20M, TK-24M, VTK-24M, TK-31M, TK-33M).	.55
36K720953	Knob, control: UHF; black; gold lettering (TK-19ME, TK-20ME, TK-24ME).........................	.55
36K730040	Knob, control: UHF; black; gold lettering (VTK-17ME)............	.75
36K730039	Knob, control: UHF; brown; gold lettering (TC-101 & B, TK-17M, VTK-17M).......................	.75
36K722236	Knob, VHF channel selector: brown (TK-19M, TK-20M, VTK-24M) See*...	1.45
36K722237	Knob, VHF channel selector: black (TK-19ME) See*..................	1.45
36K722238	Knob, VHF channel selector: brown (TK-24M) See*..................	1.45
36K722691	Knob, VHF channel selector: black (TK-24ME) See*.................	1.45
36B721980	Lever, selector (UHF-VHF).........	.80
33A722098	Nameplate, UHF-VHF (on cabinet)...	.15
64A720048	Plate, filament transformer mtg...	.05
3S7491	Screw, drive: .060-32 x 3/16 pl rnd head (nameplate mtg)......doz	.15
43A722235	Spacer, pendant: fibre (light shield behind UHF-VHF selector lever) (TK-19M, TK-19ME, TK-20M, TK-20ME, TK-24M, TK-24ME, TK-31M, TK-33M)	.20
31A21990	Strip, antenna terminal: 2-screw (antenna input).................	.15
35A711408	Strip, strain relief (antenna lead-in)..........................doz	.15
64A722753	Strip, UHF antenna (UHF strip used in combination UHF-VHF built-in antennas).......................	.10
1V720408	UHF Receptacle Assembly: includes UHF receptacle & bracket (TK-19M only)...........................	.40

MODELS TC-101 & TC-101B CABINET PARTS

Part Number	Description	List Price
16E711535	Cabinet, UHF convertor: red-brn mahogany; less dial escutcheon (TC-101)...........................	9.50
16K711536	Cabinet, UHF convertor: limed oak, less dial escutcheon (TC-101B)...	9.50
1V722782	Cover, back (with receptacle insulator).........................	.30
13C711313	Escutcheon, dial..................	1.50
14A711552	Insulator, receptacle (on back cover)...........................	.05
36K711558	Knob, control (on-off)............	.20
36B711296	Knob, control (UHF tuning)........	.35
34C711312	Scale, dial.......................	.90

* Differ from original VHF channel selector knob by shallower scale to allow clearance for UHF-VHF selector lever.

GENERAL INFORMATION

This service manual contains a record of production changes, a parts list supplement for the above UHF convertors, additional service notes, and schematic diagrams.

SCHEMATIC CHANGES

Revise TT-27M, VTT-28M etc., schematic diagram (Figure 10) in Service Manual Part No. 68P730410, to show pin numbers on PL-1 reading in clockwise instead of counterclockwise direction. All other PL-1 connections to remain as shown on diagram. The diagram note referring to pin 2 now refers to pin 7.

PRODUCTION CHANGES

Chassis Coding	Change
TT-19A TT-27MA TT-28MA VTT-28MA TT-31MA TT-35MA TT-50MA TT-52MA TT-57MA TT-58MA VTT-58MA TT-60MA	19 mmf capacitor added between pin 2 of the 6AF4 tube and the oscillator pipe to prevent oscillator drift with warm-up. A special type tube socket is used with this change. The crystal was moved under C-4 to prevent its shorting against plug button.

ADDITIONAL SERVICE NOTES

The position of the UHF mixer crystal in the UHF convertor is very important in determining the sensitivity of the unit. You will find that moving the crystal, within its lead length, may result in very good or very poor reception; in some instances, there may even be a complete loss of picture due to crystal dressing. There is no particular position into which the crystal can be placed for maximum sensitivity. If the crystal has to be moved for sensitivity peaking purposes, an insulated alignment tool should be inserted through the opening which is exposed by removing the plug button directly over the crystal location. Indiscriminate moving of the crystal should be avoided once the maximum response has been attained.

When the UHF mixer crystal is changed, the UHF convertor must be completely realigned.

Sometimes improved sensitivity can be realized by dressing the crystal take-off lead (buss wire between the crystal and the antenna transmission line assembly) for maximum performance.

If fluctuations are noticed in the picture, check to see if the white lead (C-4 to junction of L-3, C-5) is dressed close to and cemented to the chassis. The convertor sensitivity is also affected by the dressing of this lead.

Maximum oscillator efficiency can be obtained by keeping the following in mind:

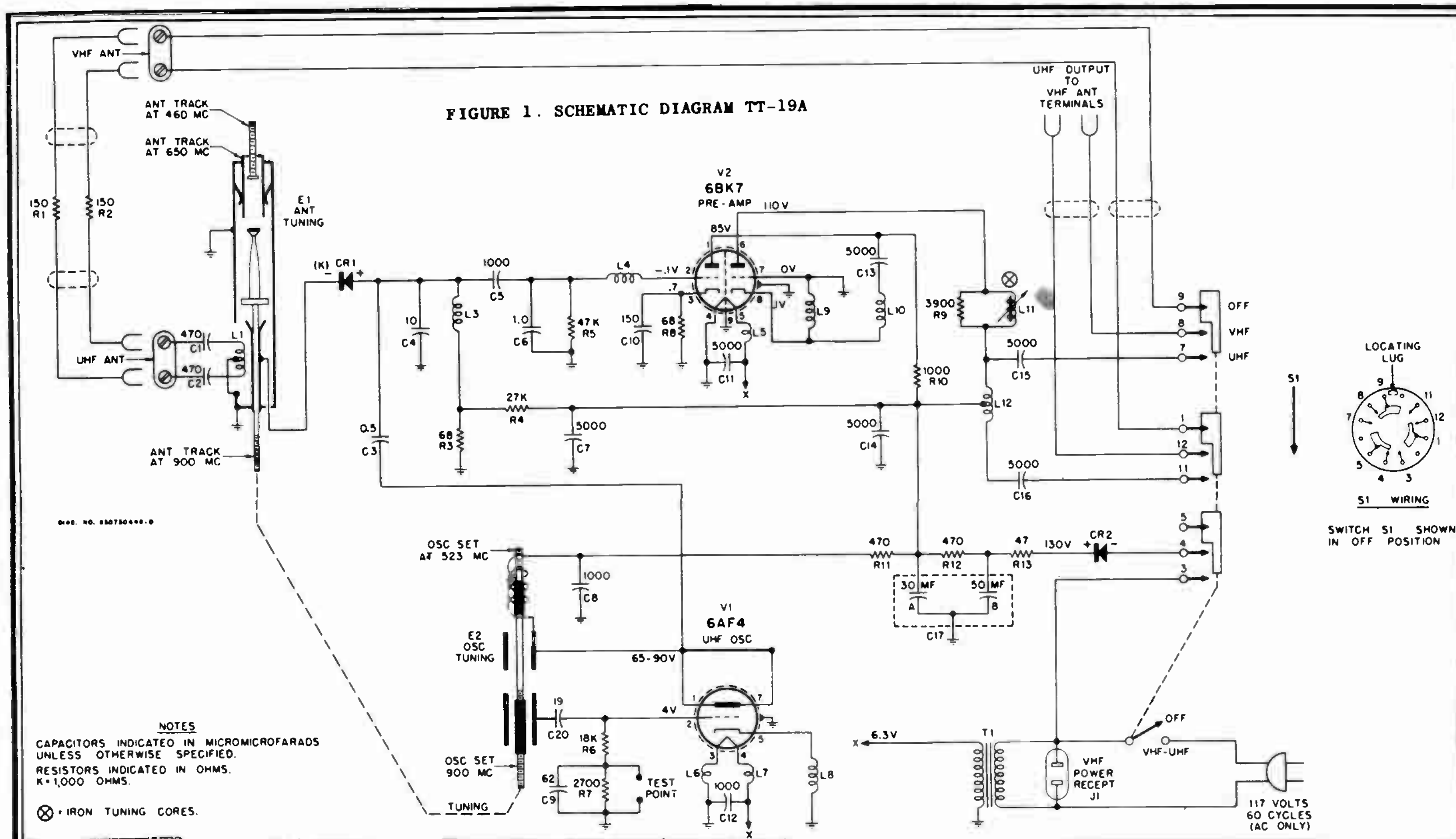
a. The blue lead from the oscillator plate coil to R-11 should be dressed close to the chassis and away from the oscillator pipe.

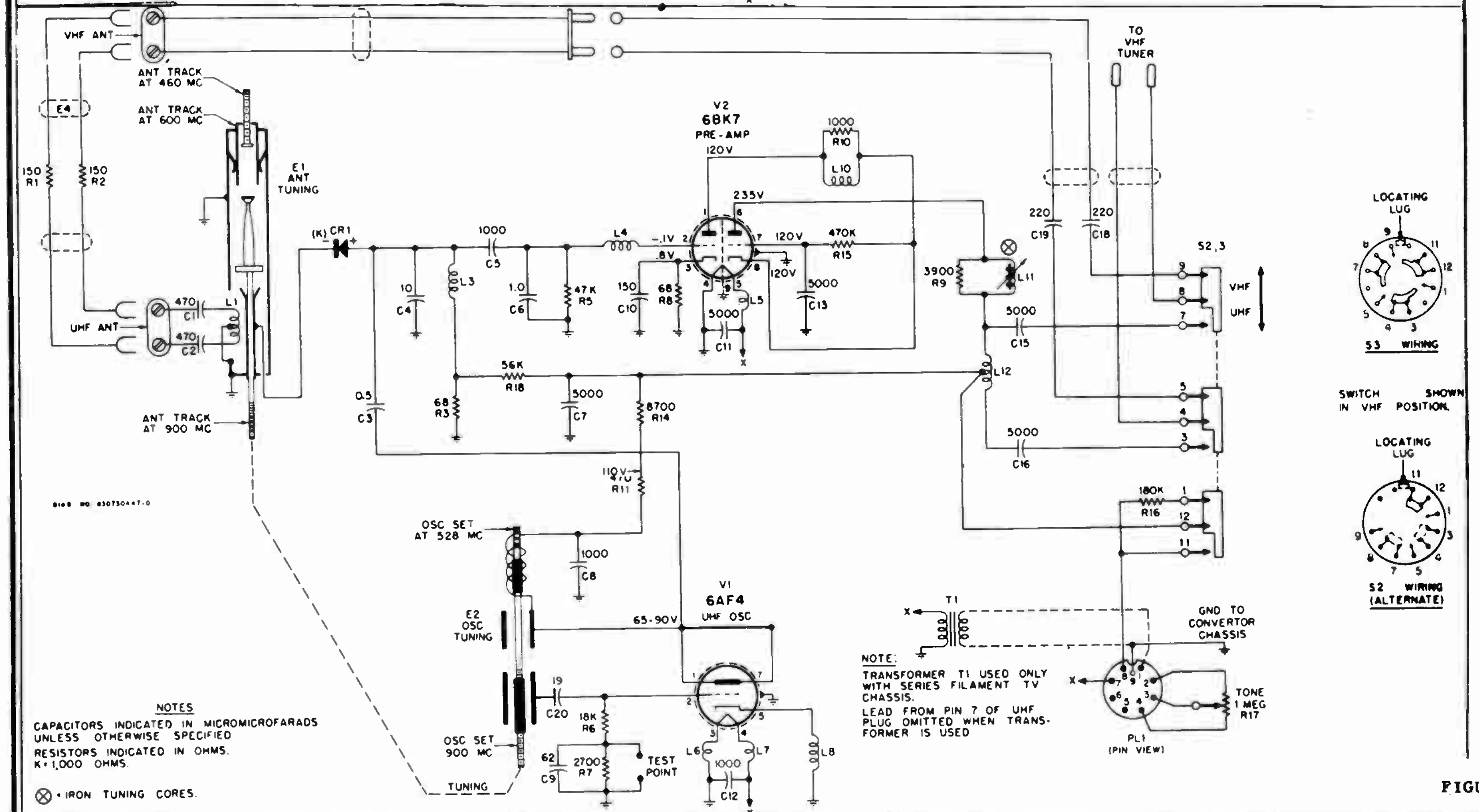
b. The injector capacitor (C-3) leads should be kept as short and straight as possible.

c. The 18,000 ohm resistor (R-6) should be dressed about 3/8" away from and parallel to the oscillator pipe.

d. The clear space on the oscillator pipe (between grid and plate sections) should be kept free of rosin and other foreign matter. Rosin or foreign matter on this clear space will cause a leakage, especially in humid areas.

FIGURE 1. SCHEMATIC DIAGRAM TT-19A





PARTS LIST SUPPLEMENT

NOTE:
When ordering parts, specify model number of convertor in addition to part number and description of part. The following parts are additions to, corrections and revisions of, the original items listed in the UHF Convertor Service Manual Part No. 68P730410.

Ref. No.	Part Number	Description	List Price
C-20	21A730056	Ceramic tubular capacitor: temperature compensating type; 19 mmf 450V NTC 4200 PPM..........	.30
	9R120404	Socket, tube: special miniature; 7-prong; #2 contact bent down and comes out between wafers (for V-1 in units having C-20).........	.20

Revise description for the following parts in the original service manual to read:

1V721979	Arm & Link Assembly (UHF-VHF actuating assembly for all except TK-17M, VTK-17M & TK-22M)....................	.30
36K721980	Lever, selector (UHF-VHF) (TK-17M, VTK-17M, VTK-17ME, TK-19M, TK-19ME, TK-20M, TK-22M, TK-23M)...........	.80

Ref. No.	Part Number	Description	List Price

The following parts should be entered in the original service manual:

85B722783	Antenna, built-in (UHF convertor).....................	.15
1V730950	Arm & Link Assembly (UHF-VHF actuating assembly -for TK-22M)..................	.30
42A730055	Clip, speed: built-in antenna mounting........doz	.25
36K721982	Lever, selector (UHF-VHF) (TK-24M, TK-24ME, TK-31M, TK-33M)..................	.85

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

FIGURE 2. SCHEMATIC DIAGRAM- TT-27MA, TT28MA, VTT-28MA, TT-31MA, TT-35MA, TT-50MA, TT-52MA, TT-57MA, TT-58MA, VTT-58MA, TT-60MA.

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MODEL 17F13C


MODEL 17K14C


MODEL 17K15C


MODEL 17K16C


MODEL 17T11C


MODEL 17T12C

RECEIVER MODEL BREAKDOWN CHART

Model	Description	Radio Chassis Used	Record Changer Used
17F13C	Combination, red-brn mahogany	HS-319	RC-40
17F13BC	Combination, limed oak	HS-319	RC-40
17K14C	Console, red-brn mahogany	-	-
17K14BC	Console, red-brn mahogany	-	-
17K14WC	Console, walnut	-	-
17K15C	Console, red-brn mahogany	-	-
17K15BC	Console, limed oak	-	-
17K16C	Console, white birch (with detachable legs)	-	-
17T11C	Table, walnut plastic	-	-
17T11EC	Table, ebony plastic	-	-
17T12C	Table, red-brn mahogany	-	-
17T12WC	Table, walnut	-	-

GENERAL INFORMATION

CHASSIS - Chassis TS-408A contains 17 tubes plus a 17" glass, rectangular, cylindrical face picture tube. The picture, sound, and scanning circuits, together with a selenium rectifier, full-wave doubler "B" supply, are contained on a single chassis. It employs the TT-44 cascode RF tuning unit and has a parallel heater circuit powered by means of a filament transformer. The channel selector knob is illuminated. Chassis TS-408A is similar to the TS-292A except for picture tube.

RADIO CHASSIS - Chassis HS-319 contains six tubes and receives AM broadcasts only. Except for a common speaker, it operates independently of the television receiver. Refer to HS-319 Service Manual for service data.

RECORD CHANGER - Three-speed Model RC-40. Refer to RC-40 Service Manual for service data.

TUNING RANGE - Channels 2 through 13 with provisions for UHF adaptation.

TV IF FREQUENCY - Sound - 21.9 mc
Picture - 26.4 mc

TV ANTENNA - "Bilt-In-Antenna" with provisions for connection of an external antenna.

TV ANTENNA INPUT IMPEDANCE - 300 ohms

POWER SUPPLY - 117 volts, 60 cycle AC only

TUBE COMPLEMENT

Ref. No.	Tube	Function
V-1	6BZ7	RF Amplifier
V-2	6U8	Mixer-Oscillator
V-3	6CB6	1st IF Amplifier
V-4	6CB6	2nd IF Amplifier
V-5	6CB6	3rd IF Amplifier
V-6	6AH6	Video Amplifier
V-7	6AU6	FM Driver
V-8	6AU6	FM Limiter
V-9	6AL5	Ratio Detector
V-10A	1/2 6SN7GT	1st Audio Amplifier
V-10B	1/2 6SN7GT	Phase Detector
V-11	6W6GT	Audio Output
V-12	6SN7GT	1st & 2nd Clippers
V-13A	1/2 12BH7	Vertical Blocking Oscillator
V-13B	1/2 12BH7	Vertical Output
V-14	6SN7GT	Horizontal Oscillator
V-15	6BQ6GT	Horizontal Output & High Voltage Generator
V-16	6AX4GT	Damping Diode
V-17	1B3GT	High Voltage Rectifier
V-18	17LP4	Picture Tube: rectangular; glass; electrostatic focus; cylindrical face

POWER CONSUMPTION - TV: 160 watts
RADIO & PHONO: 65 watts

HIGH VOLTAGE WARNING

Operation of this receiver outside its cabinet or with covers removed involves a shock hazard from the power supplies. No work should be attempted on this receiver by anyone not thoroughly familiar with the precautions necessary when working on high voltage equipment. Due to the full wave rectifier, there is always a potential difference between the chassis and earth and IT IS VERY IMPORTANT THAT AN ISOLATION TRANSFORMER BE USED WHEN SERVICING THE RECEIVER.

PICTURE TUBE HANDLING PRECAUTIONS

Extreme care must be used in handling the picture tube. This tube is highly evacuated and, due to its large size, is subjected to a considerable atmospheric pressure. The handler should wear safety goggles and gloves for protection. Avoid nicking or scratching the glass by rough contact with other objects. Before removing the coated glass picture tubes, discharge the capacitor formed by the inner and outer aquadag coatings on the tube by shorting the anode contact on the side of the tube to the outer surface with a well-insulated piece of wire.

INSTALLATION & OPERATING INSTRUCTIONS

ANTENNAS

These receivers are equipped with the Motorola "Bilt-In-Antenna", mounted inside the cabinet, for use in good signal areas.

The following precautions should be observed for best reception from the "Bilt-In-Antenna".

1. The signal should be relatively strong. As the signal strength will vary throughout the room in which the receiver is located, all possible locations should be tried, choosing the one in which the best pictures are received from all stations. Avoid large metallic objects such as radiators, metal panels, etc.

2. Lamps, vases and metallic objects, when placed on the receiver, may affect the efficiency of the "Bilt-In-Antenna".

If additional signal is necessary for good reception, an indoor or outdoor antenna may be required.

OPERATING CONTROLS

There is a dual control on the left and a triple control on the right of the receiver's front panel. See Figure 1 for control functions.

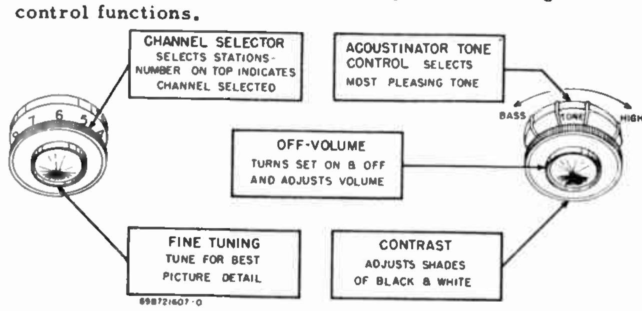


FIGURE 1. OPERATING CONTROLS

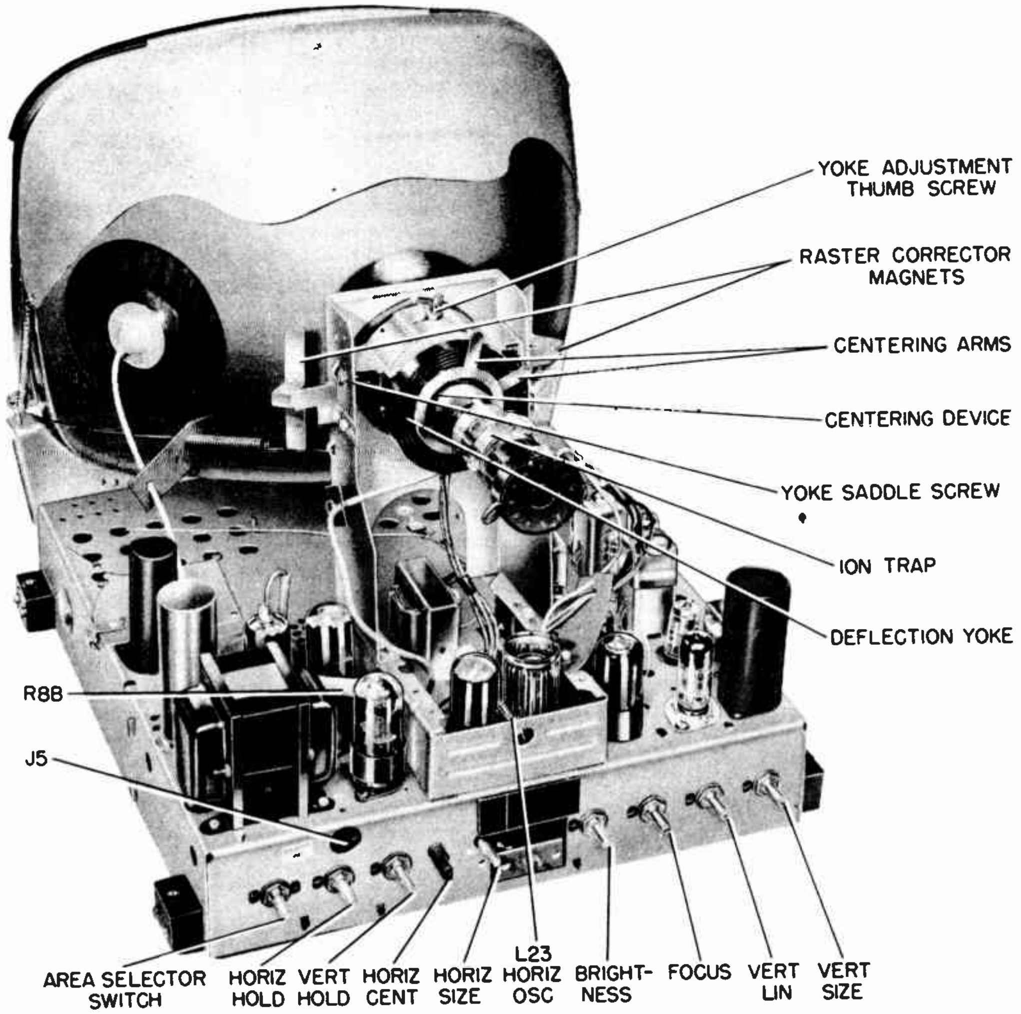


FIGURE 2. SERVICE ADJUSMENT CONTROLS

SERVICE ADJUSTMENTS

The receiver is completely adjusted at the factory, so normally none other than the front panel control operating instructions need be followed in putting the receiver in operation. However, to provide for misadjustment of the service controls due to handling, etc., the following instructions are in order. See Figure 2 for location of the service adjustment controls.

ADJUSTMENT OF THE ION TRAP

Under conditions of rough shipment, it is possible for the ion trap to become mis-adjusted. To prevent serious damage to the picture tube, the following method of adjustment should be used. See Figure 2.

Place the magnet on the neck of the tube so that it is positioned over the slash in the gun structure. (The slash is the separation between grids #1 and #2.) With the BRIGHTNESS control at low intensity, move the magnet a short distance forward and backward, at the same time rotating it, to obtain the brightest raster. If, in obtaining the brightest raster, the magnet has to be moved more than 1/2" forward from the slash, it is probably weak and should be replaced. Never correct for a shadowed raster with the ion trap magnet if such correction results in decreased brightness. The ion trap is always adjusted for maximum brightness and, if shadows occur at this setting, they should be eliminated by adjusting the magnetic centering device on the neck of the tube, or by changing the position of the yoke.

CAUTION: Keep the BRIGHTNESS control at low intensity until the ion trap is properly set.

CENTERING

NOTE: The ion trap should be properly adjusted before centering or focusing is attempted.

It is important, in achieving correct centering and good focus, that the magnetic centering device be properly adjusted. The centering device used with the electrostatically focused picture tube consists of two magnets arranged in such a way that the magnetic field intensity can be varied in angle or direction by means of the two projecting arms and by rotating the device about the tube neck. When the arms are superimposed, the fields of the two magnets cancel. Moving the arms progressively farther apart in a given direction, with respect to each other, will produce an increasing field intensity of a given polarity. If the arms are moved apart in the other direction, a field of opposite polarity will result. This controllable magnetic field, acting on the beam, normally provides a means of centering the picture vertically when the arms are initially at either side, and by rotation to a vertical arm position, it will also produce horizontal centering. Horizontal centering by means of the magnetic centering device should be held to a minimum because of the danger of defocusing and shadow.

To center the picture correctly, follow these steps:

1. Reduce the size of the picture so that all four edges are visible. Tune in a station; do not attempt centering with an uncontrolled raster.

2. Start with the magnetic centering device arms together and turned so they are horizontal. The device should be positioned as close to the yoke as possible without causing any part of it to slip inside the yoke opening.

3. Adjust the electrical horizontal centering control on the back of the chassis for best horizontal centering obtainable within the range of the control.

4. Separate the arms of the centering device in the proper direction to center the picture vertically.

5. If full horizontal centering was not obtained in step 3, complete the horizontal centering by slightly rotating the magnetic centering device as a unit one way or the other. It may then be necessary to readjust vertical centering by slightly changing the relative position of the arms.

6. Recheck adjustment of ion trap after centering is completed.

FOCUS

The zero focus type of electrostatically focused tube used in these chassis requires a fixed potential applied to the focusing anode which is supplied through the focus control potentiometer. This control, in effect, provides a means of compensating for differences in gun structure between tubes, but is far less critical in adjustment than was the focus control in the electromagnetically focused tubes. By carefully turning the control through its range, a point of adjustment will be found where optimum focus is obtained, but no misadjustment of the control will result in the extreme defocusing which resulted from the off-focus range in the control of electromagnetically focused tubes. In some tubes, the effect of the focus control is so slight as to lead the serviceman to believe that a fault exists in the circuit. The control should be adjusted to the point where the line structure is distinguishable over a 90% area of the screen.

Due to differences in gun structure between tubes mentioned above, it may be found that in some picture tubes better overall focus is obtained with the arms of the magnetic centering device pointing in a particular direction. If, after the magnetic centering device has been adjusted as in the paragraph on centering, good overall focus is not obtained, rotate the magnetic centering device 180° and repeat the centering procedure.

RASTER CORRECTOR MAGNETS

On chassis having a cylindrical face picture tube, there is a magnet on each side of the rear support bracket to straighten the raster sides, if necessary. They are correctly set at the factory but if moved in shipping or, if the yoke has been replaced, they may require readjustment. To do so:

1. Reduce raster size so that its sides are just visible.

2. Move corrector magnet forward or backward so that sides are straight.

VERTICAL HOLD

Adjust the VERTICAL HOLD control for the center of the vertical sync lock-in range.

VERTICAL SIZE AND VERTICAL LINEARITY

Adjust the VERTICAL SIZE control until the picture fills the mask vertically. Adjust the VERTICAL LINEARITY control for the best overall vertical linearity. Adjustment of the VERTICAL SIZE control may require a readjustment of the VERTICAL LINEARITY control and possibly of the VERTICAL HOLD control.

HORIZONTAL HOLD ADJUSTMENT

The HORIZONTAL HOLD control should have a sync range of approximately 50°. If the control is too critical, adjust as follows:

1. Shunt the HORIZONTAL OSCILLATOR coil L-23 to ground with a .25 mf 400V capacitor. This may be done with the chassis in the cabinet by placing the capacitor across the two-pin receptacle (J-5) located as shown in Figure 2.

2. With the HORIZONTAL CENTERING control, move the picture to the left so that the right edge of the raster can be seen, as viewed from the front of the set. Adjust the HORIZONTAL HOLD control for about 1/16" of sync pulse. (The sync pulse appears as a darker gray bar at the right edge of the blanking pulse. The blanking pulse is the gray bar at the right edge of the raster.)

3. Remove the .25 mf capacitor from across the HORIZONTAL OSCILLATOR coil.

4. Adjust the HORIZONTAL OSCILLATOR coil until the same amount of sync pulse can be seen as was noted in step 2.

HORIZONTAL SIZE

Adjust the HORIZONTAL SIZE control until the picture fills the mask horizontally. As this control also affects vertical size, it may be found necessary to readjust the VERTICAL SIZE control.

BRIGHTNESS

Adjust the BRIGHTNESS control, in combination with the CONTRAST control, for the most pleasing picture. Keep the brilliance as low as possible, to protect the fluorescent picture tube screen and to prevent poor picture detail.

DEFLECTION YOKE ADJUSTMENT

If the deflection yoke shifts, the picture will be tilted. To correct, loosen the thumbscrew on top of the deflection yoke and rotate yoke until the picture is straight. Before tightening the thumbscrew, make certain that the deflection yoke is as far forward as possible to prevent shadow.

If the yoke support and the picture tube have shifted in transit or, if for any reason, these parts have been removed and replaced, it is best to do a complete job of repositioning. See Figure 2. The picture tube should be mounted so that the front of the tube rests against the brackets on the front of the chassis. The clamp around the front of the tube should then be tightened. (NOTE: This applies only to the glass tubes. The position of the metal picture tubes is fixed by the front brackets.) The picture tube rear support bracket mounting screws should be loose enough to permit sliding the bracket forward until it fits snugly up against the flare of the tube. Loosen the yoke adjustment thumbscrew and yoke saddle screws and push the yoke up against the flare of the tube. CAUTION: Do not use force in sliding the bracket. If too much force is applied, a strain will be placed on the neck of the tube when the support bracket mounting screws are tightened, or the yoke may be forced out of position. The opening in the yoke should be concentric with the neck of the tube.

TEST RECEPTACLE

A three-pin receptacle, accessible from the side of the chassis (see J-4, Figures 4 & 11) is provided for checking sensitivity and AGC voltage. The video detector load resistor is connected to pin 3, the AGC line is brought out to pin 1, and pin 2 is grounded.

AREA SELECTOR SWITCH

A three-position AREA SELECTOR switch, located on the back of these chassis, permits them to be adapted to varying receiving conditions found in different localities. See Figure 2.

The LOCAL, SUBURBAN, and FRINGE positions correspond approximately with the settings required for strong, medium, or weak signals, respectively.

In the LOCAL position, AGC is applied to the RF amplifier, mixer, and the first two IF stages. In the SUBURBAN position, AGC is removed from the RF and mixer stages. In the FRINGE position, the AGC applied to the IF stages is reduced 50% and the video amp grid resistor is returned to ground to improve noise limiting.

Since the AREA SELECTOR switch allows the receiver to operate under best conditions for the signal strength at your location, an incorrect setting may give poor picture quality, instability, or a buzzing sound in the speaker. Set this switch in the position which gives the clearest and most stable picture.

TONE CONTROL LINKAGE SETTING

If, for any reason, it becomes necessary to replace the tone control linkage, the following procedure should be followed:

1. Set the tone control potentiometer at zero ohms (maximum counterclockwise).

2. Place the linkage over the TONE and CONTRAST-VOLUME shafts in such a manner that the arms and link are below the shafts.

3. Move the arms counterclockwise as far as possible and tighten the setscrew on the TONE control shaft.

4. After chassis has been replaced in cabinet, place the TONE control knob over the CONTRAST-VOLUME shaft so that the lettering is toward the top.

CHANGING OF TUBES

1. The power should be turned off when changing tubes.

2. Indiscriminate changing or interchanging of tubes should be avoided for the following reasons:

a. A change of IF or RF tubes or crystal detector can cause loss of sensitivity or poor picture quality. Check alignment and sensitivity.

b. A change of limiter or ratio detector tubes can cause distorted audio, buzz, or loss of audio sensitivity. Check audio alignment and sensitivity.

c. Changing horizontal oscillator tube can result in poor noise rejection or cause the horizontal hold control to be out of range. This may necessitate readjustment of the horizontal oscillator coil.

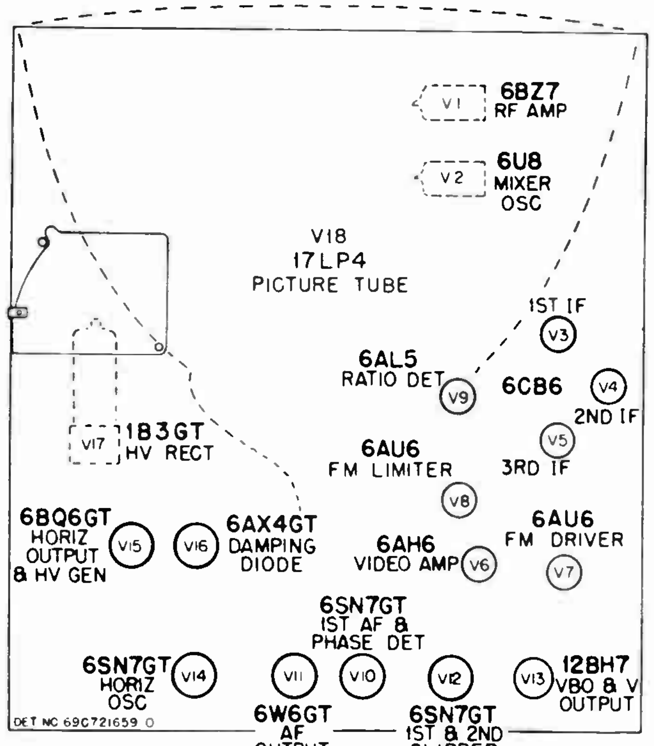


FIGURE 3. TUBE LOCATIONS

ORDER OF ALIGNMENT

A complete receiver alignment can be most conveniently performed in the following order:

1. IF & Mixer Transformers

2. Oscillator & RF Sections

3. 4.5 Mc Trap

4. Audio Take-Off, Interstage Coil, & Ratio Detector

IF AMPLIFIER ALIGNMENT

Equipment Required:

IF Sweep Generator meeting the following requirements:

1. 18 to 30 mc, approximately 12 mc sweep width.

2. Output constant and adjustable to at least 0.1 volt maximum.

3. Accurately calibrated, adjustable markers

Cathode Ray Oscilloscope - Preferably one with a calibrated attenuator.

AM Signal Generator - Adjustable Output

NOTE: If there is no built-in marker in the sweep generator, loosely couple the output of an accurately calibrated AM signal generator to the IF strip. At all times, keep the marker output low enough to prevent the marker from distorting the response curve.

If a wide band scope is used, the marker will be more distinct if a capacitor of 100 to 1000 mmf is placed across the scope input. Use the smallest size possible, since too large a value will affect the shape of the curve.

If necessary, use a variac to obtain input of 117 volts.

Procedure:

1. Remove the horizontal output tube, V-15, to eliminate RF interference in the oscilloscope.

2. By means of an external battery, apply a negative 3 volt bias, through a decoupling resistor of 47K ohms, to the AGC line, which is connected to pin 1 of the test receptacle (J-4). See Figure 4 for receptacle location.

3. Through a 47K ohm decoupling resistor, connect the oscilloscope across the video detector load resistor R-27 (4700) which may be reached from pin 3 of test receptacle (J-4). If a stronger output is required, connect the scope between picture tube cathode (yellow lead) and chassis. The curve seen at this position will be the reverse of the polarity shown in Figures 5 & 6.

4. Turn Area Selector Switch (S-2, Figure 2) to LOCAL position.

5. Using leads as short as possible, connect the sweep generator, through a 1000 mmf capacitor, to jack J-3, feeding into the grid of 1st IF tube V-3. See Figure 4. (Do not use the loose or "spraying" method of coupling.) Set the generator center frequency to 24.6 mc, with a sweep deviation of 10 mc.

6. Detune the oscillator by placing a shunt wire across the oscillator inductance (from position 2 to position 13 on the bandswitch).

7. Tune the 1st IF transformer, T-4, to place a 26.6 mc marker on the high side of the response curve 50% down from maximum response. At the same time, adjust T-6 to provide a flat top or symmetrical response curve. Tuning

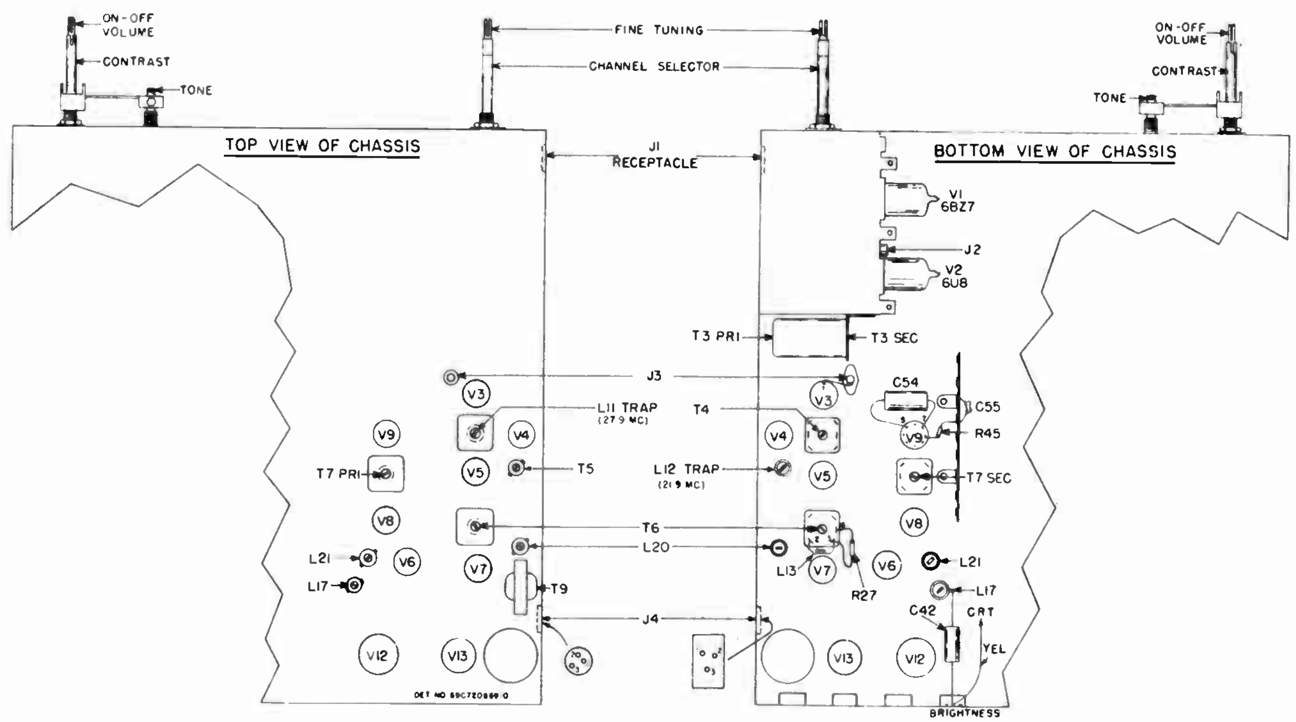


FIGURE 4. ALIGNMENT ADJUSTMENT LOCATIONS

ALIGNMENT

GENERAL

The chassis should be mounted on angle iron brackets so that all connections and adjustments may be made easily.

Since the power cord circuit is broken by the interlock when the cabinet back is removed, it will be necessary to obtain an extra power cord with the female interlock receptacle on it in order to make a power connection to the receiver. Order Motorola Part No. 30B470756.

It is important that an isolation transformer be used between the receiver and the line when any test equipment is attached to the chassis. Due to the full wave rectifier, there is always a potential difference between the chassis and earth, and it is very important that an isolation transformer be used when servicing the receiver. This precaution is especially important if grounded test equipment is used. NEVER GROUND THE RECEIVER CHASSIS DURING TESTING OPERATIONS OR INSTALLATION UNLESS AN ISOLATION TRANSFORMER IS USED.

As proper voltages are important for best alignment, use a variac if necessary to obtain 117 volt input.

the two transformers together will make for proper marker placement and "jacking" action of T-6. See Figure 5.

CAUTION: A. Keep the signal input low, to prevent flattening the top of the curve, due to limiting in the video or scope amplifiers.

B. The dressing of plate and grid components in the IF circuit affects tuning. Do not move indiscriminately.

C. The resonance point of the IF coils and the trap will be found at two settings of the core. The correct setting is the one with the core at the outer end of the winding.

8. Tune the 2nd IF transformer, T-5, to place a 22.8 mc marker on the low side of the response curve 50% down from maximum response. At the same time, adjust T-6 to provide a flat top or symmetrical response curve as in step 6. See Figure 5.

9. Tune trap L-12 for maximum attenuation on the curve at 21.9 mc, as in Figure 5. Make sure the core is toward the outside of the trap winding (toward the top).

10. Tune trap L-11 for maximum attenuation on the curve at 27.9 mc, as in Figure 5. Make sure the core is toward the outside of the trap winding (toward the top).

11. Move the generator and capacitor to jack J-2. See Figure 7. Short out R-11 (4700) located between the jack and the mixer grid.

12. Turn the primary and secondary of the mixer IF transformer, T-3 so that the bandpass appears as in Figure 6.

NOTE: This is a double-tuned circuit. Make sure the slugs are tuned away from the center of the coil.

NOTE: It is important that the 21.9 mc and 27.9 carriers are attenuated as much as shown in Figure 6. To calculate, connect an AM generator to the mixer grid and a VTVM across the detector load resistor. Take voltage readings at 21.9 mc, 24.6 mc, and 27.9 mc and divide per following formula: With proper attenuation -

$$\frac{\text{voltage reading at 24.6}}{\text{voltage reading at 21.9}} = \text{between 50 and 80}$$

and

$$\frac{\text{voltage reading at 24.6}}{\text{voltage reading at 27.9}} = \text{at least 100}$$

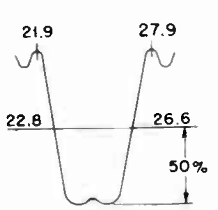


FIGURE 5.
IF RESPONSE CURVE

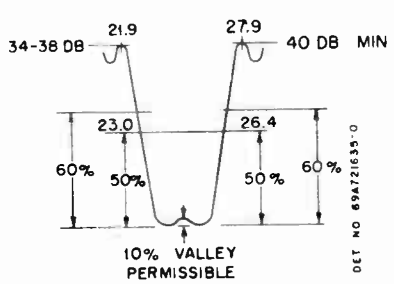


FIGURE 6.
MIXER RESPONSE CURVE

BANDWIDTH

The IF bandwidth may be checked with an AM signal generator, if desired. Connect the generator, through a 1000 mmf capacitor, to jack J-2 in the grid circuit of the mixer tube, V-2B, and an electronic voltmeter across the video detector load resistor R-27 (4700). Short out R-11 (4700), set the generator frequency to 24.6 mc, and adjust its output for a 1 volt reading on the meter. Double the output of the generator. Tune to both sides of 24.6 mc and note the frequencies at which the meter again reads 1 volt. These frequencies indicate the 6 db bandwidth points and should be 22.9 mc and 26.4 mc. By watching the meter while tuning slowly through the band, any serious peaks or holes in the response curve can be detected.

REGENERATION

After the mixer and IF stages have been aligned, a check for regeneration in the IF strip should be made as follows:

1. Remove the battery bias and observe the response curve on the scope as taken between the picture tube cathode (yellow lead) and chassis. The bandwidth may change with the bias removed, but should not change more than 0.2 mc. If the bandwidth does change more than 0.2 mc, check the cathode resistors or change tubes.

2. Set the contrast control at maximum gain (fully clockwise).

3. Decrease the generator input until the output signal shows a marked decrease.

4. Any regeneration present will be indicated by sharp peaks on the overall response curve.

NOTE: The oscillator should be detuned, as described above, during this procedure

CAUTION: Do not inject too much marker signal.

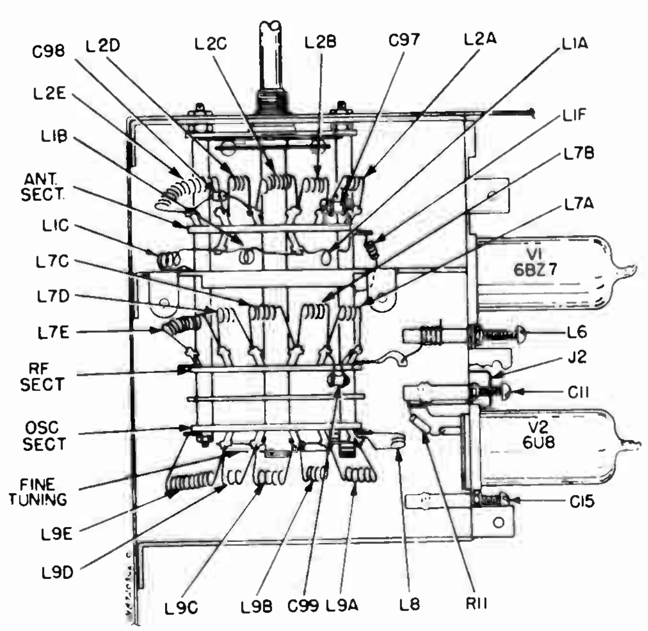


FIGURE 7. ANTENNA, RF & OSC LOCATIONS

MIXER SENSITIVITY MEASUREMENTS

1. Connect an AM signal generator, set at 24.6 mc, modulated 30% with 400 cycles, to jack J-2 through a capacitor of 1000 mmf. Short out R-11 (4700).

2. Remove the battery bias from the AGC line.

3. Remove shunt wire from oscillator.

4. Connect the oscilloscope to the cathode of the picture tube. Turn contrast control to maximum.

5. Turn the station selector switch to the low channel position which gives the lowest noise reading on the meter.

6. The signal required to produce 20 volts peak-to-peak on the scope should be less than 100 microvolts.

NOTE: To calibrate scope, connect it across the 6.3 volt filament supply. The peak-to-peak amplitude on the screen will then be approximately 18V (6.3 x 2.8).

IF SENSITIVITY MEASUREMENT

1. Move generator to jack J-3 feeding into the grid of the 1st IF tube (V-3, 6CB6).

2. Connect the electronic voltmeter, through a 100K decoupling resistor, across the video detector load resistor R-27 (4700).

3. The signal required to produce 1 volt on the voltmeter should be less than 750 microvolts.

ANTENNA, RF & OSCILLATOR ALIGNMENT

NOTE: The IF circuits must be aligned before the oscillator section can be properly phased.

Equipment Required:

Sweep generator having:

1. Frequency range 40-220 mc
2. 10 mc sweep width
3. Output constant and adjustable
4. Adjustable markers (markers should be calibrated occasionally by checking against an accurate signal generator).

AM Signal Generator having:

1. Frequency range 40-220 mc
2. Accurate frequency and attenuator calibration
3. 400 cycle, AM modulation

Oscilloscope: Preferably one with a calibrated input attenuator.

FREQUENCY CHART

Chan	Frequency	Picture	Sound	Oscillator
2	54-60	55.25	59.75	81.65
3	60-66	61.25	65.75	87.65
4	66-72	67.25	71.75	93.65
5	76-82	77.25	81.75	103.65
6	82-88	83.25	87.75	109.65
7	174-180	175.25	179.75	201.65
8	180-186	181.25	185.75	207.65
9	186-192	187.25	191.75	213.65
10	192-198	193.25	197.75	219.65
11	198-204	199.25	203.75	225.65
12	204-210	205.25	209.75	231.65
13	210-216	211.25	215.75	237.65

ANTENNA & RF ALIGNMENT PROCEDURE

1. Remove the horizontal output tube V-15, to eliminate RF interference in the oscilloscope. Connect a 5000 ohm 10 watt resistor between the red B+ bus and chassis to normalize the bus voltages.

2. Detune the oscillator by placing a shunt wire across the oscillator inductance (from position 2 to position 13 on the bandswitch).

3. Remove the antenna lead-in from the chassis, and connect the sweep generator to the antenna receptacle. Keep the leads from the generator to the socket short. Use internal markers or an accurately calibrated external signal generator for markers.

4. Connect the oscilloscope, through a decoupling resistor of 47K ohms to jack J-2 in the grid circuit of the mixer tube V-2B. See Figure 7.

5. Ground the AGC lead to the mixer and RF stages by moving the area selector switch to the suburban or fringe position.

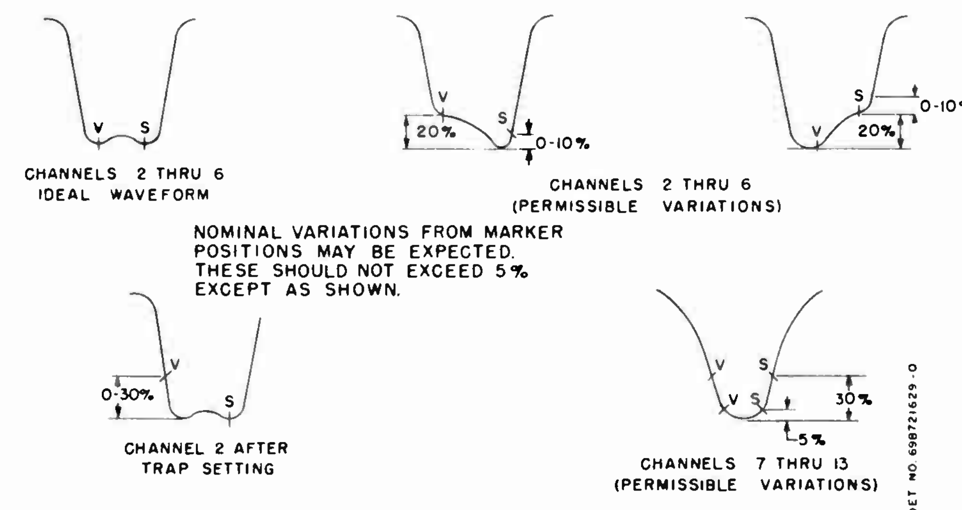


FIGURE 8. RF RESPONSE CURVE

6. Refer to Figure 7 for the location of the trimmers and coils. The chart listed above gives the picture and sound carrier frequencies.

7. The antenna coils are tuned to the video carrier side and the RF coils are tuned to the sound carrier side. Figure 8 shows the shape of the curve which should appear on the oscilloscope.

8. Set the screw in channel 13 RF coil, L-6, midway in the coil.

9. Turn the station selector switch to channel 8. Set the center frequency of the sweep generator to the center frequency of channel 8 (183 mc).

10. Adjust ceramic trimmer, C-11, so that the video and sound markers appear on the response curve within the limits shown in Figure 8.

NOTE: The two impedance matching transformers, T-1 and T-2 must be a minimum of 1/4" apart or a "suck-out" will be noted on channel 12 or 13.

11. Move the station selector switch to channel 13, and set the generator to the center frequency of the channel (213 mc). Adjust the screw in coil L-6 for the proper response on channel 13 (see Figure 8).

12. Recheck channel 8 for proper response. Readjust trimmer C-11, if necessary.

13. Check channels 13 through 7 and compare the curves in Figure 8. It is important that the antenna primary coil (L-1F) is not changed. The wave shapes may be narrowed by reducing the inductance in the coil but the signal-to-noise ratio will be seriously affected.

NOTE: If the response is checked with the cover on the tuner, the picture marker will move up the left side of the curve a short distance, but the markers should be within tolerance.

14. Move the station selector switch to channel 6 and set the generator to the center frequency of the channel (85 mc).

15. Compress or spread the channel 6 antenna coil, L-2E, and RF coil, L-7E, to obtain the proper response. See Figure 7 for coil locations and Figure 8 for response curve. The antenna coil affects the video carrier and the RF coil affects the sound carrier.

NOTE: The tilt on the low channels, particularly channels 5 and 6, can be controlled by adjusting the antenna matching coil, L-1C.

16. Align channels 5 through 2, in that order, in the same manner as channel 6. As the coils are in series, the proper phasing of channel 6 will simplify the alignment of the lower channels. On one of the lower channels, check that the same waveform is obtained with the sweeper head reversed. Waveform deviations indicate a faulty coil.

CAUTION: Make certain the bandswitch is on the correct channel before checking bandpass.

17. With channel selector on channel 2, adjust the two traps formed by C-97 & C-99 across L-2A and L-7A, respectively. Proceed as follows:

a. Move the oscilloscope to the picture tube cathode (yellow lead), and connect an AM generator, set at 104.7 mc and modulated 30%, to the antenna input.

b. With the contrast control at maximum gain (fully clockwise), adjust the fine tuning control for maximum amplitude on scope.

c. Adjust coils L-2A and L-7A (by spreading or compressing) for minimum amplitude on scope. These coils can be reached with the tuner cover on through two holes in the cover.

d. To check rejection of 104.7 mc, set the generator output high enough so that a 20 volt peak-to-peak wave appears on the scope. Note the generator output reading.

e. Tune the generator to 57 mc, tune fine tuning trimmer for maximum amplitude on scope, and adjust the generator output to give a 20 volt peak-to-peak wave on the scope. Again note the generator output reading.

f. Using figures noted in steps (d) and (e), divide using formula shown in step (g).

g. For proper rejection,

$$\frac{\text{generator output at 104.7 mc}}{\text{generator output at 57 mc}} = \text{at least 6000}$$

h. If voltage ratio in (g) is less than 6000, repeat steps (a) through (g).

OSCILLATOR ADJUSTMENT

NOTE: The IF and mixer circuit must be aligned before the oscillator is adjusted.

1. Remove shunt wire from oscillator inductance.

2. Connect the oscilloscope, through a 47K ohm resistor, across the video detector load resistor R-27 (4700). Restore AGC to the mixer and RF tubes by placing the Area Selector Switch into LOCAL position.

3. Refer to Figure 7 for the locations of the trimmers and coils. The sound carrier frequencies may be obtained from the preceding chart.

4. Set fine tuning trimmer for mid-capacity.

5. Turn station selector switch to channel 10.

6. Set the sweep generator to channel 10, with a center frequency of 195 mc. Keep the output low enough to show no evidence of limiting in the overall response curve.
NOTE: The curve should be substantially that of the mixer as in Figure 6. Any consistent tilting of the response curve indicates that the mixer and IF stages are not properly aligned.

7. Introduce a marker corresponding to the sound carrier of channel 10 (197.75 mc). Keep marker signal as low as possible.

8. Adjust the oscillator trimmer C-15 to place the sound marker slightly higher in frequency than the 21.9 mc trap dip. This allowance must be made for the shift caused by the bottom shield being off. When the shield is replaced, the sound marker will move down into the trap dip. The picture marker will then be approximately one-half down from the base line on the opposite side of the curve.

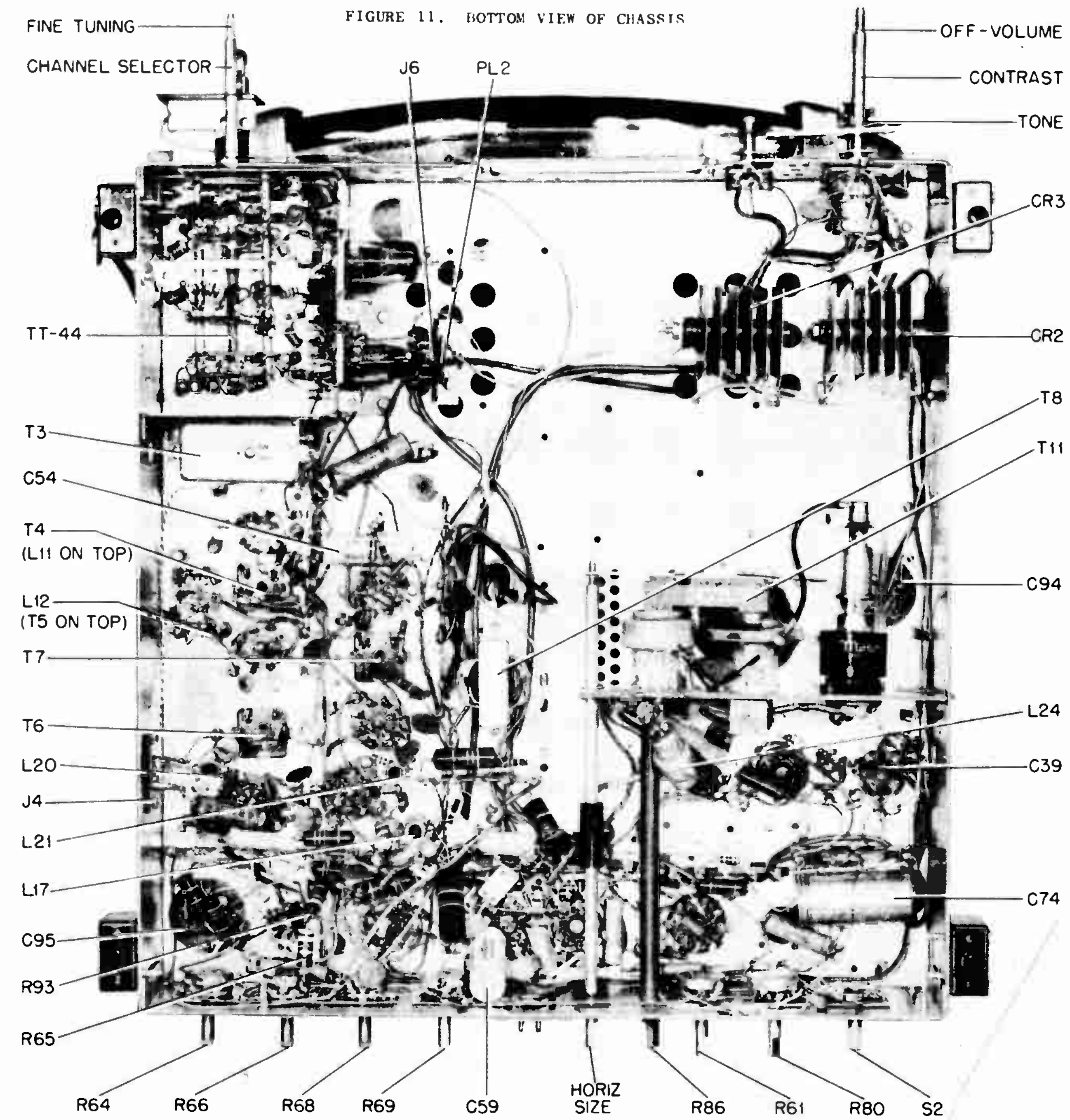
9. Check channels 7 through 13, noting whether the sound marker falls just above the trap dip, with the fine tuning trimmer at approximately mid-capacity.

10. If more than a 30 degree change in the fine tuning trimmer was needed in step 9, adjust the channel 13 oscillator coil L-8 by spreading or compressing the turns. If L-8 is adjusted, it may be necessary to readjust trimmer C-15 on channel 10. Coil L-8 has more effect on channels 10 to 13 than on channels 7 to 9.

11. Turn the station selector switch to channel 6, and set the sweep generator center frequency to 85 mc.

12. Set the fine tuning trimmer to 15° off mid-capacity (toward less capacity) as in Figure 9.

FIGURE 11. BOTTOM VIEW OF CHASSIS



NOTE: It is important that the rotor be set as nearly as possible to the drawing. Otherwise, the fine tuning trimmer may not have sufficient range to suitably tune a weak signal.

13. Introduce a marker corresponding to the sound carrier of channel 6 (87.75 mc).

14. Compress or spread the channel 6 oscillator coil L-9E until the sound marker is placed just above the dip in the 21.9 mc trap.

15. Align channels 5 through 2, in that order, in the same manner as channel 6, so that the sound marker falls just above the trap dip, with the fine tuning trimmer within 15 degrees of initial setting in step 12.

NOTE: Since the oscillator coils are in series, it is necessary to adjust the high channel coils first, before proceeding to a lower channel.

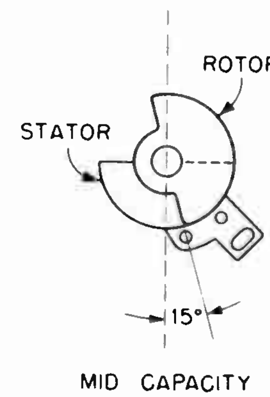


FIGURE 9. FINE TUNING TRIMMER SETTING

OVERALL SENSITIVITY MEASUREMENTS

An overall measurement of sensitivity is made as follows:

1. Connect an AM signal generator to the antenna receptacle on the receiver chassis, matching the generator to the receiver with a resistor network. In the case of a generator with a 50 ohm output impedance, insert a 100 ohm resistor in series with the output terminal, and a 150 ohm resistor in series with the ground terminal.

2. From the cathode of the picture tube (yellow lead) to chassis, connect a calibrated oscilloscope. NOTE: To calibrate scope, connect it across the 6.3 volt filament supply. The peak-to-peak amplitude on the screen will then be approximately 18V (6.3 x 2.8).

3. Set the contrast control for maximum sensitivity (fully clockwise).

4. Set the signal generator for 30% modulation at 400 cycles, tune it to the mid-carrier frequency of the channel being checked, and rotate the fine tuning trimmer for maximum output.

5. The generator signal necessary to produce 20 volts peak-to-peak on the scope should be less than:

a) 20 microvolts for channels 2 through 6
b) 30 microvolts for channels 7 through 13

4.5 MC TRAP ALIGNMENT

Equipment Required:

AM Signal Generator: Accurately calibrated at 4.5 mc Adjustable output
DC Meter: Low range electronic voltmeter

Procedure:

1. Connect the signal generator to pin 3 of test receptacle, J-4.

2. Set CONTRAST control for maximum gain (fully clockwise).

3. Connect the voltmeter and a germanium crystal detector, as shown in Figure 10, between the cathode of the picture tube (yellow lead) and chassis.

4. With the signal generator accurately set at 4.5 mc and maximum output, adjust trap L-17 for minimum reading on the lowest voltage scale of the meter.

AUDIO TAKE-OFF, INTERSTAGE COIL, & RATIO DETECTOR

Refer to Figure 4 for location of adjustments.

1. If possible, it is desirable to align the audio section from an actual station signal, since the 4.5 mc alignment frequency will be exact. To permit operation below the limiting level of the audio driver tube, for sharp alignment, the fine tuning trimmer should be turned off the station slightly so that there is between 6 and 8V as measured from one side of C-54 and chassis.

2. If a signal generator is used, tune it accurately to 4.5 mc, and adjust the output to approximately 5,000 microvolts. Connect the high side of the signal generator to pin 3 of the test receptacle and the low side to chassis. The following steps apply whether the station signal or signal generator is used.

3. From either side of electrolytic capacitor C-54 (10 mf) through a 10K ohm decoupling resistor, connect an electronic voltmeter to chassis.

4. Tune audio take-off coil L-20 for maximum reading on meter.

5. Tune interstage coil L-21 for maximum reading on meter.

NOTE: As adjustments are brought to resonance, it is advisable to reduce the signal generator output to prevent overloading.

6. Tune ratio detector (T-7) primary (top core) for maximum reading on meter.

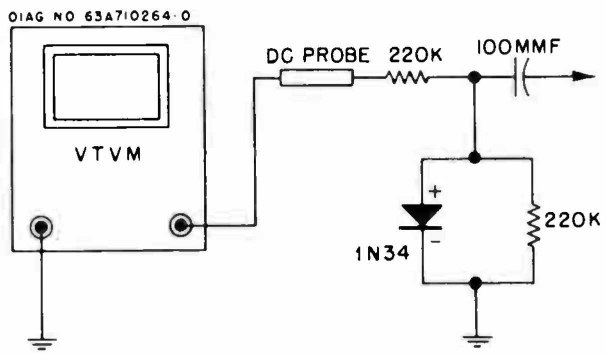


FIGURE 10. ELECTRONIC VOLTMETER CONNECTIONS

NOTE: Both the primary and secondary of the ratio detector transformer have two tuning points. Only one, with the cores at the outer end of the windings, is the proper point.

7. Move the meter and decoupling resistor to the junction of R-45 (33K) and C-55 (1000 mmf).

8. Adjust T-7 secondary (bottom core) for zero response on the lowest scale of the meter. Be sure the slug is tuned to the outside of the winding (toward the top). This corresponds to the cross-over point of the FM detector curve. If desired, the symmetry of the curve may be checked by tuning the signal generator 25 kc above and below 4.5 mc and noting the plus and minus voltage produced, reversing the meter connections, as necessary. For proper balance of the ratio detector system, the voltages in each direction should be approximately equal. If not, check the tuning of L-20, L-21, and both the primary and secondary of T-7, the ratio detector transformer. If necessary, replace the ratio detector tube V-9.

9. Repeat steps 4 through 8 for maximum accuracy.

AUDIO SENSITIVITY MEASUREMENT

1. Connect the signal generator to pin 3 of the test receptacle.

2. Connect the electronic voltmeter from either side of electrolytic capacitor C-54, through a 10K ohm decoupling resistor, to chassis.

3. Set the generator at 4.5 mc.

4. With a 5,000 microvolt signal, the AVC voltage read on the meter should be greater than 5 volts.

CHASSIS
HS-319

1. Connect a low range output meter across the speaker voice coil.

2. Connect an AM signal generator as in chart below.

3. Set the signal generator for 400 cycle, 30% modulation.

4. Rotate the PHONO-RADIO switch to the "RADIO" position.

5. Turn the receiver volume control to maximum.

6. Use a small fibre screwdriver for aligning the IF and diode transformers.

7. Adjust the signal generator output to produce 1.27 volts (.5 watts) across the voice coil. As stages are aligned, to avoid overloading the receiver, reduce the generator output to maintain the 1.27 volt level.

8. See Figure 2 for adjustment locations, and the following chart for procedure.

ALIGNMENT CHART

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Grid of conv. V-2 (pin 7, 6BE6)	455 Kc	Fully opened	1, 2, 3 & 4 (IF cores)	Adjust for maximum.
RF ALIGNMENT						
2.	.1 mf	Grid of conv. V-2 (pin 7, 6BE6)	1620 Kc	Fully opened	5 (Osc)	Adjust for maximum.*
3.	-	-	-	-	-	Connect BC loop to chassis.
4.	-	Across radiation loop**	1400 Kc	Tune in signal	8 (Ant)	Adjust for maximum.

5. If, after the receiver has been aligned as above, it is found to be badly off calibration, it will be necessary to adjust oscillator core (7) as follows: connect the generator to the grid of the converter tube and, with the gang fully closed, adjust core (7) at 535 Kc. It is advisable to repeat the oscillator adjustments at 1620 Kc and 535 Kc several times until the tuning range is correct. Core (7) has been pre-set at the factory and normally should require no retuning.

* If difficulty is encountered in tuning trimmer (5), adjust trimmer (6) to 1/2 turn from tight.

** Connect generator output across 5" diameter, 5 turn loop and couple inductively to receiver loop. Keep loops at least 12" apart.

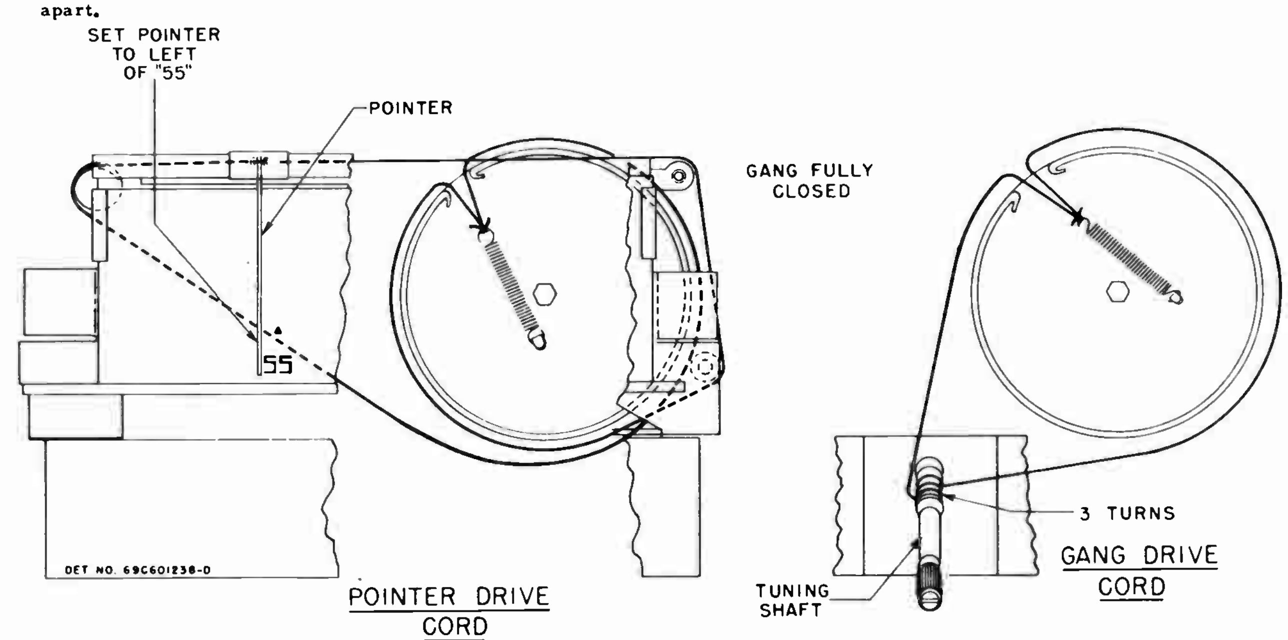


FIGURE 1. DIAL RESTRINGING DETAIL

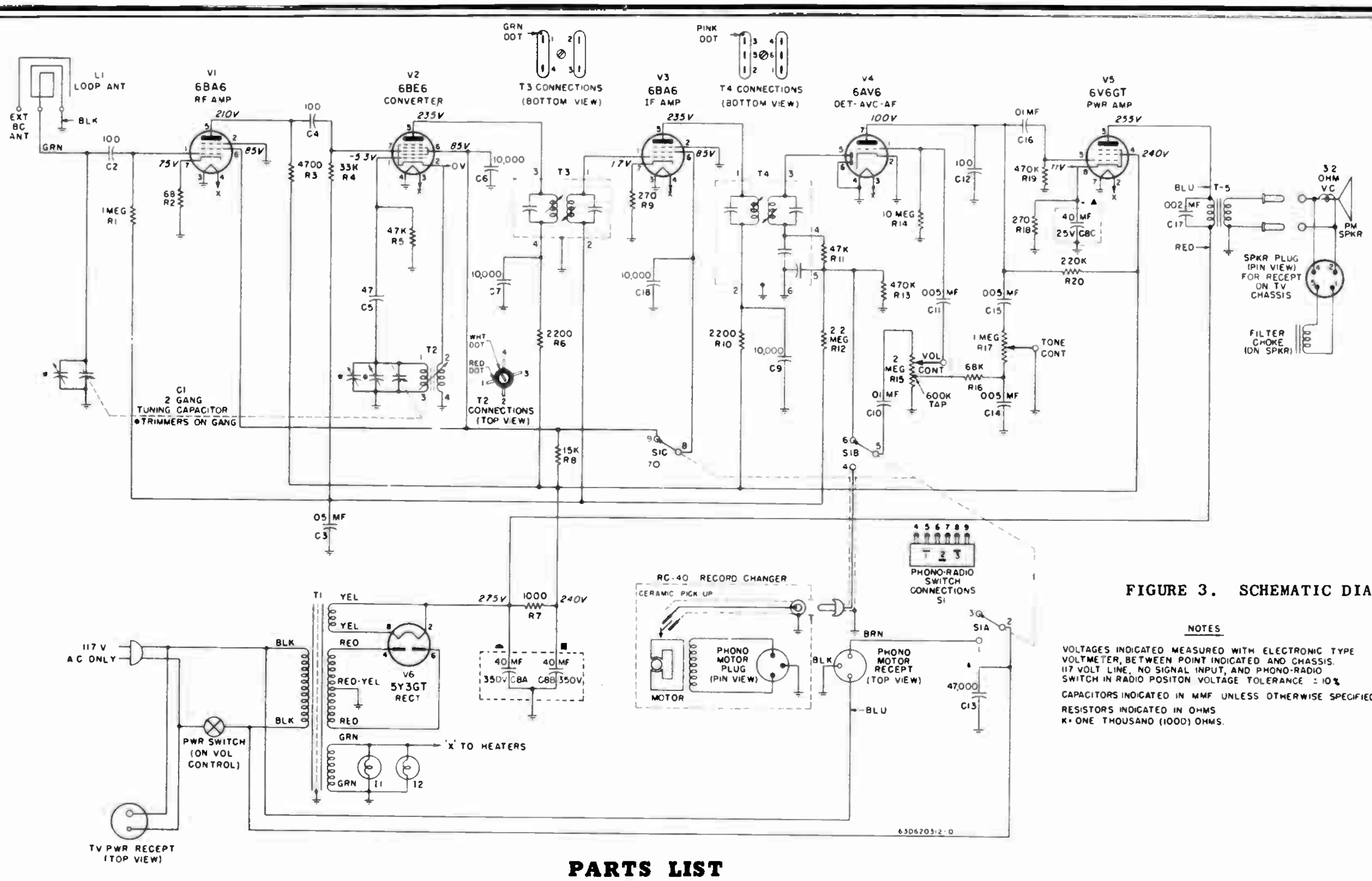


FIGURE 3. SCHEMATIC DIAGRAM

NOTES

VOLTAGES INDICATED MEASURED WITH ELECTRONIC TYPE VOLTMETER, BETWEEN POINT INDICATED AND CHASSIS. 117 VOLT LINE, NO SIGNAL INPUT, AND PHONO-RADIO SWITCH IN RADIO POSITON. VOLTAGE TOLERANCE ±10%

CAPACITORS INDICATED IN MMF UNLESS OTHERWISE SPECIFIED

RESISTORS INDICATED IN OHMS

K=ONE THOUSAND (1000) OHMS.

PARTS LIST

NOTE: When ordering parts, specify model and chassis numbers of set in addition to part number and description of part.

Ref. No.	Part Number	Description	List Price
CHASSIS HS-319 ELECTRICAL PARTS			
Capacitors			
C-1	19B691877	Variable: 2-gang............	3.00
C-2	21B77286	Ceramic: 100 mmf 500V.......	.20
C-3	8R9816	Paper: .05 mf 400V.........	.20
C-4	21B77286	Ceramic: 100 mmf 500V.......	.20
C-5	21K77373	Ceramic: 47 mmf 500V........	.20
C-6	21K482726	Ceramic disc: 10,000 mmf 450V	.30
C-7	21K482726	Ceramic disc: 10,000 mmf 450V	.30
C-8	23B610587	Electrolytic: 40-40 mf/350V, 40 mf/25V.................	2.75
C-9	21K482726	Ceramic disc: 10,000 mmf 450V	.30
C-10	8R9809	Paper: .01 mf 400V.........	.20
C-11	8R9813	Paper: .005 mf 600V........	.20
C-12	21B77286	Ceramic: 100 mmf 500V.......	.20
C-13	8R490232	Molded paper: 47,000 mmf 400V	.25
C-14	8R9813	Paper: .005 mf 600V........	.20
C-15	8R9813	Paper: .005 mf 600V........	.20
C-16	8R9809	Paper: .01 mf 400V.........	.20
C-17	8R9847	Paper: .002 mf 600V........	.20
C-18	21K482726	Ceramic disc: 10,000 mmf 450V	.30
Pilot Light			
I-1,2	65X10867	Bulb, pilot light: #44; 6-8V; .25 amp; clear; bayonet base	.15
Coils			
L-1	24C690896	Loop antenna................	1.40*

Resistors

Note: All resistors are insulated carbon type unless otherwise specified.

R-1	6R6004	1 meg 20% 1/2W.........doz	1.20
R-2	6R2039	68 10% 1/2W............doz	1.20
R-3	6R6080	4700 10% 1/2W..........doz	1.20
R-4	6R6012	33,000 20% 1/2W........doz	1.20
R-5	6R6056	47,000 20% 1/2W........doz	1.20
R-6	6R6290	2200 20% 1/2W..........doz	1.20
R-7	6R3922	1000 10% 2W...............	.25
R-8	6R5732	15,000 10% 2W.............	.25
R-9	6R6432	270 10% 1/2W...........doz	1.20
R-10	6R6290	2200 20% 1/2W..........doz	1.20
R-11	6R6056	47,000 20% 1/2W........doz	1.20
R-12	6R3927	2.2 meg 20% 1/2W.......doz	1.20
R-13	6R6032	470,000 20% 1/2W.......doz	1.20
R-14	6R2109	10 meg 20% 1/2W........doz	1.20
R-15	18A600974	Volume control: 2 meg; tapped at 600,000; includes power switch.....................	1.50
R-16	6R6074	68,000 10% 1/2W........doz	1.20
R-17	18K77399	Tone control: 1 meg.........	.80
R-18	6R6336	270 10% 1W................	.20
R-19	6R6032	470,000 20% 1/2W.......doz	1.20
R-20	6R6015	220,000 20% 1/2W.......doz	1.20
Switches			
S-1	40B601065	Switch, phono-radio.........	.85
Transformers			
T-1	25B600684	Power Transformer...........	6.95
T-2	24K691878	Oscillator Transformer: white & red dot............	.50

	Part Number	Description	List Price
T-3	24C485553	IF Transformer: 455 Kc; complete with capacitors, cores & shield.............	.95
T-4	24K485555	Diode Transformer: 455 Kc; complete with capacitors, cores & shield.............	1.20
T-5	25B502142	Audio Output Transformer....	1.60

CHASSIS HS-319 MECHANICAL PARTS

Part Number	Description	List Price
43K890398	Bushing, line cord retainer (use with 43A890397).................	.05
43A890397	Bushing, line cord strain relief (use with 43K890398)............	.05
42A485548	Clip, coil can mtg (IF transformers)......................doz	.20
30K21859	Cord, line: with plug; 9 ft lg....	1.00
1X600490	Dial Plate Assembly: less dial scale & pointer.................	1.95
34C611148	Dial scale: glass................	.65
2S7051	Nut, hex palnut: 3/8-32 x 9/16; cad pl (control mtg).........doz	.15
28K22183	Plug, phono pick-up..............	.05
52B481704	Pointer, dial.....................	.25
1A691015	Pulley, gang drive: 3-1/2" diameter; with double D washer......	.15
9A600040	Receptacle, phono motor: 3-prong; less shell & insulator..........	.15
9A791031	Receptacle, TV power: 2-prong; less shell & insulator..........	.05
1X600489	Shaft, tuning: includes pulley....	.20
15A690616	Shell, receptacle: with insulator (for phono motor receptacle).....	.05
15K74443	Shell, receptacle: with insulator (for TV power receptacle)........	.05
9K600685	Socket, pilot light: includes mtg bracket.........................	.25
9K484167	Socket, tube: miniature; 7-prong..	.20
9A76209	Socket, tube: octal..............	.15
41A14244	Spring, tension (pointer & drive cord)........................doz	.55
37K21114	Strip, channel: rubber (dial scale mtg)...................doz	.15
29A76280	Terminal, pin (on speaker leads)doz	.45
4A70015	Washer, "C" (tuning shaft retainer)....................per/c	.50

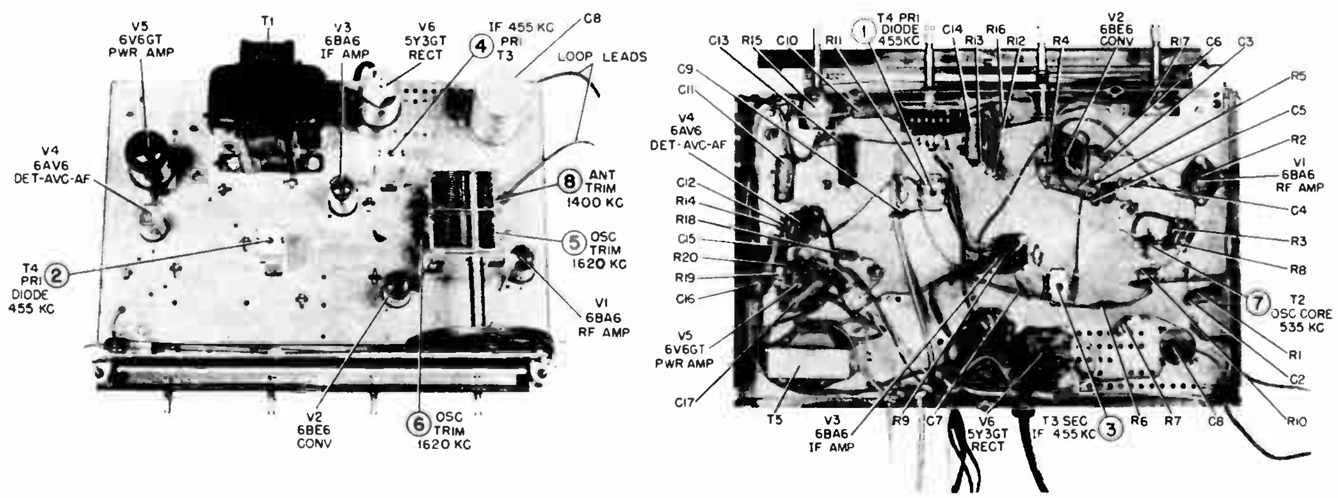


FIGURE 2. ALIGNMENT ADJUSTMENTS & PARTS LOCATIONS

SUPPLEMENT NO. 1

PRODUCTION CHANGES

Chassis Coding	Change
TS-408A-00	Original production incorporated the changes of the TS-292A-03.
TS-408A-01	Revised 3rd IF transformer. Differs from the original only in that L-13 is mounted inside the transformer shield and becomes a part of the T-6 assembly. Transformer has new part number.
TS-408A-02	C-74 changed from 20 mf to 10 mf to eliminate vertical flutter due to line voltage variations.

REPLACEMENT PARTS LIST SUPPLEMENT

NOTE: When ordering parts, specify model number of set in addition to part number and description of part. The following parts are revisions of, or additions to, the original items listed in the TS-408A Service Manual.

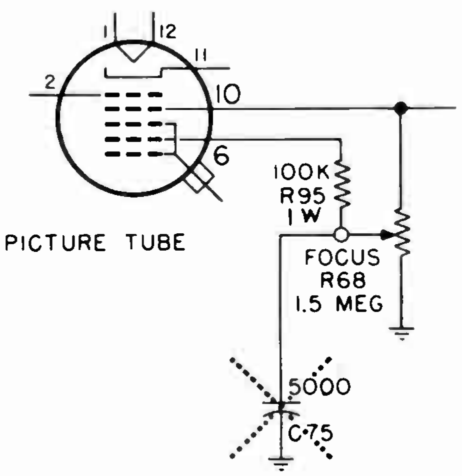
Ref. No.	Part Number	Description	List Price
C-74	23A702450	Capacitor, electrolytic: 10 mf 450V.................	1.35
T-6	24K720421	Transformer, 3rd IF: with CR-1, C-31, L-13, core & mtg base (this is electrically the same as the former transformer 24B720980 except L-13 has been added inside assembly. Use 24K720421 as replacement for 24B720980 in early chassis. The new transformer is wired the same as the old except that L-13 is inside the shield)....................	4.15

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

SUPPLEMENT NO. 2

PRODUCTION CHANGE

Chassis Coding	Change
TS-408A-03	C-75 (5000 mmf) omitted and a 100K 1-watt resistor added between the focus control arm and the blue lead to the picture tube focusing anode. This adds protection to the focus control potentiometer.



Ref. No.	Part Number	Description	List Price
R-95	6R118214	Resistor, carbon: 100,000 20% 1W..................... NOTE: The value of this resistor is not critical. Substitute values of 120K and 150K may be found in some chassis. Substitutes should have at least a one-watt rating, however.	.20

REPLACEMENT PARTS LIST SUPPLEMENT

NOTE: When ordering parts, specify model number of set in addition to part number and description of part. The following part is an addition to the original items in the TS-408 Series

PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

CHASSIS TS-408A - ELECTRICAL PARTS

Ref. No.	Part Number	Description	List Price
Capacitors			
C-1 thru C-18		See Tuner Parts List........	-
C-19	21R115384	Ceramic disc: 10,000 mmf 450V	.25
C-20 thru C-22		See Tuner Parts List........	-
C-23	21K400936	Ceramic disc: 1000 mmf 500V.	.25
C-24	21R470329	Ceramic disc: 30 mmf 500V...	.30
C-25	21K400936	Ceramic disc: 1000 mmf 500V.	.25
C-26	21K400936	Ceramic disc: 1000 mmf 500V.	.25
C-27	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-28	21A701029	Ceramic disc: 1500 mmf 500V.	.25
C-29	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-30	21R470329	Ceramic disc: 30 mmf 500V...	.30
C-31	21K478410	Ceramic disc: 1000 mmf 500V (in T-6 can)..............	.25
C-32	8R9810	Paper: .25 mf 100V.........	.35
C-33	21K38951	Molded phenolic: 4 mmf 500V.	.15
C-34	21A478274	Molded phenolic: 2.2 mmf 500V	.25
C-35	8R9814	Paper: .1 mf 100V.........	.25
C-36	21R115897	Ceramic tubular: 68 mmf 500V	.30
C-38	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-39	23B720750	Electrolytic: 4-section; A-10 mf/300V; B-200 mf/150V; C-140 mf/150V; D-30 mf/150V.	4.40
C-40	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-41	21K470329	Ceramic disc: 30 mmf 500V...	.30
C-42	8R490236	Molded paper: 100,000 mmf 400V......................	.35
C-43	21R400928	Ceramic tubular: 68 mmf 500V	.25
C-44	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-45	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-46	21R115641	Ceramic tubular: 56 mmf 500V	.25
C-47	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-48	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-49	21K790439	Silver mica: 15 mmf (part of T-7 base).................	.20
C-50	21K790131	Ceramic tubular: 150 mmf 500V (in T-7 shield)...........	.35
C-51	21K400936	Ceramic disc: 1000 mmf 500V.	.25
C-52	21R118749	Ceramic tubular: 1000 mmf 500V	.30
C-53	21K400940	Ceramic tubular: 470 mmf 500V	.25
C-54	23A90205	Electrolytic: 10 mf 50V.....	.90
C-55	21K780599	Ceramic tubular: 1000 mmf 500V	.25
C-56	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-57	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-58	8R9820	Paper: .003 mf 200V........	.25
C-59	23A90205	Electrolytic: 10 mf 50V.....	.90
C-60	8K400028	Paper: .04 mf 600V.........	.25
C-61	8R9869	Paper: .005 mf 600V........	.20
C-62	8R490222	Molded paper: 4700 mmf 400V (use this type only).......	.25
C-63	21R400942	Ceramic disc: 22 mmf 750V...	.20
C-64	21R115905	Ceramic tubular: 220 mmf 500V	.25
C-65	8R490232	Molded paper: 47,000 mmf 400V	.30
C-66	21R6673	Mica: 470 mmf 500V.........	.30
C-67	8R490222	Molded paper: 4700 mmf 400V (use this type only).......	.25
C-68	8R490222	Molded paper: 4700 mmf 400V (use this type only).......	.25
C-69	8R490226	Molded paper: 10,000 mmf 400V (use this type only).......	.25
C-70	8R9869	Paper: .005 mf 600V........	.20
C-71	8R490232	Molded paper: 47,000 mmf 400V (use this type only)..	.30
C-72	8R490232	Molded paper: 47,000 mmf 400V (use this type only).......	.30
C-73	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-74	23K710667	Electrolytic: 20 mf 450V	1.45
C-75	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-76	21R6673	Mica: 470 mmf 500V..........	.30
C-77	21R114207	Ceramic disc: 47 mmf 750V...	.25
C-78	21R6673	Mica: 470 mmf 500V..........	.30
C-79	8R9866	Paper: .001 mf 600V........	.20
C-80	8R9867	Paper: .002 mf 600V........	.20
C-81	8R9868	Paper: .003 mf 600V........	.25
C-82	8R490268	Molded paper: 1000 mmf 1000V	.35
C-83	8R9858	Paper: .01 mf 400V.........	.20
C-84	21R115905	Ceramic tubular: 220 mmf 500V	.25
C-85	8R490222	Molded paper: 4700 mmf 400V (use this type only).......	.25
C-86	21R114740	Mica: 390 mmf 500V..........	.50
C-87	21R114781	Mica: 680 mmf 500V..........	.45
C-88	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-89	8R9858	Paper: .01 mf 400V.........	.20
C-90	21K701873	Ceramic disc: 180 mmf 3000V.	.25
C-91	21K710903	Ceramic disc: 47 mmf 1500V (in deflection yoke).......	.35
C-92		Paper: .15 mf (part of L-24)	-
C-94	23B484097	Electrolytic: 140 mf/150V...	2.20
C-95	23B710941	Electrolytic: 2-section; A-200 mf/150V; B-5 mf/150V.	2.90
C-96	21K400936	Ceramic disc: 1000 mmf 500V.	.25
C-97 thru C-99		See Tuner Parts List........	-
C-100	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-101	21R115312	Ceramic disc: 5000 mmf 450V.	.25
Rectifiers			
CR-1	48C711052 or 48K711077 or 48K712198 or 48K712199 or 48K712200	Crystal, diode: special.....	1.75
CR-2,3	48B700555 or 48B720081	Selenium rectifier..........	4.15
Miscellaneous			
E-1	24K711843 or 24K711842	Trap, ion...................	.85
E-2	48A721145	Magnetic centering device & deflection yoke cover.......	.90
E-3	48B720968	Magnet, raster corrector: right-hand................	.75
E-4	48K720969	Magnet, raster corrector: left-hand.................	.75
Pilot Light			
I-1	65X11854	Bulb: 6-8V; type 47; bayonet base......................	.15
Receptacles			
J-1 & J-2		See Tuner Parts List........	-
J-3	9A702469	Receptacle, one-pin (for alignment generator).......	.15

Ref. No.	Part Number	Description	List Price
J-4	9A702778	Receptacle, three-pin (test receptacles)	.15
J-5	9A720006	Receptacle, two-pin (for L-23 adjustment)	.20
J-6	1V720408	Receptacle, UHF; with mtg brkt	.40
J-7	9A22367	Receptacle, speaker: 5-prong; less contacts	.15
Coils			
L-1 thru L-9		See Tuner Parts List	-
L-10	24A721274	Filament choke	.10
L-11		27.9 mc trap (part of T-4)	
L-12		21.9 mc trap (part of T-5)	
L-13	24B711413	RF choke: yellow dot	.35
L-14	24K721272	Compensating coil: purple dot (wound on R-29)	.35
L-15	24K710140	Compensating coil: red dot	.35
L-16	24K721116	Compensating coil: green dot (wound on R-34)	.45
L-17	1V792736	4.5 mc trap: with core & mtg nut	.75
L-18	24K710140	Compensating coil: red dot	.35
L-19	24K721271	Compensating coil: black dot (wound on R-36)	.45
L-20	1V790341	Sound take-off: with core & mtg nut	.90
L-21	1V790341	Interstage coil: with core & mtg nut	.90
L-22	24K720622	Deflection yoke: 70°; complete less cover & centering device	11.65
L-23	24K701558	Horizontal oscillator: with core & clip	2.50
L-24	24A710751	Horizontal linearity (wound on C-92)	.85
L-25	24B711413	RF choke: yellow dot	.35
L-26	25B701075	Filter choke (mounted on PM spkr frame in combination models)	1.80
Speakers			
LS-1	50C711976		
or	50C711061		
or	50C701615		
or	50C489002	Electrodynamic: 6"; 85 ohm field coil (cold); 3.2 ohm voice coil (table models)	5.50*
		exch	4.15
	50C721467	Electrodynamic: oval; 6" x 9"; 85 ohm field coil (cold); 3.2 ohm voice coil (17K16C)	7.95*
		exch	5.95
	50K700850		
or	50C703098		
or	50C720156		
or	50C703337		
or	50C721294	Electrodynamic: 8"; 85 ohm field coil (cold); 3.2 ohm voice coil (17K14C & 17K15C)	7.25*
		exch	5.45
	50C701328		
or	50C701634		
or	50C703099		
or	50C702057		
or	50C702550	PM: 10"; 3.2 ohm voice coil; with 25B701075 filter choke mounted on spkr (combination models)	12.80*
		exch	9.60

Ref. No.	Part Number	Description	List Price
Plugs			
PL-1	28K703310	Plug, antenna: 2-prong; on antenna lead	.05
PL-2	28K790063	Plug, UHF: 9-pin	.20
PL-3	28A511760	Plug, speaker (on speaker frame)	.25
Resistors			
		Note: All resistors are insulated carbon type unless otherwise specified.	
R-1 thru R-5		See Tuner Parts List	-
R-6	6R6270	220 10% 1/2W doz	1.20
R-7 thru R-15		See Tuner Parts	-
R-16	6R5550	47 10% 1/2W doz	1.20
R-17	6R6038	1500 10% 1/2W doz	1.20
R-18	6R6320	10,000 10% 1/2W doz	1.20
R-19	6R6301	1000 20% 1/2W doz	1.20
R-20	6R2039	68 10% 1/2W doz	1.20
R-21	6R6038	1500 10% 1/2W doz	1.20
R-22	6R2004	8200 10% 1/2W doz	1.20
R-23	6R6270	220 10% 1/2W doz	1.20
R-24	6R6301	1000 20% 1/2W doz	1.20
R-25	6R6460	1.5 meg 10% 1/2W doz	1.20
R-26	6R3927	2.2 meg 20% 1/2W doz	1.20
R-27	6R6080	4700 10% 1/2W doz	1.20
R-28	6R6075	100,000 20% 1/2W doz	1.20
R-29	6R2004	8200 10% 1/2W doz	1.20
R-30	6R6046	1 meg 10% 1/2W doz	1.20
R-31A, B	18B720263	Contrast & volume control: dual; 2500 tapped and 1 meg tapped respectively; includes power switch	2.75
R-33	6R5588	39,000 10% 1W	.20
R-34	6R6320	10,000 10% 1/2W doz	1.20
R-35	6R6054	10,000 20% 1/2W doz	1.20
R-36	6R6393	1200 10% 1/2W doz	1.20
R-37	6R476012	3900 10% 2W	.25
R-38	6R6326	100 10% 1/2W doz	1.20
R-39	6R6410	33,000 10% 1/2W doz	1.20
R-40	6R6326	100 10% 1/2W doz	1.20
R-41	6R5691	6800 10% 1W	.20
R-42	6R5551	120 10% 1/2W doz	1.20
R-43	6R6428	6800 10% 1/2W doz	1.20
R-44	6R6428	6800 10% 1/2W doz	1.20
R-45	6R6012	33,000 20% 1/2W doz	1.20
R-46	6R6001	68,000 20% 1/2W doz	1.20
R-47	6R6393	1200 10% 1/2W doz	1.20
R-48	18A711999	Tone control: 1 meg	.80
R-49	6R6400	33,000 10% 1W	.20
R-51	6R3966	1.5 meg 20% 1/2W doz	1.20
R-52	6R6414	270,000 10% 1/2W doz	1.20
R-53	6R6475	680,000 10% 1/2W doz	1.20
R-54	6R6028	22,000 20% 1/2W doz	1.20
R-55	6R5697	560,000 10% 1/2W doz	1.20
R-56	6R6069	2200 10% 1/2W doz	1.20
R-57	6R6428	6800 10% 1/2W doz	1.20
R-58	6R6069	2200 10% 1/2W doz	1.20
R-59	6R6028	22,000 20% 1/2W doz	1.20
R-60	6R6054	10,000 20% 1/2W doz	1.20
R-61	18A720196	Vertical hold control: 850,000 350K stop	.90
R-62	6R5581	3300 10% 1/2W doz	1.20
R-63	6R2089	1800 10% 1/2W doz	1.20
R-64	18A702443	Vertical size control: 5 meg; 1 meg stop	.85

Ref. No.	Part Number	Description	List Price
R-65	6R5671	4700 10% 2W	.25
R-66	18A702475	Vertical linearity control: 750	.80
R-67	6R5551	120 10% 1/2W doz	1.20
R-68	18A720289	Focus control: 1.5 meg	.75
R-69	18A702441	Brightness control: 5.1 meg; 100K stop	.85
R-70	6R5644	82,000 10% 1/2W doz	1.20
R-71	6R5644	82,000 10% 1/2W doz	1.20
R-72	6R6031	100,000 10% 1/2W doz	1.20
R-73	6R6397	22,000 10% 1/2W doz	1.20
R-74	6R2122	4.7 meg 20% 1/2W doz	1.20
R-75	6R410053	150,000 20% 1W	.20
R-76	6R410053	150,000 20% 1W	.20
R-77	6R6117	5600 10% 1/2W doz	1.20
R-78	6R6393	1200 10% 1/2W doz	1.20
R-80	18A720195	Horizontal hold control: 150,000 40K stop	.90
R-81	6R5631	120,000 10% 1/2W doz	1.20
R-82	6R6080	4700 10% 1/2W doz	1.20
R-83	6R2096	330,000 10% 1/2W doz	1.20
R-85	6R6080	4700 10% 1/2W doz	1.20
R-86	1V721286	Horizontal centering control: 75 ohm; with insulator & lugs	.80
R-88	1K711027	7.5 10% 5W; wire wound; with strip & eyelets	.70
R-89	6R2034	15 10% 1/2W doz	1.20
R-93	6R476012	3900 10% 2W	.25
R-94	17K721772	0.47 20% 1/2W; wire wound.	.15
Switches			
S-1		Switch, channel selector (part of tuner)	-
S-2	40A720172	Switch, Area Selector	.80
Transformers			
T-1 thru T-3		See Tuner Parts List	-
T-4	24B720977	1st IF: with L-11, C-24, core, mtg base, & shield	1.75
T-5	24B721273	2nd IF: with L-12, C-30, cores, & mtg nut	1.35
T-6	24B720980	3rd IF: with CR-1, C-31, core, mtg base & shield	3.85
T-7	24B702543	Ratio detector: with C-49, C-50, cores, mtg base & shield	3.20
T-8	25K720128	Audio output	1.80
T-9	25K702429	Vertical blocking oscillator	1.60
T-10	25K721027	Vertical output	3.40
T-11	24K721290-C	High voltage transformer: includes V-17 & horizontal centering control (specify issue "C" -early issues are not coded)	9.70
T-12	25B720749	Filament transformer	10.25

CHASSIS TS-408A - MECHANICAL PARTS

Part Number	Description	List Price
1V712011	Arms & Link Assembly, tone control: consists of two control arms, link, & anti-backlash clip.	.25
7A720122	Bracket, high-voltage (for mtg HV shield)	.05
1V720642	Bracket, picture tube support & positioning: right-hand (on front of chassis)	.80
1V720644	Bracket, picture tube support & positioning: left-hand (on front of chassis)	.75
7A710947	Bracket, selenium rectifier mtg (for 48B720081 rectifier)	.05
7B792568	Bracket, yoke mtg (across top of yoke)	.30
35K700532	Bumper, rubber (circular bumper on rear support bracket)	.15
75A721374	Bumper, rubber (on front of support & positioning brkts) doz	.25
35A700603	Bumper, rubber (for yoke)	.05
75A720718	Bumper, rubber: round (on picture tube support brkts)	.35
42A720007	Cap, plate (V-15)	.30
42A720008	Cap, plate: with lead (V-17)	.20
42K720285	Clip, retainer (for dial light)	.10
42A76244	Clip, coil retainer (L-23) doz	.25
42K721773	Clip, speed (movable clip holding rotating cover) doz	.35
42K721774	Clip, speed (stationary clip holding rotating cover) doz	.35
42A703226	Clip, tube shield (V-5)	.05
42A72609	Clip, tube shield (V-10)	.05
42K720059	Connector, 2nd anode	.50
39K711407	Contact, pin terminal (in speaker receptacle) doz	.25
46A702436	Core, iron (L-11, T-4 & T-6)	.10
46K702437	Core, iron (T-7)	.10
46A470310	Core, iron, & screw (L-12, L-17, L-20 & T-5)	.15
46A780344	Core, iron, & screw (L-23)	.45
58A702714	Coupling, shaft (couples horizontal size shaft and extension)	.10
15K721532	Cover, tuner housing (tuner bottom cover)	.40
5A790684	Grommet, rubber (V-13 & V-14 socket cushion) doz	.35
14A720238	Insulator, chassis mtg (on sides of chassis)	.20
14K712339	Insulator, control (insulates controls from chassis)	.05
14A703329	Insulator, horizontal size shaft (insulates shaft from chassis) doz	.15
14A703228	Insulator, interlock (insulates power input plug)	.05
36B712294	Knob, control: with spring insert (area selector switch)	.25
36A720197	Knob, control: push-on type (for hold controls)	.15
2A470049	Nut, coil & core mtg (L-12, L-17, L-20, & T-5) doz	.50
2S7051	Nut, hex: palnut; 3/8-32 x 3/16 (control mtg) doz	.15
35K711648	Pad, cushion (large pads on tube retaining strap)	.15
35K790169	Pad, cushion (small pad on tube retaining strap) doz	.40
9K471267	Plate, electrolytic mtg: 3-lug; wax impregnated (C-94)	.05
9A484098	Plate, electrolytic mtg: 4-lug; wax impregnated (C-95)	.05
1V703212	Plate, socket adaptor: with grommets (V-13)	.20
28K712319	Plug, line cord	.15
5A720193	Rivet, shoulder: nkl pl (V-13 & V-14 socket mtg) doz	.20

Part Number	Description	List Price
47A720282	Rod, light conducting (conducts light from bulb to dial)	.20
3K711490	Screw, thumb: cad pl (yoke adjustment)	.05
3K712076	Screw, special: slotted round head; cad pl (48B700555 selenium rectifier mtg)	.05
1A710608	Shaft & Key Assembly (horizontal centering control)	.65
47A702711	Shaft, extension (horizontal size control)	.25
47A702704	Shaft, horizontal size control (attached to core arm of T-11)	.15
1V721881	Shield, high voltage compartment: with tape	2.00
26A720284	Shield, light (for dial light)	.05
1V711012	Shield, radiation: complete (mounts with coil springs over picture tube)	.40
26A703225	Shield, tube (V-5)	.10
26A26283	Shield, tube (V-10)	.10
9K720629	Socket, picture tube: 12-pin; with leads	1.00
1V720294	Socket, dial light: with bracket & light rod clip	.45
9K702049	Socket, tube: miniature; 7-prong; 1" mc; wafer type	.20
9K702361	Socket, tube: miniature; 7-prong; with dummy lug & center shield; 1-5/16" mc; wafer type	.20
9K702360	Socket, tube: noval; molded type (V-13)	.35
9A701065	Socket, tube: octal	.20
9A480274	Socket, tube: octal (V-17)	.20
1V790307	Socket, tube: octal; cushioned type (V-14)	.40
41A70955	Spring, compression (on horizontal centering control shaft)....per/c	.50
41A721373	Spring, tension (for rotating cover)	.05
41K700032	Spring, tension (picture tube support)	.20
1V720646	Strap, picture tube retaining: with pads (around picture tube)	.60
31A700082	Strip, contact (receptacle for R-88)	.25
31A21990	Strip, terminal: two-screw (antenna terminal)	.15
4A21941	Washer, "C" (horizontal centering control shaft mtg)....doz	.15
4K73809	Washer, "C": 7/32" (on horizontal size shaft)....per/c	.50
4K24124	Washer, "C": 7/16" (on horizontal size shaft & extension)....doz	.15
4A711501	Washer, shoulder: fibre (tuner shaft mtg)....doz	.30
4K690571	Washer, shoulder: fibre (control mtg)....doz	.20
61A720692	Window, light (for dial light).doz	.20

Insulating Compounds

Part Number	Description	List Price
11M490423	Coating, high-voltage insulating: red-brn	-
11M490387	Wax, biwax	-

TUNER MODEL TT-44 - ELECTRICAL PARTS

Part Number	Description	List Price
1U720970	TT-44 Cascode Tuning Unit: complete	39.45
	exch	29.60

Capacitors

Ref. No.	Part Number	Description	List Price
C-1	21R115905	Ceramic tubular: 220 mmf 500V	.25
C-2	21R115905	Ceramic tubular: 220 mmf 500V	.25
C-3	21K720975	Ceramic disc: ribbon lead; 220 mmf 500V	.30
C-4	21R400932	Ceramic tubular:150 mmf 500V	.25
C-5	21A701029	Ceramic disc: 1500 mmf 500V.	.25
C-6	21A701029	Ceramic disc: 1500 mmf 500V.	.25
C-7	21R114554	Ceramic disc: 470 mmf 500V..	.20
C-8	21A701029	Ceramic disc: 1500 mmf 500V.	.25
C-9	21R114554	Ceramic disc: 470 mmf 500V..	.20
C-10	21A701029	Ceramic disc: 1500 mmf 500V.	.25
C-11	1V710954	Trimmer, ceramic: .5-3 mmf; with screw & mtg nut	.60
C-12	21R119049	Ceramic tubular: 22 mmf 500V (temperature compensated)..	
C-13	21A701029	Ceramic disc: 1500 mmf 500V.	.25
C-14	21R115640	Ceramic tubular: 18 mmf 500V (temperature compensated)..	.25
C-15	1V710954	Trimmer, ceramic: .5-3 mmf; with screw & mtg nut	.60
C-16	21R114071	Ceramic tubular: 1 mmf 500V (temperature compensated)..	.30
C-17		Trimmer, fine tuning (part of switch)	-
C-18	21A701029	Ceramic disc: 1500 mmf 500V.	.25
C-20	21R400936	Ceramic disc: 1000 mmf 500V.	.25
C-21	21R115312	Ceramic disc: 5000 mmf 450V.	.25
C-22	21A701029	Ceramic disc: 1500 mmf 500V.	.25
C-97	21C119295	Ceramic tubular: 27 mmf 500V (temperature compensated)..	.25
C-98	21R115959	Molded phenolic: 1.5 mmf 500V	.10
C-99	21R114153	Ceramic tubular: 47 mmf 500V (temperature compensated)..	.10

Receptacles

Ref. No.	Part Number	Description	List Price
J-1	9K703309	Receptacle, two-pin (antenna receptacle)	.15
J-2	9A702469	Receptacle, one-pin (for alignment generator)	.15

Coils

Ref. No.	Part Number	Description	List Price
L-1A,B	24K721337	Antenna primary: low frequency; channels 2-5	.20
L-1C	24K721489	Antenna primary: low frequency; channel 6	.20
L-1D, E & F	24K721338	Antenna primary: high frequency; channels 7-13	.15
L-2	24K721210	Antenna coil: channels 2 thru 6; includes L-2A thru L-2E (high channel coils are part of switch)	.25
L-3	24K721257	Neutralization coil	.10
L-4	24B721256	Neutralization coil	.05
L-5	24A721274	Filament choke	.10
L-6	24A721394	RF coil: channel 13	.15
L-7	24K721209	RF coil: channels 2 thru 6; includes L-7A thru L-7E (high channel coils are part of switch)	.25
L-8	24K703077	Oscillator coil: channel 13.	.10
L-9	24C721208	Oscillator coil: channels 2 thru 6; includes L-9A thru L-9E (high channel coils are part of switch)	.10

Resistors

Note: All resistors are insulated carbon type

Ref. No.	Part Number	Description	List Price
R-1	6R6397	22,000 10% 1/2W....doz	1.20
R-2	6R6032	470,000 20% 1/2W....doz	1.20
R-3	6R5550	47 10% 1/2W....doz	1.20
R-4	6R6377	470,000 10% 1/2W....doz	1.20
R-5	6R5700	1500 10% 1W	.20
R-7	6R5646	390,000 10% 1/2W....doz	1.20
R-8	6R2119	15,000 20% 1/2W....doz	1.20
R-9	6R6301	1000 20% 1/2W....doz	1.20
R-10	6R6301	1000 20% 1/2W....doz	1.20
R-11	6R6039	4700 20% 1/2W....doz	1.20
R-12	6R6075	100,000 20% 1/2W....doz	1.20
R-13	6R6014	330,000 20% 1/2W....doz	1.20
R-14	6R6301	1000 20% 1/2W....doz	1.20
R-15	6R6117	5600 10% 1/2W....doz	1.20

Transformers

Ref. No.	Part Number	Description	List Price
T-1	24B720936	Antenna impedance matching transformer	.75
T-2	24B720936	Antenna impedance matching transformer	.75
T-3	24B720937	Mixer IF: complete with shield, cores, & mtg base..	1.55

TUNER MODEL TT-44 - MECHANICAL PARTS

Part Number	Description	List Price
42K703087	Clip, spring: phosphor bronze (around collar on fine tuning shaft)	.10
46A702436	Core, iron (T-3)	.10
14K721396	Insulator, tuning core (L-6)	.05
2S400482	Nut: palnut (C-11, C-15 & L-6 mtg)....doz	.15
1K702822	Rotor plate, fine tuning: with bushing	.25
3S118702	Screw, machine: 5-40 x 1; slotted round head (L-6 adj)....doz	.15
3S9650	Screw, machine: 6-32 x 3/4 slotted round head (C-11 & C-15 adj)..doz	.15
47K720256	Shaft, fine tuning	1.25
9K720941	Socket, tube: noval (V-1)	.20
9K712224	Socket, tube: noval (V-2)	.20

MODEL 17F13C CABINET PARTS

Part Number	Description	List Price
24C690896	Antenna, loop, & panel (radio)	1.40
15C721218	Back cover (radio)	1.75
1V721216	Back cover (TV): complete with picture tube rear cover & line cord.	3.45
13K720279	Bezel, picture tube (window frame)	9.05
7A720704	Bracket, bezel retaining	.10
16F720722	Cabinet, combination: red-brn mahogany; less window, mask, & bezel	**
55K712372	Castor: includes 55K712373 gripneck	.85
55K72307	Catch, bullet: statuary bronze finish (door latch-on cabinet)	.10
42A720717	Clip, speed (bezel & window assembly mtg)	.05
35K720727	Cloth, grille: brown & gold;11-1/2 x 16-1/8	4.40
1V790756	Cord, line: with plug & receptacle (TV back cover)	1.35
15D721138	Cover, cabinet bottom (under TV chassis)	1.30
15B710068	Cover, picture tube rear (on back cover)	.65
13C791478	Escutcheon, radio dial: brass	3.75
55K790731	Hinge, stop: LH (at top of lower door)	.30
55K790733	Hinge, stop: LH (at LH top and RH bottom of upper doors)	.25
55K712289	Hinge, stop: RH (at bottom of lower door)	.25
55K712169	Hinge, stop: RH (at RH top and LH bottom of upper doors)	.25
36B720253	Knob, control: channel selector; includes front & rear knobs	1.50
36C720252	Knob, control: contrast	.65
36B720250	Knob, control: fine tuning & off-volume	.50
36C701150	Knob, control: radio	.45
36C720251	Knob, control: tone (TV)	.50
1V720754	Mask, picture tube: with gasket	3.05
1V721114	Medallion, UHF: with insert	1.30
2S490840	Nut: speednut; 1/16" (medallion mtg)....doz	.15
2S118784	Nut: speednut; 5/16" (med plate mtg)....doz	.15
64A720785	Plate, medallion mtg....doz	.40
55K720092	Pull, door (lower door)....pr	1.55
55K720728	Pull, door (upper door)....pr	3.60
5K791856	Rivet, shoulder (TV line cord mtg)	.05
3S114993	Screw, machine: 1/4-20 x 1-3/4 plain hex head; cad pl (TV chassis mtg)....doz	.50
3S7534	Screw, sheet metal: #8 x 1-3/8 plain hex head; cad pl (radio chassis mtg)....doz	.15
55K72308	Strike, bullet: statuary bronze finish; with 1/2" steel nail (door latch - on door)	.15
64K791029	Tracks, record changer....pr	5.90
61D720245	Window, picture tube	7.00

MODEL 17F13BC CABINET PARTS - Same as 17F13C except:

Part Number	Description	List Price
16K720723	Cabinet, combination: limed oak; less window, mask, & bezel	**
55K482792	Catch, bullet: brs (door latch - on cabinet)	.10
35K720726	Cloth, grille: eggshell & gold; 11-1/2 x 16-1/8	4.40
55K712168	Hinge, stop: semi-invisible; brs; LH (at LH top & RH bottom of upper doors)....pr	.55
55K790734	Hinge, stop: semi-invisible; brs; RH (at RH top & LH bottom of upper doors)....pr	.55
55K790732	Hinge, stop: semi-invisible; brs; LH (top of lower door)	.45
55K712288	Hinge, stop: semi-invisible; brs; RH (at bottom of lower door)	.20
55K482793	Strike, bullet: brass; with 1/2" steel nail (door latch - on door)	.10

MODEL 17K14C CABINET PARTS

Part Number	Description	List Price
1V720799	Back cover: with picture tube rear cover & line cord	4.00
13K720279	Bezel, picture tube (window frame)	9.05

Part Number	Description	List Price
7A720704	Bracket, bezel retaining	.10
16F720232	Cabinet, console: red-brn mahogany; less window, mask, & bezel	**
55K712372	Castor: includes 55K712373 gripneck	.85
42A720717	Clip, speed (window & bezel assembly mtg)	.05
35K720235	Cloth, grille: mahogany and gold; 19-15/16 x 14	3.70
30K712361	Cord, line: with plug & receptacle	1.25
15D721142	Cover, cabinet bottom	1.30
15B710068	Cover, picture tube rear (on back cover)	.65
36B720253	Knob, control: channel selector; includes front & rear knobs	1.50
36C720252	Knob, control: contrast	.65
36B720250	Knob, control: fine tuning & off-volume	.50
36C720251	Knob, control: tone	.50
1V720754	Mask, picture tube: with gasket	3.05
1V721114	Medallion, UHF: with insert	1.30
2S490840	Nut: speednut; 1/16" (medallion mtg) doz	.15
2S118784	Nut: speednut; 5/16" (medallion plate mtg) doz	.15
64A720785	Plate, medallion mtg doz	.40
5K791856	Rivet, shoulder (line cord mtg)	.05
3S114993	Screw, machine: 1/4-20 x 1-3/4 plain hex head; cad pl (chassis mtg) doz	.50
61D720245	Window, picture tube	7.00

MODEL 17K14BC CABINET PARTS - Same as 17K14C except:

Part Number	Description	List Price
16K720233	Cabinet, console: limed oak; less window, mask, & bezel	**
35K720236	Cloth, grille: eggshell & gold; 19-15/16 x 14	3.70

MODEL 17K14WC CABINET PARTS - Same as 17K14C except:

Part Number	Description	List Price
16K720234	Cabinet, console: walnut; less window, mask, & bezel	**
35K720237	Cloth, grille: walnut & gold; 19-15/16 x 14	3.70

MODEL 17K15C CABINET PARTS

Part Number	Description	List Price
1V720799	Back cover: complete with picture tube rear cover & line cord	4.00
13K720279	Bezel, picture tube (window frame)	9.05
7A720704	Bracket, bezel retaining	.10
16F720763	Cabinet, console: red-brn mahogany; less window, mask, & bezel	**
55K712372	Castor: includes 55K712373 gripneck	.85
55B72307	Catch, bullet: statuary bronze (door latch - on cabinet)	.10
35K720768	Cloth, grille: mahogany & gold; 12-5/8 x 19-3/4	3.15
42A720717	Clip, speed (window & bezel assembly mtg)	.05
15D721138	Cover, cabinet bottom	1.30
30K712361	Cord, line: with plug & receptacle	1.25
15B710068	Cover, picture tube rear (on back cover)	.65
55K790733	Hinge, stop: semi-invisible; statuary bronze finish; LH (at LH top & RH bottom) pr	.50
55K712169	Hinge, stop: semi-invisible; statuary bronze finish; RH (at RH top & LH bottom) pr	.50
36B720253	Knob, control: channel selector; includes front & rear knobs	1.50
36C720252	Knob, control: contrast	.65
36B720250	Knob, control: fine tuning & off-volume	.50
36C720251	Knob, control: tone	.50
1V720754	Mask, picture tube: with gasket	3.05
1V721114	Medallion, UHF: with insert	1.30
2S490840	Nut: speednut; 1/16" (med mtg) doz	.15
2S118784	Nut: speednut; 5/16" (medallion plate mtg) doz	.15
64A720785	Plate, medallion mtg doz	.40
55K720769	Pull, door: bright brass	1.80
5K791856	Rivet, shoulder (line cord mtg)	.05
3S114993	Screw, machine: 1/4-20 x 1-3/4 plain hex head; cad pl (TV chassis mtg) doz	.50
55K72308	Strike, bullet: statuary bronze; with 1/2" steel nail (door latch - on door)	.15
61D720245	Window, picture tube	7.00

MODEL 17K15BC CABINET PARTS - Same as 17K15BC except:

Part Number	Description	List Price
16K720764	Cabinet, console: limed oak; less window, mask, & bezel	**
55K482792	Catch, bullet: brs (door latch - on cabinet)	.10
55K720767	Cloth, grille: eggshell & gold; 12-5/8 x 19-3/4	3.15
55K712168	Hinge, stop: semi-invisible; brushed brass; LH (LH top & RH bottom) pr	.55
55K790734	Hinge, stop: semi-invisible; brushed brass; RH (RH top & LH bottom) pr	.55
55K482793	Strike, bullet: brs; with 1/2" steel nail (door latch - on door)	.10

MODEL 17K16C CABINET PARTS

Part Number	Description	List Price
1V721160	Back cover: complete with picture tube rear cover & line cord	3.80
13K720279	Bezel, picture tube (window frame)	9.05
7A720704	Bracket, bezel retaining	.10
16E721128	Cabinet, console: white birch; less window, mask, & bezel	**
55K482792	Catch, bullet: brs finish (door latch - on cabinet)	.10
42A720717	Clip, speed (window & bezel assembly mtg)	.05
35K721130	Cloth, grille: 7 x 21-3/8	2.45
30K712361	Cord, line: with plug & receptacle	1.25
15D721138	Cover, cabinet bottom	1.30
15B710068	Cover, picture tube rear (on back cover)	.65
55K721131	Hinge: brass pl pr	.40
36B720253	Knob, control: channel selector; includes front & rear knobs	1.50
36C720252	Knob, control: contrast	.65
36B720250	Knob, control: fine tuning and off-volume	.50
36C720251	Knob, control: tone	.50
1V720754	Mask, picture tube: with gasket	3.05
1V721114	Medallion, UHF: with insert	1.30
2S490840	Nut: speednut; 1/16" (medallion mtg) doz	.15
2S118784	Nut: speednut; 5/16" (medallion plate mtg) doz	.15
64A720785	Plate, medallion mtg doz	.40
5K791856	Rivet, shoulder (line cord mtg)	.05
3S114993	Screw, machine: 1/4-20 x 1-3/4 plain hex head; cad pl (TV chassis mtg) doz	.50
55K482793	Strike, bullet: brs finish; with 1/2" steel nail (door latch - on door)	.10
61D720245	Window, picture tube	7.00

MODEL 17T11C CABINET PARTS

Part Number	Description	List Price
1V721115	Back cover: complete with picture tube rear cover, antenna support bracket, and line cord	4.05
7A710929	Bracket, cabinet back support	.25
75A721050	Bumper, rubber: with bushing (cabinet feet)	.15
16F720297	Cabinet, table model: walnut plastic; less window & mask	**
42A721840	Clip, speed (mask mtg)	
16B701534	Cloth, grille: with baffle board	.50
30K712361	Cord, line: with plug & receptacle	1.25
15B710068	Cover, picture tube rear (on back cover)	.65
36B720253	Knob, control: channel selector; includes front & rear knobs	1.50
36C720252	Knob, control: contrast	.65
36B720250	Knob, control: fine tuning & off-volume	.50
36C720251	Knob, control: tone	.50
1V720754	Mask, picture tube: with gasket	3.05
1V721114	Medallion, UHF: with insert	1.30
2S490840	Nut: speednut; 1/16" (medallion mtg) doz	.15
2S118784	Nut: speednut; 5/16" (medallion plate mtg) doz	.15
64A720785	Plate, medallion mtg doz	.40
5K791856	Rivet, shoulder (line cord mtg)	.05
3K791825	Screw, insulated head (spkr mtg)	.10
3S114993	Screw, machine: 1/4-20 x 1-3/4 plain hex head; cad pl (TV chassis mtg) doz	.50
61D720245	Window, picture tube	7.00

MODEL 17T11EC CABINET PARTS - Same as 17T11C except:

Part Number	Description	List Price
16K720299	Cabinet, table model: ebony plastic; less window & mask	**
16B720183	Cloth, grille: with baffle board	.40
36K720274	Knob, control: channel selector; includes front & rear knobs	1.50
36K720269	Knob, control: contrast	.65
36K720273	Knob, control: fine tuning & off-volume	.50
36K720272	Knob, control: tone	.50

MODEL 17T12C CABINET PARTS

Part Number	Description	List Price
1V720795	Back cover: complete with picture tube rear cover & line cord	3.95
13K720279	Bezel, picture tube (window frame)	9.05
7A720704	Bracket, bezel retaining	.10
37A12748	Bumper, rubber (cabinet feet)	.05
16E720230	Cabinet, table model: red-brn mahogany; less window, mask & bezel	**
42A720717	Clip, speed (window & bezel assembly mtg)	.05
13K702667	Cloth, grille: mahogany; 7 x 7	.90
30K712361	Cord, line: with plug & receptacle	1.25
15C710789	Cover, chassis bottom	2.05
15B710068	Cover, picture tube rear (on back cover)	.65
36B720253	Knob, control: channel selector; includes front & rear knobs	1.50
36C720252	Knob, control: contrast	.65
36B720250	Knob, control: fine tuning & off-volume	.50
36C720251	Knob, control: tone	.50
1V720754	Mask, picture tube: with gasket	3.05
1V721114	Medallion, UHF: with insert	1.30
2S490840	Nut: speednut; 1/16" (medallion mtg) doz	.15
2S118784	Nut: speednut; 5/16" (medallion plate mtg) doz	.15
64A720785	Plate, medallion mtg doz	.40
5K791856	Rivet, shoulder (line cord mtg)	.05
3K702664	Screw, machine: 8-32 x 1-1/2; decorative head; statuary bronze finish (spkr mtg)	.10
3S9694	Screw, machine: 1/4-20 x 1-1/2 plain hex head (chassis mtg) doz	.50
61D720245	Window, picture tube	7.00

MODEL 17T12WC CABINET PARTS - Same as 17T12C except:

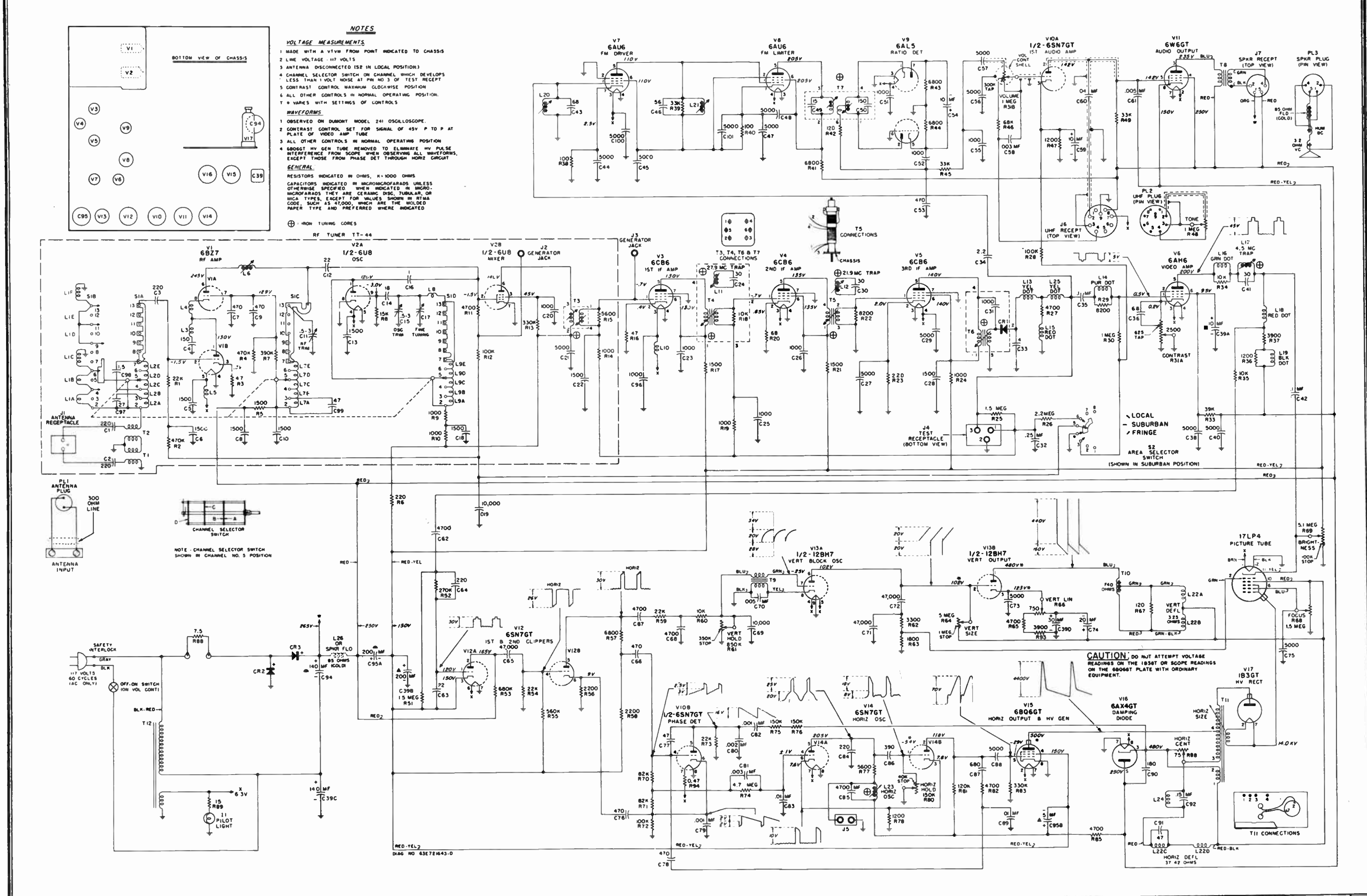
Part Number	Description	List Price
16K720716	Cabinet, table model: walnut; less window, mask, & bezel	**
35K720714	Cloth, grille: walnut; 7 x 7	.25

Bilt-In-Antenna

Part Number	Description	List Price
1X703255	TA-11 Single Loop Antenna: complete (for all receivers except plastic models and 17K16C)	.70
1X711645	TA-12 Single Loop Antenna: complete (for plastic models)	.95
1U721524	TA-15 Single Loop Antenna: complete (for 17K16C)	1.10

PRICES SUBJECT TO CHANGE WITHOUT NOTICE
*Plus Federal Excise Tax At Current Rate
**Prices Furnished Upon Request

TELEVISION CHASSIS TS-408A-00



NOTES

VOLTAGE MEASUREMENTS.

1 MADE WITH A VTVM FROM POINT INDICATED TO CHASSIS
2 LINE VOLTAGE - 117 VOLTS
3 ANTENNA DISCONNECTED (S2 IN LOCAL POSITION.)
4 CHANNEL SELECTOR SWITCH ON CHANNEL WHICH DEVELOPS LESS THAN 1 VOLT NOISE AT PIN NO 3 OF TEST RECEPT
5 CONTRAST CONTROL MAXIMUM CLOCKWISE POSITION
6 ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
7 • VARIES WITH SETTINGS OF CONTROLS

WAVEFORMS

1 OBSERVED ON DUMONT MODEL 241 OSCILLOSCOPE.
2 CONTRAST CONTROL SET FOR SIGNAL OF 45V P TO P AT PLATE OF VIDEO AMP TUBE
3 ALL OTHER CONTROLS IN NORMAL OPERATING POSITION
4 6BQ6GT HV GEN TUBE REMOVED TO ELIMINATE HV PULSE INTERFERENCE FROM SCOPE WHEN OBSERVING ALL WAVEFORMS, EXCEPT THOSE FROM PHASE DET THROUGH HORIZ CIRCUIT

GENERAL

RESISTORS INDICATED IN OHMS, K=1000 OHMS

CAPACITORS INDICATED IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED. WHEN INDICATED IN MICRO-MICROFARADS THEY ARE CERAMIC DISC, TUBULAR, OR MICA TYPES, EXCEPT FOR VALUES SHOWN IN RTMA CODE, SUCH AS 47,000, WHICH ARE THE MOLDED PAPER TYPE AND PREFERRED WHERE INDICATED

⊕ = IRON TUNING CORES

SUPPLEMENT NO. 3

GENERAL INFORMATION

This service manual supplement contains a supplementary parts list and a record of production changes for the TS-408 series chassis (from TS-408A-04 thru TS-408B-03), a listing of receivers not included in previous service manuals or supplements, and replacement parts for chassis and receivers containing factory-installed UHF tuners.

CHASSIS DESCRIPTION

The basic chassis is TS-408. Suffixes (A-04, B-01 etc.) to this basic number indicate production changes. A "Y" suffix designates a chassis containing a factory-installed UHF tuner.

CHASSIS TS-408 SERIES

Refer to TS-408A Service Manual and Supplements No. 1 and No. 2 for service information on chassis TS-408A through TS-408A-03. This manual contains supplementary data on chassis TS-408A-04 through TS-408B-03.

CHASSIS TS-408Y SERIES

Chassis model numbers with a "Y" suffix (TS-408AY-04) indicate that the chassis contains factory-installed UHF tuners. The TS-408Y series chassis uses the TT-52M UHF tuning unit. Refer to the TT-52M for service data and UHF tuning unit replacement parts.

RECEIVER MODEL CHART

Model	Type of Set	TV Chassis Used	Radio Chassis Used	Record Changer Used
17F13BCY	Combination, limed oak	TS-408Y	HS-319	RC-40
17F13CY	Combination, red-brn mahogany	TS-408Y	HS-319	RC-40
17F13F	Combination, red-brn mahogany	TS-408	HS-319	C3RC
17F13FB	Combination, limed oak	TS-408	HS-319	C3RC
17F13FBY	Combination, limed oak	TS-408Y	HS-319	C3RC
17F13FY	Combination, red-brn mahogany	TS-408Y	HS-319	C3RC
17K14BCY	Console, limed oak	TS-408Y		
17K14CY	Console, red-brn mahogany	TS-408Y		
17K14WCY	Console, walnut	TS-408Y		
17K15CY	Console, red-brn mahogany	TS-408Y		
17K16CY	Console, white birch (with detachable legs)	TS-408Y		
17T11CY	Table, walnut plastic	TS-408Y		
17T11ECY	Table, ebony plastic	TS-408Y		
17T12CY	Table, red-brn mahogany	TS-408Y		
17T12BCY	Table, limed oak	TS-408Y		
17T12WCY	Table, walnut	TS-408Y		

PRODUCTION CHANGES

Chassis Coding	Changes
TS-408A-04	Fusing wire (F-1) added to filament circuit.
TS-408A-05	R-82 (4700) changed to 6800 ohms. R-85 (4700) changed to 6800 ohms. C-80 (.002) changed to 4700 mmf, to reduce horizontal overdrive and fold-over.
TS-408A-06	R-62 (3300) changed to 1800 ohms and R-63 (1800) changed to 3300 ohms, to increase blanking pulse at the grid of the picture tube. (This change does not occur in some chassis until "B-01".)
TS-408A-07	The On-Off switch moved to the high side of the AC line.
TS-408B-00	NOTE: Chassis marked "B-00" do not incorporate the change listed under "A-06". Compensating coil L-16 and L-17 (4.5 mc trap) interchanged, to improve video response.
	"Framelock" circuit added, as listed below, to improve vertical sync under noise conditions: C-103 (33), C-104 (22), R-96 (1000) and L-27 added to 3rd IF stage. C-28 (1500) changed to 1000 mmf. C-105 (470) and R-97 (15K) added to video amplifier stage. C-63 (22) removed from 1st clipper.
TS-408B-01	These chassis incorporated all changes listed under "A-06" and "B-00".
TS-408B-02	R-53 (680K) changed to 1 meg, to improve interlace.
TS-408B-03	C-75 (5000 mmf, 2000V) added from picture tube focusing anode (blue lead) to chassis and C-73 (5000 mmf) changed to capacitor with 2000V rating, to prevent high voltage flash-over within the picture tube and the vertical output tube, respectively.

SERVICE NOTES

CAUTION: If the 6BQ6GT horizontal output tube is removed during alignment, be sure to insulate the plate cap to prevent its shorting to the chassis and ruining the high voltage transformer.

REPLACEMENT PARTS LIST SUPPLEMENT

NOTE: When ordering parts, specify model number of set in addition to part number and description of part. The following parts are additions to the original items in the TS-408 Service Manuals.

TS-408B ELECTRICAL PARTS - Same as TS-408A except:

Ref. No.	Part Number	Description	List Price
Capacitors			
C-28	21R115386	Ceramic disc: 1000 mmf 500V.	.25
C-73	21R120093	Ceramic disc: 5000 mmf 2000V	.25
C-75	21R120093	Ceramic disc: 5000 mmf 2000V	.25
C-80	8R490249	Molded paper: 4700 mmf 500V.	.20
C-84	21R115900	Ceramic tubular: 100 mmf 500V	.30
C-103	21R120132	Ceramic tubular: 33 mmf 500V	.25
C-104	21R400942	Ceramic tubular: 22 mmf 500V	.20
C-105	21R115856	Ceramic tubular: 470 mmf 500V	.20
Fuses			
F-1		$1\frac{1}{2}$" piece of #26 wire.......	
Coils			
L-27	24A722677	Choke: 1.5 microhenries.....	.35
Resistors			
		Note: All resistors are insulated carbon type unless otherwise specified.	
R-31	18B722190	Contrast & volume control (alternate for 18B720263)..	2.45
R-53	6R6046	1 meg 10% 1/2W.........doz	1.20
R-62	6R2089	1800 10% 1/2W..........doz	1.20
R-63	6R5581	3300 10% 1/2W..........doz	1.20
R-82	6R6428	6800 10% 1/2W..........doz	1.20
R-85	6R6428	6800 10% 1/2W..........doz	1.20
R-96	6R6301	1000 20% 1/2W..........doz	1.20
R-97	6R6477	15,000 10% 1/2W........doz	1.20
Transformers			
T-12	25B721779	Filament transformer (alternate for 25B720749)..	10.25

Part Number	Description	List Price
MODELS 17F13BCY, CY, F, FB, FBY, FY CABINET PARTS		
1U730050	Antenna, built-in: Model TA-23; with leads (UHF & VHF TV) (replaces single VHF antenna used in some models)..................	1.65*
24C690896	Antenna, loop (AM radio)..........	1.40*
15C721218	Back Cover, radio compartment.....	1.75
1V722142	Back Cover, TV compartment: with picture tube rear cover and line cord (17F13CY, 17F13BCY, 17F13FY, 17F13FBY)........................	3.60
1V721216	Back Cover, TV compartment: with picture tube rear cover and line cord (17F13F, 17F13FB)..........	3.45
13K720279	Bezel, picture tube (window frame)	9.05
7A720704	Bracket, bezel retaining (mounts window and bezel assembly to cabinet)........................	.10

Part Number	Description	List Price
16F720722	Cabinet, combination: red-brn mahogany; less window, mask and bezel assembly (17F13CY)	**
16K720723	Cabinet, combination: limed oak; less window, mask and bezel assembly (17F13BCY)	**
16F722468	Cabinet, combination: red-brn mahogany; less window, mask and bezel (17F13F, 17F13FY)	**
16K722469	Cabinet, combination: limed oak; less window, mask and bezel (17F13FB, 17F13FBY)	**
1K721910	Cable, antenna jumper assembly: 26½" long; includes spade lugs and 2 150 ohm resistors (jumper between UHF and VHF ant terminals when single ant is used)(17F13CY, 17F13BCY, 17F13FY, 17F13FBY)	.70
55K712372	Caster: includes 55K712373 gripneck	.85
55K72307	Catch, bullet: statuary bronze finish (door latch - on cabinet) (17F13CY, 17F13F, 17F13FY)	.10
55K482792	Catch, bullet: brass (door latch - on cabinet)(17F13BCY, 17F13FB, 17F13FBY)	.10
42A720717	Clip, speed (mounts gasket and mask to bezel)	.05
35K720727	Cloth, grille: mahogany & gold; 11½" x 16-1/8" (17F13CY, 17F13FY, 17F13F)	4.40
35K720726	Cloth, grille: eggshell & gold; 11½" x 16-1/8" (17F13BCY, 17F13FBY, 17F13FB)	4.40
30K712361	Cord, line: with plug; 9 ft long	.95
1V790756	Cord, line: with plug and interlock receptacle; 2 ft lg	1.35
15D721138	Cover, chassis bottom (TV)	1.30
15B710068	Cover, picture tube rear (on back cover)	.65
34C720956	Dial scale: brown, gold numerals (UHF channel indicator)(17F13CY, 17F13BCY, 17F13FY, 17F13FBY)	.45
13C791478	Escutcheon, radio dial: brass	3.75
5A71081	Eyelet, radio chassis mtg: plain; 9/32" long ... doz	.15
5A600963	Eyelet, radio chassis mtg: pierced; 1/8" long ... doz	.15
32K720730	Gasket, picture tube: rubber (around picture tube front)	.60
5A71092	Grommet, radio chassis mtg: rubber	.10
55K712288	Hinge, stop: RH; brushed brass finish (at bottom of lower door) (17F13BCY, 17F13FB, 17F13FBY)	.20
55K790732	Hinge, stop: LH; brushed brass finish (at top of lower door) (17F13BCY, 17F13FB, 17F13FBY)	.20
55K712168	Hinge, stop: LH; brushed brass finish (at LH top & RH bottom of upper doors)(17F13BCY, 17F13FB, 17F13FBY)	.30
55K790734	Hinge, stop: RH; brushed brass finish (at RH top & LH bottom of upper doors)(17F13BCY, 17F13FB, 17F13FBY)	.30
55K712289	Hinge, stop: RH; statuary bronze finish (at bottom of lower door) (17F13CY, 17F13F, 17F13FY)	.30
55K790731	Hinge, stop: LH; statuary bronze finish (at top of lower door) (17F13CY, 17F13F, 17F13FY)	.30

Part Number	Description	List Price
55K790733	Hinge, stop: LH; statuary bronze finish (at LH top & RH bottom of upper doors)(17F13CY, 17F13F, 17F13FY)	.30
55K712169	Hinge, stop: RH; statuary bronze finish (at RH top & LH bottom of upper doors)(17F13CY, 17F13F, 17F13FY)	.30
36B720253	Knob, control: brown (VHF channel selector)(17F13F, 17F13FB)	1.50
36K722236	Knob, control: brown (VHF channel selector)(17F13CY, 17F13BCY, 17F13FY, 17F13FBY)	1.45
36C720252	Knob, control: brown (contrast)	.65
36B720250	Knob, control: brown (fine tuning & volume)	.50
36C720251	Knob, control: white, brown lettering (tone)	.50
36C720949	Knob, control: brown, gold lettering (UHF tuning)(17F13CY, 17F13BCY, 17F13FY, 17F13FBY)	.55
36C701150	Knob, control (radio)	.45
36B721980	Lever, selector (UHF-VHF selector) (17F13CY, 17F13BCY, 17F13FY, 17F13FBY)	.80
29A791608	Lug, spade (on ant jumper cable) (17F13CY, 17F13BCY, 17F13FY, 17F13FBY) ... doz	.15
13D720621	Mask, picture tube	1.90
1V721114	Medallion, UHF (over UHF cut-out hole)(17F13F, 17F13FB)	1.30
33A722098	Name Plate (UHF-VHF indicator) (17F13CY, 17F13BCY, 17F13FY, 17F13FBY)	.15
2S118784	Nut, speednut: for 5/16" stud (medallion plate mtg)(17F13F, 17F13FB) ... doz	.15
64A720785	Plate, medallion mtg (17F13F, 17F13FB)	.10
55K720728	Pull, door: brass (upper door)	1.80
55K720092	Pull, door: brass (lower door)	.80
5K791856	Rivet, shoulder (TV line cord mtg)	.45
3S7491	Screw, drive: .060-32 x 3/16 pl rnd head; brass pltd (name plate mtg)(17F13CY, 17F13BCY, 17F13FY, 17F13FBY) ... doz	.15
3S114993	Screw, machine: 1/4-20 x 1-3/4 pl hex head; cad pl (TV chassis mtg) ... doz	.50
3S7534	Screw, sheet metal: #8-15 x 1-3/8 pl hex head; cad pl (radio chassis mtg) ... doz	.15
43A722235	Spacer, pendant: fibre; gray (behind UHF-VHF selector lever) (17F13CY, 17F13FBY)	.20
43K722467	Spacer, pendant: fibre; buff color (behind UHF-VHF selector lever) (17F13BCY, 17F13FBY)	.20
55K72308	Strike, bullet: statuary bronze finish; with 1/2" nail (door latch - on door)(17F13CY, 17F13F, 17F13FY)	.15
55K482793	Strike, bullet: brass; with 1/2" nail (door latch - on door) (17F13BCY, 17F13FB, 17F13FBY)	.10
64K791029	Track & channel, record changer drawer ... pr	5.90
61D720245	Window, picture tube	7.00

MODELS 17K14CY, BCY, WCY CABINET PARTS

Part Number	Description	List Price
1U730050	Antenna, built-in: Model TA-23; with leads (UHF & VHF TV) (replaces single VHF antenna used in some models)	1.65*
1V722037	Back Cover: with picture tube rear cover and line cord	4.00
13K720279	Bezel, picture tube (window frame)	9.05
7A720704	Bracket, bezel retaining (mounts window and bezel assembly to cabinet)	.10
16F720232	Cabinet, console: red-brn mahogany; less window, mask & bezel (17K14CY)	**
16K720233	Cabinet, console: limed oak; less window, mask & bezel (17K14BCY)	**
16K720234	Cabinet, console: walnut; less window, mask & bezel (17K14WCY)	**
1K721910	Cable, antenna jumper assembly: 26½" long; includes spade lugs and 2 150 ohm resistors (jumper between UHF and VHF antenna terminals when single ant is used)	.70
55K712372	Caster: includes 55K712373 gripneck	.85
42A720717	Clip, speed (mounts gasket and mask to bezel)	.05
35K720235	Cloth, grille: 19-15/16" x 14"; (17K14CY)	3.70
35K720236	Cloth, grille: 19-15/16" x 14"; eggshell & gold (17K14BCY)	3.70
35K720237	Cloth, grille: 19-15/16" x 14"; walnut & gold (17K14WCY)	3.70
30K712361	Cord, line: with plug and interlock receptacle; 9 ft long	.95
15D721142	Cover, chassis bottom	1.30
15B710068	Cover, picture tube rear (on back cover)	.65
34C720956	Dial scale: brown, gold numerals (UHF channel indicator)	.45
32K720730	Gasket, picture tube: rubber (around picture tube front)	.60
36K722236	Knob, control: brown (VHF channel selector)	1.45
36C720252	Knob, control: brown (contrast)	.65
36B720250	Knob, control: brown (fine tuning & volume)	.50
36C720251	Knob, control: white, brown lettering (tone)	.50
36C720949	Knob, control: brown, gold lettering (UHF tuning)	.55
36B721980	Lever, selector (UHF-VHF selector)	.80
29A791608	Lug, spade (on ant jumper cable) ... doz	.15
13D720621	Mask, picture tube	1.90
33A722098	Name Plate (UHF-VHF indicator)	.15
5K791856	Rivet, shoulder (line cord mtg) doz	.30
3S7491	Screw, drive: .060-32 x 3/16 pl rnd hd; brass pltd (name plate mtg) ... doz	.15
3S114993	Screw, machine: 1/4-20 x 1-3/4 pl hex head; cad pl (chassis mtg) doz	.50
43A722235	Spacer, pendant: fibre; gray (behind UHF-VHF selector lever) (17K14CY, 17K14WCY)	.20
43K722467	Spacer, pendant: fibre; buff color (behind UHF-VHF selector switch) (17K14BCY)	.20
61D720245	Window, picture tube	7.00

MODEL 17K15CY CABINET PARTS

Part Number	Description	List Price
1U730050	Antenna, built-in: Model TA-23; with leads (UHF & VHF TV)	1.65*
1V722037	Back Cover: with picture tube rear cover and line cord	4.00
13K720279	Bezel, picture tube (window frame)	9.05
7A720704	Bracket, bezel retaining (mounts window and bezel assembly to cabinet)	.10
16F720763	Cabinet, console: red-brn mahogany; less window, mask and bezel	**
1K721910	Cable, antenna jumper assembly: 26½" long; includes spade lugs and 2 150 ohm resistors (jumper between UHF and VHF ant terminals when single ant is used)	.70
55K712372	Caster: includes 55K712373 gripneck	.85
55K72307	Catch, bullet: statuary bronze finish (door latch - on cabinet)	.10
42A720717	Clip, speed (mounts gasket and mask to bezel)	.05
35K720768	Cloth, grille: mahogany & gold	3.15
30K712361	Cord, line: with plug and interlock receptacle; 9 ft long	.95
15D721138	Cover, chassis bottom	1.30
15B710068	Cover, picture tube rear (on back cover)	.65
34C720956	Dial scale: brown, gold numerals (UHF channel indicator)	.45
32K720730	Gasket, picture tube: rubber (around picture tube front)	.60
55K712169	Hinge, stop: RH; statuary bronze finish (at RH top and LH bottom of doors)	.30
55K790733	Hinge, stop: LH; statuary bronze finish (at LH top and RH bottom of doors)	.30
36K722236	Knob, control: brown (VHF channel selector)	1.45
36C720252	Knob, control: brown (contrast)	.65
36B720250	Knob, control: brown (fine tuning & volume)	.50
36C720251	Knob, control: white, brown lettering (tone)	.50
36C720949	Knob, control: brown, gold lettering (UHF tuning)	.55
36B721980	Lever, selector (UHF-VHF selector)	.80
29A791608	Lug, spade (on ant jumper cable) ... doz	.15
13D720621	Mask, picture tube	1.90
33A722098	Name Plate (UHF-VHF indicator)	.15
55K720769	Pull, door: bronze	1.80
5A791856	Rivet, shoulder (line cord mtg)	.05
3S7491	Screw, drive: .060-32 x 3/16 pl rnd head; brass pltd (name plate mtg) ... doz	.15
3S114993	Screw, machine: 1/4-20 x 1-3/4 pl hex head; cad pl (chassis mtg) doz	.50
43A722235	Spacer, pendant: fibre; gray (behind UHF-VHF selector lever)	.20
55K72308	Strike, bullet: statuary bronze finish; with 1/2" nail (door latch - on door)	.15
61D720245	Window, picture tube	7.00

MODEL 17K16CY CABINET PARTS

Part Number	Description	List Price
1U722756	Antenna, built-in: Model TA-21; with leads (UHF & VHF TV)........	1.65*
1V722039	Back Cover: with picture tube rear cover and line cord.............	4.15
13K720279	Bezel, picture tube (window frame)	9.05
75K721137	Bumper, rubber: white; ½" dia with tack (door stop)...............pr	.05
7A720704	Bracket, bezel retaining (mounts window and bezel assembly to cabinet)............................	.10
16E721128	Cabinet, console: white birch; less window, mask and bezel...........	**
1K721916	Cable, antenna jumper assembly: 26½" long; includes spade lugs and 2 150 ohm resistors (jumper between UHF and VHF ant terminals when single ant is used).........	.65
55K482792	Catch, bullet: statuary bronze finish (door latch - on cabinet).	.10
42A720717	Clip, speed (mounts gasket and mask to bezel)..................	.05
35K721130	Cloth, grille: 7" x 21-3/8".......	2.45
30K712361	Cord, line: with plug and interlock receptacle; 9 ft long............	.95
15D721138	Cover, chassis bottom.............	1.30
15B710068	Cover, picture tube rear (on back cover)..........................	.65
34C720956	Dial scale: brown, gold numerals (UHF channel indicator)..........	.45
32K720730	Gasket, picture tube: rubber (around picture tube front)......	.60
55R721131	Hinge, brass pl...................	.50
36K722236	Knob, control: brown (VHF channel selector).......................	1.45
36C720252	Knob, control: brown (contrast)...	.65
36B720250	Knob, control: brown (fine tuning & volume).......................	.50
36C720251	Knob, control: white, brown lettering (tone)......................	.50
36C720949	Knob, control: brown, gold lettering (UHF tuning)................	.55
36B721980	Lever, selector (UHF-VHF selector)	.80
29A791608	Lug, spade (on ant jumper cable)........................doz	.15
13D720621	Mask, picture tube...............	1.90
33A722098	Name Plate (UHF-VHF indicator)....	.15
55K721129	Plate, door stop (on rear edge of door)...........................	.25
5K791856	Rivet, shoulder (line cord mtg)...	.05
3S7491	Screw, drive: .060-32 x 3/16 pl rnd head; brs pltd (name plate mtg)doz	.15
3S114993	Screw, machine: 1/4-20 x 1-3/4 pl hex head; cad pl (chassis mtg)doz	.50
43A722235	Spacer, pendant: fibre; gray (behind UHF-VHF selector lever).....	.20
55K482793	Strike, bullet: statuary bronze finish; with 1/2" nail (door latch - on door)........................	.10
61D720245	Window, picture tube.............	7.00

MODELS 17T11CY, ECY CABINET PARTS

Part Number	Description	List Price
1U722754	Antenna, built-in: Model TA-19; with leads (UHF & VHF TV)........	1.50*
1V722032	Back Cover: with picture tube rear cover and line cord.............	4.10
16B701534	Baffle, speaker: with grille cloth (17T11CY).......................	.50
16B720183	Baffle, speaker: with grille cloth (17T11ECY)......................	.50
7A710929	Bracket, back cover mtg (at top corners of cover)...............	.25
75A721050	Bumper, rubber (cabinet feet).....	.15
16K720299	Cabinet, table model: ebony plastic; less window & mask (17T11ECY)....	**
16F720297	Cabinet, table model: walnut plastic; less window and mask (17T11CY)...	**
1K721910	Cable, antenna jumper assembly: 26½" long; includes spade lugs and 2 150 ohm resistors (jumper between UHF and VHF ant terminals when single ant is used)..........	.70
42A720717	Clip, speed: for 1/4" stud (window and mask mtg -top and bottom center).........................	.05
42A721840	Clip, speed: for 5/16" stud (window and mask mtg -corners)........	.10
30K712361	Cord, line: with plug and interlock receptacle; 9 ft lg.............	.95
15B710068	Cover, picture tube rear (on back cover)..........................	.65
34C720957	Dial scale: black, gold numerals (UHF channel indicator)(17T11ECY).	.45
34C720956	Dial scale: brown, gold numerals (UHF channel indicator)(17T11CY)..	.45
32K720730	Gasket, picture tube: rubber (around picture tube front)...............	.60
36K722237	Knob, control: black (VHF channel selector)(17T11ECY)..............	1.45
36K722236	Knob, control: brown (VHF channel selector)(17T11CY)...............	1.45
36K720269	Knob, control: black (contrast) (17T11ECY).......................	.65
36C720252	Knob, control: brown (contrast) (17T11CY)........................	.65
36K720273	Knob, control: black (fine tuning & volume)(17T11ECY)..............	.50
36B720250	Knob, control: brown (fine tuning & volume)(17T11CY)...............	.50
36K720272	Knob, control: white, black lettering (tone)(17T11ECY)............	.50
36C720251	Knob, control: white, brown lettering (tone)(17T11CY).............	.50
36K720953	Knob, control: black, gold numerals (UHF tuning)(17T11ECY)...........	.55
36C720949	Knob, control: brown, gold lettering (UHF tuning)(17T11CY)...........	.55
36B721980	Lever, selector (UHF-VHF selector).	.80
29A791608	Lug, spade (on ant jumper cable)........................doz	.15
13D720621	Mask, picture tube................	1.90
33A722098	Name Plate (UHF-VHF indicator).....	.15
5K791856	Rivet, shoulder (line cord mtg).doz	.30
3S7491	Screw, drive: .060-32 x 3/16 pl rnd head; brass pltd (name plate mtg).........................doz	.15
3K791825	Screw, machine: 8-32 x 1 decorative, insulated head; statuary bronze (spkr mtg)........................	.10
3S114993	Screw, machine: 1/4-20 x 1-3/4 pl hex head; cad pl (chassis mtg).doz	.50
43A722235	Spacer, pendant: fibre; gray (behind UHF-VHF selector lever)...........	.20
61D720245	Window, picture tube..............	7.00

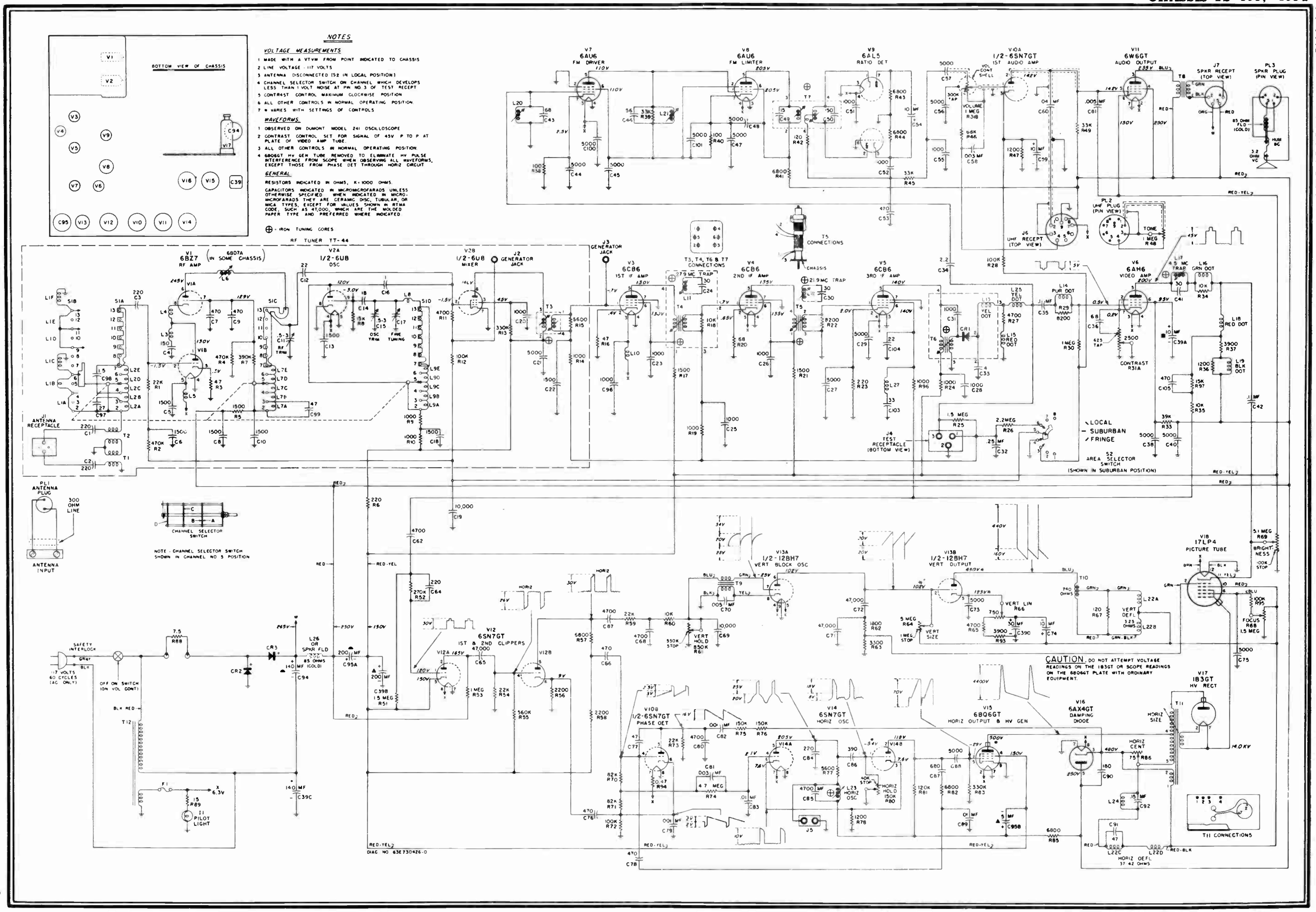
MODELS 17T12CY, BCY, WCY CABINET PARTS

Part Number	Description	List Price
1U722754	Antenna, built-in: Model TA-23; with leads (UHF & VHF TV)........	1.50*
1V722062	Back Cover: with picture tube rear cover and line cord.............	4.05
13K720279	Bezel, picture tube (window frame)	9.05
7A720704	Bracket, bezel retaining (mounts window and bezel assembly).......	.10
37A12748	Bumper, rubber (cabinet feet).....	.05
16E720230	Cabinet, table model: red-brn mahogany; less window,mask and bezel (17T12CY).................	**
16K720716	Cabinet, table model: walnut; less window, mask & bezel (17T12WCY)..	**
16K720231	Cabinet, table model: limed oak; less window, mask & bezel (17T12BCY).......................	**
1K721910	Cable, antenna jumper assembly: 26½" long; includes spade lugs and 2 150 ohm resistors (jumper between UHF and VHF ant terminals when single ant is used).........	.70
42A720717	Clip, speed (mounts gasket & mask to bezel).......................	.05
13K702667	Cloth, grille: mahogany color; 7" x 7" (17T12CY)...............	.25
13K702666	Cloth, grille: eggshell color; 7" x 7" (17T12BCY)..............	.30
35K720714	Cloth, grille: walnut; 7" x 7" (17T12WCY)......................	.25
30K712361	Cord, line: with plug and interlock receptacle; 9 ft long............	.95
15C710789	Cover, cabinet bottom............	2.05
15B710068	Cover, picture tube rear (on back cover)..........................	.65
34C720956	Dial scale: brown, gold numerals (UHF channel indicator)..........	.45
32K720730	Gasket, picture tube: rubber (around picture tube front)......	.60
36K722236	Knob, control: brown (VHF channel selector).......................	1.45
36C720252	Knob, control: brown (contrast)...	.65
36B720250	Knob, control: brown (fine tuning & volume).......................	.50
36C720251	Knob, control: white, brown lettering (tone)......................	.50
36C720949	Knob, control: brown, gold lettering (UHF tuning)................	.55
36B721980	Lever, selector (UHF-VHF selector)	.80
29A791608	Lug, spade (on ant jumper cable)........................doz	.15
13D720621	Mask, picture tube................	1.90
33A722098	Name Plate (UHF-VHF indicator)....	.15
5A791856	Rivet, shoulder (line cord mtg)doz	.30
3S7491	Screw, drive: .060-32 x 3/16 pl rnd head; brass pltd (name plate mtg).........................doz	.15
3K702664	Screw, machine: 8-32 x 1½ decorative, insulated head; bronze pltd (spkr mtg)(17T12CY, 17T12WCY)....	.10
3K702665	Screw, machine: 8-32 x 1½ decorative, insulated head; brass pltd (spkr mtg)(17T12BCY)............	.10
3S9694	Screw, machine: 1/4-20 x 1-1/2 pl hex head; cad pl (chassis mtg)doz	.50
43A722235	Spacer, pendant: fibre; gray (behind UHF-VHF selector lever) (17T12CY, 17T12WCY).............	.20
43K722467	Spacer, pendant: fibre; buff color (behind UHF-VHF selector lever) (17T12BCY).......................	.20
61D720245	Window, picture tube.............	7.00

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

*Plus Federal Excise Tax At Current Rate

**Prices Furnished Upon Request


NOTES
VOLTAGE MEASUREMENTS
1 MADE WITH A VTVM FROM POINT INDICATED TO CHASSIS
2 LINE VOLTAGE - 117 VOLTS
3 ANTENNA DISCONNECTED (S2 IN LOCAL POSITION)
4 CHANNEL SELECTOR SWITCH ON CHANNEL WHICH DEVELOPS LESS THAN 1 VOLT NOISE AT PIN NO 3 OF TEST RECEPT
5 CONTRAST CONTROL MAXIMUM CLOCKWISE POSITION
6 ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
7 * VARIES WITH SETTINGS OF CONTROLS
WAVEFORMS
1 OBSERVED ON DUMONT MODEL 241 OSCILLOSCOPE
2 CONTRAST CONTROL SET FOR SIGNAL OF 45V P TO P AT PLATE OF VIDEO AMP TUBE.
3 ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
4 6BQ6GT HV GEN TUBE REMOVED TO ELIMINATE HV PULSE INTERFERENCE FROM SCOPE WHEN OBSERVING ALL WAVEFORMS, EXCEPT THOSE FROM PHASE DET THROUGH HORIZ CIRCUIT
GENERAL
RESISTORS INDICATED IN OHMS, K=1000 OHMS.
CAPACITORS INDICATED IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED. WHEN INDICATED IN MICROMICROFARADS THEY ARE CERAMIC DISC, TUBULAR, OR MICA TYPES, EXCEPT FOR VALUES SHOWN IN RTMA CODE, SUCH AS 47,000, WHICH ARE THE MOLDED PAPER TYPE AND PREFERRED WHERE INDICATED
⊕ - IRON TUNING CORES
BOTTOM VIEW OF CHASSIS
RF TUNER TT-44
V1 6BZ7 RF AMP
V2A 1/2-6U8 OSC
V2B 1/2-6U8 MIXER
V3 6CB6 1ST IF AMP
V4 6CB6 2ND IF AMP
V5 6CB6 3RD IF AMP
V6 6AH6 VIDEO AMP
V7 6AU6 FM DRIVER
V8 6AU6 FM LIMITER
V9 6AL5 RATIO DET
V10A 1/2-6SN7GT 1ST AUDIO AMP
V11 6W6GT AUDIO OUTPUT
V12 6SN7GT 1ST & 2ND CLIPPERS
V13A 1/2-12BH7 VERT BLOCK OSC
V13B 1/2-12BH7 VERT OUTPUT
V10B 1/2-6SN7GT PHASE DET
V14 6SN7GT HORIZ OSC
V15 6BQ6GT HORIZ OUTPUT & HV GEN
V16 6AX4GT DAMPING DIODE
V17 1B3GT HV RECT
V18 17LP4 PICTURE TUBE
CHANNEL SELECTOR SWITCH
NOTE - CHANNEL SELECTOR SWITCH SHOWN IN CHANNEL NO 5 POSITION
ANTENNA INPUT
LOCAL
SUBURBAN
FRINGE
S2 AREA SELECTOR SWITCH (SHOWN IN SUBURBAN POSITION)
CAUTION. DO NOT ATTEMPT VOLTAGE READINGS ON THE 1B3GT OR SCOPE READINGS ON THE 6BQ6GT PLATE WITH ORDINARY EQUIPMENT.
T11 CONNECTIONS
DIAG NO 63E730426-0

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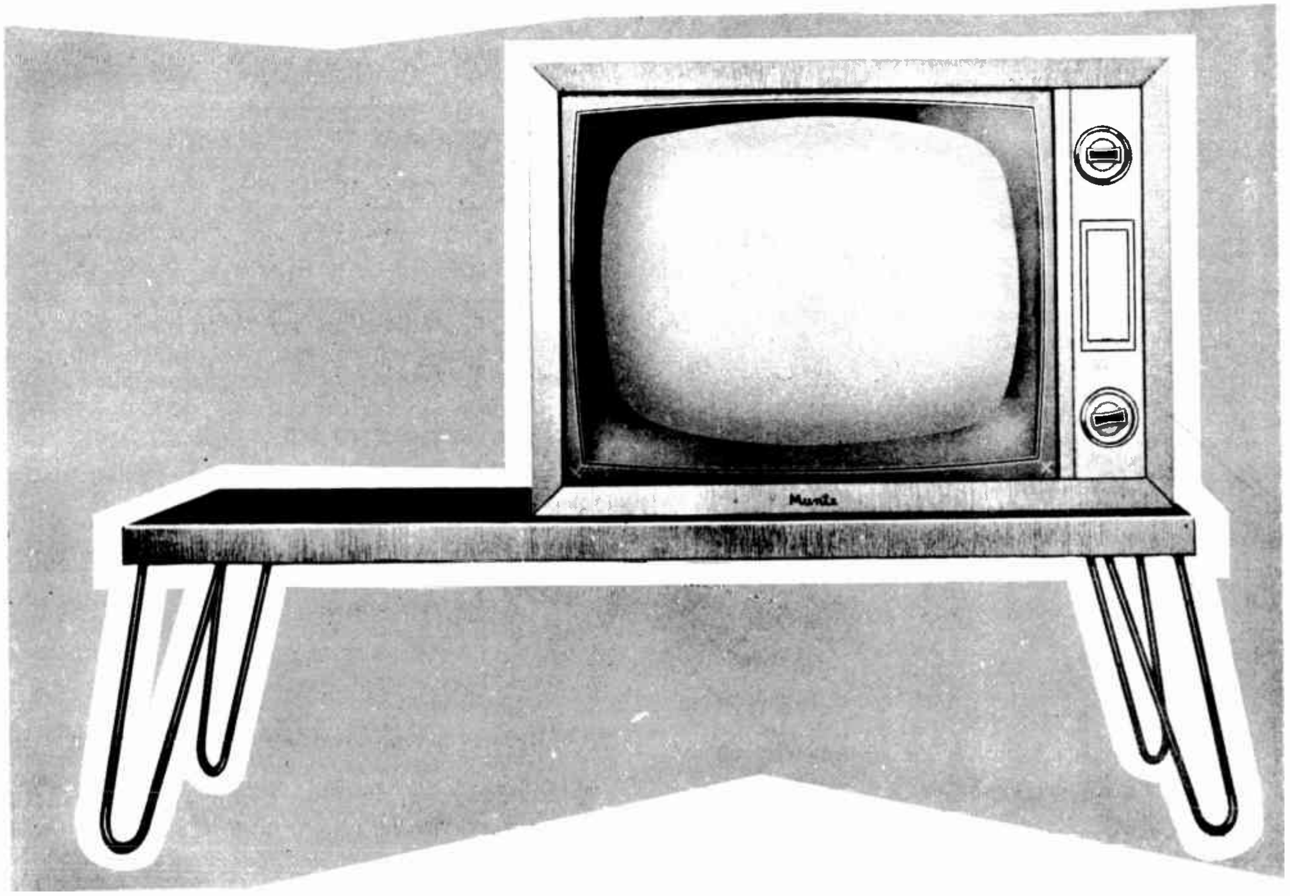
MODEL NO.	CHASSIS NO.	PICTURE TUBE	CABINET STYLE
2763A	17B8	27" Rect.	Consolette
2764A	17B8	27" Rect.	Consolette with Doors
2765A	17B8	27" Rect.	Television, AM-FM Radio and Phonograph Console Combination
327T1	17B8	27" Rect.	Table—Wrought Iron Legs



SS-0039

SPECIFICATIONS

OPERATING LINE VOLTAGE — 108 to 125 Volts 60 Cycle A.C.

CHANNEL COVERAGE—VHF Channels 2 to 13 inclusive; UHF Channels 14 to 83 with "Snap-in" adapter strips.

I.F. VIDEO CARRIER 25.1 MC — I.F. SOUND CARRIER 20.6 MC.

POWER CONSUMPTION — 235 Watts.

AUDIO POWER OUTPUT — 1.5 Watts Undistorted — measured with standard load.

LOUD SPEAKER — 10" P.M. Type using Alnico 5.

VOICE COIL IMPEDANCE — 3.2 Ohms at 400 Cycles.

PROTECTIVE FUSE.

HIGH VOLTAGE — 18,000 Volts at 2nd Anode.

OTHER ADVANTAGES ARE: ONE KNOB picture control — HIGH GAIN channel selector — R.F. STAGE on ALL channels — SNAP-IN COILS in tuner gives selection of VHF and UHF stations. — BALANCED 300 Ohm impedance input to tuner or 72 Ohm unbalanced line — SYNCHROGUIDE A.F.C. reduces noise interference in picture — DARK FLUORESCENT EYE SAVER picture tube — INTERCARRIER SOUND limits the drift to a minimum amount while locking the sound to the picture. — IMPROVED high voltage flyback circuit for BRIGHTER pictures and BETTER contrast — HIGH FIDELITY F.M. SOUND — INVERSE FEEDBACK for improved audio response — FOUR I.F. transformers for better SELECTIVITY and RESOLUTION — PLATE VOLTAGE REGULATION for smoother over-all performance — MODERATE TEMPERATURE RISE — CONVENIENT SERVICE ADJUSTMENTS — ANTI-GLARE picture mask — SAFETY GLASS protection — HAND-RUBBED WOOD cabinets of many styles. APPROVED BY NATIONAL BOARD OF UNDERWRITERS.

HIGH VOLTAGE WARNING

Operation of this receiver with interlocked back cover removed involves a shock hazard from the receiver power supplies. Work on this receiver should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment.

CATHODE RAY TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves should be worn at all times when handling the cathode ray tube. The tube should not be handled in the vicinity of any person not so equipped. When handling the cathode ray tube, always keep it away from the body. It is fitting and proper to request the customer and his children to leave the room during a Picture tube exchange.

The cathode ray tube bulb, due to its large surface area and high vacuum contained within, is subjected to high air pressure. More than ordinary care is required to prevent shattering the tube. The large end of the bulb, particularly the rim of the viewing surface, must not be struck, scratched, or subjected to more than moderate pressure at any time. If the tube sticks or fails to slip smoothly into place during replacement, remove the tube and determine the cause of the trouble.

DO NOT FORCE THE TUBE

FRONT PANEL SERVICE CONTROLS

(located under Muntz nameplate)

HORIZONTAL HOLD: The horizontal hold control locks the horizontal oscillator to the frequency of the transmitted sync. pulse. Rotating the control clockwise the picture should fall out of sync. showing one vertical blanking bar. The picture should remain in horizontal sync. when rotating the H. hold control counter clockwise. (See horizontal A.F.C. Alignment, Page 4.)

VERTICAL HOLD: The vertical hold control locks the vertical sweep with the transmitted sync. pulse. Set the vertical hold where the picture snaps into vertical lock.

BRILLIANCE: Adjust the brilliance control in combination with the picture control for the most pleasing picture. Set the brilliance to a point where the picture control will give a dark black, a brilliant white, and varying degrees of grey.

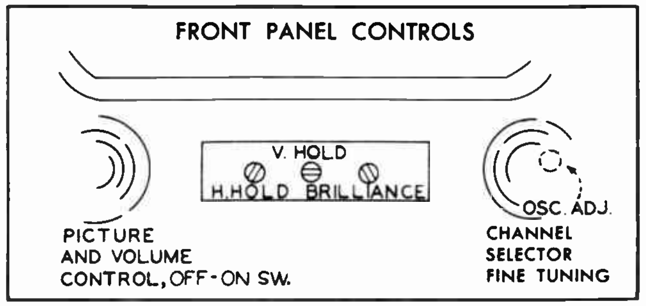


Figure No. 1

REAR CHASSIS SERVICE CONTROLS

VERTICAL LINEARITY AND VERTICAL SIZE: The Vertical linearity and Vertical size controls should be adjusted simultaneously to fill the picture mask vertically and in the proper proportions. The Vertical Size controls picture heights and the Vertical linearity picture proportion.

HORIZONTAL DRIVE: This control affects picture width and horizontal linearity, particularly the left side of the picture. This control somewhat affects the horizontal A.F.C. alignment. See Page 4. The correct setting of the Drive trimmer is at the point where the drive line is eliminated.

HORIZONTAL RANGE: See Horizontal A.F.C. Alignment (Page 4).

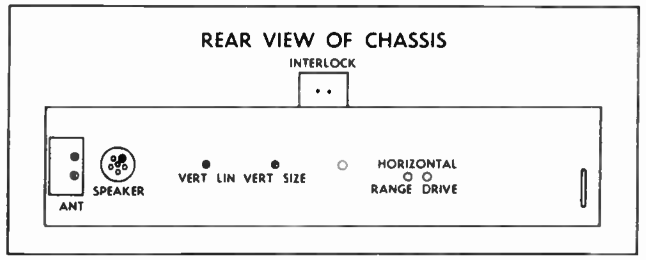


Figure No. 2

DEFLECTION YOKE ADJUSTMENT

If picture is tilted, loosen the wing nut on the deflection yoke coil and slightly rotate the yoke coil until picture is straight. Before tightening the wing nut, make sure that the deflection yoke is moved as far forward as possible, otherwise corners of the raster may be shaded. See Centering Adjustment.

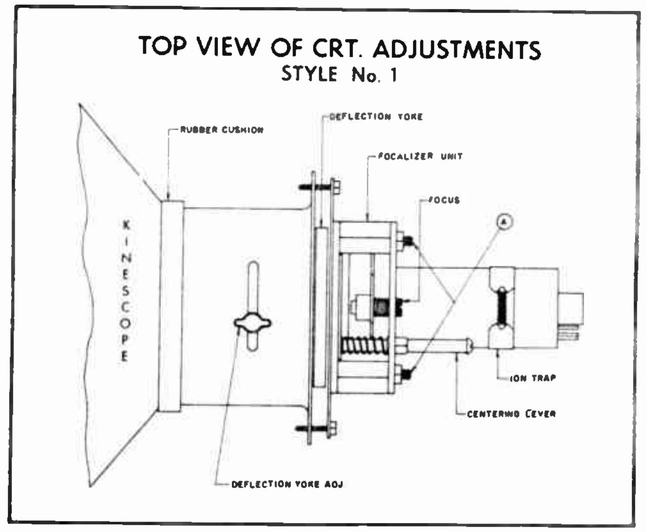


Figure No. 3

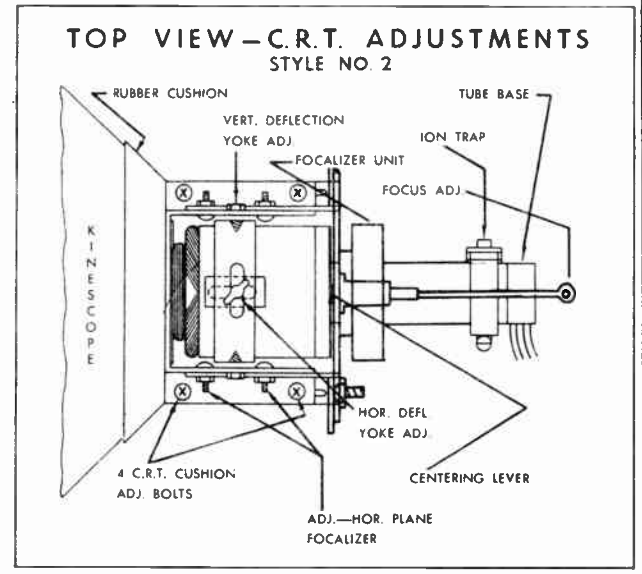


Figure No. 4

PICTURE TUBE ADJUSTMENTS

ADJUSTMENT OF ION TRAP

To prevent serious damage to the picture tube the following method of adjustment should be used: Place the Ion Trap so that it is near the picture tube base socket, and adjust the Brilliance control 80° counter-clockwise before turning set on.

Turn set on and allow for normal warm-up time. Move the Ion Trap a short distance forward or backward at the same time rotating it until the point of optimum raster brightness is found. Reduce brilliance and reset ion trap for maximum screen brilliance.

CAUTION: Keep brilliance control at low intensity until the ion trap is properly set.

DO NOT at any time adjust the ion trap to correct for centering or a shadowed raster. (See focalizer adjustment).

If the focus adjustment, centering lever, focalizer or deflection yoke are in any way readjusted or changed, the ion trap should again be readjusted for maximum brilliance.

ALWAYS MAKE THE ION TRAP THE FIRST AND LAST ADJUSTMENT.

FOCALIZER ADJUSTMENT

The focalizer is used to center the picture with the best possible line detail. Adjustments are provided as shown in Fig. 3 or Fig. 4.

The focalizer should be positioned as close to the deflection yoke as is consistent with good line detail and correct picture centering.

CENTERING ADJUSTMENT

Push deflection yoke forward on neck of tube against the flare (See deflection yoke adjustment). Centering Lever — Vertical movement of the lever shifts the picture horizontally; horizontal movement of the lever controls the vertical positioning. If picture is difficult to center or neck shadow is present, loosen and reposition focalizer.

FOCUS ADJUSTMENT

Focus is made by rotating the Focus Adjustment located on the focalizer assembly. Set the picture control to a normal picture and the Brilliance control to a slighty above average brightness. Rotate the focus adjustment until the picture is in sharp focus with the clearest line detail throughout the picture.

INDIVIDUAL CHANNEL ADJUSTMENT

The tuner is completely and accurately aligned at the factory, however, for best performance it is necessary to touch up the oscillator coil tuning slug on each of the operating channels.

The oscillator coil tuning slugs may be reached by removing the channel selector knob and the fine tuning knob. See Fig. 1.

A. Turn the TV set on and allow a 10 minute warm-up period.

B. Turn channel selector to an operating channel. Remove channel selector and fine tuning knobs.

C. Set fine tuning control shaft to center of its range.

D. Turn up volume control and picture control to a normal setting.

E. Use a non-metallic screwdriver and adjust slug for most efficient compromise of both sound and picture. Repeat procedure for each operating channel.

CAUTION: Do not screw slug past its thread limitations as it will drop into coil form. Always start by turning the adjusting slug in a counter-clockwise direction.

ADJUSTING THE HORIZONTAL A. F. C. IN THE HOME

A receiver which requires horizontal sync. adjustment may be corrected by following the procedure given below.

Check to see if adjustment is necessary by rotating the H. hold control located under the MUNTZ nameplate. The picture should hold as follows:

A. Fully counter-clockwise, the picture should remain in horizontal sync.

B. Rotate the H. hold control fully clockwise and the picture should fall out of sync. showing one vertical bar (on weak signals up to 3½ bars are acceptable).

If the horizontal A.F.C. does not fill the above requirements the circuit needs readjusting. Before making these adjustments, try replacing the following tubes V-14 HOR. AFC. & OSC. (6SN7), V-11 Sync. Separator (12AT7).

A. Reset the horizontal range trimmer (Fig. 2) ¼ turn out from full "in" position.

B. Tune in station and set picture control below a normal-contrast condition.

C. Turn H. Hold control to a full clockwise position and adjust top slug of horizontal A.F.C. can (T6) (See Fig. 20) until picture snaps into horizontal sync. with one bar. Rotating control counter-clockwise picture should remain in sync. the H. Hold should normally be set 20 degrees counter-clockwise from where the picture pulls into horizontal sync.

If the above conditions can not be met, the horizontal A.F.C. circuit needs complete alignment. Follow instructions "Complete alignment of A.F.C."

RESISTANCE CHART

All measurements taken from socket pins to points indicated by suffix number. (See Suffix Chart)

SYM.	TYPE	FUNCTION	PIN #1	PIN #2	PIN #3	PIN #4	PIN #5	PIN #6	PIN #7	PIN #8	PIN #9	PIN #10	PIN #11	PIN #12
V-3	6AU6	Sound I. F.	470K	0	0	.05	4 [2]	0 [1]	82					
V-4	6T8	F.M. Det. & 1st I. F.	600K	10K	600K	0	.05	0	0	4.7M	470K [2]			
V-5	6W6 GT	Audio Output	Inf.	0	520 [2]	270 [2]	120K [1]	T. P.	.05	0 [1]				
V-6	5U4 G	L. V. Rect.	Inf.	* 100 [3]	Inf	* 35	Inf	* 35	Inf	* 100 [3]				
V-7	6CB6	1st I. F. Amp.	857K	47	.05	0	680 [1]	680 [1]	0					
V-8	6AU6	2nd I. F. Amp.	847	0	.05	0	680 [1]	680 [1]	82					
V-9	6AU6	3rd I. F. Amp.	.4	0	.05	0	680 [1]	680 [1]	120					
V-10	6CB6	Video Amp.	1.2M	Contrast 0 to 1.5K	.05	0	5.6K [2]	0	Contrast 0 to 1.5K					
V-11	12AT7	Sync. Separator	820K [1]	3.9M	0	0	0	22K [1]	22K	0	.05			
V-12	6AV5 GT	Vert. Output	2.2M	0	V. Line 680 to 3180	Inf	800 [3]	Inf	.05	T. P.				
V-13	6J5	Vert. Osc.	0	.05	V. Size 1.8M to 3.8M	T. P.	V. Hold 2.7M to 5.2M	T. P.	0	0				
V-14	6SN7 GT	Hor. AFC & Hor. Osc.	1.48M	** 100K to 150K H. Hold	412 K	480K	74 [3]	0	.05	0				
V-15	6CD6 G	Hor. Output	T. P.	.05	100	T. P.	470K	T. P.	0	14.2K				
V-16	1B3 GT	H. V. Rect.	—	—	—	—	—	—	—	—				
V-17	6V3	Damper	T. P.	Inf	Inf	.05	0	Inf	2	Inf	Inf			
V-18	27NP4	Kinescope	0	22K	—	—	—	—	—	—	—	0 [3]	Brill. 100K to 150K	.05

*Remove V-6 from tube socket

**Disconnect Red lead from H. Hold control (340V Buss)

SUFFIX CHART

(Test Points for Neg. Lead of Meter)

(No Suffix number indicates chassis ground.)

Suffix No. 1....................145V Buss

Suffix No. 2....................280V Buss

Suffix No. 3....................340V Buss

VOLTAGE CHART

Set all controls to a counter clockwise position, short antenna connections, speaker plugged in. Line voltage set at 117 V. A.C. All measurements made to chassis ground. Readings are subject to a ± 20% variation. Readings taken with an R.C.A. V.T.V.M. Model 97A.

SYM.	TYPE	FUNCTION	PIN #1	PIN #2	PIN #3	PIN #4	PIN #5	PIN #6	PIN #7	PIN #8	PIN #9	PIN #10	PIN #11	PIN #12
V-3	6AU6	Sound I. F.	0	0	0	6.3 AC	260	145	.82					
V-4	6T8	F.M. Det. & 1st Audio	— .4	— .8	— .4	0	6.3 AC	0	0	— .7	70			
V-5	6W6	Audio Output	TP	0	220	240	125	TP	6.3 AC	145				
V-6	5U4	L.V. Rect.								355	Take at Yellow Lead of Power Transformer			
V-7	6CB6	1st I. F. Amp.	— .52	.6	6.3 AC	0	115	115	0					
V-8	6AU6	2nd I. F. Amp.	— .52	0	6.3 AC	0	120	120	.84					
V-9	6AU6	3rd I. F. Amp.	0	0	6.3 AC	0	140	120	1.4					
V-10	6CB6	Vidio Amp.	0	3.2	6.3 AC	0	230	145	3.2					
V-11	12AT7	Sync. Sep.	50	— 2	0	0	0	35	— .25	0	6.3 AC			
V-12	6AV5	Vert. Output	0	6.3 AC	32	0	340	0	0	145				
V-13	6J5	Vert. Oscillator	0	6.3 AC	80	0	— 23	0	0	0				
V-14	6SN7	Hor. A. F. C. & Osc.	— 24	120	— 11	— 75	210	0	6.3 AC	0				
V-15	6CD6	Hor. Output	TP	6.3 AC	12.5	TP	— 16	TP	0	135	Do not measure cap voltage.			
V-16	1B3	H. V. Rect.						Do not measure.						
V-17	6V3	Damper	TP	0	0	6.3 AC	0	0	340	Do not measure cap voltage.				
V-18	27NP4	Kinescope	0.	0								340	125	6.3 AC

2nd Anode Voltage 18 KV. Use a KV meter or V.T.V.M. with special High Voltage Probe. Set Contrast to maximum and Brightness to minimum and adjust Horz. Drive Trimmer to where the drive line just disappears.

ALIGNMENT INSTRUCTIONS

When observing the television receiver band pass characteristics on the scope, it is important to avoid distortion of the response curve which would occur when using an abnormal signal input from the sweep and marker generators.

Always set the generator attenuator below the point where its output voltage starts to alter the shape of the response curve shown on the scope. This applies to both sweep and marker generators.

VIDEO I. F. RESPONSE CURVE

STEP No.	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	SCOPE CONNECTION	ADJUSTMENT	REMARKS
1	High side thru un-	23 MC	20.6 MC	2-13	Alignment test point "E" Fig. 8	A (L-6)	Short antenna con-
2	grounded tube shield	with a	22.6 MC			B (Z-4)	nections. Check re-
3	floating over V2(6J6)	10 MC	24.3 MC			C (Z-5)	sponse curve with
4	Osc-Mixer Tube Fig. 8.	Sweep	25.1 MC			D (Z-6) Fig. 8	Fig. 5 and touch up where necessary.

SOUND I.F. AND DISCRIMINATOR ALIGNMENT

STEP No.	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	SCOPE CONNECTIONS	ADJUSTMENTS	REMARKS
5	High side thru .1 blocking condenser to Xtal (Y1). Low side to chassis ground.	4.5 MC (100KC Sweep)	4.5 MC	2-13	Pin 2 of (6T8) V4, and chassis ground. Fig. 10	F & H Fig. 8	Remove C22 (4 mfd.-50V. 'lytic) ground lead. Adjust for max. symmetrical wave form. Fig. 9 Solder C-22 ground lead when completed.
6	SAME	SAME	SAME	SAME	Test Point "T" Fig. 10 and Chassis ground.	G Fig. 8	Adjust for 4.5 MC marker in center of symmetrical "S" curve Fig. 11.

RF ALIGNMENT

STEP NO.	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY 10 MC SWEEP	MARKER GENERATOR FREQUENCY	CHANNEL	SCOPE CONNECTION	ADJUSTMENT	REMARKS
7	Across antenna terminals. An impedance matching network is needed with some generators. Refer to your equipment instructions.	57.50	55.25 59.75	2	Tuner RF test point "N" Fig. 8	C2 Rear Ant. trimmer — To bring up the video carrier side of response curve. C4 Center Plate trimmer— Shifts the center of the response curve in relation to the video and sound markers. C13 Front Grid Trimmer-Alternately with C4 for response curve with flat top appearance and maximum amplitude.	Remove 1st IF Amp. V7. Check with response curve Fig. 6 with markers as shown. Consistent with proper band width and correct marker location, curve should have maximum amplitude and flat top appearance. (Full skirt of response curve will not be visible unless generator sweep width extends beyond 10 MC.) Replace 1st IF. Amp. tube when alignment is completed.
		63.50	61.25 65.75	3			
		69.50	67.25 71.75	4			
		79.50	77.25 81.75	5			
		85.50	83.25 87.75	6			
		177.50	175.25 179.75	7			
		183.50	181.25 185.75	8			
		189.50	187.25 191.75	9			
		195.50	193.25 197.75	10			
		201.50	199.25 203.75	11			
		207.50	205.25 209.75	12			
		213.50	211.25 215.75	13			

OSCILLATOR ALIGNMENT

STEP NO.	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	SCOPE CONNECTION	ADJUSTMENT	REMARKS
8	Use table and instructions in RF alignment chart.				Alignment Test Point "E" Fig. 8	Individual Channel oscillator slugs Channels 2-13 inclusive.	Adjust to place sound and video markers as per Fig. 7. If the oscillator seems to be off frequency approximately, the same amount for a majority of the channels, it is possible to correct them in one step, using adjustment C4, Fig. 8. This is an all channel adjustment and should not be used for any individual channel.

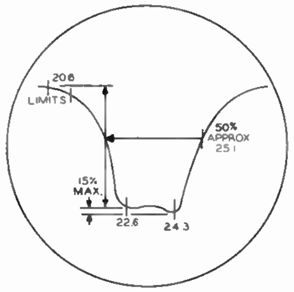


Figure No. 5

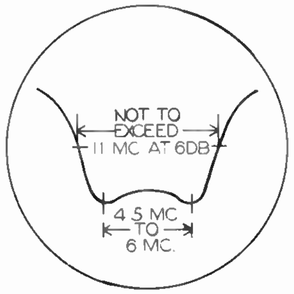


Figure No. 6

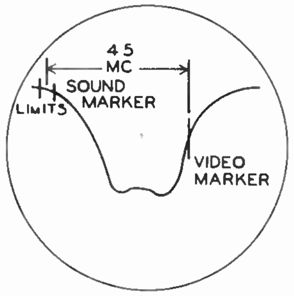


Figure No. 7

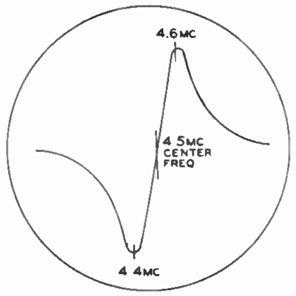


Figure No. 11

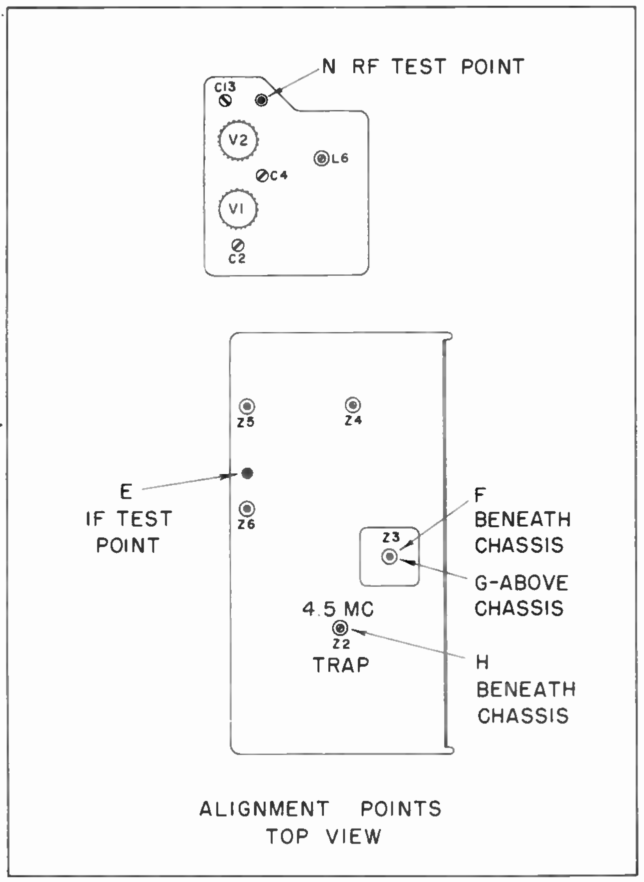


Figure No. 8

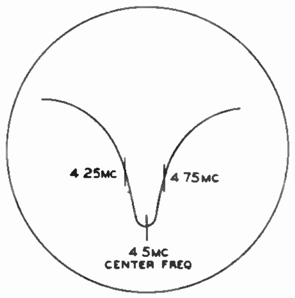


Figure No. 9

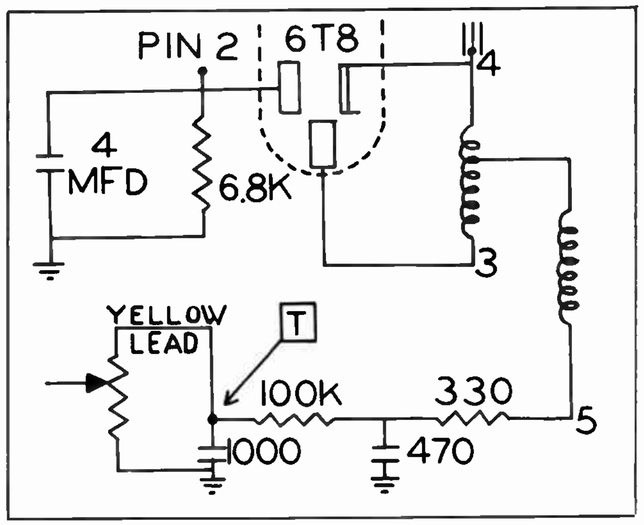


Figure No. 10

COMPLETE ALIGNMENT OF HORIZONTAL OSCILLATOR A. F. C.

1. Tune in a known good signal (test pattern where possible) and adjust the contrast control well below an over-contrast condition.
2. Turn both Horz. Osc. slugs out of coil can No. LO-0039 (T-6) as far as possible. Caution: For manufacturing convenience both of the oscillator adjustments are within the can No. LO-0039. If the Horz. Osc. slugs are turned too far in, a coupled condition is reached which is undesirable.
3. Place jumper wire between terminals C and D of T-6.

BENEATH CHASSIS

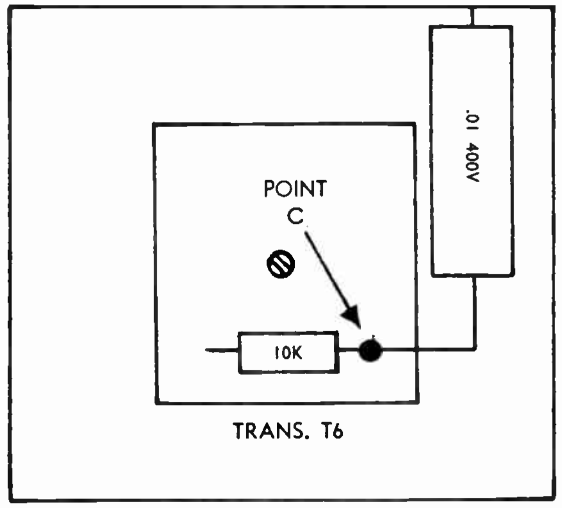


Figure No. 12

4. Preset Horz. Range Trimmer ¼ turn out from full "in" position. Turn Horz. Hold control fully clockwise. Through adjustment of top slug of T-6 cause the picture to sync. If necessary, re-adjust Horz. Range Trimmer slightly in order to sync picture.
5. With picture in sync., check picture width and linearity, adjusting Horz. Drive until a normal picture is obtained.
6. Remove jumper between terminals C and D of T-6. Picture should remain in sync. If it does not, re-adjust Horz. Range Trimmer or top slug of T-6. *IMPORTANT:* The Oscilloscope used in the following adjustment must have a flat vertical amplifier response up to 500 K. C. or better or a false waveform will result. A scope with poor vertical response will show a perfect waveform as shown in Figure 12A but when checked against a good wide band oscilloscope, the waveform will be found to have considerable tilt. This is highly undesirable because the bottom core is not adjusted properly, although we are led to believe it is. We stress the importance of a good Wide Band Scope such as the Sylvania Model 400 T.V. Oscilloscope or equivalent. Fig. 12 and 12A.
7. Connect scope having a 5 mmf. condenser in series with the vertical lead to point C Fig. 12. Adjust bottom slug of T-6 until the broad and sharp peaks are of equal height (Fig. 12A) keeping picture in sync at all times. If picture goes

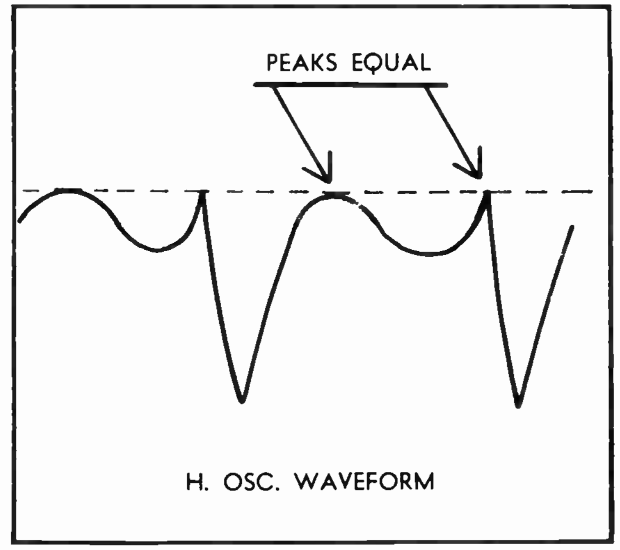


Figure No. 12A

out of sync. at any time repeat procedure under step 6. If the picture still goes out of sync., there is a defect in the Horz. control and A.F.C. circuit. Try a new 6SN7 tube before checking further.
The above adjustment is very important to correct circuit operation. If the broad peak is lower than the sharp peak the noise immunity becomes poor, hence the osc. is not stabilized as well resulting in greater drift. If the broad peak is higher than the sharp peak, the oscillator becomes over-stabilized and double triggering can occur when the hold control approaches full clockwise position. REMOVE SCOPE.
8. Set the Horz. Hold control to extreme clockwise position and adjust top slug of T-6 for one vertical blanking bar. Rotate Horz. Hold control fully counter-clockwise. Picture should remain in sync.

TUNER PR-0195-2

CASCODE TUNER—STANDARD COIL

RESISTANCE OF COMPONENT PARTS NOT SHOWN ON SCHEMATIC DIAGRAM

SYM.	DESCRIPTION	PART NO.	RESISTANCE	OHMS	%
T_1	Audio Output Transformer	TO-0033	Primary	305.	
			Secondary	.6	
T_2	Power Transformer	TP-0021	Primary	.8	
			H.V. Secondary P.P.	70.	
			Fill. (Green to Green)	.2	
			Rect. Fill.	.2	
T_3A	Vertical Deflection Yoke	LC-0061	Vertical Terminals (4 & 6)	52.7	± 10%
T_3B	Horizontal Deflection Yoke		Horizontal Terminals (1 & 3)	18.7	± 10%
T_4	Vertical Output Transformer	TO-0037	Primary (Blue-Red)	740.	± 20%
			Secondary (Red-Yellow)	7.2	± 10%
T_5	Vertical Blocking Transformer	TO-0035	Primary (Red-Blue)	195.	± 10%
			Secondary (Yellow-Green)	1110.	± 10%
T_6	Horizontal Oscillator Coil	LO-0039	Terminals		
			A - F	80.	
			C - D	45.	
T_7	Horizontal Output Transformer	TO-0036	Terminals		
			1 - 2	.606	± 10%
			2 - 5	7.142	± 10%
			6 - 7	10.48	± 10%
L_8	Filter Choke	LC-0059-1		100.	+ 15% − 10%
L_{12}	Peaking Coil (105 uh) white	LC-0057-2		6.5	
L_{13}	Peaking Coil (640 uh) brown	LC-0057-3		20.	
L_{14}	Peaking Coil (240 uh) grey	LC-0057-4		11.	
L_{15}	Peaking Coil (200 uh) yellow	LC-0057-5		10.	
L_{32}	4.5 mc Trap Coil	LC-0062		2.	
Z_2	Sound Take-off Coil 4.5 mc	TO-0038		5.	
Z_3	Ratio Detector	L1-0046B	Terminals		
			1 - 2	3.8	
			3 - 4	.25	
			4 - 5	.9	
			3 - 5	.9	
Z_4	Second I.F. Coil	L1-0042	Primary	.3	
			Secondary	.3	
Z_5	Third I.F. Coil	L1-0041	Primary	.3	
			Secondary	.3	
Z_6	Fourth I.F. Coil	L1-0040	Primary	.3	
			Secondary	.3	
Y_1	Crystal IN60 CK706	CX-0028 CX-0030	Use only Simpson Model 260 Meter or equivalent. These tests are not effective with a V.T.V.M. Forward Resistance (Use RX1 Scale.) Reject if below 30 ohms and above 250 ohms. Backward Resistance (Use RX10,000 Scale.) Reject if below 200 K ohms and above 2.5 megohms. The front to back ratio should be from approximately 1,000 to 1,500 times in a good crystal. The resistance values of the crystal detector are approximately correct, but not in every instance. The best method of checking this component is by substitution during I.F. alignment. Establish an amplitude reference on the scope, disconnect one end of the crystal in question and place a new crystal in the circuit. By comparison in amplitude, determine the efficiency of the crystal in question.		

TUNER MAINTENANCE

The entire turret drum, with coils in place, may be removed from the tuner chassis by removing the springs at each end of the unit. This gives access to the components and tube sockets which are not accessible from the side of the tuner.

CAUTION: The high frequencies used in television make it necessary that extreme care be exercised in handling or servicing tuners. Location and lead dress of components and wiring are very critical. At high frequencies, wiring leads tend to act as small inductances and stray capacities; consequently, any change made may appreciably alter the electrical characteristics of critical circuits. Parts location and ground connections should be maintained as originally made. When replacing components, it is important that they be replaced with parts of identical characteristics and physical size.

If the oscillator slug is turned too far in a clockwise direction, control of the slug will be lost, as the slug will fall into the coil form. To recover the slug remove the coil from the drum assembly, move the slug retaining spring aside, tap the coil board in a way to move the slug forward. Reset the slug retaining spring. For alignment information see Page 4, paragraph "Oscillator Alignment."

TUBE REPLACEMENT

Replacement of tubes (especially the 6J6 oscillator tube) may cause excessive change in frequency of tuner circuits. This is due to differences of inter-electrode capacitances, unavoidable in the manufacture of tubes. When replacing a 6J6 tube, it is recommended that several tubes be tried in order to select a tube which will cause the least oscillator frequency shift. Doing so, will in most cases eliminate the need for realignment of the tuner circuits.

CLEANING AND LUBRICATION

Dirty switch contacts prevent the passage of R.F. and detune the circuits. At certain high frequencies they even act as small rectifiers causing very unwanted conditions. It is VERY IMPORTANT that the switch contacts in the tuner be PERIODICALLY CLEANED AND LUBRICATED. Properly doing so reduces wear and gives lasting service to the second most costly part in the TV chassis.

Remove the bottom cover plate. Remove the drum retaining springs at either end of the tuner. The complete drum may now be removed from the chassis.

Clean the coil board contacts and stator contacts with a lint free cloth. Lubricate with a pure sulphur-free, mineral oil. Many wholesale TV stores merchandise special contact lubricants that are sulphur-free and easily stored in a repairman's kit.

CAUTION: Switch contacts are brass, silver plated, and every care is exercised to preserve the silver plating. No abrasive should be used in cleaning contacts as some of the abrasive material may become imbedded in the silver and wear it away.

MECHANICAL TROUBLES

If mechanical parts are broken, it must be determined whether to repair or replace the unit. Removal of the drum assembly was described in the paragraph "Tuner Maintenance."

Erratic operation on any one channel requires checking the coil boards of that channel. To remove a coil board, insert a screwdriver between the coil retainer spring and the turret end plate. Press the blade away from the turret and lift the end of the coil upward and remove. Parts mounted on the reverse side of the coil board can then be examined and tested. Should excessive rosin from the soldering connections be found on the coil board, clean away with care. Rosin causes high resistance leakage. A coil board may be returned to the drum assembly in the reverse manner in which it was removed.

There are eleven contact springs located in the side of the tuner wall. A side view of a spring looks like a lobe or tear drop. With continued use the contact springs may become fatigued. If this is the case, adjust the lobe of the spring as required. Clean and lubricate with an approved contact fluid. Reassemble and check all channels.

Noisy channel switching may be due to the detent spring roller not rotating on the detent plate. Lubricate both surfaces with high vacuum grease.

For microphonism produced by tapping the tubes or tuner chassis, or in case of intermittent video and sound, first replace the tubes. If trouble persists, look for loose connections; clean contact surfaces and lubricate as explained above.

CIRCUIT OPERATION

The R.F. Circuit employs a dual triode which is connected in cascode. The cascode amplifier circuit is a grounded-cathode stage followed by a grounded-grid stage. These two stages employ a new nine-pin miniature dual triode developed for use in VHF cascode circuits (6BQ7 or 6BZ7). Each triode section has a separate cathode, and the two units are electrically independent. To minimize interstage coupling, an internal shield is located between the two triode sections. This shield is connected to Pin 9, and consequently Pin 9 is connected directly to the ground. This cascode circuit design delivers several times the R.F. gain in comparison with the pentode circuit. Also the noise developed by the shielded triodes in the 6BQ7 tube is much less than in the pentode tube. Therefore the signal-to-noise ratio is also much improved for the cascode circuit.

A higher B+ voltage is used with the R.F. amplifier circuit than is used in the mixer-oscillator circuits. For this reason independent B+ feed leads are extended from the tuner, Fig. 14.

TROUBLE SHOOTING

Tube substitution is the first step. This is discussed in the paragraph on tube replacement on Page 5. The presence of oscillator grid voltage is very important. Lack of it indicates that the oscillator is not operating. Lack of voltage at test point N, when the oscillator is working, indicates trouble in the mixer circuit.

The following RESISTANCE and VOLTAGE CHARTS will be helpful. Improper voltage or resistance readings are indications of problems involved.

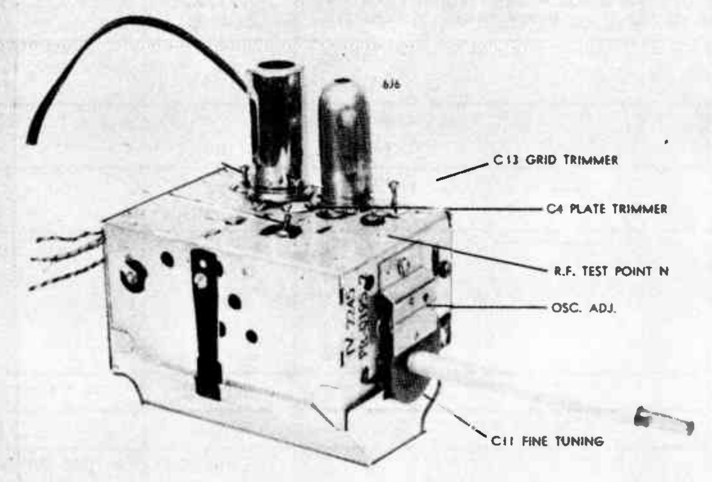


Figure No. 13

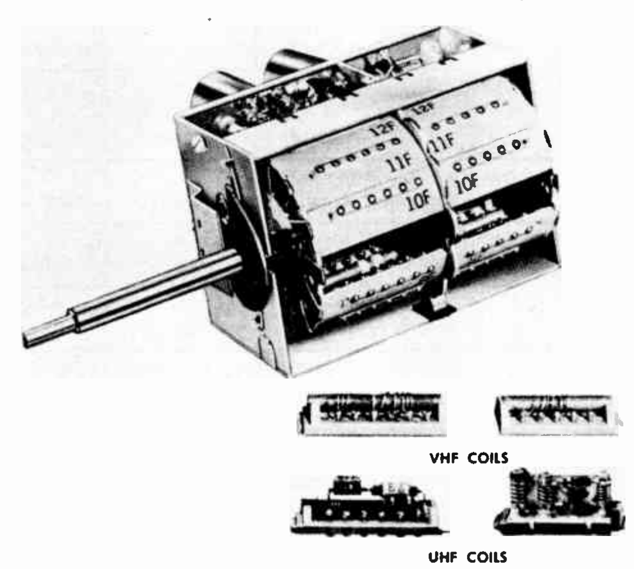


Figure No. 13A

RESISTANCE CHART

NOTE: Follow instructions carefully. — Channel Selector to Channel 13. — All controls counter-clockwise. — Line cord disconnected. — Antenna disconnected. — Speaker connected. — All measurements taken from socket pins to points indicated by suffix number. *See suffix Chart. For resistance readings of sockets V1, V2, remove tubes and measure from socket pins to points indicated. The readings below have been taken with an R.C.A. VoltOhmist. (V.T.V.M.)

*SUFFIX CHART
(Test Points for Neg. Lead of Meter)
No Suffix No. .... Chassis Ground
Suffix No. 1 .... 145V. Buss
Suffix No. 2 .... 280V. Buss

SYM.	TYPE	FUNCTION	PIN #1	PIN #2	PIN #3	PIN #4	PIN #5	PIN #6	PIN #7	PIN #8	PIN #9
V-1	6BQ7	R. F. Amp.	Inf.	900 K	0	.05	0	2500^{2}	260K	Inf.	0
V-2	6J6	Osc.-Mixer	10K^{1}	80^{1}	.05	0	230K	10K	0		

VOLTAGE CHART

NOTE: Follow instructions carefully. Turn Channel Selector to Channel 13. Turn all service controls (front and rear) counter-clockwise. — All measurements made to chassis ground. — Antenna terminals shorted. — Line voltage set at 117 V.A.C. Readings subject to a plus or minus 20% variation. — The readings below taken with an R. C. A. VoltOhmyst. (V. T. V. M.) Model 97A.

SYM.	TYPE	FUNCTION	PIN #1	PIN #2	PIN #3	PIN #4	PIN #5	PIN #6	PIN #7	PIN #8	PIN #9
V-1	6BQ7	R. F. Amp.	125	— .3	0	6.3AC	0	235	125	125	0
V-2	6J6	Osc.-Mixer	90	140	6.3AC	0	— 4.5	— 5.5	0		

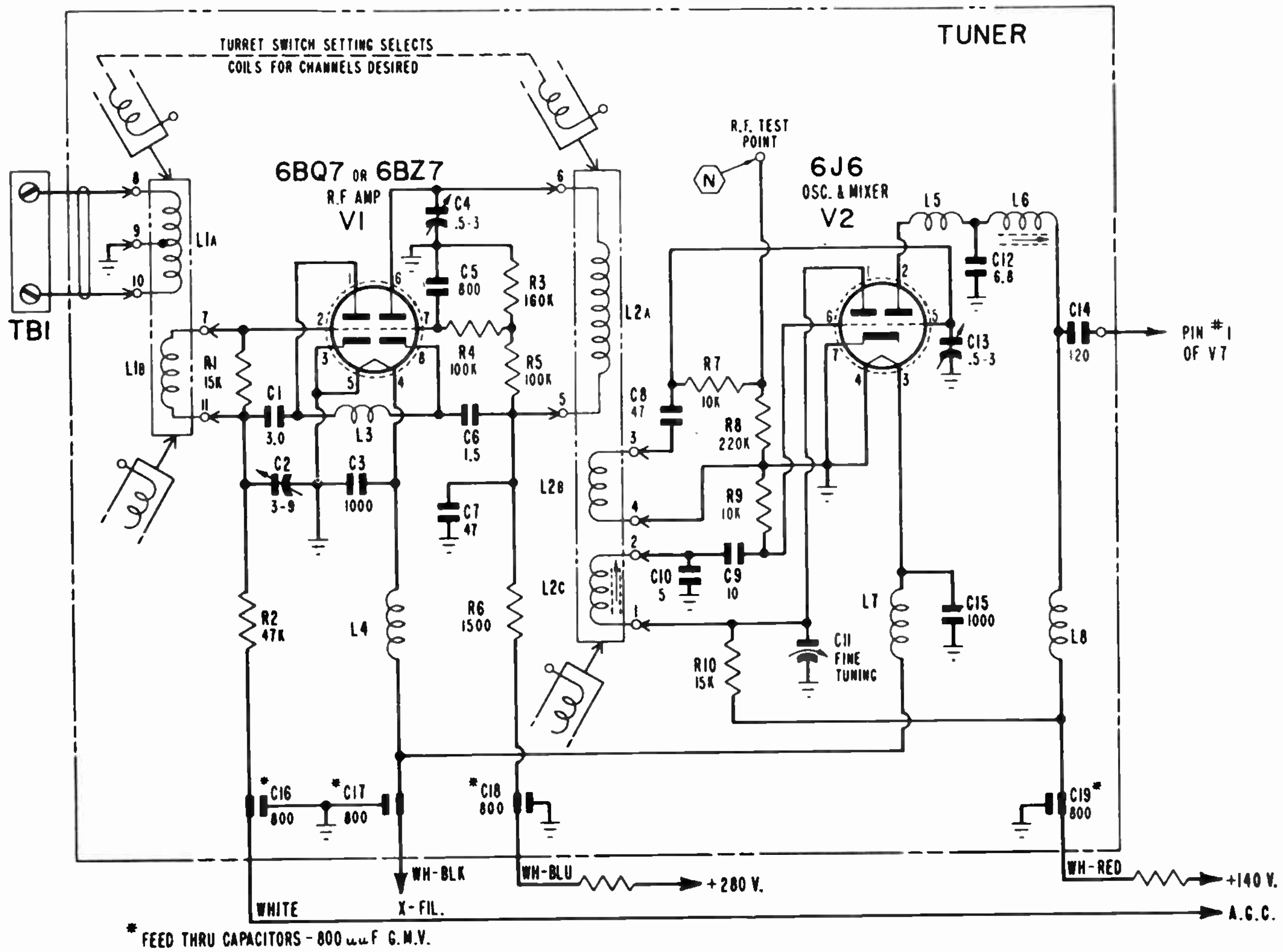


Fig. 14

PARTS LIST—CASCODE TUNER PR-0195-2

The following list of parts can be identified from the schematic diagram, Fig. No. 14.

TUNERS

PR-0195-2	Cascode Tuner with Fine Tuning. 4²⁷⁄₃₂" Shaft.

COILS

Sym.	Description	Mfr's. Part No.	Our Part No.
L1A — L1B	Antenna Coil—Chan. #13	31F-533	LR-0073
	Antenna Coil—Chan. #12	31F-532	LR-0072
	Antenna Coil—Chan. #11	31F-531	LR-0071
	Antenna Coil—Chan. #10	31F-530	LR-0070
	Antenna Coil—Chan. #9	31F-529	LR-0069
	Antenna Coil—Chan. #8	31F-528	LR-0068
	Antenna Coil—Chan. #7	31F-527	LR-0067
	Antenna Coil—Chan. #6	31F-526	LR-0066
	Antenna Coil—Chan. #5	31F-525	LR-0065
	Antenna Coil—Chan. #4	31F-524	LR-0064
	Antenna Coil—Chan. #3	31F-523	LR-0063
	Antenna Coil—Chan. #2	31F-522	LR-0062
L2A — L2B — L2C	Mixer-Osc. Coil—Chan. #13	31F-633	LO-0113
	Mixer-Osc. Coil—Chan. #12	31F-632	LO-0112
	Mixer-Osc. Coil—Chan. #11	31F-631	LO-0111
	Mixer-Osc. Coil—Chan. #10	31F-630	LO-0110
	Mixer-Osc. Coil—Chan. #9	31F-629	LO-0109
	Mixer-Osc. Coil—Chan. #8	31F-628	LO-0108
	Mixer-Osc. Coil—Chan. #7	31F-627	LO-0107
	Mixer-Osc. Coil—Chan. #6	31F-626	LO-0106
	Mixer-Osc. Coil—Chan. #5	31F-625	LO-0105
	Mixer-Osc. Coil—Chan. #4	31F-624	LO-0104
	Mixer-Osc. Coil—Chan. #3	31F-623	LO-0103
	Mixer-Osc. Coil—Chan. #2	31F-622	LO-0102
L3	Choke—Cathode TU-2200	31B-629	LO-0055
L4	Choke—Heater—R.F.	34A-546	LR-0036
L5	Choke—Mixer Plate	31B-295	LO-0057
L6	Coil—I.F. Winding	31B-257	LI-0048
L7	Choke—Heater—Osc.	34A-575	LO-0054
L8	Choke—Mixer Shunt TU-2200	31B297	LO-0056

Order coils for U.H.F. by channel number.

RESISTORS

Sym.	Description	Mfr's. Part No.	Our Part No.
R1	15K ohms, 10% ½W	12A-004	RC-1502-18
R2	47K ohms, 20% ½W	12A-039	RC-4702-28
R3	160K ohms, 5% ½W	12A-167	RC-1603-58
R4	100K ohms, 10% ½W	12A-094	RC-1003-18
R5	100K ohms, 5% ½W	12A-166	RC-1003-58
R6	1,500 ohms, 10% ½W	12A-183	RC-1500-18
R7	10K ohms, 10% ½W	12A-040	RC-1002-18
R8	10K ohms, 10% ½W	12A-040	RC-1002-18
R9	10K ohms, 10% ½W	12A-040	RC-1002-18
R10	15K ohms, 10% ½W	12A-004	RC-1502-18

MISCELLANEOUS

Sym.	Description	Mfr's. Part No.	Our Part No.
	Shield—Bottom	31B-044	MP-0461
	Screw, Mach. (#6-32 x ¼" B.H. Sems)	9A-629-3	SC-1051
	Shield, Side Cover	31B-043	MP-0462
	Spring, Shaft Retaining	31B-030	SP-0053
	Spring, Detent	31B-005	SP-0054
	Roller, Detent	31B-106	SM-0197
	Drum & Shaft Ass'y. without coils	31B-203	AS-0416
	Nut—Trimmer Spring	10E-401	NT-0038
	Screw—Trimmer	9A-410-7	SC-0053
	Contact Brk't. Ass'y.	31B-278	AS-0434
	Tube Shield, (6J6)	16S-006	PR-0196
	Tube Shield, (6BQ7 6BZ7)	16S-004	PR-0197
	Spring—Fine Tuning Ground	31B-008	SP-0060

CAPACITORS

Sym.	Description	Mfr's. Part No.	Our Part No.
C1	Cap. Disc. 3.0 mmf. ± .25 mmf.	CD8C 030C	CC-0107
C2	Capacitor—Trimmer	31A-079	CT-0013
C3, 15	Capacitor Ceramic 1,000 mmf. MIN. G.P.	CD8 x 102Z	CC-0100
C4, 13	Capacitor—Trimmer	31A-056	CT-0011
C5	Ceramic Capacitor (Stand Off)	13D-196	CC-0099
C6	Cap. Disc. 1.5 mmf. ± 20%	CD8C 1R5M	CC-0106
C7, 8	Cap. Disc. 47 mmf. ± 10% N-1400	CD8Q 470K	CC-0103
C9	Capacitor Disc. 10 mmf. ± 10% N.P.O.	CD10C 100K	CC-0102
C10	Cap. Disc. 5 mmf. ± 5% N.P.O.	CD8U 050C	CC-0105
C11	Fine Tuning Assem. (PR-0195-2)	31A066-98	AS-0437
C12	Cap. Disc. 6.8 mmf. ± .25 mmf. N.P.O.	CD8C 6R8C	CC-0104
C14	Capacitor Ceramic 120 mmf.	13D-055	CC-0101
C16, 17, 18, 19	Ceramic Capacitor (Feed Thru)	13D-153	CC-0097
	Slug Tuning	31B-041	IC-0020
	Spring, Coil Retainer	31A-010	SP-0055

U. H. F.

(ULTRA HIGH FREQUENCY

No modification is necessary to the MUNTZ TV 17B8 chassis to receive U.H.F. signals. The insertion of the U.H.F. channel strip in an unused V.H.F. position in R.F. Tuner Turret is all that is needed. The U.H.F. strip is in two sections (as is the V.H.F. strip) which contains all the required components to complete the conversion to U.H.F. reception; no other tubes, parts or external connections are required.

The short strip (Antenna) includes the antenna input circuit and a 1st I.F. grid coil. The long strip (Osc) consists of the coils for the 1st I.F. plate, converter grid and the Oscillator plus a crystal harmonic generator and its bias network.

In operation, the U.H.F. signal is fed into the antenna input coil and is coupled to the mixer circuit where it is mixed with an oscillator frequency (Harmonic of the fundamental oscillator frequency) to produce an I.F. frequency which falls in the spectrum between the two present V.H.F. television bands. This I.F. frequency is then coupled into the grid of the R.F. amplifier which in this case acts as a 1st I.F. amplifier. The amplified I.F. signal is then coupled into the mixer circuit where the fundamental oscillator frequency mixes with it to produce the regular I.F. frequency of the receiver. The functions of the receiver from this point on then are the same as for V.H.F. reception.

Figure No. 15

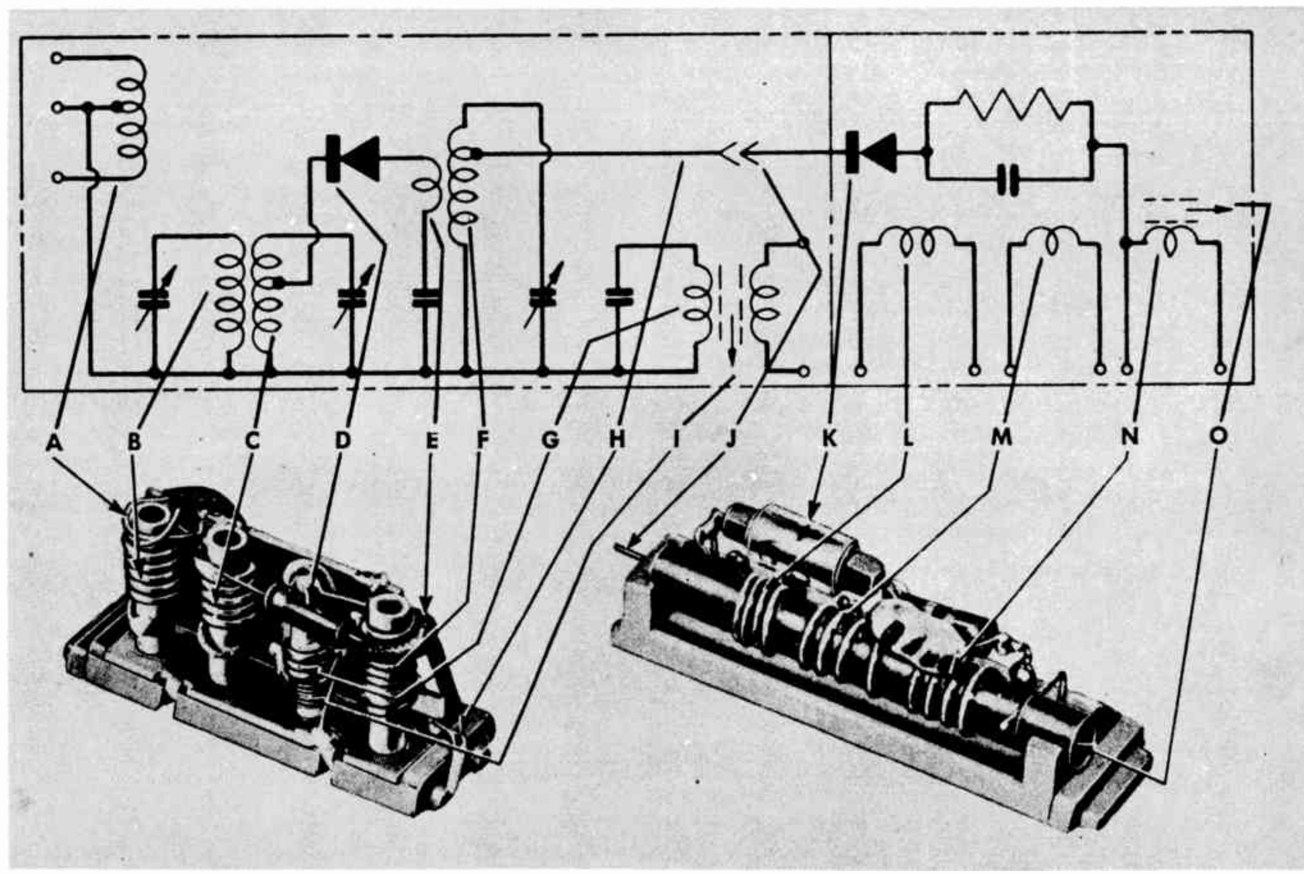


Figure No. 16

Figure No. 16A

SCHEMATIC AND PICTORIAL DIAGRAM OF UHF CHANNEL STRIPS

ANTENNA STRIP (5 CONTACT)

A—Antenna Coil
B—RF Preselector
C—Mixer R-F Coil
D—Crystal (Mixer)
E—UHF Coupling Loop
F—First IF Coupling Coil
G—Harmonic Selector
H—Added ground contact to turret detent disc
I—R.F. Choke

OSCILLATOR-CONVERTER STRIP (6 CONTACT)

J—Connecting pin between converter and Antenna Strips
K—Crystal (Harmonic Generator)
L—RF Coupling
M—Converter Grid Coil
N—Oscillator Coil
O—Oscillator Slug

INSTALLING U.H.F. STRIPS

Before installing U.H.F. channel coils, be sure that the letters stamped on the U.H.F. coils are the same as the letter stamped on the V.H.F. coils in the tuner. Each coil has the number of the channel it will receive and a letter following (ie..10Q) Channel 10 Q type coil.

Therefore this tuner will use Q type coils. If the letter is an F, it will use F type U.H.F. or V.H.F. coils. (See Figure 13A.)

Be sure the U.H.F. channel coil is stamped with the correct channel number for the U.H.F. station in operation in your area.

Handle U.H.F. coils very carefully so the spacing between wires and components is not disturbed. Do not adjust screws adjacent to contacts on the 5 contact antenna coil section. They are preset at the factory.

1. Remove the unused V.H.F. channel strips.
2. Insert long (Osc) strip in front section of tuner drum.
3. Insert short (Antenna) strip in rear section of tuner drum. Be sure that pin in long strip makes secure contact.
4. Turn on your MUNTZ TV set and rotate channel selector so that U.H.F. channel strip is in operating position.
5. Rotate fine tuning control. If the best picture is not received at the center of fine tuning range, adjust oscillator slug. (See oscillator adj. section).
6. Do not attempt to adjust individual coils in antenna section, they are factory adjusted to give correct performance.

VHF-UHF FREQUENCY ALLOCATIONS

Chan. No.	Frequency Band (Mc)	Video Carrier	Audio Carrier	Chan. No.	Frequency Band (Mc)	Video Carrier	Audio Carrier
2	54-60	55.25	59.75	43	644-650	645.25	649.75
3	60-66	61.25	65.75	44	650-656	651.25	655.75
4	66-72	67.25	71.75	45	656-662	657.25	661.75
5	76-82	77.25	81.75	46	662-668	663.25	667.75
6	82-88	83.25	87.75	47	668-674	669.25	673.75
7	174-180	175.25	179.75	48	674-680	675.25	679.75
8	180-186	181.25	185.75	49	680-686	681.25	685.75
9	186-192	187.25	191.75	50	686-692	687.25	691.75
10	192-198	193.25	197.75	51	692-698	693.25	697.75
11	198-204	199.25	203.75	52	698-704	699.25	703.75
12	204-210	205.25	209.75	53	704-710	705.25	709.75
13	210-216	211.25	215.75	54	710-716	711.25	715.75
14	470-476	471.25	475.75	55	716-722	717.25	721.75
15	476-482	477.25	481.75	56	722-728	723.25	727.75
16	482-488	483.25	487.75	57	728-734	729.25	733.25
17	488-494	489.25	493.75	58	734-740	735.25	739.75
18	494-500	495.25	499.75	59	740-746	741.25	745.75
19	500-506	501.25	505.75	60	746-752	747.25	751.75
20	506-512	507.25	511.75	61	752-758	753.25	757.75
21	512-518	513.25	517.75	62	758-764	759.25	763.75
22	518-524	519.25	523.75	63	764-770	765.25	769.75
23	524-530	525.25	529.75	64	770-776	771.25	775.75
24	530-536	531.25	535.75	65	776-782	777.25	781.75
25	536-542	537.25	541.75	66	782-788	783.25	787.75
26	542-548	543.25	547.75	67	788-794	789.25	793.75
27	548-554	549.25	553.75	68	794-800	795.25	799.75
28	554-560	555.25	559.75	69	800-806	801.25	805.75
29	560-566	561.25	565.75	70	806-812	807.25	811.75
30	566-572	567.25	571.75	71	812-818	813.25	817.75
31	572-578	573.25	577.75	72	818-824	819.25	823.75
32	578-584	579.25	583.75	73	824-830	825.25	829.75
33	584-590	585.25	589.75	74	830-836	831.25	835.75
34	590-596	591.25	595.75	75	836-842	837.25	841.75
35	596-602	597.25	601.75	76	842-848	843.25	847.75
36	602-608	603.25	607.75	77	848-854	849.25	853.75
37	608-614	609.25	613.75	78	854-860	855.25	859.75
38	614-620	615.25	619.75	79	860-866	861.25	865.75
39	620-626	621.25	625.75	80	866-872	867.25	871.75
40	626-632	627.25	631.75	81	872-878	873.25	877.75
41	632-638	633.25	637.75	82	878-884	879.25	883.75
42	638-644	639.25	643.75	83	884-890	885.25	889.75

PRODUCTION CHANGES

The following tabulation furnishes complete details on changes which occurred during receiver production. The receivers incorporating these changes are identified by a RUN NUMBER stamped on rear surface of chassis, immediately following the chassis serial number. INITIAL PRODUCTION CARRIED NO RUN NUMBER. Run No. 1 was not used.

RUN NUMBERS	DESCRIPTION OF CHANGE
NO RUN NUMBER	Vertical Oscillator and Vertical Output Circuit used in Initial Production.

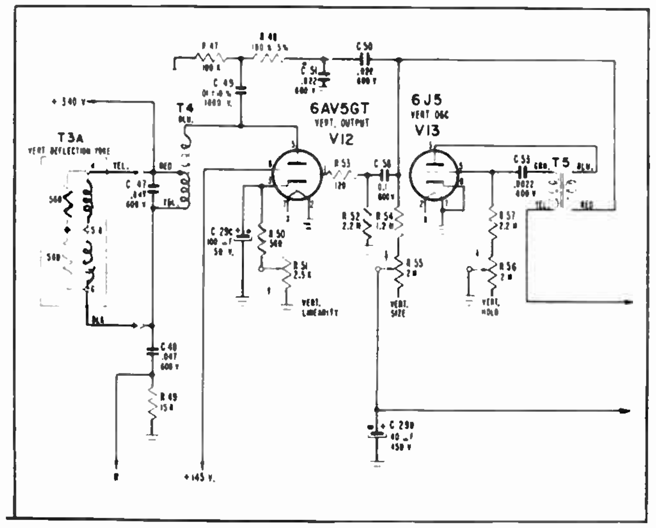


Figure No. 17

NO RUN NUMBER The Following Change was incorporated to meet a U.L. requirement.

1. The 5. ampere 250 volt fuse in the primary of the power transformer was deleted.
2. The ½ ampere 250 volt fuse was placed in series with the 340 volt buss, to the plate of the 6V3 damper tube and the screen grid of the 6CD6 Horizontal Output Tube.

NO RUN NUMBER The following change was made to allow for the use of various makes of 6CD6 tubes. The two replacements must be made simultaneously.

1. Capacitor C68 was changed from .01 mf. ± 20% 600 volts, to .022 mf. ± 20% 600 volts.
2. Resistors R66 and R71 were changed from 100K ± 10% ½ watt and 82K ± 10% 1 watt to 82K ± 10% 1 watt and 68K ± 10% 1 watt respectively, as shown on schematic.

RUN NUMBERS	DESCRIPTION OF CHANGE

NO RUN NUMBER The following changes were made to minimize component failure.

1. Capacitor C60 was changed from a Mica 68 mmf. ± 10% 500 volts to a Mica 68 mmf. ± 10% 1000 volts.
2. Capacitor C64 was changed from a tubular ceramic Durez insulated 1000 mmf. ± 20% 500 volts to a tubular ceramic 1000 mmf. ± 20% 1000 volts.
3. Capacitor C62 was changed from a tubular ceramic 180 mmf. ± 10% 500 volts negative temperature co-efficient 330 to a tubular ceramic Durez insulated 180 mmf. ± 10% 500 volts negative temperature co-efficient 330.

NO RUN NUMBER Anti Pin Cushion Magnets. In initial production, two anti pin cushion magnets were used to compensate for bowing of the raster, due to the cosine deflection yoke being used. The magnets were mounted on flanges attached to the deflection yoke collar. Engineering advancement in yoke design has eliminated the need for such magnets.

NO RUN NUMBER Vertical Pulse In Audio Output. In initial production "buzz" may be heard in the audio output due to pulse radiation of the vertical output Circuit. Placing a metal shield (Muntz Part No. MP-0487) between the 6AV5GT Vertical Output tube and the 6W6GT Audio Output Tube will reduce the pulse pick-up and the buzz will be inaudible.

RUN NUMBER 2 Relocation of the Vertical Circuits to eliminate the possibility of vertical pulses being found in the audio output. Models previous to Run Number 2 used the tube layout on following page.

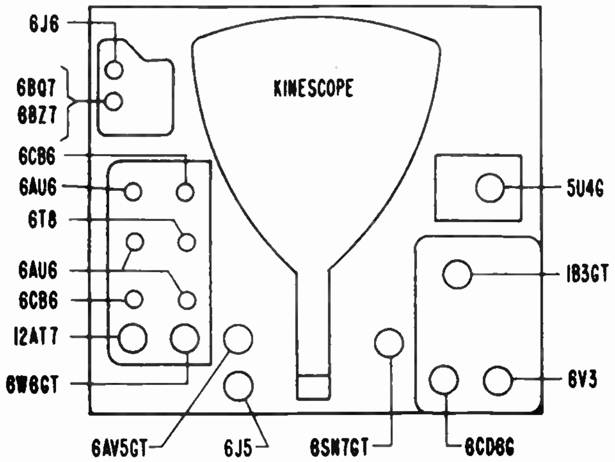


Figure No. 18

RUN NUMBERS	DESCRIPTION OF CHANGE

RUN NUMBER 3 The ½ Amp. 250 Volt Fuse (FU-0002-2) has been deleted from the 17B8 chassis and a 5 Amp. "Slo-Blo" Fuse (FU-0005-2) has been inserted in the primary circuit of the power transformer.

RUN NUMBER 4
1. To reduce the effect of the contrast control on the sound I.F. circuit; condenser C71 has been added from the cathode of the Video Amplifier to ground. C71 Capacitor, Tub. Cer. Durez 270 mmf. 20% 500 volt.
2. In addition to the above, a wiring change has been made. The wiring of electrolytic condensers C26A and C29A has been transposed. Doing so has reduced the coupling effect between sections of the condensers.

RUN NUMBER 5 To reduce the possibility of corona and arcing, of the 1B3GT high voltage rectifier tube socket assembly, the following parts have been changed.

Old Part No.	Description	New Part No.
SO-0047	H.V. Socket and Corona Ring Assembly	JC-0030
None used	Cover, H. V. Tube Socket	IN-0098
IN-0102	Insulator, H.V. Socket Mounting	SO-0042
WF-0030	Washer, Corona Shield Insulator	WF-0030-1

Note: The above new parts comprising the 1B3GT Tube Socket assembly are not interchangeable with those used in the 17B8 chassis below Run #5.

RUN NUMBER 6
1. To improve the stability of the Horizontal A.F.C. circuit, Condenser, C-63 has been changed to a moulded paper condenser.

RUN NUMBERS	DESCRIPTION OF CHANGE

C-63 Capacitor Tubular Paper Moulded —.01 Mfd.—20% 600V—CPM-0101.

2. For better isolation of the Tuner from the I.F. Circuits, a 4700 ohm Resistor (R-10) has been added in series with the (white) AGC lead to the tuner. This resistor is located on the I.F. Panel Assembly.

R-10 Resistor—4700 ohms—10% ½W RC-4701-18.

RUN NUMBER 7 To comply with an underwriter Labratory request, the interlock wiring assembly has been changed. Previous to RUN 7 a dual capacitor (2 x .01mf G.M.V. 500V.) Part No. CC-0096 was used across the A.C. input of the inter lock socket.

INTERESTING NOTES

ALL CHASSIS 17B8 The value of R54 will vary in early production models in accordance with the scan of the yoke used. A ½ watt resistor varying from 1.2 meg. to 2.2 meg., dependent upon the vertical size, may be used. The deflection yoke has now been standardized, and for that reason, a 1.8 meg. ± 10% ½ watt carbon resistor is now used at R54, see schematic diagram.

ALL CHASSIS 17B8 To minimize neck shadow at the left side of the picture and to correct centering of the picture, the 27 ohm, 2 watt resistor (R81) connected to terminals #5 and #6 of the horizontal output transformer (TO-0036) should be lowered in value. A 120 ohm ½ watt resistor connected in parallel with the 27 ohm resistor is recommended as this reduces the value of the resistance to approximately 22 ohms. However, the value of the resistor may be varied in accordance with the centering and shadow problem.

CAUTION: Before varying the resistance value of the 27 ohm resistor, check to see that all adjustments are properly completed along the neck of the CRT.

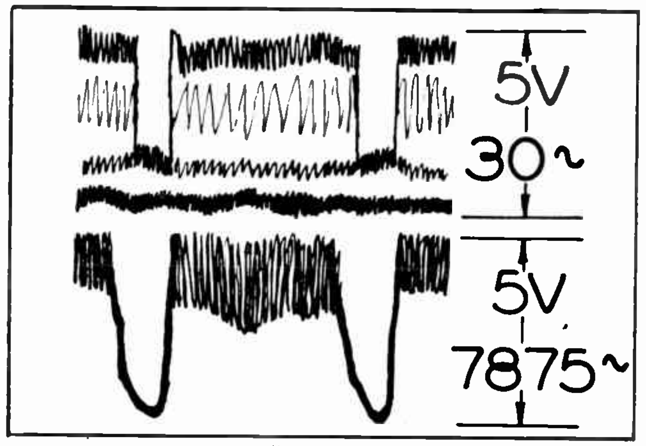
OSCILLOGRAMS

To obtain a close approximation of the wave forms and peak to peak voltages as shown, the receiver should be connected to 117 volt AC line and the contrast control set for 40 volts peak to peak at the cathode of the picture tube. Any scope may be calibrated to read peak to peak voltages by applying a 60 cycle voltage (of known RMS value) to the vertical input. The peak to peak amplitude of the sine wave seen on the scope is equal to 2.83 times its RMS value. The 6.3 volt AC filament can be used for this purpose. 6.3 times 2.82 = 17.8. This voltage may be used as a reference voltage to calibrate the scope.

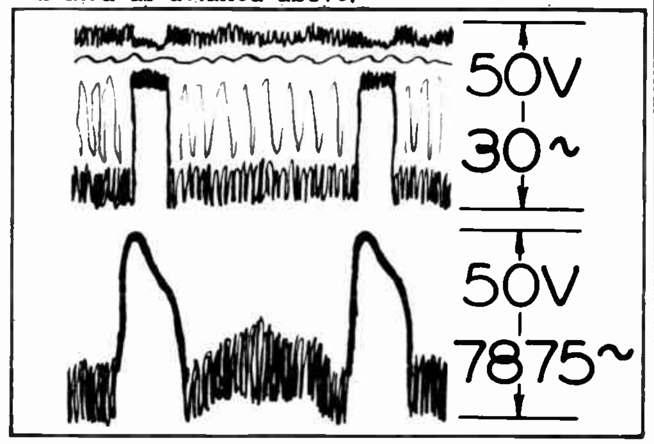
The wave forms and voltages are subject to variations due to the response of the scope used and parts tolerances.

Caution: No reading should be attempted with the scope at pin #5 of the 6AV5 Vertical Output tube due to the high pulse voltage present. Wave form #10 is indicative of the vertical output.

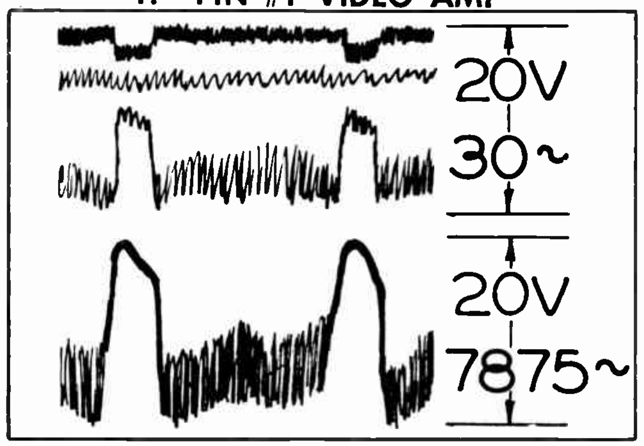
All wave forms were taken with a Model No. 400 Sylvania Oscilloscope and peak to peak voltages calibrated as detailed above.



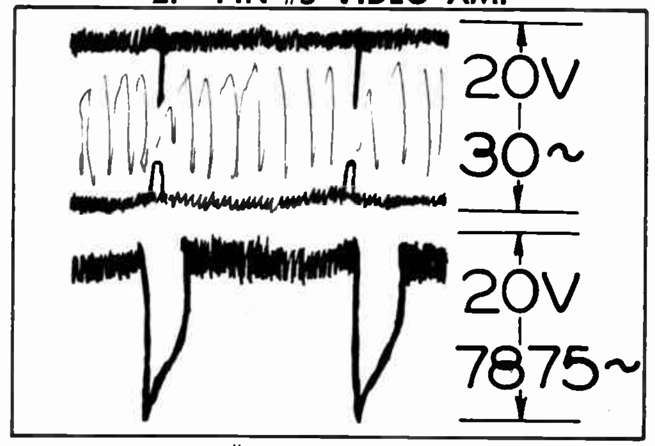
1. PIN #1 VIDEO AMP



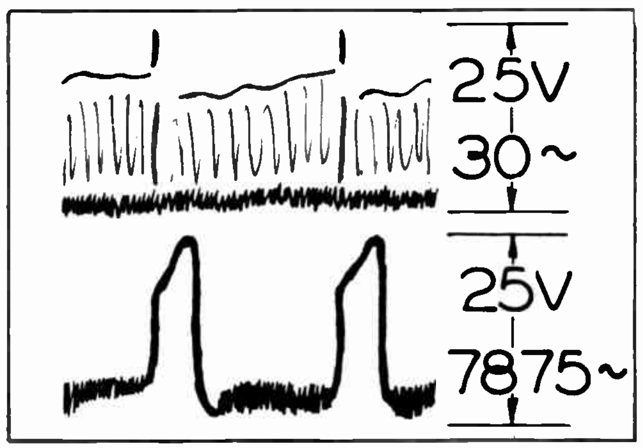
2. PIN #5 VIDEO AMP



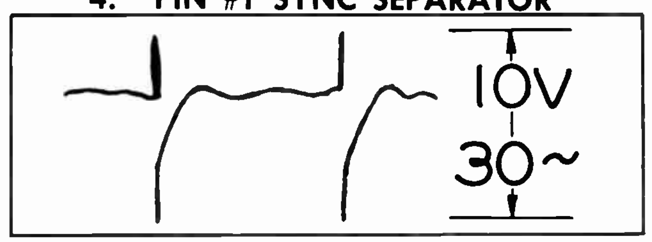
3. PIN #2 SYNC SEPARATOR



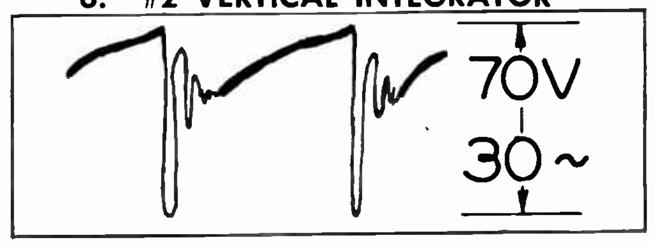
4. PIN #1 SYNC SEPARATOR



5. #3 VERTICAL INTEGRATOR

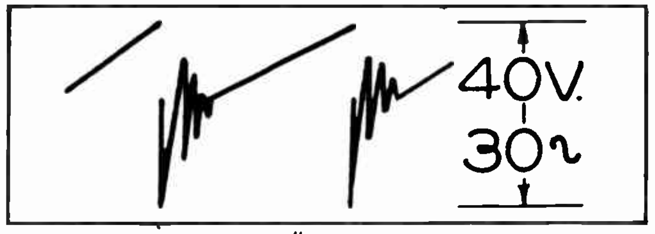


6. #2 VERTICAL INTEGRATOR

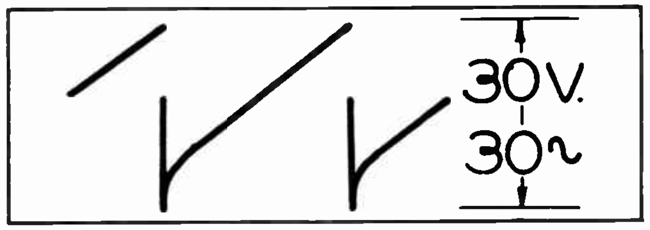


7. PIN #5 VERT. OSC.

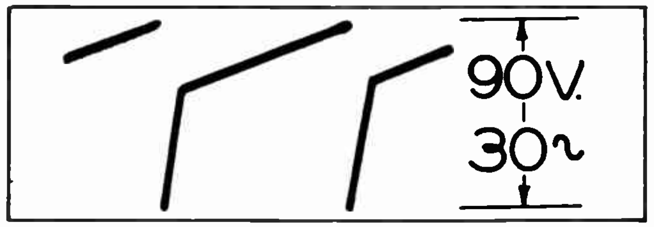
OSCILLOGRAMS (Continued)



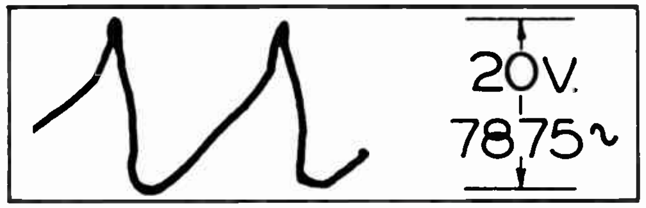
8. PIN #3 VERT. OSC.



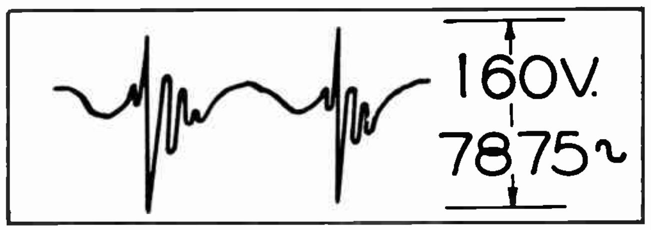
9. PIN #1 VERT. OUTPUT



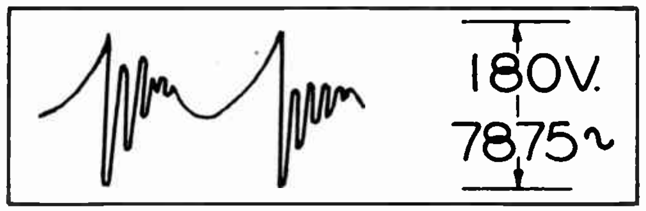
10. YELLOW LEAD VERT. OUTPUT TRANS.



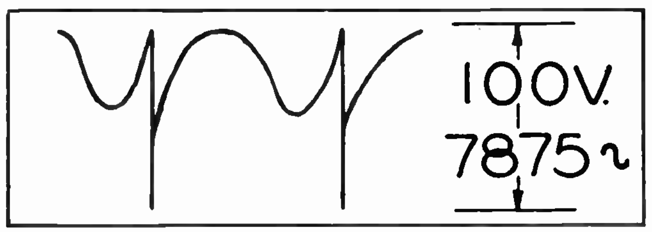
11. PIN #1 HORIZ. AFC & OSC.



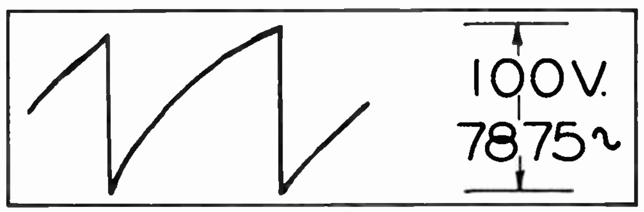
12. PIN #5 H. AFC & OSC.



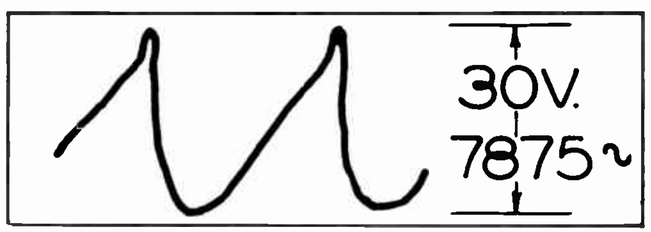
13. PIN #4 H. AFC & OSC.



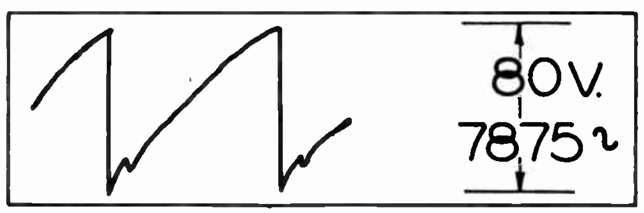
14. C OF AFC CAN



15. D OF AFC CAN



16. RANGE TRIMMER



17. DRIVE TRIMMER

TUBE LAYOUT AND SIGNAL PATH CHART

The signal path chart provided is to assist the Serviceman in isolating a particular trouble in the easiest and fastest way possible. As an example; the receiver under test has picture and no audio. A quick look at the audio signal will tell you immediately that the trouble lies somewhere between V-4 and the speaker.

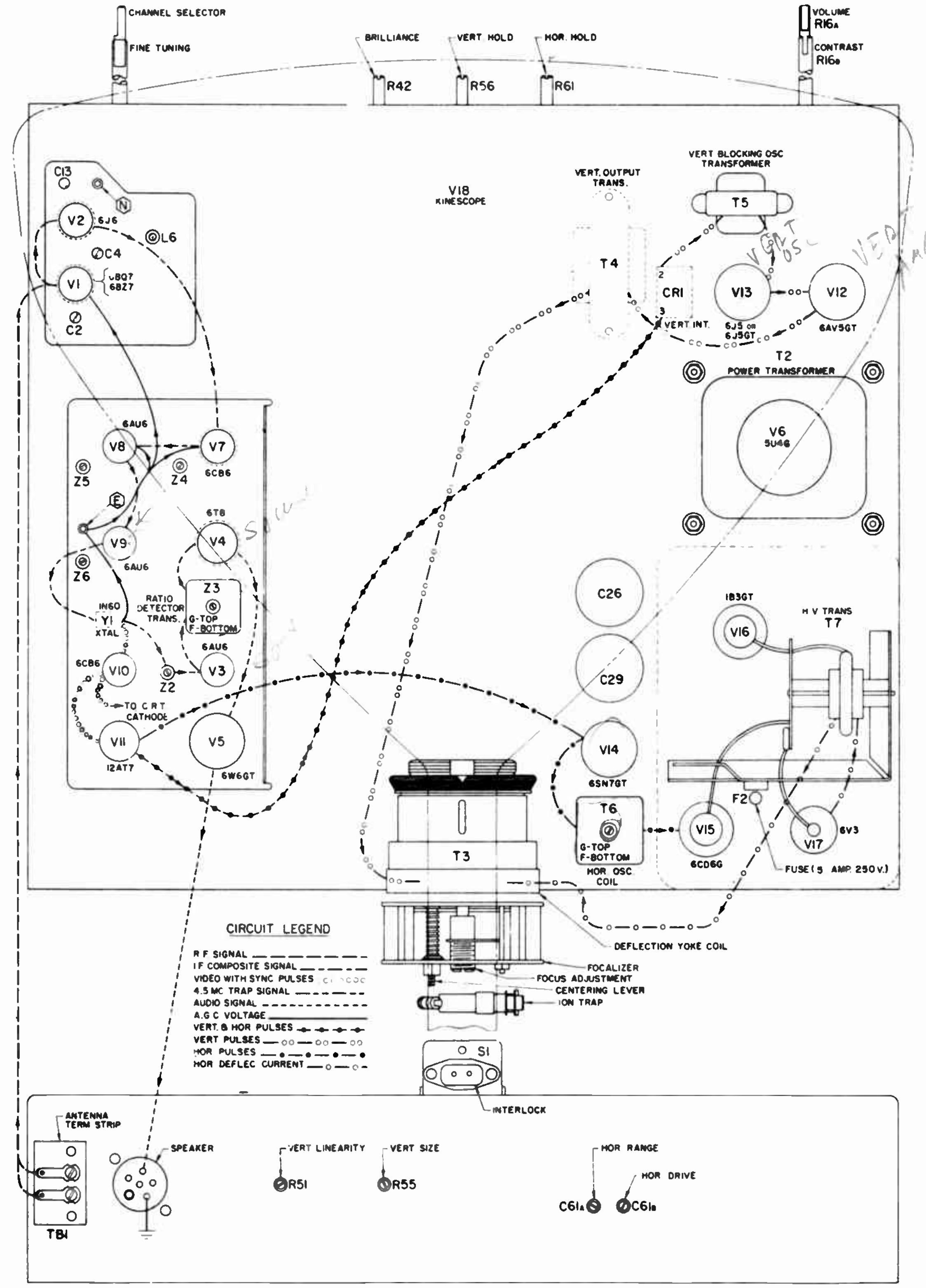


Figure No. 20

OPERATION AND SERVICE DATA

RADIO CHASSIS—8FM34

ANTENNA

(A) Broadcast Band: A highly selective loop antenna is provided for broadcast reception. The loop antenna will give excellent results in most locations. In unfavorable locations where distant reception is required a well constructed outdoor antenna about fifty feet long may be used. The antenna should be connected to the antenna terminal strip at the rear of the chassis marked "A."

(B) F-M Band: A built-in antenna is provided at the rear of the cabinet, and connected to the antenna strip F-M terminal posts for F-M reception.

Although the receiver will operate without a ground connection in most locations, a good ground will often reduce noise pickup on the broadcast band in noisy locations. A good ground connection can be made by connecting to a pipe driven into the ground. The ground wire from the clamp should be connected to the antenna strip terminal post marked "G" at the rear of the chassis.

CONTROLS

(A) On-Off switch and Volume Control: This control knob marked "VOLUME" combines the line on-off switch and volume control.

(B) Tone Control: This control knob marked "TONE" when turned to the right (clockwise) produces a deep bass effect, while rotation to the left (counter-clockwise) produces a more brilliant treble tone. Various shading between the extremes may be obtained at intermediate settings of the control.

(C) Band Selector Switch: This three position control knob is provided with a dot marker for designating the proper position in selecting the frequency band desired, and also connects the "Phono" pickup into the circuit for use of the record changer. The extreme left hand position marked "F-M" designates the "F-M" band. The second position marked "A-M" selects the "Broadcast" band. The third position marked "Phono" selects the "Phonograph" position.

(D) Tuning Control. This control marked "Tuning" selects the desired F-M or Broadcast station, the frequency of which is indicated by the dial pointer.

OPERATION

F-M Band—Set the Selector Switch to "F-M" Position. Turn the Volume control knob to the right; a click will be heard indicating that power is being delivered to your receiver. Allow about 30 seconds for the tubes to warm up. Advance the volume by turning the Volume control knob to the right. Turn the Tuning control knob slowly so that the dial pointer indicates the frequency in megacycles of the desired F-M station on the upper scale of the dial marked FREQUENCY MODULATION. The F-M band is ultra-high frequency and necessitates slow precision tuning. Rotate the Tuning knob back and forth in tuning in the desired F-M station. Tune for best sound quality and minimum hiss. When stations are properly tuned, reception on this band should be clear and free from hiss or disturbing noise. If this is not the case check your antenna installation or cabinet antenna connections. Adjust the volume by turning the Volume control knob to the left or right to suit the listener. NEVER REDUCE THE VOLUME BY DETUNING—ALWAYS USE THE VOLUME CONTROL KNOB. The tone control knob may be used to adjust the quality of reproduction to suit individual preferences, or to compensate for defects in room acoustics.

BROADCAST BAND — TURN THE BAND SELECTOR SWITCH TO THE "BC" POSITION. Turn the Tuning control knob slowly so that the dial pointer indicates the frequency of the desired station on the lower portion of the dial scale marked STANDARD BROADCAST. Then tune carefully for best and clearest reception. Adjust the Volume and Tone control knobs to suit the listener. High pitched noises such as those caused by electrical interference will be reduced when the tone control knob is turned to the right or bass position.

PHONOGRAPH—SET THE SELECTOR SWITCH TO THE "PHONO" POSITION. Open the automatic record changer compartment and follow the instructions on Page 12. Adjust the Volume and Tone control knobs to suit the listener.

LINE VOLTAGE

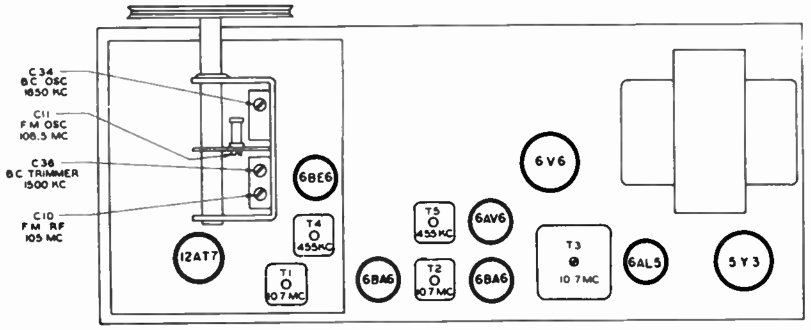
This receiver is designed for operation on 105-125 Volts; 60 Cycles, Alternating Current (AC) only. POWER CONSUMPTION INCLUDING RECORD CHANGER: 115 Watts.

TUBES

The Tubes used, and their functions, are as follows:

12AT7	R-F Amplifier and Mixer (F-M)
6BE6	A-M Converter and F-M Oscillator
6BA6	1st I-F Amplifier (A-M & F-M)
6BA6	2nd I-F Amplifier (F-M)
6AL5	F-M Detector
6AV6	A-M Detector, A.V.C. and Audio Amp.
6V6GT	Beam Power Amplifier
5Y3GT	Rectifier

For the placement of these tubes, refer to the diagram.



TUBE AND ADJUSTMENT LOCATION DIAGRAM

ALIGNMENT CHART

STEP	CIRCUIT ALIGNED	RECEIVER DIAL AT	SIGNAL GENERATOR TYPE	SIGNAL GENERATOR FREQ.	SIGNAL GENERATOR CONNECTIONS	METER TYPE	METER CONNECTIONS	ADJUST	METER INDICATION
1	B.C.I.F.	B.C. Band Max. Freq.	A.M.	455 KC 30% Mod.	Rear B.C. Section Of Variable Condenser	Output	Across Voice Coil	Top & Bot. Of T4 & T5	Max. Output
Preferred Method 2	F.M.	F.M. Band	F.M.	10.7 MC. 30% Mod.	High Side Through .005 MF. (Approx.) Cap To Pin 7 Of 12AT7	Output	Across Voice Coil	Top & Bot. Of T1 & T2; Bot. of T3	Max. Output
Alternate Method 2	I.F.	Max. Freq.	R.F. or A.M.	10.7 MC. Unmod.		D.C. V.T.V.M.	Negative To Pin 7 Of 6AL5; Positive To Ground		Max. Deflection
Preferred Method 3	F.M.	F.M. Band	F.M.	10.7 MC. 30% Mod.		Output	Across Voice Coil	Top Of T3	Max. Output
Alternate Method 3	Det.	Max. Freq.	R.F. or A.M.	10.7 MC. Unmod.		D.C. V.T.V.M.	Neg. To Junction Of 8.2K Resistor At 6AL5; Pos. To Junction Of R15 & C17.		Zero Between Two Opposite Polarity Peaks
Preferred Method 4	F.M.	F.M. Band	F.M.	108.5 MC. 30% Mod.	Each Side Of Gen. Output Through 150 OHM Resistor To F.M. Ant. Terminals	Output	Across Voice Coil	Trimmer On Top Center Of Var. Cond. (C11)	Max. Output
Alternate Method 4	OSC.	Max. Freq.	R.F. or A.M.	108.5 MC. Unmod.		D.C. V.T.V.M.	Negative To Pin 7 Of 6AL5; Positive To Ground		Max. Deflection
Preferred Method 5	F.M.	F.M. Band	F.M.	105 MC. 30% Mod.		Output	Across Voice Coil	Trimmer At Rear Of Var. Cond. (C10)	Max. Output
Alternate Method 5	R.F.	105 MC.	R.F. or A.M.	105 MC. Unmod.		D.C. V.T.V.M.	Negative To Pin 7 Of 6AL5; Positive To Ground		Max. Deflection
6	B.C. OSC.	B.C. Band Max. Freq.	A.M.	1650 KC. 30% Mod.	Rear B.C. Section Of Variable Condenser	Output	Across Voice Coil	Trimmer At Front Of Var. Cond. (C34).	Max.
7	B.C. R.F.	B.C. Band 1500 KC.	A.M.	1500 KC. 30% Mod.	Each Side Of Gen. Output To 2 Or 3-Turn Loop (1 Foot Dia.) Several Feet From Ant.	Output	Across Voice Coil	B.C. Trim. At Rear Of Var. Cond. (C36).	Output

Notes:
1—Turn Volume Control Fully Clockwise.
2—Maintain Signal Input Low Enough To Have Less Than 2 Volts Across Meters.
3—Unless Otherwise Noted, Connect Low Side Of Signal Generator to Chassis.
4—Unless Otherwise Noted, Set Variable Condenser To Minimum Capacity (Max. Freq.)
5—Use Proper Tool For Small I.F. Trans. Adjustments — I.E., .150 Dia. Bakelite With Blade .075 Thick.
6—Maintain 60 Cycle Line Voltage At Approx. 117 Volts.

PARTS LIST

Muntz TV Part Number	Description	Garod Number
(1) LI -9001	AM - I.F. Transformer	(C-1.445-3)
(2) LO -9001	BC - Oscillator Coil	(C-1.436-2)
(3) LI -9002	FM - I.F. Transformer	(C-1.446-2)
(4) LI -9003	FM - I.F. Transformer	(C-1.446-3)
(5) LI -9004	Ratio Detector Transformer Can Height 2½"	(C-1.524)
LI -9004	Ratio Detector Transformer Can Height 1 15/16"	(C-1.542-1)
(6) LC -9001	Filament Choke	(B-1.501)
(7) LC -9002	RF Choke - RF Plate	(B-1.512)
(8) LC -9003	RF Choke - Osc. Cathode	(B-1.535-1)
(9) LC -9004	RF Choke - RF Cathode	(B-1.535-2)
(10) LO -9002	FM Oscillator Coil	(B-1.538)
(11) LR -9001	FM - RF Grid Coil	(B-1.539)
(12) AN -9001	BC Loop Antenna	(D-1.540)
(13) LC -9005	Modulator Plate Choke	(B-1.536-1)
(14) LC -9006	Parasitic Suppressor	(B-1.536-2)
(15) CV -9001	Variable Condenser	(C-2.222)
(16) VC -9001	Volume Control & Switch	(C-8.201-11)
(16)(A) VC -9002	Tone Control	(C-8.201-12)
(17) TO -9001	Output Transformer	(C-9.241-3)
(18) TP -9001	Power Transformer	(D-9.248)
(19) LC -9007	Filter Choke	(C-9.255)
(20) SW-9001	Band-Switch	(C-8.228)
(21) SK -0014	10" Speaker	
(22) CC -9001	Dual Shielded Ceramic Capacitor	(B-4.125-1)
(23) CE -9001	Dry Electrolytic Capacitor Unit	(C-5.421-7)
(24) CE -9002	Electrolytic Capacitor	(C-5.430)
(25) CT -9001	Ceramic Trimmer .7 to 3.5 mmf	(B-4.118)
(26) AN -9002	Cabinet Antenna for FM	

MISCELLANEOUS PARTS

DG -0025	Dial Glass (AM - FM)	
ES -0029	Escutcheon - Radio	
KB -0034	Knob Tuning, Tone & Volume	
KB -0035	Knob, Band Switch	
FB -0009	Background - Dial Scale	
PL -0005	Plug - Phono	
PL -0025	Plug - Min. Connector	
PL -0026	Plug - Speaker Connector	
RB -0040	Strip - Dial Glass	

Radio Chassis—8FM34

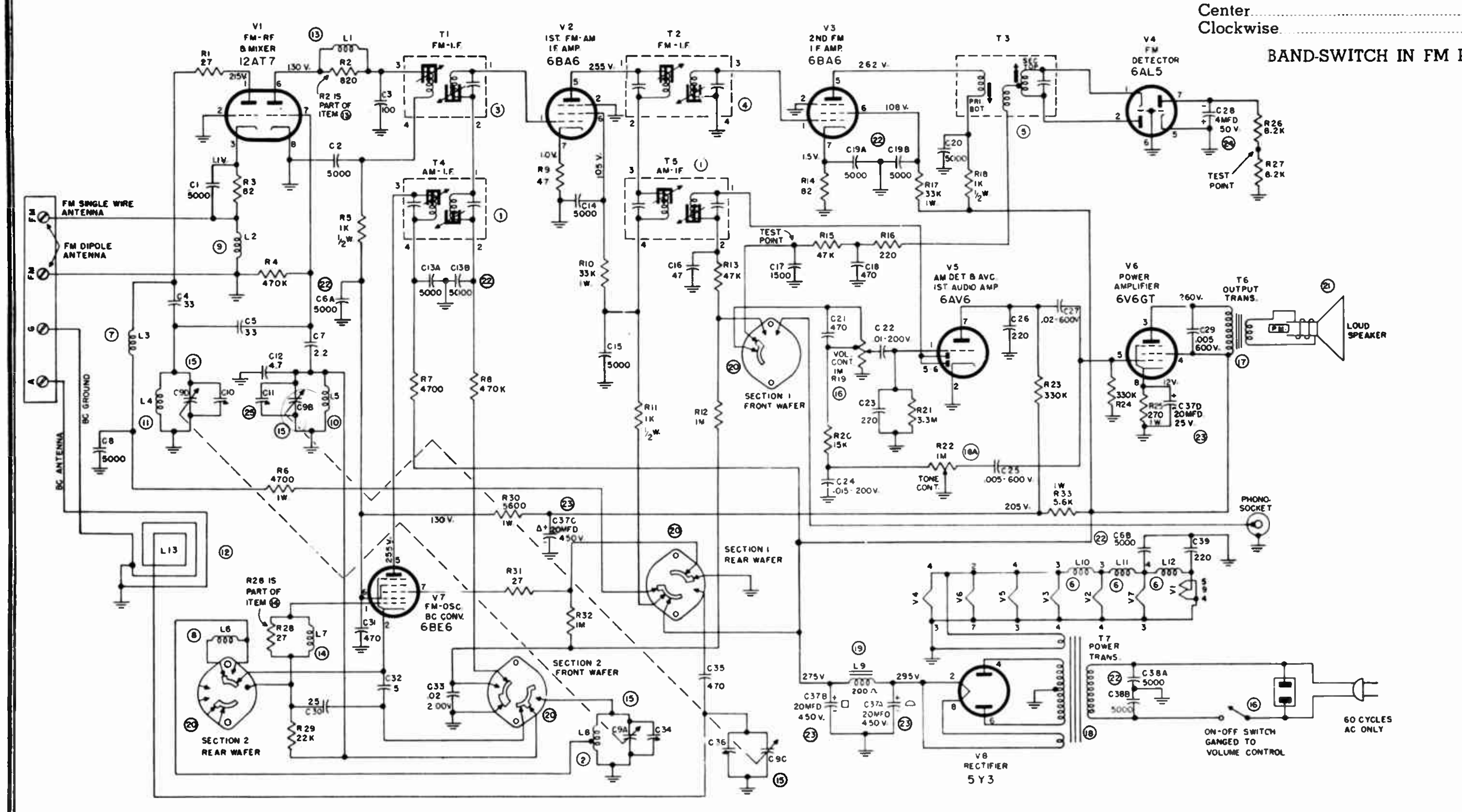
BAND-SWITCH POSITIONS

Counter Clockwise .... FM (87.5-108.5MC)
Center .... AM (540 -1650KC)
Clockwise .... Phono.

BAND-SWITCH IN FM POSITION.

K=Kilohms FM-I.F.=10.7MC
M=Megohms AM-I.F=455KC

All Condensers Shown In MMF.
All Condensers 500V. Except As Shown.
All Resistors ½ Watt Except As Shown.



OPERATION AND SERVICE DATA

AUTOMATIC RECORD CHANGER

VM MODEL 950

PREPARING FOR OPERATION

SHIPPING BOLTS: Before placing in operation, the player must be floated freely on the mounting springs. During shipment, the mechanism is secured by means of two shipping bolts. To float the changer, remove the turntable by lifting it straight up the spindle. Turn the two shipping bolts in a clockwise direction as far as they will go and replace the turntable. Before the turntable can be fully seated, the idler wheel must be gently pushed back out of the way to prevent damage to the rubber tire.

LEVELING RECORD CHANGER: It is essential to have the record changer absolutely level. Use a torpedo or similar type level on the record changer baseplate. Use adequate shims to level the record changer pan or radio combination cabinet to achieve perfect level.

OPERATION

Loading—

1. Pull straight upon record support knob until record support clears spindle. Swing record support to the left until pin in shaft drops into locating groove.

2. Changer will automatically play ten - 12" either standard or long-play records, twelve - 10" either standard or long-play records, any assortment

1. Pull straight up on record support knob until of ten—12" and 10" records intermixed, or twelve - 7" long-play or fine-groove records.

NOTE: Standard, fine-groove, and long-play records cannot be intermixed. Motor speed control knob must be reset for each type of recording.

3. Place records on spindle and lower to off-set shelf. Hold records level and replace record support over spindle.

To Play Standard Recordings—

1. Motor speed control knob must be in the "78" position.

2. To start, turn changer control knob to "Rej." and release. Changer will operate automatically until the last record has been played. Pickup arm returns to rest and the changer control knob to the "Off" position. Changer automatically stops.

To Play Long-Play (33⅓ RPM) Records—

1. Motor speed control knob must be in the "33" position.

To Play Fine-Groove (45 RPM) Records—

1. Motor speed control knob must be in the "45" position.

2. These records are manufactured with a 1½" spindle hole. It is essential that a record adapter be inserted into each 45 RPM record to be played. This is necessary to reduce the spindle hole to conventional size.

REJECTING: To reject a record at any time while changer is operating, turn changer control knob to 'Rej." and release.

STOPPING: To turn off changer before automatic shut-off, turn changer control knob to 'Off." Lift pickup arm and place on rest.

UNLOADING: Lift the record support and swing to the left until pin on shaft drops into locating groove. Lift stack of records straight up and off spindle.

MANUAL OPERATION: To play single records or home recordings, allow the changer to go through its complete shut-off cycle. Lift the record support arm and move it to the left clear of the turntable. Place record on spindle and lower to spindle shelf. Tilt record down toward the rear of pickup arm and lower record to turntable. Turn changer control knob to "On" position only. Raise pickup arm and place in lead-in groove of record.

REPEATING OF 7", 10", OR 12" RECORDS: To repeat records, swing record support clear of spindle, place record on the turntable, and start changer. Record repeats until control is turned "Off." If a 12" record is repeated, wait for the changer to finish cycling and reposition the pickup arm manually to the 12" position.

SUGGESTIONS: When loading and unloading the changer, use care to prevent bending of the spindle. Records should not be left on the spindle except during operation of changer. Records will warp. When machine is not in use, it is suggested that the speed control knob be left in the "78" position. For best reproduction, keep needle and records clean. Store records flat, in folders or in albums. Do not lay record on record.

CHANGE CYCLE

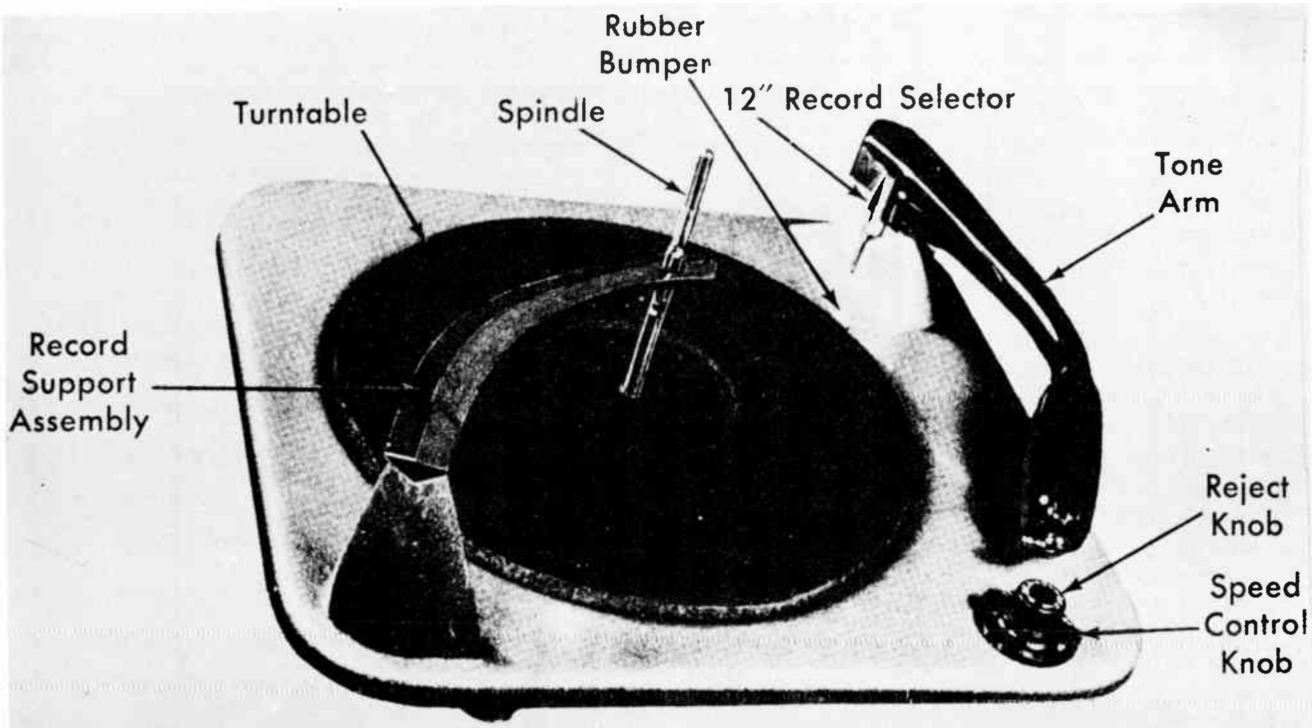
This changer is provided with what is known as a velocity trip mechanism. The change cycle is started by the faster inward motion of the pickup arm when the needle enters the trip grooves at the end of the record. Only records having fast-finishing grooves before the eccentric cycling groove will operate this velocity trip.

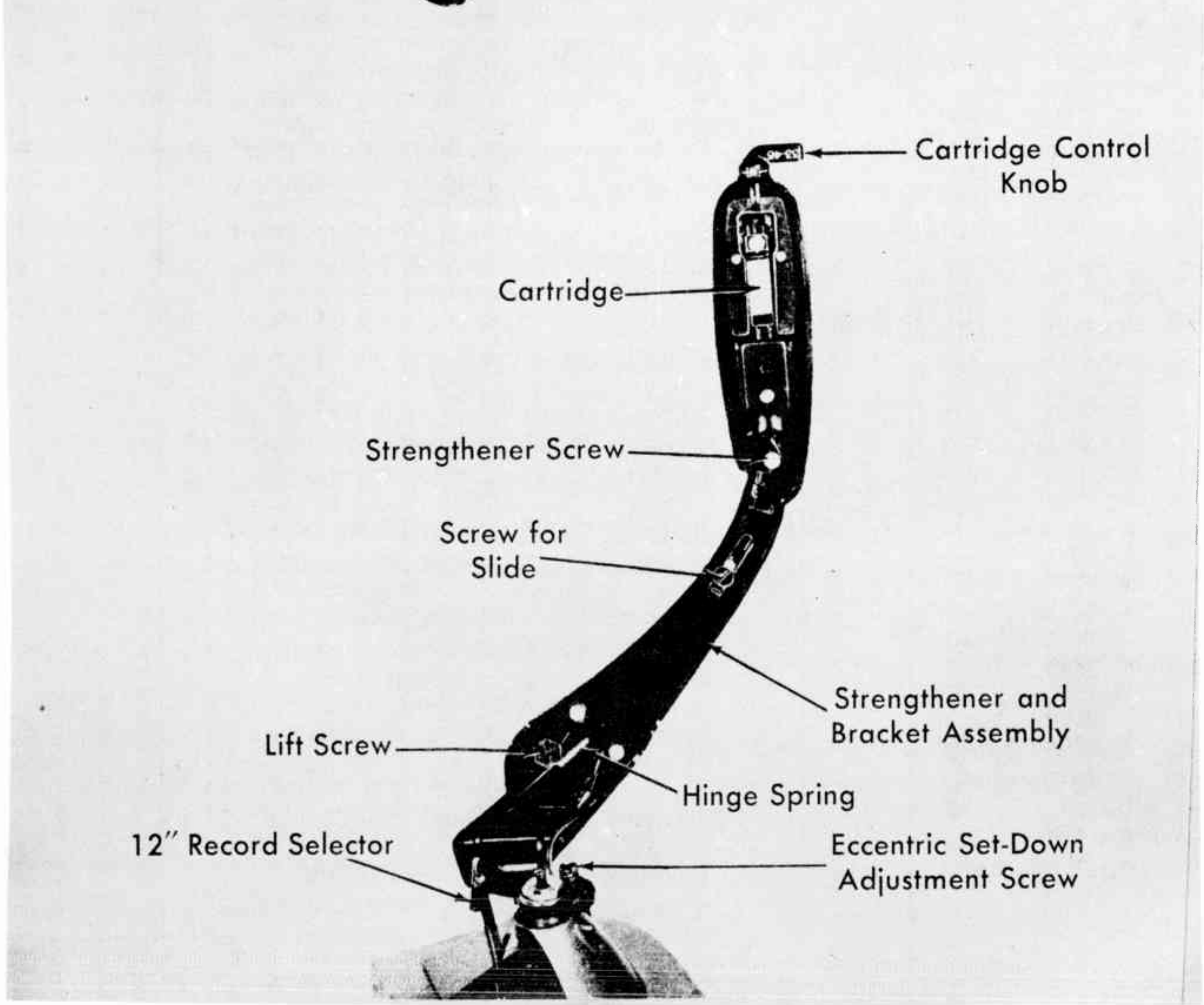
ADJUSTMENTS

NEEDLE SET-DOWN: The set-down position of the needle is adjusted by means of the set-down adjustment screw mounted on the hinge arm assembly. Turn this screw adjusting pickup arm for correct set-down on 10" record. When the correct set-down is obtained for the 10" position, the 12" and the 7" needle set-down will also be correct.

PICKUP ARM HEIGHT: The pickup arm height is adjusted by the lift screw located at the rear of the strengthener. To raise the height of the pickup arm, turn this screw counter-clockwise. To lower the pickup arm, turn clockwise. The pickup arm height should be adjusted so that with a 1⅛" stack of records the pickup arm lifts ¼" straight up as the change cycle starts.

NEEDLE PRESSURE: The needle pressure should be between 10 and 12 grams. Adjustment may be made by loosening the screw on the slide which moves in a slot in the tone arm strengthener. Move the slide back and forth until the correct needle pressure is obtained.





CABINETS—CABINET PARTS

CABINETS

Part No.	Description	Model Number
CW-0046-1	Table, Walnut	327TI
CW-0046-3	Table, Mahogany	327TI
CW-0046-4	Table, Oak-Blonde	327TI
AS-0462-3	Wrought Iron Legs, Black (optional)	327TI
AS-0462-4	Wrought Iron Legs, Gold (optional)	327TI
CW-0043-1	Consolette, Walnut	2763A
CW-0043-3	Consolette, Mahogany	2763A
CW-0043-4	Consolette, Oak-Blonde	2763A
CW-0044-1	Consolette-with Doors, Walnut	2764A
CW-0044-3	Consolette-with Doors, Mahogany	2764A
CW-0044-4	Consolette-with Doors, Oak-Blonde	2764A
CW-0042-1	Console, T.V.-Radio-Phono Combo., Walnut	2765A
CW-0042-4	Console, T.V.-Radio-Phono Combo., Mahogany	2765A
CW-0042-4	Console, T.V.-Radio-Phono Combo., Oak-Blonde	2765A

Model 327T1

CABINET PARTS LIST

Quan.	Description	Part No.
1	Cabinet Back Assembly	AS-0461
1	Back, Cabinet	BP-0142
1	Line Cord & Plug Assembly	CA-0103
1	Barrier, Cabinet Back	MP-0492
1	Label, Tube Layout & Model No.	NL-0074
1	Label, Focus Adjustment	NL-0075
1	Label, Authorized Service Emblem	NL-0076
2	Pix Tube Band Assembly	AR-0163-2
1	Bracket, Pix Tube Rear Support	BR-0151
1	Bracket, Deflection Yoke Coil Mtg.	BR-0152
2	Bracket, Focalizer Mtg.	BR-0153
2	Bracket, Pix Tube Band Anchor	BR-0154
1	Bracket, Cabinet Back Retainer	BR-0155
1	Bracket, Pix Tube Stop, (R.H.)	BR-0156-1
1	Bracket, Pix Tube Stop, (L.H.)	BR-0156-2
1	Mask, Pix Tube	ES-0045
1	Trim, Glass Retainer	ES-0046
5	Screw, Wood (#4 x ½ Phil. R.H.) Steel, Burnished Brass Plate	SC-8016-3
1	Strip, Pix Tube Cushion	FB-0007-3
1	Grommet, Pix Tube Support	GR-0013
3	Insulator, Clamp	IN-0103
1	Knob, Fine Tuning (Gold)	KB-0039-1
1	Knob, Channel Selector (Mah.-12 Pos.)	KB-0040
1	Knob, Channel Selector (Tan-12 Pos.) Use on Blonde only	KB-0040-1
1	Knob, Picture Control (Gold)	KB-0041-1
1	Knob, Volume Control (Mah.)	KB--0042
1	Knob, Volume Control (Tan) Use on Blonde Cab't only	KB-0042-1
1	Label, Control Identification	NL-0073
1	Filler, Pix Tube Neck Protector	PM-0034
2	Bumper, Pix Tube Stop	RB-0057
2	Rubber Channel, Pix Tube Protection	RB-0058
1	Strip, Filler	RB-0059
1	Glass, Pix Tube Protection	WG-0016
1	Chassis Mounting Board	CW-0046-10
1	Pix Tube Mounting Board	CW-0046-11

MODELS

2763A 2764A 2765A

CABINET PARTS LIST

Quan.	Description	Part No.
1	Cabinet Back Assembly (2764A-2763A)	AS-0443-3
1	Back, Cabinet (2764A-2763A)	BP-0138-2
1	Line Cord & Plug Assembly	CA-0103
1	Label, Danger	NL-0038-1
1	Label, Interlock	NL-0049
1	Label, Tube Layout & Model No.	NL-0074
1	Label, Focus Adjustment	NL-0075
1	Label, Authorized Service Emblem	NL-0076
1	Cabinet Back Assembly (2765A)	AS-0443-4
1	Back, Cabinet (2765A)	BP-0138-3
1	Pix Tube Band & Harness Assembly	AS-0435-1
1	Cover, Record Changer Drawer (2765A)	BC-0014
4	Bracket, Pix Tube Mtg. Assembly	BR-0144
1	Cabinet Back Assembly (2764A-2763A) Use with PR-0185	AS-0443-1
1	Back, Cabinet (2764A-2763A) Use with PR-0185	BP-0138
1	Cabinet Back Assembly (2765A) Use with PR-0185	AS-0443-2
1	Back, Cabinet (2765A) Use with PR-0185	BP-0138-1
1	Scale, Dial (AM-FM Radio) (2765A)	DG-0025
1	Escutcheon, Radio (2765A)	ES-0029-1
1	Mask, 27″ Rect. Pix Tube (Plastic)	ES-0042
1	Background, Dial Scale (AM-FM Radio) (2765A)	FB-0009

Quan.	Description	Part No.
2	Strip Escutcheon Backing (2765A)	FB-0010
1	Grille, Cabinet (2764A-2763A)	GW-0016
1	Grille, Cabinet (2765A)	GW-0017
1	Insulator, Radio Compartment (2765A)	IN-0114
1	Knob, Volume Control	KB-0032
3	Knob, Tone, Tuning, & Volume Control (Radio) 2765A	KB-0034
1	Knob, Band Switch (Radio) 2765A	KB-0035
1	Knob, Channel Selector	KB-0036
1	Knob, Fine Tuning	KB-0037
1	Knob, Picture Control	KB-0038
1	Cover, Plate (Muntz)	MO-0050
2	Brace, Pix Tube Support	MP-0478
1	Label, Radio-Phono (2765A)	NL-0071
1	Filler, Pix Tube Neck Protector	PM-0034
2	Strip, Dial Glass (Radio) 2765A	RB-0046
3	Strip, Pix Tube, Mask	RB-0048
1	Bumper, Housing	RB-0053
4	Strip, Pix Tube Stop Brkt.	RB-0054
18	Channel, Pix Tube Protection	RB-0055
1	Ring Tension, (Pix Tube Harness)	SP-0056
1	Glass, Pix Tube Protection	WG-0015
1	Rail, Wood Removable, Glass Retaining (Walnut)	WC-0001-11
1	Rail, Wood Removable, Glass Retaining (Mahogany)	WC-0001-13
1	Rail, Wood Removable, Glass Retaining (Limed Oak)	WC-0001-14
1	Rail, Wood Removable, Glass Retaining (Blonde)	WC-0001-15
1	Speaker, P.M. 10" (Radio) (2765A)	SK-0014-1
1	Speaker, P.M. 10"	SK-0020
1	Spring, 2nd Anode Cable Stand Off.	SP-0059
1	Wing Screw, Deflection Yoke	SC-0036-1
1	Spacer Clip, Deflection Yoke	MP-0477

CHASSIS PARTS LIST

CHASSIS MODEL 17B8

CAPACITORS

Sym.	Description		%	Voltage	Part No.
C18	Disc. Cer.	5000 mmf.		500V	CC-0060
C19	Disc. Cer.	5000 mmf.		500V	CC-0060
C20	Tub. Cer. Durez Insul.	470 mmf.	20	500V	CC-0078
C21	Tub. Cer. Durez Insul.	1000 mmf.	20	500V	CC-0061
C22	L'ytic	4 mfd.		50V	CE-0031
C23	Disc. Cer.	5000 mmf.		500V	CC-0060
C24	Tub. Paper	.01 mfd.	20	400V	CP-0041
C25	Tub. Paper	.01 mfd.	20	400V	CP-0041
C26a, b	L'ytic	2 x 40 mfd.		450V	CE-0026
C26c	L'ytic	100 mfd.		200V	CE-0026
C27	L'ytic	40 mfd.		250V	CE-0034
C28	Tub. Paper Moulded	.022 mfd.	20	600V	CPM-0102
C29a, b	L'ytic	2 x 40 mfd.		450V	CE-0033
C29c	L'ytic	100 mfd.		50V	CE-0033
C30a, b	Shielded Dual disc. cer.	2 x .01 mfd.		500V	CC-0096
C31	Disc. Cer.	5000 mmf.		500V	CC-0060
C32	Disc. Cer.	5000 mmf.		500V	CC-0060
C33	Disc. Cer.	5000 mmf.		500V	CC-0060
C34	Disc. Cer.	5000 mmf.		500V	CC-0060
C35	Disc. Cer.	5000 mmf.		500V	CC-0060
C36	Disc. Cer.	5000 mmf.		500V	CC-0060
C37	Disc. Cer.	5000 mmf.		500V	CC-0060
C38	Tub. Paper	.22 mfd.	20	200V	CP-0055
C39	Disc. Cer.	5000 mmf.		500V	CC-0060
C40	Disc. Cer.	5000 mmf.		500V	CC-0060
C41	Disc. Cer.	5000 mmf.		500V	CC-0060
C42	Tub. Paper	.1 mfd.	20	400V	CP-0034
C43	Tub. Paper	.1 mfd.	20	600V	CP-0013
C44	Tub. Cer. Durez Insul.	270 mmf.	20	500V	CC-0094
C45	Tub. Paper Moulded	.01 mfd.	20	600V	CPM-0101
C46	Tub. Paper Moulded	.047 mfd.	20	600V	CPM-0105
C47	Tub. Paper Moulded	.047 mfd.	20	600V	CPM-0105
C48	Tub. Paper Moulded	.047 mfd.	20	600V	CPM-0105
C49	Tub. Paper oil filled	.01 mfd.	10	1000V	CP-0061
C50	Tub. Paper	.047 mfd.	10	600V	CP-0049
C51	Tub. Paper	.047 mfd.	10	600V	CP-0049
C52	Tub. Paper	.1 mfd.	20	600V	CP-0013
C53	Tub. Paper Moulded	.0022 mfd.	10	600V	CPM-0100
C54	Tub. Paper	.0022 mfd.	20	600V	CP-0056
C55	Mica	47 mmf.	10	500V	CM-0044
C56	Tub. Paper Moulded	.047 mfd.	10	600V	CPM-0104
C57	Tub. Paper Moulded	.047 mfd.	20	600V	CPM-0105
C58	Tub. Paper	.022 mfd.	20	200V	CP-0052
C59	Tub. Paper	.47 mfd.	20	200V	CP-0045

Sym.	Description	Ohms	Watts %		Part No.
C60	Mica	68 mmf.	10	1000V	CM-0045
C61a, b	Dual Trimmer	2 x (10-160 mmf.)			CM-0012
C62	Tub. Cer. Durez	180 mmf. (-330TC)	10	500V	CC-0113
C63	Tub. Paper Moulded	.01 mfd.	20	600V	CPM-0101
C64	Tub. Cer. Durez Insul.	1000 mmf.	20	IKV	CC-0112
C65	Mica	820 mmf.	10	500V	CM-0046
C66	Tub. Paper	.47 mfd.	20	200V	CP-0045
C67	Tub. Paper	.1 mfd.	20	600V	CP-0013
C68	Tub. Paper Moulded	.022 mfd.	20	600V	CPM-0102
C69	Tub. Paper	.1 mfd.	20	600V	CP-0013
C70	Tub. Cer. Durez Insul.	1000 mmf.	20	500V	CC-0061
CR1	PEC Vert. Integrator				CC-0071
C71	Tub. Cer. Durez	270 mmf.	20	500V	CC-0094
C73	Disc. Cer.	.01 mfd.		1500V	CC-0126
C74	Disc. Cer.	.01 mfd.		1500V	CC-0126

RESISTORS

Sym.	Description	Ohms	Watts	%	Part No.
R10	Carbon	4.7K	½	10	RC-4701-18
R11	Candohm	1.5K	9	10	RW-0039
R12	Carbon	82	½	10	RC-082-18
R13	Carbon	330	½	10	RC-330-18
R14	Carbon	100K	½	10	RC-1003-18
R15	Carbon	10K	½	10	RC-1002-18
R16a	Dual Control SW & Vol.	500K			VC-0040-1
R16b	Contrast	1.5K			VC-0040-1
R17	Carbon	15	½	20	RC-015-28
R18	Carbon	270	½	10	RC-270-18
R19	Carbon	4.7M	½	20	RC-4704-28
R20	Carbon	470K	½	10	RC-4703-18
R21	Carbon	2.2M	½	5	RC-2204-58
R22	Carbon	120K	½	5	RC-1203-58
R23	Carbon	270	2	10	RC-270-12
R24	Carbon	680	½	10	RC-680-18
R25	Carbon	82	½	10	RC-082-18
R26	Carbon	680	½	10	RC-680-18
R27	Carbon	10K	½	10	RC-1002-18
R28	Carbon	47	½	10	RC-047-18
R29	Carbon	15K	½	10	RC-1502-18
R30	Carbon	82	½	10	RC-082-18
R31	Carbon	8.2K	½	10	RC-8201-18

Sym.	Description	Ohms	Watts	%	Part No.
R32	Carbon	120	½	10	RC-120-18
R33	Carbon	820K	½	10	RC-8203-18
R34	Carbon	22K	½	10	RC-2202-18
R35	Carbon	4.7K	½	10	RC-4701-18
R36	Carbon	1.2M	½	10	RC-1204-18
R37	Carbon	5.6K	2	10	RC-5601-12
R38	Carbon	10K	½	10	RC-1002-18
R39	Carbon	330K	½	10	RC-3303-18
R40	Carbon	100K	½	10	RC-1003-18
R41	Carbon	3.9M	½	10	RC-3904-18
R42	Brilliance Control	50K			VC-0036
R43	Carbon	22K	½	10	RC-2202-18
R44	Carbon	330K	½	10	RC-3303-18
R45	Carbon	820K	½	10	RC-8203-18
R46	Carbon	22K	½	10	RC-2202-18
R47	Carbon	180K	½	10	RC-1803-18
R48	Carbon	180K	½	5	RC-1803-58
R49	Carbon	22K	½	10	RC-2202-18
R50	Carbon	680	½	10	RC-680-18
R51	Vert. Lin. Control	2.5K			VC-0037
R52	Carbon	2.2M	½	10	RC-2204-18
R53	Deleted	....	....	....	....
R54	Carbon	1.8M	½	10	RC-1804-18
R55	Vert. Size Control	2M			VC-0034
R56	Vert. Hold Control	2.5M			VC-0046
R57	Carbon	2.7M	½	10	RC-2704-18
R58	Carbon	22K	½	10	RC-2202-18
R59	Carbon	8.2K	½	10	RC-8201-18
R60	Carbon	100K	½	10	RC-1003-18
R61	Hor. Hold Control	50K			VC-0036
R62	Carbon	82K	1	10	RC-8202-11
R63	Carbon	330K	½	10	RC-3303-18
R64	Carbon	4.7K	½	10	RC-4701-18
R65	Carbon	820K	½	10	RC-8203-18
R66	Carbon	82K	1	10	RC-8202-11
R67	Carbon	150K	1	10	RC-1503-11
R68	Carbon	330K	1	10	RC-3303-10
R69	Carbon	10K	½	10	RC-1002-18
R70	Carbon	150K	1	10	RC-1503-11
R71	Carbon	68K	1	10	RC-6802-11
R72	Carbon	470K	½	10	RC-4703-18
R73	Carbon	120	½	10	RC-120-18
R74	Carbon	680	½	10	RC-680-18
R75	Carbon	100	2	10	RC-100-12
R76	Wire Wound Vit. En.	13.5K	10	10	RW-0040
R77	Carbon	5.6K	½	10	RC-5601-18
R78	Carbon	680	½	10	RC-680-18
R79	Carbon	680	½	10	RC-680-18
R80	Wire Wound	5.6	½	10	RC-006-18
R81	Carbon	22	2	10	RC-022-12
R82	Carbon	470K	½	10	RC-4703-18
R83	Carbon	47K	½	10	RC-4702-18
R84	Carbon	820K	½	10	RC-8203-18
R90	Carbon	1K	½	10	RC-1001-18

TRANSFORMERS

Sym.	Description	Part No.
T1	Audio output	TO-0033
T2	Power	TP-0021
T3a	Vert. deflection yoke	LC-0061-2
T3b	Horiz. deflection yoke	LC-0061-2
T4	Vert. output	TO-0037
T5	Vert. blocking	TO-0035
T6	Horiz. osc. coil	LO-0039
T7	Horiz. output	TO-0036

COILS

Sym.	Description	Part No.
L8	Filter Choke	LC-0059-1
L12	Peaking coil (white)	LC-0057-2
L13	Peaking coil (brown)	LC-0057-3
L14	Peaking coil (gray)	LC-0057-4
L15	Peaking coil (yellow)	LC-0057-5
L32	4.5 mc trap	LC-0062
Z2	Sound take off coil (4.5 mc)	TO-0038
Z3	Ratio Detector	LI-0046B
Z4	Second I.F.	LI-0042
Z5	Third I.F.	LI-0041
Z6	Fourth I.F.	LI-0040

CRYSTAL

Sym.	Description	Part No.
Y1	Crystal 1N60	CX-0028
Y1	Crystal CK706	CX-0030

TUBES

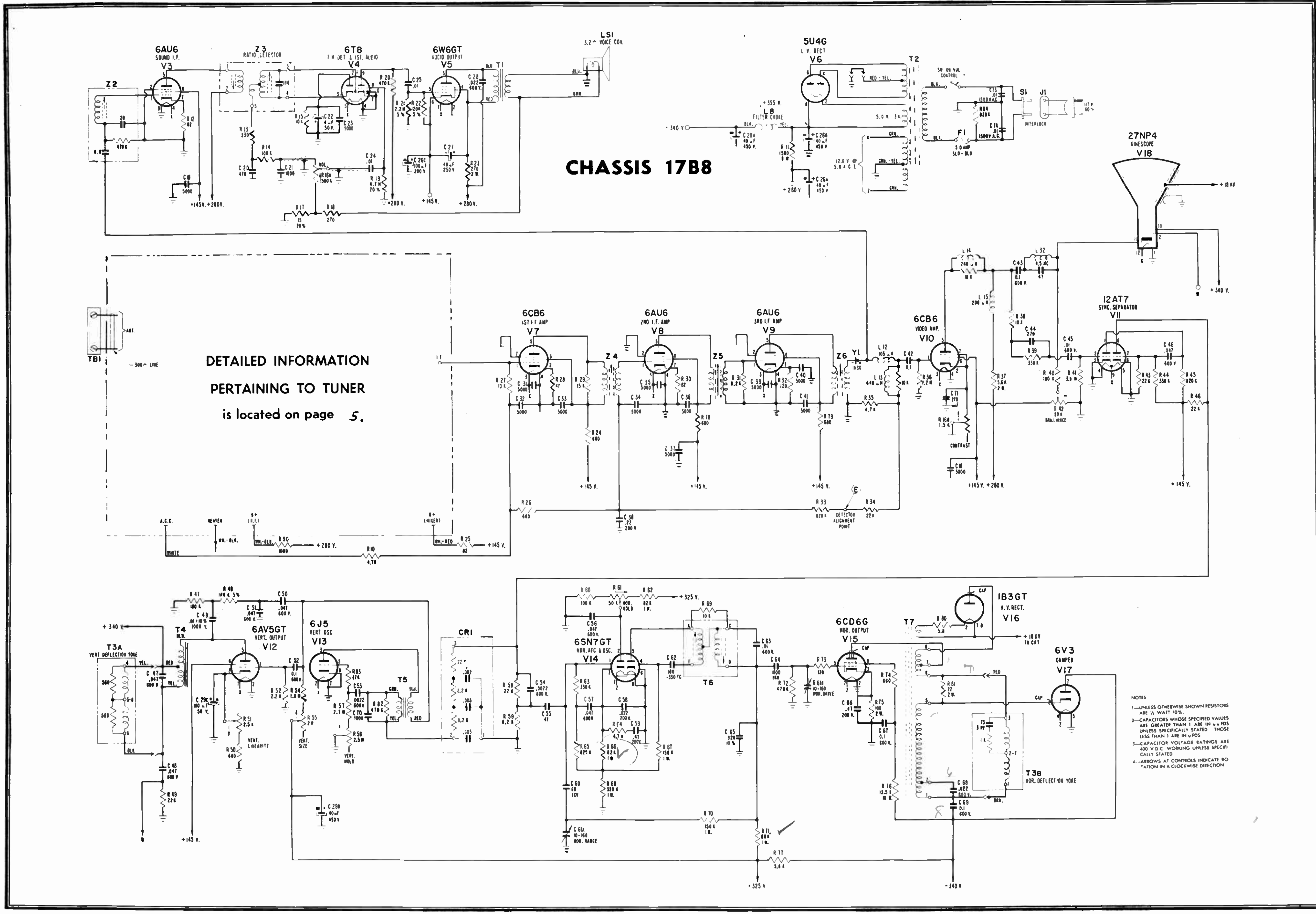
Sym.	Description	Part No.
V3	Sound I. F.	TU-6AU6
V4	F.M. Detector and First Audio	TU-6T8
V5	Audio Output	TU-6W6GT
V6	L. V. Rect.	TU-5U4G
V7	First I. F. Amp.	TU-6CB6
V8	Second I. F. Amp.	TU-6AU6
V9	Third I. F. Amp.	TU-6AU6
V10	Video Amp.	TU-6CB6
V11	Sync. Separator	TU-12AT7
V12	Vertical Output	TU-6AV5
V13	Vertical Oscillator	TU-6J5
V14	Hor. A. F. C. & Osc.	TU-6SN7GT
V15	Horizontal Output	TU-6CD6G
V16	H. V. Rect.	TU-1B3GT
V17	Damper	TU-6V3
V18	Kinescope	TU-27NP4

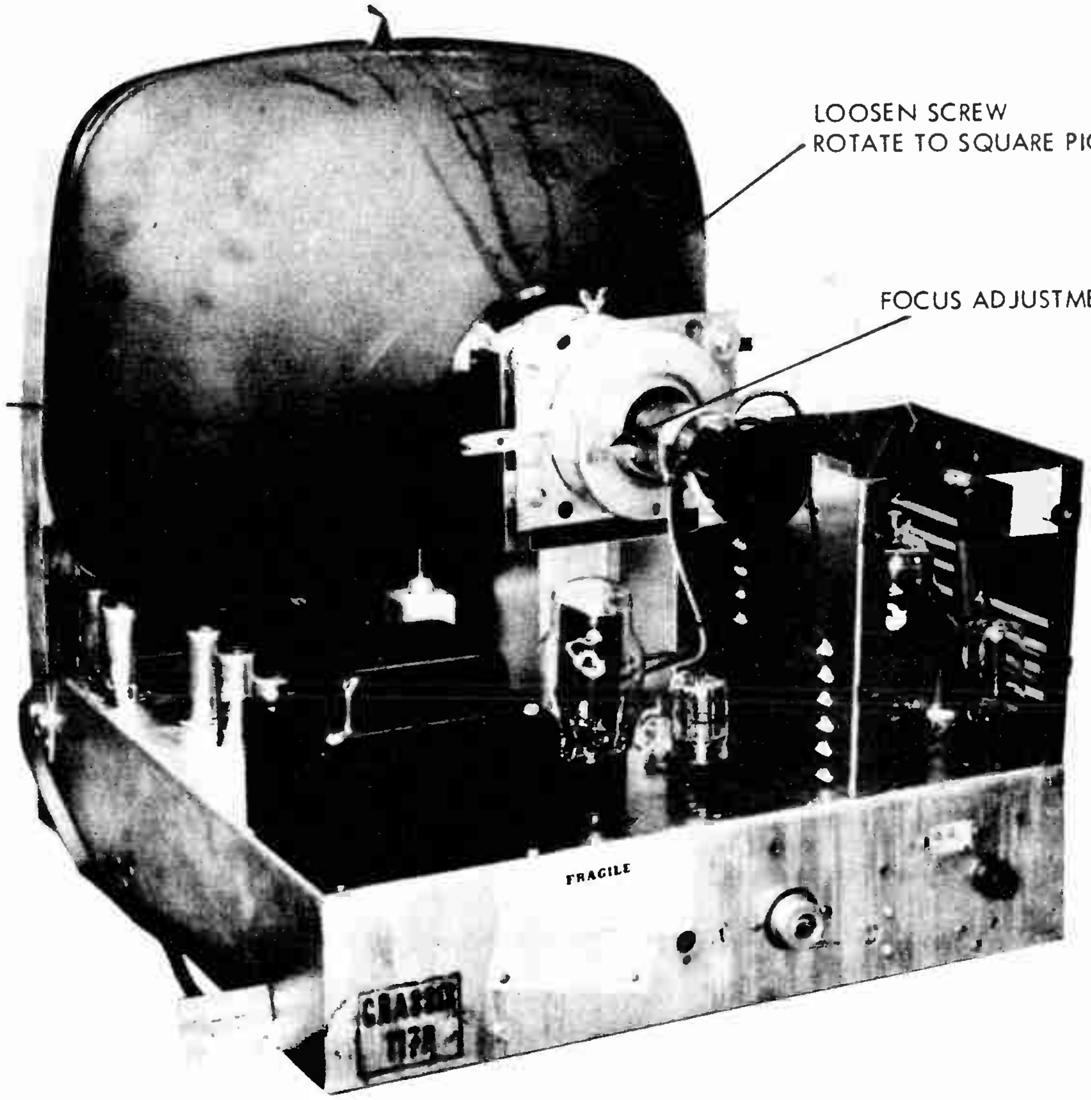
SPEAKERS

Sym.	Description	Part No.
LS1	P.M. 6 x 9 Oval (Model 327T1)	SK-0021-1
LS1	P.M. 10" (Models 2763A-2764-A 2765A)	SK-0020
	P.M. 10" (Model 2765A For Radio)	SK-0014-1

MISCELLANEOUS

Sym.	Description	Part No.
	Cable 2nd Anode H. V.	CA-0111-1
	Kinescope Socket Wiring Assembly	CA-0115-2
F1	Fuse, 5 amp. Slo-Blo (Use with chassis—Run 3 and above)	FU-0005-2
F2	Fuse, ½ amp.-250 V. (Use with chassis—Below run 3)	FU-0002-2
	Ion Trap	PR-0172
	Pin-cushion Magnets (Use 2) (Magnets used only in initial production)	PR-0199
	Focalizer (327T1)	PR-0218
	Focaizer (Models 2763A-2764A-2765A)	PR-0185
	Spring Dag Grounding Model (327T1)	SP-0051-2
	Spring Dag Grounding (Models 2763A-2764A-2765-A)	SP-0059
	Spacer Clip for Deflection Yoke on Models 2763A-2764A-2765A	MP-0477
	Socket, Tube 1B3GT (Below Run 5)	SO-0047
	Shield, Tube Socket Corona (Below Run 5)	JC-0028
	Insulator, H. V. Standoff (Below Run 5)	IN-0102
	Washer, Shield Insul. Corona (Below Run 5)	WF-0030
	H. V. Socket & Corona Ring (Above Run 5)	SO-0042
	Cover H. V. Tube Socket (Above Run 5)	JC-0030
	Insulator H. V. Socket Mtg. (Above Run 5)	IN-0098
	Washer, Corona Shield Insul. (Above Run 5)	WF-0030-1


CHASSIS 17B8
DETAILED INFORMATION
PERTAINING TO TUNER
is located on page 5.
6AU6
SOUND I.F.
V3
6T8
V4
6W6GT
AUDIO OUTPUT
V5
5U4G
L.V. RECT
V6
27NP4
KINESCOPE
V18
6CB6
1ST I.F. AMP
V7
6AU6
2ND I.F. AMP
V8
6AU6
3RD I.F. AMP
V9
6CB6
VIDEO AMP.
V10
12AT7
SYNC. SEPARATOR
V11
6AV5GT
VERT. OUTPUT
V12
6J5
VERT OSC
V13
6SN7GT
HOR. AFC & OSC.
V14
6CD6G
HOR. OUTPUT
V15
1B3GT
H.V. RECT.
V16
6V3
DAMPER
V17
T3A
VERT DEFLECTION YOKE
T3B
HOR. DEFLECTION YOKE
CONTRAST
BRILLIANCE
INTERLOCK
NOTES
1—UNLESS OTHERWISE SHOWN RESISTORS ARE ½ WATT 10%.
2—CAPACITORS WHOSE SPECIFIED VALUES ARE GREATER THAN 1 ARE IN uuFDS UNLESS SPECIFICALLY STATED. THOSE LESS THAN 1 ARE IN uFDS
3—CAPACITOR VOLTAGE RATINGS ARE 400 V D C WORKING UNLESS SPECIFICALLY STATED
4—ARROWS AT CONTROLS INDICATE ROTATION IN A CLOCKWISE DIRECTION



SPECIFICATIONS

Direct View Electromagnetic Picture Tube
- 14" Rectangular
- 17" Rectangular
- 20" Rectangular

Operating Voltage
- 110-120 60 Cycles

Wattage
- 175 Watts

Input Impedance and Transmission Line
- 300 ohm balanced (between antenna terminals)
- 75 ohm coaxial cable may be used by connecting shield to chassis and inner conductor to either antenna terminal

Intermediate Frequencies
- Video - 25.75 Mc.
- Sound - 21.25 Mc.
- Intercarrier Sound - 4.5 Mc.

Fuse Location
- Horizontal output fuse, F_1, is located inside the high voltage enclosure.
- The line fuse, F_2, is located in a fuse holder on the rear apron of the chassis.

Tube Complement

V1	6AG5, 6BC5, 6CB6	R.F. Amp.
V2	6J6	Mixer and Osc.
V3	6AG5, 6CB6*, 6BC5	1st I.F. Amp.
V4	6AG5, 6CB6*, 6BC5	2nd I.F. Amp.
V5	6AU6	3rd I.F. Amp.
V6	6AL5	Video Det. and A.G.C.
V7	6AC7	Video Amp.
V8	12AU7	D.C. Restorer, Sync Separator and Splitter
V9	6AU6	Sound I.F. Amp.
V10	6T8	Ratio Det. and 1st Audio
V11	6V6	Audio Output
V12	6AL5, 6H6*	Sync Phase Det.
V13	6SN7 GT	Horizontal Osc.
V14	6BG6 G	Horizontal Output
V15	6W4GT	Damper
V16	1X2 A	Pulse Rectifier
V17	6SN7 GT	Vertical Osc.
V18	6K6 GT	Vertical Output
V19	5U4 G	Power Rectifier
V20		Picture Tube

*Tubes not directly interchangeable see schematic.

INSTALLATION AND SERVICE ADJUSTMENTS

When installing, each set should be checked for picture centering, picture tilt, shaded corners, proper size, linearity, etc., to insure best performance. It is especially important that the Ion Trap be checked, and that the Channel Slugs be adjusted upon installation or servicing of every set to insure ease of tuning. Any adjustments required should be made as described here.

For best results, all checks or adjustments should be made using a transmitted television test pattern. A mirror placed in front of the picture tube screen will be of help in observing the picture while adjusting rear chassis controls.

HIGH VOLTAGE WARNING

Operation of this receiver outside of its cabinet involves a shock hazard from the power supplies. No work should be attempted on this receiver by anyone who is not thoroughly familiar with the precautions necessary when working on the high voltage equipment.

EXTERNAL ANTENNA

When an external indoor or an outdoor antenna is required, be sure to disconnect the built-in antenna leads from the antenna terminal board, tape them and place them away from the chassis.

OPERATING THE TELEVISION RECEIVER

The controls of this receiver are operated conventionally. When tuning, carefully adjust the TUNING control for the best picture.

INDIVIDUAL CHANNEL SLUG ADJUSTMENT "A3" USING TELEVISION SIGNAL

Individual channel oscillator adjustment of every receiver should be checked upon installation or servicing. If this adjustment is properly made, it is possible to tune from one station to another by merely turning the CHANNEL control. With correct oscillator channel adjustment, best picture will be located at the approximate center of the range of the Tuning control.

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.
b. Set the CHANNEL knob for a station in operation. Set all other controls for a normal picture.
c. Set TUNING control at center of its range by rotating it approximately half-way.
d. Remove the CHANNEL and TUNING knobs.

e. Insert a 1/8" blade, NON-METALLIC screwdriver in the 1/4" hole adjacent to the channel tuning shaft. For each channel in operation, carefully adjust the channel slug for the best picture with clear detail. Be sure that the Tuning control is set at the center of its range before adjusting each channel slug. Only slight rotation of the slug will be required; turning the slug in too far will cause it to fall into the coil. (If the slug falls into the coil, remove the coil, move the retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace slug and re-set retaining spring;)

If a number of slugs are found to tune all the way in or all the way out, or if the 6J6 oscillator-mixer tube has been replaced, it may be necessary to make the "Overall Oscillator Adjustment" as discussed below.

OVER-ALL OSCILLATOR ADJUSTMENT "A1" USING TELEVISION SIGNAL

Over-all oscillator adjustment should only be necessary when replacing the oscillator-mixer tube (6J6), or when all channel slugs are off in the same direction. When replacing the oscillator-mixer tube (6J6), it is recommended that several tubes be tried to select one which will cause least oscillator frequency shift.

A1 is generally adjusted so that approximately 3/16" of screw thread is exposed.

Adjust as follows:

a. Follow steps "a", "b", and "c" above.
b. Carefully adjust trimmer C6 (figure 8) for best picture with clear detail.
c. Check and, if necessary, make individual channel adjustments as indicated above.

ION TRAP ADJUSTMENT

To properly adjust the Ion Trap, Focusing Device and the Deflection Yoke the following procedure should be followed.

The Deflection Yoke should be placed in position closest to the "bell" of the Cathode Ray Tube as far forward on the neck of the tube as is possible. The Focus Device is next in line and Ion Trap last. See Figure 1.

The antenna should be connected to the receiver, the set should be turned on, the brilliance control turned to MAXIMUM and the contrast control at MAXIMUM.

The Ion Trap should be moved forward and backward and at the same time rotated to achieve the brightest raster on the face of the CRT.

Reduce the brilliance control to a point slightly over normal brightness and adjust the Focus Control on the rear of the Focus Device with a non-magnetic screwdriver for clearest and sharpest horizontal sweep lines. The Ion Trap should then be readjusted slightly for the brightest response on the face of the tube.

The Focus Device aperture should be moved to secure a complete raster centered and with no corners cut off.

Finally the Deflection Yoke should be rotated to "square" the raster with the chassis as a reference. The screws on the yoke brackets should then be set.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a pattern transmitted from a local station be used. Linearity adjustments, particularly, cannot be accurately made on moving transmissions. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area delineated by the mask.

The first step in linearity and size adjustment is to turn the Width Control (rear of chassis) all the way in. (clockwise)

The Horizontal Drive trimmer should then be adjusted for the best compromise between maximum brightness and good horizontal linearity. Misadjustment of the Horizontal drive condenser will show as bright vertical bars on the left hand side of the picture. The Width Control should then be backed out until the picture is the correct width.

Vertical Linearity and height adjustment are made in the conventional manner. It will be noted that there is some interaction between these controls.

HORIZONTAL OSCILLATOR ADJUSTMENT

The set should hold horizontal sync over approximately one turn of the horizontal hold control. This will vary with signal strength of the received station. The control will bind at the extreme ends of its rotation. Do not attempt to force it to turn after binding is encountered or serious damage will result. If the set does not hold at a point in the center of the control range it indicates trouble in the horizontal oscillator or sync phase detector.

PICTURE TUBE REPLACEMENT

Important: After replacing any picture tube, be sure to make all deflection adjustments -- Picture Centering, Deflection Yoke, and Ion Trap - Especially note comments on picture centering.

WARNING: Because of the high 2nd anode voltage used (approximately 12KV) and the possibility of danger of implosion due to high vacuum, the following precautions should be noted when removing or replacing picture tubes:

a. Before handling a picture tube, remove the 2nd anode static charge from both the picture tube and the 2nd anode connector by shorting them to chassis.
b. Shatterproof goggles and heavy gloves should be worn while handling or installing a picture tube.
c. Always handle the picture tube very carefully. DO NOT pick the tube up by the neck.

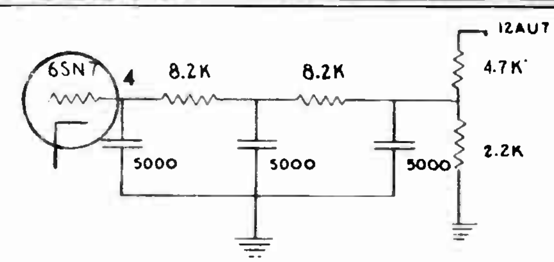
INCREASING SENSITIVITY FOR OPERATION IN FRINGE AREAS

The following hints may be helpful for improving sensitivity in fringe areas. These hints should be followed in the sequence given. The balance of the procedure can be omitted if satisfactory results are obtained at any point in the procedure.

a. Make sure that the proper antenna is used and correctly installed. Information on various types of high gain antennas is available from the Distributor.
b. Check the rectifier tube (5U4G) by substitution as the voltage output of some tubes may be slightly higher. An increase in B-voltage will increase sensitivity.
c. Check the video amplifier tube (6AC7) by substitution. Increased contrast is sometimes obtained with tube replacement.
d. Check the power line voltage. If the voltage is known to vary greatly, it is recommended that the set be operated from a constant voltage transformer with a power rating of at least 300 watts.
e. Carefully realign the receiver following the instructions given in this manual. Checking tubes (by substitution) in the RF amplifier, oscillator-mixer, IF stages, and video detector while aligning will often give considerable increase in gain. The increase in gain may be observed by an increase in amplitude, on the response curve. Realignment of the particular stage should always be made after each tube replacement, in order to realize the maximum gain possible.

Change to Improve Vertical Sync Stability in Weak Signal Area

1. Remove vertical integrator plate.
2. Make up vertical integrating circuit shown below:



PRODUCTION VARIATIONS

1. One or two 100 ohm 10 watt resistors were added between the center tap of some power transformers and chassis to reduce the B plus voltage to approximately 360 volts.

2. In sets of serial 51,200 and below the audio de-emphasis network was 33K and 2200 MMF.

3. Vertical hold control may be 750K, when this is used, a 390K resistor is connected in series with it.

4. In some sets coupling condenser between vertical multivibrator and vertical output tube may be .25 MFD - 600 V.

5. In sets of serial 50,000 and below, 1000 MMF condensers coupling sync to phase detector may be 1500 MMF $\pm$ 10%.

TELEVISION ALIGNMENT PROCEDURE

GENERAL

Complete alignment consists of the following individual procedures. Complete alignment should be performed in this sequence.

a. IF Amplifier Alignment.
b. 4.5 MC Sound IF Alignment.
c. RF and Mixer Alignment.
d. Overall RF and IF Response Curve Check and High Frequency Oscillator Alignment.

TEST EQUIPMENT

To properly service this receiver, it is recommended that the following test equipment be available. Note: Equipment below may be available as a single unit, except for the vacuum tube voltmeter.

SWEEP GENERATOR

Sweep generator must provide sweep frequencies from
18 to 30 MC range: 10 MC sweep width.
50 to 90 MC range: 10 MC sweep width.
170 to 225 MC range: 10 MC sweep width.
Output: adjustable; at least one-tenth volt maximum.
Output impedance: 300 ohms balanced to ground.
Sweep generator should preferably have a built-in marker generator with calibration crystal for checking dial accuracy.

SIGNAL GENERATOR with crystal calibrator which can also be used as a marker generator.
4.5 MC frequency.
18 to 30 MC frequency range.
50 to 90 MC frequency range.
170 to 225 MC frequency range.
Must have a built-in calibration crystal for checking dial accuracy.

OSCILLOSCOPE

Standard oscilloscope, preferably one with a wide band vertical deflection, vertical sensitivity at least .5 volt peak-to-peak per inch.

VACUUM-TUBE VOLTMETER

Standard Vacuum-tube Voltmeter with high resistance input and low voltage DC Range (3 volts or less). In addition, a zero center low voltage range will be found useful.

ALIGNMENT TOOLS

An alignment tool kit consisting of one metallic and one non-metallic screwdriver is necessary.

SWEEP GENERATOR NOTE

A sweep generator which does not have constant output voltage and reasonably linear sweep frequency distribution, will produce curves which are widely different from the "IF" Response Curve" or Overall RF and IF Response Curve" Shown in the following pages. If repeated difficulty is encountered in obtaining these curves, the sweep generator should be checked. A simple check is to observe the response curve for a set that is known to be in alignment.

Before suspecting the generator, be sure the alignment instructions have been followed carefully.

IF AMPLIFIER ALIGNMENT

a. Disconnect antenna; connect jumper wire across terminals.

b. Set receiver to channel 13 or other unassigned high channel to prevent signal interference during IF alignment. Set Picture control fully to right (clockwise).

c. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Signal Gen. Freq. (MC)	VTVM and Signal Generator Connections	Instructions	Adjust
1	21.25	VTVM high side to test point "T", low to chassis. R.F. gen. high side to floating tube shield on 6J6 low to chassis.	Use VTVM 3 volt DC scale. Adjust signal generator to maintain approximately 1 volt output.	L5 for min.
2	23.2			L 3 & 4 for max.
3	25.2			L 1 & 2 for max.
4	To insure correct I.F. alignment, make the "I.F. Response Curve Check" given below.			

IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope with sweep input to RF Mixer V2).

Differences in tube gain and component values affect IF response. These differences are not apparent in alignment of IFs when using a signal generator and VTVM (single frequency alignment); hence it is preferable that an IF response curve check be made after completion of the IF amplifier alignment.

The IF response curve check can be made as indicated directly below. However, also note that a better check can be made by feeding the sweep signal through the entire RF and IF system as given under "Overall RF and IF Response Curve Check (Step 1)". The overall check should be made after making all other alignments.

a. Make all control settings and connections as given in "a" through "c" the IF amplifier alignment chart above.

b. Connect oscilloscope* between point "T" and chassis ground, see fig. 4. Keep leads away from receiver.

c. Connect sweep generator high side to tube shield of 6J6 (V2) osc-mixer tube. Be sure to insulate tube shield from chassis. Connect sweet generator low side to chassis close to 6J6 tube base. Set sweep generator to sweep the IF band pass (19 to 29 MC).

d. If sweep generator does not have a built-in marker generator, loosely couple marker generator high side to the sweep generator lead connected to tube shield on tuner; low side to chassis ground.

To avoid distortion of the response curve, keep the sweep generator and marker generator outputs at a very minimum.

Marker pips should be just kept barely visible. To minimize distortion, set sweep generator output for VTVM reading of approximately .6 volt DC, measured between test point "T" and chassis. Connecting a 1-1/2 volt battery (negative to AGC Line, positive to chassis) will allow greater signal input without distorting the response curve.

e. Check curve obtained against the ideal IF response curve shown in figure 3. Since it is not always possible to get ideal curves, it should be noted that the height of opposite peaks should be within 30% of each other. The dip or valley in the center of the curve should not be greater than 30% down from the highest peak of the curve. Check video and sound IF carrier points by means of marker generator. It is important that marker pips be in the proper location on the response curve. The 25.75 MC marker, should be 50% below the highest peak on the high frequency side of the curve. The 22 MC marker should be at the opposite side of the response curve, located approximately 85% below the highest peak. The 21.25 MC marker should be located at least 95% below the highest peak, and may or may not be visible.

Consistent with proper band width and correct location of markers, the response curve should preferably have maximum amplitude, symmetry, and flat top appearance.

If the procedure given has been carefully followed and the response curve obtained differs greatly from the curve shown, repeat the IF Amplifier Alignment, making sure generator frequencies are precise and adjustments are accurately made.

***OSCILLOSCOPE NOTE**

*** In dealing with RF and IF response curves, it is well to remember that an inverted or mirror image may result, depending on the sweep generator and oscilloscope used. The general waveform should still be identical.**

When using a wide band oscilloscope for alignment, marker pips will be more distinct if condenser from 100 to 1,000 mmfd. is connected across the oscilloscope input. Caution: Use the smallest condenser possible, since too high a capacity will affect the shape of the response curve.

ALIGNMENT HINT

After becoming familiar with alignment procedure, some servicemen simplify subsequent alignment of sets by merely using the essential alignment data given in figures below.

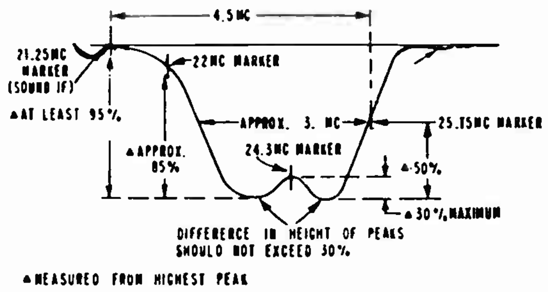


Figure 3 IF Response Curve.

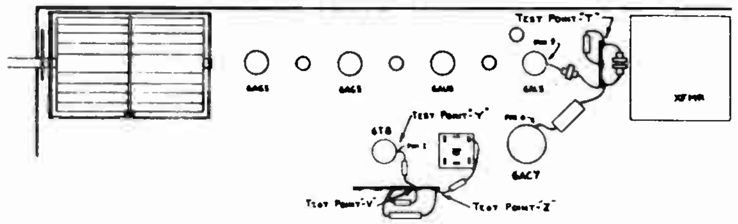


Figure 4 Bottom View Showing Test Point Connections.

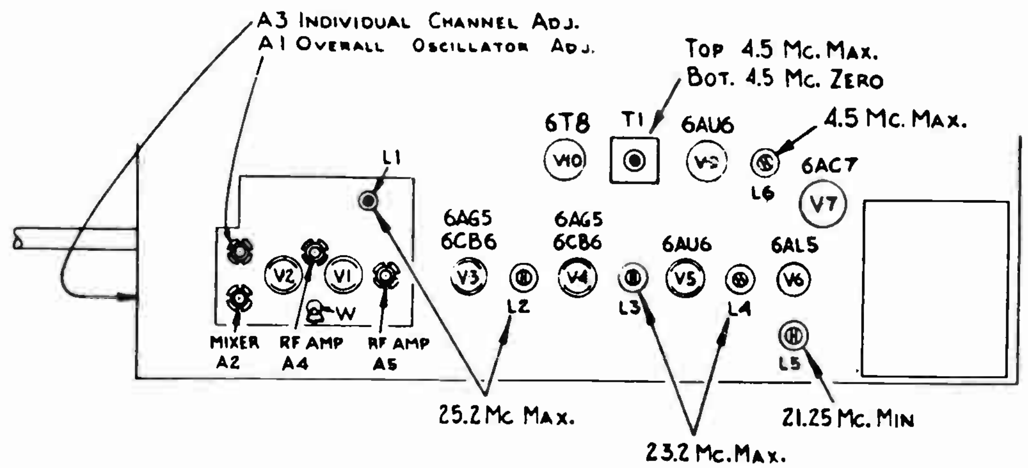


Figure 5 Top View of Chassis Showing Alignment Data.

4.5 MC SOUND IF ALIGNMENT

a. Disconnect antenna. Connect jumper wire across terminals.

b. Connect signal generator high side to Pin 4 V7, connect low side to chassis.

c. Allow about 15 minutes for receiver and test equipment to warm up.

d. Set Picture control fully to the right (clockwise).

Step	Signal Gen. Freq. (MC)	VTVM Connections	Instructions	Adjust
1	Since the transmitted video and sound carriers have an accurate 4.5 MC frequency difference, it is advisable to use a TV station signal instead of a signal generator for accurate alignment of steps below. When using a television signal, it may be necessary to use a higher scale on the VTVM. (30V) IMPORTANT: When using a signal generator, be sure to check it against a crystal calibrator or other frequency standard for accurate frequency calibration at 4.5 MC. Accuracy required is within one kilocycle.			
2	4.5 unmodulated or AM modulated. See step 1 for use of station signal.	High side to test point "Y"; common to chassis.	Use 3 volt DC scale on VTVM. Keep VTVM leads well separated from signal generator (if used) and chassis wiring.	L 6 and top of T1 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt).
3		High side to test point "Z" common to test point "V"	Use 3 volt zero center scale on VTVM, if available. Keep VTVM leads well separated from signal generator (if used) and chassis wiring.	Bottom of T1 for zero on VTVM (the correct zero point is located between a positive and a negative maximum).

(See Page 4 for MC Chart, Fig. 6. RF Response Curve, Fig. 7. Front view of T V Tuner and Fig. 8. Top of TV Tuner, Showing Adjustment Location) Fig. 4 For Test Point Location.

RF AND MIXER ALIGNMENT

a. If used earlier, disconnect 1-1/2 volt battery.

b. Disconnect antenna from receiver.

c. Connect sweep generator to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.

d. Connect oscilloscope through a 10,000 ohm resistor to test point "W" on tuner (Fig. 8). Keep scope leads away from chassis.

e. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	205.25 (Video Carrier) 209.75 (Sound Carrier)	Sweeping Channel 12	Check for curve resembling RF Response Curve shown below. If necessary, adjust A8, A9 and A10 (figure 9) as required. Note that adjusting A9 will shift the center of the response curve in relation to the video and sound carrier markers. A8 and A10 should be alternately adjusted for best gain with flat top appearance. Consistent with proper band width and correct marker location, response curve should have maximum amplitude and flat top appearance.
2	See frequency table below. Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve resembling RF Response Curve shown below. In general, the adjustment performed in step 1 is sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for the weak channel as a compromise adjustment to favor this particular channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.

OVERALL RF and IF RESPONSE CURVE CHECK (Step 1) and HF OSCILLATOR ALIGNMENT (Step 2)

(Using sweep generator and oscilloscope.)

IMPORTANT

Since HF Oscillator alignment requires absolute frequency accuracy, a station signal is generally best suited for alignment of the individual channel oscillator slugs A3. The procedure for using a station signal (and without removal of chassis) is given in "Individual Channel Slug Adjustment Using Television Signal" on page 1.

The procedure for HF Oscillator alignment with an oscilloscope and a sweep generator is given below.

a. Disconnect antenna.

b. Disconnect signal generator and VTVM (if used earlier).

c. Set the Tuning control at half rotation by rotating it approximately 150° as shown in Figure 7.

d. Connect sweep generator to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible. Connecting a 1-1/2 volt battery (negative to AGC Line; positive to chassis) will allow greater signal input without distorting response curve.

e. Connect oscilloscope between point "T" and chassis ground (see Figure 4). Keep oscilloscope leads away from chassis.

f. Allow about 15 minutes for receiver and test equipment to warm up.

g. When adjusting A3, use a NON-METALLIC alignment screwdriver with a 1/8 inch blade.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1			Sweep the RF band pass (channel 13 or other unassigned high channel) and check the shape of the overall response curve obtained against the ideal curve shown below. If shape of curve is not within limits shown, it will be necessary to repeat the IF Amplifier Alignment. The IFs must be accurately aligned before correct oscillator adjustment can be made.
2	See frequency table on page 11. Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency. Marker generator must have, or be used with, a calibrating source providing an accuracy of at least .05%.		Set the Tuning control at half rotation (see figure 7). Check to see whether oscillator alignment is required by comparing the location of the video and sound carrier markers (sound carrier marker may or may not be visible) on the response curve obtained for each channel with the "Overall RF and IF Response Curve" shown below. Note whether mis-alignment is evident on a major number of channels or on only a few channels. *If the markers for a major number of channels* are far off in the same direction, adjust the overall oscillator adjustment A1 (on channel 13 or other unassigned high channel) so that the video carrier marker is located as shown in the response curve given below. (If the video carrier marker is at the proper point on the curve, the sound carrier marker should locate at the proper point on the curve.) Be sure the Tuning control is at half rotation while making this adjustment. Recheck all channels individually for proper marker location. *If only individual channel adjustment is required,* adjust the particular individual channel slug A3, (using a NON-METALLIC alignment tool with a 1/8" blade) so that the video carrier marker is located as shown in the response curve given below. Only slight rotation of the slug will be required; turning the slug in too far will cause the slug to fall into the coil.* (If the video carrier marker is at the proper point on the curve, the sound carrier marker should locate at the proper point on the curve.) Be sure the Tuning control is at half rotation while making this adjustment.
3			To insure best reception and ease of tuning, a "touchup" adjustment of the individual channel slugs A3, using the station signal from each of the stations in the service area, must be made, preferably in the customer's home. See "Individual Channel Slug Adjustment Using Television Signal" on page 1.

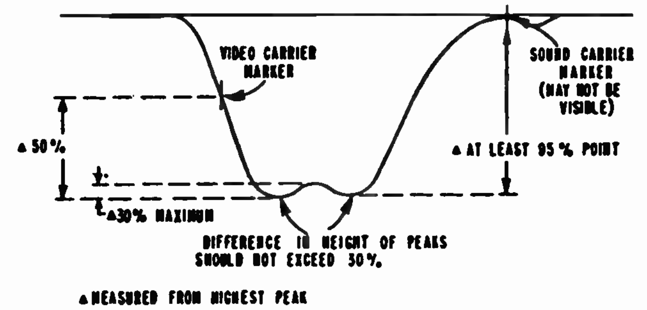
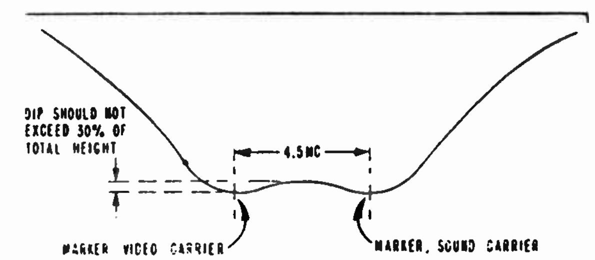


Fig. 9 Overall RF and IF Response Curve.

* If an oscillator slug should fall into a coil, remove the coil, move the slug retaining spring aside, lightly tap the open end of the coil against a solid object until the slug slips out. Replace slug and set the retaining spring into its cut-out slot.

Channel Number	Channel Freq. MC	Video Carrier, MC	Sound Carrier, MC
2	54- 60	55.25	59.75
3	60- 66	61.25	65.75
4	66- 72	67.25	71.75
5	76- 82	77.25	81.75
6	82- 88	83.25	87.75
7	174-180	175.25	179.75
8	180-186	181.25	185.75
9	186-192	187.25	191.75
10	192-198	193.25	197.75
11	198-204	199.25	203.75
12	204-210	205.25	209.75
13	210-216	211.25	215.75



Full skirt of curve will not be visible unless generator sweep width extends beyond 10 MC.

Figure 6. RF Response Curve.

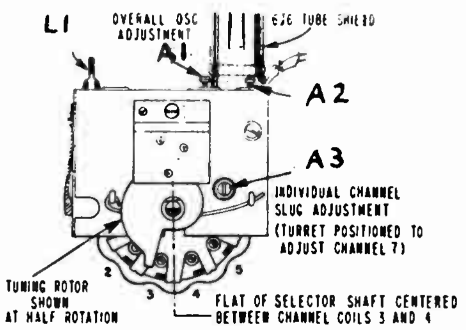


Fig. 7. Front View of TV Tuner.

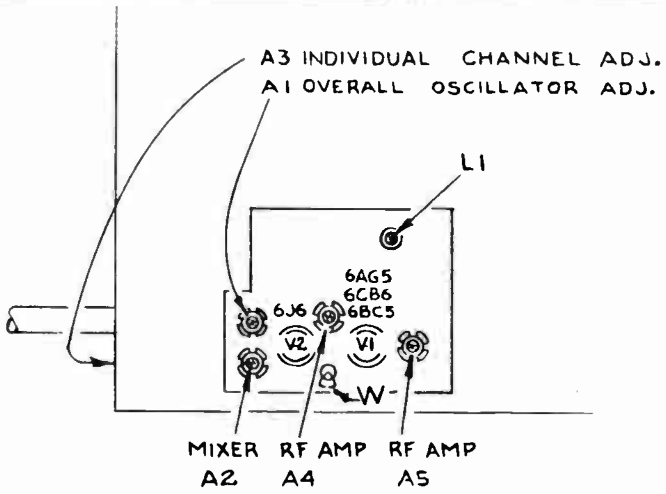


Figure 8. Top of TV Tuner, Showing Adjustment Location.

TELEVISION TUNER SERVICE

GENERAL

The TV tuner is a sub-chassis consisting of an RF amplifier stage and a mixer-oscillator stage.

Three different RF amplifier tubes, either 6AG5, 6BC5, or 6CB6, are used in this tuner. Although these tubes have similar characteristics and are generally interchangeable, it is advisable to check the RF amplifier curve with a sweep generator and oscilloscope after replacement. A dual triode 6J6 tube is used in the mixer-oscillator stage.

Channel selection is accomplished by rotation of the tuner turret assembly, which has a separate set of two coils for each of the 12 television channels. Each set consists of an antenna coil in one assembly, and a mixer-oscillator coil in another. Coils are the snap-in type. Coils can be identified as to channel by the number stamped on the outside of the coil assembly. A Tuning control permits fine adjustment of oscillator frequency.

The high frequencies used in television make it necessary that extreme care be exercised in servicing tuners.

Location and lead dress of components and wiring are usually very critical. Wiring leads, acting as small inductances or capacities, may appreciably alter electrical characteristics of critical circuits at high frequencies.

Parts location and ground connections should be as originally made. When replacing components, *it is important that they be replaced with parts of identical electrical characteristics and physical size.*

TUNING CONTROL

The Tuning control is a variable dielectric type condenser. The normal tuning range of the Tuning control for high channels is plus or minus 3 MC, for low channels plus or minus 1.5 MC.

Slight rubbing of the dielectric rotor of M104 against the grounded stator plate M107 is intentional, in order to avoid vibration with resulting microphonics. However the dielectric rotor should not be allowed to contact the circular disc riveted to the body of the tuner.

The Tuning control is permanently set at the factory and cannot be readjusted for frequency tuning range.

Refer to parts list for temperature coefficients, tolerances, and other essential description.

Note resemblance between some ceramic condensers and resistors. If in doubt, check Schematic.

Also note that replacement of tubes (especially 6J6 oscillator-mixer tube) may cause some slight detuning of tuner circuits. This is due to the inherent differences of inter-electrode capacitances. When replacing 6J6 tube, it is recommended that several tubes be tried in order to select a tube which will cause least oscillator frequency shift. This is easily checked by noting the amount of rotation of the Tuning control required to tune in the television signal. It is recommended that this check be made on the high channels. Make individual channel slug adjustments as instructed on page

Channel snap-in coils must be handled with care. Do not disturb coil windings. Also be sure the coils are properly paired for the indicated channel number, and that coils follow proper sequence when reassembled in the turret drum. For proper reference of tuner shaft in relation to coil position refer to figure 7.

TUNER REPLACEMENT

Replacement of the complete tuner should generally never become necessary since electrical and mechanical parts are easily replaceable. At time of publication, the manufacturer can supply a replacement tuner on an exchange basis, if you are unable to make repairs.

REMOVING CHANNEL COILS

Insert a screwdriver blade between the coil retainer spring and the turret end plate. Twist the blade away from the turret and lift the end of the coil upward.

CLEANING CONTACTS

Remove several sets of coils from turret and rotate turret to position making contact points of contact plate accessible for cleaning.

Using a small, stiff brush and carbon tetrachloride, clean contact surfaces of stationary contacts.

Remove accumulated dust or grease from stationary contacts and contact plate with a soft canvas cloth dampened with carbon tetrachloride. Accumulated rosin may be removed with a soft cloth dampened with alcohol.

Clean contact surfaces of rotating coils in same manner.

TUNER LUBRICATION

In general the lubrication applied to points of wear or friction at time of manufacture should make lubrication seldom, if ever necessary. However, should tuner lubrication become necessary, it is important that the correct amount and type of lubricant be used.

Using a clean brush, apply a film of switch contact oil, Viscosity Oil Co. #7069) to the surfaces of the coil contacts and stationary contact points.

Lubricate bearing surfaces of all other moving parts with light vaseline or preferably Viscosity Oil Co. #8857 lubricant.

CAUTION: Do not use lubriplate or any similar lubricant containing zinc or cadmium.

ADJUSTING CONTACT SPRINGS

Should the stationary contact springs make poor contact due to insufficient tension, remove several sets of coils from the turret. Rotate the turret to position making the bottom of the contact strip accessible for observation. With a narrow blade screwdriver, adjust the contact spring tension by carefully bending the spring inward until highest point on the spring extends about 9/64 of an inch above the plastic surface of the contact plate. With correct tension of the contact spring, the spring should clear the flat surface of the turret coil by about 1/64 of an inch.

OSCILLATOR SLUGS IN TOO FAR

If HF oscillator slugs "fall into" coil form, remove the channel coil, move the slug retaining spring M112 aside, and tap the coil assembly until the slug slips forward. Set the slug retaining spring into position; it should rest firmly against the slug.

REMOVING TUNER TURRET ASSEMBLY

a. Remove retaining bracket M107 in front of the tuner.
b. Remove rotor shaft assembly M104, rotor contact spring M124 and fibre washer M113. For reassembly, note order of parts removal.
c. Remove front and rear turret retaining springs M125 by pressing straight end away from tab on chassis.
d. Using a screwdriver blade at the side of the tuner, press the detent spring M122 and roller M121 away from the turret detent plate.
e. Grasp tuner shaft and slip out of end plate bearings.

REPLACEMENT OF THE UNGROUNDED STATOR PLATE OF TUNING CONTROL

Stator plate M118 is replaced with wiring lead and trimmer condenser C5 attached, because it is difficult to solder the wire lead to the silver plated surface on the ceramic stator plate disc.

To replace the stator plate, remove the turret assembly. Remove mounting rivets from stator plate by drilling out or clipping them out with diagonal wire cutters. Remove trimmer screw M115 and locking nut M114 from trimmer condenser C5. Unsolder wiring lead connecting trimmer to terminal on contact plate.

Assemble the replacement stator plate (M118) by placing the ceramic button over the 5/8" hole in the chassis with the wiring lead extending into the chassis. Place the mounting bracket over the ceramic button and mount securely using #4x3/16 round head machine screws with #4-40x3/16 hex nuts and #4 shake proof lock washers. Mount trimmer condenser C5 in chassis and solder wire lead to its original terminal on the contact plate making this lead as short as possible. Dress wiring lead from ceramic stator plate to trimmer condenser C5 so it does not come in contact with the turret drum. After replacement of the stator plate, adjust trimmer condenser C5 (overall oscillator adjustment).

REMOVING CONTACT PLATE ASSEMBLY M123

a. Remove turret.
b. Remove the mounting screws at the front and rear of Contact Plate and Bracket Assembly M123.
c. Unsolder both ends of contact plate assembly. Press outward the front and rear tuner chassis end plates.
d. To free contact plate assembly, release the contact plate tabs by pushing them away from the slots in the end plates.
e. Unsolder all connections to contact plate. Unsolder the solder joint holding contact plate to the center partition of the tuner chassis.
f. Reassemble in the same manner.

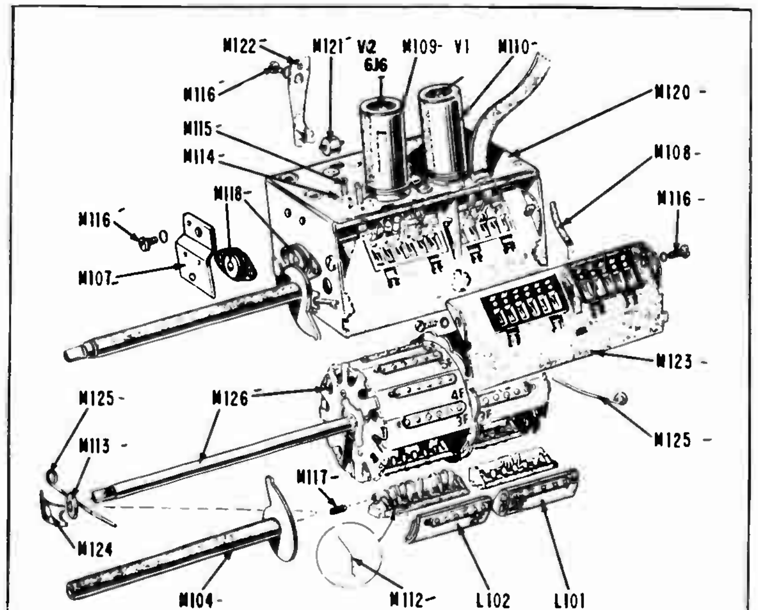


Figure 10. Exploded View, TV Tuner.

INTERMITTENT PICTURE AND SOUND

This trouble is most commonly due to an intermittent tube, loose tube socket contacts, dirty or loose coil contacts, loose or cold (rosin) soldered joints, or loose or vibrating parts in the underside of the tuner chassis.

When replacing tubes, see tube note under "General"

Loose tube socket contacts may sometimes be tightened by compressing contacts with an ice pick or a large needle. Defective tube socket contacts can sometimes be replaced individually.

For cleaning and adjusting coil contacts, see "Cleaning Contacts" and "Adjusting Contact Springs".

Loose or intermittent connections can be found by tapping components or rotating the channel selector and watching the pattern on an oscilloscope. A visual inspection or a continuity check will also be helpful.

Apply a hot soldering iron to soldered joints which appear doubtful. Caution: Do not change lead lengths or move components other than to slightly separate parts or leads which have caused trouble by contact with the chassis or other parts. See discussion under "General".

SOUND BARS IN PICTURE (DUE TO MICROPHONICS)

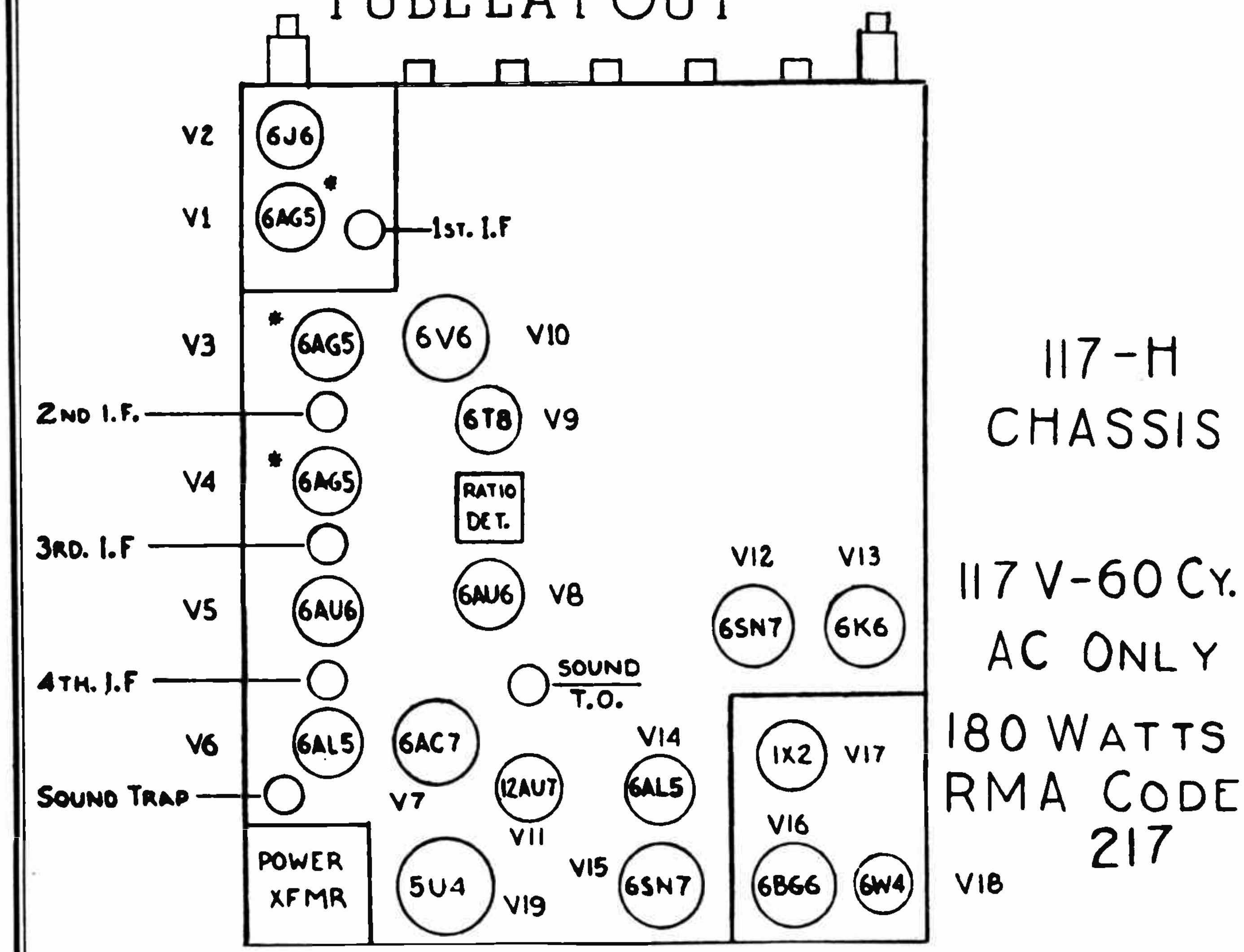
Microphonics in the TV Tuner will generally produce sound bars in the picture or a ringing sound as the volume is turned up or as the cabinet is tapped lightly.

Check for microphonic oscillator mixer tube, V2 (6J6). It is recommended that several tubes be tried, in order to select a tube which will be least microphonic and at the same time, causes a minimum of oscillator frequency shift, as noted with rotation of Tuning control. In some cases, replacement of the oscillator mixer tube, may necessitate readjustment of trimmer condenser A1 (C5) (overall oscillator adjustment).

Microphonics can also be due to vibration of loose wires or loose components. In some instances, the ceramic stator plate M118 (tuning stator) has been a source of microphonics since the rivets which fasten this part to the tuner chassis may be loose. This can be remedied by soldering the plate mounting bracket to the tuner chassis. To solder the plate mounting bracket to the tuner chassis, remove the grounded Tuning stator plate M107, and move the tuner shaft M104 forward.

Also, check for any mechanical "rub" such as loose screws which hold the tuner sub-chassis to the main chassis, loose solder connection from tube shield base to chassis, or extremely dry tuner shaft.

TUBELAYOUT



* Alternate Tubes: 6BC5-6CB6

CAPACITORS

Ref. No.	Part No.	Description	Price
C1	CCC05050D	Ceramic tubular 5uuf ± .5uuf NPO Temp. Coeff.	.24
C2	CVC030ST	Ceramic trimmer 0.5-3 uuf CRL	.30
C3	CVC030ST	Ceramic trimmer 0.5-3 uuf CRL	.30
C4	CVC030ST	Ceramic trimmer 0.5-3 uuf CRL	.30
C5	CVC030ST	Ceramic trimmer 0.5-3 uuf CRL	.30
C6	CCU05121K	Ceramic tubular 120 uuf ±10% N750 Temp. Coeff.	.24
C7	CCU05101K	Ceramic tubular 100 uuf ±10% N750 Temp. Coeff.	.24
C8	CCC05200K	Ceramic tubular 20 uuf ± 10% NPO Temp. Coeff.	.24
C9	CCU05100K	Ceramic tubular 10 uuf ± 10% N750 Temp. Coeff.	.24
C10	CCC05100K	Ceramic tubular 10 uuf ± 10% NPO Temp. Coeff.	.24
C11	CDZ05102Y	Ceramic disc 1000 uuf GMV †	.20
C12	———	Fine tuning consists of tuner parts	—
C13	CCU05121K	Ceramic tubular 120 uuf ± 10% N750 Temp. Coeff.	.24
C14	CDZ05502Y	Ceramic disc, 5000 uuf GMV	.15
C15	CDZ05502Y	Ceramic disc, 5000 uuf GMV	.15
C16	CCU05101K	Ceramic tubular, 100 uuf ± 10% N750 Temp. Coeff.	.24
C17	CDZ05502Y	Ceramic disc, 5000 uuf GMV	.15
C18	CDZ05502Y	Ceramic disc, 5000 uuf GMV	.15
C19	CDZ05502Y	Ceramic disc, 5000 uuf GMV	.15
C20	CDZ05502Y	Ceramic disc, 5000 uuf GMV	.15
C21	CDZ05502Y	Ceramic disc, 5000 uuf GMV	.15
C22	CMB05241K	Molded mica, 240 uuf ± 10% 500 V	.20
C23	CCU05101K	Ceramic tubular, 100 uuf ± 10% N750 Temp. Coeff.	.24
C24	CPZ02254M	Molded paper .25 Mfd 200 V	.30
C25	CDZ05103Y	Ceramic disc, 10,000 uuf GMV	.16
C26	CCG05050M	Ceramic tubular 5 uuf ± 1 uuf GP	.20
C27	CPZ02503M	Molded paper .05 Mfd 200 V	.20
C28	CCG05022D	Ceramic tubular 2.2 uuf ± .5uuf GP	.20
C29	CDZ05103Y	Ceramic disc, 10,000 uuf GMV	.16
C30	CPZ04104M	Molded paper .1 Mfd 400 V	.20
C31	CPZ04104M	Molded paper, .1 Mfd 400 V	.20
C32	CCU05470K	Ceromic tubular, 47 uuf ± 10% N750 Temp. Coeff.	.20
C33	CCG05390M	Ceromic tubular, 39 uuf ± 20% GP	.20
C34	CDZ05103Y	Ceramic disc, 10,000 uuf GMV	.16
C35	CDZ05103Y	Ceramic disc, 10,000 uuf GMV	.16
C36	CSC05100K	Silver mica, 10 uuf ± 10% 500V	
C37	CSC05101K	Silver mica, 100uuf ± 10% 500V	
C38	CMA05331M	Molded mica, 330 uuf ± 20% 500 V	.21
C39	CMA05152M	Molded mica, 1500 uuf ± 20% 500 V	.20
C40	CES0405	Tubular electrolytic 4 Mfd 50V	.66
C41	CDZ05103Y	Ceramic disc, 10,000 uuf GMV	.16
C42	CWZ06502M	Paper, .005 Mfd 600 V	.20
C43	CMA05102K	Molded mica, 1000 uuf ± 10%	.20
C44	CMA05102K	Molded mica, 1000 uuf ± 10%	.20
C45	CPZ06103M	Molded paper, .01 Mfd 600 V	.16
C46	CPZ06503M	Molded paper, .05 Mfd 600 V	.21

CAPACITORS

Ref. No.	Part No.	Description	Price
C47	CPZ06104M	Molded paper, .1 Mfd 600 V	.33
C48	CET21C45	Tubular electrolytic, 150 Mfd 50 V ‡	1.95
C49	CPZ06503M	Molded paper, .05 Mfd 600V	.21
C50	CPZ04103M	Molded paper, .01 Mfd 400 V	.21
C51	CDZ05502Y	Ceramic disc, 5000 uuf GMV	.15
C52	CPZ04103M	Paper tubular, .01 Mfd 400 V	.21
C53	CMB05392K	Molded mica, 3900 uuf ± 10% 500 V	.21
C54	CMA05331K	Molded mica, 330 uuf ± 10% 500 V	.21
C55	CMA05391K	Molded mica, 390 uuf ± 10% 500 V	.21
C56	CPZ06103M	Molded paper, .01 Mfd 600 V	.16
C57	CVM501ST	Compression trimmer, 50 uuf ± 500 uuf	.51
C58	CPZ06503M	Molded paper, .05 Mfd 600 V	.21
C59	CPZ06254M	Molded paper, .25 Mfd 600 V	.33
C60	CPZ02254M	Molded paper, .25 Mfd 200 V	.30
C61	CDZ20K501	Ceramic, 500 uuf GMV 20KV CRL	1.30
C62	CMA10560K	Molded mica, 56 uuf ± 10% 1000 V	.21
C63	CCZ05102Y	Ceramic tubular, 1000 uuf GMV	.15
C64	CDZ05102Y	Ceramic disc, 1000 uuf GMV	.15
C65	CDZ05502Y	Ceramic disc, 5000 uuf GMV	.15
C66	CDZ05502Y	Ceramic disc, 5000 uuf GMV	.15
C67	CDZ05502Y	Ceramic disc, 5000 uuf GMV	.15
C68	CED4445	Tubular electrolytic, 40 Mfd 450 V *	
C69	CES8045	Tubular electrolytic, 80 Mfd 450 V	1.71
C70	CED4445	Tubulor electrolytic, 40 Mfd 450 V *	1.95
C71	CET21C45	Tubular electrolytic, 20 Mfd 450 V ‡	
C72	CET21C45	Tubular electrolytic, 10 Mfd 600 V ‡	.21
C73	CPZ06503M	Molded paper .05 Mfd 600 V	.21

NOTES:

*C68 and C70 in same unit ‡C48, C71 and C72 in same unit

† C11 and C64 may be part of a dual ceramic disc capacitor

RESISTORS

Ref. No.	Part No.	Description	Price
R1	RCC392K	Carbon composition insuloted, 3900 ohms ± 10% 1/2 watt	.21
R2	RCC103K	Carbon composition insulated, 10K ± 10% 1/2 watt	.21
R3	RCC472M	Carbon composition insulated, 4700 ohms ± 20% 1/2 watt	.21
R4	RCC224M	Carbon composition insulated, 220K ± 20% 1/2 watt	.21
R5	RCC153M	Carbon composition insulated, 15K ± 20% 1/2 watt	.21
R6	RCC473M	Carbon composition insulated, 47K ± 20% 1/2 watt	.21
R7	RCC222M	Carbon composition insuloted, 2200 ohms ± 20% 1/2 watt	.21
R8	RCC103K	Carbon composition insulated, 10K ± 10% 1/2 watt	.21

PARTS LIST

RESISTORS

Ref. No.	Part No.	Description	Price
R9	RCC472M	Carbon composition insulated, 4700 ohms ± 20% 1/2 watt	.21
R10	RCC103K	Carbon composition insulated, 10K ± 10% 1/2 watt	.21
R11	RCC560K	Carbon composition insulated, 56 ohms ± 10% 1/2 watt	.21
R12	RCC151M	Carbon composition insulated, 150 ohms ± 20% 1/2 watt	.21
R13	RCC101M	Carbon composition insulated, 100 ohms ± 20% 1/2 watt	.21
R14	RCC822K	Carbon composition insulated, 8200 ohms ± 10% 1/2 watt	.21
R15	RCC560K	Carbon composition insulated, 56 ohms ± 10% 1/2 watt	.21
R16	RCC151M	Carbon composition insulated, 150 ohms ± 20% 1/2 watt	.21
R17	RCC101M	Carbon composition insulated, 100 ohms ± 20% 1/2 watt	.21
R18	RCC223M	Carbon composition insulated, 22K ± 20% 1/2 watt	.21
R19	RCC820K	Carbon composition insulated, 82 ohms ± 10% 1/2 watt	.21
R20	RCC101M	Carbon composition insulated, 100 ohms ± 20% 1/2 watt	.21
R21	RCC225M	Carbon composition insulated, 2.2 M ± 20% 1/2 watt	.21
R22	RCC684M	Carbon composition insulated, 680K ± 20% 1/2 watt	.21
R23	RCC682K	Carbon composition insulated, 6800 ohms ± 10% 1/2 watt	.21
R24	RCC105M	Carbon composition insulated, 1.0 M ± 20% 1/2 watt	.21
R25	RCC820M	Carbon composition insulated, 82 ohms ± 20% 1/2 watt	.21
R26	RVM100S	Carbon composition variable, 1000 ohms reverse audio taper *	
R27	RCF823K	Carbon composition insulated, 82K ± 10% 1 watt	.33
R28		Carbon composition insulated, 18K ± 20% 1 watt †	
R29	RCG562K	Carbon composition insulated, 5600 ohms ± 10% 2 watts	.42
R30	RCC222M	Carbon composition insulated, 2200 ohms ± 20% 1/2 watt	.21
R31	RCC274M	Carbon composition insulated, 270K ± 20% 1/2 watt	.21
R32	RCC105M	Carbon composition insulated, 1.0 M ± 20% 1/2 watt	.21
R33	RCC473M	Carbon composition insulated, 47K ± 20% 1/2 watt	.21
R34	RVC100N	Carbon composition variable, 250K linear taper 1/2 watt	.60
R35	RCC224M	Carbon composition insulated, 220K ± 20% 1/2 watt	.21
R36	RCC474M	Carbon composition insulated, 470K ± 20% 1/2 watt	.21
R37	RCC820M	Carbon composition insulated, 82 ohms ± 20% 1/2 watt	.21
R38	RWT402K	Wire wound 1000 ohms ± 10% 10 watts	1.20
R39	RCF823M	Carbon composition insulated, 82K ± 20% 1 watt	.33
R40	RCC473M	Carbon composition insulated, 47K ± 20% 1/2 watt	.21
R41	RCC682K	Carbon composition insulated, 6800 ohms ± 10% 1/2 watt	.21
R42	RCC682K	Carbon composition insulated, 6800 ohms ± 10% 1/2 watt	.21
R43	RVM100S	Carbon composition variable, 1.0 M audio taper *	1.65
R44	RCC106M	Carbon composition insulated, 10 M ± 20% 1/2 watt	.21
R45	RCF391M	Carbon composition insulated, 390 ohms ± 20% 1 watt	.33
R46	RWT402K	Wire wound 3000 ohms ± 10% 10 watts	1.20
R47	RCC103K	Carbon composition insulated, 10K ± 10% 1/2 watt	.21
R48	RCC472K	Carbon composition insulated, 4700 ohms ± 10% 1/2 watt	.21
R49	RCC222K	Carbon composition insulated, 2200 ohms ± 10% 1/2 watt	.21
R50	RCF223K	Carbon composition insulated, 22K ± 10% 1 watt	.33
R51	RCC152M	Carbon composition insulated, 1500 ohms ± 20% 1/2 watt	.21
R52	RCF104M	Carbon composition insulated, 100K ± 20% 1 watt	.33
R53	RCC154M	Carbon composition insulated, 150K ± 20% 1/2 watt	.21
R54	RVC101N	Carbon composition variable, 1.0 M linear taper 1/2 watt	.60
R55	RCC684M	Carbon composition insulated, 680K ± 20% 1/2 watt	.21
R56	RVC102N	Carbon composition variable, 3.0 M linear taper 1/2 watt	.60
R57	RCC103M	Carbon composition insulated, 10K ohms ± 20% 1/2 watt ‡	.21
R58	RCC225M	Carbon composition insulated, 2.2 M ± 20% 1/2 watt	.21
R59	RCC152M	Carbon composition insulated, 1500 ohms ± 20% 1/2 watt	.21
R60	RVC103N	Carbon composition variable, 5000 ohms linear taper 2 watts	.93
R61	RCC561K	Carbon composition insulated, 560 ohms ± 10% 1/2 watt	.21
R62	RCC561K	Carbon composition insulated, 560 ohms ± 10% 1/2 watt	.21
R63	RCF472K	Carbon composition insulated, 4700 ohms ± 10% 1 watt	.21
R64	RCC273K	Carbon composition insulated, 27K ± 10% 1/2 watt	.21
R65	RCC104K	Carbon composition insulated, 100K ± 10% 1/2 watt	.21
R66	RCC104K	Carbon composition insulated, 100K ± 10% 1/2 watt	.21
R67	RCC475M	Carbon composition insulated, 4.7 M ± 20% 1/2 watt	.21
R68	RCC474M	Carbon composition insulated, 470K ± 20% 1/2 watt	.21
R69	RCC152K	Carbon composition insulated, 1500 ohms ± 10% 1/2 watt	.21
R70	RCC392K	Carbon composition insulated, 3900 ohms ± 10% 1/2 watt	.21
R71	RCC104K	Carbon composition insulated, 100K ± 10% 1/2 watt	.21
R72	RCC274K	Carbon composition insulated, 270K ± 10% 1/2 watt	.21
R73	RCC472M	Carbon composition insulated, 4700 ohms ± 20% 1/2 watt	.21
R74	RCC474M	Carbon composition insulated, 470K ± 20% 1/2 watt	.21
R75	RCC470M	Carbon composition insulated, 47 ohms ± 20% 1/2 watt	.21
R76	RCG103M	Carbon composition insulated, 10K ± 20% 2 watts	.42
R77	RCC033K	Carbon composition insulated, 3.3 ohms ± 10% 1/2 watt	.21
R78	RCF474M	Carbon composition insulated, 470K ± 20% 1 watt	.33

NOTES:

‡R57 May vary depending upon vertical output.

* R26 and R43 are part of same unit which also includes switch S1

† used as winding form for L14

K = 1000 ohms M = 1,000,000 ohms

PRINTED CIRCUITS

Ref. No.	Part No.	Description	Price
PEC1	A-1376-6F	Audio Couplate CRL #YA401-002A	.75
PEC2	A-1375-6F	Vertical Integrator Network - CRL #YA402-002A	.60

COILS

Ref. No.	Part No.	Description	Price
L1		Mixer Plate Coil	.50
L2	A-1475-10	1st I.F. Coil	.45
L3	A-1476-10	2nd I.F. Coil	.62
L4	A-1476-10	3rd I.F. Coil	.62
L5	A-1480-10	21.25 M.C. Sound Trap	.39
L6	A-1477.10	4.5 M.C. Sound take-off Coil	.66
		Channel #2 Antenna Coil Ass.	1.02
		Channel #3 Antenna Coil Ass.	1.02
		Channel #4 Antenna Coil Ass.	1.02
		Channel #5 Antenna Coil Ass.	1.02
		Channel #6 Antenna Coil Ass.	1.02
L7		Channel #7 Antenna Coil Ass.	1.02
L8		Channel #8 Antenna Coil Ass.	1.02
		Channel #9 Antenna Coil Ass.	1.02
		Channel #10 Antenna Coil Ass.	1.02
		Channel #11 Antenna Coil Ass.	1.02
		Channel #12 Antenna Coil Ass.	1.02
		Channel #13 Antenna Coil Ass.	1.02
		Chan. # 2 Mixer-Osc.Coil Ass.	1.02
		Chan. # 3 Mixer-Osc.Coil Ass.	1.02
		Chan. # 4 Mixer-Osc.Coil Ass.	1.02
		Chan. # 5 Mixer-Osc.Coil Ass.	1.02
		Chan. # 6 Mixer-Osc.Coil Ass.	1.02
L9		Chan. # 7 Mixer-Osc.Coil Ass.	1.02
L10		Chan. # 8 Mixer-Osc.Coil Ass.	1.02
L11		Chan. # 9 Mixer-Osc.Coil Ass.	1.02
		Chan. #10 Mixer-Osc.Coil Ass.	1.02
		Chan. #11 Mixer-Osc.Coil Ass.	1.02
		Chan. #12 Mixer-Osc.Coil Ass.	1.02
		Chan. #13 Mixer-Osc.Coil Ass.	1.02
L12	A-1482-10	120UH Detector Peaking Coil	.36
L13	A-1485-10	600UH Detector Peaking Coil	.36
L14	A-1483-10	240UH Video Amp. Peaking Coil (includes R28)	.40
L15	A-1484-10	380UH Video Amp. Peaking Coil	.40
L16	A-1479-10	Horizontal Hold - A.F.C. Coil	.72
L17	A-1486-10	Width Control	1.32
L18	A-1651-10	Filter Choke, 2HY-220 MA.	3.03
L19	A-1481-10	Filament Choke (Video I.F.)	.12
L20	A-1481-10	Filament Choke (Video I.F.)	.12
L21	———	Filament Choke, Tuner	.15
L22	———	Filament Choke, Tuner	.15

TRANSFORMERS

Ref. No.	Part No.	Description	Price
T1	A-1478-10	4.5 MC Ratio Detector Transformer (includes C36 and C37)	2.31
T2	B-1653-13	Audio Output Transformer (6V6 to 3.2 V.C.)	1.49
T3	A-1652-13	Vertical Output Transformer	2.85
T4	B-1675-13A	Horizontal Output Transformer (El-Rad Type 8B12-4)	9.24
T5	B-1650-13	Power Transformer 350-0-350 @ 220 M.A.D.C., 5V @ 3A., 6.3V @ 1A, 6.3V @ 8A	16.17

FUSES

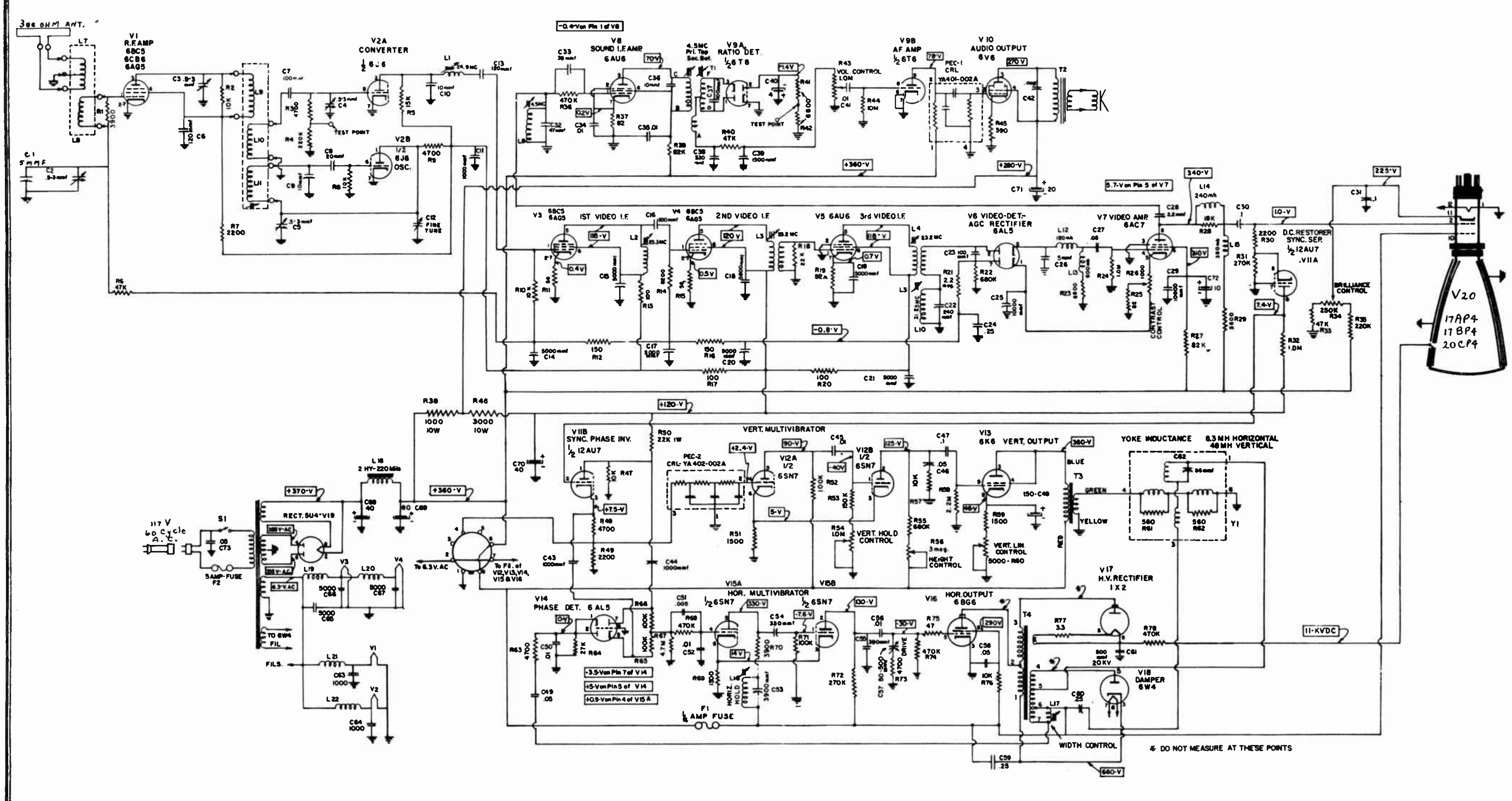
Ref. No.	Part No.	Description	Price
F1	A-3750-30	1/4 Amp 250 Volt Cartridge Fuse	.18
F2	A-3751-30	5 Amp 250 Volt 3AG Fuse.	.16

MISCELLANEOUS

Ref. No.	Part No.	Description	Price
Y1	B-1452-9	Deflection Yoke for 70 CRT (8.3 MH Hor. 48MH Vert.)	7.92
S1	———	Power Switch (included as part of Contrast volume control Part #RVM 100S)	
	B-4100-33	Tuner, Standard Coil	37.80
	A-4102-33	Ion Trap	.69
	B-4101-33	Focalizer	4.95
	A-1553-2	CRT Socket (with leads)	.60
	A-1008-1	Yoke Mounting Hood	.99
	A-1500-11	Line Cord	.60
	A-1501-11	Hi-Voltage CRT Lead with Connector	.48

CABINET PARTS

Description	Price	Description	Price
Mask - 14 Series	2.70	Bezel - 2000 Series	10.32
Mask - 17 Series	2.80	Nameplate 14, 17, 19, 20 Series	1.50
Mask - 19 Series	4.35		
Mask - 20 Series	4.35	Nameplate 1400, 1700, 2000 Ser.	3.00
Glass - 14, 17 Ser.	4.05		
Glass - 19 Series	12.80	Knob, Off, On Vol.	.20
Glass - 20 Series	12.80	Knob, Contrast	.15
Mask - 1400 Ser.	2.70	Knob, Fine Tube	.15
Mask - 1700 Ser.	2.75	Knob, Channel Selec.	.51
Mask - 2000 Ser.	4.35	Catches, Friction Nameplate	.15
Glass - 1400 Ser.	3.15		
Glass - 1700 Ser.	4.02	Bolts, Chassis Mtg. #10-32 x 1"	.10
Glass - 2000 Ser.	8.07		
Bezel - 1400 Ser.	4.92	Washers, Chassis Mounting	.05
Bezel - 1700 Ser.	5.18		

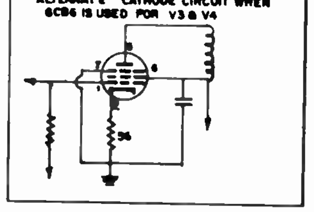


All resistors in ohms except K=1000 Ω and M=1,000,000 Ω

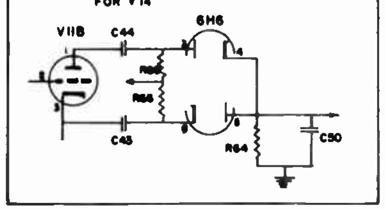
ALL CONDENSERS IN MFD. UNLESS OTHERWISE NOTED.

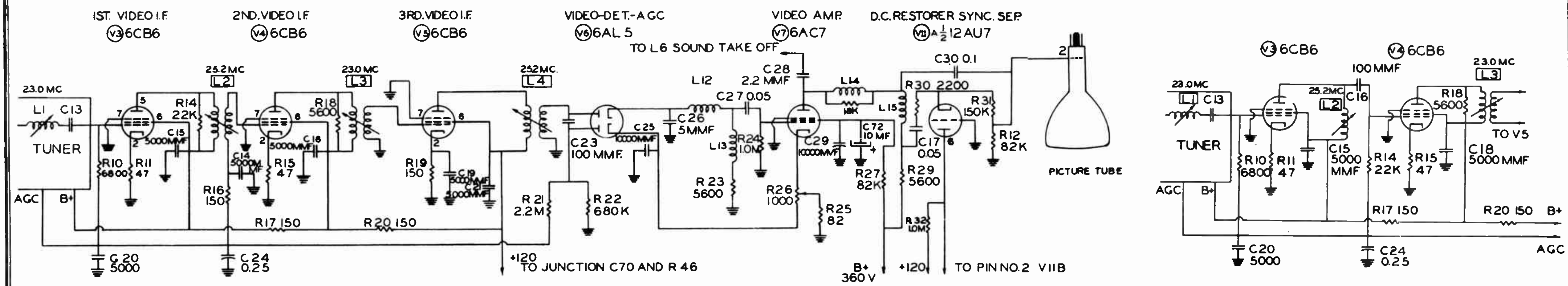
TEST CONDITIONS–
LINE 117V- 60 CYCLE A.C.
ANTENNA SHORTED– TUNE TO CHANNEL 13.
CONTRAST & BRIGHTNESS AT MINIMUM.
OTHER CONTROLS IN NORMAL OPERATING POSITION.
VOLTAGES TAKEN WITH VTVM FROM POINT INDICATED TO CHASSIS.
VOLTAGES MAY VARY ± 20 PER CENT.

ALTERNATE CATHODE CIRCUIT WHEN 6CB6 IS USED FOR V3 & V4



ALTERNATE CIRCUIT FOR V14



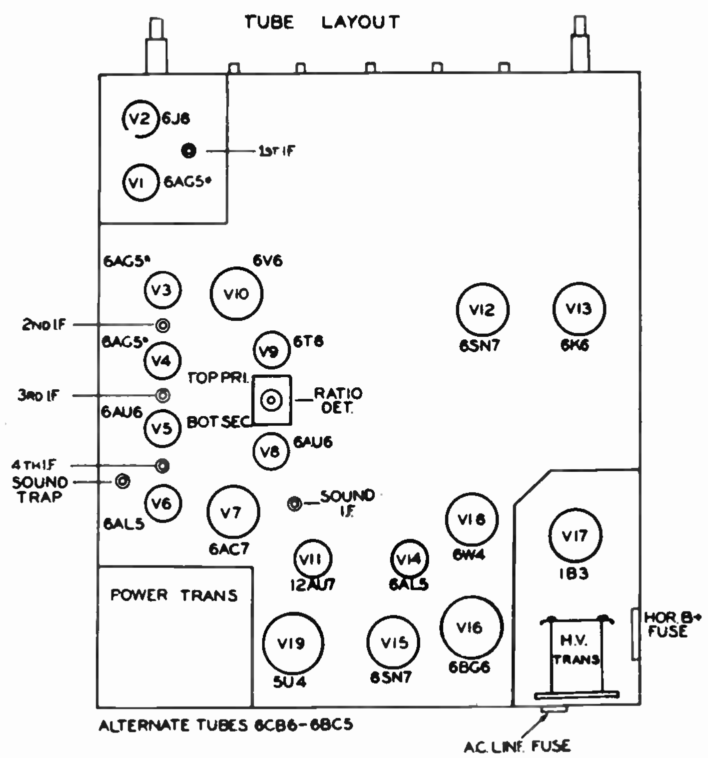


SCHEMATIC SUPPLEMENT

NOTE:
WHEN 6AG5 OR 6BC5 TUBES ARE USED FOR V3, V4, AND V5, PIN NO. 7 IS UNCONNECTED.

CHANGES IN MODEL 217 CHASSIS

The supplement to the schematic shows the changes in the video IF amplifier made. The changes in the sync separator and DC restorer were also incorporated into some chassis.
The changes in the IF amplifier were made to improve sensitivity and stability.
The changes in the DC restorer and sync separator improve the operation of the sync circuit and also improve the operation of the DC restorer so that the brightness control requires a minimum of adjustment when the contrast control is changes.
The following table should be substituted for the table labeled "IF AMPLIFIER ALIGNMENT".



ALTERNATE TUBES 6CB6-6BC5

117V-60~AC ONLY
180 WATTS
RMA CODE 217

IF AMPLIFIER ALIGNMENT

a. Disconnect antenna; connect jumper wire across terminals.

b. Set receiver to channel 13 or other unassigned high channel to prevent interference during IF alignment.

Set Picture control fully to right.

c. Allow about 15 minutes for receiver and test equipment to warm up.

STEP	SIGNAL GEN. FREQUENCY (MC)	VTVM AND SIGNAL GENERATOR CONNECTIONS	INSTRUCTIONS	ADJUST
1	25.2	VTVM high side to test point "T", low to chassis. R.F. gen. high side to floating tube shield on 6J6. Low to chassis.	Use VTVM 3 volt DC scale. Adjust signal generator to maintain approximately 1 volt output.	L4 & L2 for Max.
2	23.0			L1 & L3 for Max.
3	To insure correct I.F. alignment, make the "I.F. Response Curve Check" given below			

When ordering replacements, be sure to give complete description of part, chassis number, model number, and any other pertinent information in addition to part number if available.

SPECIFICATIONS

Direct View Electromagnetic Picture Tube
14" Rectangular — 21" Rectangular
17" Rectangular — 24" Round
20" Rectangular

Operating Voltage
110-120 60 Cycles

Wattage
175 Watts

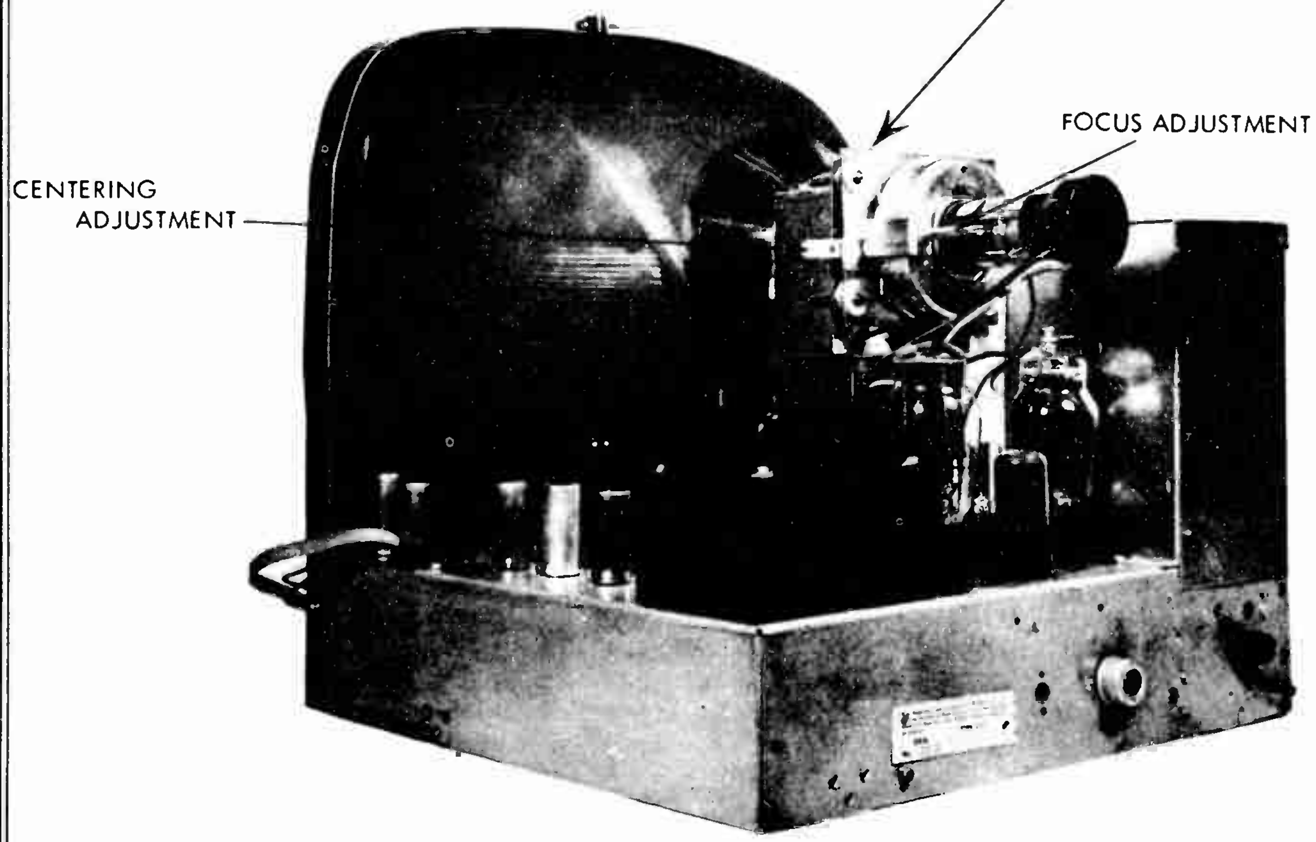
Input Impedance and Transmission Line
300 ohm balanced (between antenna terminals)
75 ohm coaxial cable may be used by connecting shield to chassis and inner conductor to either antenna terminal

Intermediate Frequencies
Video - 25.75 Mc.
Sound - 21.25 Mc.
Intercarrier Sound - 4.5 Mc.

Fuse Location
Horizontal output fuse, F_1, is located inside the high voltage enclosure.
The line fuse, F_2, is located in a fuse holder on the rear apron of the chassis.

Tube Complement

V1	6CB6	R.F. Amp.
V2	6J6	Mixer and Osc.
V3	6CB6	1st I.F. Amp.
V4	6CB6	2nd I.F. Amp.
V5	6CB6	3rd I.F. Amp.
V6	6AL5	Video detector
V7	6AC7	Video Amp.
V8	6AU6	Sound I.F.
V9	6T8	Ratio Det. & Audio Amp.
V10	6V6GT	Audio Output
V11	12AU7	Sync. Separator
V12	6BL7GT	Vert. Osc. and Output
V13	6AU6	AGC Key tube
V14	6AL5	Hor. Phase detector
V15	6SN7GT	Horizontal oscillator
V16	6BG6G	Horizontal output
V17	1B3GT	Pulse rectifier
V18	6W4GT	Damping Diode
V19	5U4G	B plus rectifier
V20	17BP4	- 17" CRT
	20DP4	- 20" CRT
	21EP4	- 21" CRT
	24AP4	- 24" CRT



INSTALLATION AND SERVICE ADJUSTMENTS

When installing, each set should be checked for picture centering, picture tilt, shaded corners, proper size, linearity, etc., to insure best performance. It is especially important that the Ion Trap be checked, and that the Channel Slugs be adjusted upon installation or servicing of every set to insure ease of tuning. Any adjustments required should be made as described here.

For best results, all checks or adjustments should be made using a transmitted television test pattern. A mirror placed in front of the picture tube screen will be of help in observing the picture while adjusting rear chassis controls.

HIGH VOLTAGE WARNING

Operation of this receiver outside of its cabinet involves a shock hazard from the power supplies. No work should be attempted on this receiver by anyone who is not thoroughly familiar with the precautions necessary when working on the high voltage equipment.

EXTERNAL ANTENNA

When an external indoor or an outdoor antenna is required, be sure to disconnect the built-in antenna leads from the antenna terminal board, tape them and place them away from the chassis.

OPERATING THE TELEVISION RECEIVER

The controls of this receiver are operated conventionally. When tuning, carefully adjust the TUNING control for the best picture.

INDIVIDUAL CHANNEL SLUG ADJUSTMENT "A3" USING TELEVISION SIGNAL

Individual channel oscillator adjustment of every receiver should be checked upon installation or servicing. If this adjustment is properly made, it is possible to tune from one station to another by merely turning the CHANNEL control. With correct oscillator channel adjustment, best picture will be located at the approximate center of the range of the Tuning control.

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.
b. Set the CHANNEL knob for a station in operation. Set all other controls for a normal picture.
c. Set TUNING control at center of its range by rotating it approximately half-way.
d. Remove the CHANNEL and TUNING knobs.
e. Insert a 1/8" blade, NON-METALLIC screwdriver in the 1/4" hole adjacent to the channel tuning shaft. For each channel in operation, carefully adjust the channel slug for the best picture with clear detail. Be sure that the Tuning control is set at the center of its range before adjusting each channel slug. Only slight rotation of the slug will be required; turning the slug in too far will cause it to fall into the coil. (If the slug falls into the coil, remove the coil, move the retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace slug and re-set retaining spring;)

If a number of slugs are found to tune all the way in or all the way out, or if the 6J6 oscillator-mixer tube has been replaced, it may be necessary to make the "Overall Oscillator Adjustment" as discussed below.

OVER-ALL OSCILLATOR ADJUSTMENT "A1" USING TELEVISION SIGNAL

Over-all oscillator adjustment should only be necessary when replacing the oscillator-mixer tube (6J6), or when all channel slugs are off in the same direction. When replacing the oscillator-mixer tube (6J6), it is recommended that several tubes be tried to select one which will cause least oscillator frequency shift.

A1 is generally adjusted so that approximately 3/16" of screw thread is exposed.

Adjust as follows:

a. Follow steps "a", "b", and "c" above.
b. Carefully adjust trimmer C6 (figure 8) for best picture with clear detail.
c. Check and, if necessary, make individual channel adjustments as indicated above.

ION TRAP ADJUSTMENT

To properly adjust the Ion Trap, Focusing Device and the Deflection Yoke the following procedure should be followed.

The Deflection Yoke should be placed in position closest to the "bell" of the Cathode Ray Tube as far forward on the neck of the tube as is possible. The Focus Device is next in line and Ion Trap last. See Figure 1.

The antenna should be connected to the receiver, the set should be turned on, the brilliance control turned to MAXIMUM and the contrast control at MAXIMUM.

The Ion Trap should be moved forward and backward and at the same time rotated to achieve the brightest raster on the face of the CRT.

Reduce the brilliance control to a point slightly over normal brightness and adjust the Focus Control on the rear of the Focus Device with a non-magnetic screwdriver for clearest and sharpest horizontal sweep lines. The Ion Trap should then be readjusted slightly for the brightest response on the face of the tube.

The Focus Device aperture should be moved to secure a complete raster centered and with no corners cut off.

Finally the Deflection Yoke should be rotated to "square" the raster with the chassis as a reference. The screws on the yoke brackets should then be set.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a pattern transmitted from a local station be used. Linearity adjustments, particularly, cannot be accurately made on moving transmissions. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area delineated by the mask.

The first step in linearity and size adjustment is to turn the Width Control (rear of chassis) all the way in. (clockwise)

The Horizontal Drive trimmer should then be adjusted for the best compromise between maximum brightness and good horizontal linearity. Misadjustment of the Horizontal drive condenser will show as bright vertical bars on the left hand side of the picture. The Width Control should then be backed out until the picture is the correct width.

Vertical Linearity and height adjustment are made in the conventional manner. It will be noted that there is some interaction between these controls.

HORIZONTAL OSCILLATOR ADJUSTMENT

The set should hold horizontal sync over approximately one turn of the horizontal hold control. This will vary with signal strength of the received station. The control will bind at the extreme ends of its rotation. Do not attempt to force it to turn after binding is encountered or serious damage will result. If the set does not hold at a point in the center of the control range it indicates trouble in the horizontal oscillator or sync phase detector.

PICTURE TUBE REPLACEMENT

Important: After replacing any picture tube, be sure to make all deflection adjustments -- Picture Centering, Deflection Yoke, and Ion Trap -- as given on page 3. Especially note comments on picture centering.

WARNING: Because of the high 2nd anode voltage used (approximately 12KV) and the possibility of danger of implosion due to high vacuum, the following precautions should be noted when removing or replacing picture tubes:

a. Before handling a picture tube, remove the 2nd anode static charge from both the picture tube and the 2nd anode connector by shorting them to chassis.
b. Shatterproof goggles and heavy gloves should be worn while handling or installing a picture tube.
c. Always handle the picture tube very carefully. DO NOT pick the tube up by the neck.

VOLTAGE CHART

TUBE		1	2	3	4	5	6	7	8	9
V1	6CB6	0ϕ	0ϕ	0ϕ	6.3ACϕ	105ϕ	105ϕ	0ϕ	-	-
V2	6J6	105ϕ	105ϕ	0ϕ	6.3ACϕ	0ϕ	0ϕ	0ϕ	-	-
V3	6CB6	-0.4	0.5	6.3AC	0	90	90	0	-	-
V4	6CB6	-0.4	0.5	6.3AC	0	95	95	0	-	-
V5	6CB6	0	1.4	6.3AC	0	100	100	0	-	-
V6	6AL5	0	0	6.3AC	0	0	0	-0.5	-	-
V7	6AC7	0	6.3AC	0	-0.5	1.4	100	0	225	-
V8	6AU6	-0.3	0	6.3AC	0	100	100	0.6	-	-
V9	6T8	-0.4	-0.8	-0.4	0	6.3AC	0	0	-0.8	75
V10	6V6	NC	0	225	250	0	NC	6.3AC	10	-
V11	12AU7	60	10	10	6.3AC	6.3AC	10	-0.7	0	0
V12	6BL7	-0.9	320	19	-30	75	0	0	6.3AC	-
V13	6AU6	235	250	250	6.3AC*	†	350	250	-	-
V14	6AL5	0	0	6.3AC	0	6	0	-4	-	-
V15	6SN7	-7	120	13	1.3	320	13	6.3AC	0	-
V16	6BG6	-25	0	0	NC	-25	NC	6.3AC	270	-
V17	1B3	†	†	†	†	†	†	†	†	-
V18	6W4	NC	NC	550	NC	†	†	250	6.3AC‡	-
V19	5U4	NC	5AC △	NC	355AC	NC	355AC	NC	360	-

TEST CONDITIONS:

LINE 117V. - 60 CYCLE A.C.
ANTENNA SHORTED-TUNE TO CHANNEL 13
CONTRAST, BRIGHTNESS, & VOLUME AT MINIMUM.
OTHER CONTROLS IN NORMAL OPERATING POSITION.
VOLTAGES TAKEN WITH VTVM FROM POINT INDICATED TO CHASSIS EXCEPT WHERE NOTED.

NOTES:

ϕ TUBE REMOVED FROM SOCKET
† DO NOT MEASURE
* MEASURE BETWEEN PINS NO.3 & NO.4
‡ MEASURED BETWEEN PINS NO.7 & NO.8
△ MEASURED BETWEEN PINS NO.2 & NO.8

TELEVISION ALIGNMENT PROCEDURE

GENERAL

Complete alignment consists of the following individual procedures. Complete alignment should be performed in this sequence.

a. IF Amplifier Alignment.
b. 4.5 MC Sound IF Alignment.
c. RF and Mixer Alignment.
d. Overall RF and IF Response Curve Check and High Frequency Oscillator Alignment.

TEST EQUIPMENT

To properly service this receiver, it is recommended that the following test equipment be available. Note: Equipment below may be available as a single unit, except for the vacuum tube voltmeter.

SWEEP GENERATOR

Sweep generator must provide sweep frequencies from
18 to 30 MC range: 10 MC sweep width.
50 to 90 MC range: 10 MC sweep width.
170 to 225 MC range: 10 MC sweep width.
Output: adjustable; at least one-tenth volt maximum.
Output impedance: 300 ohms balanced to ground.
Sweep generator should preferably have a built-in marker generator with calibration crystal for checking dial accuracy.

SIGNAL GENERATOR with crystal calibrator which can also be used as a marker generator.
4.5 MC frequency.
18 to 30 MC frequency range.
50 to 90 MC frequency range.
170 to 225 MC frequency range.
Must have a built-in calibration crystal for checking dial accuracy.

OSCILLOSCOPE

Standard oscilloscope, preferably one with a wide band vertical deflection, vertical sensitivity at least .5 volt peak-to-peak per inch.

VACUUM-TUBE VOLTMETER

Standard Vacuum-tube Voltmeter with high resistance input and low voltage DC Range (3 volts or less). In addition, a zero center low voltage range will be found useful.

ALIGNMENT TOOLS

An alignment tool kit consisting of one metallic and one non-metallic screwdriver is necessary.

SWEEP GENERATOR NOTE

A sweep generator which does not have constant output voltage and reasonably linear sweep frequency distribution, will produce curves which are widely different from the "IF" Response Curve" or Overall RF and IF Response Curve" Shown in the following pages. If repeated difficulty is encountered in obtaining these curves, the sweep generator should be checked. A simple check is to observe the response curve for a set that is known to be in alignment.

Before suspecting the generator, be sure the alignment instructions in this manual have been followed carefully.

IF AMPLIFIER ALIGNMENT

a. Disconnect antenna; connect jumper wire across terminals.
b. Set receiver to channel 13 or other unassigned high channel to prevent interference during IF alignment. Set Picture control fully to right.
c. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Signal Gen. Frequency (MC)	VTVM and Signal Generator Connections	Instructions	Adjust
1	25.2	VTVM high side to test point "T", low to chassis. R.F. gen. high side to floating tube shield on 6J6. Low to chassis.	Use VTVM 3 volt DC scale. Adjust signal generator to maintain approximately 1 volt output.	L4 & L2 for Max.
2	23.0			L1 & L3 for Max.
3	To insure correct I.F. alignment, make the "I.F. Response Curve Check" given below.			

IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope with sweep input to RF Mixer V2).

Differences in tube gain and component values affect IF response. These differences are not apparent in alignment of IFs when using a signal generator and VTVM (single frequency alignment); hence it is preferable that an IF response curve check be made after completion of the IF amplifier alignment.

The IF response curve check can be made as indicated directly below. However, also note that a better check can be made by feeding the sweep signal through the entire RF and IF system as given under "Overall RF and IF Response Curve Check (Step 1)". The overall check should be made after making all other alignments.

a. Make all control settings and connections as given in "a" through "c" the IF amplifier alignment chart above.
b. Connect oscilloscope* between point "T" and chassis ground, see fig. 4. Keep leads away from receiver.
c. Connect sweep generator high side to tube shield of 6J6 (V2) osc-mixer tube. Be sure to insulate tube shield from chassis. Connect sweet generator low side to chassis close to 6J6 tube base. Set sweep generator to sweep the IF band pass (19 to 29 MC).
d. If sweep generator does not have a built-in marker generator, loosely couple marker generator high side to the sweep generator lead connected to tube shield on tuner; low side to chassis ground.

To avoid distortion of the response curve, keep the sweep generator and marker generator outputs at a very minimum.

Marker pips should be just kept barely visible. To minimize distortion, set sweep generator output for VTVM reading of approximately .6 volt DC, measured between test point "T" and chassis. Connecting a 1-1/2 volt battery (negative to AGC Line, positive to chassis) will allow greater signal input without distorting the response curve.

e. Check curve obtained against the ideal IF response curve shown in figure 3. Since it is not always possible to get ideal curves, it should be noted that the height of opposite peaks should be within 30% of each other. The dip or valley in the center of the curve should not be greater than 30% down from the highest peak of the curve. Check video and sound IF carrier points by means of marker generator. It is important that marker pips be in the proper location on the response curve. The 25.75 MC marker, should be 50% below the highest peak on the high frequency side of the curve. The 22 MC marker should be at the opposite side of the response curve, located approximately 85% below the highest peak. The 21.25 MC marker should be located at least 95% below the highest peak, and may or may not be visible.

Consistent with proper band width and correct location of markers, the response curve should preferably have maximum amplitude; symmetry, and flat top appearance.

If the procedure given has been carefully followed and the response curve obtained differs greatly from the curve shown, repeat the IF Amplifier Alignment, making sure generator frequencies are precise and adjustments are accurately made.

***OSCILLOSCOPE NOTE**

*** In dealing with RF and IF response curves, it is well to remember that an inverted or mirror image may result, depending on the sweep generator and oscilloscope used. The general waveform should still be identical.**
When using a wide band oscilloscope for alignment, marker pips will be more distinct if condenser from 100 to 1,000 mmfd. is connected across the oscilloscope input. Caution: Use the smallest condenser possible, since too high a capacity will affect the shape of the response curve.

ALIGNMENT HINT

After becoming familiar with alignment procedure, some servicemen simplify subsequent alignment of sets by merely using the essential alignment data given in figures below.

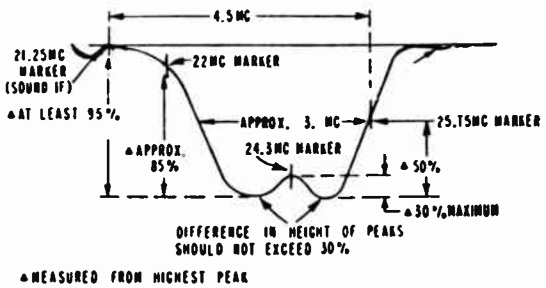


Figure 3 IF Response Curve.

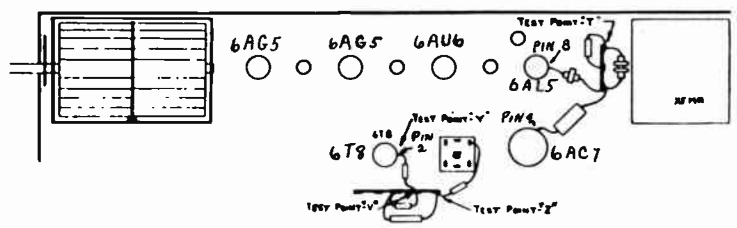


Figure 4 Bottom View Showing Test Point Connections.

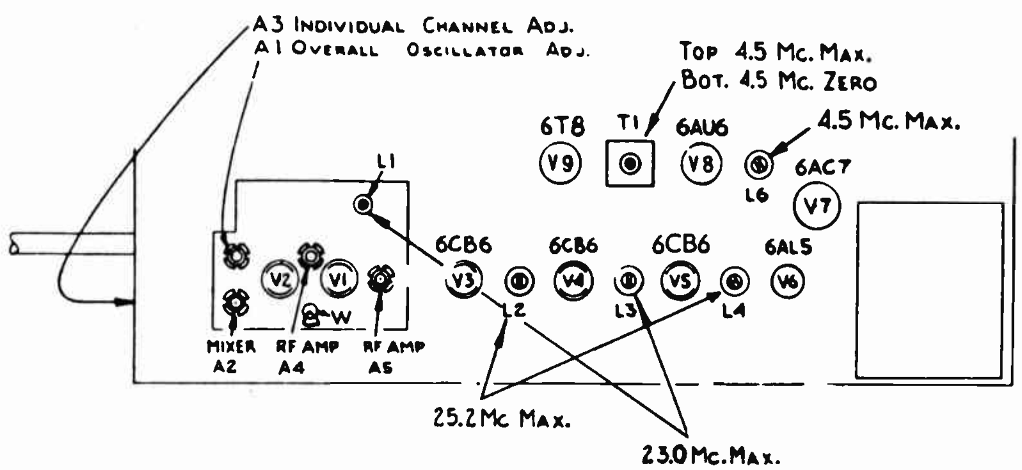


Figure 5 Top View of Chassis Showing Alignment Data.

4.5 MC SOUND IF ALIGNMENT

a. Disconnect antenna. Connect jumper wire across terminals.
b. Connect signal generator high side to Pin 4 V7, connect low side to chassis.
c. Allow about 15 minutes for receiver and test equipment to warm up.
d. Set Picture control fully to the right (clockwise).

Step	Signal Gen. Freq. (MC)	VTVM Connections	Instructions	Adjust
1	Since the transmitted video and sound carriers have an accurate 4.5 MC frequency difference, it is advisable to use a TV station signal instead of a signal generator for accurate alignment of steps below. When using a television signal, it may be necessary to use a higher scale on the VTVM. (30V) IMPORTANT: When using a signal generator, be sure to check it against a crystal calibrator or other frequency standard for accurate frequency calibration at 4.5 MC. Accuracy required is within one kilocycle.			
2	4.5 uumodulated or AM modulated. See step 1 for use of station signal.	High side to test point "Y"; common to chassis.	Use 3 volt DC scale on VTVM. Keep VTVM leads well separated from signal generator (if used) and chassis wiring.	L6 and top of T1 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt).
3		High side to test point "Z" common to test point "V"	Use 3 volt zero center scale on VTVM, if available. Keep VTVM leads well separated from signal generator (if used) and chassis wiring.	Bottom of T1 for zero on VTVM (the correct zero point is located between a positive and a negative maximum).

(See Page 11 for MC Chart, Fig. 6. RF Response Curve, Fig. 7. Front view of T V Tuner and Fig. 8. Top of TV Tuner, Showing Adjustment Location) Fig. 4 For Test Point Location.

RF AND MIXER ALIGNMENT

a. If used earlier, disconnect 1-1/2 volt battery.
b. Disconnect antenna from receiver.
c. Connect sweep generator to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.
d. Connect oscilloscope through a 10,000 ohm resistor to test point "W" on tuner (Fig. 8). Keep scope leads away from chassis.
e. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	205.25 (Video Carrier) 209.75 (Sound Carrier)	Sweeping Channel 12	Check for curve resembling RF Response Curve shown below. If necessary, adjust A8, A9 and A10 (figure 9) as required. Note that adjusting A9 will shift the center of the response curve in relation to the video and sound carrier markers. A8 and A10 should be alternately adjusted for best gain with flat top appearance. Consistent with proper band width and correct marker location, response curve should have maximum amplitude and flat top appearance.
2	See frequency table below. Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve resembling RF Response Curve shown below. In general, the adjustment performed in step 1 is sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for the weak channel as a compromise adjustment to favor this particular channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.

OVERALL RF and IF RESPONSE CURVE CHECK (Step 1) and HF OSCILLATOR ALIGNMENT (Step 2)

(Using sweep generator and oscilloscope.)

IMPORTANT

Since HF Oscillator alignment requires absolute frequency accuracy, a station signal is generally best suited for alignment of the individual channel oscillator slugs A3. The procedure for using a station signal (and without removal of chassis) is given in "Individual Channel Slug Adjustment Using Television Signal" on page 11.

The procedure for HF Oscillator alignment with an oscilloscope and a sweep generator is given below.

a. Disconnect antenna.
b. Disconnect signal generator and VTVM (if used earlier).
c. Set the Tuning control at half rotation by rotating it approximately 150° as shown in Figure 7.
d. Connect sweep generator to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible. Connecting a 1-1/2 volt battery (negative to AGC Line; positive to chassis) will allow greater signal input without distorting response curve.
e. Connect oscilloscope between point "T" and chassis ground (see Figure 4). Keep oscilloscope leads away from chassis.
f. Allow about 15 minutes for receiver and test equipment to warm up.
g. When adjusting A3, use a NON-METALLIC alignment screwdriver with a 1/8 inch blade.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	Sweep the RF band pass (channel 13 or other unassigned high channel) and check the shape of the overall response curve obtained against the ideal curve shown below. If shape of curve is not within limits shown, it will be necessary to repeat the IF Amplifier Alignment. The IFs must be accurately aligned before correct oscillator adjustment can be made.		
2	See frequency table Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency. Marker generator must have, or be used with, a calibrating source providing an accuracy of at least .05%.		Set the Tuning control at half rotation (see figure 7). Check to see whether oscillator alignment is required by comparing the location of the video and sound carrier markers (sound carrier marker may or may not be visible) on the response curve obtained for each channel with the "Overall RF and IF Response Curve" shown below. Note whether mis-alignment is evident on a major number of channels or on only a few channels. *If the markers for a major number of channels* are far off in the same direction, adjust the overall oscillator adjustment A1 (on channel 13 or other unassigned high channel) so that the video carrier marker is located as shown in the response curve given below. (If the video carrier marker is at the proper point on the curve, the sound carrier marker should locate at the proper point on the curve.) Be sure the Tuning control is at half rotation while making this adjustment. Recheck all channels individually for proper marker location. *If only individual channel adjustment is required,* adjust the particular individual channel slug A3, (using a NON-METALLIC alignment tool with a 1/8" blade) so that the video carrier marker is located as shown in the response curve given below. Only slight rotation of the slug will be required; turning the slug in too far will cause the slug to fall into the coil.* (If the video carrier marker is at the proper point on the curve, the sound carrier marker should locate at the proper point on the curve.) Be sure the Tuning control is at half rotation while making this adjustment.
3	To insure best reception and ease of tuning, a "touchup" adjustment of the individual channel slugs A3, using the station signal from each of the stations in the service area, must be made, preferably in the customer's home. See "Individual Channel Slug Adjustment Using Television Signal" on page 11.		

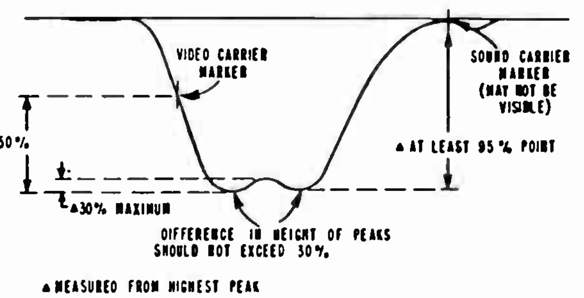
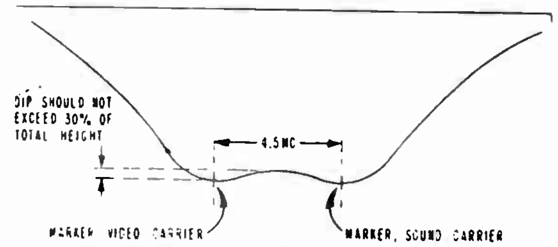


Fig. 9 Overall RF and IF Response Curve.

* If an oscillator slug should fall into a coil, remove the coil, move the slug retaining spring aside, lightly tap the open end of the coil against a solid object until the slug slips out. Replace slug and set the retaining spring into its cut-out slot.

Channel Number	Channel Freq. MC	Video Carrier, MC	Sound Carrier, MC
2	54- 60	55.25	59.75
3	60- 66	61.25	65.75
4	66- 72	67.25	71.75
5	76- 82	77.25	81.75
6	82- 88	83.25	87.75
7	174-180	175.25	179.75
8	180-186	181.25	185.75
9	186-192	187.25	191.75
10	192-198	193.25	197.75
11	198-204	199.25	203.75
12	204-210	205.25	209.75
13	210-216	211.25	215.75



Full skirt of curve will not be visible unless generator sweep width extends beyond 10 MC.
Figure 6. RF Response Curve.

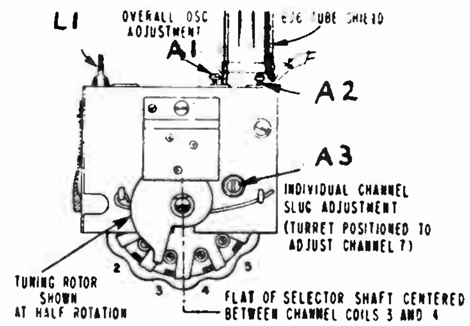


Fig. 7. Front View of TV Tuner.

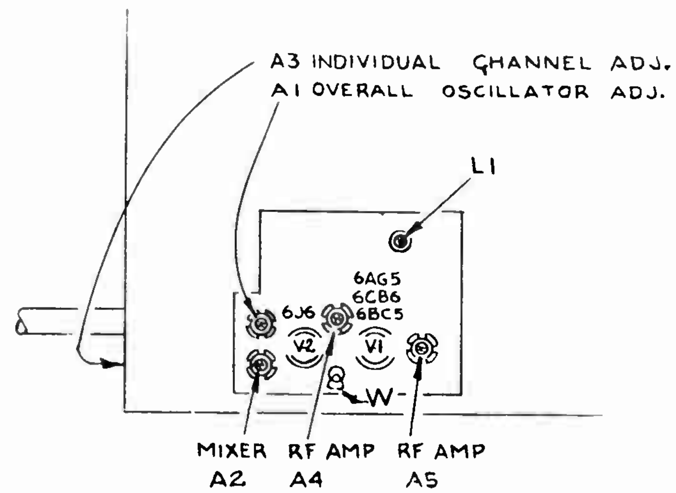


Figure 8. Top of TV Tuner, Showing Adjustment Location.

TELEVISION TUNER SERVICE

GENERAL

The TV tuner is a sub-chassis consisting of an RF amplifier stage and a mixer-oscillator stage.

Three different RF amplifier tubes, either 6AG5, 6BC5, or 6CB6, are used in this tuner. Although these tubes have similar characteristics and are generally interchangeable, it is advisable to check the RF amplifier curve with a sweep generator and oscilloscope after replacement. A dual triode 6J6 tube is used in the mixer-oscillator stage.

Channel selection is accomplished by rotation of the tuner turret assembly, which has a separate set of two coils for each of the 12 television channels. Each set consists of an antenna coil in one assembly, and a mixer-oscillator coil in another. Coils are the snap-in type. Coils can be identified as to channel by the number stamped on the outside of the coil assembly. A Tuning control permits fine adjustment of oscillator frequency.

The high frequencies used in television make it necessary that extreme care be exercised in servicing tuners.

Location and lead dress of components and wiring are usually very critical. Wiring leads, acting as small inductances or capacities, may appreciably alter electrical characteristics of critical circuits at high frequencies.

Parts location and ground connections should be as originally made. When replacing components, *it is important that they be replaced with parts of identical electrical characteristics and physical size.*

Refer to parts list for temperature coefficients, tolerances, and other essential description.

Note resemblance between some ceramic condensers and resistors. If in doubt, check Schematic.

Also note that replacement of tubes (especially 6J6 oscillator-mixer tube) may cause some slight detuning of tuner circuits. This is due to the inherent differences of interelectrode capacitances. When replacing 6J6 tube, it is recommended that several tubes be tried in order to select a tube which will cause least oscillator frequency shift. This is easily checked by noting the amount of rotation of the Tuning control required to tune in the television signal. It is recommended that this check be made on the high channels. Make individual channel slug adjustments as instructed on page 11.

Channel snap-in coils must be handled with care. Do not disturb coil windings. Also be sure the coils are properly paired for the indicated channel number, and that coils follow proper sequence when reassembled in the turret drum. For proper reference of tuner shaft in relation to coil position refer to figure 7.

TUNER REPLACEMENT

Replacement of the complete tuner should generally never become necessary since electrical and mechanical parts are easily replaceable. At time of publication, the manufacturer can supply a replacement tuner on an exchange basis, if you are unable to make repairs.

TUNING CONTROL

The Tuning control is a variable dielectric type condenser. The normal tuning range of the Tuning control for high channels is plus or minus 3 MC, for low channels plus or minus 1.5 MC.

Slight rubbing of the dielectric rotor of M104 against the grounded stator plate M107 is intentional, in order to avoid vibration with resulting microphonics. However the dielectric rotor should not be allowed to contact the circular disc riveted to the body of the tuner.

The Tuning control is permanently set at the factory and cannot be readjusted for frequency tuning range.

REMOVING CHANNEL COILS

Insert a screwdriver blade between the coil retainer spring and the turret end plate. Twist the blade away from the turret and lift the end of the coil upward.

CLEANING CONTACTS

Remove several sets of coils from turret and rotate turret to position making contact points of contact plate accessible for cleaning.

Using a small, stiff brush and carbon tetrachloride, clean contact surfaces of stationary contacts.

Remove accumulated dust or grease from stationary contacts and contact plate with a soft canvas cloth dampened with carbon tetrachloride. Accumulated rosin may be removed with a soft cloth dampened with alcohol.

Clean contact surfaces of rotating coils in same manner.

TUNER LUBRICATION

In general the lubrication applied to points of wear or friction at time of manufacture should make lubrication seldom, if ever necessary. However, should tuner lubrication become necessary, it is important that the correct amount and type of lubricant be used.

Using a clean brush, apply a film of switch contact oil, Viscosity Oil Co. #7069) to the surfaces of the coil contacts and stationary contact points.

Lubricate bearing surfaces of all other moving parts with light vaseline or preferably Viscosity Oil Co. #8857 lubricant.

CAUTION: Do not use lubriplate or any similar lubricant containing zinc or cadmium.

ADJUSTING CONTACT SPRINGS

Should the stationary contact springs make poor contact due to insufficient tension, remove several sets of coils from the turret. Rotate the turret to position making the bottom of the contact strip accessible for observation. With a narrow blade screwdriver, adjust the contact spring tension by carefully bending the spring inward until highest point on the spring extends about 9/64 of an inch above the plastic surface of the contact plate. With correct tension of the contact spring, the spring should clear the flat surface of the turret coil by about 1/64 of an inch.

OSCILLATOR SLUGS IN TOO FAR

If HF oscillator slugs "fall into" coil form, remove the channel coil, move the slug retaining spring M112 aside, and tap the coil assembly until the slug slips forward. Set the slug retaining spring into position; it should rest firmly against the slug.

REMOVING TUNER TURRET ASSEMBLY

a. Remove retaining bracket M107 in front of the tuner.
b. Remove rotor shaft assembly M104, rotor contact spring M124 and fibre washer M113. For reassembly, note order of parts removal.
c. Remove front and rear turret retaining springs M125 by pressing straight end away from tab on chassis.
d. Using a screwdriver blade at the side of the tuner, press the detent spring M122 and roller M121 away from the turret detent plate.
e. Grasp tuner shaft and slip out of end plate bearings.

REPLACEMENT OF THE UNGROUNDED STATOR PLATE OF TUNING CONTROL

Stator plate M118 is replaced with wiring lead and trimmer condenser C5 attached, because it is difficult to solder the wire lead to the silver plated surface on the ceramic stator plate disc.

To replace the stator plate, remove the turret assembly. Remove mounting rivets from stator plate by drilling out or clipping them out with diagonal wire cutters. Remove trimmer screw M115 and locking nut M114 from trimmer condenser C5. Unsolder wiring lead connecting trimmer to terminal on contact plate.

Assemble the replacement stator plate (M118) by placing the ceramic button over the 5/8" hole in the chassis with the wiring lead extending into the chassis. Place the mounting bracket over the ceramic button and mount securely using #4x3/16 round head machine screws with #4-40x3/16 hex nuts and #4 shake proof lock washers. Mount trimmer condenser C5 in chassis and solder wire lead to its original terminal on the contact plate making this lead as short as possible. Dress wiring lead from ceramic stator plate to trimmer condenser C5 so it does not come in contact with the turret drum. After replacement of the stator plate, adjust trimmer condenser C5 (overall oscillator adjustment).

REMOVING CONTACT PLATE ASSEMBLY M123

a. Remove turret.
b. Remove the mounting screws at the front and rear of Contact Plate and Bracket Assembly M123.
c. Unsolder both ends of contact plate assembly. Press outward the front and rear tuner chassis end plates.
d. To free contact plate assembly, release the contact plate tabs by pushing them away from the slots in the end plates.
e. Unsolder all connections to contact plate. Unsolder the solder joint holding contact plate to the center partition of the tuner chassis.
f. Reassemble in the same manner.

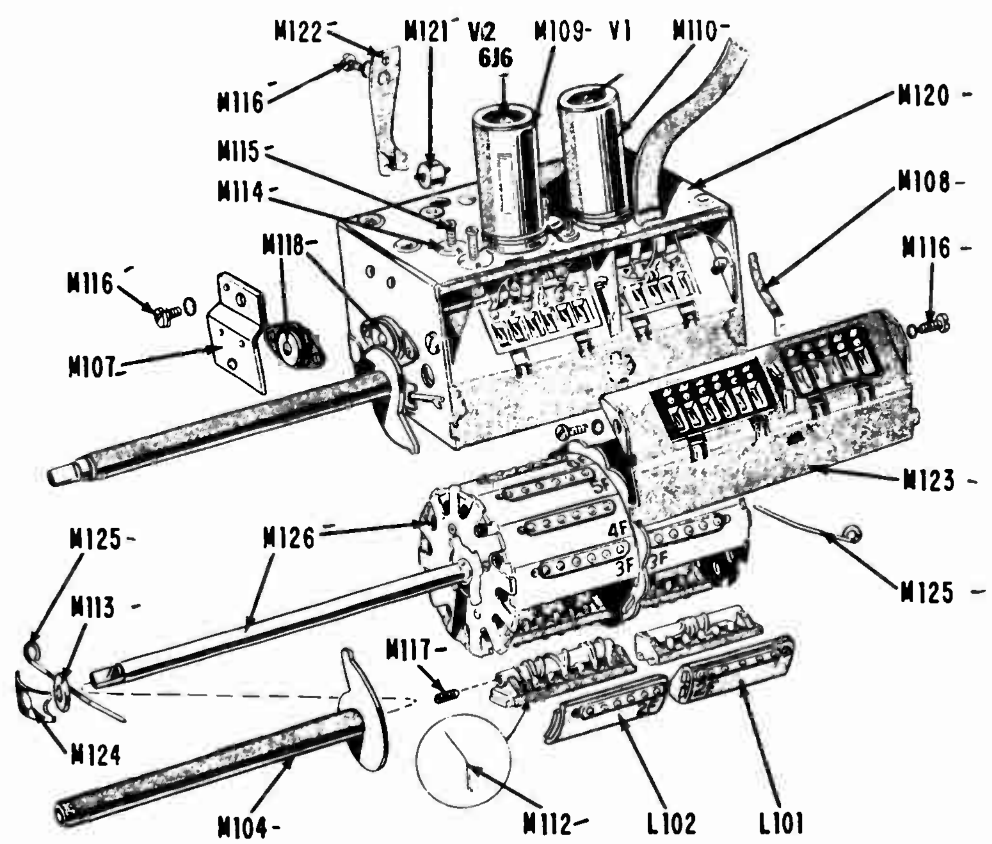


Figure 10. Exploded View, TV Tuner.

INTERMITTENT PICTURE AND SOUND

This trouble is most commonly due to an intermittent tube, loose tube socket contacts, dirty or loose coil contacts, loose or cold (rosin) soldered joints, or loose or vibrating parts in the underside of the tuner chassis.

When replacing tubes, see tube note under "General"

Loose tube socket contacts may sometimes be tightened by compressing contacts with an ice pick or a large needle. Defective tube socket contacts can sometimes be replaced individually.

For cleaning and adjusting coil contacts, see "Cleaning Contacts" and "Adjusting Contact Springs".

Loose or intermittent connections can be found by tapping components or rotating the channel selector and watching the pattern on an oscilloscope. A visual inspection or a continuity check will also be helpful.

Apply a hot soldering iron to soldered joints which appear doubtful. Caution: Do not change lead lengths or move components other than to slightly separate parts or leads which have caused trouble by contact with the chassis or other parts. See discussion under "General".

SOUND BARS IN PICTURE (DUE TO MICROPHONICS)

Microphonics in the TV Tuner will generally produce sound bars in the picture or a ringing sound as the volume is turned up or as the cabinet is tapped lightly.

Check for microphonic oscillator mixer tube, V2 (6J6). It is recommended that several tubes be tried, in order to select a tube which will be least microphonic and at the same time, causes a minimum of oscillator frequency shift, as noted with rotation of Tuning control. In some cases, replacement of the oscillator mixer tube, may necessitate readjustment of trimmer condenser A1 (C5) (overall oscillator adjustment).

Microphonics can also be due to vibration of loose wires or loose components. In some instances, the ceramic stator plate M118 (tuning stator) has been a source of microphonics since the rivets which fasten this part to the tuner chassis may be loose. This can be remedied by soldering the plate mounting bracket to the tuner chassis. To solder the plate mounting bracket to the tuner chassis, remove the grounded Tuning stator plate M107, and move the tuner shaft M104 forward.

Also, check for any mechanical "rub" such as loose screws which hold the tuner sub-chassis to the main chassis, loose solder connection from tube shield base to chassis, or extremely dry tuner shaft.

PARTS LIST

CAPACITORS

Ref. No.	Part No.	Description
C1	CCC05050D	Ceramic tubular 5 uuf ± .5 uuf NPO
C2	CVC030ST	Ceramic trimmer 0.5-3 uuf CRL
C3	CVC030ST	Ceramic trimmer 0.5-3 uuf CRL
C4	CVC030ST	Ceramic trimmer 0.5-3 uuf CRL
C5	CVC030ST	Ceramic trimmer 0.5-3 uuf CRL
C6	CCU05121K	Ceramic tubular 120 uuf ± 100% N750
C7	CCU05101K	Ceramic tubular 100 uuf ± 10% N750
C8	CCC05200K	Ceramic tubular 20 uuf ± 10% NPO
C9	CCU05100K	Ceramic tubular 10 uuf ± 10% N750
C10	CCC05100K	Ceramic tubular 10 uuf ± 10% NPO
C11	CDZ05102Y	Ceramic disc 1000 uuf GMV †
C12		Fine tuning consists of tuner parts
C13	CCU05121K	Ceramic tubular 120 uuf ± 10% N750
C14	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C15	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C16	CCC05200K	Ceramic tubular 20 MMF ± 10% NPO
C17	CDZ05103Y	Ceramic disc 10,000 MMF GMV
C18	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C19	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C20	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C21	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C22	CCZ05102Y	Ceramic tubular 1000 MMF GMV
C23	CDZ05102Y	Ceramic disc 1000 MMF GMV †
C24	CPZ02504M	Molded paper .5 MFD - 200V
C25	CDZ05502Y	Ceramic disc 5000 MMF GMV
C26	CDZ05502Y	Ceramic disc 5000 MMF GMV
C27	CDZ05502Y	Ceramic disc 5000 MMF GMV
C28	CCC05068K	Ceramic tubular 6.8 MMF ± 10% NPO
C29	CDZ05103Y	Ceramic disc, 10,000 uuf GMV
C30	CPZ04104M	Molded paper .1 MFD 400 V
C31	CPZ04104M	Molded paper, .1 MFD 400 V
C32	CPZ04503M	Molded paper .05 MFD 400 V
C33	CMA03221M	Molded mica 220 MMF ± 20% 300 V
C34	CPZ06103M	Molded paper .001 MFD 600V
C35	CDZ05103Y	Ceramic disc, 10,000 uuf GMV
C36	CSC05100K	Silver mica, 10 uuf ± 10% 500V
C37	CSC05101K	Silver mica, 100 uuf ± 10% 500V
C38	CMA05331M	Molded mica, 330 uuf ± 20% 500V
C39	CMA05152M	Molded mica, 1500 uuf ± 20% 500V
C40	CES0405	Tubular electrolytic 4 MFD 50V
C41	CDZ05502Y	Ceramic disc 5000 MMF GMV
C42	CWZ06502M	Molded paper, .005 MFD 600V
C43	CMA05102K	Molded mica, 1000 uuf ± 10%
C44	CMA05102K	Molded mica, 1000 uuf ± 10%
C45	CPZ06502M	Molded paper .005 MFD 600V
C46	CPZ06503M	Molded paper, .05 MFD 600V
C47	CPZ06104M	Molded paper, .1 MFD 600V
C48	CET21C45	Tubular electrolytic, 150 MFD 50V ‡
C49	CES2003	Tubular electrolytic 20 MFD 25V
C50	CDZ05103Y	Ceramic disc 10,000 MMF GMV
C51	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C52	CDZ05103Y	Ceramic disc 10,000 MMF GMP
C53	CMB05392K	Molded mica, 3900 uuf ± 10% 500V
C54	CMA05331K	Molded mica, 330 uuf ± 10% 500V
C55	CMA05391K	Molded mica, 390 uuf ± 10% 500V
C56	CPZ06103M	Molded paper, .01 MFD 600V
C57	CVM501ST	Compression trimmer, 50 uuf ± 500 uuf
C58	CPZ06503M	Molded paper, .05 MFD 600V
C59	CPZ06254M	Molded paper, .25 MFD 600V
C60	CPZ02254M	Molded paper, .25 MFD 200V
C61	CDZ20K501	Ceramic, 500 uuf GMV 20KV CRL
C62	CMA10560K	Molded mica, 56 uuf ± 10% 1000V
C63	CET21C45	Tubular electrolytic 20 MFD 450V ‡
C64	CET21C45	Tubular electrolytic 10 MFD 450V ‡
C65	CED4445	Tubular electrolytic 40 MFD 450V *
C66	CED4445	Tubular electrolytic 40 MFD 450V *
C67	CES8045	Tubular electrolytic 80 MFD 450V

NOTES:
*C65 and C66 in same unit. ‡C48, C63, & C64 in same unit.
†C11 & C23 may be a dual disc capacitor.

RESISTORS

Ref. No.	Part No.	Description
R1	RCC392K	Carbon, 3900 ohms ± 10% 1/2 watt
R2	RCC103K	Carbon, 10K ± 10% 1/2 watt
R3	RCC472M	Carbon, 4700 ohms ± 20% 1/2 watt
R4	RCC224M	Carbon, 220K ± 20% 1/2 watt
R5	RCC153M	Carbon, 15K ± 20% 1/2 watt
R6	RCC473M	Carbon, 47K ± 20% 1/2 watt
R7	RCC222M	Carbon, 2200 ohms ± 20% 1/2 watt
R8	RCC103K	Carbon, 10K ± 10% 1/2 watt
R9	RCC472M	Carbon, 4700 ohms ± 20% 1/2 watt
R10	RCC682K	Carbon, 6800 ohms ± 10% 1/2 watt
R11	RCC470K	Carbon, 47 ohms ± 10% 1/2 watt
R12	RCC103M	Carbon, 10K ± 20% 1/2 watt
R13	RCC104M	Carbon, 100K ± 20% 1/2 watt
R14	RCC223K	Carbon, 22K ± 10% 1/2 watt
R15	RCC470K	Carbon, 47 ohms ± 10% 1/2 watt
R16	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R17	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R18	RCC562K	Carbon, 5600 ohms ± 10% 1/2 watt
R19	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R20	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R21	RCC471M	Carbon, 470 ohms ± 20% 1/2 watt
R22	RCC183M	Carbon, 18K ± 20% 1/2 watt
R23	RCC562K	Carbon, 5600 ohms ± 10% 1/2 watt
R24	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R25	RCC270M	Carbon, 27 ohms ± 20% 1/2 watt
R26	RVM100S	Carbon composition variable 1000 ohms reverse audio taper*
R27	RCC564M	Carbon, 560K ± 20% 1/2 watt
R28		Carbon, 18K ± 20% 1 watt †
R29	RCF682K	Carbon, 6800 ohms ± 10% 1 watt
R30	RCC474M	Carbon, 470K ± 20% 1/2 watt
R31	RCC225M	Carbon, 2.2M ± 20% 1/2 watt
R32	RCC824M	Carbon, 820K ± 20% 1/2 watt
R33	RCC394M	Carbon, 390K ± 20% 1/2 watt
R34	RVC100N	Carbon composition variable, 250K linear taper 1/2 watt
R35	RCC684M	Carbon, 680K ± 20% 1/2 watt
R36	RCC474M	Carbon, 470K ± 20% 1/2 watt
R37	RCC820M	Carbon, 82 ohms ± 20% 1/2 watt
R38	RWT332K	Wire wound 1000 ohms ± 10% 12 watts
R39	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R40	RCC473M	Carbon, 47K ± 20% 1/2 watt
R41	RCC682K	Carbon, 6800 ohms ± 10% 1/2 watt
R42	RCC682K	Carbon, 6800 ohms ± 10% 1/2 watt
R43	RVM100S	Carbon composition variable. 1.0 M audio taper*
R44	RCC475M	Carbon, 4.7M ± 20% 1/2 watt
R45	RCF271M	Carbon, 270 ohms 1 watt
R46	RWT332K	Wire wound 2300 ohms ± 10% 9 watts
R47	RCC472K	Carbon, 4700 ohms ± 10% 1/2 watt
R48	RCC682K	Carbon, 6800 ohms ± 10% 1/2 watt
R49	RCC272K	Carbon, 2700 ohms ± 10% 1/2 watt
R50	RCC474M	Carbon, 470K ± 20% 1/2 watt
R51	RCF102M	Carbon, 1000 ohms ± 20% 1 watt
R52	RCC104M	Carbon, 100K ± 20% 1/2 watt
R53	RCC155M	Carbon, 1.5M ± 200% 1/2 watt
R54	RVC101N	Carbon composition variable, 1.0M linear taper 1/2 watt
R55	RCC155M	Carbon, 1.5M ± 20% 1/2 watt
R56	RVC102N	Carbon composition variable, 3.0M linear taper 1/2 watt
R57	RCC822K	Carbon, 8200 ohms ± 10% 1/2 watt
R58	RCC225M	Carbon, 2.2M ± 20% 1/2 watt
R59	RCC471M	Carbon, 470 ohms ± 20% 1/2 watt
R60	RVC103N	Carbon composition variable, 5000 ohms linear taper 2 watts
R61	RCC561K	Carbon, 560 ohms ± 10% 1/2 watt
R62	RCC561K	Carbon, 560 ohms ± 10% 1/2 watt
R63	RCF472K	Carbon, 4700 ohms ± 10% 1 watt
R64	RCC224M	Carbon, 220K ± 20% 1/2 watt
R65	RCC104K	Carbon, 100K ± 10% 1/2 watt
R66	RCC104K	Carbon, 100K ± 10% 1/2 watt
R67	RCC475M	Carbon, 4.7M ± 20% 1/2 watt
R68	RCC474M	Carbon, 470K ± 20% 1/2 watt
R69	RCC152K	Carbon, 1500 ohms ± 10% 1/2 watt
R70	RCC392K	Carbon, 3900 ohms ± 10% 1/2 watt
R71	RCC104K	Carbon, 100K ± 10% 1/2 watt
R72	RCC274K	Carbon, 270K ± 10% 1/2 watt
R73	RCC472M	Carbon, 4700 ohms ± 20% 1/2 watt
R74	RCC474M	Carbon, 470K ± 20% 1/2 watt
R75	RCG103M	Carbon, 47 ohms ± 20% 1/2 watt
R76	RCG103M	Carbon, 10K ± 20% 2 watts
R77	RCC033K	Carbon, 3.3 ohms ± 10% 1/2 watt
R78	RCF684M	Carbon, 680K ± 20% 1 watt
R79	RCC104M	Carbon, 100K ± 20% 1/2 watt

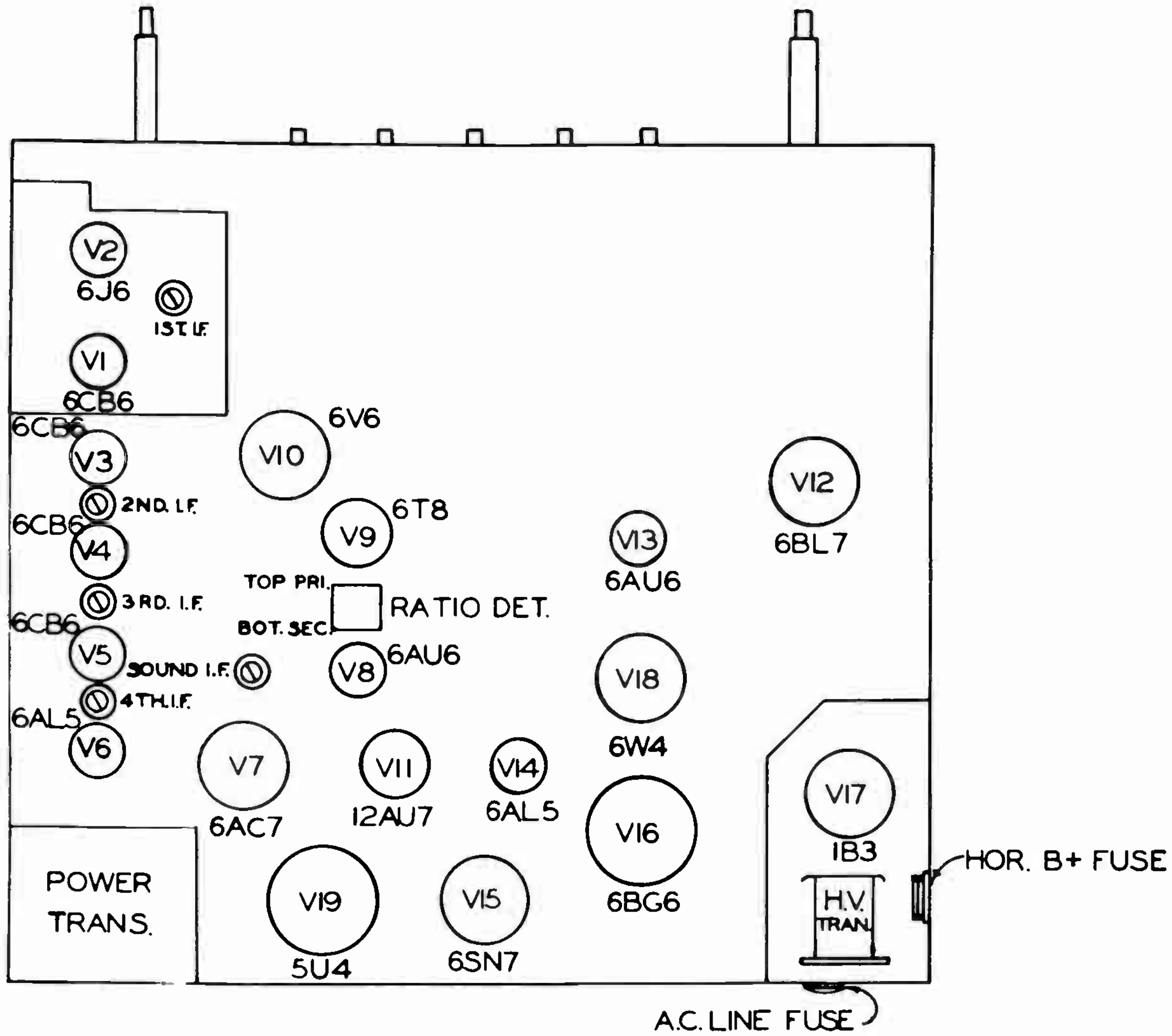
NOTES: *R26 and R43 are part of same unit which also includes switch S1. † used as winding form for L14.
K = 1000 ohms M = 1,000,000 ohms

Ref. No.	Part No.	Description	Price
		PRINTED CIRCUITS	
PC80	A-1376-6F	Audio Couplate CRL FC-80	
PC100	A-1375-6F	Vertical Integrator Network - CRL PC-100	
		COILS	
L1		Mixer Plate Coil	
L2	B-1471-10	1st I.F. Coil	
L3	B-1471-10	2nd I.F. Coil	
L4	B-1471-10	3rd I.F. Coil	
L6	A-1470-10	4.5 M.C. Sound take-off Coil	
		Channel #2 Antenna Coil Ass.	
		Channel #3 Antenna Coil Ass.	
		Channel #4 Antenna Coil Ass.	
		Channel #5 Antenna Coil Ass.	
		Channel #6 Antenna Coil Ass.	
L7		Channel #7 Antenna Coil Ass.	
L8		Channel #8 Antenna Coil Ass.	
		Channel #9 Antenna Coil Ass.	
		Channel #10 Antenna Coil Ass.	
		Channel #11 Antenna Coil Ass.	
		Channel #12 Antenna Coil Ass.	
		Channel #13 Antenna Coil Ass.	
		Chan. #2 Mixer-Osc. Coil Ass.	
		Chan. #3 Mixer-Osc. Coil Ass.	
		Chan. #4 Mixer-Osc. Coil Ass.	
		Chan. #5 Mixer-Osc. Coil Ass.	
L9		Chan. #6 Mixer-Osc. Coil Ass.	
L10		Chan. #7 Mixer-Osc. Coil Ass.	
L11		Chan. #8 Mixer-Osc. Coil Ass.	
		Chan. #9 Mixer-Osc. Coil Ass.	
		Chan. #10 Mixer-Osc. Coil Ass.	
		Chan. #11 Mixer-Osc. Coil Ass.	
		Chan. #12 Mixer-Osc. Coil Ass.	
		Chan. #13 Mixer-Osc. Coil Ass.	
L12	A-1469-10	36UH Peaking Coil	
L13	A-1482-10	120UH Peaking Coil	
L14	A-1483-10	240UH Video Amp. Peaking Coil (includes R28)	
L15	A-1484-10	380UH Video Amp. Peaking Coil	
L16	A-1479-10	Horizontal Hold - A.F.C. Coil	
L17	A-1486-10	Width Control	
L18	A-1651-10	Filter Choke, 2HY-220 MA.	
L19	A-1481-10	Filament Choke (Video I.F.)	
L20	A-1481-10	Filament Choke (Video I.F.)	
L21		Filament Choke, Tuner	
L22		Filament Choke, Tuner	
		TRANSFORMERS	
T1	B-1472-10	4.5 MC Ratio Detector Transformer (includes C36 and C37)	
T2	B-1653-13	Audio Output Transformer (6V6 to 3.2 V.C.)	

Ref. No.	Part No.	Description
T3	A-1661-13	Vertical blocking Osc. Transformer
T4	B-1662-13	Vertical Output Transformer
T5	C-1677-13A	Horizontal Output Transformer
T6	B-1650-13	Power Transformer 350-0-350 @ 220 MA. DC., 5V @ 3A, 6.3V @ 1.2A, 6.3V @ 1.2A, 6.3V @ 8A
		FUSES
F1	A-3750-30	1/4 Amp 250 Volt Cartridge Fuse
F2	A-3751-30	5 Amp 250 Volt 3AG Fuse.

MISCELLANEOUS		
Y1	B-1452-9	Deflection Yoke for 70 CRT (8.3 MH Hor. 48MH Vert.)
S1		Power Switch (included as part of Contrast volume control Part #RVM 100S)
	B-4100-33	Tuner, Standard Coil
	A-4102-33	Ion Trap
	B-4101-33	Focalizer
	A-1553-2	CRT Socket (with leads)
	A-1008-1	Yoke Mounting Hood
	A-1500-11	Line Cord
	A-1501-11	Hi-Voltage CRT Lead with Connector

TUBE LAYOUT



117V–60∿AC ONLY
180 WATTS
RM.A. CODE 217

ADDITIONAL SERVICE INFORMATION

These chassis use a keyed AGC system and unless certain precautions are observed some difficulties may be encountered when IF or RF alignment adjustments are made. First be sure to read carefully the "Television Alignment Procedure"

A $1\frac{1}{2}$ volt bias battery should be connected across the AGC line (negative to junction of C24 and R52, positive to chassis), when making all alignment adjustments. This will prevent the amplifiers from overloading in the event that it is not possible to attenuate the signal generator sufficiently. Also, when the RF or IF amplifiers are sweep aligned the response curves will be distorted if a fixed bias is not applied to the AGC line due to the fact that the time constant of the keyed AGC circuit is short compared to the sweep frequency of the sweep generator. Therefore, the gain of the IF and RF amplifiers will not remain constant while the signal is sweeping through the response curve. When a sweep generator which does not have blanking is used, it will be impossible to make the forward and reverse response curves coincide unless a fixed bias is used.

In order to check the keyed AGC circuit for proper operation, the following simple test will be useful. When the grid of the AGC key tube (pin 1 V13) is shorted to the cathode (pin 7) the voltage on the AGC bus (across C24) should be approximately 40 to 70 volts **negative** as measured with a VTVM. In the event that this voltage is not obtained the trouble will probably be in the key tube V13, the horizontal output transformer T5, in one of the coupling or bypass condensers in the AGC line, or R52.

It may be found that in some cases there are minor deviations in the receivers in part values from those specified in the schematic. For example a .047 mfd condenser may be used in place of a .05 mfd condenser or a .22 mfd condenser in place of a .25 mfd condenser. In decoupling circuits in the AGC and B+ lines 100 ohm or 200 ohm resistors may be used in place of the 150 ohm resistors specified with negligible effect on the performance. When such substitutions are made they are always made in locations where the value of the part is not critical for it to effectively perform its function. There are many locations where tolerances of 100% or more are permissible. However, when replacements are made, if there is any doubt as to the suitability of the replacement part, the value as specified in the manual should be used.

Occasionally 6AG5 tubes are used in place of the 6CB6 tubes specified in the manual for the IF amplifiers V3, V4, and V5. It should be noted that these tubes are not directly interchangeable due to the different internal wiring of the tubes. Therefore, when replacing these tubes, be sure to use the same type that was originally supplied in the receiver. If 6AG5 tubes were originally used this type number will appear on the chassis near the tubes.

When requesting technical advice concerning service problems please give as complete detailed information as possible as regards to the remedies tried and the specific effects caused by the troubles. This will better enable us to suggest possible remedies for the trouble. Be sure to mention the model number, serial number, and chassis number when requesting information.

RADIO SPECIFICATIONS

Power Supply	105-125 volts 60 cycle AC only.
Power Consumption	65 Watts.
Frequency Range FM	88 to 108 MC.
Frequency Range AM	540 to 1600 KC.
I.F. Frequency FM	10.7 MC.
I.F. Frequency AM	455 KC.
Band width, FM, Ratio Detector	330 KC.
Band width, FM, 1st I.F.	280 KC.
Band width, FM, Converter	220 KC.

The tubes used are as follows:

12AT7	FM RF Amplifier, Converter
6BE6	FM Osc, Am Osc, Converter
6BA6	FM-AM, 1st I.F. Amplifier
6BA6	FM, 2nd I.F. Amplifier
6AL5	FM Detector
6AT6	AM Detector, AVC, Audio
6AQ5	Power Output
6X4	Power Rectifier
No. 44	Pilot Lights (2)

SERVICE NOTES

GENERAL

CAUTION: If realignment is necessary be sure the proper test equipment is available, as listed below, before proceeding with the alignment procedure as given.

Due to the high frequencies at which FM signals are received the service man must use great care when servicing thes sets. Extreme caution must be used regarding the moving of component parts in the R.F. and oscillator circuits of the receiver as those circuits can be detuned in this manner.

If it becomes necessary to replace components such as resistors and condensers they must be replaced with parts of the same size, type, voltage rating and tolerance as called for in the parts list.

When installing new parts they should be placed in the same position as the original, and the leads should be cut to the same length.

ALIGNMENT NOTES

This receiver has been thoroughly inspected and tested at the factory, using the most modern test equipment available, such as FM sweep generators and oscilloscopes. All R.F. and I.F. circuits have been accurately adjusted at the factory and no attempt should be made to realign these circuits unless it is absolutely necessary.

EQUIPMENT USED FOR ALIGNMENT

- Vacuum tube voltmeter.
- AM Signal generator
- FM Sweep generator.
- Oscilloscope.
- Insulated screw driver.
- Dummy antenna:
  - .1 MFD condenser
  - .00025 MFD mica condenser
  - 150 ohm resistor (2)
- Output meter.

NOTE A: When aligning the FM I.F. circuits, keep the out put from the signal generator as low as possible.

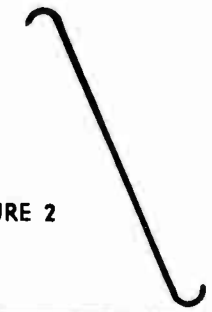


FIGURE 2

ALIGNMENT PROCEDURE

STEPS	RECEIVER DIAL SETTING	BAND SWITCH POSITION	SIGNAL GENERATOR FREQUENCY	DUMMY ANTENNA	SIGNAL GENERATOR CONNECTIONS	OUTPUT INDICATOR	TRIMMER ADJUSTMENT	TRIMMER FUNCTION	REMARKS
1	Minimum capacity	AM	455 KC 400 cycle AM	.1 MFD	High side—grid of AM converter tube (6BE6) Low side—chassis	Output Meter across voice coil	T2 & T4	AM I.F.	Adjust for maximum output
2	"	"	1600 KC 400 cycle AM	"	"	"	AM OSC	AM Oscillator	"
3	1400 KC	"	1400 KC 400 cycle AM	.00025 MFD	High side—One ant. terminal Low side—Other ant. terminal	"	Ant Loop	AM Antenna	"
4	Any position where there is no station interference.	FM	10.7 MC unmodulated .1 volt output.	.1 MFD	High side—grid of 2nd I.F. amplifier tube (6BA6) Low side—chassis	Connect V.T.V.M. to plate of Ratio Detector tube, pin 2 (6AL5)	Top T5	Ratio detector primary	Adjust for maximum negative voltage.
5	"	"	10.7 MC 400 cycle 250 KC Deviation	"	-	Connect scope to audio take-off point (across vol. cont.)	Bottom T5	Ratio detector secondary	Adjust for a balanced pattern on scope. See Fig. 2
6	"	"	10.7 MC 400 cycle 80 KC Deviation	"	High side—grid of 1st I.F. amplifier tube (6BA6) Low side—chassis	"	T3	FM 2nd I.F.	Adjust for maximum gain and best pattern on scope. See Fig. 2
7	"	"	"	"	High side—grid (pin 7) of FM converter tube (12AT7) Low side—chassis	"	T1	FM 1st I.F.	"
8	108.5 MC	"	108.5 MC 400 cycle 30% modulation (22.5 KC deviation)	300 ohms in high side	High side—ant. terminal Low side—chassis	Connect output meter across voice coil	FM OSC.	FM oscillator	Adjust for maximum output
9	105 MC	"	105 MC 400 cycle 30% modulation (22.5 KC deviation)	"	"	"	FM RF	FM R.F.	"

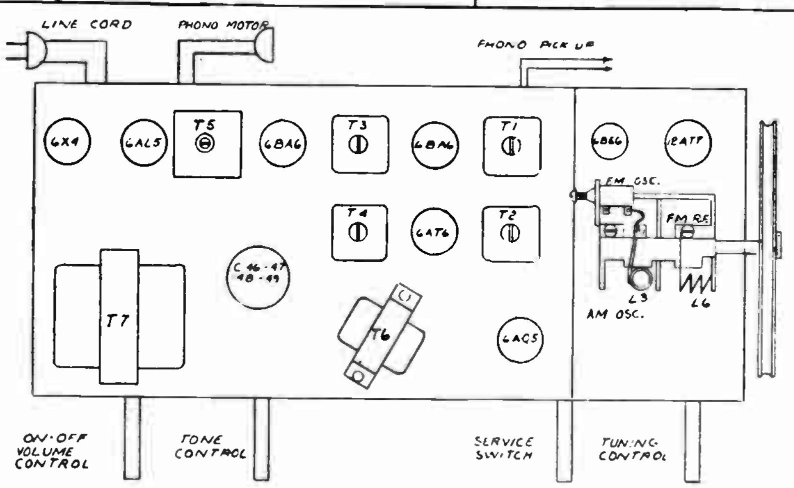
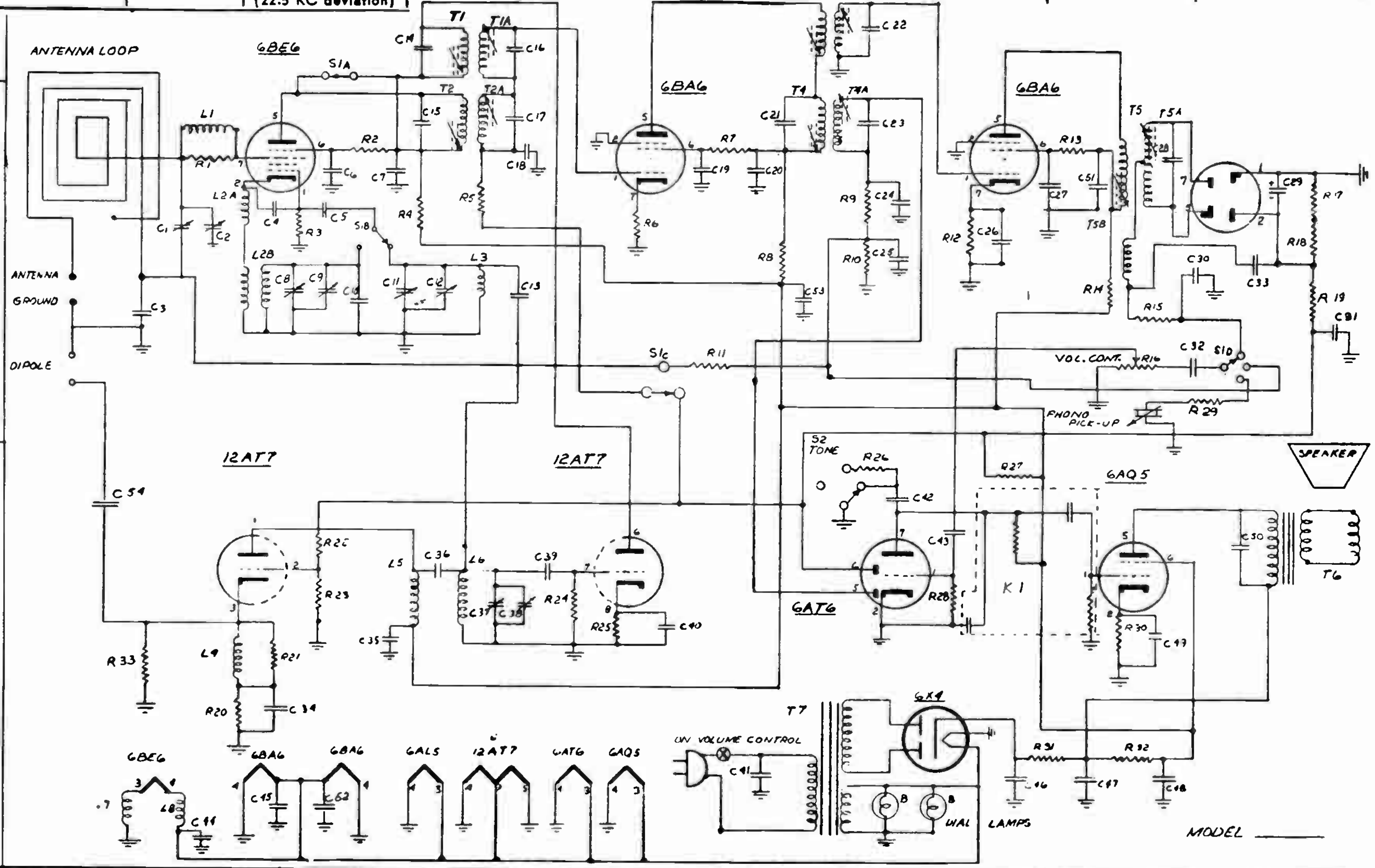


FIG. 3 TUBE AND TRIMMER LOCATIONS



VOLTAGE CHART

	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
6BE6 FM & AM OSC AM CONV	0	0	0	6 AC	155	125	0		
12AT7 FM RF AMP & CONV	170	0	1.5	0	0	155	0	1	6 AC
6BA6 1st IF AM & FM	0	0	6 AC	0 AC	150	100	0		
6BA6 2nd IF FM	0	0	6 AC	0 AC	155	110	1		
6AL5 FM DETECTOR	0	0	6 AC	0 AC		0	0		
6AT6 AM DETECTOR, AVC, AUDIO	−.5	0	6 AC	0 AC	0	0	60		
6AQ5 POWER OUTPUT	0	7.5	6 AC	0 AC	215	170	0		
6x4 POWER RECTIFIER	230 AC		6 AC	0 AC	235	230 AC	235		

Band Switch on AM position. Dial 1600 KC. No Signal.

All voltage readings are taken from tube pin to chassis.

All measurements are made with no signal, using a 20,000 ohm per volt meter.

AC input voltage must be maintained at 117 volts for accurate readings.

AC voltages shown are at 1000 ohms per volt.

All voltages shown are approximate.

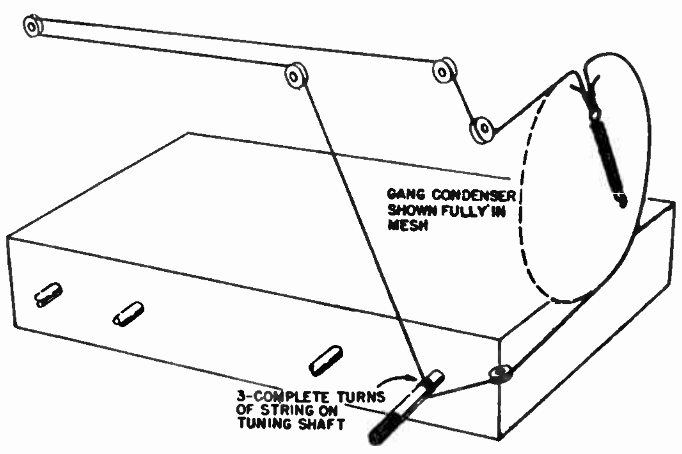


FIG. 4 DIAL CORD STRINGING

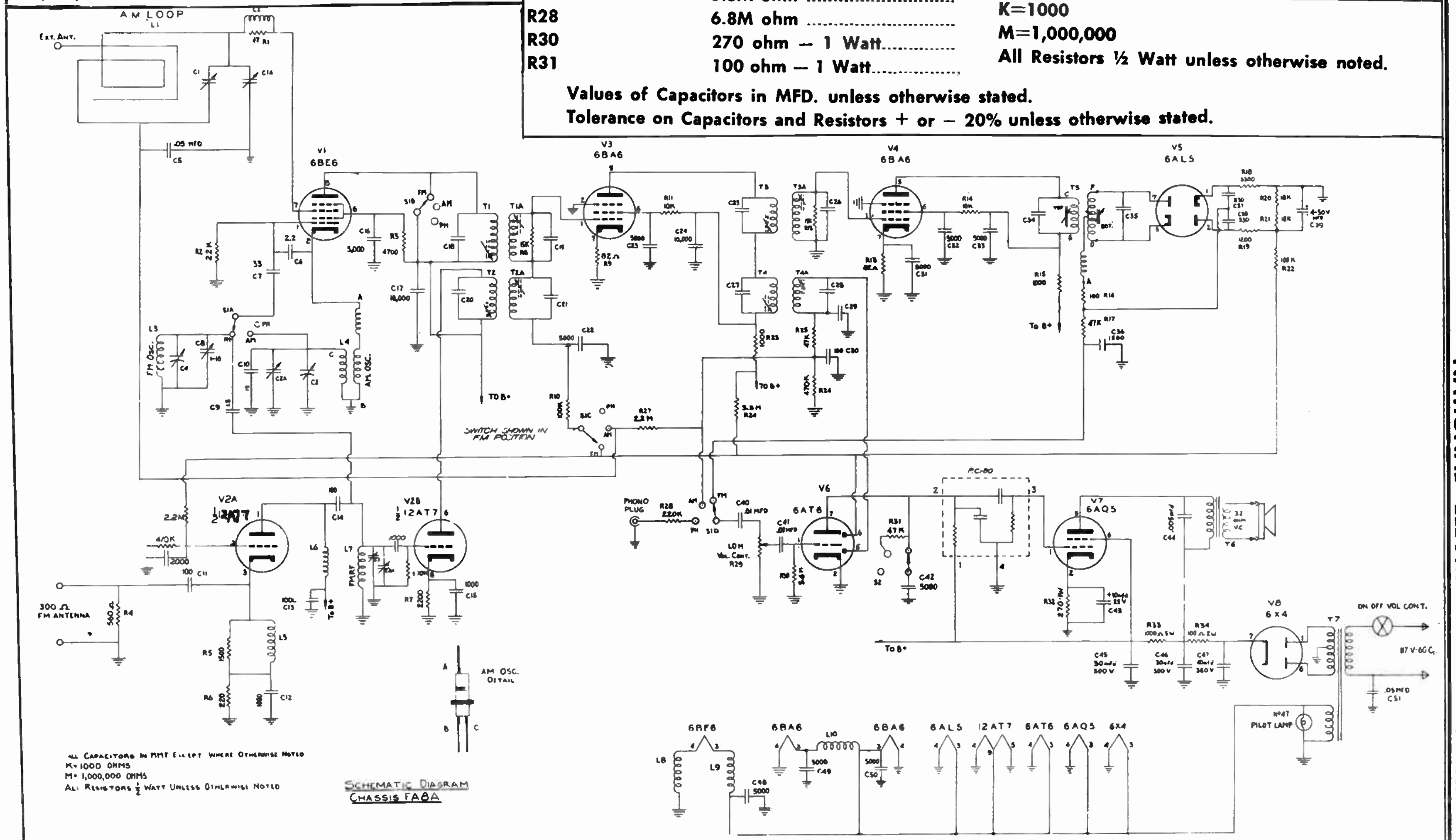
HOW TO ORDER REPAIR PARTS

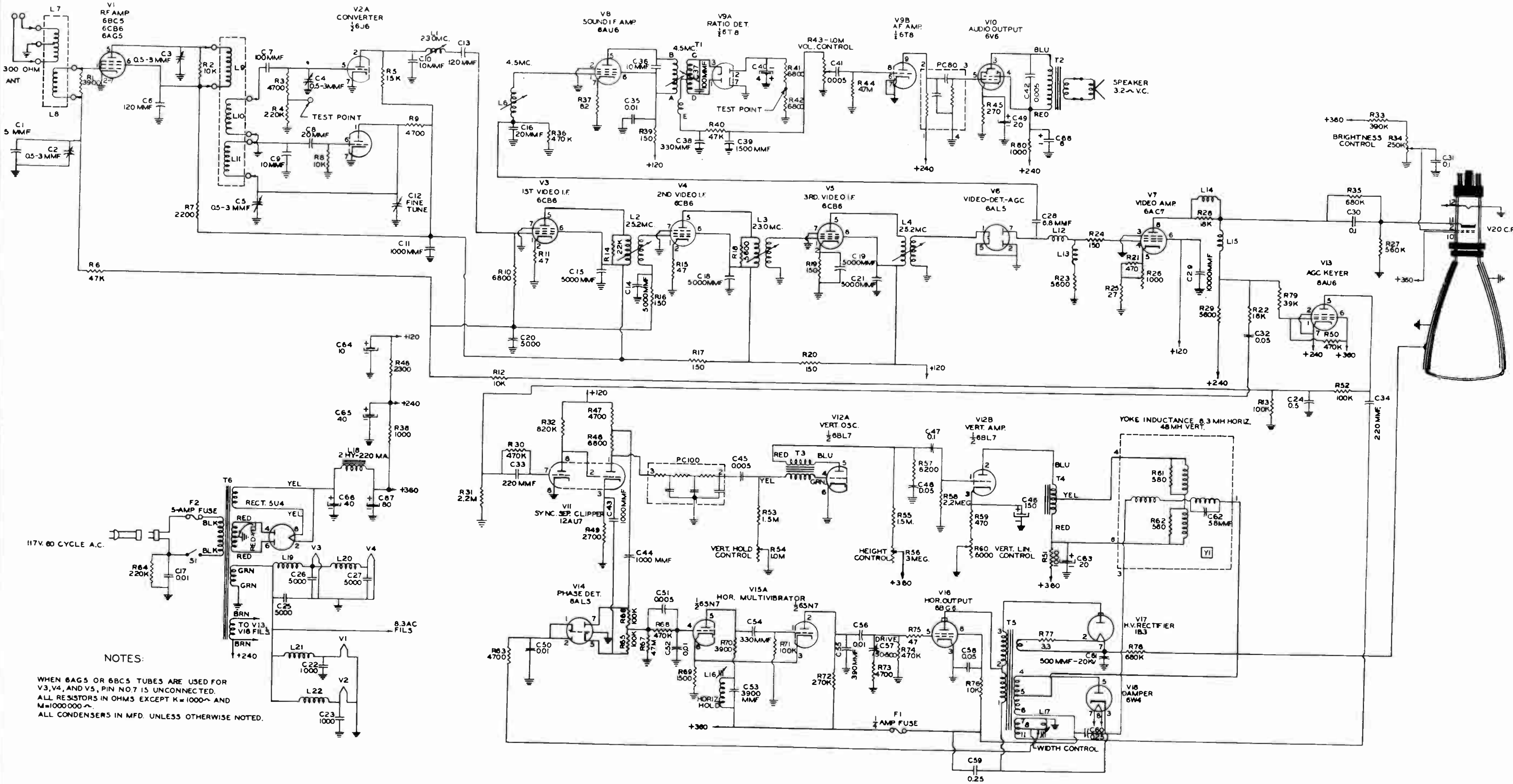
Always give the part No. (No. printed on the part if different from that shown on this list), and the name of the part. When No. is not available, give complete description of part. Be sure to always give the Model No. and Catalog No. The Model No. will be found on a printed label which will be found at the back of the cabinet.

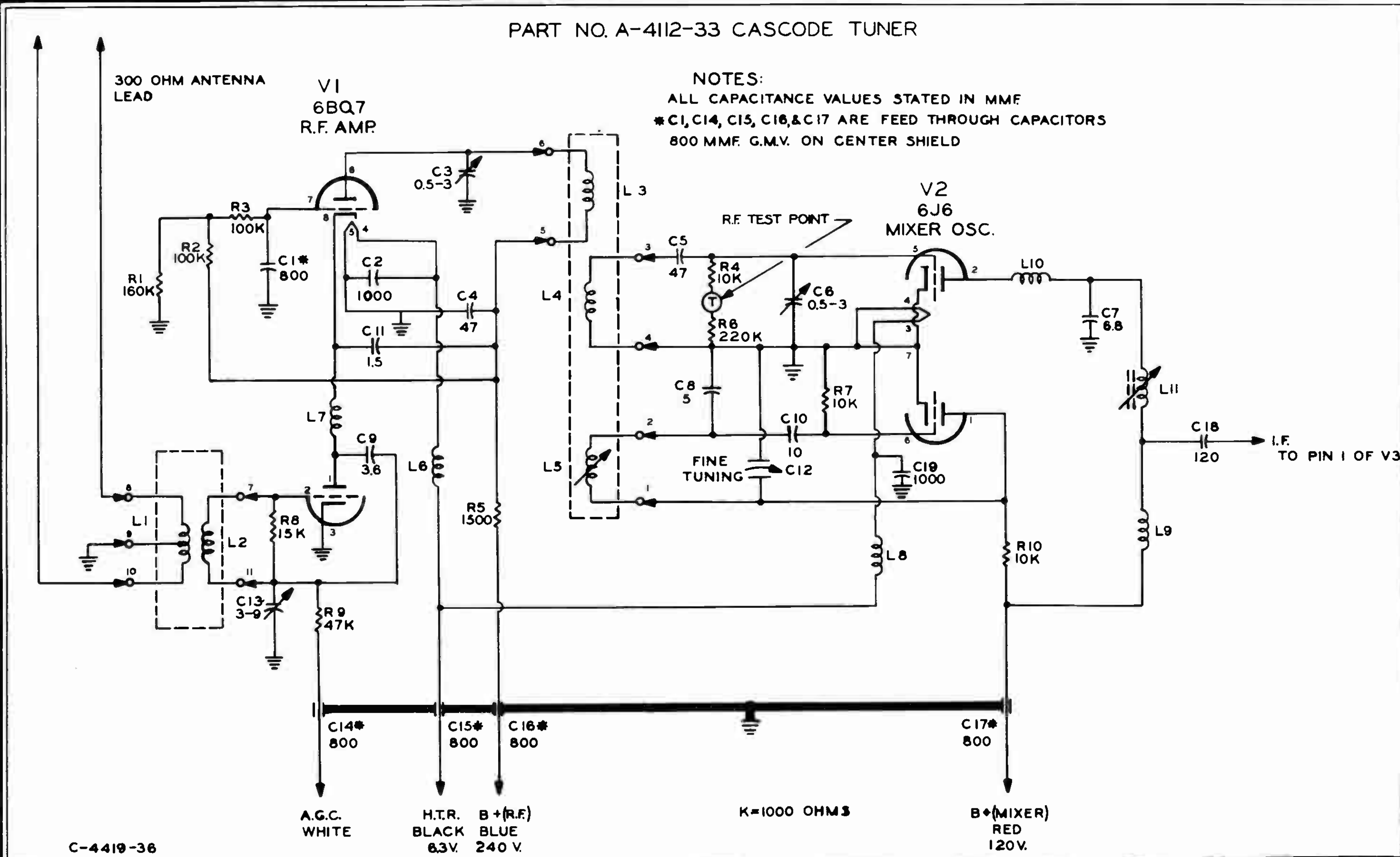
Schematic Diagram Reference	Description
C1	Loop Trimmer
C2	Variable Cond.
C8, C9	
C11, C37	
C38	.05-200V Condenser
C3	
C4	2.2 MMF Gimmick Cond.
C5	33 MMF (Erie Style A N14004)
C6, 18 C19, 27 C26 C42, C45, 51 C50, C52	5000 MMFD GMV
C10	15 MMFD + or − 10% O° T.C. (Erie)
C12	FM Osc Trimmer
C13	1.5 MMFD (Erie Style "A")
C14, 15, 16, 17 21, 22, 23, 24, 28	Integral part of respective IF—XFMRS
C31, 32, 53, 7, 20	10,000 MMFD GMV
C25 36, 39, 54	100 MMF ceramic cond.
C29	4 - 50V Lytic condenser
C30	2000 MMFD Condenser
C33	470 MMFD Condenser
C34, 35 40, 44, 53	1000 MMFD GMV condenser
C41	.1 - 400V condenser
C43	.01 - 200V condenser
C46, 47 48, 49	40-350V, 30-300V FP Lytic Condenser 30-300V, 10-25V
R2	4.7K ohm Resistor
R3, R15	22K ohm Resistor
R4, R8, R14	1K ohm Resistor
R5, R19	100K ohm Resistor
R6, R12	68 ohm Resistor
R7, R13	10K ohm Resistor
R9, R26	47K ohm Resistor
R10, R23, R24	470K ohm Resistor
R11, R22	2.2M ohm Resistor
R16	.5M Vol. Cont. — SPST
R17, R18	12K Resistor
R20	220 ohm Resistor
R25	2.2K ohm
R27	3.3M ohm
R28	6.8M ohm
R30	270 ohm — 1 Watt
R31	100 ohm — 1 Watt
R32	1000 ohm — 5 Watt
R33	560 ohm
K1	CRL Triode couplate
L1	AM Grid Choke on R1
L2A, B	AM Osc. Coil
L3	FM Osc. Coil
L4	FM Cathode choke on R21
L5	FM plate choke
L6	FM RF Coil
D-1	Dial Scale
L7, 8	Filament choke
T1	1st FM IF
T2	1st AM IF
T3	2nd FM IF
T4	2nd AM IF
T5	Ratio Detector
T6	Out Put XFMR
T7	Power XFMR
	Loop Ant.
B	No. 44 Pilot Light
	Line cord
	300 ohm Line Di-Pole Ant.

K=1000
M=1,000,000
All Resistors ½ Watt unless otherwise noted.

Values of Capacitors in MFD. unless otherwise stated.
Tolerance on Capacitors and Resistors + or − 20% unless otherwise stated.




300 OHM ANT
V1 RF AMP 6BC5 6CB6 6AG5
V2A CONVERTER ½6J6
TEST POINT
C12 FINE TUNE
V8 SOUND I.F. AMP 6AU6
V9A RATIO DET ½6T8
R43-1.0M VOL. CONTROL
V9B AF AMP ½6T8
V10 AUDIO OUTPUT 6V6
SPEAKER 3.2 Ω V.C.
BRIGHTNESS CONTROL
V3 1ST VIDEO I.F. 6CB6
V4 2ND VIDEO I.F. 6CB6
V5 3RD. VIDEO I.F. 6CB6
V6 VIDEO-DET.-AGC 6AL5
V7 VIDEO AMP. 6AC7
V13 AGC KEYER 6AU6
V20 C.R.T.
V11 SYNC SEP. CLIPPER 12AU7
V12A VERT OSC. ½6BL7
V12B VERT AMP. ½6BL7
YOKE INDUCTANCE 8.3 MH HORIZ. 48 MH VERT.
VERT. HOLD CONTROL
HEIGHT CONTROL
VERT. LIN. CONTROL
RECT. 5U4
2 HY-220 MA.
117 V. 60 CYCLE A.C.
5-AMP FUSE
TO V13, V16 FILS
8.3 AC FILS
V14 PHASE DET. 6AL5
V15A HOR. MULTIVIBRATOR ½6SN7
V16 HOR. OUTPUT 6BG6
V17 H.V. RECTIFIER 1B3
V18 DAMPER 6W4
HORIZ HOLD
¼ AMP FUSE
WIDTH CONTROL
500 MMF-20KV
NOTES:
WHEN 6AG5 OR 6BC5 TUBES ARE USED FOR V3, V4, AND V5, PIN NO. 7 IS UNCONNECTED.
ALL RESISTORS IN OHMS EXCEPT K=1000 Ω AND M=1000000 Ω.
ALL CONDENSERS IN MFD. UNLESS OTHERWISE NOTED.



Ref. No.	Part No.	Description
C11	CDG05015C	1.5 MMF ±.25 MMF ceramic disc GP
C12		Fine tuning condenser
C13	CVC05090ST	3-9 MMF ceramic trimmer
C14	CBZ05802Y	800 MMF GMV feed through
C15	CBZ05802Y	800 MMF GMV feed through
C16	CBZ05802Y	800 MMF GMV feed through
C17	CBZ05802Y	800 MMF GMV feed through
C18	CCU05121K	120 MMF ±10% ceramic tubular N750
C19	CDZ05102Y	1000 MMF GMV ceramic disc

The general instructions for servicing this tuner are very similar to those outlined in the service manual for the pentode tuner as regards oscillator adjustments, disassembly, contact cleaning and etc. The schematic and parts list for the cascode tuner are given below. The part number for the complete tuner assembly with tubes is A-4110-33.

PARTS LIST FOR CASCODE TUNER

CAPACITORS

Ref. No.	Part No.	Description
C 1	CBZ05802Y	800 MMF GMV feed through
C 2	CDZ05102Y	1000 MMF GMV Ceramic disc
C 3	CVC030ST	.5-3 MMF Trimmer
C 4	CDP05470K	47 MMF ±10% Ceramic disc N140
C 5	CDP05470K	47 MMF ±10% Ceramic disc N140
C 6	CVC030ST	.5-3 MMF Trimmer
C 7	CDC05068C	6.8 MMF ±.25 MMF ceramic disc NPO
C 8	CDU05050D	5 MMF ±.5 MMF ceramic disc N750
C 9	CDC05039C	3.9 MMF ±.25 MMF ceramic disc NPO
C10	CDC05100K	10 MMF ±10% ceramic disc NPO

RESISTORS

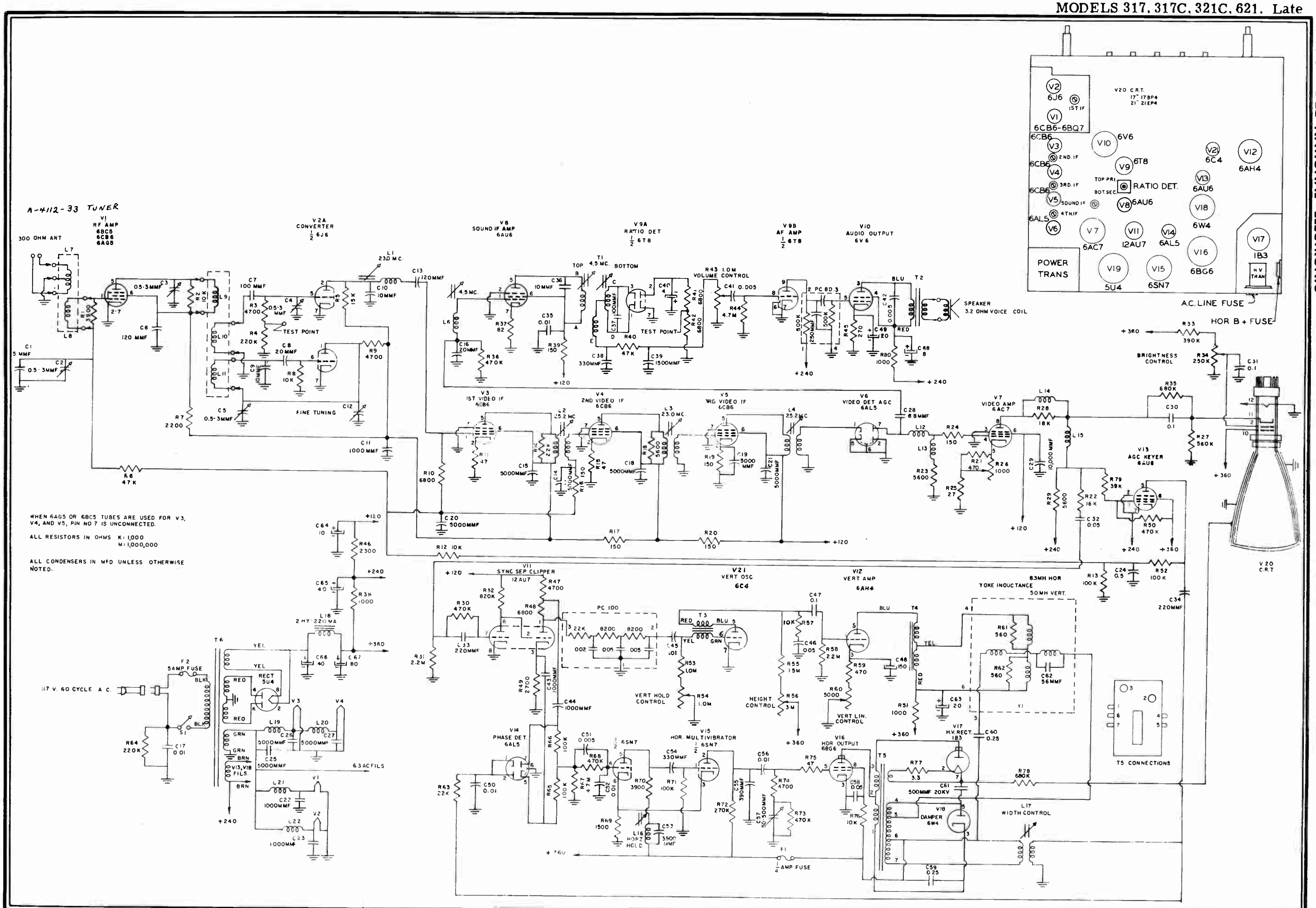
½ watt carbon composition insulated

R 1	RCC164J	160K ± 5%
R 2	RCC104J	100K ± 5%
R 3	RCC104K	100K ± 10%
R 4	RCC103M	10K ± 20%
R 5	RCC152M	1500 ohms ± 20%
R 6	RCC224M	220K ± 20%
R 7	RCC103K	10K ± 10%
R 8	RCC153K	15K ± 10%
R 9	RCC473M	47K ± 20%
R10	RCC103K	10K ± 10%

COILS

L 1, L 2	Antenna coil assembly (Specify channel)
L 3, L 4, L 5	Mixer / oscillator coil assembly (Specify channel)
L 6	6BQ7 filament choke
L 7	RF plate choke
L 8	6J6 filament choke
L 9	Mixer plate shunt choke
L10	Mixer plate series choke
L11	Mixer plate tuning coil

When ordering parts please give model number, chassis number and serial number of receiver. Give description and part number of items (if available) and specify that parts are for use in Cascode tuner.


A-4112-33 TUNER
WHEN 6AG5 OR 6BC5 TUBES ARE USED FOR V3, V4, AND V5, PIN NO 7 IS UNCONNECTED.
ALL RESISTORS IN OHMS K=1,000 M=1,000,000
ALL CONDENSERS IN MFD UNLESS OTHERWISE NOTED.
POWER TRANS
A.C. LINE FUSE
HOR B+ FUSE
T5 CONNECTIONS
V20 C.R.T.

OLYMPIC TELEVISION RECEIVERS, CHASSIS TYPES TM AND TN

These models are twenty tube direct viewing television receivers differing only in type of cabinet, size of speaker and their use in conjunction with a radio receiver and automatic record changer in the combination models. A 17" electrostatically focused rectangular tube (17HP4) is used in the 17" models and a 21" magnetically focused rectangular tube (21ZP4A) is used in the 21" models. Replacement, in all cases, must be of the identical size and type.

Service information for radio chassis in combination models will be found in the Operating and Service Instructions (IB-3020), which is furnished with each set along with operating instructions for the automatic record changer.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

TUBE COMPLEMENT	REF. NO.	FUNCTION
6BK7 or 6BQ7	V1	RF Amplifier
6J6	V2	RF Oscillator and Converter
6AU6	V3	2nd Sound IF Amplifier
6AL5	V4	Ratio Detector
6AV6	V5	Audio Amplifier
6W6/GT	V6	Audio Output
6CB6	V7	1st Video IF Amplifier
6CB6	V8	2nd Video IF Amplifier
6CB6	V9	3rd Video IF Amplifier
6U8	V10A-1/2	Video Detector & AGC
	V10B-1/2	1st Sound IF Amplifier
6AC7	V11	Video Amplifier
12AU7	V12	Sync Separator & Clipper
12AU7	V13	Sync Amplifier & Noise Clipper
12BH7	V14	Vertical Oscillator & Amplifier
6SN7/GT	V15	Horizontal Oscillator & AFC
6BQ6/GT	V16	Horizontal Output
1B3/GT	V17	High Voltage Rectifier
6W4/GT	V18	Damper
5U4/G	V19	Power Rectifier
17HP4	V20	Picture Tube — TM Chassis
21ZP4A	V20	Picture Tube — TN Chassis

Power Supply .... 105-125 Volts 60 Cycle AC only
Power Consumption .... 185 Watts TM — 200 Watts TN
Speaker:
- 17T56, 21T58, 21T69, 21T70.......... 5" PM
- 21T74 .... 8" PM
- 17C57, 17K55, 21C65, 21C68, 21C72, 21C73, 21D60, 21D64, 21K61, 21K62, 21K63 .... 10" PM

Voice Coil Impedance .... 3.2 Ohms at 400 Cycles
Antenna Input Impedance .... 300 Ohms

OPERATING CONTROLS (SEE FIG. 1)

Front Panel — Exposed

Channel Selector / Fine Tuning .... Dual Control
Power Switch and Volume / Contrast (Picture) Control .... Dual Control

Front Panel — Concealed

Horizontal Hold .... Single Control
Vertical Hold .... Single Control
Brightness .... Single Control
Local-Distance Control .... Switch

NON OPERATING CONTROLS (SEE FIGS. 1 AND 6)

Width Control .... Top Chassis Screwdriver Adjustment
Horizontal Drive .... Rear Screwdriver Adjustment
Horizontal Oscillator .... Top Chassis Screwdriver Adjustment
Horizontal Phasing .... Top Chassis Screwdriver Adjustment
Height .... Front Panel Screwdriver Adjustment (Concealed)
Vertical Linearity .... Front Panel Screwdriver Adjustment (Concealed)
Centering .... Centering Magnet on Neck of Pix Tube
Focus .... Single Control — Screwdriver Adjustment (Concealed) Front Panel — TN Only

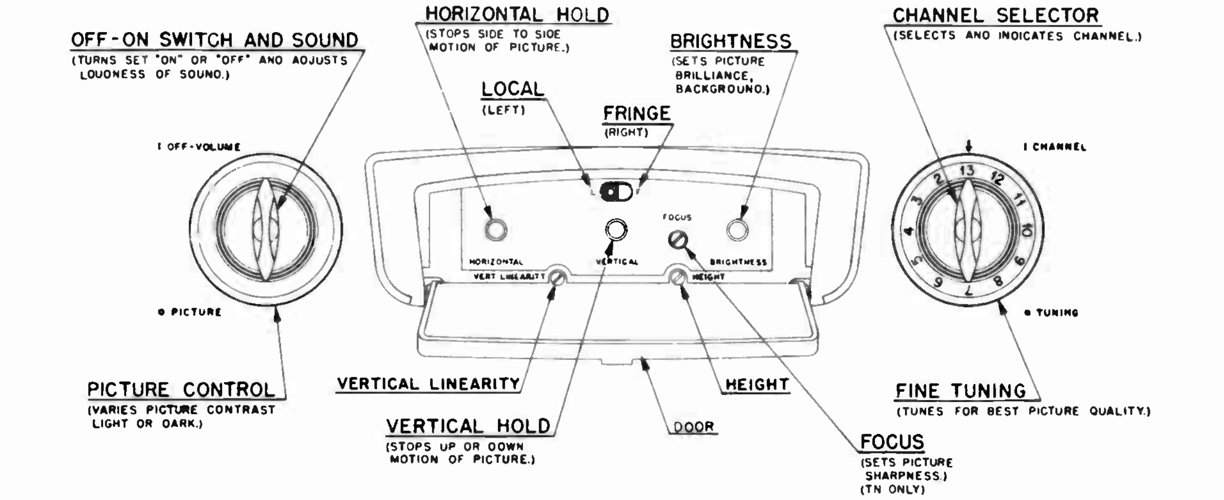


FIG. 1

CIRCUIT DESCRIPTION

GENERAL

The Olympic receivers covered by this manual use the Intercarrier type of Video and Sound IF System. Both Picture and Sound signals are received by the tuner, converted to an IF frequency and then fed, together, through three stages of video IF amplification. At the Video detector stage the two signals are separated. The sound signal is fed into a Sound IF Amplifier and then through a Ratio Detector, an Audio amplifier, an Audio Output stage and ultimately to the speaker. The Video signal with its accompanying Sync pulses are fed through a Video Amplifier after which the Sync pulses are diverted into four Sync Separating and Clipping Stages and from there to the Vertical and Horizontal Sweep Oscillators. The Video information is fed from the Video amplifier to the Cathode of the Cathode Ray (Picture) Tube.

TUNER

These receivers include the Olympic "Rocket" Tuner which is of the new cascode type. The principal advantages of the Rocket tuner are; greater sensitivity, improved Signal-to-noise ratio, and low radiation. Most of these properties are accomplished through the use of a dual triode (6BQ7 or 6BK7 — V1) in which the two sections of the tube are separated by a grounded shield. The first triode is used as grounded cathode amplifier and the AGC voltage, generated later in the Video Detector and AGC Stage, is applied to the grid. The second Triode section of the tube is a Grounded Grid Amplifier and is directly coupled to the first section. The first section is neutralized by a factory adjusted coil to resonate with the grid-cathode capacity of the second section. The overall gain of the two stages is only slightly higher than that of a single pentode but through the use of triodes, which have a smaller amount of tube noise, the signal to noise ratio is greatly improved.

The Oscillator and Mixer stages are essentially the same as earlier Olympic turret type tuners with the addition of a complete shield covering the entire underside of the tuner, internal shielding, and added decoupling, all to minimize radiation.

PICTURE IF SYSTEM

These receivers have three stages of Video IF Amplification. 6CB6's are used in all three positions (V7, 8 and 9). The first IF coil (L301) is located on the tuner and functions as the output coupling of the tuner. The second IF coil (L-5) is followed by the Adjacent Sound Trap (L-6). The adjacent sound trap eliminates interference in the picture which might be caused by the sound signal of the next lowest channel when the lower channel is used in the same area. The third Picture IF transformer (L-7) has no trap but the Fourth Picture IF (L-8) is followed by an Accompanying Sound Trap (L-9). All coils and traps are adjusted from the top of the chassis. The IF coils are "stagger-tuned" to four frequencies described later in this manual under "RF-IF Alignment Procedure."

VIDEO DETECTOR AND AGC

Both video detection and the development of the AGC voltage are accomplished in the triode section of a 6U8 (triode-pentode) V10. Video detection occurs between cathode (Input) and grid (output) while the AGC voltage is generated from cathode (input) to plate (output) of this triode (V10A). The AGC voltage is fed to the tuner and to the IF stages in the "local" position of the "Local-Distance" switch. In the fringe position "Average" AGC from the Detector load resistor is fed to the IF stages and half the AGC voltage to the tuner.

The sound portion of the composite signal is picked off the output of the Video detector by the 1st Sound IF Amplifier. This stage utilizes the pentode section of the 6U8 (V10B).

VIDEO AMPLIFIER

The signal that is fed into the grid (Pin 4) of the 6AC7 Video Amplifier (V11) has already had the sound information removed. (See "Video Detector and AGC" above). The Video information and the Sync and Blanking pulses are amplified in this stage. The Sync is picked off through an "RC" network consisting of R42 and C37 in the Plate circuit and fed to the Sync Separator and Clipper stages (V 12). The Video information goes to the cathode of the Kinescope (V 19 — Pin 11) after passing through a 4.5 Mc trap (L10) to eliminate any sound interference in the picture.

SYNC SEPARATOR AND CLIPPERS

The sync system of these receivers employs four stages. Two dual triodes, both 12AU7's, (V12 & V13). The first triode of the first tube (V12) is the sync separator stage. This in turn feeds into the first triode of the second tube (V13), the sync amplifier. The sync amplifier supplies pulses to the Horizontal AFC and oscillator (V15) and simultaneously to the Vertical Blocking oscillator (V14) (through the vertical integrating network). The second half of the first tube (V12) is the sync clipper and the second half of the second tube (V13) is the noise clipper.

SWEEP SYSTEM — VERTICAL

The second triode of the 12BH7, Vertical Oscillator and Output tube (V 14) serves as a vertical oscillator and discharge tube. The sync pulses from the Sync Separator and Clipper (V 12), after being shaped by the Vertical Integrating Network, are used to control the frequency of this section. The output of the oscillator stage is amplified in the first section of the same tube (V 14) and then fed through the Vertical Output Transformer to the vertical windings of the Deflection Yoke.

SWEEP SYSTEM — HORIZONTAL

The Horizontal Oscillator is essentially of the blocking oscillator type. The operation of the A.F.C. system depends upon a correcting voltage developed in the control section of the Horizontal Oscillator and AFC tube (V 15) where the oscillator output and the incoming pulses differ in either phase or frequency. The control tube, (first section V 15) is maintained at cut-off until such time as the sync pulse is either ahead or behind the Oscillator sawtooth peak. When either case occurs the control tube develops a voltage which is applied as a bias to the oscillator grid and alters the oscillator frequency to coincide with the frequency of the incoming pulses. The Horizontal Oscillator transformer (L16) has an adjustable core which is a coarse adjustment of the oscillator frequency and the front panel Horizontal Hold Control is a fine adjustment in the same sense.

Note: Many of the components in the horizontal circuits are of critical value and therefore should only be replaced by the exact replacement part. Care should also be taken in dressing leads and locating parts when replacing. This can be accomplished by carefully noting positions of parts and leads before removal.

SOUND SYSTEM

The sound carrier is taken off the plate (Pin 1) of the Video detector and AGC tube (V10A) and fed into the grid of the 1st Sound IF Amplifier (V10B — Pin 2) and from there through the Ratio Detector (V4), the Audio Amplifier (V5), the Audio Output tube (V6) and then to the speaker.

HIGH VOLTAGE POWER SUPPLY

The Energy stored in the horizontal windings of the deflection yoke during the forward sweep produces high voltage surges during retrace. This is multiplied by the "Auto Transformer" (primary) winding of the Horizontal Output Transformer (TR 2771) and is then rectified by a 1B3/G (V17) to provide approximately 15 Kilovolts for the picture tube anode (V20).

"B" VOLTAGE POWER SUPPLY

The "B" voltage in these chassis is provided by a standard transformer-rectifier circuit. The secondary of the Power Transformer provides, in addition to a center-tapped "B" voltage winding, a five-volt filament winding for the 5U4G Power Rectifier (V19), and two six-volt windings. One six-volt source is used for the filaments of the Damper Tube (V18) only, and the other for the filaments of all other tubes. A "B" voltage of +145 volts is derived from the cathode of the 6W6/GT Audio Output Tube (V 6). This voltage is utilized primarily in the IF circuits and removal of the 6W6 from its socket will therefore make the entire IF strip inoperative.

ADJUSTMENTS

ION TRAP MAGNET ADJUSTMENT

Turn the brightness control fully clockwise and the contrast control fully counterclockwise. Adjust the ion trap magnet by moving it forward or backward and at the same time rotating it slightly around the neck of the kinescope until the raster on the screen is brightest. Of two possible positions, use the one nearest the tube base. Reduce the brightness control setting until the raster is slightly above average brilliance. Adjust focus control until the line structure of the raster is clearly visible (sharp). Readjust the ion trap magnet again for maximum raster brilliance. The final touches on this adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained. Never correct for a shadowed raster with the ion trap.

DEFLECTION YOKE ADJUSTMENT

If the lines of the raster are not horizontal or squared with the picture mask. Loosen the deflection yoke adjustment screw and rotate the deflection yoke until this condition is obtained, and retighten the yoke adjustment screw. If neck shadow is evident or the corners of the raster are dark, the deflection yoke must be moved forward as far as possible and the wing screw retightened.

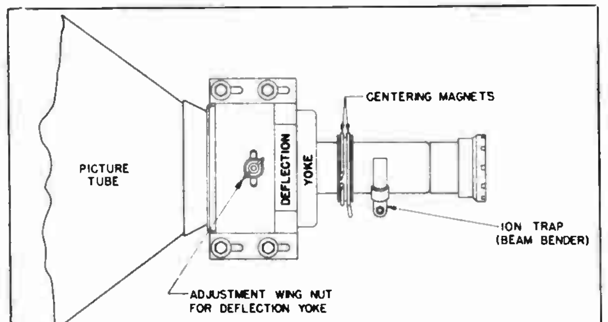


FIG. 2 - TM ONLY

CENTERING MAGNET ADJUSTMENT (17"—"TM" ONLY)

The centering magnet consists of two magnetic rings located on the neck of the picture tube. Each ring has a small tab and adjustment is accomplished by rotating these tabs around the neck of the tube. The tab which extends horizontally will affect the vertical position of the picture and the tab which extends vertically will affect the horizontal position of the picture. The two magnetic rings have their maximum affect when they are farthest apart but should never be more than 45° apart to avoid neck shadow.

CENTERING ADJUSTMENT (21" — "TN" — ONLY)

The 21" receivers are electromagnetically focused and centering is accomplished by adjusting an arm which extends vertically from the front of the focus coil. This arm may be rotated, for a limited distance, around the neck of the tube and may also be moved up and down. The physical setting of the focus coil itself in relation to the neck of the tube will also affect picture position. Before the adjustment arm is used, it should be ascertained that (1) the focus coil is at right angles to the neck of the tube (by setting the two nuts which tighten the tube support rods) and (2) that the neck of the tube is directly centered in the focus coil (by loosening the two mounting screws on either side of the focus coil and sliding up or down).

Note: Remove corrugated shipping clip from around neck of pix tube before attempting any adjustments.

ADJUSTMENT OF HORIZONTAL OSCILLATOR

(1) Allow set to warm up to operating temperature. Select station operating normally.

(2) Short out horizontal Phasing Coil (L 17) Terminals C and D.

(3) Set horizontal hold control at maximum clock-wise rotation.

(4) Adjust horizontal frequency screw (L 16) until picture falls into sync. Turning the horizontal frequency screw (L 16) clockwise lowers the frequency, (bars sloping downward to left). Turning the screw counter-clockwise increases frequency (bars sloping downward to right).

(5) Connect vertical input lead of oscilloscope with 5 MMF isolating condenser in series to terminal "C" of horizontal oscillator transformer and ground oscilloscope to chassis. Set frequency of scope to approximately 5 KC.

(6) Remove short from terminals of the horizontal phasing coil (L 17) and adjust screw (L 17) until wave shape as observed on scope is like that shown in sketch. (See Fig. 3.)

(7) Some further adjustment of horizontal frequency screw (L 16) may be necessary to keep picture in sync after adjusting L 17 for proper wave shape.

(8) Remove scope from terminal "C" and retouch L 16, as per "9" below.

(9) Turn horizontal hold control through entire range. Picture should fall out of sync at either end of rotation. At full clockwise rotation blanking bar or jitter should be evident. At full counter-clockwise position picture should fall out to $4\frac{1}{2}$ to 5 bars sloping downward to the left. (If picture stays in sync the tuner switch should be rotated to interrupt signal momentarily)

Caution: It is important that the picture be centered in the mask properly with the horizontal hold control in the mid-position, otherwise the set user may attempt to center the picture by means of the hold control. Under this condition the control may be on "edge" and impulse noise or change of camera will cause the picture to fall out of synchronization. It should also be noted that some manufacturers types of 6SN7GT may perform better than others in the horizontal oscillator socket and excessive drift of the horizontal oscillator circuit may be caused by a weak or defective 6SN7GT tube.

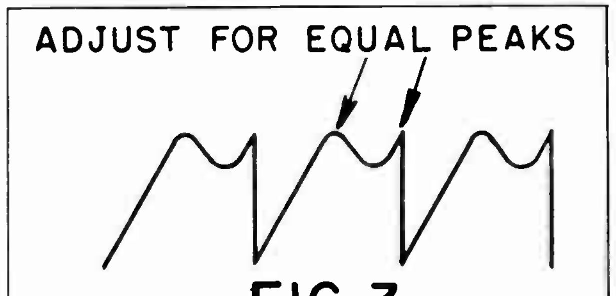


FIG. 3

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS

For best results it is preferable that these adjustments be made on a transmitted test pattern; although satisfactory results can be obtained from an active picture.

Both controls will affect the height **AND** linearity of the picture and therefore must be adjusted simultaneously. It will be found that the Height Control has a tendency to affect the bottom of the picture more than the top and the linearity control just the reverse.

Note: It is advisable that both height and width of the picture be adjusted to a size slightly larger than the mask opening, so that during periods of low line voltage adequate picture size is maintained.

HORIZONTAL WIDTH & DRIVE ADJUSTMENT

The Horizontal Width Control Coil (L19) and the Horizontal Drive Trimmer (C67) should be adjusted simultaneously. The Horizontal Drive Trimmer should be screwed tight (clockwise) and then backed off (counter-clockwise) until Horizontal Drive bars appear. Then turn Drive Trimmer in again (clockwise) until drive bars, just disappear. (Note: In some sets no horizontal drive bars will appear regardless of Drive Trimmer adjustment. In these sets the trimmer should be set at 2 turns out (counter-clockwise) from tight.) After the drive trimmer has been set, the width coil should be adjusted for proper picture width to fill the mask aperture.

Important: The horizontal oscillator frequency must be checked for proper range of horizontal control after any adjustment of horizontal drive (C67). Any adjustment of C67 will usually require resetting of the horizontal frequency adjustment coil (L-16).

BUILT-IN ANTENNA

All models are equipped with a built-in antenna which provide satisfactory reception in many locations. In areas of weak reception an outside antenna will substantially improve the performance of the receiver. Antenna binding posts are provided at the rear of chassis and are accessible through the opening in the masonite back to permit the connection of an outside aerial. The built-in antenna is normally connected to the antenna posts and must be disconnected when attaching the outside aerial. To prevent the lead-in wires of the built-in antenna from contacting chassis parts and tubes, it is recommended that the lead-in wire be folded and held in place by tape or a rubber band. In some cases reception can be improved by changing the location of the receiver in the room when set is operating with built-in antenna.

RF-IF ALIGNMENT PROCEDURE

EQUIPMENT REQUIRED

(1) RF signal generator to provide the following accurate frequencies:

(a) 4.5 Mc (Video Amplifier Trap, Sound IF and Ratio Detector)

(b) IF Frequencies

21.75	MC	Accompanying Sound Trap (L9)
27.75	MC	Adjacent Sound Trap (L6)
25.5	MC	First Pix IF Transformer (L301)
23.25	MC	Second Pix IF Transformer (L5)
25.25	MC	Third Pix IF Transformer (L7)
23.25	MC	Fourth Pix IF Coil (L8)
21.75	MC	Sound Carrier Marker
26.25	MC	Picture Carrier Marker
23.5	MC	Shoulder Marker

(c) **RF Frequencies**

CHANNEL NUMBER	PICTURE CARRIER FREQ. MC	SOUND CARRIER FREQ. MC
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

(d) Output on these ranges should be adjustable and capable of providing at least .1 volt.

If the accuracy of the generator frequencies is not known, some type of crystal calibrator should be utilized to check the correct settings of the RF generator for each particular frequency.

(2) Electronic Voltmeter

(3) Cathode Ray Oscilloscope, 3" minimum screen.

(4) RF Sweep Generator, meeting the following requirements:

(a) Frequency Ranges:

18 to 30 MC
40 to 90 MC } 10 MC sweep width
170 to 225 MC

(b) Output adjustable to .1 volt.

TO REMOVE CHASSIS FROM CABINET

Remove: (1) Line cord from power outlet
(2) Masonite back.
(3) Antenna Lead-in from terminal posts.
(4) Speaker plug from rear of chassis.
(5) Knobs from front of cabinet.
(6) Four mounting screws and washers from bottom of cabinet.

In sliding chassis out of cabinet, be careful that the kinescope tube does not strike against speaker or any other obstruction.

Before proceding it will be necessary to use an extra line (or "cheater") cord to supply AC current to the chassis as the set's line cord is attached to the masonite back of the cabinet.

ORDER OF ALIGNMENT

When complete receiver alignment is necessary, it should be performed in the following sequence:

(1) Accompanying Sound Trap
(2) Adjacent Sound Trap
(3) Pix IF Coils
(4) 4.5 MC Trap
(5) 4.5 MC Sound IF and Ratio Detector
(6) Tuner

After removing chassis from cabinet re-connect power and speaker plugs.

If a local station is not operating on Channel 9 set the tuner to this channel, turn on power switch and proceed as follows: (If 9 is a local station, use Channel 8 or 10.)

ACCOMPANYING AND ADJACENT SOUND TRAPS

Insert a 100,000 ohm $1/2$ watt resistor in series with the "Hot Lead" of the electronic voltmeter and connect to the junction of L12 and C33. Meter switch should be set to the lowest negative scale. Ground lead of meter should be connected to chassis.

Remove the shield of the RF Oscillator and Mixer tube (V2) from ground clips leaving shield resting on tube and connect hot lead of the RF Signal Generator to it. This will couple generator output to mixer plate.

Set the generator frequency accurately to 21.75 MC, and adjust (L9) sound trap (See Fig. 6 Tube and Trimmer Layout) for **minimum** reading on voltmeter.

Set the generator frequency accurately to 27.75 MC and adjust (L6) Adjacent Sound Trap for **minimum** reading on voltmeter.

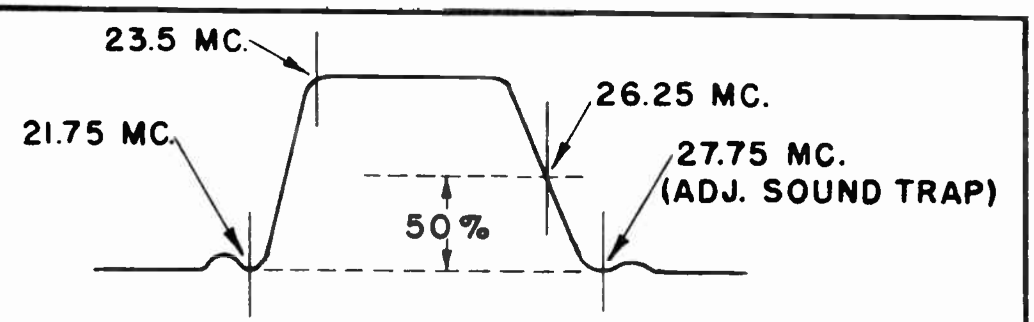


FIG. 4 STANDARD RESPONSE CURVE

PIX IF COIL ADJUSTMENT

Adjust the following slugs for maximum output at frequencies and sequence indicated with meter and generator connected as above: (See Sound Traps.)

L301	25.5 MC
L5	23.25 MC
L7	26.00 MC
L8	23.00 MC

Note: After setting L301 **DO NOT** readjust to improve wave shape.

If oscillation occurs during alignment, temporarily raise frequency of L5 by turning screw counter-clockwise until screw projects approximately 3/4". Oscillation is evidenced by high reading on voltmeter (—5V to —20V) with signal generator OFF and no signal coming in through the antenna terminals. After properly adjusting L301, L7 and L8 reset L5 to proper frequency, if it had been necessary to detune.

Connect hot lead of sweep generator through a 330 uuf condenser to test point on tuner and connect ground lead to chassis.

Connect vertical input terminal of oscilloscope to junction of peaking coil L12 and C33 and connect ground lead of scope to chassis.

Connect 1.5 V flashlight battery with positive terminal to chassis and negative terminal to junction of R32 and R33. Place the Local Distance Switch in the Local position. This point is origin of AGC bias voltage. Set tuner to Channel 9 unless local station is operating on this frequency, in which case an adjacent channel should be used.

Set Sweep Generator frequency to IF sweep on the 20 to 30 MC range.

Adjust sweep generator output to produce a curve on the scope which is approximately 2/3 of the screen diameter.

Loosely couple output of RF signal generator by using shield on V2 and set frequency of RF signal generator to 26.25 MC (marker).

Curve shown on scope should be similar to the response curve shown in Figure 4. For proper setting of the pix carrier the 26.25 MC marker should appear on the curve at a point approximately 50% of the vertical height of the curve.

To obtain this setting retouch L7.

Reset RF signal generator frequency to 23.5 MC and retouch L525 and L8 for correct positioning of marker on shoulder of curve.

Recheck setting of 26.25 MC marker to make sure that position has not shifted on curve.

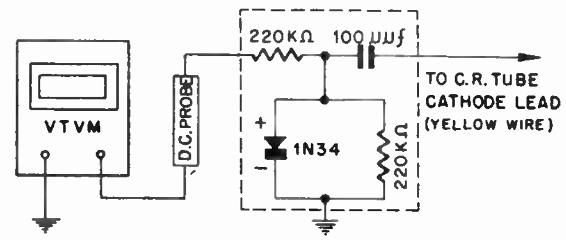
Disconnect bias battery.

Note: If the curve cannot be made to appear as above due to a local station or other interference, or if multiple markers appear, remove (V1-6BK7 or 6BQ7) RF tube from tuner.

4.5 MC TRAP ALIGNMENT

Connect voltmeter lead to Diode crystal rectifier as shown in Fig. 5. Connect Diode crystal rectifier between C.R. Tube Cathode lead (yellow wire) and chassis ground. Signal generator is connected at junction of L12 and C33. Set contrast control at maximum and voltmeter to 3 volt scale (negative). Remove 6CB6 (V9) from socket. Use maximum output of generator at 4.5 MC. Adjust L14 trap for **minimum** reading on meter.

When it is necessary to retouch this trap in the field, proper adjustment can be made by using the local station signal and turning the Fine Tuning Control to bring fine herringbone sound beat into the picture. The 4.5 MC trap (L14) should then be adjusted to minimize this beat interference.



VOLTMETER AND CRYSTAL DIODE CONNECTIONS

FIG. 5

SOUND IF TRANSFORMER, (4.5 MC) AND RATIO DETECTOR ADJUSTMENT

In view of the fact that the transmitted sound signal from a TV station is probably the most accurate available, as far as frequency is concerned, it is recommended that a working signal be used for sound alignment. The set should be connected to an antenna, turned on, allowed to warm up for about 5 to 10 minutes and then tuned for the best picture. A vacuum tube voltmeter should be connected to Pin 2-V4 and the meter set to the minus 30 volt scale. The 4.5 MC Sound IF Transformer (L1 & L2) and the primary of the Ratio Detector (L3 — bottom of chassis) should be tuned for maximum deflection of the meter. The vacuum tube voltmeter should then be connected to the junction of R10 and C9 and one side of the volume control and the secondary of the Ratio Detector (L4 — top adjustment) should be adjusted for a zero reading with the meter set to the 3 volt scale. The secondary can also be adjusted by ear by tuning L4 for the elimination of buzz in the sound.

TUNER ALIGNMENT FOR MODELS USING TUNER PART CL-2755-1

Note: Before making a complete tuner adjustment it is essential that all the IF, Trap, Sound and Discriminator circuits be aligned to their proper frequencies as described above. WHEN CHANGING THE CONVERTER TUBE IT IS NECESSARY TO REALIGN THE OSCILLATOR ADJUSTMENT ON ALL CHANNELS WITH THE V2 TUBE SHIELD IN PLACE.

A. RF and Converter Alignment

(1) Set Channel Selector switch to #12.

(2) Connect oscilloscope through 10,000 ohms to test point on tuner (bare tinned copper loop wire located between V1 and V2).

(3) Set fine tuning control at approximately midpoint of its tuning range. Temporarily connect jumper wire from Test Point "D" to chassis.

(4) Feed sweep generator into antenna terminals, sweeping channel 12.

(5) Adjust C301, C302 and C304 for flat top response curve. Check picture and sound carrier markers corresponding to frequencies shown in Service Data Section.

(6) Remove jumper from Test Point "D" to chassis.

B. Oscillator Alignment

Note: Oscillator adjustments (which are accessible through the hole in the front of the tuner) are provided for each channel. See "Tube and Trimmer Layout". Any oscillator coil slug can be adjusted without interaction on any other channel since individual coils are used for each of the 12 channels. This adjustment may be made on the station or with sweep generator and signal generator as follows:

(1) Set fine tuning control to midpoint of range. Do not touch during alignment.

(2) Connect sweep generator and marker (signal) generator to antenna terminals.

(3) Connect vertical input lead of scope with 50K resistor in series to test point A.

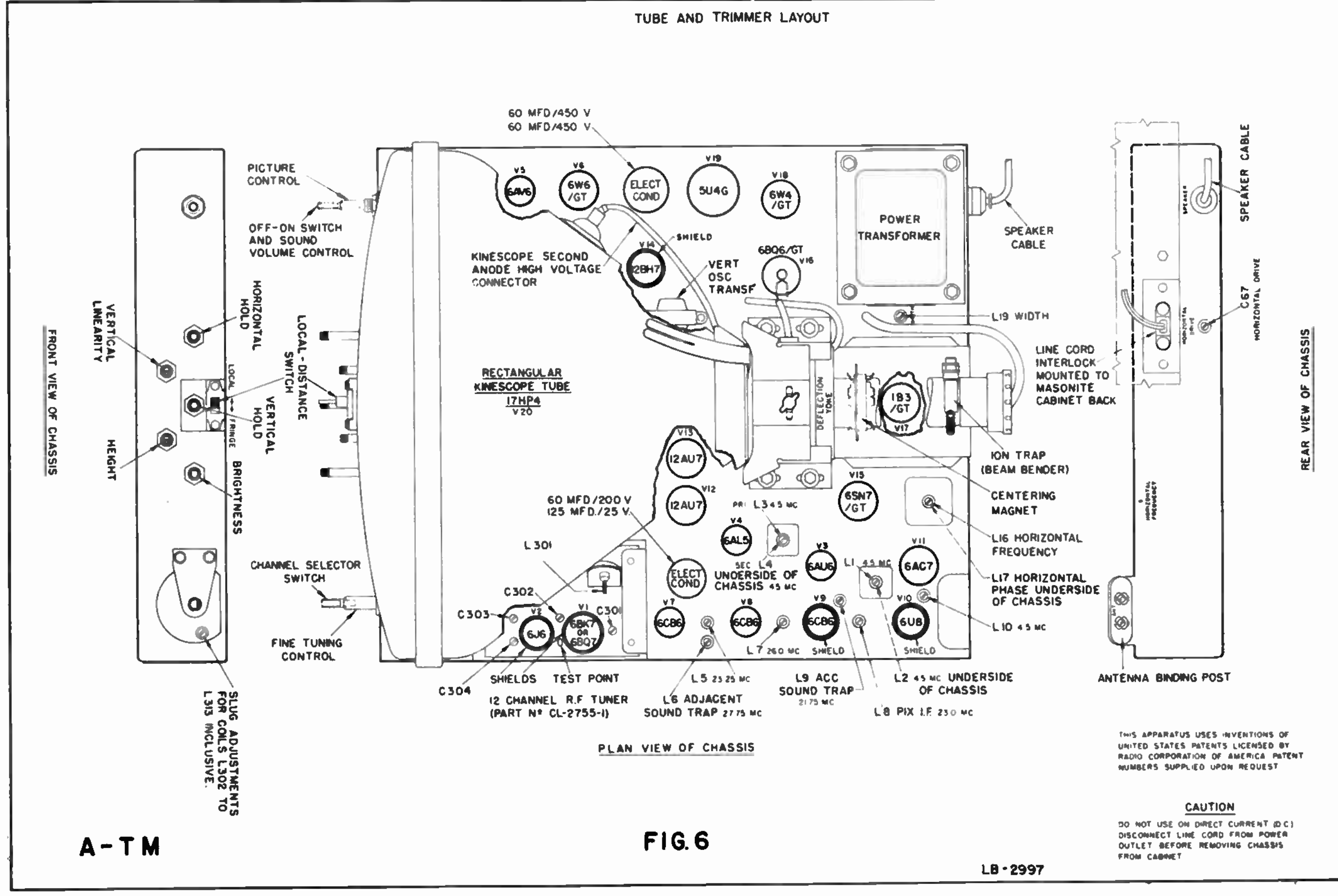
(4) Refer to following table for frequencies and adjustments.

Couple marker and Sweep Generator as in Section "B", Step 2

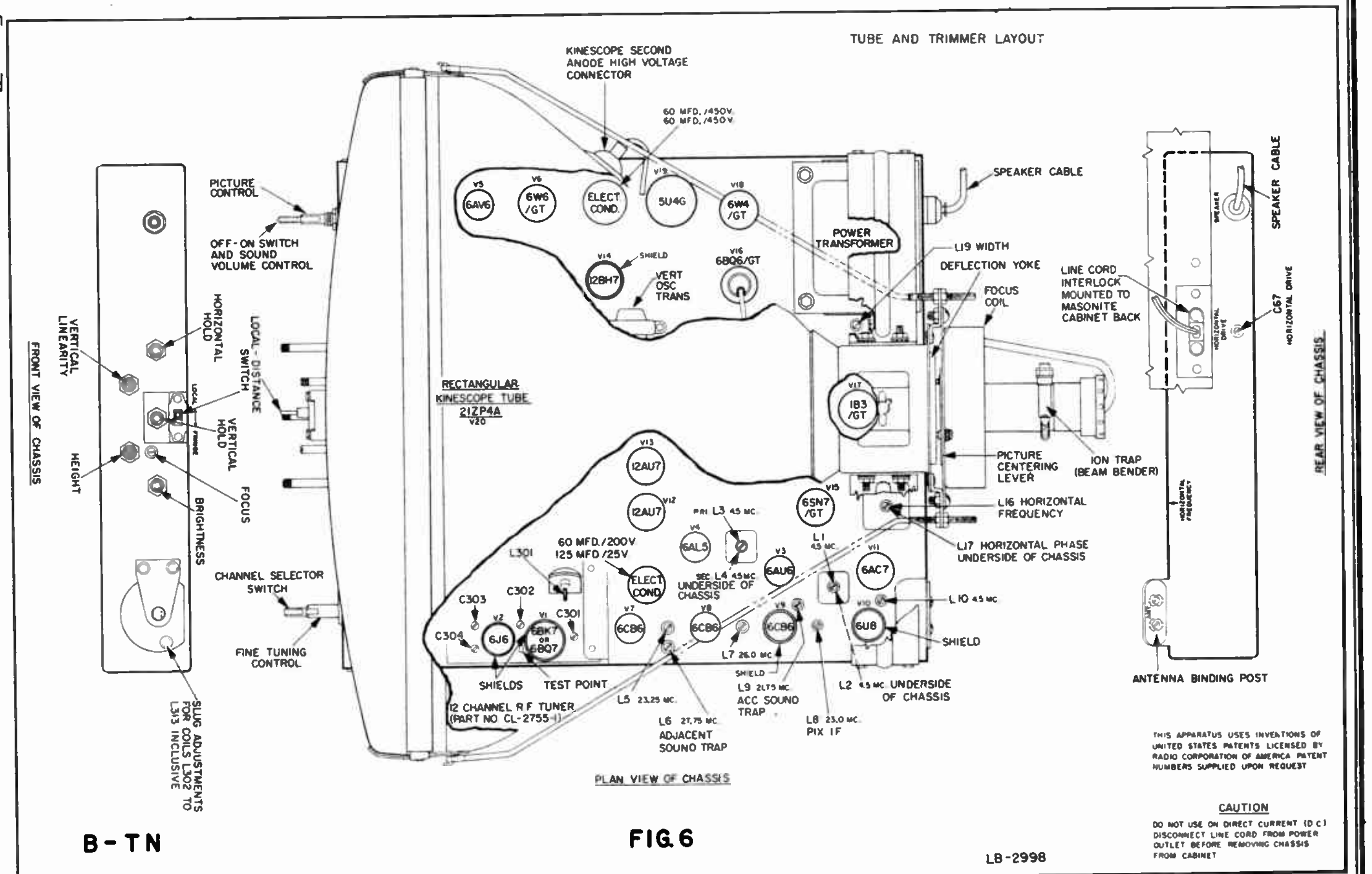
Connect Scope Through 10K Isolating Resistor to Test Point "A" and Low Side to Chassis

SIGNAL GENERATOR INPUT

Step	Sweep Gen.	Marker Gen.	Channel	Adjust	Procedure
1	207.0 MC.	209.75 MC.	12	L-312	Adjust for placement of 21.25 MC. marker as per response curve Fig. 4.
2	207.0 MC.	209.75 MC.	12	C-301 C-302 C-304	Adjust shape of response curve Fig. 4 for maximum amplitude and bandwidth.
3	213.0 MC.	215.75 MC.	13	L-313	Adjust as in Step 1.
4	201.0 MC.	203.75 MC.	11	L-311	Adjust as in Step 1.
5	195.0 MC.	197.75 MC.	10	L-310	Adjust as in Step 1.
6	189.0 MC.	191.75 MC.	9	L-309	Adjust as in Step 1.
7	183.0 MC.	185.75 MC.	8	L-308	Adjust as in Step 1.
8	177.0 MC.	179.75 MC.	7	L-307	Adjust as in Step 1.
9	85.0 MC.	87.75 MC.	6	L-306	Adjust as in Step 1.
10	79.0 MC.	81.75 MC.	5	L-305	Adjust as in Step 1.
11	69.0 MC.	71.75 MC.	4	L-304	Adjust as in Step 1.
12	63.0 MC.	65.75 MC.	3	L-303	Adjust as in Step 1.
13	57.0 MC.	59.75 MC.	2	L-302	Adjust as in Step 1.



A-TM FIG.6



B-TN FIG.6

OPERATING AND SERVICE INSTRUCTIONS

for

OLYMPIC AM-PHONO-TV 3-SPEED CHANGER COMBINATION

Frequency Range: A.M. 540-1620 kc.

Power Requirement: 105-120 Volts a-c 60 cycles.

Power Consumption: Receiver: 30 watts. Receiver with Record Changer: 50 watts.

IMPORTANT NOTICE:

This AM-PHONO-TV receiver and automatic 3-speed record changer console is for use on alternating current ONLY and should never be used on direct current.

Before operating the record changer it will be necessary to loosen the two record changer mounting screws completely as described in separate accompanying Record Changer Instruction Sheet.

This instrument is equipped with two separate chassis; one a 5 tube (including rectifier) AM chassis and a 20 tube (including rectifiers) television chassis. Built-in antennas are provided for both AM and TV sections of the receiver which will provide satisfactory reception under normal operating conditions. For AM reception an outside antenna will seldom be required whereas on TV the use of an outside antenna will generally improve the quality of reception.

AM RECEIVER CONTROLS: (see separate folder for television controls and operation)
The AM receiver has four control knobs marked according to their function, and reading from left to right as follows:

1. VOLUME   2. OFF-ON-TONE   3. AM-PH-TV   4. TUNING

NOTE: The power switches for operating the television and radio sections of this instrument are interconnected and therefore it is necessary that the power switch of the unit which is not in operation be turned to the "OFF" position.

TUNING:

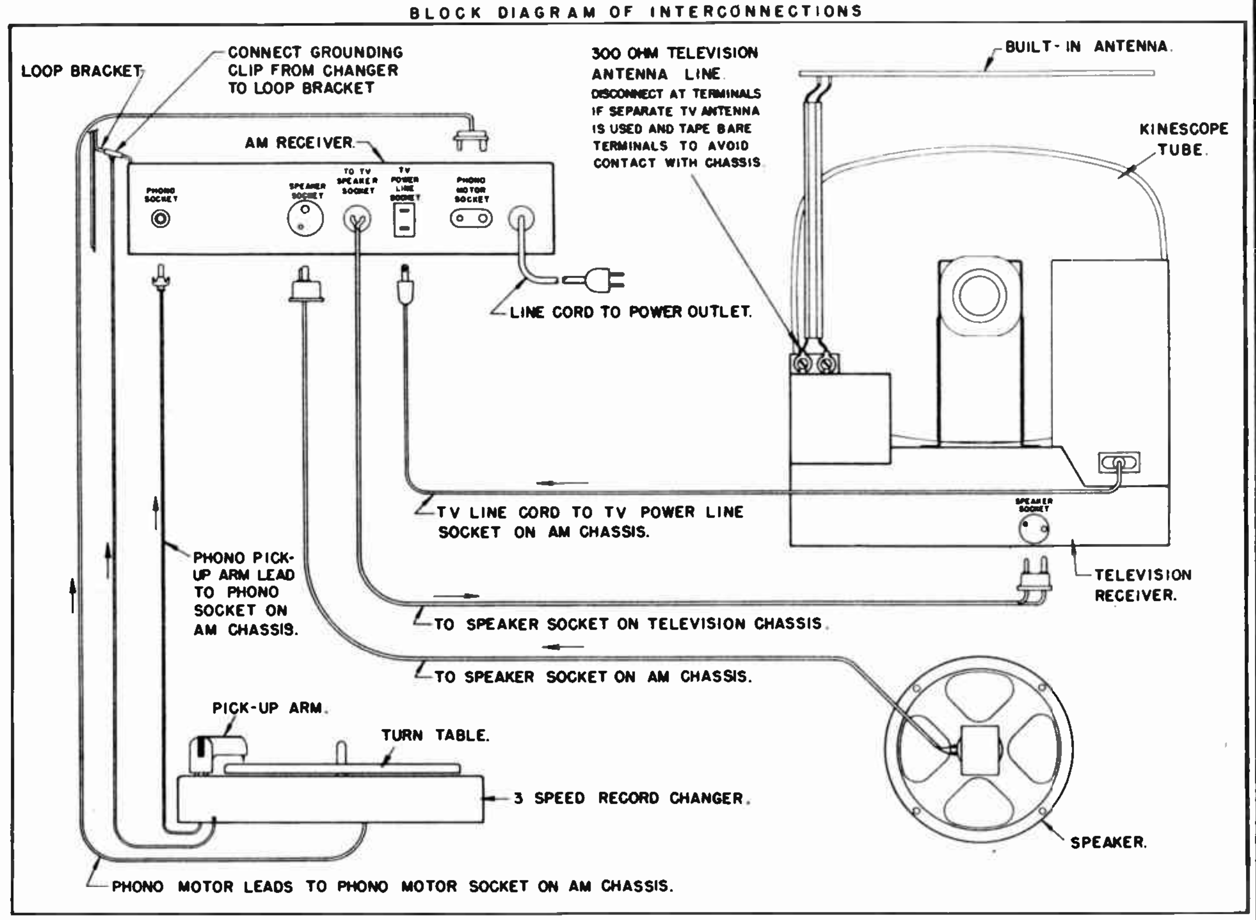
To place receiver in operation turn the OFF-ON knob clockwise until a click is heard. The tubes require a warm-up period of about one-half minute before the set is ready to function.

A.M.

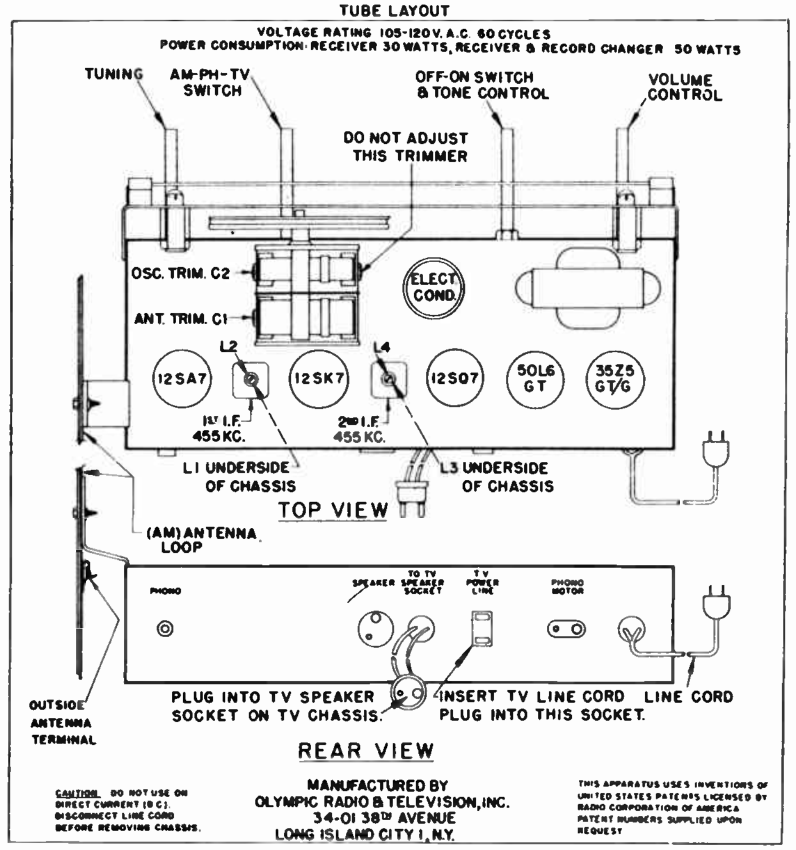
For AM reception turn AM-PH-TV knob to the position where AM faces the indicator dot. The tuning knob should now be turned until the dial pointer is at the frequency of the desired station. Dial numbers are converted to kilocycles by adding one zero. For example, 70 on the dial is 700 kilocycles. With volume control set to LOW volume level turn the station selector knob until the desired station is received loudest. Now adjust volume to the desired level and the tone control to the desired tone. DO NOT USE TUNING KNOB TO ADJUST VOLUME BY TUNING OFF STATION AS THIS WILL RESULT IN POOR TONE QUALITY.

NOTE: When operating this console as a Radio Receiver be sure that the motor switch on the record changer is in the OFF position.

BLOCK DIAGRAM OF INTERCONNECTIONS

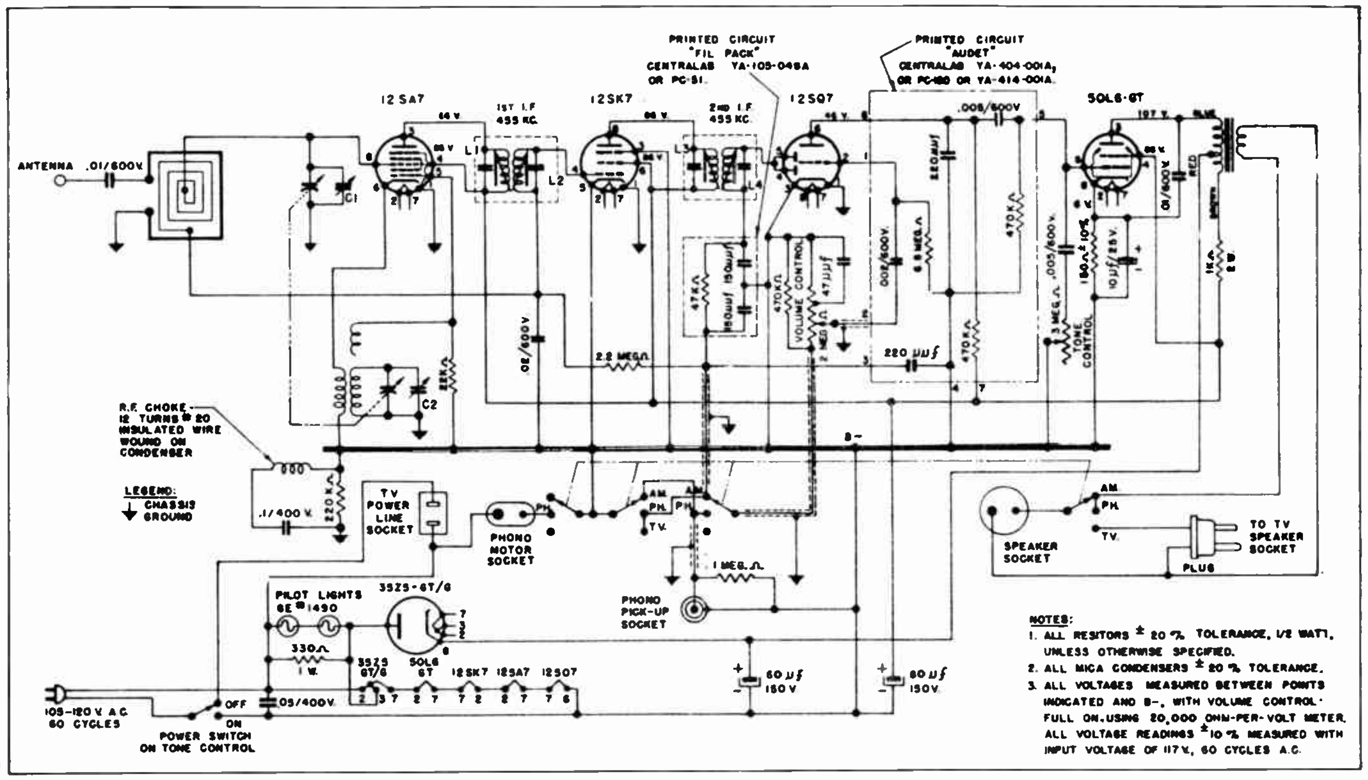


TUBE LAYOUT



LB-2822

CIRCUIT DIAGRAM



REPLACEMENT PARTS LIST

Part No.	Description
BU 2688	3.2v 16 amp GE # 1490 Pilot Light Bulb
CL 2709	Oscil. Coil
CO 1133	10 MFD/25 wv Electrolytic Cond.
CO 2820	60 x 80/150 wv Electrolytic Cond.
CO B 4503	.05/400 wv Tub. Paper Cond.
CO H 4104	.1/400 wv Tub. Paper Cond.
CO H 6103	.01/600 wv Paper Cond.
CO H 6203	.02/600 wv Tub. Paper Cond.
CO H 6502	.005/600 wv Paper Cond.
CV 2681	2 gang Variable Condenser
DL 2682	Glass Dial Scale
KN 422	Walnut Knob "Volume"
KN 423	Walnut Knob "Off-On Tone"
KN 425	Walnut Knob "Tuning"
KN 2684	Walnut Knob "AM-PH-TV"
LC 748	Line Cord
LP 2687	Loop
MS 965	Dial Back Plate St. C.P.
PC 2477	Audet Network
PC 2478	Fil-Pack Network
PL 637	Alden 2 Prong Plug
PO 1011	Pointer, Dial
PT 567	2 Meg. Volume Control, Tapped
PT 2160	3 Meg. Tone Control, SPDT Switch
RCM 20A470M	47 MMF ± 20% Mica Cond.
REB 105M	1 Meg ± 20% 1/2 Watt Resistor
REB 151K	150 ohms ± 10% 1/2 W. Resistor
REB 223M	22K ± 20% 1/2 W. Resistor
REB 224M	220K ± 20% 1/2 W. Resistor
REB 225M	2.2 Meg 20% 1/2 W. Resistor
REB 474M	470K ± 20% 1/2 Watt Resistor
REC 331K	330 ohms ± 10% 1 W. Resistor
RED 102M	1000 ohms ± 20% 2 W. Resistor
SH 238	Drive Shaft Brass 2 1/4"
SO 638	2 Prong Speaker Receptacle
SO 764	2 Prong Motor Socket
SO 1650	A.C. Power Outlet
SO 2705	Pilot Light Socket Assembly
SW 2689	Band Switch
TR 1644	AM-IF Transformer (K-Tran)
TR 2690-1	Output Transformer

RECORD CHANGER OPERATION:

To operate the record changer, turn the AM-PH-TV knob so that PH faces indicator dot. Leave the "OFF-ON' 'knob in the "ON" position and adjust volume and tone with the same knobs as used in receiver operation. FOR DETAILED INSTRUCTIONS CONCERNING RECORD CHANGER SEE SEPARATE FOLDER ACCOMPANYING THIS INSTRUMENT.

TELEVISION RECEPTION:

To use the television receiver in this instrument it is IMPORTANT that the AM-PH-TV knob be set in the position where TV faces indicator dot. If this is not observed the sound section of the television receiver will be inoperative. For instructions how to use television receiver read the separate instructions accompanying this instrument.

SERVICE AND ALIGNMENT INSTRUCTIONS

To remove the chassis from the console, it is first necessary to disconnect all plugs and sockets between the rear of the receiver chassis, the speaker, the television set and the record changer, respectively. Then remove the four knobs and the three screws holding the chassis to its mounting panel.

CAUTION: WHEN REMOVING THE CHANGER BE SURE TO PLACE IT IN A POSITION IN WHICH THE CHANGER MECHANISM WILL NOT BE DAMAGED.

ALIGNMENT:

Equipment Required: Modulated R.F. signal generator; output meter; insulated screw-driver; two .1 mfd 400 volt condensers.

To insure proper alignment a radiated signal will be required during part of the alignment procedure. To radiate a signal connect a loop of about 6" to 8" diameter (one turn of #14 or #12 wire) across the output of the signal generator and place this loop parallel to the loop of the receiver to be aligned at a distance of about 8" or 10".

To align the receiver it is necessary to remove the chassis from the cabinet, check that the pointer coincides with the left vertical side of the gold rectangle surrounding the calibration points (below 550 kc.). In this position the condenser should be completely closed. Connect the output meter and signal generator as follows:

Output meter — Connect across voice coil and turn volume control to maximum.

Signal generator — Connect the low side of the signal generator to the common B minus bus thru a .1 mfd condenser and keep the output as low as possible, then proceed in the sequence shown on the alignment chart.

ALIGNMENT PROCEDURE CHART

STEP	CONNECT HIGH SIDE OF SIGNAL GENERATOR TO-	SET SIGNAL GENERATOR TO-	TURN RECEIVER DIAL TO-	ADJUST THE FOLLOWING FOR MAXIMUM OUTPUT. (KEEP SIGNAL FROM SIGNAL GENERATOR AS LOW AS POSSIBLE.)
1	ANTENNA SECTION TUNING CONDENSER IN SERIES WITH .1 MFD COND.	455 KC.	FULL CLOCKWISE POSITION. (CONDENSER PLATES FULLY OPEN)	L4, L3, L2, L1 AND REPEAT IN SAME ORDER (1ST. AND 2ND I.F. TRANSFORMERS)
2	USE RADIATED SIGNAL	1500 KC.	1500 KC. (150 ON DIAL)	C2 (OSCILLATOR)
3		1500 KC	MAXIMUM SIGNAL (APPROX. 150 ON DIAL)	C1 (ANTENNA)
4		REPEAT STEPS 2 AND 3		

PARTS LIST

TM-TN Chassis

COILS & TRANSFORMERS

SCH. NO	DESCRIPTION	PART NO.
L11	Choke-Filter 62 ohms	CK-1346
L12	Peaking Coil — 36 uh — Black Dot	CL-1535
L14 (R41)	Peaking Coil — 120 uh — Blue Dot	CL-1536
L15	Peaking Coil — 180 uh — White Dot	CL-1537
L5, 7, 8	Peaking Coil — 250 uh — Green Dot	CL-2073
L10 (C-35)	Transformer — Pix IF — Bifilar	CL-2309
L13	4.5 mc Sound Trap	CL-2331
L19	Peaking Coil — 500 uh — Gr. & White Dot	CL-2614
	Coil — Width Control	CL-2752
	Deflection Yoke	CL-2753
L9 (C-29)	Tuner	CL-2755-1
L6 (C-23)	Accompanying Sound Trap	CL-2972
TN only	Adjacent Sound Trap	CL-2973
	Focus Coil	CL-2979
L3, 4	Transformer — Vert. Oscillator	TR-1473
	Transformer — Ratio Det.	TR-2630
	Transformer — Vert. Output	TR-2765
TM only	Transformer — Audio Output ½x½	TR-2766
	Transformer — Power	TR-2770
L1, 2	Transformer — Flyback	TR-2771-1
TN only	Transformer — 4.5 Mc Sound IF	TR-2977
L16, 17	Transformer — Power	TR-2978
	Transformer — Horiz. Osc. & Stabilizer	TR-2990

CONDENSERS

SCH. NO	DESCRIPTION	PART NO.
C3, 5, 6 (18 TN only)	Condenser — 5000 mmf Disc. Ceramic	CCD-502X
C76	Condenser — Ceramic 56 mmf 10% 2 KV(N750)	CCD-560K
C17, 19, 20, 21, 24, 25, 27, 73	Condenser — Ceramic Dual 1500 mmf	CC2D-152K
C31, 66 (77 TN only)	Condenser — Electrolytic 4mfd 450V	CO-1056
C22, 28	Condenser 2.2 mmf	CO-1112
C30	Condenser — Mica 4 mmf— 20% 1500V.	CO-1915
C13, 52	Condenser — Electrolytic 50 mfd 350 V.	CO-2344
C78, TN only	Condenser — Electrolytic 20 mfd 450V	CO-2560
C8	Condenser — Electrolytic 4 mfd 50V	CO-2756
C55, 56	Condenser — Electrolytic 60/450 x 60/450	CO-2758
C14, 47	Condenser — Electrolytic 60/200V x 125/25V	CO-2759
C53, 54, 65	Condenser — Moulded .01/600V — Oil	CO-B-6103
C63	Condenser — Paper .47/200V	CO-H-2474
C16, 33, 36, 74, 75	Condenser — Paper .1/400V	CO-H-4104
C50, 51, 62	Condenser — Paper .02/400V	CO-H-4203
C26, 48, 71	Condenser — Paper .25/400	CO-H-4254
C2, 12, 39, 40, 49, 57, 61, 72	Condenser — Paper .05/400V	CO-H-4503
C10, 11, 15, 70	Condenser — Paper .01/600V	CO-H-6103
C41, 42	Condenser — Paper .002/600V	CO-H-6202
C9, 37	Condenser — Paper .005/600V	CO-H-6502
C68, 69	Condenser — Paper .001/600V — Oil	CO-O-6102K
C46	Condenser — Paper .0047/600V — Oil	CO-O-6472K
C67	Condenser — Drive Trimmer 50/370 mmf	CT-2757
C43, 44, 45 R59, 60, 61	Vertical Int. Network	PC-2435
C1	Condenser — Mica 10 mmf 20% 500V	RCM-20A-100M
C32	Condenser — Mica 100 mmf 20% 500V	RCM-20A-101M
C38	Condenser — Mica 220 mmf 20% 500V	RCM-20A-221M
C7, 34	Condenser — Mica 330 mmf 20% 500V	RCM-20A-331M
C4	Condenser — Mica 47 mmf 20% 500V	RCM-20A-470M
C58, 59, 60	Condenser — Mica 47 mmf 10% Silver	RCM-20C-470K
C64	Condenser — Mica 180 mmf 10% 1000V Silver	SCM-40C-181K

CONTROLS

SCH. NO	DESCRIPTION	PART NO.
	Control — Horiz. Hold 50,000	PT-2268
	Control — Vert. Hold 1 meg	PT-2269
	Control — Brightness ½ meg	PT-2270
	Control — Vert. Linearity 5,000	PT-2271
	Control — Height 2.5 meg	PT-2272
	Control — Contrast (1000) & Volume (1 meg)	PT-2774
TN only	Control — Focus (2250 W.W.)	PT-2975

RESISTORS

SCH. NO	DESCRIPTION	PART NO.
R97 TN only	Resistor — 5000 ohm 10% 10 W.	RE-2995
R3, 6, 18, 22, 40 (28 TN only)	Resistor — 1000 ohm 20% ½ W.	REB-102M
R8, 9, 17, 25	Resistor — 10K 10% ½ W.	REB-103K
R51 (15 TN only)	Resistor — 100 K 10% ½ W.	REB-104K
R1, 4, 14, 87, 91	Resistor — 100 K 20% ½ W.	REB-104M
R30, 31, 32, 35	Resistor 1 meg 20% ½ W.	REB-105M
R11	Resistor — 10 meg ½ W. 20%	REB-106M
R66	Resistor — 12K 10% ½ W.	REB-123K
R7, 26	Resistor — 150 20% ½ W.	REB-151M
R21	Resistor — 15K 10% ½ W.	REB-153K
R72	Resistor — 150K 10% ½ W. Allen-Bradley	REB-154K-A
R38, 63, 65	Resistor — 1.5 meg 10% ½ W.	REB-155K
R74 (15 TM only)	Resistor — 180K 10% ½ W. Allen-Bradley	REB-184K-A
R10, 82	Resistor — 22K 20% ½ W.	REB-223M
R13, 49, 85	Resistor — 220K 10% ½ W.	REB-224K
R44, 62	Resistor — 220 K 20% ½ W.	REB-224-M
R29, 33, 39, 48, 53, 56	Resistor — 2.2 meg ½ W. 10%	REB-225K
R54, 55, 93	Resistor — 2700 ½ W. 10%	REB-272K
R20, 24 (28 TM only)	Resistor — 330 ½ W. 20%	REB-331M
R42, 45	Resistor — 33K ½W. 20%	REB-333M
R75 (95 TN only)	Resistor — 330K ½ W. 10% Allen Bradley	REB-334K-A
R79	Resistor — 3900 ½ W. 10%	REB-392K
R2, 19, 23, 88	Resistor — 47 ohm ½ W. 20%	REB-470M
R5, 50, 52, 58, 92	Resistor — 47K ½ W. 20%	REB-473M
R12, 34, 47, 67, 86	Resistor — 470K ½ W. 20%	REB-474M
R64, 69, 70	Resistor — 560 ½ W. 10%	REB-561K
R36, 37, 57	Resistor — 5600 ½ W. 10%	REB-562K
R27, 81	Resistor — 8200 ½ W. 10%	REB-822K
R89	Resistor — 100 1 W. 20%	REC-101M
R68	Resistor — 1000 1 W. 20%	REC-102M
R71	Resistor — 100K 1 W. 20%	REC-104M
R80	Resistor — 150K 1 W. 5% Allen Bradley	REC-154J-A
R84	Resistor — 33K 1 W. 20%	REC-333M
R77	Resistor — 330 K 1 W. 5% Allen Bradley	REC-334J-A
R73	Resistor — 68K 1 W. 10% Allen Bradley	REC-683K-A
R94	Resistor — 68K 1 W. 20%	REC-683M
R78, 83	Resistor — 82K 1 W. 5% Allen Bradley	REC-823J-A
R76	Resistor — 820K 1 W. 10% Allen Bradley	REC-824K-A
R98 TN only	Resistor — 18K 2 W. 10%	RED-183K
R90	Resistor — 22K 2 W. 10%	RED-223K
R16 (96 TN only)	Resistor — 390 2 W. 20%	RED-391M
R43	Resistor — 4700 2 W. 10%	RED-472K
R46	Resistor — 8200 2 W. 10%	RED-822K

MISCELLANEOUS

DESCRIPTION	PART NO.
Ant. Binding Post	BP-1700
Fuse ¼ Amp.	FU-1683
Line Cord 6'	LC-1523
Built-in TV Antenna	LP-2353
Plastic Cup (Hi-Voltage)	MP-2769
Speaker Plug — 2 Prong	PL-637
Interlock — Pin Plug	PL-1524
Ion Trap (Single) — 45 gauss TN only (Red Dot)	PP-2248
Ion Trap (Single) — 35 gauss TM only (Green dot)	PP-2623
Centering Magnet — TM only	PP-2763
Hi-Voltage Lead TM only	PP-2772
Hi-Voltage Lead TN only	PP-2896
CRT Socket TM only	SO-2621
CRT Socket TN only	SO-2907

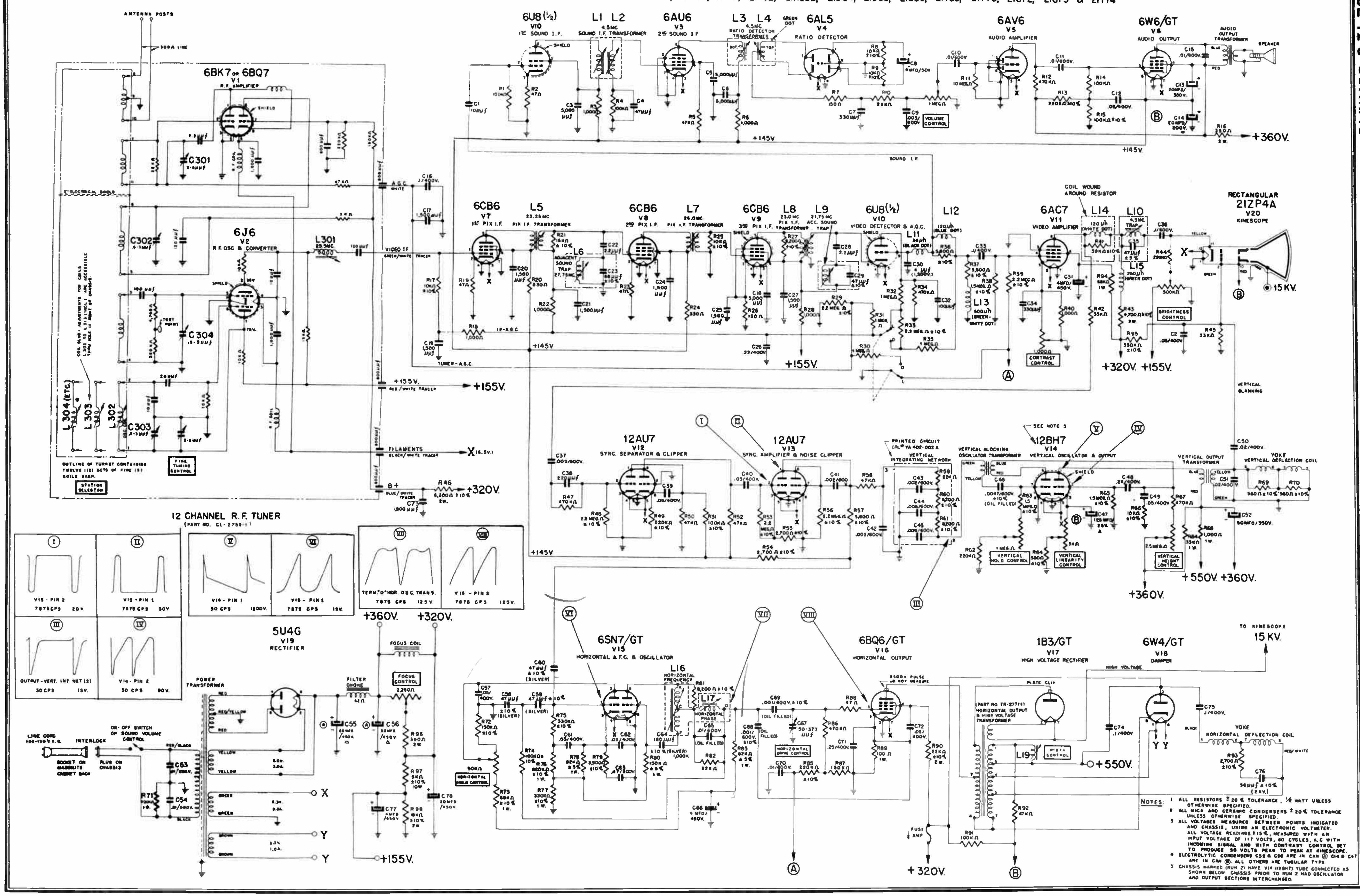
CABINETS & ACCESSORIES

DESCRIPTION	PART NO.
Cabinet for Model 17T56	CA-2912
Cabinet for Model 17C57	CA-2914
Cabinet for Model 17K55	CA-2916
Cabinet for Model 21T58	CA-2918
Cabinet for Model 21C68	CA-2920
Cabinet for Model 21C65	CA-2922
Cabinet for Model 21C72	CA-3034
Cabinet for Model 21C73	CA-3034
Cabinet for Model 21D64	CA-2924
Cabinet for Model 21D60	CA-2926
Cabinet for Models 21K61, 21K62	CA-2928
Cabinet for Model 21T69	CA-3023
Cabinet for Model 21T70	CA-3023-1
Cabinet for Model 21T74	CA-3023-2
Cabinet for Model 21C72 & 21C73	CA-3034
Cabinet for Model 21K63 Blonde	CA-2930
Escutcheon for Radio only — 17K55, 21K61, 21K62, 21K63	ES-2967
Grille Silk for Models 17T56, 21T58, 21T69, 21T70	GL-2030
Grille Silk Model 21T74	GL-2030-1
Caster Wheels	HW-2658
Mahog. Fine Tuning Knob	KN-2296
Mahog. Channel Selec. Knob (With Gold Fill-In)	KN-2295-1
Mahog. Volume Control Knob (With Gold Fill-In)	KN-2297-1
Mahog. Contrast Control Knob	KN-2298
Tan Channel Selec. Knob	KN-2545

DESCRIPTION	PART NO.
Tan Fine Tuning Knob	KN-2546
Tan Volume Control Knob	KN-2547
Tan Contrast Control Knob	KN-2548
10' Cord & Plug	LC-2829
Moulded Cup — TM only	MP-2666
Moulded TV Door	MP-2775
Moulded TV Escutcheon — TM only	MP-2969
Moulded TV Escutcheon — TN only	MP-2970
Moulded Cup — TN only	MP-2981
Extruded Channel — TM only	MP-2991-17
Extruded Channel — TN only	MP-2991-21
Trap Door Spring	MS-2779
Saftee Glass TM only	PP-2937
Saftee Glass TN only	PP-2938
Mask — 17" — TM only	PP-2939
Mask — 21" — TN only	PP-2940
Wrought Iron Legs 21C72 & 21C73	PP-3029
3 Speed Record Changer	RX-2875
5" P.M. Speaker	SK-1788-1
10" P.M. Speaker	SK-1789-1
8" P.M. Speaker	SK-1906
Knob Spring	SP-1512
Knob Spring	SP-1513
Cabinet Back 17C57	ST-2802
Cabinet Back 17K55	ST-2803
Back Radio 17K55	ST-2818
Cabinet Back 17T56	ST-2941
Cabinet Back 21D60	ST-2942
Cabinet Back 21T58, 21T69, 21T70, 21T74	ST-2944
Cabinet Back 21C65, 21C68	ST-2945
Cabinet Back 21D64	ST-2946
Cabinet Back 21K61, 21K62, 21K63	ST-2947
Back Radio 21K61	ST-2988
Back Radio 21K62, 21K63	ST-2994

OLYMPIC TN-21 CHASSIS

21" TN MODELS: 21T58, 21D60, 21K61, 21K62, 21K63B, 21D64, 21C65, 21C68, 21T69, 21T70, 21C72, 21C73 & 21T74

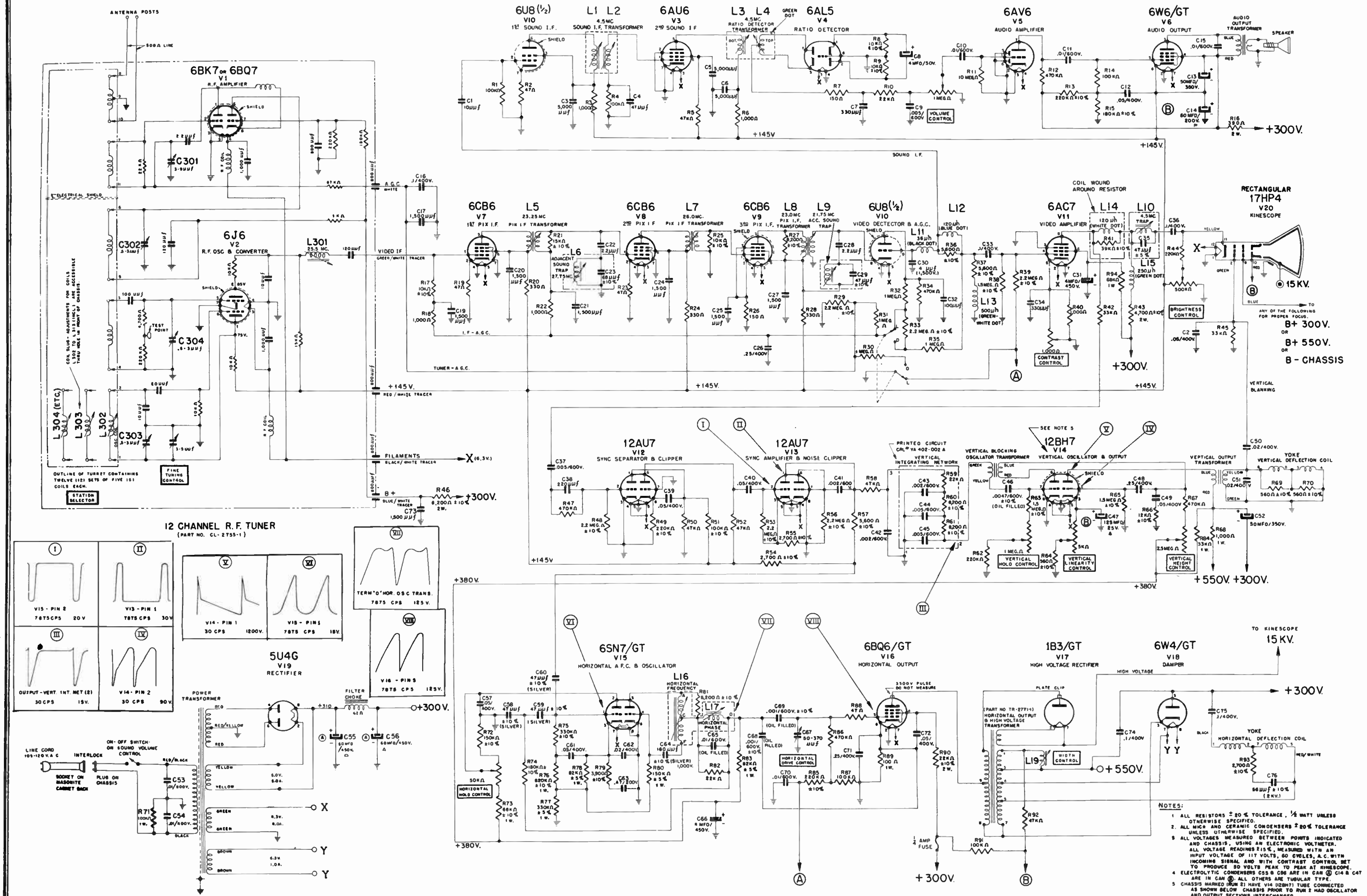


NOTES:

1. ALL RESISTORS ± 20% TOLERANCE, ½ WATT UNLESS OTHERWISE SPECIFIED.
2. ALL MICA AND CERAMIC CONDENSERS ± 20% TOLERANCE UNLESS OTHERWISE SPECIFIED.
3. ALL VOLTAGES MEASURED BETWEEN POINTS INDICATED AND CHASSIS, USING AN ELECTRONIC VOLTMETER. ALL VOLTAGE READINGS ±15%, MEASURED WITH AN INPUT VOLTAGE OF 117 VOLTS, 60 CYCLES, A.C WITH INCOMING SIGNAL AND WITH CONTRAST CONTROL SET TO PRODUCE 50 VOLTS PEAK TO PEAK AT KINESCOPE.
4. ELECTROLYTIC CONDENSERS C55 & C56 ARE IN CAN (A) C14 & C47 ARE IN CAN (B). ALL OTHERS ARE TUBULAR TYPE
5. CHASSIS MARKED (RUN 2) HAVE V14 (12BH7) TUBE CONNECTED AS SHOWN BELOW. CHASSIS PRIOR TO RUN 2 HAD OSCILLATOR AND OUTPUT SECTIONS INTERCHANGED.

OLYMPIC TM-17 CHASSIS

17" TM MODELS: 17K55, 17T56 & 17C57



NOTES:

1. ALL RESISTORS ± 20 % TOLERANCE, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. ALL MICA AND CERAMIC CONDENSERS ± 20 % TOLERANCE UNLESS OTHERWISE SPECIFIED.
3. ALL VOLTAGES MEASURED BETWEEN POINTS INDICATED AND CHASSIS, USING AN ELECTRONIC VOLTMETER. ALL VOLTAGE READINGS ± 15 %, MEASURED WITH AN INPUT VOLTAGE OF 117 VOLTS, 60 CYCLES, A.C. WITH INCOMING SIGNAL AND WITH CONTRAST CONTROL SET TO PRODUCE 50 VOLTS PEAK TO PEAK AT KINESCOPE.
4. ELECTROLYTIC CONDENSERS C55 & C56 ARE IN CAN (A) C14 & C47 ARE IN CAN (B). ALL OTHERS ARE TUBULAR TYPE.
5. CHASSIS MARKED (RUN 2) HAVE V14 (12BH7) TUBE CONNECTED AS SHOWN BELOW. CHASSIS PRIOR TO RUN 2 HAD OSCILLATOR AND OUTPUT SECTIONS INTERCHANGED.

MODEL 180 UHF TUNER
(ALSO USED IN MODEL 2152)

ALIGNMENT PROCEDURE

PRELIMINARY NOTES:

VHF tuner and TV I-F strip must be in proper alignment before attempting alignment of UHF tuner.

Connect oscilloscope or VTVM across the 4.7K ohms video detector load, R-12, TV schematic.

EQUIPMENT REQUIRED—AM VHF signal generator with 12 Mc sweep; oscilloscope or VTVM; insulated screwdriver.

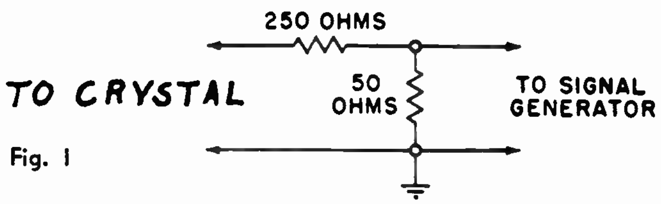


Fig. 1

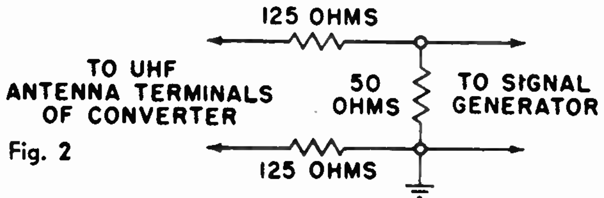


Fig. 2

SIG. GEN. CONNECTION	SIG GEN. FREQ.	ADJUST	REMARKS
I-F ALIGNMENT			
1—To crystal at junction of items 21, 29, 45, 51, UHF schematic, thru matching net. Fig. 1.	82 Mc	I-F transformers. Items 5 & 6, Figs. 3 & 4.	Adjust for maximum signal.
2—Same as 1.	82 Mc with 12 Mc sweep.	Item 6, Figs. 3 & 4.	Adjust for equal signal response at VHF channels 5 & 6. Maximum gain for minimum band-width of 12 Mc.
OSCILLATOR ALIGNMENT			
3—UHF antenna terminals thru matching net. See Fig. 2.	465 Mc (5th harmonic of 93 Mc)	Oscillator trimmer, item 48, Fig. 3.	Set pointer at extreme left of dial. Adjust for maximum.
4—Same as 3.	900 Mc (5th harmonic of 180 Mc)	Carefully spread or pinch legs of oscillator end-inductor, see Fig. 3.	Set pointer at extreme right of dial. Adjust for maximum.
5—Repeat steps 3 and 4 until no further improvement in signal is apparent. 465 Mc and 900 Mc are approximations and may not fall precisely at extreme left and right dial positions. However, oscillator alignment must be made so that both frequencies may be tuned within dial limits.			
6—Same as 3.	465 Mc	R-F trimmers, Item 72, Fig. 4.	Set pointer at extreme left of dial. Adjust for maximum.
7—Same as 3.	900 Mc	R-F end-inductors, Fig. 3.	Set pointer at extreme right of dial. Adjust for maximum.
8—Repeat steps 6 and 7 until no further improvement in signal is apparent.			
9—Same as 3.	465 Mc	Coupling trimmer, item 74, Fig. 4.	Set pointer at extreme left of dial. Adjust for maximum.

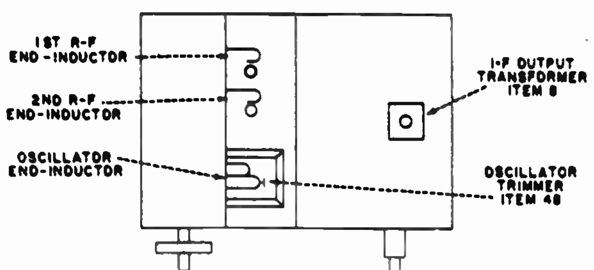


Fig. 3—BOTTOM VIEW

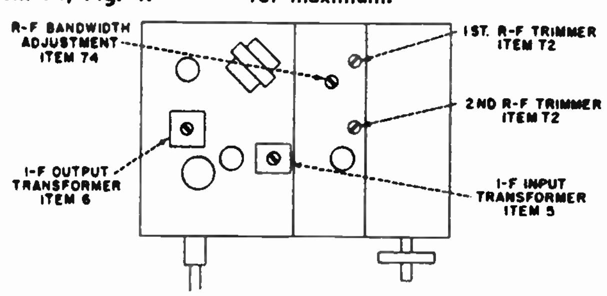


Fig. 4—TOP VIEW

VOLTAGE MEASUREMENTS

Notes: VTVM used. Measurements taken between terminals and chassis. Measurements within 20% of specified values are satisfactory. Values in DC volts unless otherwise noted. Switch in UHF position.

TUBE TYPE	FUNCTION	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
6X4	Rect.	170 AC	NC	0	6.3 AC	NC	170 AC	190	......	......
6BK7/ 6BQ7	I-F Amp.	120	0	.85	6.3 AC	0	125	0	1	0
6AF4	Osc.	85*	5.7	0	6.3 AC	0	5.7*	85	......	......

*Use 15K ohms isolating resistor in series with voltmeter probe.

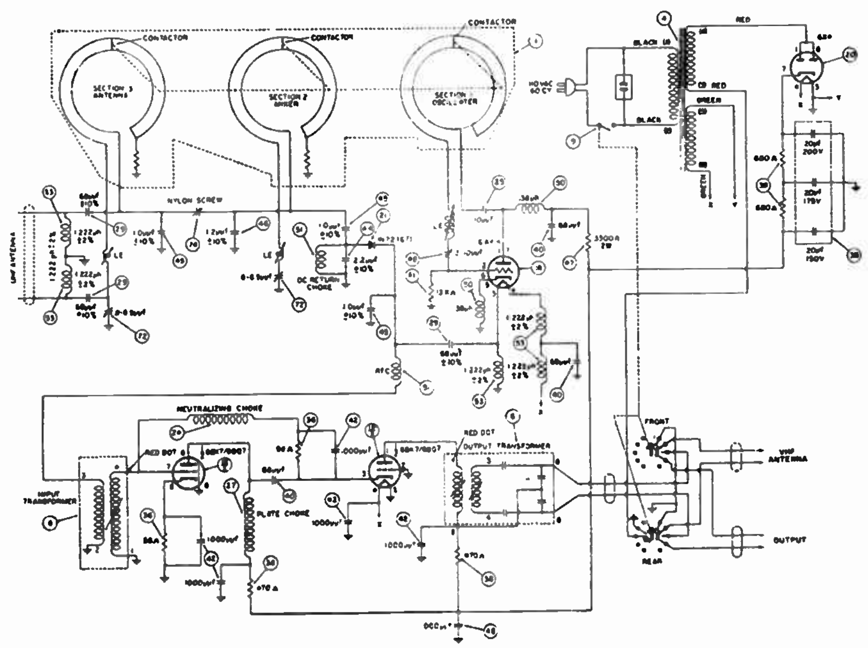
RESISTANCE MEASUREMENTS

Notes: VTVM used. Measurements taken between terminals and chassis. Measurements within 20% of specified values are satisfactory. Switch in UHF position. AC cord disconnected.

TUBE TYPE	FUNCTION	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
6X4	Rect.	130	NC	0	.3	NC	130	50K*	......	......
6BK7/ 6BQ7	I-F Amp.	50K*	0	56	.3	0	50K*	0	56	0
6AF4	Osc.	50K*	12K	0	.3	0	12K	50K*	......	......

*Or more.

CIRCUIT DIAGRAM



REPAIR PARTS LIST

SCHEMATIC	ITEM NO.	
PMA-65011-1	1	Inductuner, UHF
PMA-65011-4	4	Transformer, Power
PMA-65011-5	5	Transformer, I-F Input
PMA-65011-6	6	Transformer, I-F Output
PMA-65011-9	9	Switch AC & Antenna Changeover
PMA-65011-24	24	Choke, Neutralizing
PMA-65011-25	25	Capacitor, Ceramic Tubular, 10 UUF
PMA-65011-27	27	Choke, I-F Plate
PMA-65011-29	29	Capacitor, Ceramic Tubular, .68 UUF ± 10%
PMA-65011-35	35	Capacitor, Electrolytic Filter, 20-20-20/200-175-150 UUF
PMA-65011-36	36	Resistor, Carbon, 56 Ohms, ± 10%
PMA-65011-38	38	Resistor, Carbon, 470 Ohms
PMA-65011-39	39	Resistor, Carbon, 680 Ohms
PMA-65011-40	40	Capacitor, Ceramic Tubular, 68 UUF
PMA-65011-41	41	Resistor, Carbon, 12K Ohms
PMA-65011-42	42	Capacitor, Ceramic Disc, 1000 UUF
PMA-65011-44	44	Capacitor, Ceramic Tubular, 2.2 UUF
PMA-65011-45	45	Capacitor, Ceramic Tubular, 1.0 UUF
PMA-65011-46	46	Capacitor, Ceramic Tubular, 1.2 UUF
PMA-65011-47	47	Resistor, Carbon, 3300 Ohms, 2 Watt
PMA-65011-48	48	Capacitor, Ceramic Trimmer, 3-10 UUF
PMA-65011-50	50	Choke, Oscillator
PHA-65011-51	51	Choke, Oscillator
PMA-65011-53	53	Choke, Oscillator & R-F
PMA-65011-72	72	Capacitor, Ceramic Trimmer, .8-6.5 UUF
PMA-65011-74	74	Nylon Adjustment Screw

CHASSIS VARIATIONS

NUMBER	PICTURE TUBE TYPE	TUNERS VHF	TUNERS UHF
200-1	17HP4	PMC-57006	PMC-57007
200-2	17HP4	PMC-57006	PMC-57008
200-3	17HP4	PMC-57006	PMC-57009
200-4	17HP4	PMC-57006	None
200-5	17HP4	PMC-57011	None
200-11	21MP4	PMC-57006	PMC-57007
200-12	21MP4	PMC-57006	PMC-57008
200-13	21MP4	PMC-57006	PMC-57009
200-14	21MP4	PMC-57006	None
200-15	21MP4	PMC-57011	None

GENERAL SPECIFICATIONS

Antenna	Built-in with Provisions for External 300 Ohms Antenna
Intercarrier Sound System .	4.5 Megacycles
Picture Carrier I-F . . .	45.75 Megacycles
Sound Carrier I-F . . .	41.25 Megacycles
Power Supply	110-120 Volts, 60 Cycle, AC.
Power Consumption . .	215 Watts
Speaker	PM Type 3.2 Ohms Voice Coil

ADJUSTMENTS

WARNING — OPERATION OF THE RECEIVER CHASSIS OUTSIDE OF THE CABINET INVOLVES THE DANGER OF WORKING WITH HIGH VOLTAGES. EXTREME CAUTION SHOULD BE EXERCISED AT ALL TIMES.

Occasional minor adjustments will be needed if any circuit work or tube replacement is required. A test pattern, generated locally or from a broadcast station, is recommended for best results. The operating and auxiliary controls, located on the front panel and rear apron, should be set for as good a pattern as possible before making the following adjustments:

CENTERING

Rotate each of the Centering Rings separately until the picture is properly centered.

HEIGHT AND WIDTH

Adjust the Height and Width Controls so that the picture fills out the dimensions of the screen. A slight re-adjustment of the centering control may be necessary.

HORIZONTAL DRIVE CONTROL

The Horizontal Drive Control (C51B) is adjustetd by backing off the control until a vertical white bar appears in the middle of the picture, and then going in one full turn from this point. This adjustment may be reached from the underside of the chassis mounting board. See below for detailed description of Horizontal Oscillator Sync Adjustment.

VERTICAL LINEARITY CONTROL

Set the Vertical Linearity Adjustments for a symmetrical pattern. A slight re-adjustment of the Height and Width Controls may then be necessary.

Note: The sequence of adjustments outlined above is suggested as a convenient method of approach and not an arbitrary procedure. The procedure used to obtain the final results may be varied to fit the circumstances.

NOISE BALANCE CONTROL

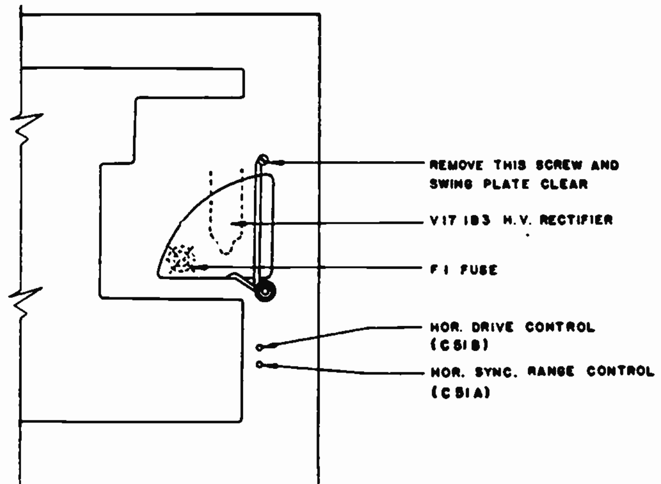
Turn the Channel Selector to the strongest station signal on the air. Slowly turn the Noise Balance Control from full clockwise position counterclockwise until the picture just starts to show a distorted shape. Then turn the control slightly in the opposite direction so that the picture shape is normal. Check all channels. If the picture shape is distorted on any channel, advance the control slightly clockwise to restore normal shape. (NOTE: WHENEVER THE PICTURE IS DISTORTED, OR SLANTING BARS ARE ENCOUNTERED WHICH CANNOT BE ADJUSTED CORRECTLY WITH THE HORIZONTAL LOCK OR FINE TUNING CONTROLS, ALWAYS SET THE NOISE BALANCE CONTROL FULLY CLOCKWISE BEFORE MAKING ANY OTHER ADJUSTMENT.)

PICTURE TUBE ADJUSTMENTS

WARNING: THE PICTURE TUBE ENVELOPE ENCLOSES A HIGH VACUUM. ANY ACCIDENTAL BLOW OR ROUGH HANDLING MAY CAUSE THE TUBE TO IMPLODE WITH DANGEROUS AND DESTRUCTIVE FORCE. THE WEARING OF HEAVY GLOVES AND SHATTER-PROOF GOGGLES IS ADVISED WHEN HANDLING THE PICTURE TUBE.

1. Turn the Brightness Control to maximum (clockwise) and the Picture Control to minimum (Counterclockwise).
2. Rotate the Ion Trap Magnet and at the same time move it backward and forward to obtain the brightest raster.
3. Reduce the Brightness Control so that the raster is slightly over normal brilliance and re-adjust the Ion Trap Magnet for maximum brightness.
4. Loosen the Deflection Yoke adjusting screws and rotate the Deflection Yoke so that the top and bottom edges of the raster are parallel to the top of the chassis. When this adjustment is made, tighten screws.
5. Adjust the Centering Control until the entire raster is visible, centered within the opening of the mask, with no shadowed corners.
6. Move the Ion Trap Magnet as in step 2 for final adjustment.

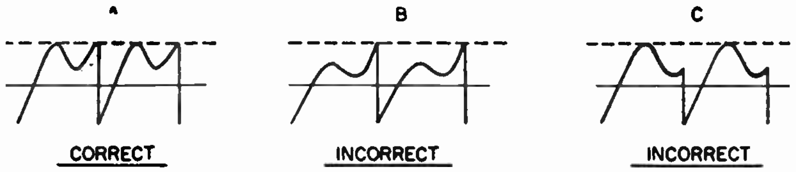
HORIZONTAL OSCILLATOR SYNC ADJUSTMENT



CHASSIS SHELF BOTTOM

1. Set the Noise Balance control to maximum clockwise.
2. Connect an oscilloscope to terminal "C" on the Synchroguide transformer (T-8) through a small capacitor, from 10 to 50 UUF.
3. Connect a DC VTMV from the grid of the type 6AU5 Horizontal Output tube (V-15) to the chassis. Use a high impedance probe.
4. Set the trimming capacitor adjustment screws in tight for the Horizontal Locking Range (C-51a) and the Horizontal Drive (C-51b).
5. Back off the trimmer for the Horizontal Locking Range 1/4 turn.
6. Back of the trimmer for the Horizontal Drive until the VTVM registers —9 volts (approximately one full turn).
7. Adjust front screw of Synchroguide to lock-in picture horizontally.

8. Adjust inside core of Synchroguide to give correct wave form. Re-adjust front screw simultaneously to keep in sync. Use non-metallic screw driver on inside core.



9. Trim front screw to get approximately three bars break-out when switching channels, with Horizontal Lock control in maximum clockwise position.

THE HORIZONTAL LOCK CONTROL SHOULD PRODUCE THE FOLLOWING CONDITIONS:

A. Sync should hold with control in maximum counterclockwise position.

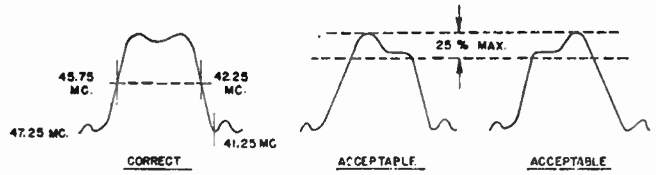
B. Sync should pull in when switching channels over at least half of the rotation range of the control.

C. Picture should not jitter at any position of the control.
   a. If sync does not hold in maximum counterclockwise position, back off front screw of Synchroguide. Retain correct wave form by adjustment of inside core.
   b. If sync does not pull in when switching channels over half of rotation range, back off C-51a, 1/4 turn at a time, until correct lock-in range is established.
   c. If the picture jitters at any position of the Horizontal Lock control, advance the control in a clockwise direction to the position that produces the greatest amount of jitter and adjust the front screw of the Synchroguide in a clockwise direction until the jitter stops. If jitter is not eliminated, advance C-51a trimmer adjustment. If jitter persists, shunt a 100 UUF capacitor across C-51a. Re-check break-out on clockwise end when switching channels. Back off C-51a if sync does not pull in over at least half of rotation range of Horizontal Lock control.

ALIGNMENT

NOTE: ALWAYS SET NOISE BALANCE CONTROL FULLY CLOCKWISE BEFORE MAKING ANY ALIGNMENT TESTS OR ADJUSTMENTS.

I-F ALIGNMENT



Lift the top section of the shield on the R-F oscillator-mixer tube so that it does not make electrical contact with its base. Connect one side of the output of an A-M signal generator to the shield, the other side to the chassis.

Connect a VTVM across the 4.7K video detector load. Use the lowest scale reading on the meter. Always attenuate the signal generator output for a reading below the limits of the meter, approximately —1 to —1.5 volts.

Set the Volume and Contrast controls to minimum. Set the Channel Selector to channel 7 or 13, depending on local conditions or interference.

PROCEDURE

SIG. GEN FREQUENCY	ADJUST	METER READING	REMARKS
1. 43.90 Mc	T-11	Maximum	
2. 44 Mc	I-F Adjustment on Tuner	Maximum	Connect a 1K resistor from grid of V-1 to AGC line for this step only.
3. 44.0 Mc	Bottom of T-1	Maximum	
4. 42.50 Mc	Bottom of T2	Maximum	
5. 45.35 Mc	Bottom of T-10	Maximum	
6. 41.25 Mc	top of T-1	Minimum	
7. 41.25 Mc	Top of T-2	Minimum	
8. 47.25 Mc	Top of T-10	Minimum	
9. Repeat steps 3, 4, and 5			
10. Repeat step 1.			

The I-F passband may be observed by substituting a sweep generator for the A-M signal generator and substituting an oscilloscope for the VTVM. Connect a 3 volt battery so that its positive terminal is connected to the chassis and the negative terminal is connected to the AGC lead. The sweep generator should be set to approximately 44 Mc and then adjusted to center the wave form on the scope face. To avoid overload and to assure a true view of the wave shape, the output of the sweep generator should be attenuated until further attenuation has a minimum effect on the wave shape. If necessary, a slight adjustment of the I-F transformers may be made to obtain a close approximation to the ideal curve. Adjustment of T-2 or T-10 affects the band width. Adjustment of T-1 or T-11 affects the slope of the top. However, T-1 should be preferred for slope adjustment.

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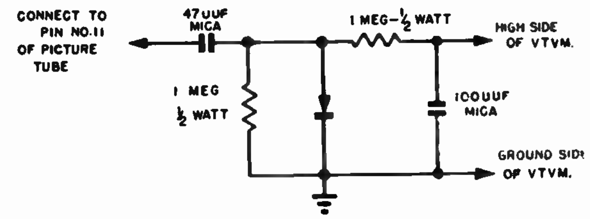
SOUND ALIGNMENT

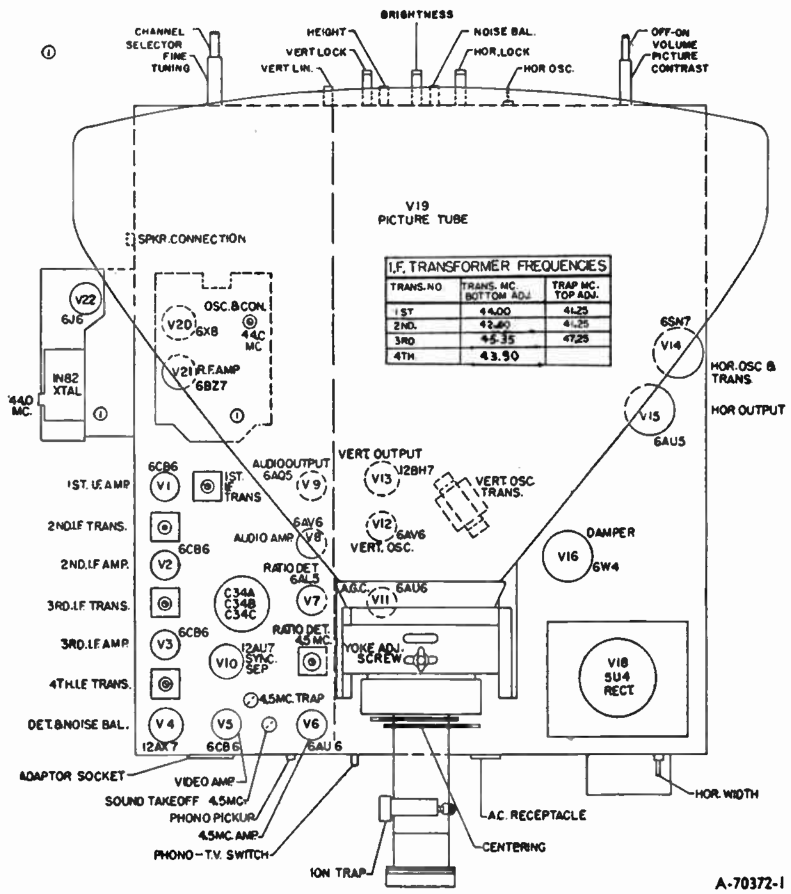
1. Connect an A-M signal generator tuned to 4.5 Mc between the grid of V5 and ground. Connect the alignment test circuit shown below and tune L8 for a minimum reading on a VTVM.

2. Disconnect the alignment test circuit and connect the VTVM to ground and Pin 5 of V7. Adjust L9 and primary of T3 (Bottom) for maximum indication.

3. Remove the VTVM and re-connect it to ground and junction of R27 and R28. Adjust secondary of T3 (Top) for zero. (Note: When tuning through the proper setting, the meter should swing negative on one side and positive on the other side.)



USE IN34 CRYSTAL
SOUND ALIGNMENT TEST CIRCUIT



TUBE LOCATION CHART FOR CHASSIS NO. S
200-1
200-11

TV REPAIR PARTS LIST

PART NO.	SCHEMATIC LOCATION	DESCRIPTION	
		COMPOSITION CAPACITORS	
PMB-40519-3	C22	2 UUF	
		CERAMIC CAPACITORS	
PMB-40518-1	C11	5 UUF	500 DCWV
	C14, C23	47 UUF† (Part of L8 & L9)	500 DCWV
PMB-40518-14	C47	100 UUF	500 DCWV
PMA-40523-23	C19	100 UUF	2000 DCWV
PMB-40518-17	C36	150 UUF	500 DCWV
PMB-40518-19	C13, C73	220 UUF	500 DCWV
PMA-40520-23	C72	470UUF	1000 DCWV
PMA-40521-42	C4, C7, C10	620 UUF †	500 DCWV
PMB-40518-24	C1, C2, C3, C5, C6, C8, C9, C25, C38, C39, C40, C67, C75, C76, C77, C78	1500 UUF	500 DCWV
PMA-40517-2	C24, C26, C37, C42, C68, C69	1500 UUF	500 DCWV
PMA-40517-4	C30a, C30b	1500 UUF Dual	500 DCWV
PMB-40518-32	C27	5000 UUF †	500 DCWV
PMA-40517-3	C12, C31	5000 UUF	500 DCWV
		MOLDED PAPER CAPACITORS	
PMB-41007-74	C15, C35	.02 MFD	400 DCWV
PMB-41007-75	C62	.03 MFD	400 DCWV
PMB-41007-30	C21	.05 MFD	400 DCWV
PMB-41007-51	C16	.1 MFD	600 DCWV
PMB-41007-53	C66	.25 MFD	600 DCWV
PMB-41007-17	C17	.5 MFD	200 DCWV
		ELECTROLYTIC CAPACITORS (Continued)	
PMA-42000	C33a	1'0 MFD	400 DCWV
	C33b	80 MFD	450 DCWV
PMA-42005	C46	100 MFD Paper Case	50 DCWV
		MICA TRIMMER CAPACITORS	
PMA-43001	C51a, C51b	25 to 280 & 80 to 480 UUF	
		COILS	
PMB-52053	L1, L2, L3, L14	Filament Choke Coils	
PMA-52023	L4	100 UH Peaking Coil	

PART NO.	SCHEMATIC LOCATION	DESCRIPTION	
		PAPER CAPACITORS	
PMB-41006-39	C58	.001 MFD	600 DCWV
PMA-41009	C56	.01 MFD (Oil Filled)	200 DCWV
PMB-41006-7	C28	.01 MFD	200 DCWV
PMB-41006-45	C32	.01 MFD	600 DCWV
PMB-41006-28	C53	.02 MFD	400 DCWV
PMB-41006-47	C60	.025 MFD	600 DCWV
PMB-41006-49	C44	.05 MFD	600 OCWV
PMB-41006-30	C54	.05 MFD	400 DCWV
PMB-41006-51	C45	.1 MFD	600 DCWV
PMB-41006-15	C52, C59	.25 MFD	200 DCWV
		MICA CAPACITORS	
PMB-40003-15	C18, C50	47 UUF †	500 DCWV
PMB-40002-15	C65	47 UUF *	1000 DCWV
PMB-40003-29	C48	180 UUF †	500 DCWV
PMA-40005-1	C20	220 UUF †	1500 DCWV
PMB-40003-37	C55	390 UUF †	500 DCWV
PMA-40004	C64	500 UUF	20,000 DCWV
PMB-40003-47	C57	1000 UUF †	500 DCWV
PMB-40003-55	C49	2200 UUF †	500 DCWV
PMB-40003-63	C41	4700 UUF †	500 DCWV
		ELECTROLYTIC CAPACITORS	
PMA-42002	C29	1 MFD	50 DCWV
PMA-42006	C61, C43	20 MFD Paper Case	300 DCWV
PMA-42001	C34a	40 MFD	450 DCWV
	C34b	50 MFD	350 DCWV
	C34c	50 MFD	300 DCWV
PMA-45017-50	R64	120K OHMS	1 WATT
PMA-45015-51	R48, R62	150K OHMS	½ WATT
PMA-45017-51	R69, R70	150K OHMS	1 WATT
PMA-45015-53	R51, R87	220K OHMS	½ WATT
PMA-45015-54	R24, R52	270K OHMS	½ WATT
PMA-45015-56	R19	390K OHMS	½ WATT
PMA-45015-57	R41, R42, R75	470K OHMS	½ WATT
PMA-45017-57	R80	470K OHMS	1 WATT
PMA-45015-60	R50, R67	820K OHMS	½ WATT
PMA-45015-61	R14, R32, R56	1 MEGOHM	½ WATT
PMA-45017-66	R72	2.7 MEGOHMS	1 WATT

PART NO.	SCHEMATIC LOCATION	DESCRIPTION	
PMA-52024	L5, L6	450 UH Peaking Coil	
PMA-52025	L7 & R15	200 UH Peaking Coil Wound on 22K Resistor	
PMA-52028-2	L8 & C14, L9 & C23	4.5 MC Take Off Trap	
PMA-56000	L10	Yoke	
PMA-56003	L12	Width Coil	
		PRINTED CIRCUITS	
PMA-95000	N1	Vertical Integrating Network	
PMA-95001	N2	Audio Couplate	
		COMPOSITION RESISTORS	
PMA-45013-1	R81	3.3 OHMS	½ WATT
PMA-45015-9	R3, R7, R88	47 OHMS	½ WATT
PMA-45015-12	R25	82 OHMS	½ WATT
PMA-45015-15	R1, R10	150 OHMS	½ WATT
PMA-45015-18	R27	270 OHMS	½ WATT
PMA-45015-19	R2, R4, R11	330 OHMS	½ WATT
PMA-45017-19	R33	330 OHMS	1 WATT
PMA-45015-21	R57	470 OHMS	½ WATT
PMA-45015-22	R59, R60	560 OHMS	½ WATT
PMA-45019-24	R34	820 OHMS	2 WATT
PMA-45015-25	R5, R8, R26, R79	1K OHMS	½ WATT
PMA-45017-25	R78	1K OHMS	1 WATT
PMA-45015-28	R44	1.8K OHMS	½ WATT
PMA-45015-29	R45, R84, R85	2.2K OHMS	½ WATT
PMA-45015-30	R43	2.7K OHMS	½ WATT
PMA-45015-33	R2, R12	4.7K OHMS	½ WATT
PMA-45019-35	R17, R77	6.8K OHMS	½ WATT
PMA-45015-36	R55, R68, R73	8.2K OHMS	½ WATT
PMA-45015-37	R30, R31, R61, R83	10K OHMS	½ WATT
PMA-45015-42	R46	27K OHMS	½ WATT
PMA-45017-42	R39	27K OHMS	1 WATT
PMA-45015-44	R16, R18	39K OHMS	½ WATT
PMA-45015-45	R28, R54	47K OHMS	½ WATT
PMA-45017-47	R66, R74	68K OHMS	1 WATT
PMA-45015-49	R20, R21, R22, R63, R82, R86	100K OHMS	½ WATT
PMA-45017-49	R71	100K OHMS	1 WATT

PART NO.	SCHEMATIC LOCATION	DESCRIPTION	
PMA-45015-69	R40	4.7 MEGOHMS	½ WATT
PMA-45015-73	R29	10 MEGOHMS	½ WATT
		WIRE WOUND RESISTORS	
PMB-47007-4	R35	60 OHMS	6 WATT
PMB-47007-3	R76	220 OHMS	4 WATT
PMB-47007-5	R36	250 OHMS	15 WATT
PMB-47007-1	R37, R38	1K OHMS	7.5 WATT
		VARIABLE RESISTORS	
PMA-48016	R58	5K Ohms, Vertical Linearity Control	
PMB-48014-1	R65	50K Ohms, Horizontal Hold Control	
PMB-48014-2	R23	100K, Brightness Control	
PMB-48014-3	R47	250K, Noise Balance Control	
PMB-48015	R13a, R13b, S1	.5 Megohm & 750 Ohms, Volume & Contrast Control and On-Off Switch	
PMB-48014-7	R49	1.5 Megohm, Vertical Hold Control	
PMB-48014-5	R53	2.5 Megohms, Height Control	
		TRANSFORMERS	
PMB-52051	T1	1st I-F	
PMB-52050	T2	2nd I-F	
PMB-52049	T10	3rd I-F	
PMB-52052	T11	I-F Output	
PMA-52027	T3	4.5 MC Ratio Detector	
PMB-51005	T4	Audio Output	
PMB-50003	T5	Power	
PMA-56005	T6	Vertical Oscillator	
PMA-56004	T7	Vertical Output	
PMB-52019	T8	Synchrouigde	
PMC-56002	T9	Horizontal Output	

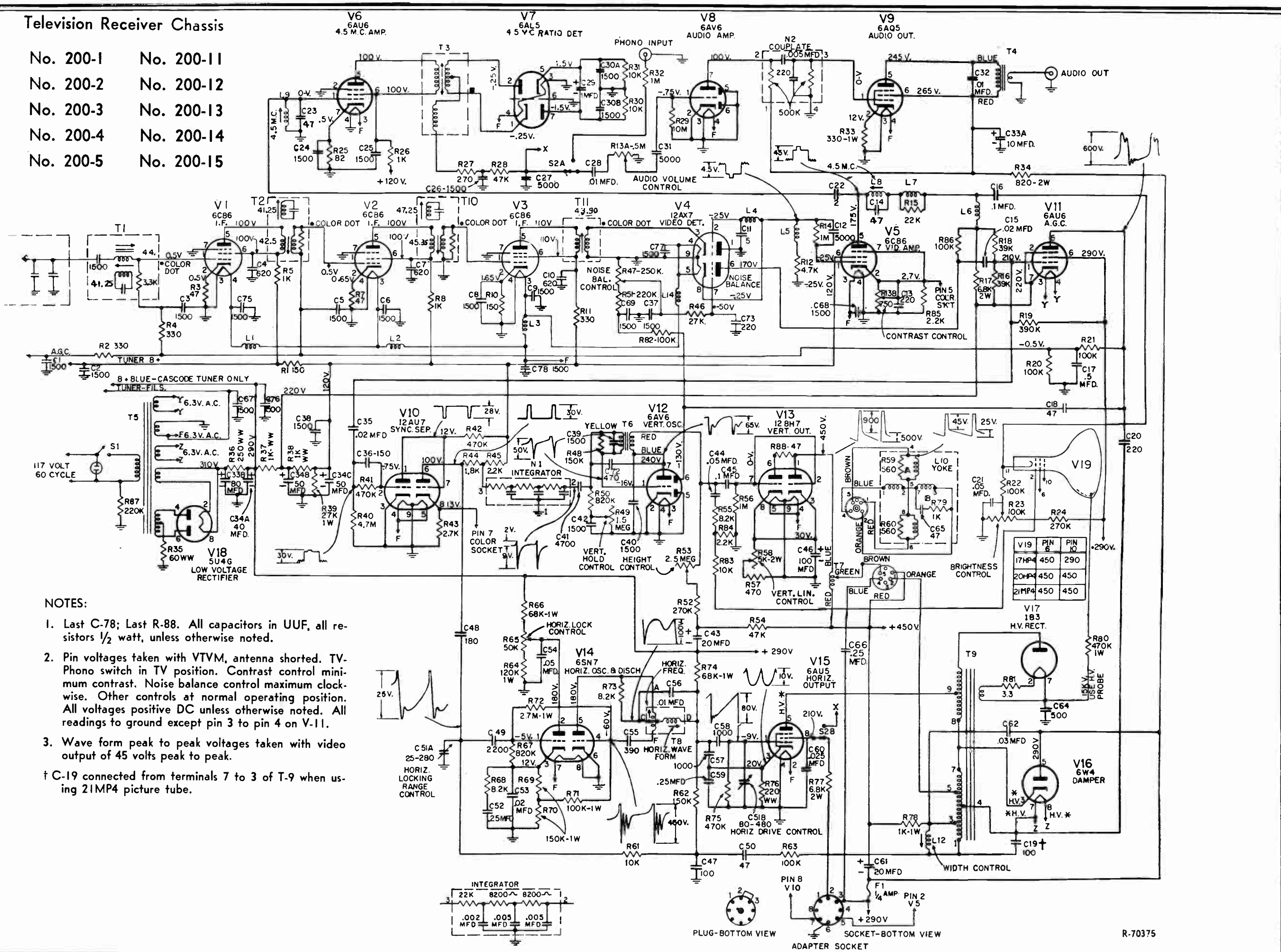
ALL CAPACITOR TOLERANCES ± 20%, EXCEPT:
* ± 5%; † ± 10%
ALL RESISTORS ± 10%.

F-106

C-70373-1

Television Receiver Chassis

No. 200-1	No. 200-11
No. 200-2	No. 200-12
No. 200-3	No. 200-13
No. 200-4	No. 200-14
No. 200-5	No. 200-15



V19	PIN 6	PIN 10
17HP4	450	290
20HP4	450	450
21MP4	450	450

NOTES:

1. Last C-78; Last R-88. All capacitors in UUF, all resistors 1/2 watt, unless otherwise noted.
2. Pin voltages taken with VTVM, antenna shorted. TV-Phono switch in TV position. Contrast control minimum contrast. Noise balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except pin 3 to pin 4 on V-11.
3. Wave form peak to peak voltages taken with video output of 45 volts peak to peak.

† C-19 connected from terminals 7 to 3 of T-9 when using 21MP4 picture tube.

CHASSIS	RADIO CHASSIS	NO. OF TUBES		PICTURE TUBE	TUNER	
150-4	155	21	2	20CP4	PMB-57001	Turret Pentode
150-5		21		24AP4	PMB-57001	
150-7		20		17HP4	PMB-57003	Rotary Switch
150-9		21		17HP4	PMB-57001	
150-10	160	21	2	21MP4	PMB-57002-1	Turret Cascode
150-12		21		17HP4	PMB-57001	
150-16		21		17HP4	PMB-57002-1	
150-31	155	21	2	21AP4	PMB-57002-1	
150-51		21		24AP4	PMB-57002-1	
150-61	155	21	2	21MP4	PMB-57002-1	

CABINET MODELS AND CORRESPONDING CHASSIS NUMBERS

CABINET MODEL NO.	STYLE	CHASSIS MODEL NUMBER TV	RADIO	PHONO
2081	Console Comb.	150-4	155	90023
2181	Console Comb.	150-31 150-61	155	90023 90025
2184	Console Comb.	150-61	155-1	90023
2192	Consolette Comb.	150-10	160	90026
2193	Consolette Comb.	150-10	160	90026
2194	Console Comb.	150-10	160	90023
2401	Console	150-5 150-51		
4317	Table Model	150-7 150-9 150-12		
4721	Table Model Comb.	150-10	160	
5517	Table Model	150-16	160	

Power consumption of combination sets is 240 watt.

DESCRIPTION

COMBINATION RECEIVERS USING CHASSIS 155 & 155-1 A-M RADIO TUNER TV CHASSS 150-4, 150-31, & 150-61

Chassis model 155 is a two tube A-M radio tuner with built-in loop antenna, a type 6BE6 converter tube, a type 6BA6, 455 Kc, I-F amplifier, tube, and a crystal diode detector, type 1N65. This A-M radio tuner has a control panel separate from the television controls. The audio amplifying and audio output circuits of the television receiver provide these functions for radio reception. A three position function switch on the radio control panel (S1a, 1b, 1c radio schematic) permits changing the source of the audio signal voltage across the volume control potentiometer (R-13a, TV schematic) from TV to radio or phonograph, as desired. The 155 A-M radio tuner is connected to the television circuit through an adapter socket on the back of the TV chassis. The phono motor is also plugged into the back of the TV chassis, but the phono pick-up lead is plugged into the A-M radio tuner.

Chassis 155-1 is the same as 155 except for length of control shafts.

COMBINATION RECEIVERS USING CHASSIS 160 AM RADIO TUNER TV CHASSIS 150-10

Chassis model 160 is also a two tube A-M radio tuner with the same type of converter, I-F amplifier, and detector as chassis 155. The function of the two tuners is also the same. However, a single set of controls is used to provide both television and radio reception on receivers with the 160 chassis. The radio dial is attached to the TV Fine Tuning control, which gives this control a dual capacity, depending on the position of the TV-RADIO-PHONO function switch. The 160 chassis is mounted on the underside of the TV chassis directly behind the front panel auxiliary controls. Its tuning gang is driven off the fine tune shaft with a pulley and string-ing arrangement. The function switch (S-1a, 1b, 1c radio schematic) is connected directly into the TV audio circuit between the high frequency de-emphasis net, R-28 - C27, and the coupling capacitor C-28, to the volume control potentiometer, R-13a (TV schematic).

The phono motor and phono pick-up leads are plugged into the back of the TV chassis.

COMBINATION RECEIVERS USING CHASSIS 113 RADIO, TV CHASSIS 150-2, MODEL 2080

Chassis model 113 is a 5 tube superheterodyne A-M radio receiver with built-in loop antenna. The radio and TV chassis are complete within themselves, with separate power supplies and control panels. One speaker is used, with the secondaries of the two voice coils wired to the speaker in parallel through the PHONO-RADIO-TV function switch on the radio panel. On some sets the audio output transformer of the TV is mounted on the radio chassis.

RECORD CHANGERS

There are three types of record changers used in Pacific Mercury combination receivers.

Pacific Mercury model 90023 is a V-M, model 950, record changer. Pacific Mercury model 90025 is a Webster-Chicago, model 114 record changer.

Pacific Mercury model 90026 is a General Instrument & Appliance Corp., model 700F-33/45, record changer.

All three record changers operate on 117 volts AC, 60 cycle power.

CHASSIS 150-9 & 150-16

Chassis 150-9 and 150-16 use a 17HP4 type picture tube. The 17HP4 has electrostatic focus with 450 volts on Pin No. 6, and 290 volts on Pin No. 10. See installation and adjustment instructions of electrostatic focus picture tubes.

CHASSIS 150-7 & 150-12

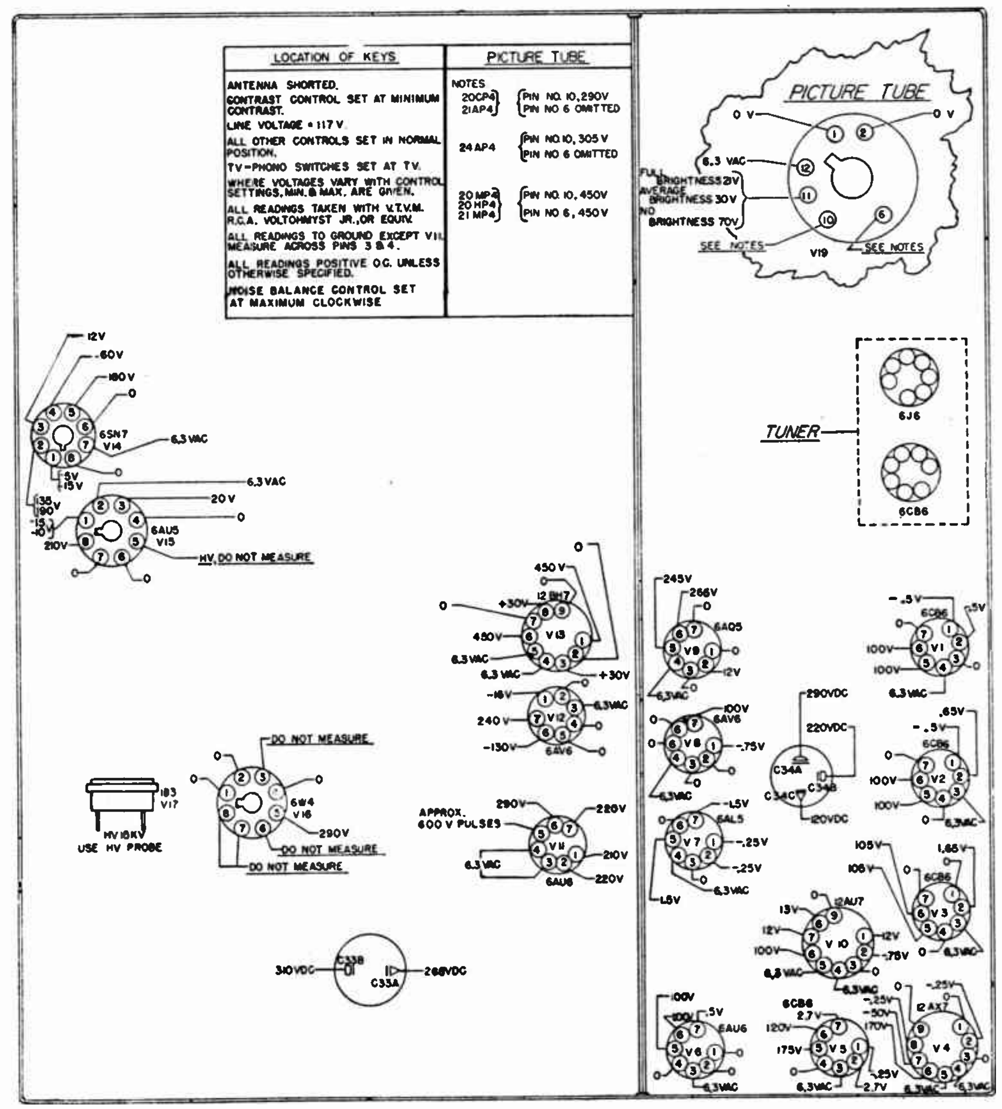
Chassis 150-7 and 150-12 also use a type 17HP4 picture tube. These two models are 20 tube chassis, similar to the basic chassis 150-Series except for the omission of the Noise Balance circuit.

The second half of V-4 (Type 12AX7), which formerly functioned as the Noise Balance Control, is used as the audio amplifier in these models, and V-8, the type 6AV6 tube, which was formerly used for audio amplification, is omitted.

There is no coupling between the two halves of the twin triode V-4, in the twenty tube receivers even though they are in the same envelope. The output from the first half, the video detector, is coupled to the video amplifier (V-5) only. The signal input to the second half of V-4 is taken off the pontentiometer, R-13A (Volume Control), across which is developed the audio signal voltage from the 4.5 Mc ratio detector, V-7. There is no phono jack on the twenty tube chassis. The voltage readings on the pins of V-4 are as follows:

VIDEO DETECTOR PIN NO.	VOLTAGE	FUNCTION	AUDIO AMPLIFIER PIN NO.	VOLTAGE
1	0	Plate	6	100
2	—.25	Control Grid	7	—.75
3	0	Cathode	8	0
4	6.3 AC	Filament	5	6.3 AC

Pin No. 9 is a common ground for both halves of the filament. The voltage readings on the pins of the other tubes in the twenty tube chassis are the same as for the twenty-one tube chassis, 150-Series.



150-SERIES CHASSIS.

ROTARY SWITCH TUNER—PMB-57003

Chassis 150-7 only, uses a rotary switch R-F tuner. This R-F selector is electrically equivalent to a tapped coil whose inductance is reduced from its maximum value by means of a rotary switch. The switch progressively shorts additional taps to ground as the selector knob is rotated and the oscillator coils are switched in and out of the circuit from channel 2 to channel 13.

The R-F amplifier tube is a type 6AG5, 6BC5, or 6CB6.

A twin triode, type 6J6, is used for the combination mixer and oscillator.

CHASSIS 150-5 & 150-51

Chassis models 150-5 and 150-51 use a 24 inch, magnetic focus, metal picture tube, type 24AP4. The use of this tube requires changing the circuit of the basic 150-Series chassis as follows:

Resistor R-36 in the low voltage rectifier filter circuit has been replaced by a choke coil, L-13. A filter network (R-89, C-43, and R-90, C-73) is used to increase stability of the vertical sweep circuit with line voltage variations.

The capacity of C-66 has been reduced from .25 mfd. to .1 mfd. to provide the additional linearity and width control necessary for the larger raster.

ADJUSTMENTS

The chassis listed in this supplement require the same type of adjustments as described in the 150-Series Service Manual.

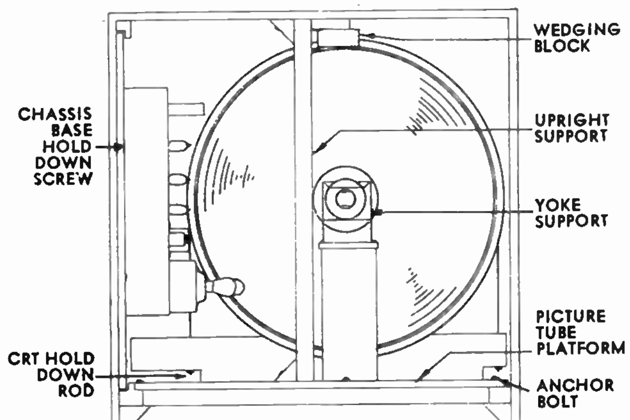
INSTALLING AND ADJUSTING PICTURE TUBES

17HP4

Rotate each of the Centering Rings separately until the picture is properly centered.

24AP4

The 24 inch picture tube is mounted on a triangular wooden platform, and this platform is bolted to the cabinet at each of its three corners. The chassis is mounted separately on a flat wooden base which in turn is fastened to the side of the cabinet with four wood screws.



MODEL 2401—REAR VIEW

REMOVING THE PICTURE TUBE

To remove the picture tube, it is first necessary, to remove the chassis.

WARNING: OBSERVE ALL HIGH VOLTAGE AND PICTURE TUBE HANDLING PRECAUTIONS

1. Remove the push-on type control knobs on the front panel and remove the back of the cabinet.
2. Remove the upright support (Held in place by two wood screws) located in the rear of the cabinet to the left of the neck of the picture tube.
3. Disconnect:
   a. Speaker plug.
   b. Antenna.
   c. Anode lead of picture tube.
   d. Picture tube socket.
   e. Ion trap.
   f. Deflection yoke (Some models have plug-in yoke leads).
   g. Focusing assembly.
   h. Wire or spring that is used to ground the deflection yoke support and tube mounting strap to the chassis.
4. Remove the four screws on the side of the cabinet that hold the wooden base of the chassis in place and slide the chassis and base out of the cabinet.

Note: The chassis may be operated for servicing without removing the picture tube from the cabinet by taking the chassis off its base and placing it next to the cabinet in such a position that all necessary connections can be made.

5. Remove the wooden block that acts as a wedge support for the top of the rim of the picture tube.
6. Remove the three anchor bolts that fasten the platform support to the cabinet and slide the platform and picture tube out of the cabinet.
7. Unfasten the mounting strap from the rim of the tube.

INSTALLING THE PICTURE TUBE

1. Set the picture tube on its supporting platform, with its rim resting in the cradle, and attach the mounting strap. Position the tube so that the key-way for the tube socket will be toward the chassis. Place the rubber collar and deflection yoke support as far forward on the neck of the tube as possible.
2. Slide the supporting platform inside the cabinet and bolt it in the proper position. The supporting platform has elongated holes for the three bolts that anchor it to the cabinet. This allows adjustment of the platform's position so that the face of the tube can be made to fit properly against the mask, regardless of variations in dimensions or shapes of new tubes.
3. Replace the wooden block that acts as a wedge support for the top of the rim of the picture tube.
4. Slide the chassis, mounted on its base, into the grooved track on the side of the cabinet and fasten it in place with the four wood screws. The holes through which the chassis is bolted to its base are large enough to shift the chassis to the position that will allow the control shafts to fit properly.
5. Connect:
   a. Focusing assembly.
   b. Deflection yoke (or plug).
   c. Ion trap.
   d. Picture tube socket.
   e. Anode lead.
   f. Wire or spring that is used to ground the deflection yoke support and tube mounting strap to the chassis.
   g. Speaker plug.
   h. Antenna.
6. If the picture is not properly centered, move the Centering Control Lever on the rear of the receiver a short distance in any direction necessary for correction. Do not use force in making this adjustment as excessive strain may be exerted on the neck of the picture tube. If proper centering cannot be restored in this manner, a slight adjustment of the deflection yoke or focus magnet mountings may be necessary.
7. Replace the upright support.
8. Replace the back of the cabinet and the push-on control knobs.

ALIGNMENT

NOTE: ALWAYS SET NOISE BALANCE CONTROL FULLY CLOCKWISE BEFORE MAKING ANY ALIGNMENT TESTS OR ADJUSTMENTS.

I-F SWEEP PATTERNS AND ALIGNMENT CHART

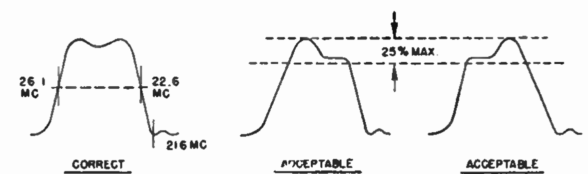


FIG. 8

SIGNAL GENERATOR FREQUENCY	ADJUSTMENT	VTVM INDICATION
24.35 Mc	T2, 1st I-F coil on tuner, and L1	Maximum
23.2 Mc	L3	Maximum
25.2 Mc	T1	Maximum
21.6 Mc	L2	Minimum

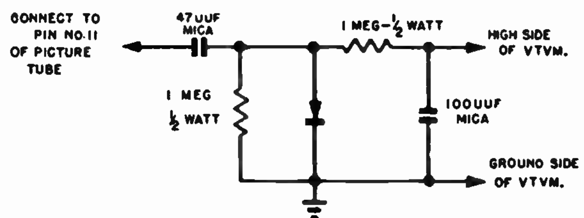
I-F ALIGNMENT

1. Lift the top section of the shield on the 6J6 mixer so that the shield does not make electrical contact with its base. Connect the output of an A-M signal generator to the shield and ground to the chassis.
2. Connect a VTVM across R12, the 4,700 ohm video detector load.
3. Set the Volume and Contrast Controls to minimum.
4. Tune the signal generator to 24.35 Mc and attenuate the signal generator output for a reading of —1 to —1.5 volts to avoid overload and consequent inaccurate alignment.
5. Peak the fourth I-F transformer (T2) to 24.35 Mc keeping the VTVM reading at —1 to —1.5 volts by adjustment of the attenuator on the signal generator.
6. Connect a 1,000 ohm resistor from the grid of V1 to the junction of R2 and R4. Adjust the first I-F coil located on the tuner for a maximum reading on the VTVM of between —1 and —1.5 volts (L9, Fig. 10). Remove the 1,000 ohm resistor.
7. Place the tuner turret so that it is between any two channels and adjust L1 for maximum indication on the VTVM. (Note: on sets below serial number 10525, L1 is fixed and step 7 should be disregarded.)
8. Peak the third I-F coil (L3) to 23.2 Mc keeping the VTVM reading at —1 to —1.5 volts.

9. Tune the signal generator to 25.2 Mc and adjust the second I-F transformer (T1) for maximum, keeping the VTVM reading at —1 to —1.5 volts.
10. Adjust the signal generator to 21.6 Mc and tune the trap L2 for a minimum reading.
11. The I-F passband may be observed by connecting a sweep generator across the terminals of the A-M signal generator and substituting an oscilloscope for the VTVM. Place a 3 volt battery so that its positive terminal is connected to the chassis and its negative terminal is connected to the junction of R2 and R4. The sweep generator should be set to approximately 24.35 Mc and then adjusted to center the waveform on the scope face. To avoid overload, and to assure a true view of the wave shape, the output of the sweep generator should be attenuated until further attenuation has a minimum effect on the wave shape. If necessary, a slight adjustment of the I-F transformers may be made to obtain a close approximation to the ideal curve. Adjustment of L3 or T1 affects the bandwidth. Adjustment of T2 affects the slope of the top.

SOUND ALIGNMENT

1. Connect an A-M signal generator tuned to 4.5 Mc between the grid of V5 and ground. Connect the alignment test circuit shown below and tune L8 for a minimum reading on a VTVM.
2. Disconnect the alignment test circuit and connect the VTVM to ground and Pin 5 of V7. Adjust L9 and primary of T3 (Bottom) for maximum indication.
3. Remove the VTVM and re-connect it to ground and junction of R27 and R28. Adjust secondary of T3 (Top) for zero. (Note: When tuning through the proper setting, the meter should swing negative on one side and positive on the other side.)

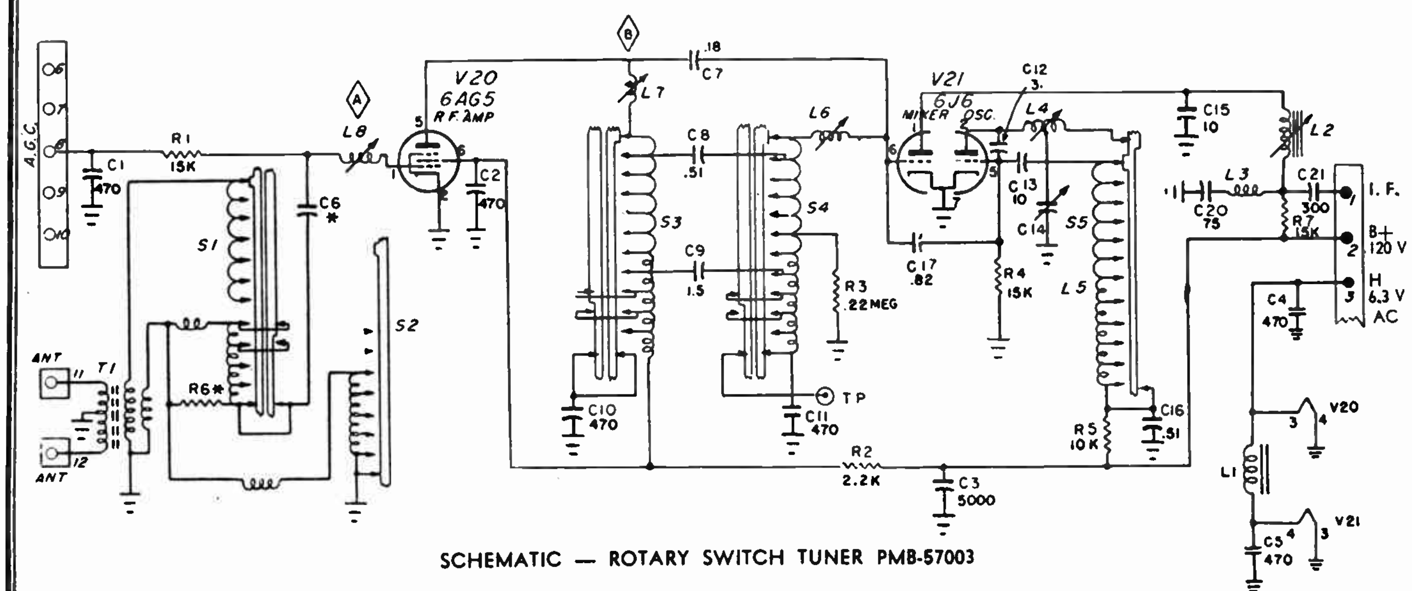


USE IN34 CRYSTAL

FIG. 9—SOUND ALIGNMENT TEST CIRCUIT

ALIGNMENT OF THE ROTARY SWITCH TUNER PMB-57003

Note: This tuner has been carefully checked and aligned at the factory to give the best possible performance. Alignment should not be necessary in the field unless tubes or other components are replaced.



SCHEMATIC — ROTARY SWITCH TUNER PMB-57003

OSCILLATOR ADJUSTMENT

1. Turn station selector to channel 13.
2. Connect signal generator, adjusted to correct channel 13 oscillator frequency, to the antenna.
3. Connect oscilloscope to test point through 10,000 ohms.
4. Set fine tuning in center of range. Check channel 13 and 6 for zero beat on scope.

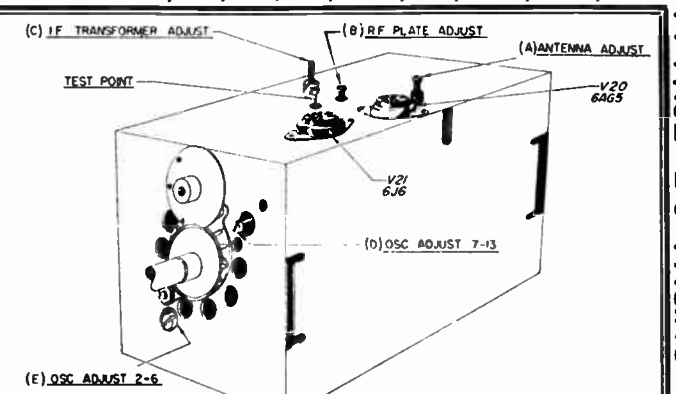
If it is necessary to make adjustments to the oscillator, the following steps should be followed:

A. Align high channels for correct frequency with channel 13 oscillator screw (See illustration, Adjustment D). A non-metallic screwdriver is advisable.
B. Align low channels for correct frequency with channel 6 oscillator screw (Adjustment E).
C. Adjustment of channel 13 and channel 6 oscillator brings all other channels in adjustment. Do not back up the screws more than 8 turns from tight. At that point the electrical effect has ceased. Further backing up will cause the screw to drop out.

Notes: Cover and tube shields to be on. Have rated supply voltages fed to tuner. Allow at least 3 minutes warm up. When replacing oscillator tube, select one which requires minimum touch-up. Clockwise rotation of screws increases frequency.

BAND PASS ALIGNMENT

1. Use R-F sweep to antenna and oscilloscope to the test point through 10,000 ohms.
2. The oscillator must be operating for each channel at nearly the correct frequency.
3. Align channel 13 R-F plate (Adjustment B) and R-F grid (Adjustment A) end inductances. Align channel 13 mixer grid end inductances by spreading or pushing together the turns. The band pass should include both carriers, have steep sides, and maximum gain.
4. Align the incremental loops of the R-F plate, R-F grid, and mixer grid from 12 to 7, in that order. Pushing the loops inwards increases the frequency.
5. Align channel 6 R-F plate, R-F grid, and mixer grid to obtain a flat response with maximum gain. Spreading the coils increases the frequency. Band pass should include both carriers and have steep sides.
6. Align incremental coils of R-F plate, R-F grid, and mixer grid from 5 to 2 in that order. Spreading coils increases the frequency. A tuning wand may be used to determine what change is necessary.



ROTARY SWITCH TUNER PMB-57003 ADJUSTMENTS

CAUTION: Band pass alignment is carefully made at the factory. Attempt this alignment only with proper equipment and set-up.

CONDITIONS OF MEASUREMENT:

"B" Supply .... 120 Volts
Heater Supply .... 6.3 Volts AC
Grid Bias .... —.5 Volts

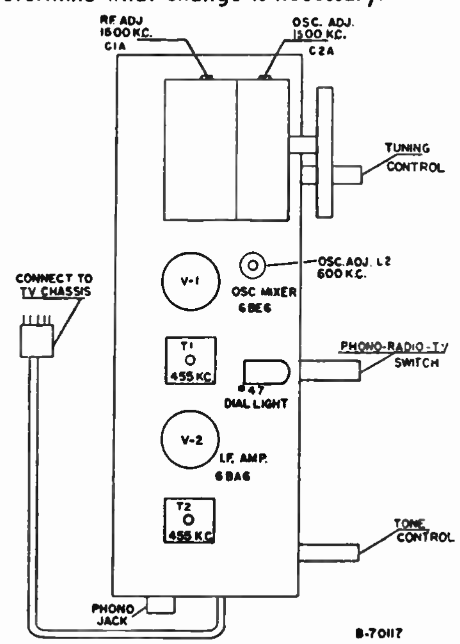
ALIGNMENT OF THE A-M RADIO TUNER, CHASSIS 155

Set RADIO-PHONO-TV function switch to RADIO position.

Set Volume and Tone controls at full clockwise position. With tuning gang fully closed, align dial pointer exactly ⅝" from left edge of dial panel background.

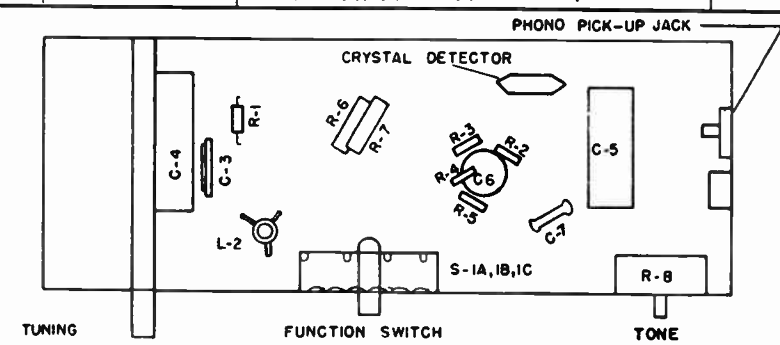
Connect output meter across voice coil.

Notes: Use an insulated alignment screwdriver. Use signal generator having 30% modulation at 400 cycles. Attenuate signal generator to keep output meter reading below 1.25 volts.



CHASSIS 155—TOP VIEW

DUMMY ANTENNA	SIG. GEN. COUPLING	SIG. GEN. FREQUENCY	DIAL SETTING	ADJUST	REMARKS
1.) .1 mfd.	High side to Pin No. 7, V-1 Radio, through .05 mfd. Low side to ground.	455 Kc	Tuning gang fully open.	Top & Bottom T1. 1st I-F Top & Bottom T2 2nd I-F	Adjust for max.
2.) None	To loop (form from a few turns of wire). Place in proximity of built-in antenna.	1500 Kc	Adjust gang to bring pointer 4⅛" from left edge of dial panel background.	C-2a Osc. trimmer.	Adjust for max.
3.) None	Same as (2).	600 Kc	1½" from left edge.	L-2 Osc. Slug Rock Gang.	Adjust for max.
4.) None	Same as (2).	1500 Kc	4⅛" from left edge.	C-1a R-F.	Adjust for max.
		Repeat (2), (3) and (4) if necessary.			

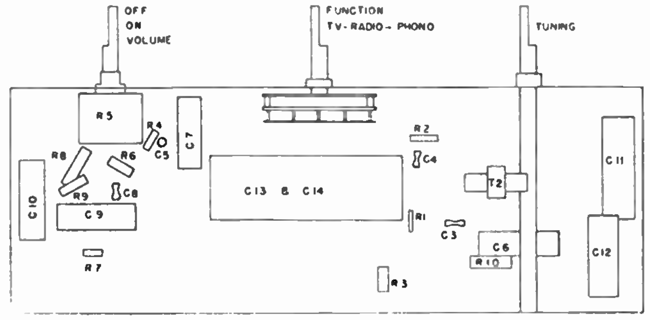


CHASSIS 155—BOTTOM VIEW

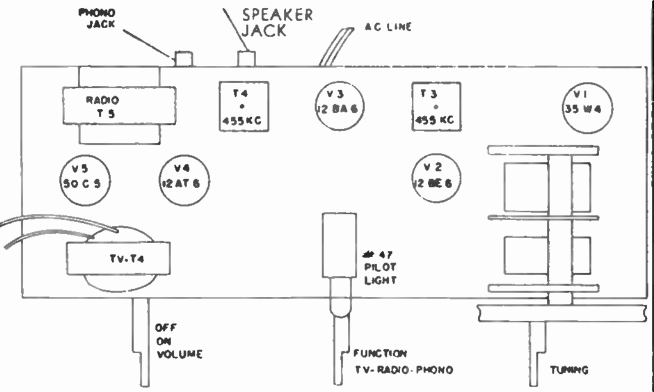
ALIGNMENT OF THE A-M RADIO TUNER, CHASSIS 160

The alignment procedure for this tuner is basically the same as for chassis 155, except for dial setting. The radio dial is fastened to the TV Fine Tuning dial in such a manner that the low end mark on the dial is opposite the radio Index with the gang fully closed. (The radio Index is either to the right, or above the dial. When ordering dial replacement give position of Index.) Before removing the chassis from the cabinet, mark the TV Channel Selector Knob with a grease pencil or bit of plastic tape opposite the radio Index. Remove and replace the knobs when removing the chassis, without changing the position of the TV Channel Selector or Fine Tuning controls. This will provide a reference point for the radio dial settings under the alignment procedure. Dial settings will correspond to signal generator frequencies except for 455 Kc. For this frequency open tuning gang fully.

It is necessary to retain the connections between the radio tuner and the radio built-in antenna fastened to the cabinet, during alignment.

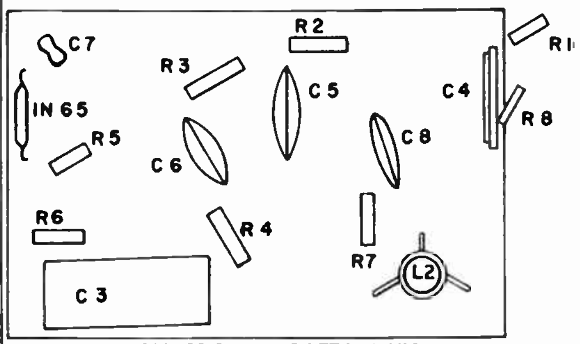


CHASSIS 113—BOTTOM VIEW

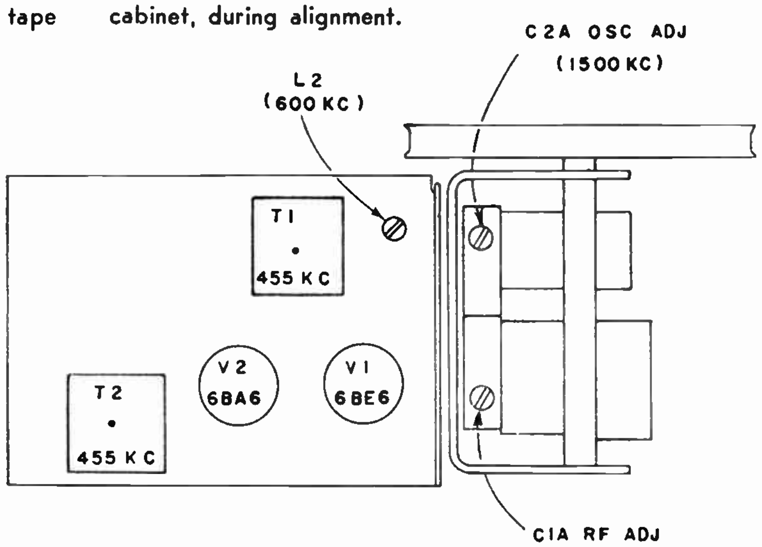


CHASSIS 113—TOP VIEW

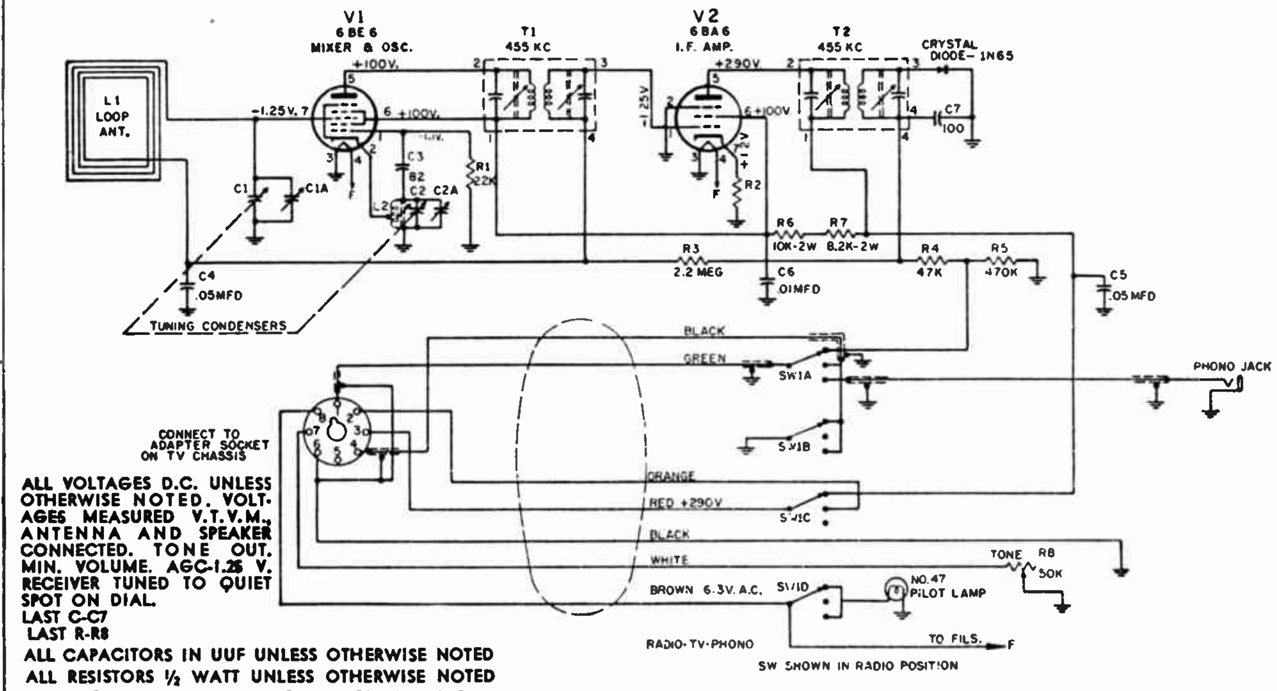
Note: For dial stringing, and schematic, See Page 12.



CHASSIS 160—BOTTOM VIEW



CHASSIS 160—TOP VIEW



ALL VOLTAGES D.C. UNLESS OTHERWISE NOTED. VOLTAGES MEASURED V.T.V.M., ANTENNA AND SPEAKER CONNECTED. TONE OUT. MIN. VOLUME. AGC-1.25 V. RECEIVER TUNED TO QUIET SPOT ON DIAL.
LAST C-C7
LAST R-R8
ALL CAPACITORS IN UUF UNLESS OTHERWISE NOTED
ALL RESISTORS 1/2 WATT UNLESS OTHERWISE NOTED
R2, 330 OHMS, WAS 150 OHMS IN EARLY MODELS.

ALIGNMENT OF AM RADIO—CHASSIS 113

Set RADIO-PHONO-TV function switch to RADIO position.

Set Volume control at full clockwise position.

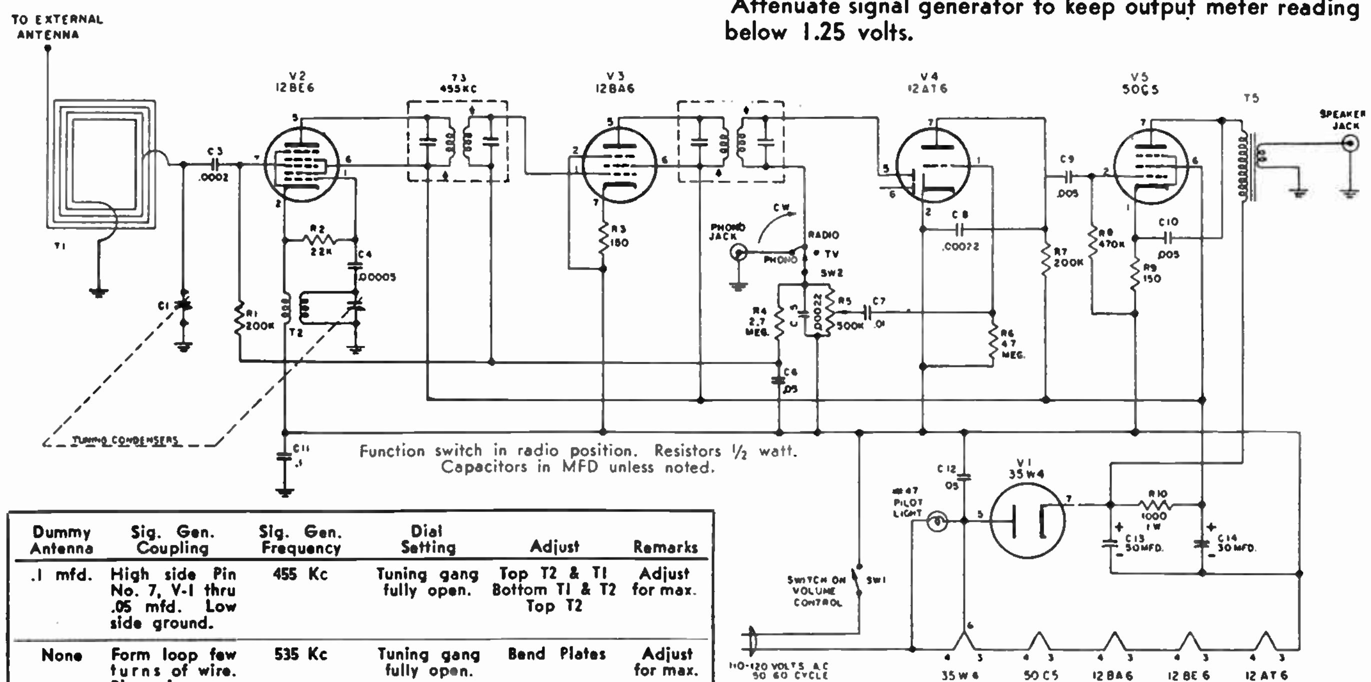
Connect output meter across voice coil.

NOTES:

Use an insulated alignment screwdriver.

Use signal generator having 30% modulation at 40 cycles.

Attenuate signal generator to keep output meter reading below 1.25 volts.

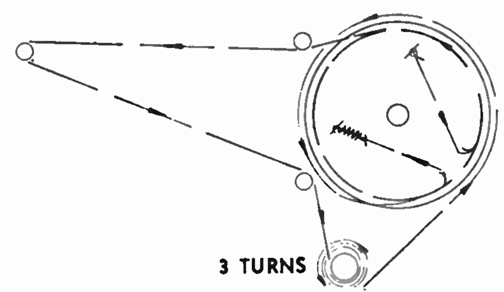


Function switch in radio position. Resistors 1/2 watt. Capacitors in MFD unless noted.

CHASSIS 113—SCHEMATIC

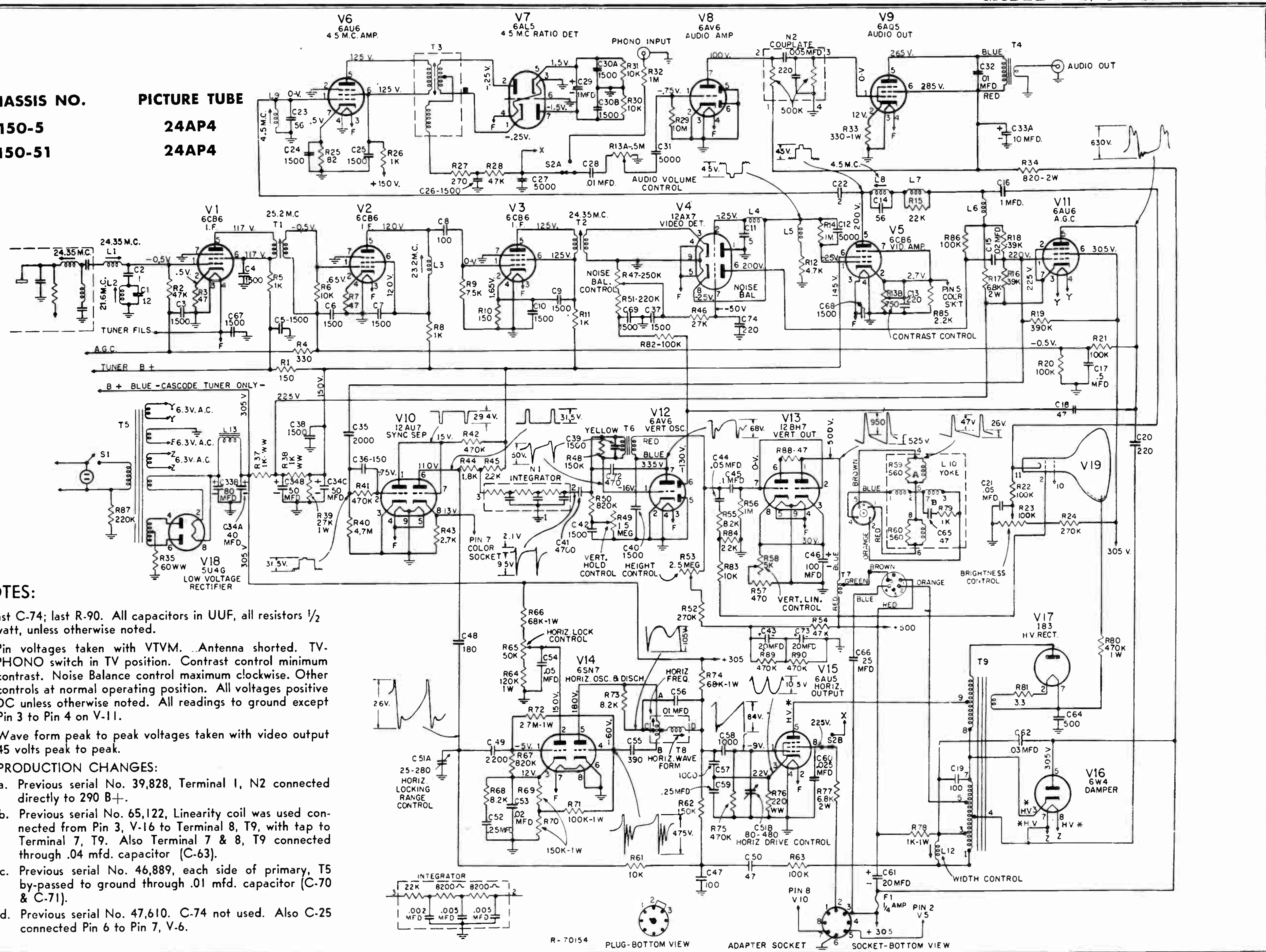
Dummy Antenna	Sig. Gen. Coupling	Sig. Gen. Frequency	Dial Setting	Adjust	Remarks
.1 mfd.	High side Pin No. 7, V-1 thru .05 mfd. Low side ground.	455 Kc	Tuning gang fully open.	Top T2 & T1 Bottom T1 & T2 Top T2	Adjust for max.
None	Form loop few turns of wire. Place in proximity built-in antenna.	535 Kc	Tuning gang fully open.	Bend Plates	Adjust for max.

When the chassis is replaced in the cabinet, adjust the pointer to make the dial settings conform with known frequencies.



155 RADIO DIAL STRINGING

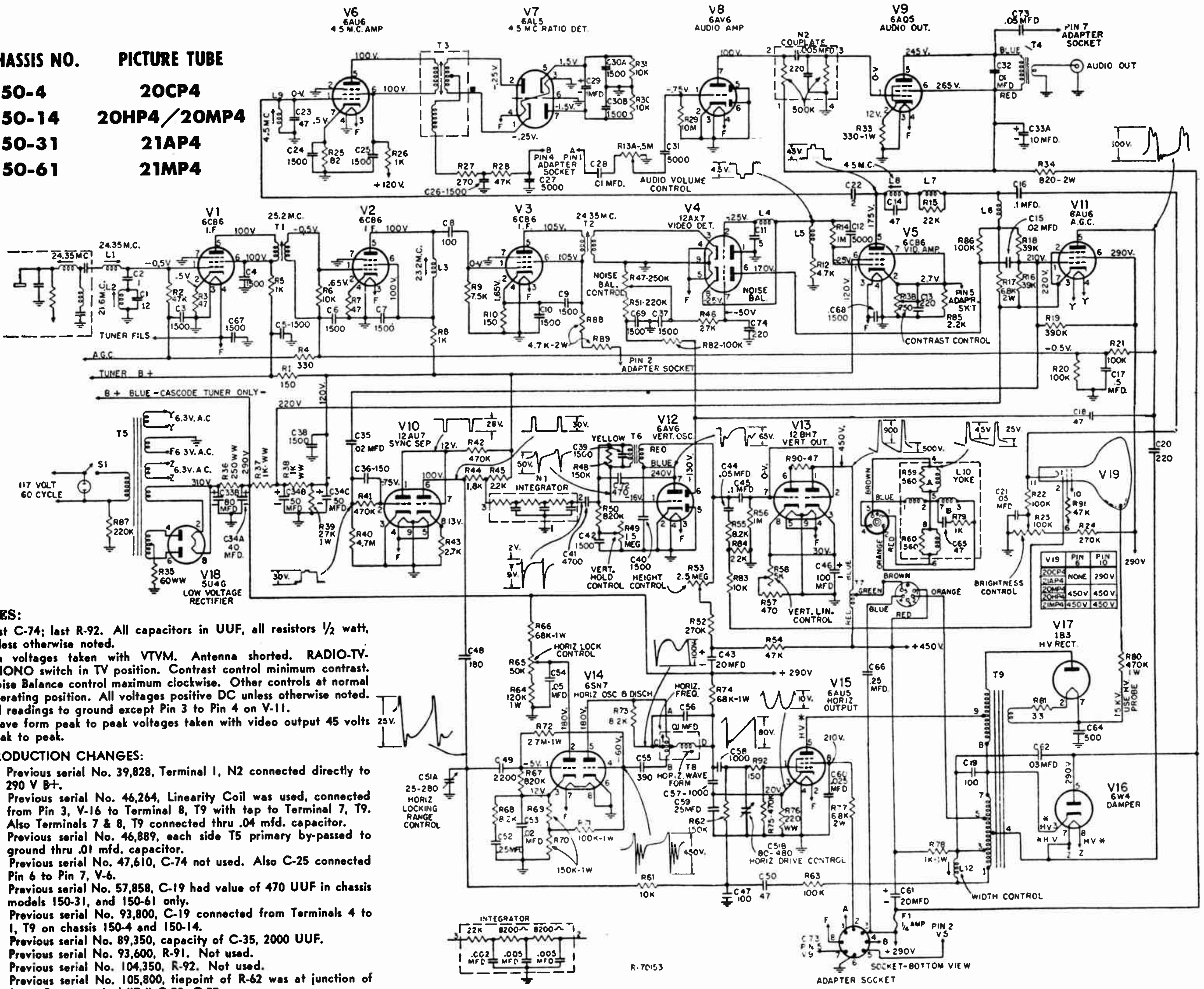
TV CHASSIS NO.	PICTURE TUBE
150-5	24AP4
150-51	24AP4



NOTES:

1. Last C-74; last R-90. All capacitors in UUF, all resistors 1/2 watt, unless otherwise noted.
2. Pin voltages taken with VTVM. Antenna shorted. TV-PHONO switch in TV position. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltages taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 B+.
   b. Previous serial No. 65,122, Linearity coil was used connected from Pin 3, V-16 to Terminal 8, T9, with tap to Terminal 7, T9. Also Terminal 7 & 8, T9 connected through .04 mfd. capacitor (C-63).
   c. Previous serial No. 46,889, each side of primary, T5 by-passed to ground through .01 mfd. capacitor (C-70 & C-71).
   d. Previous serial No. 47,610. C-74 not used. Also C-25 connected Pin 6 to Pin 7, V-6.

TV CHASSIS NO.	PICTURE TUBE
150-4	20CP4
150-14	20HP4/20MP4
150-31	21AP4
150-61	21MP4



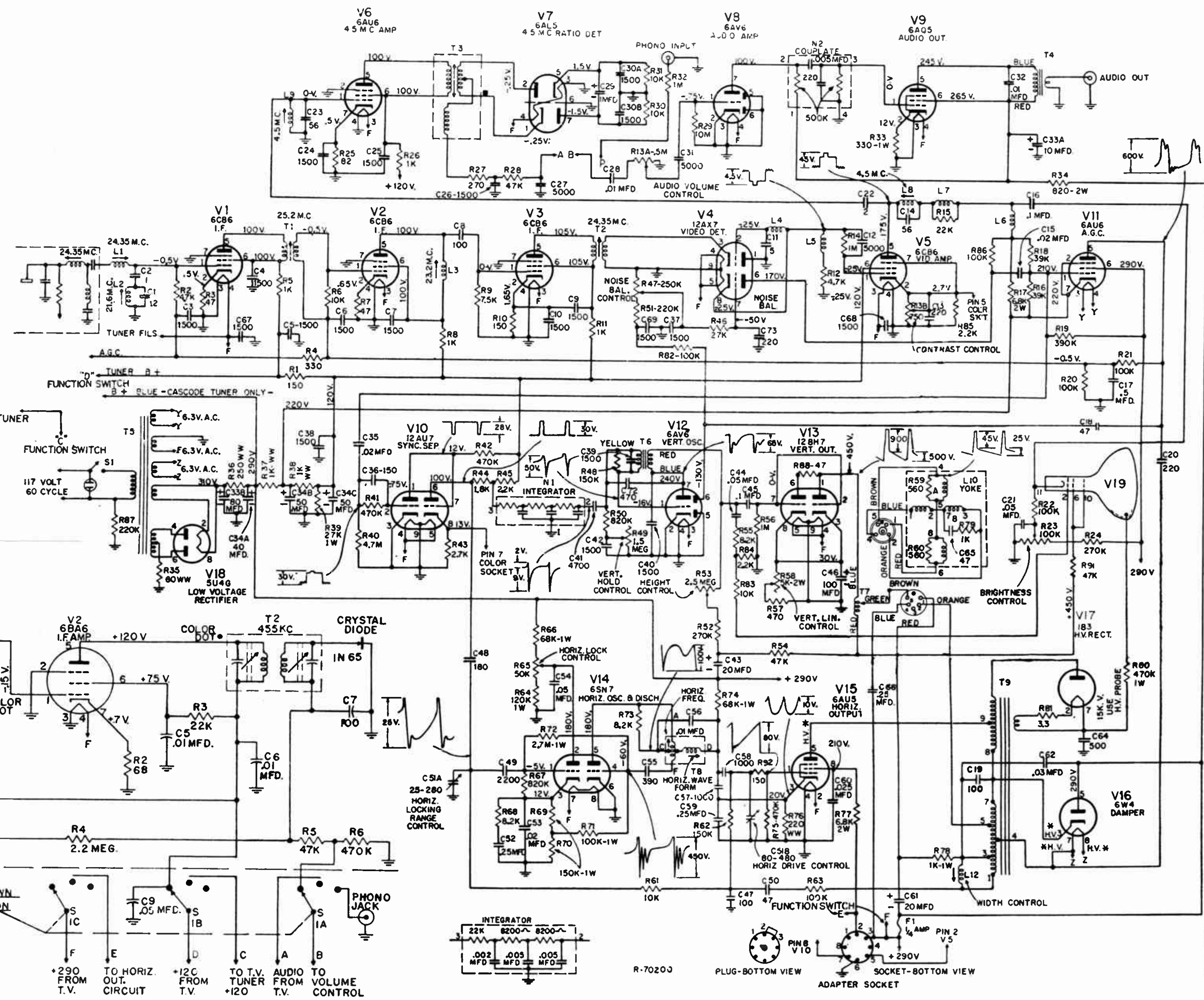
NOTES:

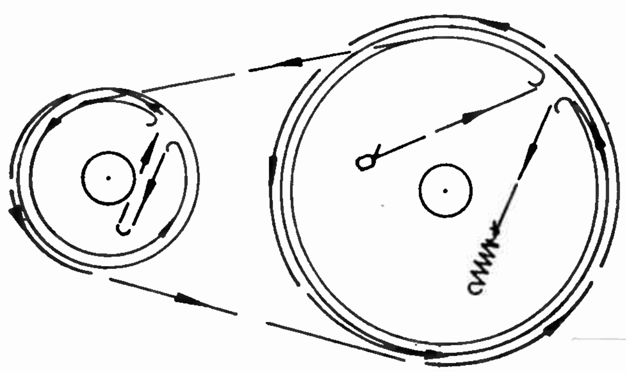
1. Last C-74; last R-92. All capacitors in UUF, all resistors ½ watt, unless otherwise noted.
2. Pin voltages taken with VTVM. Antenna shorted. RADIO-TV-PHONO switch in TV position. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltages taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 V B+.
   b. Previous serial No. 46,264, Linearity Coil was used, connected from Pin 3, V-16 to Terminal 8, T9 with tap to Terminal 7, T9. Also Terminals 7 & 8, T9 connected thru .04 mfd. capacitor.
   c. Previous serial No. 46,889, each side T5 primary by-passed to ground thru .01 mfd. capacitor.
   d. Previous serial No. 47,610, C-74 not used. Also C-25 connected Pin 6 to Pin 7, V-6.
   e. Previous serial No. 57,858, C-19 had value of 470 UUF in chassis models 150-31, and 150-61 only.
   f. Previous serial No. 93,800, C-19 connected from Terminals 4 to 1, T9 on chassis 150-4 and 150-14.
   g. Previous serial No. 89,350, capacity of C-35, 2000 UUF.
   h. Previous serial No. 93,600, R-91. Not used.
   i. Previous serial No. 104,350, R-92. Not used.
   j. Previous serial No. 105,800, tiepoint of R-62 was at junction of R-74, C-56, terminal "D," C-58, C-57.

NOTES:

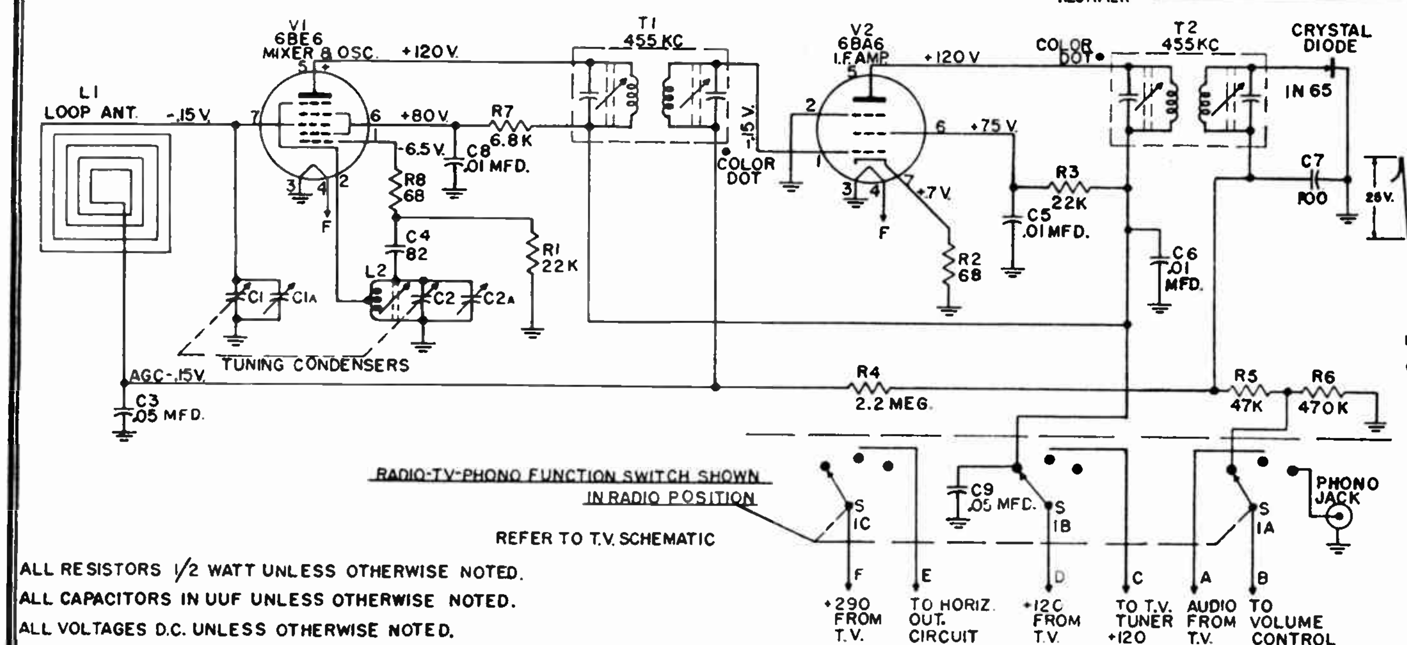
1. Last C-73; last R-92. All capacitors in UUF, all resistors 1/2 watt, unless otherwise noted.
2. Pin voltages taken with VTVM. Antenna shorted. TV-PHONO switch in TV position. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltages taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 V B+.
   b. Previous serial No. 46,264, Linearity Coil was used, connected from Pin 3, V-16 to Terminal 8, T9 with tap to Terminal 7, T9. Also Terminals 7 & 8, T9 connected thru .04 mfd. capacitor.
   c. Previous serial No. 46,889, each side T5 primary by-passed to ground thru .01 mfd. capacitor.
   d. Previous serial No. 47,610, C-73 not used. Also C-25 connected Pin 6 to Pin 7, V-6.
   e. Previous serial No. 89,350, capacity of C-35, 2000 UUF.
   f. Previous serial No. 93,600, R-91 not used.
   g. Previous serial No. 104,350, R-92 not used.
   h. Previous serial No. 105,800 tiepoint of R-62 was at junction of R-74, C-56, terminal "D," C-58, C-57.

TV CHASSIS NO. 150-10 **PICTURE TUBE 21MP4**





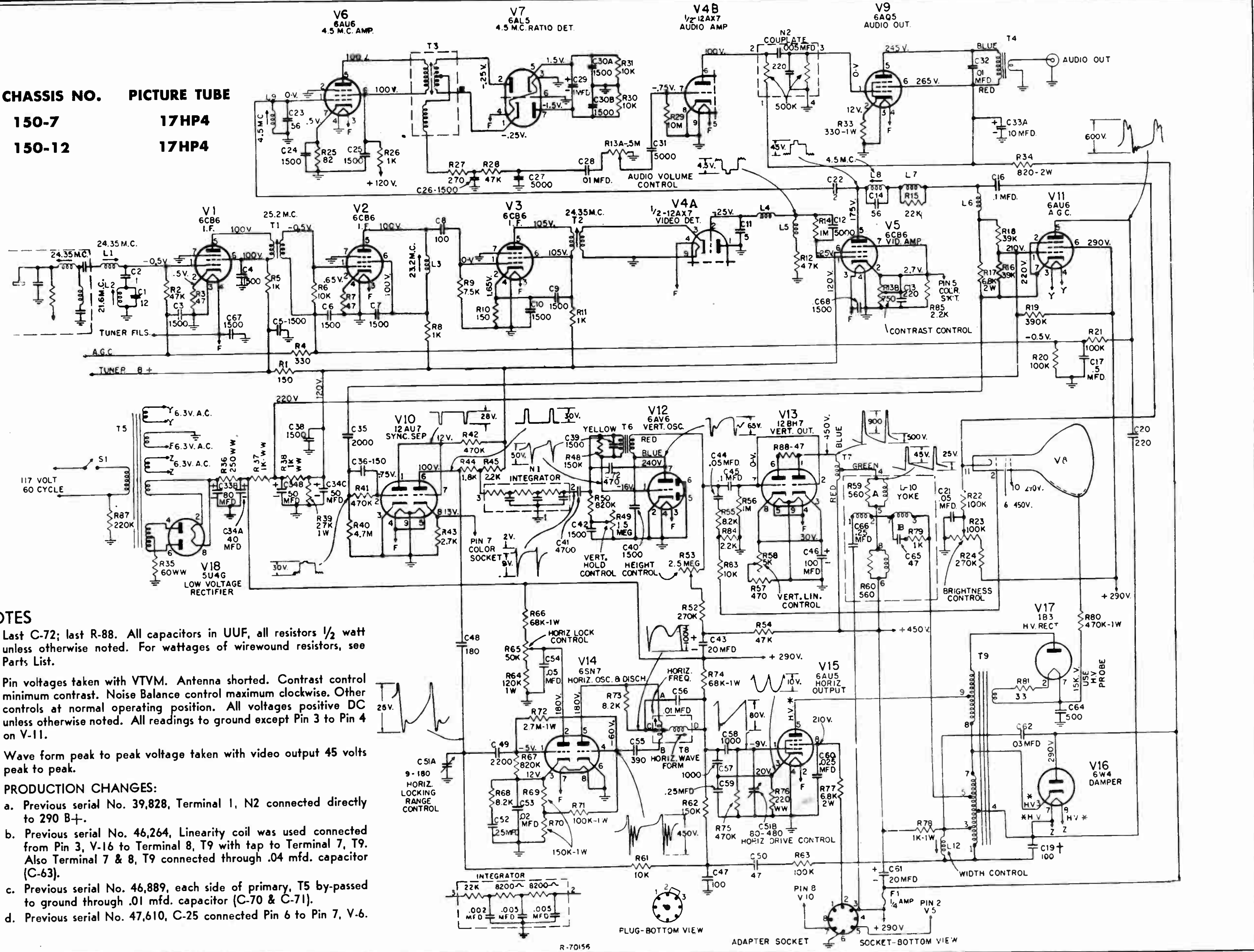
160 RADIO DIAL STRINGING



ALL RESISTORS 1/2 WATT UNLESS OTHERWISE NOTED.
ALL CAPACITORS IN UUF UNLESS OTHERWISE NOTED.
ALL VOLTAGES D.C. UNLESS OTHERWISE NOTED.
VOLTAGES MEASURED WITH V.T.V.M. RECEIVER OFF STATION, ANTENNA SHORTED, SPEAKER CONNECTED.
MAX. VOLUME A.G.C.-.15 V.

CHASSIS 160—SCHEMATIC

TV CHASSIS NO.	PICTURE TUBE
150-7	17HP4
150-12	17HP4



NOTES

1. Last C-72; last R-88. All capacitors in UUF, all resistors 1/2 watt unless otherwise noted. For wattages of wirewound resistors, see Parts List.
2. Pin voltages taken with VTVM. Antenna shorted. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltage taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 B+.
   b. Previous serial No. 46,264, Linearity coil was used connected from Pin 3, V-16 to Terminal 8, T9 with tap to Terminal 7, T9. Also Terminal 7 & 8, T9 connected through .04 mfd. capacitor (C-63).
   c. Previous serial No. 46,889, each side of primary, T5 by-passed to ground through .01 mfd. capacitor (C-70 & C-71).
   d. Previous serial No. 47,610, C-25 connected Pin 6 to Pin 7, V-6.

REPAIR PARTS LIST

TELEVISION CHASSIS

PART NO.	SCHEMATIC LOCATION	DESCRIPTION	
		COMPOSITION CAPACITORS	
PMA-40519-1	C2	1 UUF	
PMA-40519-3	C22	2 UUF	
		CERAMIC CAPACITORS	
PMB-40518-1	C11	5 UUF	500 DCWV
	C1 (Part of L2)	12 UUF †	500 DCWV
	C14, C23 (Part of L8-L9)	47 UUF	500 DCWV
PMB-40518-14	C8, C47	100 UUF	500 DCWV
PMA-40523-23	C19	100 UUF	2 KV
PMB-40518-17	C36	150 UUF	500 DCWV
PMB-40518-19	C13, C73 (C74, 150-4, 150-5, 150-31, 150-51, 150-61)	220 UUF	500 DCWV
PMA-40520-23	C72	470 UUF	1000 DCWV
PMB-40518-24	C25, C39, C40	1500 UUF	500 DCWV
PMA-40517-2	C3, C4, C5, C6, C7, C9, C10, C24, C26, C37, C38, C42, C67, C68, C69	1500 UUF	500 DCWV
PMA-40517-4	C30a, C30b (Dual)	1500 UUF	500 DCWV
PMB-40518-27	C35 (150-5, 150-7, 150-12, 150-51)	2000 UUF	500 DCWV
PMB-40518-32	C27	5000 UUF	500 DCWV
PMA-40517-3	C12, C31	5000 UUF	500 DCWV
		MOLDED PAPER CAPACITORS	
PMB-41007-45	C70, C71	.01 MFD	600 DCWV
PMB-41007-74	C15	.02 MFD	400 DCWV
PMB-41007-85	C35	.02 MFD	600 DCWV
PMB-41007-86	C62	.03 MFD	600 DCWV
PMB-41007-30	C21	.05 MFD	400 DCWV
PMB-41007-51	C16	.1 MFD	600 DCWV
PMB-41007-53	C66	.25 MFD	600 DCWV
PMB-41007-17	C17	.5 MFD	200 DCWV
		PAPER CAPACITORS	
PMB-41006-39	C58	.001 MFD	600 DCWV
PMA-41009	C56 (Oil Filled)	.01 MFD	200 DCWV
PMB-41006-45	C32	.01 MFD	600 DCWV
PMB-41006-7	C28	.01 MFD	200 DCWV
PMB-41006-28	C53	.02 MFD	400 DCWV
PMB-41006-47	C60	.025 MFD	600 DCWV
PMB-41006-76	C63	.04 MFD	400 DCWV
PMB-41006-49	C44, (C73, 150-4, 150-31, 150-61)	.05 MFD	600 DCWV
PMB-41006-30	C54	.05 MFD	400 DCWV
PMB-41006-51	C45 (C66, 150-5, 150-51)	.1 MFD	600 DCWV
PMB-41006-15	C52, C59	.25 MFD	200 DCWV
		MICA CAPACITORS	
PMB-40003-15	C18, C50	47 UUF †	500 DCWV
PMB-40002-15	C65	47 UUF *	100 DCWV
PMB-40003-29	C48	180 UUF †	500 DCWV
PMA-40005-1	C20	220 UUF †	1500 DCWV
PMB-40003-37	C55	390 UUF †	500 DCWV
PMA-40004	C64	500 UUF	20 KV
PMB-40003-47	C57	1000 UUF †	500 DCWV
PMB-40003-55	C49	2200 UUF†	500 DCWV
PMB-40003-63	C41	4700 UUF †	500 DCWV
		ELECTROLYTIC CAPACITORS	
PMA-42002	C29	1 MFD	50 DCWV
PMA-42006	C61, C43 (Paper Case) (C73, 150-5; 150-51)	20 MFD	300 DCWV
	(C43a	40 MFD	450 DCWV
PMA-42001	(C43b	50 MFD	350 DCWV
	(C43c	50 MFD	300 DCWV
PMA-42000	(C33a	10 MFD	400 DCWV
	(C33b	80 MFD	450 DCWV
PMA-42005	C46 (Paper Case)	100 MFD	50 DCWV
		MICA TRIMMER CAPACITORS	
PMA-43001	C51a, C51b	25 to 280 UUF, 80 to 480 UUF	

Capacity Values ± 20% Tolerance Except: * ± 5%, † ± 10%.

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
		COILS
PMA-52020	L2	21.5 Mc I. F. Trap
PMA-52021	L3, L1	24 Mc I. F. Coil
PMA-52023	L4	100 UH Peaking Coil
PMA-52024	L5, L6	450 UH Peaking Coil
PMA-52025	L7 & R15	200 UH Peaking Coil Wound on 22K Resistor
PMA-52028-2	L8 & C14, L9 & C23	4.5 Mc Take-off Trap
PMA-56000	L10	Yoke
PMA-56001	L11	Linearity Coil
PMA-56003	L12	Width Coil
PMB-56011	L13	Filter Choke

PART NO.	SCHEMATIC LOCATION	DESCRIPTION	
PMA-95000	N1	Vert. Integrating Network	
PMA-95001	N2	Audio Couplate	
		COMPOSITION RESISTORS	
PMA-45013-1	R81	3.3 OHMS	½ WATT
PMA-45015-9	R3, R7, R88, (R90, 150-4, 150-31, 150-61)	47 OHMS	½ WATT
PMA-45015-12	R25	82 OHMS	½ WATT
PMA-45015-15	R1, R10, R90	150 OHMS	½ WATT
PMA-45015-18	R27	270 OHMS	½ WATT
PMA-45015-19	R4	330 OHMS	½ WATT
PMA-45017-19	R33	330 OHMS	1 WATT
PMA-45015-21	R57	470 OHMS	½ WATT
PMA-45015-22	R59, R60	560 OHMS	½ WATT
PMA-45019-24	R34	820 OHMS	2 WATT
PMA-45015-25	R5, R8, R11, R26, R79	1K	½ WATT
PMA-45017-25	R78	1K	1 WATT
PMA-45015-28	R44	1.8K	½ WATT
PMA-45015-29	R45, R84, R85	2.2K	½ WATT
PMA-45015-30	R43	2.7K	½ WATT
PMA-45015-33	R2, R12	4.7K	½ WATT
PMA-45019-33	R89, R90 (150-4, 150-31, 150-61)	4.7K	2 WATT
PMA-45019-35	R17, R77	6.8K	2 WATT
PMA-45014-70	R9	7.5K *	½ WATT
PMA-45015-36	R55, R68, R73	8.2K	½ WATT
PMA-45015-37	R6, R30, R31, R61, R83	10K	½ WATT
PMA-45015-42	R46	27K	½ WATT
PMA-45017-42	R39	27K	1 WATT
PMA-45015-44	R16, R18	39K	½ WATT
PMA-45015-45	R28, R54, R89, R92	47K	½ WATT
PMA-45017-47	R66, R74	68K	1 WATT
PMA-45015-49	R20, R21, R22, R63, R82,R86	100K	½ WATT
PMA-45017-49	R71	100K	1 WATT
PMA-45017-50	R64	120K	1 WATT
PMA-45015-51	R48, R62	150K	½ WATT
PMA-45017-51	R69, R70	150K	1 WATT
PMA-45015-53	R51, R87	220K	½ WATT
PMA-45015-54	R24, R52	270K	½ WATT
PMA-45015-56	R19	390K	½ WATT
PMA-45015-57	R41, R42, R75 (R89, R90, 150-5 & 150-51)	470K	½ WATT
PMA-45017-57	R80	470K	1 WATT
PMA-45015-60	R50, R67	820K	½ WATT
PMA-45015-61	R14, R32, R56	1 MEG	½ WATT
PMA-45017-66	R72	2.7 MEG	1 WATT
PMA-45015-69	R40	4.7 MEG	½ WATT
PMA-45015-73	R29	10 MEG	½ WATT
		WIRE WOUND RESISTORS	
PMB-47007-4	R35	60 OHMS	6 WATT
PMB-47007-3	R76	220 OHMS	4 WATT
PMB-47007-5	R36	250 OHMS	15 WATT
PMB-47007-1	R37, R38	1K	7.5 WATT
		VARIABLE RESISTORS	
PMA-48016	R58	5K, Control, Vertical Linearity	
PMB-48014-8	R65	50K, Control, Horizontal Hold	
PMB-48014-9	R23	100K, Control, Brightness	
PMB-48014-3	R47	250K, Control, Noise Inverter	
PMB-48015	R13a, R13b, S1	.5 Meg., 750 Ohms Control, Volume & Contrast & Off Switch	
PMB-48014-10	R49	1.5 Meg, Control, Vertical Hold	
PMB-48014-5	R53	2.5 Meg, Control, Vertical Height	

Resistance Values ± 10% Tolerance Except: * ± 5%.

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
		TRANSFORMERS
PMA-52029	T1, T2	Bifilar I. F. Coil
PMA-52027	T3	4.5 Mc Ratio Detector
PMB-51005	T4	Audio Output Transformer
PMB-50003	T5	Power Transformer
PMB-56005	T6	Vertical Oscillator Trans.
PMA-56004	T7	Vertical Output Trans.
PMB-52019	T8	Synchroguide
PMC-56002	T9	Horizontal Output Trans.

PART NO.	DESCRIPTION	Used Only in Chassis No.
PM-155	AM Radio Tuner	150-4 150-31, 150-61
PM-160	AM Radio Tuner	150-10
PMA-52017	Antenna	
PMB-56012	Centering Magnet	150-7, 150-9, 150-12, 150-16 & 150-61
PMA-10044-2	Extension, Focus Control Screw	150-4, 150-5, 150-31, 150-51
PMB-56008	Focus Magnet	150-4, 150-5, 150-31, 150-51
PMA-95002-1	Fuse, ¼ Amp., 250 V, Type 3AG	
PMB-56013	Ion Trap	
PMA-62001	Jack, Speaker and Phono	
PMA-10043	Lever—Centering Ring	150-4, 150-5, 150-31, 150-51
PMB-97088	Plug, Yoke Connection	
PMB-57003	Rotary Switch Tuner	150-7
PMB-97089	Receptacle, Yoke Connection	
PMB-80094	Spring, Ground	
PMA-23057	Tube Mount Strap	150-10, 150-31, 150-61
PMA-23046-3	Tube Mount Strap	150-7, 150-9, 150-12, 150-16

TV CHASSIS—Continued

PART NO.	DESCRIPTION	Used Only in Chassis No.
PMA-23066	Tube Mount Strap	150-5, 150-51
PMB-61012-4	Tube Socket, Octal, Molded (V-16 & V-17)	
PMB-61012-5	Tube Socket, Octal, Molded (V-15)	
PMA-61106	Tube Socket, 9 Pin Molded (V-13)	
PMA-61107	Tube Socket, 9 Pin	
PMB-57002-1	Turret Cascode Tuner	150-10, 150-16, 150-31, 150-51, 150-61
PMB-57001	Turret Pentode Tuner	150-4, 150-5, 150-9, 150-12

AM RADIO TUNER CHASSIS 155 & 155-1

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
		CAPACITORS
PMB-40003-21	C3	82 UUF Mica 300 DCWV
PMB-40518-14	C7	100 UUF Ceramic 500 DCWV
PMB-44001	C1,C1a,C2,C2a	420/162 UUF Variable
PMA-40517-5	C6	.01 MFD Ceramic 500 DCWV
PMB-41006-30	C4	.05 MFD Paper 400 DCWV
PMB-41006-49	C5	.05 MFD Paper 600 DCWV
		RESISTORS
PMB-45015-19	R2	330 Ohms ½ WATT
PMB-45019-36	R7	8.2K 2 WATT
PMB-45019-37	R6	10K 2 WATT
PMB-45015-41	R1	22K ½ WATT
PMB-45015-45	R4	47K ½ WATT
PMB-48018-2	R8	50K Variable ½ WATT
PMB-45015-57	R5	570K ½ WATT
PMB-45015-65	R3	2.2 MEG ½ WATT
		COILS & TRANSFORMERS
PMB-52034	L1	Coil—Antenna Loop
PMA-52032	L2	Coil—Oscillator
PMD-52033-1	T1	Transformer—Interstage I. F.
PMD-52033-2	T2	Transformer—Diode I. F.
		SWITCHES
PMB-60006	SW1, a,b,c,d	Switch—Rotary
PMB-97077		Cable Assembly & Plug
PMB-97075		Tuner Shaft & Pulley Assembly
PMA-97076		Cord—Dial Assembly
PMA-61104		Pilot Light Socket
		Pilot Light—Bayonet Base—Type 49
PMB-61012-1		Tube Socket, 7 Pin, Mini
PMA-62001		Phono Jack
PMA-62007		Plug
PMA-57502		Crystal Detector, 1N65

AM RADIO TUNER CHASSIS 160

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
		CAPACITORS
PMB-40006-21	C4	82 UUF Mica 300 DCWV
PMB-40518-14	C7	100 UUF Ceramic 500 DCWV
PMB-44001	C1,C1a,C2,C2a	420/162 UUF, Variable
PMA-40517-5	C5, C6, C8	.01 MFD Ceramic 500 DCWV
PMB-41006-66	C3	.05 MFD Paper 200 DCWV
PMB-41006-30	C9	.05 MFD Paper 400 DCWV
		COMPOSITION RESISTORS
PMA-45015-11	R2, R8	68 Ohms ½ WATT
PMA-45015-35	R3	6.8K ½ WATT
PMA-45015-41	R1, R7	22K ½ WATT
PMA-45015-45	R5	47K ½ WATT
PMA-45015-57	R6	470K ½ WATT
PMA-45015-65	R4	2.2 MEG ½ WATT
		COILS, TRANSFORMERS AND SWITCHES
PMB-52034	L1	Coil-Antenna Loop
PMA-52035	L2	Oscillator Coil
PMD-52037	T1, T2	Interstage & Diode I.F. Transformers
PMB-60007	SW1a, b, c	Switch—Rotary
PMA-97086		Cord Assembly
PMB-62012-1		Tube Socket, 7 Pin, Mini
PMA-57502		Crystal Detector, 1N65
PMB-40518-6	C4	47 UUF Ceramic 500 DCWV
PMB-40518-19	C3, C5, C8	220 UUF Ceramic 500 DCWV

AM RADIO CHASSIS 113

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
PMB-44001	C1, C2	420/162 UUF Variable
PMB-41006-43	C9, C10	500 UUF Paper 500 DCWV
PMB-41006-26	C7	.01 MFD Paper 400 DCWV
PMB-41006-30	C6, C12	.05 MFD Paper 400 DCWV
PMB-41006-51	C11	.1 MFD Paper 400 DCWV
PMA-65009-1	C13, C14	50 MFD, 30 MFD Electrolytic Dual 150 DCWV
PMA-45015-15	R3, R9	150 Ohms Composition ½ WATT
PMA-45017-25	R10	1K Composition 1 WATT
PMA-45015-41	R2	22K Composition ½ WATT
PMA-45015-53	R1, R7	220K Composition ½ WATT
PMA-45015-57	R8	470K Composition ½ WATT
PMA-45017-66	R4	2.7 MEG Composition 1 WATT
PMA-45015-69	R6	4.7 MEG Composition ½ WATT
PMA-65009-4	R5 & S1	500K Volume Control—On-Off Switch
PMA-65009-5	S2	Function Switch
PMA-65009-2	L1	Coil—Antenna Loop
PMA-65009-3	L2	Coil—Oscillator
PMA-65009-7	T1	Transformer—I. F. Interstage
PMA-65009-8	T2	Transformer—I. F. Diode
PMA-65009-6	T3	Transformer—Audio Output

CABINET ACCESSORIES

PART NO.	DESCRIPTION
PMB-80066-1	Back, Models 2080, 2081
PMD-80117	Back, Models 2117, 2192, 2193
PMB-80119	Back, Model 2114
PMB-80164	Back, Models 2118, 2194
PMB-80177	Back, Model 2119
PMB-80155	Back, Model 2124
PMB-80066-2	Back, Models 2152 & 2181
PMB-80182-1	Back, Model 2184
PMB-80083	Back, Model 2401
PMB-80091	Back, Model 4317
PMB-80180	Back, Model 4321
PMB-80062-2	Back, Model 4721
PMD-7018	Bezel, Models 2080, 2081
PMD-7023	Bezel, Models 2181, 2114
PMB-30007-1	Cup, Tube Protection CRT, 2" Deep
PMB-30026-1	Cup, Tube Protection CRT, 3½" Deep
PMA-5029	Dial, Station Selector, 160 Radio
PMA-5031	Dial, 155-1 Radio
PMB-80085	Glass, 155 Radio Dial
PMB-5026	Glass, UHF Dial, Model 2152
PMA-80089	Glass, 12½" x 16"
PMA-80107	Glass, 16" x 20"
PMB-80151-2	Glass, 16" x 20½"
PMB-80151-3	Glass, 16" x 24"
PMA-80084	Glass, 20" x 25"
PMA-80056-1	Knob, Channel Selector, Gold (outer)
PMB-80056-2	Knob, Channel Selector, Model 2401
PMB-80056-3	Knob, Channel Selector, Tan (outer)
PMA-80158-1	Knob, Channel Selector, Brown (inner)
PMA-80158-3	Knob, Channel Selector, Tan (inner)
PMA-80054-1	Knob, Fine Tuning, Brown (inner)
PMA-80054-2	Knob, Fine Tuning, Tan (inner)
PMB-80159-1	Knob, Fine Tuning, Brown outer)
PMB-80159-2	Knob, Fine Tuning, Tan (outer)
PMB-80055-1	Knob, On-Off-Volume, Gold (outer)
PMB-80055-2	Knob, On-Off-Volume, Tan (outer)
PMB-80160-1	Knob, On-Off-Volume, Brown (inner)
PMB-80160-2	Knob, On-Off-Volume, Tan (inner)
PMB 80053-1	Knob, Picture Contrast, Brown (inner)
PMB-80053-2	Knob, Picture Contrast, Tan (inner)
PMB-80161-1	Knob, Picture Contrast, Brown (outer)
PMB-80161-2	Knob, Picture Contrast, Tan (outer)
PMA-80087-1	Knob, Function Switch, Radio & UHF, Brown
PMA-80087-3	Knob, Function Switch, Radio & UHF, Tan
PMA-80068-1	Knob, Function Switch, Radio, Model 2080, Brown
PMA-80068-2	Knob, Tone & Tune—155 Radio, Tuning—UHF, Brown
PMA-80068-5	Knob, Function Switch, Radio Model 2080, Tan
PMA-80068-6	Knob, Tone & Tune—155 Radio, Tuning—UHF, Tan
PMD-7012	Mask, Models 2080 and 2081
PMD-7031	Mask, Models 2117, 2118, 2119, 2152, 2181, 2184, 2194
PMD-7032	Mask, Models 2192, 2193, 4321, 4721
PMD-7035	Mask, Models 2114, 2181 with Bezel
PMR-7042	Mask, Model 2124
PMD-7026	Mask, Model 2401
PMD-7034	Mask, Model 4317
PMA-90021	Speaker, 5"
PMA-90012	Speaker, 8"
PMA-90017	Speaker, 10"

Fig. 1. Model 2721

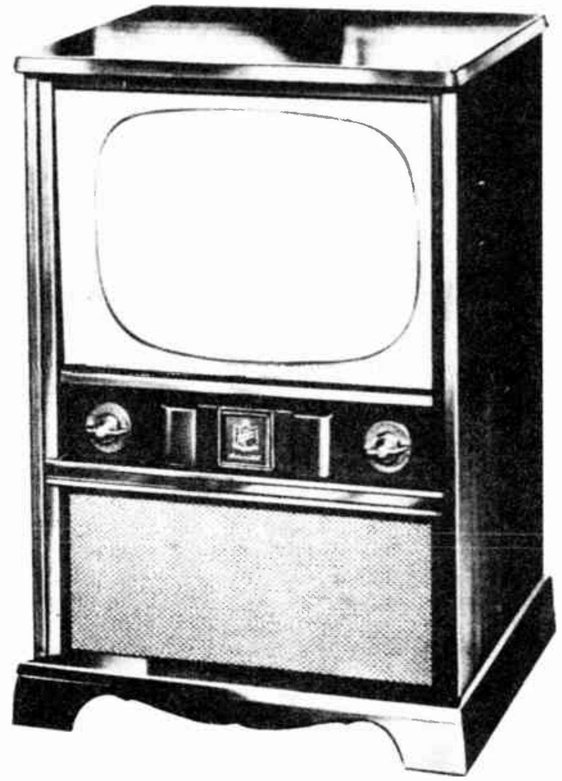


Fig. 3. Model 2723 Standard

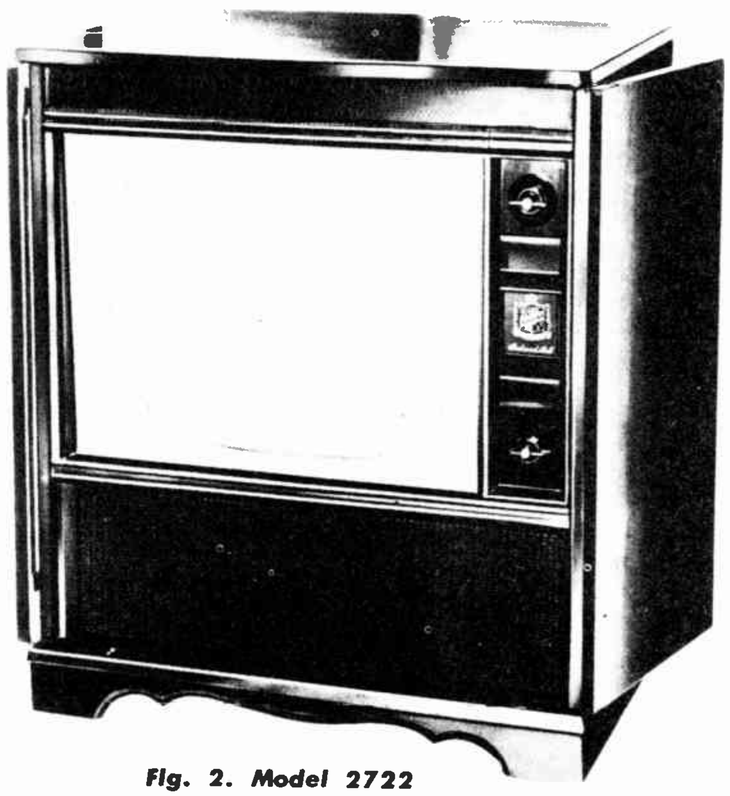


Fig. 2. Model 2722

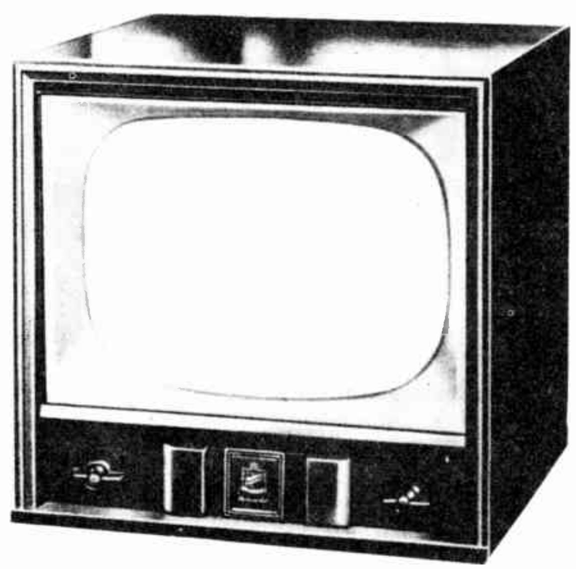


Fig. 4. Model 2724

SECTION I

GENERAL INFORMATION

DESCRIPTION OF MODELS:

MODEL 2721, Fig. 1, is a console television receiver with full length doors. Chassis 2720 is used. The 21 inch rectangular picture tube is mounted in the cabinet on a removable shelf. Cabinet finishes are Mahogany, American Colonial, French Provincial, and Blonde Oak.

MODEL 2722, Fig. 2, is a console television receiver with full length doors. Chassis 2720 is used. The 24 inch round, metal picture tube is mounted in the cabinet on a removable shelf. Cabinet finishes are Mahogany, American Colonial, French Provincial, and Blonde Oak.

MODEL 2723 STANDARD, Fig. 3, is an open face console television receiver using chassis 2710. The 21 inch rectangular picture tube is mounted on the chassis. Cabinet finishes are Mahogany, Maple, and Blonde Oak.

MODEL 2723 DE LUXE, (not shown) has full length doors. Otherwise it looks exactly like the 2723 standard shown in Fig. 3.

MODEL 2724, Fig. 4, is a table model television receiver using chassis 2710. The 21 inch rectangular picture tube is mounted on the chassis. Cabinet finishes are Mahogany and Blonde.

CHASSIS 2710, Figs. 8 and 9, is designed for horizontal mounting in the cabinet and mounts a 21 inch rectangular picture tube. It is used in models 2723 Standard and De Luxe and in Model 2724 (table model).

CHASSIS 2720, Figs. 10 and 11, is smaller than the 2710 chassis since it does not mount the picture tube. It is designed for vertical mounting in the cabinet and is used in Models 2721 and 2722.

SPECIFICATIONS:

OVERALL DIMENSIONS:

	2721	2722	2723 std	2723 dlx	2724
Height	37 in.	39 in.	37 in.	37 in.	23 in.
Width	31 in.	35 in.	25 in.	26 in.	24 in.
Depth	24 in.	25 in.	23 in.	24 in.	22 in.
Ship. Wt.	180 lbs.	210 lbs.	150 lbs.	165 lbs.	115 lbs.

TELEVISION TUNING FREQUENCY RANGE:

All 12 VHF television channels currently allocated in the United States, consisting of channels 2 thru 13, and covering frequencies from 54 to 88 Mc. and 174 to 216 Mc.

Coil strips are available for UHF channels 14 thru 83.

INTERMEDIATE FREQUENCIES:

Picture Carrier: 25.0 Mc.
Sound Carrier: 20.5 Mc.
Intercarrier Sound: 4.5 Mc.

ELECTRICAL RATINGS:

Line voltage (all models), 110-120 volts AC, 60 cycles per second.

Power consumprion (all models), 190 watts.

LOUDSPEAKER DATA:

Type (all models): Permanent Magnet.

Voice coil impedance (all models): 3.2 ohms at 400 cycles per second.

Cone diameter, 2721, 2722 and 2723 de luxe: 10 in. with 3.16 oz. Alnico V.

Cone diameter, 2723 standard and 2724: 6 in. with 2.15 oz. Alnico V.

FOCUS:

Electrostatic.

SWEEP DEFLECTION:

Electromagnetic, 70 degree.

SCANNING:

525 lines interlaced.

HORIZONTAL SCANNING FREQUENCY:

15,750 cycles per second.

VERTICAL SCANNING FREQUENCY:

60 fields per second.

PICTURE REPETITION RATE:

30 frames per second.

TUBE COMPLEMENT:

No.	Tube	Function
V-1	6AU6	Sound I-F
V-2	6CB6	Driver
V-3	6AL5	Ratio Detector
V-4	6AV6	1st Audio Amplifier
V-5	6V6-GT	Audio Output
V-6	6CB6	1st Pix I-F
V-7	6CB6	2nd Pix I-F
V-8	6CB6	3rd Pix I-F
V-9	6CB6	4th Pix I-F
V-10A	½6AL5	Pix Detector
V-10B	½6AL5	D. C. Restorer
V-11	6CB6	1st Video Amplifier
V-12	6K6-GT	2nd Video Amplifier
V-13	12AU7	Sync Pulse Separator and Amplifier
V-14	6AL5	Automatic Frequency Control and Discriminator
V-15	6SN7-GT	Horizontal Oscillator
V-16	6J5 or 6J5-GT	Horizontal Discharge
V-17	6AV5-GT or 6AU5-GT	Horizontal Output
V-18	6AX4-GT	Damper
V-19	1B3-GT	High Voltage Rectifier
V-20	6AV6	Automatic Noise Inverter
V-21	6AU6	Keyed Automatic Gain Control
V-22	6J5 or 6J5-GT	Vertical Oscillator
V-23	6S4	Vertical Output
V-24	5U4-G	Low Voltage Rectifier
V-25	21FP4A	Pix Tube for models 2721, 2723 (both standard and deluxe), and 2724.
	24BP4	Pix Tube for model 2722.
V-26	6BQ7	R-F Amplifier Note: Early models using R-F Tuner 10531 may use either a 6BQ7 or a 6BK7. Tube must be replaced with type removed.
V-27	6J6	Oscillator and Mixer

PHONO RECEPTACLE AND SWITCH

There is a receptacle on the rear of the chassis to accommodate a record player. There is also a TV-PHONO switch that connects either the set or the record player.

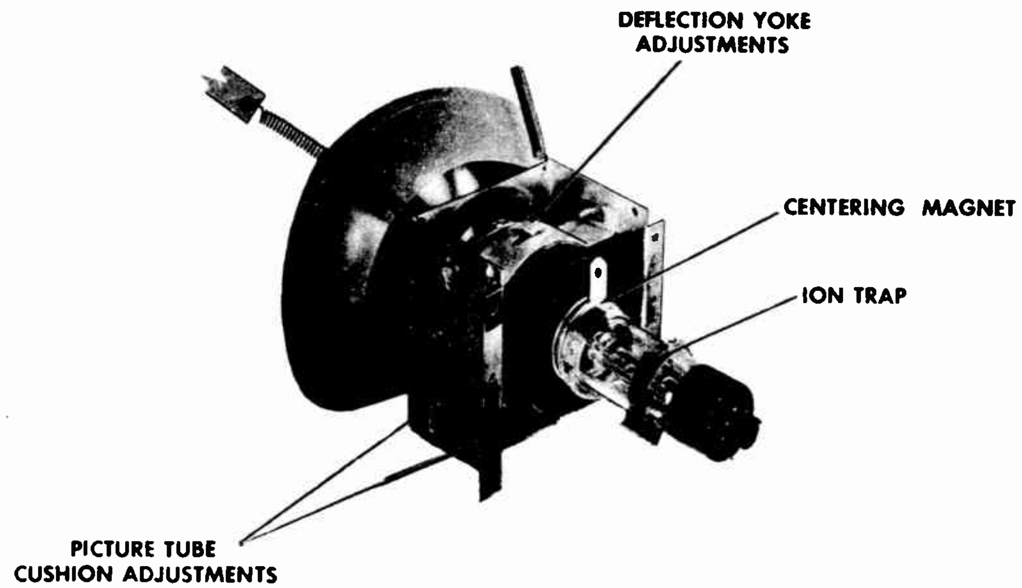


Fig. 5. Picture Tube Yoke Assembly

SECTION II

INSTALLATION INSTRUCTIONS

PICTURE TUBE ADJUSTMENTS:

The following picture tube adjustments are to be checked upon installation or whenever the receiver is serviced. (See Fig. 5, Picture Tube Yoke Assembly.)

1. Deflection Yoke. Loosen deflection yoke adjustment screw and rotate yoke so that raster is square with picture tube frame. Make certain yoke is positioned firmly against cone of tube.
2. Ion Trap. Turn contrast control to minimum. Set brightness control at approximately 90% clockwise and slowly slide ion trap backward and forward, at the same time rotating around neck of tube, until maximum brightness is obtained.
   Reset brightness control to just light tube. Turn contrast control clockwise to 90% of maximum and readjust ion trap for peak brightness.
3. Centering. The centering magnet is a dual ring magnet. The centering is dependent upon the relation of the rings to each other and the relation of both to the tube. The centering magnet is positioned almost against the deflection yoke, then the two sections rotated in relation to each other, and as a whole, until proper centering is obtained. This adjustment is quite stable and will need little attention unless its position is disturbed.

NOTE: If centering magnet requires adjustment, repeat step 2 above.

REMOVING AND REPLACING PICTURE TUBE:

CAUTION

WEAR GOGGLES OR A MASK AND USE GLOVES TO HANDLE TUBE. DO NOT STRIKE OR SCRATCH TUBE OR SUBJECT IT TO MORE THAN MODERATE PRESSURE.

NOTE: It is not necessary to remove the picture tube to clean the tube face. Simply remove three screws in front rail and remove safety glass. Clean glass and face of tube with window cleaning fluid on a soft cloth.

In all models it is necessary to remove the chassis before removing the picture tube.

The procedure on models 2721 and 2722 is as follows:

1. Disconnect power plug.
2. Remove back.
3. Remove picture tube socket, yoke plug, anode lead clip, and speaker plug.
4. Remove chassis by removing the four mounting bolts, removing knobs from control panel, and sliding chassis out.
5. Remove four bolts holding tube support platform.
6. Slide picture tube and tube support platform out of the cabinet.
7. Slide ion trap and centering magnet off neck of picture tube.
8. Remove tube securing band, rubber band and mounting ring. This step applies to model 2722 only.
9. Replace the tube by reversing the above procedure. Shell should be flush against deflection yoke rubber cushions.

The procedure on models 2723 and 2724 is as follows:

1. Disconnect power plug.
2. Remove back.
3. Remove chassis by removing control knobs on panel and four bolts on bottom of shelf.
4. Remove picture tube socket.
5. Remove ion trap and centering magnet.
6. Disconnect high voltage lead from picture tube.
7. Remove spring harness and unfasten band over top of picture tube.
8. Pull tube forward and out of yoke.

OPERATING INSTRUCTIONS, ALL MODELS:

1. Turn receiver on by turning VOLUME CONTROL clockwise.
2. Allow for normal tube warm up.
3. Turn SELECTOR to desired television channel.
4. Adjust FINE TUNING CONTROL for maximum picture quality.
5. Adjust CONTRAST CONTROL for most pleasing picture.
6. Adjust VOLUME CONTROL to desired level.

NON-OPERATING CONTROLS:

GENERAL:

The non-operating controls are located similarly on all models. Six of them are under the nameplate escutcheon on the front of the set. They are:

ANI (automatic noise inverter)
Vertical hold
Brightness
Vertical linearity
Height
Focus

To reach these controls open the spring doors on the escutcheon.

There are four non-operating controls at the rear of the chassis. They are:

Horizontal hold
Horizontal drive
Horizontal linearity
Width

All controls are marked. Read the following instructions before making any adjustments.

ADJUSTMENT OF NON-OPERATING CONTROLS:

The following adjustments should be made while observing a station test pattern. Allow receiver to warm up for ten minutes.

Adjustment of FOCUS control and BRIGHTNESS control is self explanatory.

Set HORIZONTAL HOLD to synchronize picture horizontally.

Set VERTICAL HOLD so that picture does not move up or down.

Adjust HEIGHT and WIDTH controls in conjunction with VERTICAL LINEARITY and HORIZONTAL LINEARITY controls to obtain symmetrical pattern of correct size.

The automatic noise inverter (ANI) control MUST be adjusted at the location where the receiver is to be used. Moreover, it must be adjusted using the weakest signal that will be received. The procedure is as follows:

1. Rotate the ANI control to its extreme counterclockwise position.
2. Advance the control clockwise until the picture begins to distort.
3. Return the control counterclockwise slightly beyond where the distortion disappears.
4. Check all channels for picture stability. If adjustment has not been made on the weakest signal, synchronization may be lost on another channel.

The HORIZONTAL DRIVE control is adjusted by rotating it clockwise until a bright vertical bar appears, causing picture compression. Then the control is rotated counterclockwise until the compression just disappears.

SECTION III

ALIGNMENT PROCEDURE

GENERAL:

It is important that the service technician read and adhere to the alignment instructions in this section. This point cannot be stressed too strongly, especially in the case of the picture I-F alignment.

Many service technicians have been accustomed to aligning the picture I-F response curve on the oscilloscope alone. This procedure is not recommended because it is actually quite possible to get what appears to be an acceptable curve and still be lacking in horizontal resolution.

Instead, the spot frequency alignment outlined below should be followed.

It will be noted that in the following procedure the sweep generator is fed in through the antenna terminals. This being the case, the output impedance of the generator must match the 300 ohm input impedance of the set. A matching network may be devised to accomplish this. At the factory a Sylvania type 500 sweep generator was used. This generator has an output impedance of 75 ohms. The network used to match this particular impedance to the set is shown in Fig. 6. For a generator with 50 ohms impedance, use 56 ohms for the shunt resistor, and 130 ohms for each of the series resistors.

Also in step 12 it is directed that the generator be loosely coupled to the converter tube. This is done by disconnecting the tube shield from ground and connecting the generator between the shield and ground.

Test point locations are shown on the schematic diagram, Fig. 20, and on the chassis illustrations, Figs. 8, 9, 10, and 11.

Allow the set to warm up for 10 minutes before alignment.

PICTURE I-F ALIGNMENT:

1. Remove ANI tube, 6AV6 (V-20).
2. Connect a 3 volt battery between point "A" and ground, with the negative lead to point "A."
3. Connect a vacuum tube voltmeter between points "B" and "C."
4. Connect signal generator between ground and first I-F grid (V-6, pin 1), through a .001 mfd capacitor. Set output at maximum.

NOTE: Early models have traps on 1st and 2nd I-F's only. These are tuned to 26.5 Mc. and 20.5 Mc. respectively. Alignment procedure is as described in steps 6 and 7 below, using 26.5 Mc. instead of 26.25 Mc.

Steps 5 through 12 are listed in tabular form.

Step	Signal Generator Frequency	Adjust.	For
5.	18.75 Mc.	S-22B	Minimum
6.	26.25 Mc.	S-21B and S-19B	Minimum
7.	20.50 Mc.	S-20B	Minimum
8.	22.15 Mc.	S-22A	Maximum
	(Adjust generator output for 2.5 to 3 volt VTVM reading for steps 8 thru 12.)		
9.	23.70 Mc.	S-21A	Maximum
10.	21.25 Mc.	S-20A	Maximum
11.	24.80 Mc.	S-19A	Maximum

REPEAT STEPS 5 THROUGH 11

Disconnect signal generator from I-F grid and loosely couple it to converter tube, V-27. See general instructions, this section.

Step	Signal Generator Frequency	Adjust.	For
12.	21.05 Mc.	S-6A (on R-F tuner)	Maximum

13. Disconnect VTVM and 3 volt battery.
14. Connect oscilloscope to point "B," using a 22,000 ohm isolating resistor in series with the scope probe. Connect an electrolytic capacitor, 5 mfd., 50 volt, between point "J" and ground, the negative lead going to point "J." The capacitor should previously have been checked for leakage. There should be no drop in A.G.C. voltage when the capacitor is connected.

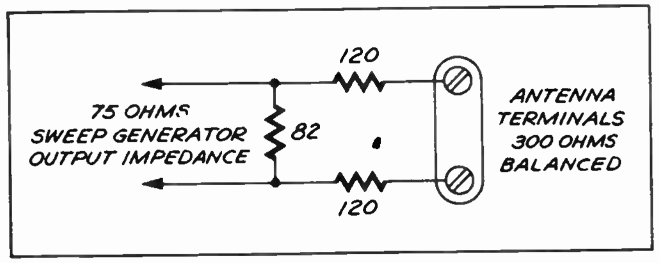


Fig. 6. Matching Network

15. Connect sweep generator to antenna terminals through an impedance matching network. (See preceding general instructions.)
16. Rotate tuner to a low frequency channel, say channel 3, and set sweep generator to center frequency of channel used (63 Mc. for channel 3). With a sweep width of 10 Mc., adjust generator output to develop approximately 4 volts of A.G.C.
17. With signal generator loosely coupled to converter tube, adjust output to provide the markers shown on the response curve, Fig. 7. Check the position of the markers one at a time.
18. Observe the waveform obtained on the oscilloscope, and compare it with the waveform shown in Fig. 7. If the spot frequency alignment has been carefully done, the comparison will be favorable. However, slight retouching of the I-F adjustments may be required. It should not be necessary to change any adjustment appreciably. The markers should be located as follows:
    The 20.5 Mc., the 26.25 Mc. and the 18.75 Mc. markers at minimum response.
    The 25.0 Mc. marker at 50% response.
    The 21.55 Mc. marker at 100% response.

ALIGNMENT OF 4.5 Mc. TRAP:

1. Remove Pix Detector-D.C. Restorer tube, 6AL5 (V-10).
2. Connect signal generator between point "B" and ground thru a .001 mfd isolating capacitor.
3. Turn contrast control to maximum.
4. Connect a R-F VTVM to point "D." If an R-F vacuum tube voltmeter is not available, connect a germanium diode crystal in series with the positive probe of a conventional VTVM.
5. Set signal generator to 4.5 Mc., exactly, with the output at one volt or more.
6. Adjust trap, S-23, for minimum VTVM reading.

Note: If signal generator is not capable of one volt output, it will be necessary to adjust the trap by visual means. To do this, observe the picture and adjust the trap to eliminate the 4.5 Mc. beat.

SOUND I-F AND RATIO DETECTOR ALIGNMENT:

1. Connect signal generator between point "B" and ground.
2. Connect VTVM between points "E" and "F."
3. With generator frequency at 4.5 Mc., adjust S-1, S-2, and S-3 for maximum output.
4. Connect VTVM between point "G" and ground.
5. With generator at 4.5 Mc., adjust Ratio Detector primary, S-4, for maximum output. A positive voltage will be noted.
6. Connect VTVM between points "G" and "H."
7. Adjust Ratio Detector secondary, S-5, for zero between positive and negative peaks.

RADIO FREQUENCY TUNER:

The radio frequency tuner used is the "Standard Cascode Tuner" manufactured by Standard Coil Products Inc. for Packard-Bell Co. Most models use tuner 10532 (Packard-Bell part number), but early models incorporated tuner 10531. Schematics of both are shown, Figs. 17 and 18.

The 10531 tuner uses a 6BK7 or a 6BQ7 tube as an R-F amplifier, but these tubes are not interchangeable. A tube must be replaced by the type that is removed.

The 10532 tuner has an improved circuit designed for use with the 6BQ7 tube only as the R-F amplifier.

Special Note: Some 10532 tuners are supplied with a 6BQ7A or a 6BZ7. These tubes are interchangeable with the usual 6BQ7.

Alignment of the tuner, other than channel slugs and converter I-F, is not recommended.

UHF OPERATION:

UHF coil strips for the radio frequency tuner will be available through Packard-Bell Factory Service Departments for channels 14 through 83. When requesting strips specify the tuner part number. Tuner 10531 uses "K" strips and tuner 10532 uses "Q" strips. These strips are not interchangeable.

No tuner adjustment is needed after strip installation except normal oscillator slug adjustment.

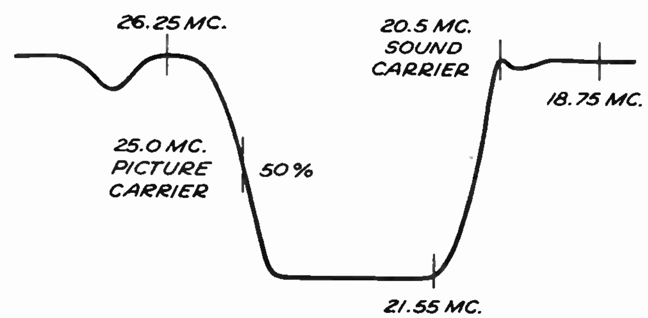


Fig. 7. I-F Response Curve

CHASSIS 2710 IS USED ON MODELS 2723 AND 2724.

LIST OF ADUSTMENTS:

Reference Symbol	Description
S-1	Intercarrier sound, 4.5 Mc.
S-2	Sound I-F, primary, 4.5 Mc.
S-3	Sound I-F, secondary, 4.5 Mc.
S-4	Ratio detector, primary
S-5	Ratio detector, secondary
S-6A	Converter I-F, in R-F tuner
S-6B	Mixer, in R-F tuner
S-6C	R-F, in R-F tuner
S-6D	Antenna, in R-F tuner
S-6E	Oscillator trimmer, in 10531 tuner only
S-7 thru S-18	Oscillator slugs for the 12 channels

Reference Symbol	Description
S-19A	1st picture I-F, 24.8 Mc.
S-19B	Trap, 26.25 Mc.
S-20A	2nd picture I-F, 21.25 Mc.
S-20B	Trap, 20.5 Mc.
S-21A	3rd picture I-F, 23.7 Mc.
S-21B	Trap, 26.25 Mc.
S-22A	4th picture I-F, 22.15 Mc.
S-22B	Trap, 18.75 Mc.
S-23	Trap, 4.5 Mc.
S-24	Horizontal hold
S-25	Horizontal linearity
S-26	Width

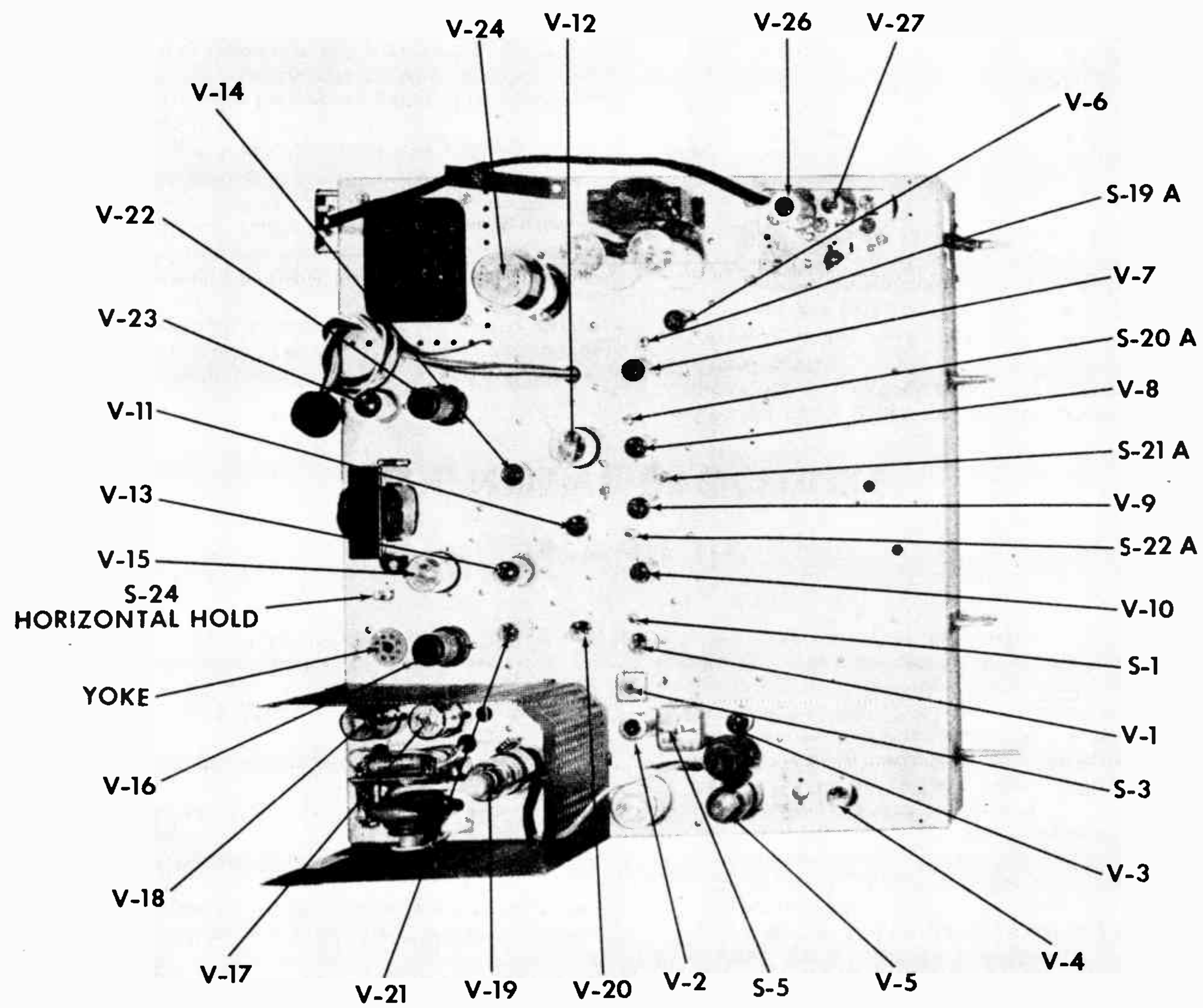


Fig. 8. Chassis 2710, Top View

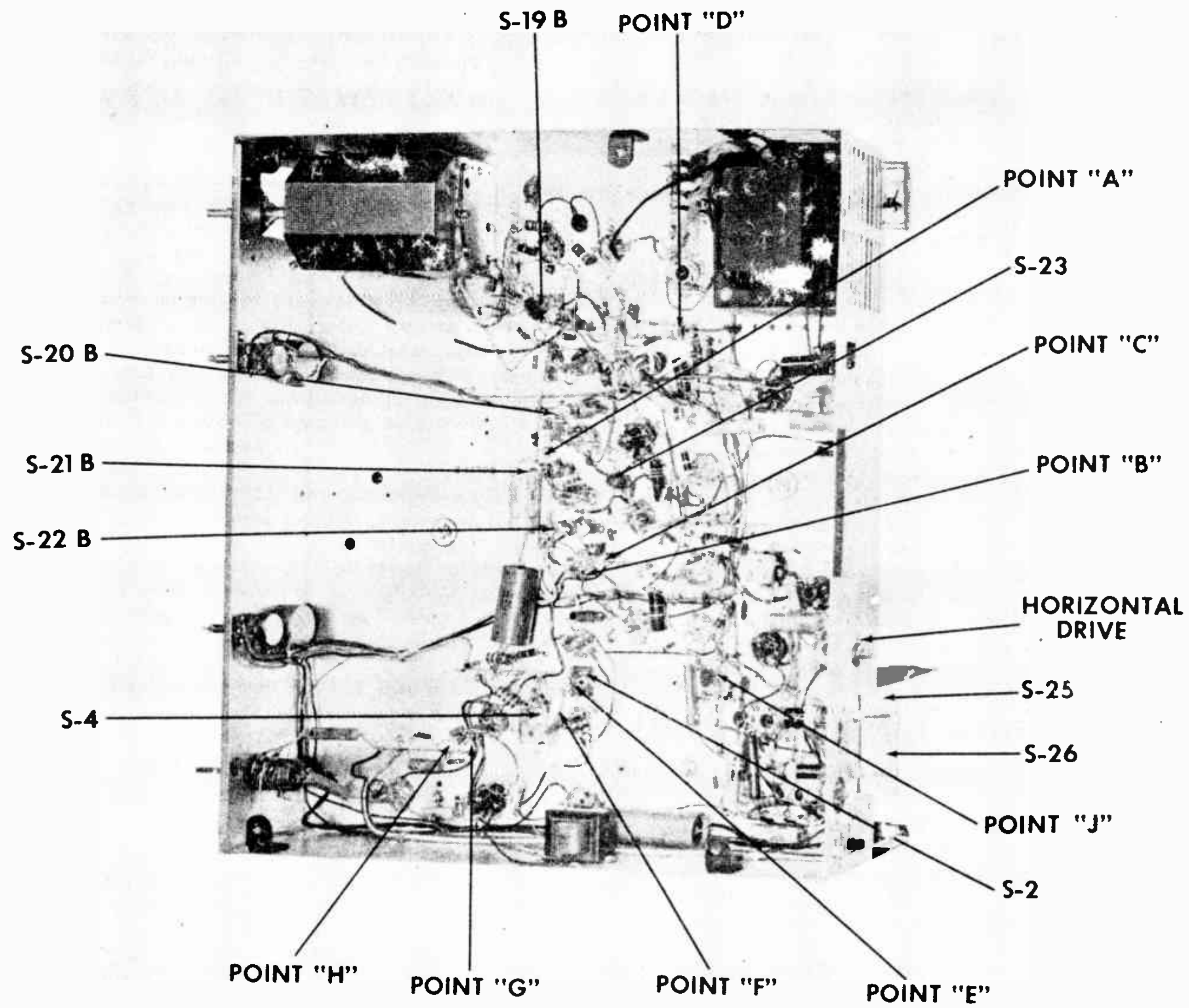


Fig. 9. Chassis 2710, Bottom View

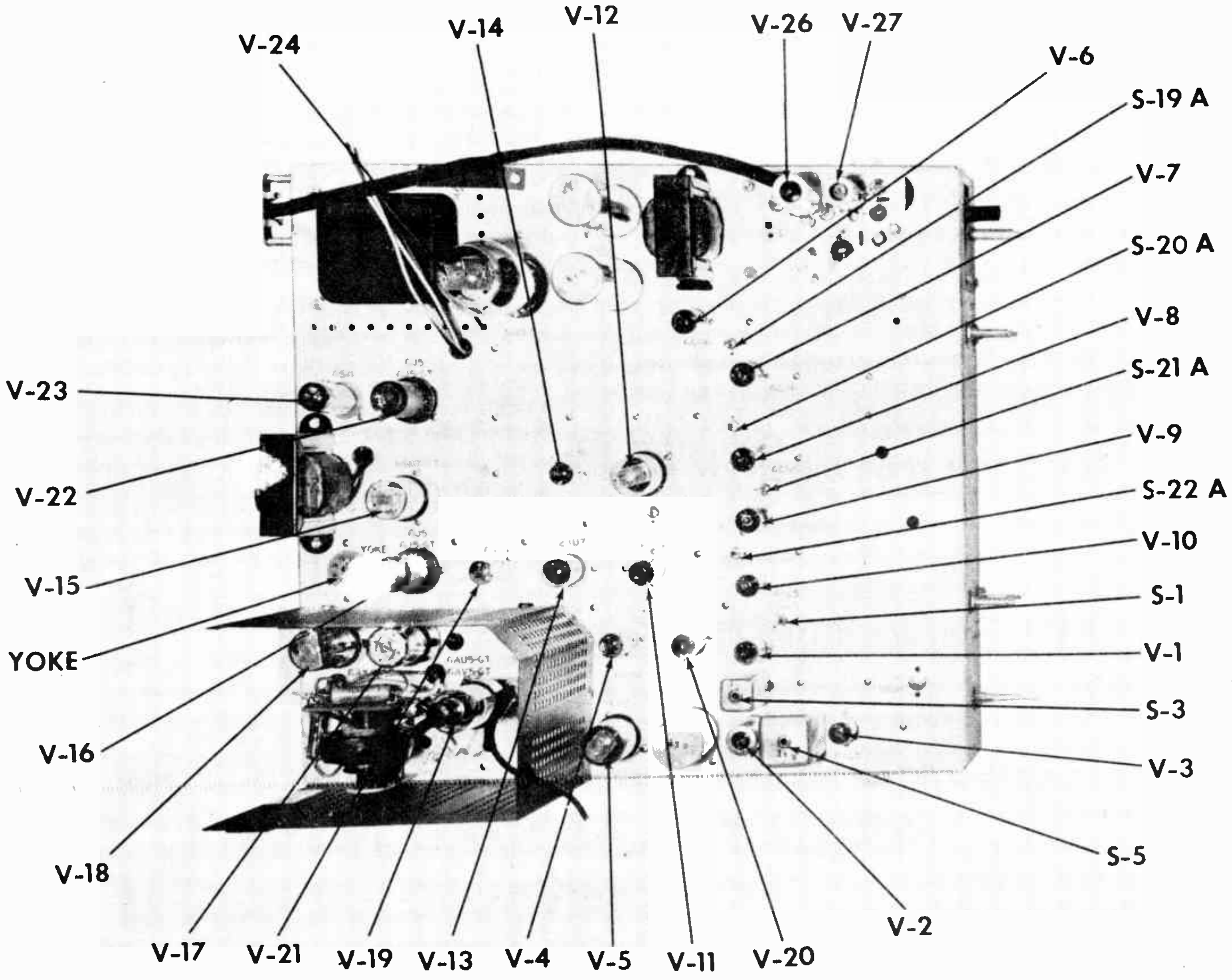


Fig. 10. Chassis 2720, Top View

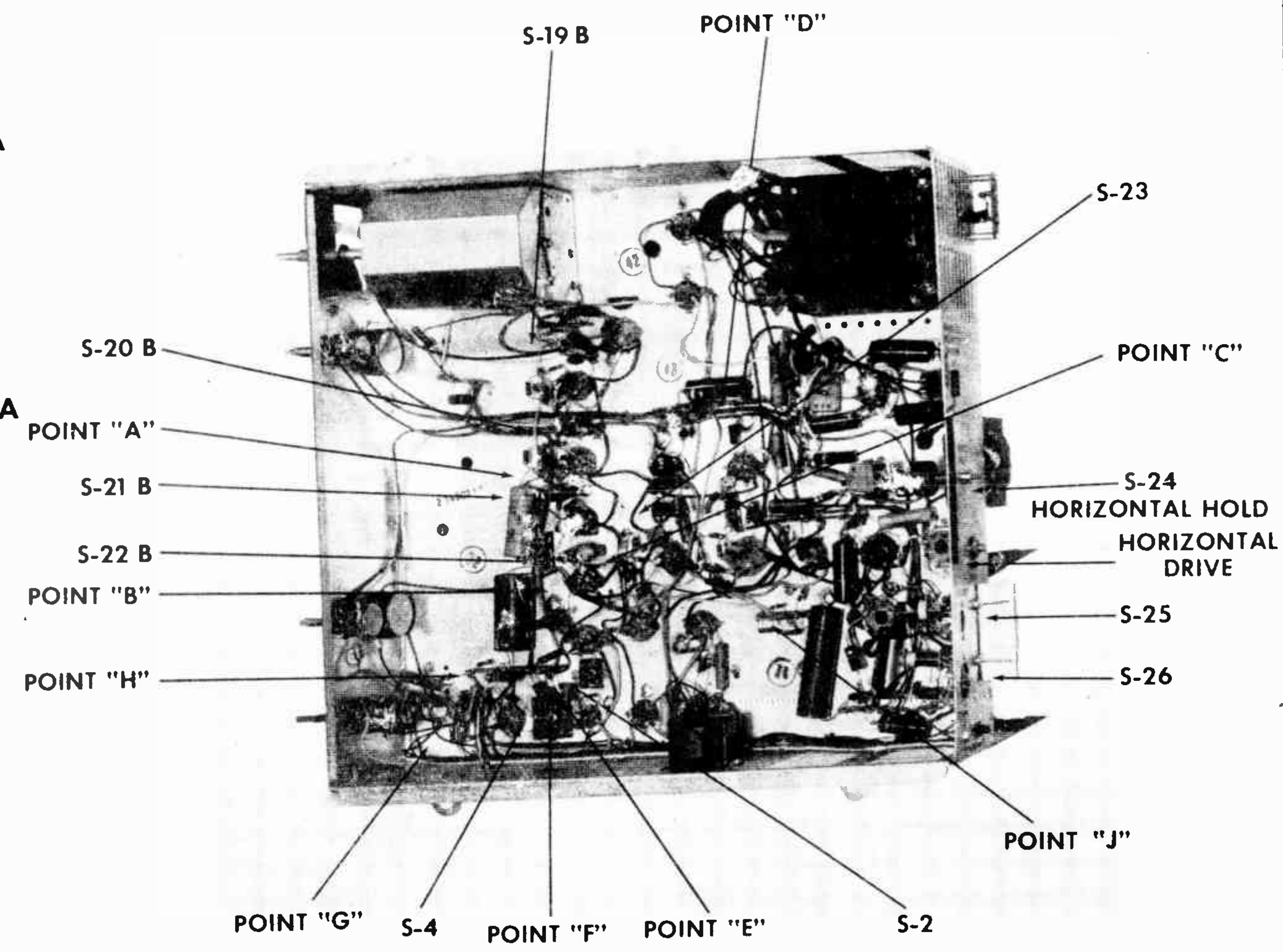
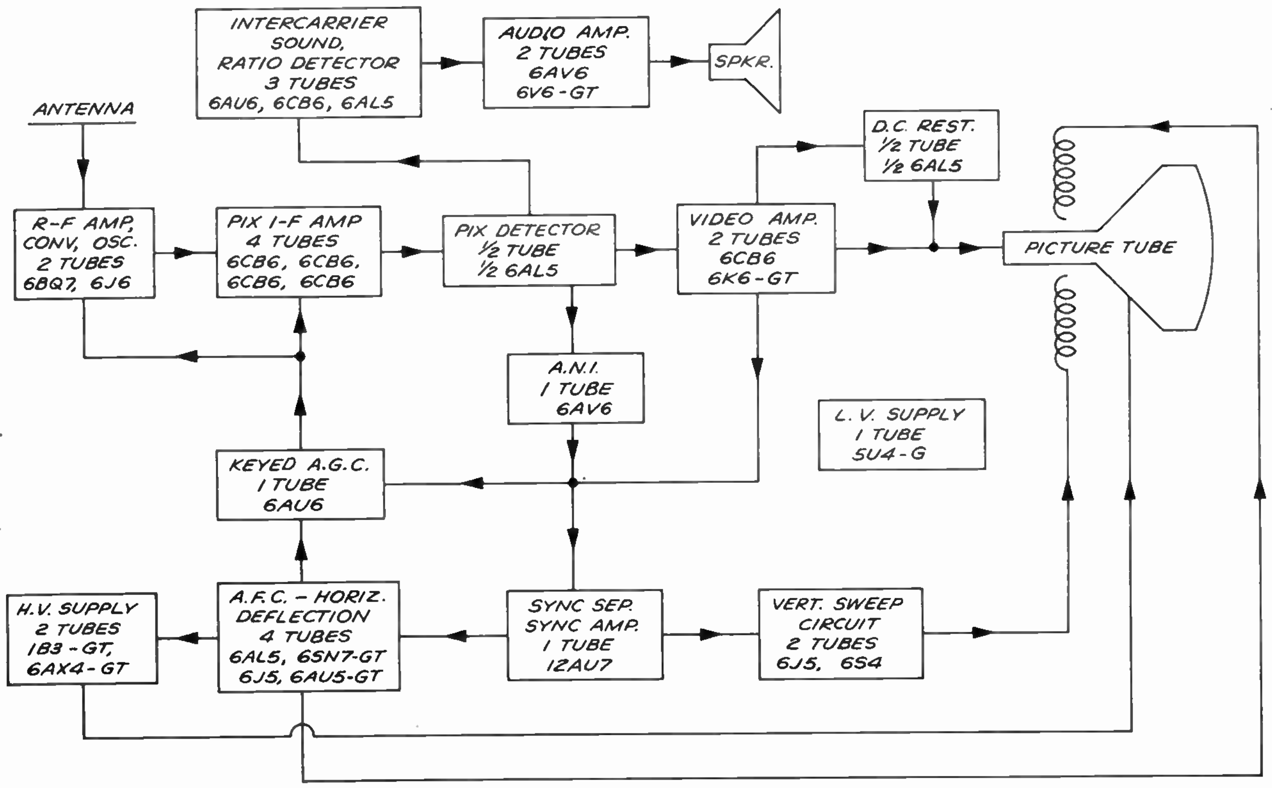


Fig. 11. Chassis 2720, Bottom View

CHASSIS 2720 IS USED ON MODELS 2721 AND 2722.

LIST OF ADJUSTMENTS :

Reference Symbol	Description	Reference Symbol	Description
S-1	Intercarrier sound, 4.5 Mc.	S-19A	1st picture I-F, 24.8 Mc.
S-2	Sound I-F, primary, 4.5 Mc.	S-19B	Trap, 26.25 Mc.
S-3	Sound I-F, secondary, 4.5 Mc.	S-20A	2nd picture I-F, 21.25 Mc.
S-4	Ratio detector, primary	S-20B	Trap, 20.5 Mc.
S-5	Ratio detector, secondary	S-21A	3rd picture I-F, 23.7 Mc.
S-6A	Converter I-F, in R-F tuner	S-21B	Trap, 26.25 Mc.
S-6B	Mixer, in R-F tuner	S-22A	4th picture I-F, 22.15 Mc.
S-6C	R-F, in R-F tuner	S-22B	Trap, 18.75 Mc.
S-6D	Antenna, in R-F tuner	S-23	Trap, 4.5 Mc.
S-6E	Oscillator trimmer, in 10531 tuner only	S-24	Horizontal hold
S-7 thru S-18	Oscillator slugs for the 12 channels	S-25	Horizontal linearity
		S-26	Width



SECTION IV

SPECIAL SERVICING INFORMATION

BLOCK CIRCUIT DIAGRAM:

The block circuit diagram shown in Fig. 12 will enable service personnel to trace the signal through the receiver in a logical manner.

PRODUCTION MODIFICATIONS:

The following production modifications were made since the publication of "Preliminary Service Data" concerning these models. They are mentioned here in order to explain any variation between the schematic diagram and the receiver being serviced. THE REASON FOR THE CHANGE IS SHOWN IN CAPITAL LETTERS.

1. EASE IN ASSEMBLY. Capacitor C-3, 100 mmf, and R-4, 22,000 ohms are now combined into one unit called a "capristor." The Packard-Bell part number of the capristor is 23970.
2. IMPROVED PERFORMANCE. The front end tuner, Packard-Bell number 10531, has been replaced with tuner 10532.
3. IMPROVED OVERALL AUDIO RESPONSE. Capacitor C-13, .005 mfd. has been changed to .01 mfd., and resistor R-97, 1.5 megohms, has been added between plates of V-4 and V-5.
4. SUPPRESSION OF ADJACENT-CHANNEL INTERFERENCE. All four picture I-F transformers have been changed to a new type embodying adjacent-channel traps on each. In making this change, R-26 was changed from 8200 ohms to 10,000 ohms and resistor R-34 from 5600 ohms to 4700 ohms.

RASTER BUT NO SOUND OR PICTURE

1. Tuner defective.
2. V-21 defective, check A.G.C. voltage.
3. V-5 defective.

SOUND AND RASTER BUT NO PICTURE

1. V-11 or V-12 may be defective; change V-11, check voltages; if trouble does not disappear, change V-12 and check voltages.
2. Check video wave-forms.

PICTURE STABLE BUT POOR RESOLUTION OR DEFINITION

1. V-11 or V-12 may be defective. Change tubes successively, then check voltages and associated components.
2. Check centering magnet and ion trap for proper adjustment.
3. R-F or I-F circuit may be improperly aligned.
4. Video peaking coils may be open or shorted.

WEAK RASTER

1. Low B plus or line voltage.
2. V-24 may be defective; change tube then check voltages.
3. V-16, V-18, V-19 defective; change tubes, then check voltages and associated components.
4. Power transformer T-4 may be defective. Check plate winding.
5. Filter capacitors may be defective. Check C-11B, C-11C, C-60B and C-60C.

LOCATING TROUBLE BY PICTURE TUBE OBSERVATION:

A large proportion of circuit failures may be isolated by observing certain characteristics present in the picture. Listed below are a number of possible picture faults and their probable cause.

NO RASTER ON PICTURE TUBE

1. Incorrect adjustment of ion trap magnet.
2. V-16, V-18, V-19, V-24 defective; check voltages and associated components.
3. V-15 defective (no horizontal drive); change tube, then check voltages and associated components.
4. Check horizontal sweep wave-forms.
5. No high voltage; check transformer T-2 for defects.
6. Blown fuse; if fuse continues to blow out, check for short in B boost voltage.
7. Defective picture tube or picture tube socket.

PICTURE NOT STABLE

1. If regular sections of the left picture are displaced, V-16 may be defective; check voltages.
2. Check for loose connections or noise.

PICTURE WILL NOT HOLD HORIZONTAL SYNC.

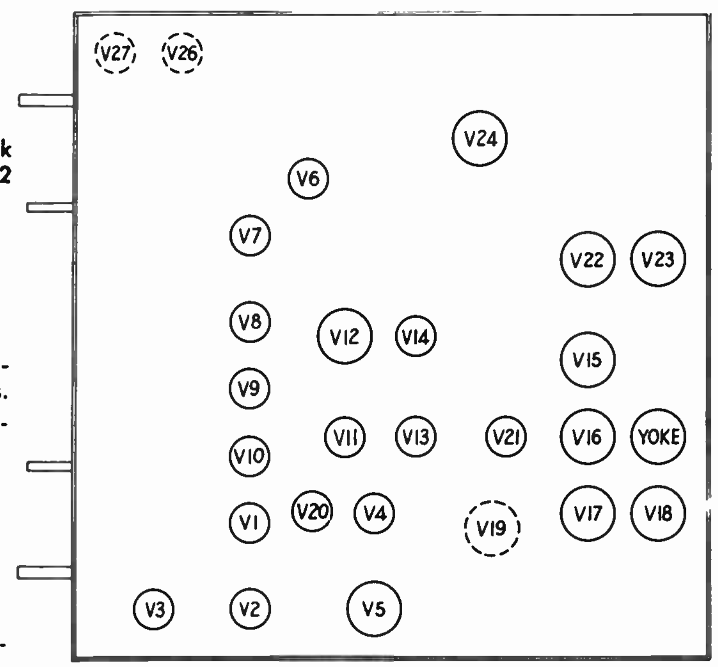
1. Horizontal hold control out of adjustment. See NON-OPERATING CONTROLS.
2. V-15 defective; change tube then check voltages and associated components.
3. Check horizontal sweep circuit wave-forms.

POOR VERTICAL LINEARITY

1. Incorrect adjustment of vertical linearity control. See NON-OPERATING CONTROLS.
2. Vertical output transformer defective, (T-3).

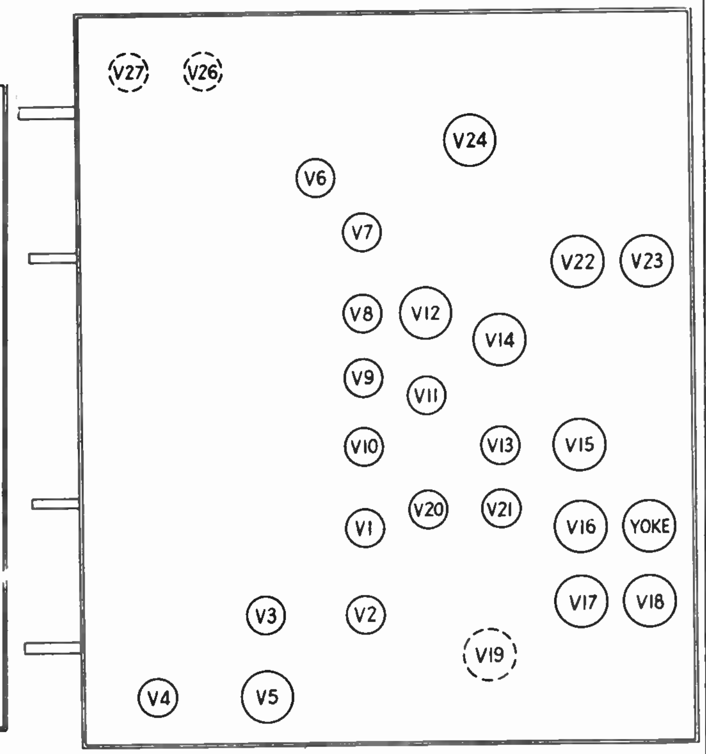
HIGH VOLTAGE WARNING

The picture tube second anode voltage is approximately 15,500 volts. Only personnel familiar with high voltage handling procedure should undertake servicing the chassis after it has been removed from the cabinet. DO NOT, AT ANY TIME, WORK ON THE CHASSIS WITH THE HIGH VOLTAGE CAGE COVER REMOVED AND THE RECEIVER CURRENT ON.



Bottom View

Fig. 14. Tube Location Chart, Chassis 2720



Bottom View

Fig. 13. Tube Location Chart, Chassis 2710

NO HORIZONTAL DEFLECTION

1. Horizontal deflection coil L-19B open.

NO VERTICAL DEFLECTION

1. V-23 defective; change tube then check voltages and associated components.
2. Vertical deflection coil L-19A open.

INSUFFICIENT WIDTH

1. V-24 defective; change tube, then check for adequate B plus voltage.
2. Power transformer T-4 may be defective; check plate winding.
3. V-16, V-19 defective; change tubes then check voltages.
4. Defective horizontal output transformer T-2.
5. Check horizontal sweep wave-forms.

NON-SYMMETRICAL RASTER

1. Check centering magnet and ion trap adjustments.
2. Yoke assembly may be defective.
3. Check vertical linearity and height adjustments.

PICTURE BUT NO SOUND

1. V-1, V-2, V-3, V-4, or V-5 defective; change tubes, then check voltages and associated components.
2. Audio output transformer T-1 open.
3. Speaker voice coil open.

CRITICAL LEAD DRESS:

In the event parts are replaced, refer to the appropriate chassis illustration, Fig. 8, 9, 10, or 11 for proper placement and lead dress. Particular attention should be given the following:

1. Do not displace components in the picture I-F circuit. If it is necessary to replace components in this section, the alignment should be checked following the changes.
2. Dress high voltage leads up and away from the chassis.
3. If parts are replaced in the high voltage section, solder joints must be rounded and free from sharp corners.
4. The lead from the ANI control, R-68, should be dressed away from the 4.5 Mc. trap S-23.

SOCKET VOLTAGES:

The socket voltages shown were measured on a typical chassis, under the following conditions:

1. No signal.
2. Line voltage, 117 volts.
3. Volume and contrast controls set at minimum, other controls at normal operating position.
4. D.C. voltages measured with a vacuum tube voltmeter.
5. A.C. voltages measured with a 1000 ohms per volt meter.
6. Voltages measured with respect to ground with the exception of those on V-1, V-2, V-5, and V-21. Voltages on these tubes were measured with respect to the cathode of V-5, which itself is 117 volts above ground.

NOTE: Some voltage readings are subject to a variation depending upon the setting of related controls. Thus the voltages on the vertical oscillator tube V-22 depend on the setting of the vertical hold control and the height control. Likewise the voltages on V-23 are varied by R-91.

All figures given below show the approximate magnitude of the reading to be expected, rather than the exact voltage.

Tube location is shown on Figs. 13 and 14, which are diagrams of the bottom view of each chassis.

V-1—6AU6, Sound I-F*

Pin	Element	Voltage
1	Grid 1	0
2	Grid 3	0
3	Heater	0
4	Heater	6.3 AC
5	Plate	135
6	Grid 2	135
7	Cathode	1.4

V-2—6CB6, Driver*

Pin	Element	Voltage
1	Grid 1	2.9
2	Cathode	3.6
3	Heater	0
4	Heater	6.3 AC
5	Plate	52
6	Grid 2	52
7	Grid 3	3.2

V-3—6AL5, Ratio Detector

Pin	Element	Voltage
1	Cathode 1	9.5
2	Plate 2	0
3	Heater	0
4	Heater	6.3 AC
5	Cathode 2	6.2
6	Shield	0
7	Plate 1	4.3

V-4—6AV6, 1st Audio

Pin	Element	Voltage
1	Grid	–.65
2	Cathode	0
3	Heater	6.3 AC
4	Heater	0
5	Diode Plate, not used	
6	Diode Plate, not used	
7	Plate	110

V-5—6V6-GT, Audio Output*

Pin	Element	Voltage
1	No connection	
2	Heater	6.3 AC
3	Plate	160
4	Grid 2	177
5	Grid 1	–5.5
6	No connection	
7	Heater	0
8	Cathode	0

V-6—6CB6, 1st Pix I-F

Pin	Element	Voltage
1	Grid 1	–.3
2	Cathode	1.05
3	Heater	0
4	Heater	6.3 AC
5	Plate	109
6	Grid 2	109
7	Grid 3	0

*Voltages taken with respect to cathode of V-5; see Par. 6 at beginning of this section.

V-7—6CB6, 2nd Pix I-F

Pin	Element	Voltage
1	Grid 1	–.3
2	Cathode	1.25
3	Heater	0
4	Heater	6.3 AC
5	Plate	110
6	Grid 2	110
7	Grid 3	0

V-8—6CB6, 3rd Pix I-F

Pin	Element	Voltage
1	Grid 1	–.3
2	Cathode	1.05
3	Heater	0
4	Heater	6.3 AC
5	Plate	113
6	Grid 2	113
7	Grid 3	0

V-9—6CB6, 4th Pix I-F

Pin	Element	Voltage
1	Grid 1	0
2	Cathode	2.0
3	Heater	0
4	Heater	6.3 AC
5	Plate	117
6	Grid 2	117
7	Grid 3	0

V-10—A & B, 6AL5—Pix Detector and D.C. Restorer

Pin	Element	Voltage
1	Cathode 1	11.
2	Plate 2	0
3	Heater	0
4	Heater	6.3 AC
5	Cathode 2	5.6
6	Shield	0
7	Plate 1	9.8

V-11—6CB6, 1st Video

Pin	Element	Voltage
1	Grid 1	9.8
2	Cathode	12.0
3	Heater	0
4	Heater	6.3 AC
5	Plate	95
6	Grid 2	117
7	Grid 3	0

V-12—6K6-GT, 2nd Video

Pin	Element	Voltage
1	No connection	
2	Heater	0
3	Plate	320
4	Grid 2	117
5	Grid 1	0
6	No connection	
7	Heater	6.3 AC
8	Cathode	14

V-13—12AU7, Sync. Amplifier

Pin	Element	Voltage
1	Plate 2	13.5
2	Grid 2	–3.5
3	Cathode 2	0
4	Heater	0
5	Heater	0
6	Plate 1	76
7	Grid 1	13.5
8	Cathode 1	13.5
9	Heater Tap	6.3 AC

V-14—6AL5, A.F.C., Discriminator

Pin	Element	Voltage
1	Cathode 1	0
2	Plate 2	0
3	Heater	0
4	Heater	6.3 AC
5	Cathode 2	6
6	Shield	0
7	Plate 1	–4.2

V-15—6SN7-GT, Horiz. Osc.

Pin	Element	Voltage
1	Grid 2	–1.
2	Plate 2	110
3	Cathode 2	13
4	Grid 1	1
5	Plate 1	300
6	Cathode 1	13.
7	Heater	0
8	Heater	6.3 AC

V-16—6J5 or 6J5-GT, Horiz. Discharge

Pin	Element	Voltage
1	Shell in 6J5 No connection in 6J5-GT	0
2	Heater	0
3	Plate	165
4	No connection	
5	Grid	–21
6	No connection	
7	Heater	6.3 AC
8	Cathode	0

V-17—6AV5-GT or 6AU5-GT, Horiz. Output

Pin	Element	Voltage
1	Grid 1	4.8
2	Heater	0
3	Cathode, Grid 3	62
4	No connection	
5	Plate	5 Kv. pulse
6	No connection	
7	Heater	6.3 AC
8	Grid 2	240

V-18—6AX4-GT, Damper

Pin	Element	Voltage
1	No connection	
2	No connection	
3	Cathode	580
4	No connection	
5	Plate	330
6	No connection	
7	Heater	0
8	Heater	6.3 AC

V-19—1B3-GT, H.V. Rectifier

15,500 volts between pin 2 and ground

V-20—6AV6, Automatic Noise Inverter

Pin	Element	Voltage
1	Grid	–.3
2	Cathode	9.8
3	Heater	0
4	Heater	6.3 AC
5	Diode Plate, not used	
6	Diode Plate, not used	
7	Plate	116

V-21—6AU6, Keyed Automatic Gain Control*

Pin	Element	Voltage
1	Grid 1	–22
2	Grid 3	0
3	Heater	0
4	Heater	6.3 AC
5	Plate	–115
6	Grid 2	210
7	Cathode	0

V-22, 6J5 or 6J5-GT, Vertical Oscillator

Pin	Element	Voltage
1	Shell in 6J5 No connection in 6J5-GT	0
2	Heater	0
3	Plate	150
4	No connection	
5	Grid	–8.
6	No connection	
7	Heater	6.3 AC
8	Cathode	13.5

V-23—6S4, Vertical Output

Pin	Element	Voltage
1	Internal connection	
2	Cathode	29
3	Grid	0
4	Heater	0
5	Heater	6.3 AC
6	Grid (same as 3)	0
7	Internal connection	
8	Internal connection	
9	Plate	500

V-24—5U4-G, L.V. Rectifier

Pin	Element	Voltage
1	No connection	
2	Filament	5 AC, 340 DC
3	No connection	
4	Plate	350 AC
5	No connection	
6	Plate	350 AC
7	No connection	
8	Filament	340 DC

*Voltages taken with respect to cathode of V-5; see Par. 6 at beginning of this section.

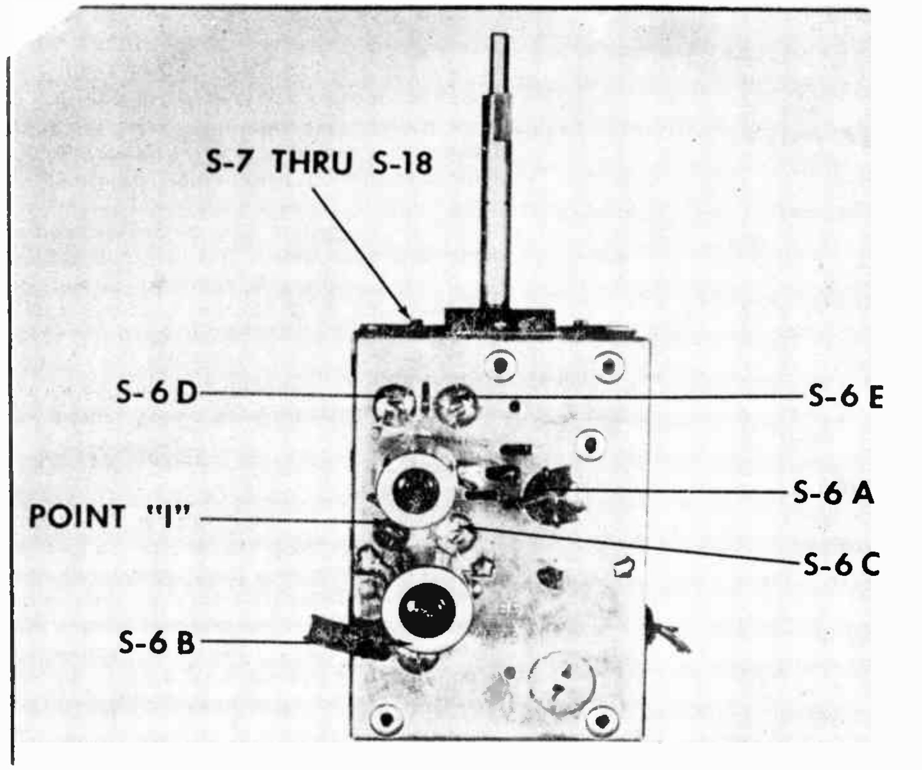


Fig. 15. R-F Tuner 10531

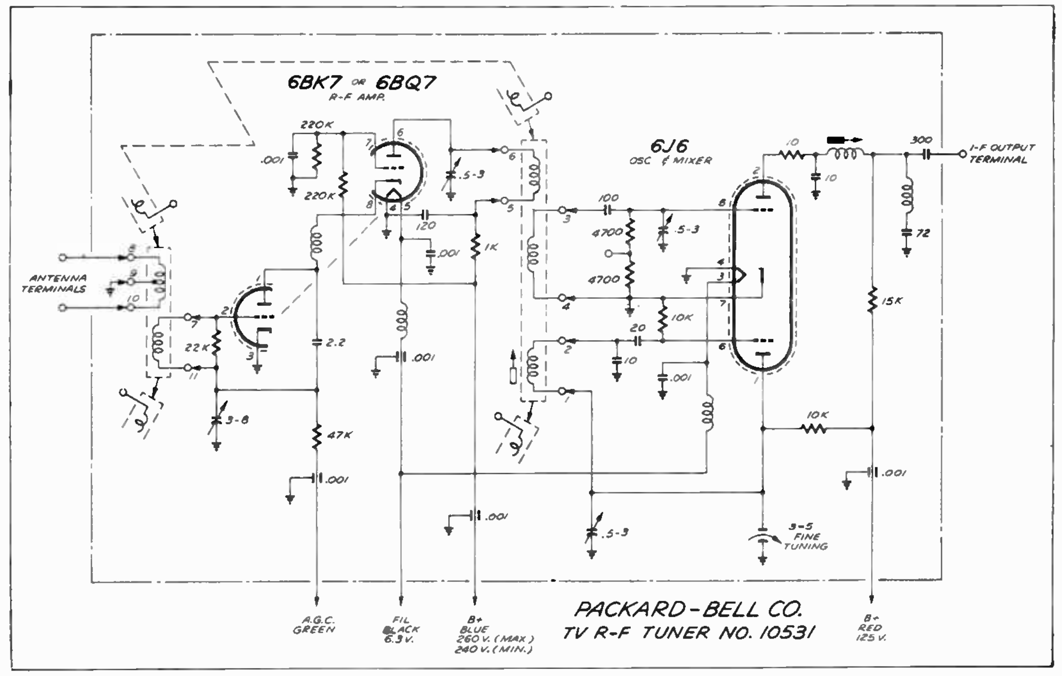


Fig. 17. Schematic Diagram, Tuner 10531

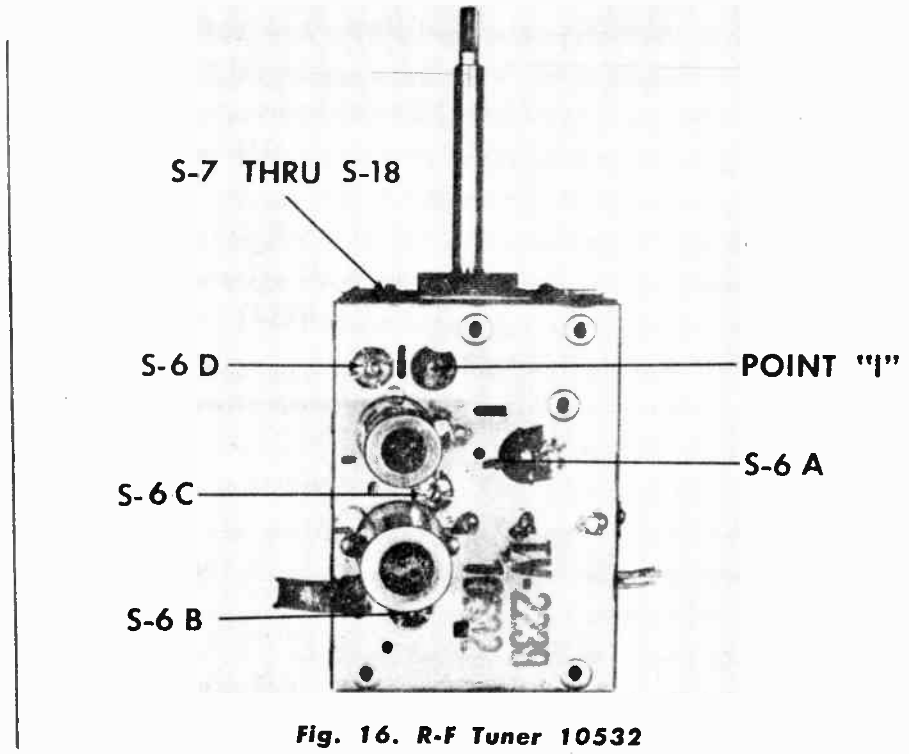


Fig. 16. R-F Tuner 10532

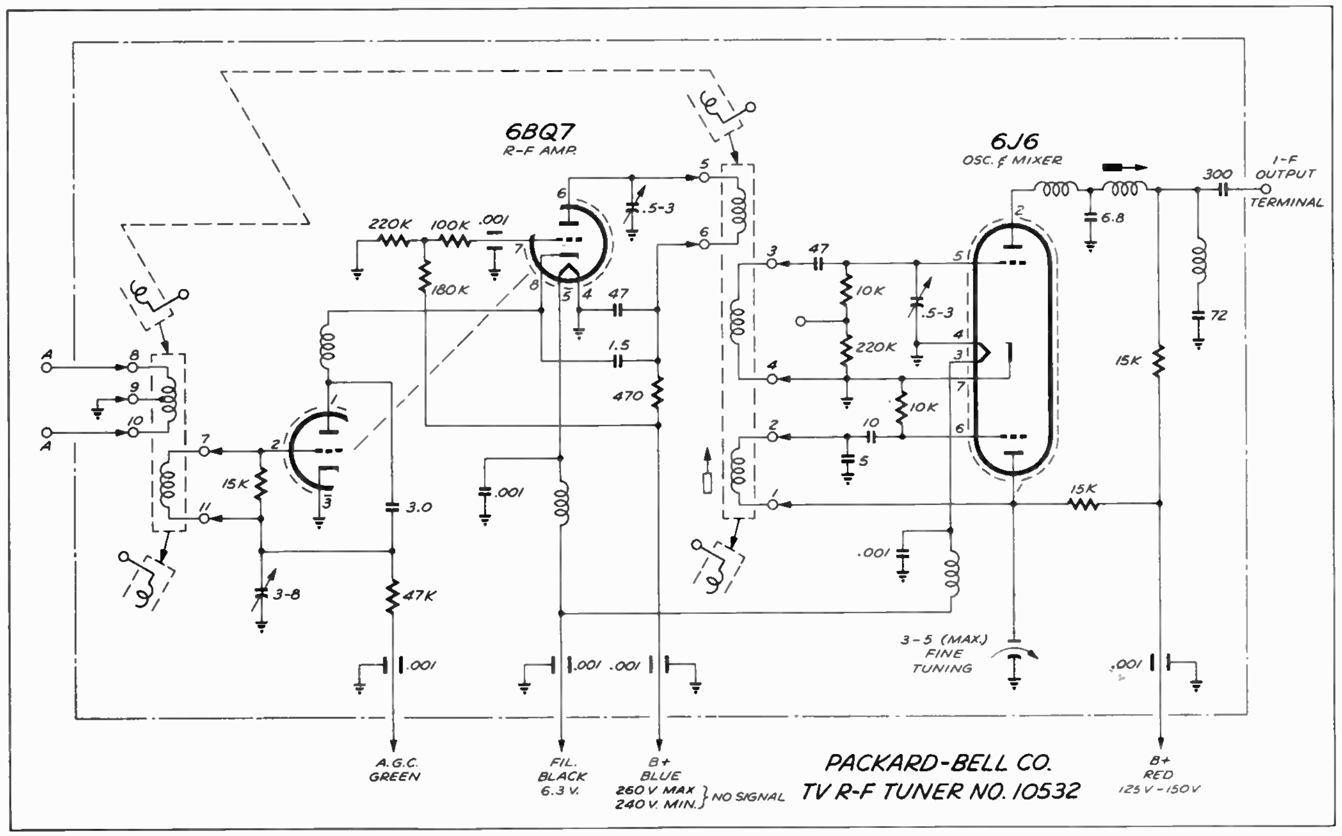
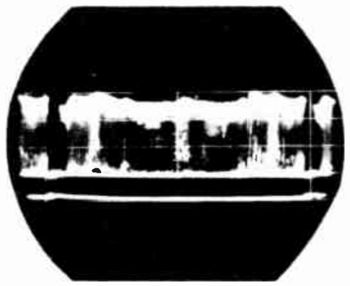
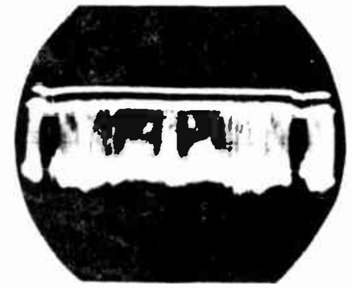


Figure 18. Schematic Diagram, Tuner 10532



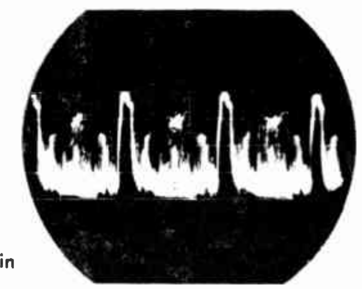
1. (V-11) 1st Video, Grid, (Pin 1), 60 C.P.S., 2.5 V.P.P.

2. (V-11) 1st Video, Plate, (Pin 5) 60 CP.S., 24 V.P.P.



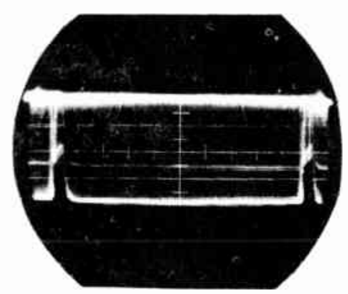
3. (V-13) Sync. Separator, Grid, (Pin 2) 60 C.P.S., 16 V.P.P.

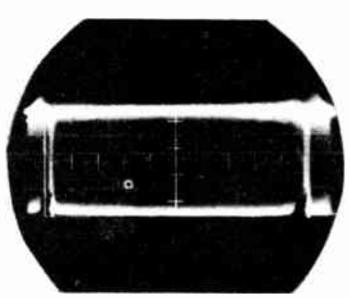
4. (V-13) Sync. Separator, Grid, (Pin 2) 15750 C.P.S., 16 V.P.P.



5. (V-13) Sync. Separator, Plate, (Pin 1) 15750 C.P.S., 16 V.P.P.

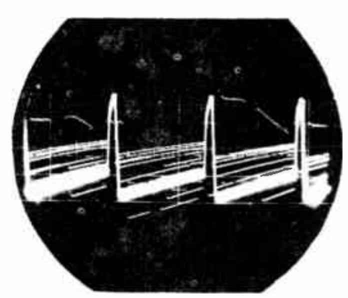
6. (V-13) Sync. Separator, Plate, (Pin 1), 60 C.P.S., 16 V.P.P.





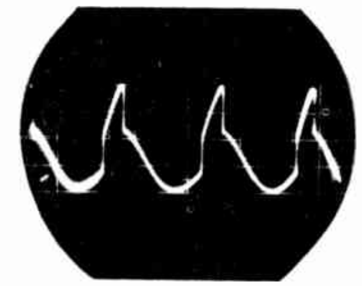
7. (V-13) Sync. Amplifier, Plate, (Pin 6), 60 C.P.S., 26 V.P.P.

8. (V-14) Phase Detector, Plate, (Pin 7) 15750 C.P.S., 12 V.P.P.



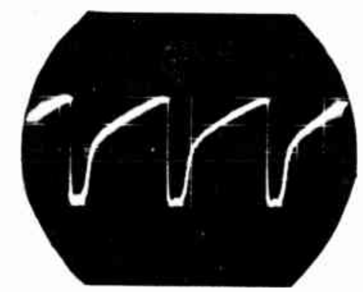
9. (V-14) Phase Detector, Cathode, (Pin 5) 15750 C.P.S., 12 V.P.P.

10. (V-14) Phase Detector, Cathode, (Pin 1) 15750 C.P.S., 7 V.P.P.



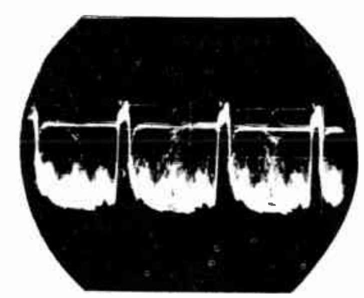
12. (V-16) Horizontal Discharge, Grid, (Pin 5) 15750 C.P.S., 37 V.P.P.

13. (V-17) Horizontal Output, Grid, (Pin 1) 15750 C.P.S., 200 V.P.P.



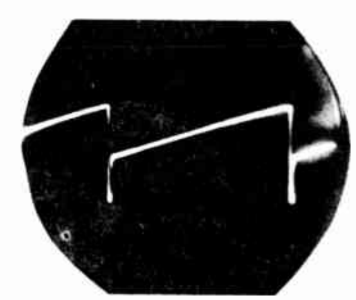
14. (V-22) Keyed A.G.C., Plate, (Pin 5) 15750 C.P.S., 700 V.P.P.

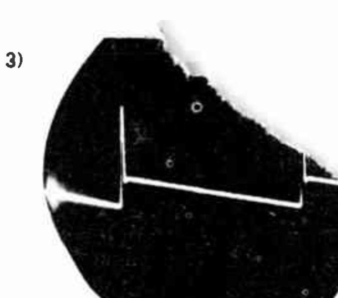
15. (V-22) Keyed A.G.C., Grid, (Pin 1) 15750 C.P.S., 16 V.P.P.



16. (V-18) Vertical Oscil, Grid, (Pin 5) 60 C.P.S., 70 V.P.P.

17. (V-18) Vert. Oscil., Plate, (Pin 3) 60 C.P.S., 105 V.P.P.





18. (V-19) Vert. Output, Plate, (Pin 9) 60 C.P.S., 1500 V.P.P.

Fig. 19. Waveforms

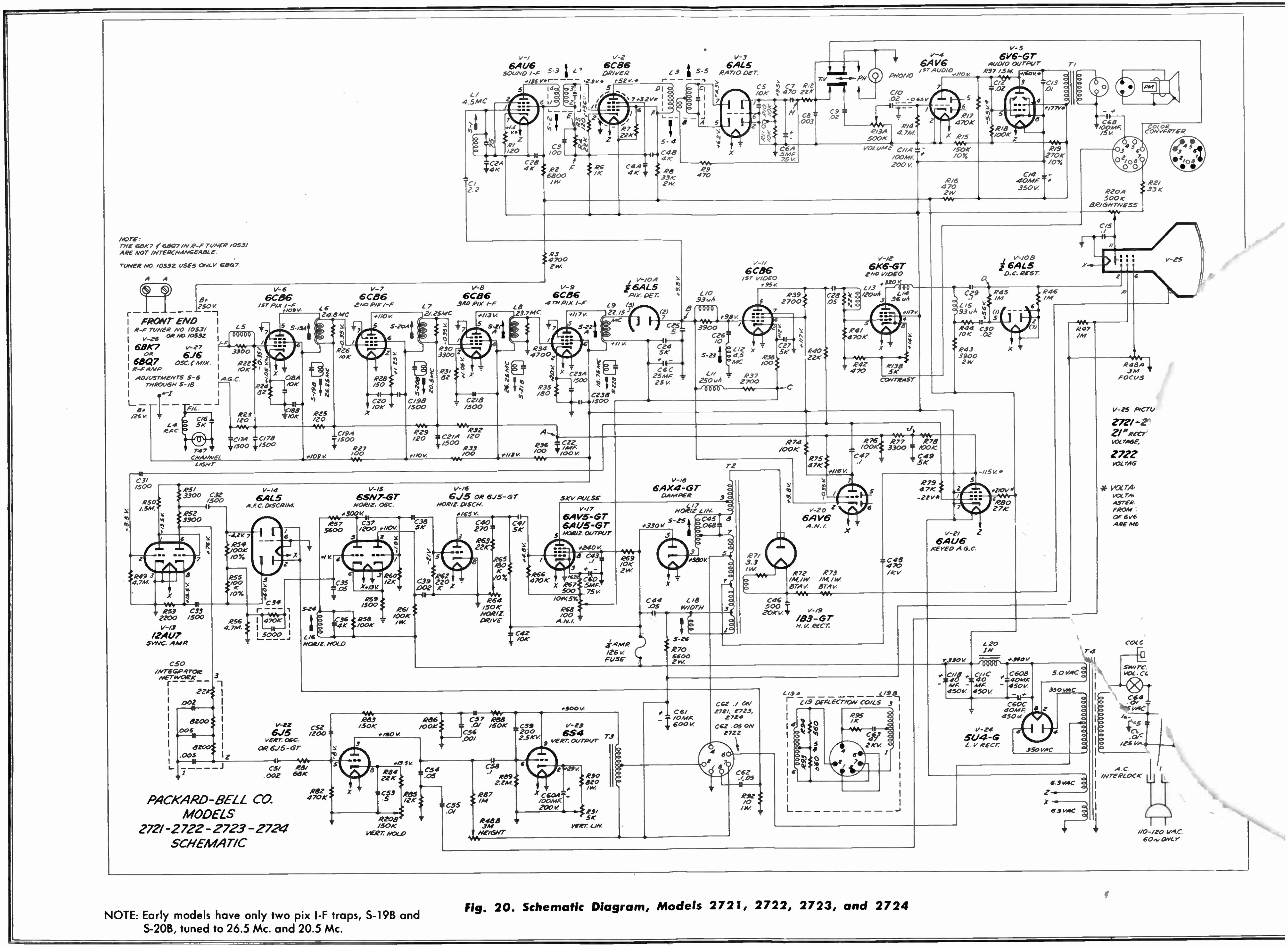
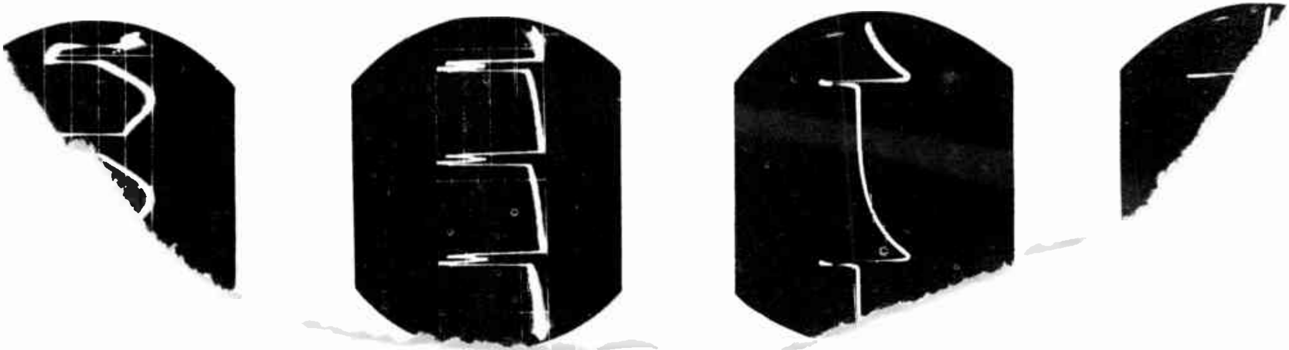


Fig. 20. Schematic Diagram, Models 2721, 2722, 2723, and 2724

NOTE: Early models have only two pix I-F traps, S-19B and S-20B, tuned to 26.5 Mc. and 20.5 Mc.



ARD-BELL

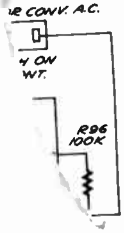
RE TUBE.

723-2724

NGULAR, LOW
ELECTROSTATIC FOCUS.

-24" ROUND, LOW
E, ELECTROSTATIC FOCUS.

SE MEASUREMENTS
GES SHOWN WITH AN
ISK (*) ARE MEASURED
TUBE PIN TO CATHODE
-GT. ALL OTHERS
ASURED TO GROUND.



SECTION V

TABLE OF REPLACEABLE PARTS

To be assured of genuine Packard-Bell replacement parts, order by the Packard-Bell part number from your nearest Packard-Bell Service Department. Their addresses are listed below.

City	Address
Los Angeles (home office)	1101 So. Hope St.
Alhambra	2221 West Valley Blvd.
Burbank	3007 Magnolia Blvd.
Compton	14912 So. Atlantic Blvd.
Culver City	2405 So. La Cienega Blvd.
Denver	1441 Ogden St.
El Paso	1515 Wyoming St.
Fresno	531 "P" St.
Honolulu	1923 Kalakaua Ave.
Oakland	1009 Cypress St.
Phoenix	228 E. Roosevelt St.
Portland	326 N. W. 21st Ave.
Riverside	247 La Cadena Dr.
Salt Lake City	624 So. State St.
San Diego	3069 El Cajon Blvd.
San Francisco	1157 Post St.
San Mateo	1037 No. Bayshore Blvd.
Santa Ana	1324 W. First St.
Seattle	2310 4th Ave.
Spokane	South 125 Stevens St.
Tacoma	2327 So. Tacoma Ave.

CAPACITORS

Notes: (1) "GMV" means "capacities listed are Guaranteed Minimum Values over a range of from plus 10 degrees C. to plus 65 degrees C."

(2) Unless otherwise specified, tolerances are:
Electrolytic capacitors, +50%, —10%
Paper capacitors, +30%, —10%

(3) "NPO" denotes zero temperature coefficient.

REFERENCE SYMBOL	DESCRIPTION		PACKARD-BELL PART NO.
C-1	Ceramic, 2.2 mmf ±.25 mmf, 500 volt, NPO		23969
C-2A	Ceramic, 4000 mmf GMV, 500 volts	dual, disc	23955
C-2B	Ceramic, 4000 mmf GMV, 500 volts		
C-3	Capristor (consists of a 100 mmf capacitor in parallel with a 22,000 ohm resistor)		23970
C-4A	Ceramic, 4000 mmf GMV, 500 volt	dual, disc	23955
C-4B	Ceramic, 4000 mmf GMV, 500 volt		
C-5	Ceramic, 10,000 mmf GMV, 500 volt, disc		23939
C-6A	Electrolytic, 5 mfd 75 volt	quadruple	24069
C-6B	Electrolytic, 100 mfd 15 volt		
C-6C	Electrolytic, 25 mfd 25 volt		
C-6D	Electrolytic, 5 mfd 75 volt		
C-7	Ceramic, 470 mmf, 20%, 500 volt		23916
C-8	Paper, .003 mfd 600 volt		23016
C-9	Paper, .02 mfd 600 volt		23007
C-10	Paper, .02 mfd 600 volt		23007
C-11A	Electrolytic, 100 mfd 200 volt	triple	24055
C-11B	Electrolytic, 40 mfd 450 volt		
C-11C	Electrolytic, 40 mfd 450 volt		

CAPACITORS (Cont.)

REFERENCE SYMBOL	DESCRIPTION		PACKARD-BELL PART NO.
C-12	Paper, .02 mfd 600 volt		23007
C-13	Paper, .01 mfd 600 volt		23006
C-14	Electrolytic, 40 mfd 350		24063
C-15	Paper, .1 mfd 200 volt		23019
C-16	Ceramic, 5000 mmf GMV, 500 volt, disc		23931
C-17A	Ceramic, 1500 mmf GMV, 500 volt	dual, disc	23954
C-17B	Ceramic, 1500 mmf GMV, 500 volt		
C-18A	Ceramic, 10,000 mmf GMV, 500 volt	dual, disc	23962
C-18B	Ceramic, 10,000 mmf GMV, 500 volt		
C-19A	Ceramic, 1500 mmf GMV, 500 volt	dual, disc	23954
C-19B	Ceramic, 1500 mmf GMV, 500 volt		
C-20	Ceramic, 10,000 mmf GMV, 400 volt, disc		23939
C-21A	Ceramic, 1500 mmf GMV, 500 volt	dual, disc	23954
C-21B	Ceramic, 1500 mmf GMV, 500 volt		
C-22	Paper, 1 mfd 100 volt		23040
C-23A	Ceramic, 1500 mmf GMV, 500 volt	dual, disc	23954
C-23B	Ceramic, 1500 mmf GMV, 500 volt		
C-24	Ceramic, 5000 mmf GMV, 500 volt, disc		23931
C-25	Ceramic, 5 mmf, 20%, 500 volt		23908
C-26	Ceramic, 10 mmf, 5% NPO, 500 volt		23927
C-27	Ceramic, 5000 mmf GMV, 500 volt, disc		23931
C-28	Paper, .05 mfd 200 volts		23017
C-29	Paper, .1 mfd 600 volts		23012
C-30	Paper, .02 mfd 600 volts		23007
C-31	Ceramic, 1500 mmf, 20%, 500 volts		23936
C-32	Ceramic, 1500 mmf, 20%, 500 volt		23936
C-33	Ceramic, 1500 mmf, 20%, 500 volt		23936
C-34	Capristor (consists of a 5000 mmf capacitor in parallel with a 470,000 ohm resistor)		23960
C-35	Paper, .05 mfd 600 volt		23010
C-36	Mica, 4000 mmf, 10%, 500 volt		23208
C-37	Mica, 1200 mmf, 10%, 500 volt		23219
C-38	Ceramic, 5000 mmf GMV, 500 volt, disc		23931
C-39	Paper, .002 mfd, +30%, —20%, 600 volt		23002
C-40	Ceramic, 270 mmf, 20%, 500 volt		23943
C-41	Ceramic, 5000 mmf GMV, 500 volt, disc		23931
C-42	Ceramic, 10,000 mmf GMV, 500 volt, disc		23939
C-43	Paper, .1 mfd 600 volt		23012
C-44	Paper, .05 mfd 600 volt		23010
C-45	Paper, .068 mfd, 10%, 400 volt		23041
C-46	Ceramic, 500 mmf, +50%, —20% 20,000 volt		23959
C-47	Paper, .1 mfd 200 volt		23019
C-48	Ceramic, 470 mmf, 20%, 1000 volt		23967
C-49	Ceramic, 5000 mmf GMV, 500 volt, disc		23931
C-50	Integrator Network (see schematic diagram for components)		23951
C-51	Paper, .002 mfd, +30%, —20%, 600 volt		23002
C-52	Mica, 1200 mmf, 10%, 500 volt		23219
C-53	Paper, .5 mfd 200 volt		23035
C-54	Paper, .05 mfd 200 volt		23017
C-55	Paper, .01 mfd 600 volt		23006
C-56	Paper, .001 mfd, +50%, —25%, 600 volt		23001
C-57	Paper, .01 mfd 600 volt		23006
C-58	Paper, .1 mfd 600 volt		23012
C-59	Ceramic, 200 mmf, 10%, 2500 volt		23958
C-60A	Electrolytic, 100 mfd 200 volt	triple	24055
C-60B	Electrolytic, 40 mfd 450 volt		
C-60C	Electrolytic, 40 mfd 450 volt		
C-61	Electrolytic, 10 mfd 600 volt		24068
C-62	Paper	.1 mfd, 600 volt, on 2721, 2723, 2724	23012
		.05 mfd, 600 volt on 2722	23010
C-63	Ceramic, 47 mmf, 10%, 2000 volt		23956
C-64	Bakelite enclosed tubular, .01 mfd 125 volts AC		23932
C-65	Bakelite enclosed tubular, .01 mfd 125 volts AC		23932

RESISTORS

Notes: (1) Resistors are ½ watt unless otherwise specified.
(2) Tolerance is 10% unless otherwise specified.

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
R-1	Composition, 120 ohms	73014
R-2	Composition, 6800 ohms, 1 watt	73235
R-3	Composition, 4700 ohms, 2 watt	73433
R-4	Composition, 22,000 ohms	73041
R-5	Composition, 120 ohms	73014
R-6	Composition, 1000 ohms	73025
R-7	Composition, 22,000 ohms	73041
R-8	Composition, 33,000 ohms, 2 watt	73443
R-9	Composition, 470 ohms	73021
R-10	Composition, 10,000 ohms	73037
R-11	Composition, 10,000 ohms	73037
R-12	Composition, 22,000 ohms	73041
R-13	See "CONTROLS"	
R-14	Composition, 4.7 megohms, 20%	73169
R-15	Composition, 150,000 ohms	73051
R-16	Composition, 470 ohms, 2 watt	73421
R-17	Composition, 470,000 ohms, 20%	73157
R-18	Composition, 100,000 ohms, 20%	73149

RESISTORS (Cont.)

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
R-19	Composition, 270,000 ohms	73054
R-20	See "CONTROLS"	
R-21	Composition, 33,000 ohms	73043
R-22	Composition, 10,000 ohms	73037
R-23	Composition, 120 ohms	73014
R-24	Composition, 82 ohms	73012
R-25	Composition, 120 ohms	73014
R-26	Composition, 10,000 ohms	73037
R-27	Composition, 100 ohms	73013
R-28	Composition, 150 ohms	73015
R-29	Composition, 120 ohms	73014
R-30	Composition, 3300 ohms	73031
R-31	Composition, 82 ohms	73012
R-32	Composition, 120 ohms	73014
R-33	Composition, 100 ohms	73013
R-34	Composition, 4700 ohms	73033
R-35	Composition, 180 ohms	73016
R-36	Composition, 100 ohms	73013
R-37	Composition, 2700 ohms	73030
R-38	Composition, 100 ohms	73013
R-39	Composition, 2700 ohms	73030
R-40	Composition, 22,000 ohms	73041
R-41	Composition, 470,000 ohms, 20%	73157
R-42	Composition, 470 ohms	73021
R-43	Composition, 3900 ohms, 2 watt	73432
R-44	Composition, 10,000 ohms	73037
R-45	Composition, 1 megohm, 20%	73161
R-46	Composition, 1 megohm, 20%	73161
R-47	Composition, 1 megohm, 20%	73161
R-48	See "CONTROLS"	
R-49	Composition, 4.7 megohms, 20%	73169
R-50	Composition, 1.5 megohm, 20%	73163
R-51	Composition, 3300 ohms	73031
R-52	Composition, 3300 ohms	73031
R-53	Composition, 2200 ohms	73029
R-54	Composition, 100,000 ohms	73049
R-55	Composition, 100,000 ohms	73049
R-56	Composition, 4.7 megohms, 20%	73169
R-57	Composition, 5600 ohms	73034
R-58	Composition, 100,000 ohms, 20%	73149
R-59	Composition, 1500 ohms	73027
R-60	Composition, 12,000 ohms	73038
R-61	Composition, 100,000 ohms, 1 watt	73249
R-62	Composition, 220,000 ohms, 20%	73153
R-63	Composition, 22,000 ohms	73041
R-64	See "CONTROLS"	
R-65	Composition, 180,000 ohms	73052
R-66	Composition, 470,000 ohms, 20%	73157
R-67	Wire wound, 500 ohms, 10 watt, 5%	73616
R-68	See "CONTROLS"	
R-69	Composition, 10,000 ohms, 2 watt	73437
R-70	Composition, 5600 ohms, 2 watt	73434
R-71	Composition, 3.3 ohms, 1 watt	73291
R-72	Composition, 1 megohm, 1 watt, 20%, type BTAV	73398
R-73	Composition, 1 megohm, 1 watt, 20%, type BTAV	73398
R-74	Composition, 100,000 ohms, 20%	73149
R-75	Composition, 47,000 ohms	73045
R-76	Composition, 100,000 ohms, 20%	73149
R-77	Composition, 3300 ohms	73031
R-78	Composition, 100,000 ohms, 20%	73149
R-79	Composition, 47,000 ohms	73045
R-80	Composition, 27,000 ohms	73042
R-81	Composition, 68,000 ohms	73047
R-82	Composition, 470,000 ohms, 20%	73157
R-83	Composition, 150,000 ohms, 20%	73151
R-84	Composition, 22,000 ohms	73041
R-85	Composition, 12,000 ohms	73038
R-86	Composition, 100,000 ohms, 20%	73149
R-87	Composition, 1 megohm, 20%	73161
R-88	Composition, 150,000 ohms, 20%	73151
R-89	Composition, 2.2 megohms, 20%	73165
R-90	Composition, 820 ohms, 1 wqtt	73224
R-91	See "CONTROLS"	
R-92	Composition, 10 ohms, 1 watt	73201
R-93	Composition, 560 ohms	73022
R-94	Composition, 560 ohms	73022
R-95	Composition, 1000 ohms	73025
R-96	Composition, 100,000 ohms, 20%	73149
R-97	Composition, 1.5 megohms, 20%	73163

INDUCTANCES

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
L-1	Adjustable, Sound I-F input coil, 4.5 Mc.	29053
L-2	Adjustable, Sound I-F transformer, 4.5 Mc.	29541
L-3	Adjustable, Ratio Detector transformer	29054
L-4	Radio Frequency Choke	29551
L-5	Tuner Coupling	29523
L-6	Adjustable, 1st Pix I-F, 24.8 Mc. and Trap	29553
L-7	Adjustable, 2nd Pix I-F, 21.25 Mc. and Trap	29554
L-8	Adjustable, 3rd Pix I-F, 23.7 Mc. and Trap	29553
L-9	Adjustable, 4th Pix I-F, 22.15 Mc. and Trap	29554
L-10	Peaking Coil, 93 uh wound on 3900 ohm resistor	29552
L-11	Peaking Coil, 250 uh	29509
L-12	Adjustable, 4.5 Mc. Trap	29548
L-13	Peaking Coil, 120 uh wound on 22,000 ohm resistor	29506
L-14	Peaking Coil, 36 uh	29520
L-15	Peaking Coil, 93 uh	29507
L-16	See "CONTROLS"	
L-17	See "CONTROLS"	
L-18	See "CONTROLS"	
L-19	Deflection Coils, (Yoke)	29542
L-20	Filter Choke, 1 henry at 320 ma., D.C. resistance 39 ohms	27005

CONTROLS

VARIABLE RESISTORS

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
R-13A	Volume, 500,000 ohms	25850
R-13B	Contrast, 5000 ohms	
R-20A	Brightness, 500,000 ohms	25848
R-20B	Vertical Hold, 150,000 ohms	
R-48A	Focus, 3 megohm	25847
R-48B	Height, 3 megohm	
R-64	Horizontal Drive, 150,000 ohms	25839
R-68	Automatic Noise Inverter, 100 ohms	25846
R-91	Vertical Linearity, 5000 ohms	25845

VARIABLE INDUCTANCES

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
L-16	Horizontal Hold	29527
L-17	Horizontal Linearity	29531
L-18	Width	29540

TRANSFORMERS

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
T-1	Audio Output, 5500 ohms to 3.2 ohms	89436
T-2	Horizontal Output	89438
T-3	Vertical Output	89434
T-4	Power Primary, 117 volts Sec. 1, 680 volts, C.T., 210 ma. Sec. 2, 6.3 volts, 9.35 amp. Sec. 3, 6.3 volts, 1.35 amp. Sec. 4, 5.0 volts, 3.0 amp.	89043

MISCELLANEOUS PARTS

DESCRIPTION	PACKARD-BELL PART NO.
Cabinet, Model 2721 (specify finish)	2721
Cabinet, Model 2722 (specify finish)	2722
Cabinet, Model 2723 Standard (specify finish)	2723 STD
Cabinet, Model 2723 De Luxe (specify finish)	2723 DLX
Cabinet, Model 2724 (specify finish)	2724
Cord, AC power, 6 ft.	32021
Fuse, 1/4 ampere, 125 volt "Slo Blo," Littelfuse catalog number 313.250	45005
Lamp T47	54002
Ion Trap	28099
Knob, Fine Tuning (specify cabinet finish)	52068
Knob, Volume Control (specify cabinet finish)	52069-1
Knob, Contrast Control (specify cabinet finish)	52070
Knob, Channel Selector (specify cabinet finish)	
Models 2721 and 2722	52076-1
Models 2723 (std and dlx) and 2724	52067-1
Escutcheon (specify cabinet finish)	41049
Radio Frequency Tuner	10532
Speaker:	
Models 2721, 2722, and 2723 DLX	83705
Models 2723 STD and 2724	83305

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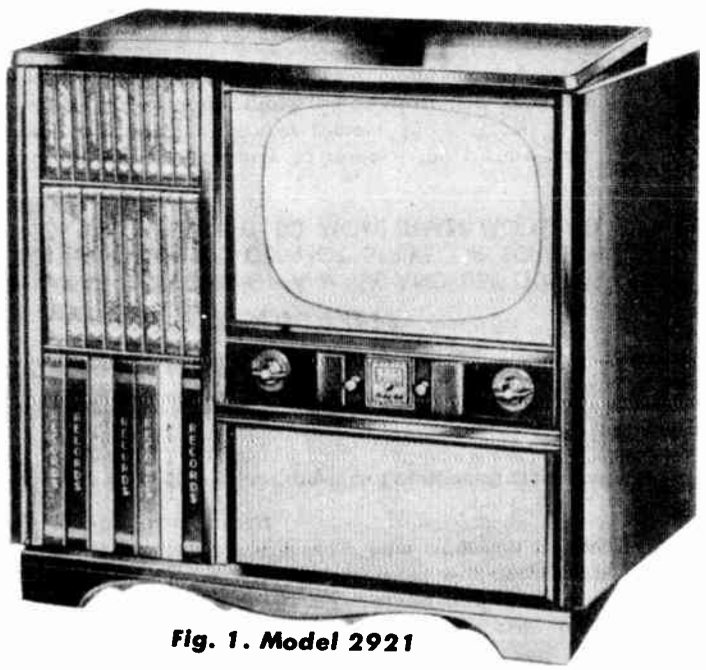


Fig. 1. Model 2921

Fig. 2. Model 2922

GENERAL INFORMATION

DESCRIPTION OF MODELS:

MODEL 2921, Fig. 1, is a console television-radio-phonograph with full length doors. A 21 inch rectangular picture tube is employed, and the record changer is a three speed V-M, model 950. Cabinet finishes are Mahogany, French Provincial, American Colonial, and Blonde Oak.

MODEL 2922, Fig. 2, is a console television-radio-phonograph with full length doors. A 24 inch round metal picture tube is employed, and the record changer is a three speed Webster, model 114. Cabinet finishes are Mahogany, French Provincial, American Colonial, and Blonde Oak.

DESCRIPTION OF CHASSIS:

CHASSIS 2921, Figs. 8 and 9, is designed for horizontal mounting in the cabinet and mounts a 21 inch rectangular picture tube. The tuner is mounted in such a manner that it need not be removed for servicing. Tube replacement in the tuner, however, will necessitate removal of the chassis from the cabinet. Chassis 2921 is used in Model 2921.

CHASSIS 2922, Figs. 10 and 11, is the same electrically as the 2921 chassis, but is designed for vertical mounting in the cabinet. It is used in Model 2922.

SPECIFICATIONS:

OVERALL DIMENSIONS:

	Model 2921	Model 2922
Height	37 in.	39 in.
Width	38 in.	43 in.
Depth	25 in.	25 in.
Shipping Weight	220 lbs.	260 lbs.

TELEVISION TUNING FREQUENCY RANGE:

All 12 VHF television channels currently allocated in the United States, consisting of channels 2 thru 13, and covering frequencies from 54 to 88 Mc. and 174 to 216 Mc.

Coil strips are available for UHF channels 14 thru 83.

INTERMEDIATE FREQUENCIES:

AM Radio: 455 Kc.
Picture Carrier: 25.0 Mc.
Sound Carrier: 20.5 Mc.
Intercarrier Sound: 4.5 Mc.

ELECTRICAL RATINGS:

Line voltage, both models: 110-120 volts AC, 60 cycles per second.

Power consumption, both models:

TV	190 watts
Radio	80 watts
Phono	80 watts

TUBE COMPLEMENT:

Reference Symbol	Tube	Function
V-1	6BE6	Converter, AM Tuner
V-2	6BA6	I-F Amplifier, AM Tuner
V-3	6AU6	Sound I-F
V-4	6CB6	Driver
V-5	6AL5	Ratio Detector
V-6	6AV6	1st Audio Amplifier
V-7	6V6-GT	Audio Output
V-8	6CB6	1st Pix I-F
V-9	6CB6	2nd Pix I-F
V-10	6CB6	3rd Pix I-F
V-11	6CB6	4th Pix I-F
V-12A	½6AL5	Pix Detector
V-12B	½6AL5	D. C. Restorer
V-13	6CB6	1st Video Amplifier
V-14	6K6-GT	2nd Video Amplifier
V-15	12AU7	Sync Pulse Separator and Inverter
V-16	6AL5	Automatic Frequency Control Discriminator
V-17	6SN7-GT	Horizontal Oscillator
V-18	6J5 or 6J5-GT	Horizontal Discharge
V-19	6AV5-GT or 6AU5-GT	Horizontal Output
V-20	6AX4-GT	Damper
V-21	1B3-GT	High Voltage Rectifier
V-22	6AV6	Automatic Noise Inverter
V-23	6AU6	Keyed Automatic Gain Control
V-24	6J5 or 6J5GT	Vertical Oscillator
V-25	6S4	Vertical Output
V-26	5U4-G	Low Voltage Rectifier
V-27	21FP4A Model 2921	Pix Tube
	24BP4 Model 2922	Pix Tube
V-28	6BQ7	R-F Amplifier Note: Early models using R-F Tuner 10531 may use either a 6BQ7 or a 6BK7. Tube must be replaced with type removed.
V-29	6J6	Oscillator and Mixer

LOUDSPEAKER DATA:

	Model 2921	Model 2922
Type . . .	Permanent Magnet	Permanent Magnet
Voice coil impedance at 400 cycles	3.2 ohms	6.0 ohms (two speakers used, 3 ohm voice coils connected in series).
Size	10 in.	6 in. by 9 in. elliptical
Magnet . .	3.16 oz. Alnico V	2.15 oz. Alnico V

FOCUS:

Electrostatic.

SWEEP DEFLECTION:

Electromagnetic, 70 degree.

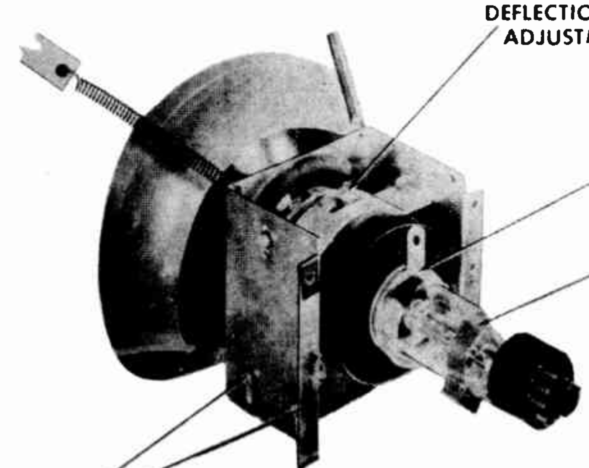


Fig. 3. Picture Tube Yoke Assembly

SECTION II

INSTALLATION INSTRUCTIONS

PICTURE TUBE ADJUSTMENTS:

The following picture tube adjustments are to be checked upon installation or whenever the receiver is serviced. (See Fig. 3. Picture Tube Yoke Assembly.)

1. Deflection Yoke. Loosen deflection yoke adjustment screw and rotate yoke so that raster is square with picture tube frame. Make certain yoke is positioned firmly against cone of tube.
2. Ion Trap. Turn contrast control to minimum. Set brightness control at approximately 90% clockwise and slowly slide ion trap backward and forward, at the same time rotating around neck of tube, until maximum brightness is obtained.
   Reset brightness control to just light tube. Turn contrast control clockwise to 90% of maximum and readjust ion trap for peak brightness.
3. Centering. The centering magnet is a dual ring magnet. The centering is dependent upon the relation of the rings to each other and the relation of both to the tube. The centering magnet is positioned almost against the deflection yoke, then the two sections rotated in relation to each other, and as a whole, until proper centering is obtained. This adjustment is quite stable and will need little attention unless its position is disturbed.

NOTE: If centering magnet requires adjustment, repeat step 2 above.

REMOVING AND REPLACING PICTURE TUBE:

CAUTION

WEAR GOGGLES OR A MASK AND USE GLOVES TO HANDLE TUBE. DO NOT STRIKE OR SCRATCH TUBE OR SUBJECT IT TO MORE THAN MODERATE PRESSURE.

NOTE: It is not necessary to remove the picture tube to clean the tube face. Simply remove three screws in front rail and remove safety glass. Clean glass and face of tube with window cleaning fluid on a soft cloth.

In both models it is necessary to remove the chassis before removing the picture tube.

The procedure on model 2921 is as follows:

1. Disconnect power plug.
2. Remove back.
3. Remove chassis by removing control knobs on panel and four bolts on bottom of shelf.
4. Remove picture tube socket.
5. Remove ion trap and centering magnet.
6. Disconnect high voltage lead from picture tube.
7. Remove spring harness and unfasten band over top of picture tube.
8. Pull tube forward and out of yoke.

The procedure on model 2922 is as follows:

1. Disconnect power plug.
2. Remove back.
3. Remove picture tube socket, yoke plug, anode lead clip, and speaker plug.
4. Remove chassis by removing the four mounting bolts, removing knobs from control panel, and sliding chassis out.
5. Remove four bolts holding tube support platform.
6. Slide picture tube and tube support platform out of the cabinet.
7. Slide ion trap and centering magnet off neck of picture tube.
8. Remove tube securing band, rubber band and mounting ring.
9. Replace the tube by reversing the above procedure. Shell should be flush against deflection yoke rubber cushions.

OPERATING INSTRUCTIONS:

TELEVISION OPERATION, BOTH MODELS:

1. Turn receiver on and set SELECTOR to TV position.
2. Allow for normal tube warm up.
3. Rotate CHANNEL SELECTOR to desired television channel.
4. Adjust FINE TUNING CONTROL for maximum picture quality.
5. Adjust CONTRAST CONTROL for most pleasing picture.
6. Adjust VOLUME CONTROL to desired level.

WHEN SWITCHING FROM TELEVISION TO RADIO OR VICE VERSA, ALLOW FOR TUBE WARM UP PERIOD.

RADIO OPERATION, BOTH MODELS:

1. Turn receiver on and set SELECTOR to AM position.
2. Allow for normal tube warm up.
3. Adjust TUNING CONTROL to desired station.
4. Adjust VOLUME and TONE CONTROLS to desired level.

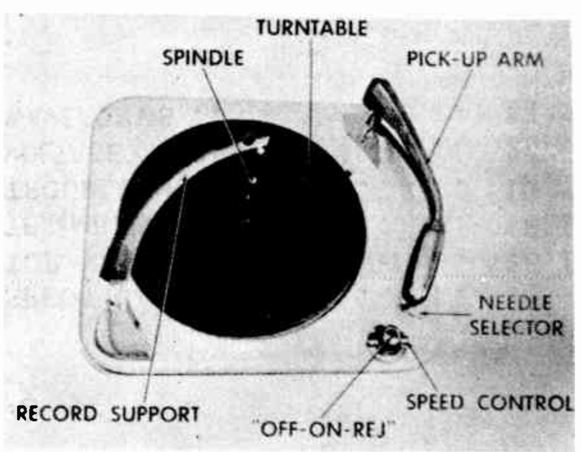


Fig. 4. V-M Record Changer

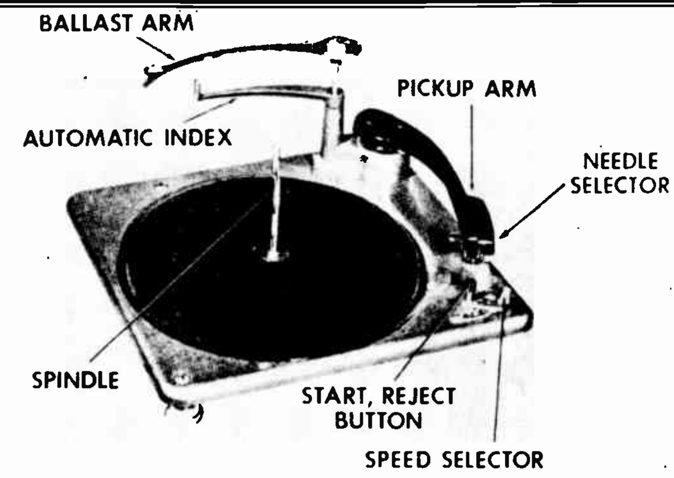


Fig. 5. Webster Record Changer

PHONOGRAPH OPERATION, MODEL 2921:

(Model 2921 uses the V-M Model 950 three speed automatic record changer, Fig. 4.)

1. Turn receiver on and set SELECTOR to Phono position.
2. Pull record support straight up and swing it to side until small pin on shaft drops into locating groove.
3. Place records on spindle and lower to offset shelf. Hold records level and replace record support over spindle. Changer will play ten 12 inch records, twelve 10 inch records, (standard or long playing), or twelve 7 inch records. The 10 inch and 12 inch may be intermixed if they are to be played at the same speed.
4. Set speed control and needle selector to correspond with type of record being played.
5. Turn on-off-reject button to "REJ." to start turntable and drop first record. Operation is now automatic; the changer will shut off after the last record has been played.
6. To reject any record while playing, turn on-off-reject button to "REJ."

REMOVING RECORDS, (model 2921):

1. Lift record support and swing it to side until small pin on shaft drops into locating groove.
2. Lift stack straight up off spindle.

MANUAL OPERATION, (model 2921):

1. With no records on turntable and record support in position on spindle, turn on-off-reject button and allow changer to go thru shut off cycle.
2. Lift record support and swing it to side. Place record on turntable and return record support to position on spindle.
3. Set speed control and needle selector to correspond with the type record being played.
4. Start turntable and place needle on record.

PHONOGRAPH OPERATION, MODEL 2922:

(Model 2922 uses the Webster Model 114 three speed automatic record changer, Fig. 5.)

1. Turn receiver on and set SELECTOR to Phono position.
2. Lift the record ballast arm and swing it away from the spindle and exert a slight downward pressure until it latches.
3. Place up to a one inch stack of any one size of records on the spindle and swing the record ballast arm back to the spindle, allowing it to drop in position with the spindle in the hole. The automatic index finger will remain away from the record until the change cycle starts. It will then move in to feel the diameter of the record and automatically index the pickup arm to the proper playing position.
4. Rotate needle selector to correspond with the type of the records to be played, "33-45" for 33⅓ or 45 R. P. M. records, "78" for 78 R. P. M. records.
5. Move the speed selector lever to correspond with the speed of the records to be played. Push the START-REJECT button to drop the first record. Hold button down until pickup arm moves.
6. To reject any record while playing automatically, push the START-REJECT button.
7. After the last record has been played, the turntable will shut off automatically and pickup arm will return to rest position.

REMOVING RECORDS, (model 2922):

1. Set the speed selector to off.
2. Lift and swing ballast arm away from spindle until it latches.
3. Place the fingers of both hands under opposite sides of the bottom record. Do not apply pressure to the top, but keep thumbs free, lifting the entire stack of records up following the contour of the spindle.

MANUAL OPERATION, (model 2922):

1. Lift the record ballast arm and swing it away from the spindle and exert a slight downward pressure until it latches.
2. Place a record on the turntable and move the speed control lever to correspond with the record being played.
3. Rotate needle selector to correspond with record being played.
4. Place pickup arm on record, turntable will start automatically.
5. When record has been played, remove pickup arm to rest position, turntable will shut off automatically.

IMPORTANT: ALWAYS MOVE SPEED SELECTOR TO "N" (NEUTRAL) POSITION WHEN RECORD PLAYER IS NOT IN USE.

NON-OPERATING CONTROLS:

GENERAL:

The non-operating controls are located similarly on both models. Six of them are under the nameplate escutcheon on the front of the set. They are:

ANI (automatic noise inverter)
Vertical hold
Brightness
Vertical linearity
Height
Focus

To reach these controls open the spring doors on the escutcheon.

There are four non-operating controls at the rear of the chassis. They are:

Horizontal hold
Horizontal drive
Horizontal linearity
Width

All controls are marked. Read the following instructions before making any adjustments.

ADJUSTMENT OF NON-OPERATING CONTROLS:

The following adjustments should be made while observing a station test pattern. Allow receiver to warm up for ten minutes.

Adjustment of FOCUS control and BRIGHTNESS control is self explanatory.

Set HORIZONTAL HOLD to synchronize picture horizontally.

Set VERTICAL HOLD so that picture does not move up or down.

Adjust HEIGHT and WIDTH controls in conjunction with VERTICAL LINEARITY and HORIZONTAL LINEARITY controls to obtain symmetrical pattern of correct size.

The automatic noise inverter (ANI) control MUST be adjusted at the location where the receiver is to be used. Moreover, it must be adjusted using the weakest signal that will be received. The procedure is as follows:

1. Rotate the ANI control to its extreme counterclockwise position.
2. Advance the control clockwise until the picture begins to distort.
3. Return the control counterclockwise slightly beyond where the distortion disappears.
4. Check all channels for picture stability. If adjustment has not been made on the weakest signal, synchronization may be lost on another channel.

The HORIZONTAL DRIVE control is adjusted by rotating it clockwise until a bright vertical bar appears, causing picture compression. Then the control is rotated counterclockwise until the compression just disappears.

SECTION III

ALIGNMENT PROCEDURE

GENERAL:

It is important that the service technician read and adhere to the alignment instructions in this section. This point cannot be stressed too strongly, especially in the case of the picture I-F alignment.

Many service technicians have been accustomed to aligning the picture I-F response curve on the oscilloscope alone. This procedure is not recommended because it is actually quite possible to get what appears to be an acceptable curve and still be lacking in horizontal resolution.

Instead, the spot frequency alignment outlined below should be followed.

It will be noted that in the following procedure the sweep generator is fed in through the antenna terminals. This being the case, the output impedance of the generator must match the 300 ohm input impedance of the set. A matching network may be devised to accomplish this. At the factory a Sylvania type 500 sweep generator was used. This generator has an output impedance of 75 ohms. The network used to match this particular impedance to the set is shown in Fig. 6. For a generator with 50 ohms impedance, use 56 ohms for the shunt resistor, and 130 ohms for each of the series resistors.

Also in step 12 it is directed that the generator be loosely coupled to the converter tube. This is done by disconnecting the tube shield from ground and connecting the generator between the shield and ground.

Test point locations are shown on the schematic diagram, Fig. 20, and on the chassis illustrations, Figs. 8, 9, 10, and 11.

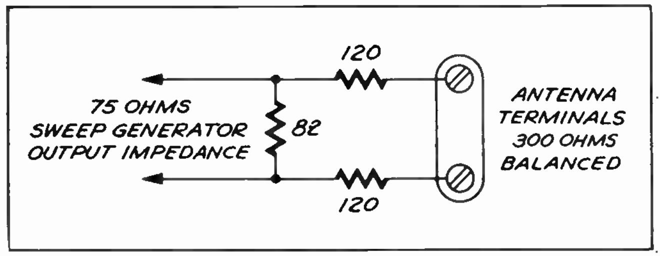


Fig. 6. Impedance Matching Network

Allow the set to warm up for 10 minutes before alignment.

PICTURE I-F ALIGNMENT:

1. Remove ANI tube, 6AV6 (V-22).
2. Connect a 3 volt battery between point "A" and ground, with the negative lead to point "A."
3. Connect a vacuum tube voltmeter between points "B" and "C."
4. Connect signal generator between ground and first I-F grid, (V-8, pin 1), through a .001 mfd capacitor. Set output at maximum.

NOTE: Early models have traps on 1st and 2nd I-F's only. These are tuned to 26.5 Mc. and 20.5 Mc. respectively. Alignment procedure is as described in steps 6 and 7 below, using 26.5 Mc. instead of 26.25 Mc. Steps 5 through 12 are listed in tabular form.

Step	Signal Generator Frequency	Adjust	For
5.	18.75 Mc.	S-32B	Minimum
6.	26.25 Mc.	S-31B and S-29B	Minimum
7.	20.50 Mc.	S-30B	Minimum
8.	22.15 Mc. (Adjust generator output for 2.5 to 3 volt VTVM reading for steps 8 thru 12.)	S-32A	Maximum
9.	23.70 Mc.	S-31A	Maximum
10.	21.25 Mc.	S-30A	Maximum
11.	24.80 Mc.	S-29A	Maximum

REPEAT STEPS 5 THROUGH 11

Disconnect signal generator from I-F grid and loosely couple it to converter tube, V-29. See general instructions, this section.

Step	Signal Generator Frequency	Adjust	For
12.	21.05 Mc.	S-12 (on R-F tuner)	Maximum

13. Disconnect VTVM and 3 volt battery.
14. Connect oscilloscope to point "B," using a 22,000 ohm isolating resistor in series with the scope probe. Connect an electrolytic capacitor, 5 mfd., 50 volt, between point "J" and ground, the negative lead going to point "J." The capacitor should previously have been checked for leakage. There should be no drop in A.G.C. voltage when the capacitor is connected.
15. Connect sweep generator to antenna terminals through an impedance matching network. (See preceding general instructions.)
16. Rotate tuner to a low frequency channel, say channel 3, and set sweep generator to center frequency of channel used (63 Mc. for channel 3). With a sweep width of 10 Mc., adjust generator output to develop approximately 4 volts of A.G.C.
17. With signal generator loosely coupled to converter tube, adjust output to provide the markers shown on the response curve, Fig. 7. Check the position of the markers one at a time.
18. Observe the waveform obtained on the oscilloscope, and compare it with the waveform shown in Fig. 7. If the spot frequency alignment has been carefully done, the comparison will be favorable. However, slight retouching of the I-F adjustments may be required. It should not be necessary to change any adjustment appreciably. The markers should be located as follows:

The 20.5 Mc., the 26.25 Mc. and the 18.75 Mc. markers at minimum response.

The 25.0 Mc. marker at 50% response.

The 21.55 Mc. marker at 100% response.

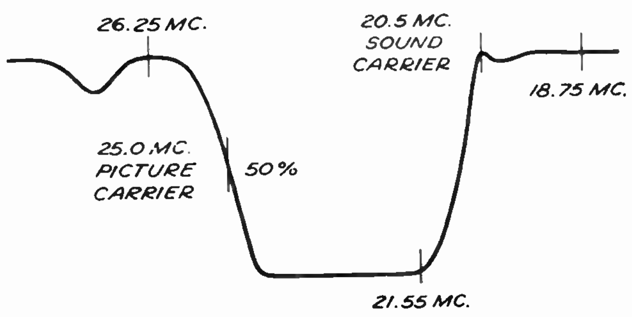


Fig. 7. I-F Response Curve

ALIGNMENT OF 4.5 Mc. TRAP:

1. Remove Pix Detector-D.C. Restorer tube, 6AL5 (V-12).
2. Connect signal generator between point "B" and ground thru a .001 mfd. isolating capacitor.
3. Turn contrast control to maximum.
4. Connect a R-F VTVM to point "D." If an R-F vacuum tube voltmeter is not available, connect a germanium diode crystal in series with the positive probe of a conventional VTVM.
5. Set signal generator to 4.5 Mc., exactly, with the output at one volt or more.
6. Adjust trap, S-33, for minimum VTVM reading.

Note: If signal generator is not capable of one volt output, it will be necessary to adjust the trap by visual means. To do this, observe the picture and adjust the trap to eliminate the 4.5 Mc. beat.

SOUND I-F AND RATIO DETECTOR ALIGNMENT:

1. Connect signal generator between point "B" and ground.
2. Connect VTVM between points "E" and "F."
3. With generator frequency at 4.5 Mc., adjust S-7, S-8, and S-9 for maximum output.
4. Connect VTVM between point "G" and ground.
5. With generator at 4.5 Mc., adjust Ratio Detector primary, S-10, for maximum output. A positive voltage will be noted.
6. Connect VTVM between points "G" and "H."
7. Adjust Ratio Detector secondary, S-11, for zero between positive and negative peaks.

THIS CHASSIS IS USED ON MODEL 2921

LIST OF ADJUSTMENTS:

Reference Symbol	Description
S-1	Antenna Trimmer, AM Tuner
S-2	Oscillator Trimmer, AM Tuner
S-3	1st I-F Primary, AM Tuner (455 Kc.)
S-4	1st I-F Secondary, AM Tuner (455 Kc.)
S-5	2nd I-F Primary, AM Tuner (455 Kc.)
S-6	2nd I-F Secondary, AM Tuner (455 Kc.)
S-7	Intercarrier Sound, 4.5 Mc.
S-8	Sound I-F Primary, 4.5 Mc.
S-9	Sound I-F Secondary, 4.5 Mc.
S-10	Ratio Detector Primary
S-11	Ratio Detector Secondary
S-12	Converter I-F, in R-F tuner
S-13	Mixer, in R-F tuner
S-14	R-F, in R-F tuner

Reference Symbol	Description
S-15	Antenna, in R-F tuner
S-16	Oscillator trimmer, in 10531 tuner only
S-17 thru S-28	Oscillator slugs for the 12 channels
S-29A	1st Picture I-F, 24.8 Mc.
S-29B	Trap, 26.25 Mc.
S-30A	2nd Picture I-F, 21.25 Mc
S-30B	Trap, 20.5 Mc.
S-31A	3rd Picture I-F, 23.7 Mc.
S-31B	Trap, 26.25 Mc.
S-32A	4th Picture I-F, 22.15 Mc.
S-32B	Trap, 18.75 Mc.
S-33	Trap, 4.5 Mc.
S-34	Horizontal Hold
S-35	Horizontal Linearity
S-36	Width

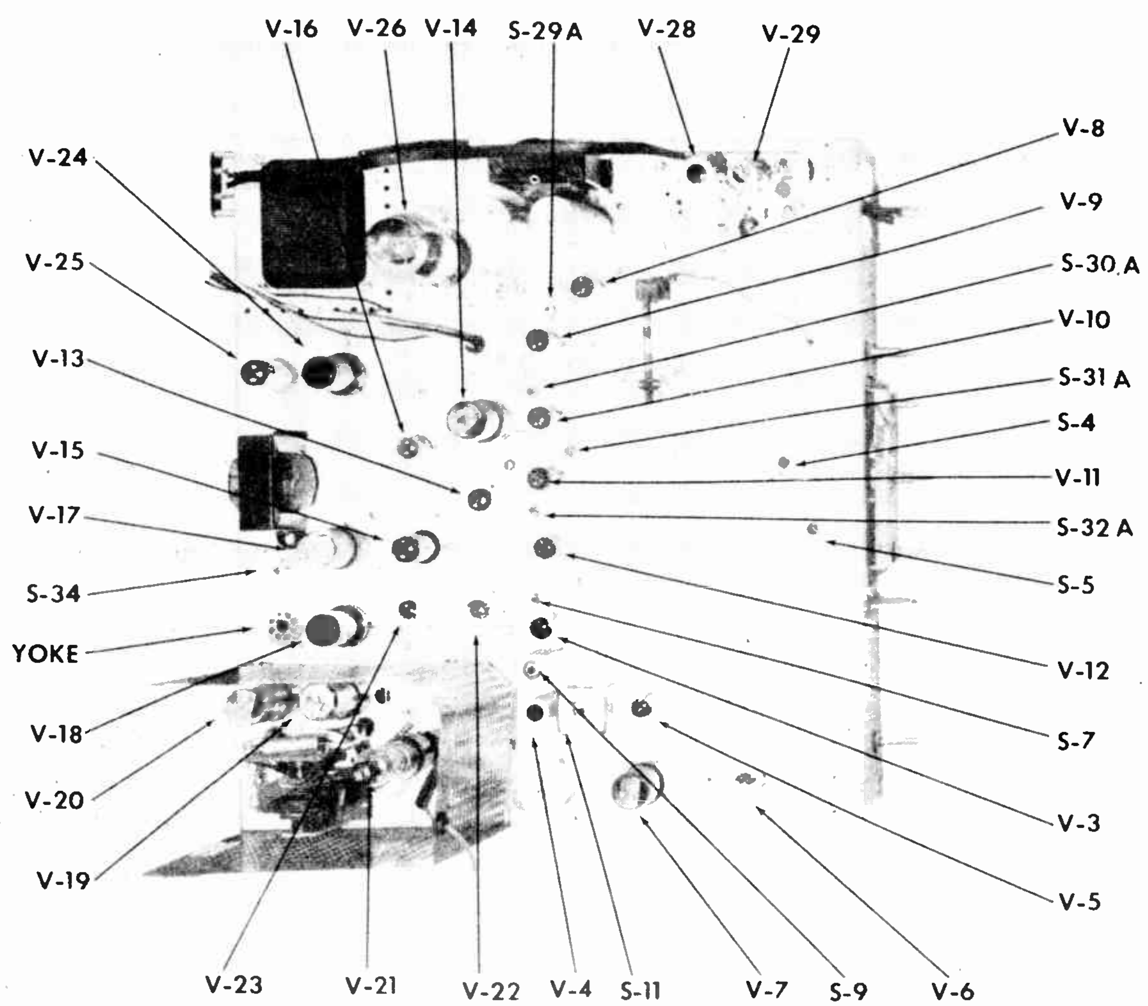


Fig. 8. Chassis 2921 Top View

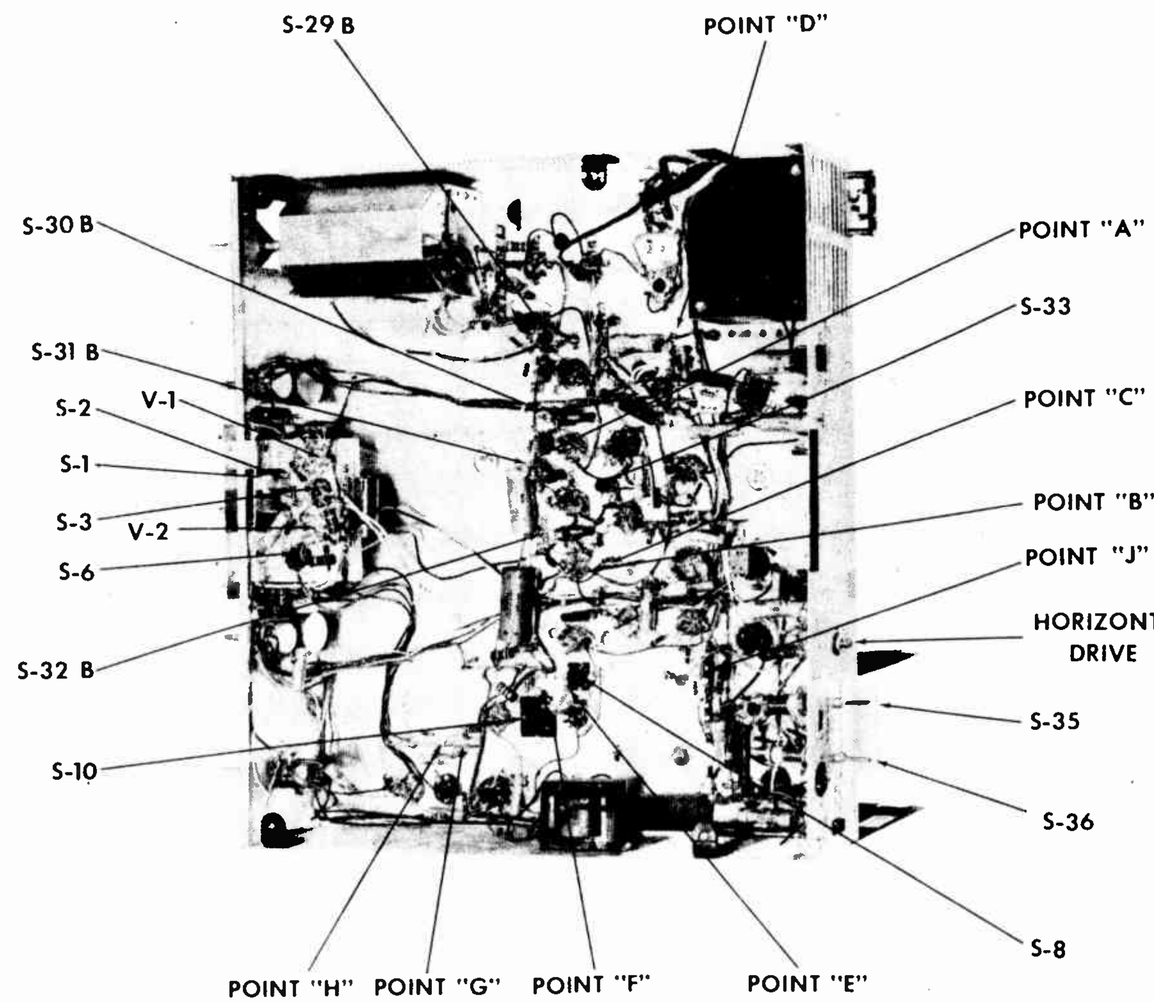


Fig. 9. Chassis 2921, Bottom View

THIS CHASSIS IS USED ON MODEL 2922

LIST OF ADJUSTMENTS:

Reference Symbol	Description
S-1	Antenna Trimmer, AM Tuner
S-2	Oscillator Trimmer, AM Tuner
S-3	1st I-F Primary, AM Tuner (455 Kc.)
S-4	1st I-F Secondary, AM Tuner (455 Kc.)
S-5	2nd I-F Primary, AM Tuner (455 Kc.)
S-6	2nd I-F Secondary, AM Tuner (455 Kc.)
S-7	Intercarrier Sound, 4.5 Mc.
S-8	Sound I-F Primary, 4.5 Mc.
S-9	Sound I-F Secondary, 4.5 Mc.
S-10	Ratio Detector Primary
S-11	Ratio Detector Secondary
S-12	Converter I-F, in R-F tuner
S-13	Mixer, in R-F tuner
S-14	R-F, in R-F tuner
S-15	Antenna, in R-F tuner
S-16	Oscillator trimmer, in 10531 tuner only
S-17 thru S-28	Oscillator slugs for the 12 channels
S-29A	1st Picture I-F, 24.8 Mc.
S-29B	Trap, 26.25 Mc.
S-30A	2nd Picture I-F, 21.25 Mc.
S-30B	Trap, 20.5 Mc.
S-31A	3rd Picture I-F, 23.7 Mc.
S-31B	Trap, 26.25 Mc.
S-32A	4th Picture I-F, 22.15 Mc.
S-32B	Trap, 18.75 Mc.
S-33	Trap, 4.5 Mc.
S-34	Horizontal Hold
S-35	Horizontal Linearity
S-36	Width

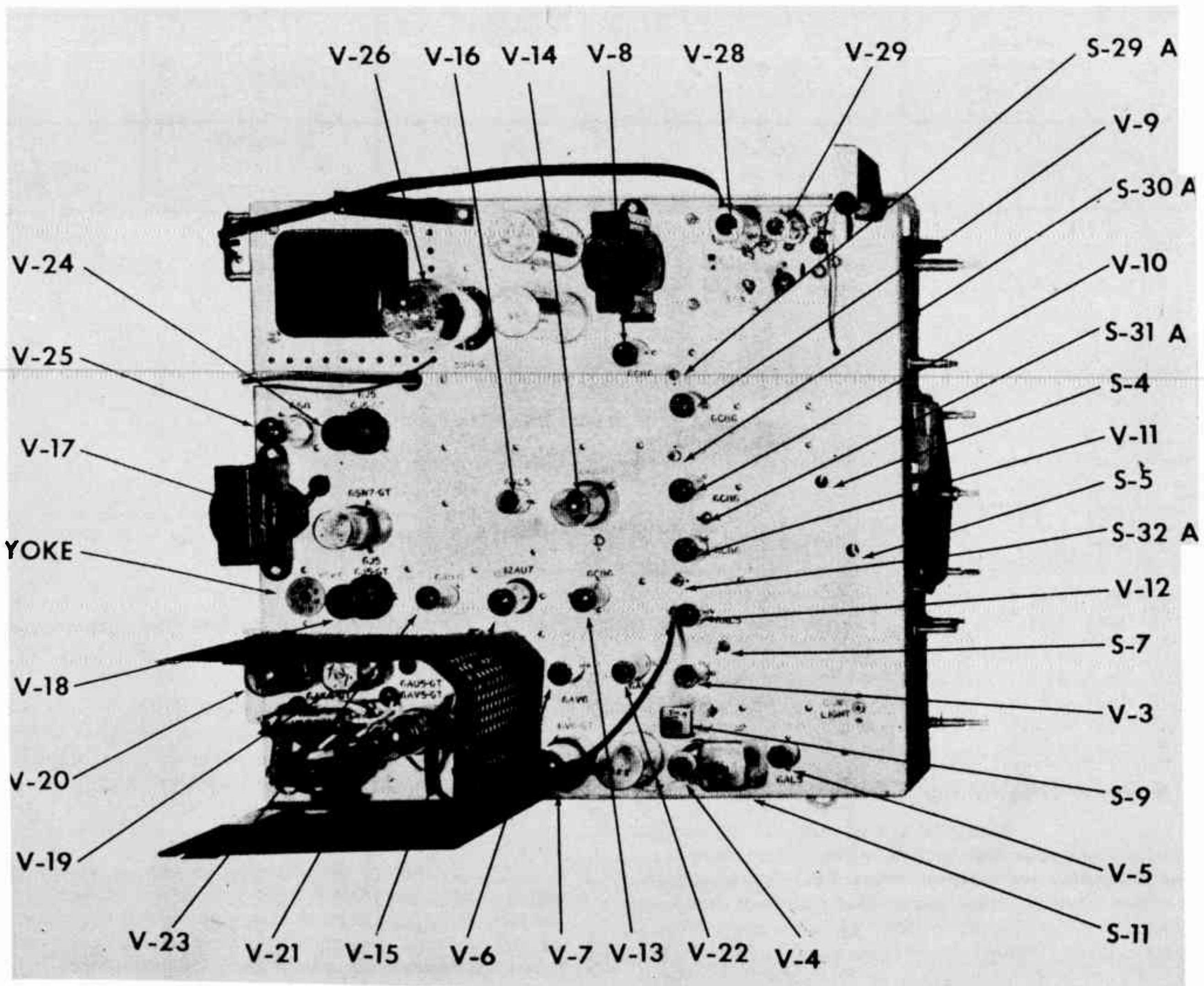


Fig. 10. Chassis 2922, Top View

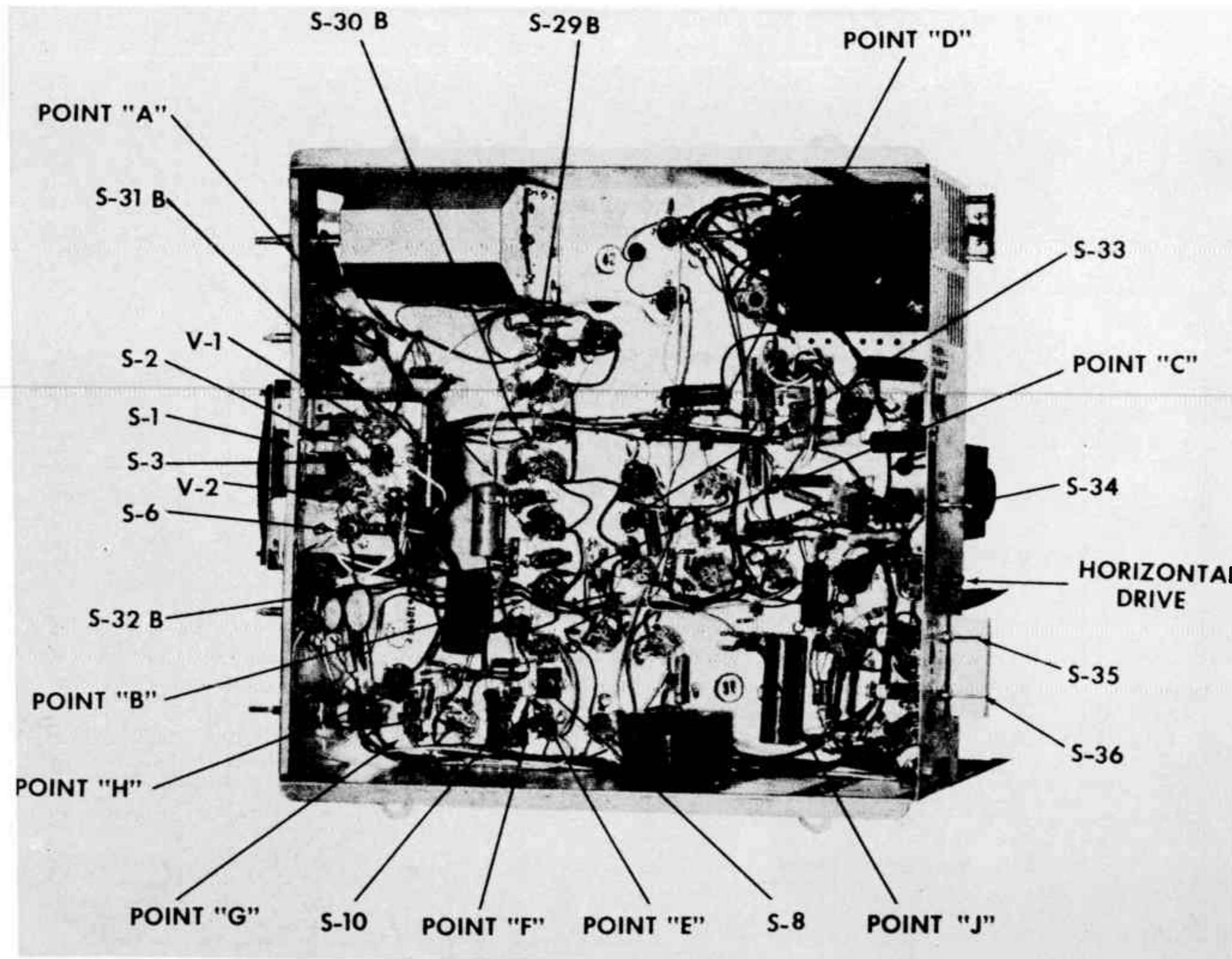


Fig. 11. Chassis 2922, Bottom View

RADIO FREQUENCY TUNER:

The radio frequency tuner used is the "Standard Cascode Tuner" manufactured by Standard Coil Products Inc. for Packard-Bell Co. Most models use tuner 10532 (Packard-Bell part number), but early models incorporated tuner 10531. Schematics of both are shown, Figs. 17 and 18.

The 10531 tuner uses a 6BK7 or a 6BQ7 tube as an R-F amplifier, but these tubes are not interchangeable. A tube must be replaced by the type that is removed.

The 10532 tuner has an improved circuit designed for use with the 6BQ7 tube only as the R-F amplifier.

Special Note: Some 10532 tuners are supplied with a 6BQ7A or a 6BZ7. These tubes are interchangeable with the usual 6BQ7.

UHF OPERATION:

UHF coil strips for the radio frequency tuner will be available through Packard-Bell Factory Service Departments for channels 14 through 83. When requesting strips specify the tuner part number. Tuner 10531 uses "K" strips and tuner 10532 uses "Q" strips. These strips are not interchangeable.

No tuner adjustment is needed after strip installation except normal oscillator slug adjustment.

D. C. RESISTANCE MEASUREMENTS, AM RADIO:

1st I-F Transformer, AM Radio	
Primary (terminals 2 & 3)	14.9 ohms
Secondary (terminals 1 & 4)	14.9 ohms
2nd I-F Transformer, AM Radio	
Primary (terminals 2 & 3)	16.5 ohms
Secondary (terminals 1 & 4)	11.5 ohms
Oscillator Coil, AM Radio	
Start to ground	5.5 ohms
Tap to ground	.65 ohms

ALIGNMENT OF AM RADIO:

The alignment of the AM radio consists of the steps shown in the following chart. Use the smallest possible input signal in each case. Connect the output meter to the speaker voice coil.

Refer to Figs. 8, 9, 10, and 11 for location of adjustments and test points.

Step	Connect Oscillator thru a .01 mfd. capacitor to:	Oscillator Setting	Pointer Setting	Adjust
1.	V-1 grid (pin 7) and ground	455 Kc.	540 Kc.	S-3, S-4, S-5 and S-6 for max. output
2.	Test loop*	1620 Kc.	1620 Kc.	S-2 for max. output
3.	Test loop*	1500 Kc.	1500 Kc.	S-1 for max. output
4.	Test loop* *Two or three turns of wire approximately 10 inches in diameter placed about two feet from receiver.	600 Kc.	600 Kc.	Move sleeve on which ferroloop is wound for maximum output. On some models a segment of the coil is movable.
Repeat step 3 and 4 several times to insure perfect tracking.				

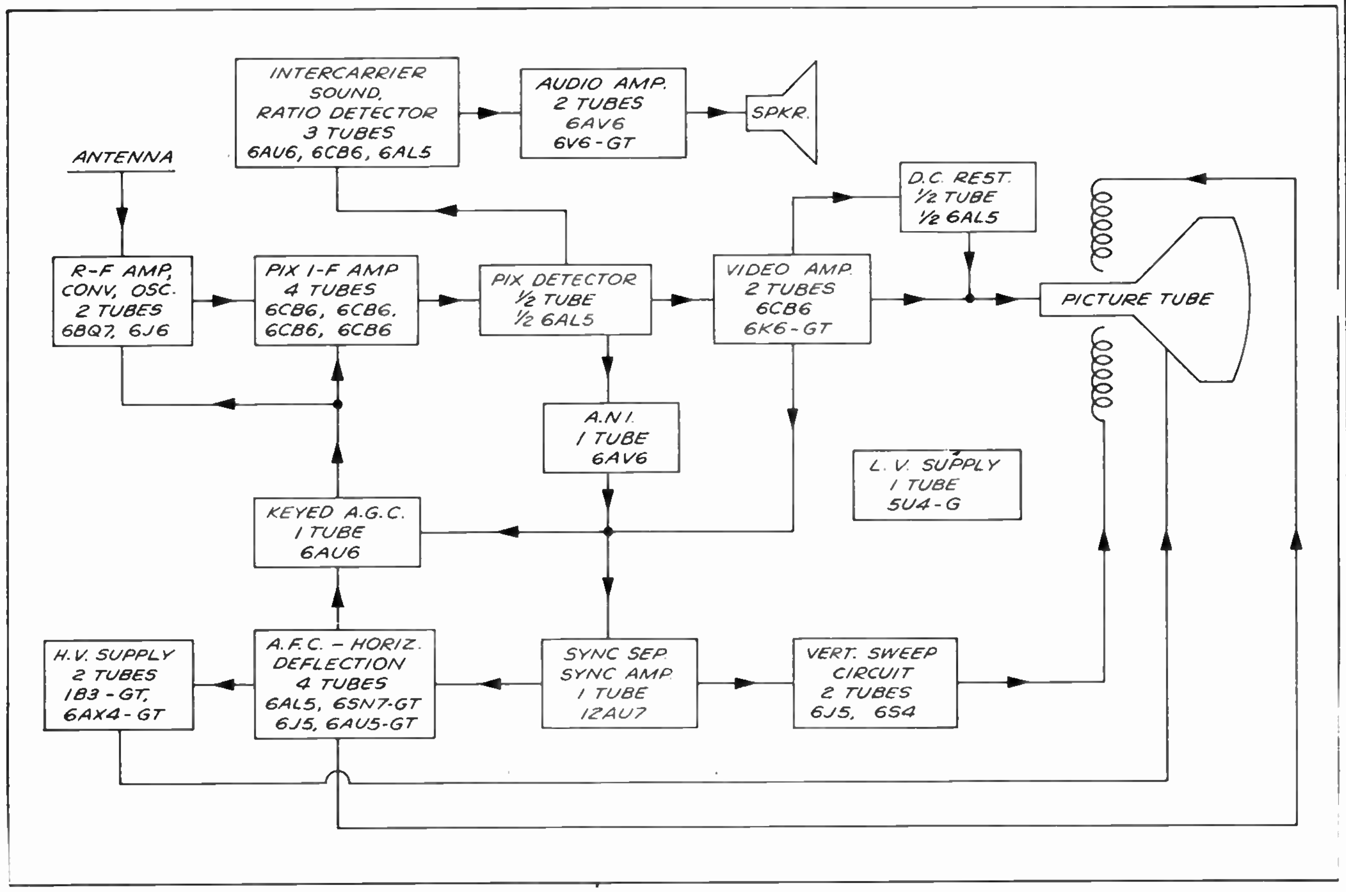


Fig. 12. Block Circuit Diagram, TV Section

HIGH VOLTAGE WARNING

The picture tube second anode voltage is approximately 15,500 volts. Only personnel familiar with high voltage handling procedure should undertake servicing the chassis after it has been removed from the cabinet. DO NOT, AT ANY TIME, WORK ON THE CHASSIS WITH THE HIGH VOLTAGE CAGE COVER REMOVED AND THE RECEIVER CURRENT ON.

SECTION IV

SPECIAL SERVICING INFORMATION

BLOCK CIRCUIT DIAGRAM:

The block circuit diagram shown in Fig. 12 will enable service personnel to trace the signal through the receiver in a logical manner.

PRODUCTION MODIFICATIONS:

The following production modifications were made since the publication of "Preliminary Service Data" concerning these models. They are mentioned here in order to explain any variation between the schematic diagram and the receiver being serviced. THE REASON FOR THE CHANGE IS SHOWN IN CAPITAL LETTERS.

1. EASE IN ASSEMBLY. Capacitor C-10, 100 mmf, and R-11, 22,000 ohms, are now combined into one unit called a "capristor". The Packard-Bell part number of the capristor is 23970.
2. IMPROVED PERFORMANCE. The front end tuner, Packard-Bell number 10531, has been replaced with tuner 10532.
3. SUPPRESSION OF ADJACENT-CHANNEL INTERFERENCE. All four picture I-F transformers have been changed to a new type embodying adjacent-channel traps on each. In making this change, R-35 was changed from 8200 ohms to 10,000 ohms and resistor R-43 from 5600 ohms to 4700 ohms.

LOCATING TROUBLE BY PICTURE TUBE OBSERVATION:

A large proportion of circuit failures may be isolated by observing certain characteristics present in the picture. Listed below are a number of possible picture faults and their probable cause.

NO RASTER ON PICTURE TUBE

1. Incorrect adjustment of ion trap magnet.
2. V-18, V-20, V-21, V-26 defective; check voltages and associated components.
3. V-17 defective, (no horizontal drive); change tube, then check voltages and associated components.
4. Check horizontal sweep wave-forms.
5. No high voltage; check transformer T-2 for defects.
6. Blown fuse; if fuse continues to blow out, check for short in B boost voltage.
7. Defective picture tube or picture tube socket.

RASTER BUT NO SOUND OR PICTURE

1. Tuner defective.
2. V-23 defective, check A. G. C. voltage.
3. V-7 defective.

SOUND AND RASTER BUT NO PICTURE

1. V-13 or V-14 may be defective; change V-13, check voltages; if trouble does not disappear, change V-14 and check voltages.
2. Check video wave-forms.

PICTURE STABLE BUT POOR RESOLUTION OR DEFINITION

1. V-13 or V-14 may be defective. Change tubes successively, then check voltages and associated components.
2. Check centering magnet and ion trap for proper adjustment.
3. R-F or I-F circuit may be improperly aligned.
4. Video peaking coils may be open or shorted.

WEAK RASTER

1. Low B plus or line voltage.
2. V-26 may be defective; change tube then check voltages.
3. V-18, V-20, V-21 defective; change tubes, then check voltages and associated components.
4. Power transformer T-4 may be defective. Check plate winding.
5. Filter capacitors may be defective. Check C-20B, C-20C, C-69B, and C-69C.

PICTURE NOT STABLE

1. If regular sections of the left picture are displaced, V-18 may be defective; check voltages.
2. Check for loose connections or noise.

PICTURE WILL NOT HOLD HORIZONTAL SYNC.

1. Horizontal hold control out of adjustment. See non-operating controls on page 14.
2. V-17 defective; change tube, then check voltages and associated components.
3. Check horizontal sweep circuit wave-forms.

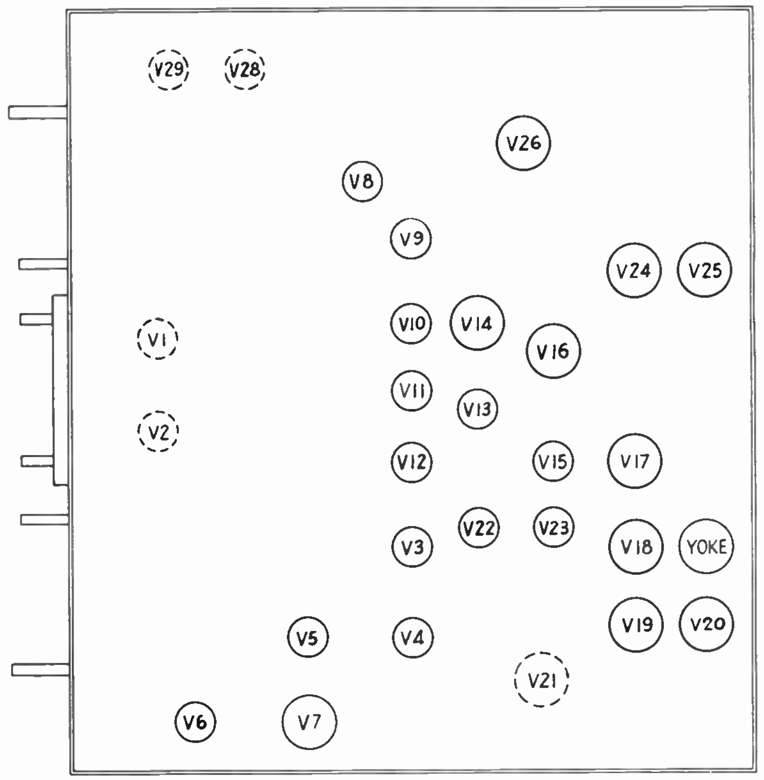


Fig. 13. Tube Location Chart, Chassis 2921, Bottom View

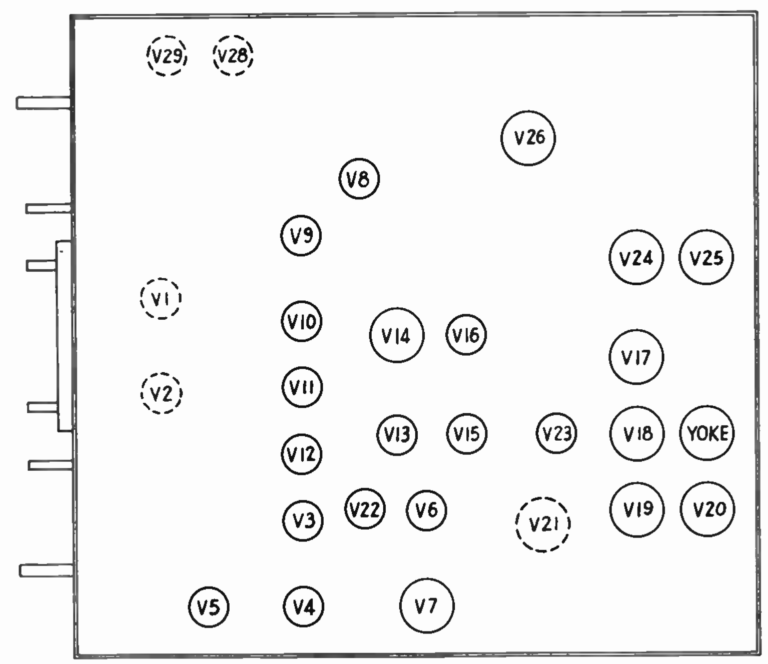


Fig. 14. Tube Location Chart, Chassis 2922, Bottom View

POOR VERTICAL LINEARITY

1. Incorrect adjustment of vertical linearity control. See non-operating controls on page 7.
2. Vertical output transformer defective, (T-3).

NO HORIZONTAL DEFLECTION

1. Horizontal deflection coil L-22B open.

NO VERTICAL DEFLECTION

1. V-25 defective; change tube, then check voltages and associated components.
2. Vertical deflection coil L-22A open.

INSUFFICIENT WIDTH

1. V-26 defective; change tube, then check for adequate B plus voltage.
2. Power transformer T-4 may be defective; check plate winding.
3. V-18, V-21 defective; change tubes, then check voltages.
4. Defective horizontal output transformer T-2.
5. Check horizontal sweep wave-forms.

NON-SYMMETRICAL RASTER

1. Check centering magnet and ion trap adjustments.
2. Yoke assembly may be defective.
3. Check vertical linearity and height adjustments.

PICTURE BUT NO SOUND

1. V-3, V-4, V-5, V-6, or V-7 defective; change tubes, then check voltages and associated components.
2. Audio output transformer T-1 open.
3. Speaker voice coil open.

CRITICAL LEAD DRESS:

In the event parts are replaced, refer to the appropriate chassis illustration, Fig. 8, 9, 10, or 11, for proper placement and lead dress. Particular attention should be given the following:

1. Do not displace components in the picture I-F circuit. If it is necessary to replace components in this section, the alignment should be checked following the changes.
2. Dress high voltage leads up and away from the chassis.
3. If parts are replaced in the high voltage section, solder joints must be rounded and free from sharp corners.
4. The lead from the ANI control, R-77, should be dressed away from the 4.5 Mc. trap, S-33.
5. The lead from the center tap of the height control, R-57B, should be dressed away from the tone control, R-20.

SOCKET VOLTAGES:

The socket voltages shown were measured on a typical chassis, under the following conditions:

1. No signal.
2. Line voltage, 117 volts.
3. Volume and contrast controls set at minimum, other controls at normal operating position.
4. D.C. voltages measured with a vacuum tube voltmeter.
5. A.C. voltages measured with a 1000 ohms per volt meter.
6. Voltages measured with respect to ground with the exception of those on V-3, V-4, V-7, and V-23. Voltages on these tubes were measured with respect to the cathode of V-7, which itself is 117 volts above ground.

NOTE: Some voltage readings are subject to a variation depending upon the setting of related controls. Thus the voltages on the vertical oscillator tube V-24 depend on the setting of the vertical hold control and the height control. Likewise the voltages on V-25 are varied by R-100.

All figures given below show the approximate magnitude of the reading to be expected, rather than the exact voltage.

Tube location is shown on Figs. 13 and 14, which are diagrams of the bottom view of each chassis.

SOCKET VOLTAGES, SWITCH IN "TV" POSITION

V-1, 6BE6, A.M. Converter
Not used in TV reception

V-2, 6BA6, A.M. I-F Amp.
Not used in TV reception

V-3, 6AU6, Sound I-F*

Pin	Element	Voltage
1	Grid 1	0
2	Grid 3	0
3	Heater	0
4	Heater	6.3 AC
5	Plate	135
6	Grid 2	135
7	Cathode	1 4

V-4, 6CB6, Driver*

Pin	Element	Voltage
1	Grid 1	2.9
2	Cathode	3.6
3	Heater	0
4	Heater	6.3 AC
5	Plate	52
6	Grid 2	52
7	Grid 3	3.2

V-5, 6AL5, Ratio Detector

Pin	Element	Voltage
1	Cathode 1	9.5
2	Plate 2	0
3	Heater	0
4	Heater	6.3 AC
5	Cathode 2	6.2
6	Shield	0
7	Plate 1	4.3

V-6, 6AV6, 1st Audio

Pin	Element	Voltage
1	Grid	–.56
2	Cathode	0
3	Heater	6.3 AC
4	Heater	0
5	Diode Plate	0
6	Diode Plate, not used	
7	Plate	110

V-7, 6V6-GT, Audio Output*

Pin	Element	Voltage
1	No connection	
2	Heater	6.3 AC
3	Plate	160
4	Grid 2	177
5	Grid 1	–5.5
6	No connection	
7	Heater	0
8	Cathode	0

V-8, 6CB6, 1st Pix I-F

Pin	Element	Voltage
1	Grid 1	–.3
2	Cathode	1.05
3	Heater	0
4	Heater	6.3 AC
5	Plate	109
6	Grid 2	109
7	Grid 3	0

V-9, 6CB6, 2nd Pix I-F

Pin	Element	Voltage
1	Grid 1	–.3
2	Cathode	1.25
3	Heater	0
4	Heater	6.3 AC
5	Plate	110
6	Grid 2	110
7	Grid 3	0

V-10, 6CB6, 3rd Pix I-F

Pin	Element	Voltage
1	Grid 1	–.3
2	Cathode	1.05
3	Heater	0
4	Heater	6.3 AC
5	Plate	113
6	Grid 2	113
7	Grid 3	0

V-11, 6CB6, 4th Pix I-F

Pin	Element	Voltage
1	Grid 1	0
2	Cathode	2.0
3	Heater	0
4	Heater	6.3 AC
5	Plate	117
6	Grid 2	117
7	Grid 3	0

V-12, (A & B), 6AL5 Pix Detector and D. C. Restorer

Pin	Element	Voltage
1	Cathode 1	11
2	Plate 2	0
3	Heater	0
4	Heater	6.3 AC
5	Cathode 2	5.6
6	Shield	0
7	Plate 1	9.8

V-13, 6CB6, 1st Video

Pin	Element	Voltage
1	Grid 1	9.8
2	Cathode	12.0
3	Heater	0
4	Heater	6.3 AC
5	Plate	95
6	Grid 2	117
7	Grid 3	0

V-14, 6K6-GT, 2nd Video

Pin	Element	Voltage
1	No connection	
2	Heater	0
3	Plate	320
4	Grid 2	117
5	Grid 1	0
6	No connection	
7	Heater	6.3 AC
8	Cathode	14

*Voltages taken with respect to cathode of V-7; see paragraph 6 at beginning of this section.

V-15, 12AU7, Sync. Amplifier

Pin	Element	Voltage
1	Plate 2	13.5
2	Grid 2	–3.5
3	Cathode 2	0
4	Heater	0
5	Heater	0
6	Plate 1	76
7	Grid 1	13.5
8	Cathode 1	13.5
9	Heater Tap	6.3 AC

V-16, 6AL5, A. F. C., Discriminator

Pin	Element	Voltage
1	Cathode 1	0
2	Plate 2	0
3	Heater	0
4	Heater	6.3 AC
5	Cathode 2	6
6	Shield	0
7	Plate 1	–4.2

V-17, 6SN7-GT, Horiz. Osc.

Pin	Element	Voltage
1	Grid 2	–1
2	Plate 2	110
3	Cathode 2	13
4	Grid 1	1
5	Plate 1	300
6	Cathode 1	13
7	Heater	0
8	Heater	6.3 AC

V-18, 6J5 or 6J5-GT, Horiz. Discharge

Pin	Element	Voltage
1	Shell in 6J5 No connection in 6J5-GT	0
2	Heater	0
3	Plate	165
4	No connection	
5	Grid	–21
6	No connection	
7	Heater	6.3 AC
8	Cathode	0

V-19, 6AV5-GT or 6AU5-GT, Horiz. Output

Pin	Element	Voltage
1	Grid 1	4.8
2	Heater	0
3	Cathode, Grid 3	62
4	No connection	
5	Plate	5 Kv. pulse
6	No connection	
7	Heater	6.3 AC
8	Grid 2	240

V-20, 6AX4-GT, Damper

Pin	Element	Voltage
1	No connection	
2	No connection	
3	Cathode	580
4	No connection	
5	Plate	330
6	No connection	
7	Heater	0
8	Heater	6.3 AC

V-21, 1B3-GT, H.V. Rectifier

15,500 volts between pin 2 and ground

V-22, 6AV6, Automatic Noise Inverter

Pin	Element	Voltage
1	Grid	–.3
2	Cathode	9.8
3	Heater	0
4	Heater	6.3 AC
5	Diode Plate, not used	
6	Diode Plate, not used	
7	Plate	116

V-23, 6AU6, Keyed Automatic Gain Control*

Pin	Element	Voltage
1	Grid 1	–22
2	Grid 3	0
3	Heater	0
4	Heater	6.3 AC
5	Plate	–115
6	Grid 2	210
7	Cathode	0

*Voltages taken with respect to cathode of V-7; see paragraph 6 at beginning of this section.

V-24, 6J5 or 6J5-GT, Vertical Oscillator

Pin	Element	Voltage
1	Shell in 6J5 No connection in 6J5-GT	0
2	Heater	0
3	Plate	150
4	No connection	
5	Grid	–8
6	No connection	
7	Heater	6.3 AC
8	Cathode	13.5

V-25, 6S4, Vertical Output

Pin	Element	Voltage
1	Internal connection	
2	Cathode	29
3	Grid	0
4	Heater	0
5	Heater	6.3 AC
6	Grid (same as 3)	0
7	Internal connection	
8	Internal connection	
9	Plate	500

V-26, 5U4-G, L. V. Rectifier

Pin	Element	Voltage
1	No connection	
2	Filament	5 AC, 340 DC
3	No connection	
4	Plate	350 AC
5	No connection	
6	Plate	350 AC
7	No connection	
8	Filament	5 AC, 340 DC

SOCKET VOLTAGES, SWITCH IN "RADIO" OR "PHONO" POSITION:

V-1, 6BE6, A.M. Converter

Pin	Element	Voltage (radio or phono)
1	Grid 1	–3.5
2	Cathode, Grid 5	0
3	Heater	0
4	Heater	6.3 AC
5	Plate	90
6	Grids 2 & 4	90
7	Grid 3	–.8

V-2, 6BA6, A.M. I-F Amplifier

Pin	Element	Voltage (radio or phono)
1	Grid 1	–.8
2	Grid 3	0
3	Heater	0
4	Heater	6.3 AC
5	Plate	95
6	Grid 2	95
7	Cathode	1

V-6, 6AV6, A. M. Detector and Amplifier

Pin	Element	Voltage (radio or phono)
1	Grid	–.56
2	Cathode	0
3	Heater	0
4	Heater	6.3 AC
5	Diode plate	0
6	Diode plate, not used	
7	Plate	110

V-7, 6V6-GT, Audio Output*

Pin	Element	Voltage (Radio)	Voltage (Phono)
1	No connection		
2	Heater	0	0
3	Plate	220	225
4	Grid 2	240	245
5	Grid 1	–14.5	–16
6	No connection		
7	Heater	6.3 AC	6.3 AC
8	Cathode	0	0

*Voltages taken with respect to cathode of V-7; see paragraph 6 at beginning of this section.

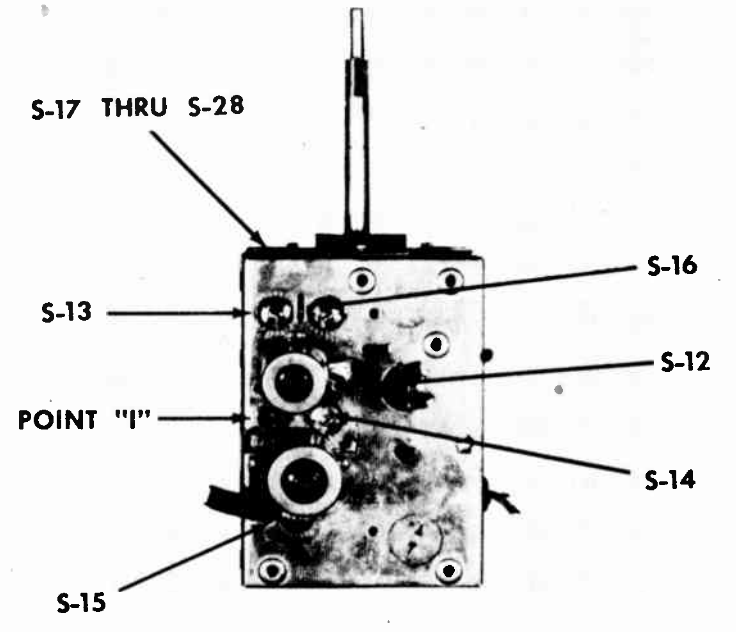


Fig. 15. R-F Tuner 10531

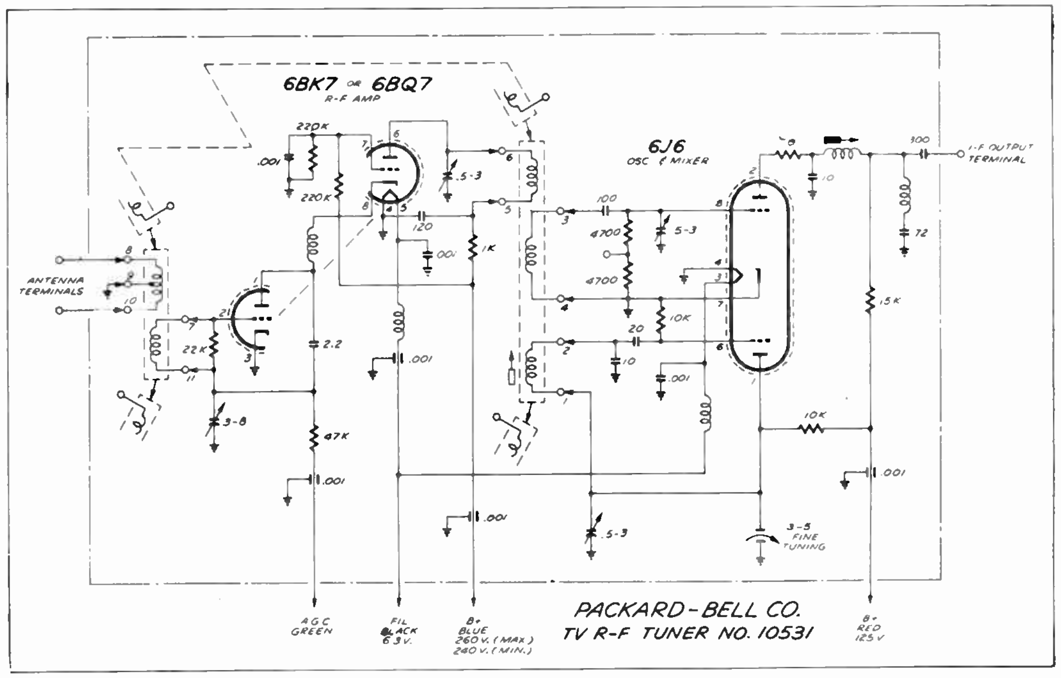


Fig. 17. Schematic Diagram, Tuner 10531

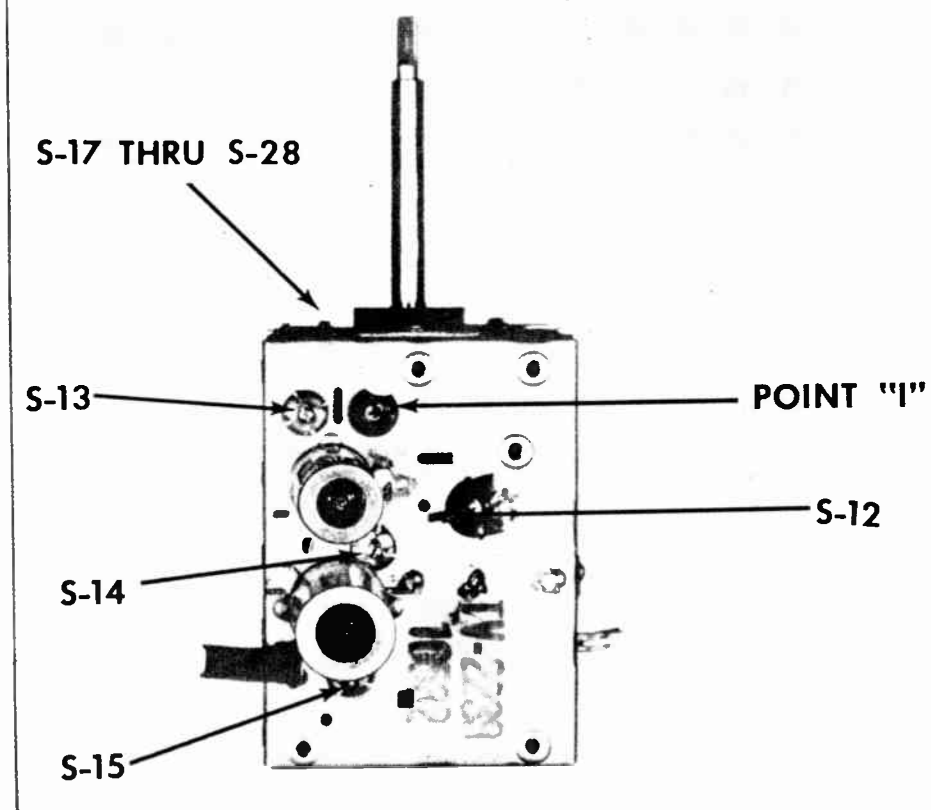


Fig. 16. R-F Tuner 10532

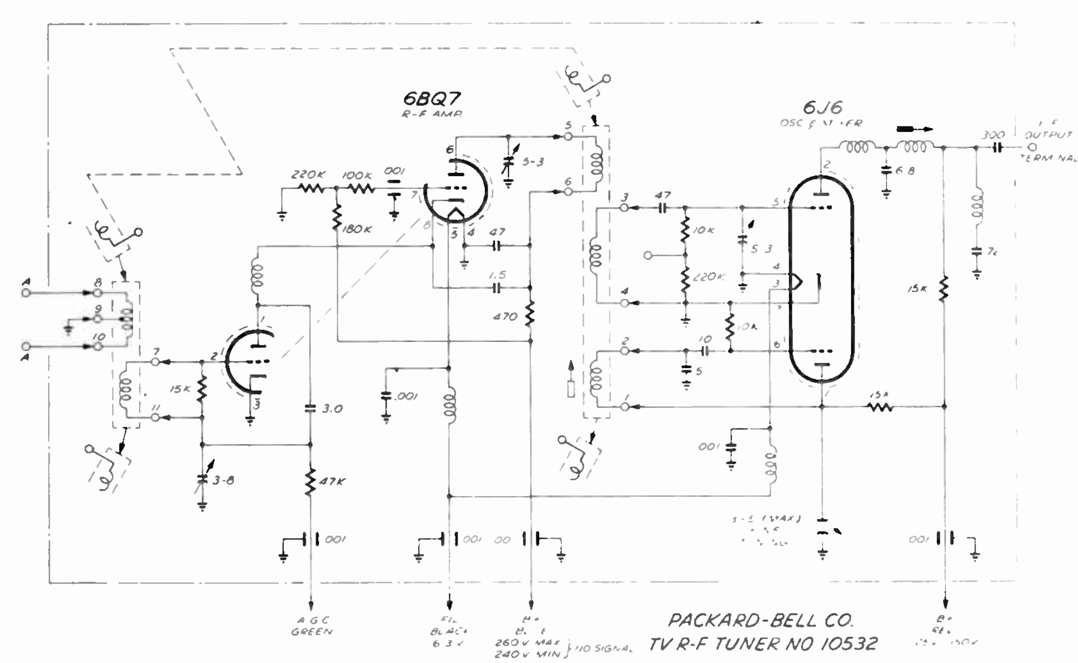
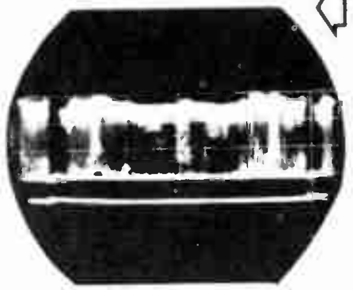
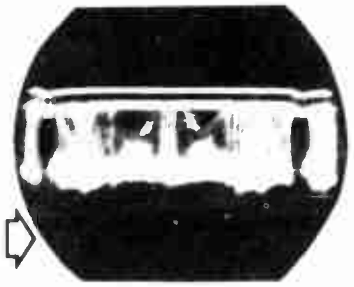


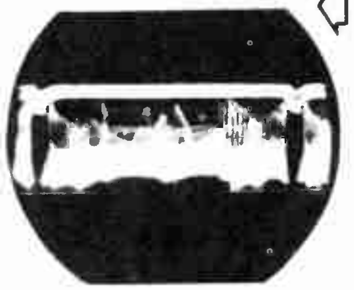
Figure 18. Schematic Diagram, Tuner 10532



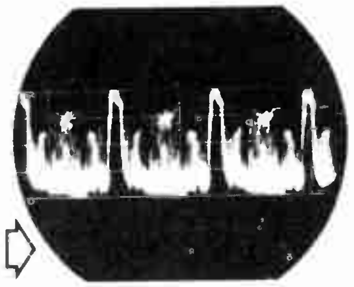
1. (V-13) 1st Video, Grid, (Pin 1), 60 C.P.S., 2.5 V.P.P.



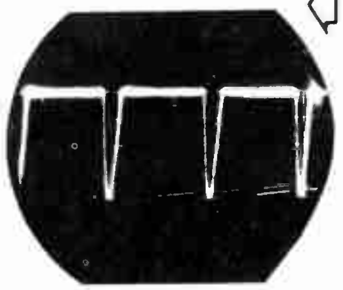
2. (V-13) 1st Video, Plate, (Pin 5) 60 C.P.S., 24 V.P.P.



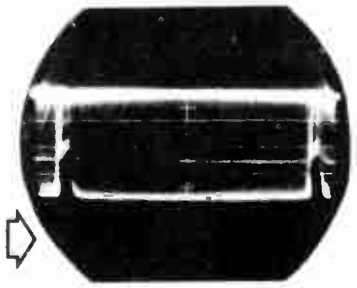
3. (V-15) Sync. Separator, Grid, (Pin 2) 60 C.P.S., 16 V.P.P.



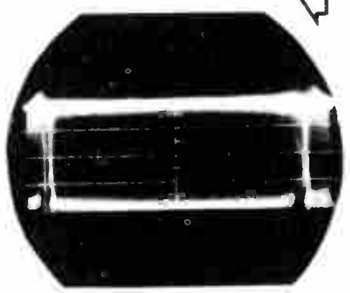
4. (V-15) Sync. Separator, Grid, (Pin 2) 15750 C.P.S., 16 V.P.P.



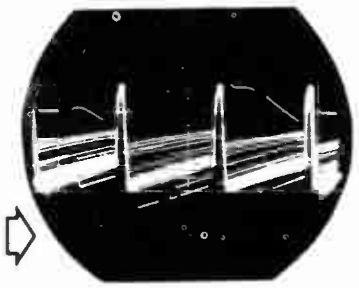
5. (V-15) Sync. Separator, Plate, (Pin 1) 15750 C.P.S., 16 V.P.P.



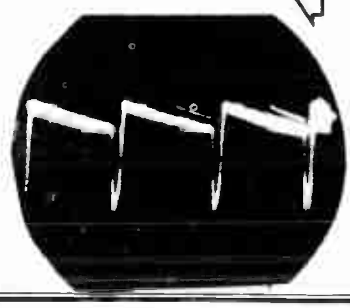
6. (V-15) Sync. Separator, Plate, (Pin 1) 60 C.P.S.. 16 V.P.P.



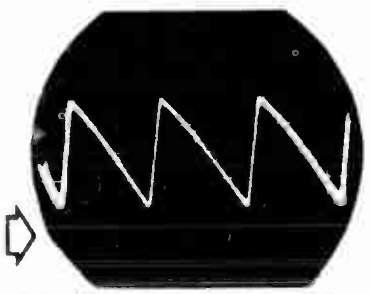
7. (V-15) Sync. Amplifier, Plate, (Pin 6) 60 C.P.S., 26 V.P.P.



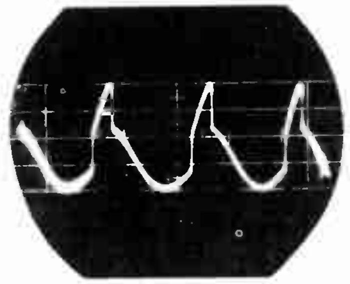
8. (V-16) Phase Detector, Plate, (Pin 7) 15750 C.P.S., 12 V.P.P.



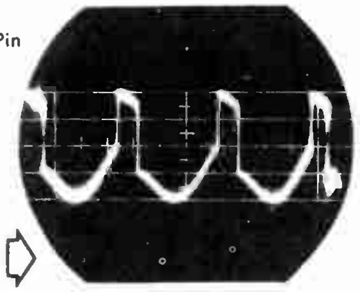
9. (V-16) Phase Detector, Cathode, (Pin 5) 15750 C.P.S., 12 V.P.P.



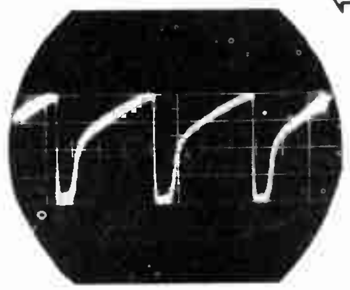
10. (V-16) Phase Detector, Cathode, (Pin 1) 15750 C.P.S., 7 V.P.P.



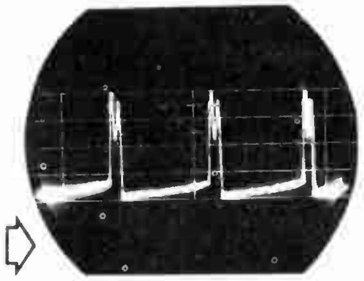
11. (V-17) Horiz. Oscillator, Plate, (Pin 5) 15750 C.P.S., 60 V.P.P.



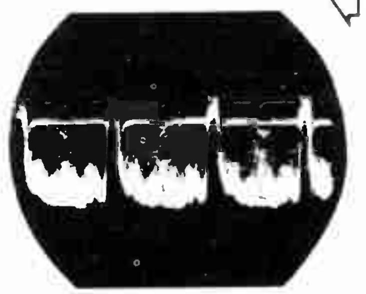
12. (V-18) Horizontal Discharge, Grid, (Pin 5) 15750 C.P.S., 37 V.P.P.



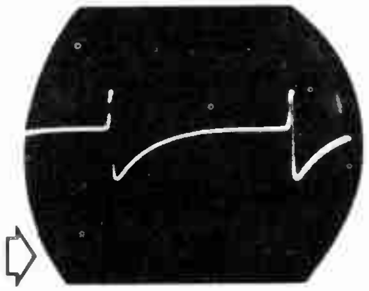
13. (V-19) Horizontal Output, Grid, (Pin 1) 15750 C.P.S., 200 V.P.P.



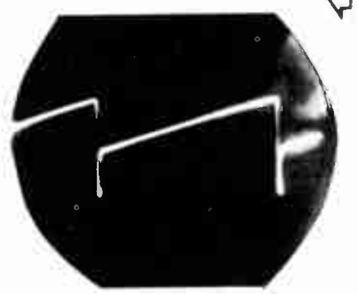
14. (V-23) Keyed A.G.C., Plate, (Pin 5) 15750 C.P.S., 700 V.P.P.



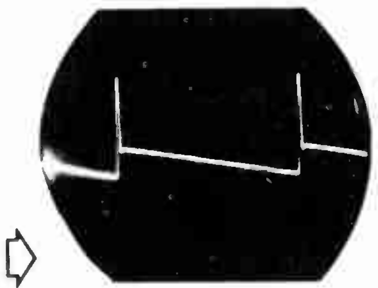
15. (V-23) Keyed A.G.C., Grid, (Pin 1) 15750 C.P.S., 16 V.P.P.



16. (V-24) Vertical Oscil, Grid, (Pin 5) 60 C.P.S., 70 V.P.P.

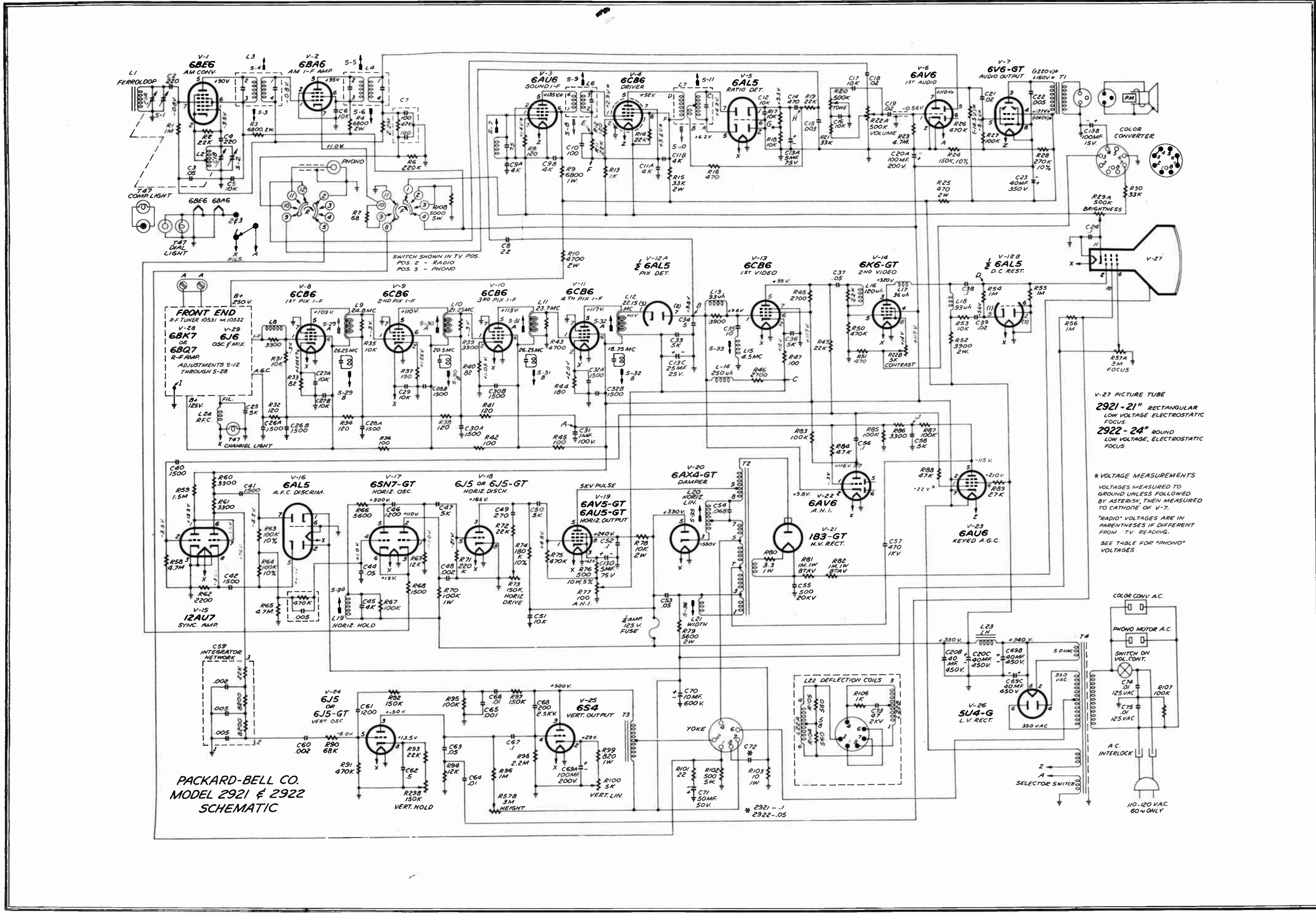


17. (V-24) Vert. Oscil., Plate, (Pin 3) 60 C.P.S., 105 V.P.P.



18. (V-25) Vert. Output, Plote, (Pin 9) 60 C.P.S., 1500 V.P.P.

Fig. 19. Waveforms


PACKARD-BELL CO.
MODEL 2921 & 2922
SCHEMATIC
V-27 PICTURE TUBE
2921 - 21" RECTANGULAR
LOW VOLTAGE ELECTROSTATIC FOCUS.
2922 - 24" ROUND
LOW VOLTAGE, ELECTROSTATIC FOCUS
* VOLTAGE MEASUREMENTS
VOLTAGES MEASURED TO GROUND UNLESS FOLLOWED BY ASTERISK, THEN MEASURED TO CATHODE OF V-7.
"RADIO" VOLTAGES ARE IN PARENTHESES IF DIFFERENT FROM "TV" READING.
SEE TABLE FOR "PHONO" VOLTAGES
SWITCH SHOWN IN TV POS.
POS. 2 - RADIO
POS. 3 - PHONO
FRONT END
R-F TUNER 10531 or 10532
V-28 6BK7 OR 6BQ7 R-F AMP.
V-29 6J6 OSC & MIX.
ADJUSTMENTS S-12 THROUGH S-28
V-1 6BE6 AM CONV.
V-2 6BA6 AM I-F AMP.
V-3 6AU6 SOUND I-F
V-4 6CB6 DRIVER
V-5 6AL5 RATIO DET.
V-6 6AV6 1ST AUDIO
V-7 6V6-GT AUDIO OUTPUT
V-8 6CB6 1ST PIX I-F
V-9 6CB6 2ND PIX I-F
V-10 6CB6 3RD PIX I-F
V-11 6CB6 4TH PIX I-F
V-12A ½ 6AL5 PIX DET.
V-12B ½ 6AL5 D.C. REST.
V-13 6CB6 1ST VIDEO
V-14 6K6-GT 2ND VIDEO
V-15 12AU7 SYNC. AMP.
V-16 6AL5 A.F.C. DISCRIM.
V-17 6SN7-GT HORIZ. OSC.
V-18 6J5 OR 6J5-GT HORIZ. DISCH.
V-19 6AV5-GT 6AU5-GT HORIZ. OUTPUT
V-20 6AX4-GT DAMPER
V-21 1B3-GT H.V. RECT.
V-22 6AV6 A.N.I.
V-23 6AU6 KEYED A.G.C.
V-24 6J5 OR 6J5-GT VERT. OSC
V-25 6S4 VERT. OUTPUT
V-26 5U4-G L.V. RECT.
COLOR CONVERTER
L22 DEFLECTION COILS
YOKE
110-120 VAC. 60~ ONLY
* 2921 - .1
2922 - .05

SECTION V

TABLE OF REPLACEABLE PARTS

To be assured of genuine Packard-Bell replacement parts, order by the Packard-Bell part number from your nearest Packard-Bell Service Department. Their addresses are listed below.

City	Address	Phone
Los Angeles (home office)	1101 So. Hope St.	RIchmond 7-6411
Alhambra	2221 West Valley Blvd.	ATlantic 2-3195
Burbank	3007 Magnolia Blvd.	CHarleston 0-4877
Compton	14912 So. Atlantic Blvd.	NEwmark 5-8148
Culver City	2405 So. La Cienega Blvd.	VErmont 9-8953
Denver	1441 Ogden St.	Keystone 6365
El Paso	1515 Wyoming St.	2-1608
Fresno	531 "P" St.	
Honolulu	1923 Kalakaua Ave.	99-8420
Oakland	1009 Cypress St.	TEmplebar 6-1662
Phoenix	228 E. Roosevelt St.	ALpine 4-5514
Portland	326 N. W. 21st Ave.	Capital 9716
Riverside	247 La Cadena Dr.	1338
Salt Lake City	624 So. State St.	9-3748
San Diego	3536 Adams	TAlbot 1-8163
San Francisco	1157 Post St.	PRospect 6-1880
San Mateo	1037 No. Bayshore Blvd.	DIamond 4-6882
Santa Ana	1324 W. First St.	KImberly 3-6571
Seattle	2310 4th Ave.	Mutual 2400
Spokane	South 125 Stevens St.	Riverside 6153
Tacoma	2327 So. Tacoma Ave.	Broadway 2175
Tucson	745 No. 4th Ave.	4-2408

CAPACITORS

Notes: (1) "GMV" means "capacities listed are Guaranteed Minimum Values over a range of from plus 10 degrees C. to plus 65 degrees C."

(2) Unless otherwise specified, tolerances are:
Electrolytic capacitors, +50%, —10%
Paper capacitors, +30%, —10%

(3) "NPO" denotes zero temperature coefficient.

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
C-1	See "CONTROLS"	
C-2	Ceramic, 220 mmf, 20%, 350 volt	23915
C-3	Paper, .05 mfd, 200 volts	23017
C-4	Ceramic, 220 mmf, 20%, 350 volt	23915
C-5	Ceramic, 10,000 mmf GMV, 500 volt, disc	23939
C-6	Ceramic, 10,000 mmf GMV, 500 volt, disc	23939
C-7	Tweet filter network, consisting of two 100 mmf capacitors and a 47,000 ohm resistor	23930
C-8	Ceramic, 2.2 mmf ±.25 mmf, 500 volt, NPO	23969
C-9A	Ceramic, 4000 mmf GMV, 500 volts } dual, disc	23955
C-9B	Ceramic, 4000 mmf GMV, 500 volts } dual, disc	
C-10	Capristor (consists of a 100 mmf capacitor in parallel with a 22,000 ohm resistor)	23970
C-11A	Ceramic, 4000 mmf GMV, 500 volt } dual, disc	23955
C-11B	Ceramic, 4000 mmf GMV, 500 volt } dual, disc	
C-12	Ceramic, 10,000 mmf GMV, 500 volt, disc	23939
C-13A	Electrolytic, 5 mfd 75 volt } quadruple	24069
C-13B	Electrolytic, 100 mfd 15 volt } quadruple	
C-13C	Electrolytic, 25 mfd 25 volt } quadruple	
C-13D	Electrolytic, 5 mfd 75 volt } quadruple	
C-14	Ceramic, 470 mmf, 20%, 500 volt	23916
C-15	Paper, .003 mfd 600 volt	23016
C-16	Ceramic, 10,000 mmf GMV, 500 volt, disc	23939
C-17	Ceramic, 10,000 mmf GMV, 500 volt, disc	23939
C-18	Paper, .02 mfd 600 volt	23007
C-19	Paper, .02 mfd 600 volt	23007
C-20A	Electrolytic, 100 mfd 200 volt } triple	24055
C-20B	Electrolytic, 40 mfd 450 volt } triple	
C-20C	Electrolytic, 40 mfd 450 volt } triple	
C-21	Paper, .02 mfd 600 volt	23007
C-22	Paper, .005 mfd, 600 volt	23004
C-23	Electrolytic, 40 mfd 350	24063
C-24	Paper, .1 mfd 200 volt	23019
C-25	Ceramic, 5000 mmf GMV, 500 volt, disc	23931
C-26A	Ceramic, 1500 mmf GMV, 500 volt } dual, disc	23954
C-26B	Ceramic, 1500 mmf GMV, 500 volt } dual, disc	
C-27A	Ceramic, 10,000 mmf GMV, 500 volt } dual, disc	23962
C-27B	Ceramic, 10,000 mmf GMV, 500 volt } dual, disc	
C-28A	Ceramic, 1500 mmf GMV, 500 volt } dual, disc	23954
C-28B	Ceramic, 1500 mmf GMV, 500 volt } dual, disc	
C-29	Ceramic, 10,000 mmf GMV, 500 volt, disc	23939
C-30A	Ceramic, 1500 mmf GMV, 500 volt } dual, disc	23954
C-30B	Ceramic, 1500 mmf GMV, 500 volt } dual, disc	
C-31	Paper, 1 mfd 100 volt	23040
C-32A	Ceramic, 1500 mmf GMV, 500 volt } dual, disc	23954
C-32B	Ceramic, 1500 mmf GMV, 500 volt } dual, disc	
C-33	Ceramic, 5000 mmf GMV, 500 volt, disc	23931
C-34	Ceramic, 5 mmf, 20%, 500 volt	23908
C-35	Ceramic, 10 mmf, 5% NPO, 500 volt	23927
C-36	Ceramic, 5000 mmf GMV, 500 volt, disc	23931
C-37	Paper, .05 mfd 200 volts	23017
C-38	Paper, .1 mfd 600 volts	23012
C-39	Paper, .02 mfd 600 volts	23007
C-40	Ceramic, 1500 mmf, 20%, 500 volts	23936
C-41	Ceramic, 1500 mmf, 20%, 500 volt	23936
C-42	Ceramic, 1500 mmf, 20%, 500 volt	23936
C-43	Capristor (consists of a 5000 mmf capacitor in parallel with a 470,000 ohm resistor)	23960
C-44	Paper, .05 mfd 600 volt	23010
C-45	Mica, 4000 mmf, 10%, 500 volt	23208
C-46	Mica, 1200 mmf, 10%, 500 volt	23219
C-47	Ceramic, 5000 mmf GMV, 500 volt, disc	23931
C-48	Paper, .002 mfd, +30%, —20%, 600 volt	23002
C-49	Ceramic, 270 mmf, 20%, 500 volt	23943
C-50	Ceramic, 5000 mmf GMV, 500 volt, disc	23931
C-51	Ceramic, 10,000 mmf GMV, 500 volt, disc	23939
C-52	Paper, .1 mfd 600 volt	23012
C-53	Paper, .05 mfd 600 volt	23010
C-54	Paper, .068 mfd, 10%, 400 volt	23041
C-55	Ceramic, 500 mmf, +50%, —20% 20,000 volt	23959
C-56	Paper, .1 mfd 200 volt	23019
C-57	Ceramic, 470 mmf, 20%, 1000 volt	23967
C-58	Ceramic, 5000 mmf GMV, 500 volt, disc	23931
C-59	Integrator Network (see schematic diagram for components)	23951
C-60	Paper, .002 mfd, +30%, —20%, 600 volt	23002
C-61	Mica, 1200 mmf, 10%, 500 volt	23219
C-62	Paper, .5 mfd 200 volt	23035
C-63	Paper, .05 mfd 200 volt	23017
C-64	Paper, .01 mfd 600 volt	23006
C-65	Paper, .001 mfd, +50%, —25%, 600 volt	23001
C-66	Paper, .01 mfd 600 volt	23006
C-67	Paper, .1 mfd 600 volt	23012
C-68	Ceramic, 200 mmf, 10%, 2500 volt	23958
C-69A	Electrolytic, 100 mfd 200 volt } triple	24055
C-69B	Electrolytic, 40 mfd 450 volt } triple	
C-69C	Electrolytic, 40 mfd 450 volt } triple	
C-70	Electrolytic, 10 mfd 600 volt	24068
C-71	Electrolytic, 50 mfd 50 volt	24042
C-72	Paper { .1 mfd, 600 volt, on 2921,	23012
	Paper { .05 mfd, 600 volt on 2922	23010
C-73	Ceramic, 47 mmf, 10%, 2000 volt	23956
C-74	Bakelite enclosed tubular, .01 mfd 125 volts AC	23932
C-75	Bakelite enclosed tubular, .01 mfd 125 volts AC	23932

RESISTORS

Notes: (1) Resistors are ½ watt unless otherwise specified.
(2) Tolerance is 10% unless otherwise specified.

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
R-1	Composition, 1 megohm, 20%	73161
R-2	Composition, 22,000 ohms	73041
R-3	Composition,6800 ohms, 2 watt	73435
R-4	Composition, 6800 ohms, 2 watt	73435
R-5	Composition, 2.2 megohm, 20%	73165
R-6	Composition, 220,000 ohms, 20%	73153
R-7	Composition, 68 ohms	73011
R-8	Composition, 120 ohms	73014
R-9	Composition, 6800 ohms, 1 watt	73235
R-10	Composition, 4700 ohms, 2 watt	73433
R-11	Composition, 22,000 ohms	73041
R-12	Composition, 120 ohms	73014
R-13	Composition, 1000 ohms	73025
R-14	Composition, 22,000 ohms	73041
R-15	Composition, 33,000 ohms, 2 watt	73443
R-16	Composition, 470 ohms	73021
R-17	Composition, 10,000 ohms	73037
R-18	Composition, 10,000 ohms	73037
R-19	Composition, 22,000 ohms	73041
R-20	See "CONTROLS"	
R-21	Composition, 22,000 ohms	73043
R-22	See "Controls"	
R-23	Composition, 4.7 megohm, 20%	73169
R-24	Composition, 150,000 ohms	73051
R-25	Composition, 470 ohms, 2 watt	73421
R-26	Composition, 470,000 ohms, 20%	73157
R-27	Composition, 100,000 ohms, 20%	73149
R-28	Composition, 270,000 ohms	73054
R-29	See "CONTROLS"	
R-30	Composition, 33,000 ohms	73043
R-31	Composition, 10,000 ohms	73037
R-32	Composition, 120 ohms	73014
R-33	Composition, 82 ohms	73012
R-34	Composition, 120 ohms	73014
R-35	Composition, 10,000 ohms	73037
R-36	Composition, 100 ohms	73013
R-37	Composition, 150 ohms	73015
R-38	Composition, 120 ohms	73014
R-39	Composition, 3300 ohms	73031
R-40	Composition, 82 ohms	73012
R-41	Composition, 120 ohms	73014
R-42	Composition, 100 ohms	73013
R-43	Composition, 4700 ohms	73033
R-44	Composition, 180 ohms	73016
R-45	Composition, 100 ohms	73013
R-46	Composition, 2700 ohms	73030
R-47	Composition, 100 ohms	73013
R-48	Composition, 2700 ohms	73030
R-49	Composition, 22,000 ohms	73041
R-50	Composition, 470,000 ohms, 20%	73157
R-51	Composition, 470 ohms	73021
R-52	Composition, 3900 ohms, 2 watt	73432
R-53	Composition, 10,000 ohms	73037
R-54	Composition, 1 megohm, 20%	73161
R-55	Composition, 1 megohm, 20%	73161
R-56	Composition, 1 megohm, 20%	73161
R-57	See "CONTROLS"	
R-58	Composition, 4.7 megohms, 20%	73169
R-59	Composition, 1.5 megohm, 20%	73163
R-60	Composition, 3300 ohms	73031
R-61	Composition, 3300 ohms	73031
R-62	Composition, 2200 ohms	73029
R-63	Composition, 100,000 ohms	73049
R-64	Composition, 100,000 ohms	73049
R-65	Composition, 4.7 megohms, 20%	73169
R-66	Composition, 5600 ohms	73034
R-67	Composition, 100,000 ohms, 20%	73149
R-68	Composition, 1500 ohms	73027
R-69	Composition, 12,000 ohms	73038
R-70	Composition, 100,000 ohms, 1 watt	73249
R-71	Composition, 220,000 ohms, 20%	73153
R-72	Composition, 22,000 ohms	73041
R-73	See "CONTROLS"	
R-74	Composition, 180,000 ohms	73052
R-75	Composition, 470,000 ohms, 20%	73157
R-76	Wire wound, 500 ohms, 10 watt, 5%	73616
R-77	See "CONTROLS"	
R-78	Composition, 10,000 ohms, 2 watt	73437
R-79	Composition, 5600 ohms, 2 watt	73434
R-80	Composition, 3.3 ohms, 1 watt	73291
R-81	Composition, 1 megohm, 1 watt, 20%, type BTAV	73398
R-82	Composition, 1 megohm, 1 watt, 20%, type BTAV	73398
R-83	Composition, 100,000 ohms, 20%	73149
R-84	Composition, 47,000 ohms	73045
R-85	Composition, 100,000 ohms, 20%	73149
R-86	Composition, 3300 ohms	73031
R-87	Composition, 100,000 ohms, 20%	73149
R-88	Composition, 47,000 ohms	73045
R-89	Composition, 27,000 ohms	73042
R-90	Composition, 68,000 ohms	73047
R-91	Composition, 470,000 ohms, 20%	73157
R-92	Composition, 150,000 ohms, 20%	73151
R-93	Composition, 22,000 ohms	73041
R-94	Composition, 12,000 ohms	73038
R-95	Composition, 100,000 ohms, 20%	73149
R-96	Composition, 1 megohm, 20%	73161
R-97	Composition, 150,000 ohms, 20%	73151
R-98	Composition, 2.2 megohms, 20%	73165
R-99	Composition, 820 ohms, 1 watt	73224
R-100	See "CONTROLS"	
R-101	Composition, 22 ohms	73005
R-102	Wire wound, 500 ohms, 5 watt	73617
R-103	Composition, 10 ohms, 1 watt	73201
R-104	Composition, 560 ohms	73022
R-105	Composition, 560 ohms	73022
R-106	Composition, 1000 ohms	73025
R-107	Composition, 100,000 ohms, 20%	73149
R-108	Wire wound, 5000 ohms, 5 watt	73640

INDUCTANCES

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
L-1	Ferroloop for AM tuner	29345
L-2	Oscillator coil for AM tuner	29202A
L-3	Adjustable, 1st I-F transformer, AM tuner	29063
L-4	Adjustable, 2nd I-F transformer, AM tuner	29064
L-5	Adjustable, Sound I-F input coil, 4.5 Mc.	29053
L-6	Adjustable, Sound I-F transformer, 4.5 Mc.	29541
L-7	Adjustable, Ratio Detector transformer	29054
L-8	Tuner Coupling	29523
L-9	Adjustable, 1st Pix I-F, 24.8 Mc. and Trap	29553
L-10	Adjustable, 2nd Pix I-F, 21.25 Mc. and Trap	29554
L-11	Adjustable, 3rd Pix I-F, 23.7 Mc. and Trap	29553
L-12	Adjustable, 4th Pix I-F, 22.15 Mc. and Trap	29554
L-13	Peaking Coil, 93 uh wound on 3900 ohm resistor	29552
L-14	Peaking Coil, 250 uh	29509
L-15	Adjustable, 4.5 Mc. Trap	29548
L-16	Peaking Coil, 120 uh wound on 22,000 ohm resistor	29506
L-17	Peaking Coil, 36 uh	29520
L-18	Peaking Coil, 93 uh	29507
L-19	See "CONTROLS"	
L-20	See "CONTROLS"	
L-21	See "CONTROLS"	
L-22	Deflection Coils, (Yoke)	29542A
L-23	Filter Choke, 1 henry	27005
L-24	Radio Frequency Choke	29551

CONTROLS

VARIABLE RESISTORS

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
R-20	Tone, 500,000 ohms	25849
R-22A	Volume, 500,000 ohms } dual	25850A
R-22B	Contrast, 5000 ohms } dual	
R-29A	Brightness, 500,000 ohms } dual	25848
R-29B	Vertical Hold, 150,000 ohms } dual	
R-57A	Focus, 3 megohm } dual	25847
R-57B	Height, 3 megohm } dual	
R-73	Horizontal Drive, 150,000 ohms	25839C
R-77	Automatic Noise Inverter, 100 ohms, 2 watts	25846
R-100	Vertical Linearity, 5000 ohms	25845

VARIABLE INDUCTANCES

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
L-19	Horizontal Hold	29527
L-20	Horizontal Linearity	29531B
L-21	Width	29540B

VARIABLE CAPACITORS

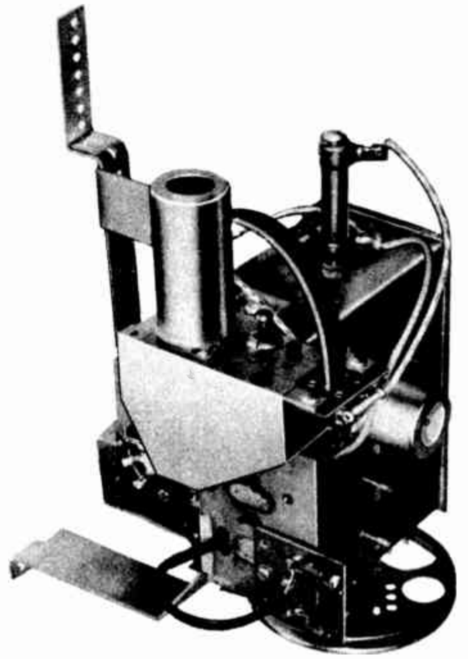
REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
C-1A, C-1B	Two section AM tuner	23531

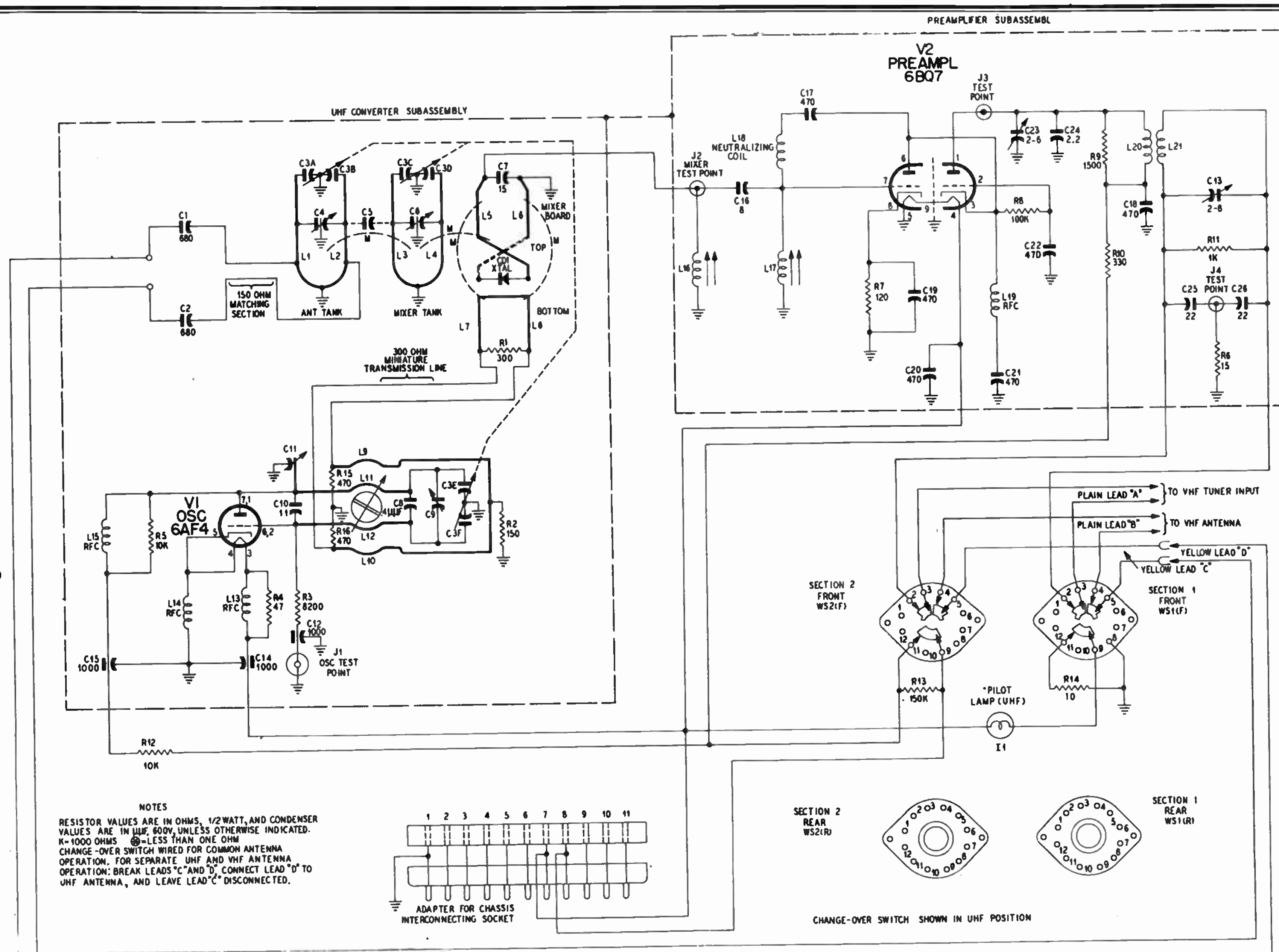
TRANSFORMERS

REFERENCE SYMBOL	DESCRIPTION	PACKARD-BELL PART NO.
T-1	Audio Output, Model 2921	89426A
	Audio Output, Model 2922	89439
T-2	Horizontal Output	89438
T-3	Vertical Output	89434A
T-4	Power	89043B

MISCELLANEOUS PARTS

DESCRIPTION	PACKARD-BELL PART NO.
Cabinet, Model 2921 (specify finish)	2921
Cabinet, Model 2922 (specify finish)	2922
Cord, AC power, 6 ft.	32021
Fuse, ¼ ampere, 125 volt	45005
Lamp T47	54002
Ion Trap, 45 gausses	28099
Knob, Fine Tuning (specify cabinet finish)	52068
Knob, Volume Control (specify cabinet finish)	52069-1
Knob, Contrast Control (specify cabinet finish)	52070
Knob, Channel Selector (specify cabinet finish)	
Model 2921	52067-1
Model 2922	52076-1
Knob, Radio, Tuning or Switching or Tone Control (specify cabinet finish)	52080
Escutcheon (specify cabinet finish)	
Model 2921	41048
Model 2922	41050
Radio Frequency Tuner	10532
Speaker:	
Model 2921	83705
Model 2922 (2 speakers used in each set)	83106





PHILCO UHF TUNER-ADAPTER UT-21, PART No. 43-6475

Philco UHF Tuner-Adapter Part No. 43-6475 provides for reception of UHF signals on television channels 14 through 83. It is designed for installation in Philco Television Receivers using r-f chassis 41, 42, 44, or 71. The Tuner-Adapter consists of a UHF converter and preamplifier unit, a change-over switch, adapter cables and plugs, a tuner driving assembly, and mounting hardware.

CIRCUIT DESCRIPTION

The UHF Tuner-Adapter functions as a converter, and converts the signals of the UHF band to a frequency selected within the VHF band. The frequency selected is that of either Channel 2 or Channel 3, depending upon the locality in which the receiver is used.

The incoming UHF signals are coupled through the antenna input line, and through two 680-μμf. condensers and a 150-ohm transmission line to the antenna tank of the tuner. See figure 1. The antenna tank is coupled to the mixer tank by means of the mutual coupling of L2 and L3 and the stray capacitance, C5. The desired UHF signal is selected by tuning the antenna tank and the mixer tank to the proper frequency, and the signal is then coupled to the crystal mixer circuit by means of the mutual coupling of L4 and L5. The local-oscillator signal is generated by a 6AF4 tube, V1, and the associated circuit. The local-oscillator signal is coupled to the crystal mixer circuit by means of a 300-ohm, miniature transmission line and the mutual coupling of L7 to L5 and L8 to L6. The UHF r-f signal and the oscillator signal are mixed in the crystal mixer circuit to produce a radio-frequency signal that is within the range of the VHF tuner when the tuner is set to either Channel 2 or Channel 3. This signal is fed into a preamplifier, and the amplified signal is then fed into the VHF tuner through a twin-wire lead. In the VHF tuner, the signal is reconverted to the intermediate frequency of the television receiver.

On VHF operation, a 150,000-ohm resistor is placed in series with the UHF oscillator plate, thus making the oscillator inoperative.

The purpose of using two r-f tanks in the UHF tuner is to readily admit the r-f signals, and, at the same time, to prevent the i-f and oscillator signals from feeding back into the antenna and causing interference with other receivers.

CHANGE-OVER SWITCH

The change-over switch supplied with the Tuner-Adapter is used to switch from VHF to UHF, and vice versa. It is operated either by pulling the UHF tuning knob forward or pushing it back toward the control panel. When the knob is pulled forward, the switch is thrown to the UHF position; when the knob is pushed back, the switch is thrown to the VHF position. When thrown to the UHF position, the switch connects the antenna to the UHF tuner, turns on the UHF pilot light, and connects the output of the UHF tuner to the antenna input of the VHF tuner. When thrown to the VHF position, the switch connects the antenna to the VHF tuner input, turns off the UHF pilot light, and places a 150,000-ohm resistor in series with the UHF oscillator plate, as explained above.

TUNER AND POINTER DRIVE

The shaft of the tuning-condenser gang is connected to the tuning shaft by means of a drive cord and pulley assembly. Another drive cord connects the tuning-gang shaft to the pointer and pointer shaft assembly. A switch washer, which is fastened to the tuning shaft, operates the change-over switch when the shaft is pulled forward or pushed back.

ALIGNMENT AND REPAIRS

The frequencies at which the tuner operates are extremely high; therefore, it is important that the utmost care be taken to safeguard against upsetting the delicate adjustments of the tuner. It is recommended that the serviceman make only minor repairs on the tuner, such as replacement of a tube or crystal and the wiring of external leads. The tuner should be returned to the factory for alignment and major repairs, unless the serviceman is properly equipped to perform this work. In general, a good rule to follow is not to remove the cover of the tuner.

Replacing a tube with a new one may detune the tuner. If this occurs, try a number of tubes until the best substitute for the original tube is found.

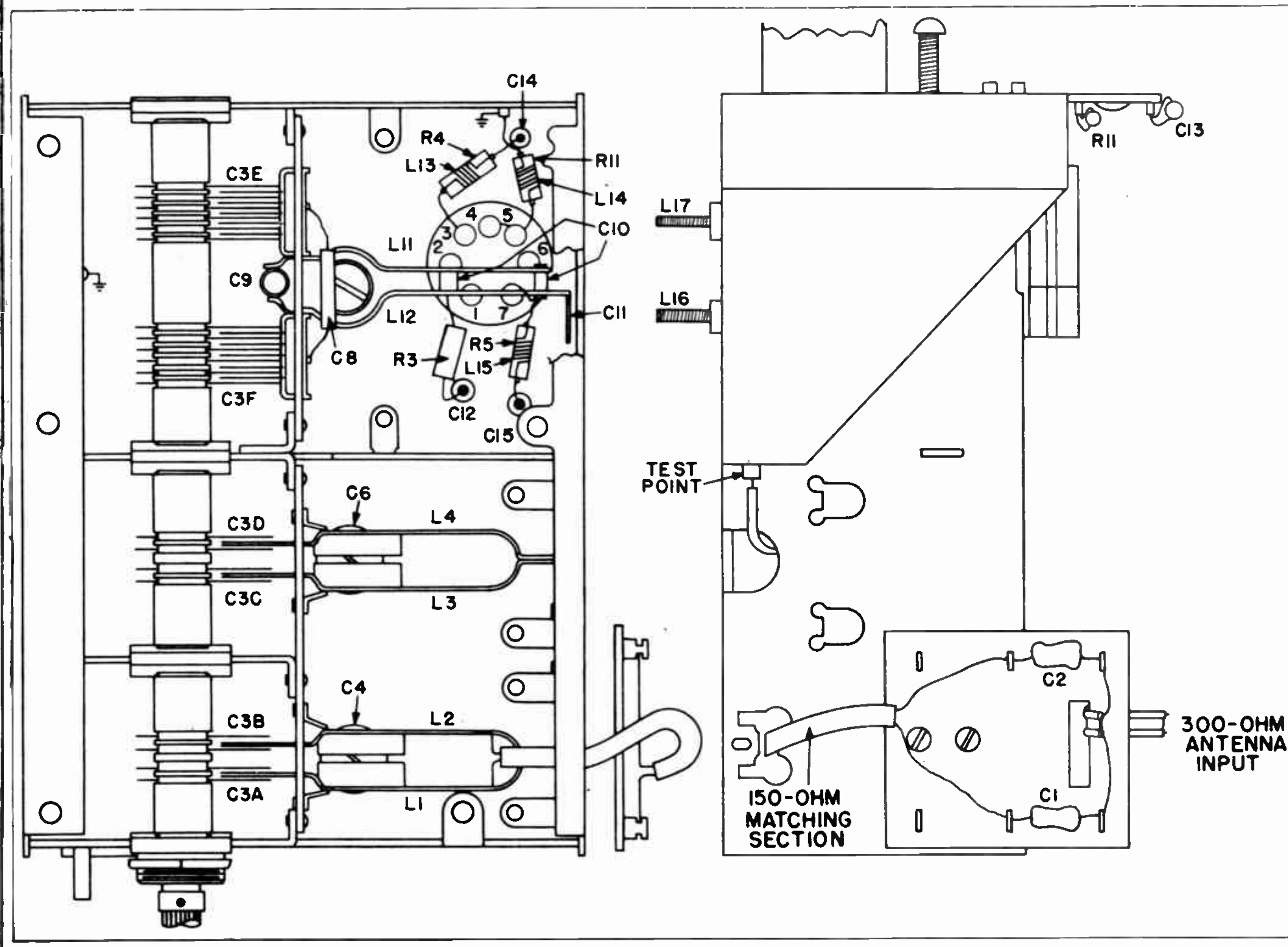


Figure 2. Base Layout of UHF Tuner-Adapter, with Oscillator and Mixer Boards Removed

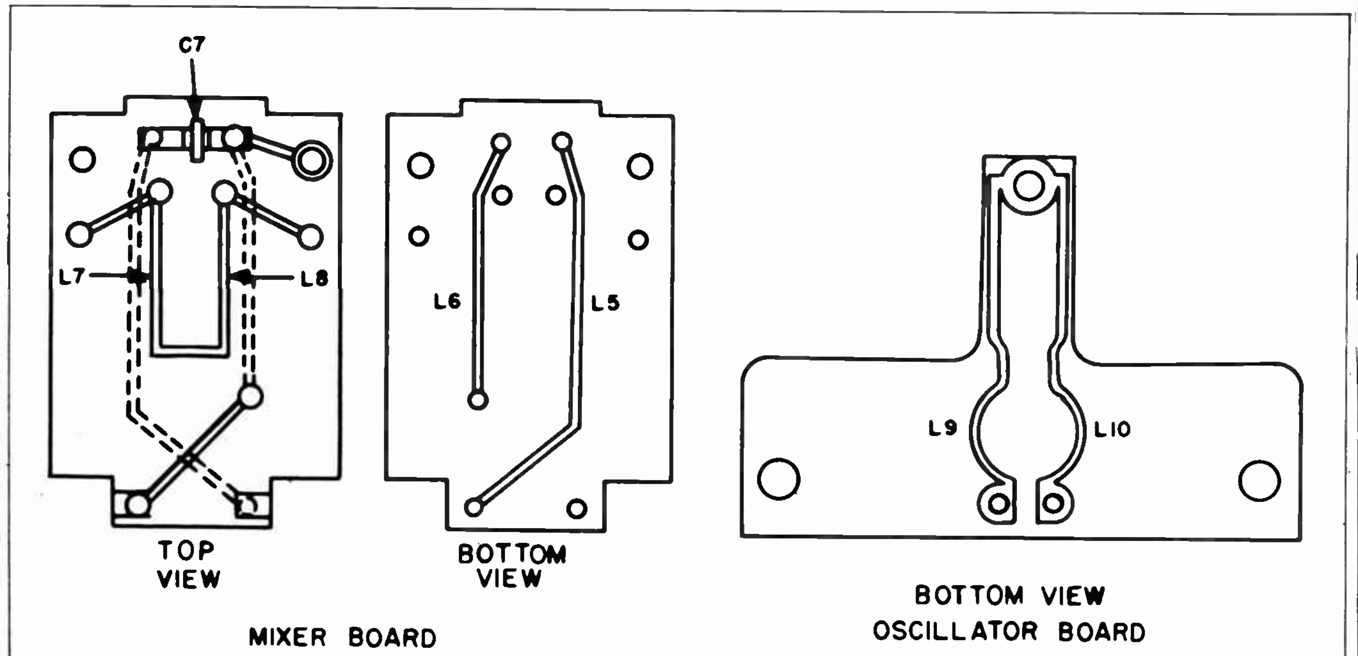


Figure 4. Oscillator Board and Mixer Board

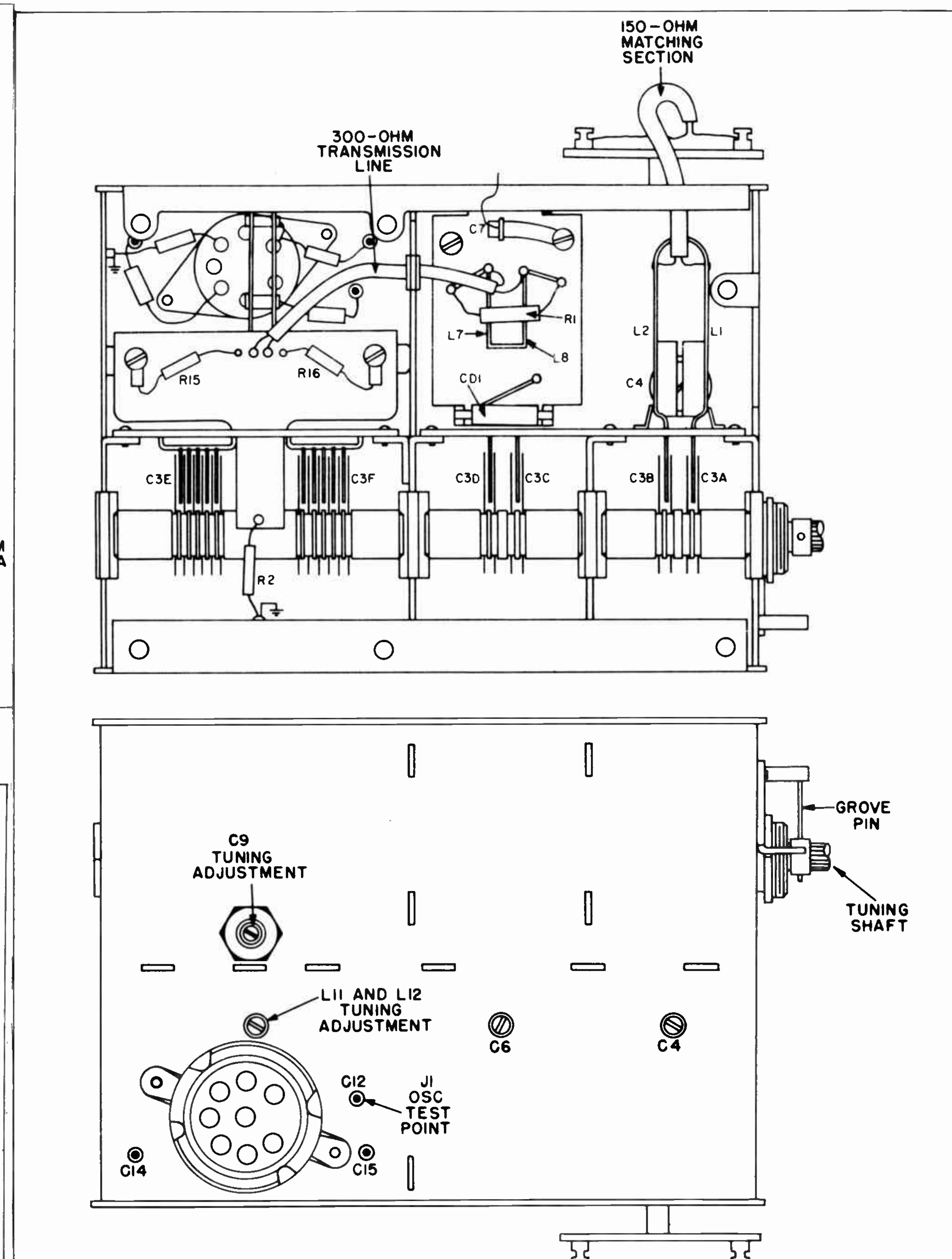
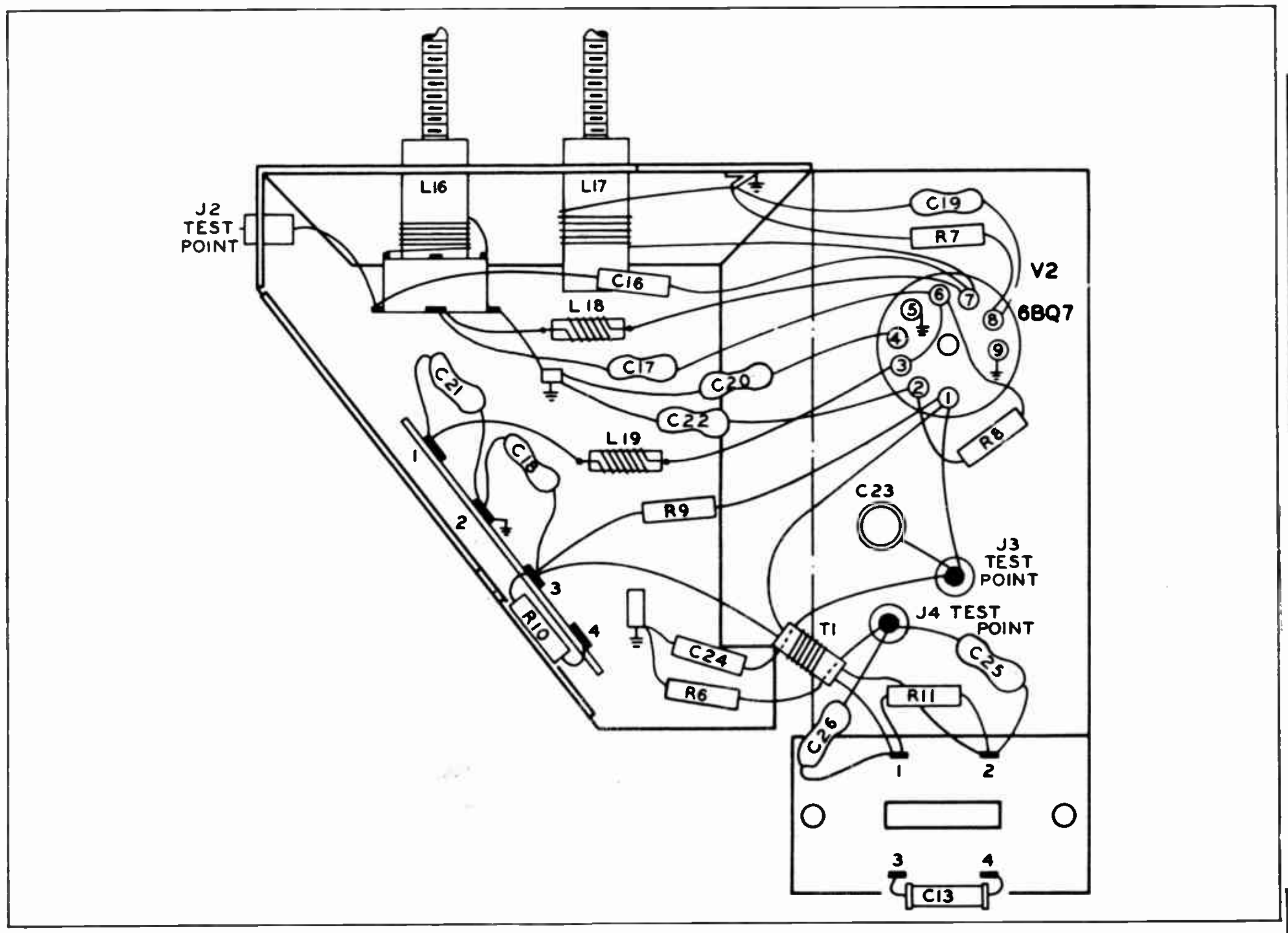


Figure 3. Base Layout of UHF Tuner-Adapter, with Oscillator and Mixer Boards in Place

TP2-3242



TP2-3179

Figure 5. Base Layout of Preamplifier Assembly

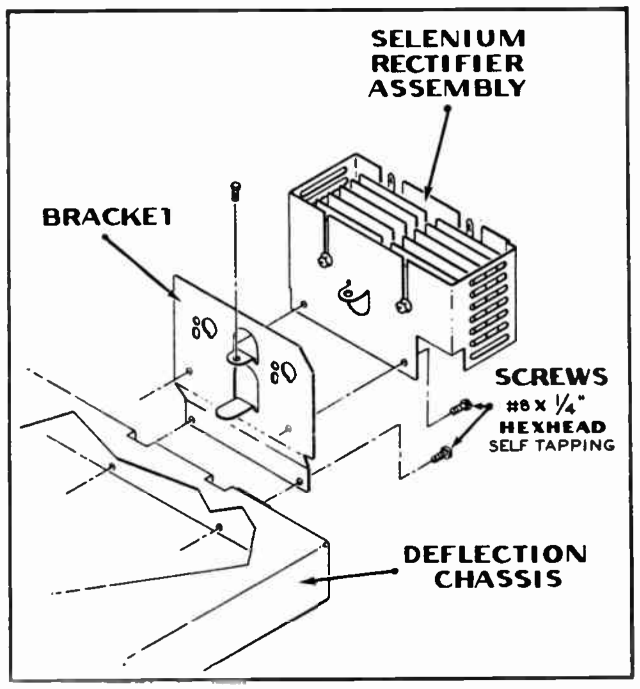
INSTALLATION INSTRUCTIONS

To install the Tuner-Adapter, proceed as follows:

1. Remove the cabinet back from the cabinet.

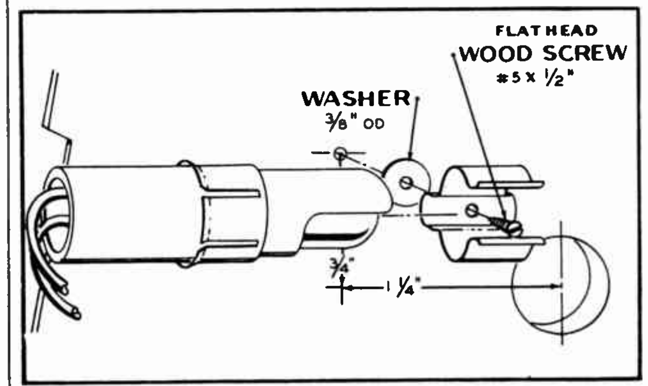
2. Remove the medallion on the control panel by pushing it out from the back. If the set does not have a medallion on the panel, drill a 9/16-inch hole in line with the shafts, and centered between the two inner shafts.

3. If the selenium rectifiers do not leave sufficient clearance for the UHF tuner assembly, remove the deflection chassis from the cabinet. Then remove the three mounting screws that hold the selenium-rectifier assembly to the chassis. Mount the selenium-rectifier bracket (supplied) on the chassis, using the same mounting screws and holes that were used to hold the rectifier assembly. Then mount the rectifier assembly on the bracket. See figure 6.



TP2-2665

Figure 6. Selenium Rectifier Mounting Details



P2-2581

Figure 7. Pilot-Light-Clip Installation Details

4. Mount the pilot-light clip near the UHF tuner shaft hole, as shown in figure 7.

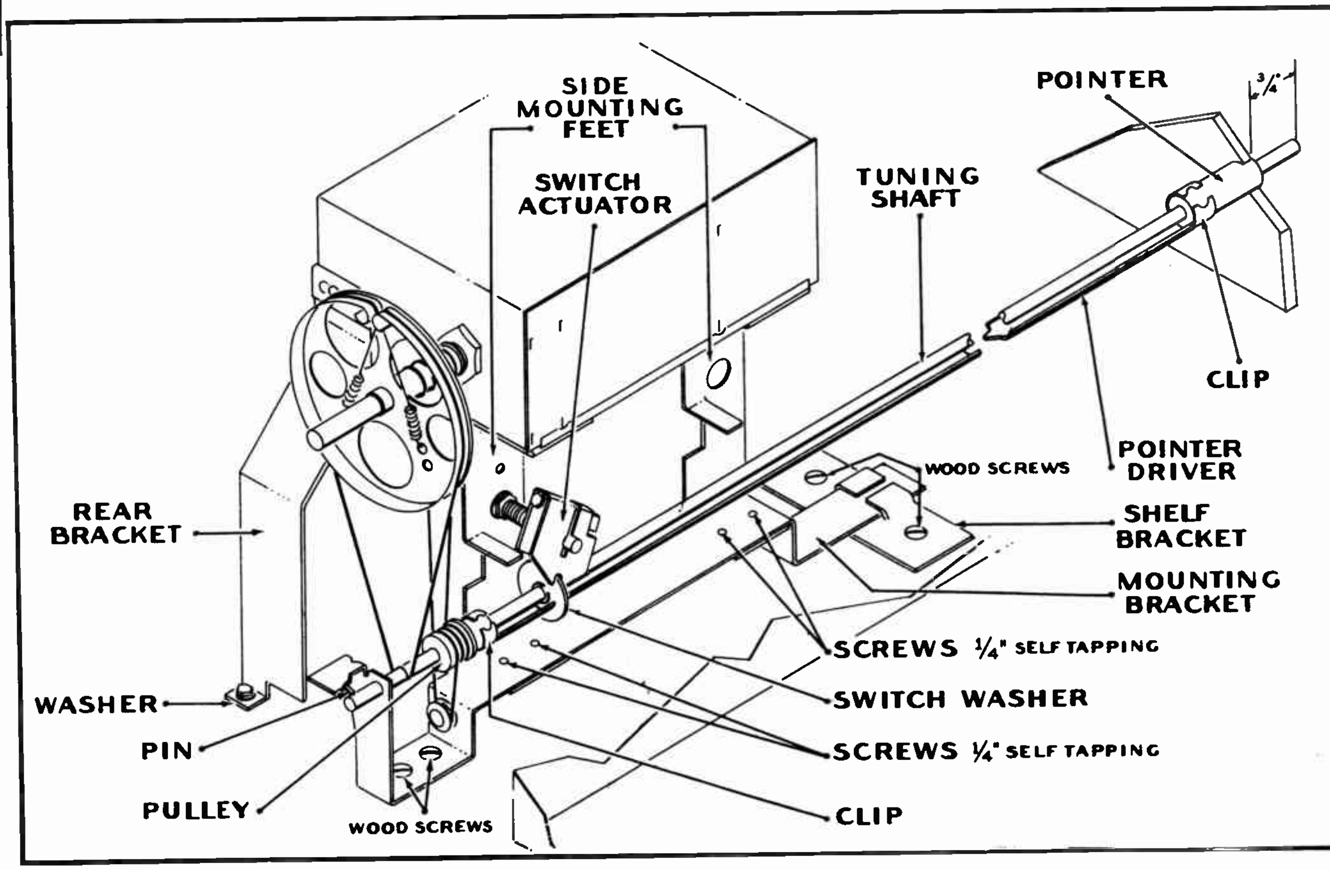
5. Attach the tuner assembly side mounting feet to the mounting bracket, using the four 1/4-inch self-tapping screws provided. See figure 8.

6. Draw a line on the chassis shelf, in line with the center of the middle shaft hole in the cabinet, and extend this line to the rear of the shelf. This line is to be used as a reference line for mounting the UHF tuner assembly.

7. Insert the switch washer on the tuning shaft, and then insert the "E" washers into the grooves on the tuning shaft—one on each side of the switch washer. See figure 9. For 17-inch models with metal cabinets, use grooves "A". For all other models, use grooves "B".

8. Slide the clip onto the pulley, and then slide the pulley and clip onto the tuning shaft, between the switch washer and the rear of the shaft. Insert the shaft through the rear bearing hole of the mounting bracket, with the switch washer in the slot of the switch actuator. See figure 8. Set the switch in the VHF position (tuning shaft to the rear).

9. Place the shelf bracket on the chassis shelf, with the screw holes 8 inches back from the front edge of the r-f chassis, and the scored line on the bracket over the reference line on the cabinet shelf. (See step 6.)



TP2-2608-B

Figure 8. Tuner Mounting Details

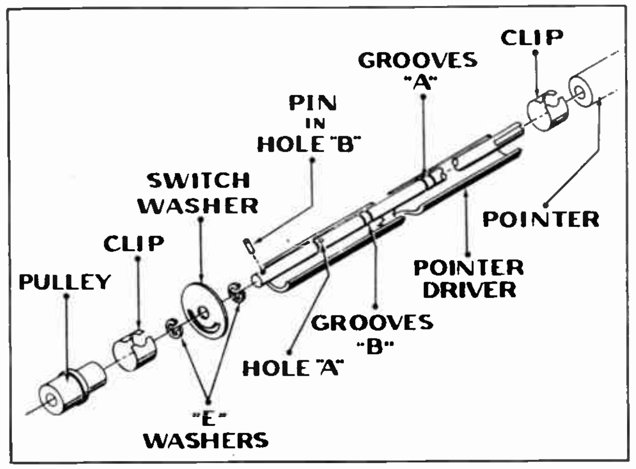


Figure 9. Tuning Shaft and Switch Washer Details

The score line on the bracket should be placed to the rear of the shelf. Fasten the bracket with the two ⅜-inch wood screws provided. (See figure 8.)

10. Reinstall the deflection chassis if the chassis was removed in step 3.

NOTE: The chassis must be installed before mounting the UHF tuner, so that the UHF tuner will not interfere with the installation of the chassis.

11. Insert the adapter plug into the interconnecting power socket on the deflection chassis, and then insert the plug of the interconnecting power cable into the socket on the adapter.

12. Insert the pilot-light socket into the clip, near the UHF tuning shaft.

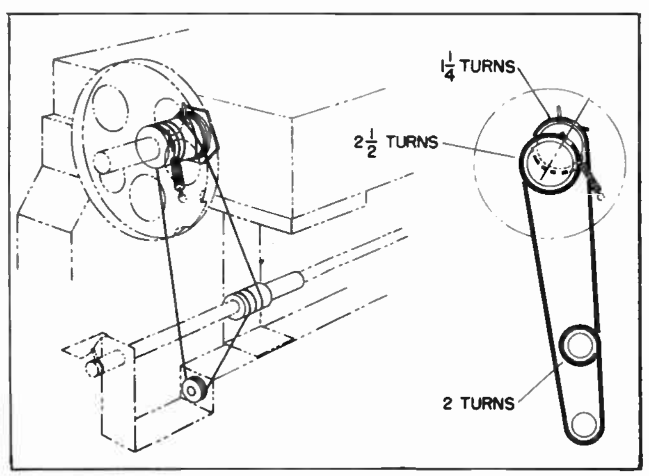


Figure 10. Pointer-Drive-Cord Installation Details

13. Position the assembly inside the cabinet by inserting the front foot of the mounting bracket into the slot of the shelf bracket. Slide the tuner assembly forward until the front end of the tuning shaft extends through the center hole ¾-inch beyond the front of the control panel. See figure 8. Use one of the two mounting holes in the rear foot of the mounting bracket, and fasten the bracket in place with the #5 x ⅜-inch wood screw provided. In some models the rear foot of the mounting bracket will locate over the vent hole in the chassis shelf. In these models, use the remaining shelf bracket to straddle the vent hole, and fasten the shelf bracket under the side mounting foot, with the extruded section facing downward. Fasten the shelf bracket and rear bracket to the chassis mounting board. When the rear side mounting foot is mounted on top of the shelf bracket, use one washer under the rear bracket.

14. Using a pair of pliers, push the pin provided into hole "A" or hole "B" in the tuning shaft. See figure 9. For 17-inch models with metal cabinets, use hole "A"; for these models, remove the excess length by cutting the shaft at the slot behind the pin. For all other models, use hole "B".

15. Fasten the pointer to the pointer driver with the clip provided. See figure 9. Place a felt washer on the pointer, and feed the pointer through the hole in the dial backing plate so that the backing plate of the color which matches the cabinet faces the front of the pointer. Insert the pointer driver through the center hole in the cabinet, and feed the pointer, felt washer, and backing plate over the tuning shaft.

16. Feed the pointer driver through the switch washer, and join the pointer driver to the pulley on the tuning shaft, using the clip provided.

17. String the pointer drive assembly cord as shown in figure 10, using the long dial cord supplied.

18. String the main drive-shaft cord as shown in figure 11, using the short dial cord supplied.

19. Put the knob on the tuning shaft, and turn the shaft to the extreme counterclockwise position. Place the template (figure 12) behind the pointer, and line up the pointer with the index mark on the template. Remove the knob and template, place the dial over the tuning shaft and pointer, center the dial on the control panel, and fasten in place.

20. Cut the antenna lead from the VHF tuner to about 4 inches in length, and remove about one-half inch of insulation from the end. Insert the bare ends of the wires into the twin-lead connector, and fasten them with the screws in the side of the connector.

21. Replace the fishpaper antenna-lead holder with the new holder provided. Fasten the new holder with the two nails provided, and then pass the twin-wire leads through the holes, as shown in figure 13.

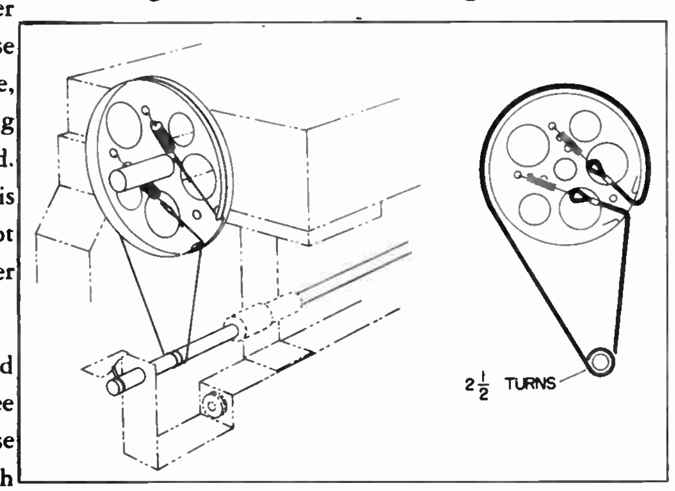


Figure 11. Drive-Shaft Drive-Cord Installation Details

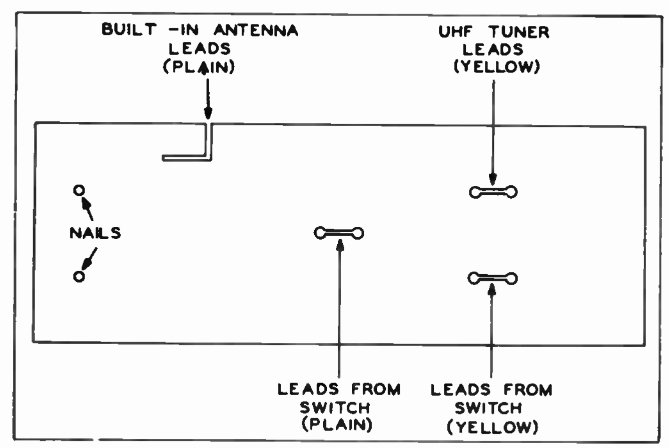


Figure 13. Lead Dress and Lead Holder Details

22. Cut holes in the cabinet back, and fasten the antenna terminal board provided, as shown in figures 14 through 18. Replace the cabinet back and make connections as illustrated, according to the type of antenna installation being used.

23. Paste the label provided over the outside-antenna instructions on the cabinet back.

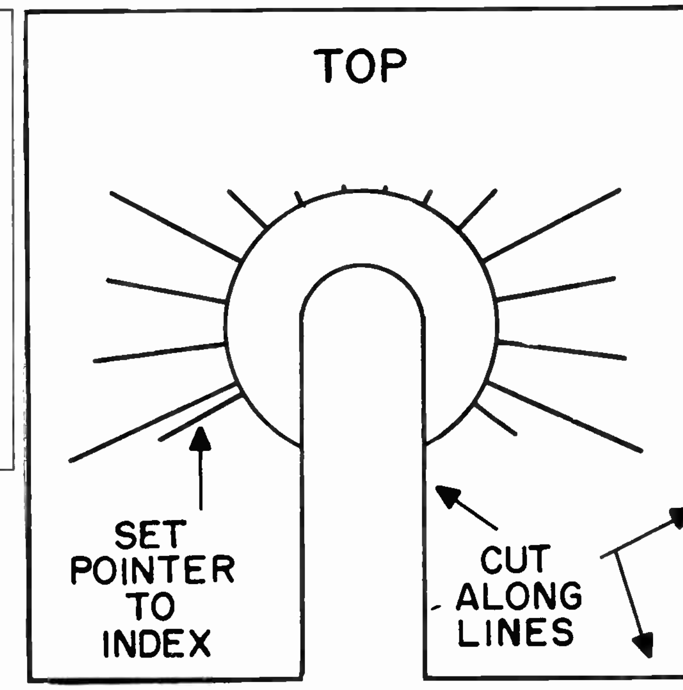


Figure 12. Pointer Positioning Template

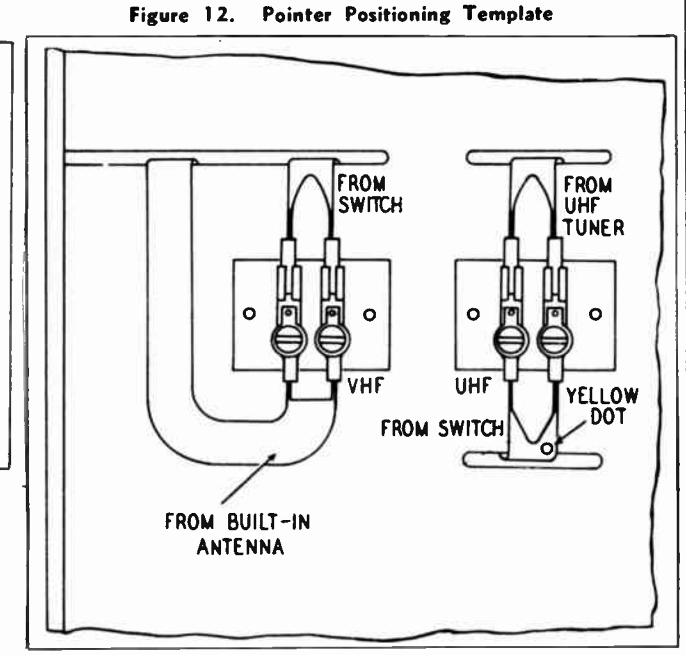


Figure 14. Antenna-Lead Connections, Common UHF and VHF Built-in Antenna

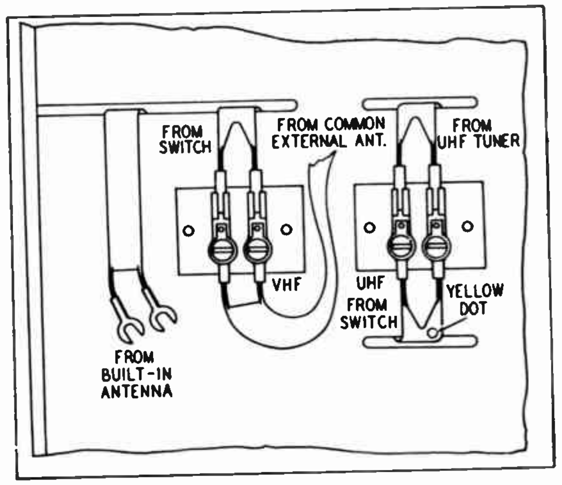


Figure 15. Antenna-Lead Connections, Common UHF and VHF External Antenna

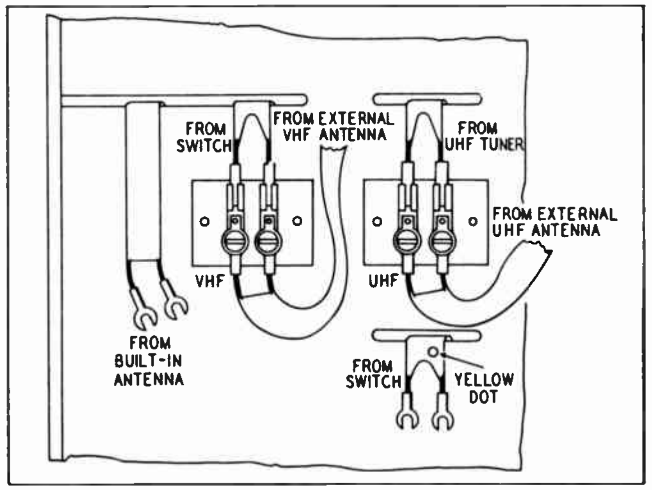


Figure 16. Antenna-Lead Connections, Separate UHF and VHF External Antennas

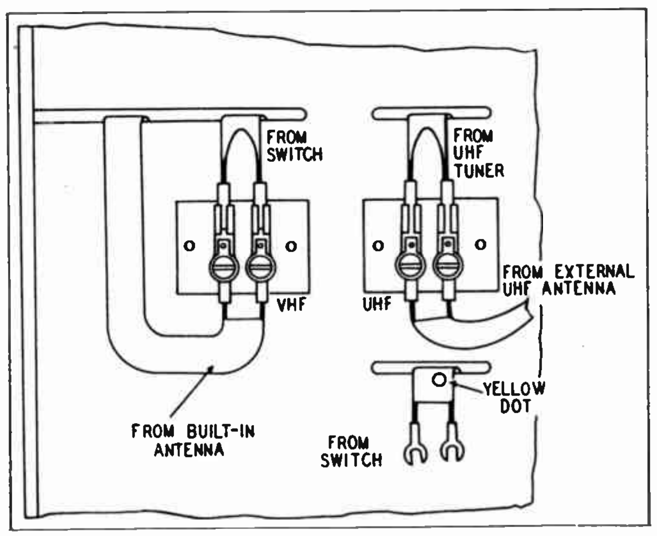


Figure 17. Antenna-Lead Connections, VHF Built-in and UHF External Antennas

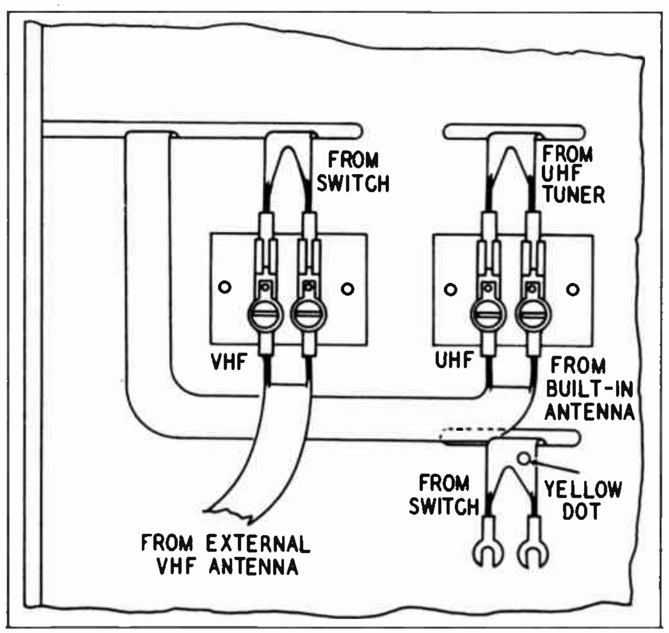


Figure 18. Antenna-Lead Connections, VHF External and UHF Built-in Antennas

PARTS LIST

Reference Symbol	Description	Service Part No.
C1 and C2	Condenser, antenna input, 680 μμf.	Part of Panel, filter
C3	Condenser, tuning:	
	Shaft and rotor ass'y.	76-7481
C3A	Stator, r-f, l.h.	56-9595
C3B	Stator, r-f, r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator ass'y., oscillator	76-7479
C3F	Stator ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f	76-7472
C7	Condenser, mixer tank, 15 μμf.	Part of Board ass'y., mixer
C8	Condenser, temperature compensating, .4 μμf.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 11 μμf.	Part of Tank ass'y., osc.
C11	Condenser, by-pass	Part of Tank ass'y., osc.
C12	Condenser, grid by-pass, 1000 μμf.	30-1245-1
C13	Condenser, output tuning, 2—8 μμf.	31-6527
C14	Condenser, heater by-pass, 1000 μμf.	30-1245-1
C15	Condenser, plate by-pass, 1000 μμf.	30-1245-1
C16	Condenser, input coupling, 8 μμf.	30-1224-46
C17	Condenser, neutralizing, 470 μμf.	62-147001011
C18	Condenser, decoupling, 470 μμf.	62-147001011
C19	Condenser, cathode by-pass, 470 μμf.	62-147001011
C20	Condenser, filament by-pass, 470 μμf.	62-147001011
C21	Condenser, cathode tuning, 470 μμf.	62-147001011
C22	Condenser, grid by-pass, 470 μμf.	62-147001011
C23	Condenser, plate by-pass, 2—6 μμf.	31-6520-4
C24	Condenser, plate by-pass, 2.2 μμf.	30-1221-6
C25 and C26	Condenser, output tuning, 22 μμf.	62-022009001
CD1	Crystal diode, mixer circuit	34-8024
I1	Lamp, pilot, UHF	34-2068
I2	Lamp, pilot, VHF	34-2068
L1	Inductor, r-f, l.h.	Part of C3A
L2	Inductor, r-f, r.h.	Part of C3B
L3	Inductor, r-f, l.h.	Part of C3C
L4	Inductor, r-f, r.h.	Part of C3D
L5 and L6	Inductors, crystal mixer	Part of Board ass'y., mixer
L7 and L8	Inductors, oscillator coupling	Part of Board ass'y., mixer
L9 and L10	Inductors, oscillator	Part of Board ass'y., osc.
L11 and L12	Inductors, oscillator	Part of Tank ass'y., osc.
L13	Choke, heater decoupling	32-4556
L14	Choke, heater-cathode decoupling	32-4550-6
L15	Choke, plate decoupling	32-4556-2
L16	Coil, input tuning primary	32-4359-14
L17	Coil, input tuning secondary	32-4578
L18	Coil, neutralizing	32-4551-2
L19	Choke, cathode tuning	32-4548-13
L20	Coil, primary	Part of T1
L21	Coil, secondary	Part of T1
R1	Resistor, damping, 330 ohms	66-1338340
R2	Resistor, damping, 150 ohms	66-1158340
R3	Resistor, decoupling, 8200 ohms	66-2828340
R4	Resistor, decoupling, 47 ohms	Part of L13
R5	Resistor, decoupling, 10,000 ohms	Part of L15
R6	Resistor, parasitic damping, 15 ohms	66-0158340

Reference Symbol	Description	Service Part No.
R7	Resistor, cathode bias, 120 ohms	66-1128340
R8	Resistor, grid leak, 100,000 ohms	66-4108340
R9	Resistor, plate damping, 1500 ohms	66-2158340
R10	Resistor, plate decoupling, 330 ohms	66-1338340
R11	Resistor, output damping, 1000 ohms	66-2108340
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
R13	Resistor, filament dropping, 10 ohms	66-0108340
R14	Resistor, B+ dropping, 150,000 ohms	66-4158340
R15 and R16	Resistor, damping, 470 ohms	66-1478340
T1	Transformer, i-f output	32-4575
Board ass'y., mixer		76-7475-1
Board ass'y., oscillator		76-7480
Panel, filter		76-8078-1
Tank ass'y., oscillator		76-7473

MISCELLANEOUS

Description	Service Part No.
Electrical Parts	
Adapter cable and bracket	41-4177
Connector, twin-lead	54-5181
Cable ass'y., pilot light	27-6233-50
Padder ass'y. (L11 and L12 tuning adjustment)	76-8193
Padder ass'y. (C9 tuning adjustment)	76-7564
Panel, antenna, UHF	76-7097
Switch	42-1994
Mechanical Parts	
Shaft and Rotor Assembly, Mounting Hardware	
Ball, bearing (10)	W2510-5
Bearing, front	56-9593
Bearing, rear	56-9609
Nut, front bearing	56-9594
Nut, rear bearing	56-9599
Nut, insert	W1679-1FA3
Spring, grounding, center (2)	56-9590
Spring, grounding, end (2)	56-9591
Mounting Hardware	
Bracket, rear	76-8230
Bracket ass'y., sides	76-8231
Clip, pilot light	56-3545-6
Clip, pointer driver (2)	28-9108
Dial	54-5172
Dial background	54-5180
Grommet, feed-through	27-4707
Grove pin	1W41033FA3
Knob	54-5177
Lever assembly	76-8233
Pointer	54-8850
Pulley assembly	76-7528
Pulley, pointer driving	28-9102
Shaft, pointer driver	28-9102
Shaft, tuning	28-9105
Shield, tube, preamplifier	56-5629-5
Shield, tube, oscillator	56-5629-9
Socket, 9-pin miniature	27-6203-21
Spring, drive cord	56-3167
Assemblies	
Tuner, and preamplifier ass'y.	76-8222
Preamplifier ass'y.	76-8109

CIRCUIT DESCRIPTION

Philco "B line", Code 130 Television Receivers use two chassis—r-f chassis R-181, containing the r-f, video, audio, and sync circuits, and deflection chassis D-181, containing the power and deflection circuits. Since these chassis are not isolated from the 60-cycle power line, all protruding shafts and mounting feet are insulated from the chassis.

CAUTION: See A-C LINE ISOLATION.

A separate subchassis contains the r-f amplifier, the oscillator, and the mixer. The r-f amplifier uses a 6BZ7 tube, V1. The oscillator and mixer each use one half of a 12AZ7 tube, V2. The output of the mixer is fed to a three-stage, stagger-tuned, i-f amplifier system employing three 6CB6 tubes. A type 1N64 crystal diode is used for the video detector, the output of which is amplified by a single-stage video amplifier utilizing a type 12BY7 tube, V6. The connections at the detector are such as to produce a composite video signal with negative-going sync pulses. The signal, which is subjected to a 180-degree phase shift through the video amplifier, is applied to the cathode of the picture tube; therefore, the sync pulses at this point are positive-going. The grid of the picture tube is returned to ground through a resistor (R309). A blanking pulse, taken from the vertical output stage, is applied across R309, for suppression of the vertical retrace.

Sound i.f. (intercarrier) is obtained by utilizing the beat frequency produced when the 26.6-mc. video carrier and the 22.1-mc. sound carrier are mixed in the video detector. The 4.5-mc. beat frequency is the difference between 26.6 mc. and 22.1 mc., and contains the FM sound signal. This 4.5-mc. signal contains only a negligible amount of video amplitude modulation, provided that the amplitude of the 22.1-mc. signal is considerably lower than that of the 26.6-mc. signal. The proper relationship between the two carriers is established during the alignment of the receiver. There is sound output only when both the video and sound carriers are present.

The oscillator is tuned primarily to obtain the best picture, since the 4.5-mc. relationship always exists between the two carriers. The 4.5-mc. sound i.f. (intercarrier), which is taken from the plate circuit of the video amplifier, is passed through a 4.5-mc. sound i-f stage using a 6AU6 tube, V7, and is then applied to the FM detector, which utilizes two diode sections of a 6T8 tube, V8A. The triode section of the 6T8, V8B, is used as the first audio amplifier. The power amplifier uses a 6K6GT tube, V9.

A portion of the video signal appearing at the grid of the video amplifier is applied to the pentode section of a 6U8 tube which operates as a sync amplifier V10A. The output of this stage is composite video with positive-going sync, and is applied to grid 3 (pin 7) of the 6BE6 sync separator, V11. Since grid-leak bias is used on grid 3, the tips of the sync pulses are clamped to zero, and the video components swing in a negative direction from zero. Because of the cut-off characteristics of grid 3, the video components are eliminated, and only negative-going sync pulses appear in the plate circuit of the sync separator. At the same time, however, a signal is taken from the video detector and applied to grid 1 (pin 1) of the 6BE6 tube. This grid is returned to B plus, and the bias is maintained close to zero, because of a small grid-current flow. Since the signal applied to grid 1 is composite video with negative-going sync, any noise modulation present in the signal appears in the form of sharp spikes, driving in a negative direction. The circuit constants are chosen to allow grid 1 to cut off plate current whenever the signal goes more negative than the sync pulses. A series grid-limiting resistor (R614) is also incorporated, to prevent the video components from appearing in the plate circuit of the sync separator. A-G-C voltage is also developed in the sync separator circuit in the following manner: On tips of the sync pulses, grid 3 (pin 7) of the 6BE6 tube draws current, which flows downward through the network composed of R609, R610, R611, L214, and R211, causing capacitors C604, C602, and C603 to assume negative charges that are proportional to the amount of peak signal applied to grid 3. The tuner a-g-c voltage is delayed by means of a resistor divider network, which applies a small positive voltage to the tuner a-g-c circuit. This positive voltage prevents a-g-c action from lowering the tuner gain on weak signals. To prevent the delay voltage from driving the tuner a-g-c voltage positive on weak signals, a diode clamp (part of V8B) is connected across C602.

The negative-going sync pulses appearing in the plate circuit of the sync separator are fed to the sync inverter stage, V10B (triode section of the 6U8 tube). This stage acts as a phase-splitter circuit; positive sync pulses appear in the plate circuit, and negative sync pulses are taken from the cathode. Both positive and negative sync pulses are fed through the interchassis cable into the deflection chassis.

Proper triggering of the vertical oscillator requires negative synchronizing pulses. The vertical sync signal is separated from the horizontal sync signal by the integrator circuit, and is fed to the grid of the vertical oscilator (V12), a cathode-coupled multivibrator. The output of the vertical oscillator is amplified by a type 12B4 tube, V13, which is employed as the vertical output amplifier. The output of the amplifier is applied to the vertical-deflection coils through the vertical-output transformer.

The horizontal sweep circuits require both positive and negative sync pulses. The phase-comparer circuit uses a 6AL5 tube, V14. Positive sync pulses are applied to the plate of V14A, and negative sync pulses are applied to the cathode of V14B. A saw-tooth voltage is fed to the plate of V14B and to the cathode of V14A, for comparison of the sync and horizontal sweep voltages. When the saw-tooth and sync signals are exactly in phase, no voltage is developed across R800, but when the two signals are out of phase, either a positive or a negative voltage is developed, depending upon whether the horizontal-oscillator frequency is lower or higher than the sync-pulse frequency. The grid circuit of the horizontal oscillator, a 12AU7 (V15) cathode-coupled multivibrator, is connected to R800 through a filter network; when the voltage at this point goes in a positive direction, the frequency of the horizontal oscillator is increased, and when the voltage swings negative, the frequency of the oscillator is decreased. In this manner the frequency of the horizontal oscillator is controlled over the lock-in range of the circuit. The horizontal-oscillator hold control (R812) adjusts the horizontal-oscillator frequency so that it is within the control range of the phase comparer. The output of the horizontal oscillator is fed to the horizontal output amplifier, which makes use of a 6BQ6GT tube, V16. The screen voltage for the horizontal amplifier is supplied from a voltage-divider network. R816, R817, (the WIDTH control), R818, R307 (the BRIGHTNESS control), and R311 are parts of this divider. R817 varies the voltage applied to the screen, thus adjusting for proper picture width. Adjusting R307 for brightness varies the bias on the picture tube. The change in bias causes a change in beam current, and would tend to result in a change in picture width and variation in the second-anode voltage. However, when the control arm of the BRIGHTNESS control, R307, is moved toward ground, less of the control is shunted by the 22K resistor, R311, and the total resistance of the voltage divider is increased. This increase in resistance results in a decrease in the current through the divider, and the screen voltage on the horizontal amplifier is increased proportionally, thus compensating automatically for the increase in beam current in the picture tube. The horizontal amplifier feeds the deflection coils through the horizontal output transformer. A 6AX4GT tube, V17, is used as the horizontal damper.

The second-anode voltage for the picture tube is supplied by one 1B3GT high-voltage rectifier tube, V18. The B plus voltage for the receiver is supplied by two selenium rectifiers, CR100 and CR101, in a full-wave, voltage-doubler circuit, operating directly from the power line. Bias voltage is obtained from across a filter choke, L405, which is in series with the negative side of the B plus supply. The B plus boost voltage, derived from the horizontal damper circuit, supplies higher B plus voltage to the vertical oscillator and the first anode of the picture tube. Filament voltage for all the tubes except the high-voltage rectifier is supplied by a step-down transformer. Filament voltage for the high-voltage rectifier is supplied by a winding on the horizontal output transformer.

IMPORTANT
A-C LINE ISOLATION

CAUTION: One side of the a-c line is connected to the chassis through C101 and L405. The other side of the a-c line is connected to the chassis through R100, F100, CR100, and C103, in series. Grounding the chassis will result in a short circuit across one or the other of these two branches in the voltage-doubler circuit. During servicing and alignment it is desirable that an a-c line isolation transformer capable of handling at least 225 watts (Philco Part No. 45-9600) be used. Failure to use an isolation transformer will greatly increase the shock hazard, and may result in damage to the test equipment or receiver, or both.

SPECIFICATIONS

VHF TUNING .... Twelve channel, 12-position incremental tuner, covering VHF Television Channels 2 through 13; fine tuning of local oscillator

UHF TUNING .... Continuous tuning, covering UHF Television Channels 14 through 83; fine and coarse tuning

INTERMEDIATE FREQUENCIES
- Video Carrier .... 26.6 mc.
- Sound (intercarrier) .... 4.5 mc.

TRANSMISSION LINE .... 300-ohm, twin-wire lead

OPERATING VOLTAGE .... 110 to 120 volts, 60 cycles, a.c.

POWER CONSUMPTION .... Without UHF, 175 watts; with UHF, 180 watts

TUBE COMPLEMENT
R-F CHASSIS R-181

Reference Symbol	Tube Type	Function
V1	6BZ7 miniature	R-F Amplifier
V2	12AZ7 miniature	Oscillator-Mixer
V3, V4, V5	6CB6 miniature	Video I-F Amplifiers
V6	12BY7 miniature	Video Output Amplifier
V7	6AU6 miniature	Sound I-F Amplifier
V8	6T8 miniature	Ratio Detector, First Audio, and Tuner A-G-C Clamp
V9	6K6GT octal	Audio Output
V10	6U8 miniature	Sync Amplifier, Sync Inverter
V11	6BE6 miniature	Sync Separator, A.G.C.
V19	17YP4, or 21ZP4A	Picture Tube

DEFLECTION CHASSIS D-181

Reference Symbol	Tube Type	Function
V12	12BH7 miniature	Vertical Oscillator
V13	12B4 miniature	Vertical Output Amplifier
V14	6AL5 miniature	Horizontal Phase Comparer
V15	12AU7 miniature	Horizontal Oscillator
V16	6BQ6GT octal	Horizontal Output Amplifier
V17	6AX4GT octal	Horizontal Damper
V18	1B3GT octal	High-Voltage Rectifier

B SUPPLY FUSE REPLACEMENT

The B supply protective fuse, F100, is wired into the low-voltage section, and is in series with the selenium rectifiers. For replacement, use a 1.6-ampere, delayed-action-type fuse, Philco Part No. 45-2656-23.

CAUTION: Discharge the circuit before replacing the fuse.

HORIZONTAL-OSCILLATOR ADJUSTMENT

To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

1. Reduce the width of the picture until approximately 1 inch of blank screen appears at the right-hand and left-hand sides of the picture.
2. Increase the BRIGHTNESS control setting until the blanking becomes visible. This will appear as a dark vertical bar on each side of the picture.
3. Connect a .1-μf. condenser from the test point, adjacent to TC800, to ground. (The plate side of the horizontal ringing coil, L800, is connected to the test point.)
4. Set the HORIZONTAL HOLD control to the approximate center of its mechanical rotation.
5. Adjust the HORIZ. HOLD CENTERING control until equal portions of the blanking bar appear on both sides of the picture.
6. Remove the .1-μf. condenser from the test point.
7. Adjust the horizontal ringing coil, L800, until equal portions of the blanking bar again appear on both sides of the picture.
8. Rotate the HORIZONTAL HOLD control through its range. The picture should fall out of sync on both sides of the center of its rotation. If the picture does not fall out of sync on both sides, re-adjust the HORIZ. HOLD CENTERING control.
9. Rotate the HORIZONTAL HOLD control through its range, and observe the number of diagonal blanking bars that appear just before the picture pulls into sync. The pull-in should occur with from 1 to 2 diagonal bars when the sync position is approached from either direction. If proper pull-in is not obtained, repeat the above procedure.

VIDEO-DETECTOR PEAKING-COIL ADJUSTMENT

The video-detector peaking coil, L214, is adjusted at the factory for proper transient response of the video circuit. Ordinarily, this coil will require no further adjustment by the serviceman. On any station where excessive overshoot or excessive smear is present, a slight adjustment of L214 may improve the picture quality on that station; however, this adjustment may sacrifice the quality on other channels. If L214 is replaced in servicing, adjustment will be required.

Before adjusting L214, check the tuner alignment and i-f alignment. (Never adjust L214 until the alignment of the receiver is correct.) Then tune in a station and adjust L214 until there are no trailing whites or smear in the picture. Turning TC206 clockwise reduces trailing whites and overshoot; turning TC206 counterclockwise reduces picture smear and increases trailing whites. The proper position is the point where no smear or trailing whites appear in the picture.

The above procedure for adjustment of TC206 applies to a particular station exhibiting smear or overshoot. After TC206 is adjusted, reception on all the other stations should be checked, to make certain that the adjustment has not impaired the picture quality.

TELEVISION ALIGNMENT

GENERAL

The alignment consists of tuning each i-f coil to a given frequency, using an AM signal, and then feeding in a sweep signal at the antenna terminals and touching up the adjustments to obtain the desired pass band.

The over-all response curve (r-f, i-f) of the circuits from the antenna terminals to the video detector, after the i-f stages have been aligned, should appear essentially the same, regardless of the channel under test. If not, the tuner should be aligned.

The video-carrier intermediate frequency is 26.6 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the receiver chassis and the test equipment. This is most easily obtained by having the top of the workbench metallic. The receiver chasis should be placed tuner-side down on the bench. If the bench has no metallic top, the test equipment and chassis can be bonded by a strip of copper about 2 inches wide. The section of the chassis nearest the tuner should rest on the strip.
2. Do not disconnect the picture tube, picture-tube yoke, or speaker while the receiver is turned on.
3. Allow the receiver and test equipment to warm up for 15 minutes before starting the alignment.
4. The marker (AM) signal generator should be calibrated accurately to the frequencies used and to the sound and video r-f carriers of each channel used during alignment. If Model 7008 is used, the built-in crystal calibrator provides an excellent means of calibration. An alternate method for calibrating the signal generator to the sound and video r-f carrier frequencies is to zero-beat the signal generator with the received signals.

For further information regarding calibration, refer to Philco Lesson PR-1745 (J), entitled "Television Service in the Home."

TEST EQUIPMENT REQUIRED

The following test equipment is recommended for aligning the receiver:

1. Philco Precision Visual Alignment Generator for Television and FM, Model 7008, or equivalent.
2. Vacuum-tube voltmeter, or 20,000-ohms-per-volt voltmeter.
3. R-F Probe, Philco Part No. 76-3595 (for use with Model 7008 generator).

JIGS AND ADAPTERS REQUIRED

Mixer Jig

Connections to the grid of the mixer tube may be made through the alignment jack provided for that purpose. To connect the generator to this point, a mixer jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adapter, Part No. 45-1636, with as short a ground lead as possible, may be used to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68-ohm resistor (carbon), so that regeneration, caused by connection of the lead to the mixer, is held to a minimum.

Antenna-Input Matching Network

Figure 1 shows an impedance-matching network for coupling the signal generator to the antenna-input terminals of the receiver. This network, which is designed to have an input impedance of 75 ohms and an output impedance of 300 ohms, is used to match a 75-ohm generator to a 300-ohm antenna-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group to obtain values within 10% of those indicated. The resistors should be placed in a shield can, to prevent variable effects. An antenna matching jig, Philco Part No. 45-1736, which consists of a matching transformer and connecting box, may be used in place of the resistor network.

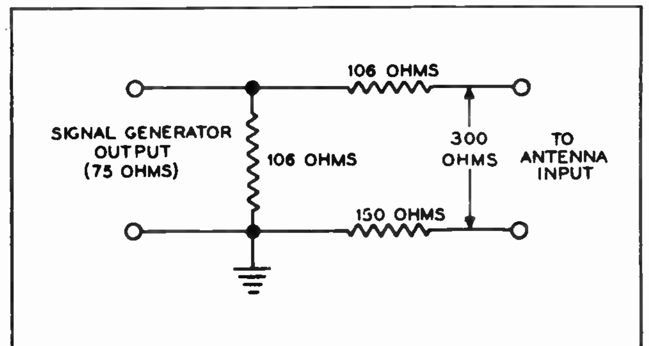


Figure 1. Antenna-Input Matching Network

Video I-F Alignment Jig
(Video Test Jack Adapter)

The alignment jig shown in figure 2 should be used during the i-f alignment, to apply the proper bias to the a-g-c bus, and to provide a convenient oscilloscope connection. This jig consists of a 5-prong plug, a 10,000-ohm potentiometer, a 2200-ohm isolating resistor, and a 7½-volt battery. A suggested method of fabricating the jig is also shown. It is suggested that the bias battery and potentiometer be mounted in a metal box of convenient size.

The potentiometer and switch are connected across the 7½-volt battery. The switch is used to disconnect the potentiometer, to prevent the discharge of the battery while not in use. The 1000-ohm resistor in series with the arm of the control will prevent rapid discharge of the battery if the leads are accidentally shorted.

Sound I-F Alignment Jig

Figure 3 shows the jig that should be used to connect the voltmeter and oscilloscope to the VOLUME CONTROL socket, J400. A suggested method of fabricating the jig is also shown.

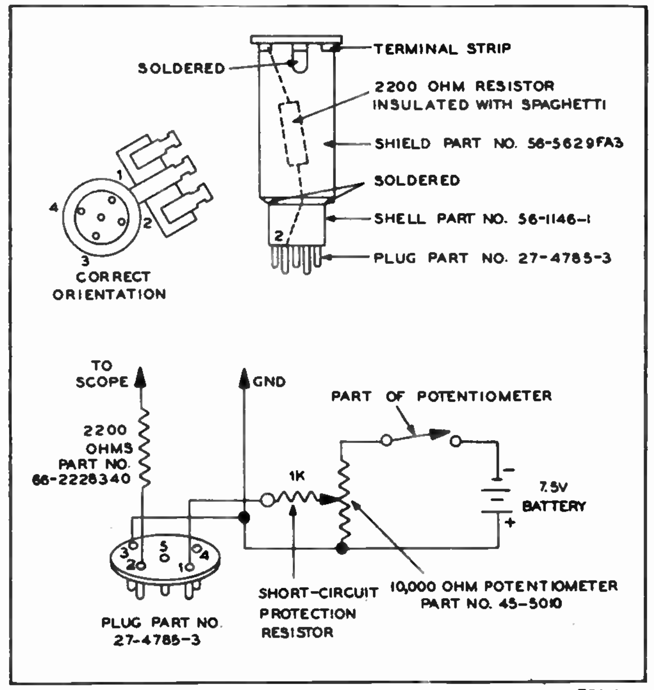


Figure 2. Video I-F Alignment Jig

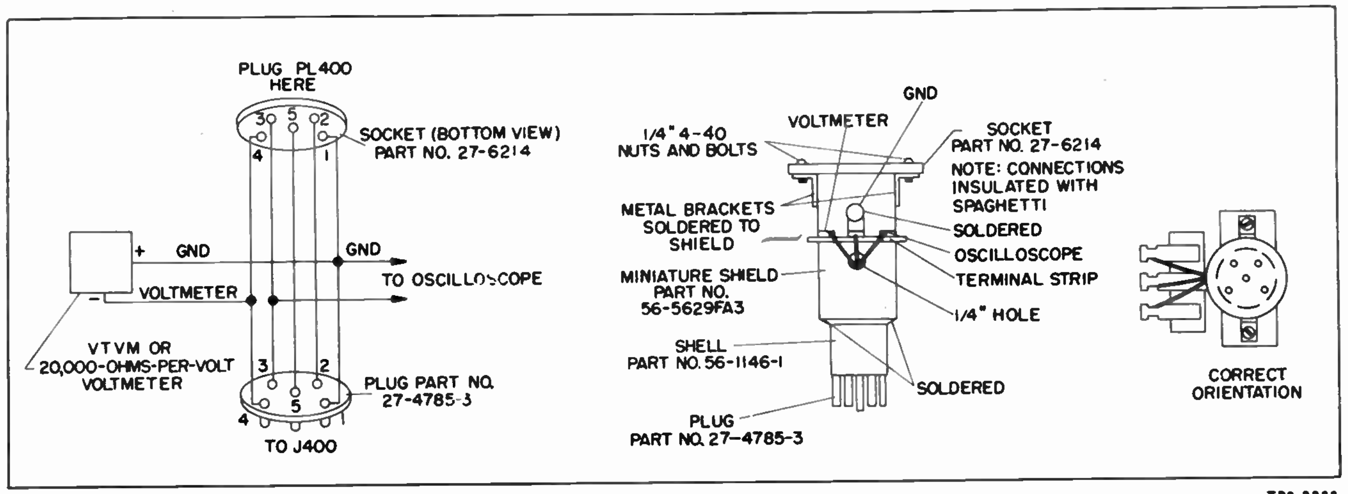


Figure 3. Sound I-F Alignment Jig TP2-2200

TELEVISION TUNER ALIGNMENT

After the tuner is serviced, or if an i-f alignment is required, the tuner alignment should be checked by observing the tuner response curve, as given under Bandpass Alignment. If the response curve does not fall within the limits shown in figure 5, the tuner should be realigned. If realignment is necessary, use the procedure given below.

Since the frequency of the local oscillator affects the tuner response, the local-oscillator alignment should be made first.

Oscillator Alignment

General

Tuning cores are provided in the oscillator coils at channels 13, 11, 9, 7, 6, and 4. By adjusting these tuning cores, all channels may be placed on frequency. This procedure should be carried out with the highest-frequency channel first, since the alignment of each channel affects the alignment of all the channels below it in frequency. The channel adjustments are so arranged that, with one exception, each adjustment corrects the tuning of more than one channel. The coverage of the various adjustments is as follows:

Channel Adjustment	Channels Corrected By Adjustment
13	13 and 12
11	11 and 10
9	9 and 8
7	7 only
6	6 and 5
4	4, 3, and 2

The FINE TUNING cam should be preset for all adjustments by placing the stop on the FINE TUNING cam between the Channel 7 and 8 holes on the front plate of the tuner. See figure 4.

Procedure Using Signal Generator

An r-f signal (unmodulated), at the oscillator frequency, is fed into the antenna input from an AM signal generator, and the oscillator tuning cores are adjusted for zero beat. The r-f signal frequency should be accurately determined. It is preferable that the signal be taken from a crystal-controlled source; if this is not available, the signal generator may be calibrated against the television station.

1. Connect the hot lead of the oscilloscope to the mixer plate test point, G2, through a 1000-ohm resistor, and connect the ground lead of the oscilloscope to the chassis, near the test point. (High oscilloscope gain may be necessary to obtain a visual beat. In this instance, base-line hum may be ignored.)

2. Connect the AM (marker) generator to the 300-ohm antenna-input terminals. For this purpose the antenna-input matching network is not required.

3. Disconnect the white (a-g-c) lead from the tuner, and connect it to the negative terminal of a 1½-volt battery. Ground the positive terminal. If regeneration is observed, the bias may be increased to 4 or 5 volts, to reduce the regeneration.

4. Mechanically preset the fine-tuning cam as shown in figure 4.

5. Feed in an r-f signal (unmodulated), at the oscillator frequency for Channel 13, with the CHANNEL SELECTOR set for Channel 13.

6. Adjust the Channel 13 tuning core (see figure 4).

7. Reset the signal-generator frequency and the CHANNEL SELECTOR, and adjust the tuning cores for Channels 11 and 9, respectively.

8. Repeat steps 5, 6 and 7 until Channels 13, 11, and 9 are within plus or minus 500 kc. of the correct frequency.

9. Feed in r-f (unmodulated) signals, at the oscillator frequencies for Channels 7, 6, and 4, consecutively (see NOTE below), and adjust the respective tuning cores (see figure 4).

NOTE: The exact position of the FINE TUNING cam should be marked when Channel 4 is correctly aligned. This position is to be used in step 4 of the i-f alignment procedure.

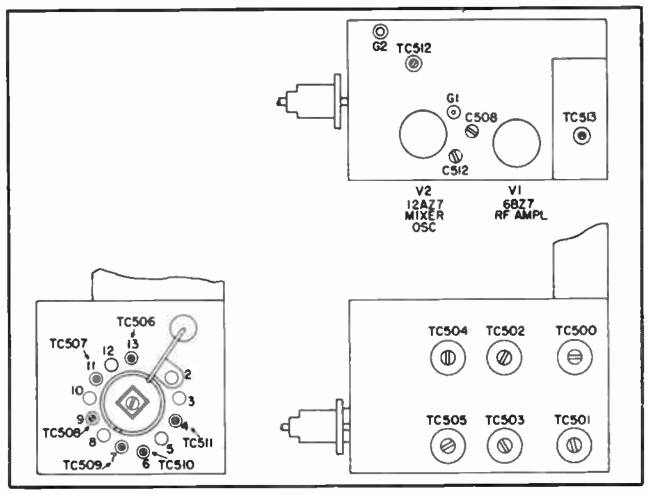


Figure 4. Television Tuner, Showing Locations of Adjustments TP2-2201

Procedure Using Station Signal

The following simplified procedure may be used to align the oscillator when the television i-f alignment is satisfactory and a station signal is available:

1. Mechanically preset the FINE TUNING cam to the center of its range (see figure 4).

2. Tune in the highest frequency channel to be received.

3. Adjust the tuning core for that channel, or the next highest channel, for the best picture; that is, starting with sound in the picture, turn the tuning core until the sound disappears. Repeat for each channel received in the area.

Bandpass Alignment

General

The bandpass alignment consists of aligning the tuner at Channels 13 and 6, and then making it track down to Channels 7 and 2, respectively.

During the alignment, a fixed bias of 1½ volts is applied to the r-f amplifier tube.

An FM (sweep) signal is applied to the antenna-input circuit, and an oscilloscope is connected to the mixer plate circuit. The oscilloscope gain should be as high as possible, consistent with hum level and "bounce" conditions. Hum conditions will cause distortion of the time base and response. Bounce conditions, which are caused by poor line regulation, will cause the response and time base to jump up and down. The use of too high an oscilloscope gain aggravates these conditions, whereas the use of too low a gain necessitates increasing the generator output to a point where the tuner may be overloaded. Overload may be checked by changing the generator output while observing the shape of the response curve; any change in the shape of the curve indicates overload, in which case a lower generator output and higher oscilloscope gain must be used. The tuner coupling link should be disconnected from the i-f section and a 40- to 70-ohm resistor connected across the open end of the link, to eliminate the absorption effect of this coil on the response curve.

1. Disconnect the white (a-g-c) lead from the tuner, and connect it to the negative terminal of a 1½-volt battery. Ground the positive terminal.

2. Disconnect the tuner link at terminal board B11-5 and B11-7 (see figure 36), and connect a 40- to 70-ohm carbon resistor to the two leads of the link.

3. Connect a 1000-ohm resistor in series with the hot lead of the oscilloscope. Connect the other end of the resistor to the mixer plate test point, G2, and connect the ground lead of the oscilloscope to the chassis, near the test point.

4. Connect the FM (sweep) generator to the 300-ohm antenna-input terminals through an antenna-input matching network. See figure 1.

Procedure

1. Set the CHANNEL SELECTOR and FM (sweep) generator to Channel 13 (213 mc.): Adjust the generator for sufficient sweep to show the complete response curve.

2. Establish the channel limits (see figure 5) by using the marker (AM r-f) signal generator to produce marker pips on the response curve. (Set the marker generator first to 210 mc., then to 216 mc.)

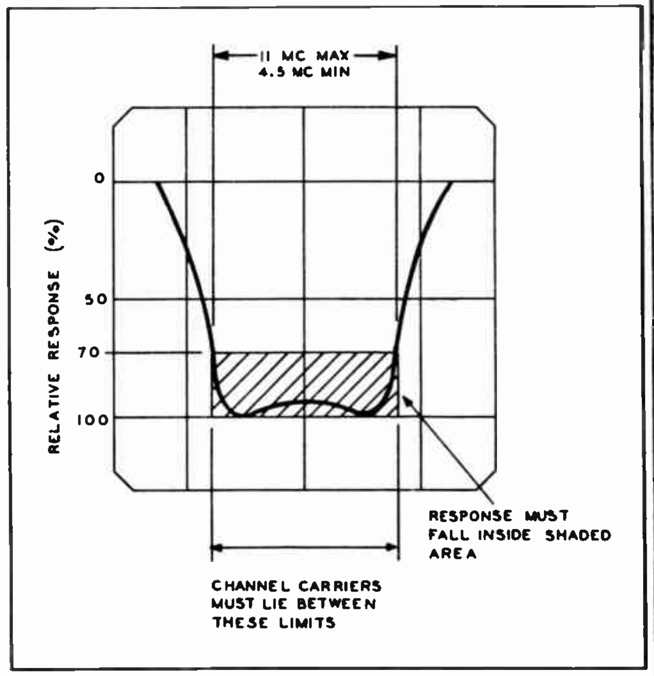


Figure 5. Television Tuner Response Curve, Showing Bandpass Limits TP9-5128-1

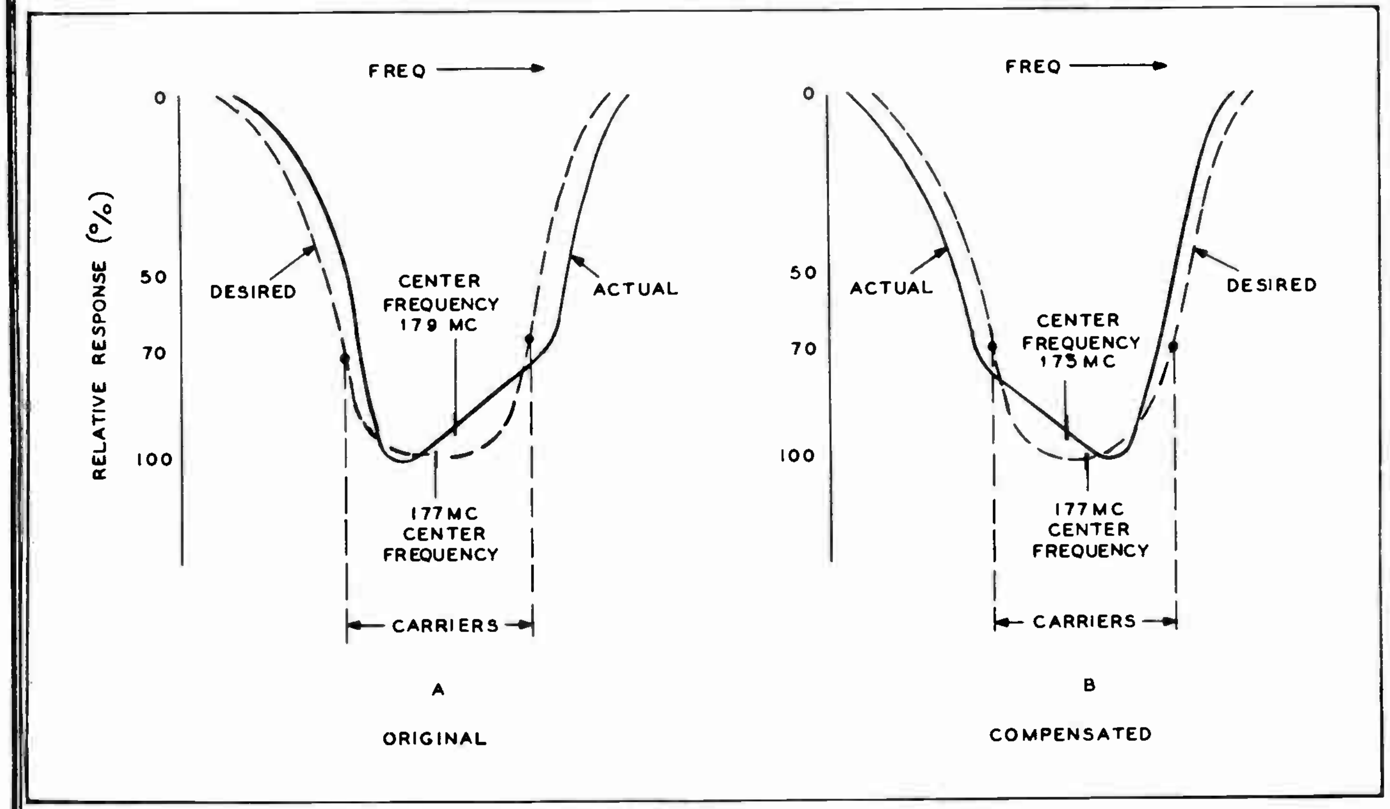


Figure 6. Television Tuner Response Curve, Showing Tracking Compensation

The curve should be reasonably flat between the limits shown in figure 5.

3. Adjust TC502 and TC504 (figure 4) for a symmetrical, approximately centered pass band. Set the marker generator to 213 mc. Detune TC504 counterclockwise until a single peak appears. Adjust TC502 until the peak falls on the 213-mc. marker. It may be necessary to increase the output of the generator during this adjustment. Then adjust TC500 for maximum curve height and symmetry of the single peak. The antenna circuit is now tuned for the high-frequency channels.

4. Readjust TC502 and TC504 for a symmetrical response, centered about 213 mc., and falling within the limits shown in figure 5.

5. Set the CHANNEL SELECTOR and FM generator to Channel 7 (177 mc.).

6. Establish the channel limits by using the marker generator to produce marker pips on the response curve. (Set the generator first to 174 mc., then to 180 mc.). The curve should be reasonably flat between the limits.

7. On Channel 7, note the response curve, with respect to tilt and center frequency. The curve should be centered in the pass band, and should be symmetrical.

8. If the curve is not symmetrical, and appears unbalanced, as shown in figure 6, leave the generator and tuner set to Channel 7, and adjust C508 and C512 (see figure 4) to obtain a response curve which is the mirror image (tilt in the opposite direction) of the original. This is a form of overcompensation, to allow for the effect of Channel 13 adjustment on Channel 7. For example, if the Channel 7 response appears as in figure 6A, then the trimmer should be adjusted to obtain the response shown in figure 6B.

9. Reset the CHANNEL SELECTOR and generators to Channel 13. Readjust TC502 and TC504 for a symmetrical and centered pass band. See step 4.

10. Set the CHANNEL SELECTOR and generators to Channel 7, and check the response for center frequency and symmetry. Repeat steps 8 and 9 as many times as necessary to obtain the most symmetrical and centered response curves on Channels 13 and 7. Channels 7 through 13 are now correctly aligned.

11. Set the CHANNEL SELECTOR and sweep generator to Channel 6 (85 mc.).

12. Establish the channel limits, using the marker generator to produce marker pips on the response curve. (Set the generator first to 82 mc., then to 88 mc.)

13. Adjust TC503 and TC505 for a symmetrical, approximately centered pass band. Set the marker generator to 85 mc. Detune TC505 counterclockwise until a single peak appears.

> CAUTION: Do not turn TC505 excessively, or it will fall out of the coil.

Adjust TC503 until the peak falls on the 85-mc. marker. It may be necessary to increase the output of the generator during this adjustment. Then adjust TC501 for maximum curve height and symmetry of the single peak. The antenna circuit is now tuned for Channels 2 through 6. To prevent overloading, the output of the generator should be reduced after this adjustment is completed.

14. Readjust TC503 and TC505 for a symmetrical response, centered about 85 mc.

VIDEO I-F ALIGNMENT

Preliminary

Before proceeding with the alignment or making an alignment check, observe the following preliminary instructions:

1. Preset the CONTRAST and BRIGHTNESS controls to the maximum counterclockwise position.
2. Preset the CHANNEL SELECTOR to Channel 4.
3. Insert the video i-f alignment jig into J200.
4. Connect the oscilloscope to the 2200-ohm resistor from the video i-f alignment jig. Connect the ground lead of the oscilloscope to the ground lead of the jig.
5. Connect a 3-volt bias battery to the video i-f alignment jig, with the negative terminal of the battery to the bias lead of the jig, and the positive terminal to the ground lead.
6. Connect the AM generator to the mixer test point, G-1, through a mixer jig, and adjust the generator for approximately 30 percent modulation at 400 cycles. Adjust the output of the generator during alignment, to keep the output at the second detector below .6 volt, peak to peak.

> NOTE: If the i-f shield has been removed for repairs, it must be replaced before proceeding with the alignment.

Procedure

1. Tune the AM generator to 28.1 mc., and adjust TC200 (see figure 7) for minimum output, as observed on the oscilloscope.
2. Tune the AM generator to 22.1 mc., and adjust TC203 for minimum output, as observed on the oscilloscope.

> NOTE: In steps 1 and 2 it is necessary to keep the generator output sufficiently high that a null indication may be observed on the oscilloscope; however, avoid overloading of the receiver by excessive signal.

3. Tune the AM generator to the frequencies indicated below, and adjust the tuning cores for maximum output.
   - a. 24.0 mc., adjust TC512.
   - b. 25.7 mc., adjust TC201.
   - c. 23.6 mc., adjust TC202.
   - d. 26.4 mc., adjust TC204.
   - e. 24.5 mc., adjust TC205.

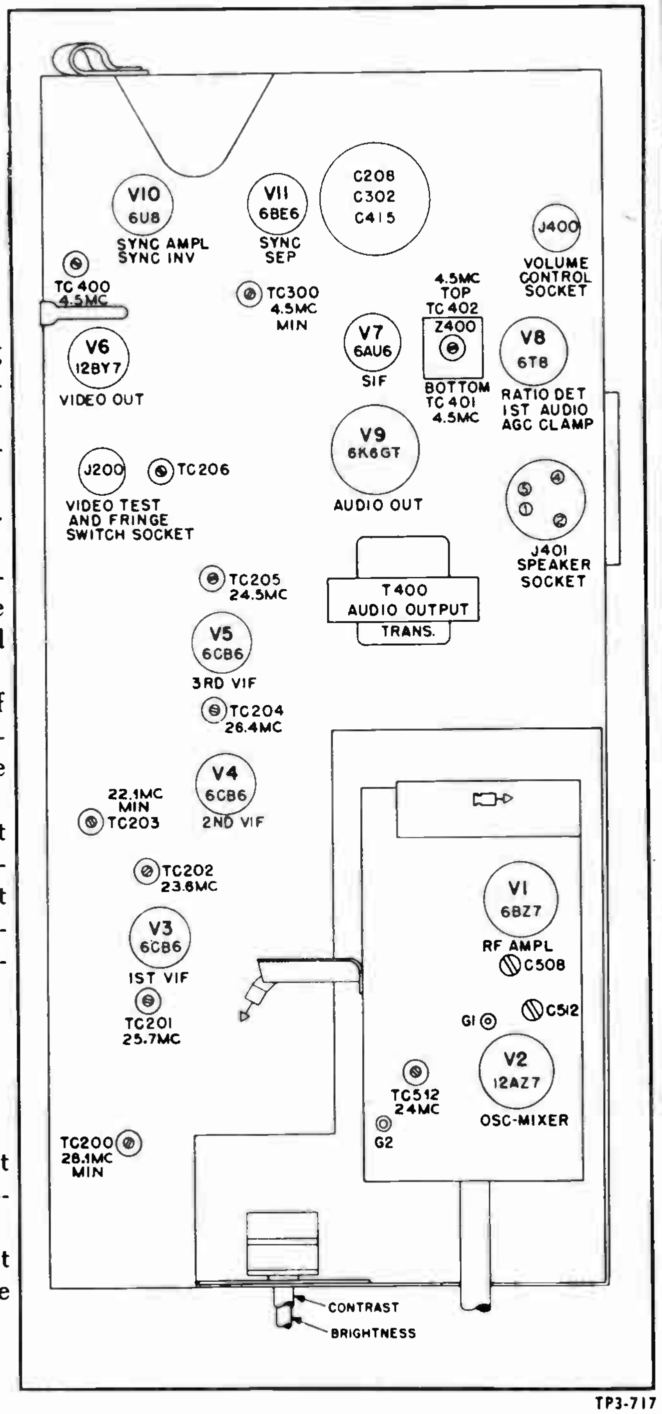
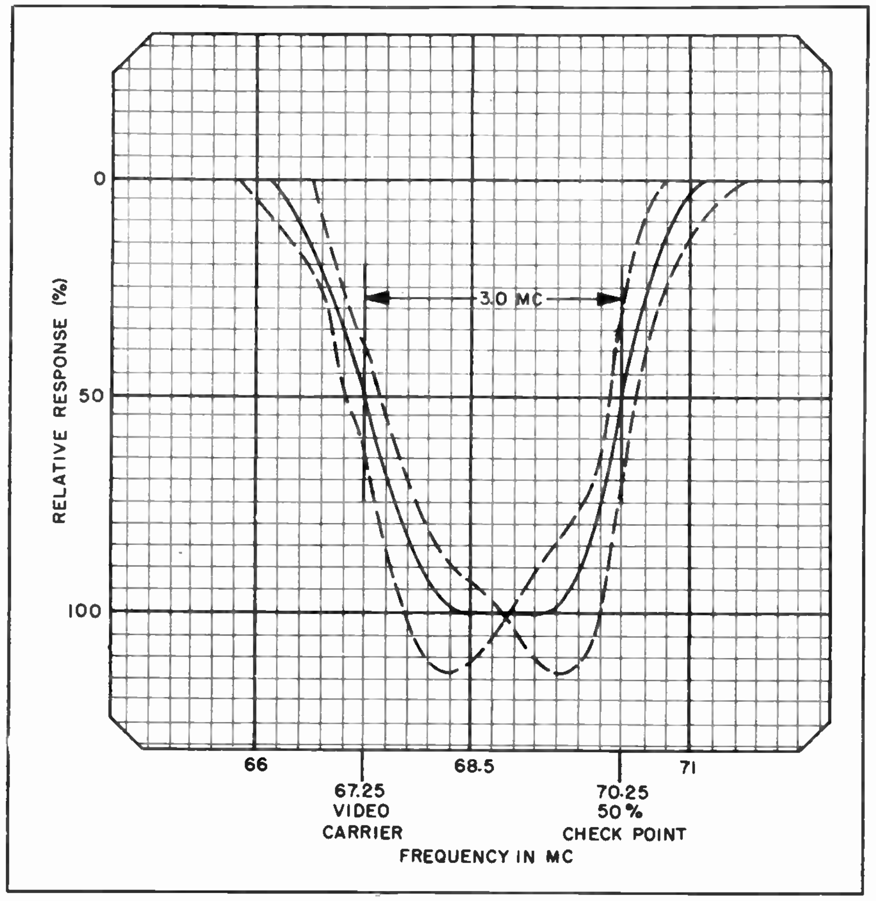


Figure 7. R-F Chassis R-181, Top View, Showing Locations of Adjustments

4. Connect the sweep generator and r-f marker generator to the antenna terminals through a matching jig. (If a separate oscilloscope is used, connect the sweep output of the generator to the horizontal input of the oscilloscope.) Set the CHANNEL SELECTOR to Channel 4, and tune the sweep generator for output on Channel 4. After the equipment is properly connected, adjust the FINE TUN-



TP2-2202

Figure 8. Over-all R-F, I-F Response Curve, Showing Tolerance Limits

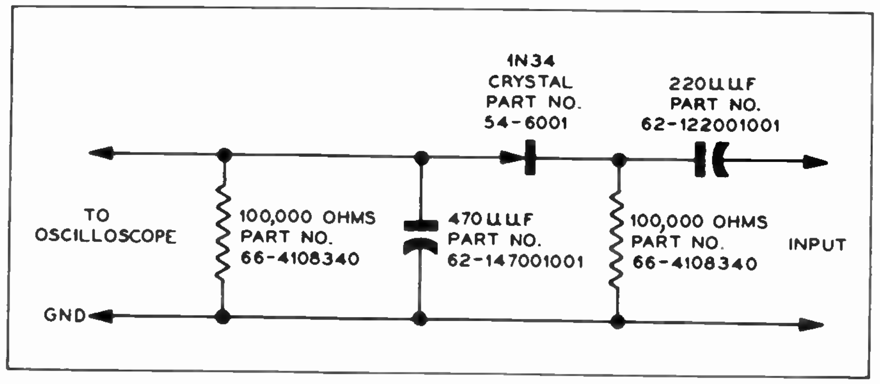
ING control to the mark previously made (see NOTE under Oscillator Alignment).

5. If the response curve does not fall within the limits shown in figure 8, the adjustment of the tuning cores may be touched up slightly while observing the response curve with the sweep generator. Do not touch the setting of TC200 and TC203. To adjust the curve, adjust TC201 and TC204 for proper video carrier level. The top of the curve may be leveled by adjusting TC205, and the low-frequency side of the curve may be adjusted by adjusting TC202. By means of these adjustments the response curve should be brought within the limits shown in figure 8.

> CAUTION: Do not turn any of the tuning cores excessively. To retouch, only turn the tuning cores slightly. This caution applies particularly to TC202.

SOUND I-F ALIGNMENT

1. Remove the 1st v-i-f tube, and connect a v.t.v.m. or a 20,000-ohms-per-volt voltmeter to the sound i-f alignment jig. Adjust the VOLUME control for moderate speaker output.



TP0-1150

Figure 9. Wiring Diagram of Crystal Detector

2. Feed in an accurately calibrated 4.5-mc. AM signal through the 2200-ohm resistor in the video i-f alignment jig, to pin 2 of J200.

3. Tune TC400, TC401, and TC402 for maximum indications on the meter. The point of maximum meter indication for TC402 should also be the point of minimum speaker output.

4. Tune TC402 for minimum speaker output.

5. Connect an r-f probe or crystal detector to the cathode (pin 11) of the picture tube. See NOTE below.

6. Tune TC300 for minimum indication on oscilloscope. (If a crystal detector is not available, TC300 may be adjusted for minimum beat pattern, as observed on the picture tube, with a station picture present.)

7. Replace the 1st v-i-f tube. Tune in a station and use the speaker output as an indication.

8. Turn the FINE TUNING control clockwise to obtain a slightly fuzzy picture.

9. Tune TC402 for minimum AM (noise) output.

> NOTE: The R-F Probe, Part No. 76-3595, is used as a detector of the 4.5-mc. signal, and the oscilloscope is used as an indicating device. An alternate crystal detector may be made up as shown in figure 9.

OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 3 volts at the video detector. The voltage given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms are more rounded than those shown, and the peak voltages differ from those shown.

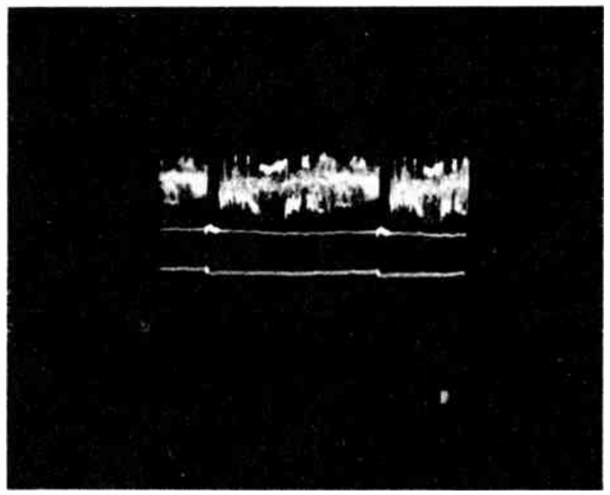


Figure 10. Video Detector Output, Pin 2 of J200 3 volts, 60 c.p.s. TP2-787

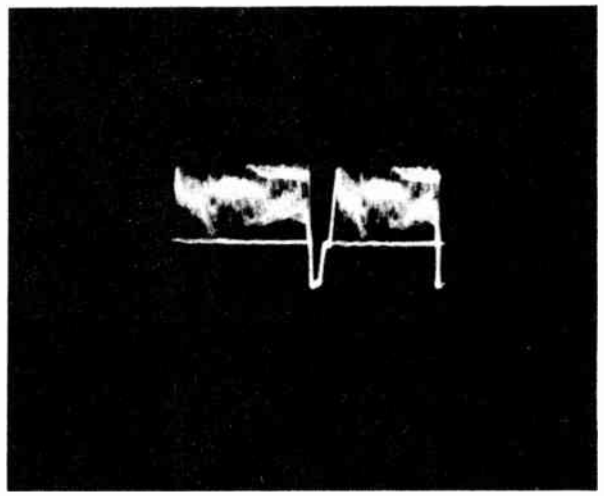


Figure 11. Video Detector Output, Pin 2 of J200 3 volts, 15,750 c.p.s. TP2-786

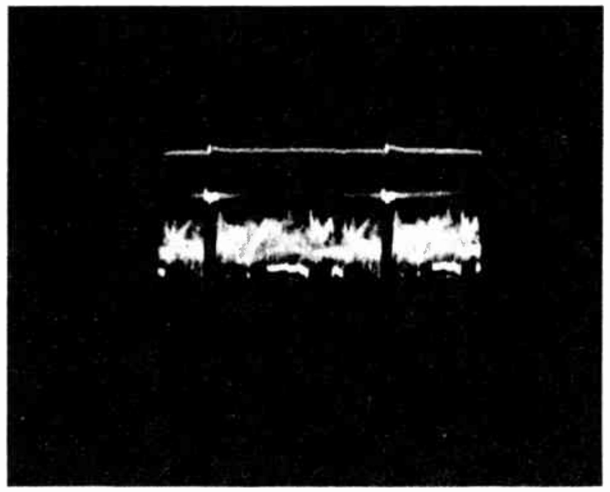


Figure 12. Video Amplifier Plate, Pin 7 66 volts, 60 c.p.s. TP2-788

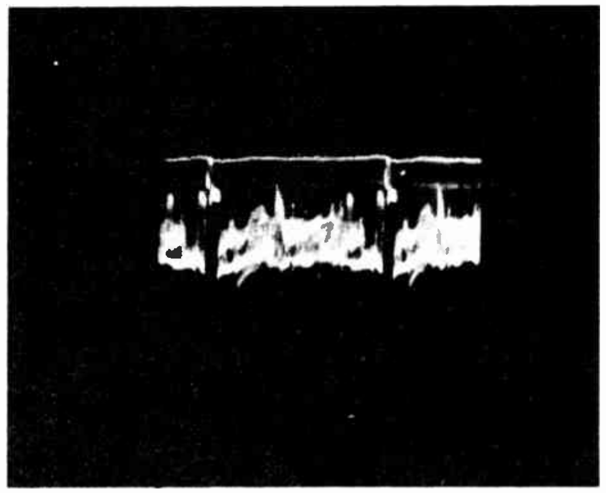
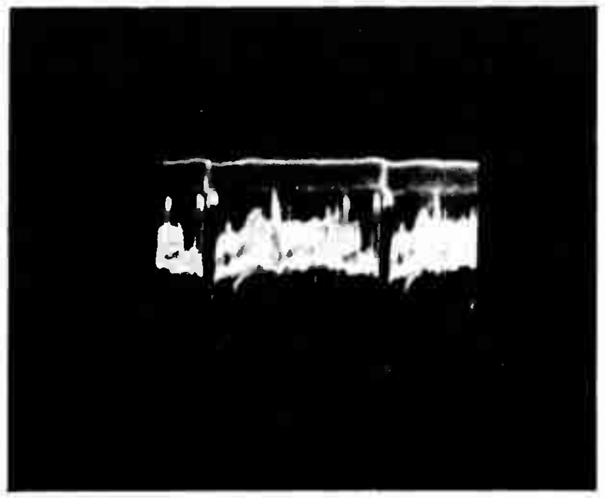
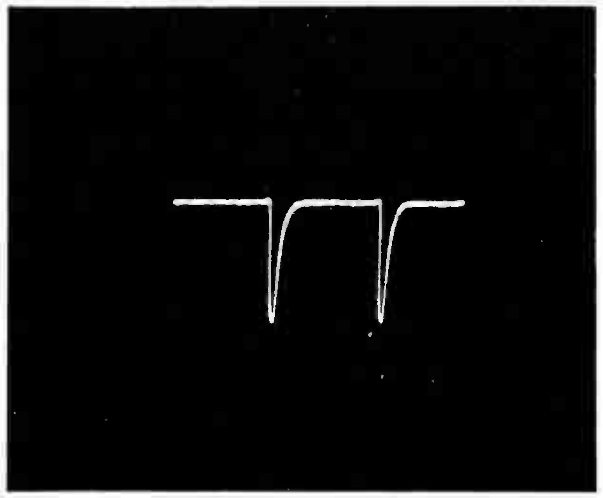


Figure 13. Sync Amplifier Plate, Pin 6 66 volts, 60 c.p.s. TP2-790



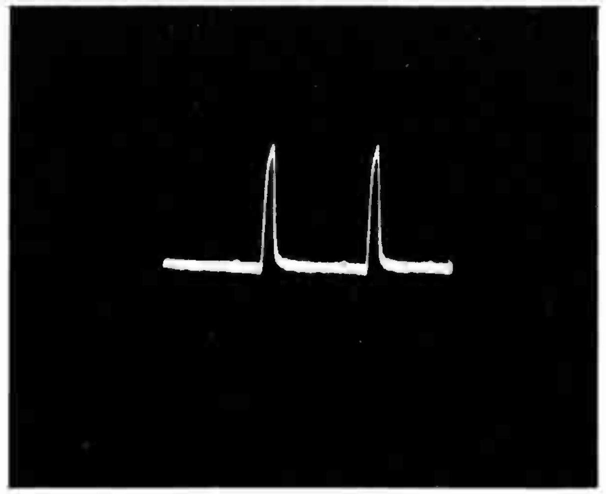
TP2-790

Figure 14. Sync Separator Grid,
Pin 7
50 volts, 60 c.p.s.



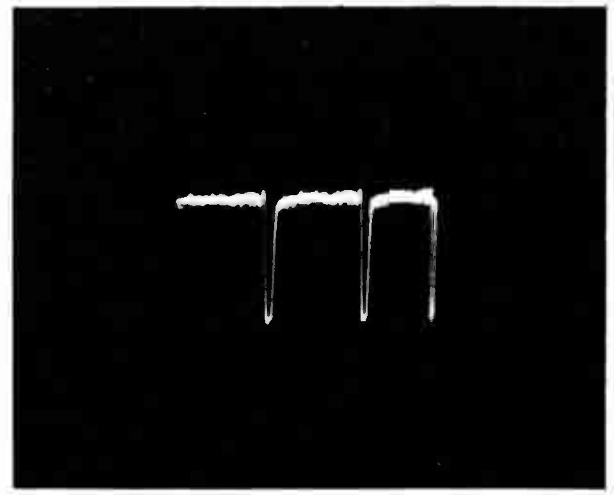
TP2-792

Figure 15. Sync Separator Plate,
Pin 5
20 volts, 15,750 c.p.s.



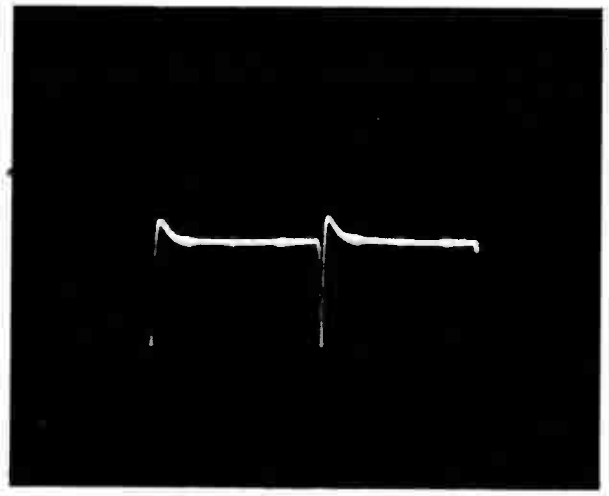
TP2-791

Figure 16. Sync Inverter Plate,
Pin 1
20 volts, 15,750 c.p.s.



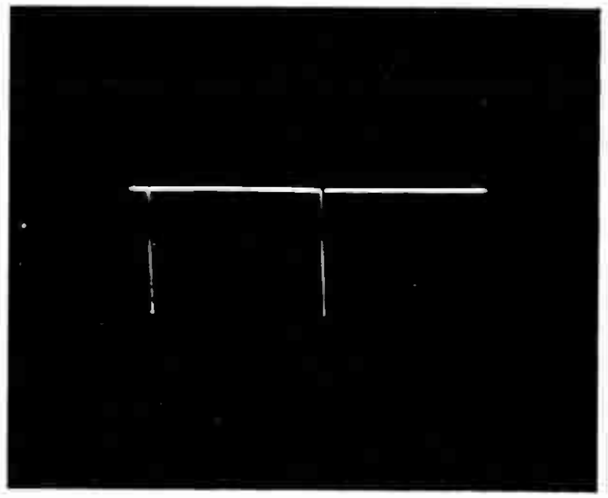
TP2-793

Figure 17. Sync Inverter Cathode,
Pin 8
6.8 volts, 15,750 c.p.s.



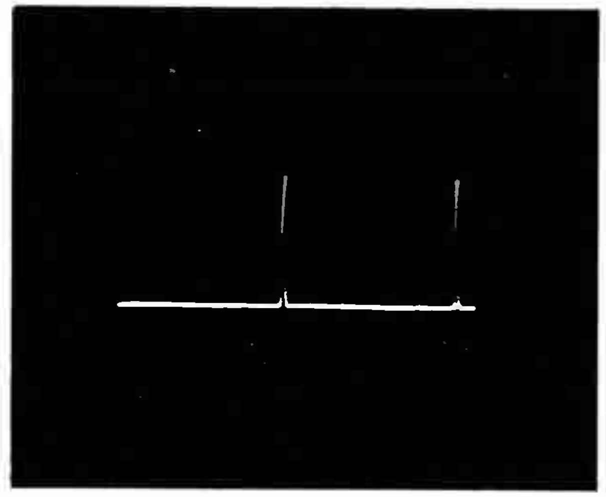
TP3-330

Figure 18. Vertical-Oscillator Grid,
Pin 2
.5 volt, 60 c.p.s.



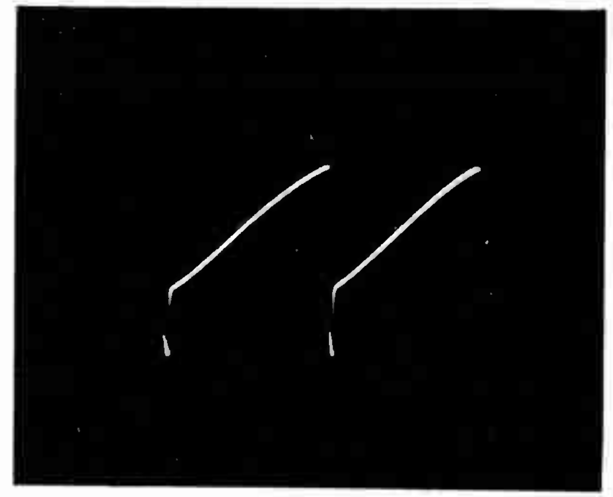
TP3-327

Figure 19. Vertical-Oscillator Cathode,
Pins 3 and 8
15 volts, 60 c.p.s.



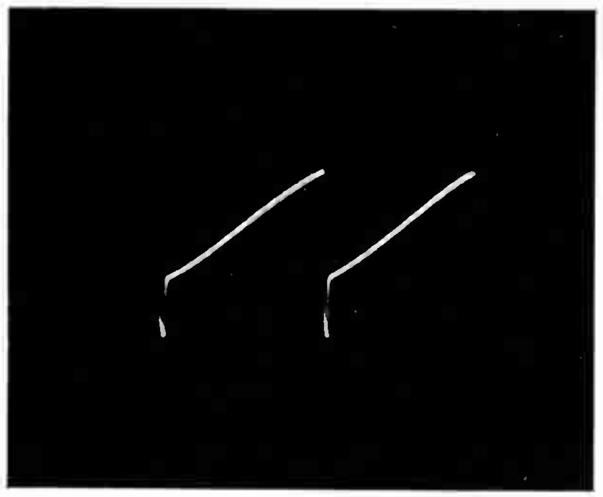
TP3-328

Figure 20. Vertical-Oscillator Plate,
Pin 1
65 volts, 60 c.p.s.



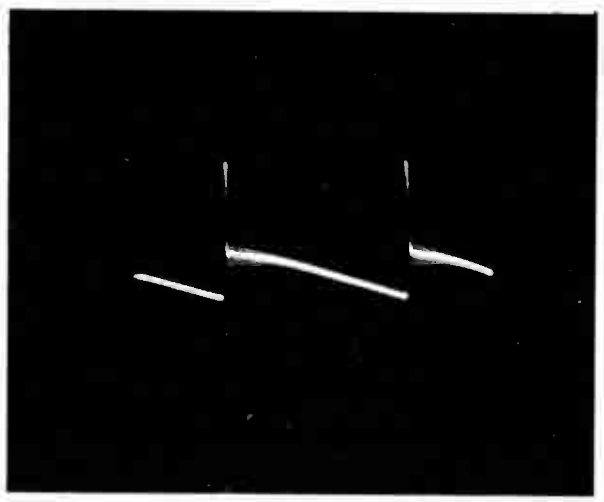
TP3-326

Figure 21. Vertical-Oscillator Plate,*
Pin 6
100 volts, 60 c.p.s.



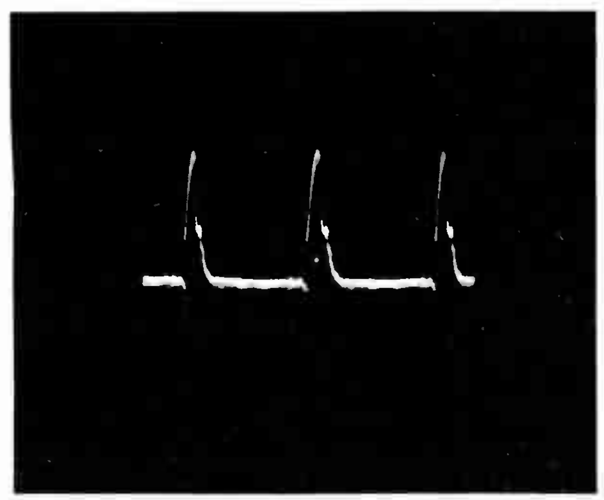
TP3-332

Figure 22. Vertical-Output Grid,*
Pins 2 and 7
100 volts, 60 c.p.s.



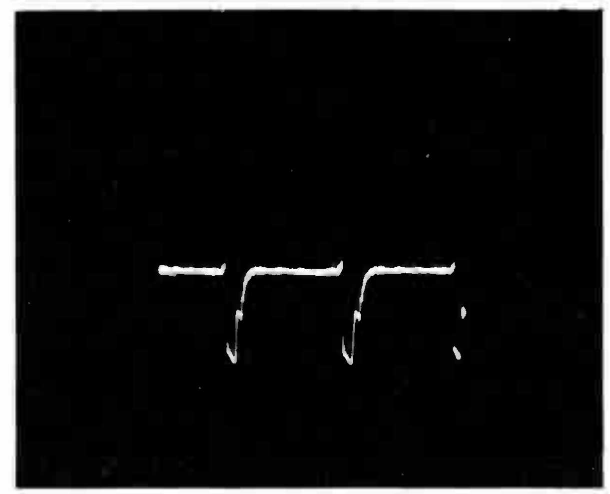
TP3-329

Figure 23. Vertical-Output Plate,*
Pin 9
450 volts, 60 c.p.s.



TP2-641

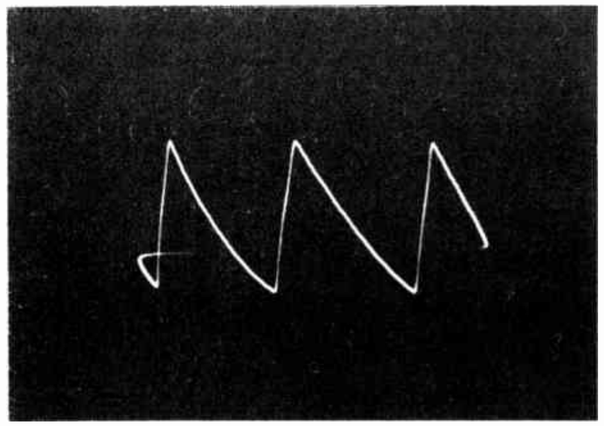
Figure 24. Phase Comparer Plate,
Pin 2
10 volts, 15,750 c.p.s.



TP2-642

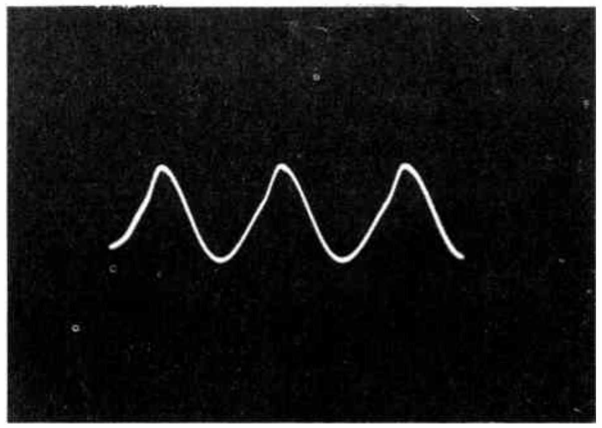
Figure 25. Phase Comparer Cathode,
Pin 1
10 volts, 15,750 c.p.s.

* Waveforms and voltages taken with 1—megohm isolation resistor in series with oscilloscope lead.



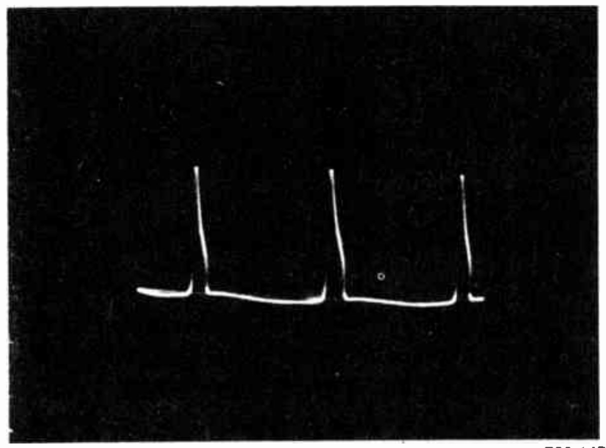
TP2-652

Figure 26. Phase Comparer
Pins 5 and 7
6 volts, 15,750 c.p.s.



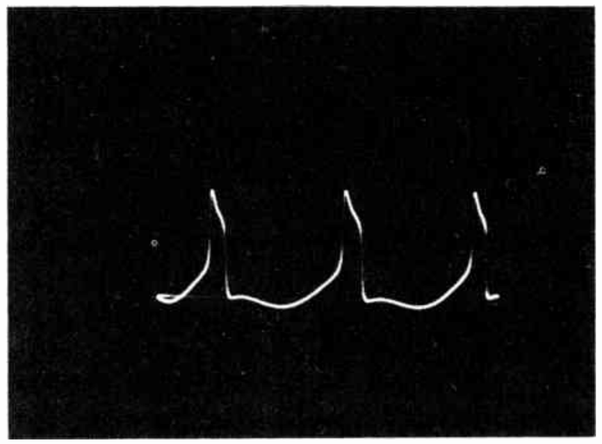
TP2-2852

Figure 27. Horizontal Oscillator
Test Point
35 volts, 15,750 c.p.s.



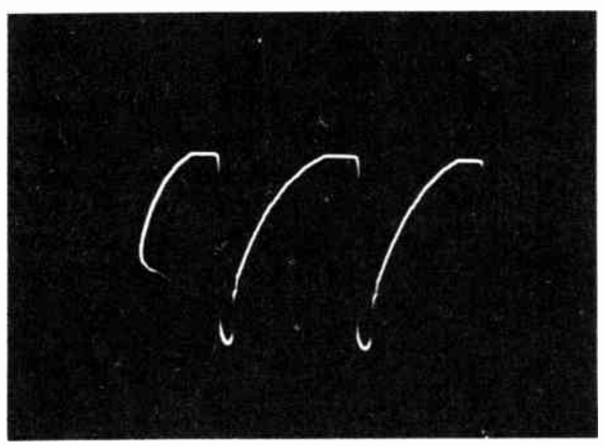
TP2-647

Figure 28. Horizontal-Oscillator Cathode,
Pins 8 and 3
16 volts, 15,750 c.p.s.



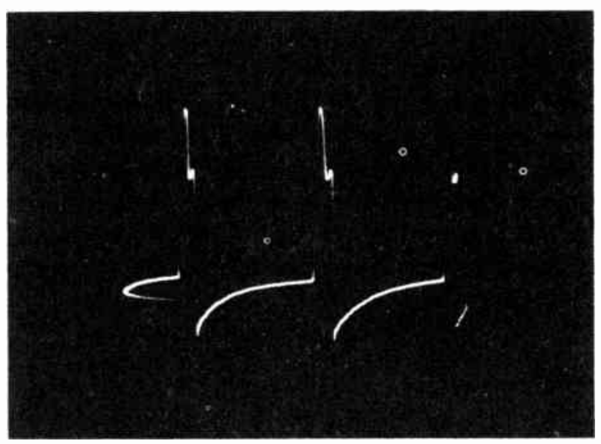
TP2-648

Figure 29. Horizontal-Oscillator Grid,
Pin 2
38 volts, 15,750 c.p.s.



TP2-649

Figure 30. Horizontal-Output Grid,
Pin 5
130 volts, 15,750 c.p.s.



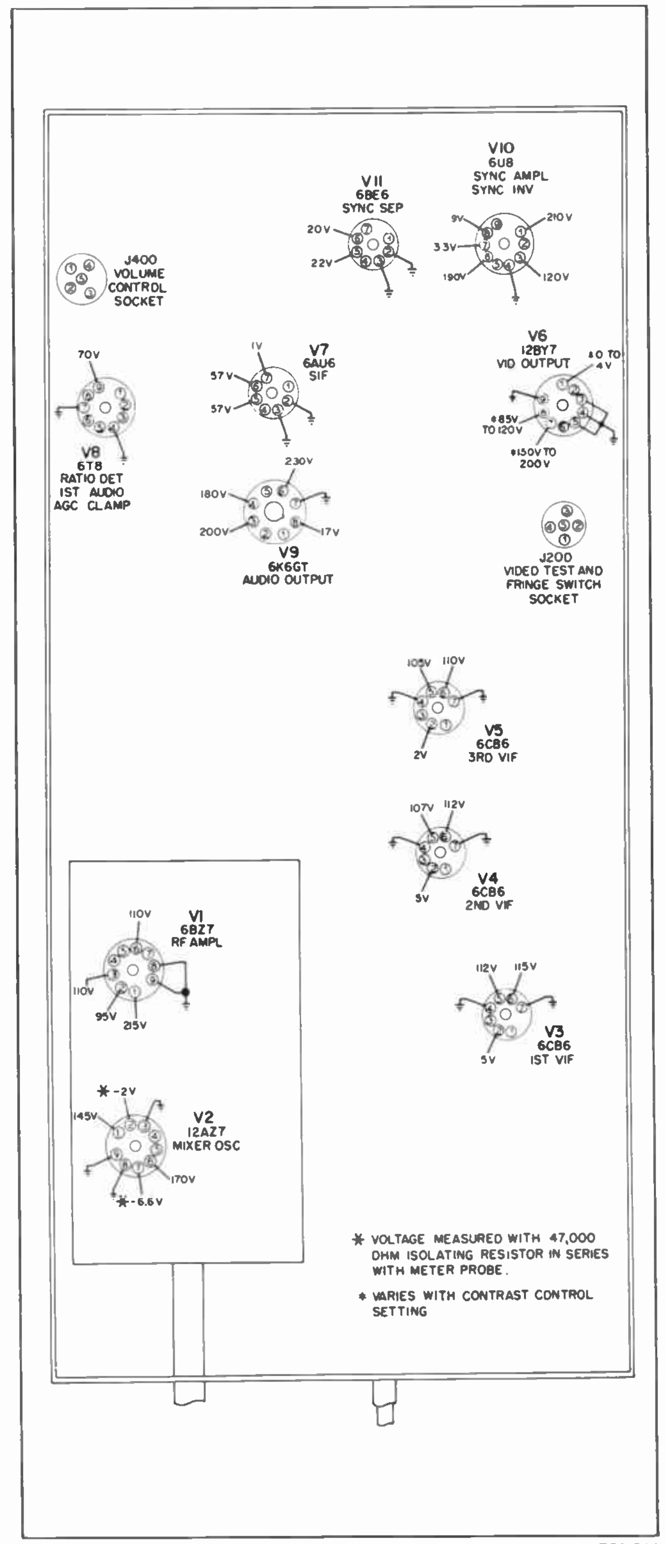
TP2-650

Figure 31. Horizontal-Deflection Yoke,
***Pin 7 of J800**
3000 volts, 15,750 c.p.s.
***See CAUTION note**

*CAUTION: High-voltage pulses are present in the horizontal-output circuit. The waveform in figure 31 was taken with the alligator clip of the oscilloscope lead clipped over the insulation of the lead connected to pin 7 of J800. (To prevent puncture of the insulation of the lead, file off the teeth of the alligator clip, and wrap friction tape around the clip.) Connection to other points in the horizontal-output circuit is dangerous, because of the high voltages present. The peak-to-peak voltage shown for figure 31 is the actual voltage present; however, the amplitude of the scope presentation depends upon the degree of coupling.

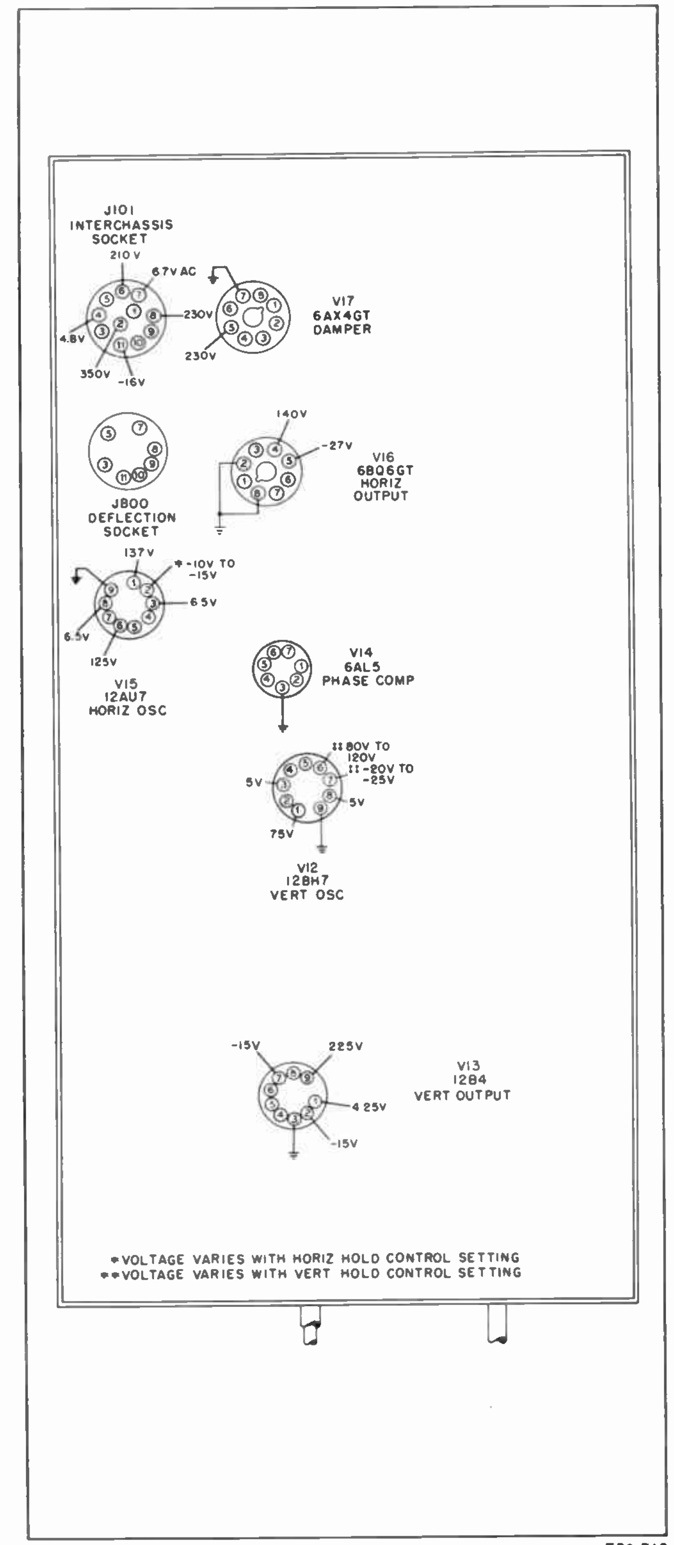
VOLTAGE MEASUREMENTS

The voltages given here and on the schematics were taken with a 20,000-ohms-per-volt voltmeter, with a line voltage of 117 volts, and no signal input to the receiver.



TP3-711

Figure 32. R-F Chassis R-181, Bottom View, Showing Voltages at the Sockets



TP3-712

Figure 33. Deflection Chassis D-181, Bottom View, Showing Voltages at the Sockets

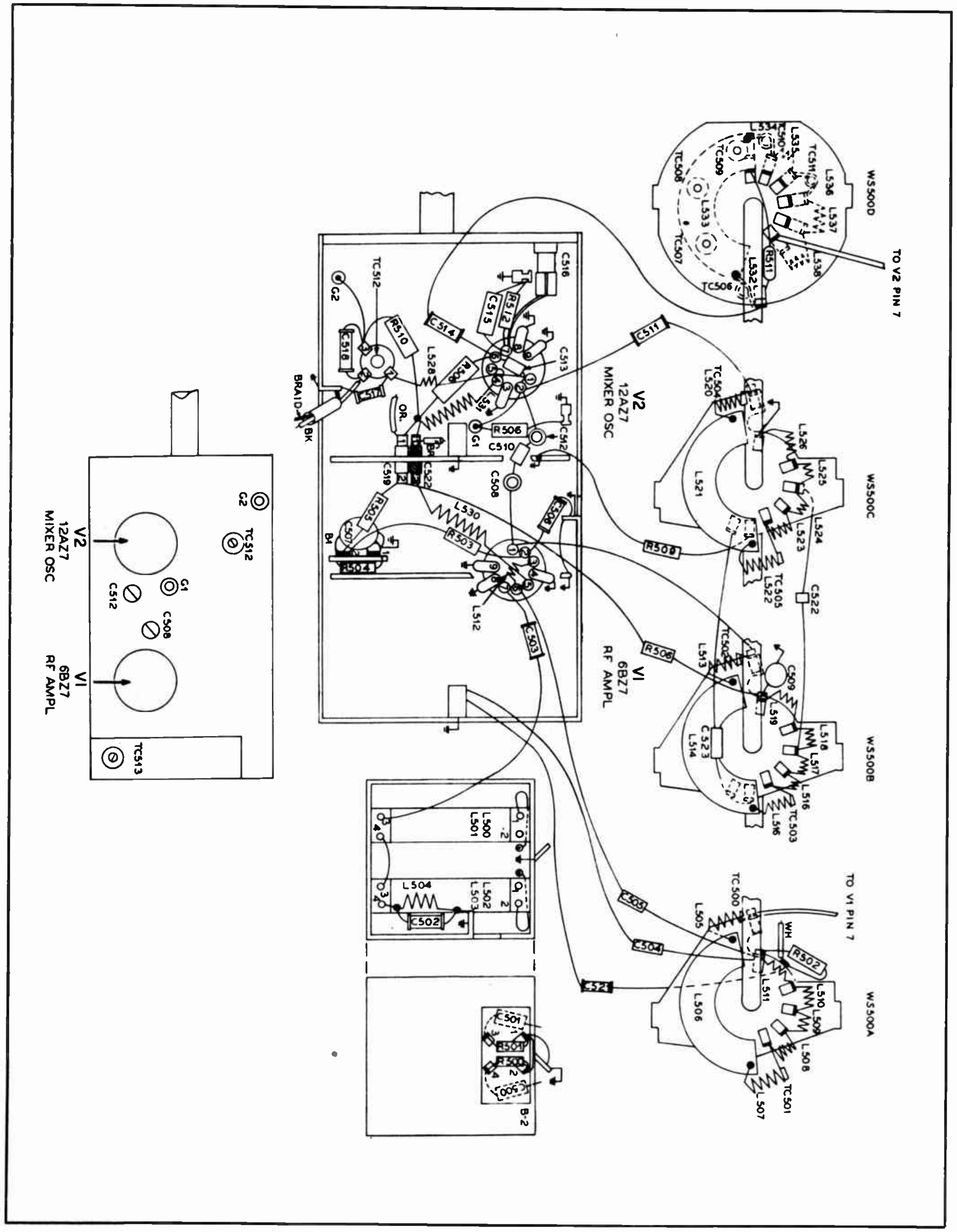


Figure 34. Television Tuner, Part No. 76-7664, Base Layout

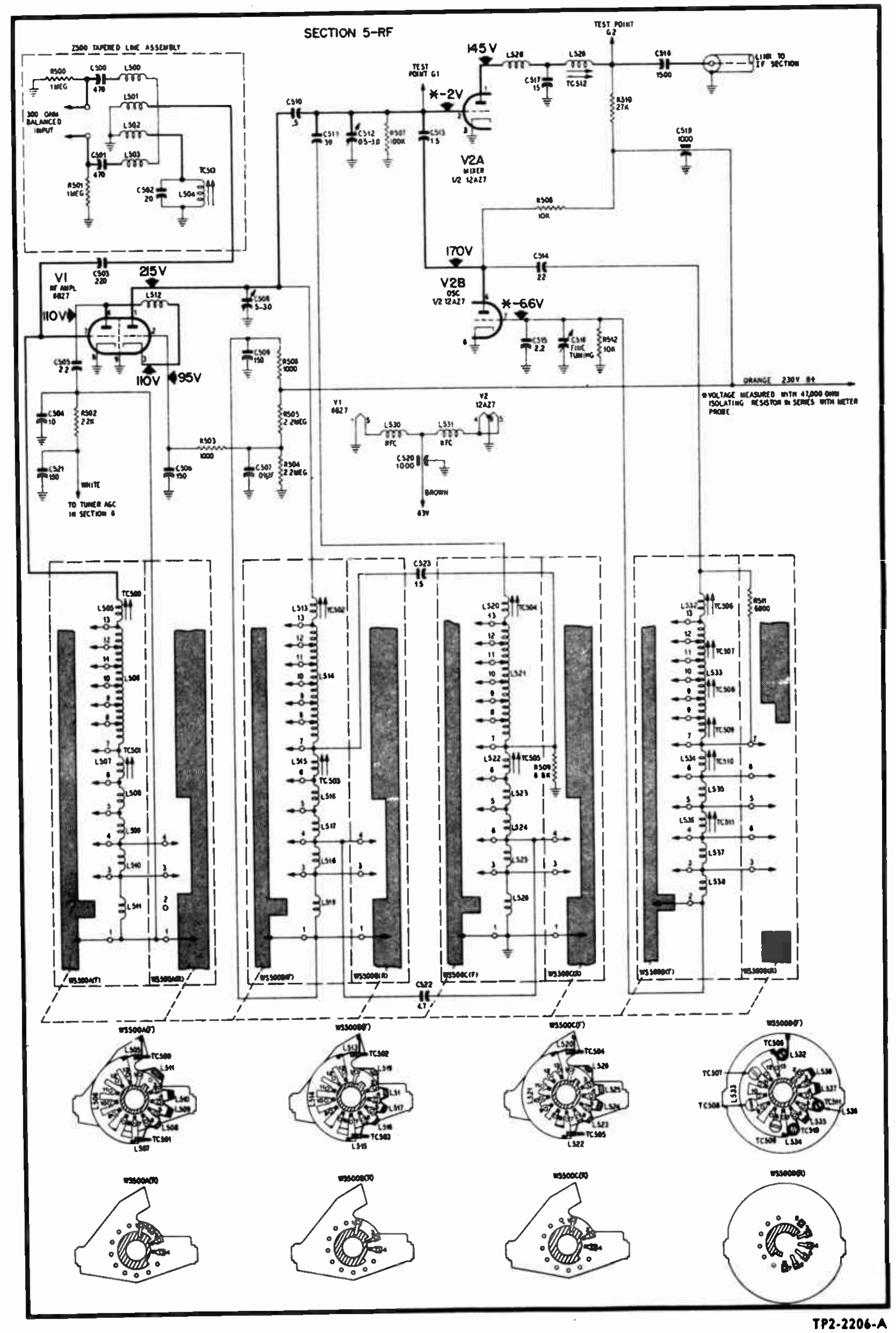
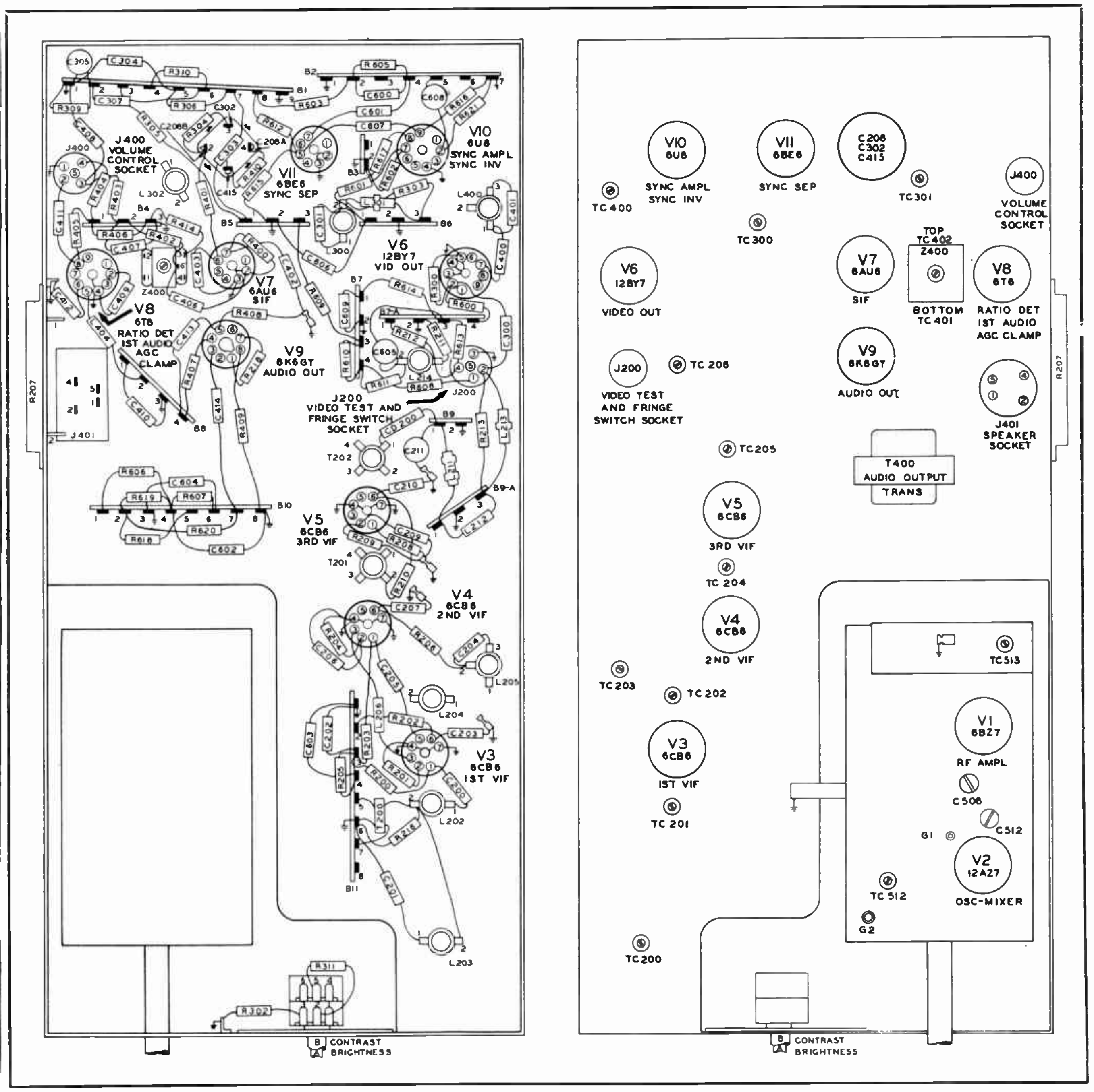
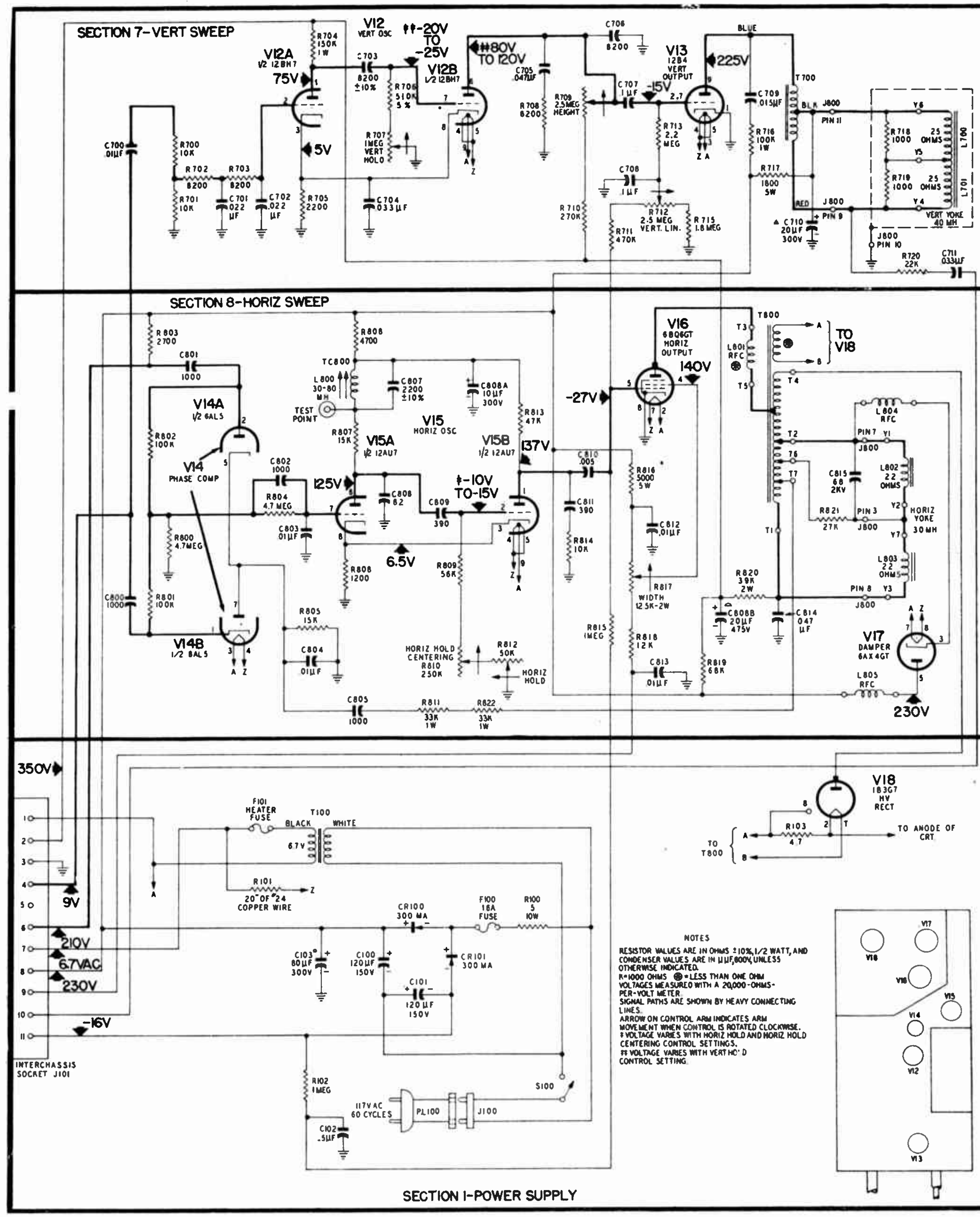


Figure 35. Television Tuner, Part No. 76-7664, Schematic Diagram



TP3-713

Figure 36. R-F Chassis R-181, Run 15 (First Production), Base Layout



TP3-344-A

Figure 38. Deflection Chassis D-181, Run 4 (First Production), Schematic Diagram

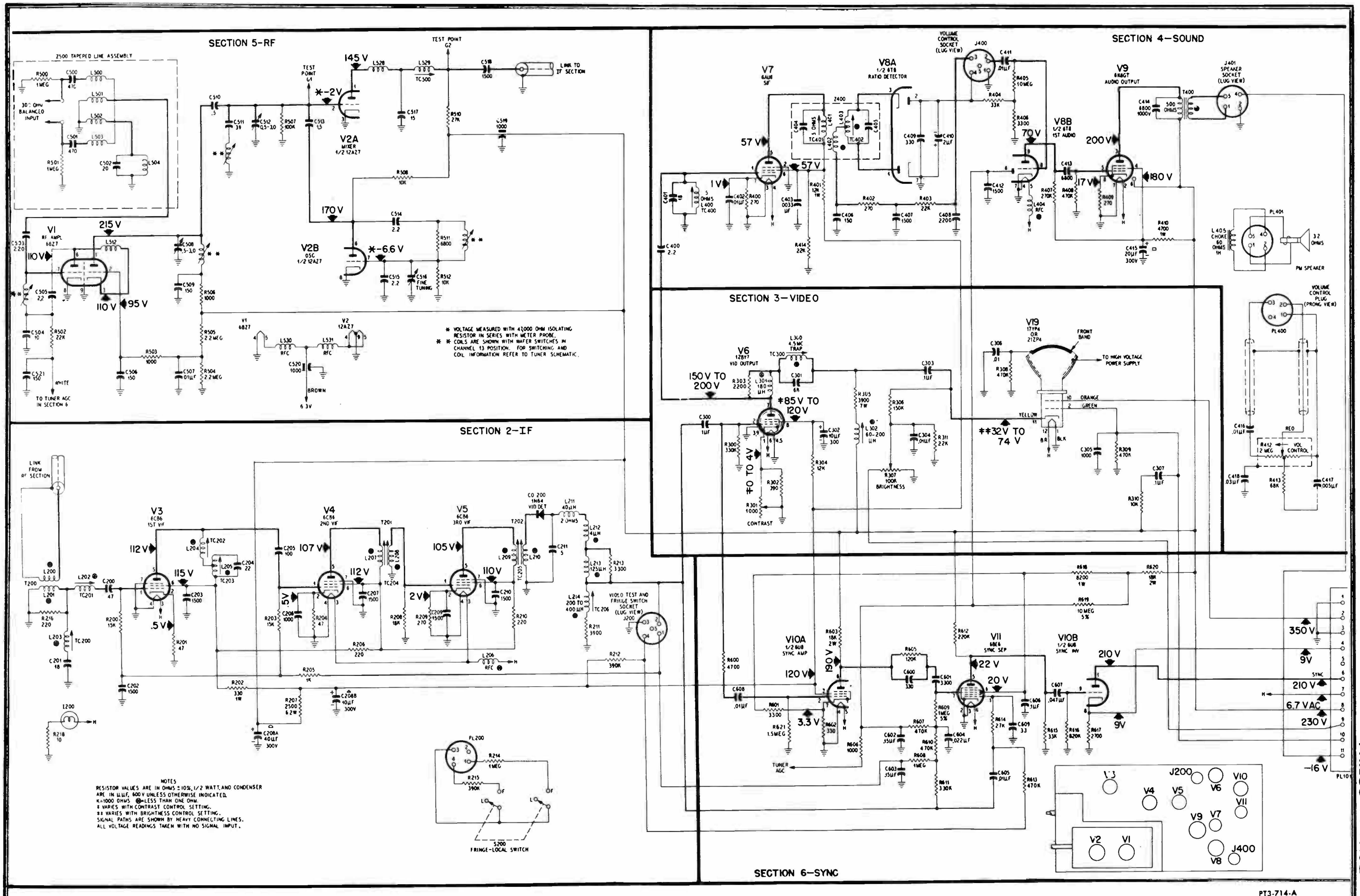


Figure 37. R-F Chassis R-181, Run 15 (First Production), Schematic Diagram

UHF TUNER-ADAPTER UT21D, PART NO. 43-6778 FOR RECEIVERS USING R-F CHASSIS R-181

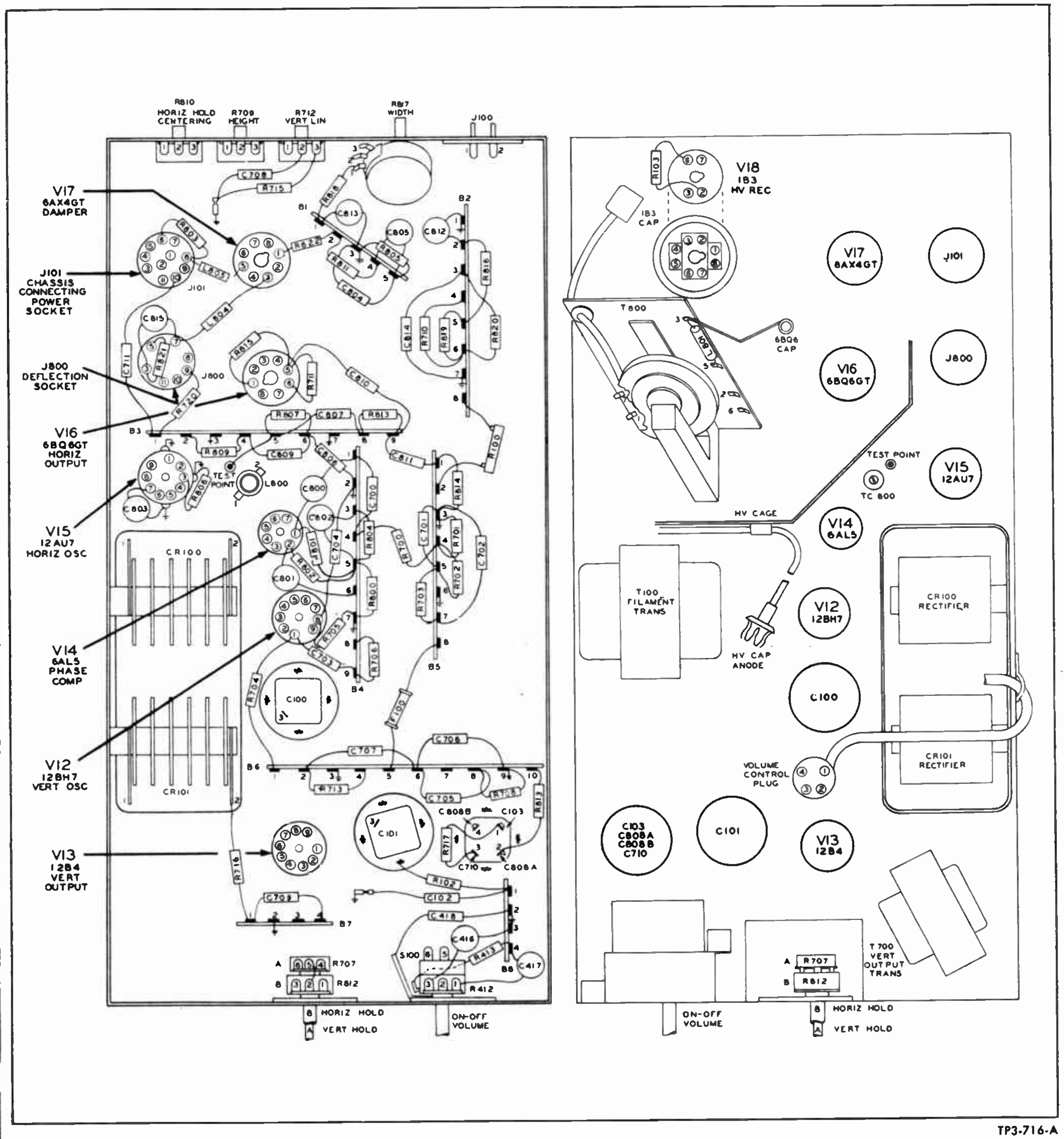


Figure 39. Deflection Chassis D-181, Run 4 (First Production), Base Layout

UHF Tuner-Adapter UT21D, Part No. 43-6778, provides for the reception of UHF signals on television channels 14 through 83. It is designed for installation in Philco Television Receiver models that have a model number beginning with "B," and use r-f chassis R181. The adapter consists of a UHF converter and preamplifier unit, a change-over switch, adapter cables and plugs, a planetary drive tuning-assembly, and mounting hardware.

CIRCUIT DESCRIPTION

The UHF Tuner-Adapter functions as a converter, and converts the signals of the UHF band to a frequency selected within the VFH band. The frequency selected is that of either Channel 2 or Channel 3, depending upon the locality in which the receiver is used.

The incoming UHF signal is coupled through the antenna input line, and through two 680-$\mu\mu$f. condensers and a 150-ohm transmission line to the antenna tank of the tuner. See figure 42. The antenna tank is coupled to the mixer tank by means of the mutual coupling of L2 and L3 and the stray capacitance, C5. The desired signal is selected by tuning the antenna tank and the mixer tank to the proper frequency, and the signal is then coupled to the crystal mixer circuit by means of the mutual coupling of L4 and L5. The local-oscillator signal is generated by a 6AF4 tube, and the associated circuit. The local-oscillator signal is coupled to the crystal mixer circuit by means of a 300-ohm, miniature transmission line and the mutual coupling of L7 to L5 and L8 to L6. The UHF r-f signal and the oscillator signal are mixed in the crystal mixer circuit, producing a radio-frequency signal within range of the VHF tuner when the tuner is set to either Channel 2 or Channel 3. This signal is fed into a preamplifier, which amplies it, and it is then fed into the VHF tuner through a twin-wire lead. In the VHF tuner, the signal is converted to the intermediate frequency of the television receiver. In VHF operation, a 150,000-ohm resistor is placed in series with the UHF oscillator plate, which makes this oscillator inoperative.

The purpose of using two r-f tanks in the UHF tuner is to readily admit the r-f signals, and, at the same time, prevent the UHF i-f and oscillator signals from feeding back into the antenna and causing interference with other receivers.

CHANGE-OVER SWITCH

The change-over switch supplied with the Tuner-Adapter is used to switch from VHF to UHF, and vice versa. It is installed on the back of the VHF tuner, and is operated by an actuator mounted on the VHF tuner shaft. When the VHF Channel Selector is turned to the position for UHF operation, the switch connects the antenna to the UHF tuner, turns off the VHF pilot light, turns on the UHF pilot light, and connects the output of the UHF tuner to the antenna input of the VHF tuner. When the VHF Channel Selector is turned to any VHF position, the switch connects the antenna to the VHF tuner, turns off the UHF pilot light, turns on the VHF pilot light, and places a 150,000-ohm resistor in series with the UHF oscillator plate, as explained above.

PLANETARY DRIVE

The UHF tuner is tuned by means of a 3-gang tuning condenser, which is driven through a specially designed planetary drive. The planetary drive is so constructed that fine tuning and coarse tuning can be accomplished with a single control knob. The tuning shaft is coupled to the driving shaft through three balls, which form a planetary drive that produces slow rotation for fine tuning. See figure 40. After rotating 180 degrees with the tuning shaft, a pin engages the driving shaft, and the two shafts are direct-coupled, for coarse tuning. To re-engage the planetary drive for fine tuning, it is only necessary to reverse the direction of the rotation. The dial pointer is connected to the tuning gang through a cord drive, and indicates the channel number to which the tuner is tuned.

ALIGNMENT AND REPAIRS

The frequencies at which the Tuner-Adapter operates are extremely high; therefore, it is necessary that the utmost care be taken to safeguard against upsetting the delicate adjustments of the tuner. It is recommended that the serviceman make only minor repairs to the tuner, such as replacement of the tube or crystal and the wiring of external leads. The Tuner-Adapter should be returned to the factory for alignment and major repairs, unless the serviceman is properly equipped to perform these jobs. In general, a good rule to follow is not to remove the cover of the Tuner-Adapter unless so equipped.

NOTE: Replacing the tube with a new one may detune the tuner. If this occurs, a number of tubes should be tried, until the most satisfactory substitute for the original is found.

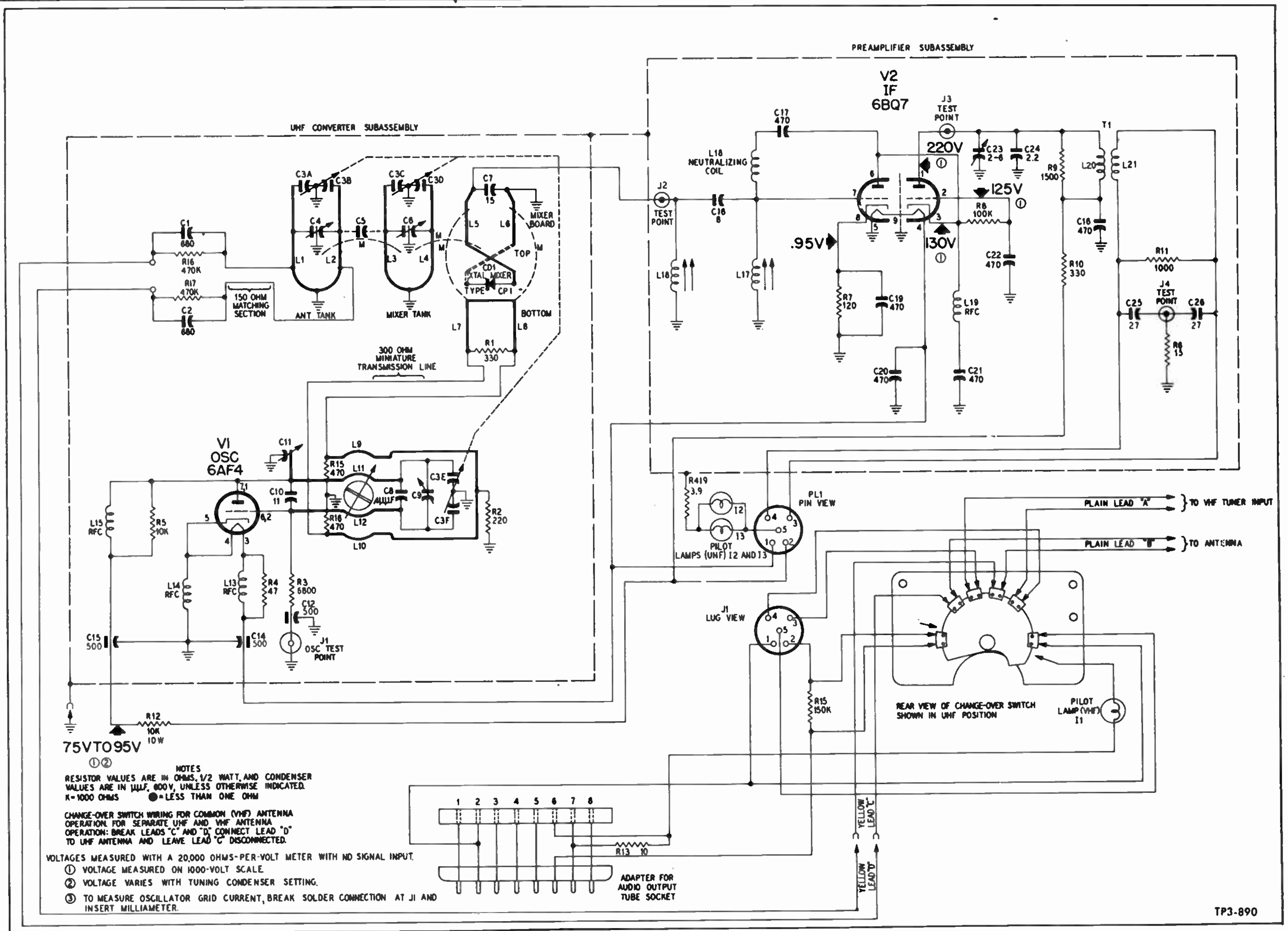


Figure 42. UHF Tuner-Adapter UT21D, Part No. 43-6778, Schematic Diagram

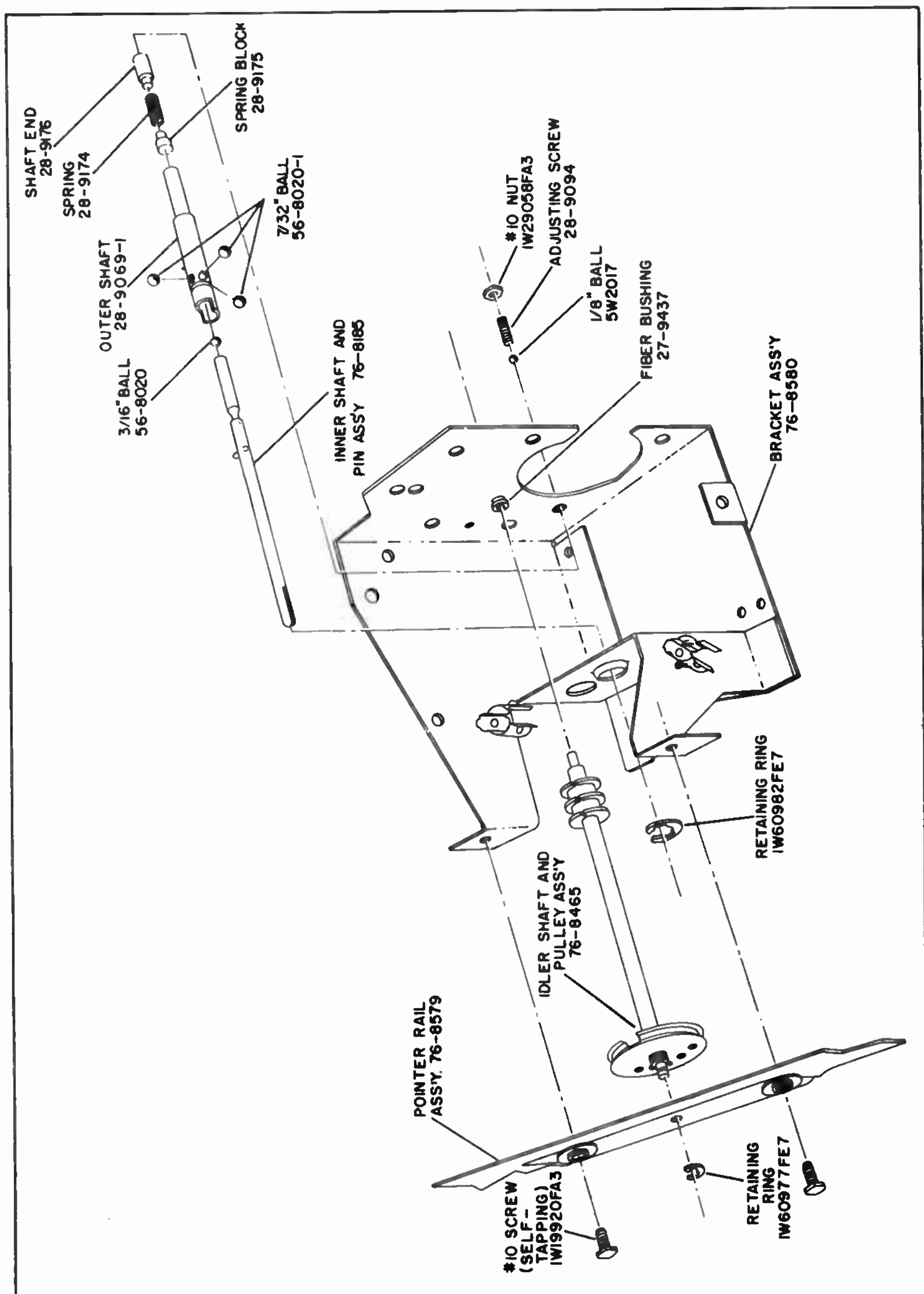


Figure 40. Planetary Drive Assembly, Exploded View, Showing Mechanical Construction

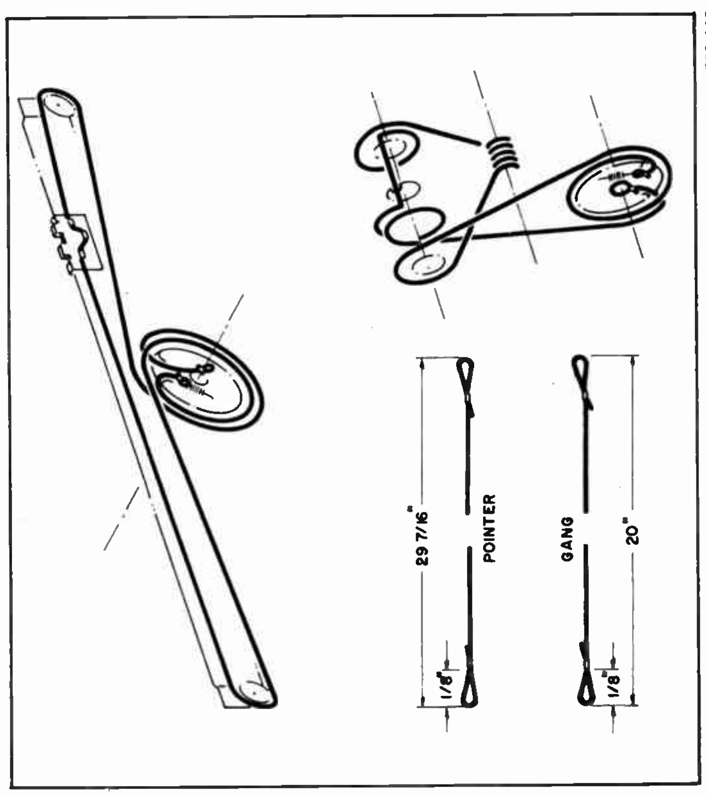


Figure 41. Drive Cord Stringing Arrangement

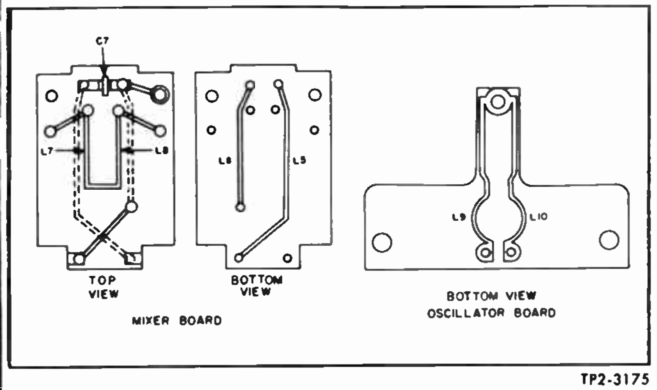


Figure 43. Oscillator and Mixer Board Layout

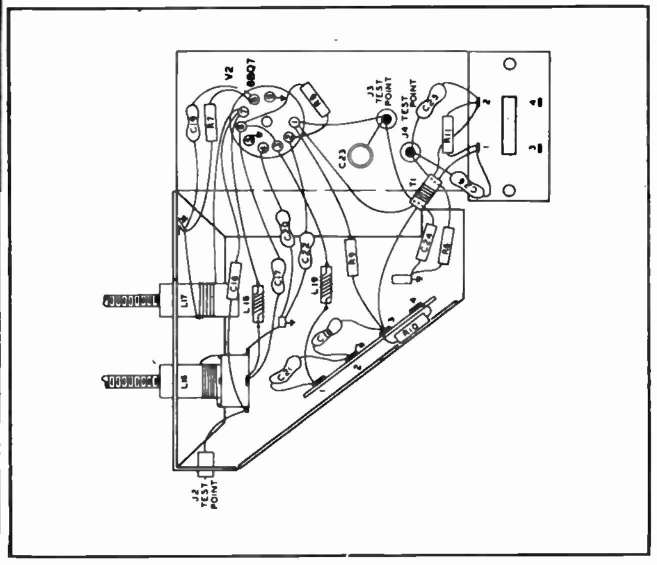


Figure 44. Base View of Tuner-Adapter UT21D, Part No. 43-6778, Preamplifier Assembly

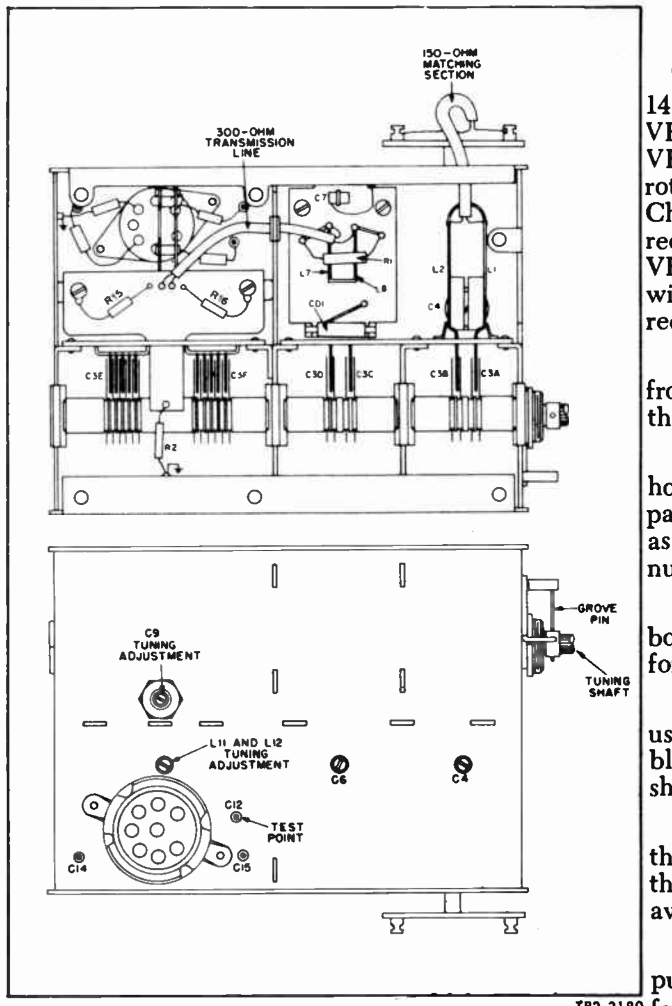


Figure 46. Top View and Base View of Tuner-Adapter UT21D, Part No. 43-6778, With Board Assemblies in Place

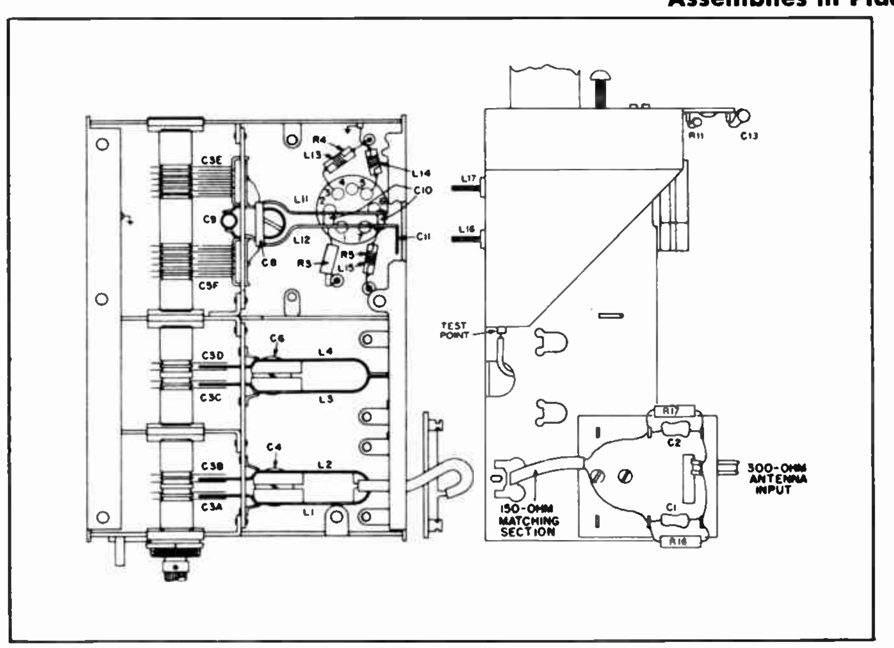


Figure 45. Side View and Base View of Tuner-Adapter UT21D, Part No. 43-6778, Without Board Assemblies

INSTALLATION INSTRUCTIONS

This tuner will provide reception of UHF Channels 14 through 83 by converting the UHF signal to the VHF frequency of Channel 2 or Channel 3. When the VHF CHANNEL SELECTOR of the Receiver is rotated in the counterclockwise direction, either the Channel 2 or Channel 3 position may be used for the reception of the converted UHF signal; when the VHF CHANNEL SELECTOR is rotated in the clockwise direction, both Channel 2 and Channel 3 may be received. To install the tuner, proceed as follows:

1. Remove the cabinet back and the r-f chassis from the cabinet. Then remove the nameplate from the control panel.

2. Insert the dial scale and bezel assembly into the hole provided in the cabinet. The four studs should be passed through the four holes provided. Fasten the assembly in place with the washers and small pal-nuts supplied.

3. Remove the tuner assembly from the mounting board with which it was shipped. Keep the screws for mounting the tuner in the cabinet.

4. Place the spacers on the mounting studs, and use the studs to attach the bracket and socket assembly to the rear of the VHF tuner on the r-f chassis, as shown in figure 47.

5. Place the switch-actuator assembly on the shaft that extends from the rear of the VHF tuner; position the assembly so that the switch-actuator studs point away from the tuner. See figure 47.

6. Place the switch assembly on the mounting studs, push the switch toward the top of the tuner, and fasten it in place with the washers, lock washers, and nuts provided. See figure 47.

7. Set the VHF CHANNEL SELECTOR to Channel 3, and rotate the switch actuator on the tuner shaft in the counterclockwise direction (as viewed from the rear of the VHF tuner) until the switch-actuator studs are positioned as shown in figure 48. Exert slight pressure against the actuator in the clockwise direction, and fasten the actuator securely on the shaft in this position. Then check to make certain that the operation of the UHF-VHF change-over switch and actuator is as follows: When the change-over switch is thrown to UHF in the Channel 3 position, the switch actuator should throw to the position shown in figure 49. The change-over switch should throw to UHF on Channels 2 and 3 when the VHF CHANNEL SELECTOR is switched from Channel 4 to Channel 3 and then to Channel 2. The change-over switch should not throw when the VHF CHANNEL SELECTOR is switched from Channel 13 to Channel

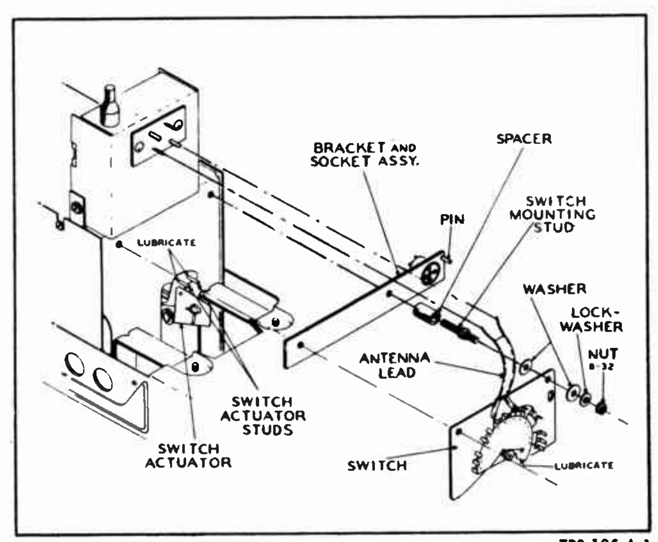


Figure 47. UHF-VHF Change-over Switch, Showing Mounting Details

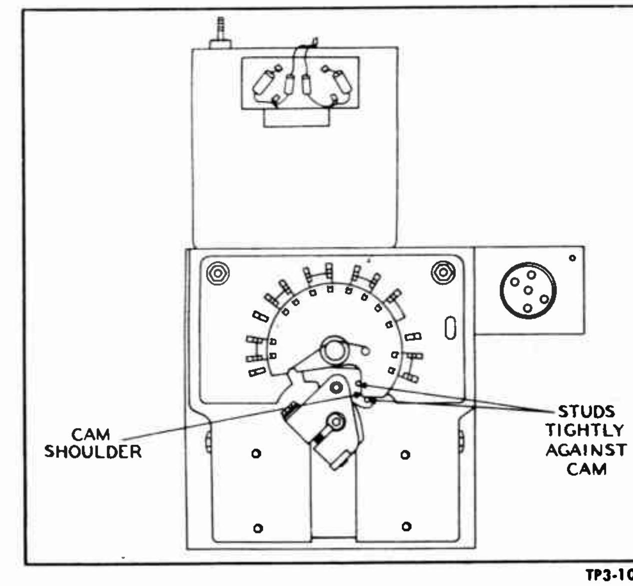


Figure 48. Switch Actuator Stud Position with Change-over Switch in VHF Position and VHF CHANNEL SELECTOR on Channel 3

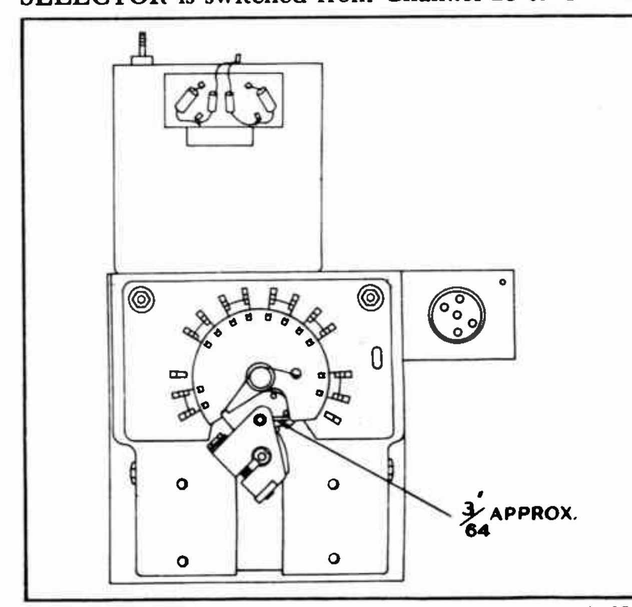


Figure 49. Switch Actuator Stud Position with Change-over Switch in UHF Position and VHF CHANNEL SELECTOR on Channel 3

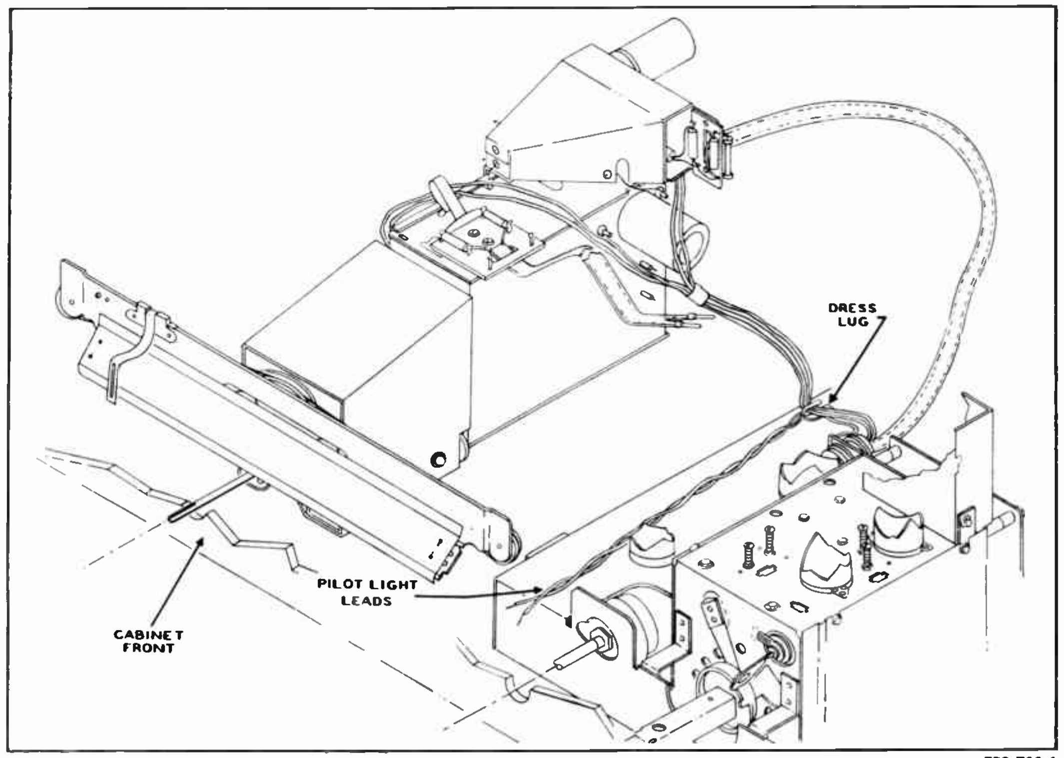


Figure 50. Lead Dress and UHF Tuner Mounting Details

2 and then to Channel 3. Make certain that the actuator clears the cam shoulder when the CHANNEL SELECTOR is switched from Channel 3 to Channel 4. If the switch does not throw properly, reposition the switch on the mounting studs and the switch actuator on the VHF tuner shaft until the switch operates as described above. Lubricate the switch cam and switch actuator studs with cup grease.

8. Remove the bulb and shield from the pilot-light assembly on the r-f chassis, place the bulb in the empty socket of the UHF tuner assembly, and place the shield over the bulb. Cut the pilot-light leads about one inch from the chassis, and tape up each end separately.

9. Remove the audio output tube, plug the octal adapter into the tube socket, and place the tube in the adapter socket. The octal adapter is wired to the switch.

CAUTION: MAKE SURE THAT THE LEADS DO NOT TOUCH THE TUBES.

10. Remove the antenna lead from the VHF tuner, and solder the short lead from the UHF-VHF change-over switch to the VHF tuner antenna terminals from which the antenna lead was removed. See figure 47. Insert the two twin-wire leads from the change-over switch through the paper lead holder, and then slide the lead holder over the tapered-line assembly on the VHF tuner.

11. Fasten the dress lug to the chassis with the screw provided (sec figuro 50).

12. Place the UHF tuner in the cabinet, in the center of the chassis shelf, and position it so that the UHF knob shaft protrudes 9/16 inch from the front of the cabinet. Fasten the UHF tuner to the chassis shelf with the three screws removed in step 3. It is important that these screws be tightened securely to hold the UHF tuner firmly in place on the chassis shelf. Turn the UHF tuning shaft to its extreme counterclockwise position, and check the pointer position on the scale. If the pointer is not properly positioned, loosen the three mounting bolts, move the UHF tuner to properly position the pointer, and fasten the assembly with the three mounting screws.

13. Install the r-f chassis in the cabinet, and insert the pilot-light socket into the pilot-light clip. Fasten the r-f chassis with the original bolts, and place the original knobs on their shafts.

14. Connect the 5-pin plug of the UHF tuner to the 5-pin socket in the bracket and socket assembly installed in step 4. Connect the remaining single-wire lead from the UHF tuner to the single pin located near the 5-pin socket. Dress the leads under the dress lug as shown in figure 50.

15. Replace the fishpaper antenna-lead holder with the new holder provided. Fasten the new holder with the two nails supplied, and then pass the twin-wire leads through the holes as shown in figure 51. Wrap tape around the yellow-marked twin-wire leads with the lug ends, to prevent the leads from passing back through the twin holder.

16. Fasten the antenna terminal board on the cabinet back. Replace the cabinet back on the cabinet, and dress the leads through the back. Connect the antennas to their respective terminal boards as shown in figures 52 through 56.

17. Paste the label provided over the outside-antenna instructions on the cabinet back.

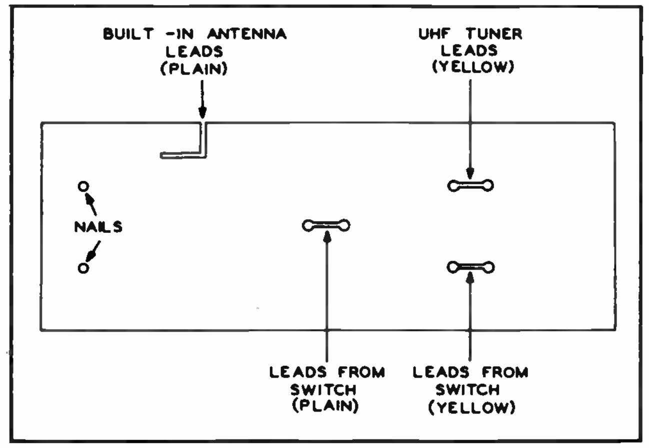


Figure 51. Antenna Lead Holder

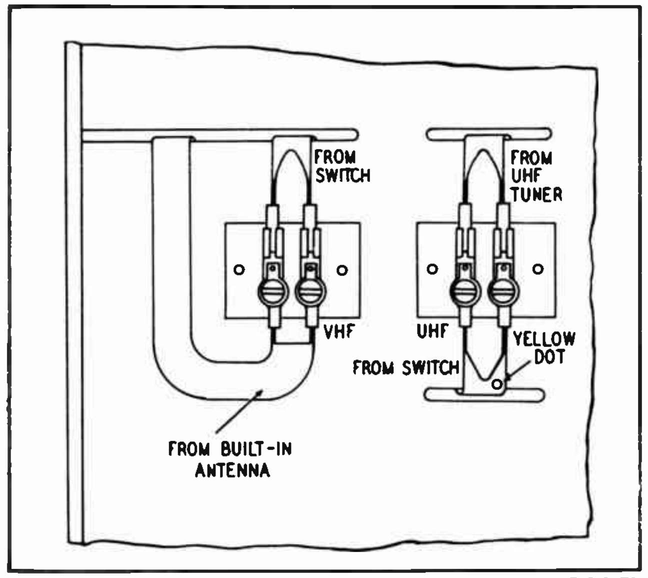


Figure 52. Antenna-Lead Connections, Common Built-in Antenna

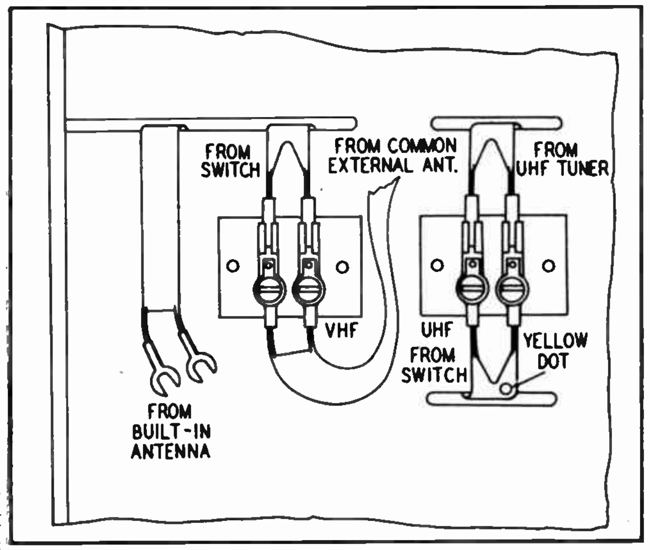


Figure 53. Antenna-Lead Connections, Common External Antenna

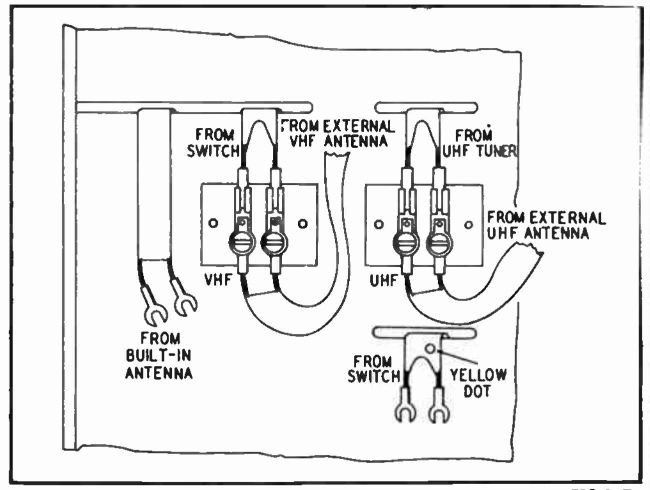


Figure 54. Antenna-Lead Connections, Separate External Antennas

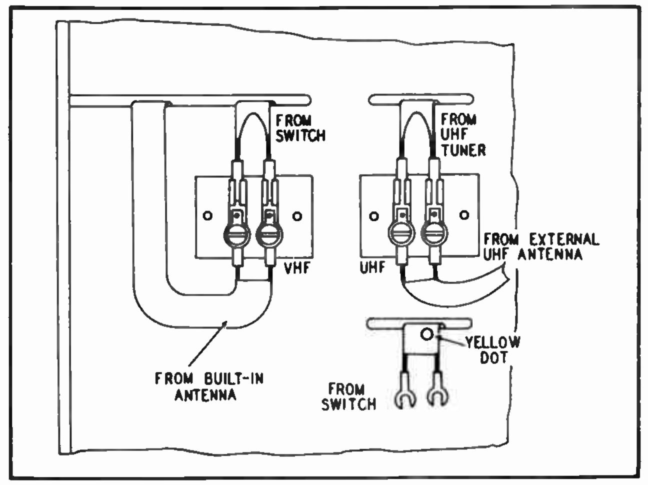


Figure 55. Antenna-Lead Connections, VHF Built-in and UHF External Antennas

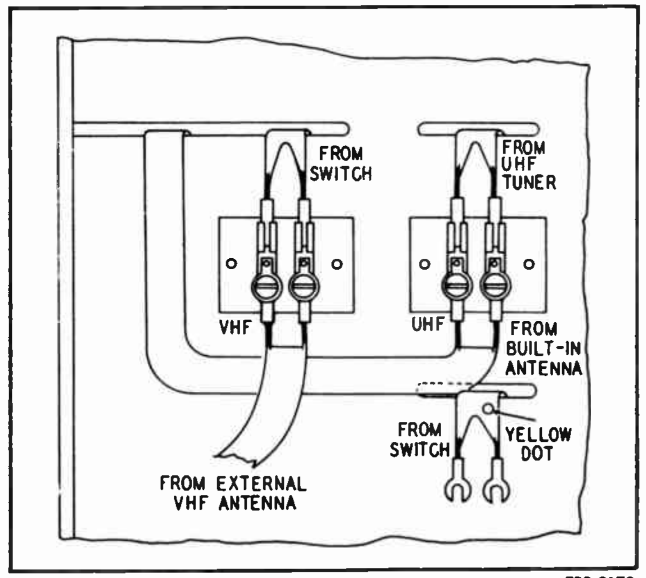


Figure 56. Antenna-Lead Connections, VHF External and UHF Built-in Antennas

PARTS LIST

IMPORTANT

General replacement items commonly stocked by the serviceman are omitted from this parts list. All condensers are molded-bakelite Philco condensers, with a 600-volt rating, and all resistors are ½ watt, unless otherwise indicated. Parts are listed according to chassis type, and should be ordered in this way rather than by model number. A list of miscellaneous parts is given at the end of the parts list for each chassis type. All parts are symbolized in the schematic diagram and base layout, for identification purposes.

NOTE: Part numbers identified by an asterisk (*) are general replacement items. These numbers may not be identical with those on factory parts. Also, the electrical values of some replacement items may differ from the values indicated in the schematic diagram and parts list. The values substituted in any case are so chosen that the operation will be unchanged. When ordering replacements, use only the "Service Part No."

DEFLECTION CHASSIS D-181

SECTION 1—POWER SUPPLY

Reference Symbol	Description	Service Part No.
C100 and C101	Condensers, electrolytic filter, 120 µf., 150v	30-2568-51
C103	Condenser, electrolytic filter, 80 µf., 300v	30-2584-35
CR100 and CR101	Rectifiers, selenium, 300 ma.	34-8003-16
F100	Fuse, line, 1.6 amperes	45-2656-23
F101	Fuse, heater protective link	Piece of No. 26 wire
J101	Socket, chassis connecting	27-6274-1
J100	Socket, a-c line	27-6240-3
PL101	Plug and cable ass'y., chassis connecting	(See Misc. "B")
PL100	Plug, a-c line	Part of a-c line cord ass'y. (see Misc. "A")
R100	Resistor, current limiting, 5 ohms, 10 watts	33-3448-5
R101	Resistor, voltage dropping	20 inches of No. 24 wire
R103	Resistor, voltage dropping, 4.7 ohms, 1 watt	66-9478340
S100	Switch, off-on	Part of R412
T100	Transformer, filament	32-8573-1

SECTION 7—VERTICAL SWEEP

Reference Symbol	Description	Service Part No.
L700 and L701	Coils, vertical deflection	Part of deflection yoke (see Misc. "A")
R704	Resistor, vertical-oscillator plate load, 150,000 ohms, 1 watt	66-4154340
R705	Resistor, vertical-oscillator cathode, 2200 ohms, ½ watt, 5%	66-2228240
R706	Resistor, vertical-oscillator grid, 510,000 ohms, ½ watt, 5%	66-4518240
R707	Potentiometer, VERT. HOLD control, 1 megohm	Part of R812
R709	Potentiometer, HEIGHT control, 2.5 megohms	33-5565-32
R712	Potentiometer, VERT. LIN. control, 2.5 megohms	33-5565-32
R716	Resistor, vertical-output damping, 100,000 ohms, 1 watt	66-4104340
R717	Resistor, vertical-output decoupling, 1800 ohms, 5 watts	33-1335-102
T700	Transformer, vertical output	32-8625

SECTION 8—HORIZONTAL SWEEP

Reference Symbol	Description	Service Part No.
C806	Condenser, by-pass, 82 µµf.	60-00825317
C808A	Condenser, electrolytic, 10 µf., 300v	Part of C103
C808B	Condenser, electrolytic, 20 µf., 475v	Part of C103
C809	Condenser, coupling, 390 µµf.	60-10395417
C811	Condenser, saw-tooth forming, 390 µµf.	60-10395417
C815	Condenser, damping, 68 µµf.	30-1246-1*
J800	Socket, deflection-yoke connector	27-6274-8
L800	Coil, horizontal stabilizing, 30 to 80 mh.	32-4557
L801	Coil, r-f choke, horizontal-output plate	Part of T800
L802 and L803	Coils, horizontal deflection	Part of deflection yoke (see Misc. "A")
L804	Coil, r-f choke, damper cathode	32-4112-24
L805	Coil, r-f choke, damper plate	32-4112-24
R810	Potentiometer, HORIZ. HOLD CENTERING control, 250,000 ohms	33-5565-17
R811	Resistor, feedback coupling, 33,000 ohms, 1 watt	66-334340
R812	Potentiometer, HORIZ. HOLD control, 50,000 ohms	33-5563-62
R816	Resistor, screen supply divider, 5000 ohms, 5 watts	33-1335-118
R817	Potentiometer, WIDTH control, 12,500 ohms	33-5546-51
R820	Resistor, voltage dropping, 39,000 ohms, 2 watts	66-3395340
R821	Resistor, feedback coupling, 33,000 ohms, 1 watt	66-3334340
T800	Transformer, horizontal output	32-8624

MISCELLANEOUS "A"

Description	Part No.
Arm and magnet ass'y., picture tube	76-6594
Beam bender	76-6077-2
Cable assembly, volume control	41-4136-3
Cable and plug ass'y., deflection (17" picture tube)	41-4086-18
Cable and plug ass'y., deflection (21" picture tube)	41-4086-25
Cable, high voltage	AD-2631*
Cord, a-c line	41-3865
Deflection yoke ass'y.	32-9648
Focus ass'y., p.m.	76-6126-4
Insulator, electrolytic condenser mtg.	27-9508-1
Shield, h.v. corona	56-9684
Socket, damper (6AX4GT)	27-6174-7
Socket, high-voltage rectifier (1B3GT)	27-6290-1
Socket, horizontal oscillator (12AU7)	76-6115-1
Socket, horizontal output (6BQ6GT)	27-6174
Socket, horizontal phase comparer (6AL5)	27-6203-12
Socket, vertical oscillator (12BH7)	27-6203-6
Socket, vertical output (12B4)	76-6115-2
Spring, high-voltage cable	28-9137

R-F CHASSIS R-181

SECTION 2—VIDEO I.F.

Reference Symbol	Description	Service Part No.
C200	Condenser, d-c blocking, 47 µµf.	60-00475420
C201	Condenser, trap, 18 µµf.	62-018400021
C204	Condenser, fixed trimmer, 22 µµf.	62-022009001
C205	Condenser, d-c blocking, 100 µµf.	62-110409001
C208	Condenser, electrolytic	30-2570-57
C208A	Condenser, filter, 40 µf., 300v	Part of C208
C208B	Condenser, decoupling filter, 10 µf., 300v	Part of C208
C211	Condenser, detector by-pass, 5 µµf.	30-1224-28
CD200	Crystal, video detector, 1N64	34-8022
I200	Pilot light	34-2068
J200	Socket, video test and fringe switch	27-6273
L200 and L201	Coils, tuner coupling	Part of T200
L202	Coil, 1st i-f grid	32-4486-32
L203	Coil, 28.1-mc. trap	32-4486-27
L204	Coil, 1st i-f plate	32-4486-30
L205	Coil, 22.1-mc. trap	32-4496
L206	Coil, filament choke	32-4112-15
L207 and L208	Coils, coupling	Part of T201
L209 and L210	Coils, coupling	Part of T202
L211	Coil, series peaking, 40 µh.	32-4143-1
L212	Coil, series peaking, 4 µh.	32-4112-24
L213	Coil, series peaking, 125 µh.	32-4480-8
L214	Coil, variable, video peaking, 200—400 µh.	32-4467-17
R202	Resistor, filter, 330 ohms, 1 watt	66-1334340*
R207	Resistor, voltage dropping, 2500 ohms, 6.2 watts	33-3446-5
T200	Transformer, video i-f input	32-4486-32
T201	Transformer, 2nd video i-f	32-4486-29
T202	Transformer, 3rd video i-f	32-4486-33

SECTION 3—VIDEO

Reference Symbol	Description	Service Part No.
C301	Condenser, 4.5-mc. trap, 68 µµf.	62-068409011
C302	Condenser, filter, 10 µf., 300v	Part of C208
L300	Coil, 4.5-mc. trap	32-4463-2
L301	Coil, series peaking, 180 µh.	32-4480-9
L302	Coil, variable, video peaking, 60—200 µh.	32-4467-18
R301	Potentiometer, CONTRAST control, 1000 ohms	Part of R307
R305	Resistor, plate load, 3900 ohms, 7 watts	33-1335-116
R307	Potentiometer, BRIGHTNESS control, 100,000 ohms	33-5563-63

SECTION 4—SOUND

Reference Symbol	Description	Service Part No.
C400	Condenser, coupling, 2.2 µµf.	30-1221-6
C401	Condenser, fixed trimmer, 18 µµf.	62-018400021
C404	Condenser, fixed trimmer	Part of Z400
C405	Condenser, fixed trimmer	Part of Z400
C406	Condenser, detector balancing, 150 µµf.	62-115001011
C409	Condenser, r-f by-pass, 330 µµf.	62-133001001
C410	Condenser, filter, 2 µf.	30-2417-7
C414	Condenser, plate by-pass, 6800 µµf., 1000v	30-4650-91
C415	Condenser, filter, 20 µf., 300v	Part of C208
J400	Socket, volume control	27-6273
J401	Socket, speaker	27-4785-22
L400	Coil, audio take-off	32-4463-10
L401, L402 and L403	Coils, ratio detector	Part of Z400
L404	Coil, filament choke	32-4112-15
L405	Choke, filter, 1 hy., 60 ohms	32-8617
PL400	Plug, volume control	Part of cable and plug ass'y. (see Misc. "A")
PL401	Plug, speaker	Part of speaker cable ass'y. (see cabinet parts)
R401	Resistor, screen dropping, 12,000 ohms, 1 watt	66-3124340*
R409	Resistor, cathode bias, 270 ohms, 1 watt	66-1274340*
R410	Resistor, screen dropping, 4700 ohms, 1 watt	66-2474340*
R412	Potentiometer, VOLUME control, 2 megohms	33-5564-14
T400	Transformer, audio output	32-8578
Z400	Transformer, ratio detector	32-4450-6A

SECTION 6—SYNC

Reference Symbol	Description	Service Part No.
C600	Condenser, by-pass, 330 µµf.	62-133001001
R603	Resistor, plate load, 18,000 ohms, 2 watts	66-3185340*
R609	Resistor, voltage divider, 1 megohm, ½ watt, 5%	66-5108240
R618	Resistor, voltage divider, 8200 ohms, 1 watt	66-2824340*
R619	Resistor, voltage divider, 10 megohms, ½ watt, 5%	66-6108240
R620	Resistor, decoupling, 18,000 ohms, 2 watts	66-3185340*

MISCELLANEOUS "B"

Description	Service Part No.
Cable and plug ass'y., chassis connecting	41-4146-10°
Cable and socket ass'y., picture tube	41-4147
Cable and socket ass'y., pilot light	27-6233-103°
Shield, tube, 6T8	56-5629-5
Shield, tube, 6CB6	56-5629FA3
Shield, pilot light	56-9074-2FA3
Socket and base ass'y., 6CB6	27-6203-14
Socket and base ass'y., 6T8	27-6203-18
Socket, tube, 7-pin miniature	27-6203
Socket, tube, 9-pin miniature	27-6203-6°
Socket, tube, octal	27-6174

SECTION 5—TV TUNER, PART No. 76-7664

Reference Symbol	Description	Service Part No.
C500 and C501	Condensers, antenna isolating, 470 μμf.	30-1225-18
C502	Condenser, FM trap, 20 μμf.	62-020309011
C503	Condenser, coupling, 220 μμf.	62-122001001
C504	Condenser, by-pass, 10 μμf.	62-010409011
C505	Condenser, neutralizing, 2.2 μμf.	30-1221-6
C506	Condenser, grid by-pass, 150 μμf.	62-115001011
C507	Condenser, decoupling, .01 μf.	30-1238-2°
C508	Condenser, trimmer, r-f plate, .5—3 μμf.	31-6520-3
C509	Condenser, by-pass, 150 μμf.	62-115001011
C510	Condenser, coupling, .5 μμf.	30-1221-15
C511	Condenser, coupling, 39 μμf.	62-039409011
C512	Condenser, trimmer, mixer grid, .5—3 μμf.	31-6520-3
C513	Condenser, oscillator coupling, 1.5 μμf.	30-1221-8
C514	Condenser, grid blocking, 22 μμf.	62-022009001
C515	Condenser, fixed trimmer, 2.2 μμf.	30-1224-66
C516	Condenser, FINE TUNING (bakelite tube)	76-6935-1
C517	Condenser, fixed trimmer, 15 μμf.	62-015409011
C519	Condenser, feed-through, 1000 μμf.	30-1245-1
C520	Condenser, feed-through, 1000 μμf.	30-1245-1
C521	Condenser, by-pass, 150 μμf.	62-115001011
C522	Condenser, coupling, 4.7 μμf.	30-1221-13
C523	Condenser, coupling, 1.5 μμf.	30-1221-8
L500, L501, L502, and L503	Coils, tapered line	32-4432-2
L504	Coil, FM trap	32-4438-2
L505 to L511 incl.	Coils, antenna tuning	Part of WS500A
L512	Coil, r-f coupling	32-4550-10
L513 to L519 incl.	Coils, r-f plate tuning	Part of WS500B
L520 to L526 incl.	Coils, mixer grid tuning	Part of WS500C
L528	Coil, mixer plate	32-4550-7
L529	Coil, i-f primary	32-4359-13
L530 and L531	Coils, r-f choke	32-4500-1
L532 to L538	Coils, oscillator tuning	Part of WS500D
R508	Resistor, oscillator feed, 10,000 ohms, 1 watt	66-3104340
R510	Resistor, mixer plate feed, 27,000 ohms, 1 watt	66-3274340
WS500A(F) and WS500A(R)	Switch, wafer, antenna	76-7654

SECTION 5—TV TUNER, PART No. 76-7664 (Cont.)

Reference Symbol	Description	Service Part No.
WS500B(F) and WS500B(R)	Switch, wafer, r-f plate	76-7656
WS500C(F) and WS500C(R)	Switch, wafer, mixer grid	76-7658
WS500D(F) and WS500D(R)	Switch, wafer, oscillator	76-7660
Z500	Tapered-line ass'y.	76-7661

MISCELLANEOUS "C"

Description	Service Part No.
Cam and shaft, fine tuning	76-6936
Coupling, fine tuning shaft	54-4912
Detent, ball	56-8020
Front panel ass'y.	76-6928-2
Hairpin, plunger	1W42704FA3
Hairpin, plunger grounding	56-9858
Pivot pin, lever	56-9149
Lever, plunger	56-9148
Plunger	56-8034-1
Retaining ring	1W61043
Shaft	76-6914-3
Shaft, extension	56-8358
Shield, tube, 9-pin miniature	56-5629-5
Socket, tube, 9-pin miniature	27-6203-21
Spring, shaft	56-8023
Spring, plunger	56-9628
Spring, rotor index detent	56-9158
Terminal panel, antenna	76-5504-2
Washer	56-9351
Washer, fiber	27-4109-13
"E" washer	1W60980FE5
Washer, spring	56-9157

CONNECTING CABLES, PLUGS AND SOCKETS

Reference Symbol	Description	Service Part No.
J101	Socket, chassis connecting	27-6274-1
J100	Socket, a-c line	27-6240-3
J200	Socket, video test and fringe switch	27-6273
J400	Socket, volume control	27-6273
J401	Socket, speaker	27-4785-22
J800	Socket, deflection-yoke connector	27-6274-8
PL101	Plug and cable ass'y., chassis connecting	41-4146-10
PL100	Plug and line cord ass'y.	41-3865
PL400	Plug and cable ass'y., volume control	41-4136-3°
PL401	°°Plug and cable ass'y., speaker	See cabinet parts list
PL800	Plug and cable ass'y., deflection	41-4086-25
	Cable, high voltage	AD-2631
	Cable and socket ass'y., picture tube	41-4147
	Cable and socket ass'y., pilot light	27-6233-103

°°NOTE: The length of this cable varies with cabinet and speaker size. For Service Part No. refer to cabinet parts list in Philco Service Bulletins.

UHF TUNER-ADAPTER UT21D, PART No. 43-6778

Reference Symbol	Description	Service Part No.
C1 and C2	Condenser, antenna input, 680 μμf.	Part of Panel, filter
C3	Condenser, tuning: Shaft and rotor ass'y.	76-7481-3
C3A	Stator, r-f, ell.h.	56-9595
C3B	Stator, r-f., r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator ass'y., oscillator	76-7479
C3F	Stator ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f	76-7472
C7	Condenser, mixer tank, 15 μμf.	Part of Board ass'y., mixer
C8	Condenser, temperature compensating, .4 μμf.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 11 μμf.	Part of Tank ass'y., osc.
C11	Condenser, trimmer	Part of Tank ass'y., osc.
C12	Condenser, grid by-pass, 1000 μμf.	30-1245-1
C13	Condenser, output tuning, 2—8 μμf.	31-6527
C14	Condenser, heater by-pass, 1000 μμf.	30-1245-1
C15	Condenser, plate by-pass, 1000 μμf.	30-1245-1
C16	Condenser, input coupling, 8 μμf.	30-1224-46
C17	Condenser, neutralizing, 470 μμf.	62-147001011
C18	Condenser, decoupling, 470 μμf.	62-147001011
C19	Condenser, cathode by-pass, 470 μμf.	62-147001011
C20	Condenser, heater by-pass, 470 μμf.	62-147001011
C21	Condenser, cathode tuning, 470 μμf.	62-147001011
C22	Condenser, grid by-pass, 470 μμf.	62-147001011
C23	Condenser, plate tuning, 2—6 μμf.	31-6520-4
C24	Condenser, plate tuning, 2.2 μμf.	30-1221-6
C25 and C26	Condenser, output balancing, 15 μμf.	62-015409011
CD1	Crystal detector, mixer circuit	34-8024
I1	Lamp, pilot, VHF	34-2068
I2	Lamp, pilot, UHF	34-2064
L1	Inductor, r-f, l.h.	Part of C3A Stator

Reference Symbol	Description	Service Part No.
L2	Inductor, r-f, r.h.	Part of C3B Stator
L3	Inductor, r-f, l.h.	Part of C3C Stator
L4	Inductor, r-f, r.h.	Part of C3D Stator
L5 and L6	Inductors, crystal mixer	Part of Board ass'y., mixer
L7 and L8	Inductors, oscillator coupling	Part of Board ass'y., mixer
L9 and L10	Inductors, oscillator	Part of Board ass'y., osc.
L11 and L12	Inductors, oscillator	Part of Tank ass'y., osc.
L13	Choke, heater decoupling	32-4556
L14	Choke, oscillator cathode	32-4550-6
L15	Choke, oscillator plate	32-4556-2
L16	Coil, input tuning primary	32-4359-14
L17	Coil, input tuning secondary	32-4578
L18	Coil, neutralizing	32-4551-2
L19	Choke, cathode tuning	32-4548-13
L20	Coil, primary	Part of T1
L21	Coil, secondary	Part of T1
R1	Resistor, damping, 300 ohms	66-1308340
R2	Resistor, damping, 150 ohms	66-1158340
R3	Resistor, decoupling, 8200 ohms	66-2828340
R4	Resistor, decoupling, 47 ohms	Part of L13
R5	Resistor, decoupling, 10,000 ohms	Part of L15
R6	Resistor, parasitic damping, 15 ohms	66-0158340
R7	Resistor, cathode bias, 120 ohms	66-1128340
R8	Resistor, grid leak, 100,000 ohms	66-4108340
R9	Resistor, plate damping, 1500 ohms	66-2158340
R10	Resistor, plate decoupling, 330 ohms	66-1338340
R11	Resistor, output damping, 1000 ohms	66-2108340
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
R13	Resistor, filament dropping, 10 ohms	66-0108340
R14	Resistor, pilot lamp, 3.9 ohms	66-9898340
R15	Resistor, B+ dropping, 150,000 ohms	66-4158340
T1	Transformer, i-f output	32-4575
	Board ass'y., mixer	76-7475-3
	Board ass'y., oscillator	76-7480
	Panel, filter	76-8078-1
	Tank ass'y., oscillator	76-7473
	Padder ass'y., oscillator	76-7564

MISCELLANEOUS

ELECTRICAL PARTS

Description	Service Part No.
Cable ass'y., pilot light	27-6233-50
Padder ass'y. (L11 and L12 tuning adjustment)	76-8193
Panel, antenna, UHF	76-7097
Switch	42-1996-4

MECHANICAL PARTS

Description	Service Part No.
Tuner Shaft Mounting:	
Ball, bearing (10)	W2510-5
Bearing, front	56-9593
Bearing, rear	56-9609
Grove pin	1W41033FA3
Nut, front bearing	56-9594
Nut, rear bearing	56-9599
Nut, insert	W1679-1AF3
Switch Mounting:	
Actuator assembly	76-8442
Bracket and socket assembly	76-8426
Collar stud (2)	28-9126-1
Lock washer (2)	1W24515FA1
Nut, #8, special (2)	1W20506FA3
Spacer, 3/8" (2)	1W29155FA3
Washer, fiber (2)	27-4109-29
Planetary Assembly:	
Bracket	76-8580
Ball, ⅛"	5W2017
Ball, 3/16"	56-8020
Ball, 7/32"	56-8020-1
Block, spring	28-9175
Insulator, tuning shaft	27-9437
Pulley and shaft assembly, idler	76-8465
Ring, retaining, drive shaft	1W60982FE7
Ring, retaining, idler shaft	1W60977FE7
Shaft, inner, end	28-9176
Shaft, outer	28-9069-1
Shaft and pin assembly, inner	76-8300

MECHANICAL PARTS Cont.)

Description	Service Part No.
Screw, adjusting	28-9094
Spring	28-9174
Background, dial	54-9059
Dial scale and bezel assembly	76-8293-1
Foot and insulator assembly	76-8505
Grommet, feed-through	27-4707
Knob	76-8292
Lock washer, mounting (2)	1W24254FA3
Nut, mounting (2)	1W19982FA3
Panel, antenna	76-7097
Pointer, dial	28-9605
Pulley, tuner shaft	28-9090-1
Screw, #4, mounting (2)	1W10583FA3
Screw, (2)	1W32694FA3
Screw, 8/32 (3)	1W32696FA3
Screw, #8 (3)	1W19907FA3
Screw, #10 (2)	1W19920FA3
Shield, 6BQ7 tube	56-5629-5
Shield, 6AF4 tube	56-5629-9
Socket, 9-pin miniature	27-6203-21
Socket, 7-pin miniature	27-6288
Spacer, (3)	54-9042
Spring clip, dial background (2)	28-9606
Spring, converter (6)	28-9339
Spring, drive cord	28-9490
Spring, pointer drive	28-9098
Terminal panel	76-5504
Trimount, spring fasteners (6)	W2235-7FA9
Washer, insulator (3)	54-8544
Washer, fiber (2)	27-4109-29
Assemblies:	
Tuner and preamplifier	76-8222-2
Planetary drive assembly	76-8578
Pointer guide assembly	76-8579
Preamplifier assembly	76-8109
Shaft and rotor assembly, tuner	76-7481-3

CIRCUIT DESCRIPTION

The Philco "B" line, Code 150 television receivers use two chassis, the r-f chassis, R-204, containing the r-f, video, audio, and sync circuits, and the deflection chassis, D-204, containing the power and deflection circuits.

Since these chassis are not isolated from the 60-cycle power line, all protruding shafts and mounting feet are insulated from the chassis.

CAUTION: See A-C Line Isolation.

The r-f amplifier, oscillator, and mixer section is built on a separate subchassis. The r-f amplifier uses a 6BZ7 tube, V1. The oscillator and mixer each use one half of a 12AZ7 tube, V2. The output of the mixer is fed to a four-stage, stagger-tuned, i-f amplifier system employing four 6CB6 tubes, V3, V4, V5, and V6. A 1N64 crystal diode is used for the video detector. One half of a 6U8 tube, V7A, is used as the first video amplifier, which drives a 6AQ5 video output amplifier, V8.

Sound i.f. (intercarrier) is obtained by utilizing the beat frequency produced when the 45.75-mc. video carrier and the 41.25-mc. sound carrier are mixed in the video detector. The beat frequency, 4.5 mc., is the difference between 45.75 mc., and 41.25 mc., and contains the FM sound signal. This 4.5-mc. signal contains only a negligible amount of the video amplitude modulation, provided that the amplitude of the 41.25-mc. signal is considerably lower than that of the 45.75-mc. signal. The proper relative amplitudes of the two carriers are established in the alignment of the receiver. There is sound output only when both the video and sound carriers are present.

The oscillator is tuned primarily to obtain the best picture, since the 4.5-mc. relationship always exists between the two carriers. The 4.5-mc. sound i.f. (intercarrier), which is taken from the video detector, is amplified by a 6BA6 tube, V9, and a 6AU6 tube, V10, and is fed to the FM detector, which utilizes two diode sections of a 6T8 tube, V11A. The triode section of the 6T8 tube, V11B, is used as the first audio amplifier. The power amplifier uses a type 6L6GA tube, V12.

A-G-C voltage for the video i-f system and the r-f amplifier is obtained from a keyed a-g-c system which uses a 6AU6 tube, V13, as the a-g-c gate. Composite video from the video-amplifier plate circuit, V7A, is fed to the grid of the a-g-c gate tube, while a gating or keying pulse, obtained from a winding on the horizontal-output transformer, located on the deflection chassis, is applied to the plate. The sync-pulse polarity applied to the grid of V13 is positive; therefore, the a-g-c gate can conduct in proportion to the amplitude of the sync-pulse tips if the gating or keying pulse occurs at the same time as the sync. Because the keying or gate pulse is of constant amplitude, approximately 500 volts peak, the amplitude of the sync pulse determines the amount of conduction in the gate tube. The plate current of the keyed a-g-c gate tube flows through R220, R219, and R218, developing a voltage which is negative with respect to the chassis and whose amplitude is proportional to the plate current. This negative voltage is used to control the gain of the receiver. Since conduction cannot occur in the a-g-c gate tube unless the sync pulse and gating pulse occur at the same time, noise disturbances that occur during the intervals between sync pulses cannot affect the a-g-c voltage.

Composite video for the sync circuits is taken from the plate circuit of the video amplifier, V7A. The full output of the amplifier is fed to the grid of the noise inverter, one half of a 12AU7 tube, V14B, and to the grid of the sync separator, one half of a 6U8 tube, V7B. The noise inverter is operated with a low value of plate voltage and high bias (applied to the cathode by a voltage-divider network), which keeps the tube beyond cutoff. When the composite video signal is applied to the grid of the noise inverter through C601, the sync appears as positive pulses; noise which could affect the sweep circuits also appears as positive pulses. Harmful noise pulses usually have amplitudes far greater than the sync pulses, and, therefore, drive the grid of the noise inverter positive sufficiently to allow conduction in the noise-inverter plate circuit. To prevent the noise inverter from conducting during the sync-pulse interval, the gated leveler, using one half of a 12AU7 tube, V14A, is employed to clamp the sync pulses below the conduction level of the noise inverter. The gated leveler conducts only when the sync pulses and gating pulse occur at the same time, thus leveling the noise-inverter input to the sync-pulse level.

The output of the noise inverter consists of negative-going noise pulses. It should be noted that the noise pulses which exceed the sync level have been passed and their polarity reversed by the noise inverter. The output of the noise inverter is now mixed with the composite video and fed to the grid of the sync separator. Since the composite video fed to the grid of the sync separator has positive sync polarity, the positive noise pulses carried with the composite video would be passed by the sync separator; however, the output of the noise inverter consists of these same noise pulses, but they are of opposite polarity; thus, the noise pulses are cancelled. The output of the sync separator contains only the sync pulses which are fed to the deflection chassis through the connecting cable.

The phase splitter, using one half of a 12AU7 tube, V15A, inverts the sync polarity for proper triggering of the vertical oscillator. The vertical sync is separated from the horizontal sync by the integrator circuit, and is fed to the grid of the vertical blocking oscillator, using one half of a 12AU7 tube, V15B. The output of the vertical oscillator is amplified by the vertical-output amplifier, a 12B4 tube, V16. The output of the amplifier is applied to the vertical-deflection coils through the vertical-output transformer.

The phase splitter also supplies horizontal sync to the phase-comparer diodes, a 6AL5 tube, V17. The horizontal sync outputs are taken from the phase splitter, one from the cathode, the other from the plate circuit. These two outputs are of opposite polarity, and are fed to the two diodes of the phase comparer, the negative pulses to the cathode of V17B, and the positive pulses to the plate of V17A. A saw-tooth voltage is fed to the plate of V17B and the cathode of V17A for comparison of the sync and horizontal-sweep voltages. When the sweep and sync are in phase, no voltage is developed across R800, but when the two signals are out of phase, a voltage is developed. This voltage controls the frequency of the horizontal oscillator, a 12AU7 tube, V18. When this control voltage is positive, it increases the frequency of the oscillator; when the voltage is negative, it reduces the frequency of the oscillator. Thus the control voltage acts to hold the horizontal oscillator in phase with the sync signal. The HORIZ. HOLD control, R811, adjusts the horizontal oscillator to the proper frequency, so that it may be controlled by the phase comparer. The output of the horizontal oscillator is fed to the horizontal-output amplifier, which uses a 6BQ6GT tube, V19.

The screen voltage for the horizontal amplifier is supplied from a voltage-divider network. R816, R815 (the WIDTH control), R822, R313 (the BRIGHTNESS control), and R314 are parts of this divider. R815 varies the voltage applied to the screen, thus adjusting for proper picture width. Adjusting R313 for brightness varies the bias on the picture tube. The change in bias causes a change in beam current, and would tend to result in a change in picture width and variation in the second-anode voltage. However, when the control arm of the BRIGHTNESS control, R313, is moved toward ground, a smaller part of the control is shunted by the 22,000-ohm resistor, R314, and the total resistance of the voltage divider is increased. This increase in resistance results in a decrease in the current through the divider, and the screen voltage on the horizontal amplifier is increased proportionately, thus compensating automatically for the increase in beam current in the picture tube. The horizontal amplifier feeds the deflection coils through the horizontal-output transformer. A 6AX4GT tube, V20, is used as the horizontal damper.

The second-anode voltage for the picture tube is furnished by a high-voltage winding of the horizontal-output transformer, T800, and is rectified by a 1B3GT high-voltage rectifier tube, V21. The B-plus voltage for the receiver is supplied by two selenium rectifiers, CR100 and CR101, in a full-wave voltage-doubler circuit, operating directly from the power line. Bias voltage is obtained from across a filter choke, mounted on the speaker, which is in series with the negative side of the B-plus supply. The B-plus boost voltage, derived from the horizontal-damper circuit, supplies higher B-plus voltage to the vertical amplifier, the vertical oscillator, and the first anode of the picture tube. Filament current for all the tubes except the high-voltage rectifier is supplied by a 110-volt, 60-cycle filament transformer. Filament current for the high-voltage rectifier is supplied by a winding on the horizontal-output transformer.

IMPORTANT

A-C LINE ISOLATION

CAUTION: One side of the a-c line is connected to the chassis through C101 and L406. The other side of the a-c line is connected to the chassis through F100, R100, CR100, and C103, in series. Grounding the chassis will result in a short circuit across one or the other of these two branches in the voltage-doubler circuit. During servicing and alignment, it is desirable that an a-c line isolation transformer capable of handling at least 225 watts (Philco Part No. 45-9600) be used. Failure to use an isolation transformer will greatly increase the shock hazard, and may result in damage to the equipment.

SPECIFICATIONS

VHF TUNING ....Twelve channel, 13-position incremental tuner, covering VHF Television Channels 2 through 13 and UHF position; fine tuning of local oscillator

UHF TUNING (if provided) ....Continuous tuning, covering UHF Television Channels 14 through 83; fine and coarse tuning

INTERMEDIATE FREQUENCIES
Video carrier ....45.75 mc.
Sound (intercarrier) ....4.5 mc.

TRANSMISSION LINE ....300-ohm, twin-wire lead

OPERATING VOLTAGE ....110 to 120 volts, 60 cycles, a. c.

POWER CONSUMPTION..without UHF, 215 watts; with UHF, 220 watts

TUBE COMPLEMENT

REFERENCE SYMBOL	TUBE TYPE	FUNCTION
R-F CHASSIS R-204		
V1	6BZ7—miniature	R-F amplifier
V2	12AZ7—miniature	Oscillator, mixer
V3, V4, V5, V6	6CB6—miniature	Video i-f amplifiers
V7	6U8—miniature	Video amplifier, sync separator
V8	6AQ5—miniature	Video output
V9	6BA6—miniature	First sound i-f amplifier
V10	6AU6—miniature	Second sound i-f amplifier
V11	6T8—miniature	FM detector, first audio amplifier
V12	6L6GA—octal	Audio output
V13	6AU6—miniature	A-G-C gate
V14	12AU7—miniature	Gated leveler, noise inverter
V22	17YP4 or 21ZP4A or 21EP4A	Picture tube
DEFLECTION CHASSIS D-204		
V15	12AU7—miniature	Phase splitter, vertical oscillator
V16	12B4—miniature	Vertical output
V17	6AL5—miniature	Phase comparer
V18	12AU7—miniature	Horizontal oscillator
V19	6BQ6GT—octal	Horizontal output
V20	6AX4GT—octal	Damper
V21	1B3GT—octal	High-voltage rectifier

B SUPPLY FUSE REPLACEMENT

The B supply protective fuse, F100, is wired into the low-voltage section, and is in series with the selenium rectifiers. For replacement, use a 1.6-ampere delayed-action-type fuse, Philco Part No. 45-2656-23.

CAUTION: Discharge the circuit before replacing the fuse.

HORIZONTAL-OSCILLATOR ADJUSTMENT

To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

1. Reduce the width of the picture so that approximately one inch of blank screen appears on the right-hand and left-hand sides of the picture.

2. Increase the BRIGHTNESS control setting so that the blanking time becomes visible. This appears as a dark bar along the right-hand and left-hand sides of the picture.

3. Connect a .1-µf. condenser from pin 2 of the gate-pulse socket, J801, to ground.

4. Set the HORIZ. HOLD control to the center of its mechanical rotation.

5. Adjust the HORIZ. HOLD CENTERING control to bring the picture into the center of the blanking bars. When the picture is centered in the blanking bars, the bars on the right-hand and left-hand sides of the picture will be of equal width.

6. Remove the .1-µf. condenser previously connected to pin 2 of the gate-pulse socket.

7. Adjust the horizontal ringing coil, L800, until the picture is again centered in the blanking bar.

8. Rotate the HORIZ. HOLD control through its range. The picture should fall out of sync on both sides of the center of its rotation. If the picture does not fall out of sync to both sides, readjust the HORIZ. HOLD CENTERING control to obtain fall-out to either side of sync.

9. Rotate the HORIZ. HOLD control through its range and observe the number of diagonal blanking bars just before the picture pulls into sync. The pull-in should occur with from 1 to 2 diagonal bars when the sync position is approached from either direction. If proper pull-in is not obtained, repeat the above procedure.

VIDEO PEAKING-COIL ADJUSTMENT

The video peaking coils, L305 and L307, are adjusted at the factory for proper transient response of the video amplifiers. Ordinarily, these coils will require no further adjustment by the serviceman except in cases where they have been tampered with, or where replacement becomes necessary. Under normal circumstances, when alignment of the tuner or i-f stages is undertaken, the video peaking coils should not require adjustment.

Before adjusting L305 and L307, check both the tuner and i-f alignment. (Never adjust L305 and L307 until the alignment of the receiver is correct.) Then tune in a station and adjust the receiver to give a picture of the best obtainable quality, with medium contrast. Turn the fine tuning control clockwise until a very slight beat pattern appears in the picture. Carefully observe the appearance of the picture regarding smear or overshoot (trailing whites). A small amount of overshoot may be desirable, to produce a sharper picture. Conversely, in weak-signal areas, a small amount of smear may be desirable, to reduce the harsh appearance of snow. The adjustments of L305 and L307, and their effects on the picture are as follows:

1. The amount of overshoot may be reduced by turning both TC302 and TC303 counterclockwise.

2. The amount of smear may be reduced by turning both TC302 and TC303 clockwise.

Normally, the point of proper adjustment is where minimum smear and trailing whites appear in the picture; however, a compromise adjustment may be made to suit prevailing conditions. As a rule, when properly adjusted, the adjustment screws (TC302 and TC303) should protrude from the chassis by approximately ½ to ¾ inch.

TELEVISION ALIGNMENT

GENERAL

The alignment consists of tuning each i-f coil to a given frequency, using an AM signal, and then feeding in a sweep signal at the antenna terminals and touching up the adjustments to obtain the desired pass band.

The over-all response curve (r-f, i-f) of the circuits from the antenna terminals to the video detector, after the i-f stages have been aligned, should appear essentially the same, regardless of the channel under test. If not, the tuner should be aligned. Before aligning the tuner, refer to the CAUTION given under Procedure, in Tuner Bandpass Alignment.

The video-carrier intermediate frequency is 45.75 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the receiver chassis and the test equipment. This is most easily obtained if the top of the workbench is metallic. The receiver chassis should be placed tuner-side-down on the bench. If the bench has no metallic top, the test equipment and chassis can be bonded by a strip of copper about two inches wide. The section of the chassis nearest the tuner should rest on the strip.

2. Do not disconnect the picture tube, picture-tube yoke, or speaker while the receiver is turned on.

3. Allow the receiver and test equipment to warm up for 15 minutes before starting the alignment.

4. The marker (AM) signal generator should be calibrated accurately to the frequencies used and to the sound and video r-f carriers of each channel used during alignment. If the Philco Model 7008 is used, the built-in crystal calibrator provides an excellent means of calibration. An alternate method of calibrating the signal generator to the sound and video r-f carrier frequencies is to zero-beat the signal generator with the received signals.

For further information regarding calibration, refer to Philco Lesson PR-1745(J), entitled "Television Service in the Home."

TEST EQUIPMENT REQUIRED

The following test equipment is recommended for aligning the receiver:

1. Philco Precision Visual Alignment Generator for Television and FM, Model 7008, or equivalent.

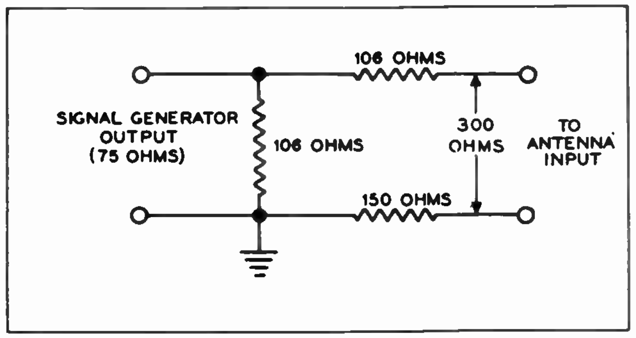
2. Vacuum-tube voltmeter, or 20,000-ohms-per-volt voltmeter.

3. R-F Probe, Philco Part No. 76-3595 (for use with Model 7008 generator).

JIGS AND ADAPTERS REQUIRED

Mixer Jig

Connections to the grid of the mixer tube may be made through the alignment jack provided for this purpose. To connect the generator to this point, a mixer-grid jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adapter, Part No. 45-1636, with as short a ground lead as possible, may be used to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68-ohm resistor (carbon), so that regeneration, caused by connection of the lead to the mixer, is held to a minimum.



TP0-1179

Figure 1. Antenna-Input Matching Network

Antenna-Input Matching Network

An impedance-matching network for coupling the signal generator to the antenna input terminals of the receiver is shown in figure 1. This network, which is designed to have an input impedance of 75 ohms and an output impedance of 300 ohms, is used to match a 75-ohm generator to a 300-ohm antenna-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group, to obtain values within ten percent of those indicated. The resistors should be placed in a shield can, to prevent variable effects. An antenna-matching jig, Philco Part No. 45-1736, which consists of a matching transformer and connecting box, may be used in place of the resistor network.

Video I-F Alignment Jig *(Video Test Jack Adapter No. 1)*

This alignment jig designed for use at J200, and shown in figure 2, should be used during the i-f alignment, to apply the proper bias to the a-g-c bus, and to provide a convenient oscilloscope connection. The adapter consists of a five-pin plug, two 10,000-ohm resistors, and a 1500-μμf. condenser for isolation of the bias supply. To isolate the oscilloscope from the receiver circuits, a 15,000-ohm resistor, by-passed by a 1500-μμf. condenser, is used. A suggested method of fabricating the jig is also shown in figure 2. This jig should not be used to observe the composite video from the video detector output.

Sound I-F Input Alignment Jig *(Video Test Jack Adapter No. 2)*

To observe the composite video at J200, a jig may be made with a five-pin plug and a 2200-ohm resistor. (See figure 3.) The 2200-ohm resistor should be connected to pin 2 of the plug. A ground lead should be connected to pin 3. To observe the composite video, connect the oscilloscope to the 2200-ohm resistor and the ground lead. This jig is also used for injection of the 4.5-mc. signal during sound i-f alignment.

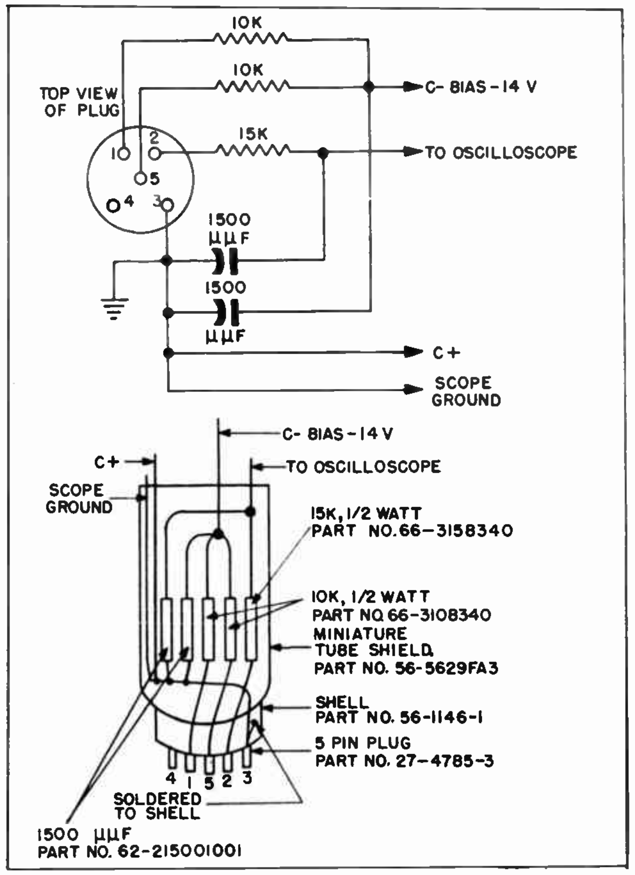


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Figure 2. Video I-F Alignment Jig (Video Test Jack Adapter No. 1)

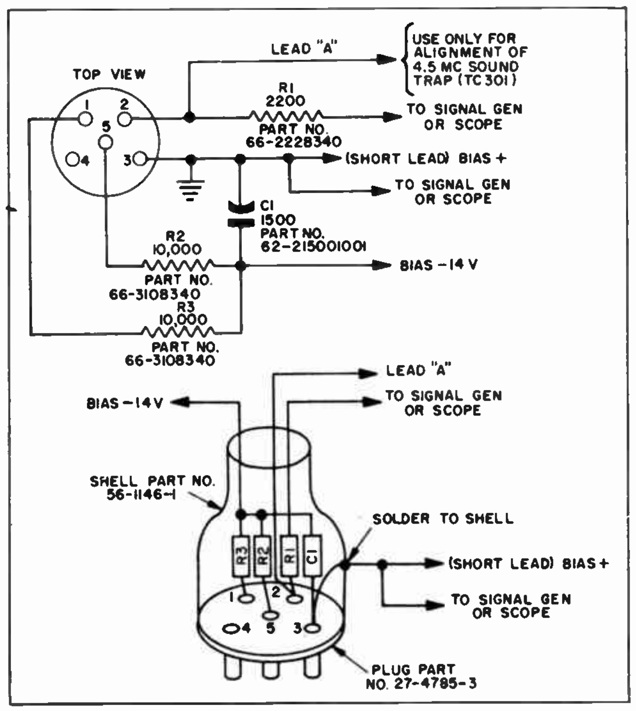

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Figure 3. Sound I-F Input Alignment Jig (Video Test Jack Adapter No. 2)

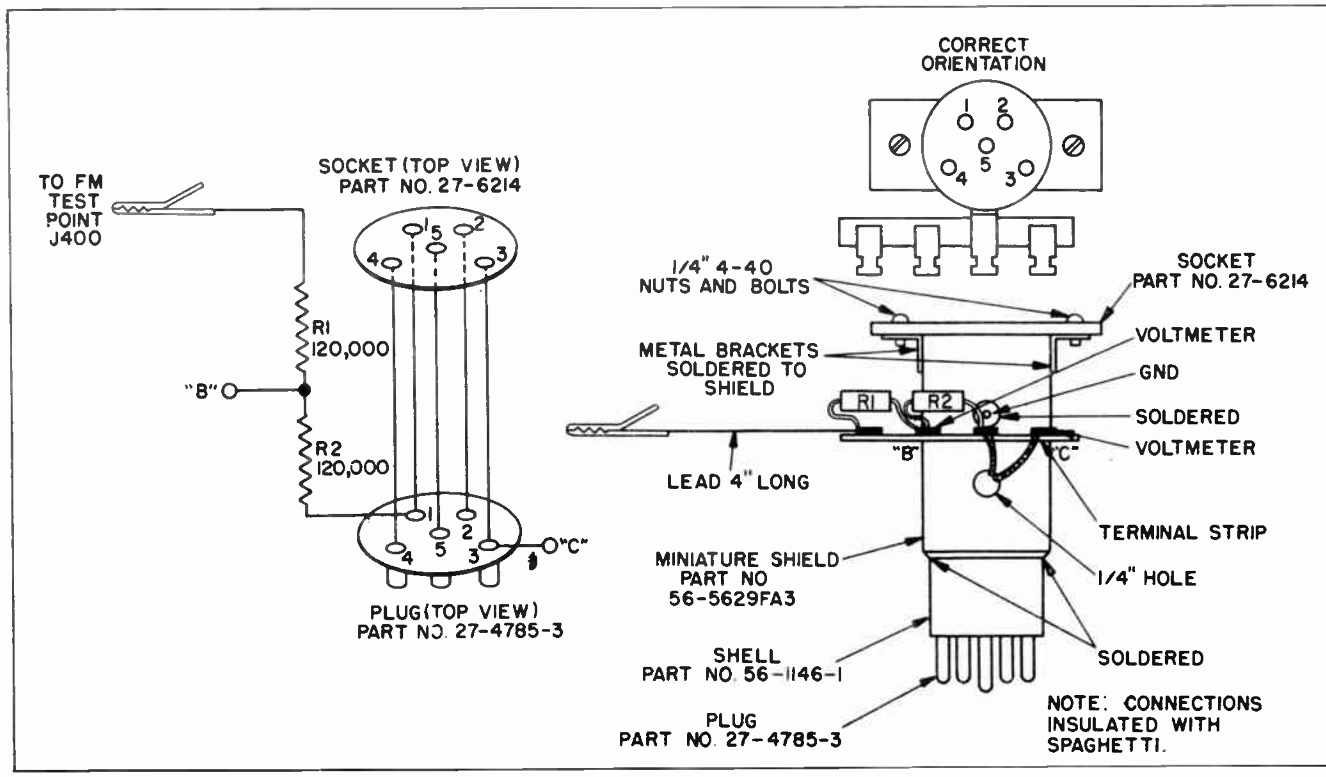

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Figure 4. Sound I-F Output Alignment Jig (FM Test Point and Volume Control Jack Adapter)

Sound I-F Output Alignment Jig *(FM Test Point and Volume Control Socket Adapter)*

Figure 4 shows the adapter that should be used to connect the voltmeter to the FM detector through the volume control socket, J400, and FM test point (G400). The adapter should be inserted into the volume control socket, and the clip lead from the adapter connected to the FM test point. The volume control cable and plug, PL400, is inserted into the socket on top of the adapter.

TELEVISION TUNER ALIGNMENT

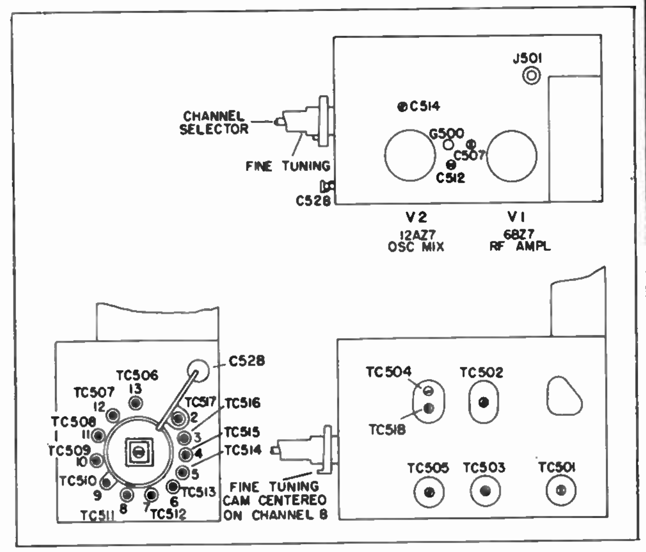
After the tuner is serviced, or if an i-f alignment is required, the tuner alignment should be checked. If realignment is necessary, use the procedure given below.

Since the frequency of the local oscillator affects the tuner response, the local-oscillator alignment should be made first.

Oscillator Alignment

General

It is possible to place each channel exactly on frequency by adjusting the tuning core of each coil, the adjustment procedure should be carried out with the highest channel (13) first, since the alignment of each channel will affect the alignment of the channels below it in frequency. The FINE TUNING control should be preset for all adjustments by placing the stop on the fine-tuning cam at Channel 8 oscillator tuning core. See figure 5.



TP3-942-A

Figure 5. Television Tuner, Showing Locations of Adjustments

Procedure Using Signal Generators

An r-f signal (unmodulated), at the video carrier frequency of the channel, is fed into the antenna input, and an i-f signal, at the i-f carrier frequency, is fed to the first i-f amplifier. Two AM signal generators are used to supply these signals. An oscilloscope is connected to the video detector output. The oscillator core is then adjusted for zero beat on each channel. The two generators should be accurately calibrated as described in Philco Lesson Series PR-1745(J).

To align the oscillator, proceed as follows:

1. To observe the zero beat, connect the oscilloscope to the video-detector output through the video i-f alignment jig. See figure 2. Bias the tuner and i-f a-g-c circuits with $1\frac{1}{2}$ volts, and remove the gate-pulse plug, PL801, from the socket, J801. To apply the bias to the tuner, connect the battery to the white lead which comes from the feed-through condenser at the top of the tuner. To make certain that good connection is made to the tuner a-g-c circuit, remove the glyptol coating on this condenser terminal.

2. To feed in the i-f comparison signal, remove the shield from the first v-i-f tube and wrap several turns of insulated copper wire around the tube. Connect the output leads of the v-i-f signal generator to the two ends of the wire loop, and set the generator for unmodulated output at 45.75 mc.

3. To feed in the signal representing the channel frequency, set the r-f signal generator at the video carrier frequency of Channel 13, and connect the output to the antenna-input terminals of the receiver, through the proper matching jig.

4. Mechanically preset the fine-tuning cam, as shown in figure 5, and set the CHANNEL SELECTOR to Channel 13.

5. Adjust the Channel 13 tuning core for zero beat, as indicated by the oscilloscope.

6. Retune the r-f signal generator and reset the CHANNEL SELECTOR for Channel 12, then 11, etc., each time adjusting the respective tuning core for zero beat. The tuning cores should be adjusted progressively from the highest-frequency channel to the lowest, because the higher channel adjustments will affect the lower channels.

Procedure Using Station Signal

The following simplified procedure may be used to align the oscillator when the television i-f alignment is satisfactory and a station signal is available. If this procedure is used in the service shop, signals from all stations which the customer can receive must be available in the service shop.

1. Mechanically preset the fine-tuning cam as shown in figure 5.

2. Tune in the highest-frequency channel to be received, and adjust the tuning core for that channel for the best picture; that is, starting with sound in the picture, turn the tuning core until the sound in the picture just disappears.

3. Repeat step 2 for each channel received in the area, starting with the highest-frequency channel and finishing with the lowest channel.

Tuner Bandpass Alignment

General

The bandpass alignment consists of aligning the tuner at Channels 13 and 6, and then making it track properly.

During the alignment, a fixed bias of $1\frac{1}{2}$ volts is applied to the r-f amplifier tube through the white a-g-c lead.

An FM (sweep) signal is applied to the antenna-input circuit through the proper matching jig, and an oscilloscope is connected to the junction of R518 and the tuner red lead. The oscilloscope gain should be as high as possible, consistent with "hum" level and "bounce" conditions. Hum conditions will cause distortion of the time base and response. Bounce conditions will cause the response and the time base to jump up and down, and this effect is caused by poor line regulation. The use of too high an oscilloscope gain aggravates these conditions, whereas the use of too low a gain necessitates increasing the generator output to a point where the tuner may be overloaded. The scope controls should be adjusted so that the width of the presentation is double the height. Overload may then be checked by changing the generator output while observing the shape of the response curve. When the generator output is changed, the vertical gain of the oscilloscope should be readjusted to keep the scope presentation amplitude the same. Do not readjust the horizontal gain control. Any change in the shape of the curve indicates overload, in which case a lower generator output and higher oscilloscope gain must be used.

The signal-generator output must be properly matched to the antenna-input circuit of the tuner. The antenna-input matching network shown in figure 1, or a Philco Antenna Matching Jig, Part No. 45-1637, may be used for this purpose. If a matching jig is not used, the result obtained will be extremely unreliable.

Regeneration or a mismatch in the test setup will also cause poor and unreliable results. To check for regeneration or mismatch move the hand along the generator cable after all equipment is connected, and observe the response curve on the oscilloscope screen. If the response curve on the oscilloscope changes as the hand is moved along the cable, regeneration or mismatch is indicated. Another check may also be made with the volume control advanced until noise can be heard from the speaker. If the level of the noise changes as the hand is moved along the generator cable, regeneration or mismatch is indicated. The symptoms which indicate these conditions may also be caused by failure to use the proper matching jig, as described above.

Procedure

CAUTION: When comparing the response curves from channel to channel, maintain the 2-to-1 width-to-height relationship in the oscilloscope presentation, as described above.

1. Connect the FM (sweep) and AM marker generators to the 300-ohm antenna input terminals through an antenna-input matching jig.

2. Connect the oscilloscope to the junction of R518 (15k, 1w) and the tuner red lead.

3. Apply $1\frac{1}{2}$ volts of bias to the white tuner a-g-c lead.

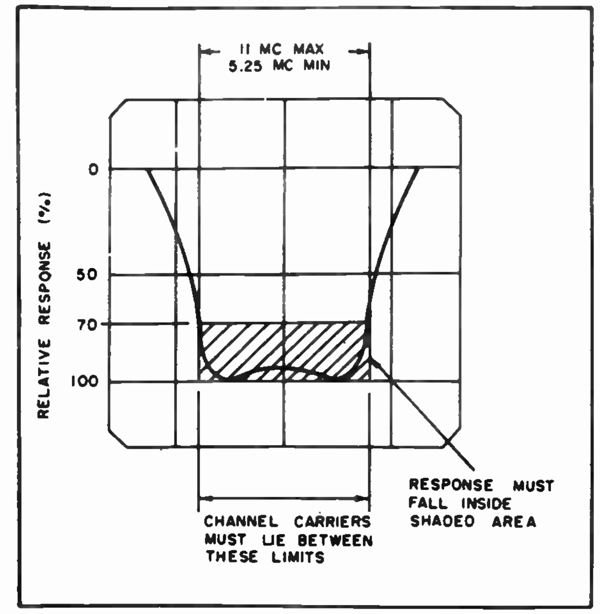
4. Disconnect the tuner coupling link at wiring panel B-14, terminals 1 and 4, and solder a 68-ohm, one-half watt carbon resistor to the open link coming from the tuner. See figure 8. Remove the first i-f tube from its socket.

5. Set the CHANNEL SELECTOR and FM (sweep) generator to Channel 13 (213 mc.). Adjust the generator for sufficient sweep width to show the complete response curve.

6. Establish channel limits (see figure 6) by using the marker (AM r-f) signal generator to produce marker pips on the response curve. (Set the marker generator first to 210 mc., then 216 mc.) The response curve should be reasonably flat between the limits.

7. Readjust TC502 and TC504 for a symmetrical response, centered about 213 mc. and falling within the specifications, as shown in figure 6.

8. Set the CHANNEL SELECTOR and FM (sweep) generator to Channel 7 (177 mc.). Establish the channel limits by using the marker-signal generator to produce marker pips on the response curve. (Set the marker generator first to 174 mc., and then to 180 mc.) The curve should be reasonably flat between the limits.



TP3-1213

Figure 6. Television Tuner Response Curve, Showing Bandpass Limits

9. On Channel 7, observe the tilt and center frequency of the response curve. The curve should be centered on the pass band and should be symmetrical. If it is not symmetrical, and appears unbalanced, as in figure 7, adjust C507 and C512 (figure 5) to obtain a response curve which is the mirror image (tilt in the opposite direction) of the original; for example, if Channel 7 response curve appears as in figure 7A, adjust C507 and C512 until the curve appears as in figure 7B. This adjustment overcompensates to make allowance for the effect of Channel 13 adjustments (to be made in step 10) upon Channel 7 response.

10. Reset the CHANNEL SELECTOR and generators to Channel 13, and repeat steps 8 through 10 as many times as is necessary, to obtain the most symmetrical and centered response curves on Channels 13 and 7. Channels 7 through 13 are now correctly aligned.

11. Set the CHANNEL SELECTOR and sweep generator to Channel 6 (85 mc.).

12. Establish the channel limits, using the marker generator to produce marker pips on the response curve. (Set the marker generator first to 82 mc., then to 88 mc.).

13. Adjust TC503 and TC505 for a symmetrical, approximately centered pass band. Set the marker generator to 85 mc. Detune TC505 counterclockwise until a single peak appears. Adjust TC503 until the peak falls on the 85-mc. marker. It may be necessary

to increase the output of the generator during this adjustment. Then adjust TC501 for maximum curve height and symmetry of the single peak. The antenna circuit is now tuned for Channels 2 through 6.

14. Readjust TC503 and TC506 for a symmetrical response, centered about 85 mc. and falling within the specifications, as shown in figure 6. Channels 2 through 6 are now correctly aligned.

VIDEO I-F ALIGNMENT

Preliminary

Before proceeding with the i-f alignment or making an alignment check, observe the following preliminary instructions:

1. Preset the CONTRAST and BRIGHTNESS controls to the maximum counterclockwise position.

2. Preset the CHANNEL SELECTOR to Channel 4.

3. Insert the video i-f alignment jig into J200.

4. Connect the oscilloscope to the 15,000-ohm resistor from the video i-f alignment jig. Connect the ground lead of the oscilloscope to the ground lead from the adapter.

5. With a voltmeter connected across the points shown in figure 2, set the potentiometer to furnish –14 volts of bias.

6. Connect the AM generator to the mixer test point, G500, through a mixer jig, and adjust the generator for approximately 30 percent modulation at 400 cycles. Adjust the output of the generator during the alignment to keep the output at the second detector below .6 volt, peak to peak.

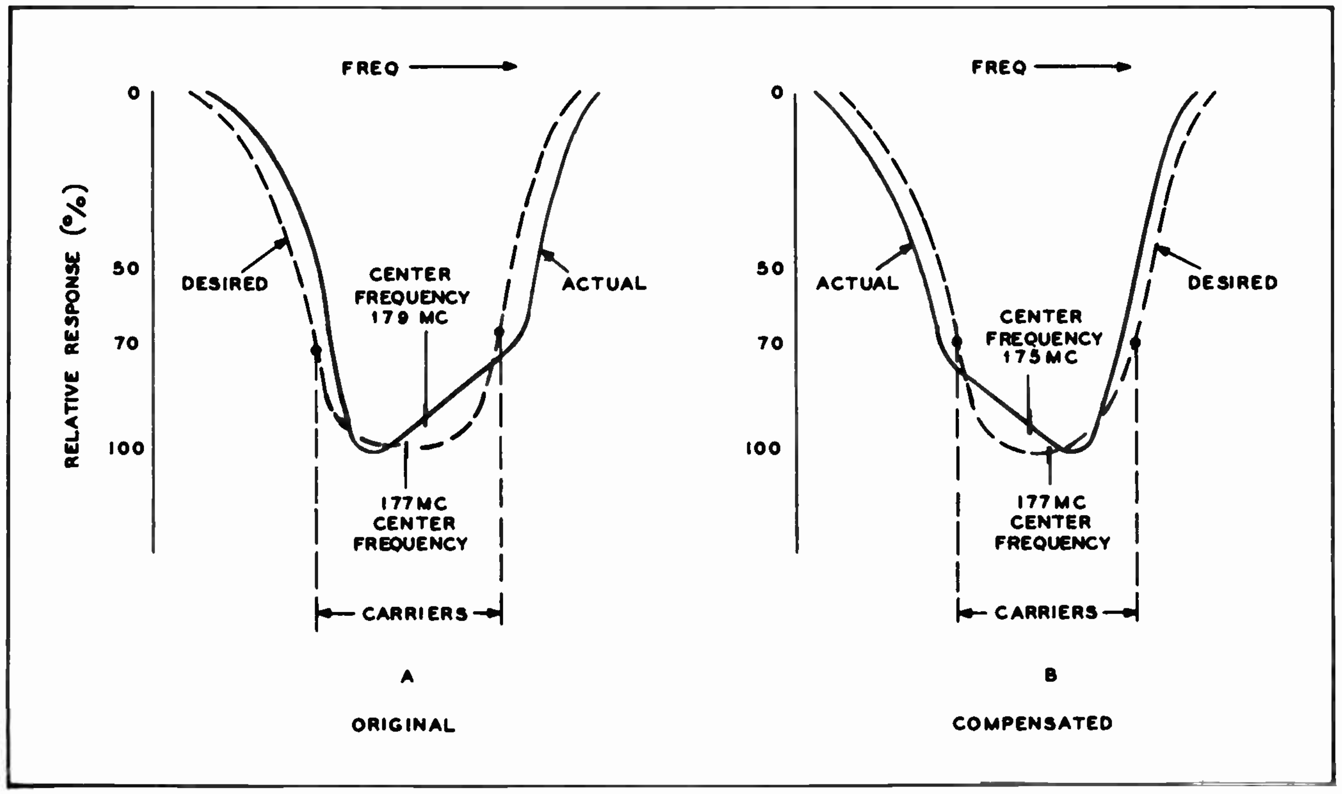
NOTE: If the i-f shield has been removed for repairs, it must be replaced before proceeding with the alignment.

Procedure

1. Tune the AM generator to 47.25 mc., and adjust C201 for minimum output, as observed on the oscilloscope.

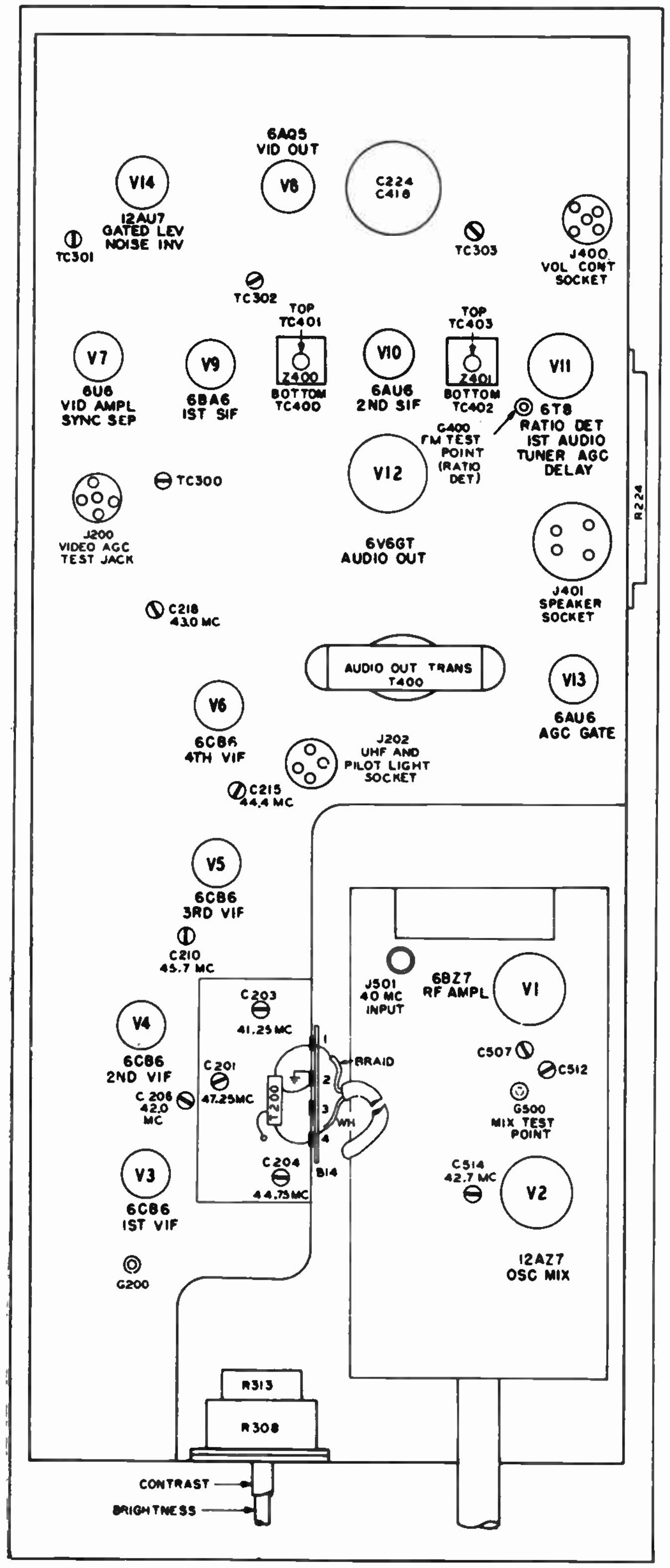
2. Tune the AM generator to 41.25 mc., and adjust C203 for minimum output, as observed on the oscilloscope.

NOTE: In steps 1 and 2, it is necessary to keep the generator output sufficiently high that a null indication may be observed on the oscilloscope; however, avoid overloading of the receiver by excessive signal.



TP0-1174

Figure 7. Television Tuner Response Curve, Showing Tracking Compensation



TP3-943-A

Figure 8. R-F Chassis R-204, Top View, Showing Locations of Adjustments

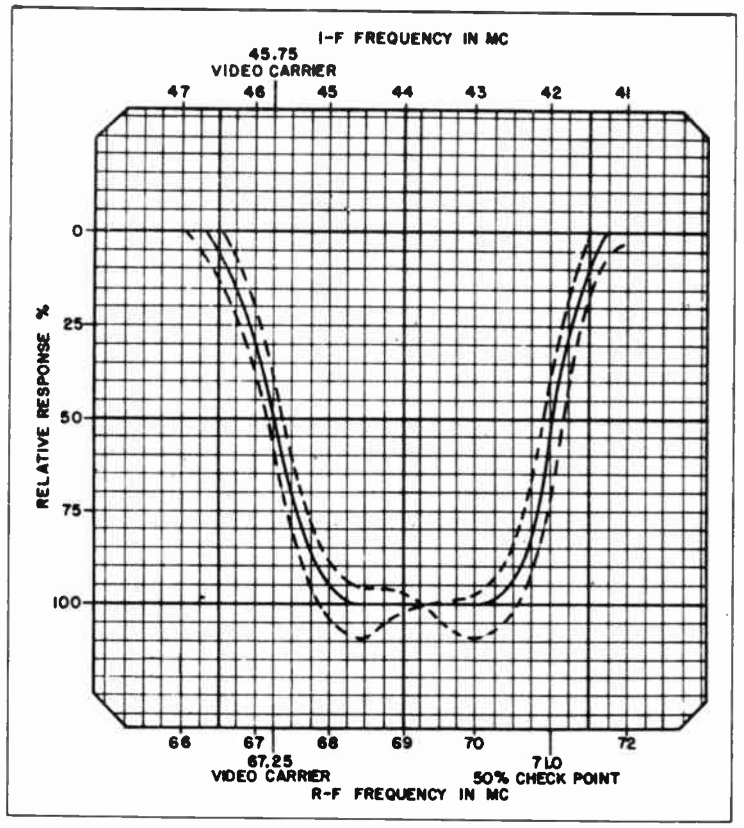
3. Tune the AM generator to the frequencies indicated below, and adjust the trimmers (see figure 8) for maximum output.

a. 42.7 mc.—adjust C514
b. 44.75 mc.—adjust C204
c. 45.7 mc.—adjust C210
d. 44.4 mc.—adjust C215
e. 43.0 mc.—adjust C218
f. 42.0 mc.—adjust C206

4. Increase the bias (by means of the potentiometer) until the scope presentation of step f, above, is reduced to 50 percent of its previous amplitude, and retouch C206 for maximum indication on the oscilloscope.

5. Connect the sweep generator and r-f marker generator to the antenna terminals through a matching jig. (If a separate oscilloscope is used, connect the sweep output of the generator to the horizontal input of the oscilloscope.) Set the CHANNEL SELECTOR to Channel 4, and tune the sweep generator for output on Channel 4. Tune the r-f marker generator for the video carrier frequency of Channel 4 (67.25 mc.), and tune the i-f marker generator (connected through jig to mixer grid) to 45.75 mc. Note that two marker generators are used for this procedure. The r-f marker generator is connected to the antenna terminals, while the i-f marker generator is connected capacitively to the mixer grid test point, G500. A jig constructed from a piece of fiber tubing, with $\frac{3}{16}$ inch inside diameter, and a brass machine screw which fits tightly into the tubing, is used to connect the generator capacitively to the test point. The screw is adjusted so that it clears the test point by approximately $\frac{1}{64}$ inch. The output cable of the marker generator is connected to the head of the brass screw in the jig and to chassis near the mixer tube. Both marker generators should be adjusted for the minimum output required to make the markers barely visible. Failure to observe this precaution, or the use of excessive output from the sweep generator, will cause misleading results. After the equipment is properly connected, adjust the FINE TUNING control for zero-beat of the two markers, as observed on the oscilloscope. When zero beat is obtained, remove the i-f marker.

6. If the response curve does not fall within the limits, as shown in figure 9, the adjustment of the trimmers may be touched up slightly, while observing the response curve. Do not retouch the setting of C201, C203, or C206. To adjust the curve, first adjust C215 and C218 alternately until maximum improvement is obtained. C215 affects the tilt of the



TP3-944

Figure 9. Over-all R-F, I-F Response Curve

curve, and C218 affects the dip of the curve. After C215 and C218 have been adjusted, adjust C514 for proper slope at the 42.25-mc. side of the curve, and then adjust C204 and C210 for proper level at the video carrier frequency (45.75 mc.).

CAUTION: Do not turn any of the trimmers excessively. To retouch, only turn the trimmers slightly.

SOUND I-F ALIGNMENT

The sound i-f system may be aligned by the use of a station signal or an accurately calibrated signal generator, for the signal source. If the station signal is used, tune the FINE TUNING control for the best picture, regardless of sound. It will be necessary to reduce the signal input to the receiver, so that the d-c output at the sound detector, as measured with the aid of the sound i-f output alignment jig (between point "B" and ground), is kept below 5 volts, maximum, and preferably below 3 volts. To establish this level in strong-signal areas, it may be necessary to short the antenna terminals and to apply bias to the a-g-c circuit. The signal input to the receiver may be adjusted by varying the length of the shorting lead. The bias may be applied to the a-g-c circuit by means of the jig shown in figure 3. The sound i-f output alignment jig shown in figure 4 should be used for convenient connection of the meter to the sound-detector output.

When a signal generator is used, bias should be applied to the a-g-c circuit, to avoid any possibility of regeneration, using the sound i-f input alignment jig (figure 3). In addition, the first video i-f tube should be removed, to aid in the reduction of circuit noises from the i-f system.

NOTE: To perform the sound i-f alignment it will be necessary to plug the radio-tuner plug, PL402, into socket J402 and set the function switch to the TV position.

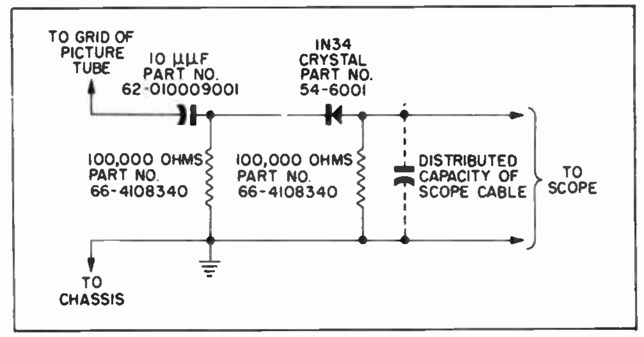
1. Connect the generator through the 2200-ohm resistor, in the sound i-f input alignment jig, to pin 2 of J200. The generator should be adjusted for unmodulated output at 4.5 mc.

2. Insert the sound i-f output alignment jig into the volume-control socket, J400, and insert the volume-control plug, PL400, in the top of the jig. Connect the clip lead to the FM test point, G400; connect a 20,000-ohms-per-volt voltmeter between point "B" and the ground lug of the jig, with the negative lead of the meter going to point "B."

3. Adjust TC300, TC400, TC401, and TC402 for maximum output, as indicated on the meter. If the output exceeds 5 volts, reduce the signal input to the receiver.

4. Shift the positive lead of the meter to point "C" on the sound i-f output alignment jig, and adjust TC403 for zero crossover. Zero crossover is indicated by a zero indication on the meter. When TC403 is turned in one direction from this zero point, the meter will swing positive; turning TC403 in the opposite direction will cause a negative swing. (To aid in reading a positive and negative swing on the meter, set the pointer, by means of its zero-adjustment screw, to a convenient calibration mark on the scale, before connecting the meter to the circuit.)

5. Replace the first video i-f tube, and tune in a station on the receiver. Turn the FINE TUNING control to obtain a slightly fuzzy picture, and retouch TC403 for minimum AM (noise or buzz), using the speaker output as an indication.



TP2-2670

Figure 10. R-F Probe for Sound-Trap Adjustment

ADJUSTMENT OF 4.5-MC. TRAP

To adjust the 4.5-mc. trap in the plate circuit of the first video amplifier, proceed as follows:

1. Connect the output of the signal generator to the lead from pin 2 of the sound i-f alignment jig (see figure 2). Adjust the generator for 4.5 mc., 400-cycle modulated output. Set the output attenuator for maximum output from the generator.

2. Connect the input of the r-f probe, shown in figure 10, to the grid of the picture tube, and connect the output of the probe to the vertical input of the oscilloscope. Adjust the vertical gain of the oscilloscope to maximum.

3. Adjust TC301 for minimum indication on the oscilloscope. (The normal setting for TC301 is with the screw approximately ⅝ inch out from the chassis.)

An alternate method for adjustment of TC301 may be used if a 4.5-mc. generator is not available. To adjust TC301 without the generator, proceed as follows:

1. Tune in a strong station signal.

2. Turn the FINE TUNING control in a clockwise direction until a fine beat pattern appears in the picture.

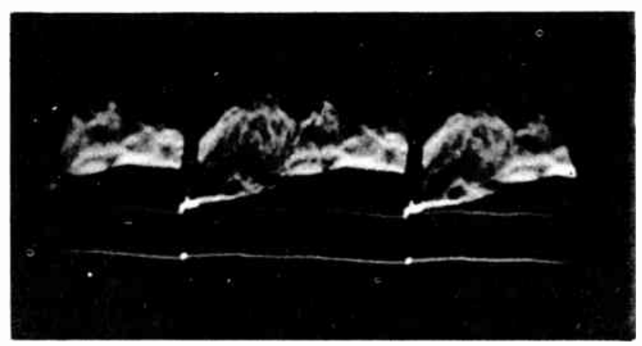
3. Adjust TC301 until the beat disappears or is at a minimum. When correctly adjusted, the screw will be out from the chassis approximately ⅝ inch.

4. If more than one station is available, check the setting of TC301 on all stations.

OSCILLOSCOPE WAVEFORM PATTERNS

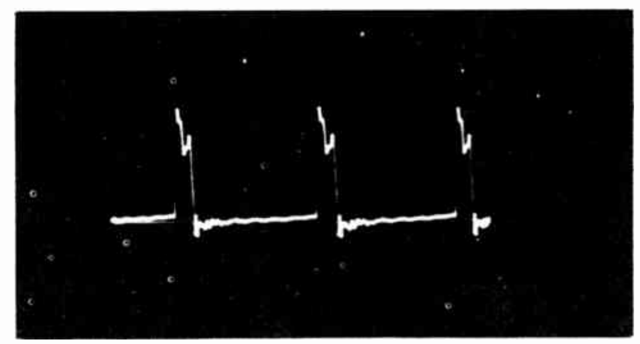
The waveforms illustrated were taken with the receiver adjusted for an approximate peak-to-peak output of 2 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope.

The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms are more rounded than those shown, and the peak voltages differ from those shown.



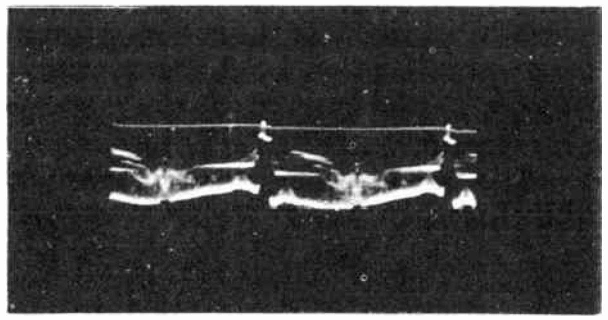
TP1-1200-A

Figure 11. Video-Detector Output, Pin 2 of J200 2 volts, 60 c.p.s.



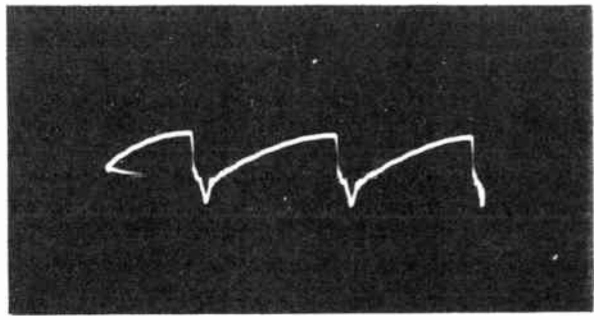
TP2-654

Figure 12. Gate-Pulse Plug, Pin 4 500 volts, 15,750 c.p.s.



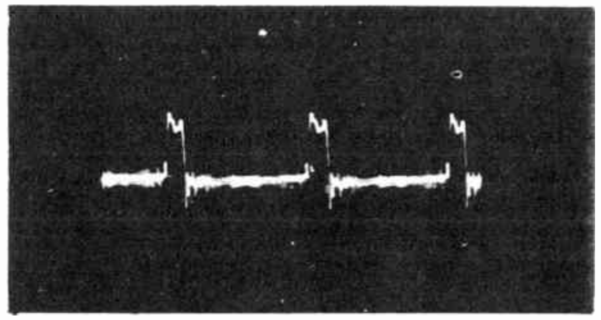
TP2-653

Figure 13. A-G-C Gate Grid, Pin 1
22 volts, 60 c.p.s.



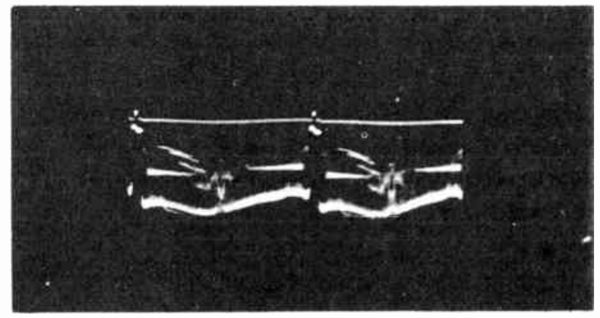
TP2-656

Figure 14. Gate-Pulse Plug, Pin 3
10 volts, 15,750 c.p.s.



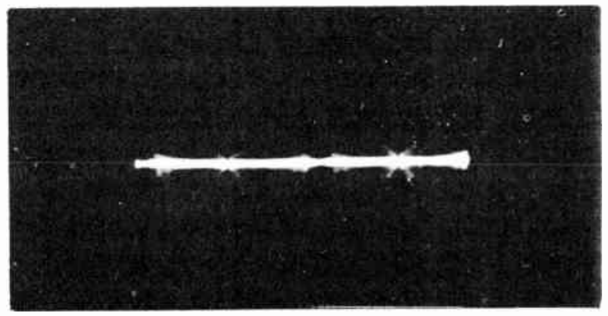
TP2-655

Figure 15. Gated-Leveler Grid, Pin 2
2.5 volts, 15,750 c.p.s.



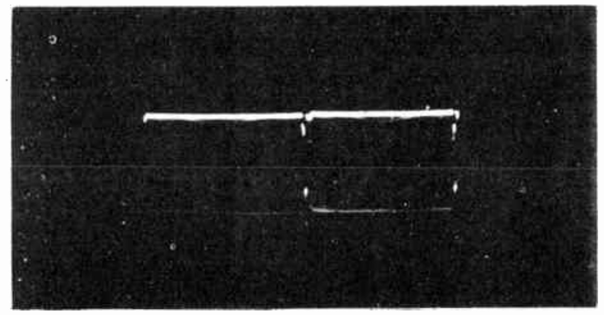
TP2-657

Figure 16. Noise-Inverter Plate, Junction of R605, C602, and C604
23 volts, 15,750 c.p.s.



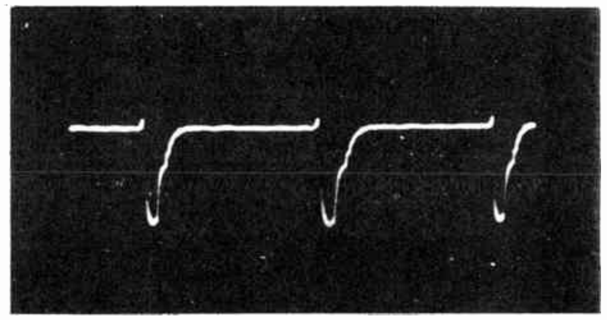
TP2-658

Figure 17. Noise-Inverter Cathode, Pin 8
(Wave shape and amplitude vary with noise)



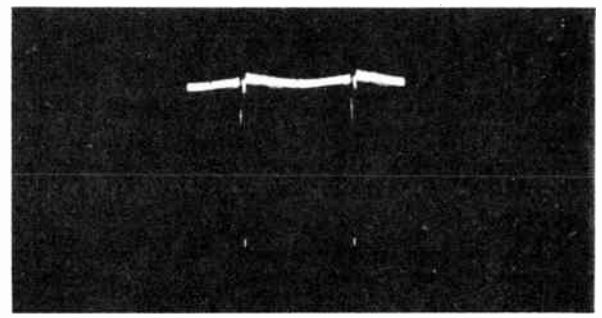
TP2-659

Figure 18. Sync Separator Plate, Pin 1
17 volts, 60 c.p.s.



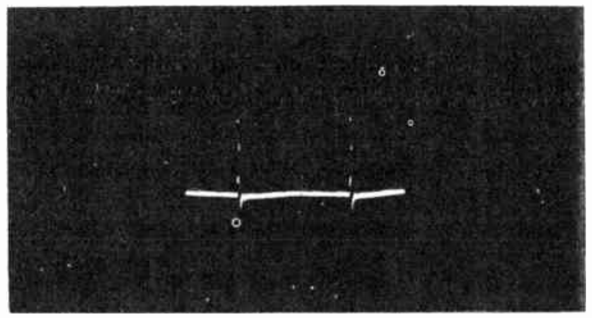
TP2-660

Figure 19. Sync Separator Plate, Pin 1
17 volts, 15,750 c.p.s.



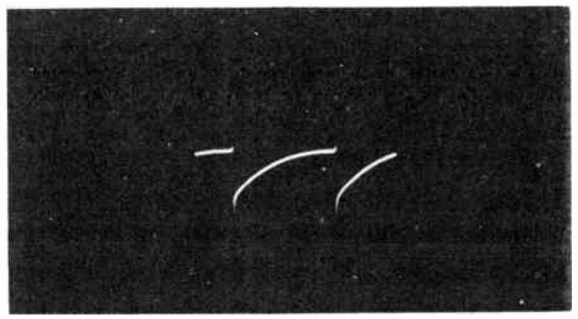
TP2-639

Figure 20. Phase-Splitter Grid, Pin 7
14 volts, 60 c.p.s.



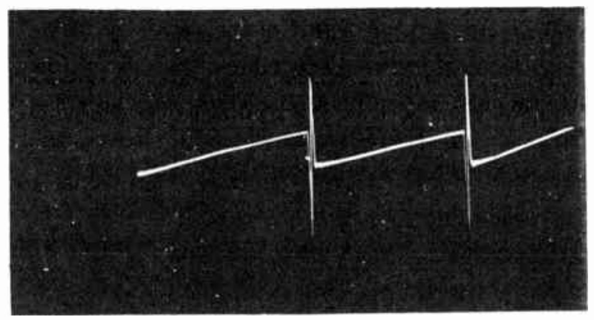
TP2-640

Figure 21. Phase-Splitter Plate, Pin 6
30 volts, 60 c.p.s.



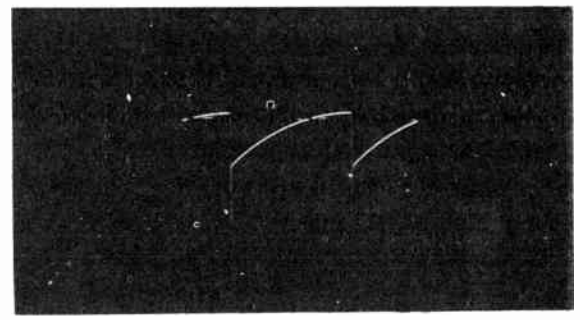
TP2-643

Figure 22. Vertical-Oscillator Grid, Pin 2
165 volts, 60 c.p.s.



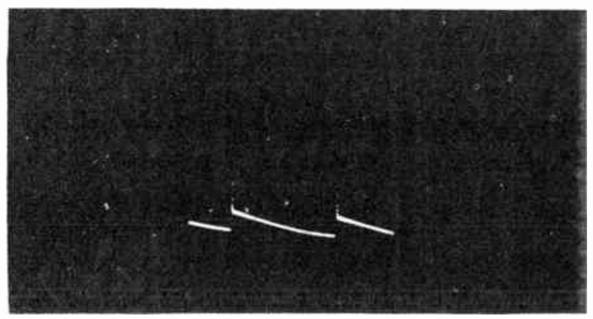
TP2-697

Figure 23. Vertical-Oscillator Plate, Pin 1
130 volts, 60 c.p.s.



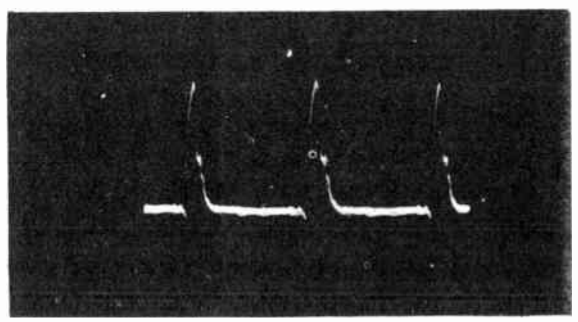
TP2-644

Figure 24. Vertical-Output Grid, Pins 2 and 7
120 volts, 60 c.p.s.



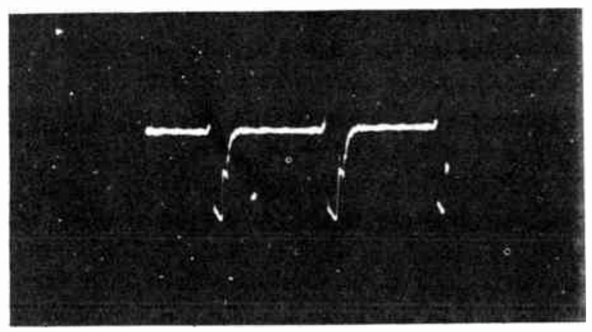
TP2-645

Figure 25. Vertical-Output Plate, Pin 9
800 volts, 60 c.p.s.



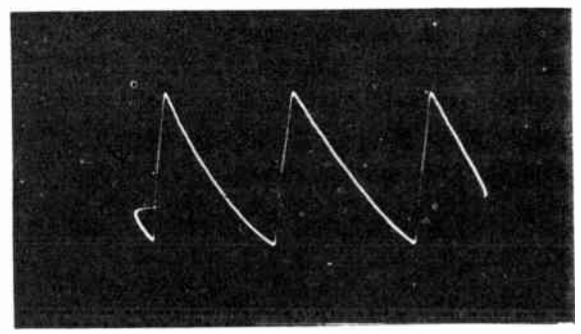
TP2-641

Figure 26. Phase-Splitter Plate, Junction of R614, R615, and C800
8 volts, 15,750 c.p.s.



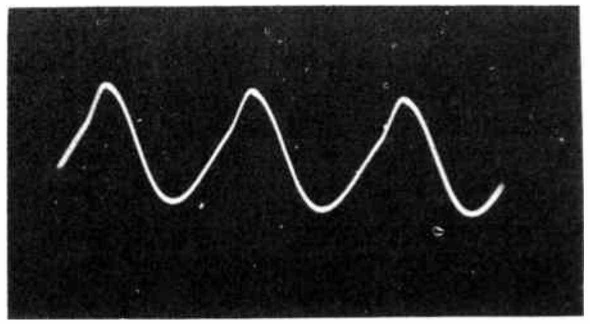
TP2-642

Figure 27. Phase-Splitter Cathode, Pin 8
8 volts, 15,750 c.p.s.



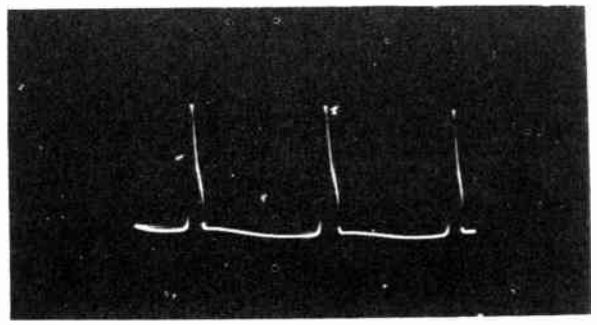
TP2-652

Figure 28. Phase Comparer, Pins 5 and 7
6 volts, 15,750 c.p.s.



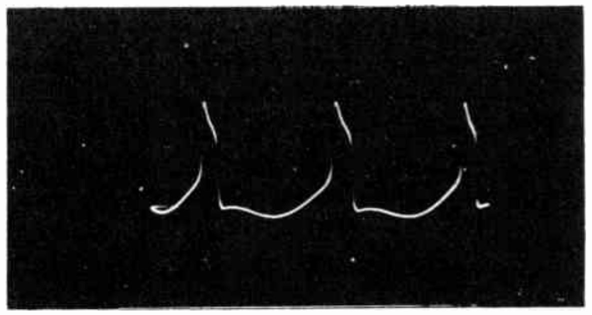
TP2-2852

Figure 29. Horizontal Oscillator, Pin 2 of Gate-Pulse Socket J801
35 volts, 15,750 c.p.s.



TP2-647

Figure 30. Horizontal-Oscillator Cathode, Pins 8 and 3
16 volts, 15,750 c.p.s.

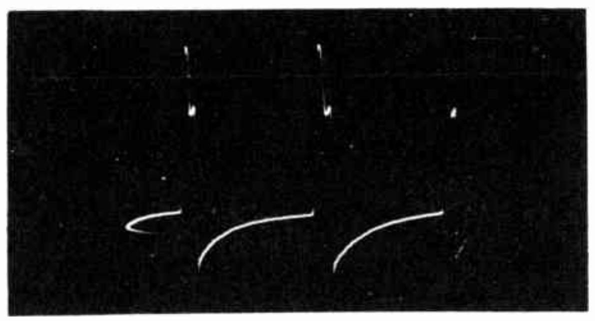


TP2-648

Figure 31. Horizontal-Oscillator Grid, Pin 2
38 volts, 15,750 c.p.s.

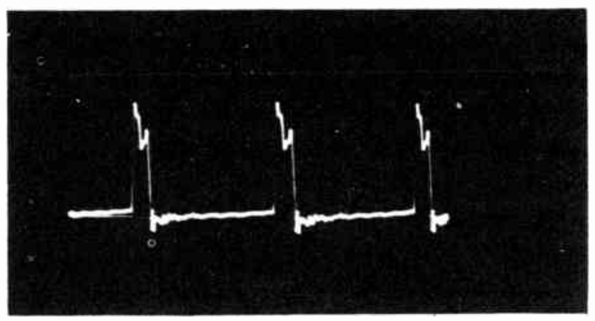
TP2-649

Figure 32. Horizontal-Output Grid, Pin 5
130 volts, 15,750 c.p.s.



TP2-650

Figure 33. Horizontal-Deflection Yoke, *Pin 7 of J800
3000 volts, 15,750 c.p.s.
***See CAUTION.**



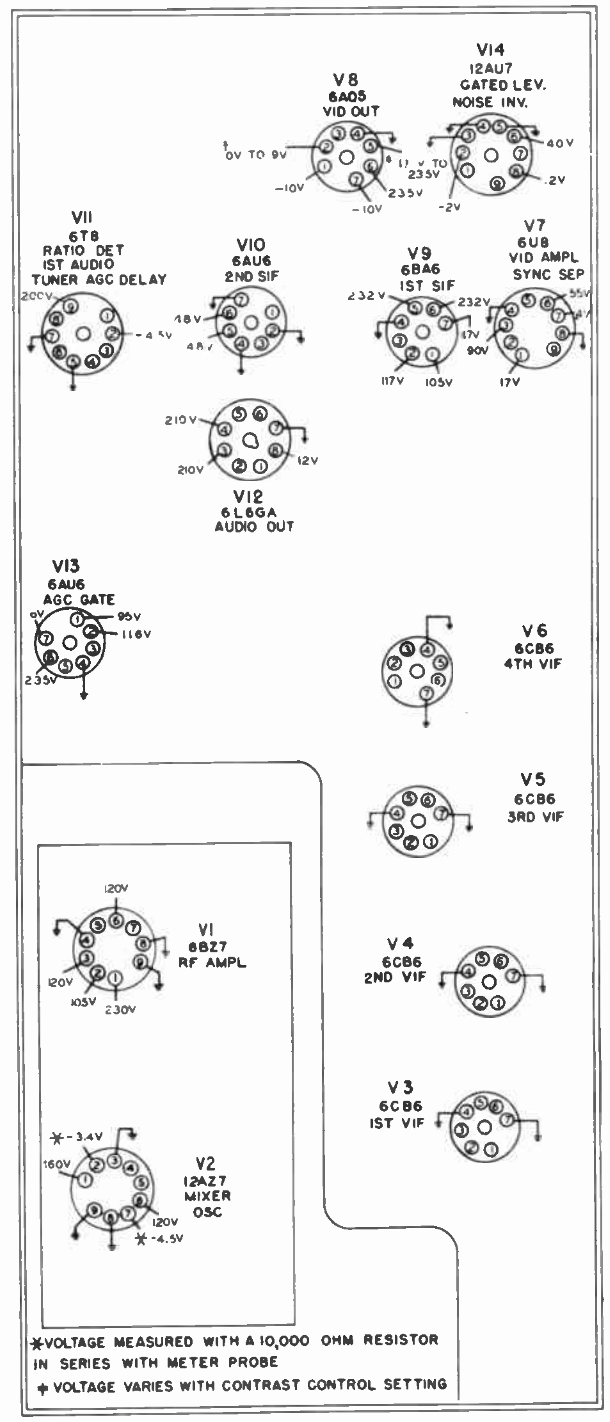
TP2-654

Figure 34. Gate-Pulse Socket, Pin 4 of J801
500 volts, 15,750 c.p.s.

* CAUTION: High-voltage pulses are present in the horizontal-output circuit. The waveform shown in figure 33 was taken with the alligator clip of the oscilloscope lead clipped over the insulation of the lead connected to pin 7 of J800. (To prevent puncture of the insulation of the lead, file off the teeth of the alligator clip, and wrap friction tape around the clip.) Connection to other points in the horizontal-output circuit is dangerous, because of the high voltages present. The peak-to-peak voltage shown for figure 33 is the actual voltage present; however, the amplitude of the scope presentation depends upon the degree of coupling.

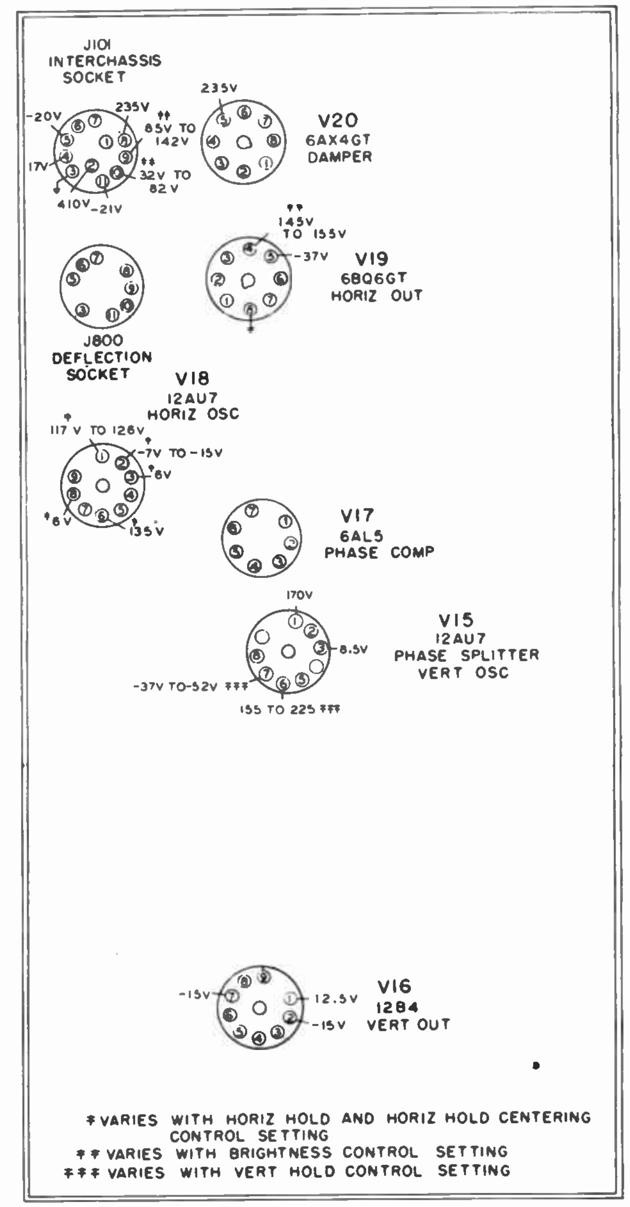
VOLTAGE MEASUREMENTS

The voltages given below and on the schematics were taken with a 20,000-ohms-per-volt voltmeter, with a line voltage of 117 volts, and no signal input to the receiver. Since voltage readings taken in the video i-f stages vary widely with different test equipment setups, voltage measurements for these stages are omitted from the diagrams.



TP3-892

Figure 35. R-F Chassis R-204, Bottom View, Showing Voltages at the Sockets



TP3-1202

Figure 36. Deflection Chassis D-204, Bottom View, Showing Voltages at the Sockets

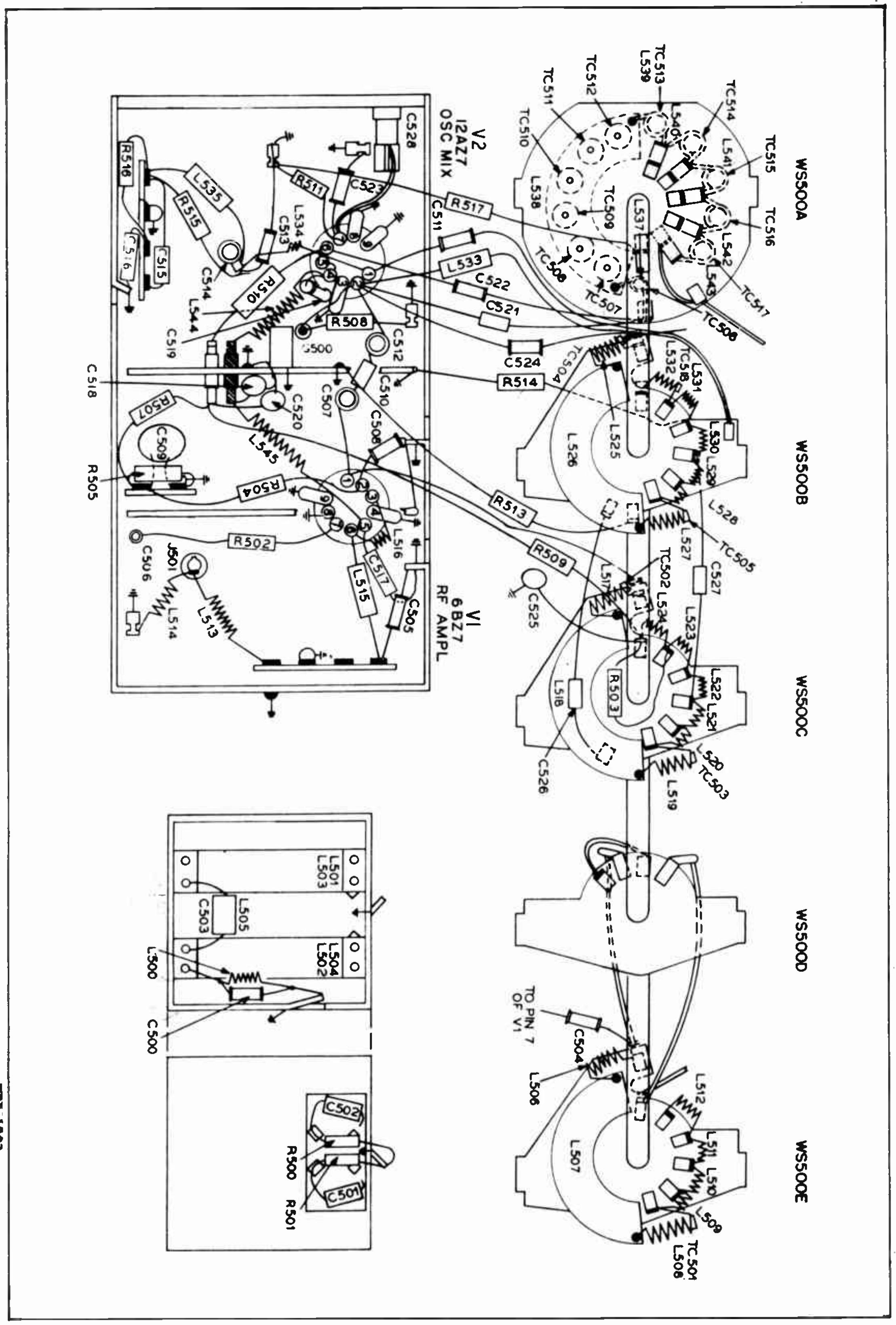
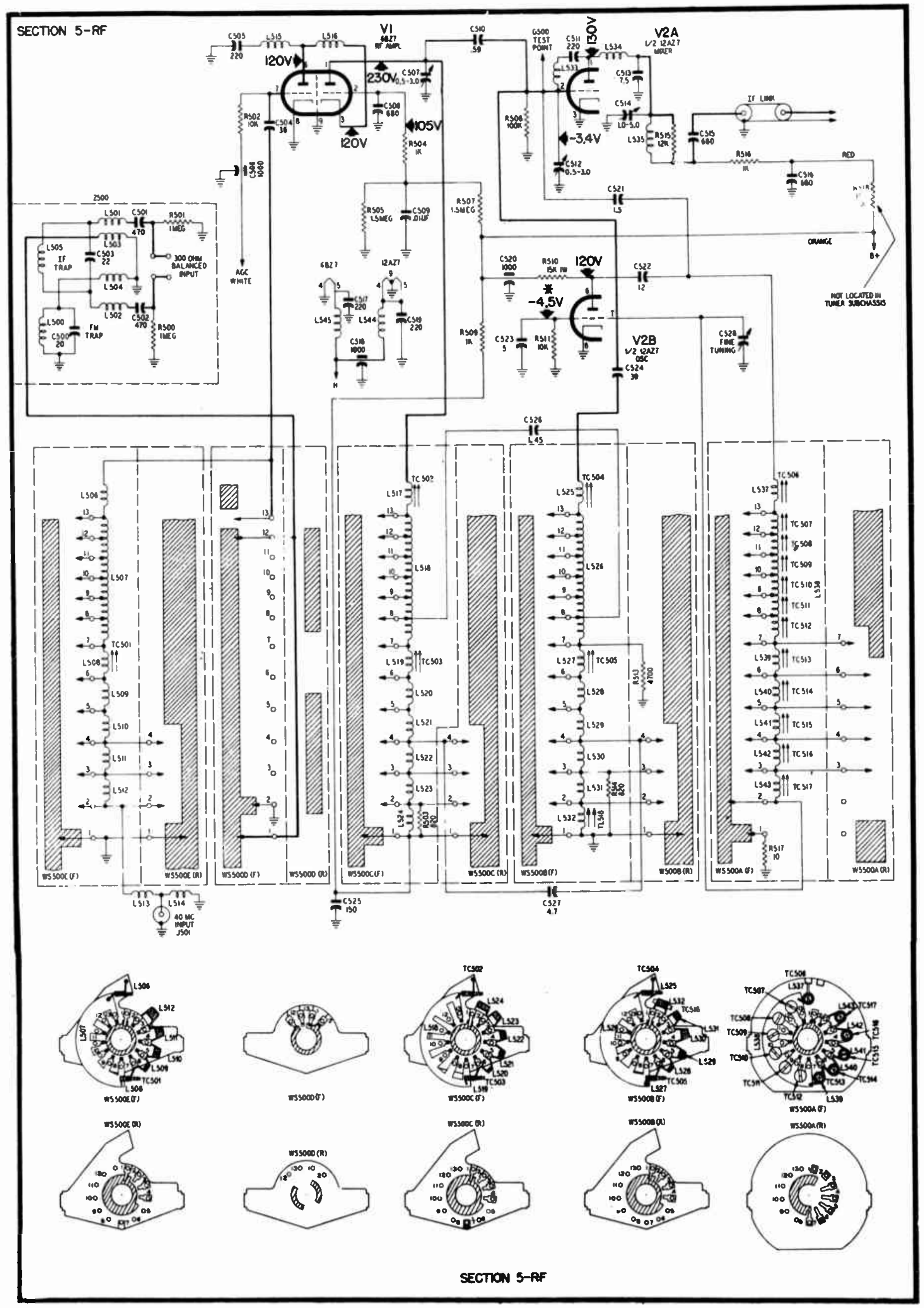


Figure 37. Television Tuner, Part No. 76-7600-3, Base Layout



TP3-1204

Figure 38. Television Tuner, Part No. 76-7600-3, Schematic Diagram

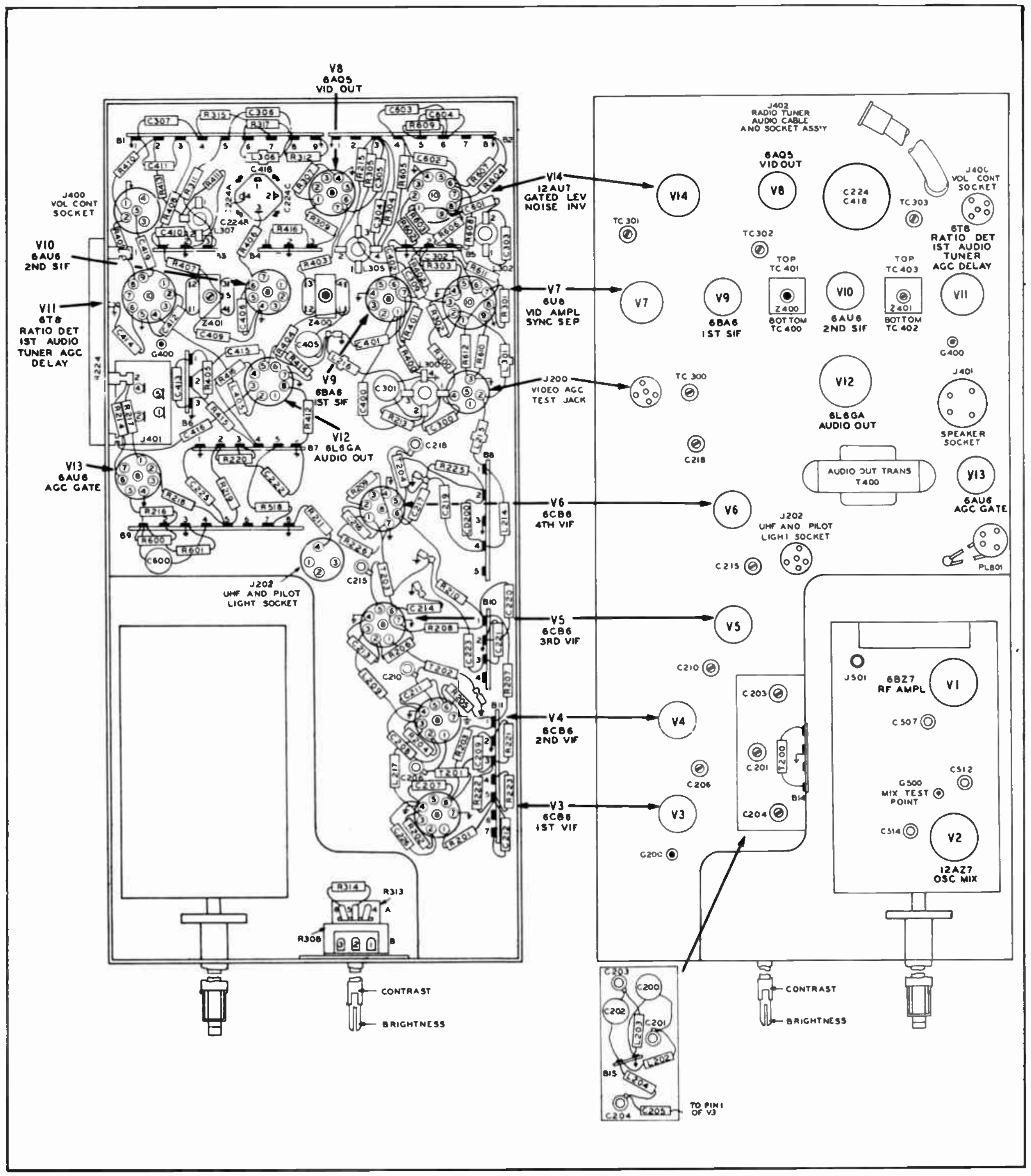

TP3-1205

Figure 39. R-F Chassis R-204, Base Layout

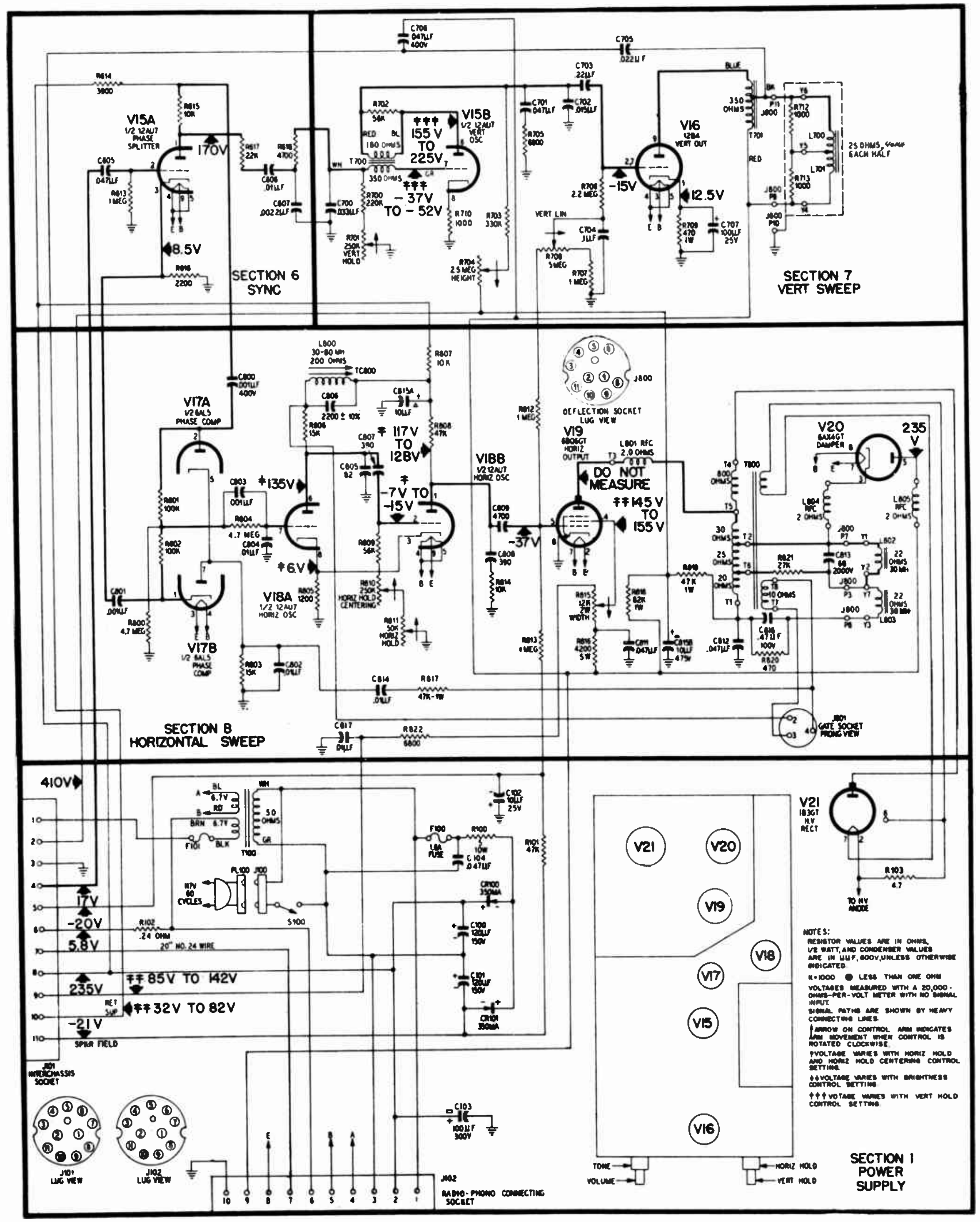

TP3-1207

Figure 41. Deflection Chassis D-204, Schematic Diagram

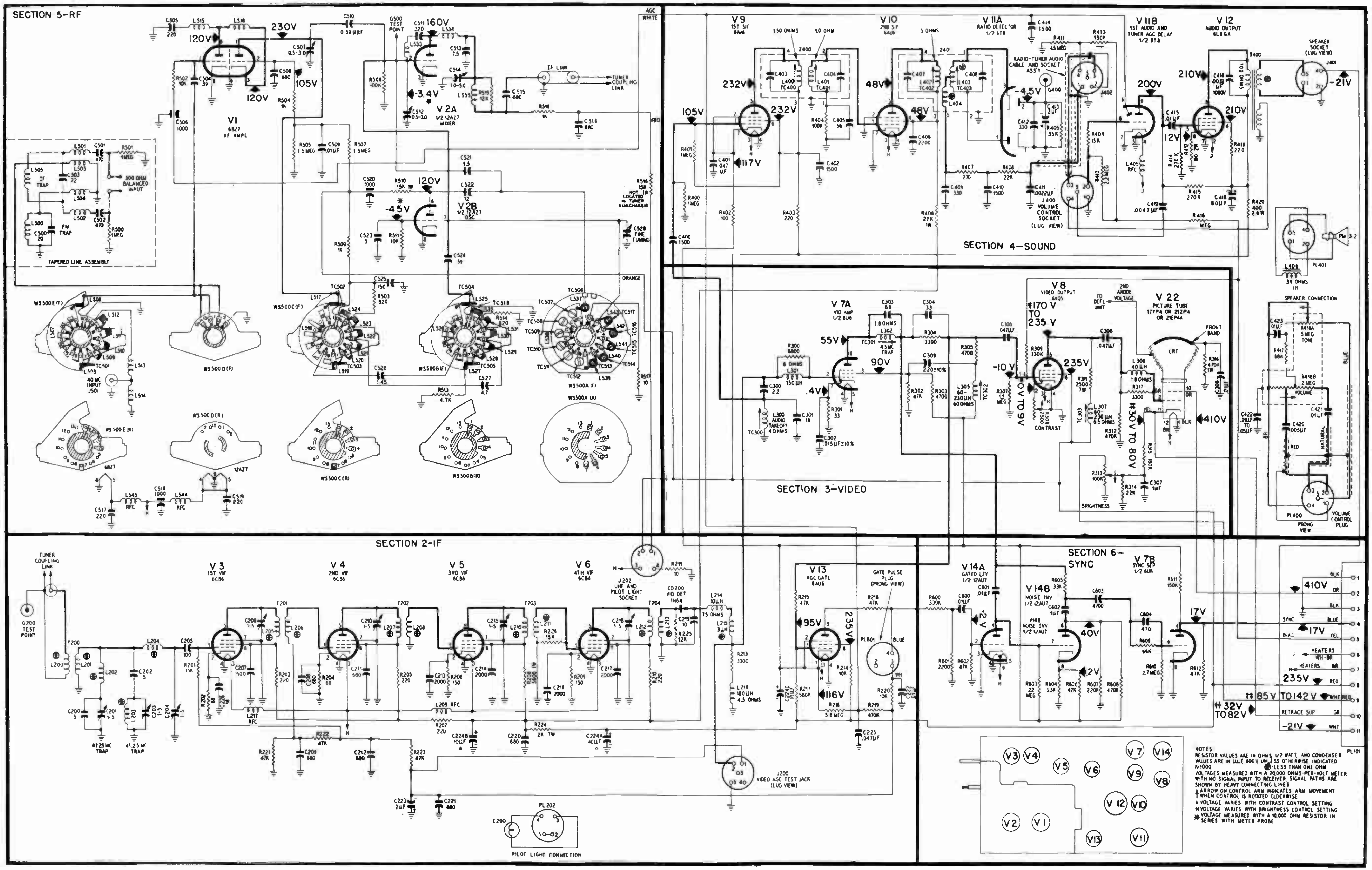
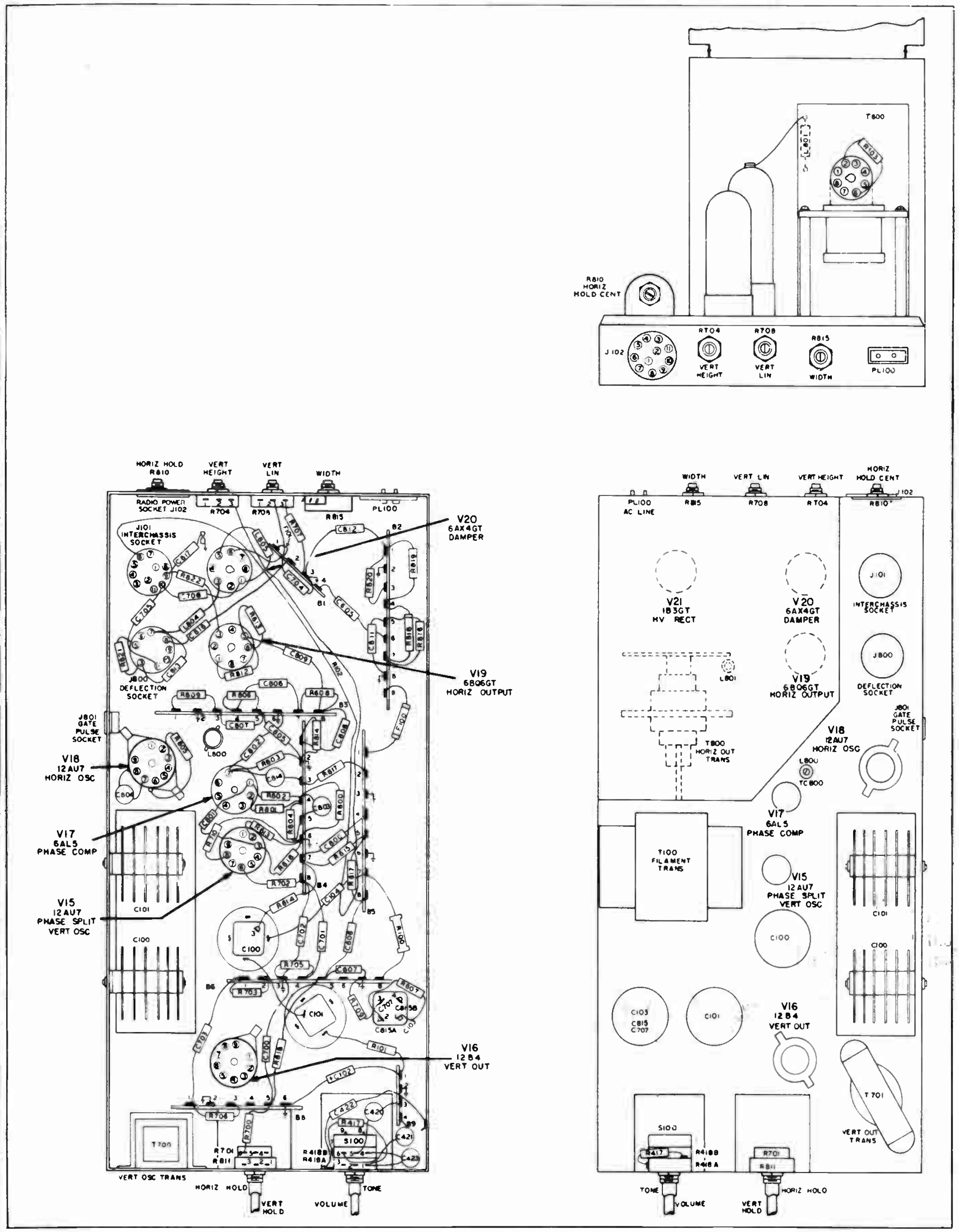


Figure 40. R-F Chassis R-204, Schematic Diagram

PHILCO TV PAGE 12-33



TP3-1208

Figure 42. Deflection Chassis D-204, Base Layout

UHF TUNER-ADAPTER UT20B, PART NO. 43-6701

UHF Tuner-Adapter UT20B, Part No. 43-6701, provides for reception of UHF signals on television Channels 14 through 83. UHF Tuner-Adapter UT20B is designed for installation in Philco B line television receivers and is installed on BU models. These receivers use r-f chassis R-204.

The Tuner-Adapter consists of a UHF Tuner, a VHF-UHF change-over switch, adapter cables and plugs, a planetary tuner driving assembly and mounting hardware.

CIRCUIT DESCRIPTION

The UHF tuner converts the UHF signals to the intermediate frequency of the r-f chassis.

The incoming UHF signal is coupled through the antenna input line, and through two i-f traps, two 680-$\mu\mu$f. condensers, and a 150-ohm transmission line to the antenna tank of the tuner. See figure 45. The antenna tank is coupled to the mixer tank by means of the mutual coupling of L2 and L3 and the stray capacitance, C5. The desired signal is and the stray capacitance, C5. The desired signal is selected by tuning the antenna tank and the mixer tank to the correct frequency, and the signal is then coupled to the crystal mixer circuit by means of the mutual coupling of L4 and L5. The local-oscillator signal is generated by a 6AF4 tube, V1, and the associated circuit. The oscillator circuit is coupled to the crystal mixer circuit by a 300-ohm, miniature transmission line and the mutual coupling of L7 to L5 and L8 to L6. The r-f signal and the oscillator signal are mixed in the crystal mixer circuit to produce a 45.75-mc. video carrier intermediate-frequency signal. This signal is coupled to the VHF tuner through L18, a coaxial cable, and J500 on the VHF tuner. In UHF operation, the local oscillator of the VHF tuner is inoperative, and the r-f amplifier and mixer tubes of the VHF tuner operate as i-f amplifiers.

The two tanks of the UHF tuner, the antenna tank and the mixer tank, are used to prevent the i-f and oscillator signals from feeding back to the antenna and interfering with other receivers. The two tanks pass incoming signals readily, but do not pass the i-f or oscillator signal.

CHANGE-OVER SWITCH

The change-over switch supplied with the Tuner-Adapter is used to switch from VHF to UHF, and vice versa. It is installed on the back of the VHF tuner, and is operated by an actuator mounted on the VHF tuner shaft. When the Channel Selector of the VHF tuner is turned to the UHF position, the change-over switch makes proper connections for UHF operation. In this position, the switch places a 150,000-ohm resistor in series with the VHF mixer plate, which drops the voltage on the plate of the tube. (In the UHF position, the VHF Channel Selector places extra inductances in the VHF r-f and mixer circuits, permitting them to operate as i-f amplifiers, and it also shunts the VHF oscillator grid circuit with a 10-ohm resistor, putting the oscillator out of operation.) The change-over switch also turns off the VHF pilot light, turns on the UHF dial pilot lights, and connects the antenna to the UHF tuner.

When the VHF Channel Selector is turned to any VHF position, the change-over switch places a 150,000-ohm resistor in series with the UHF local oscillator plate circuit, which drops the voltage applied to the plate, and puts the oscillator out of operation. The switch also turns on the VHF pilot light, turns off the UHF dial pilot lights, and connects the antenna to the VHF tuner.

PLANETARY DRIVE

The UHF tuner is tuned by means of a 3-gang tuning condenser, which is driven through a specially designed planetary drive. The planetary drive is so constructed that fine tuning and course tuning can be accomplished with a single control knob. The tuning shaft is coupled to the driving shaft through three balls, which form a planetary drive that produces slow rotation for fine tuning. See figure 43. After rotating 180 degrees with the tuning shaft, a pin engages the driving shaft, and the two shafts are direct-coupled, for coarse tuning. To re-engage the planetary drive for fine tuning, it is only necessary to reverse the direction of rotation. The dial pointer is connected to the tuning gang through a cord drive, and indicates the channel number to which the tuner is tuned.

ALIGNMENT AND REPAIRS

The frequencies at which the Tuner-Adapter operates are extremely high; therefore, it is necessary that the utmost care be taken to safeguard against upsetting the delicate adjustments of the tuner. It is recommended that the serviceman make only minor repairs to the tuner, such as replacement of the tube or crystal and the wiring of external leads. The

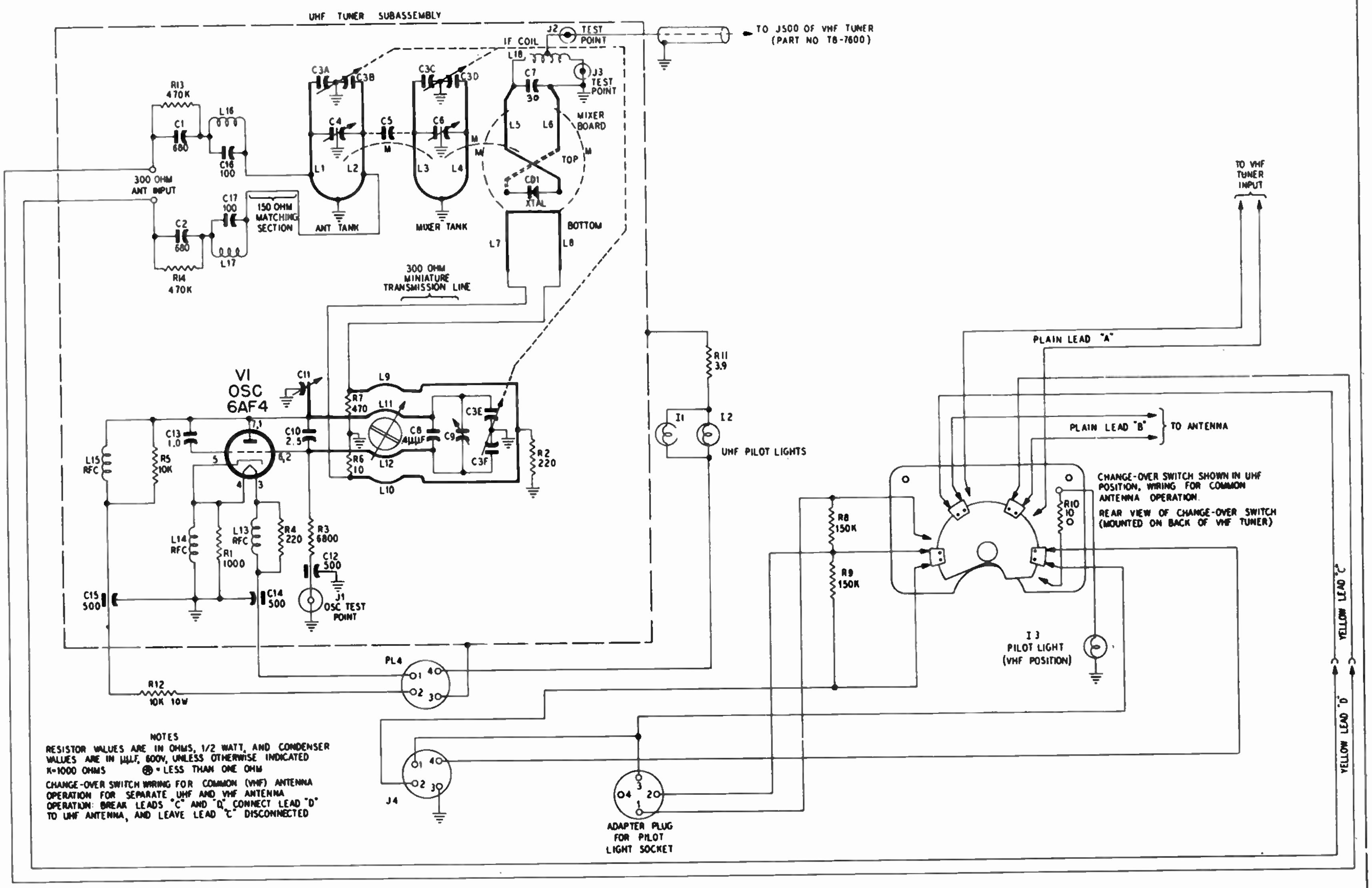


Figure 45. UHF Tuner-Adapter UT20B, Part No. 43-6701, Schematic Diagram TP3-873

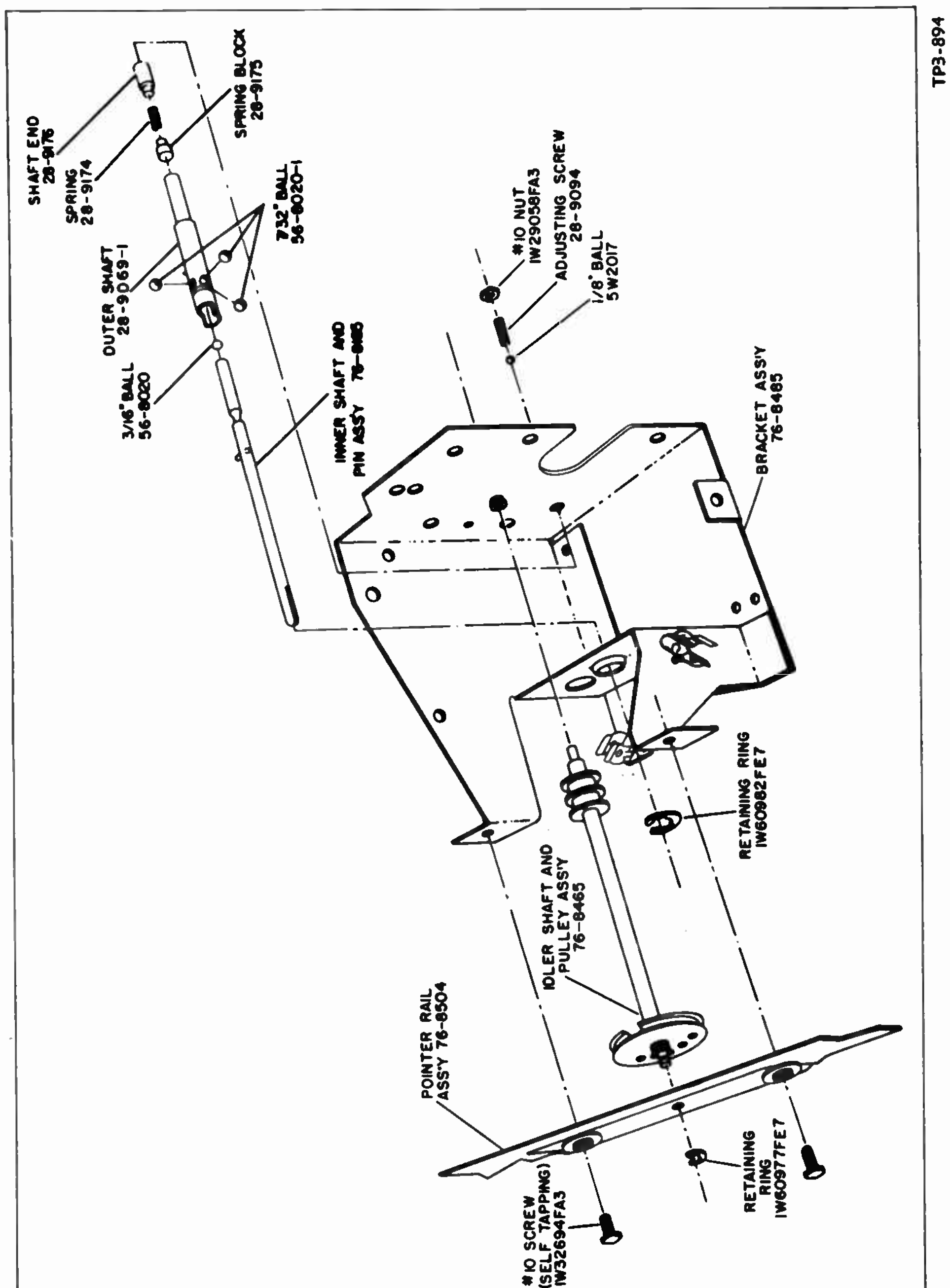


Figure 43. UHF Planetary Drive Assembly, Exploded View, Showing Mechanical Construction

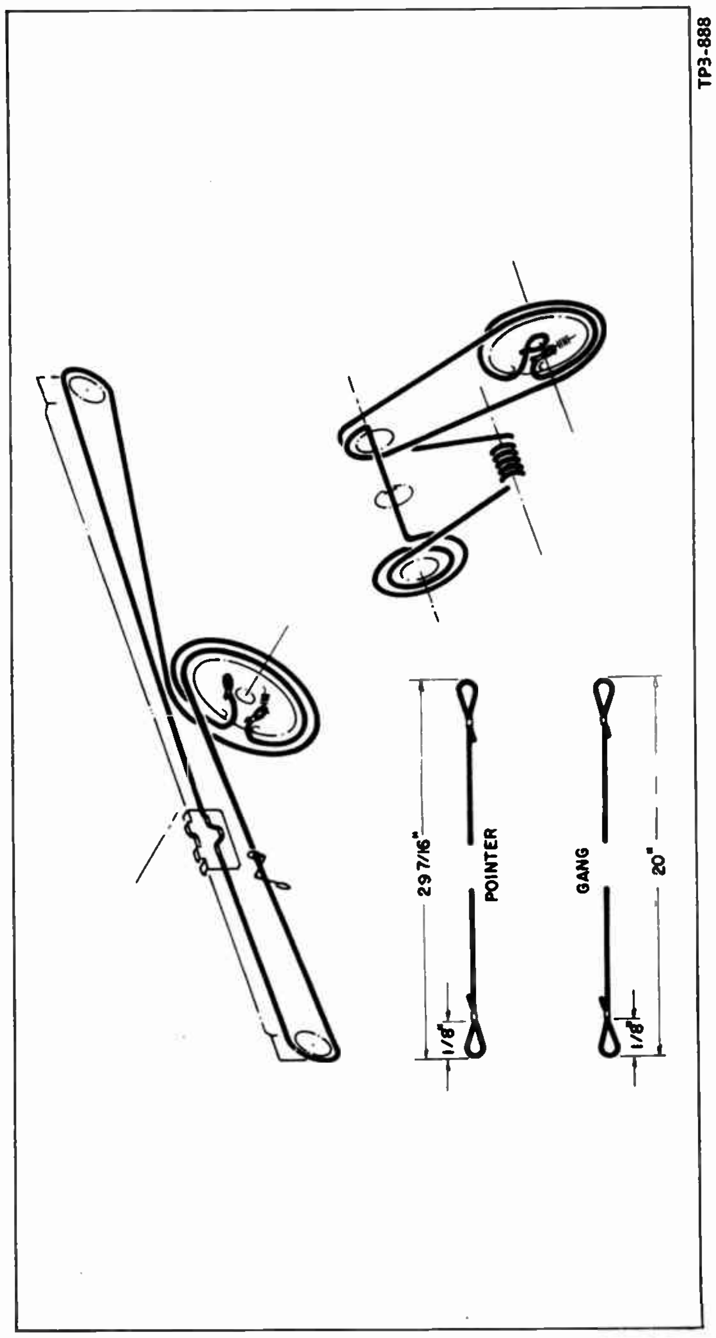
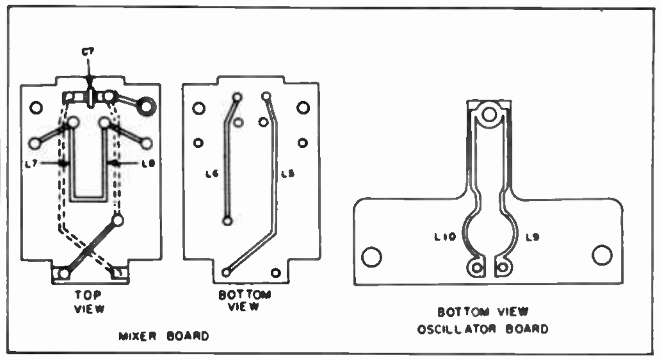
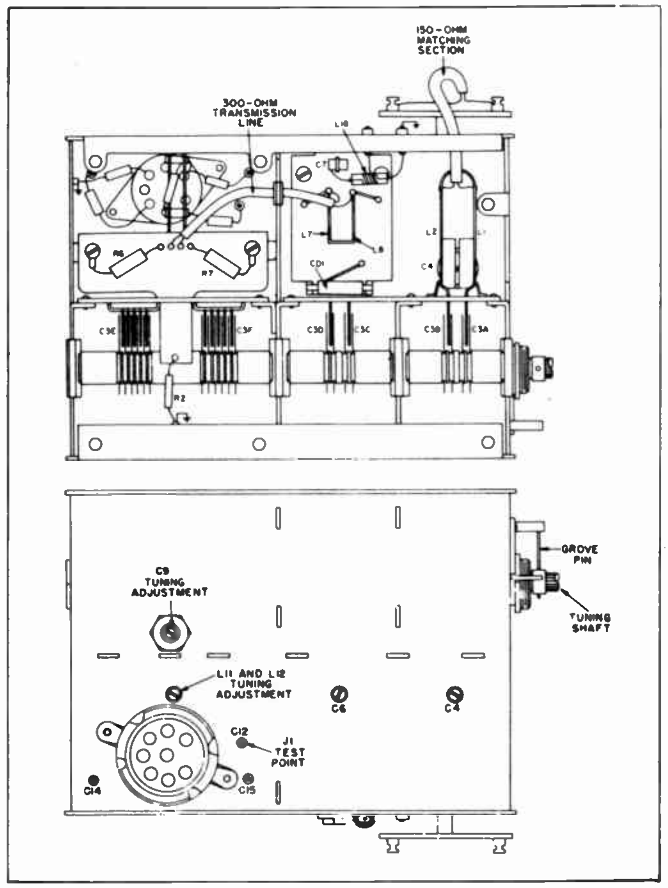


Figure 44. UHF Drive-Cord Stringing Arrangement



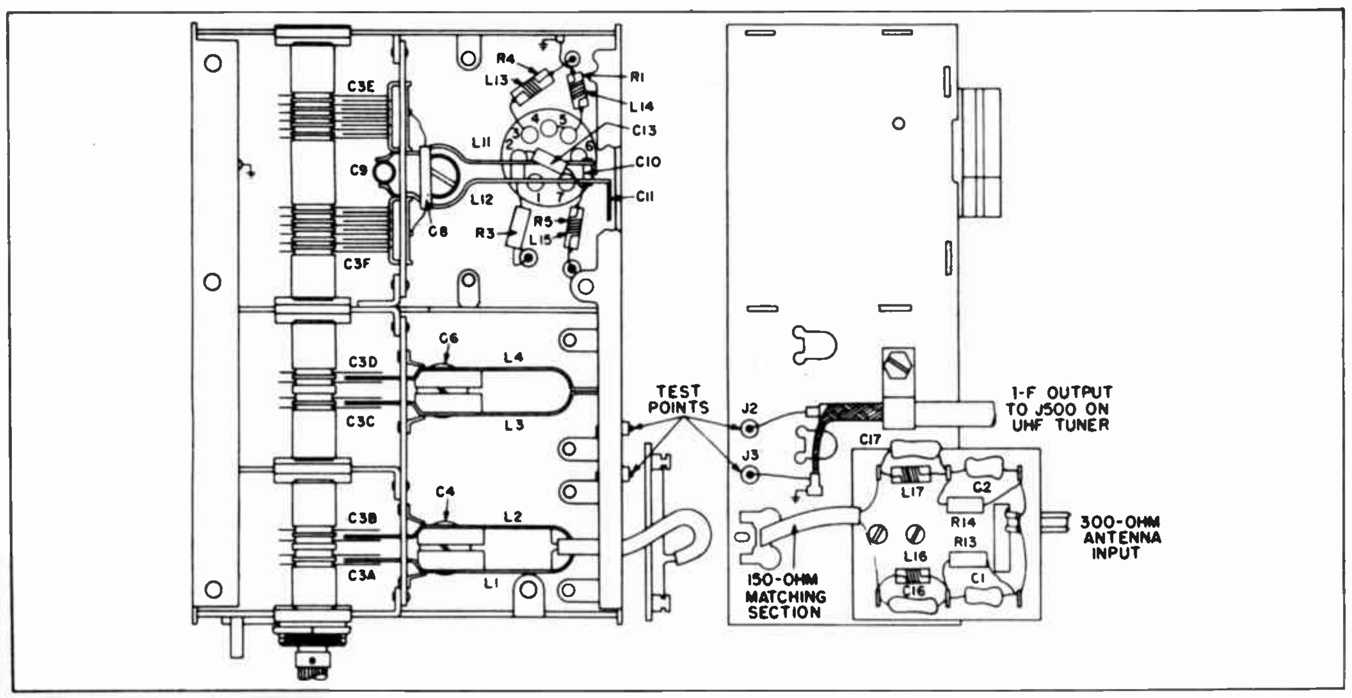
TP2-3175

Figure 46. Oscillator and Mixer Board Layouts, UHF Tuner



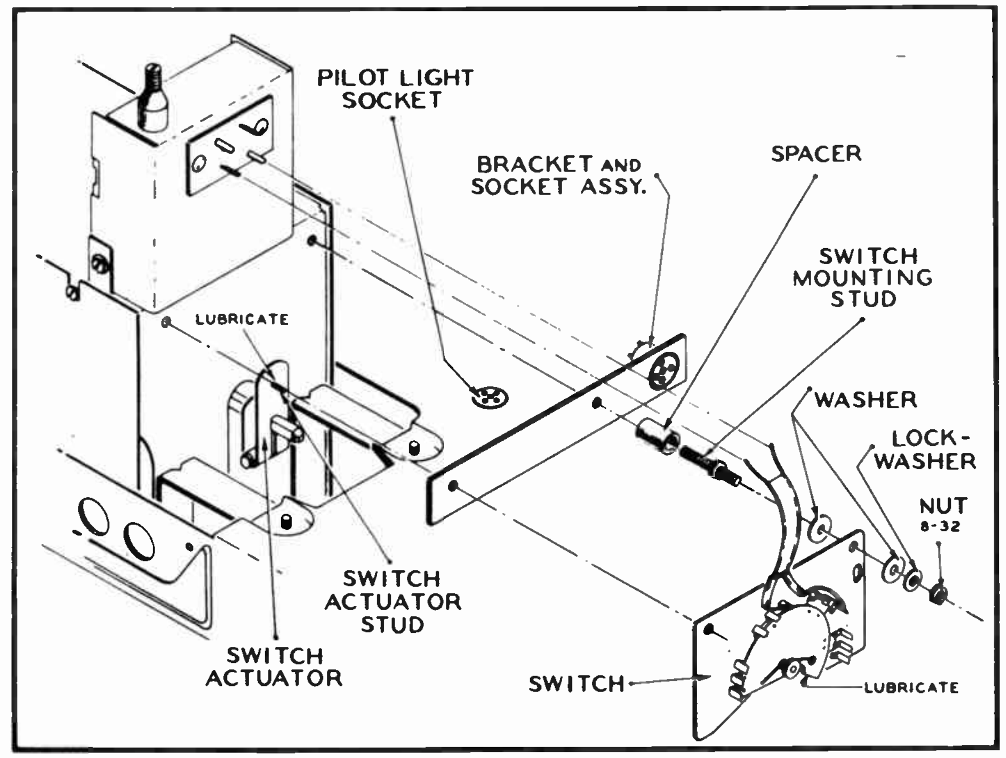
TP3-875

Figure 48. Side View and Base View of UHF Tuner-Adapter UT20B, With Board Assemblies



TP3-874

Figure 47. Top View and Base View of UHF Tuner-Adapter UT20B, Without Board Assemblies



TP3-480-A

Figure 49. VHF-UHF Change-Over Switch, Mounting Details

Tuner-Adapter should be returned to the factory for alignment and major repairs, unless the serviceman is properly equipped to perform these jobs. In general, a good rule to follow is not to remove the cover of the Tuner-Adapter.

NOTE: Replacing the tube with a new one may detune the tuner. If this occurs, a number of tubes should be tried, until the most satisfactory performance is obtained.

INSTALLATION INSTRUCTIONS

To install the UHF tuner-adapter, proceed as follows:

1. Remove the cabinet back and r-f chassis from the cabinet; then remove the nameplate on the control panel by pushing it out from inside the cabinet.

2. Insert the dial scale and bezel assembly into the hole provided in the cabinet. Fasten the assembly in place with the two 10-32 nuts provided.

3. Remove the tuner assembly from the mounting board with which it was shipped. Keep the three screws for mounting the tuner in the cabinet.

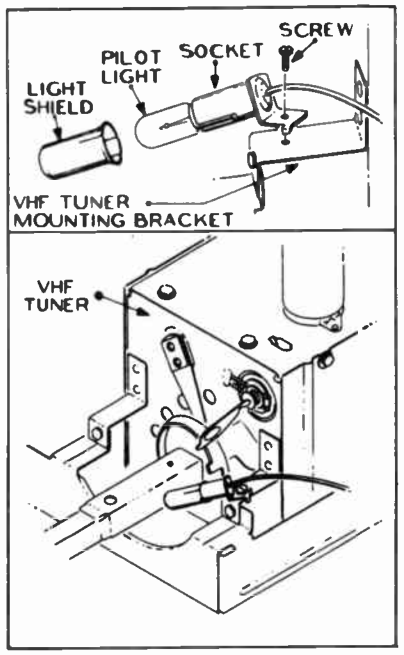
4. Place the spacers on the mounting studs and attach the bracket and socket assembly to the rear of the VHF tuner on the r-f chassis. See figure 49.

5. Place the switch-actuator assembly on the shaft extending from the rear of the VHF tuner with the switch-actuator stud pointing away from the tuner. See figure 49.

6. Place the switch assembly on the two mounting studs, and fasten it in place with the flat washers, lock washers, and nuts provided. See figure 49.

7. Put the VHF Channel Selector in the Channel 2 position. Rotate the switch actuator clockwise on the tuner shaft until the actuator touches the fiber cam on the change-over switch, and fasten the switch actuator in this position. Rotate the VHF Channel Selector to the UHF position. Check the switch operation, to make sure that the switch is thrown properly. Rotate the VHF Channel Selector to Channel 13 position, and check the switch operation, to make sure that the switch is not thrown in this position. Lubricate the switch-actuator stud and switch cam with cup grease.

8. Remove the pilot lamp from the r-f chassis pilot-light socket. Remove and discard the pilot-light socket and cable assembly from the r-f chassis. Insert the plug from the change-over switch into the socket on the r-f chassis from which the pilot-light cable was removed. Mount the new pilot-light socket from the change-over switch as shown in figure 50. Insert the pilot light in the socket, and install the shield provided over it.



TP3-755

Figure 50. Pilot-Light Socket, Mounting Details

9. Remove the antenna lead from the VHF tuner, and solder the short lead from the UHF-VHF change-over switch to the VHF tuner terminals from which the antenna lead was removed. Slide the folded fiber lead holder over the tapered-line coil assembly on the VHF tuner, and dress the twin-wire antenna leads through the holder. See figure 51. The fiber holder will prevent the twin-wire leads from touching the tubes on the r-f chassis.

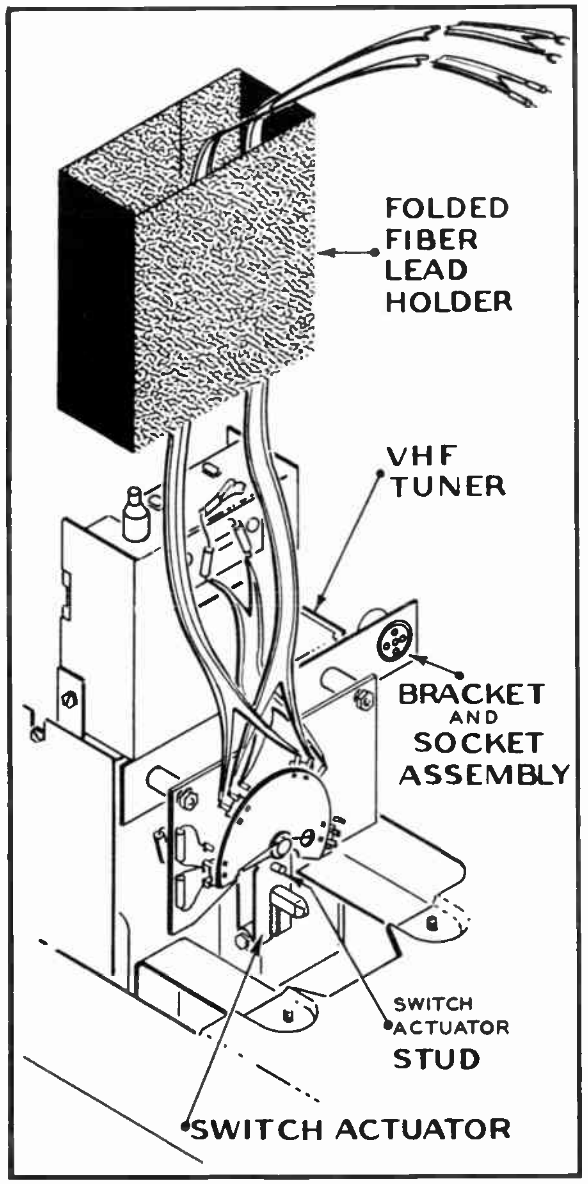
10. Place the UHF tuner in the cabinet between the r-f and deflection chassis, and fasten the UHF tuner to the chassis shelf with the three screws removed in step 3. It is important that these screws be tightened securely, so as to hold the UHF tuner in place on the chassis shelf.

11. Fasten one end of the ground lead to the r-f chassis with the drive screw. See figure 52. Install the chassis in the cabinet, and fasten the other end of the ground lead to the UHF tuner with the 8-32 x 1/4 inch hex-head machine screw. Fasten the r-f chassis with the original mounting bolts. Place the original knobs on their shafts, and the knob provided on the UHF tuning shaft.

12. Insert the plug from the UHF tuner into the socket on the bracket installed in step 4.

13. Insert the coaxial cable into the jack on the VHF tuner. See figure 52.

14. Replace the fiber antenna-lead holder with the new holder provided. Fasten the new holder with the



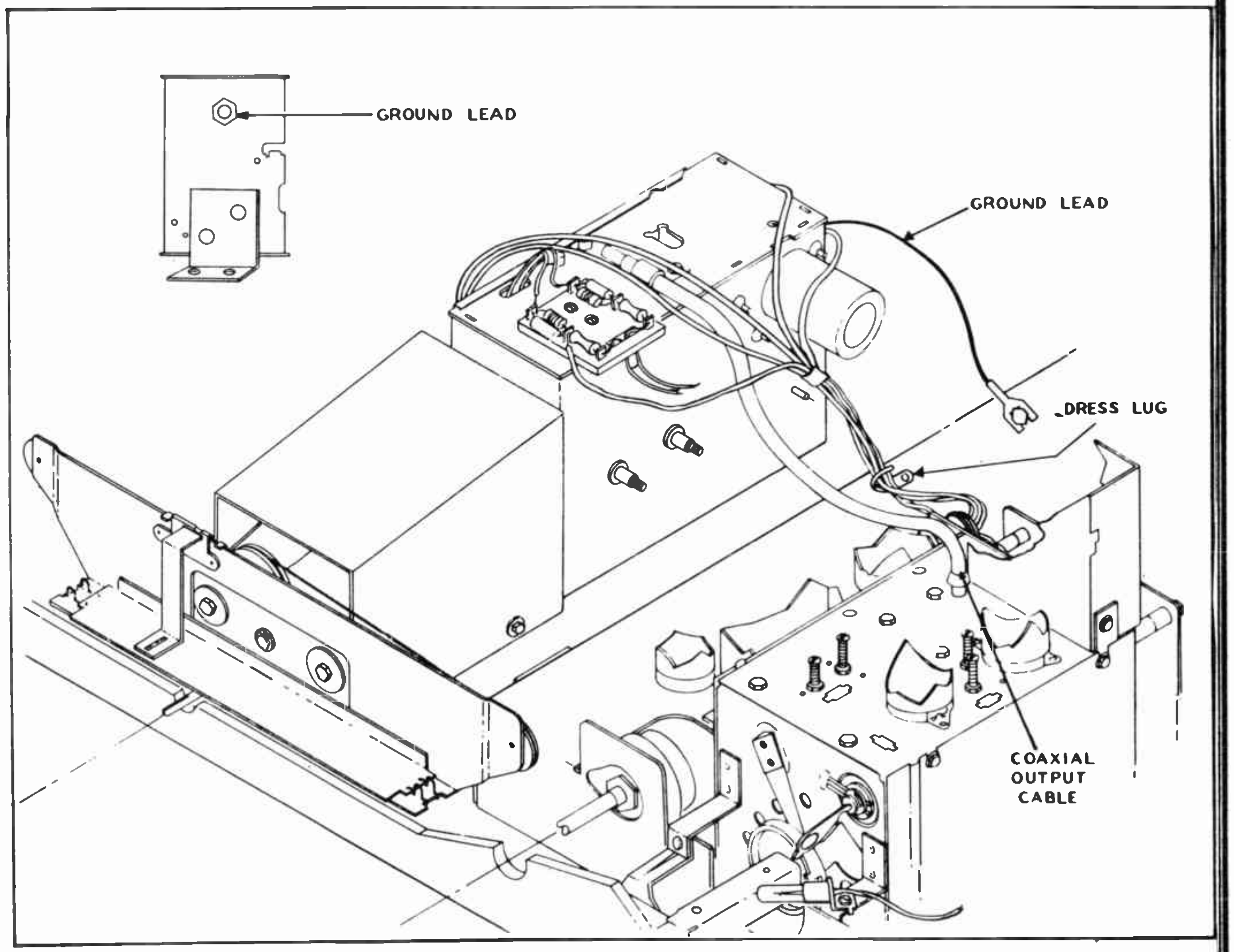
TP3-756

Figure 51. Folded Fiber Lead Holder and VHF-UHF Change-over Switch, Mounting Details

nails provided, and then pass the twin-wire leads through the holes as shown in figure 53. Pull the leads through the holder until they are tight, making certain that the leads do not contact the tubes or the chassis. Wrap tape around the yellow-marked twin-wire leads with the spade lug ends, to prevent the leads from passing back through the fiber holder.

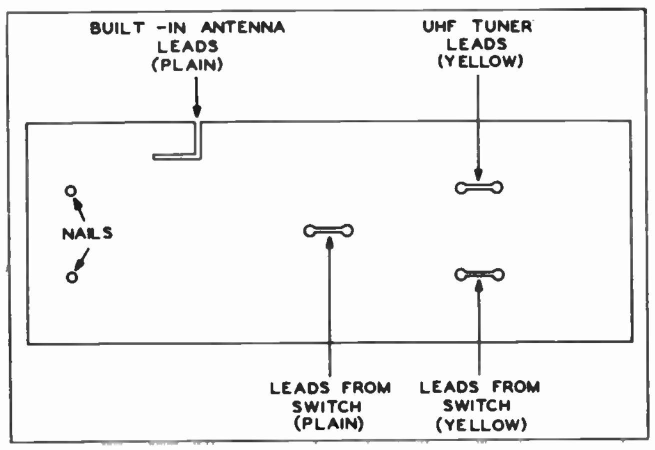
15. Fasten the antenna terminal board provided as shown in figures 54 through 58. Replace the cabinet back and make the connections illustrated for the type of antenna installation being used.

16. Paste the label provided over the outside-antenna instructions on the cabinet back.



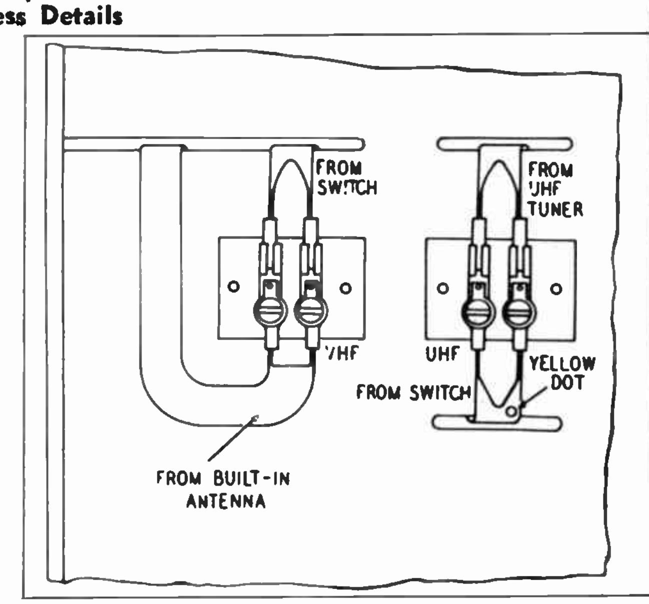
TP3-757

Figure 52. UHF Tuner-Adapter and R-F Chassis, with Lead Dress Details



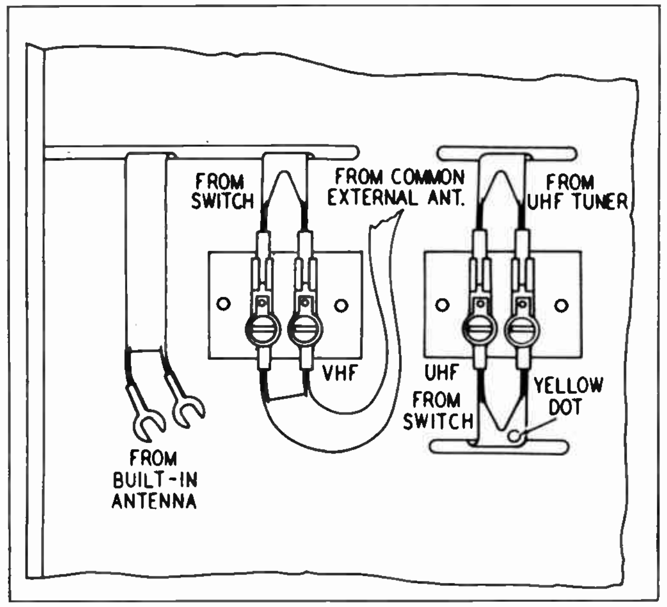
TP2-3169

Figure 53. Fiber Lead Holder, with Lead Dress Details



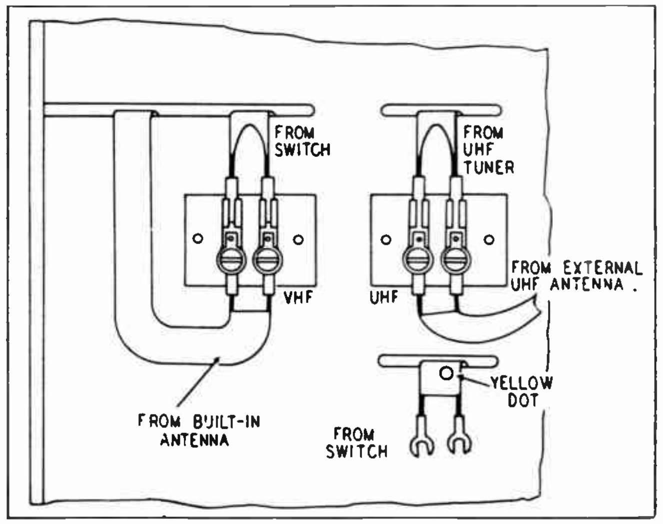
TP2-3170

Figure 54. Antenna-Lead Connections, Common VHF and UHF Built-In Antenna



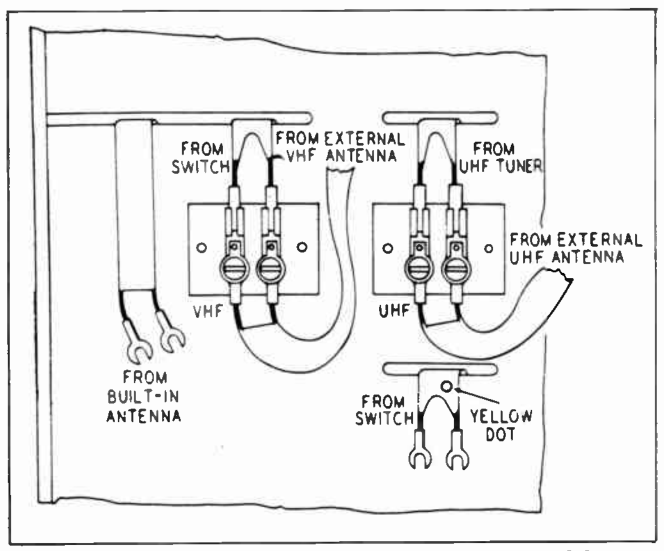
TP2-3172

Figure 55. Antenna-Lead Connections, Common VHF and UHF External Antenna



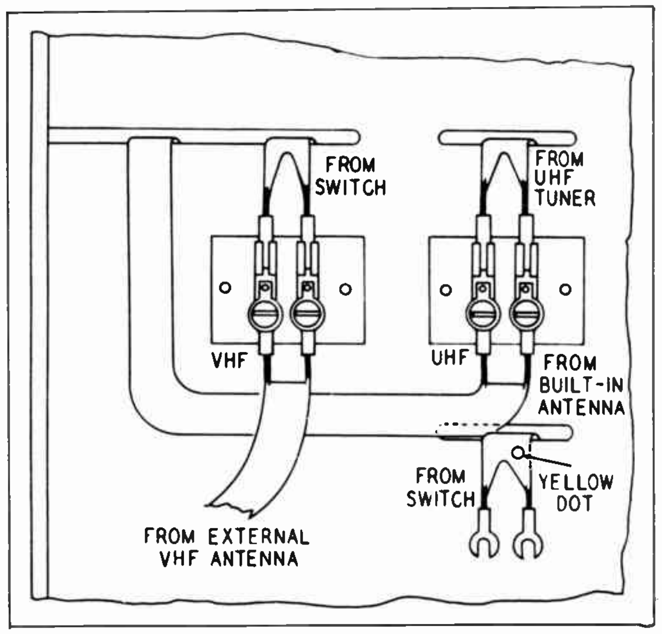
TP2-3171

Figure 57. Antenna-Lead Connections, VHF Built-In and UHF External Antennas



TP2-3174

Figure 56. Antenna-Lead Connections, Separate VHF and UHF External Antennas



TP2-3173

Figure 58. Antenna-Lead Connections, VHF External and UHF Built-In Antennas

PARTS LIST

IMPORTANT

General replacement items commonly stocked by the serviceman are omitted from this parts list. All condensers are molded-bakelite Philco condensers, with a 600-volt rating, and all resistors are ½ watt, unless otherwise indicated. Parts are listed according to chassis type, and should be ordered in this way rather than by model number; in addition, a miscellaneous listing will be found at the end of the parts list for each chassis type. All parts are symbolized in the schematic diagrams and base layouts, for identification purposes.

NOTE: Part numbers identified by an asterisk (*) are general replacement items. These numbers may not be identical with those on factory parts. Also, the electrical values of some replacement items may differ from the values indicated in the schematic diagrams and parts list. The values substituted in any case are so chosen that the operation will be unchanged. When ordering replacements, use only the "Service Part No."

DEFLECTION CHASSIS D-204

SECTION 1—POWER SUPPLY

Reference Symbol	Description	Service Part No.
C100 and C101	Condenser, filter, electrolytic, 120 μf., 150v	30-2568-51
C102	Condenser, filter, electrolytic, 10 μf., 50v	45-3035-6
C103	Condenser, filter, electrolytic, 100 μf., 300v	30-2584-27
CR100 and CR101	Rectifier, selenium, 350 ma.	34-8003-7
F100	Fuse, line, 1.6 amperes	AD2248-19
J100	Socket, a-c line	27-6240-3
J101	Socket, chassis connecting	27-6274-1
J-102	Socket, radio chassis connecting	27-6274-4
PL100	Plug, a-c line	Part of a-c line cord ass'y. (See Misc. "A")
PL101	Plug and cable ass'y., chassis connecting	(See Misc. "B")
R100	Resistor, current limiting, 5 ohms, 10 watts	33-3448-5
R102	Resistor, voltage dropping	20 inches No. 24 wire
R103	Resistor, voltage dropping, 4.7 ohms, 1 watt	66-9474340
S100	Switch, off-on	Part of volume control
T100	Transformer, filament	32-8575

SECTION 7—VERTICAL SWEEP

Reference Symbol	Description	Service Part No.
C707	Condenser, cathode by-pass, 100 μf., 25v	Part of C103
L700 and L701	Coils, vertical deflection	Part of deflection yoke (See Misc. "A")

SECTION 7—VERTICAL SWEEP (Cont.)

Reference Symbol	Description	Service Part No.
R701	Potentiometer, VERT. HOLD control, 250,000 ohms	Part of R811
R704	Potentiometer, HEIGHT control, 2.5 megohms	33-5565-32
R708	Potentiometer, VERT. LIN. control, 5 megohms	33-5565-31
T700	Transformer, vertical oscillator	32-8431-2
T701	Transformer, vertical output	32-8539

SECTION 8—HORIZONTAL SWEEP

Reference Symbol	Description	Service Part No.
C803	Condenser, filter, .001 μf.	30-1238-3
C804	Condenser, filter, .01 μf.	30-1238-2
C805	Condenser, by-pass, 82 μμf.	60-00825317
C806	Condenser, ringing, .0022 μf. ±10%	60-20225004
C807	Condenser, d-c blocking, 390 μμf.	60-10395417
C808	Condenser, charging, 390 μμf.	60-10395417
C813	Condenser, anti-ringing, 68 μμf.	30-1246-1
C814	Condenser, horizontal a-f-c feedback, .01 μf.	30-1238-2
C815	Condenser, electrolytic	Part of C103
C815A	Condenser, by-pass, 10 μf., 300v	Part of C103
C815B	Condenser, by-pass, 10 μf., 475v	Part of C103
C-816	Condenser, yoke blocking, .47 μf., 100v	30-4651-16
J800	Socket, deflection	27-6274-8
J801	Socket, gate pulse	27-6273
L800	Coil, stabilizing, 30—80 mh.	32-4557
L801	Coil, r-f choke, horizontal-output plate	Part of T800

SECTION 8—HORIZONTAL SWEEP (Cont.)

Reference Symbol	Description	Service Part No.
L802 and L803	Coils, horizontal deflection ..	Part of deflection yoke (See Misc. "A")
L804	Coil, r-f choke, damper cathode	32-4112-24
L805	Coil, r-f choke, damper plate	32-4112-24
PL800	Plug, deflection	Part of cable ass'y. (See Misc. "A")
PL801	Plug, gate pulse	Part of cable ass'y. (See Misc. "A")
R810	Potentiometer, HORIZ. HOLD CENTERING, 250,000 ohms	33-5565-17
R811	Potentiometer, HORIZ. HOLD control, 50,000 ohms	33-5563-50
R815	Potentiometer, WIDTH control, 12,000 ohms, 2 watts ..	33-5546-51
R816	Resistor, screen voltage dropping, 4200 ohms, 5 watts ...	33-1335-101
R817	Resistor, feedback, 47,000 ohms, 1 watt	66-3474340
R818	Resistor, voltage divider, 82,-000 ohms, 1 watt	66-3824340

SECTION 8—HORIZONTAL SWEEP (Cont.)

Reference Symbol	Description	Service Part No.
R819	Resistor, voltage divider, 47,-000 ohms, 1 watt	66-3474340
T800	Transformer, horizontal output	32-8607

MISCELLANEOUS "A"

Description	Service Part No.
Cable assembly, high voltage	AD2631
Cable and plug assembly, deflection	41-4086-25
Cable and plug assembly, volume control.	41-4136-4
Cord, line	41-3865
Shield, corona	56-9684
Socket, damper tube	27-6174-7
Socket, high-voltage rectifier	27-6290-1
Socket, miniature, 7-pin	27-6203-12
Socket, miniature, 9-pin	27-6203-6
Socket, octal	27-6174
Socket, 12AU7 tube	76-6115-1
Socket, vertical output, 12B4	76-6115-2
Spring, anode lead	28-9137

R-F CHASSIS R-204

SECTION 2—VIDEO I.F.

Reference Symbol	Description	Service Part No.
C200	Condenser, 47.25-mc. trap, 5 μμf.	30-1224-28
C201	Condenser, 47.25-mc. trap, 1 to 5 μμf.	31-6520-9
C202	Condenser, 41.25-mc. trap, 5 μμf.	30-1224-28
C203	Condenser, 41.25-mc. trap, 1 to 5 μμf.	31-6520-9
C204	Condenser, trimmer, 1 to 5 μμf.	31-6520-9
C205	Condenser, d-c blocking, 100 μμf.	30-1224-18
C206	Condenser, trimmer, 1 to 5 μμf.	31-6520-9
C207	Condenser, screen by-pass, 1500 μμf.	62-215001011
C208	Condenser, cathode by-pass, 680 μμf.	62-168001001
C209	Condenser, a-g-c by-pass, 680 μμf.	62-168001001
C210	Condenser, trimmer, 1 to 5 μμf.	31-6520-9
C211	Condenser, screen by-pass, 680 μμf.	62-168001001
C212	Condenser, a-g-c by-pass, 680 μμf.	62-168001001
C215	Condenser, trimmer, 1 to 5 μμf.	31-6520-9
C218	Condenser, trimmer, 1 to 5 μμf.	31-6520-9

SECTION 2—VIDEO I.F. (Cont.)

Reference Symbol	Description	Service Part No.
C219	Condenser, detector by-pass, 10 μμf.	62-010409001
C220	Condenser, by-pass, 680 μμf. .	62-168001001
C221	Condenser, by-pass, 680 μμf. .	62-168001001
C223	Condenser, a-g-c filter, 2 μf. ..	45-3035
C224	Condenser, electrolytic	30-2584-25
C224A	Condenser, filter, 40 μf.	Part of C224
C224B	Condenser, filter, 10 μf.	Part of C224
C224C	Condenser, filter, 10 μf.	Part of C224
C226	Condenser, cathode by-pass, 18 μμf.	62-018400021
CD200	Crystal, video detector	34-8022
I200	Lamp, pilot	34-2068
J200	Socket, video test	27-6273
J202	Socket, pilot light	27-6273
L200 and L201	Coils, tuner coupling	Part of T200
L202	Coil, 47.25-mc. trap	32-4597-2
L203	Coil, 41.25-mc. trap	32-4112-31
L204	Coil, 1st i-f grid	32-4597-3
L205 and L206	Coils, coupling	Part of T201
L207 and L208	Coils, coupling	Part of T202
L209	Coil, filament choke	32-4112-15
L210 and L211	Coils, coupling	Part of T203
L212 and L213	Coils, coupling	Part of T204

R-F CHASSIS R-204 (Cont.)

SECTION 2—VIDEO I.F. (Cont.)

Reference Symbol	Description	Service Part No.
L214	Coil, series peaking, 10 μh. .	32-4422-27
L215	Coil, series peaking, 1.7 μh. .	32-4480-17
L216	Coil, shunt peaking, 180 μh. .	32-4480-9
L217	Coil, filament choke	32-4112-15
R208	Resistor, voltage dropping, 5600 ohms, 1 watt	66-2564340
R224	Resistor, B+ dropping, 2000 ohms, 7 watts	33-3446-8
T200	Transformer, video i-f input .	32-4599-2
T201	Transformer, 1st video i-f ...	32-4598-5
T202	Transformer, 2nd video i-f ..	32-4598-3
T203	Transformer, 3rd video i-f ..	32-4548-26
T204	Transformer, 4th video i-f ..	32-4548-27

SECTION 3—VIDEO

Reference Symbol	Description	Service Part No.
C300	Condenser, audio take-off, 2.2 μμf.	30-1221-6
C301	Condenser, by-pass, 18 μμf. ..	62-018400021
C303	Condenser, by-pass, 68 μμf. ..	62-068409011
C304	Condenser, by-pass, 33 μμf. ..	62-033009001
C309	Condenser, screen by-pass, 220 μμf.	60-10225417
L300	Coil, audio take-off	32-4463-9
L301	Coil, video-amplifier grid, peaking, 150 μh.	32-4480-18
L302	Coil, 4.5-mc. trap	32-4463-2
L305	Coil, shunt peaking, 60—230 μh.	32-4467-20
L306	Coil, picture-tube grid peaking, 40 μh.	32-4480-1
L307	Coil, shunt peaking, 60—230 μh.	32-4467-20
R308	Potentiometer, CONTRAST control, 2500 ohms	33-5563-51
R311	Resistor, plate load, 2500 ohms, 7 watts	33-1335-93
R313	Potentiometer, BRIGHTNESS control, 100,000 ohms	Part of R308
R316	Resistor, grounding, 470,000 ohms, 1 watt	66-4474340

SECTION 4—AUDIO

Reference Symbol	Description	Service Part No.
C405	Condenser, by-pass, 56 μμf. ..	30-1224-25
C409	Condenser, detector balancing, 330 μμf.	62-133001001
C412	Condenser, r-f by-pass, 330 μμf.	62-133001001
C413	Condenser, filter, 2 μf.	45-3035
C416	Condenser, plate by-pass, .0033 μμf., 1000v	30-4650-89
C418	Condenser, filter, 60 μf.	Part of C224
J400	Socket, volume control	27-6273
J401	Socket, speaker	27-4785-22

SECTION 4—AUDIO

Reference Symbol	Description	Service Part No.
L405	Coil, filament choke	32-4112-15
L406	Coil, filter choke	Speaker field
R406	Resistor, voltage divider, 27,-000 ohms, 1 watt	66-3274340
R412	Resistor, cathode bias, 180 ohms, 1 watt	66-1185340
R418	Potentiometer, dual	33-5563-44
R418A	Potentiometer, TONE control, 5 megohms	Part of R418
R418B	Potentiometer, VOLUME control, 2 megohms	Part of R418
T400	Transformer, audio output ..	32-8579
Z400	Transformer, 1st sound i-f ..	32-4497A
Z401	Transformer, FM detector ...	32-4450-6A

SECTION 6—SYNC

Reference Symbol	Description	Service Part No.
C604	Condenser, by-pass, 470 μμf. ..	30-1225-18

MISCELLANEOUS "B"

Description	Service Part No.
Cable and plug assembly, audio	41-41951
Cable and plug assembly, chassis connecting	41-4146-10
Cable and plug assembly, gate pulse	41-4141
Cable and socket assembly, picture tube ..	41-3964-19
Cable and socket assembly, pilot light	41-4176-3
Shield, tube, 6CB6	56-5629FA3
Shield, tube, 6T8	56-5629-5
Socket and base assembly, 6L6 tube	27-6174
Socket and base assembly, 6CB6 tube	27-6203-14
Socket and base assembly, 6T8 tube	27-6203-18
Socket, miniature, 6AU6, 6AQ5, and 6BA6 tubes	27-6203
Socket, miniature, 9-pin	27-6203-6

SECTION 5—T.V. TUNER, PART No. 76-7600-3

Reference Symbol	Description	Service Part No.
C500	Condenser, FM trap, 20 μμf. .	62-020309011
C501 and C502	Condenser, antenna isolating, 470 μμf.	30-1225-18
C503	Condenser, i-f trap, 22 μμf. ..	Part of L505
C504	Condenser, r-f coupling, 39 μμf.	62-039409011
C505	Condenser, neutralizing, 220 μμf.	62-122001001
C506	Condenser, a-g-c decoupling, 1000 μμf.	30-1245-1
C507	Condenser, r-f trimmer, 0.5 to 3.0 μμf.	31-6520-3

UHF TUNER-ADAPTER UT20B, PART No. 43-6701

SECTION 5—T.V. TUNER (Cont.)

Reference Symbol	Description	Service Part No.
C508	Condenser, r-f by-pass, 680 μμf.	62-168001001
C509	Condenser, grid by-pass, .01 μf.	30-1238-2
C510	Condenser, coupling, .59 μμf.	311-5050-3
C511	Condenser, neutralizing, 220 μμf.	62-122001011
C512	Condenser, mixer-grid trimmer, 0.5 to 3.0 μμf.	31-6520-3
C513	Condenser, by-pass, 7.5 μμf.	30-1224-13
C514	Condenser, trimmer, 1 to 5 μμf.	31-6520-11
C515	Condenser, i-f link coupling, 680 μμf.	62-168001021
C516	Condenser, by-pass, 680 μμf.	62-168001001
C517	Condenser, filament decoupling, 220 μμf.	62-122001011
C518	Condenser, filament by-pass, 1000 μμf.	30-1245-1
C519	Condenser, filament decoupling, 220 μμf.	62-122001011
C520	Condenser, by-pass, 1000 μμf.	30-1245-1
C521	Condenser, oscillator injection	30-1221-8
C522	Condenser, oscillator plate, 12 μμf.	30-1224-5
C523	Condenser, grid blocking, 5 μμf.	30-1224-35
C524	Condenser, mixer-grid blocking, 39 μμf.	30-1238-9
C525	Condenser, by-pass, 150 μμf.	62-115001011
C528	Condenser, fine tuning, (bakelite tube)	76-6935-1
J500	Connector, 40-mc. input	57-0590-2
L500	Coil, FM trap	32-4550-3
L501, L502, L503, and L504	Coils, tapered-line assembly	32-4432-3
L505	Coil, r-f trap (44.75 mc.)	32-4552-1
L506 to L512 inclusive	Coils, r-f grid tuning	Part of WS500E
L513	Coil, 40-mc. channel	312-5146-16
L514	Coil, 40-mc. channel	312-5146-19
L515	Coil, r-f amplifier neutralizing	32-4548-13
L516	Coil, r-f coupling	312-5146-22
L517 to L524 inclusive	Coil, r-f plate tuning	Part of WS500C
L525 to L532 inclusive	Coil, mixer grid	Part of WS500B
L533	Coil, mixer neutralizing	32-4551-1
L534	Coil, mixer plate	312-5146-8
L535	Coil, i-f primary	312-5151-6
L537 to L543 inclusive	Coil, oscillator tuning	Part of WS500A

SECTION 5—T.V. TUNER (Cont.)

Reference Symbol	Description	Service Part No.
L544 and L545	Coils, r-f choke	32-4550-1
R518	Resistor, B+ dropping, 15,000 ohms, 1 watt	66-3154340
WS500A(F) and WS500A(R)	Switch, wafer, oscillator	76-7604
WS500B(F) and WS500B(R)	Switch wafer, mixer grid	76-7606
WS500C(F) and WS500C(R)	Switch wafer, r-f plate	76-7608
WS500D(F) and WS500D(R)	Switch wafer, r-f grid	76-7612
WS500E(F) and WS500E(R)	Switch wafer, r-f grid	76-7610

MISCELLANEOUS "C"

Description	Service Part No.
Coupling, fine tuning shaft	54-4912
Detent, ball	56-8020
Front plate ass'y.	76-8395
Hairpin, plunger grounding	1W42704FA3
Hairpin, plunger	56-9858
Plunger	56-8034-1
Retaining ring (2 used)	1W61043
Shaft ass'y.	76-6914-4
Shaft, extension	56-8358
Cam and shaft, fine tuning	76-6936-3
Shaft, spring	56-8023
Shield, tube, 9-pin miniature	56-5629-5
Socket, tube, 9-pin miniature	27-6203-21
Spring, detent	56-9158
Spring, plunger	56-9628
Tapered line ass'y.	76-7602
Terminal panel, antenna	76-5504-2
Washer	56-9351
Washer, fiber	27-4109-13
Washer, detent spring	W2556-5
"E" washer	1W60980FE5

Reference Symbol	Description	Service Part No.
C1 and C2	Condenser, antenna coupling, 680 μμf.	Part of Panel, filter
C3	Condenser, tuning:	
	Shaft and rotor ass'y.	76-7481-4
C3A	Stator, r-f, l.h.	56-9595
C3B	Stator, r-f, r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator ass'y., oscillator	76-7479
C3F	Stator ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f	76-7472

MISCELLANEOUS "C" (Cont.)

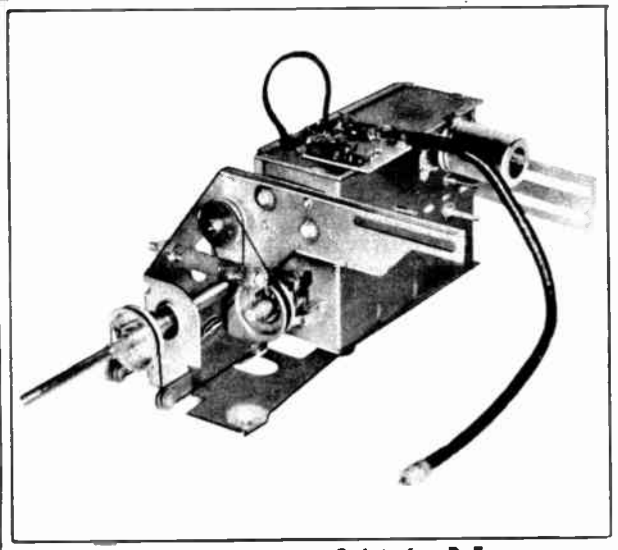
Reference Symbol	Description	Service Part No.
C7	Condenser, crystal, mixer tank, 30 μμf.	Part of Board ass'y., mixer
C8	Condenser, temperature compensating, .4 μμf.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 2.5 μμf.	Part of Tank ass'y., osc.
C11	Condenser, by-pass	Part of Tank ass'y., osc.
C12	Condenser, grid by-pass, 500 μμf.	30-1245-3
C13	Condenser, temperature compensating, 1.0 μμf.	30-1224-107
C14	Condenser, filament by-pass, 500 μμf.	30-1245-3
C15	Condenser, plate by-pass, 500 μμf.	30-1245-3
C16 and C17	Condenser, 45.75-mc. i-f trap	Part of Panel, filter
CD1	Crystal detector, mixer circuit	34-8026
I1 and I2	Lamp, pilot, UHF	34-2068
L1	Inductor, r-f, l.h.	Part of C3A Stator
L2	Inductor, r-f, r.h.	Part of C3B Stator
L3	Inductor, r-f, l.h.	Part of C3C Stator
L4	Inductor, r-f, r.h.	Part of C3D Stator
L5	Inductor, crystal mixer	Part of Board ass'y., mixer
L6	Inductor, crystal mixer	Part of Board ass'y., mixer
L7	Inductor, oscillator coupling	Part of Board ass'y., mixer
L8	Inductor, oscillator coupling	Part of Board ass'y., mixer
L9	Inductor, oscillator coupling	Part of Board ass'y., osc.
L10	Inductor, oscillator coupling	Part of Board ass'y., osc.
L11	Inductor, oscillator	Part of Tank ass'y., osc.
L12	Inductor, oscillator	Part of Tank ass'y., osc.
L13	Choke, r-f, heater decoupling	32-4556-3
L14	Choke, r-f, cathode decoupling	32-4556-4
L15	Choke, r-f, plate decoupling	32-4556-2
L16 and L17	Coils, 45.75-mc. i-f trap	Part of Panel, filter
L18	Coil, i-f output	32-4558
R1	Resistor, damping, 1000 ohms	66-2108340
R2	Resistor, damping, 220 ohms.	66-1228340
R3	Resistor, grid leak, 6800 ohms	66-2688340
R4	Resistor, filament decoupling, 220 ohms	Part of L13
R5	Resistor, plate decoupling, 10-000 ohms	Part of L15
R6	Resistor, balancing, 470 ohms	66-1478340
R7	Resistor, balancing, 10 ohms.	66-0108340
R8 and R9	Resistor, B+ dropping, 150,000 ohms	66-4158340
R10	Resistor, pilot-light dropping, 10 ohms	66-0108340
R11	Resistor, pilot-light dropping, 3.9 ohms	66-9138340
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
R13 and R14	Resistor, antenna coupling, 470,000 ohms	66-4478340
	Board ass'y., mixer	76-7475-4
	Board ass'y., oscillator	76-7480
	Panel, filter, i-f trap	76-8078
	Tank ass'y., oscillator	76-7627

MISCELLANEOUS ELECTRICAL PARTS

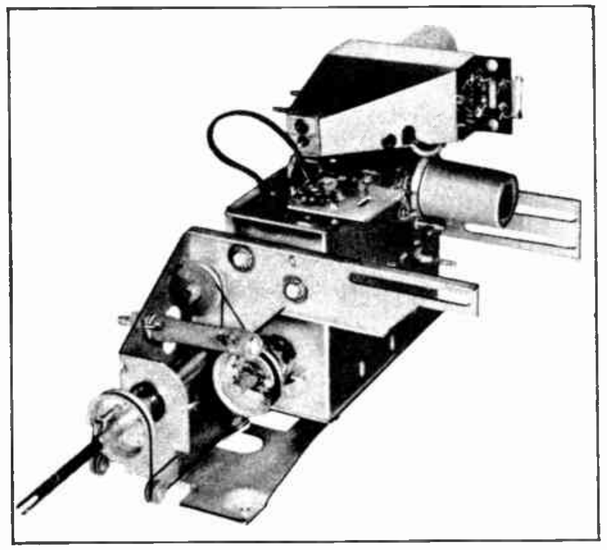
Adapter cable	41-4171-2
Cable ass'y., i-f	41-4143
Cable, power input	41-4141-4
Cable, pilot light, UHF (2)	27-6233-6
Cable, pilot light, VHF	27-6233-103
Padder, osc. (L11 and L12 tuning adjustment)	76-8193
Panel, antenna, UHF	76-7097
Socket, oscillator	27-6288
Switch	42-1996-6

MECHANICAL PARTS

Description	Service Part No.
Tuner-shaft and rotor mounting:	
Ball, bearing (10)	W2510-5
Bearing, front	56-9593
Bearing, rear	56-9609
Nut, front bearing	56-9594
Nut, rear bearing	56-9599
Spring, center (2)	56-9590
Spring, end (2)	56-9591
Switch mounting:	
Switch-actuator ass'y.	76-8189-1
Collar stud (2)	28-9126-1
Lock washer (2)	1W24515FA1
Nut, #8, special (2)	1W20506FA3
Spacer, ⅜" (2)	1W29155FA3
Washer, fiber (4)	27-4109-29
Planetary assembly:	
Ball, ⅛"	5W2017
Ball, 3/16"	56-8020
Ball, 7/32" (3)	56-8020-1
Housing, drive	76-8485
Ring, retaining, shaft	1W60982FE7
Screw, adjusting	28-9094
Shaft, inner end	28-9176
Shaft, outer, drive	28-9069-1
Shaft and pin ass'y., inner	76-8300-1
Spring	28-9174
Clip, background plate (2)	28-9462
Background plate	54-8993
Bracket and connector ass'y.	76-8425
Block, spring	28-9175
Dial scale, prism and bezel assembly	76-8506-2
Rear mounting foot and insulator	76-8505
Grommet, feed-through	27-4707
Insulator, tuning shaft	27-9437
Knob	76-8508
Lock washer, antenna panel mounting	1W24515FA1
Nut, antenna panel mounting	1W19982FA3
Pulley, tuner shaft	28-9090
Shield, tube	56-5629-9
Spring, drive cord, pointer	28-9088
Spring, drive cord, tuner	28-9490
Tuner, and planetary ass'y., complete	76-7595-3
Planetary drive assembly	76-8507
Pointer	56-5630-59
Pointer guide ass'y.	76-8504
Ring, retaining, idler shaft	1W60977FE7
Screw, pointer guide mounting (2)	1W19920FA3
Screw, drive housing, mounting (3)	1W61075FA3
Screw, foot mounting (2)	1W32694FA3
Screw, drive housing insulator mounting (3)	1W19907FA3
Screw, antenna panel mounting (2)	1W10583FA3
Screw, tuner mounting (3)	1W19907FA3
Screw, pilot-light mounting	1W19670FA3
Shaft and pulley, idler	76-8465
Spacer, drive housing mounting (3)	54-8994
Washer, insulator, drive housing mounting (3)	54-8544
Washer, fiber, pointer guide mounting (2)	27-4109-29



UHF Tuner-Adapter (Chassis Only) for R-F Chassis 91, 91R, 94, and 94R TP2-2869



UHF Tuner-Adapter (Chassis Only) for R-F Chassis 81 and 84 TP2-2870

UHF TUNER-ADAPTER PART No. 43-6474, FOR RECEIVERS USING R-F CHASSIS 81 OR 84

UHF Tuner-Adapter Part No. 43-6474 provides for the reception of UHF signals on television channels 14 through 83. It is designed for installation in Philco Television Receivers using r-f chassis 81 or 84. The adapter consists of a UHF converter and preamplifier unit, a change-over switch, adapter cables and plugs, a planetary tuner driving assembly, and mounting hardware.

CIRCUIT DESCRIPTION

The UHF Tuner-Adapter functions as a converter, and converts the signals of the UHF band to a frequency selected within the VHF band. The frequency selected is that of either Channel 2 or Channel 3, depending upon the locality in which the receiver is used.

The incoming UHF signal is coupled through the antenna input line, and through two 680-$\mu\mu f$. condensers and a 150-ohm transmission line to the antenna tank of the tuner. See figure 1. The antenna tank is coupled to the mixer tank by means of the mutual coupling of L2 and L3 and the stray capacitance, C5. The desired signal is selected by tuning the antenna tank and the mixer tank to the proper frequency, and the signal is then coupled to the crystal mixer circuit by means of the mutual coupling of L4 and L5. The local-oscillator signal is generated by a 6AF4 tube, V1, and the associated circuit. The local-oscillator signal is coupled to the crystal mixer circuit by means of a 300-ohm, miniature transmission line and the mutual coupling of L7 to L5 and L8 to L6. The UHF r-f signal and the oscillator signal are mixed in the crystal mixer circuit, producing a radio-frequency signal within range of the VHF tuner when the tuner is set to either Channel 2 or Channel 3. This signal is fed into a preamplifier, which amplifies it, and it is then fed into the VHF tuner through a twin-wire lead. In the VHF tuner, the signal is converted to the intermediate frequency of the television receiver. On VHF operation, a 150,000-ohm resistor is placed in series with the UHF oscillator plate, which makes this oscillator inoperative.

The purpose of using two r-f tanks in the UHF tuner is to readily admit the r-f signals, and, at the same time, prevent the UHF i-f signal from feeding back into the antenna and causing interference with other receivers.

CHANGE-OVER SWITCH

The change-over switch supplied with the Tuner-Adapter is used to switch from VHF to UHF, and vice versa. It is installed on the back of the VHF tuner, and is operated by an actuator mounted on the VHF tuner shaft. When the VHF Channel Selector is turned to the position for UHF operation, the switch connects the antenna to the UHF tuner, turns off the VHF pilot light, turns on the UHF pilot light, and connects the output of the UHF tuner to the antenna input of the VHF tuner. When the VHF Channel Selector is turned to any VHF position, the switch connects the antenna to the VHF tuner, turns off the UHF pilot light, turns on the VHF pilot light, and places a 150,000-ohm resistor in series with the UHF oscillator plate, as explained above.

ADAPTER CABLES AND PLUGS

The adapter plugs shown in the schematic diagram are not used in factory-installed units; the cables are wired directly into the chassis at the proper places. The plugs are used only in field-installed units. (Refer

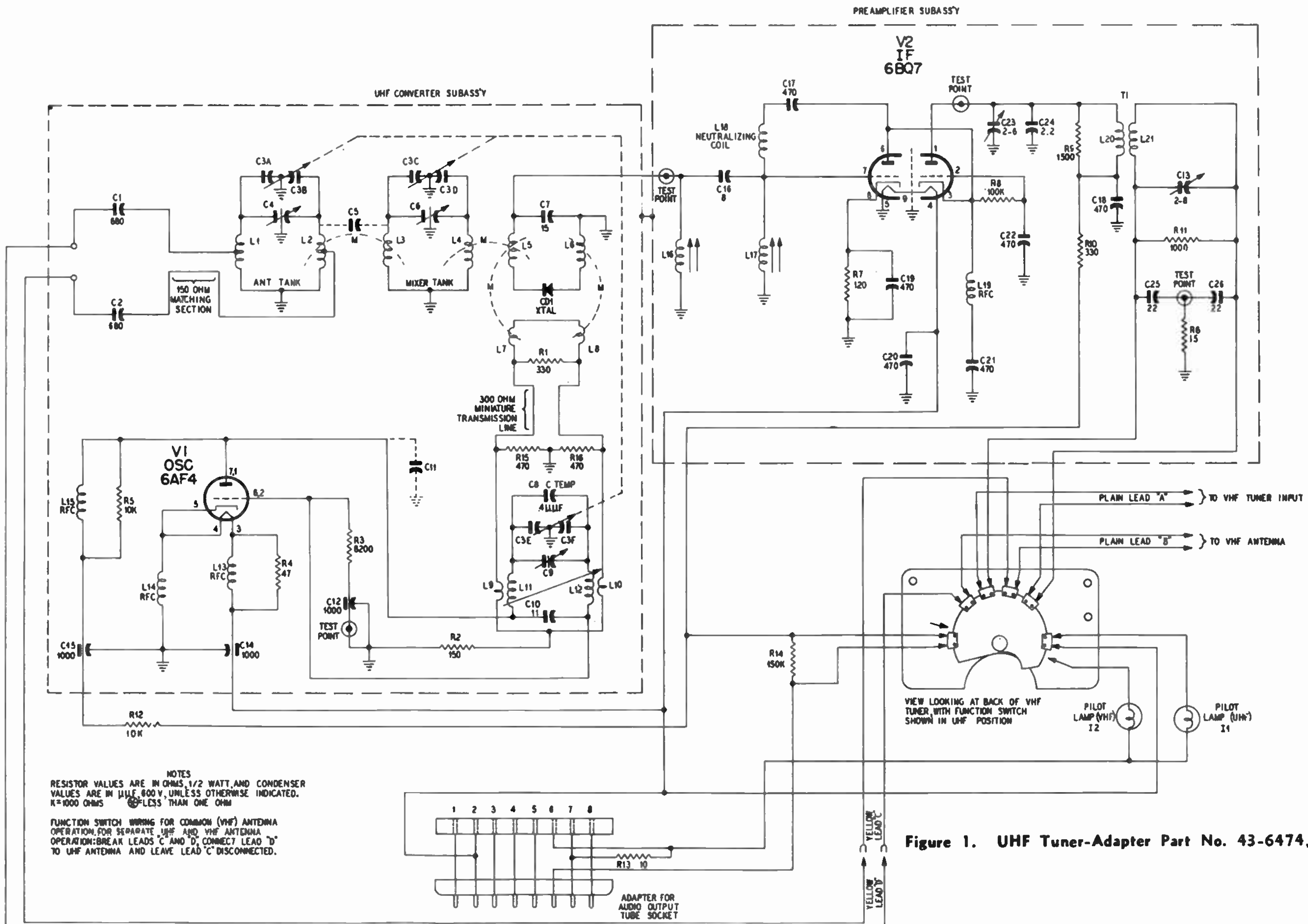


Figure 1. UHF Tuner-Adapter Part No. 43-6474, Schematic Diagram

to steps 10 and 11 of the installation instructions given below.)

PLANETARY DRIVE

The UHF tuner is tuned by means of a 3-gang tuning condenser, which is driven through a specially designed planetary drive. The planetary drive is constructed so that fine tuning and coarse tuning can be accomplished with a single control knob. The tuning shaft is coupled to the driving shaft through three balls, which form a planetary drive that produce slow rotation for fine tuning. See figure 2. After rotating 180 degrees with the tuning shaft, a pin engages the driving shaft, and the two shafts are direct-coupled, for coarse tuning. To re-engage the planetary drive for fine tuning, it is only necessary to reverse the direction of the rotation. The dial pointer is connected to the tuning gang through a cord drive, and indicates the channel number to which the tuner is tuned.

ALIGNMENT AND REPAIRS

The frequencies at which the Tuner-Adapter operates are extremely high; therefore it is necessary that the utmost care be taken to safeguard against upsetting the delicate adjustments of the tuner. It is recommended that the serviceman make only minor repairs to the tuner, such as replacement of the tube or crystal and the wiring of external leads. The Tuner-Adapter should be returned to the factory for alignment and major repairs, unless the serviceman is properly equipped to perform these jobs. In general, a good rule to follow is not to remove the cover of the Tuner-Adapter.

NOTE: Replacing the tube with a new one may detune the tuner. If this occurs, try a number of tubes until one is found that will most nearly replace the original.

INSTALLATION INSTRUCTIONS

To install the UHF Tuner-Adapter on the r-f chassis, proceed as follows:

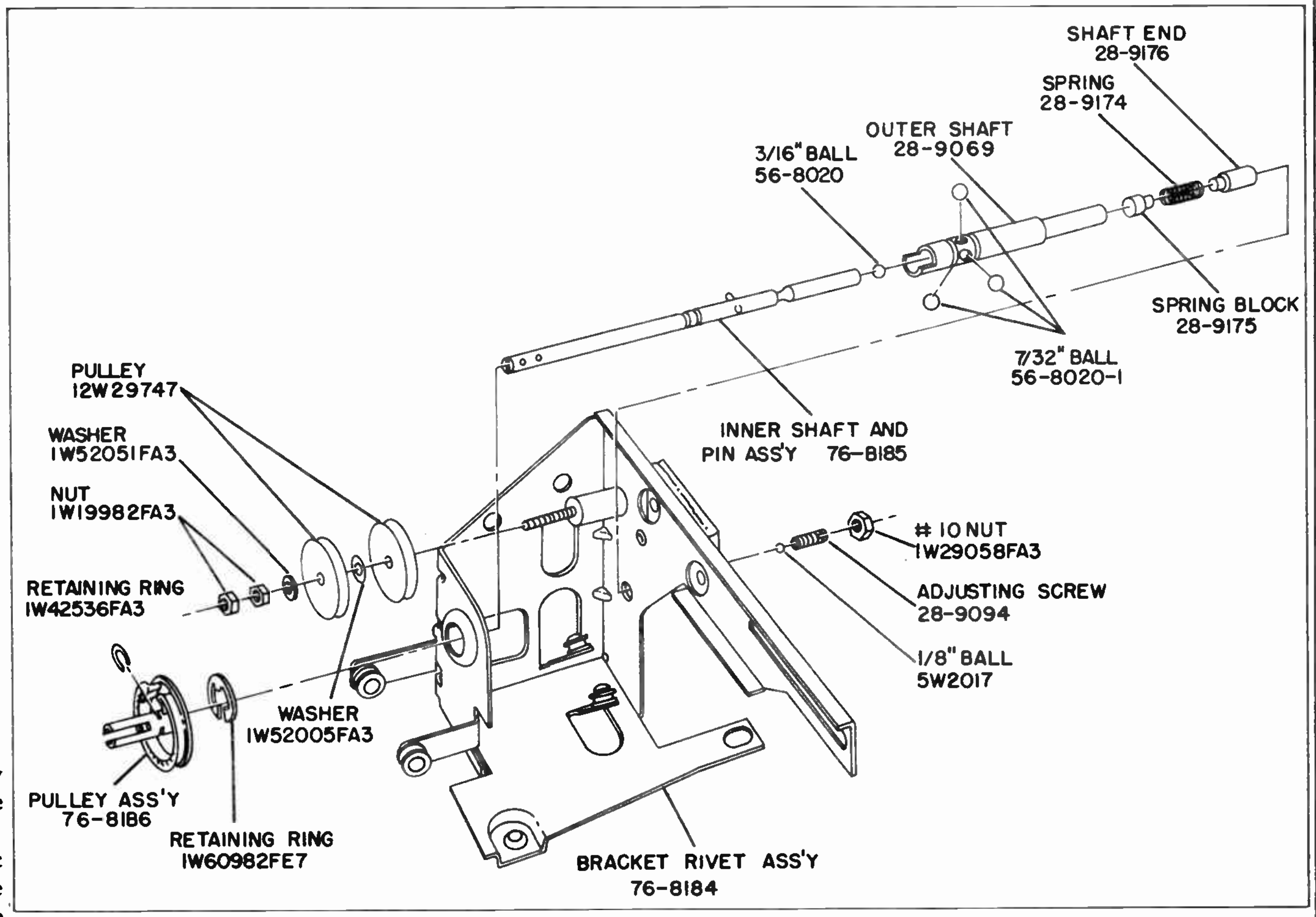
1. Remove the cabinet back and r-f chassis from the cabinet. Then remove the nameplate on the control panel by pushing it out from inside the cabinet.
2. Attach the front chassis bracket to the r-f chassis with the two screws provided with the tuner. See figure 4.
3. Attach the rear support angle to the r-f chassis with the two screws provided. See figure 4.
4. Measure the distance between the centers of the shaft hole for the contrast-brightness control and the center hole (previously covered by the nameplate) on the control panel. Mount the UHF tuner assembly loosely on the r-f chassis with the screws, nut, and washers provided; then slide the UHF tuner so that the distance between the centers of the UHF shaft and contrast-brightness shaft is equal to the distance between the centers of the two holes in the control panel. Make certain that the fish paper insulator is in place over the mounting arm of the tuner assembly. See figure 5. Fasten the UHF tuner securely in place.
5. Put the spacers on the mounting studs, and attach the mounting studs to the rear of the VHF tuner, on the r-f chassis. See figure 6.
6. Place the switch-actuator assembly on the shaft extending from the rear of the VHF tuner, with the switch-actuator stud pointing away from the tuner. See figure 6.
7. Place the switch assembly on the mounting studs, and fasten it in place with the fiber washers, lock washers, and nuts provided. See figure 6.

   NOTE: In some cases the switch mounting hardware provided may be as shown in figure 7. If so, disregard steps 5 and 7, and mount the switch as shown in figure 7.

8. Put the VHF Channel Selector on the channel position to be used for UHF operation (Channel 2 or Channel 3). Rotate the switch actuator on the tuner shaft until the actuator stud throws the switch. Fasten the switch actuator in this position. Rotate the Channel Selector on either side of the UHF position, and check the switch operation, to make sure that the switch is thrown in the UHF position but not on either side of the UHF position. Lubricate the switch-actuator stud and the switch cam with cup grease.

   On factory-installed units, the switch actuator may have two studs, as shown in figure 8. If so, remove the one stud, as indicated in the drawing.

9. Remove the bulb and shield from the pilot-light assembly on the r-f chassis, and place them in the empty socket from the UHF tuner assembly. Tape up the old socket from the r-f chassis.
10. Remove the audio output tube (6K6GT in r-f chassis 81, or 6L6GA in r-f chassis 84), plug the octal adapter into the tube socket, and place the tube in the adapter socket. The octal adapter is wired to the switch.
11. Cut the antenna lead from the VHF tuner to about 3 inches in length, and remove about ½ inch of insulation from the end. Insert the bare ends of the wires into the twin-lead connector, and fasten them with the screws in the sides of the connector.
12. Install the UHF pilot-light clip inside the cabinet near the UHF tuner shaft hole, as shown in figure 9.
13. Fasten the dress lug to the chassis with the screw provided (see figure 5); then dress the leads except the 300-ohm twin leads, under the lug.
14. Install the chassis in the cabinet, and insert the pilot-light sockets into the pilot-light clips. The socket with the red leads must be installed in the UHF clip, and the socket with the brown leads, in the VHF clip.
15. Put the knob on the UHF shaft, and set the shaft in the extreme counterclockwise position. Then remove the knob.
16. Install the background plate and pointer over the UHF tuning shaft. The background plate has the two sides colored differently, so that the proper color may be chosen to harmonize with the cabinet color.



TP2-3182

Figure 2. Planetary Assembly, Exploded View, Showing Mechanical Layout (Both Tuner-Adapters)

17. Place the dial scale over the tuner shaft, and line up the holes in the dial background plate with the holes in the dial scale. Line up the dial scale with the front panel, and fasten the scale with the screws provided. Place the knob on the UHF tuner shaft. Replace the control knobs on the r-f chassis control shaft.
18. Replace the fish paper antenna-lead holder with the new holder provided. Fasten the new holder with the two nails provided, and then pass the twin-wire leads through the holes, as shown in figure 10.
19. Cut holes in the cabinet back, and fasten the antenna terminal board provided, as shown in the illustrations above (figures 11 through 15). Replace the cabinet back, and make the connections as illustrated, according to the type of antenna installation being used.
20. Paste the label provided over the outside-antenna instructions on the cabinet back.

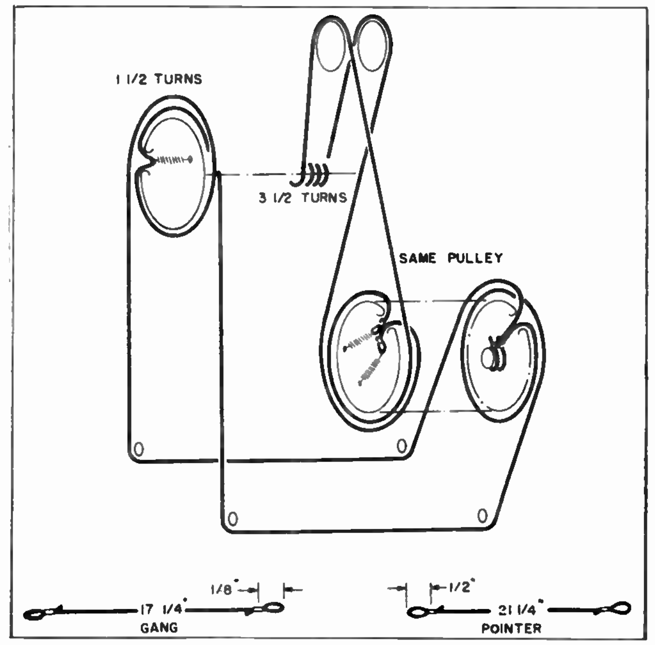


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Figure 3. Drive-Cord Stringing Arrangement (Both Tuner-Adapters)

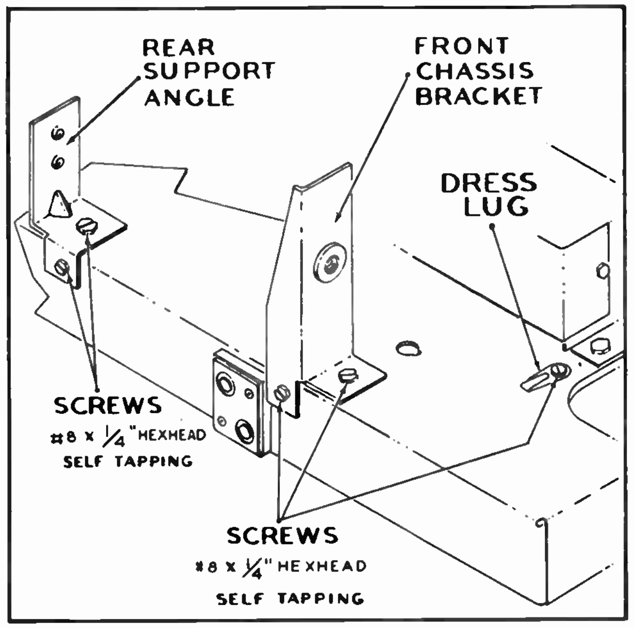

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Figure 4. Placement of Mounting Brackets on R-F Chassis (Tuner-Adapter Part No. 43-6474)

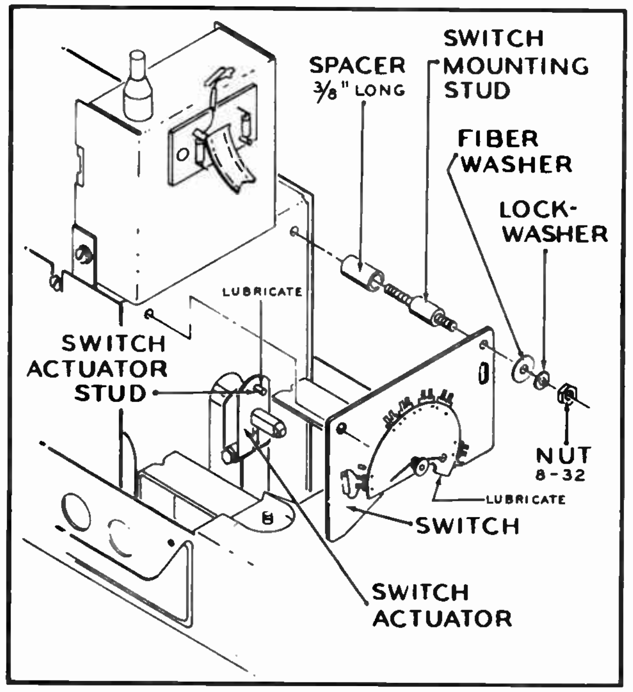

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Figure 6. Change-Over Switch Mounting Details (Tuner-Adapter Part No. 43-6474)

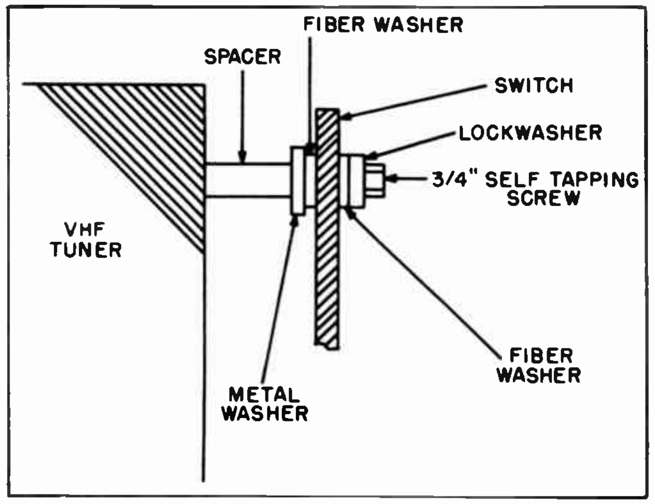

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Figure 7. Switch Mounting, Alternate Method (Both Tuner-Adapters)

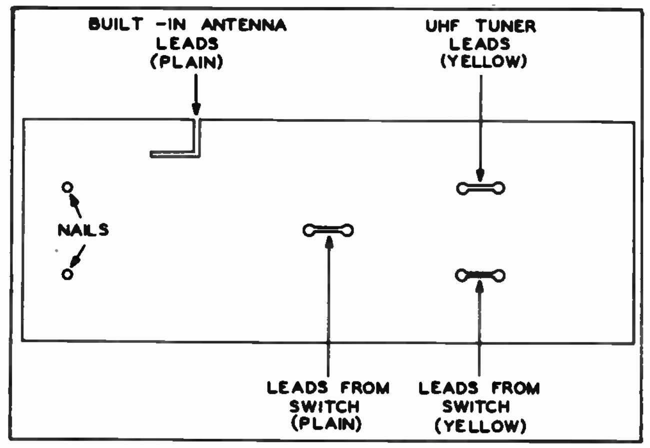

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Figure 10. Antenna-Lead Holder (Both Tuner-Adapters)

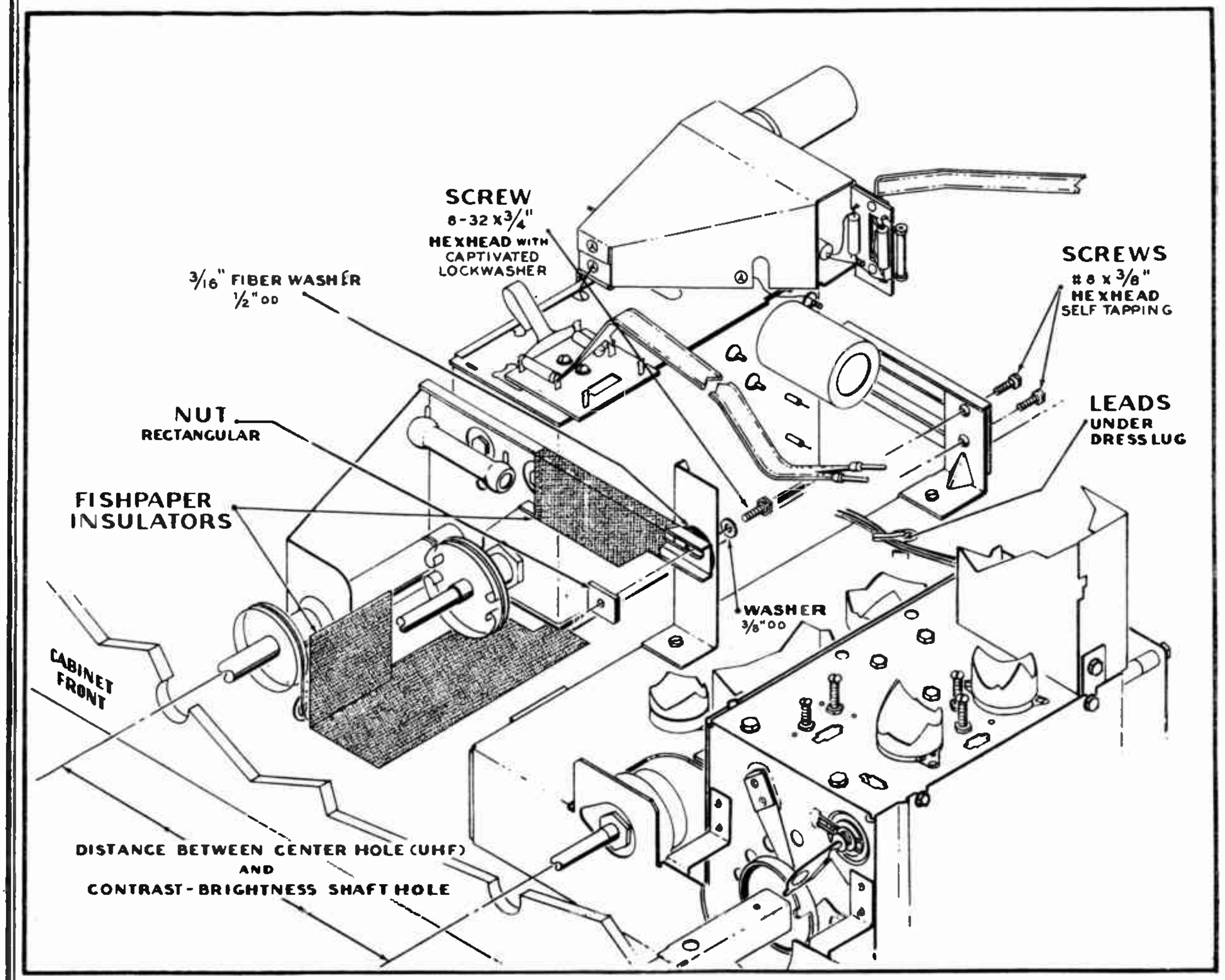

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Figure 5. UHF Tuner-Adapter Part No. 43-6474, Mounted on R-F Chassis

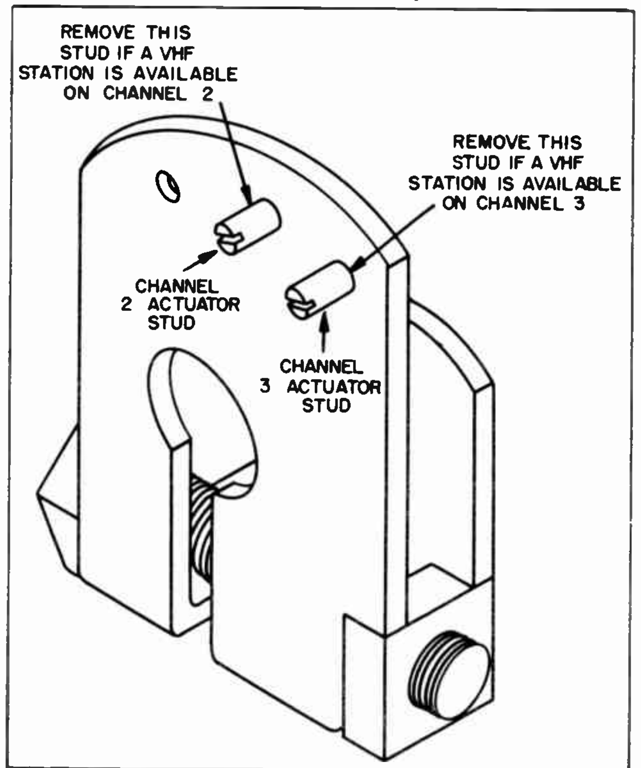

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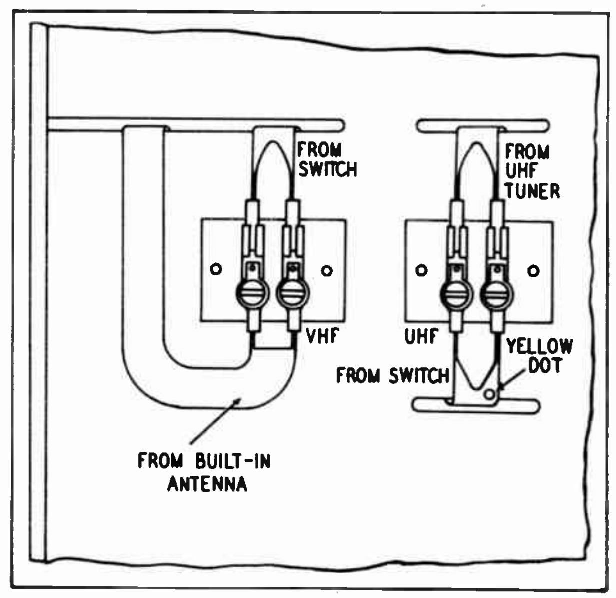
Figure 8. Switch Actuator Stud Removal (Tuner-Adapter Part No. 43-6474)



TP2-3170

Figure 11. Antenna-Lead Connections, Common Built-In Antenna (Both Tuner-Adapters)

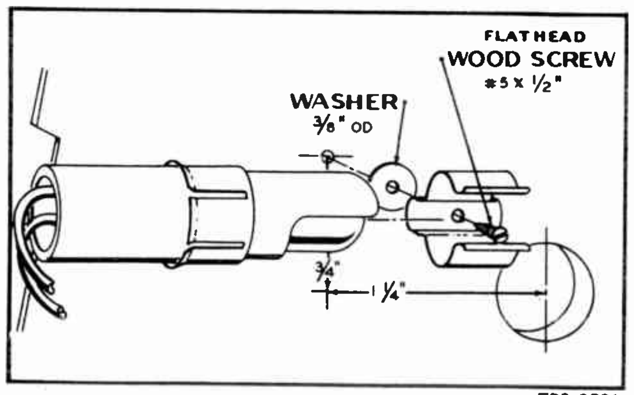


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Figure 9. Pilot-Light-Clip Installation Details (Both Tuner-Adapters)

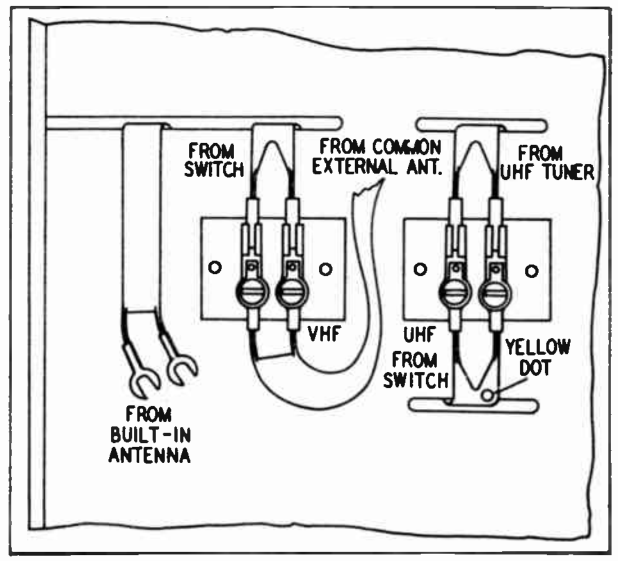

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Figure 12. Antenna-Lead Connections, Common External Antenna (Both Tuner-Adapters)

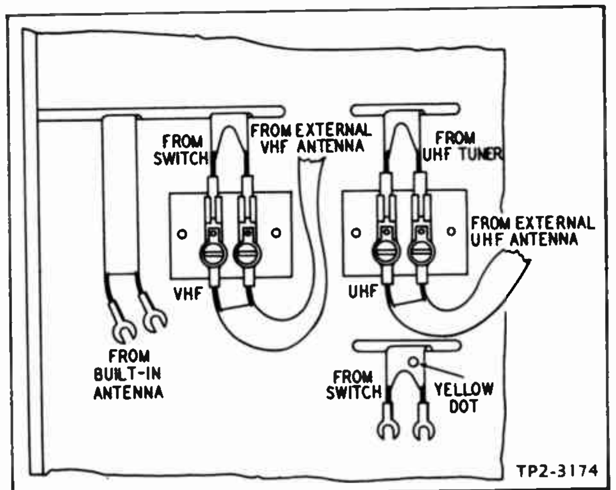


Figure 13. Antenna-Lead Connections, Separate External Antennas (Both Tuner-Adapters)

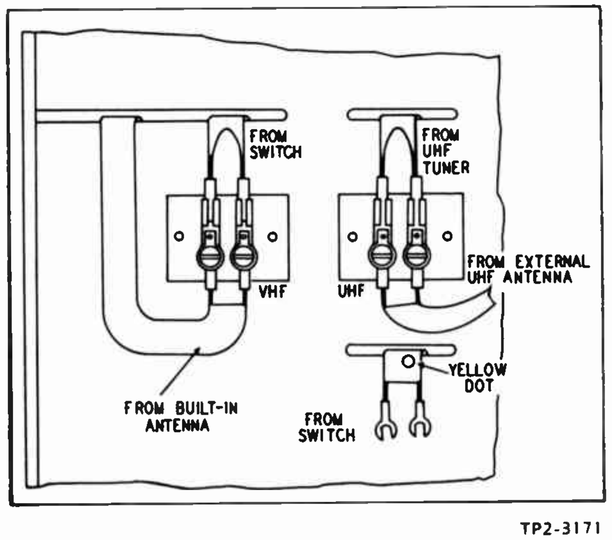


Figure 14. Antenna-Lead Connections, VHF Built-In and UHF External Antennas (Both Tuner-Adapters)

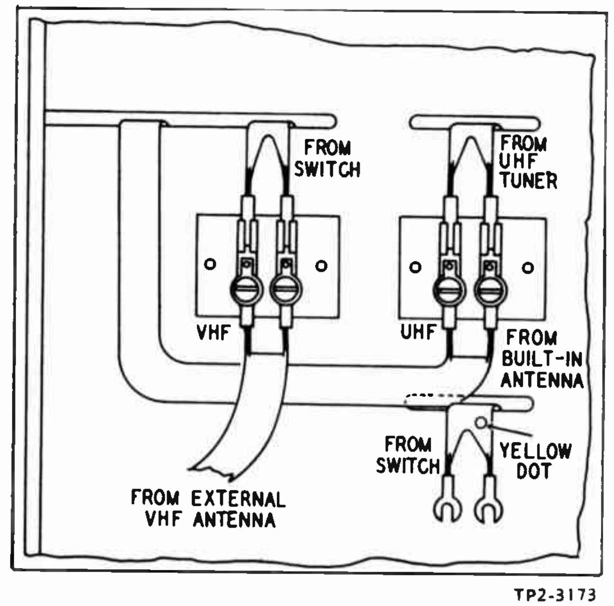


Figure 15. Antenna-Lead Connections, VHF External and UHF Built-In Antennas (Both Tuner-Adapters)

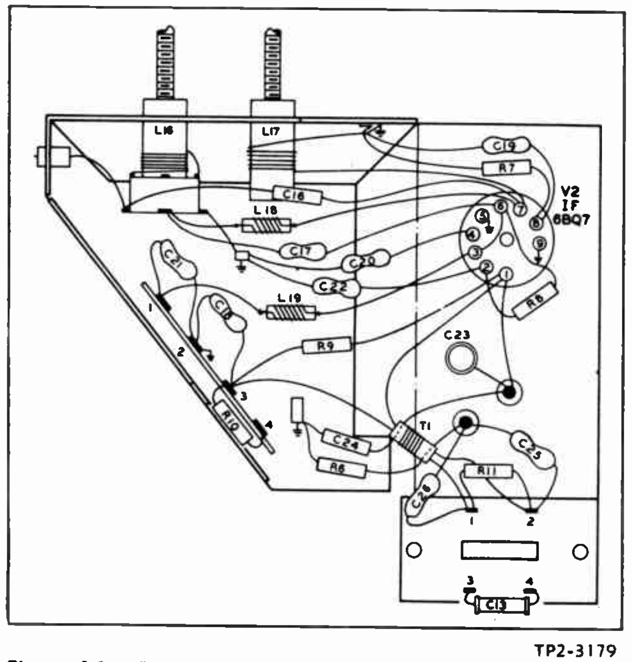


Figure 16. Base View of Tuner-Adapter Part No. 43-6474, Preamplifier Assembly

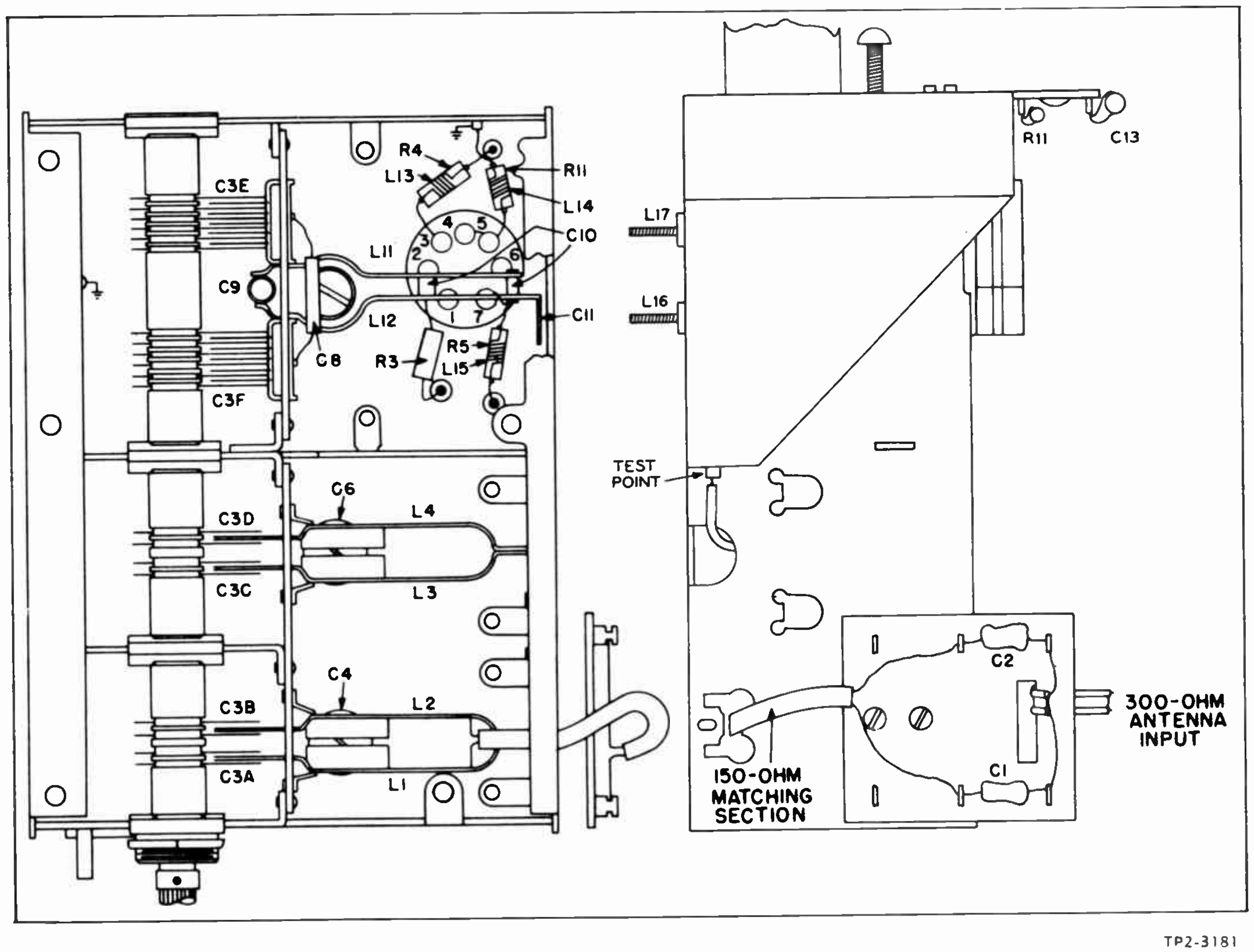


Figure 17. Side View and Base View of Tuner-Adapter Part No. 43-6474, Without Board Assemblies

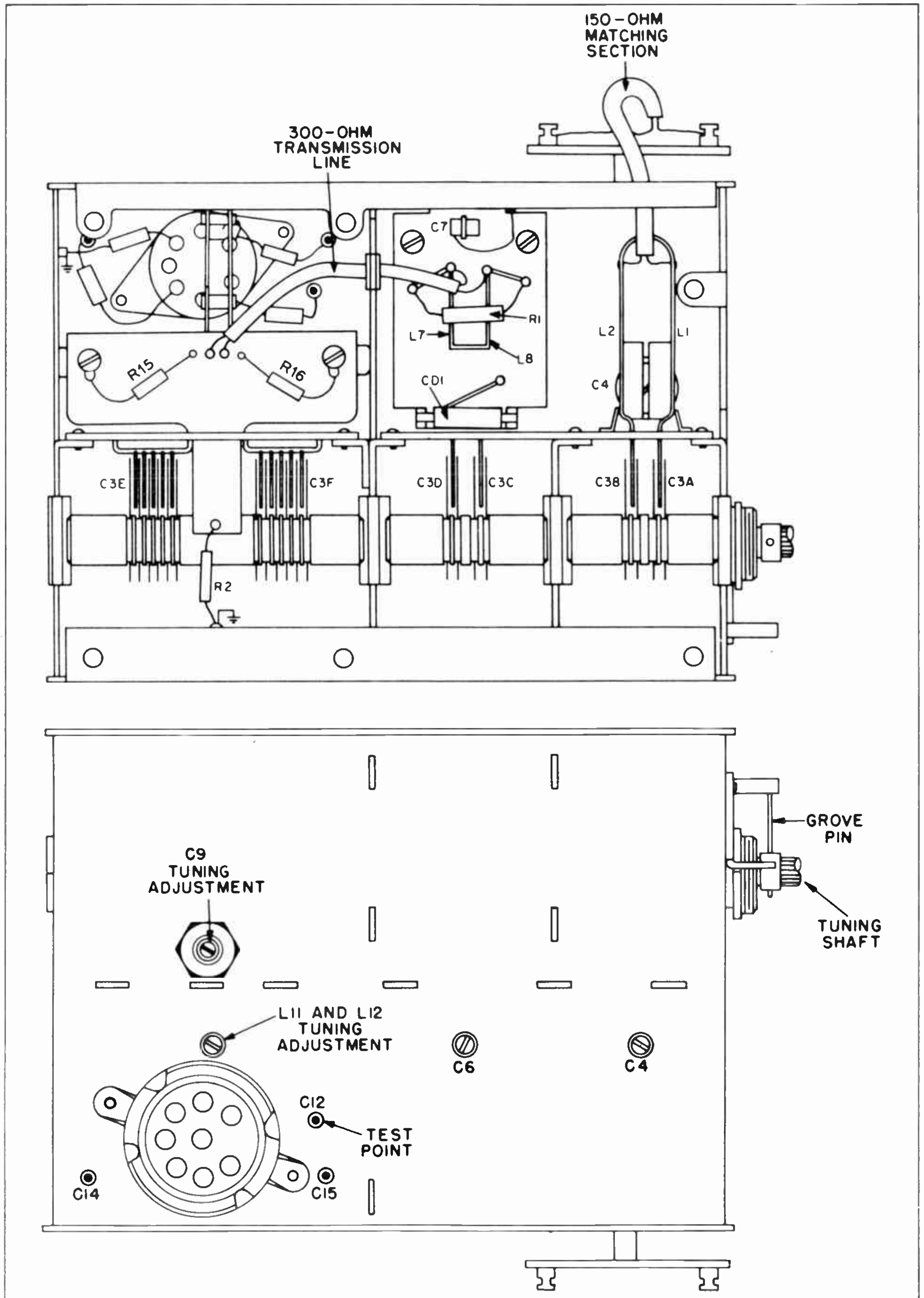


Figure 18. Top View and Base View of Tuner-Adapter Part No. 43-6474, With Board Assemblies

UHF TUNER-ADAPTER PART No. 43-6473, FOR RECEIVERS USING R-F CHASSIS 91, 91R, 94 OR 94R

UHF Tuner-Adapter Part No. 43-6473 provides for the reception of UHF signals on television channels 14 through 83. It is designed for installation in Philco High-Fidelity Television Receivers using r-f chassis 91 or 94. The Tuner-Adapter may also be used in remote-control sets using r-f chassis 91R or 94R, if it is used in conjunction with Shaft Extension Adapter, Part No. 43-6476.

The Tuner-Adapter consists of a UHF tuner, a change-over switch, adapter cables and plugs, a planetary tuner driving assembly, and mounting hardware.

CIRCUIT DESCRIPTION

The UHF tuner converts the UHF signals to the intermediate frequency of the r-f chassis.

The incoming UHF signal is coupled through the antenna input line, and through two i-f traps, two 680-$\mu\mu$f. condensers, and a 150-ohm transmission line to the antenna tank of the tuner. See figure 19. The antenna tank is coupled to the mixer tank by means of the mutual coupling of L2 and L3 and the stray capacitance, C5. The desired signal is selected by tuning the antenna tank and the mixer tank to the correct frequency, and the signal is then coupled to the crystal mixer circuit by means of the mutual coupling of L4 and L5. The local-oscillator signal is generated by a 6AF4 tube, V1, and the associated circuit. The oscillator signal is coupled to the crystal mixer circuit by a 300-ohm, miniature transmission line and the mutual coupling of L7 to L5 and L8 to L6. The r-f signal and the oscillator signal are mixed in the crystal mixer circuit to produce a 45.75-mc. video carrier intermediate frequency signal. This signal is coupled to the VHF tuner through L18, a coaxial cable, and J500 on the VHF tuner. In UHF operation, the local oscillator of the VHF tuner is inoperative, and the r-f amplifier and mixer tubes of the VHF tuner operate as i-f amplifiers.

The two tanks of the UHF tuner, the antenna tank and the mixer tank, are used to prevent the i-f signal from feeding back to the antenna and interfering with other receivers. The two tanks pass incoming signals very readily, but do not pass the i-f signal.

CHANGE-OVER SWITCH

The change-over switch supplied with the Tuner-Adapter is used to switch from VHF to UHF, and vice versa. It is installed on the back of the VHF tuner, and is operated by an actuator mounted on the VHF tuner shaft. When the Channel Selector of the VHF tuner is turned to the UHF position, the change-over switch makes proper connections for UHF operation. In this position, the switch places a 150,000-ohm resistor in series with the VHF mixer plate, which drops the voltage on the plate of the tube.

(In the UHF position, the VHF Channel Selector places extra inductances in the VHF r-f and mixer circuits, permitting them to operate as i-f amplifiers, and it also removes the inductances from the VHF oscillator circuit, putting it out of operation.) The change-over switch also tuns off the VHF pilot light, turns on the UHF pilot light, and connects the antenna to the UHF tuner. When the VHF Channel Selector is turned to any VHF position, the change-over switch places a 150,000-ohm resistor in series with the UHF local-oscillator plate circuit, which drops the voltage applied to the plate, and puts the oscillator out of operation. The switch also turns on the VHF pilot light, turns off the UHF pilot light, and connects the antenna to the VHF tuner.

ADAPTER PLUGS

The adapter plugs shown in the schematic diagram are not used in factory-installed units; the cables are wired directly into the chassis at the proper places. The plugs are used only in field-installed units. (Refer to steps 9 and 11 of the installation procedure given below.)

The octal adapter is inserted into the audio output tube socket, and the tube is then inserted into the adapter socket. This adapter supplies B+ and filament voltages to the UHF tuner.

The B+ disconnect assembly of the r-f chassis is in series with the VHF mixer plate.

When the UHF tuner is installed, this socket and plug are separated, and the plug, which is connected to the VHF mixer plate, is plugged into the socket of the UHF tuner, so that, in UHF operation, the change-over switch can place a 150,000-ohm resistor in series with the VHF mixer plate. (The original socket of the B+ disconnect assembly is left disconnected, since it has no further function after the UHF tuner is installed.)

The antenna disconnect assembly is used to connect the VHF tuner antenna input to the change-over switch.

PLANETARY DRIVE

The UHF tuner is tuned by means of a 3-gang tuning condenser, which is driven through a specially designed planetary drive. The planetary drive is constructed so that fine tuning and coarse tuning can be accomplished with a single control knob. The tuning shaft is coupled to the driving shaft through three balls, which form a planetary drive that produces slow rotation for fine tuning. See figure 2. After rotating 180 degrees with the tuning shaft, a pin engages the driving shaft, and the two shafts are direct-coupled, for coarse tuning. To re-engage the planetary drive for fine tuning, it is only necessary to reverse the direc-

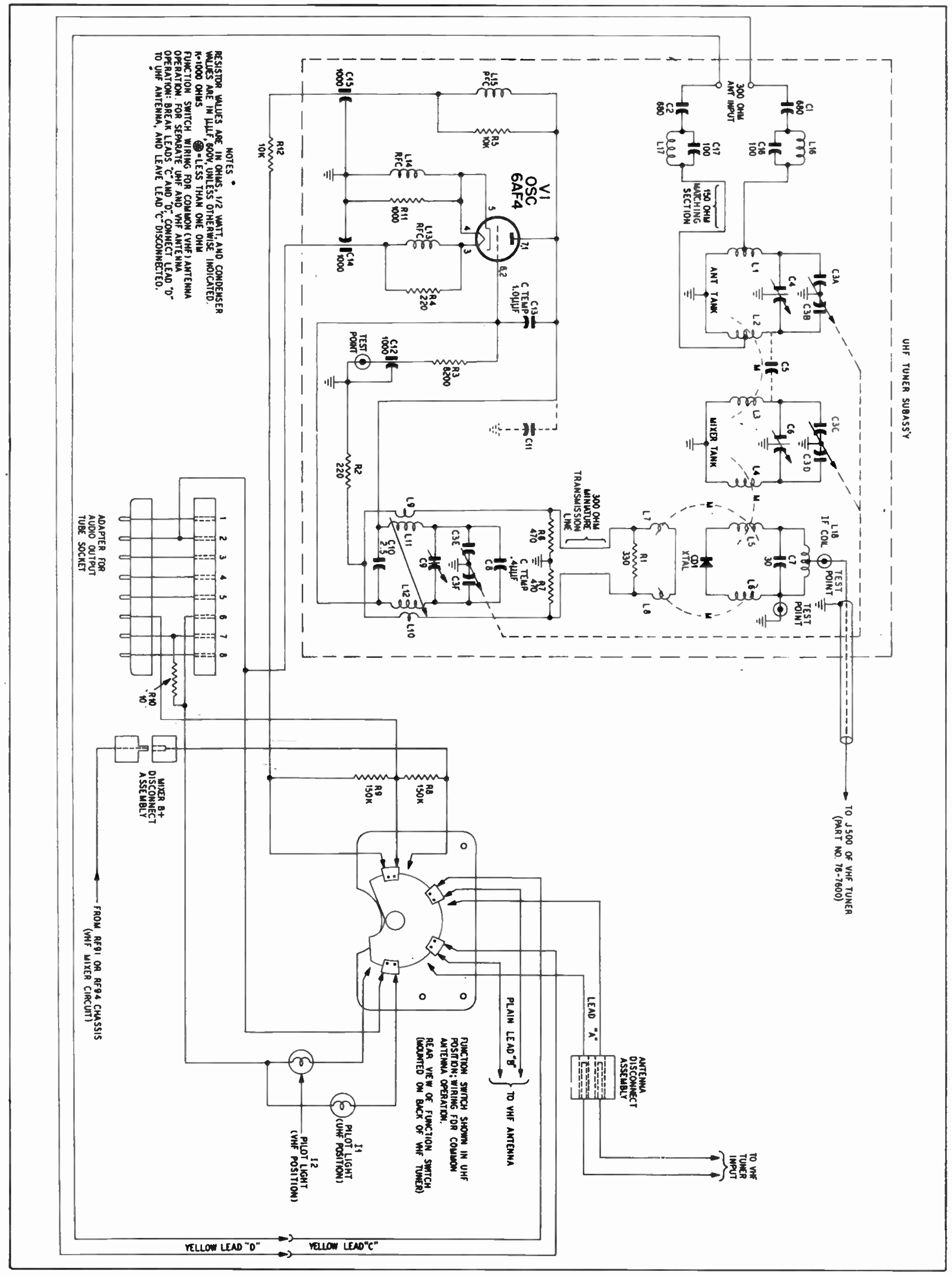


Figure 19. Philco UHF Tuner-Adapter Part No. 43-6473, Schematic Diagram

TP2-2669

tion of rotation. The dial pointer is connected to the tuning gang through a cord drive, and indicates the channel number to which the tuner is tuned.

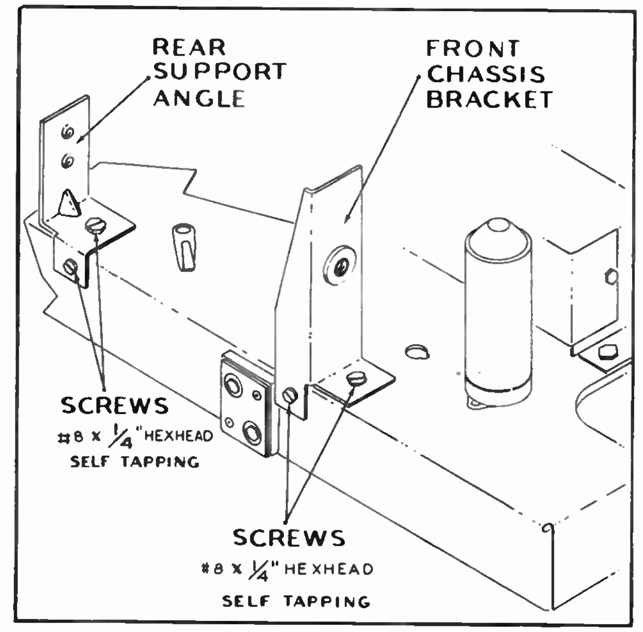
ALIGNMENT AND REPAIRS

The frequencies at which the Tuner-Adapter operates are extremely high; therefore, it is necessary that the utmost care be taken to safeguard against upsetting the delicate adjustments of the tuner. It is recommended that the serviceman make only minor repairs to the tuner, such as replacement of the tube or crystal and the wiring of external leads. The Tuner-Adapter should be returned to the factory for alignment and major repairs, unless the serviceman is properly equipped to perform these jobs. In general, a good rule to follow is, not to remove the cover of the Tuner-Adapter.

NOTE: Replacing the tube with a new one may detune the tuner. If this occurs, try a number of tubes until one is found that will most nearly replace the original.

INSTALLATION INSTRUCTIONS

To install the UHF Tuner-Adapter on the r-f chassis, proceed as follows:



TP2-2578A

Figure 20. Placement of Mounting Brackets on R-F Chassis (Tuner-Adapter Part No. 43-6473)

1. Remove the cabinet back and r-f chassis from the cabinet; then remove the nameplate on the control panel by pushing it out from inside the cabinet.

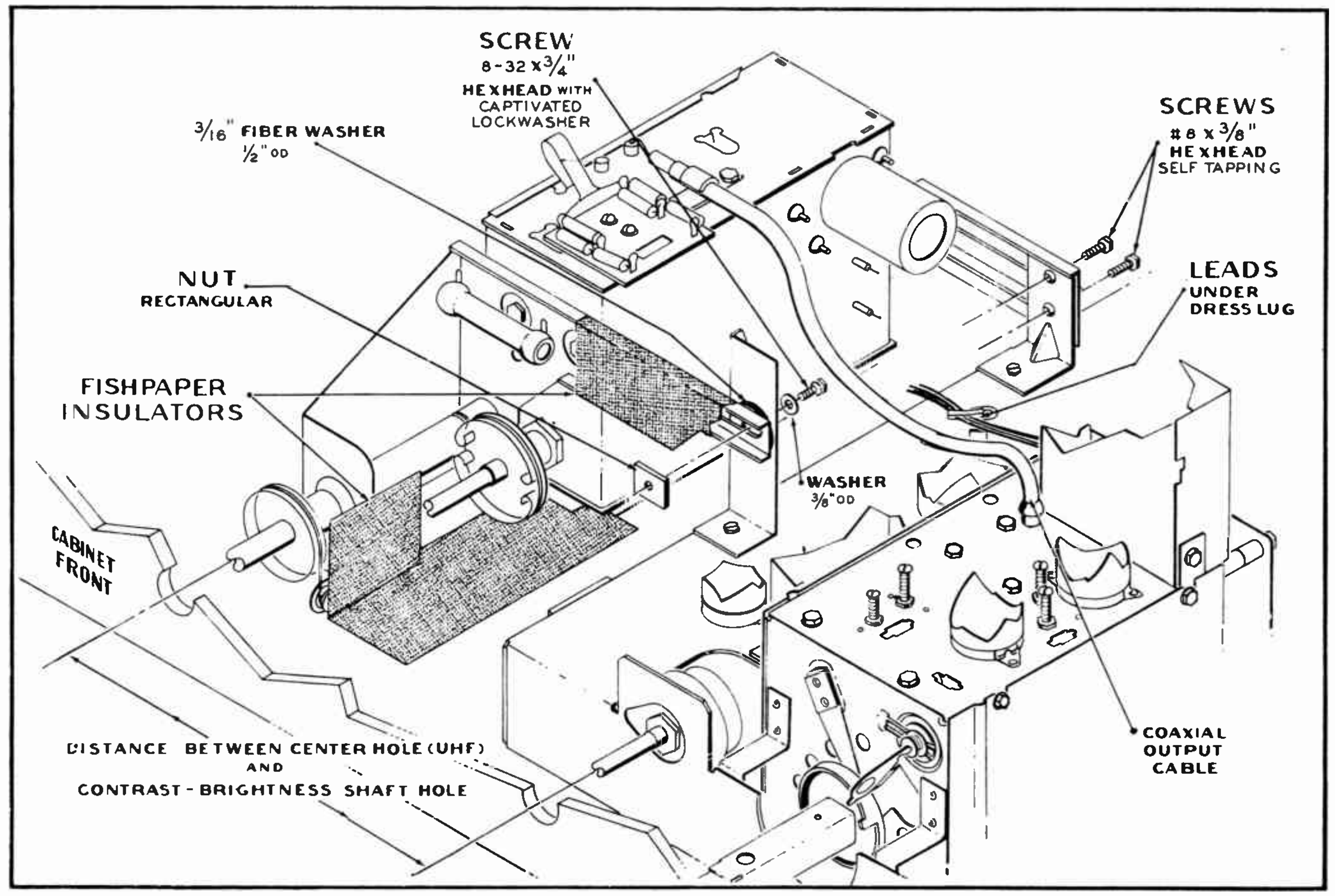


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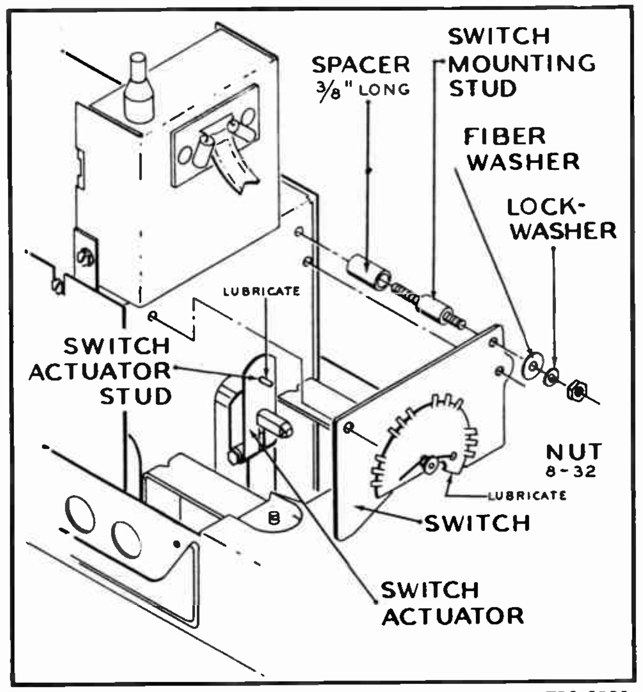
Figure 21. UHF Tuner-Adapter Part No. 43-6473, Mounted on R-F Chassis



TP2-2580

Figure 22. Change-Over Switch Mounting Details (Tuner-Adapter Part No. 6473)

2. Attach the front chassis bracket to the r-f chassis with the two screws provided. See figure 20.

3. Attach the rear support angle to the r-f chassis with the two screws provided. See figure 20.

4. Measure the distance between the centers of the shaft hole for the contrast-brightness control and the center hole (previously covered by the nameplate) on the control panel. Mount the UHF tuner assembly loosely on the r-f chassis with the screws, nuts, and washers provided (see figure 21); then slide the UHF tuner so that the distance between the centers of the UHF tuner shaft and contrast-brightness shaft is equal to the distance between the centers of the two holes in the control panel. Make certain that the fish paper insulator is in place over the mounting arm of the tuner assembly. Fasten the UHF tuner securely in place.

5. Put the spacers on the mounting studs, and attach the mounting studs to the rear of the VHF tuner on the r-f chassis. See figure 22.

6. Place the switch-actuator assembly on the shaft extending from the rear of the VHF tuner with the switch-actuator stud pointing away from the tuner.

7. Place the switch assembly on the two mounting studs, and fasten it in place with the fiber washers, lock washers, and nuts provided. See figure 22.

NOTE: In some cases the switch mounting hardware provided may be as shown in figure 7. If so, disregard the procedure given in steps 5 and 7, and attach the switch as illustrated in figure 7.

8. Put the VHF Channel Selector in the Channel 2 position. Rotate the switch actuator on the tuner shaft (clockwise, as viewed from the rear of the chassis) until it just touches the edge of the movable portion of the switch. Secure the actuator in this position. Turn the VHF Channel Selector to the UHF position, and then to the Channel 13 position. Make sure that the switch contacts make proper contact in each position. If not, loosen the switch mounting screws and adjust the switch so that it functions properly. Recheck the switch on the Channel 2, UHF, and Channel 13 positions. Lubricate the switch-actuator stud and the switch cam with cup grease.

9. Open the B+ disconnect assembly (small plug and socket on r-f chassis, near rear of tuner), and plug the male connector from the r-f chassis into the socket from the switch. Tape up the old socket from the r-f chassis.

10. Remove the bulb and shield from the pilot-light assembly on the r-f chassis, and place them in the empty socket from the UHF tuner assembly. Tape up the old socket from the r-f chassis.

11. Remove the audio output tube (6V6GT in r-f chassis 91, or 6L6GA in r-f chassis 94), plug the octal adapter into the tube socket, and place the tube in the adapter socket. The octal adapter is wired to the switch.

12. Plug the UHF tuner coaxial output cable into the jack on the VHF tuner. See figure 21.

13. Cut the antenna lead from the VHF tuner to about 3 inches in length, and remove about ½ inch of insulation from the end. Insert the bare ends of the wires into the twin-lead connector, and fasten them with screws in the sides of the connector.

14. Dress all leads except the 300-ohm twin leads under the dress lugs, as shown in figure 21.

15. Install the UHF pilot-light clip inside the cabinet, near the UHF tuner shaft hole, as shown in figure 9.

16. Install the chassis in the cabinet, and insert the pilot-light sockets into the pilot-light clips. The socket with the red leads must be installed in the UHF clip, and the socket with the brown leads, in the VHF clip.

17. Put the knob on the UHF shaft, and turn the shaft until the pointer pulley shaft is in the extreme counterclockwise position; then remove the knob.

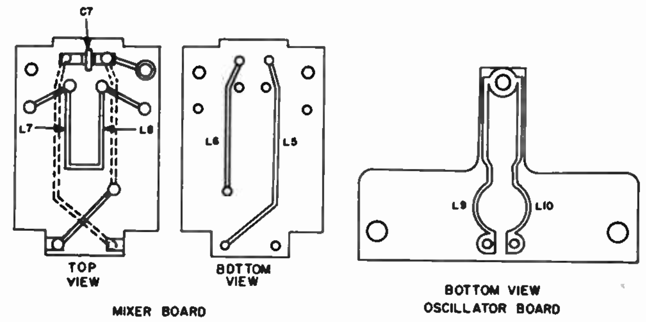
18. Install the background plate and pointer on the UHF tuner shaft. The background plate has the two sides colored differently, so that the proper color may be chosen to harmonize with the cabinet color.

19. Place the dial scale over the tuner shaft, and line up the holes in the dial background plate with the holes in the dial scale. Line up the dial scale with the front panel, and fasten the scale with the screws provided. Place the knob on the UHF tuner shaft, and replace the control knobs on the r-f chassis shafts.

20. Replace the fish paper antenna-lead holder with the new holder provided. Fasten the new holder with the two nails provided, and then pass the twin-wire leads through the holes, as shown in figure 10.

21. Cut the holes in the cabinet back, and fasten the antenna terminal board provided as shown in the illustrations above (figures 11 through 15). Replace the cabinet back, and make the connections as illustrated, according to the type of antenna installation being used.

22. Paste the label provided over the outside-antenna instructions on the cabinet back.



TP2-3175

Figure 23. Oscillator and Mixer Board Layouts (Both Tuner-Adapters)

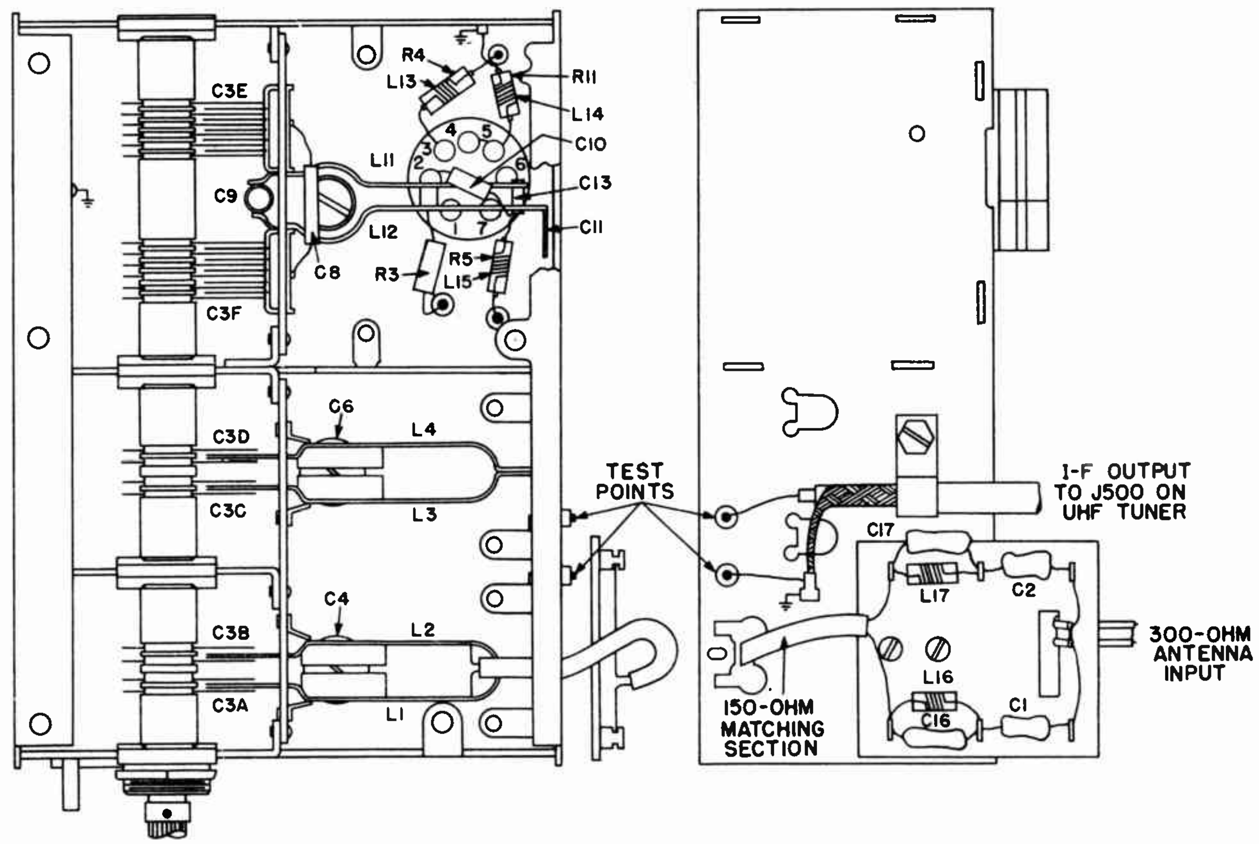


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Figure 24. Side View and Base View of Tuner-Adapter Part No. 43-6473, Without Board Assemblies

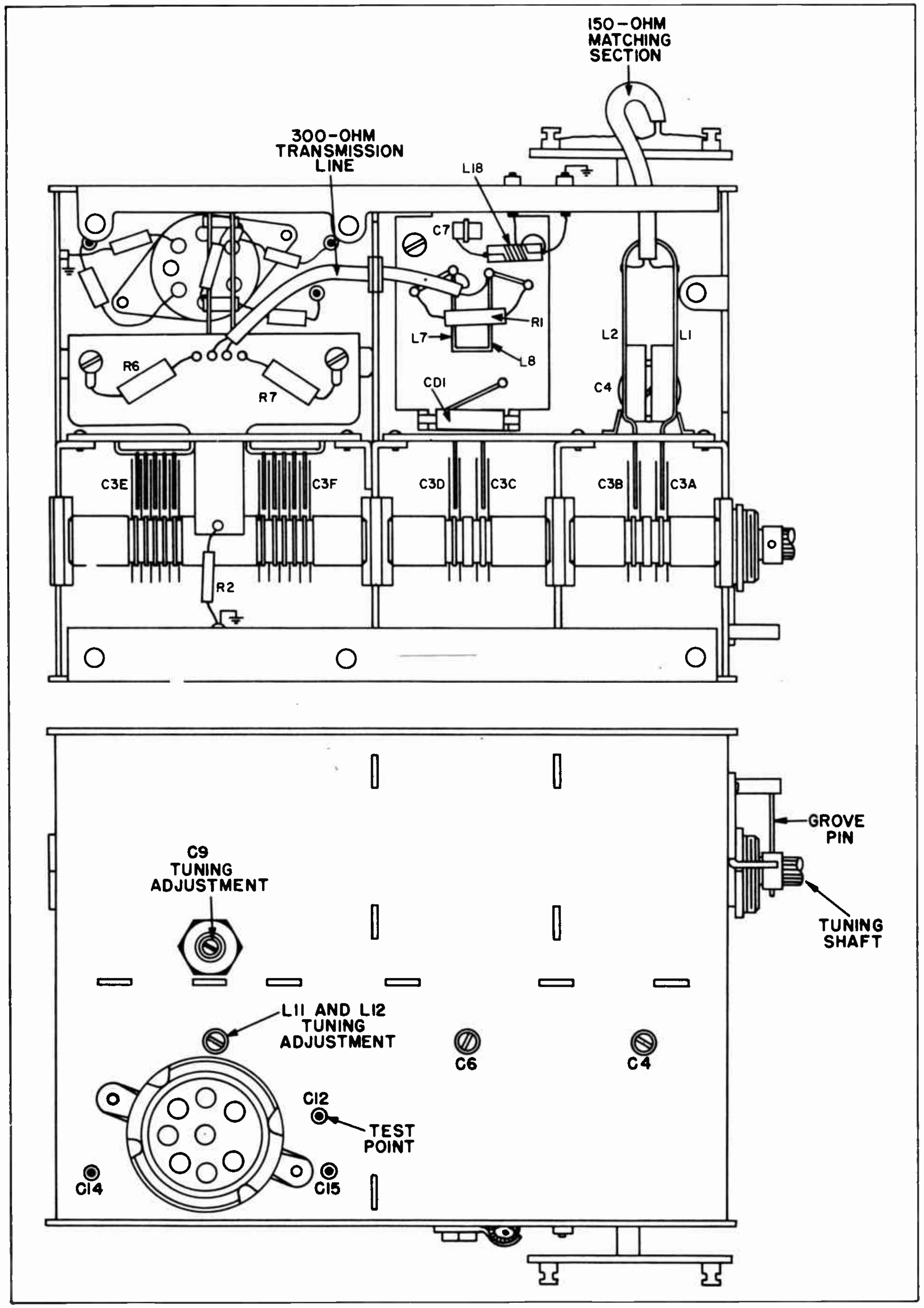


Figure 25. Top View and Base View of Tuner-Adapter Part No. 43-6473, With Board Assemblies

PARTS LIST

UHF TUNER-ADAPTER PART No. 43-6474

Reference Symbol	Description	Service Part No.
C1 and C2	Condenser, antenna input, 680 μμf.	Part of Panel, filter
C3	Condenser, tuning:	
	Shaft and rotor ass'y.	76-7481
C3A	Stator, r-f, l.h.	56-9595
C3B	Stator, r-f, r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator ass'y., oscillator	76-7479
C3F	Stator ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f	76-7472
C7	Condenser, mixer tank, 15 μμf.	Part of Board ass'y., mixer
C8	Condenser, temperature compensating, .4 μμf.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 11 μμf.	Part of Tank ass'y., osc.
C11	Condenser, by-pass	Part of Tank ass'y., osc.
C12	Condenser, grid by-pass, 1000 μμf.	30-1245-1
C13	Condenser, output tuning, 2—8 μμf.	31-6527
C14	Condenser, heater by-pass, 1000 μμf.	30-1245-1
C15	Condenser, plate by-pass, 1000 μμf.	30-1245-1
C16	Condenser, input coupling, 8 μμf.	30-1224-46
C17	Condenser, neutralizing, 470 μμf.	62-147001011
C18	Condenser, decoupling, 470 μμf.	62-147001011
C19	Condenser, cathode by-pass, 470 μμf.	62-147001011
C20	Condenser, filament by-pass, 470 μμf.	62-147001011
C21	Condenser, cathode tuning, 470 μμf.	62-147001011
C22	Condenser, grid by-pass, 470 μμf.	62-147001011
C23	Condenser, plate by-pass, 2—6 μμf.	31-6520-4
C24	Condenser, plate by-pass, 2.2 μμf.	30-1221-6
C25 and C26	Condenser, output tuning, 22 μμf.	62-022009001
CD1	Crystal detector, mixer circuit	34-8024
I1	Lamp, pilot, UHF	34-2068
I2	Lamp, pilot, VHF	34-2068
L1	Inductor, r-f, l.h.	Part of C3A-Stator
L2	Inductor, r-f, r.h.	Part of C3B-Stator
L3	Inductor, r-f, l.h.	Part of C3C-Stator
L4	Inductor, r-f, r.h.	Part of C3D-Stator
L5 and L6	Inductors, crystal mixer	Part of Board ass'y., mixer
L7 and L8	Inductors, oscillator coupling	Part of Board ass'y., mixer
L9 and L10	Inductors, oscillator	Part of Board ass'y., osc.
L11 and L12	Inductors, oscillator	Part of Tank ass'y., osc.
L13	Choke, heater decoupling	32-4556
L14	Choke, heater-cathode decoupling	32-4550-6
L15	Choke, plate decoupling	32-4556-2
L16	Coil, input tuning primary	32-4359-14
L17	Coil, input tuning secondary	32-4578
L18	Coil, neutralizing	32-4551-2
L19	Choke, cathode tuning	32-4548-13
L20	Coil, primary	Part of T1
L21	Coil, secondary	Part of T1
R1	Resistor, damping, 330 ohms	62-1338340
R2	Resistor, damping, 150 ohms	62-1158340
R3	Resistor, decoupling, 8200 ohms	62-2828340
R4	Resistor, decoupling, 47 ohms	Part of L13
R5	Resistor, decoupling, 10,000 ohms	Part of L15
R6	Resistor, parasitic damping, 15 ohms	66-0158340
R7	Resistor, cathode bias, 120 ohms	66-1128340
R8	Resistor, grid leak, 100,000 ohms	66-4108340
R9	Resistor, plate damping, 1500 ohms	66-2158340
R10	Resistor, plate decoupling, 330 ohms	66-1338340
R11	Resistor, output damping, 1000 ohms	66-2108340
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
R13	Resistor, filament dropping, 10 ohms	66-0108340
R14	Resistor, B+ dropping, 150,000 ohms	66-4158340
R15 and R16	Resistor, damping, 470 ohms	66-1478340
T1	Transformer, i-f output	32-4575
	Board ass'y., mixer	76-7475-1
	Board ass'y., oscillator	76-7480
	Panel, filter	76-8078-1
	Tank ass'y., oscillator	76-7473

MISCELLANEOUS

ELECTRICAL PARTS

Description	Service Part No.
Adapter cable	41-4120-1
Connector, twin-lead	54-5181
Cable ass'y., pilot light	27-6233-50
Padder ass'y. (L11 and L12 tuning adjustment)	76-8193
Panel, antenna, UHF	76-7097
Switch	42-1996-1

MECHANICAL PARTS

Planetary Assembly	
Ball, 1/8"	5W2017
Ball, 3/16"	56-8020
Ball, 7/32"	56-8020-1
Pulley ass'y.	76-8186
Ring, retaining	1W42536FA3
Ring, retaining	1W60982FE7
Shaft, inner end	28-9176
Shaft, outer	28-9069
Shaft and pin ass'y., inner	76-8185
Screw, adjusting	28-9094
Spring	28-9174
Shaft and Rotor Assembly, Mounting	
Ball, bearing (10)	W2510-5
Bearing, front	56-9593
Bearing, rear	56-9609
Nut, front bearing	56-9594
Nut, rear bearing	56-9599
Nut, insert	W1679-1FA3
Spring, center (2)	56-9590
Spring, end (2)	56-9591
Switch Mounting	
Collar stud (2)	28-9126
Lock washer (2)	1W24515FA1
Nut, #8, special (2)	1W20506FA3
Spacer, 3/8" (2)	1W29158FA3
Washer, fiber (2)	27-4109-29

PARTS LIST (Cont.)

Description	Service Part No.
Mounting Hardware	
Bracket, rear	28-9096
Bracket ass'y., front	76-8187
Insulator, bottom	27-9437
Support, angle, rear	28-9093
Washer, fiber	11W52604
Clip, pilot light	56-3545-6
Dial	54-5172
Dial background	54-5180
Grommet, feed-through	27-4707
Grove pin	1W41033FA3
Knob	54-5177
Pointer	54-8850
Pulley, tuner shaft	28-9090
Shield, tube, preamplifier	56-5629-5
Shield, tube, oscillator	56-5629-9
Socket, 9-pin miniature	27-6203-21
Spring (3), drive cord	28-9088
Switch actuator	76-8260
Assemblies	
Tuner, preamplifier, and planetary ass'y.	76-8229
Preamplifier assembly	76-8109

UHF TUNER-ADAPTER PART No. 43-6473

Reference Symbol	Description	Service Part No.
C1 and C2	Condensers, antenna, 680 $\mu\mu$f.	Part of Panel, filter
C3	Condenser, tuning:	
	Shaft and rotor ass'y.	76-7481
C3A	Stator, r-f, l.h.	56-9595
C3B	Stator, r-f, r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator ass'y., oscillator	76-7479
C3F	Stator ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f	76-7472
C7	Condenser, crystal mixer tank, 30 $\mu\mu$f.	Part of Board ass'y., mixer
C8	Condenser, temperature compensating, .4 $\mu\mu$f.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 2.5 $\mu\mu$f.	Part of Tank ass'y., osc.
C11	Condenser, by-pass	Part of Tank ass'y., osc.
C12	Condenser, grid by-pass, 1000 $\mu\mu$f.	30-1245-1
C13	Condenser, temperature compensating, 1.0 $\mu\mu$f.	30-1224-107
C14	Condenser, filament by-pass, 1000 $\mu\mu$f.	30-1245-1
C15	Condenser, plate by-pass, 1000 $\mu\mu$f.	30-1245-1
C16 and C17	Condensers, 45.75-mc. i-f trap	Part of Panel, filter
CD1	Crystal detector	34-8024
I1	Lamp, pilot, UHF	34-2068
I2	Lamp, pilot, VHF	34-2068
L1	Inductor, r-f, l.h.	Part of C3A-Stator
L2	Inductor, r-f, r.h.	Part of C3B-Stator
L3	Inductor, r-f, l.h.	Part of C3C-Stator
L4	Inductor, r-f, r.h.	Part of C3D-Stator
L5	Inductor, crystal mixer	Part of Board ass'y., mixer
L6	Inductor, crystal mixer	Part of Board ass'y., mixer
L7	Inductor, oscillator coupling	Part of Board ass'y., mixer
L8	Inductor, oscillator coupling	Part of Board ass'y., mixer
L9	Inductor, oscillator coupling	Part of Board ass'y., osc.
L10	Inductor, oscillator coupling	Part of Board ass'y., osc.
L11	Inductor, oscillator	Part of Tank ass'y., osc.
L12	Inductor, oscillator	Part of Tank coupling ass'y., osc.
L13	Choke, r-f, heater decoupling	32-4556-3
L14	Choke, r-f, cathode decoupling	32-4556-4
L15	Choke, r-f, plate decoupling	32-4556-2
L16 and L17	Coils, 45.75-mc. i-f trap	Part of Panel, filter
L18	Coil, i-f output	32-4558
R1	Resistor, damping, 330 ohms	66-1338340
R2	Resistor, damping, 220 ohms	66-1228340
R3	Resistor, grid decoupling, 8200 ohms	66-2828340
R4	Resistor, filament decoupling, 220 ohms	Part of L13
R5	Resistor, plate decoupling, 10,000 ohms	Part of L15
R6 and R7	Resistor, damping, 470 ohms	66-1478340
R8 and R9	Resistor, B+ dropping, 150,000 ohms	66-4158340
R10	Resistor, filament dropping, 10 ohms	66-0108340
R11	Resistor, cathode decoupling, 1000 ohms	Part of L14
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
	Board ass'y., mixer	76-7475
	Board ass'y., oscillator	76-7480
	Panel, filter, i-f trap	76-8078
	Tank ass'y., oscillator	76-7627

MISCELLANEOUS

ELECTRICAL PARTS

Description	Service Part No.
Adapter cable	41-4120-1
Cable ass'y., pilot light (2)	27-6233-50
Connector, twin-wire lead	54-5181
Lead and disconnect ass'y., female	41-4099-1
Padder, osc. (L11 and L12 tuning adjustment)	76-8193
Panel, antenna, UHF	76-7097
Plug, i-f cable	56-2027-3
Switch	42-1996

MECHANICAL PARTS

Description	Service Part No.
Tuner Shaft Mounting	
Ball, bearing (10)	W2510-5
Bearing, front	56-9593
Tuner Shaft Mounting	
Bearing, rear	56-9609
Grove pin	1W41033FA3
Nut, front bearing	56-9594
Nut, rear bearing	56-9599
Nut, insert	W1679-1FA3
Spring, center (2)	56-9590
Spring, end (2)	56-9591
Switch Mounting	
Switch actuator ass'y.	76-8189
Collar stud (2)	28-9126
Lock washer (2)	1W24515FA1
Nut, #8, special (2)	1W20506FA3
Spacer, 3/8" (2)	1W29158FA3
Washer, fiber (2)	27-4109-29
Planetary Assembly	
Ball, 1/8"	5W2017
Ball, 3/16"	56-8020
Ball, 7/32" (3)	56-8020-1
Pulley ass'y.	76-8186
Ring, retaining	1W42536FA3
Ring, retaining, shaft	1W60982FE7
Planetary Assembly	
Screw, adjusting	28-9094
Shaft, inner end	28-9176
Shaft, outer	28-9069
Shaft and pin ass'y., inner	76-8185
Spring	28-9174
Mounting Hardware, Tuner and Planetary Assembly	
Bracket ass'y., front	76-8187
Bracket, rear	28-9096
Support, angle, rear	28-9093
Washer, fiber	54-8544
Washer, fiber	11W52604
Bushing, fiber	54-8474
Clip, pilot light	56-3545-6
Dial scale	54-5172
Dial background	54-5180
Grommet, feed-through	27-4707
Knob	54-5177
Pointer	54-8850
Pulley, tuner shaft	28-9090
Shield, tube	56-5629-9
Spring (3), drive cord	28-9088
Tuner and planetary ass'y., complete	76-8182

CIRCUIT DESCRIPTION

Philco 1953, Code 127, Television Receivers use two chassis—the r-f chassis 97, containing the r-f, video, audio, and sync circuits, and the deflection chassis J-7, containing the power and deflection circuits.

Since these chassis are not isolated from the 60-cycle power line, all protruding shafts and mounting feet are insulated from the chassis.

CAUTION: See A-C Line Isolation.

The r-f amplifier, oscillator, and mixer section is built on a separate subchassis. The r-f amplifier uses a 6BZ7 or 6BQ7 tube, V1. The oscillator and mixer each use one half of a 12AZ7 tube, V2. The output of the mixer is fed to a four-stage i-f amplifier system employing four 6CB6 tubes, V3, V4, V5, and V6. A 1N64 crystal diode is used for the video detector. One half of a 6U8 tube, V7A, is used as the first video amplifier, which feeds into a 6AQ5 video output amplifier, V8.

Sound i-f (intercarrier) is obtained by utilizing the beat frequency produced when the 45.75-mc. video carrier and the 41.25-mc. sound carrier are mixed in the video detector. The beat frequency, 4.5 mc., is the difference between 45.75 mc. and 41.25 mc., and contains the FM sound signal. This 4.5-mc. signal contains only a negligible amount of the video amplitude modulation, provided that the amplitude of the 41.25-mc. signal is considerably lower than that of the 45.75-mc. signal. The proper relative amplitude of the two carriers is established in the alignment of the receiver. There is sound output only when both the video and sound carriers are present.

The oscillator is tuned primarily to obtain the best picture, since the 4.5-mc. relationship always exists between the two carriers. The 4.5-mc. sound i.f. (intercarrier), which is taken from the video detector, is amplified by a 6BA6 tube, V9, and a 6AU6 tube, V10, and is fed to the FM detector, which utilizes two diode sections of a 6T8 tube, V11A. The triode section of the 6T8 tube, V11B, is used as the first audio amplifier. The power amplifier uses a 6L6GA tube, V12.

A-G-C voltage for the video i-f system and the r-f amplifier is obtained from a keyed a-g-c system which uses a 6AU6 tube, V13, as the a-g-c gate. Composite video from the video amplifier plate circuit, V7A, is fed to the grid of the a-g-c gate tube, while a gating or keying pulse, obtained from a winding on the horizontal-output transformer located on the deflection chassis, is applied to the plate. The sync-pulse polarity applied to the grid of V13 is positive; therefore, the a-g-c gate can conduct in proportion to the amplitude of the sync-pulse tips if the gating or keying pulse occurs at the same time as the sync. Because the keying, or gate pulse, is of constant amplitude (approximately 500 volts peak), the amplitude of the sync pulse determines the amount of conduction in the gate tube. The plate current of the keyed a-g-c gate tube flows through R220, R219, and R218, developing a voltage which is negative with respect to the chassis, and is proportional to the plate current. This negative voltage is used to control the gain of the receiver. Since conduction cannot occur in the a-g-c gate tube unless the sync pulse and gating pulse occur at the same time, noise disturbances that occur during the intervals between sync pulses cannot affect the a-g-c voltage.

Composite video for the sync circuits is taken from the plate circuit of the video amplifier, V7A. The plate load of the video amplifier consists of two sections, R304 and R305. The full output of the amplifier is fed to the grid of the noise inverter, one half of a 12AU7 tube, V14B, and to the grid of the sync separator, one half of a 6U8 tube, V7B. The output developed across R305 only is fed to the grid of the a-g-c gate, a 6AU6 tube, V13. The noise inverter is operated with a low value of plate voltage and with high bias (applied to the cathode by a voltage-divider network), which keeps the tube beyond cutoff. When the composite video signal is applied to the grid of the noise inverter through C601, the sync appears as positive pulses, and noise which could affect the sweep circuits also appears as positive pulses. Harmful noise pulses usually have amplitudes far greater than that of the sync pulses and, therefore, drive the grid of the noise inverter positive sufficiently to allow conduction in the noise inverter plate circuit. To prevent the noise inverter from conducting during the sync pulse interval, the gated leveler, using one half of a 12AU7 tube, V14A, is used to clamp the sync pulses below the conduction level of the noise inverter. The gated leveler conducts only when the sync pulses and gating pulse occur at the same time, thus leveling the noise inverter input to the sync-pulse level.

The output of the noise inverter consists of negative-going noise pulses. It should be noted that the noise pulses which exceed the sync level have been passed and their polarity reversed by the noise inverter. The output of the noise inverter is now mixed with the composite video and fed to the grid of the sync separator. Since the composite video fed to the grid of the sync separator has positive sync polarity, the positive noise pulses carried with the composite video would be passed by the sync separator; however, the output of the noise inverter consists of these same noise pulses, but of opposite polarity. Thus, cancellation of the noise pulses is effected. The output of the sync separator contains only the sync pulses, which are fed to the deflection chassis through the connecting cable.

The phase splitter, using one half of a 12AU7 tube, V15A, inverts the sync polarity for proper triggering of the vertical oscillator. The vertical sync is separated from the horizontal sync by the integrator circuits, and is fed to the grid of the vertical blocking oscillator, which uses one half of a 12AU7 tube, V13B. The output of the vertical oscillator is amplified by the vertical-output amplifier, which uses a 6BQ6GT tube, V16. The output of this amplifier is applied to the vertical-deflection coils through the vertical-output transformer.

In addition to the vertical-sync output, two horizontal-sync outputs are taken from the phase splitter, one from the cathode, and the other from the plate circuit. These two outputs are of opposite polarity, and are fed to the two diodes of the phase comparer, a 6AL5 tube, V17; the negative pulses are fed to the cathode of V17B, and the positive pulses, to the plate of V17A. A portion of the horizontal sweep output voltage is taken from the horizontal-output transformer, and is fed to the plate of V17B and the cathode of V17A, for comparison of the horizontal-sync and horizontal-sweep voltages. When the sweep and sync are in phase, no voltage is developed across R800, but when the two signals are out of phase, a voltage is developed across R800. When this voltage is positive, it increases the frequency of the horizontal oscillator (a 12AU7 tube, V18); when the voltage is negative, it reduces the frequency of the oscillator. This action holds the horizontal oscillator in phase with the sync signal. The horizontal hold control, R811, adjusts the horizontal-oscillator frequency so that it may be controlled by the phase comparer. The output of the horizontal oscillator is fed to the horizontal-output amplifier, which uses a 6CD6G tube, V19. The horizontal-output tube feeds the deflection coils through the horizontal-output transformer. A 6V3 tube, V20, is used as the horizontal damper.

The second-anode voltage for the picture tube is supplied by two 1B3GT high-voltage-rectifier tubes, V21 and V22, connected in a voltage-doubler circuit. The B-plus voltage for the receiver is supplied by two selenium rectifiers, CR100 and CR101, in a full-wave voltage-doubler circuit, operating directly from the power line. Bias voltage is obtained across the filter choke which is in series with the negative side of the B-plus supply. The B-plus-boost voltage derived from the horizontal-damper circuit supplies higher B-plus voltage to the first anode of the picture tube. Filament current for all the tubes except the high-voltage rectifiers is supplied by a 117-volt, 60-cycle step-down transformer. Filament current for the high-voltage rectifiers is supplied by two windings on the horizontal-output transformer.

NOTE: The J-7 Chassis incorporates a protective high-voltage shorting switch (located on the rear of the high-voltage cage), which shorts the output of the 1B3GT high-voltage doubler-rectifier (V22) to ground when the cabinet back is removed. Do not attempt to operate the receiver with the cabinet back removed without first disabling this shorting switch. The switch can be disabled temporarily for service work by removing the two self-tapping screws at the bottom edge of the rear cover of the high-voltage cage, and propping up the rear cover.

IMPORTANT

A-C LINE ISOLATION

CAUTION: One side of the a-c line is connected to the chassis through C101, L100, and R104, in series. The other side of the a-c line is connected to the chassis through R100, F100, CR100, and C103, in series. Grounding the chassis will result in a short circuit across one or the other of these two branches in the voltage-doubler circuit. During servicing and alignment, it is desirable that an a-c line isolation transformer capable of handling at least 250 watts (Philco Part No. 45-9600) be used. Failure to use an isolation transformer will greatly increase the shock hazard, and may result in damage to the test equipment, or receiver, or both.

SPECIFICATIONS

CHANNEL TUNING — Twelve-channel, 13-position, wafer-switch incremental tuner; fine tuning of local oscillator

FREQUENCY RANGE — Television Channels 2 through 13 and U-H-F position

INTERMEDIATE FREQUENCIES
- Video carrier — 45.75 mc.
- Sound (intercarrier) — 4.5 mc.

TRANSMISSION LINE — 300-ohm, twin-wire lead

OPERATING VOLTAGE — 110 to 120 volts, 60 cycles, a.c.

POWER CONSUMPTION — 250 watts

TUBE COMPLEMENT

R-F 97 CHASSIS

Reference Symbol	*Tube Type*	*Function*
V1	6BQ7 or 6BZ7 — miniature	R-F amplifier
V2	12AZ7—miniature	Oscillator, mixer
V3, V4, V5, V6	6CB6—miniature	Video i-f amplifiers
V7	6U8—miniature	Video amplifier, sync separator
V8	6AQ5—miniature	Video output
V9	6BA6—miniature	First sound i-f amplifier
V10	6AU6—miniature	Second sound i-f amplifier
V11	6T8—miniature	FM detector, first audio amplifier
V12	6L6GA—octal	Audio output
V13	6AU6—miniature	A-G-C gate
V14	12AU7—miniature	Gated leveler, noise inverter
V23	27LP4	Picture tube

J-7 DEFLECTION CHASSIS

Reference Symbol	*Tube Type*	*Function*
V15	12AU7—miniature	Phase splitter, vertical oscillator
V16	6BQ6GT—octal	Vertical output
V17	6AL5—miniature	Phase comparer
V18	12AU7—miniature	Horizontal oscillator
V19	6CD6G—octal	Horizontal output
V20	6V3—miniature	Damper
V21, V22	1B3GT—octal	High-voltage rectifier

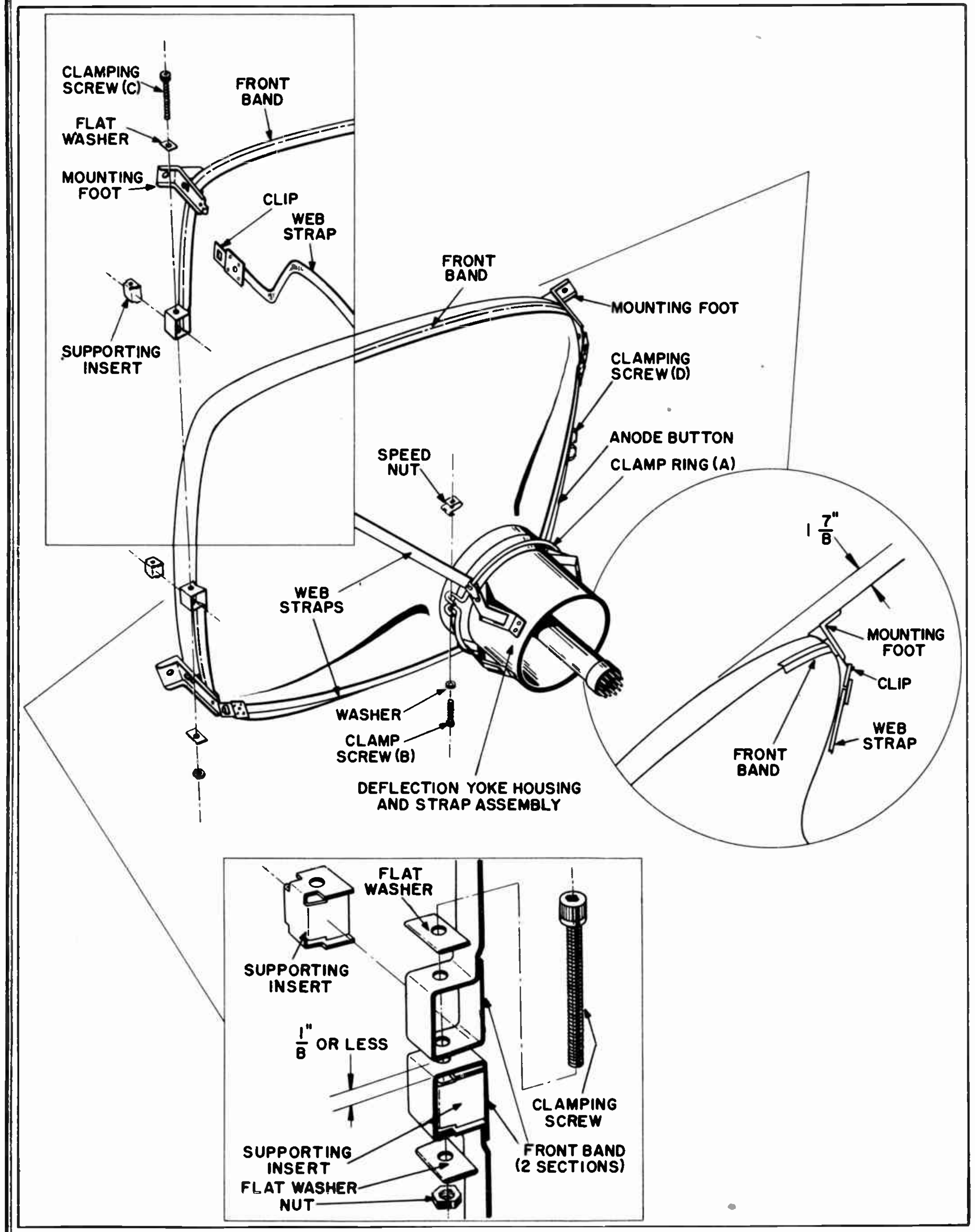


Figure 1. 27LP4 Picture-Tube Assembly

TP2-3264

REMOVING AND REPLACING 27LP4 PICTURE TUBE

GENERAL

The Philco 27LP4 picture tube is designed for a maximum of safety. Moreover, when properly mounted in the frame assembly, the picture tube is supported in such a manner as to provide a maximum of protection against breakage. Therefore, it is important that the tube be properly installed in its supporting frame. It is suggested that the service technician protect his eyes and the exposed parts of his body when handling all picture tubes. The removal and installation of the 27LP4 picture tube is quite safe if the procedure given below is followed.

> CAUTION: Because of the bulkiness and increased weight of the 27LP4 tube, as compared with that of the smaller picture tubes, replacement of the 27LP4 requires two men. These tubes are not delicate when handled in the proper manner; however, care must be taken not to mar the glass in any way, as surface scratches and chips weaken a glass structure considerably. Also, because of its weight, do not attempt to handle this tube by the neck.

PROCEDURE FOR REMOVING 27LP4 TUBE

1. Remove both the deflection chassis and the r-f chassis from the cabinet.

2. Lay the cabinet face-down on the floor, taking precautions against marring the cabinet.

3. Remove the four nuts and washers that secure the mounting feet of the assembly to the front of the cabinet.

4. Remove the two wood screws that secure the rear supporting struts of the tube assembly to the cabinet.

5. Remove the tube assembly (one man on each side of the cabinet).

6. Place the tube assembly face-down on a soft, protective cloth or mat, and slip the beam-bender magnet off the rear end of the tube. Referring to figure 1, loosen clamp ring (A) by means of clamp screw (B), unhook the four clips securing the web straps to the mounting feet, and lift the deflection-yoke housing and strap assembly (containing the deflection yoke and focus assembly) off the neck of the tube.

7. Mark the positions of the four mounting feet on the front band with a pencil or scriber (this is necessary because the mounting feet are free to slide, once the front band is loosened).

8. Loosen the two Allen head clamping screws (C) and (D) with a 5/16-inch Allen wrench, and remove the front band assembly.

PROCEDURE FOR INSTALLING 27LP4 TUBE

1. Place the picture tube face-down on a soft, protective cloth or mat, and position the front band assembly over the tube so that the lateral indentation in the band coincides with the welded seam around the outer edge of the tube's face plate.

Take up slack in the band, tightening both clamping screws (C) and (D) by hand.

> NOTE: If the front band is positioned correctly, the distance from the bottom edge of each mounting foot to the surface on which the tube is resting will be 1⅞ inches, as shown in figure 1.

2. Position the mounting feet, on the front band, to coincide with the marks previously made on the front band.

3. Tighten both clamping screws (C) and (D) alternately, using a 5/16-inch Allen wrench.

> NOTE: Take up on clamping screws (C) and (D) as tightly as possible. As can be seen from figure 1, the separation between the ends of the bands must be less than ⅛ inch, when tightened.

4. Slip the deflection-yoke housing and strap assembly (containing the deflection yoke and focus assembly) over the neck of the tube, and position it so that clamp screw (B) on clamp ring (A) is on the side of the tube opposite the anode button.

5. Place the clips (on the web straps) over the hooks on the four mounting feet, and tighten clamp ring (A) by means of clamp screw (B).

6. With the cabinet face-down on the floor, place the tube assembly in the cabinet (one man on each side of cabinet), and replace the four nuts and washers that secure the mounting feet to the front of the cabinet.

7. Replace the two wood screws that secure the rear supporting struts of the tube assembly to the cabinet.

8. Stand the cabinet upright, and install the r-f chassis, deflection chassis, and beam-bender magnet.

ADJUSTING 27LP4 PICTURE-TUBE ASSEMBLY

1. Mechanically center the focus assembly, over the neck of the tube, by adjusting the centering plate. It is important that the focus assembly and yoke be concentric with the tube neck for best focus and shadow clearance.

2. Set the HORIZ. CENTERING control (R824) to its extreme counterclockwise position, and set the BRIGHTNESS control for maximum brightness of the picture.

3. Adjust the beam bender for maximum brightness of the picture.

4. If necessary, loosen the wing nuts and rotate the deflection yoke, to correct for picture tilt. Make certain that the deflection yoke is as far forward as possible, and tighten the wing nuts.

5. Adjust the centering plate so that neck shadow is just eliminated on the right-hand side of the screen, at the same time keeping the picture centered vertically. Do not attempt to center the picture horizontally by means of the centering plate.

6. Adjust the FOCUS control (on focus assembly). Set the CONTRAST control for the proper level, and readjust the FOCUS control for the best over-all focus.

7. Repeat steps 3 and 5, if necessary.

8. Adjust the HORIZ. CENTERING control (R824) for proper horizontal centering of the picture.

9. Turn the BRIGHTNESS control slowly toward the minimum position, checking that shadow does not appear at any brightness level. If shadow does appear, repeat steps 5 and 8, and recheck.

B SUPPLY FUSE REPLACEMENT

The B supply protective fuse, F100, is wired into the low-voltage section, and is in series with the selenium rectifiers. For replacement, use a 1.6-ampere delayed-action-type fuse, Philco Part No. 45-2656-23.

CAUTION: Discharge the circuit before replacing the fuse.

HORIZONTAL-OSCILLATOR ADJUSTMENT

To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

1. Reduce the width of the picture so that approximately one inch of blank screen appears at the right-hand and left-hand sides of the picture.

2. Increase the BRIGHTNESS control setting so that the blanking time becomes visible. This appears as a dark vertical bar at the right-hand and left-hand sides of the picture.

3. Connect a .1-μf. condenser from Test Point J802 to ground.

4. Set the HORIZ. HOLD control to the center of its mechanical rotation.

5. Adjust the HORIZ. HOLD CENTERING control to bring the picture into the center of the blanking bars. When the picture is centered in the blanking bars, the bars at the left-hand and right-hand sides of the picture will be of equal width.

6. Remove the .1-μf. condenser from the Test Point. (See step 3.)

7. Adjust the horizontal ringing coil, L800, until the picture is again centered in the blanking bar.

8. Rotate the HORIZ. HOLD control through its range. The picture should fall out of sync to both sides of the center of rotation. If the picture does not fall out of sync to both sides, readjust the HORIZ. HOLD CENTERING control to obtain fall-out to either side of sync.

9. Rotate the HORIZ. HOLD control through its range, and observe the number of diagonal blanking bars that are visible just before the picture pulls into sync. The pull-in should occur with from 1 to 2 diagonal bars when the sync position is approached from either direction. If proper pull-in is not obtained, repeat the above procedure.

VIDEO PEAKING COIL ADJUSTMENT

The video peaking coils, L305 and L307, are adjusted at the factory for proper transient response of the video amplifiers. Ordinarily, these coils will require no further adjustment by the serviceman except in cases where they have been tampered with, or where replacement becomes necessary. Under normal circumstances, when alignment of the tuner or i-f stages is undertaken, the video peaking coils should not require adjustment.

Before adjusting L305 and L307, check both the tuner and i-f alignment. (Never adjust L305 and L307 until the alignment of the receiver is correct.) Then tune in a station and adjust the receiver to give a picture of the best obtainable quality, with medium contrast. Turn the fine tuning control clockwise until a very slight beat pattern appears in the picture. Carefully observe the appearance of the picture regarding smear or overshoot (trailing whites). A small amount of overshoot may be desirable, to produce a sharper picture. Conversely, in weak-signal areas, a small amount of smear may be desirable, to reduce the harsh appearance of "snow". The adjustments of L305 and L307, and their effects on the picture, are as follows:

1. The amount of overshoot may be reduced by turning both TC302 and TC303 counterclockwise.

2. The amount of smear may be reduced by turning both TC302 and TC303 clockwise.

Normally the point of proper adjustment is where minimum smear and trailing whites appear in the picture; however, a compromise adjustment may be made to suit prevailing conditions. As a rule, when properly adjusted, the adjustment screws (TC302 and TC303) should protrude from the chassis by approximately ½ inch to ¾ inch.

TELEVISION ALIGNMENT PROCEDURE

General

The alignment consists of tuning each i-f coil to a given frequency, using an AM signal, then feeding in a sweep signal at the antenna terminals and touching up the adjustments to obtain the desired pass band.

The over-all response curve (r-f, i-f) of the circuits from the antenna terminals to the video detector, after the i-f stages have been aligned, should appear essentially the same, regardless of the channel under test. If not, the tuner should be aligned. Before aligning the tuner, refer to the CAUTION given under TUNER BANDPASS ALIGNMENT.

The video-carrier intermediate frequency is 45.75 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the receiver chassis and the test equipment. This is most easily obtained by providing the workbench with a metallic top. The receiver chassis should be placed tuner-side-down on the bench. If the bench has no metallic top, the test equipment and chassis can be bonded by a strip of copper about 2 inches wide. The section of the chassis nearest the tuner should rest on the strip.

2. Do not disconnect the picture tube, picture-tube yoke, or speaker while the receiver is turned on.

3. Allow the receiver and test equipment to warm up for 15 minutes before starting the alignment.

4. The marker (AM) signal generator should be calibrated accurately to the sound and video r-f carriers of each channel used during alignment. If Model 7008 is used, the built-in crystal calibrator provides an excellent means of calibration. An alternate method of calibrating the signal generator to the sound and video r-f carrier frequencies is to zero-beat the signal generator with the received signals.

For further information concerning calibration, refer to Philco Lesson PR-1745 (J), entitled "Television Service in the Home."

Test Equipment Required

The following test equipment is recommended for aligning the receiver:

1. Philco Precision Visual Alignment Generator for Television and FM, Model 7008, or equivalent.

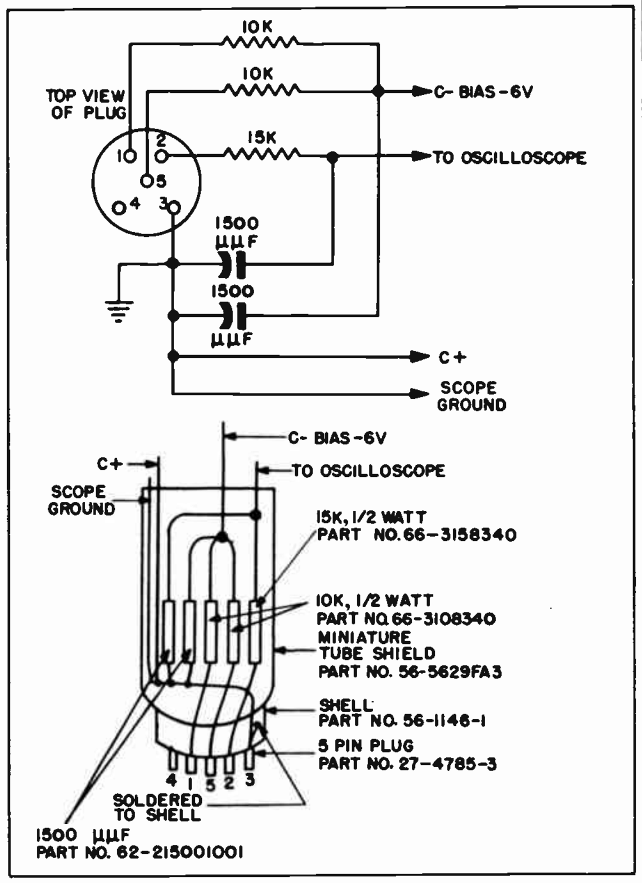
2. Vacuum-tube voltmeter, or 20,000-ohms-per-volt voltmeter.

3. R-F Probe, Philco Part No. 76-3595 (for use with Model 7008 generator).

Jigs and Adapters Required

Mixer Jig

Connections to the grid of the mixer tube may be made through the alignment jack provided for this purpose. To connect the generator to this point, a mixer-grid jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adapter, Part No. 45-1636, with as short a ground lead as possible, may be used to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68-ohm carbon resistor (used with alligator-clip adapter only), so that any regeneration caused by connection of the lead to the mixer is held to a minimum.



TP2-1507-A

Figure 2. Video I-F Alignment Jig (VIDEO TEST Jack Adapter No. 1)

Antenna-Input Matching Network

An impedance-matching network for coupling the signal generator to the antenna-input terminals of the receiver is shown in figure 2 on page 5 of Service Manual PR-2170. This network, which is designed to have an input impedance of 75 ohms and an output impedance of 300 ohms, is used to match a 75-ohm generator to a 300-ohm antenna-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group, to obtain values within 10% of those indicated. The resistors should be placed in a shield can, to prevent variable effects. An antenna-matching jig, Philco Part No. 45-1736, which consists of a matching transformer and connecting box, may be used in place of the resistor network.

Video I-F Alignment Jig (VIDEO TEST Jack Adapter No. 1)

The alignment jig shown in figure 2 should be used during the i-f alignment, to apply the proper bias to the a-g-c bus, and to provide a convenient oscilloscope connection. This adapter consists of a 5-prong plug, two 10,000-ohm resistors, and a 1500-$\mu\mu$f. condenser for isolation of the bias supply. To isolate the oscillo-

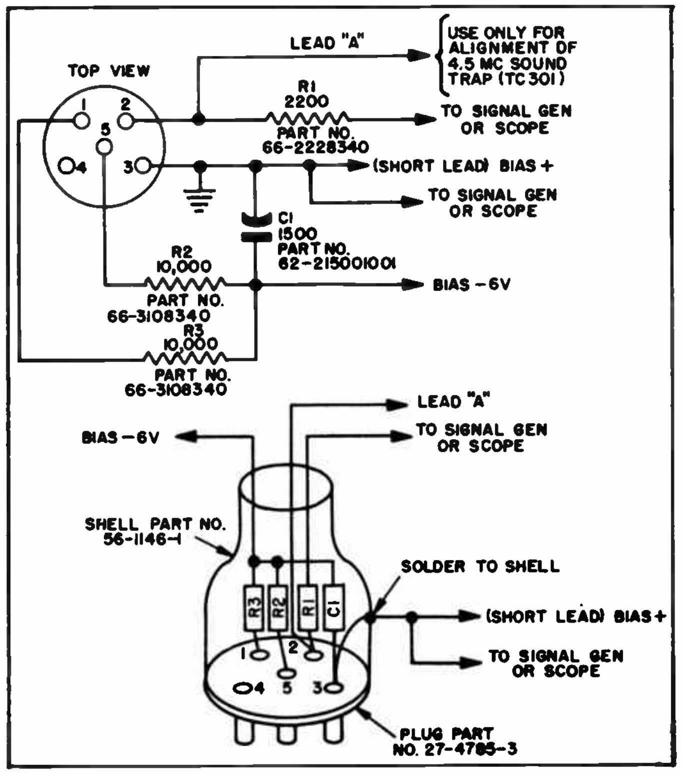


Figure 3. Sound I-F Input Alignment Jig (VIDEO TEST Jack Adapter No. 2

scope from the receiver circuits, a 15,000-ohm resistor, by-passed by a 1500-$\mu\mu$f. condenser, is used. A suggested method of fabricating the jig is also shown in figure 2. This jig should not be used to observe the composite video from the video-detector output.

Sound I-F Input Alignment Jig (VIDEO TEST Jack Adapter No. 2)

To observe the composite video, a jig may be made with a 5-pin plug and a 2200-ohm resistor. See figure 3. The 2200-ohm resistor should be connected to pin 2 of the plug. A ground lead should be connected to pin 3. For convenience in applying bias to the a-g-c circuits, a lead should be connected to pin 5. To observe the composite video, connect the oscilloscope to the 2200-ohm resistor and the ground lead. This jig is also used for injection of the 4.5-mc. signal during sound i-f alignment.

Sound I-F Output Alignment Jig (FM Test Point and Volume Control Socket Adapter)

Figure 4 shows the adapter that should be used to connect the voltmeter to the FM detector through the Volume Control socket (J401) and FM Test Point (J403). The adapter should be inserted into the Volume Control socket, and the clip lead from the adapter connected to the FM Test Point. The Volume Control cable and plug (PL401) is inserted into the socket on top of the adapter.

TELEVISION TUNER ALIGNMENT

After the tuner is serviced, or if an i-f alignment is required, the tuner alignment should be checked. If realignment is necessary, use the procedure given below.

Since the frequency of the local oscillator affects the tuner response, the local-oscillator alignment should be made first.

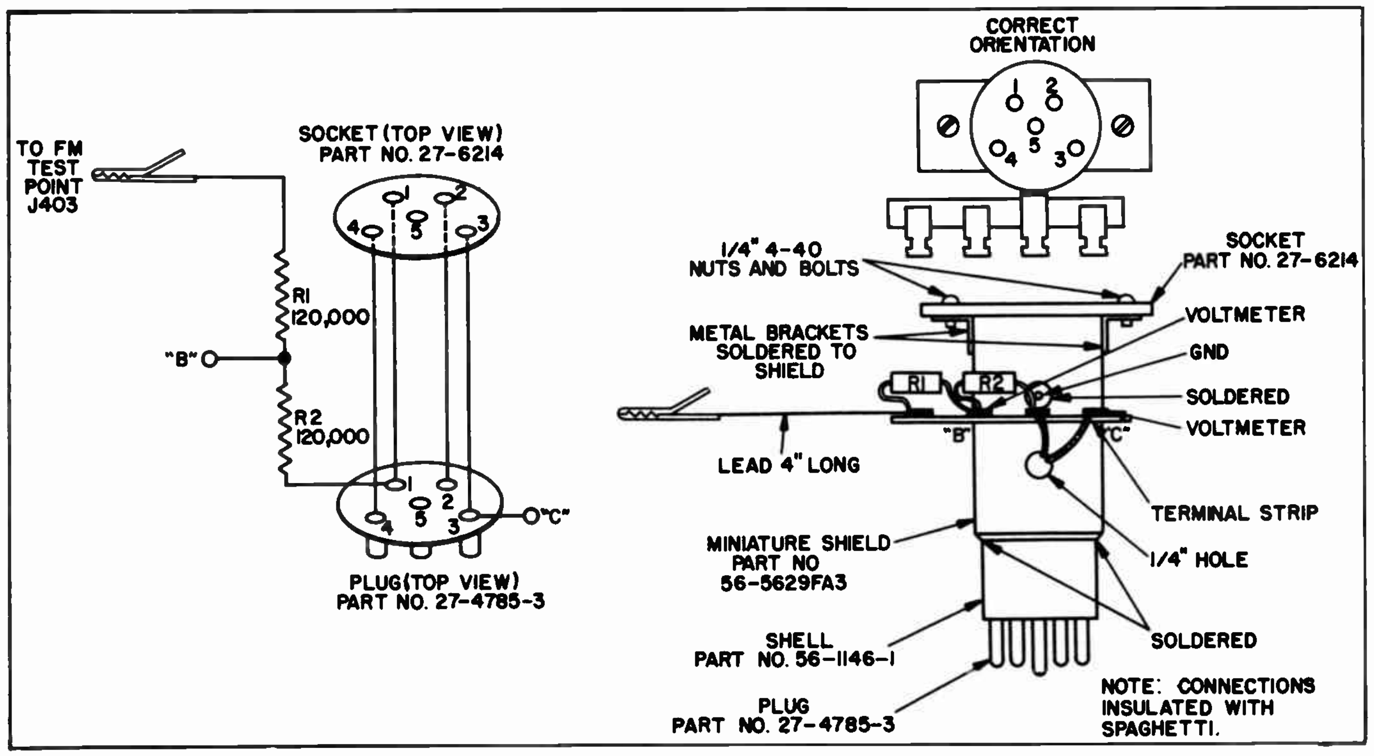


Figure 4. Sound I-F Output Alignment Jig (FM Test Point and Volume Control Socket Adapter)

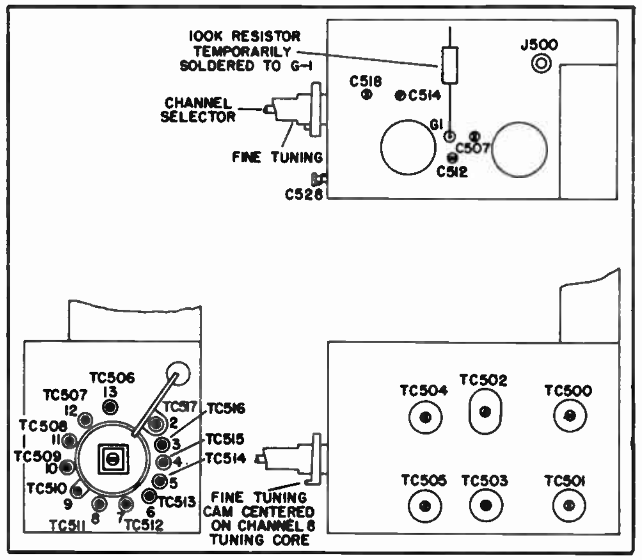


Figure 5. Television Tuner, Showing Location of Adjustments

OSCILLATOR ALIGNMENT

General

It is possible to place each channel exactly on frequency by adjusting the tuning core of each coil. The adjustment procedure should be carried out with the highest-frequency channel (13) first, since the alignment of each channel will affect the alignment of the channels below it in frequency. The FINE TUNING control should be preset for all adjustments by placing the stop on the fine-tuning cam at the Channel 8 oscillator tuning core. See figure 5.

Procedure Using Signal Generators

An r-f signal (unmodulated), at the video carrier frequency of the channel, is fed into the antenna input, and an i-f signal, at the i-f carrier frequency is fed to the first i-f amplifier. Two AM signal generators are used to supply the above signals. An oscilloscope is connected to the video detector output. The oscillator core is then adjusted for zero beat on each channel. The two generators should be accurately calibrated, as described in Philco Lesson PR-1745(J).

To align the oscillator, proceed as follows:

1. To observe the zero beat, connect the oscilloscope to the video-detector output through the video i-f alignment jig. See figure 2. Bias the tuner and the i-f a-g-c circuits with 1.5 volts, and remove the Gate Pulse Plug, PL801, from the socket, J801. To apply bias to the tuner, connect the battery to the white lead which comes out of the top of the tuner. On later runs of this tuner, the white a-g-c lead connects to a feed-through condenser on top of the tuner. To make certain that good connection is made to the tuner a-g-c circuit, remove the glyptol coating on this condenser terminal before connecting the bias battery.

2. To feed in the i-f comparison signal, remove the shield from the first v-i-f tube and wrap several turns of insulated copper wire around the tube. Connect the output leads of the v-i-f signal generator to the two ends of the wire loop, and set the generator for unmodulated output at 45.75 mc.

3. To feed in the signal representing the channel frequency, set the r-f signal generator to the video carrier frequency of Channel 13, and connect the output to the antenna terminals of the receiver, through the proper matching jig.

4. Mechanically preset the fine-tuning cam, as shown in figure 5, and set the CHANNEL SELECTOR to Channel 13.

5. Adjust the Channel 13 tuning core for zero beat, as indicated by the oscilloscope.

6. Retune the r-f signal generator and the CHANNEL SELECTOR for Channels 13, then 11, etc., each time adjusting the respective tuning core for zero beat. The tuning cores should be adjusted progressively from the highest-frequency channel to the lowest, because the higher channel adjustments will affect the lower channels.

Procedure Using Station Signal

The following simplified procedure may be used to align the oscillator when the television i-f alignment is satisfactory and a station signal is available. If this procedure is used in the service shop, signals from all stations which the customer can receive must be available in the service shop.

1. Mechanically preset the fine-tuning cam to the center of its range. See figure 5.

2. Tune in the highest-frequency channel to be received, and adjust the tuning core for that channel for the best picture; that is, starting with sound in the picture, turn the tuning core until the sound in the picture just disappears.

3. Repeat step 2 for each channel received in the area, starting with the highest-frequency channel and finishing with the lowest.

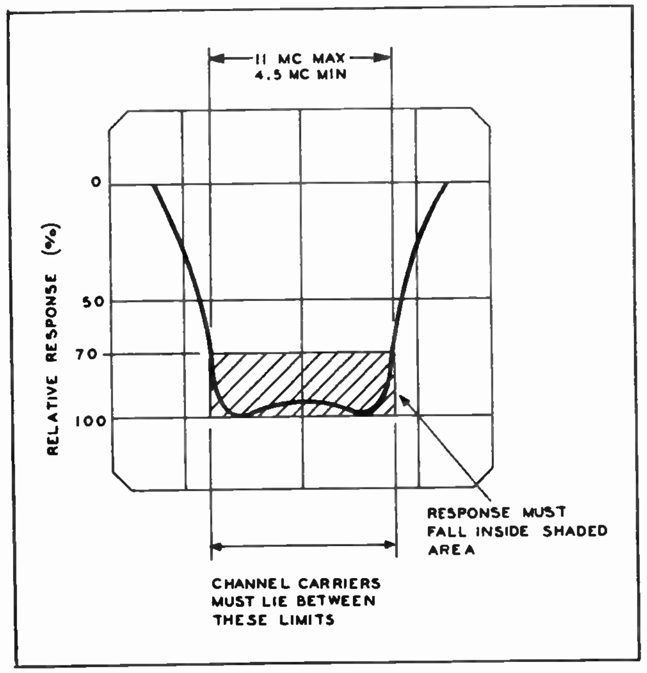
TUNER BANDPASS ALIGNMENT

General

The bandpass alignment consists of aligning the tuner at Channels 13 and 6, and then making it track properly.

During the alignment, a fixed bias of 1.5 volts is applied to the r-f amplifier tube through the white a-g-c lead.

An FM (sweep) signal is applied to the antenna-input circuit through the proper matching jig, and an oscilloscope is connected through a 100,000-ohm resistor to the mixer-grid test point. The oscilloscope gain should be as high as possible, consistent with hum level and "bounce" condition. Hum conditions will cause distortion of the time base and response. Bounce conditions will cause the response and the time base to jump up and down, and is caused by poor line regulation. The use of too high an oscilloscope gain aggravates these conditions, whereas the use of too low a



TP9-512B-1

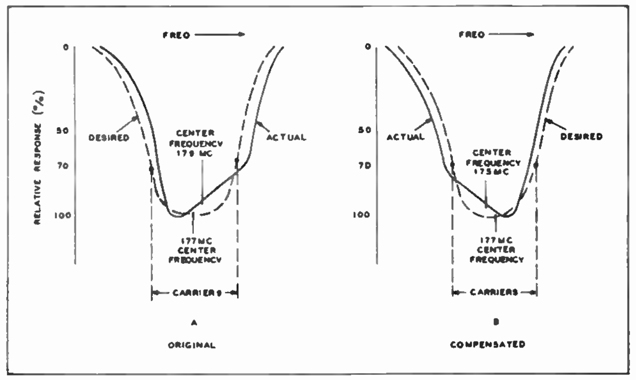
Figure 6. Television Tuner Response Curve, Showing Bandpass Limits

gain necessitates increasing the generator output to a point where the tuner may be overloaded. The scope controls should be adjusted so that the width of the presentation is 2 times the height. Overload may then be checked by changing the generator output while observing the shape of the response curve. When the generator output is changed, the vertical gain of the oscilloscope should be readjusted, to keep the scope presentation amplitude the same. Do not readjust the horizontal gain control. Any flattening of the curve indicates overload, in which case a lower generator output and higher oscilloscope gain must be used.

The signal-generator output must be properly matched to the antenna input of the tuner.

Correct alignment cannot be obtained without the use of a suitable matching jig.

Regeneration or a mismatch in the test setup will also make it impossible to obtain correct alignment. To check for these conditions, move the hand along the generator cable, after all equipment is connected, and observe the response curve on the oscilloscope screen. If the response curve changes as the hand is moved along the cable, regeneration or mismatch is indicated. Another check may also be made with the volume control advanced until noise can be heard from the speaker. If the level of the noise changes as the hand is moved along the generator cable, regeneration or mismatch is indicated. The symptoms which indicate these conditions may also be caused by failure to use the proper matching jig, as described above.



TP0-1174

Figure 7. Television Tuner Response Curve, Showing Tracking Compensation

CAUTION: When comparing the response curves from channel to channel, maintain the 2-to-1 width-to-height relationship in the oscilloscope presentation, as described above.

Procedure

1. Connect the FM (sweep) and AM marker generators to the 300-ohm antenna input through an antenna-input matching jig.

2. Connect the oscilloscope to the mixer-grid test point through a 100,000-ohm, one-half watt resistor, as shown in figure 5. Connect the ground lead of the oscilloscope as close to the mixer tube as possible.

3. Apply 1.5 volts bias to the white tuner a-g-c lead.

4. Disconnect the tuner coupling link at wiring panel B-13, terminals 1 and 4, and solder a 68-ohm, one-half watt carbon resistor to the open link coming from the tuner. See figure 7. Remove the first i-f tube from the socket.

5. Set the CHANNEL SELECTOR and FM (sweep) generator to Channel 13 (213 mc.). Adjust the generator for sufficient sweep width to show the complete response curve.

6. Establish the channel limits (see figure 6) by using the marker (AM r-f) signal generator to produce marker pips on the response curve. (Set the marker generator first to 210 mc., then to 216 mc.) The response curve should be reasonably flat between the limits.

7. Adjust TC502 and TC504 (figure 5) for a symmetrical, approximately centered pass band. Set the marker generator to 213 mc. Detune TC504 counterclockwise until a single peak appears. Adjust TC502 until the peak falls on the 213-mc. marker. (It may be necessary to increase the output of the generator during this adjustment.) Then adjust TC500 for maximum curve height and symmetry of the single peak. The antenna circuit is now tuned for the high-band channels.

NOTE: On later runs of the tuner, L506 is not tunable and TC500 is omitted; therefore, the adjustments in step 7 should be confined to TC502 and TC504 when later run tuners are encountered.

8. Readjust TC502 and TC504 for a symmetrical response, centered about 213 mc., and falling within the specifications, as shown in figure 6.

9. Set the CHANNEL SELECTOR and FM generator to Channel 7 (177 mc.). Establish the channel limits by using the marker signal generator to produce marker pips on the response curve. (Set the marker generator first to 174 mc., then to 180 mc.) The curve should be reasonably flat between the limits.

10. On Channel 7, observe the tilt and center frequency of the response curve. The curve should be centered on the pass band, and should be symmetrical. If it is not symmetrical, and appears unbalanced, as in figure 7, adjust C507 and C512 (figure 5) to obtain a response curve which is the mirror image (tilt in the opposite direction) of the original; for example, if Channel 7 response curve appears as in figure 7A, adjust C506 and C514 until the curve appears as in figure 7B. This adjustment overcompensates, to make allowance for the effect of Channel 13 adjustments (to be made in step 11) upon Channel 7 response.

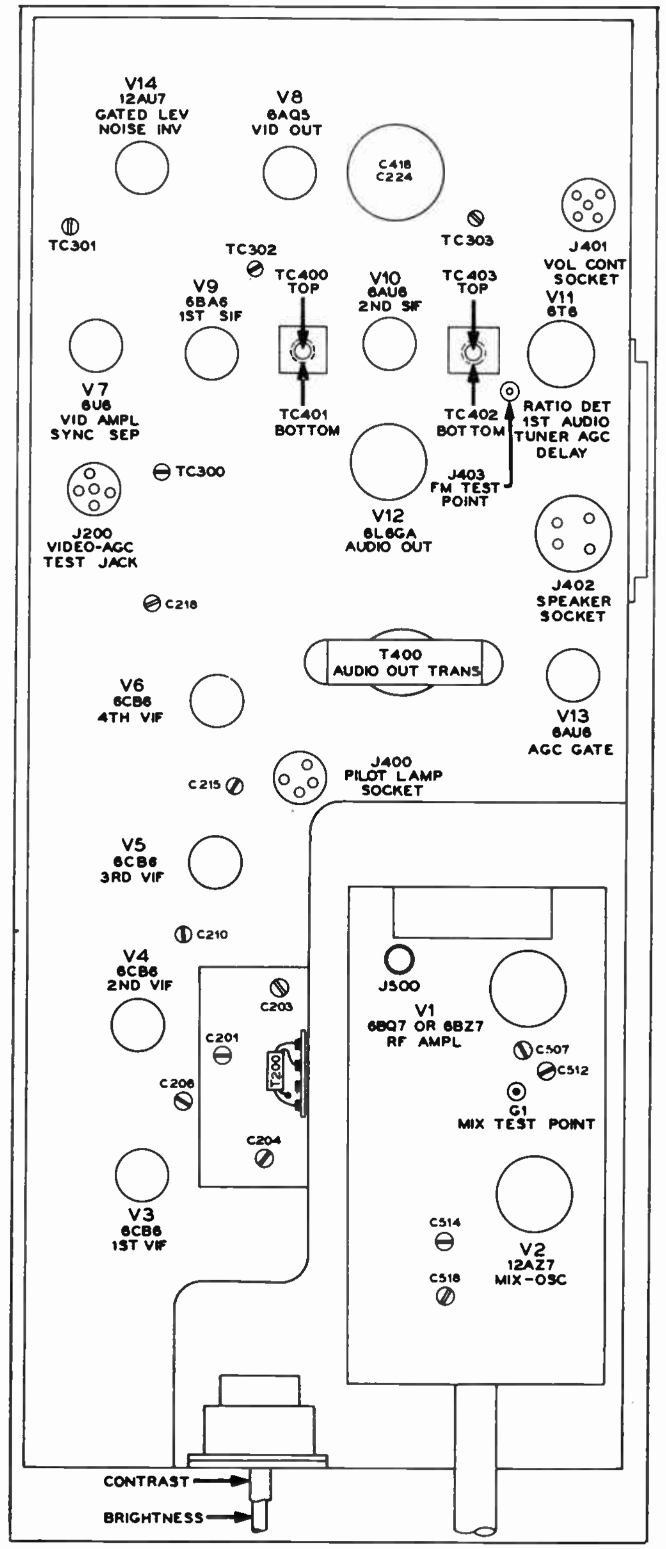
11. Reset the CHANNEL SELECTOR and generators to Channel 13, and repeat steps 8 through 10 as many times as necessary to obtain the most symmetrical and centered response curves on Channels 13 and 7. Channels 7 through 13 are now correctly aligned.

12. Set the CHANNEL SELECTOR and sweep generator to Channel 6 (85 mc.).

13. Establish the channel limits, using the marker generator to produce marker pips on the response curve. (Set the marker generator first to 82 mc., then to 88 mc.)

14. Adjust TC503 and TC505 for a symmetrical, approximately centered pass band. Set the marker generator to 85 mc. Detune TC505 counterclockwise until a single peak appears. Adjust TC503 until the peak falls on the 85-mc. marker. It may be necessary to increase the output of the generator during this adjustment. Then adjust TC501 for maximum curve height and symmetry of the single peak. The antenna circuit is now tuned for Channels 2 through 6.

15. Readjust TC503 and TC506 for a symmetrical response, centered about 85 mc., and falling within the specifications, as shown in figure 6. Channels 2 through 6 are now correctly aligned.



TP2-3191

Figure 8. R-F Chassis 97, Top View, Showing Location of Adjustments

VIDEO I-F ALIGNMENT

PRELIMINARY

Before proceeding with the i-f alignment or making an alignment check, observe the following preliminary instructions:

1. Preset the CONTRAST and BRIGHTNESS controls to the maximum counterclockwise position.
2. Preset the CHANNEL SELECTOR to Channel 4.
3. Insert the video i-f alignment jig into J200.
4. Connect the oscilloscope to the 15,000-ohm resistor from the video i-f alignment jig. Connect the ground lead of the oscilloscope to the ground lead from the adapter.
5. Connect a 6-volt battery to the a-g-c test jack, with the negative terminal to the bias lead and the positive terminal to the ground lead.
6. Connect the AM generator to the mixer-grid

test point, G1, through a mixer jig, and adjust the generator for approximately 30 percent modulation at 400 cycles.

NOTE: If the i-f shield has been removed for repairs, it must be replaced before proceeding with the alignment.

PROCEDURE

1. Tune the AM generator to 39.75 mc., and adjust C518 (see figure 8) for minimum output, as observed on the oscilloscope.
2. Tune the AM generator to 47.25 mc., and adjust C201 for minimum output, as observed on the oscilloscope.
3. Tune the AM generator to 41.25 mc., and adjust C203 for minimum output, as observed on the oscilloscope.

NOTE: In steps 1, 2, and 3, it is necessary to keep the generator output sufficiently high that a null indication may be observed on the oscilloscope. However, avoid overloading of the receiver by excessive signal.

4. Tune the AM generator to the frequencies indicated below, and adjust the trimmers for maximum output.
   a. 42.7 mc.—adjust C514
   b. 45.4 mc.—adjust C204
   c. 42.0 mc.—adjust C206
   d. 45.0 mc.—adjust C210
   e. 44.4 mc.—adjust C215
   f. 43.0 mc.—adjust C218
5. Connect the sweep generator and r-f marker generator to the antenna terminals through a matching jig. (If a separate oscilloscope is used, connect the sweep output of the generator to the horizontal input of the oscilloscope.) Connect a 7.5-volt battery to the a-g-c test jack, with the negative terminal to the bias lead and the positive terminal to the ground lead. Set the CHANNEL SELECTOR to Channel 4, and tune the sweep generator for output on Channel 4. Tune the r-f marker generator for the video carrier frequency of Channel 4 (67.25 mc.), and tune the i-f marker generator (connected to mixer grid) to 45.75 mc. Note that two marker generators are used for this procedure. The r-f marker generator is connected to the antenna terminals, while the i-f marker generator is connected to the mixer-grid test point, G1. A jig constructed from a piece of fiber tubing, with 3/16 inch inside diameter, and a brass machine screw which fits tightly into the tubing, is used to connect the generator to the test point. The screw is adjusted so that it clears the test point by approximately 1/64 inch. The output cable of the marker generator is connected to the head of the brass screw in the jig and to the chassis near the mixer tube. Both marker generators should be adjusted for the minimum output required to make the markers barely visible. Failure to observe this precaution, or the use of excessive output from the sweep generator, will cause misleading results. After the equipment is properly connected, adjust the FINE TUNING control for zero beat of the two markers, as observed on the oscilloscope. When zero beat is obtained, remove the i-f marker.
6. If the response curve does not fall within the limits, as shown in figure 9, the adjustment of the trimmers may be touched up slightly. Do not retouch the setting of C518, C201, C203, or C206. To adjust the curve, first adjust C215 and C218 alternately, until maximum improvement has been obtained. C215 affects the tilt of the curve, and C218 affects the dip of the curve. After C215 and C218 have been adjusted, adjust C514 for the proper slope at the 42.25-mc. side of the curve, then adjust C204 and C210 for the proper level at the video carrier frequency (45.75 mc.).

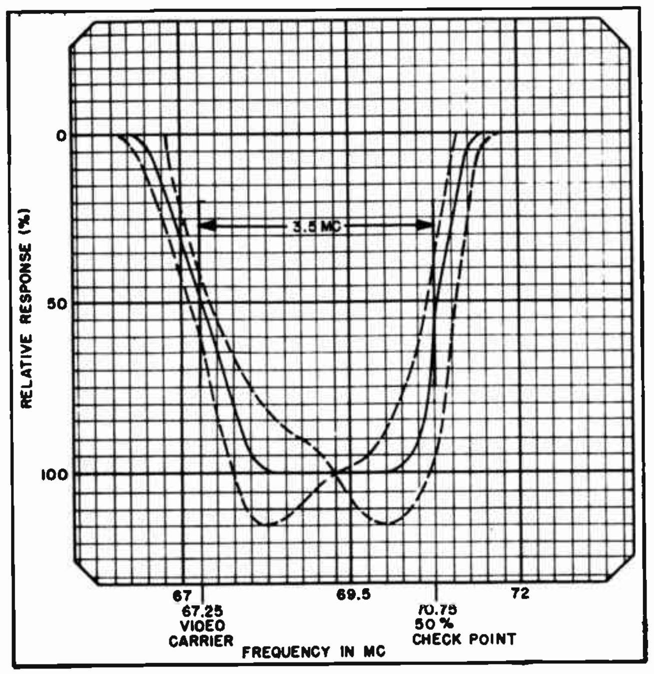


Figure 9. Over-all R-F, I-F Response Curve

CAUTION: Do not turn any of the trimmers excessively. To retouch, make only a slight adjustment.

SOUND I-F ALIGNMENT

The sound i-f system may be aligned by the use of a station signal or an accurately calibrated signal generator, for the signal source. If the station signal is used, tune the FINE TUNING control for the best picture, regardless of sound. It will be necessary to reduce the signal input to the receiver, so that the d-c output at the sound detector, as measured with the aid of the sound i-f output alignment jig (between point "B" and ground), is kept below 5 volts maximum, and preferably below 3 volts. To establish this level in strong signal areas, it may be necessary to short the antenna terminals and to apply bias to the a-g-c circuit. The signal input to the receiver may be adjusted by varying the length of the shorting lead. The bias may be applied to the a-g-c circuit by means of the jig shown in figure 3. The sound i-f output alignment jig shown in figure 4 should be used for convenient connection of the meter to the sound-detector output.

When signal generator (accurately calibrated) is used, bias should be applied to the a-g-c circuit, to avoid any possibility of regeneration, using the sound i-f input alignment jig (figure 3). In addition, the first video i-f tube should be removed, to aid in the reduction of circuit noises from the i-f system.

1. Connect the generator through the 2200-ohm resistor, in the sound i-f input alignment jig, to pin 2 of J200. The generator should be adjusted for unmodulated output at 4.5 mc.
2. Insert the sound i-f output alignment jig in the volume-control socket (J401), and insert the volume-control plug (PL401) in the top of the jig. Connect the clip lead to the FM Test Point (J403); connect a 20,000-ohms-per-volt voltmeter between point "B" and the ground lug of the jig, the negative lead of the meter going to point "B."
3. Adjust TC300, TC400, TC401, and TC402 for maximum output, as indicated on the meter. If the output exceeds 5 volts, reduce the signal input to the receiver.
4. Shift the positive lead of the meter to point "C" on the sound i-f output alignment jig, and adjust TC403 for zero crossover. Zero crossover is indicated by a zero indication on the meter. When TC403 is turned in one direction from this zero point, the meter will swing positive; turning TC403 in the opposite direction will cause a negative swing. (To aid in reading a positive and negative swing on the meter, set the pointer, by means of its zero-adjustment screw, to a convenient calibration mark on the scale, before connecting the meter to the circuit.)
5. Replace the first video i-f tube, and tune in a station on the receiver. Turn the FINE TUNING control to obtain a slightly fuzzy picture, and tune TC403 for minimum AM noise, using the speaker output as an indication.

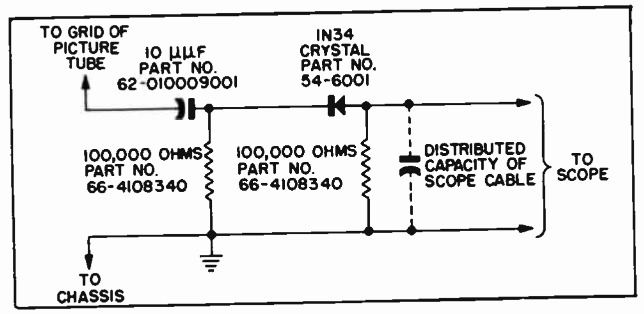


Figure 10. R-F Probe for Sound-Trap Adjustment

ADJUSTMENT OF 4.5-MC. TRAP

To adjust the 4.5 mc. trap in the plate circuit of the first video amplifier, proceed as follows:

1. Connect the output of the signal generator to lead "A" from pin 2 of the sound i-f input alignment jig (see figure 3). Adjust the generator for 4.5 mc., 400-cycle modulated output. Set the output attenuator for maximum output from the generator.
2. Connect the input of the r-f probe, shown in figure 10, to the grid of the picture tube, and connect the output of the probe to the vertical input of the oscilloscope. Adjust the vertical gain of the oscilloscope to maximum. Adjust the horizontal sweep of the oscilloscope for 400 cycles.
3. Adjust TC301 for minimum indication on the oscilloscope. (The normal setting for TC301 is with the screw approximately 3/8 inch out from the chassis.)

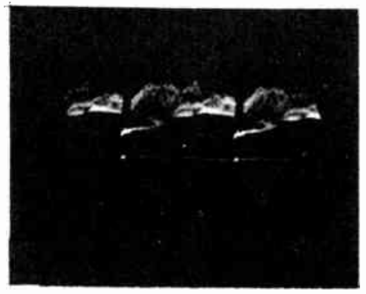
An alternate method for adjustment of TC301 may be used if a 4.5-mc. generator is not available. To adjust TC301 without the generator, proceed as follows:

1. Tune in a strong station signal.
2. Turn the FINE TUNING control in the clockwise direction until a fine beat pattern appears in the picture.
3. Adjust TC301 until the beat disappears or is at a minimum. When correctly adjusted, the screw will be out from the chassis by approximately 3/8 inch.
4. If more than one station is available, check the setting of TC301 on all stations.

OSCILLOSCOPE WAVEFORM PATTERNS

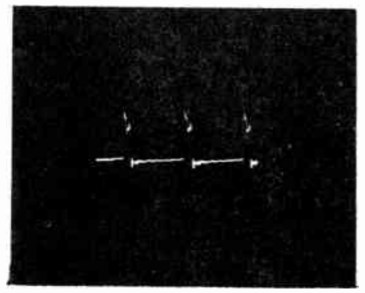
The waveforms shown below were taken with the receiver adjusted for an approximate peak-to-peak output of 2 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak voltages will differ from those shown.

*CAUTION: High-voltage pulses are present in the horizontal-output circuit. The waveform in figure 33 was taken with the alligator clip of the oscilloscope lead clipped over the insulation of the lead connected to pin 7 of J800. (To prevent puncture of the insulation of the lead, file off the teeth of the alligator clip and wrap friction tape around the clip.) Connection to other points in the horizontal-output circuit is dangerous, due to the high voltages present. The peak-to-peak voltage shown for figure 33 is the actual voltage present; however, the amplitude of the scope presentation depends upon the degree of coupling.



TP1-1200-A

Figure 11. Video-Detector Output, Pin 2 of J200
2 volts, 60 c.p.s.

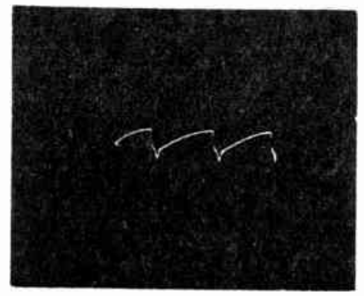


TP2-654

Figure 12. Gate-Pulse Plug, Pin 4
500 volts, 15,750 c.p.s.

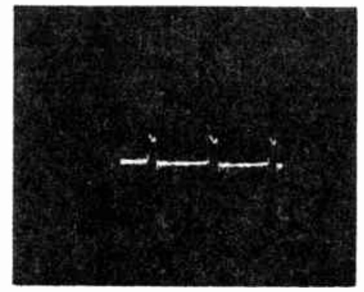
TP2-653

Figure 13. A-G-C Gate Grid, Pin 1
22 volts, 60 c.p.s.



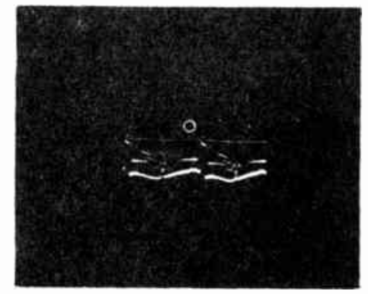
TP2-656

Figure 14. Gate-Pulse Plug, Pin 3
9 volts, 15,750 c.p.s.



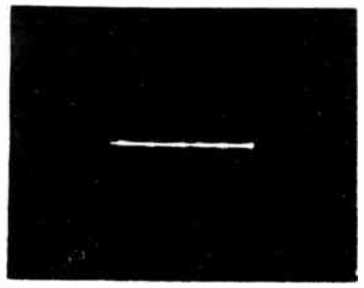
TP2-655

Figure 15. Gated-Leveler Grid, Pin 2
3 volts, 15,750 c.p.s.



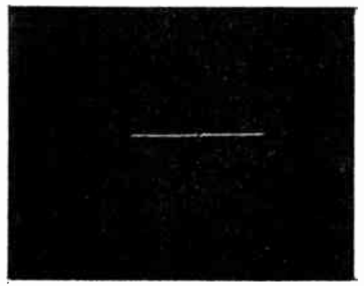
TP2-657

Figure 16. Noise-Inverter Plate, Junction of R605, C602, and C603
23 volts, 15,750 c.p.s.



TP2-658

Figure 17. Noise-Inverter Cathode, Pin 8
Wave shape and amplitude vary with noise

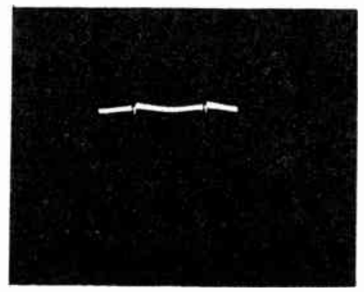


TP2-659

Figure 18. Sync-Separator Plate, Pin 1
17 volts, 60 c.p.s.

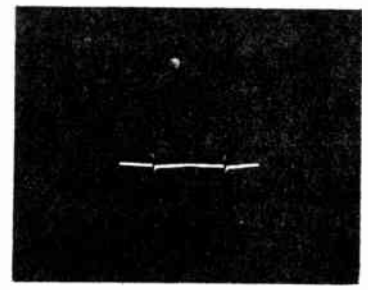
TP2-660

Figure 19. Sync-Separator Plate, Pin 1
17 volts, 15,750 c.p.s.



TP2-639

Figure 20. Phase-Splitter Grid, Pin 7
16 volts, 60 c.p.s.

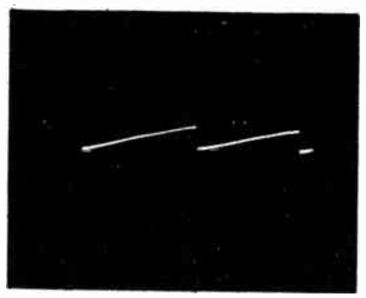


TP2-640

Figure 21. Phase-Splitter Plate, Pin 6
35 volts, 60 c.p.s.

TP2-643

Figure 22. Vertical-Oscillator Grid, Pin 2
170 volts, 60 c.p.s

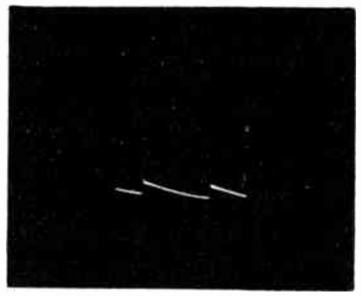


TP2-697

Figure 23. Vertical-Oscillator Plate, Pin 1
130 volts, 60 c.p.s.

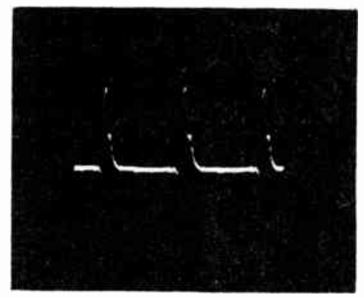
TP2-644

Figure 24. Vertical-Output Grid, Pin 5
40 volts, 60 c.p.s.



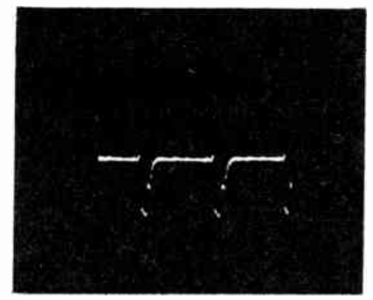
TP2-645

Figure 25. Vertical-Output Plate, Plate Cap
450 volts, 60 c.p.s.



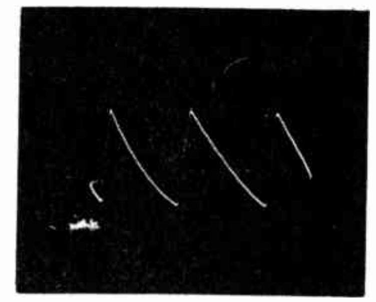
TP2-641

Figure 26. Phase-Splitter Plate, Junction of R614, R615, and C800
13 volts, 15,750 c.p.s.



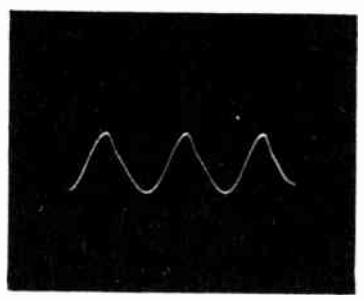
TP2-642

Figure 27. Phase-Splitter Cathode, Pin 8
9 volts, 15,750 c.p.s.



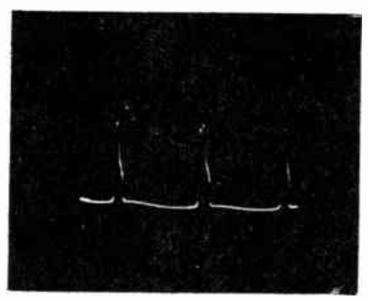
TP2-652

Figure 28. Phase Comparer, Pins 1 and 2
6 volts, 15,750 c.p.s.



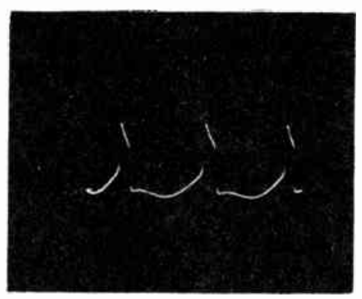
TP2-2852

Figure 29. Horizontal Oscillator, Junction of L800, R806, and C806
20 volts, 15,750 c.p.s.



TP2-647

Figure 30. Horizontal-Oscillator Cathode, Pins 8 and 3
12 volts, 15,750 c.p.s.



TP2-648

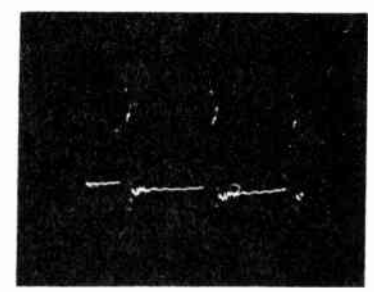
Figure 31. Horizontal-Oscillator Grid, Pin 2
34 volts, 15,750 c.p.s.

TP2-649

Figure 32. Horizontal-Output Grid, Pin 5
120 volts, 15,750 c.p.s.

TP2-650

Figure 33. Horizontal-Deflection Yoke, *Pin 7 of J800
5600 volts, 15,750 c.p.s.
*See CAUTION above.



TP2-651

Figure 34. Gate-Pulse Socket, Pin 4 of J801
400 volts, 15,750 c.p.s.

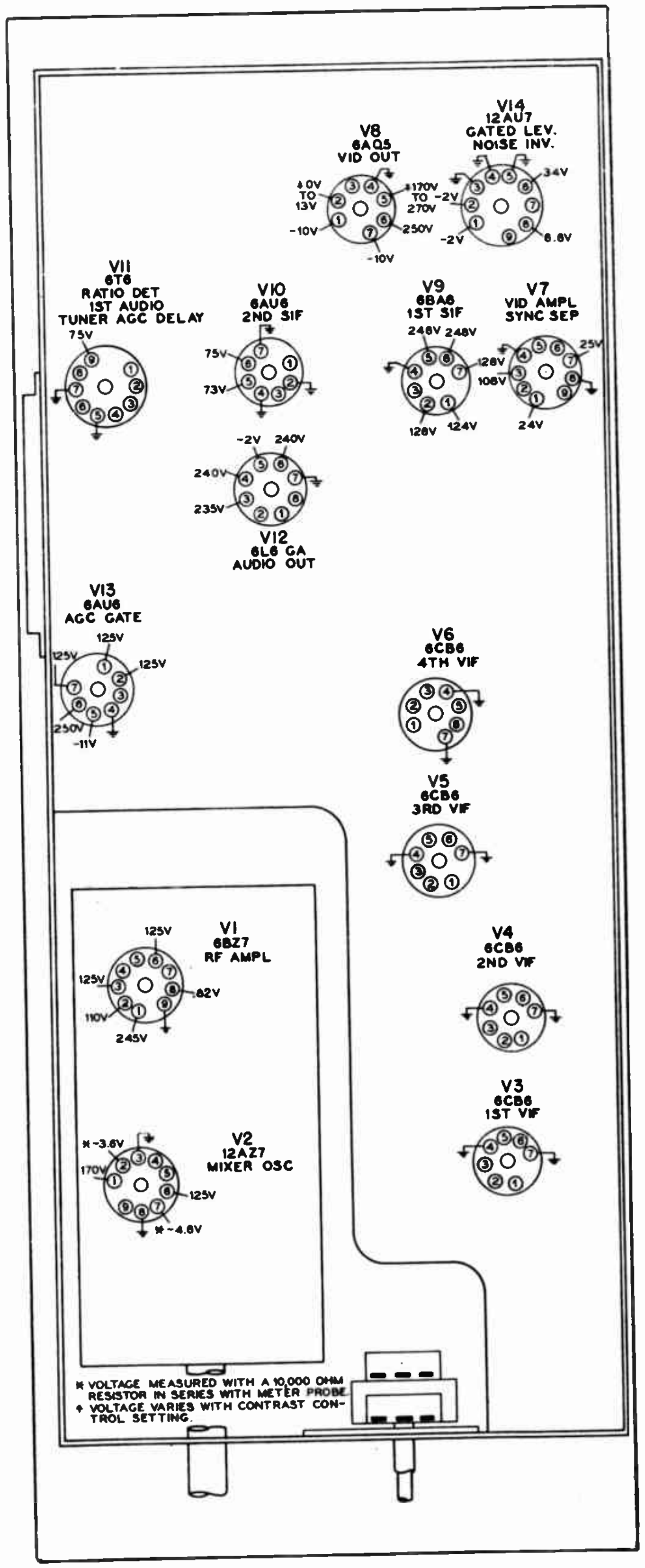


Figure 35. R-F Chassis 97, Bottom View, Showing Voltages at Socket Pins

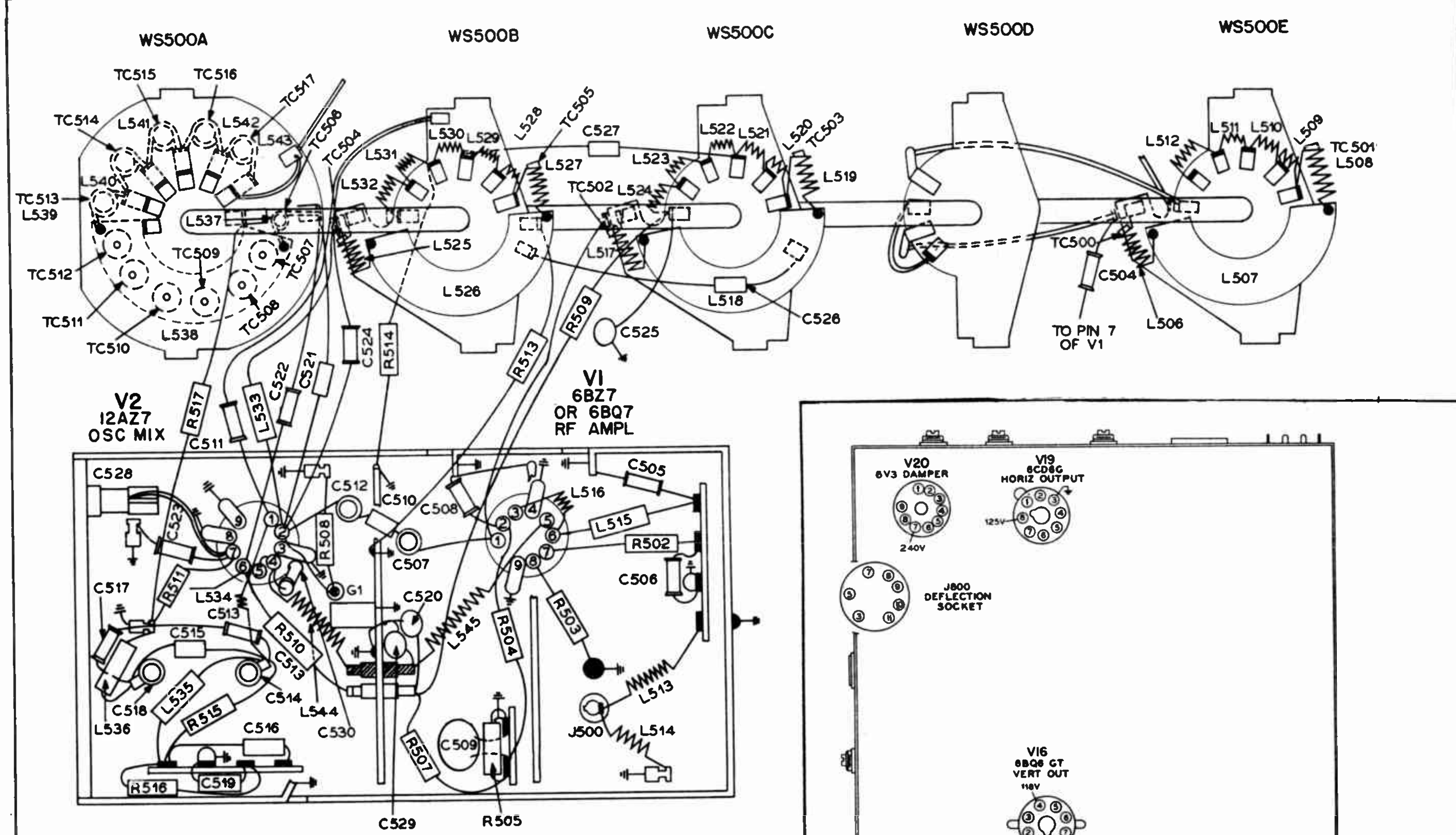
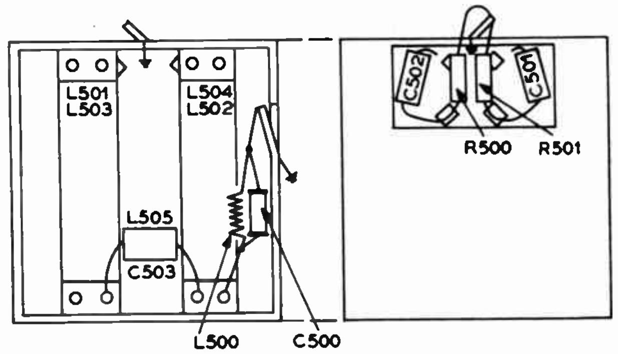


Figure 37. Television Tuner, Part No. 76-7600, Base Layout

TP2-1518



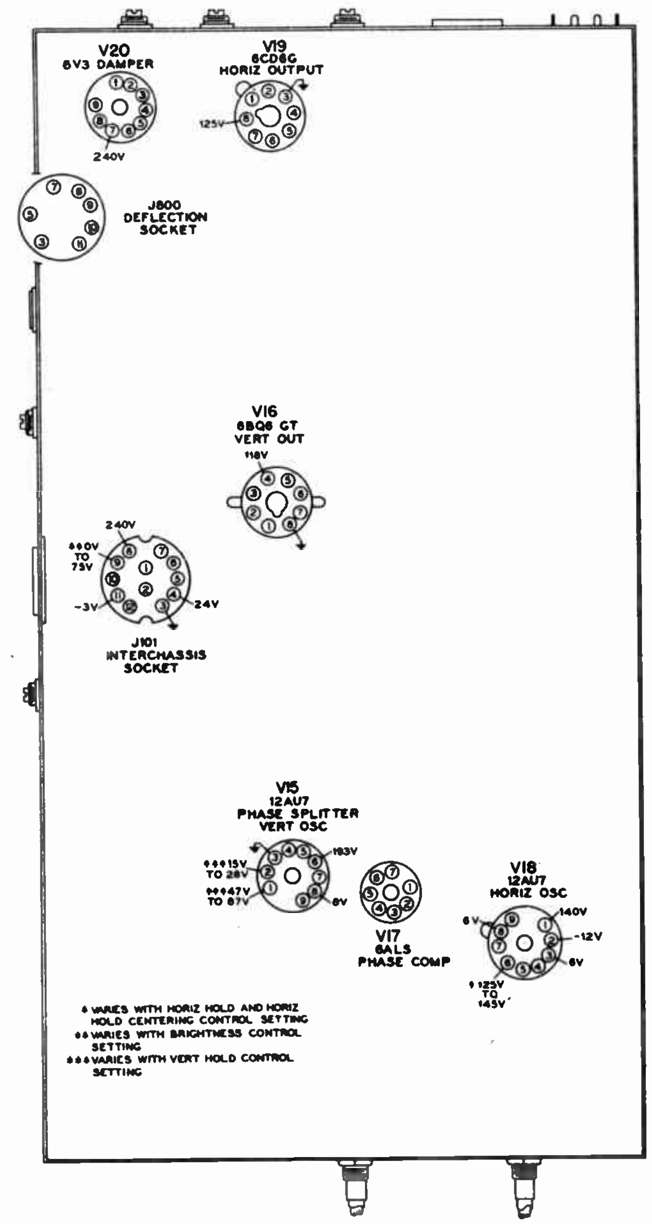


Figure 36. Deflection Chassis J-7, Bottom View, Showing Voltages at Socket Pins

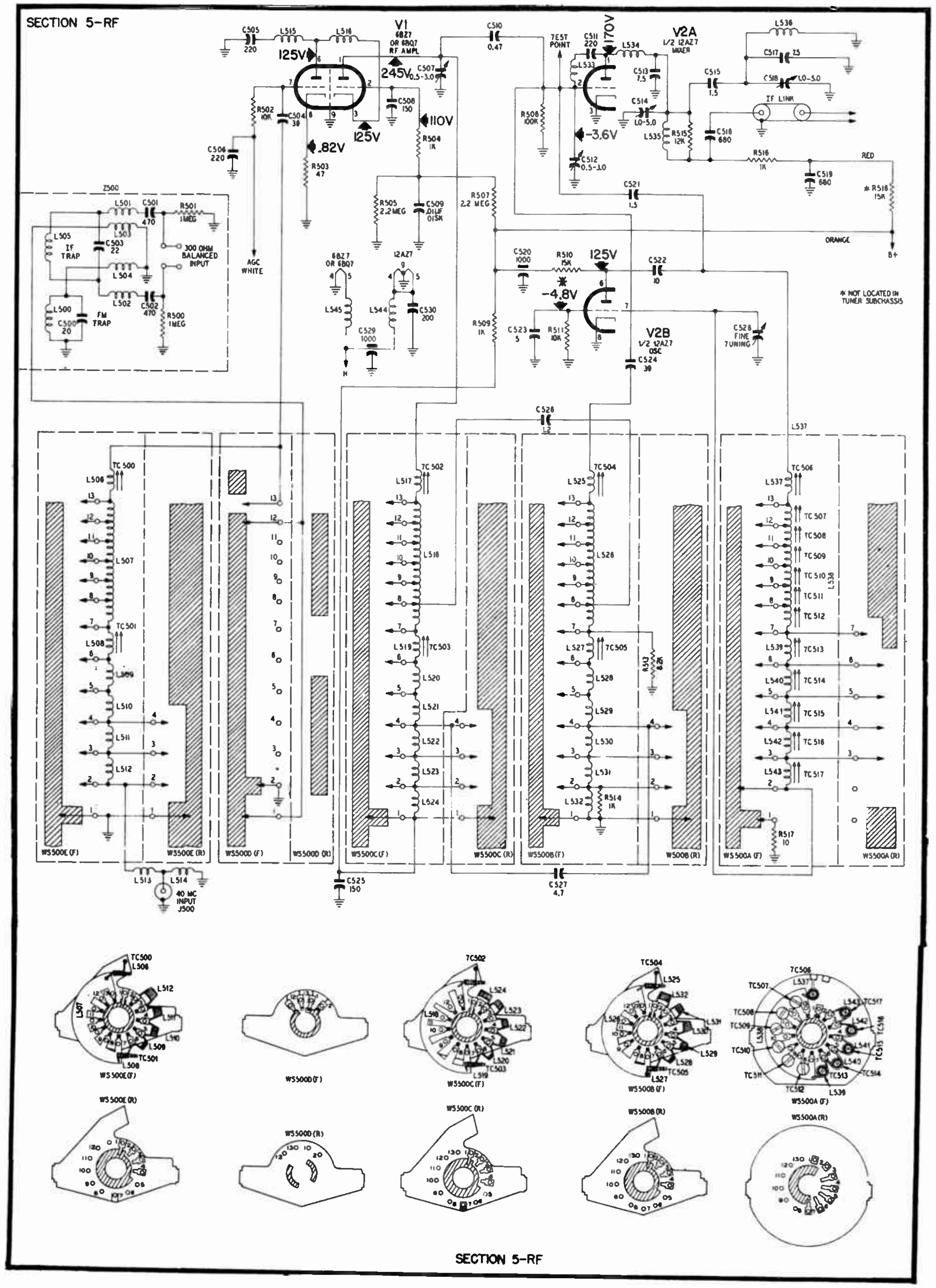


Figure 38. Television Tuner, Part No. 76-7600, Schematic Diagram TP2-2245

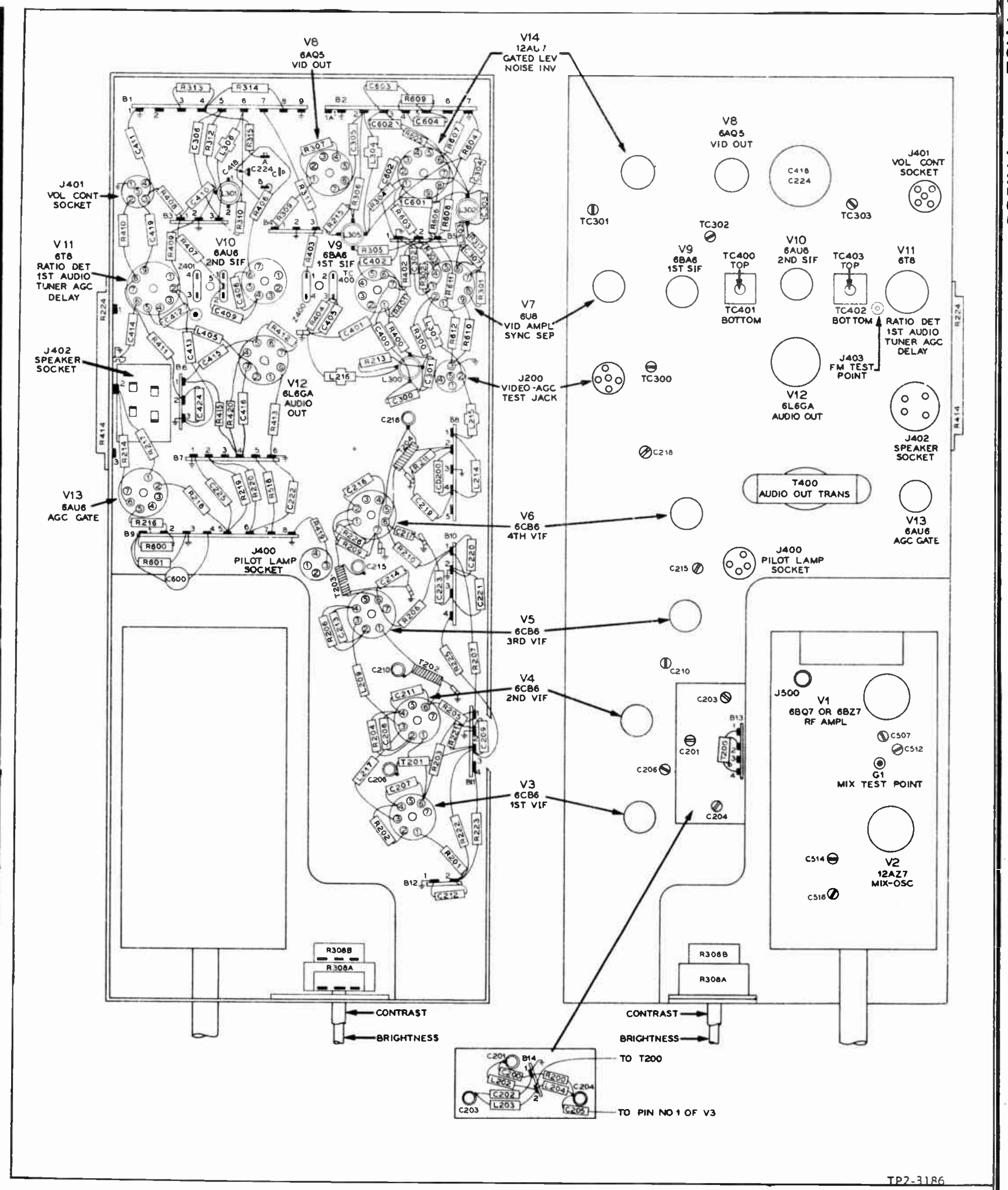
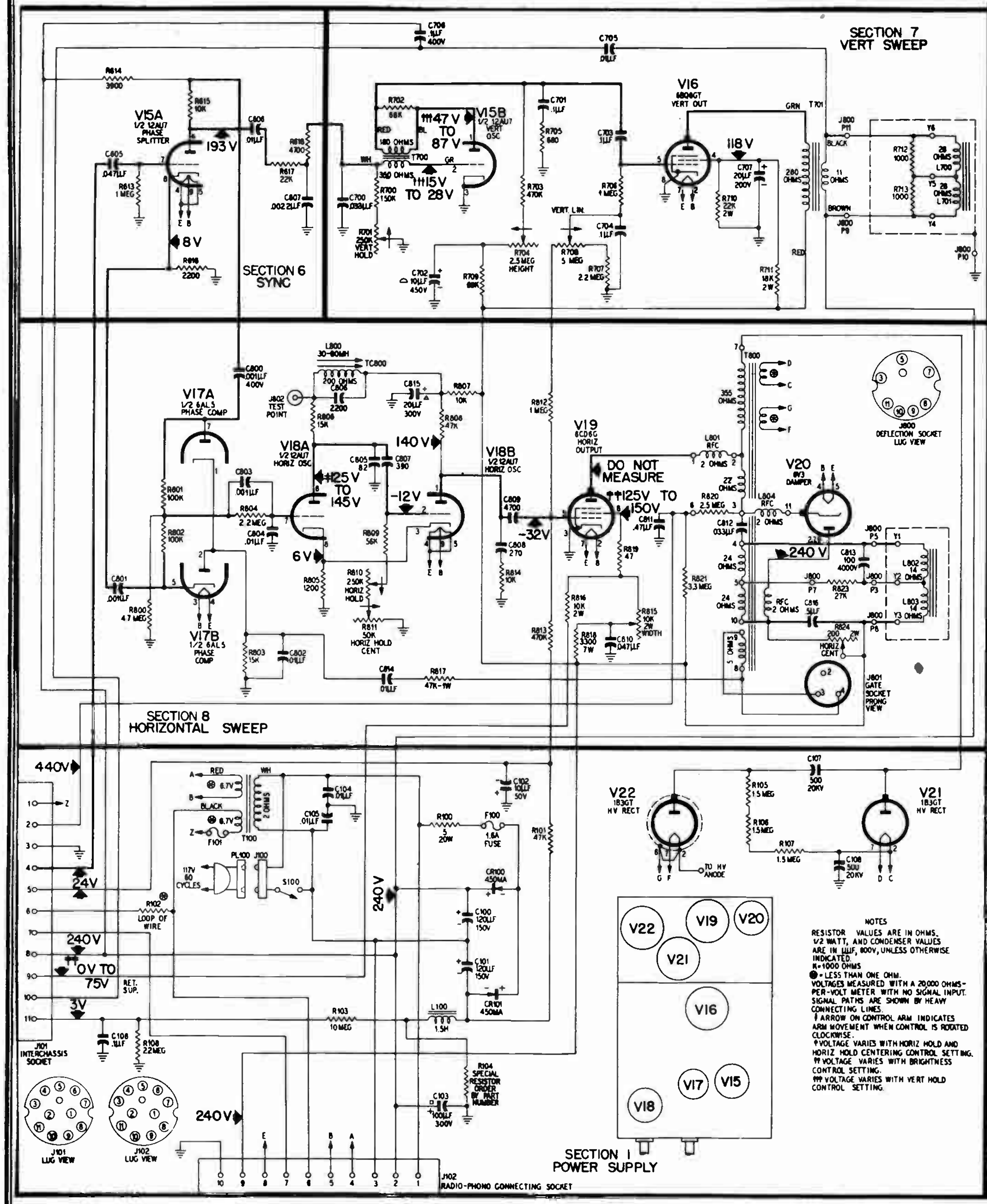
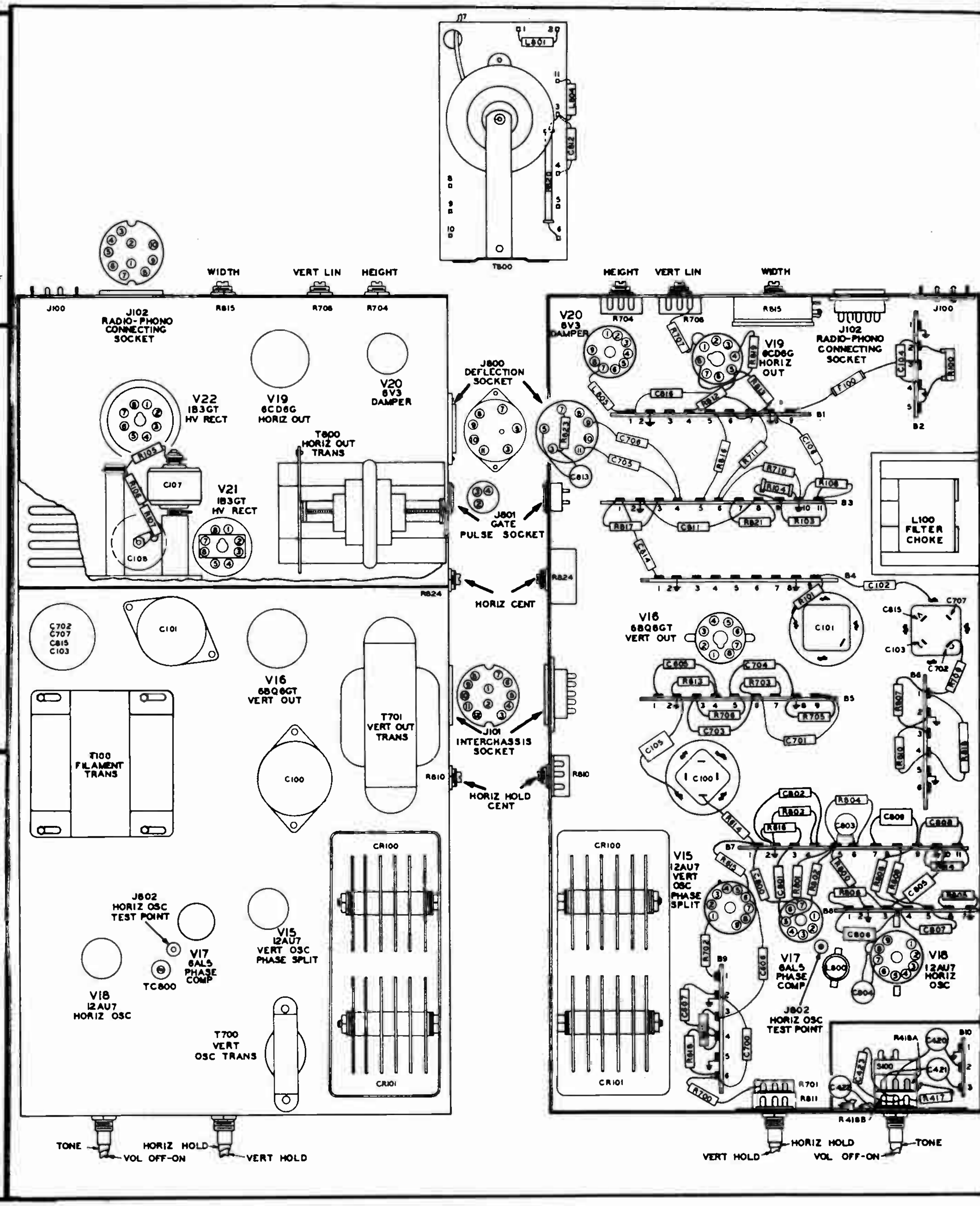


Figure 39. R-F Chassis 97, Base Layout



TP2-3188

Figure 41. Deflection Chassis J-7, Schematic Diagram



TP2-3189

Figure 42. Deflection Chassis J-7, Base Layout

PARTS LIST

IMPORTANT

General replacement items commonly stocked by the serviceman are omitted from this parts list. All condensers are molded-bakelite Philco condensers, with a 600-volt rating, and all resistors are ½ watt, unless otherwise indicated. Parts are listed according to chassis type and should be ordered in this way rather than by model number; in addition, a miscellaneous listing will be found at the end of the parts list for each chassis type. All parts are symbolized in the schematic diagrams and base layouts, for identification purposes.

NOTE: Part numbers identified by an asterisk (*) are general replacement items. These numbers may not be identical with those on factory parts. Also, the electrical values of some replacement items may differ from the values indicated in the schematic diagram and parts list. The values substituted in any case are so chosen that the operation will either be unchanged or improved. When ordering replacements, use only the "Service Part No."

DEFLECTION CHASSIS J-7

SECTION 1—POWER SUPPLY

Reference Symbol	Description	Service Part No.
C100 and C101	Condenser, filter, electrolytic, 120 µf., 150v	30-2568-51*
C102	Condenser, filter, electrolytic, 10 µf., 50v	30-2417-3
C103	Condenser, filter, electrolytic, 100 µf., 300v	30-2584-7
C107 and C108	Condenser, 500 µµf., 20,000v	30-1229-6
CR100 and CR101	Rectifier, selenium, 450 ma.	34-8003-8
F100	Fuse, line, 1.6 amperes	45-2656-23
J100	Socket, a-c line	27-6240-3
J101	Socket, television chassis connecting	27-6274-1
J102	Socket, radio chassis connecting	27-6274-4
L100	Choke, 1.5 henrys	32-8600
PL100	Plug, a-c line	Part of line cord assy. (See Misc. "A")
PL101	Plug and cable ass'y., television chassis connecting	See Misc. "B"
PL102	Plug and cable ass'y., radio chassis connecting	See Parts List of Radio Tuner used
R100	Resistor, current limiting, 5 ohms, 20 watts	33-3448-18
R102	Resistor, voltage dropping, .24 ohm	41-4149-2
R104	Resistor, special	33-1354
R105, R106, and R107	Resistor, high voltage, 1.5 megohms	33-1352-2
S100	Switch, off-on	Part of volume control
T100	Transformer, filament	32-8597

SECTION 7—VERTICAL SWEEP

Reference Symbol	Description	Service Part No.
C702	Condenser, 10 µf., 450v	Part of C103
C707	Condenser, by-pass, 20 µf., 200v	Part of C103

SECTION 7—VERTICAL SWEEP (Cont.)

Reference Symbol	Description	Service Part No.
L700 and L701	Coils, vertical deflection	Part of deflection yoke (See Misc. "A")
R701	Potentiometer, VERT. HOLD control, 250,000 ohms	Part of R811
R704	Potentiometer, HEIGHT control, 2.5 megohms	33-5565-32
R708	Potentiometer, VERT. LIN. control, 5 megohms	33-5565-31
R710	Resistor, voltage dropping, 22,000 ohms, 2 watts	66-3225340
R711	Resistor, screen dropping, 18,000 ohms, 2 watts	66-3185340
T700	Transformer, vertical oscillator	32-8431-2*
T701	Transformer, vertical output	32-8599

SECTION 8—HORIZONTAL SWEEP

Reference Symbol	Description	Service Part No.
C805	Condenser, by-pass, 80 µµf., ±5%	60-00825317
C807	Condenser, d-c blocking, 390 µµf., ±5%	60-10395417
C808	Condenser, charging, 270 µµf., ±5%	60-10275417
C813	Condenser, anti-ringing, 100 µµf., 4000v	30-1246-2
C815	Condenser, by-pass, 20 µf., 300v	Part of C103
J800	Socket, deflection	27-6274-7
J801	Socket, gate pulse	27-6273
L800	Coil, stabilizing, 30 to 80 mh.	32-4557
L801	Coil, r-f choke, horizontal output plate	Part of T800
L802 and L803	Coils, horizontal deflection	Part of deflection yoke (See Misc. "A")
L804	Coil, r-f choke, damper cathode	Part of T800
L805	Coil, r-f choke, damper plate	32-4112-24
PL800	Plug, deflection	Part of cable ass'y. (See Misc. "A")
PL801	Plug, gate pulse	Part of cable ass'y. (See Misc. "B")

DEFLECTION CHASSIS J-7 (Cont.)

SECTION 8—HORIZONTAL SWEEP (Cont.)

Reference Symbol	Description	Service Part No.
R810	Potentiometer, HORIZ. HOLD CENTERING control, 250,000 ohms	33-5565-17
R811	Potentiometer, HORIZ. HOLD control, 50,000 ohms	33-5563-57
R815	Potentiometer, WIDTH control, 10,000 ohms, 2 watts	33-5546-18
R816	Resistor, screen voltage dropping, 10,000 ohms, 2 watts	66-3105340
R817	Resistor, feedback, 47,000 ohms, 1 watt	66-3474340
R818	Resistor, voltage divider, 3300 ohms, 7 watts	33-1335-115
R824	Resistor, HORIZ. CENTERING control, 200 ohms, 2 watts	33-5546-50
T800	Transformer, horizontal output	32-8598

MISCELLANEOUS "A"

Description	Service Part No.
Arm and magnet ass'y., picture tube	76-6594
Beam bender	76-6077-4
Cable assembly, high voltage, picture tube	41-4064-6
Cable and plug assembly, deflection	41-4146-9
Cable and plug assembly, volume control	41-4136-2
Cord, line	41-3865
Focus assembly	76-8087
Insulator, electrolytic condenser mounting	27-9508-1
Shield, corona	56-9684
Socket, high-voltage rectifier (V22)	27-6290-1
Socket, high-voltage rectifier (V21)	27-6290-2
Socket, miniature, 7 pin, 6AL5	27-6203*
Socket, miniature, 9 pin, 6V3 and 12AU7	27-6203-6*
Socket ass'y., octal, 6BQ6GT	76-6119
Socket, octal, 6CD6G	27-6174
Socket, ass'y., miniature, 12AU7	76-6115-1
Stand-off, 2 inch	54-7309-8
Yoke, deflection	32-9650

R-F CHASSIS 97

SECTION 2—VIDEO I.F.

Reference Symbol	Description	Service Part No.
C200	Condenser, 47.25-mc. trap, 10 µµf., ±5%	60-00105417
C201	Condenser, trimmer, 47.25-mc. trap, 1 to 5 µµf.	31-6520-9
C202	Condenser, 41.25-mc. trap, 5 µµf.	30-1224-28
C203	Condenser, trimmer, 41.25-mc. trap, 1 to 5 µµf.	31-6520-9
C204	Condenser, trimmer, 1 to 5 µµf.	31-6520-12
C205	Condenser, d-c blocking, 12 µµf.	62-012300001
C206	Condenser, trimmer, 1 to 5 µµf.	31-6520-9
C209	Condenser, a-g-c by-pass, 680 µµf.	62-168001001*
C210	Condenser, trimmer, 1 to 5 µµf.	31-6520-9
C211	Condenser, screen by-pass, 680 µµf.	62-168001001*
C212	Condenser, by-pass, 680 µµf.	62-168001001*
C215	Condenser, trimmer, 1 to 5 µµf.	31-6520-9
C218	Condenser, trimmer, 1 to 5 µµf.	31-6520-9
C219	Condenser, detector by-pass, 5 µµf.	30-1224-28
C220	Condenser, by-pass, 680 µµf.	62-168001001
C221	Condenser, by-pass, 680 µµf.	62-168001001
C223	Condenser, a-g-c filter, 2 µf.	30-2417-7
C224	Condenser, electrolytic	30-2584-24
C224A	Condenser, filter, 40 µf., 300v	Part of C224
C224B	Condenser, filter, 10 µf., 300v	Part of C224
C224C	Condenser, filter, 10 µf., 300v	Part of C224
CD200	Crystal, video detector, 1N64	34-8022
J200	Socket, video test	27-6273*
L200 and L201	Coils, tuner coupling	Part of T200
L202	Coil, 47.25-mc. trap	32-4548-15
L203	Coil, 41.25-mc. trap	32-4112-31
L204	Coil, 1st i-f grid	32-4112-31

SECTION 2—VIDEO I.F. (Cont.)

Reference Symbol	Description	Service Part No.
L205 and L206	Coils, coupling	Part of T201
L207 and L208	Coils, coupling	Part of T202
L209	Coil, filament choke	32-4112-15
L210 and L211	Coils, coupling	Part of T203
L212 and L213	Coils, coupling	Part of T204
L214	Coils, series peaking, 10 µh.	32-4422-27
L215	Coil, series peaking, 4 µh.	32-4143-22
L216	Coil, shunt peaking, 400 µh.	32-4480-5
L217	Coil, filament choke	32-4112-15
R208	Resistor, B+ dropping, 5600 ohms, 1 watt	66-2564340
R224	Resistor, voltage dropping, 2,000 ohms, 7 watts	33-3446-8
T200	Transformer, video i-f input	32-4548-23
T201	Transformer, first video i-f	32-4548-28
T202	Transformer, second video i-f	32-4548-25
T203	Transformer, third video i-f	32-4548-26
T204	Transformer, fourth video i-f	32-4548-27

SECTION 3—VIDEO

Reference Symbol	Description	Service Part No.
C300	Condenser, audio take-off, 2.2 µµf.	30-1221-6
C301	Condenser, by-pass, 18 µµf.	62-018400021
C302	Condenser, screen by-pass, 33 µµf.	62-033009001
C303	Condenser, by-pass, 68 µµf.	62-068409011
C304	Condenser, by-pass, 33 µµf.	62-033009001
L300	Coil, audio take-off	32-4463-9
L301	Coil, peaking, video amplifier grid, 180 µh.	32-4480-9

R-F CHASSIS 97 (Cont.)

SECTION 3—VIDEO (Cont.)

Reference Symbol	Description	Service Part No.
L302	Coil, 4.5-mc. trap	32-4463-7
L303	Coil, series peaking, 150 µh.	32-4480-18
L304	Coil, series peaking, 125 µh.	32-4480-8
L305	Coil, shunt peaking, 160 to 410 µh.	32-4467-16
L306	Coil, series peaking, 100 µh.	32-4480-3
L307	Coil, shunt peaking, 60 to 240 µh.	32-4467-15
R308	Potentiometer, dual	33-5563-42
R308A	Potentiometer, CONTRAST control, 2500 ohms	Part of R308
R308B	Potentiometer, BRIGHTNESS control, 10,000 ohms, 2 watts	Part of R308
R311	Resistor, plate load, 2500 ohms, 7 watts	33-1335-93
R313	Resistor, voltage divider, 27,000 ohms, ±5%	66-3278240
R314	Resistor, voltage divider, 150,000 ohms, ±5%	66-4158240
R315	Resistor, voltage divider, 68,000 ohms, 1 watt, ±5%	66-3684240
R316	Resistor, grounding, 470,000 ohms, 1 watt	66-4474340

SECTION 4—AUDIO

Reference Symbol	Description	Service Part No.
C405	Condenser, by-pass, 56 µµf.	30-1224-25
C409	Condenser, detector, balancing, 330 µµf.	62-133001001
C412	Condenser, r-f by-pass, 330 µµf.	62-133001001
C413	Condenser, filter, 2 µf.	30-2417-7
C416	Condenser, plate by-pass, .0033 µf., 1000v	30-4650-89
C418	Condenser, filter, 60 µf.	Part of C224
J400	Lamp, pilot	34-2068
J400	Socket, pilot lamp	27-6273*
J401	Socket, volume control	27-6273*
J402	Socket, speaker	27-4785-22
L405	Coil, filament choke	41-4112-15
PL400	Plug and cable ass'y., pilot lamp	See Misc."B"
PL401	Plug and cable ass'y., volume control	See Misc. "A"
PL402	Plug and cable ass'y., speaker	**See Cabinet Parts List
R406	Resistor, voltage dropping, 27,000 ohms, 1 watt	66-3274340
R413	Resistor, cathode bias, 180 ohms, 2 watts	66-1185340
R414	Resistor, voltage dropping, 400 ohms, 2.6 watts	Part of R224
R418	Potentiometer, dual	33-5563-56
R418A	Potentiometer, volume control, 2 megohms	Part of R418
R418B	Potentiometer, tone control, 5 meghoms	Part of R418
T400	Transformer, audio output	32-8579
Z400	Transformer, first sound i-f	32-4497A*
Z401	Transformer, FM detector	32-4450-5

SECTION 6—SYNC

Reference Symbol	Description	Service Part No.
C604	Condenser, by-pass, 470 µµf.	30-1225-7

MISCELLANEOUS "B"

Description	Service Part No.
Cable and plug assembly, television chassis connecting	41-4146-5
Cable and plug assembly, gate pulse	41-4141
Cable and socket assembly, picture tube	41-3964-20
Cable and socket assembly, pilot light	41-4176
Insulator, control	54-8435
Shield, 6CB6 tube	56-5629FA-3
Shield, 6T8 tube	56-5629-5
Socket and base assembly, 6CB6 tube (4)	27-6203-14
Socket and base assembly, 6T8 tube	27-6203-18
Sockets, miniature, 6AU6 (2), 6AQ5, and 6BA6 tubes	27-6203
Socket, miniature, 9 pin (2)	27-6203-6*
Socket, octal	27-6174

TV TUNER, PART NO. 76-7600-2

SECTION 5—R.F.

Reference Symbol	Description	Service Part No.
C500	Condenser, FM trap, 20 µµf. ±5%	62-020309011
C501 and C502	Condensers, antenna isolating, 470 µµf.	30-1225-18
C503	Condenser, i-f trap, 22 µµf.	Part of L505
C504	Condenser, r-f coupling, 39 µµf. ±10%	62-039409011
C505	Condenser, neutralizing, 220 µµf.	62-122001001
C506	Condenser, a-g-c coupling, 220 µµf.	62-122001001
C507	Condenser, r-f trimmer, .5 to 3 µµf.	31-6520-3
C508	Condenser, r-f by-pass, 150 µµf.	62-115001011
C509	Condenser, grid by-pass, .01 µf.	30-1238-2
C510	Condenser, coupling, .47 µf.	30-1221-15
C511	Condenser, neutralizing, 220 µµf.	62-122001001
C512	Condenser, trimmer, mixer grid, .5 to 3 µµf.	31-6520-7
C513	Condenser, by-pass, 7.5 µµf.	30-1224-8
C514	Condenser, trimmer, 1.0 to 5.0 µµf.	31-6520-11
C515	Condenser, i-f trap coupling, 1.5 µµf.	30-1221-8
C516	Condenser, i-f link coupling, 680 µµf.	62-168001001
C517	Condenser, i-f trap, 7.5 µµf.	30-1224-8
C518	Condenser, i-f trap trimmer, 1.0 to 5.0 µµf.	31-6520-11
C519	Condenser, by-pass, 680 µµf.	62-168001001
C520	Condenser, by-pass, 1000 µµf.	30-1245-1
C521	Condenser, oscillator injection, 1.5 µµf.	30-1221-8
C522	Condenser, oscillator plate, 10 µµf.	62-012300001
C523	Condenser, grid blocking, 5 µµf.	30-1224-5
C524	Condenser, mixer grid blocking, 39 µµf.	62-039409011
C525	Condenser, by-pass, 150 µµf.	62-115001011
C526	Condenser, coupling, 1.2 µµf.	30-1221-7
C527	Condenser, coupling, 4.7 µµf.	
C528	Condenser, fine tuning	76-6935-1
C529	Condenser, filament by-pass, 1000 µµf.	30-1245-1
C540	Condenser, filament by-pass, 200 µµf.	62-120001001
J500	Connector, 40 mc., input	57-0590-2
L500	Coil, FM trap	32-4550-2
L501, L502, L503, and L504	Coils, tapered line assembly	32-4432-1

SECTION 5—R.F. (Cont.)

Reference Symbol	Description	Service Part No.
L505	Coil, i-f trap (44.75 mc.)	32-4552-1
L506 to L512, inc.	Coils, r-f grid tuning	Part of WS500B
L513	Coil, 40-mc. channel	32-4550-5
L514	Coil, 40-mc. channel	32-4550-6
L515	Coil, r-f amplifier neutralizing	32-4551-1
L516	Coil, r-f coupling	32-4550-9
L517 to L524, inc.	Coil, r-f plate tuning	Part of WS500C
L525 to L532, inc.	Coil, mixer grid	Part of WS500B
L533	Coil, mixer neutralizing	32-4551-1
L534	Coil, mixer plate	32-4550-4
L535	Coil, i-f primary	312-5151-6
L536	Coil, i-f trap	312-5151-5
L537 to L543, inc.	Coil, oscillator tuning	Part of WS500A
L544 and L545	Coil, r-f choke	32-4550-1
R518	Resistor, B+ dropping, 15,000 ohms, 1 watt	66-3154340
WS500A (F) and WS500A (R)	Switch wafer, oscillator	76-7604
WS500B (F) and WS500B (R)	Switch wafer, mixer grid	76-7606
WS500C (F) and WS500C (R)	Switch wafer, r-f plate	76-7607
WS500D (F) and WS500D (R)	Switch wafer, r-f grid	76-7612
WS500E (F) and WS500E (R)	Switch wafer, r-f grid	76-7610

** NOTE: The length of this cable varies with cabinet model and speaker size.

MISCELLANEOUS "C"

Description	Service Part No.
Coupling, fine tuning shaft	54-4912
Detent, ball	56-8020
Front panel ass'y.	76-6928-2
Hairpin, plunger grounding	1W42704FA3
Hairpin, plunger	56-9858
Plunger	56-8034-1
Retaining ring	1W61043
Shaft	76-6914
Shaft, extension	56-8358
Cam and shaft, fine tuning	76-6936
Shaft, spring	56-8023
Shield, tube, 9 pin miniature	56-5629-5
Socket, tube, 9 pin miniature	27-6203-21
Spring, plunger	56-9628
Tapered line ass'y.	76-7602
Terminal panel (antenna)	76-5504-2
Washer	56-9351
Washer, fiber	27-4109-13
"E" washer	1W60980FE5

CONNECTING CABLES, PLUGS, AND SOCKETS

Reference Symbol	Description	Service Part No.
J100	Socket, a-c line	27-6240-3
J101	Socket, television chassis connecting	27-6274-1
J102	Socket, radio chassis connecting	27-6274-4
J200	Socket, VIDEO TEST	27-6273*
J400	Socket, pilot lamp	27-6273*
J401	Socket, volume control	27-6273*
J402	Socket, speaker	27-4785-22
J500	Connector, 40-mc. input	57-0590-2
J800	Socket, deflection	27-6274-7
J801	Socket, gate pulse	27-6273
PL100	Plug and line cord ass'y.	41-3865
PL101	Plug and cable ass'y., television chassis connecting	41-4146-5
PL102	Plug and cable ass'y., radio chassis connecting	See Parts List of Radio Tuner used
PL401	Plug and cable ass'y., volume control	41-4136-2
PL402	Plug and cable ass'y., speaker	**See Cabinet Parts List
PL800	Plug and cable ass'y., deflection	41-4158-11
PL801	Plug and cable ass'y., gate pulse	41-4141
	Cable ass'y., high voltage, picture tube	41-4064-6*
	Cable and socket ass'y., picture tube	41-3964-20
	Cable and socket ass'y., pilot light	41-4176

DESCRIPTION	A-T2750 Code 127
Built-in Aerial Parts:	
Coil	32-4560
Foil (above rear of r-f chassis or front of deflection chassis)	56-9790
Foil (above rear of deflection chassis or front of r-f chassis)	56-9790-1
Knob	76-7710
Shaft	54-4974
Switch	42-1979
Mahogany	10975
Back and Cup Ass'y.	76-7517-56
Bolt, Speaker	W700-2
Bullet Catch	45-6002
Caster (4)	76-7143
Caster Socket (4)	56-9288
Clip, Light	56-3545-6
Dome	45-6190
Doors (matched pair)	45-6752
Frame Ass'y., Picture Tube	318-3472
Hinge, Knife, L.H.	56-9922-1
Hinge, Knife, R.H.	56-9922
Knob, Brightness	54-4799
Knob, Channel Selector	76-6863-12
Knob, Contrast	76-6048
Knob, Fine Tuning	76-6104
Knob, Horizontal Hold	76-6048
Knob, Tone	76-6213
Knob, Vertical Hold	54-4799
Knob, Vol-Off-On (TV)	54-4799
Mask	54-8882
Strike Plate	45-6003
Window	54-7943-65
Cable and Plug Ass'y., Speaker	41-4082-8
Line Cord, A.C.	41-3865
Shield, Pilot Lamp	54-8228-1
Speaker	36-1610-9
Washer, Light	54-8273

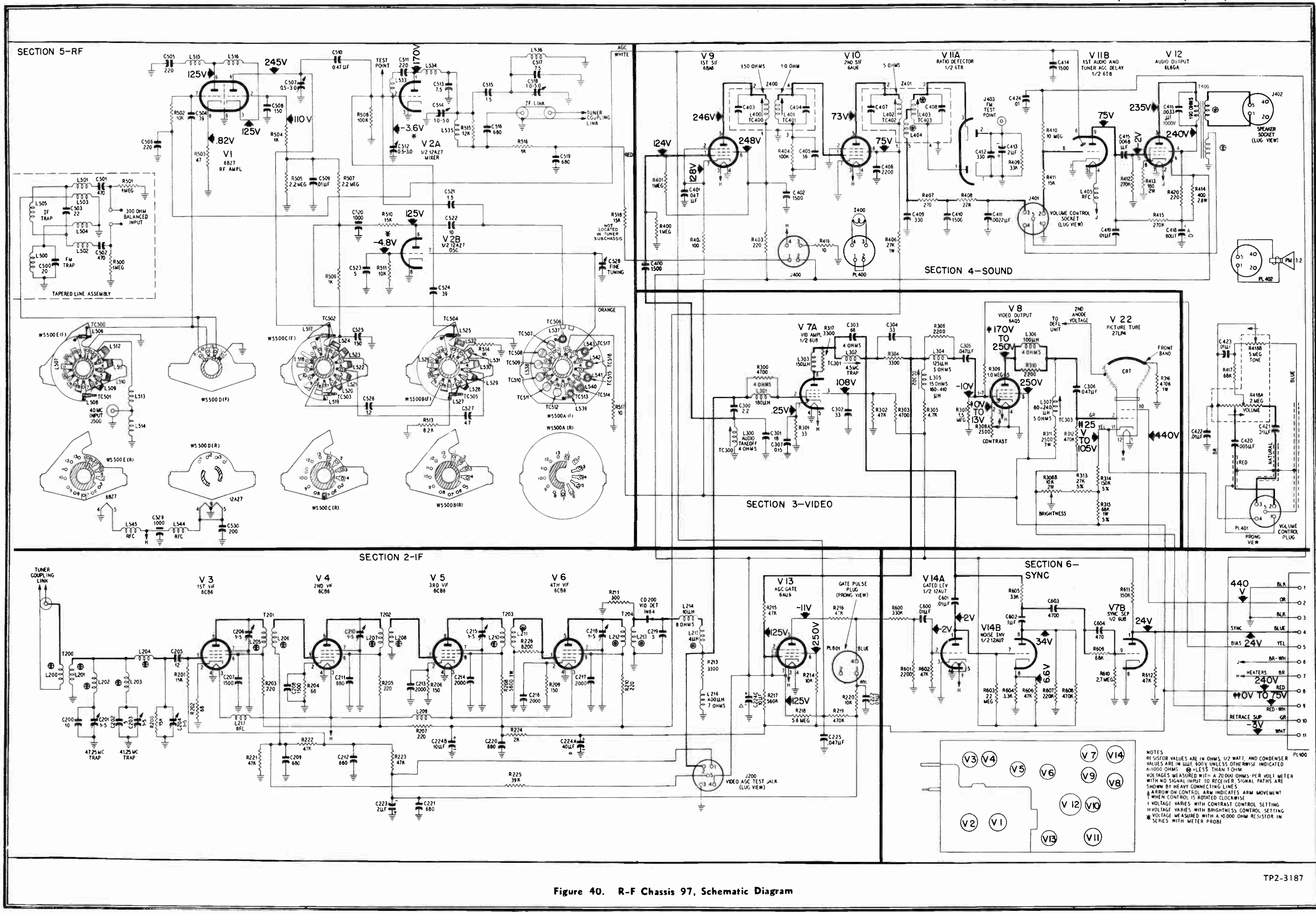


Figure 40. R-F Chassis 97, Schematic Diagram

CIRCUIT DESCRIPTION

Philco "B" line, Code 140, Television Receivers use two chassis—the r-f chassis R-191, containing the r-f, video, audio, and sync circuits, and deflection chassis D-191, containing the power and deflection circuits. Since these chassis are not isolated from the 60-cycle power line, all protruding shafts and mounting feet are insulated from the chassis.

CAUTION: See A-C LINE ISOLATION

A separate subchassis contains the r-f amplifier, the oscillator, and the mixer. The r-f amplifier uses a type 6BZ7 tube, V1. The oscillator and the mixer use a type 6X8 tube, V2, the pentode section of the tube being used for the mixer, and the triode section for the oscillator. The output of the mixer is fed to a three-stage, stagger-tuned, i-f amplifier system employing three type 6CB6 tubes, V3, V4, and V5. A type 1N64 crystal diode, CD200, is used for the video detector, the output of which is amplified by a two-stage video amplifier utilizing a type 6AU6 tube, V6, and a type 6AQ5 output tube, V7. The connections at the detector are such as to produce a composite video signal with negative-going sync pulses. The signal, which is subjected to a 360-degree phase shift through the video amplifier, is applied to the grid of the picture tube, V19; therefore the sync pulses at this point are negative-going. A positive-going blanking pulse, taken from the vertical-output stage, is applied to the cathode of the picture tube for suppression of the vertical retrace.

Sound i.f. (intercarrier) is obtained by utilizing the beat frequency produced when the 45.75-mc. video carrier and the 41.25-mc. sound carrier are mixed in the video detector. The 4.5-mc. beat frequency is the difference between 45.75 mc. and 41.25 mc., and contains the FM sound signal. This 4.5-mc. signal contains only a negligible amount of video amplitude modulation, provided that the amplitude of the 41.25-mc. signal is considerably lower than that of the 45.75-mc. signal. The proper relationship between the two carriers is established during the alignment of the receiver. There is sound output only when both the video and sound carriers are present.

The oscillator is tuned primarily to obtain the best picture, since the 4.5-mc. relationship always exists between the two carriers. The 4.5-mc. sound i.f. (intercarrier), which is taken from the plate circuit of the video amplifier, is passed through a 4.5-mc. sound i-f stage using a 6AU6 tube, V8, and is then applied to the FM detector, which utilizes two diode sections of a 6T8 tube, V9A. The triode section of the 6T8, V9B, is used as the first audio amplifier. The power amplifier uses a type 6V6GT tube, V10.

A portion of the video signal appearing at the output of the first video amplifier is applied to grid 3 (pin 7) of the 6CS6 sync separator, V11. Since grid-leak bias is used on grid 3, the tips of the sync pulses are clamped to zero, and the video components swing in a negative direction from zero. Because of the cut-off characteristics of grid 3, the video components are eliminated, and only negative-going sync pulses appear in the plate circuit of the sync separator. At the same time, however, a signal is taken from the video detector and applied to grid 1 (pin 1) of the 6CS6 tube. This grid is returned to B plus, and the bias is maintained close to zero, because of a small grid-current flow. Since the signal applied to grid 1 is composite video with negative-going sync, any noise modulation present in the signal appears in the form of sharp spikes, driving in a negative direction. The circuit constants are chosen to allow grid 1 to cut off plate current whenever the signal goes more negative than the sync pulses. A series grid-limiting resistor, R608, is also incorporated to prevent the video components from appearing in the plate circuit of the sync separator. A-G-C voltage is also developed in the sync separator circuit in the following manner: On tips of the sync pulses, grid 3 (pin 7) of the 6CS6 tube draws current which flows downward through the network R602, R603, R604, R211, and L214, causing capacitors C605, C602, and C603, to assume negative charges proportional to the amount of peak signal applied to grid 3. The tuner a-g-c voltage is delayed by means of a resistor divider network which applies a small positive voltage to the tuner a-g-c circuit. This positive voltage prevents a-g-c action from lowering the tuner gain on weak signals. To prevent the delay voltage from driving the tuner a-g-c voltage positive on weak signals, a diode clamp (part of V9B) is connected across C602.

The negative-going sync pulses appearing in the plate circuit of the sync separator are fed to one half of a 12AU7 tube, V12A, connected as a phase-splitter circuit; positive sync pulses appear in the plate circuit, and negative sync pulses are taken from the cathode.

Proper triggering of the vertical oscillator requires positive synchronizing pulses. The vertical sync signal is separated from the horizontal sync signal by the vertical integrator circuit, and is fed to the grid circuit of the vertical blocking oscillator, one half of a 12AU7 tube (V12B). The output of the vertical oscillator is amplified by a type 12B4 tube, V13, which is employed as the vertical-output amplifier. The output of the amplifier is applied to the vertical-deflection coils through the vertical-output transformer.

The horizontal-sweep circuits require both positive and negative sync pulses. The phase-comparer circuit uses a 6AL5 tube, V14. Positive sync pulses are applied to the plate of V14A, and negative sync pulses are applied to the cathode of V14B. A saw-tooth voltage, taken from the horizontal-output circuit, is fed to the plate of V14B and to the cathode of V14A, for comparison of the sync and horizontal sweep voltages. When the saw-tooth and sync signals are exactly in phase, no voltage is developed across R800, but when the two signals are out of phase, either a positive or a negative voltage is developed, depending upon whether the horizontal-oscillator frequency is lower or higher than the sync-pulse frequency. The grid circuit of the horizontal oscillator, a type 12AU7 tube, V15, operating as a cathode-coupled multivibrator, is connected to R800 through a filter network. When the voltage at this point goes in a positive direction, the frequency of the horizontal oscillator is increased; when the voltage swings negative, the frequency of the oscillator is decreased. In this manner the frequency of the horizontal oscillator is controlled over the lock-in range of the circuit. The horizontal hold control, R811, adjusts the horizontal-oscillator frequency so that it is within the control range of the phase comparer. The output of the horizontal oscillator is fed to the horizontal output amplifier, which makes use of a type 6BQ6GT tube, V16. The screen voltage for the horizontal amplifier is supplied from a voltage-divider network. The network includes R818, R816 (the WIDTH control), R817, R315 (the BRIGHTNESS control), and R316. R816 varies the voltage applied to the screen, thus adjusting for proper picture width. Adjusting R315 for brightness varies the bias on the picture tube. The change in bias causes a change in beam current, and would tend to result in a change in picture width and a variation in the second-anode voltage. However, when the control arm of the BRIGHTNESS control, R315, is moved toward ground, a smaller part of the control is shunted by the 22,000-ohm resistor, R316, and the total resistance of the voltage divider is increased. This increase in resistance results in a decrease in the current through the divider, and the screen voltage on the horizontal amplifier is increased proportionally, thus compensating automatically for the increase in beam current in the picture tube. The horizontal amplifier feeds the deflection coils through the horizontal-output transformer. A 6AX4GT tube, V17, is used as the horizontal damper.

The second-anode voltage for the picture tube is supplied by one 1B3GT high-voltage rectifier tube, V18. The B plus voltage for the receiver is supplied by two selenium rectifiers, CR100 and CR101 in a full-wave, voltage-doubler circuit, operating directly from the power line. Bias voltage is obtained from across a filter choke, which is in series with the negative side of the B plus supply. The B plus boost voltage, derived from the horizontal damper circuit, supplies higher B plus voltage to the vertical oscillator, first audio stage, and the first anode of the picture tube. Filament voltage for all the tubes except the high-voltage rectifier is supplied by a step-down transformer. Filament voltage for the high-voltage rectifier is supplied by a winding of the horizontal-output transformer.

IMPORTANT

A-C LINE ISOLATION

CAUTION: One side of the a-c line is connected to the chassis through C101 and L405. The other side of the a-c line is connected to the chassis through F100, R100, CR100, and C103, in series. Grounding the chassis will result in a short circuit across one or the other of these two branches in the voltage-doubler circuit. During servicing and alignment it is desirable that an a-c line isolation transformer capable of handling at least 225 watts (Philco Part No. 45-9600) be used. Failure to use an isolation transformer will greatly increase the shock hazard, and may result in damage to the test equipment or receiver, or both.

SPECIFICATIONS

VHF TUNING ....Twelve channel, 12-position incremental tuner, covering VHF Television Channels 2 through 13; fine tuning of local oscillator

UHF TUNING (if provided).......Continuous tuning, covering UHF Television Channels 14 through 83; fine and coarse tuning

INTERMEDIATE FREQUENCIES
Video Carrier ....45.75 mc.
Sound (intercarrier) ....4.75 mc.

TRANSMISSION LINE ....300-ohm, twin-wire lead

OPERATING VOLTAGE ....110 to 120 volts, 60 cycles, a. c.

POWER CONSUMPTION..without UHF, 175 watts; with UHF, 180 watts

TUBE COMPLEMENT

R-F CHASSIS R-191

REFERENCE SYMBOL	TUBE TYPE	FUNCTION
V1	6BZ7 miniature	R-F Amplifier
V2	6X8 miniature	Oscillator-Mixer
V3, V4, V5	6CB6 miniature	Video I-F Amplifiers
V6	6AU6 miniature	Video Amplifier
V7	6AQ5 miniature	Video Output Amplifier
V8	6AU6 miniature	Sound I-F Amplifier
V9	6T8 miniature	Ratio Detector, First Audio, and Tuner A-G-C Clamp
V10	6V6GT octal	Audio Output
V11	6CS6 miniature	Sync Separator
V19	17YP4 or 21ZP4A	Picture Tube

DEFLECTION CHASSIS D-191

REFERENCE SYMBOL	TUBE TYPE	FUNCTION
V12	12AU7 miniature	Phase Splitter, Vertical Oscillator
V13	12B4 miniature	Vertical-Output Amplifier
V14	6AL5 miniature	Horizontal Phase Comparer
V15	12AU7 miniature	Horizontal Oscillator
V16	6BQ6GT octal	Horizontal-Output Amplifier
V17	6AX4GT octal	Horizontal Damper
V18	1B3GT octal	High-Voltage Rectifier

B SUPPLY FUSE REPLACEMENT

The B supply protective fuse, F100, is wired into the low-voltage section, and is in series with the selenium rectifiers. For replacement, use a 1.6-ampere delayed-action-type fuse, Philco Part No. 45-2656-23.

CAUTION: Discharge the circuit before replacing the fuse.

HORIZONTAL-OSCILLATOR ADJUSTMENT

To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

1. Reduce the width of the picture until approximately 1 inch of blank screen appears at the right-hand and left-hand sides of the picture.

2. Increase the BRIGHTNESS control setting until the blanking becomes visible. This will appear as a dark vertical bar on each side of the picture.

3. Connect a .1 μf. condenser from the test point, adjacent to TC800, to ground. (The plate side of the horizontal ringing coil, L800, is connected to the test point.)

4. Set the HORIZONTAL HOLD control to the approximate center of its mechanical rotation.

5. Adjust the HORIZ HOLD CENTERING control until equal portions of the blanking bar appear on both sides of the picture.

6. Remove the .1-μf. condenser from the test point.

7. Adjust the horizontal ringing coil, L800, until equal portions of the blanking bar again appear on both sides of the picture.

8. Rotate the HORIZONTAL HOLD control through its range. The picture should fall out of sync on both sides of the center of its rotation. If the picture does not fall out of sync on both sides, readjust the HORIZ HOLD CENTERING control.

9. Rotate the HORIZONTAL HOLD control through its range, and observe the number of diagonal blanking bars that appear just before the picture pulls into sync. The pull-in should occur with from 1 to 2 diagonal bars when the sync position is approached from either direction. If proper pull-in is not obtained, repeat the above procedure.

VIDEO PEAKING-COIL ADJUSTMENT

The video peaking coil, L303, is adjusted at the factory for proper transient response of the video circuits. Ordinarily, this coil will require no further adjustment by the serviceman. On any station where excessive overshoot or excessive smear is present, a slight adjustment of L303 may improve the picture quality on that station; however, this adjustment may sacrifice the quality on other channels. If L303 is replaced in servicing, adjustment will be required.

Before adjusting L303, check the tuner alignment and i-f alignment. (Never adjust L303 until the alignment of the receiver is correct.) Then tune in a station and adjust L303 until there are no trailing whites or smear in the picture. Turning TC301 clockwise reduces trailing whites and overshoot; turning TC301 counterclockwise reduces picture smear and increases trailing whites. The proper position is the point where no smear or trailing whites appear in the picture.

The above procedure for adjustment of TC301 applies to a particular station exhibiting smear or overshoot. After TC301 is adjusted, reception on all the other stations should be checked, to make certain that the adjustment has not impaired the picture quality.

TELEVISION ALIGNMENT

GENERAL

The alignment procedure follows the general pattern of first checking the tuner response with an FM sweep generator and oscilloscope, comparing the response curve with that given in the manual, and aligning the tuner if necessary. After it is established that the tuner is in correct alignment, the video i-f channel is aligned by tuning each coil to its assigned pole frequency, using an AM signal, and then feeding in a sweep signal at the antenna terminals and retouching the i-f adjustments to obtain the desired pass band. Finally, the sound channel is aligned, using an AM signal, by tuning the sound take-off coil and the i-f and ratio-detector transformers.

The over-all response curve (r-f, i-f) of the circuits from the antenna terminals to the video detector, after the i-f stages have been aligned, should appear essentially the same, regardless of the channel under test. If not, the tuner should be aligned.

The video-carrier intermediate frequency is 45.75 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the receiver chassis and the test equipment. This is most easily obtained by having the top of the workbench metallic. The receiver chassis should be placed tuner-side down on the bench. If the bench has no metallic top, the test equipment and chassis can be bonded by a strip of copper about 2 inches wide. The section of the chassis nearest the tuner should rest on the strip.

2. Do not disconnect the picture tube, picture-tube yoke, or speaker while the receiver is turned on.

3. Allow the receiver and test equipment to warm up for 15 minutes before starting the alignment.

4. The marker (AM) signal generator should be calibrated accurately to the frequencies used and to the sound and video r-f carriers of each channel used during alignment. If Model 7008 is used, the built-in crystal calibrator provides an excellent means of calibration. An alternate method for calibrating the signal generator to the sound and video r-f carrier frequencies is to zero-beat the signal generator with the received signals.

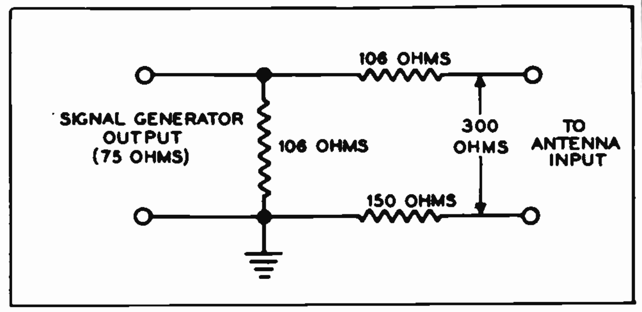
For further information regarding calibration, refer to Philco Lesson PR-1745 (J) entitled "Television Service in the Home."

TEST EQUIPMENT REQUIRED

The following test equipment is recommended for aligning the receiver:

1. Philco Precision Visual Alignment Generator for Television and FM, Model 7008, or equivalent.

2. Vacuum-tube voltmeter, or 20,000-ohms-per-volt voltmeter.



TPO-1179

Figure 1. Antenna-Input Matching Network

3. R-F Probe, Philco Part No. 76-3595 (for use with Model 7008 generator).

JIGS AND ADAPTERS REQUIRED

Mixer Jig

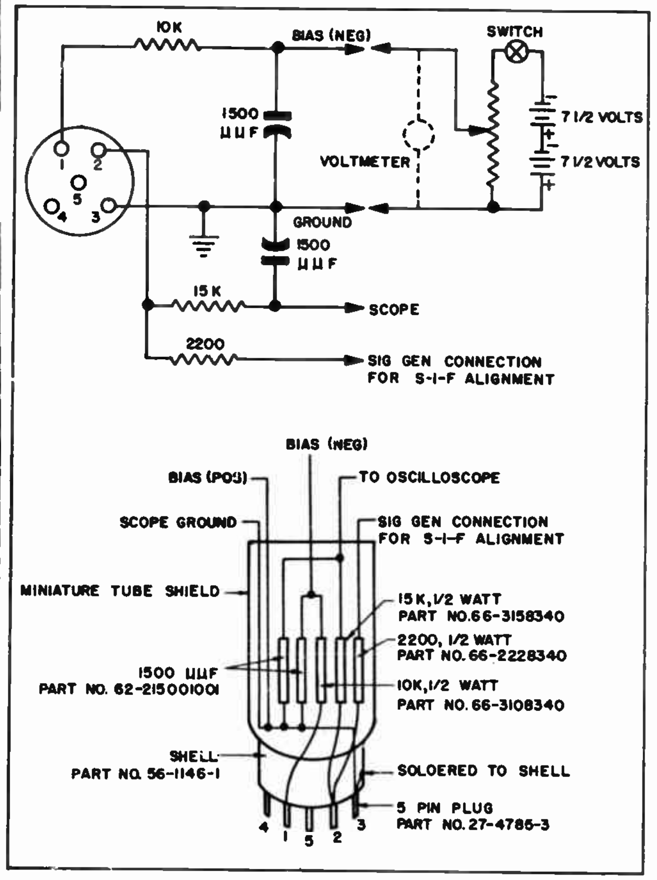
Connections to the grid of the mixer tube may be made through the alignment jack provided for that purpose. To connect the generator to this point, a mixer jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adapter, Part No. 45-1636, with as short a ground lead as possible, may be used to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68-ohm resistor (carbon), so that regeneration, caused by connection of the lead to the mixer, is held to a minimum.

Antenna-Input Matching Network

Figure 1 shows an impedance-matching network for coupling the signal generator to the antenna-input terminals of the receiver. This network, which is designed to have an input impedance of 75 ohms and an output impedance of 300 ohms, is used to match a 75-ohm generator to a 300-ohm antenna-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group to obtain values within 10% of those indicated. The resistors should be placed in a shield can, to prevent variable effects. An antenna matching jig, Philco Part No. 45-1736, which consists of a matching transformer and connecting box, may be used in place of the resistor network.

Video I-F Alignment Jig
(Video Test Jack Adapter)

The alignment jig shown in figure 2 should be used during the i-f alignment, to apply the proper bias to the a-g-c bus, and to provide a convenient oscilloscope connection. This jig consists of a 5-prong plug, a 10,000-ohm potentiometer, two isolating resistors (one 10,000-ohm and one 15,000-ohm), two 1500-



TP3-988

Figure 2. Video I-F Alignment Jig

micromicrofarad capacitors, two 7½-volt batteries and switch. A suggested method of fabricating the jig is also shown. It is suggested that the bias batteries and potentiometer be mounted in a metal box of convenient size.

The potentiometer and switch are connected across the two 7½-volt batteries. The switch is used to disconnect the potentiometer, to prevent the discharge of the battery while not in use.

Sound I-F Alignment Jig

Figure 3 shows the jig that should be used to connect the voltmeter and oscilloscope to the VOLUME CONTROL socket, J400.

TELEVISION TUNER ALIGNMENT

After the tuner is serviced, or if an i-f alignment is required, the tuner alignment should be checked by observing the tuner response curve, as given under Bandpass Alignment. If the response curve does not fall within the limits shown in figure 5, the tuner should be realigned. If realignment is necessary, use the procedure given below.

Since the frequency of the local oscillator affects the tuner response, the local-oscillator alignment should be made first.

Oscillator Alignment

General

Tuning cores are provided in the oscillator coils at channels 13, 11, 9, 7, 6, and 4. By adjusting these tuning cores, all channels may be placed on frequency. This procedure should be carried out with the highest-frequency channel first, since the alignment of each channel affects the alignment of all the channels below it in frequency. The channel adjustments are so arranged that, with one exception, each adjustment corrects the tuning of more than one channel. The coverage of the various adjustments is as follows:

CHANNEL ADJUSTMENT	CHANNELS CORRECTED BY ADJUSTMENT
13	13 and 12
11	11 and 10
9	9 and 8
7	7 only
6	6 and 5
4	4, 3, and 2

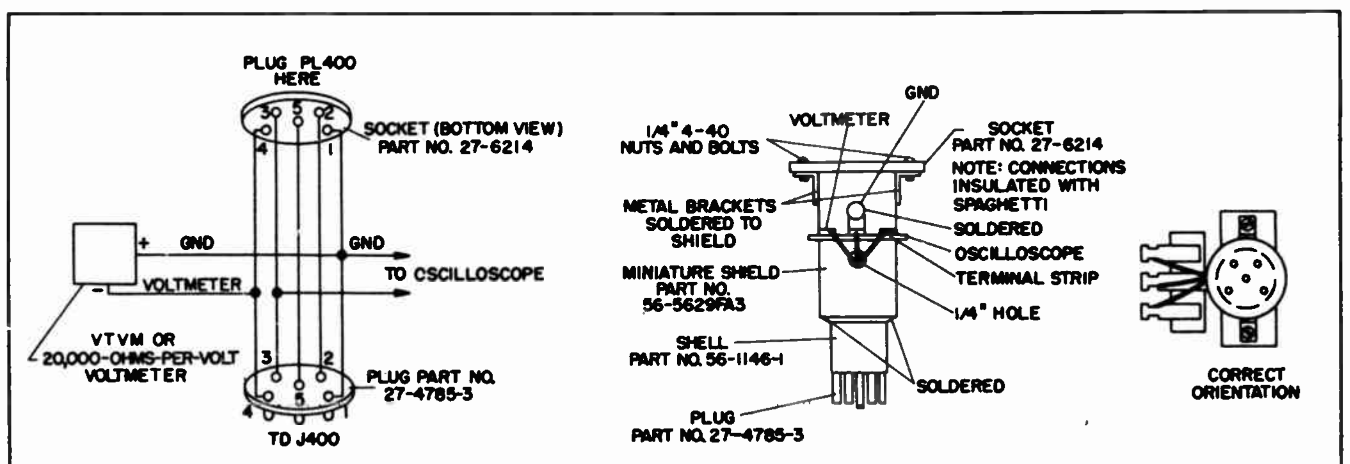


Figure 3. Sound I-F Alignment Jig TP2-2200

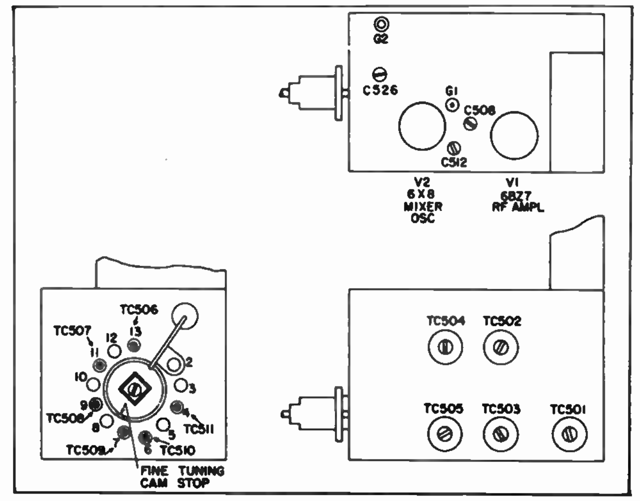


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Figure 4. Television Tuner, Showing Locations of Adjustments

The FINE TUNING cam should be preset for all adjustments by placing the stop on the FINE TUNING cam between the Channel 7 and 8 holes on the front plate of the tuner. See figure 4.

Procedure Using Signal Generator

An r-f signal (unmodulated), at the oscillator frequency, is fed into the antenna input from an AM signal generator, and the oscillator tuning cores are adjusted for zero beat. The r-f signal frequency should be accurately determined. It is preferable that the signal be taken from a crystal-controlled source; if this is not available, the signal generator may be calibrated against the television station.

1. Connect the hot lead of the oscilloscope to the mixer plate test point, G2, through a 1000-ohm resistor, and connect the ground lead of the oscilloscope to the chassis, near the test point. (High oscilloscope gain may be necessary to obtain a visual beat. In this instance, base-line hum may be ignored.)
2. Connect the AM (marker) generator to the 300-ohm antenna-input terminals. For this purpose the antenna-input matching network is not required.
3. Disconnect the white lead from the tuner, and connect it to the negative terminal of a 1½-volt battery. Ground the positive terminal. If regeneration is observed, the bias may be increased to 4 or 5 volts, to reduce the regeneration.
4. Mechanically preset the fine-tuning cam stop as shown in figure 4.
5. Feed in an r-f signal (unmodulated), at the oscillator frequency for Channel 13, with the CHANNEL SELECTOR set for Channel 13.
6. Adjust the tuning core for Channel 13 (see figure 4).
7. Reset the signal-generator frequency and the CHANNEL SELECTOR, and adjust the tuning cores for Channels 11 and 9, respectively.
8. Repeat steps 5, 6, and 7 until Channels 13, 11, and 9 are within plus or minus 500 kc. of the correct frequency.
9. Feed in r-f (unmodulated) signals, at the oscillator frequencies for Channels 7, 6, and 4, consecutively (see NOTE below), and adjust the respective tuning cores (see figure 4).

NOTE: The exact position of the FINE TUNING cam should be marked when Channel 4 is correctly aligned. This position is to be used in step 4 of the i-f alignment procedure.

Procedure Using Station Signal

The following simplified procedure may be used to align the oscillator when the television i-f alignment is satisfactory and a station signal is available:

1. Mechanically preset the FINE TUNING cam to the center of its range (see figure 4).
2. Tune in the highest-frequency channel to be received.
3. Adjust the tuning core for that channel, or the next higher channel, for the best picture; that is, starting with sound in the picture, turn the tuning core until the sound disappears. Repeat for each channel received in the area.

Bandpass Alignment

General

The bandpass alignment consists of aligning the tuner at Channels 13 and 6, and then making it track down to Channels 7 and 2, respectively.

During the alignment, a fixed bias of 1½ volts is applied to the r-f amplifier tube.

An FM (sweep) signal is applied to the antenna-input circuit, and an oscilloscope is connected to the mixer plate circuit. The oscilloscope gain should be as high as possible, consistent with hum level and "bounce" conditions. Hum conditions will cause distortion of the time base and response. Bounce conditions, which are caused by poor line regulation, will cause the response and time base to jump up and down. The use of too high an oscilloscope gain aggravates these conditions, whereas the use of too low a gain necessitates increasing the generator output to a point where the tuner may be overloaded. Overload may be checked by changing the generator output while observing the shape of the response curve; any change in the shape of the curve indicates overload, in which case a lower generator output and higher oscilloscope gain must be used. The tuner coupling link should be disconnected from the

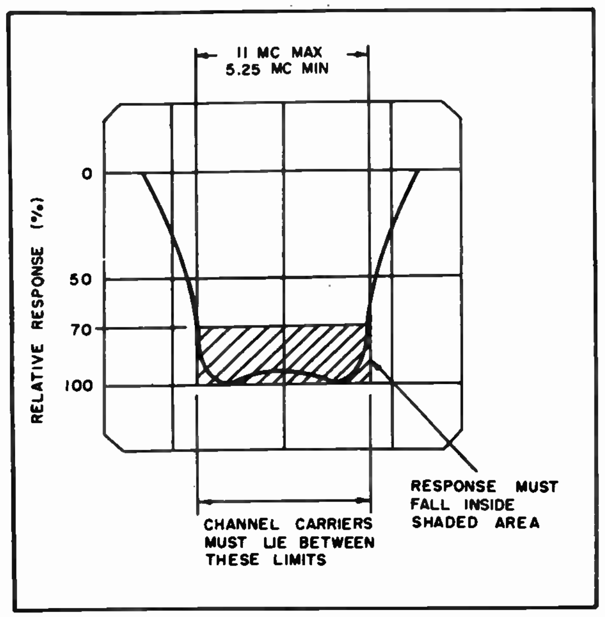


Figure 5. Television Tuner Response Curve, Showing Bandpass

i-f section by removing the plug, PL500, and a 40- to 70-ohm carbon resistor should be connected across the open end of the plug. This is done to eliminate the absorption effect of the tuner link coil, L200, on the response curve.

Procedure

1. Disconnect the white (a-g-c) lead, from the tuner, and connect it to the negative terminal of a $1\frac{1}{2}$-volt battery. Ground the positive terminal.
2. Disconnect the tuner plug, PL500, at terminal board B13 (see figure 33), and connect a 40- to 70-ohm carbon resistor across the plug.
3. Connect a 1000-ohm resistor in series with the hot lead of the oscilloscope. Connect the other end of the resistor to the mixer plate test point, G2, and connect the ground lead of the oscilloscope to the chassis, near the test point.
4. Connect the FM (sweep) generator to the 300-ohm antenna-input terminals through an antenna-input matching network. See figure 1.
5. Set the CHANNEL SELECTOR and FM (sweep) generator to Channel 13 (213 mc.). Adjust the generator for sufficient sweep to show the complete response curve.
6. Establish the channel limits (see figure 5) by using the marker (AM r-f) signal generator to produce marker pips on the response curve. (Set the marker generator first to 210 mc., then to 216 mc.) The curve should be reasonably flat between the limits shown in figure 5.
7. Adjust TC502 and TC504 (figure 4) for a symmetrical, approximately centered pass band.
8. Set the CHANNEL SELECTOR and FM generator to Channel 7 (177 mc.).
9. Establish the channel limits by using the marker generator to produce marker pips on the response curve. (Set the generator first to 174 mc., then to 180 mc.) The curve should be reasonably flat between the limits.
10. On Channel 7, note the response curve, with respect to tilt and center frequency. The curve should be centered in the pass band, and should be symmetrical.
11. If the curve is not symmetrical, and appears unbalanced, as shown in figure 6, leave the generator and tuner set to Channel 7, and adjust C508 and C512 (see figure 4) to obtain a response curve which is the mirror image (tilt in the opposite direction) of the original. This is a form of overcompensation, to allow for the effect of Channel 13 adjustment on Channel 7. For example, if the Channel 7 response appears as in figure 6A, then the trimmer should be adjusted to obtain the response shown in figure 6B.
12. Reset the CHANNEL SELECTOR and generators to Channel 13. Readjust TC502 and TC504 for a symmetrical and centered band pass. See step 4.
13. Set the CHANNEL SELECTOR and generators to Channel 7, and check the response for center frequency and symmetry. Repeat steps 8 and 9 as many times as is necessary to obtain the most symmetrical, centered response curves on Channels 13 and 7. Channels 7 through 13 are now correctly aligned.
14. Set the CHANNEL SELECTOR and sweep generator to Channel 6 (85 mc.).
15. Establish the channel limits, using the marker generator to produce marker pips on the response curve. (Set the generator first to 82 mc., then to 88 mc.)
16. Adjust TC503 and TC505 for a symmetrical, approximately centered pass band. Set the marker generator to 85 mc. Detune TC505 counterclockwise until a single peak appears.

    CAUTION: Do not turn the core of TC505 excessively, or it will fall out of the coil.

    Adjust TC503 until the peak falls on the 85-mc. marker. It may be necessary to increase the output of the generator during this adjustment. Then adjust TC501 for maximum curve height and symmetry of the single peak. The antenna circuit is now tuned for Channels 2 through 6. To prevent overloading, the output of the generator should be reduced after this adjustment is completed.
17. Readjust TC503 and TC505 for a symmetrical response, centered about 85 mc.

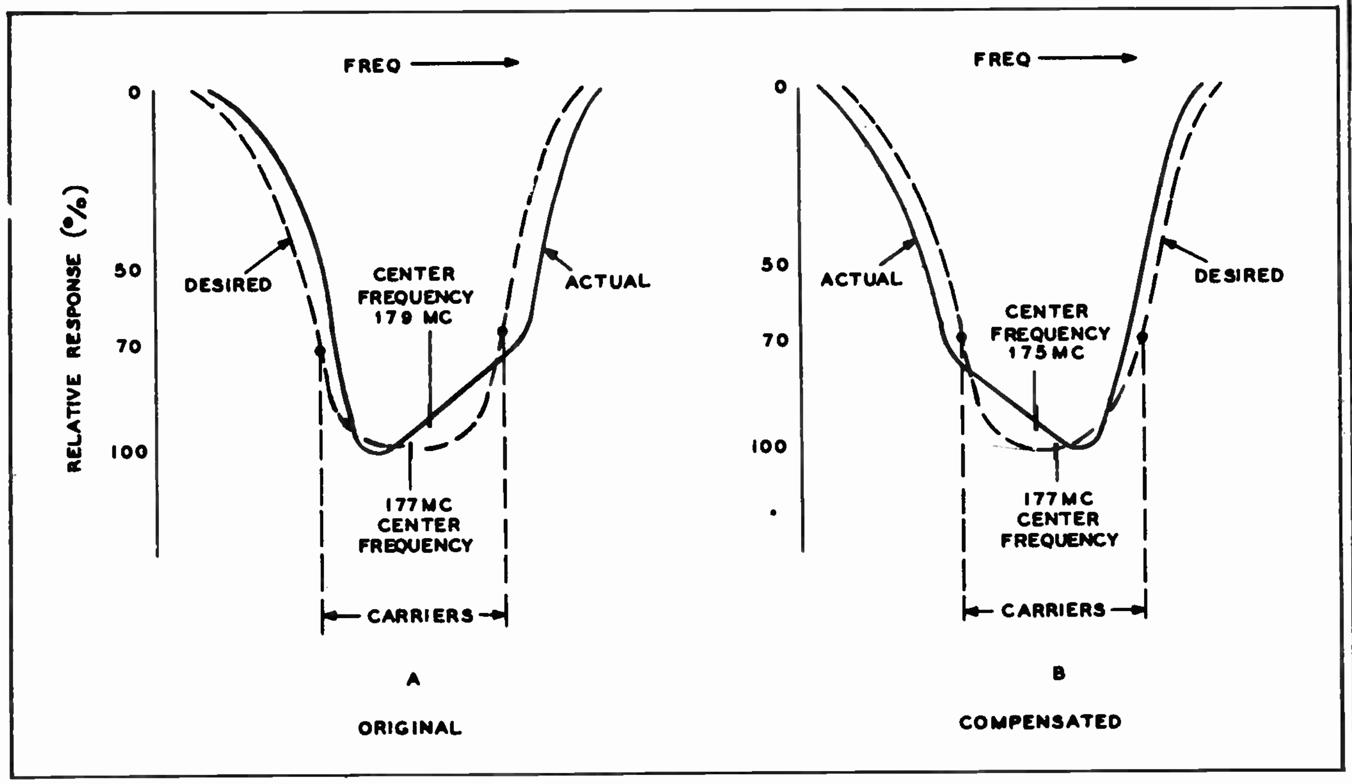


Figure 6. Television Tuner Response Curve, Showing Tracking Compensation

VIDEO I-F ALIGNMENT

Preliminary

Before proceeding with the i-f alignment or making an alignment check, observe the following preliminary instructions:

1. Preset the CONTRAST and BRIGHTNESS controls to the maximum counterclockwise position.
2. Preset the CHANNEL SELECTOR to Channel 4.
3. Insert the video i-f alignment jig (figure 2) into J200.
4. Connect the oscilloscope to the 15,000-ohm resistor from the video i-f alignment jig. Connect the ground lead of the oscilloscope to the ground lead from the adapter.
5. With a voltmeter connected across the points shown in figure 2, set the potentiometer to furnish –6 volts of bias.
6. Connect the AM generator to the mixer test point, G1, through a mixer jig (described in step 4 of procedure given below), and adjust the generator for approximately 30 percent modulation with 400 cycles. Adjust the output of the generator during the alignment to keep the output at the second detector below .6 volt, peak to peak.

    NOTE: If the i-f shield has been removed for repairs, it must be replaced before proceeding with the alignment.

Procedure

1. Preset condenser C526 for minimum capacitance (turn screw counterclockwise).
2. Tune the AM generator to 47.25 mc., and adjust C200 for minimum output, as observed on the oscilloscope. See figure 7.

    NOTE: It is necessary to keep the generator output sufficiently high that a null indication may be observed on the oscilloscope; however, avoid overloading of the receiver by excessive signal.
3. Tune the AM generator to the frequencies indicated below, and adjust the trimmers for maximum output, as observed on the oscilloscope.
    a. 45.7 mc.—adjust C526
    b. 42.6 mc.—adjust C202
    c. 45.0 mc.—adjust C206
    d. 43.2 mc.—adjust C210
    e. 44.3 mc.—adjust C212
4. Connect the sweep generator and r-f marker generator to the antenna terminals through a matching jig. (If a separate oscilloscope is used, connect the sweep output of the generator to the horizontal input of the oscilloscope.) Set the CHANNEL SELECTOR to Channel 4, and tune the sweep generator for output on Channel 4. Tune the r-f marker generator to the video carrier frequency of Channel 4 (67.25 mc.),

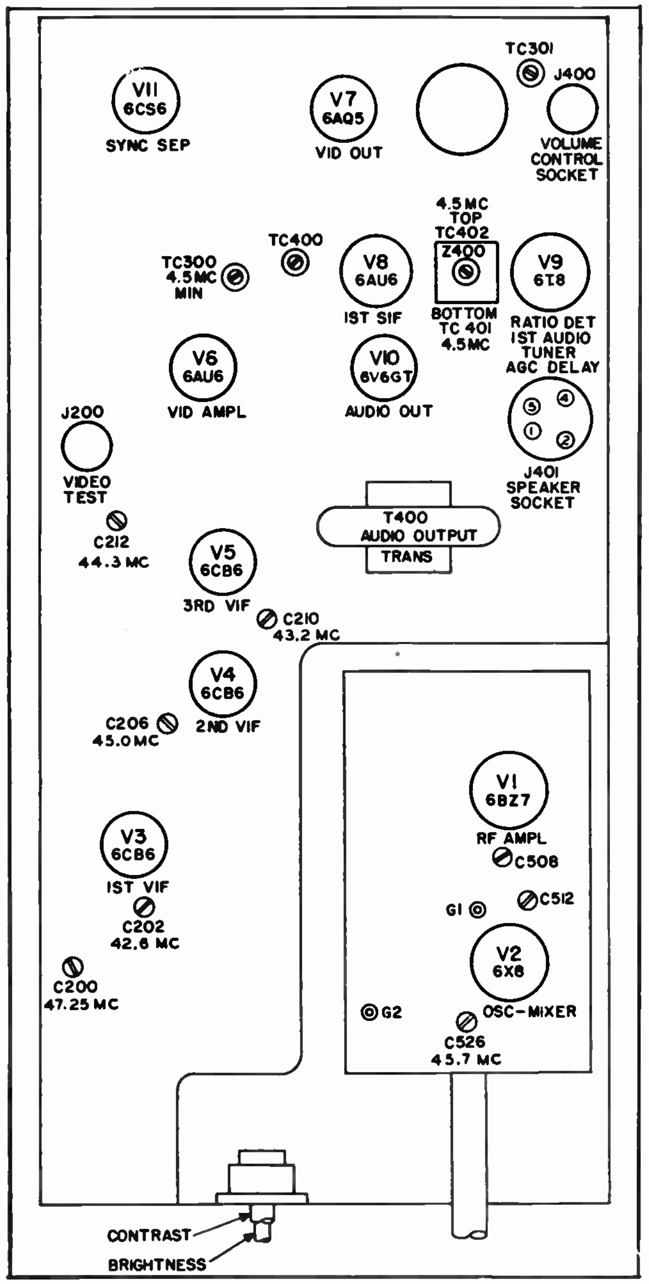


Figure 7. R-F Chassis R-191, Top View, Showing Locations of Adjustments

and tune the i-f marker generator (capacitively coupled to the mixer grid) to 45.75 mc. Note two marker generators are used for this procedure. The r-f marker generator is connected to the antenna terminals, while the i-f marker generator is coupled capacitively to the mixer grid test point, G1. A jig constructed from a piece of fiber tubing, with $\frac{3}{16}$-inch inside diameter, and a brass machine screw which fits tightly into the tubing, is used to couple the generator capacitively to the test point. The screw is adjusted so that its tip clears the test point by approximately $\frac{1}{64}$ inch. The output cable of the marker generator is connected to the head of the brass screw in the jig and to the chassis near the mixer tube. Both marker generators should be adjusted for the minimum output required to make the markers barely visible. Failure to observe this precaution, or the use of excessive output from the sweep generator, will cause misleading results. After the equipment is properly connected, adjust the FINE TUNING control for zero beat of the two markers, as observed on the oscilloscope. When zero beat is obtained, remove the i-f marker.

5. If the response curve does not fall within the limits shown in figure 8, the adjustment of the trimmers may be touched up slightly, while observing the response curve. Do not retouch the setting of C202 at this point. To adjust the curve, first adjust C206 and C212, alternately, until maximum improvement has been obtained. C212 affects the tilt of the curve, and C206 affects the dip of the curve. After C212 and C206 have been adjusted, adjust C210 for proper slope at the 42.5-mc. side of the curve, then adjust C526 for proper level at the video carrier frequency (45.75 mc.). After these adjustments have been made, if the response curve still does not fall within the limits shown in figure 8, a slight readjustment of C202 is permissible.

CAUTION: Do not turn any of the trimmers excessively. To retouch, turn the trimmers only slightly.

SOUND I-F ALIGNMENT

1. Remove the 1st v-i-f tube, and connect a v.t.v.m. or a 20,000-ohms-per-volt voltmeter to the sound i-f alignment jig (figure 3). Adjust the VOLUME control for moderate speaker output.

2. Feed in an accurately calibrated 4.5-mc. AM signal, through the 2200-ohm resistor in the video i-f alignment jig, to pin 2 of J200.

3. Tune TC400, TC401, and TC402 for maximum indications on the meter. The point of maximum meter indication for TC402 should also be the point of minimum speaker output.

4. Tune TC402 for minimum speaker output.

5. Connect an r-f probe or crystal detector to the grid (pin 2) of the picture tube. See NOTE below.

6. Tune TC300 for minimum indication on oscilloscope. (If a crystal detector is not available, TC300 may be adjusted for minimum beat pattern, as observed on the picture tube, with a station picture present.)

7. Replace the 1st v-i-f tube. Tune in a station, using the speaker output as an indication of correct tuning.

8. Turn the FINE TUNING control clockwise to obtain a slightly fuzzy picture.

9. Tune TC402 for minimum AM (noise) output.

NOTE: The R-F Probe, Part No. 76-3595, is used as a detector of the 4.5-mc. signal, and the oscilloscope is used as an indicating device. An alternate crystal detector may be made up as shown in figure 9.

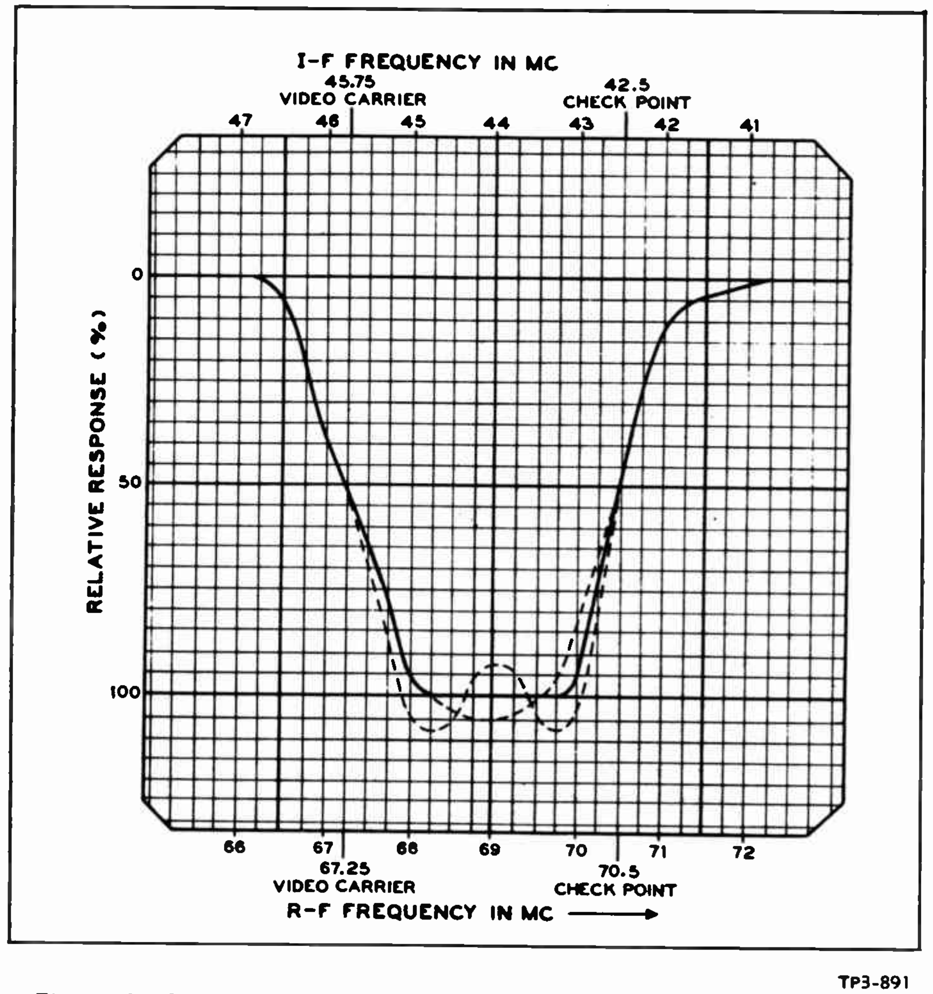


Figure 8. Over-All, R-F, I-F Response Curve, Showing Tolerance Limits

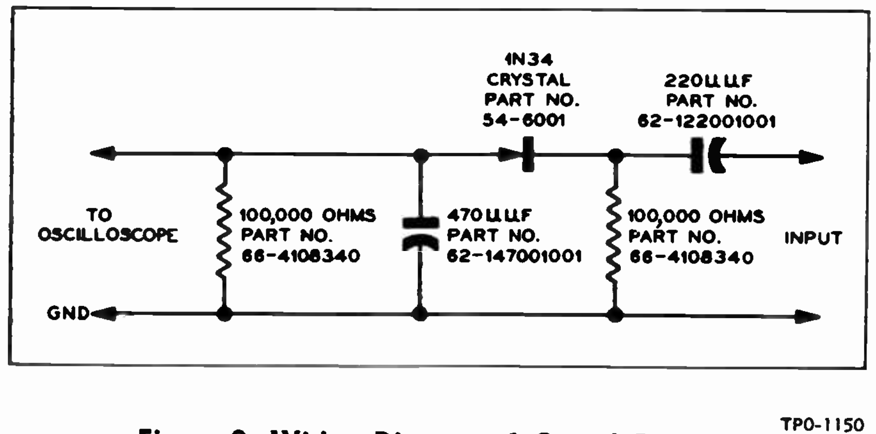


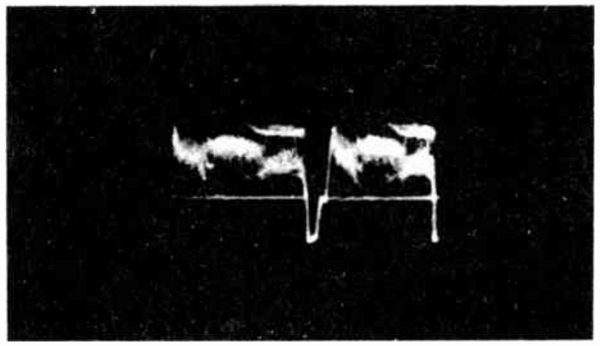
Figure 9. Wiring Diagram of Crystal Detector

OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 2 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.

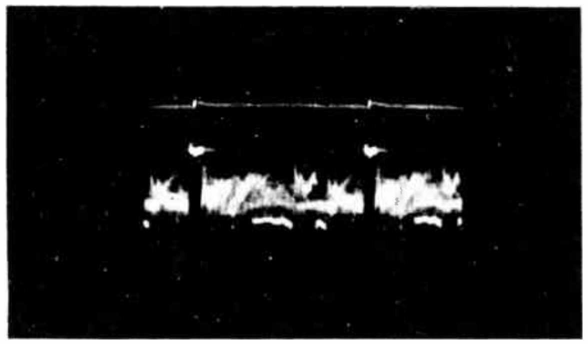
TP2-787

**Figure 10. Video Detector Output, Pin 2 of J200
2 volts, 60 c.p.s.**



TP2-786

**Figure 11. Video Detector Output, Pin 2 of J200
2 volts, 15,750 c.p.s.**

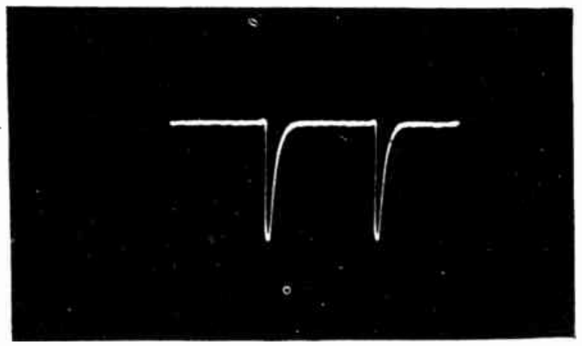


TP2-788

**Figure 12. Video Amplifier Plate, Pin 5
50 volts, 60 c.p.s.**

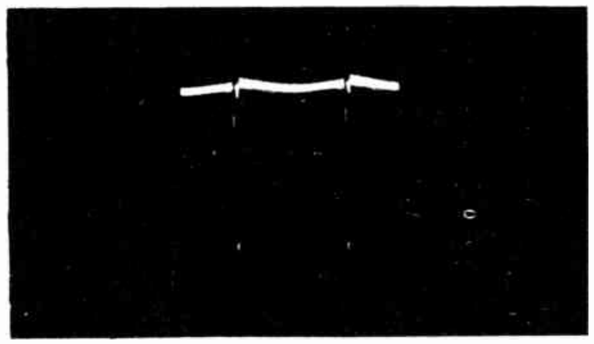
TP2-790

**Figure 13. Sync Separator Grid, Pin 7
40 volts, 60 c.p.s.**



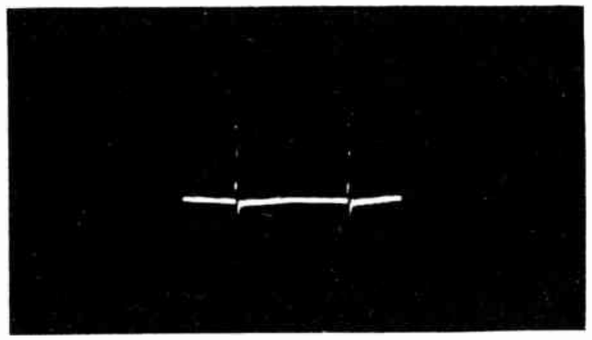
TP2-792

**Figure 14. Sync Separator Plate, Pin 5
26 volts, 15,750 c.p.s.**



TP2-639

**Figure 15. Phase-Splitter Grid, Pin 2
28 volts, 60 c.p.s.**

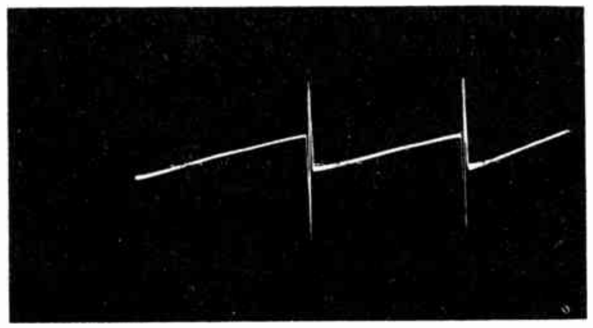


TP2-640

**Figure 16. Phase-Splitter Plate, Pin 1
44 volts, 60 c.p.s.**

TP2-643

**Figure 17. Vertical-Oscillator Grid, Pin 7
390 volts, 60 c.p.s.**

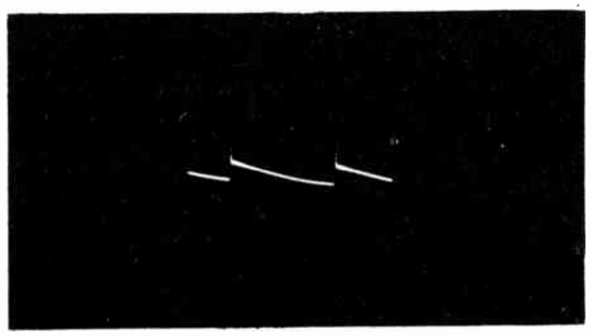


TP2-697A

**Figure 18. Vertical-Oscillator Plate, Pin 6
260 volts, 60 c.p.s.**

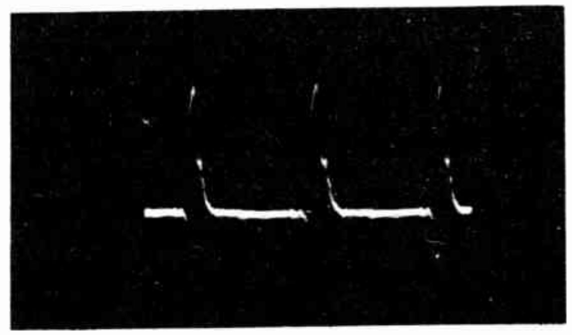
TP2-644A

**Figure 19. Vertical-Output Grid, Pin 2
120 volts, 60 c.p.s.**



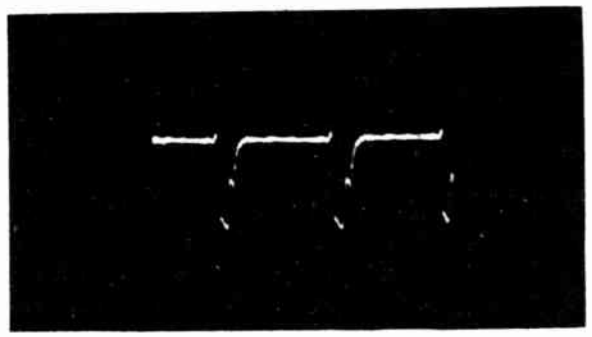
TP2-645

**Figure 20. Vertical-Output Plate, Pin 9
450 volts, 60 c.p.s.**



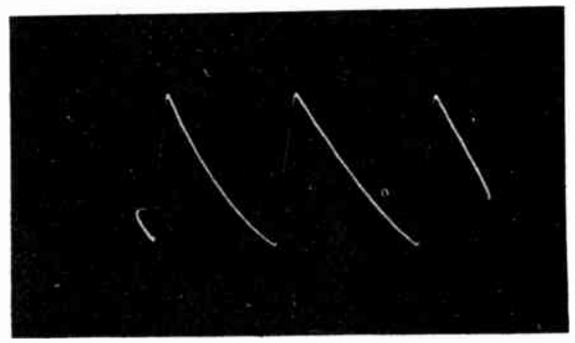
TP2-641

**Figure 21. Phase-Splitter Plate, Junction of R613, R614, and C800
13 volts, 15,750 c.p.s.**



TP2-642

**Figure 22. Phase-Splitter Cathode, Pin 3
10 volts, 15,750 c.p.s.**

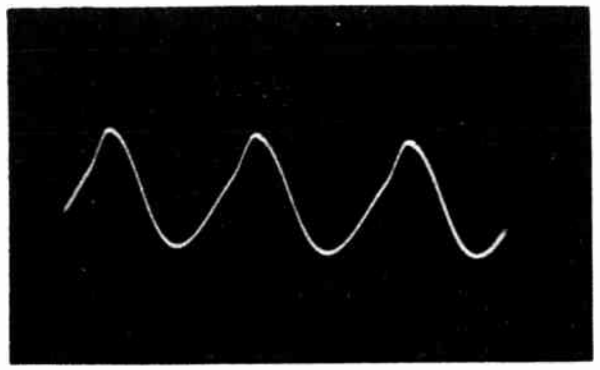


TP2-652

**Figure 23. Phase Comparer, Pins 5 and 7
8 volts, 15,750 c.p.s.**

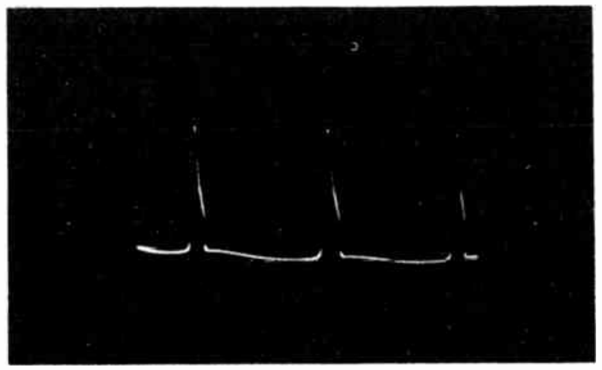
VOLTAGE MEASUREMENTS

The voltages given here and on the schematics were taken with a 20,000-ohms-per-volt voltmeter, with a line voltage of 117 volts, and no signal input to the receiver. Since voltage readings taken in the video i-f stages vary widely with different test equipment setups, voltage measurements for these stages are omitted from the diagrams.



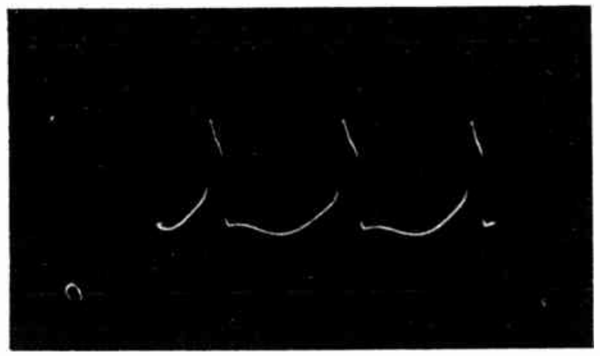
TP2-2852

Figure 24. Horizontal Oscillator, Junction of L800 and R806
34 volts, 15,750 c.p.s.



TP2-647

Figure 25. Horizontal-Oscillator Cathode, Pins 3 and 8
12 volts, 15,750 c.p.s.



TP2-648

Figure 26. Horizontal-Oscillator Grid, Pin 2
34 volts, 15,750 c.p.s.

TP2-649

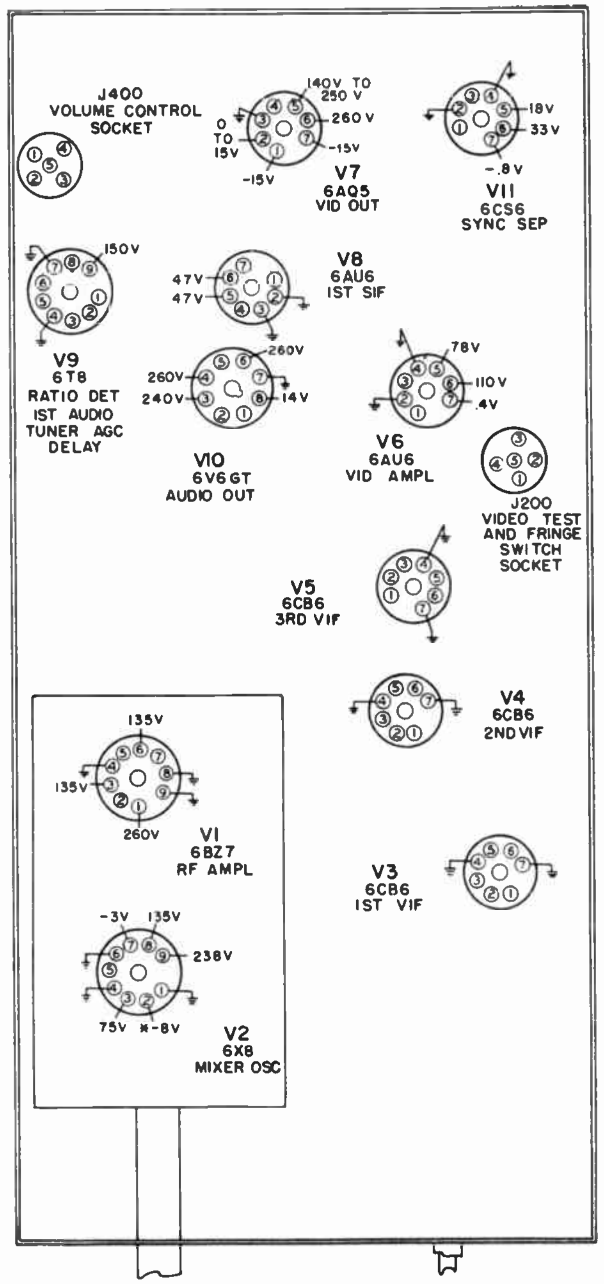
Figure 27. Horizontal-Output Grid, Pin 5
150 volts, 15,750 c.p.s.

TP2-650

Figure 28. Horizontal-Deflection Yoke, *Pin 7 of J800
2800 volts, 15,750 c.p.s.

*** See CAUTION.**

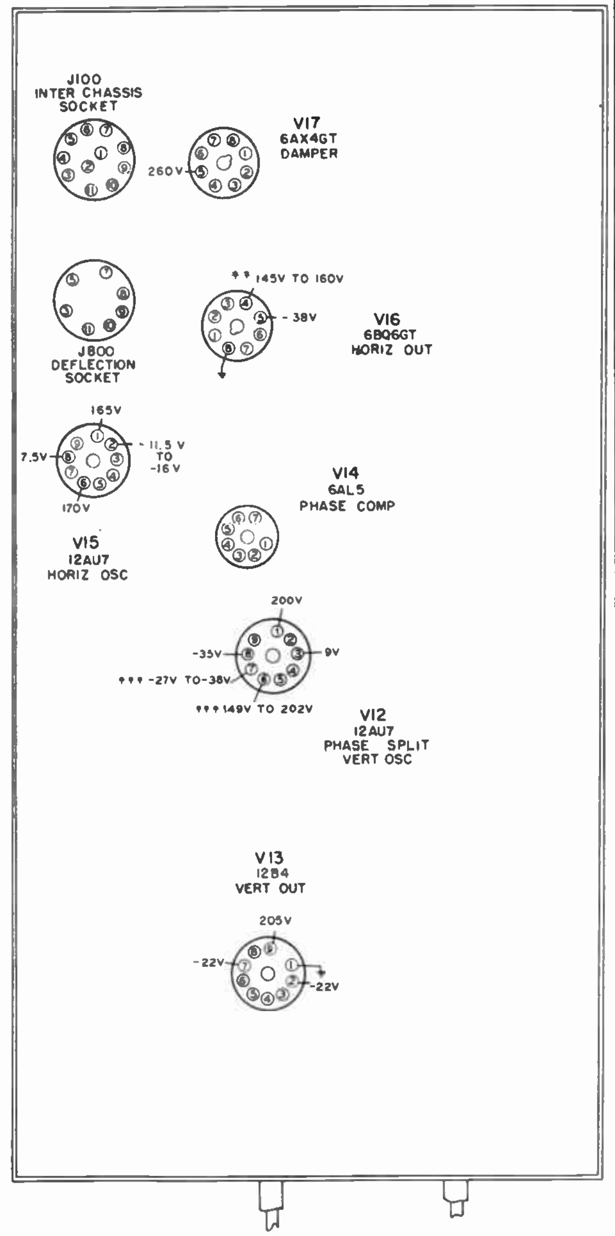
* CAUTION: High-voltage pulses are present in the horizontal-output circuit. The waveform in figure 28 was taken with the alligator clip of the oscilloscope lead clipped over the insulation of the lead connected to pin 7 of J800. (To prevent puncture of the insulation of the lead, file off the teeth of the alligator clip, and wrap friction tape around the clip.) Connection to other points in the horizontal-output circuit is dangerous, because of the high voltages present. The peak-to-peak voltage shown for figure 28 is the actual voltage present; however, the amplitude of the scope presentation depends upon the degree of coupling.



* VOLTAGE MEASURED WITH 47,000 OHM ISOLATING RESISTOR IN SERIES WITH METER PROBE

TP3-906

Figure 29. R-F Chassis R-191, Bottom View, Showing Voltages at Socket Pins



** VOLTAGE VARIES WITH HORIZ HOLD CONTROL SETTING
*** VOLTAGE VARIES WITH VERT HOLD CONTROL SETTING

TP3-907

Figure 30. Deflection Chassis D-191, Showing Voltages at Socket Pins

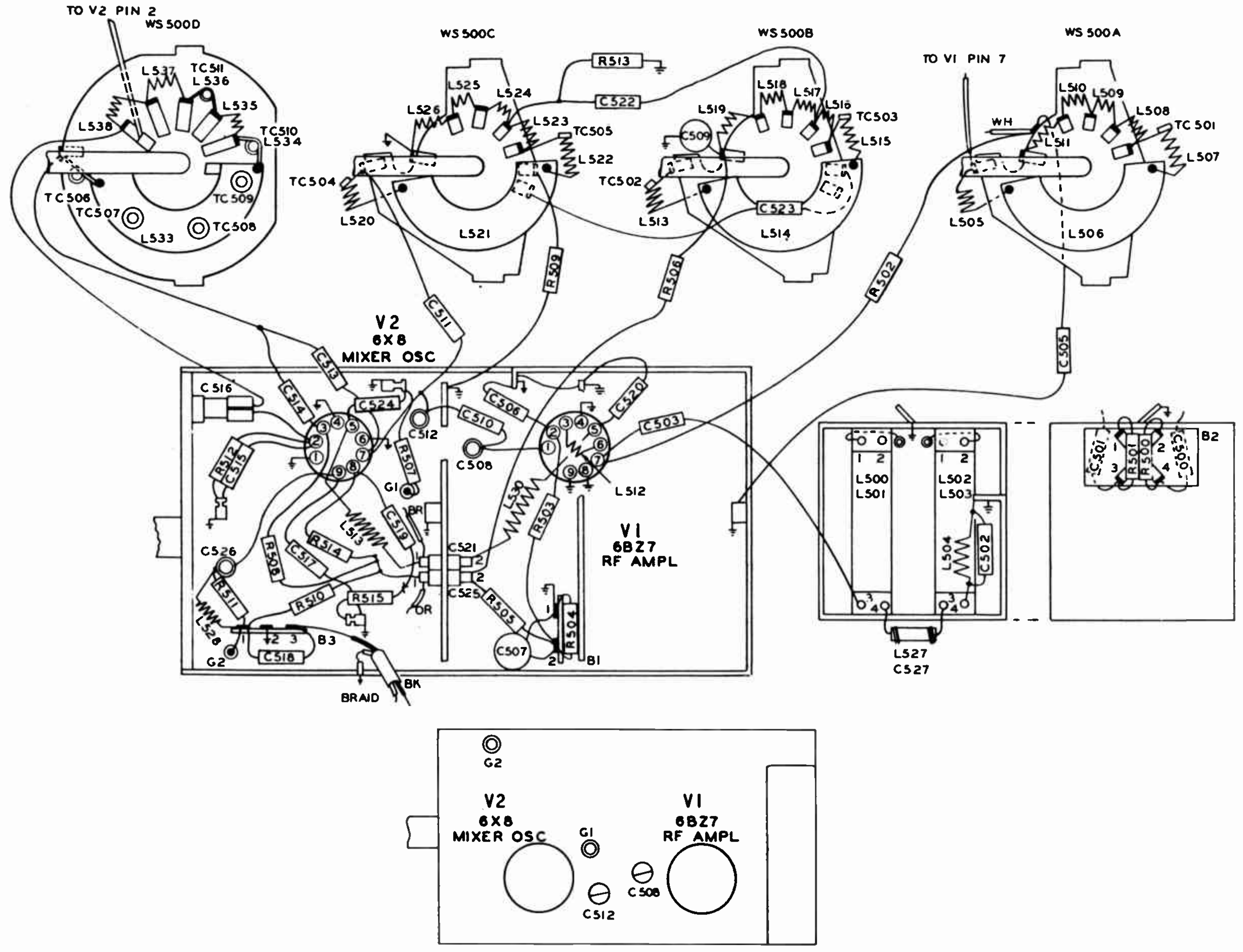


Figure 31. Television (VHF) Tuner, Part No. 76-8400, Base Layout

TP3-908

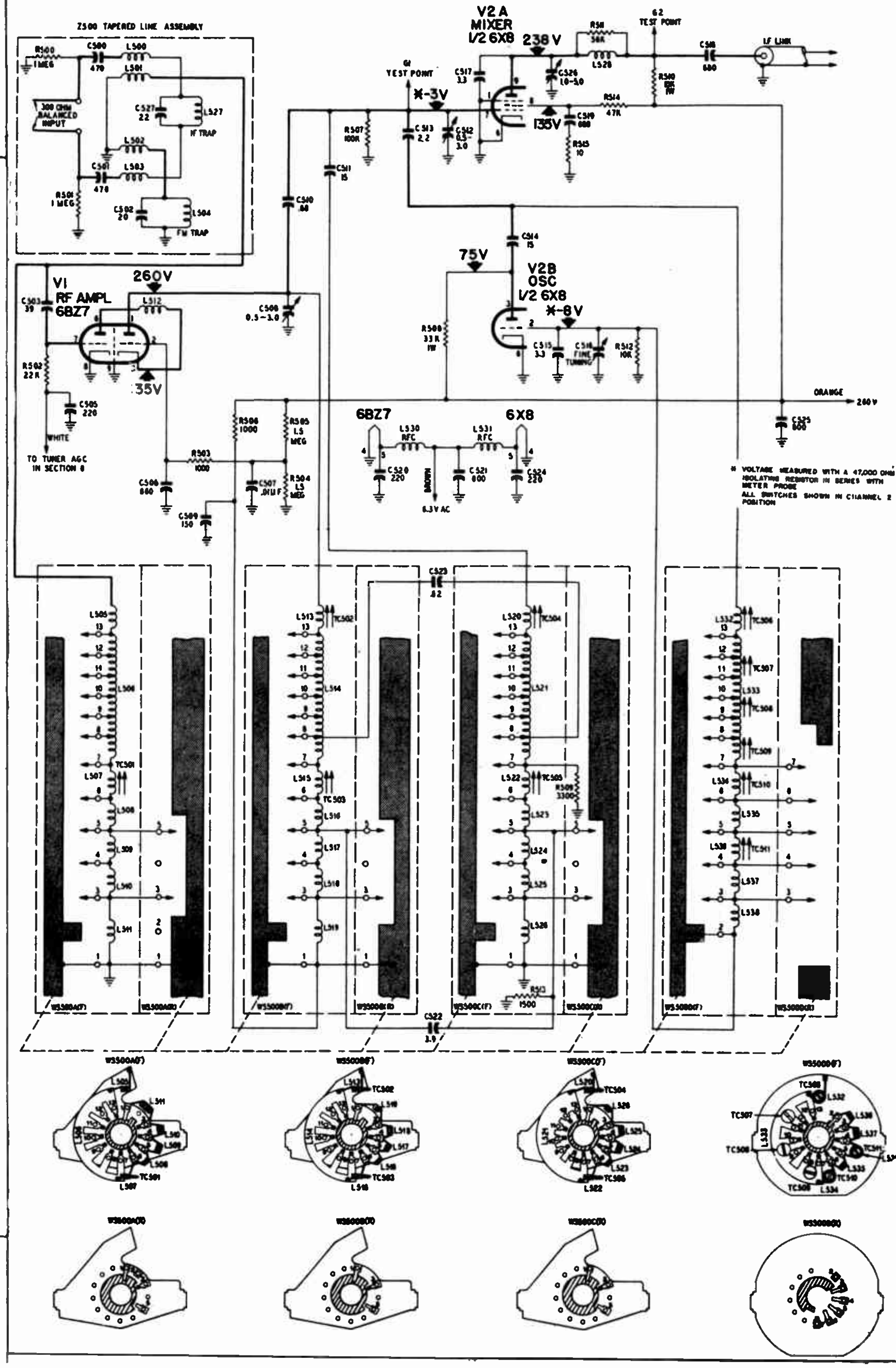


Figure 32. Television (VHF) Tuner, Part No. 76-8400, Schematic Diagram

TP3-909

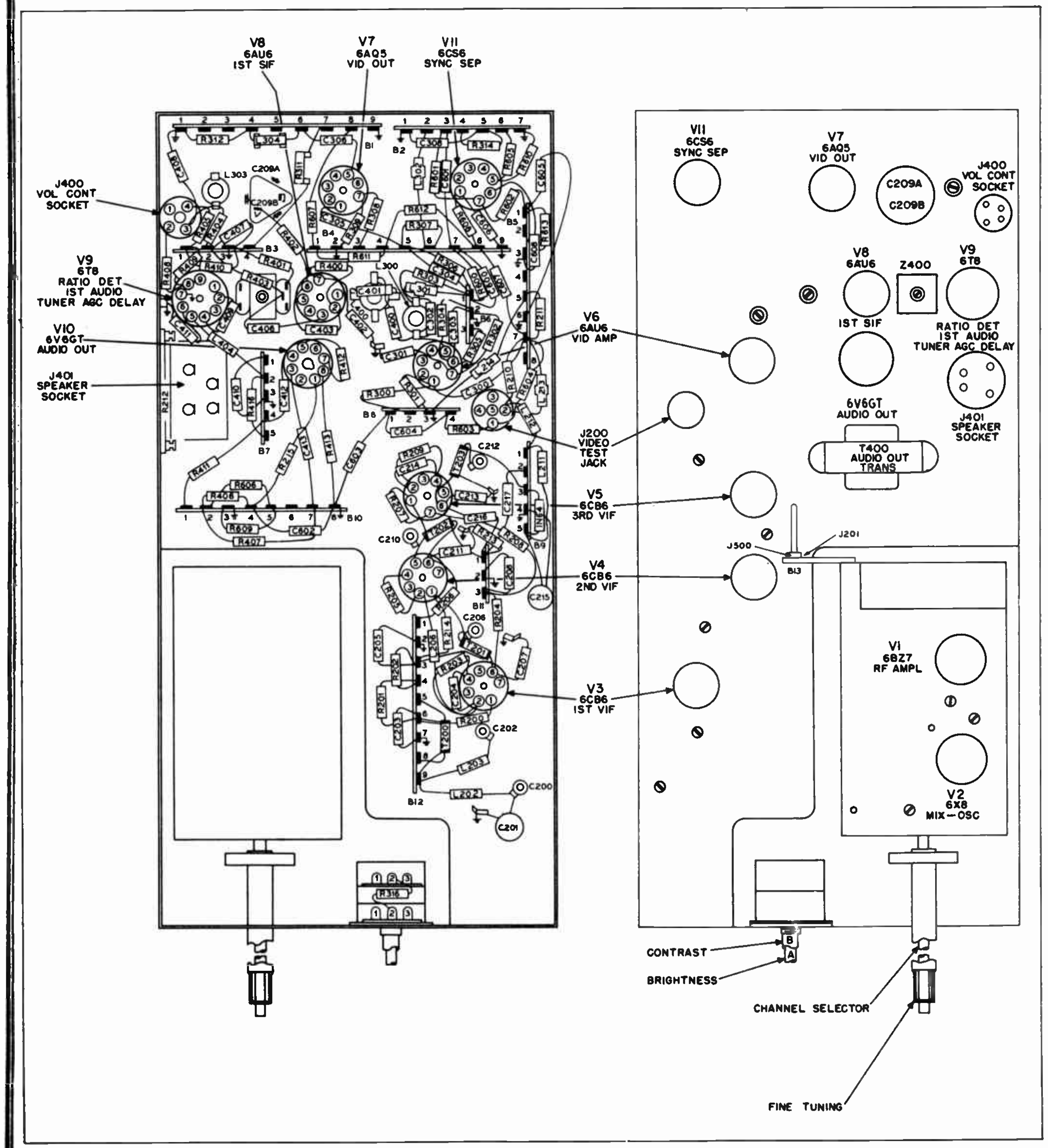


Figure 33. R-F Chassis R-191, Base Layout

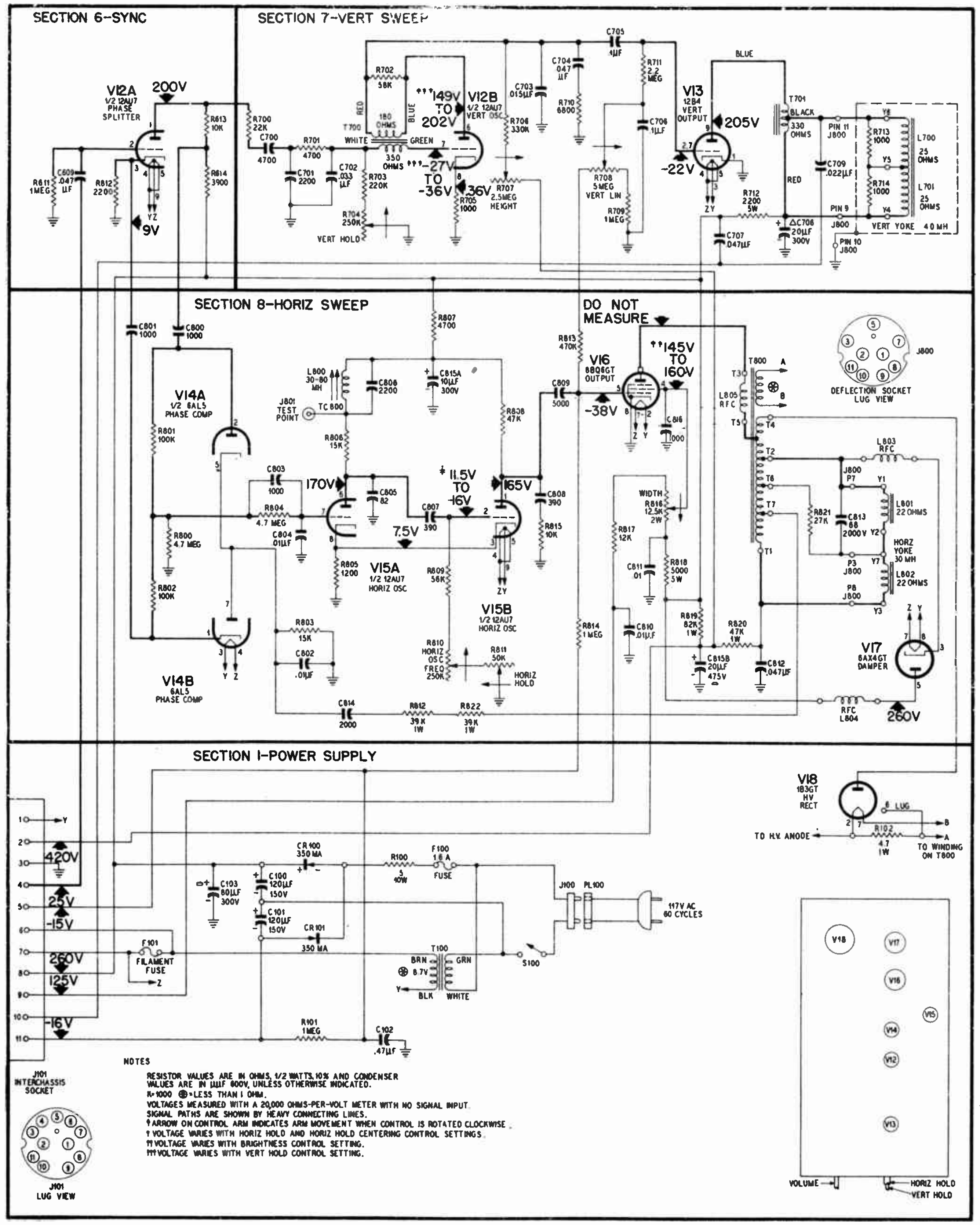


Figure 35. Deflection Chassis D-191, Schematic Diagram

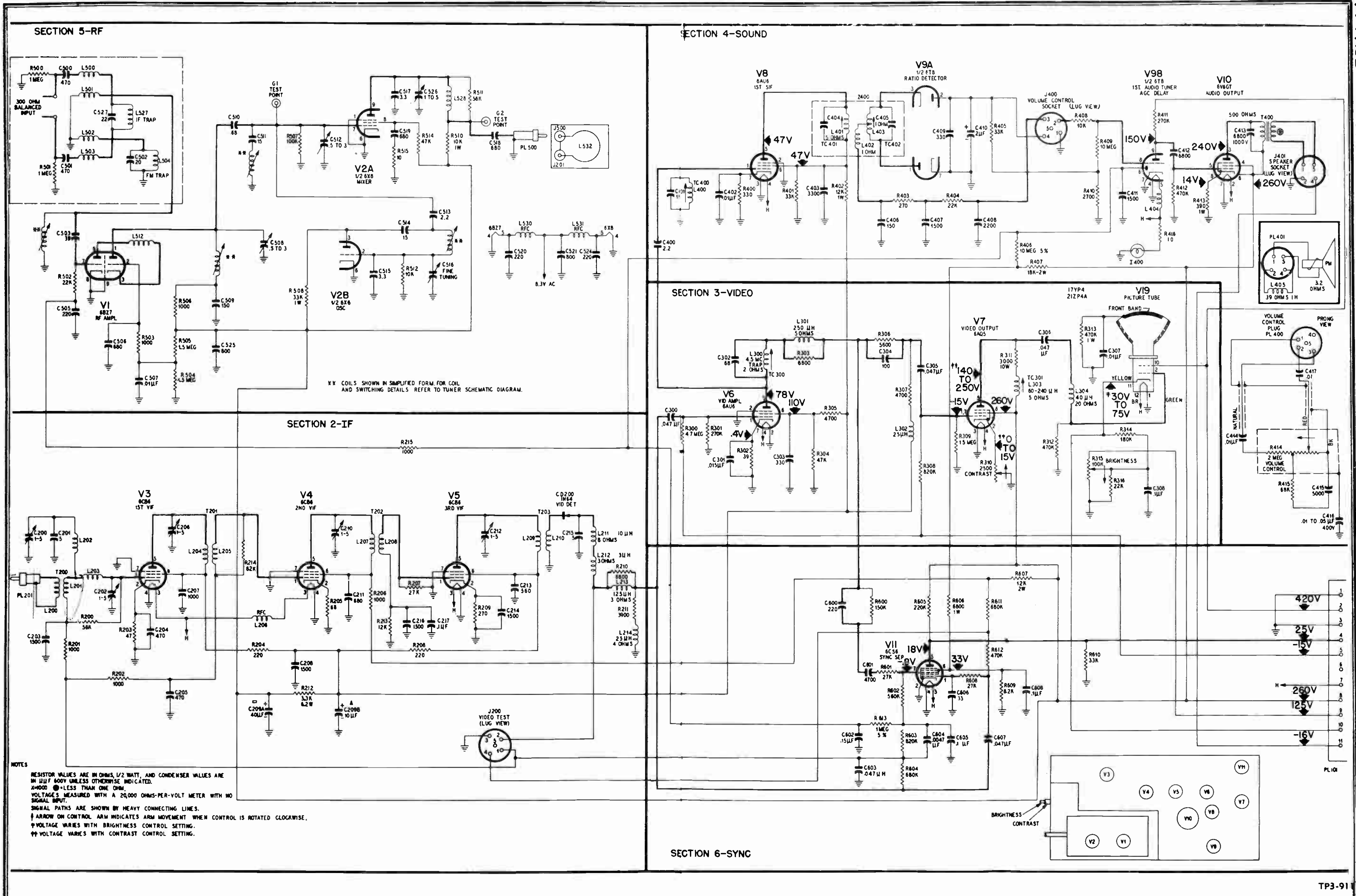


Figure 34. R-F Chassis R-191, Schematic Diagram

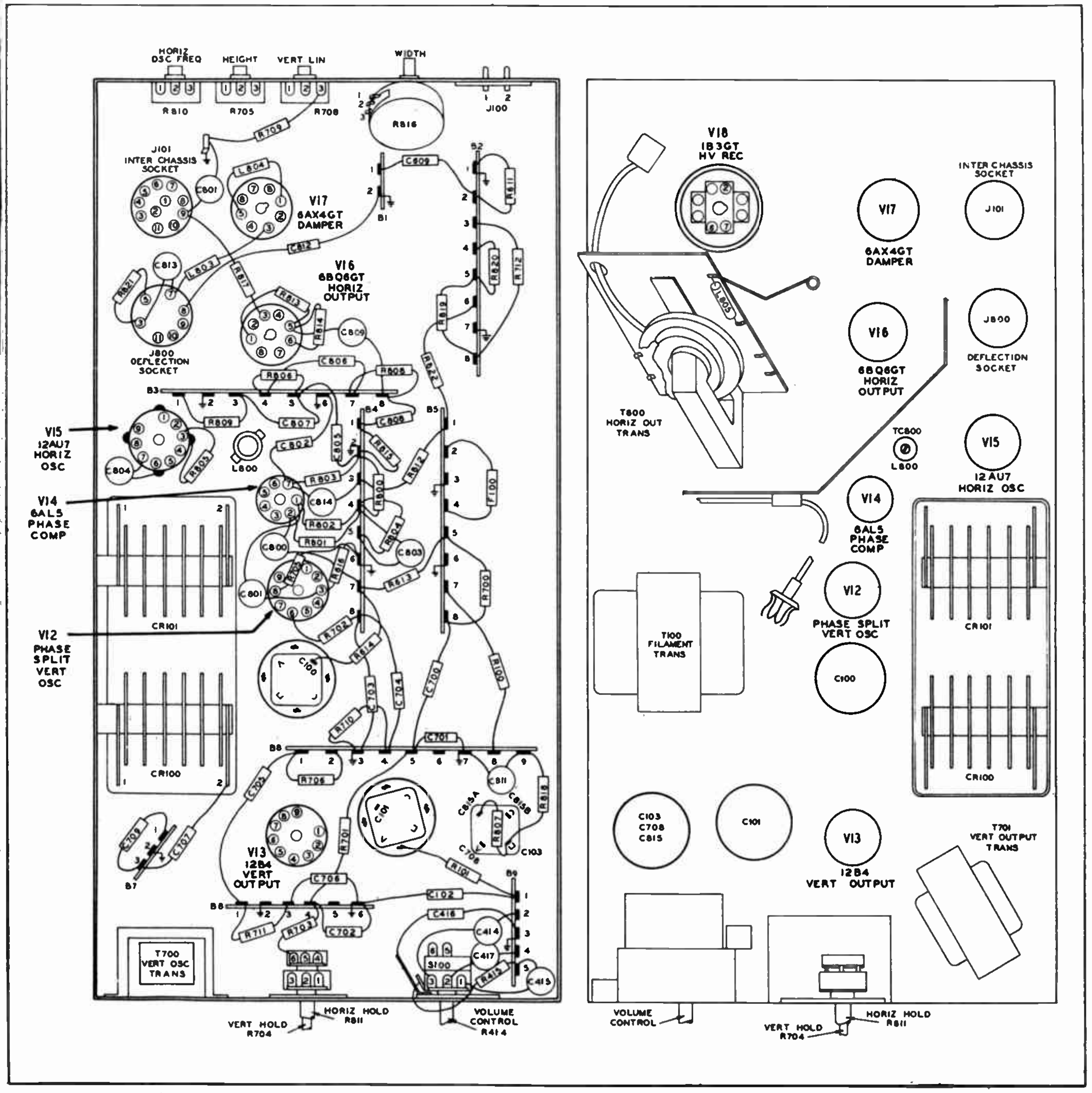


Figure 36. Deflection Chassis D-191, Base Layout

TP3-913

UHF TUNER-ADAPTER UT22, PART NO. 43-6703, FOR RECEIVERS USING R-F CHASSIS R-191

UHF Tuner-Adapter UT22, Part No. 43-6703, will provide for the reception of UHF Channels 14 through 83. It is designed for installation in Philco B line television receivers, and is installed on all BU models. These receivers use r-f chassis R-191.

The Tuner-Adapter consists of a UHF tuner, a change-over switch, adapter cables and plugs, a planetary tuner driving assembly, and mounting hardware.

CIRCUIT DESCRIPTION

The incoming UHF signal is coupled through the antenna input line to blocking condensers C1 and C2, leakage resistors R8 and R9, an i-f trap, C5-L1, C6-L2, and a 150-ohm transmission line, to the antenna tank of the tuner. See figure 37. The antenna tank is coupled to the mixer tank by means of the mutual coupling of L2 and L3 and the stray capacitance, C5. The desired signal is selected by tuning the antenna tank and the mixer tank to the correct frequency; this is accomplished by tuning condensers C3A, C3B, C3C, and C3D. These condensers, plus C3E and C3F, located in the oscillator tank circuit, form the manual tuning gang.

The signal is then fed to the crystal mixer circuit by means of the mutual coupling of L4 and L5. The local-oscillator signal is generated by a 6AF4 tube, V1, and its associated circuit. The frequency of oscillation is maintained at 45.75 mc. above the signal frequency in the antenna and mixer tank, in order to effect a 45.75-mc. video carrier intermediate frequency when the two signals are subsequently mixed in the crystal mixer tank.

The output signal from this local oscillator is introduced into the crystal mixer circuit through a 300-ohm, miniature transmission line and the mutual coupling of L7 to L5 and L8 to L6. These four printed inductances, in addition to C7, form the mixer board assembly. The signal is fed into a 6BQ7 preamplifier stage, then to the video i-f circuits, and through the UHF change-over switch, by means of a coaxial connection. On VHF operation, a 150,000-ohm resistor is placed in series with the UHF oscillator plate, rendering this oscillator inoperative.

The two tanks of the UHF tuner, the antenna tank and the mixer tank, are used to prevent the i-f signal from feeding back to the antenna and interfering with other receivers. These two tanks pass incoming signals very readily, but do not pass the i-f signal.

CHANGE-OVER SWITCH

The change-over switch supplied with the Tuner-Adapter is used to switch from VHF to UHF, and vice versa. It is installed on the back of the VHF tuner, and is operated by an actuator mounted on the VHF tuner shaft. When the Channel Selector of the VHF tuner is turned to the UHF position, the change-over switch makes proper connection for UHF operation. In this position, the switch places a 150,000-ohm resistor in series with the VHF B-plus lead, which drops the B-plus voltage applied to the VHF tuner. The antenna is connected to the UHF tuner, the VHF pilot light is turned off, and the UHF pilot lights are turned on; the output of the UHF tuner is connected to the video i-f input circuit.

When the VHF Channel Selector is turned to any VHF position, the change-over switch places a 150,000-ohm resistor in series with the UHF local-oscillator plate circuit, which drops the voltage applied to the plate, and disables the oscillator. The switch also connects the antenna to the VHF tuner, turns off the UHF pilot lights, and turns on the VHF pilot light.

ADAPTER CABLES AND PLUGS

The adapter plugs shown in the schematic diagram are not used in factory-installed units; the cables are wired directly into the chassis at the proper places. The plugs are used only in field-installed units. (Refer to the installation instructions for the proper method of inserting and connecting all plugs and cables.)

PLANETARY DRIVE

The UHF tuner is tuned by means of a 3-gang tuning condenser, which is driven through a specially designed planetary drive. The planetary drive is constructed so that fine tuning and coarse tuning can be accomplished with a single control knob. The tuning shaft is coupled to the driving shaft through three steel balls, which form a planetary drive that produces a slow rotation for fine tuning. See figure 38. After rotating 180 degrees with the tuning shaft, a pin engages the driving shaft, and the two shafts are direct-coupled, for coarse tuning. To re-engage the planetary drive for fine tuning, it is only necessary to reverse the direction of the rotation. The dial pointer

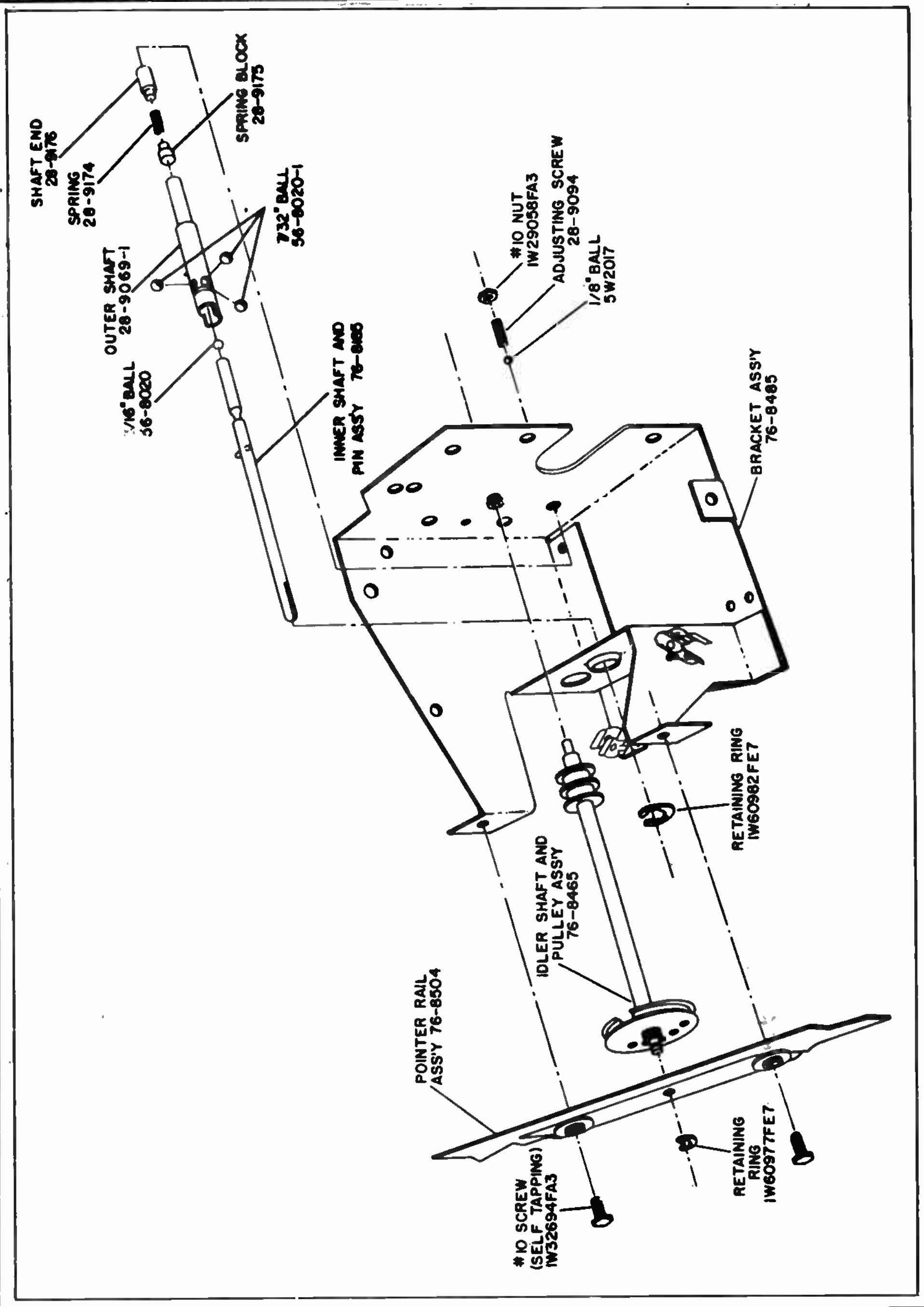


Figure 38. Planetary Assembly, Exploded View, Showing Mechanical Layout

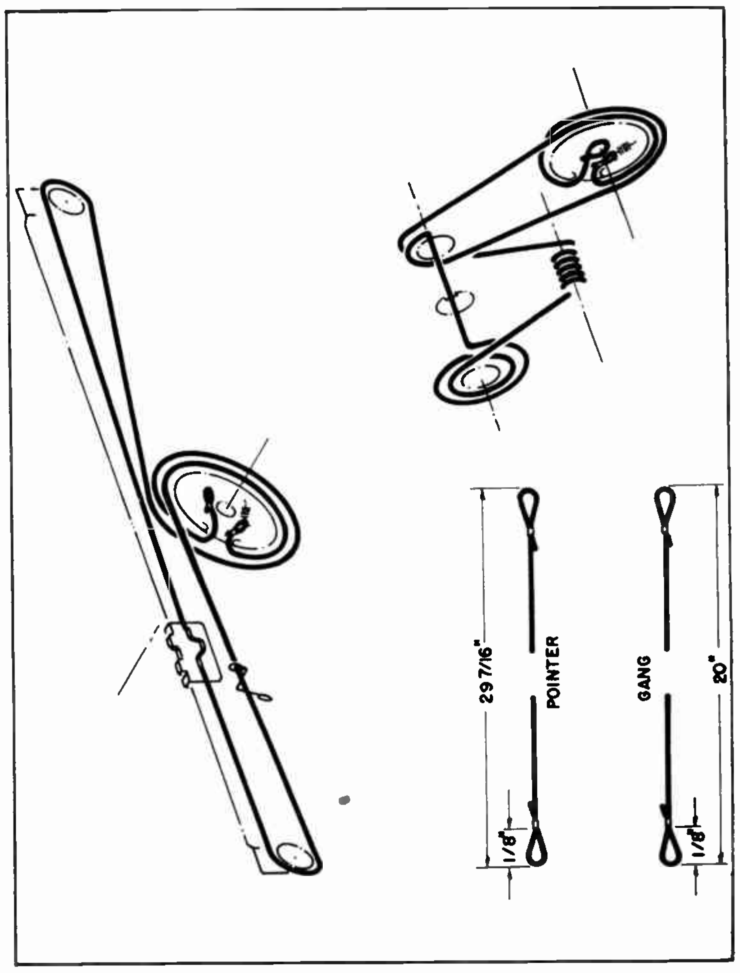
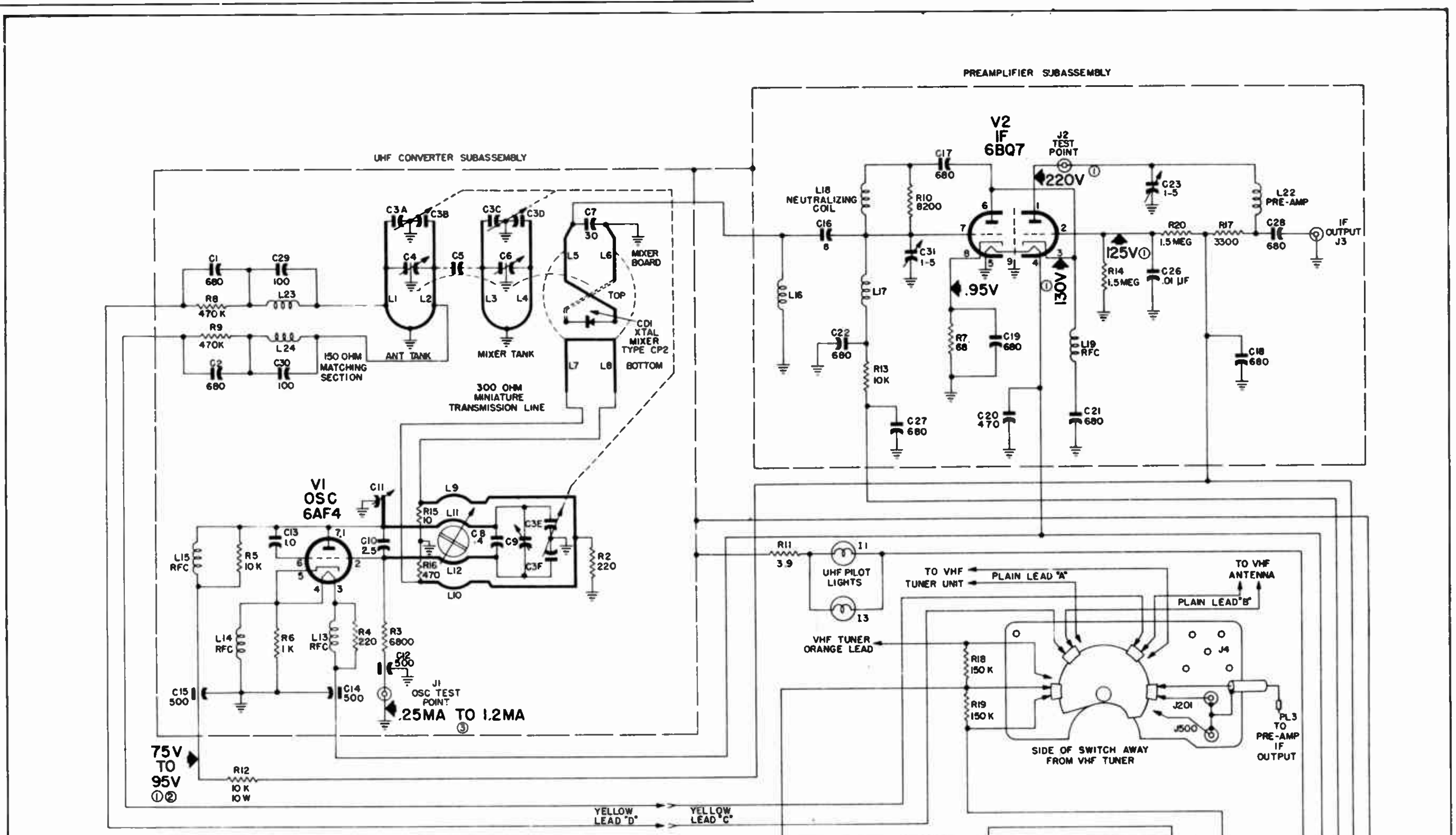


Figure 39. Drive-Cord Stringing Arrangement



NOTES

RESISTOR VALUES ARE IN OHMS ± 10%, 1/2 WATT AND CONDENSER VALUES ARE IN UUF, 600V UNLESS OTHERWISE INDICATED
K=1000 OHMS ⊗ = LESS THAN ONE OHM

CHANGE-OVER SWITCH WIRING FOR COMMON (VHF) ANTENNA OPERATION. FOR SEPARATE UHF AND VHF ANTENNA OPERATION BREAK LEADS "C" AND "D", CONNECT LEAD "D" TO UHF ANTENNA AND LEAVE LEAD "C" DISCONNECTED

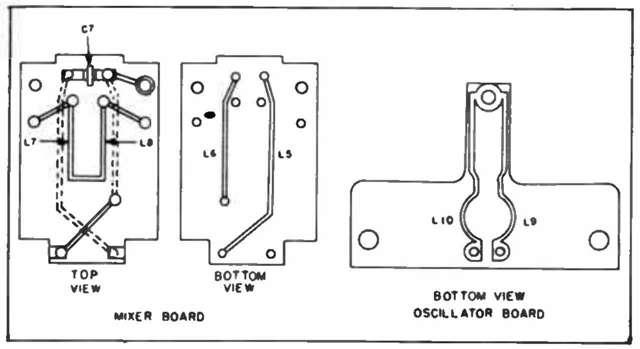
VOLTAGES MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH NO SIGNAL INPUT

① VOLTAGE MEASURED ON 1000-VOLT SCALE

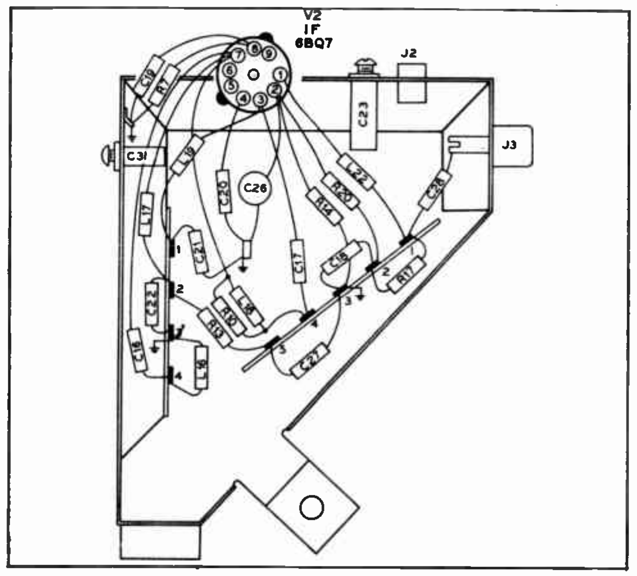
② VOLTAGE VARIES WITH TUNING CONDENSER SETTING

③ TO MEASURE OSCILLATOR GRID CURRENT, BREAK SOLDER CONNECTION AT J1 AND INSERT MILLIAMMETER

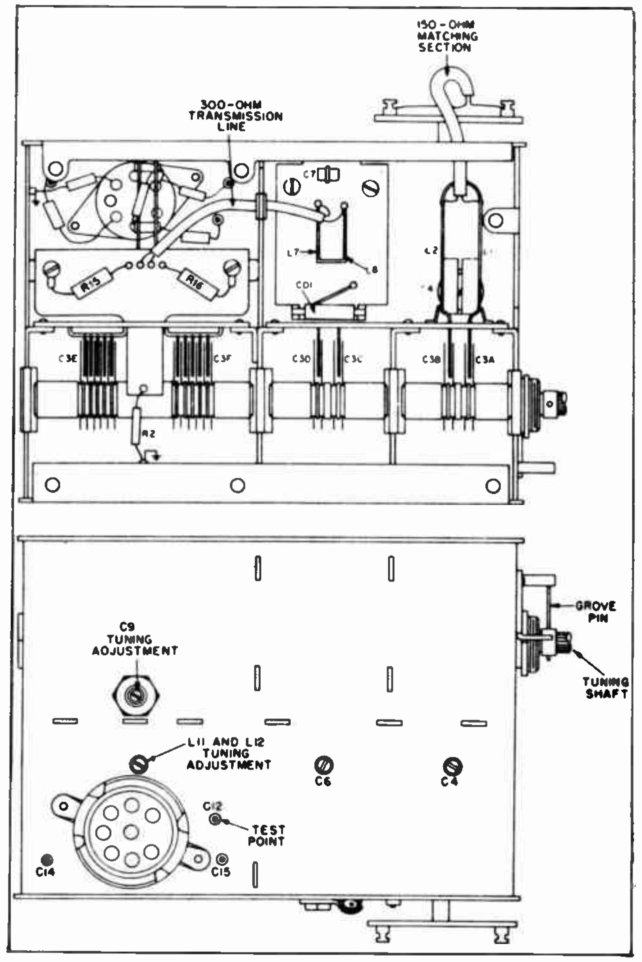
Figure 37. Philco UHF Tuner-Adapter UT22, Part No. 43-6703, Schematic Diagram



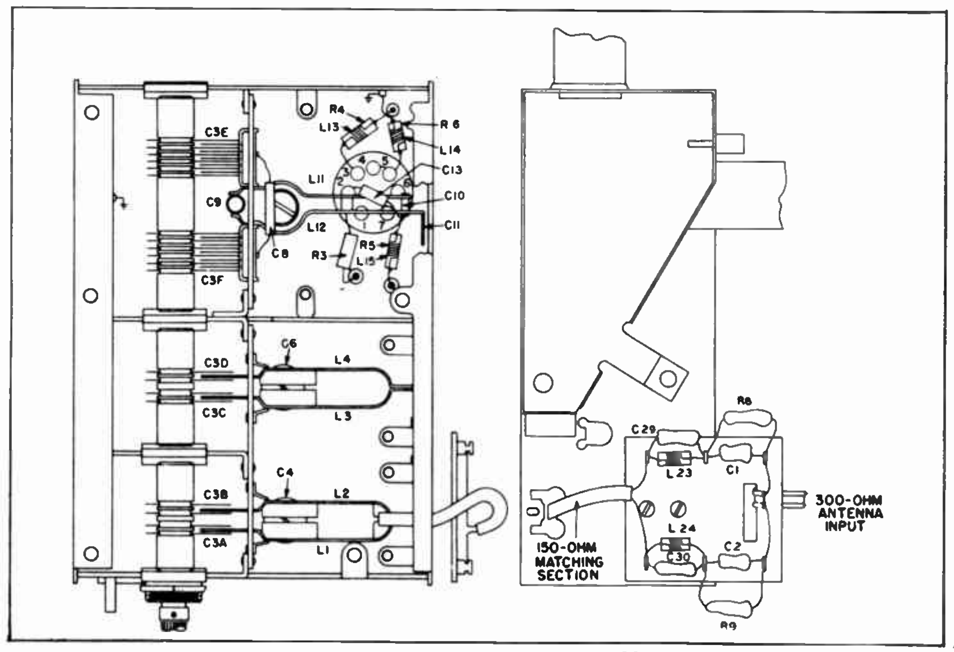
TP2-3175
Figure 40. Oscillator and Mixer Board Layouts



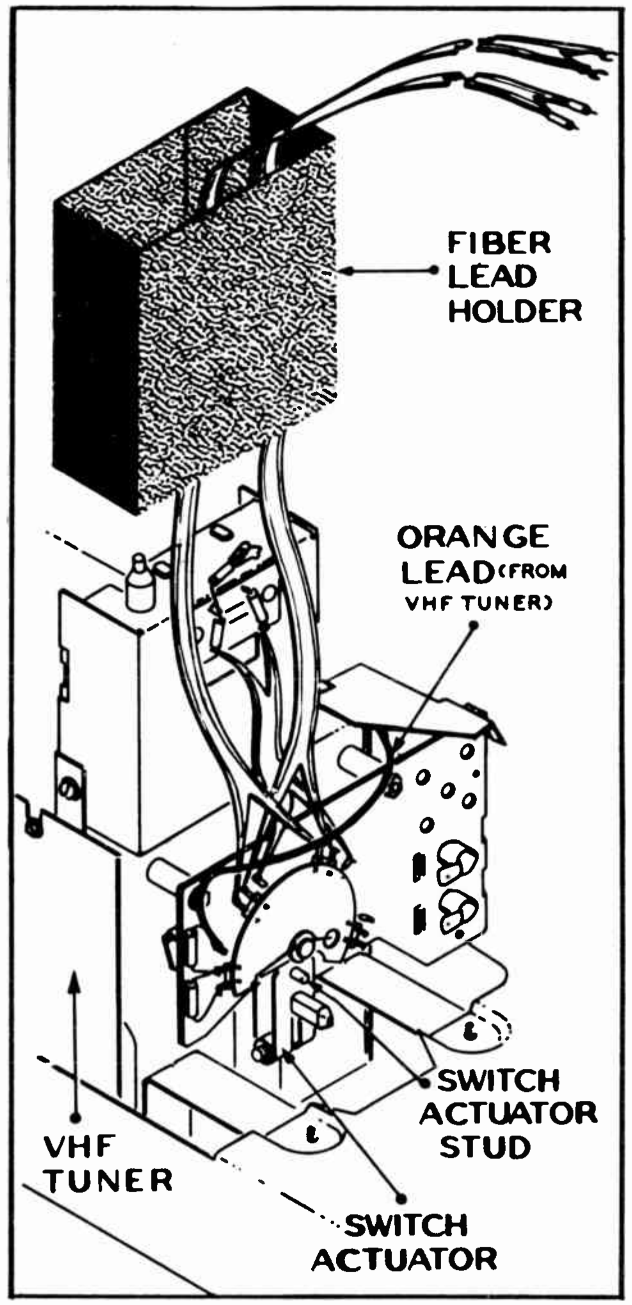
TP3-883
Figure 41. Base View of Preamplifier Assembly of UHF Tuner-Adapter UT22, Part No. 43-6703



TP3-895
Figure 43. Top View and Base View of UHF Tuner-Adapter UT22, Part No. 43-6703, With Board Assemblies



TP3-896
Figure 42. Side View and Base View of UHF Tuner-Adapter UT22, Part No. 43-6703, Without Board Assemblies

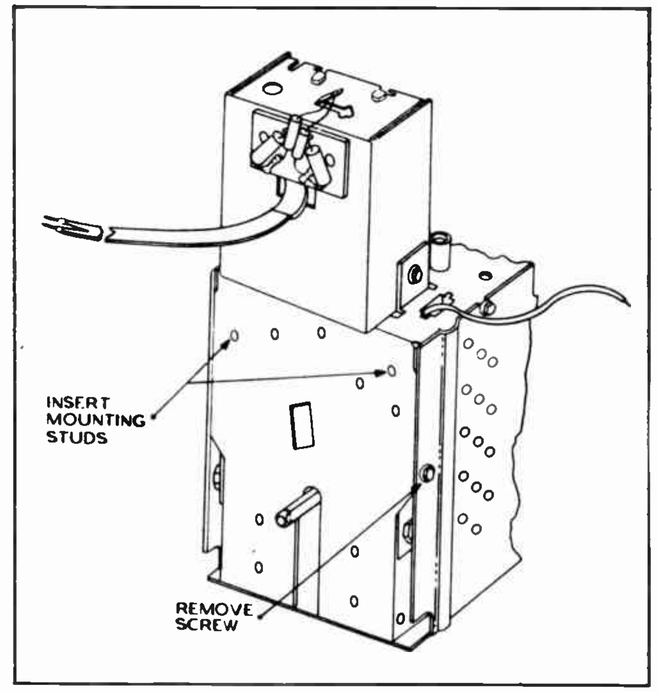


TP3-760
Figure 44. Change-Over Switch, Switch Actuator, and Lead-Dress Details

is connected to the tuning gang through a cord drive, and indicates the channel number to which the tuner is tuned.

ALIGNMENT AND REPAIRS

The frequencies at which the Tuner-Adapter operates are extremely high; therefore, it is necessary that the utmost care be taken to safeguard against upsetting the delicate adjustments of the tuner. It is recommended that the serviceman make only minor repairs to the tuner, such as replacement of the tube or crystal and the wiring of external leads. The



TP3-793
Figure 45. Rear View of VHF Tuner

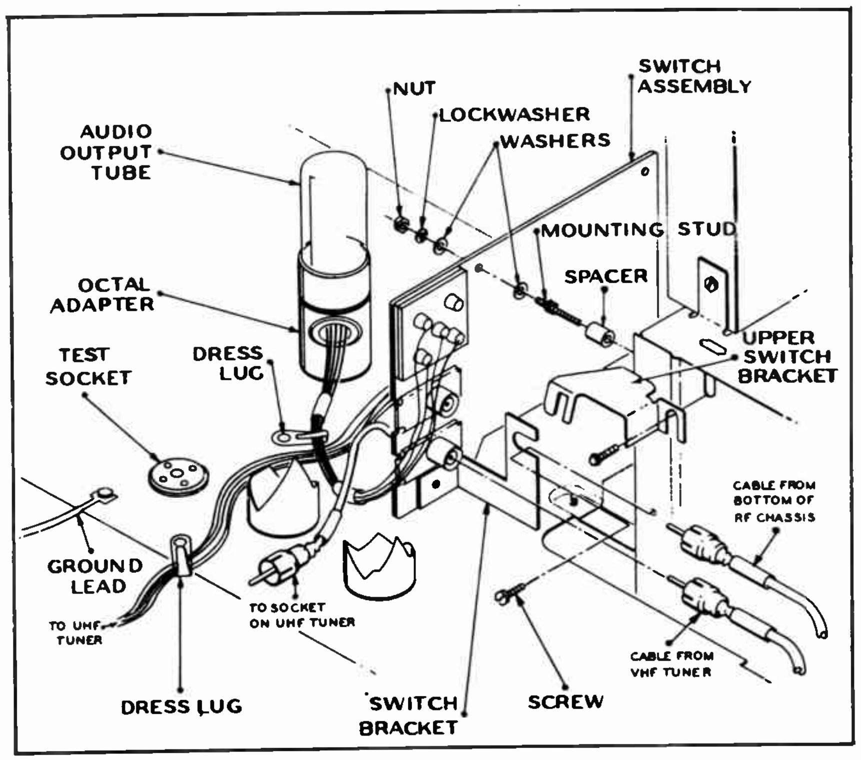
Tuner-Adapter should be returned to the factory for alignment or major repairs, unless the serviceman is properly equipped to perform these jobs. In general, a good rule to follow is not to remove the cover of the Tuner-Adapter, unless so equipped.

NOTE: Replacing the tube with a new one may detune the tuner. If this occurs, try a number of tubes until one is found that will provide the most satisfactory performance.

INSTALLATION INSTRUCTIONS

To install the UHF Tuner-Adapter on the r-f chassis, proceed as follows:

1. Remove the cabinet back and r-f chassis from the cabinet; then remove the nameplate on the control panel by pushing it out from inside the cabinet.
2. Insert the dial scale and bezel assembly into the hole provided in the cabinet. Fasten the assembly in place with the two nuts provided.
3. Remove the UHF tuner assembly from the mounting board with which it was shipped. Keep the three screws for mounting the tuner in the cabinet.
4. Remove the coaxial cables from the two sockets at the side of the VHF tuner. Remove the bracket and socket assembly (J500 and J201) from the back of the VHF tuner, and discard them.
5. Place the switch-actuator assembly on the shaft extending from the rear of the VHF tuner so that the switch-actuator stud points away from the tuner. See figure 44. Place the spacers on the mounting studs



TP3-795

Figure 46. Change-Over Switch Mounting Details and Lead-Dress Details

and attach to the rear of the VHF tuner on the r-f chassis. See figure 45.

6. Remove the screw on the side of the VHF tuner, as shown in figure 41. Place the switch assembly on the two mounting studs, and fasten it in place with the flat washers, lock washers, and nuts provided. See figure 46. Fasten the upper switch bracket in place as shown in figure 46.

7. Put the VHF Channel Selector in the Channel 2 position. Rotate the switch actuator clockwise (as viewed from the rear of the VHF tuner) on the tuner shaft until the actuator touches the fiber cam on the change-over switch. Fasten the switch actuator in this position. Rotate the Channel Selector to the UHF position. Check the switch operation to make sure that the switch is thrown properly. Rotate the Channel Selector to Channel 13 position and check the switch operation to make sure that the switch is not thrown in this position. Fasten the lower switch bracket to the side of the VHF tuner with the screw removed in step 6. Lubricate the switch-actuator stud and switch cam with cup grease.

8. Remove the audio-output tube from its socket, and insert the adapter plug into the socket. Insert the tube into the adapter. See figure 46.

9. Insert the coaxial cable from the VHF tuner into the bottom socket on the change-over switch. Insert the coaxial cable from the r-f chassis into the top socket on the switch. See figure 46.

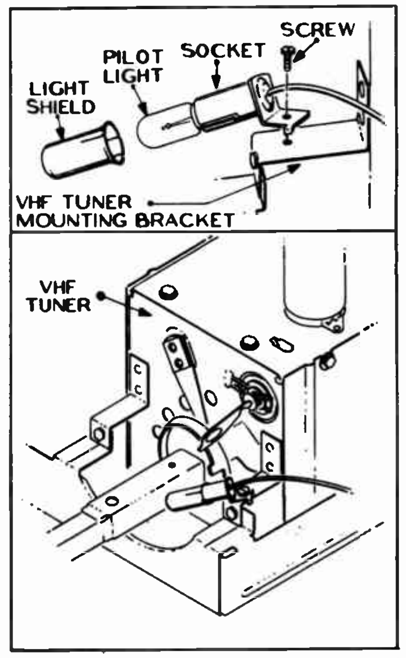
10. Pull the orange lead from the VHF tuner up out of the r-f chassis, and cut it off at the point where it comes through the chassis. Skin the orange lead attached to the VHF tuner, and solder it to the lug on the change-over switch, as shown in figure 44.

CAUTION: The orange lead supplies B plus to the VHF tuner. Tape the loose end to prevent shorting to the chassis.

11. Remove the pilot lamp from the r-f chassis pilot-light socket. Cut the pilot-light lead from the r-f chassis where it passes through the chassis, and discard the socket and lead. Tape up the lead to prevent the possibility of a short circuit. Mount the new pilot-light socket from the change-over switch with the drive screw provided, as shown in figure 47. Insert the pilot light in the socket, and install the shield provided over it.

12. Remove the antenna lead from the VHF tuner, and solder the short lead from the UHF-VHF change-over switch to the VHF tuner terminals from which the antenna lead was removed. Slide the folded fiber lead holder over the tapered-line coil assembly on the VHF tuner, and dress the twin-wire antenna leads through the holder. See figure 44. The fiber holder will prevent the twin-wire leads from touching the tubes on the r-f chassis.

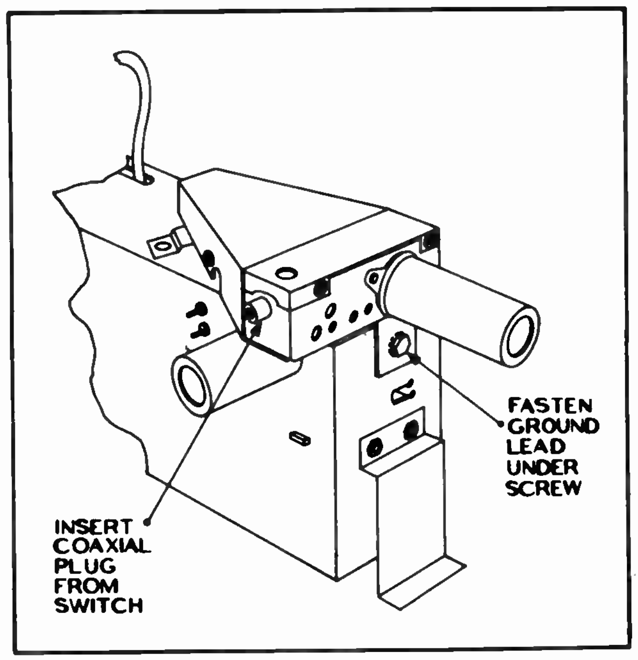
13. Place the UHF tuner in the cabinet between the r-f and deflection chassis, and fasten the UHF



TP3-755

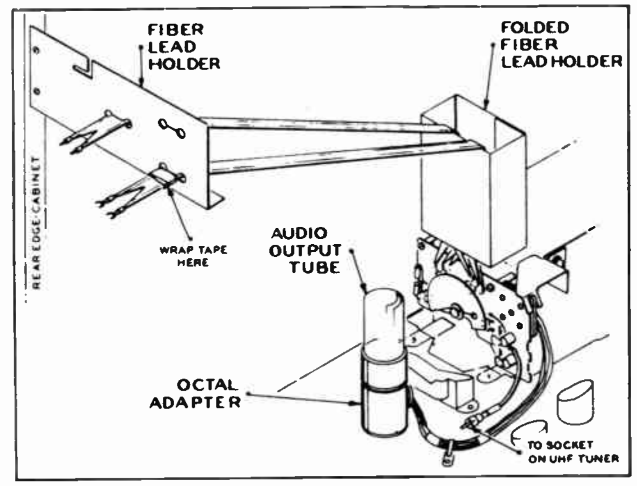
Figure 47. Pilot Light Mounting Details

tuner to the chassis shelf with the three screws removed in step 3. It is important that these screws be tightened securely, so as to hold the UHF tuner in place on the chassis shelf. Turn the UHF tuning shaft to its extreme counterclockwise position, and check the pointer position on the scale. The pointer should be positioned just below the Channel 14 mark on the scale. If the pointer is not properly positioned, loosen the three mounting bolts and move the UHF tuner



TP3-792

Figure 48. UHF Tuner, Showing Location of Ground Lead and Coaxial Socket



TP3-794

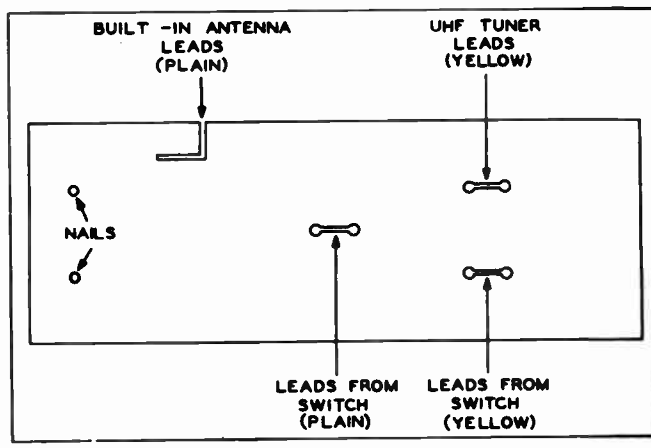
Figure 49. Rear View of VHF Tuner, Showing Lead Dress

assembly to properly position the pointer; then fasten the assembly with the three mounting screws.

14. Fasten the ground lead and the dress lugs to the r-f chassis with drive screws. See figure 46. Install the chassis in the cabinet, and fasten the ground strap under the screw on the UHF tuner as shown in figure 48. Fasten the r-f chassis with the original mounting bolts. Place the original knobs on their shafts, and the felt washer and knob supplied on the UHF tuning shaft.

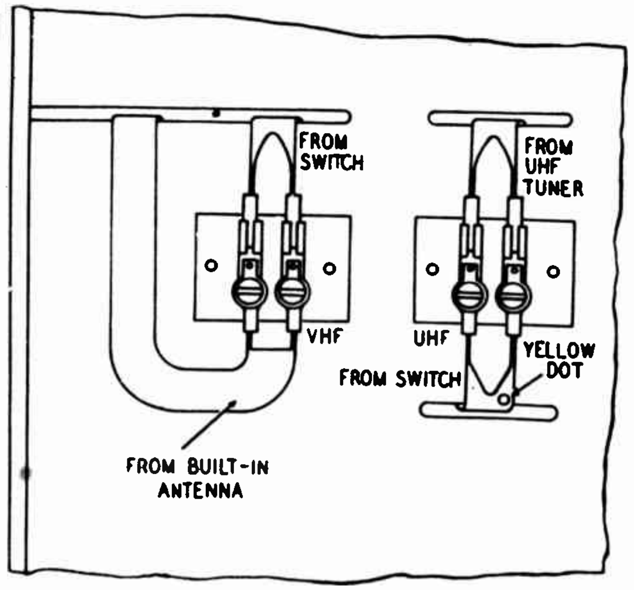
15. Insert the coaxial plug from the change-over switch into the socket on the UHF tuner. See figure 48. Insert the 5-pin plug from the UHF tuner into the socket on the bracket at the rear of the VHF tuner. Dress the leads under the dress lug as shown in figure 46.

16. Replace the fiber antenna-lead holder with the new holder provided. Fasten the new holder with the nails provided (or screws for metal cabinets), and then pass the twin-wire leads through the holes as shown in figures 49 and 50. Pull the leads through



TP2-3169

Figure 50. Antenna-Lead Holder



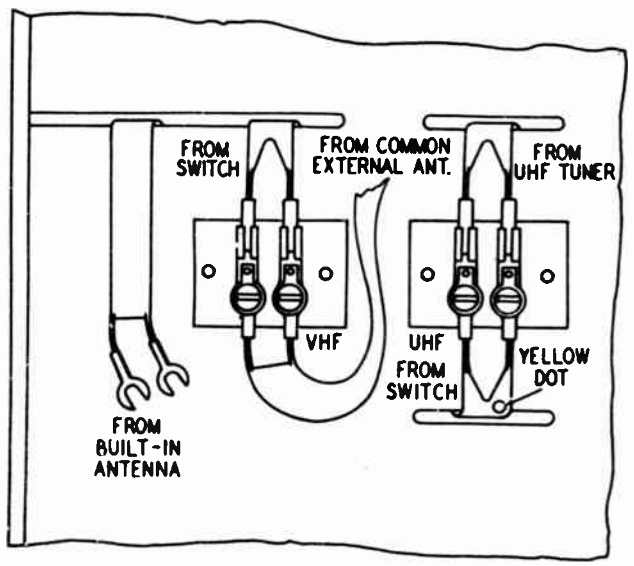
TP2-3170-1

Figure 51. Antenna-Lead Connections, Common Built-In Antenna

the holder until they are tight, making certain that the leads do not contact the tubes or the chassis. Wrap tape around the yellow-marked twin-wire leads with the spade-lug ends, to prevent the leads from passing back through the fiber holder..

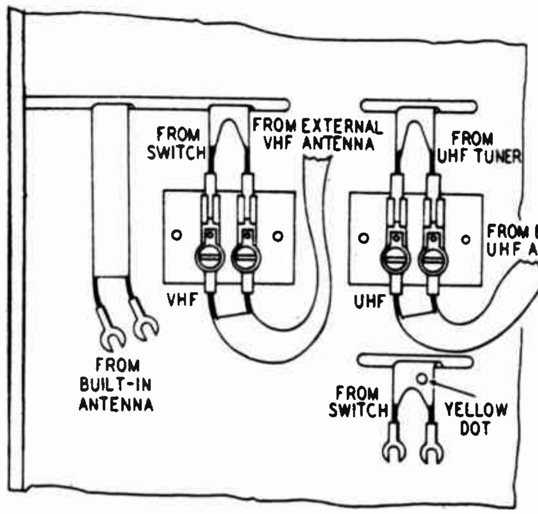
17. Fasten the antenna terminal board provided as shown in the illustrations above (figures 51 to 55). Replace the cabinet back, and make the connections as illustrated, according to the type of antenna installation being used.

18. Paste the label provided over the outside-antenna instructions on the cabinet back.



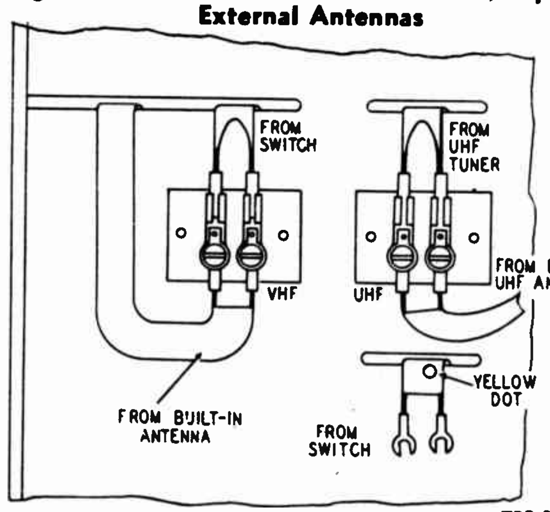
TP2-3172-1

Figure 52. Antenna-Lead Connections, Common External Antenna



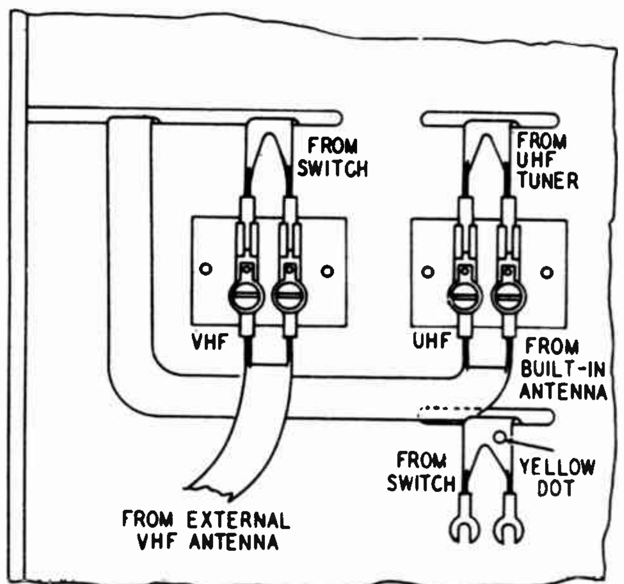
TP2-3174-1

Figure 53. Antenna-Lead Connections, Separate External Antennas



TP2-3171-1

Figure 54. Antenna-Lead Connections, VHF Built-In and UHF External Antennas



TP2-3173-1

Figure 55. Antenna-Lead Connections, VHF External and UHF Built-In Antennas

PARTS LIST

IMPORTANT

General replacement items commonly stocked by the serviceman are omitted from this parts list. All condensers are molded-bakelite Philco condensers, with a 600-volt rating, and all resistors are ½ watt, unless otherwise indicated. Parts are listed according to chassis type, and should be ordered in this way rather than by model number. A list of miscellaneous parts is given at the end of the parts list for each chassis type. All parts are symbolized in the schematic diagram and base layout, for identification purposes.

NOTE: Part numbers identified by an asterisk (*) are general replacement items. These numbers may not be identical with those on factory parts. Also, the electrical values of some replacement items may differ from the values indicated in the schematic diagram and parts list. The values substituted in any case are so chosen that the operation will be unchanged. When ordering replacements, use only the "Service Part No."

DEFLECTION CHASSIS D-191

SECTION 1—POWER SUPPLY

Reference Symbol	Description	Service Part No.
C100 and C101	Condensers, electrolytic filter, 120 µf., 150v	30-2568-51
C103	Condenser, electrolytic filter, 80 µf., 300v	30-2584-35
CR100 and CR101	Rectifiers, selenium, 350 ma.	34-8003-16
F100	Fuse, line, 1.6 amperes	45-2656-23
F101	Fuse, heater protective link	Piece of No. 26 wire
J100	Socket, a-c line	27-6240-3
J101	Socket, chassis connecting	27-6274-1
PL100	Plug, chassis, a-c line	Part of a-c line cord ass'y. (see Misc. "A")
PL101	Plug and cable ass'y., chassis connecting	(See Misc. "B")
R100	Resistor, current limiting, 5 ohms, 10 watts	33-3448-5
R102	Resistor, voltage dropping, 4.7 ohms, 1 watt	66-9474340
S100	Switch, off-on	Part of R414
T100	Transformer, filament	32-8590

SECTION 7—VERTICAL SWEEP

Reference Symbol	Description	Service Part No.
C708	Condenser, electrolytic, 20 µf.	Part of C103
L700 and L701	Coils, vertical deflection	Part of deflection yoke (see Misc. "A")
R704	Potentiometer, VERT. HOLD control, 250,000 ohms	Part of R811
R707	Potentiometer, HEIGHT control, 2.5 megohms	33-5565-32
R708	Potentiometer, VERT. LIN. control, 5 megohms	33-5565-31
R712	Resistor, vertical output decoupling, 2200 ohms, 5 watts	33-1335-97
T700	Transformer, vertical oscillator	32-8431-2
T701	Transformer, vertical output	32-8625

SECTION 8—HORIZONTAL SWEEP

Reference Symbol	Description	Service Part No.
C805	Condenser, plate by-pass, 82 µµf.	60-00825317
C807	Condenser, coupling, 390 µµf.	60-10395417
C808	Condenser, saw-tooth forming, 390 µµf.	60-10395417
C813	Condenser, damping, 68 µµf., 2000v	30-1246-1*
C815A	Condenser, electrolytic, 10 µf., 300v	Part of C103
C815B	Condenser, electrolytic, 20 µf., 475v	Part of C103
J800	Socket, deflection-yoke connector	27-6274-8
L800	Coil, horizontal stabilizing, 30 to 80 mh.	32-4557
L801 and L802	Coils, horizontal deflection	Part of deflection yoke (see Misc. "A")
L803	Coil, r-f choke, damper cathode	32-4112-24
L804	Coil, r-f choke, damper plate	32-4112-24
L805	Coil, r-f choke, horizontal-output plate	Part of T800
R810	Potentiometer, HORIZ. OSC. FREQ. control, 250,000 ohms	33-5565-17
PL800	Plug and cable ass'y., deflection	
	(17" picture tube)	41-4086-18
	(21" picture tube)	41-4086-25
R812	Resistor, feedback coupling, 39,000 ohms, 1 watt	66-3394340
R811	Potentiometer, HORIZ. HOLD control, 50,000 ohms	33-5563-50
R818	Resistor, screen-supply divider, 5000 ohms, 5 watts	33-1335-101
R816	Potentiometer, WIDTH control, 12,500 ohms, 2 watts	33-5546-41
R819	Resistor, screen-supply divider, 82,000 ohms, 1 watt	66-3824340
R820	Resistor, B plus boost, filter, 47,000 ohms, 1 watt	66-3474340
R822	Resistor, feedback coupling, 39,000 ohms, 1 watt	66-3394340
T800	Transformer, horizontal output	32-8624

DEFLECTION CHASSIS D-191 (Cont.)

MISCELLANEOUS "A"

Description	Service Part No.
Arm and magnet ass'y., picture tube	76-6594
Beam bender	76-6077-2
Cable assembly, volume control	41-4136-3
Cable and plug ass'y., deflection (17" picture tube)	41-4086-18
Cable and plug ass'y., deflection (21" picture tube)	41-4086-25
Cable, high voltage	AD-2631
Cord, a-c line	41-3865
Deflection-yoke ass'y.	32-9648
Focus ass'y., p.m.	76-6126-4
Insulator, electrolytic condenser mtg.	27-9508-1
Shield, h.v. corona	56-9684
Socket, damper (6AX4GT)	27-6174-7
Socket, high-voltage rectifier (1B3GT)	27-6290-1
Socket, horizontal oscillator (12AU7)	76-6115-1
Socket, horizontal output (6BQ6GT)	27-6174
Socket, horizontal phase comparer (6AL5)	27-6203-12
Socket, vertical oscillator-phase splitter (12AU7)	27-6203-16
Socket, vertical output (12B4)	76-6115-2
Spring, high-voltage cable	28-9137

R-F CHASSIS R-191

SECTION 2—VIDEO I.F.

Reference Symbol	Description	Service Part No.
C200	Condenser, trimmer, 1—5 $\mu\mu$f.	31-6520-9
C201	Condenser, trap, 5 $\mu\mu$f.	30-1224-28
C202	Condenser, 1st i-f tuning, 1—5 $\mu\mu$f.	31-6520-9
C204	Condenser, cathode by-pass, 470 $\mu\mu$f.	30-1225-18
C205	Condenser, a-g-c decoupling, 470 $\mu\mu$f.	30-1225-18
C206	Condenser, 1st i-f plate tuning, 1—5 $\mu\mu$f.	31-6520-9
C209	Condenser, electrolytic	30-2584-33
C209A	Condenser, filter, 40 μf., 300v	Part of C209
C209B	Condenser, decoupling, filter, 10 μf., 300v	Part of C209
C210	Condenser, 2nd i-f plate tuning, 1—5 $\mu\mu$f.	31-6520-9
C211	Condenser, screen by-pass, 680 $\mu\mu$f.	62-168001001
C212	Condenser, 3rd i-f plate tuning, 1—5 $\mu\mu$f.	31-6520-9
C213	Condenser, screen by-pass, 560 $\mu\mu$f.	62-156001011
C215	Condenser, detector by-pass, 5 $\mu\mu$f.	30-1224-28
CD200	Crystal, video detector 1N64	34-8022
J200	Socket, video test	27-6273
J201	Socket, tuner to i-f coupling	Part of connector ass'y. (see Misc. "C")
L200 and L201	Coils, tuner coupling	Part of T200
L202	Coil, trap	32-4597-2
L203	Coil, 1st i-f grid	32-4548-12
L204 and L205	Coils, coupling	Part of T201
L206	Coil, filament choke	32-4112-15
L207 and L208	Coils, coupling	Part of T202
L209 and L210	Coils, coupling	Part of T203

SECTION 2—VIDEO I.F. (Cont.)

Reference Symbol	Description	Service Part No.
L211	Coil, series peaking, 10 μh.	32-4422-27
L212	Coil, series peaking, 3 μh.	
L213	Coil, series peaking, 125 μh.	32-4480-8
L214	Coil, video peaking, 250 μh.	32-4480-4
PL201	Plug, tuner link	Part of cable and plug ass'y. (see Misc. "B")
R212	Resistor, voltage dropping, 3300 ohms, 6.2 watts	33-3446-11
T200	Transformer, video i-f input	32-4599-1
T201	Transformer, 1st video i-f plate	32-4598-4
T202	Transformer, 2nd video i-f plate	32-4598
T203	Transformer, 3rd video i-f plate	32-4598-2

SECTION 3—VIDEO

Reference Symbol	Description	Service Part No.
C302	Condenser, 4.5-mc. trap, 68 $\mu\mu$f.	62-068409001
C303	Condenser, screen by-pass, 330 $\mu\mu$f.	62-133001001
C304	Condenser, by-pass, 100 $\mu\mu$f.	62-110409001
L300	Coil, 4.5-mc. trap	32-4463-2
L301	Coil, series peaking, 250 μh.	32-4480-4
L302	Coil, shunt peaking, 250 μh.	32-4480-4
L303	Coil, variable video peaking, 60—240 μh.	32-4467-18
L304	Coil, series peaking, 40 μh.	
L310	Potentiometer, CONTRAST, 2500 ohms	Part of R315
R311	Resistor, plate load, 3000 ohms, 10 watts	33-1335-121
R313	Resistor, picture-tube grounding, 470,000 ohms, 1 watt	66-4474340
R315	Potentiometer, BRIGHTNESS, 100,000 ohms	33-5563-51

R-F CHASSIS R-191 (Cont.)

SECTION 4—SOUND

Reference Symbol	Description	Service Part No.
C400	Condenser, coupling, 2.2 $\mu\mu$f.	30-1221-6
C401	Condenser, fixed trimmer, 18 $\mu\mu$f.	62-018400021
C404	Condenser, fixed trimmer	Part of Z400
C405	Condenser, fixed trimmer	Part of Z400
C406	Condenser, detector balancing, 150 $\mu\mu$f.	62-115001011
C409	Condenser, r-f by-pass, 330 $\mu\mu$f.	62-133001001
C410	Condenser, filter, 2 μf.	30-2417-7
C413	Condenser, plate by-pass, 6800 $\mu\mu$f., 1000v	30-4650-91
I400	Pilot light	34-2068
J400	Socket, volume control	27-6273
J401	Socket, speaker	27-4785-22
L400	Coil, audio take-off	32-4463-9
L401, L402, and L403	Coils, ratio detector	Part of Z400
L404	Coils, ratio detector	32-4112-15
L405	Filter choke, 1 henry, 39 ohms	32-8617
PL400	Plug, volume control	(Part of cable and plug ass'y. (see Misc. "A")
PL401	Plug, speaker	Part of speaker cable ass'y. (see cabinet parts)
R400	Resistor, cathode bias, 390 ohms, 1 watt	66-1394340
R402	Resistor, screen dropping, 12,000 ohms, 1 watt	66-3124340*
R407	Resistor, voltage dropping, 18,000 ohms, 2 watts	66-3185340
R413	Resistor, cathode bias, 390 ohms, 1 watt	66-1394340
R414	Potentiometer, VOLUME control, 2 megohms	33-5564-14
T400	Transformer, audio output	32-8629
Z400	Transformer, ratio detector	32-4450-6A

SECTION 6—SYNC

Reference Symbol	Description	Service Part No.
C600	Condenser, by-pass, 220 $\mu\mu$f.	62-122001001
R606	Resistor, voltage divider, 6800 ohms, 1 watt	66-2684340
R607	Resistor, decoupling, 12,000 ohms, 2 watts	66-3125340
R613	Resistor, voltage divider, 1 megohm, ½ watt, ±5%	66-5108240

MISCELLANEOUS "B"

Description	Service Part No.
Cable and plug ass'y., chassis connecting	41-4146-10*
Cable and plug, i.f. to tuner	41-3754-55
Cable and socket ass'y., picture tube	41-3964-19
Cable and socket ass'y., pilot light	27-6233-6*

MISCELLANEOUS "B" (Cont.)

Description	Service Part No.
Insulator, CONTRAST and BRIGHTNESS control	54-8488
Shield, tube (6T8)	56-5629-5
Shield, tube (6CB6)	56-5629FA3
Shield, pilot light	56-9074-2FA3
Socket and base ass'y. (6CB6)	27-6203-14
Socket and base ass'y. (6T8)	27-6203-18
Socket, tube, 7-pin miniature	27-6203
Socket, tube, 7-pin miniature (6AQ5)	27-6294
Socket, tube, 9-pin miniature	27-6203-6*
Socket, tube, octal	27-6174

TV TUNER, PART No. 76-8400

Reference Symbol	Description	Service Part No.
C500 and C501	Condensers, antenna isolating, 470 $\mu\mu$f.	30-1225-18
C502	Condenser, FM trap, 20 $\mu\mu$f.	30-1251-4
C503	Condenser, grid coupling, 39 $\mu\mu$f.	62-039403011
C505	Condenser, a-g-c by-pass, 220 $\mu\mu$f.	62-122001011
C506	Condenser, grid by-pass, 680 $\mu\mu$f.	62-168001011
C507	Condenser, decoupling, .01 μf.	30-1238-6
C508	Condenser, trimmer, r-f plate, .5—3 $\mu\mu$f.	31-6520-3
C509	Condenser, by-pass, 150 $\mu\mu$f.	62-115001011
C510	Condenser, coupling, .68 $\mu\mu$f.	30-1221-11
C511	Condenser, coupling, 15 $\mu\mu$f.	62-015409011
C512	Condenser, trimmer, mixer grid, .5—3 $\mu\mu$f.	31-6520-7
C513	Condenser, oscillator coupling, 2.2 $\mu\mu$f.	30-1221-6
C514	Condenser, grid blocking, 15 $\mu\mu$f.	30-1224-113
C515	Condenser, fixed trimmer, 3.3 $\mu\mu$f.	30-1224-114
C516	Condenser, FINE TUNING, plastic tube	76-6935-1
C517	Condenser, by-pass, 3.3 $\mu\mu$f.	30-1224-58
C518	Condenser, output coupling, 680 $\mu\mu$f.	62-168001021
C519	Condenser, screen by-pass, 680 $\mu\mu$f.	62-168001011
C520	Condenser, filament by-pass, 220 $\mu\mu$f.	62-122001011
C521	Condenser, filament by-pass, 800 $\mu\mu$f.	30-1238-7
C522	Condenser, coupling, 3.9 $\mu\mu$f.	30-1221-14
C523	Condenser, coupling, .82 $\mu\mu$f.	30-1221-10
C524	Condenser, filament by-pass, 220 $\mu\mu$f.	62-122001011
C525	Condenser, by-pass, 800 $\mu\mu$f.	30-1238-7
C527	Condenser, i-f trap, 22 $\mu\mu$f.	Part of L527

R-F CHASSIS R-191 (Cont.)

TV TUNER, PART No. 76-8400 (Cont.)

Reference Symbol	Description	Service Part No.
J500	Socket, tuner link	Part of Connector ass'y., tuner to i-f (see Misc. "C")
L500, L501, L502, and L503	Coils, tapered line	32-4432-3
L504	Coil, FM trap	32-4550-3
L505 to L511 incl.	Coils, antenna tuning	Part of WS500A
L512	Coil, r-f coupling	312-5145-22
L513 to L519 incl.	Coils, r-f plate tuning	Part of WS500B
L520 to L526 incl.	Coils, mixer grid tuning	Part of WS500C
L527	Coil, i-f trap	32-4552-1
L528	Coil, mixer plate	312-5151-10
L530	Coil, filament choke	32-4550-1
L531	Coil, filament choke	32-4550-11
L532 to L538 incl.	Coils, oscillator tuning	Part of WS500D
PL500	Plug, tuner link	Part of Cable and Plug ass'y. (see Misc. "C")
R508	Resistor, oscillator feed, 33,000 ohms	66-3334340
R510	Resistor, mixer plate feed, 10,000 ohms, 1 watt	66-3104540
WS500A(F) and WS500A(R)	Switch, wafer, antenna	76-8410
WS500B(F) and WS500B(R)	Switch, wafer, r-f plate	76-8409
WS500C(F) and WS500C(R)	Switch, wafer, mixer grid	76-8408
WS500D(F) and WS500D(R)	Switch, wafer, oscillator	76-8407
Z500	Tapered line ass'y.	76-8417

MISCELLANEOUS "C"

Description	Service Part No.
Cam and shaft, fine tuning	76-6936-3
Cable and plug, tuner to i-f	41-3754-55
Connector ass'y., tuner to i-f	76-8521
Coupling, fine tuning shaft	54-4912-2
Detent, ball	56-8020
"E" Washer, detent (in back of fine tuning cam)	1W60980FA3

MISCELLANEOUS "C" (Cont.)

Description	Service Part No.
Front panel ass'y.	76-8395
Hairpin, plunger grounding	56-9858
Hairpin, plunger-pivot lever-pin	1W42704FA3
Pivot pin, lever	56-9149
Lever, plunger	56-9148
Plunger	56-8034-1
Retaining ring	1W61043
Shaft	76-6914-4
Shaft extension	56-8358
Shield, tube, 9-pin miniature	56-5629-5
Socket, tube, 9-pin miniature	27-6203-21
Spring, shaft	56-8023
Spring, plunger	56-9628
Spring, detent index	56-9158
Terminal panel, antenna	76-5504-2
Washer, detent (in back of fine tuning cam)	56-9351
Washer, fiber, fine tuning plunger	27-4109-13
Washer, spring, plunger lever	56-9157

CONNECTING CABLES, PLUGS, AND SOCKETS

Reference Symbol	Description	Service Part No.
J100	Socket, a-c line	27-6240-3
J101	Socket, chassis connecting	27-6274-1
J200	Socket, video test	27-6273
J400	Socket, volume control	27-6273
J401	Socket, speaker	27-4785-2
J800	Socket, deflection-yoke connector	27-6274-8
PL100	Plug and line cord ass'y.	41-3865
PL101	Plug and cable ass'y., chassis connecting	41-4146-10
PL400	Plug and cable ass'y., volume control	41-4136-3
PL401	**Plug and cable ass'y., speaker	See cabinet parts list
PL800	Plug and cable ass'y., deflection (17" picture tube)	41-4086-18
	(21" picture tube)	41-4086-25
	Cable, high voltage	AD-2631
	Cable and socket ass'y., picture tube	41-3964-19
	Cable and socket ass'y., pilot light	27-6233-103

** NOTE: The length of this cable varies with cabinet and speaker size. For Service Part No. refer to cabinet parts list.

UHF TUNER-ADAPTER UT22, PART No. 43-6703

Reference Symbol	Description	Service Part No.
C1 and C2	Condenser, antenna input, 680 μμf.	Part of panel filter
C3	Condenser, tuning:	
	Shaft and rotor ass'y.	76-7481-4
C3A	Stator, r-f, l.h.	56-9595
C3B	Stator, r-f, r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator ass'y., oscillator	76-7479
C3F	Stator ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f.	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f.	76-7472
C7	Condenser, mixer tank, 30 μμf.	Part of board ass'y., mixer
C8	Condenser, temperature compensating, .4 μμf.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 2.5 μμf.	Part of tank ass'y., osc.
C11	Condenser, by-pass	Part of tank ass'y., osc.
C12	Condenser, grid by-pass, 500 μμf.	30-1245-3
C13	Condenser, feedback, 1.0 μμf.	30-1238-2
C14	Condenser, heater by-pass, 500 μμf.	30-1245-3
C15	Condenser, plate by-pass, 500 μμf.	30-1245-3
C16	Condenser, input coupling, 8 μμf.	30-1224-46
C17	Condenser, neutralizing, 680 μμf.	62-168001001
C18	Condenser, decoupling, 680 μμf.	62-168001001
C19	Condenser, cathode by-pass, 680 μμf.	62-168001001
C20	Condenser, filament by-pass, 470 μμf.	62-147001011
C21	Condenser, cathode tuning, 680 μμf.	62-168001001
C22	Condenser, grid by-pass, 680 μμf.	62-168001001
C23	Condenser, plate tuning, 1—5 μμf.	31-6520-10
C26	Condenser, grid by-pass, .01 μf.	30-1238-2
C27	Condenser, decoupling, 680 μμf.	62-168001001
C28	Condenser, output coupling, 680 μμf.	62-168001001
C29 and C30	Condenser, antenna input, 100 μμf.	30-1225-13
C31	Condenser, grid tuning, 1—5 μμf.	31-6520-10
CD1	Crystal detector, mixer circuit	34-8026
I1 and I3	Lamps, pilot, UHF	34-2068
I2	Lamp, pilot, VHF	34-2068
L1	Inductor, r-f, l.h.	Part of C3A-Stator

UHF TUNER-ADAPTER UT22, PART No. 43-6703

Reference Symbol	Description	Service Part No.
L2	Inductor, r-f, r.h.	Part of C3B-Stator
L3	Inductor, r-f, l.h.	Part of C3C-Stator
L4	Inductor, r-f, r.h.	Part of C3D-Stator
L5 and L6	Inductors, crystal mixer	Part of board ass'y., mixer
L7 and L8	Inductors, oscillator coupling	Part of board ass'y., mixer
L9 and L10	Inductors, oscillator	Part of board ass'y., osc.
L11 and L12	Inductors, oscillator	76-7627
L13	Choke, heater decoupling	32-4556-3
L14	Choke, heater-cathode decoupling	32-4556-4
L15	Choke, plate decoupling	32-4556-2
L16	Coil, input tuning, primary	32-4597-7
L17	Coil, input tuning, secondary	32-4597-9
L18	Coil, neutralizing	32-4597-4
L19	Choke, cathode tuning	32-4597-5
L22	Choke, plate decoupling	32-4556-2
L23 and L24	Coils, i-f trap	Part of panel filter
R2	Resistor, damping, 220 ohms	66-1228340
R3	Resistor, decoupling, 6800 ohms	66-2688340
R4	Resistor, decoupling, 220 ohms	Part of L13
R5	Resistor, decoupling, 10,000 ohms	Part of L15
R6	Resistor, cathode bias, 1000 ohms	66-2104240
R7	Resistor, cathode bias, 68 ohms	66-0688340
R8 and R9	Resistor, antenna input, 470,000 ohms	Part of panel filter
R10	Resistor, grid loading, 8200 ohms	66-2828340
R11	Resistor, pilot light, 3.9 ohms	66-9398340
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
R13	Resistor, a-g-c decoupling, 10,000 ohms	66-3108340
R14	Resistor, bias divider, 1.5 megohms	66-5158340
R15	Resistor, damping, 10 ohms	66-0108340
R16	Resistor, damping, 470 ohms	66-1478340
R17	Resistor, plate load, 3300 ohms	66-2338340
R18 and R19	Resistor, tuner disabling, 150,000 ohms	66-4158340
R20	Resistor, bias divider, 1.5 megohms	66-5158340
R21	Resistor, pilot light, 10 ohms	66-0108340
	Board ass'y., mixer	76-7475-4
	Board ass'y., oscillator	76-7480
	Panel, filter	76-8078
	Tank ass'y., oscillator	76-7627

Reference Symbol	Description	Service Part No.
C1 and C2	Condenser, antenna input, 680 $\mu\mu$f.	Part of panel filter
C3	Condenser, tuning:	
	Shaft and rotor ass'y.	76-7481-4
C3A	Stator, r-f, l.h.	56-9595
C3B	Stator, r-f, r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator ass'y., oscillator	76-7479
C3F	Stator ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f.	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f.	76-7472
C7	Condenser, mixer tank, 30 $\mu\mu$f.	Part of board ass'y., mixer
C8	Condenser, temperature compensating, .4 $\mu\mu$f.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 2.5 $\mu\mu$f.	Part of tank ass'y., osc.
C11	Condenser, by-pass	Part of tank ass'y., osc.
C12	Condenser, grid by-pass, 500 $\mu\mu$f.	30-1245-3
C13	Condenser, feedback, 1.0 $\mu\mu$f.	30-1238-2
C14	Condenser, heater by-pass, 500 $\mu\mu$f.	30-1245-3
C15	Condenser, plate by-pass, 500 $\mu\mu$f.	30-1245-3
C16	Condenser, input coupling, 8 $\mu\mu$f.	30-1224-46
C17	Condenser, neutralizing, 680 $\mu\mu$f.	62-168001001
C18	Condenser, decoupling, 680 $\mu\mu$f.	62-168001001
C19	Condenser, cathode by-pass, 680 $\mu\mu$f.	62-168001001
C20	Condenser, filament by-pass, 470 $\mu\mu$f.	62-147001011
C21	Condenser, cathode tuning, 680 $\mu\mu$f.	62-168001001
C22	Condenser, grid by-pass, 680 $\mu\mu$f.	62-168001001
C23	Condenser, plate tuning, 1—5 $\mu\mu$f.	31-6520-10
C26	Condenser, grid by-pass, .01 μf.	30-1238-2
C27	Condenser, decoupling, 680 $\mu\mu$f.	62-168001001
C28	Condenser, output coupling, 680 $\mu\mu$f.	62-168001001
C29 and C30	Condenser, antenna input, 100 $\mu\mu$f.	30-1225-13
C31	Condenser, grid tuning, 1—5 $\mu\mu$f.	31-6520-10
CD1	Crystal detector, mixer circuit	34-8026
I1 and I3	Lamps, pilot, UHF	34-2068
I2	Lamp, pilot, VHF	34-2068
L1	Inductor, r-f, l.h.	Part of C3A-Stator

Reference Symbol	Description	Service Part No.
L2	Inductor, r-f, r.h.	Part of C3B-Stator
L3	Inductor, r-f, l.h.	Part of C3C-Stator
L4	Inductor, r-f, r.h.	Part of C3D-Stator
L5 and L6	Inductors, crystal mixer	Part of board ass'y., mixer
L7 and L8	Inductors, oscillator coupling	Part of board ass'y., mixer
L9 and L10	Inductors, oscillator	Part of board ass'y., osc.
L11 and L12	Inductors, oscillator	76-7627
L13	Choke, heater decoupling	32-4556-3
L14	Choke, heater-cathode decoupling	32-4556-4
L15	Choke, plate decoupling	32-4556-2
L16	Coil, input tuning, primary	32-4597-7
L17	Coil, input tuning, secondary	32-4597-9
L18	Coil, neutralizing	32-4597-4
L19	Choke, cathode tuning	32-4597-5
L22	Choke, plate decoupling	32-4556-2
L23 and L24	Coils, i-f trap	Part of panel filter
R2	Resistor, damping, 220 ohms	66-1228340
R3	Resistor, decoupling, 6800 ohms	66-2688340
R4	Resistor, decoupling, 220 ohms	Part of L13
R5	Resistor, decoupling, 10,000 ohms	Part of L15
R6	Resistor, cathode bias, 1000 ohms	66-2104240
R7	Resistor, cathode bias, 68 ohms	66-0688340
R8 and R9	Resistor, antenna input, 470,000 ohms	Part of panel filter
R10	Resistor, grid loading, 8200 ohms	66-2828340
R11	Resistor, pilot light, 3.9 ohms	66-9398340
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
R13	Resistor, a-g-c decoupling, 10,000 ohms	66-3108340
R14	Resistor, bias divider, 1.5 megohms	66-5158340
R15	Resistor, damping, 10 ohms	66-0108340
R16	Resistor, damping, 470 ohms	66-1478340
R17	Resistor, plate load, 3300 ohms	66-2338340
R18 and R19	Resistor, tuner disabling, 150,000 ohms	66-4158340
R20	Resistor, bias divider, 1.5 megohms	66-5158340
R21	Resistor, pilot light, 10 ohms	66-0108340
	Board ass'y., mixer	76-7475-4
	Board ass'y., oscillator	76-7480
	Panel, filter	76-8078
	Tank ass'y., oscillator	76-7627

UHF TUNER-ADAPTER UT21B, PART NO. 43-6592 FOR RECEIVERS USING R-F CHASSIS 81 OR 84

UHF Tuner-Adapter UT21B, Part No. 43-6592, provides for the reception of UHF signals on television channels 14 through 83. It is designed for installation in Philco Television Receiver models that have a model number beginning with "A-T," and use r-f chassis 81 or 84. The adapter consists of a UHF converter and preamplifier unit, a change-over switch, adapter cables and plugs, a planetary tuner driving assembly, and mounting hardware.

CIRCUIT DESCRIPTION

The UHF Tuner-Adapter functions as a converter, and converts the signals of the UHF band to a frequency selected within the VHF band. The frequency selected is that of either Channel 2 or Channel 3, depending upon the locality in which the receiver is used.

The incoming UHF signal is coupled through the antenna input line, and through two 680-$\mu\mu$f. condensers and a 150-ohm transmission line to the antenna tank of the tuner. See figure 1. The antenna tank is coupled to the mixer tank by means of the mutual coupling of L2 and L3 and the stray capacitance, C5. The desired signal is selected by tuning the antenna tank and the mixer tank to the proper frequency, and the signal is then coupled to the crystal mixer circuit by means of the mutual coupling of L4 and L5. The local-oscillator signal is generated by a 6AF4 tube, V1, and the associated circuit. The local-oscillator signal is coupled to the crystal mixer circuit by means of a 300-ohm, miniature transmission line and the mutual coupling of L7 to L5 and L8 to L6. The UHF r-f signal and the oscillator signal are mixed in the crystal mixer circuit, producing a radio-frequency signal within range of the VHF tuner when the tuner is set to either Channel 2 or Channel 3. This signal is fed into a preamplifier, which amplifies it, and it is then fed into the VHF tuner through a twin-wire lead. In the VHF tuner, the signal is converted to the intermediate frequency of the television receiver. In VHF operation, a 150,000-ohm resistor is placed in series with the UHF oscillator plate, which makes this oscillator inoperative.

The purpose of using two r-f tanks in the UHF tuner is to readily admit the r-f signals, and, at the same time, prevent the UHF i-f and oscillator signals from feeding back into the antenna and causing interference with other receivers.

CHANGE-OVER SWITCH

The change-over switch supplied with the Tuner-Adapter is used to switch from VHF to UHF, and vice versa. It is installed on the back of the VHF tuner, and is operated by an actuator mounted on the VHF tuner shaft. When the VHF Channel Selector is turned to the position fo- UHF operation, the switch connects the antenna to the UHF tuner, turns off the VHF pilot light, turns on the UHF pointer pilot light, and connects the output of the UHF tuner to the antenna input of the VHF tuner. When the VHF Channel Selector is turned to any VHF position, the switch connects the antenna to the VHF tuner, turns off the UHF pointer pilot light, turns on the VHF pilot light, and places a 150,000-ohm resistor in series with the UHF oscillator plate, as explained above.

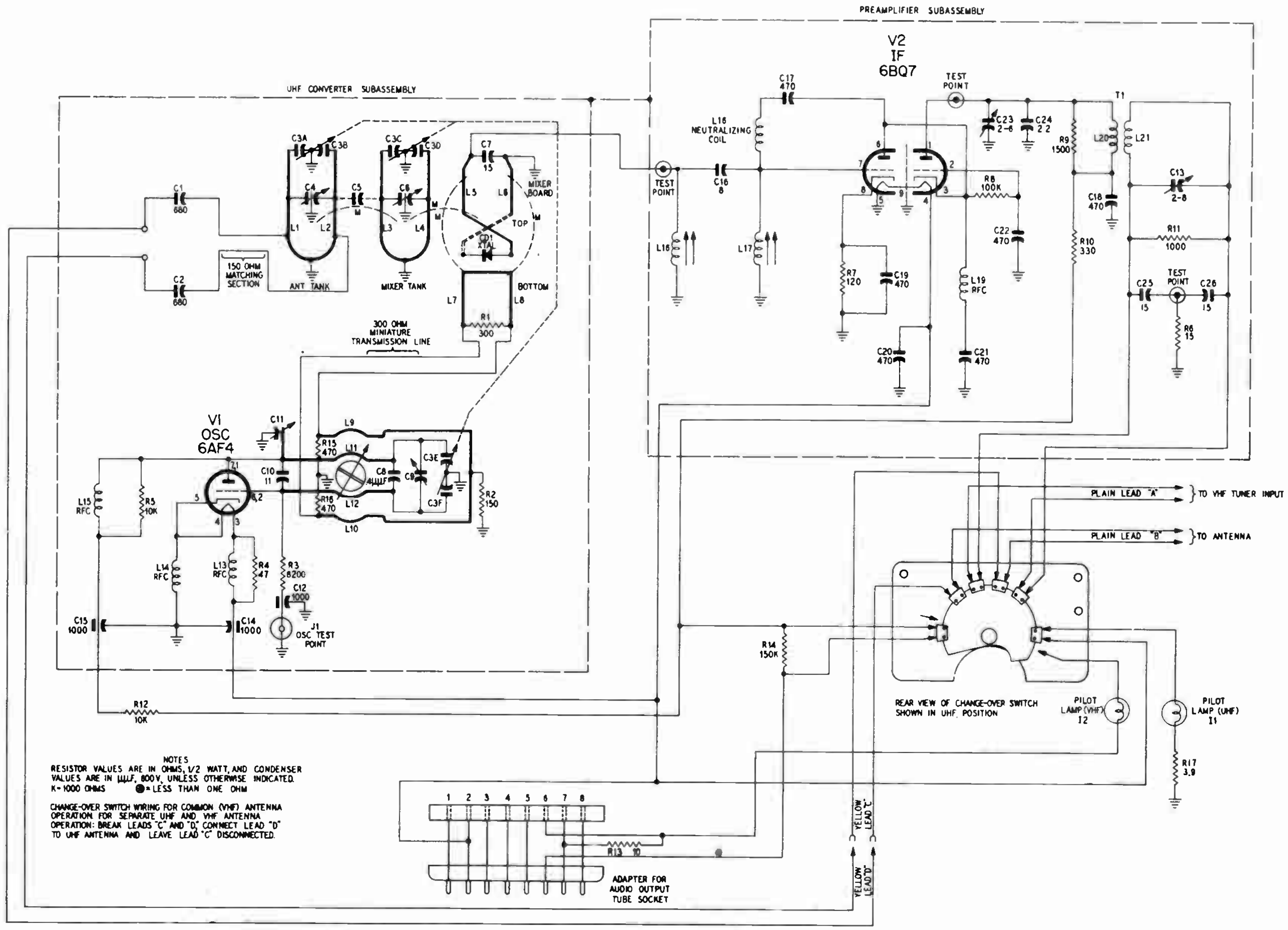


Figure 1. UHF Tuner-Adapter UT21B, Part No. 43-6592, Schematic Diagram

PLANETARY DRIVE

The UHF tuner is tuned by means of a 3-gang tuning condenser, which is driven through a specially designed planetary drive. The planetary drive is so constructed that fine tuning and coarse tuning can be accomplished with a single control knob. The tuning shaft is coupled to the driving shaft through three balls, which form a planetary drive that produces slow rotation for fine tuning. See figure 2. After rotating 180 degrees with the tuning shaft, a pin engages the driving shaft, and the two shafts are direct-coupled, for coarse tuning. To re-engage the planetary drive for fine tuning, it is only necessary to reverse the direction of the rotation. The dial pointer is connected to the tuning gang through a cord drive, and indicates the channel number to which the tuner is tuned.

BEAM-OF-LIGHT POINTER

The beam-of-light pointer consists of a pilot-light-socket assembly, a small light box, a focusing lens, and a mechanical assembly which moves the unit as the tuning shaft is rotated. The lamp, light box, and lens project a beam of light on the dial scale, and the mechanical assembly moves this beam across the scale. The pointer drive cord connects the pointer assembly to the tuning shaft.

ALIGNMENT AND REPAIRS

The frequencies at which the Tuner-Adapter operates are extremely high; therefore, it is necessary that the utmost care be taken to safeguard against upsetting the delicate adjustments of the tuner. It is recommended that the serviceman make only minor repairs to the tuner, such as replacement of the tube or crystal and the wiring of external leads. The Tuner-Adapter should be returned to the factory for alignment and major repairs, unless the serviceman is properly equipped to perform these jobs. In general, a good rule to follow is not to remove the cover of the Tuner-Adapter.

NOTE: Replacing the tube with a new one may detune the tuner. If this occurs, a number of tubes should be tried, until the most satisfactory substitute for the original is found.

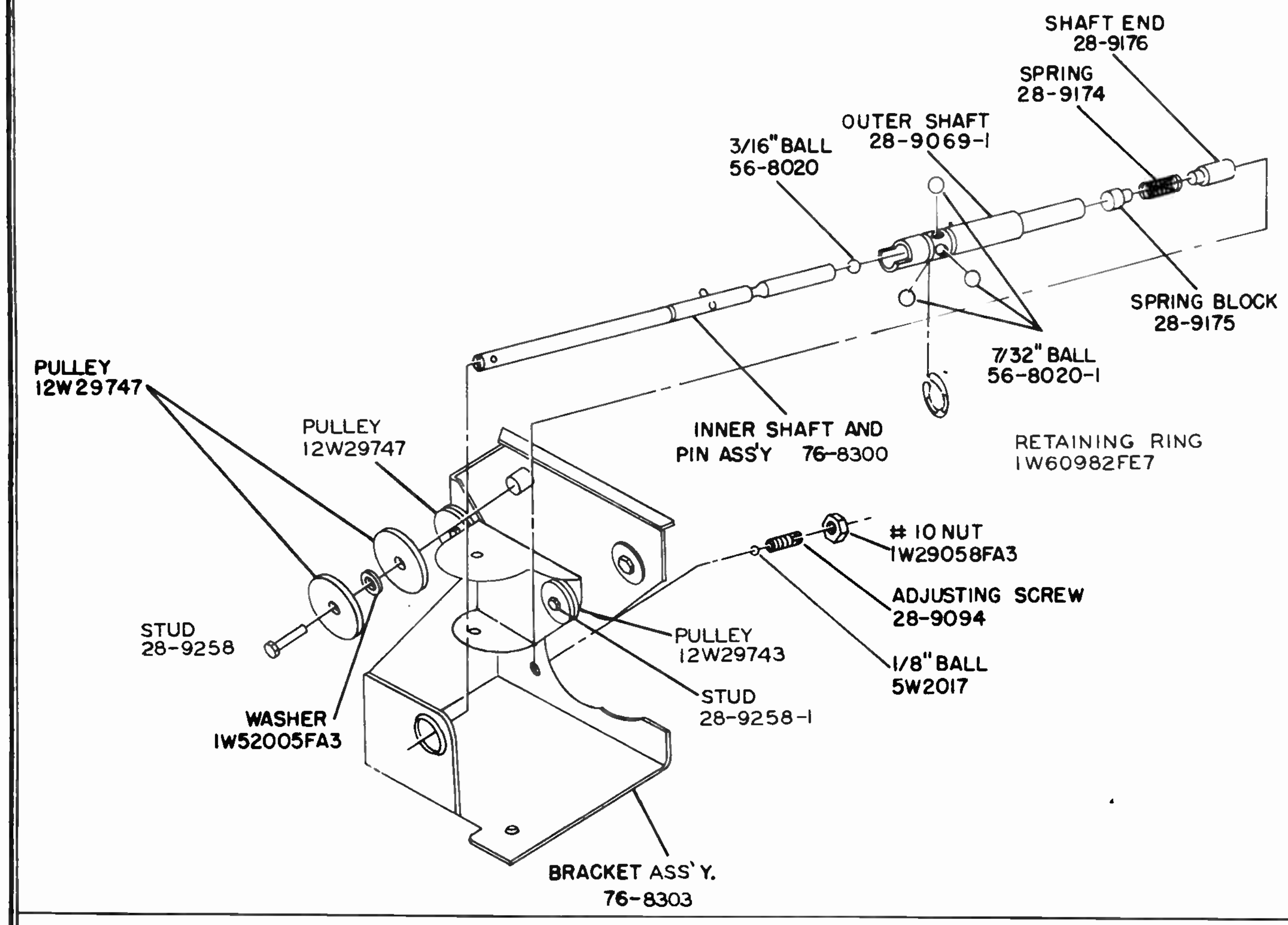


Figure 2. Planetary Drive Assembly, Exploded View, Showing Mechanical Construction (Both Tuner-Adapters)

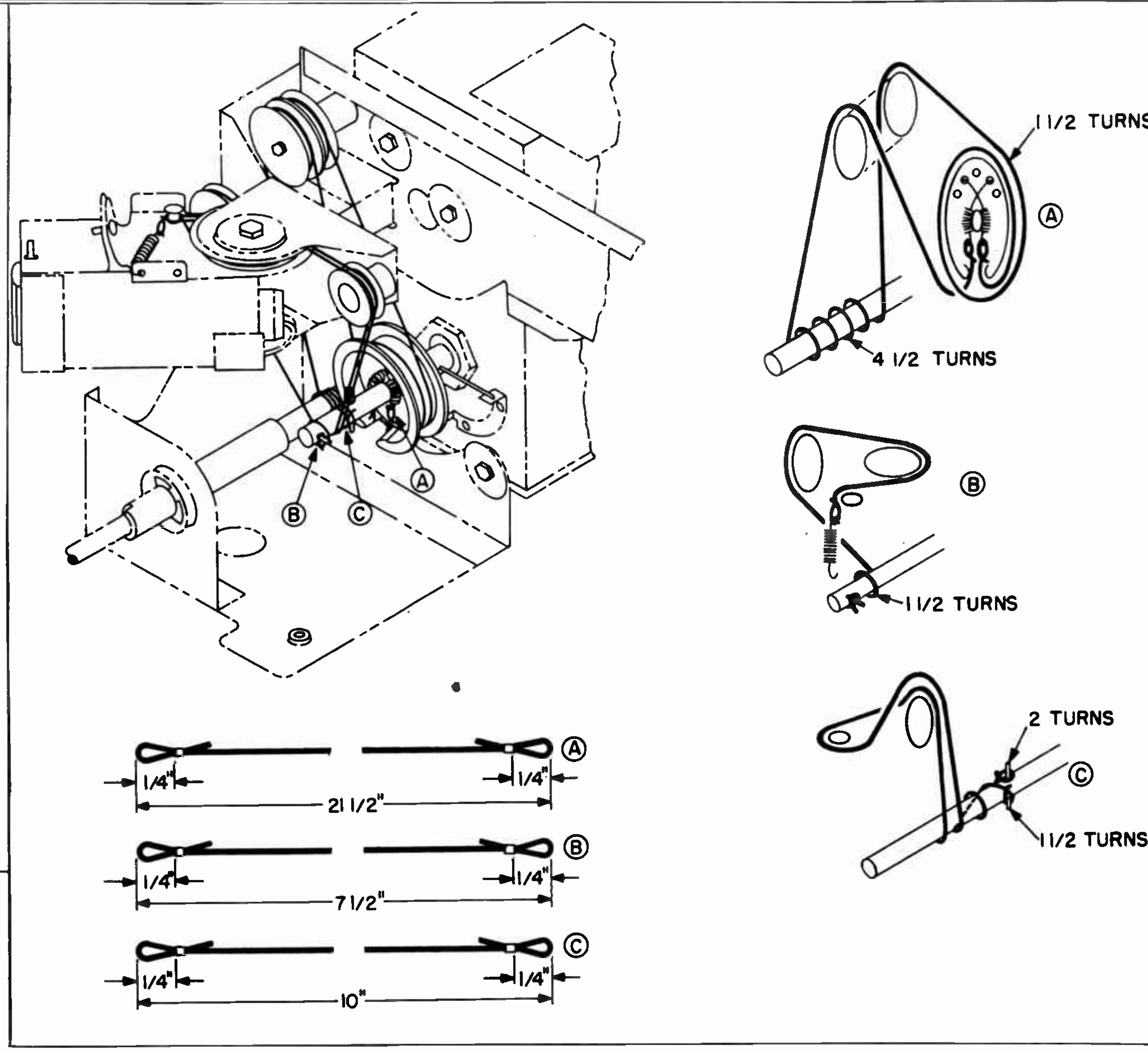


Figure 3. Drive-Cord Stringing Arrangement (Both Tuner-Adapters)

INSTALLATION INSTRUCTIONS

To install the Tuner-Adapter on the r-f chassis, proceed as follows:

1. Remove the cabinet back and r-f chassis from the cabinet. Then remove the nameplate on the control panel by pushing it out from inside the cabinet.

2. Insert the dial scale and bezel assembly into the hole provided in the cabinet. The four studs should be passed through the four holes provided. Fasten the assembly in place with the washers and small palnuts provided.

3. Remove the tuner assembly from the mounting board with which it is was shipped. Keep the screws for mounting the tuner in the cabinet.

4. Place the spacers on the mounting studs, and use the studs to attach the bracket and socket assembly to the rear of the VHF tuner on the r-f chassis, as shown in figure 4.

5. Place the switch-actuator assembly on the shaft extending from the rear of the VHF tuner so that the switch-actuator stud points away from the tuner. See figure 4.

6. Place the switch assembly on the mounting studs, and fasten it in place with the fiber washers, lock washers, and nuts provided. See figure 4.

7. The UHF tuner is designed to convert the UHF signals to the frequency of Channel 2 or Channel 3. If a VHF station is available on Channel 2 in the area where the receiver is to be used, set the switch actuator to operate the switch on Channel 3. If a station is available on Channel 3, set the actuator to throw the switch on Channel 2. Fasten the actuator in place, and check the operation of the actuator stud and the switch, to see that the switch is thrown properly.

8. Remove the bulb and shield from the pilot-light assembly on the r-f chassis, and place them in the empty socket of the UHF tuner assembly. Tape up the old socket of the r-f chassis with the tape provided.

9. Remove the audio output tube (6K6GT in r-f chassis 81, or 6L6GA in r-f chassis 84), plug the octal adapter into the tube socket, and place the tube in the adapter socket. The octal adapter is wired to the switch.

10. Remove the antenna lead from the VHF tuner, and solder the short lead from the UHF-VHF change-over switch to the VHF tuner antenna terminals from which the antenna lead was removed. See figure 4.

11. Fasten the dress lug to the chassis with the screw provided (see figure 5); then dress the leads under the lug.

12. Install the r-f chassis in the cabir t, and insert the pilot-light socket into the pilot-light clip. Fasten the r-f chassis with the original bolts. Place the original knobs on their shafts.

13. Place the UHF tuner in the cabinet, between the r-f and deflection chassis, and fasten the UHF tuner to the chassis shelf with the three screws removed in step 3. It is important that these screws be tightened securely, to hold the UHF tuner in place on the chassis shelf.

14. Plug the 5-pin plug of the UHF tuner into the 5-pin socket on the bracket installed in step 4. Fasten the lead with the clip over the pin located near the 5-pin socket. Dress the leads as shown in figure 5.

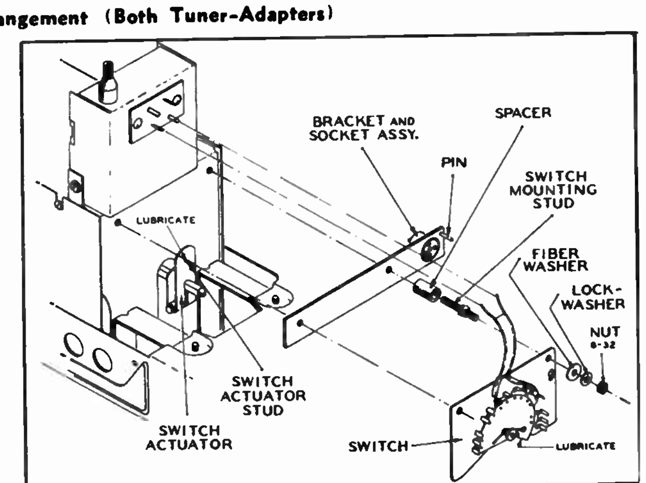


Figure 4. Change-Over Switch Mounting Details (Tuner-Adapter Part No. 43-6592)

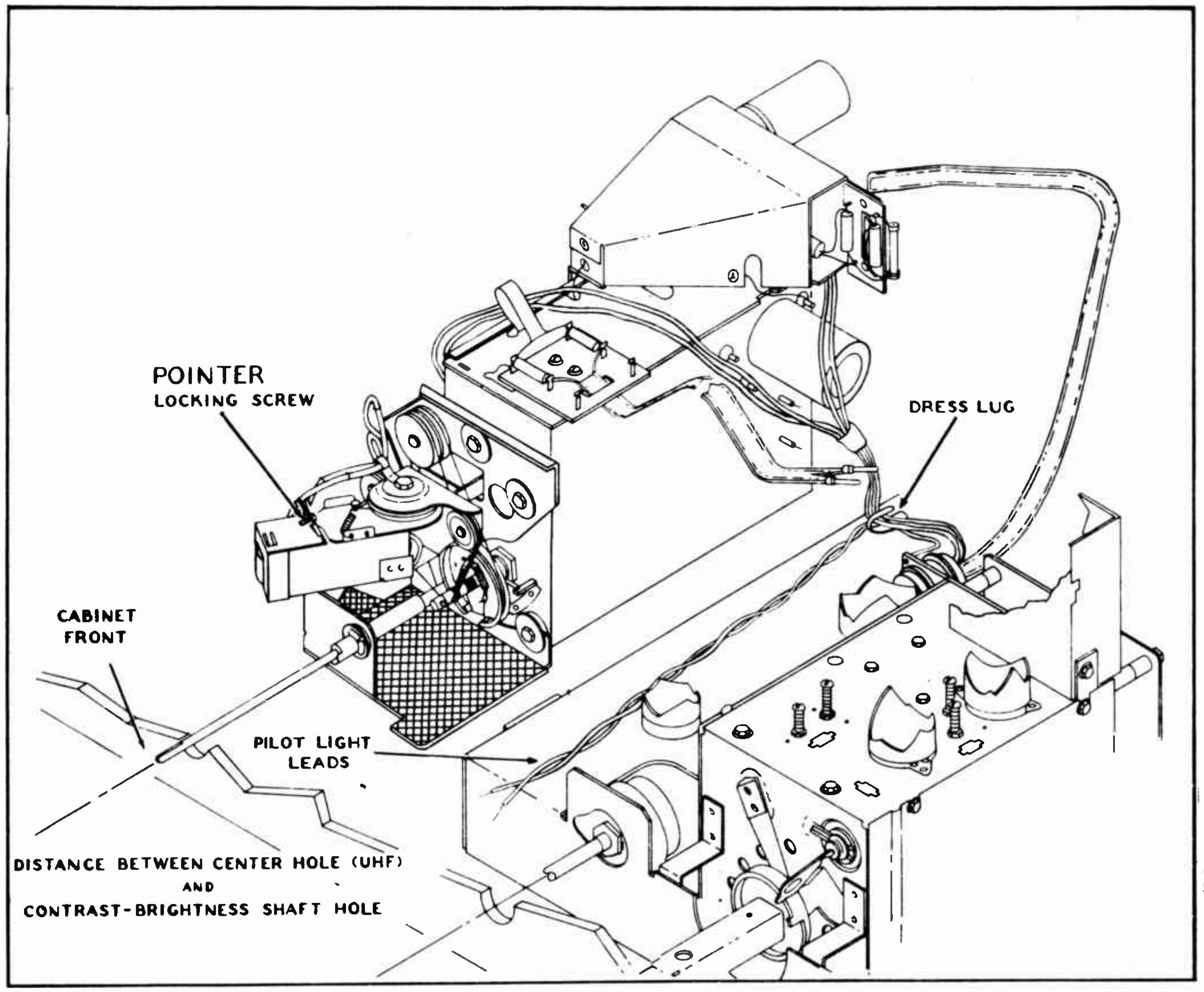


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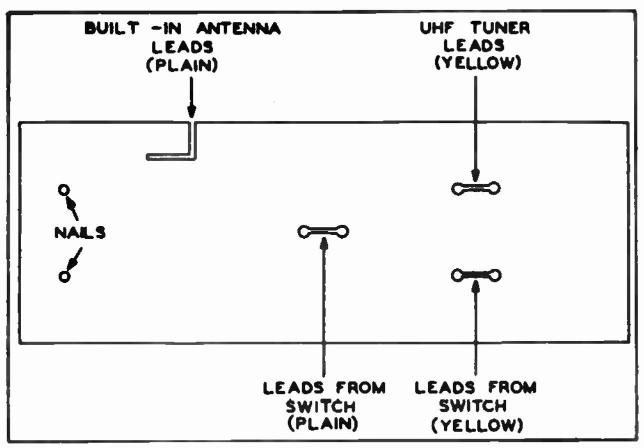
Figure 5. Lead Dress and Tuner Mounting Details (Tuner-Adapter Part No. 43-6592)



TP2-3169

Figure 6. Antenna-Lead Holder (Both Tuner-Adapters)

15. Place the knob provided on the UHF tuner shaft, and set the tuning shaft in the extreme counter-clockwise position. Turn the receiver on, and set the VHF Channel Selector to UHF. From the back of the cabinet, observe the position of the beam-of-light pointer on the back of the scale. If the light beam does not fall on the index mark, turn the receiver off and loosen the locking screw on the pointer. See figure 5. Move the pointer assembly slightly in the required direction. Again turn the receiver on and observe the position of the light-beam pointer. If necessary, repeat the adjustment until the pointer falls on the index mark; then fasten the locking screw.

16. Replace the fishpaper antenna-lead holder with the new holder provided. Fasten the new holder with the two nails provided, and then pass the twin-wire leads through the holes as indicated in figure 6.

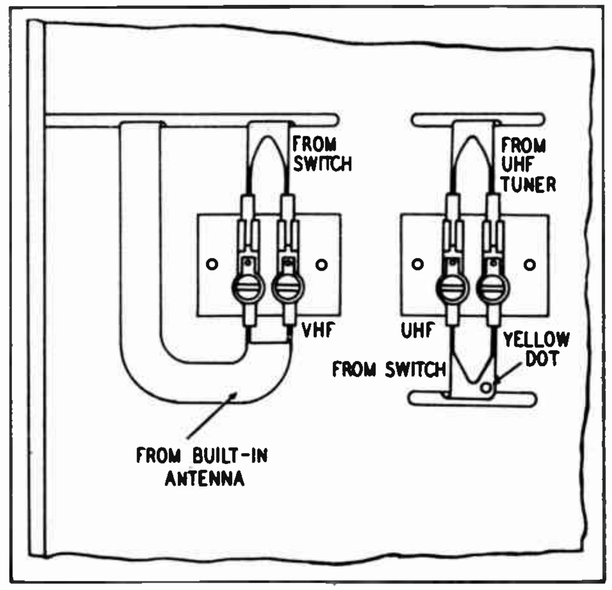


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Figure 7. Antenna-Lead Connections, Common Built-in Antenna (Both Tuner-Adapters)

17. Fasten the antenna terminal board provided as shown in figures 7 through 11. Replace the cabinet back, and make the connections illustrated for the type of antenna installation being used.

18. Paste the label provided over the outside-antenna instructions on the cabinet back.

REPLACING AND ADJUSTING BEAM-OF-LIGHT POINTER PILOT LAMP

When the beam-of-light pointer pilot lamp is replaced, or if the assembly is disturbed, the pointer assembly must be refocused. To refocus the assembly, follow the procedure given under the above heading in the section on UHF Tuner-Adapter UT20A, Part No. 43-6591.

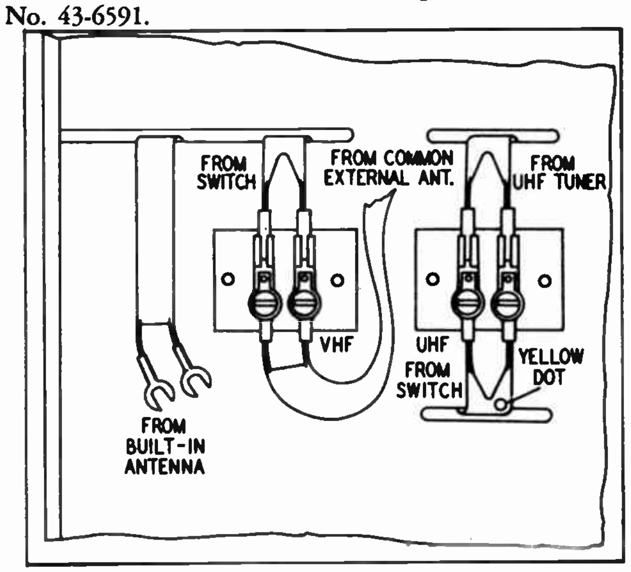

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Figure 8. Antenna-Lead Connections, Common External Antenna (Both Tuner-Adapters)

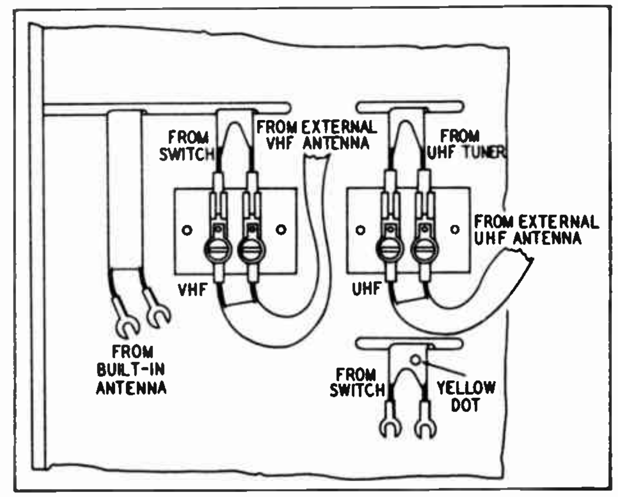

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Figure 9. Antenna-Lead Connections, Separate External Antennas (Both Tuner-Adapters)

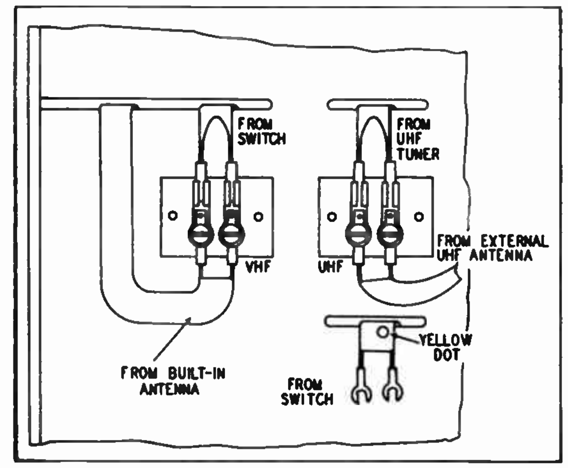

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Figure 10. Antenna-Lead Connections, VHF Built-In and UHF External Antennas (Both Tuner-Adapters)

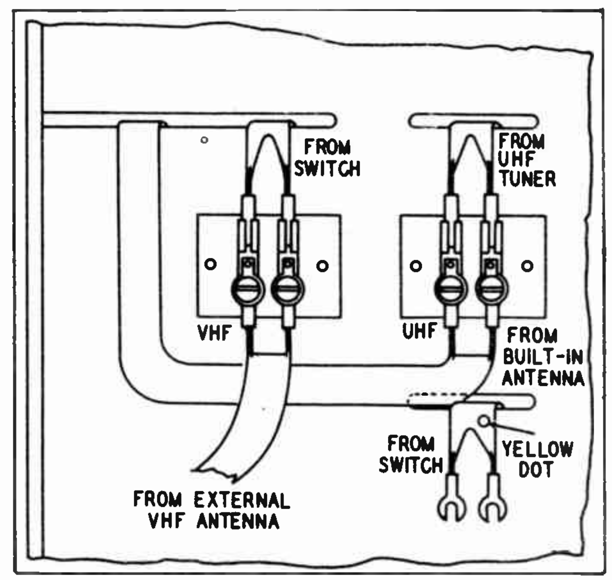

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Figure 11. Antenna-Lead Connections, VHF External and UHF Built-In Antennas (Both Tuner-Adapters)

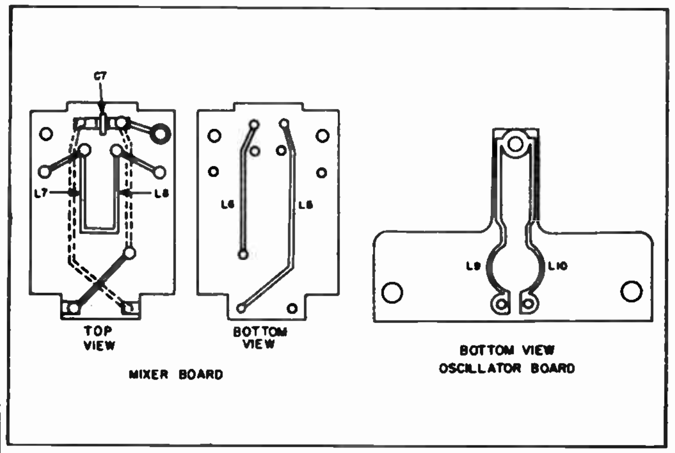

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Figure 12. Oscillator and Mixer Board Layouts (Both Tuner-Adapters)

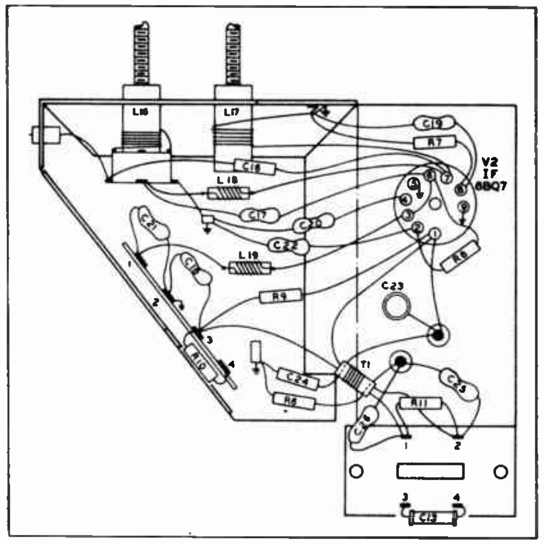

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Figure 13. Base View of Tuner-Adapter UT21B, Part No. 43-6592, Preamplifier Assembly

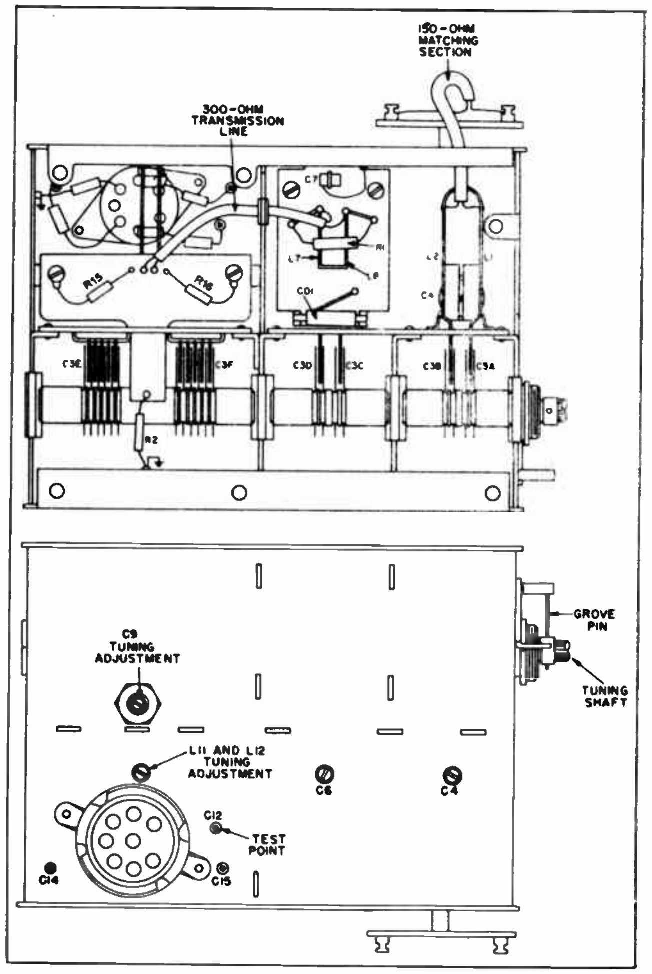

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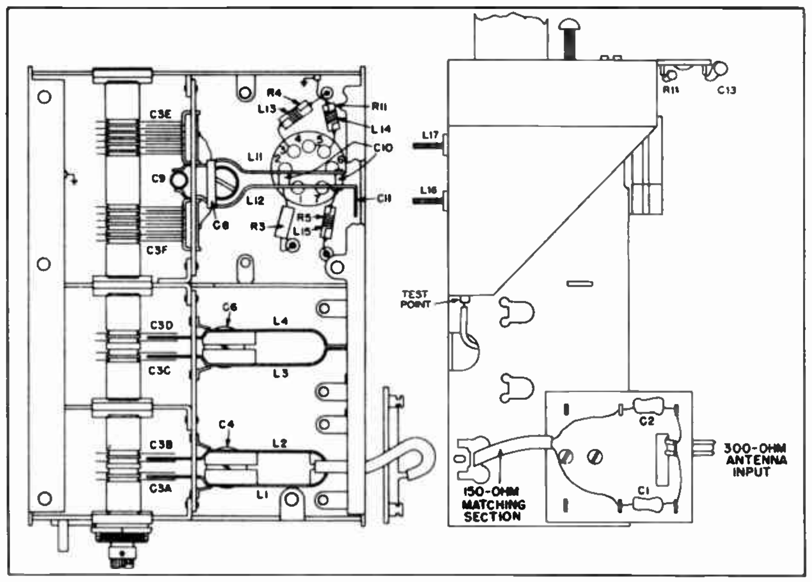
Figure 15. Top View and Base View of Tuner-Adapter UT21B, Part No. 43-6592, With Board Assemblies



TP2-3181

Figure 14. Side View and Base View of Tuner-Adapter UT21B, Part No. 43-6592, Without Board Assemblies

UHF TUNER-ADAPTER UT20A, PART NO. 43-6591, FOR RECEIVERS USING R-F CHASSIS 91A, 94A, OR 97

UHF Tuner-Adapter UT20A, Part No. 43-6591, provides for the reception of UHF signals on television channels 14 through 83. It is designed for installation in Philco High-Fidelity Television Receivers using r-f chassis 91A or 94A. The Tuner-Adapter may also be used in receivers using r-f chassis 97, if it is used in conjunction with Extension Kit, Part No. 43-6593.

The Tuner-Adapter consists of a UHF tuner, a change-over switch, adapter cables and plugs, a planetary tuner driving assembly, and mounting hardware.

CIRCUIT DESCRIPTION

The UHF tuner converts the UHF signals to the intermediate frequency of the r-f chassis.

The incoming UHF signal is coupled through the antenna input line, and through two i-f traps, two 680-$\mu\mu$f. condensers, and a 150-ohm transmission line to the antenna tank of the tuner. See figure 16. The antenna tank is coupled to the mixer tank by means of the mutual coupling of L2 and L3 and the stray capacitance, C5. The desired signal is selected by tuning the antenna tank and the mixer tank to the correct frequency, and the signal is then coupled to the crystal mixer circuit by means of the mutual coupling of L4 and L5. The local-oscillator signal is generated by a 6AF4 tube, V1, and the associated circuit. The oscillator signal is coupled to the crystal mixer circuit by a 300-ohm, miniature transmission line and the mutual coupling of L7 to L5 and L8 to L6. The r-f signal and the oscillator signal are mixed in the crystal mixer circuit to produce a 45.75-mc. video-carrier intermediate-frequency signal. This signal is coupled to the VHF tuner through L18, a coaxial cable, and J500 on the VHF tuner. In UHF operation, the local oscillator of the VHF tuner is inoperative, and the r-f amplifier and mixer tubes of the VHF tuner operate as i-f amplifiers.

The two tanks of the UHF tuner, the antenna tank and the mixer tank, are used to prevent the i-f and oscillator signals from feeding back to the antenna and interfering with other receivers. The two tanks pass incoming signals readily, but do not pass the i-f or oscillator signal.

CHANGE-OVER SWITCH

The change-over switch supplied with the Tuner-Adapter is used to switch from VHF to UHF, and vice versa. It is installed on the back of the VHF tuner, and is operated by an actuator mounted on the VHF tuner shaft. When the Channel Selector of the VHF tuner is turned to the UHF position, the change-over switch makes proper connections for UHF operation. In this position, the switch places a 150,000-ohm resistor in series with the VHF mixer plate, which drops the voltage on the plate of the tube. (In the UHF position, the VHF Channel Selector places extra inductances in the VHF r-f and mixer circuits, permitting them to operate as i-f amplifiers, and it also shunts the VHF oscillator grid circuit with a 10-ohm resistor, putting the oscillator out of operation.) The change-over switch also turns off the VHF pilot light, turns on the UHF pointer pilot light, and connects the antenna to the UHF tuner.

When the VHF Channel Selector is turned to any VHF position, the change-over switch places a 150,000-ohm resistor in series with the UHF local-oscillator plate circuit, which drops the voltage applied to the plate, and puts the oscillator out of operation. The switch also turns on the VHF pilot light, turns off the UHF pointer pilot light, and connects the antenna to the VHF tuner.

PLANETARY DRIVE

The UHF tuner is tuned by means of a 3-gang tuning condenser, which is driven through a specially designed planetary drive. The planetary drive is so constructed that fine tuning and coarse tuning can be accomplished with a single control knob. The tuning shaft is coupled to the driving shaft through three balls, which form a planetary drive that produces slow rotation for fine tuning. See figure 2. After rotating 180 degrees with the tuning shaft, a pin engages the driving shaft, and the two shafts are direct-coupled, for coarse tuning. To re-engage the planetary drive for fine tuning, it is only necessary to reverse the direction of rotation. The dial pointer is connected to the tuning gang through a cord drive, and indicates the channel number to which the tuner is tuned.

BEAM-OF-LIGHT POINTER

The beam-of-light pointer consists of a pilot light and socket assembly, a small light box, a focusing lens, and a mechanical assembly which moves the unit as the tuning shaft is rotated. The lamp, light box, and lens project a beam of light on the dial scale, and the mechanical assembly moves this beam across the scale. The pointer drive cord connects the pointer assembly to the tuning shaft.

ALIGNMENT AND REPAIRS

The frequencies at which the Tuner-Adapter operates are extremely high; therefore, it is necessary that the utmost care be taken to safeguard against upsetting the delicate adjustments of the tuner. It is recommended that the serviceman make only minor repairs to the tuner, such as replacement of the tube or crystal and the wiring of external leads. The Tuner-Adapter should be returned to the factory for alignment and major repairs, unless the serviceman is properly equipped to perform these jobs. In general, a good

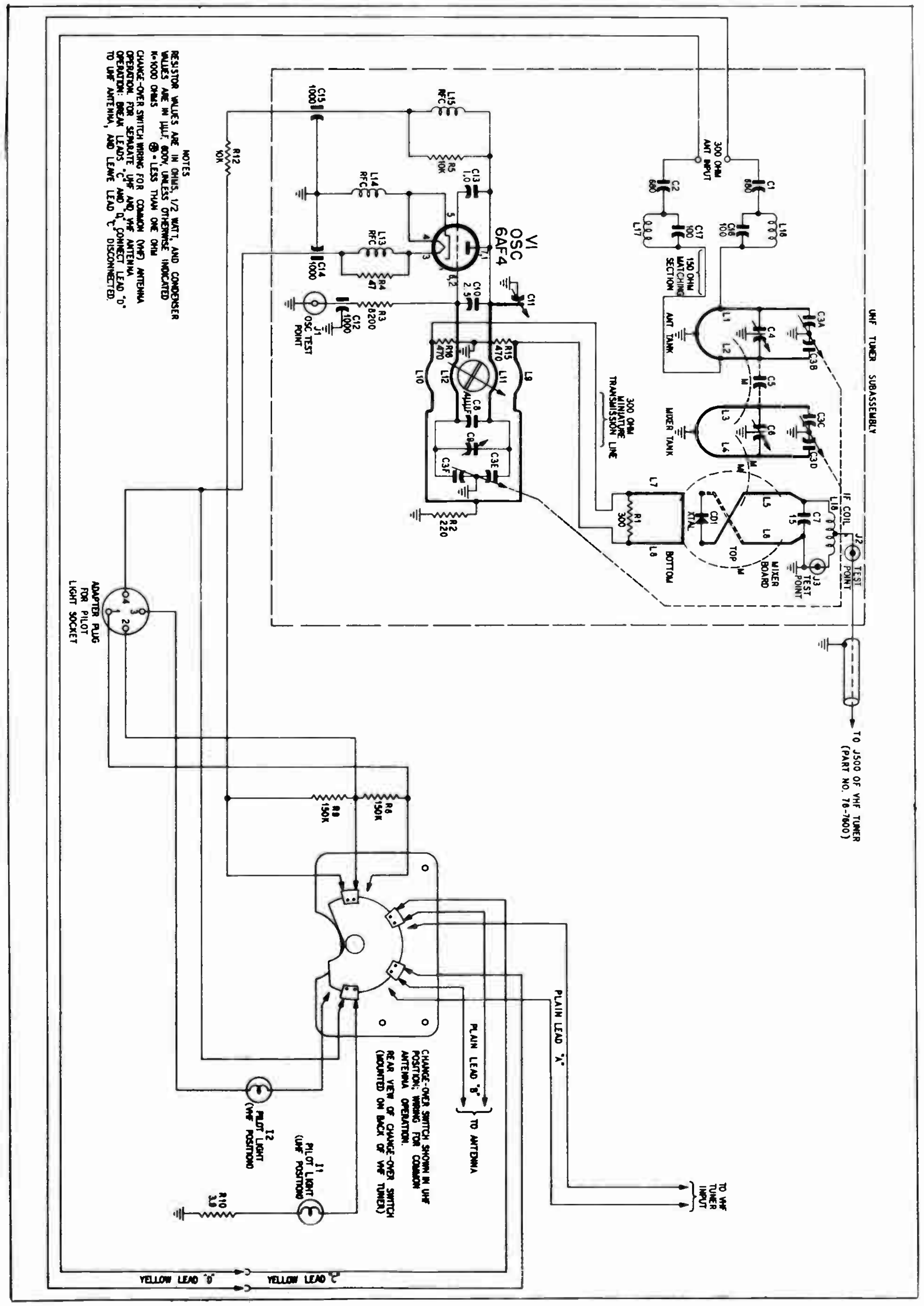


Figure 16. UHF Tuner Adapter UT20A, Part No. 43-6591, Schematic Diagram

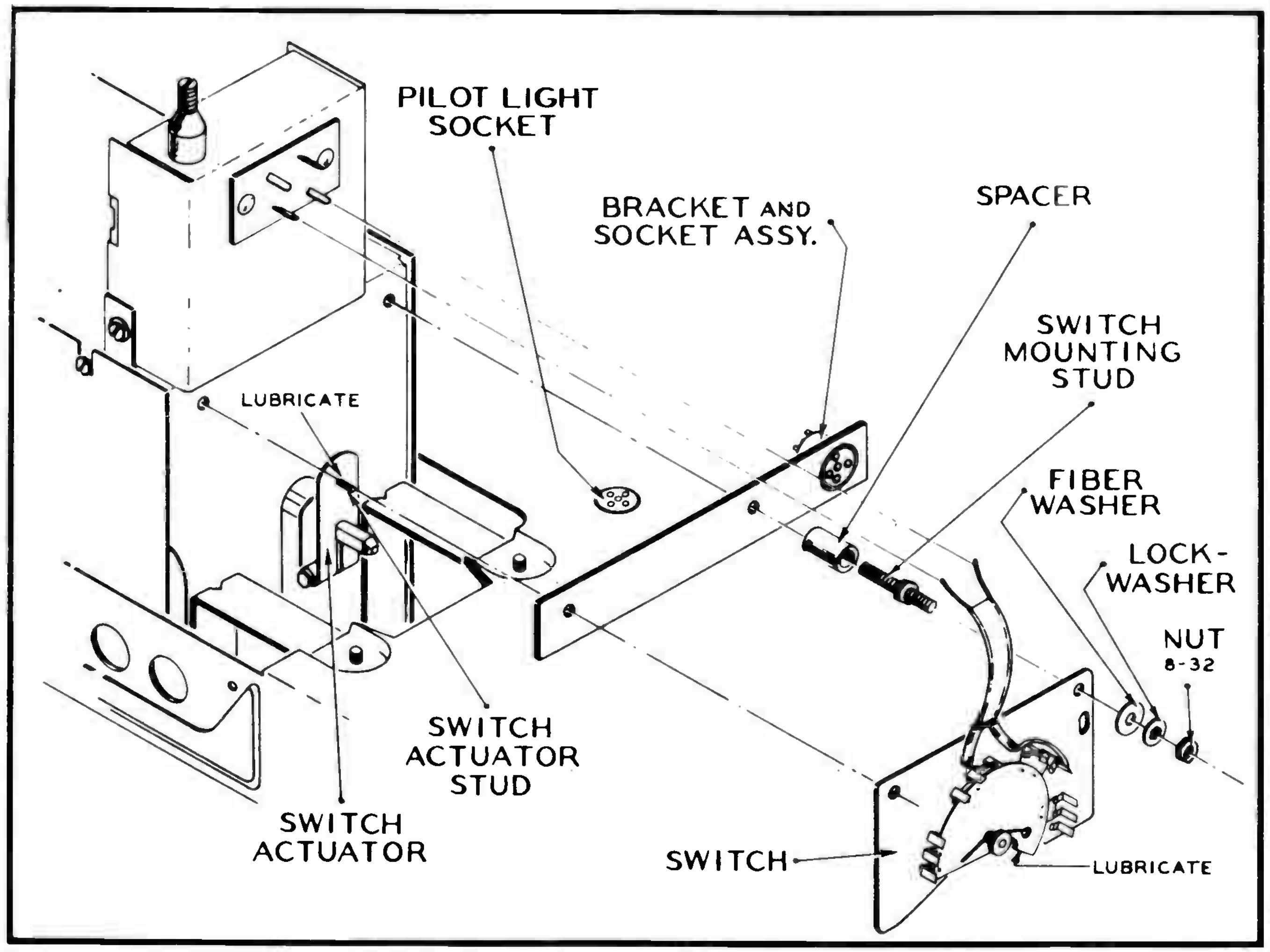


Figure 17. Change-Over Switch Mounting Details (Tuner-Adapter Part No. 43-6591)

rule to follow is not to remove the cover of the Tuner-Adapter.

NOTE: Replacing the tube with a new one may detune the tuner. If this occurs, a number of tubes should be tried, until the most satisfactory substitute for the original is found.

INSTALLATION INSTRUCTIONS

UHF Tuner-Adapter UT20A, Part No. 43-6591, is designed for installation in Philco High Fidelity TV-90 Television Receivers using r-f chassis 91A or 94A; with Extension Kit, Part No. 43-6593, this Tuner-Adapter may also be used in Television Receivers using r-f chassis 97. To install the UHF Tuner-Adapter on the r-f chassis, proceed as follows:

1. Remove the cabinet back and r-f chassis from the cabinet; then remove the nameplate on the control panel by pushing it out from inside the cabinet.

2. Insert the dial scale and bezel assembly into the hole provided in the cabinet. The four studs should be passed through the four holes provided. Fasten the assembly in place with the clips provided.

3. Remove the tuner assembly from the mounting board with which it was shipped. Keep the three screws for mounting the tuner in the cabinet.

4. Place the spacers on the mounting studs, and use the studs to attach the bracket and socket assembly to the rear of the VHF tuner on the r-f chassis. See figure 17.

5. Place the switch-actuator assembly on the shaft extending from the rear of the VHF tuner so that the switch-actuator stud points away from the tuner. See figure 17.

6. Place the switch assembly on the two mounting studs, and fasten it in place with the fiber washers, lock washers, and nuts provided. See figure 17.

7. Put the VHF Channel Selector in the Channel 2 position. Rotate the switch actuator on the tuner shaft until the actuater touches the fiber cam on the changeover switch. Fasten the switch actuator in this position. Rotate the Channel Selector to the UHF position. Check the switch operation, to make sure that the switch is thrown properly. Rotate the Chan-

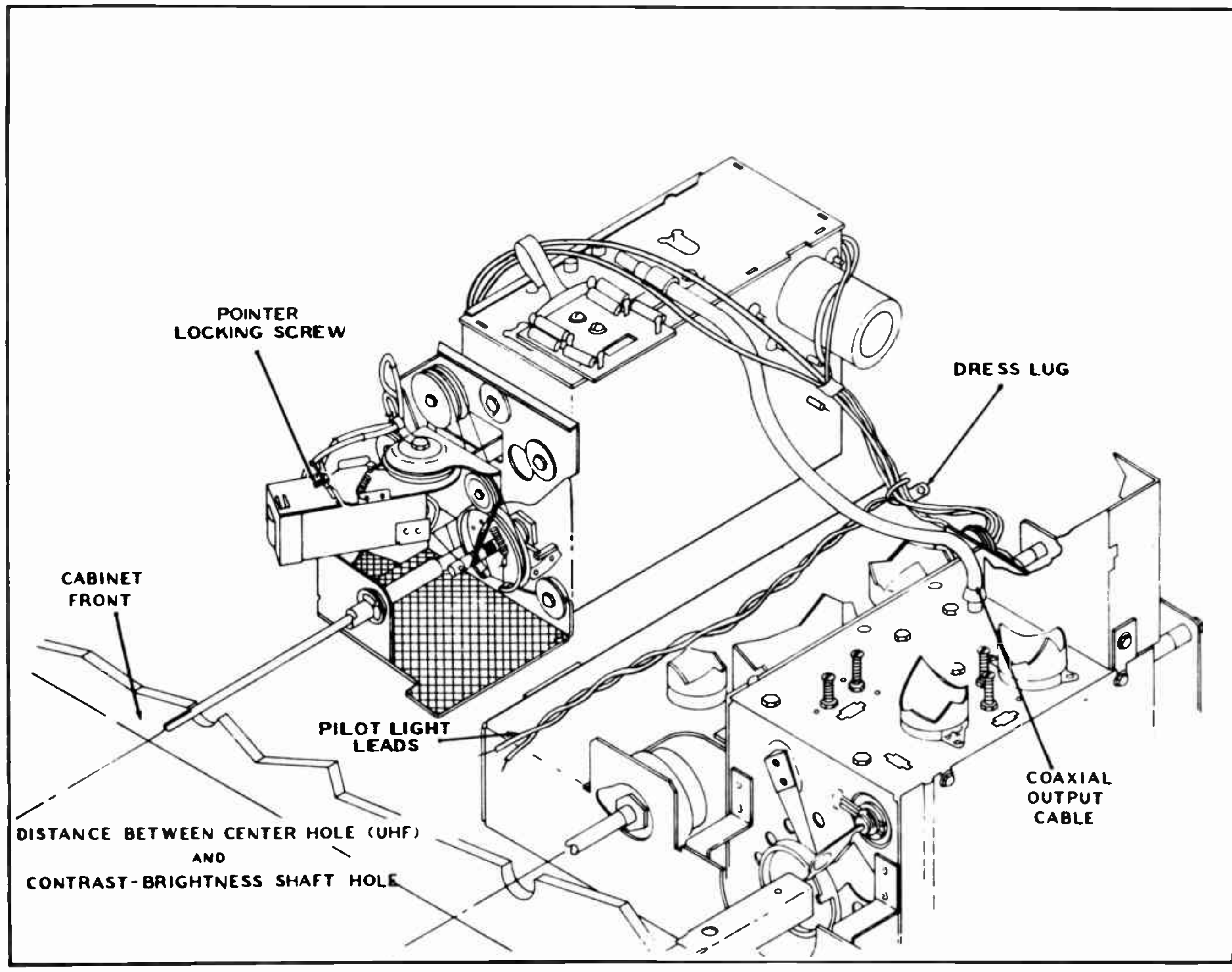


Figure 18. Lead Dress and Tuner Mounting Details (Tuner-Adapter Part No. 43-6591)

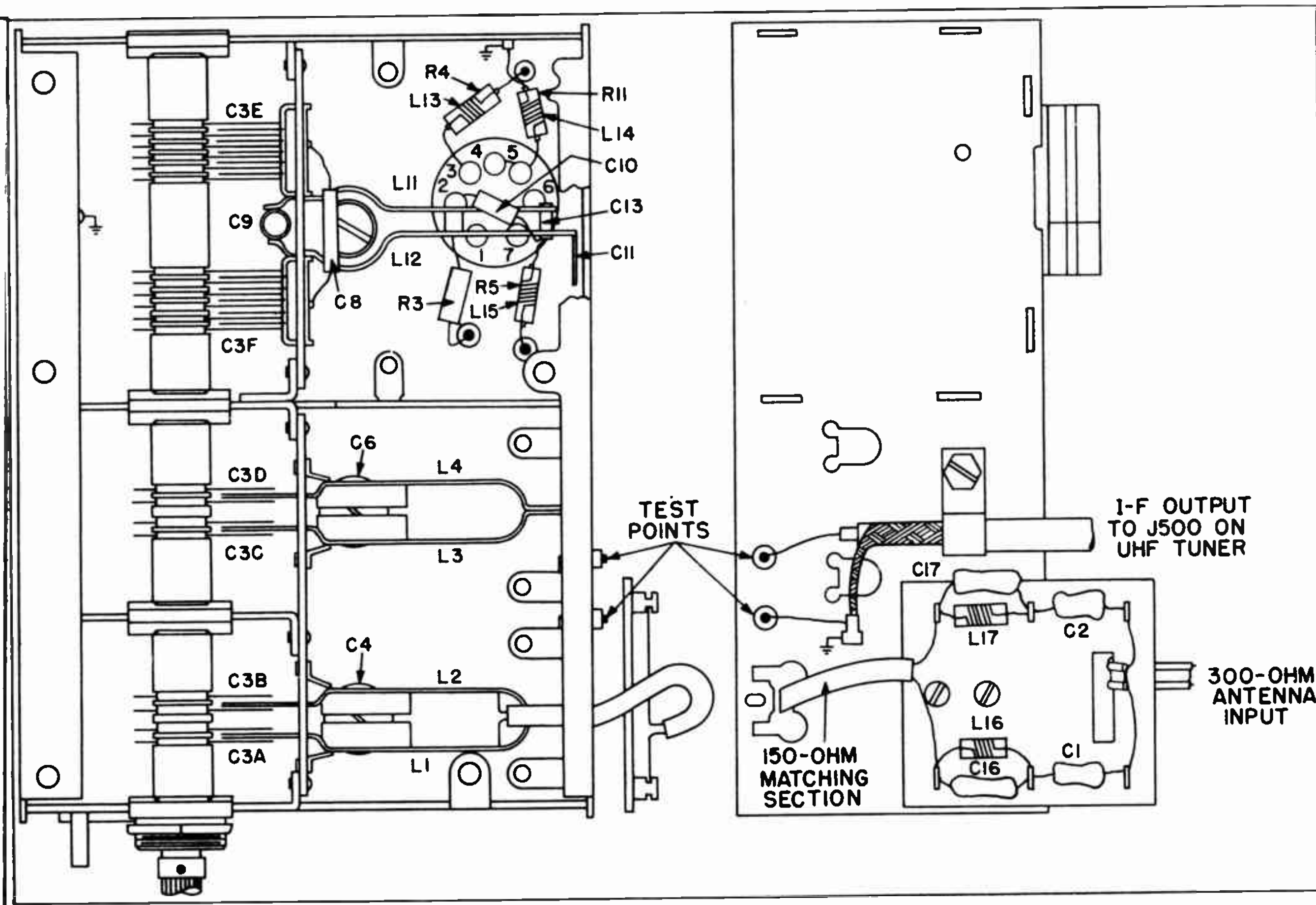


Figure 19. Side View and Base View of Tuner-Adapter UT20A, Part No. 43-6591, Without Board Assemblies

nel Selector to Channel 13 position, and check the switch operation, to make sure that the switch is not thrown in this position. Lubricate the switch-actuator stud and switch cam with cup grease.

8. Remove the bulb and shield from the pilot-light assembly on the r-f chassis, and place them in the pilot-light socket of the UHF tuner assembly. Remove the pilot-light socket and cable assembly from the r-f chassis. (The socket and cable assembly may be discarded, as it is no longer required.) Insert the 4-pin plug from the switch into the 4-pin pilot-light socket on the r-f chassis. See figure 17.

9. Remove the antenna lead from the VHF tuner, and solder the short lead from the UHF-VHF change-over switch to the VHF tuner terminals from which the antenna lead was removed.

10. Install the chassis in the cabinet, and insert the pilot-light socket into the pilot-light clip. Fasten the r-f chassis with the original mounting bolts. Place the original knobs on their shafts.

11. Place the UHF tuner in the cabinet, between the r-f and deflection chassis, and fasten the UHF tuner to the chassis shelf with the three screws removed in step 3. It is important that these screws be tightened securely, to hold the UHF tuner in place on the chassis shelf.

12. Insert the coaxial cable into the jack on the VHF tuner. See figure 18.

13. Insert the 4-pin plug of the UHF tuner into the 4-pin socket on the bracket installed in step 4. Dress the leads as shown in figure 18.

14. Place the knob provided on the UHF tuner shaft, and set the tuning shaft in the counterclockwise position. Turn the receiver on, and, from the back of the cabinet, observe the position of the beam-of-light pointer on the dial scale. If the light beam does not fall on the scale index mark on the back of the scale, turn the receiver off and loosen the locking screw on the pointer. See figure 18. Move the pointer assembly slightly in the required direction. Again turn on the receiver and observe the position of the light-beam pointer. If necessary, repeat the adjustment until the pointer falls on the index mark; then fasten the locking screw.

15. Replace the fishpaper antenna-lead holder with the new holder provided. Fasten the new holder with the two nails provided, and then pass the twin-wire leads through the holes as shown in figure 6.

16. Fasten the antenna terminal board provided as shown in figures 7 through 11. Replace the cabinet back, and make the connections illustrated for the type of antenna installation being used.

17. Paste the label provided over the outside-antenna instructions on the cabinet back.

INSTALLATION INSTRUCTIONS FOR EXTENSION CABLE PART NO. 43-6593

Extension Cable Part No. 43-6593 is designed to provide for installation of UHF Tuner-Adapter UT20A, Part No. 43-6591, in Philco Television Receivers using r-f chassis 97. To install the extension cable with the Tuner-Adapter, follow the instructions supplied with the Tuner-Adapter, except for step 12. Change step 12 to read as follows:

Insert the coaxial cable from the UHF tuner into the jack on the end of the extension cable. Insert the extension cable into the jack on the VHF tuner.

REPLACING AND ADJUSTING BEAM-OF-LIGHT POINTER PILOT LAMP

When the beam-of-light pointer pilot lamp is replaced, or if the assembly is disturbed, the pointer assembly must be refocused. To refocus the assembly, proceed as follows:

1. Remove the pointer locking screw, and remove the pilot light and lens assembly from the tuner by sliding the assembly forward.

2. Disconnect the two wires of the pilot-light socket at the terminal board on the side of the tuner.

3. Remove the cement that holds the pilot-light socket in position; then place the assembly in a focusing jig such as that shown in figure 21. This jig may be constructed from heavy-gauge sheet metal. Connect the two leads from the socket to a 6.3-volt source.

NOTE: If the pilot lamp requires replacement, it must be replaced with one having a straight-wire type of filament. If the filament is of coiled wire, proper focus cannot be obtained.

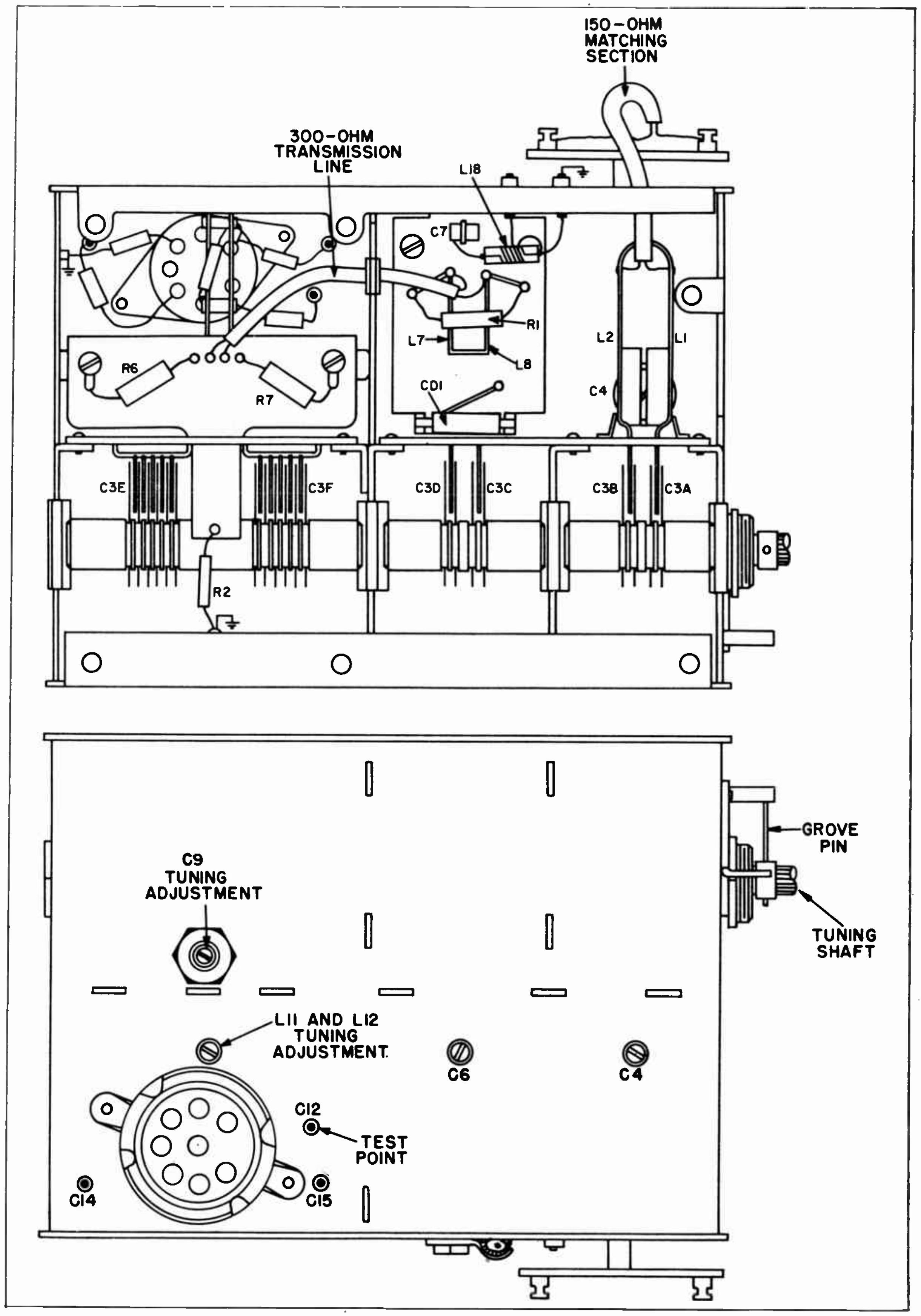


Figure 20. Top View and Base View of Tuner-Adapter UT20A, Part No. 43-6591, With Board Assemblies

PARTS LIST

UHF TUNER-ADAPTER PART NO. 43-6592

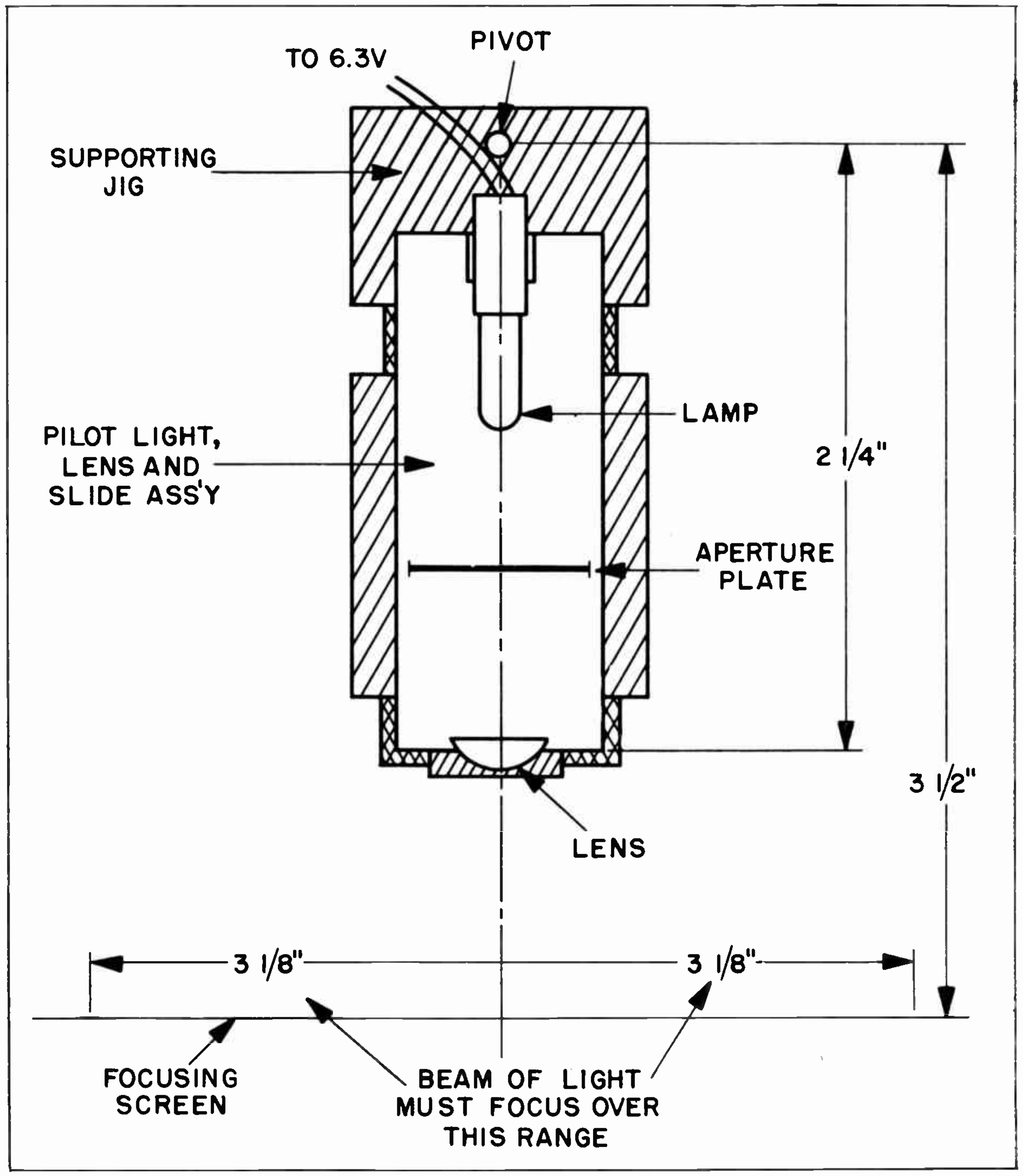
Reference Symbol	Description	Service Part No.
C1 and C2	Condenser, antenna input, 680 $\mu\mu f$.	Part of Panel, filter
C3	Condenser, tuning:	
	Shaft and rotor ass'y.	76-7481-3
C3A	Stator, r-f, l.h.	56-9595
C3B	Stator, r-f, r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator ass'y., oscillator	76-7479
C3F	Stator ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f	76-7472
C7	Condenser, mixer tank, 15 $\mu\mu f$.	Part of Board ass'y., mixer
C8	Condenser, temperature compensating, .4 $\mu\mu f$.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 11 $\mu\mu f$.	Part of Tank ass'y., osc.
C11	Condenser, by-pass	Part of Tank ass'y., osc.
C12	Condenser, grid by-pass, 1000 $\mu\mu f$.	30-1245-1
C13	Condenser, output tuning, 2—8 $\mu\mu f$.	31-6527
C14	Condenser, heater by-pass, 1000 $\mu\mu f$.	30-1245-1
C15	Condenser, plate by-pass, 1000 $\mu\mu f$.	30-1245-1
C16	Condenser, input coupling, 8 $\mu\mu f$.	30-1224-46
C17	Condenser, neutralizing, 470 $\mu\mu f$.	62-147001011
C18	Condenser, decoupling, 470 $\mu\mu f$.	62-147001011
C19	Condenser, cathode by-pass, 470 $\mu\mu f$.	62-147001011
C20	Condenser, filament by-pass, 470 $\mu\mu f$.	62-147001011
C21	Condenser, cathode tuning, 470 $\mu\mu f$.	62-147001011
C22	Condenser, grid by-pass, 470 $\mu\mu f$.	62-147001011
C23	Condenser, plate tuning, 2—6 $\mu\mu f$.	31-6520-4
C24	Condenser, plate tuning, 2.2 $\mu\mu f$.	30-1221-6
C25 and C26	Condenser, output tuning, 15 $\mu\mu f$.	62-015409011
CD1	Crystal detector, mixer circuit	34-8024
I1	Lamp, pilot, UHF	34-2064
I2	Lamp, pilot, VHF	34-2068
L1	Inductor, r-f, l.h.	Part of C3A Stator
L2	Inductor, r-f, r.h.	Part of C3B Stator
L3	Inductor, r-f, l.h.	Part of C3C Stator
L4	Inductor, r-f, r.h.	Part of C3D Stator
L5 and L6	Inductors, crystal mixer	Part of Board ass'y., mixer
L7 and L8	Inductors, oscillator coupling	Part of Board ass'y., mixer
L9 and L10	Inductors, oscillator	Part of Board ass'y., osc.
L11 and L12	Inductors, oscillator	Part of Tank ass'y., osc.
L13	Choke, heater decoupling	32-4556
L14	Choke, heater-cathode decoupling	32-4550-6
L15	Choke, plate decoupling	32-4556-2
L16	Coil, input tuning primary	32-4359-14
L17	Coil, input tuning secondary	32-4578
L18	Coil, neutralizing	32-4551-2
L19	Choke, cathode tuning	32-4548-13
L20	Coil, primary	Part of T1
L21	Coil, secondary	Part of T1
R1	Resistor, damping, 330 ohms	62-1338340
R2	Resistor, damping, 150 ohms	62-1158340
R3	Resistor, decoupling, 8200 ohms	62-2828340
R4	Resistor, decoupling, 47 ohms	Part of L13
R5	Resistor, decoupling, 10,000 ohms	Part of L15
R6	Resistor, parasitic damping, 15 ohms	66-0158340
R7	Resistor, cathode bias, 120 ohms	66-1128340
R8	Resistor, grid leak, 100,000 ohms	66-4108340
R9	Resistor, plate damping, 1500 ohms	66-2158340
R10	Resistor, plate decoupling, 330 ohms	66-1338340
R11	Resistor, output damping, 1000 ohms	66-2108340
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
R13	Resistor, filament dropping, 10 ohms	66-0108340
R14	Resistor, B+ dropping, 150,000 ohms	66-4158340
R15 and R16	Resistor, damping, 470 ohms	66-1478340
R17	Resistor, pilot lamp, 3.9 ohms	66-9898340
T1	Transformer, i-f output	32-4575
	Board ass'y., mixer	76-7475-3
	Board ass'y., oscillator	76-7480
	Panel, filter	76-8078-1
	Tank ass'y., oscillator	76-7473
	Padder ass'y., oscillator	76-7564

MISCELLANEOUS ELECTRICAL PARTS

Description	Service Part No.
Cable ass'y., pilot light	27-6233-50
Padder ass'y. (L11 and L12 tuning adjustment)	76-8193
Panel, antenna, UHF	76-7097
Switch	42-1996-1

MECHANICAL PARTS

Description	Service Part No.
Beam-of-light pointer assembly:	
Housing, lamp	28-9251
Lens	54-8908
Speed nut, pointer assembly	1W56958
Screw, pointer adjusting	1W12492FA3
Pivot, threaded	28-9?76
Planetary assembly:	
Bracket	76-8303
Ball, 1/8"	5W2017
Ball, 3/16"	56-8020
Ball, 7/32"	56-8020-1
Block, spring	28-9175
Ring, retaining	1W60982FE7
Shaft, inner end	28-9176
Shaft, outer	28-9069-1
Shaft and pin ass'y., inner	76-8300
Screw, adjusting	28-9094
Spring	28-9174
Shaft and rotor assembly, mounting:	
Ball, bearing (10)	W2510-5
Bearing, front	56-9593
Bearing, rear	56-9609
Nut, front bearing	56-9594
Nut, rear bearing	56-9599
Nut, insert	W1679-1FA3
Spring, center (2)	56-9590
Spring, end (2)	56-9591
Switch mounting:	
Actuator assembly	76-8189
Collar stud (2)	28-9126-1
Lock washer (2)	1W24515FA1
Nut, #8, special (2)	1W20506FA3
Spacer, 3/8" (2)	1W29158FA?
Washer, fiber (2)	27-4109-29



TP2-3286

Figure 21. Beam-of-Light Pointer Focusing Jig

Description	*Service Part No.*
Dial scale and bezel assembly	76-8293
Grommet, feed-through	27-4707
Knob	76-8293
Pulley (3)	12W29747
Pulley	12W29743
Pulley, tuner shaft	28-9090
Screw (3)	1W32696FA3
Shield, tube, preamplifier	56-5629-5
Shield, tube, oscillator	56-5629-9
Socket, 9-pin miniature	27-6203-21
Spacer (3)	54-8912
Spring, pointer drive	28-9262

Description	*Service Part No.*
Spring, drive cord (2)	28-9088
Stud	28-9258
Stud (2)	28-9258-1
Stud, trimount (6)	W2235-7FA9
Washer	1W52005FA3
Assemblies:	
Tuner, preamplifier, and planetary ass'y.	76-8222-2
Preamplifier assembly	76-8109
Planetary and bracket assembly	76-8302
Top plate and pulley assembly	76-8297
Lamp and lamp slide assembly	76-8299

UHF TUNER-ADAPTER PART NO. 43-6591

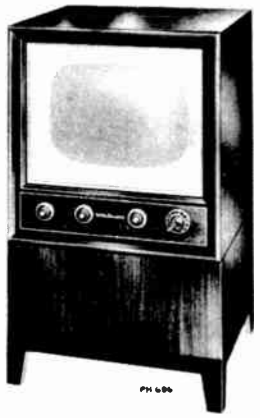
Reference Symbol	*Description*	*Service Part No.*
C1 and C2	Condenser, antenna coupling, 680 $\mu\mu$f.	Part of Panel, filter
C3	Condenser, tuning:	
	Shaft and rotor ass'y.	76-7481-2
C3A	Stator, r-f, l.h.	56-9595
C3B	Stator, r-f, r.h.	56-9595-1
C3C	Stator, r-f, l.h.	56-9595
C3D	Stator, r-f, r.h.	56-9595-1
C3E	Stator, ass'y., oscillator	76-7479
C3F	Stator, ass'y., oscillator	76-7479
C4	Condenser, padder ass'y., r-f	76-7472
C5	Condenser	Stray capacitance
C6	Condenser, padder ass'y., r-f	76-7472
C7	Condenser, crystal, mixer tank, 30 $\mu\mu$f.	Part of Board ass'y.. mixer
C8	Condenser, temperature compensating, .4 $\mu\mu$f.	30-1224-109
C9	Condenser, oscillator trimmer	31-6525
C10	Condenser, oscillator tank, 2.5 $\mu\mu$f.	Part of Tank ass'y., osc.
C11	Condenser, by-pass	Part of Tank ass'y., osc.
C12	Condenser, grid by-pass, 1000 $\mu\mu$f.	30-1245-1
C13	Condenser, temperature compensating, 1.0 $\mu\mu$f.	30-1224-107
C14	Condenser, filament by-pass, 1000 $\mu\mu$f.	30-1245-1
C15	Condenser, plate by-pass, 1000 $\mu\mu$f.	30-1245-1
C16 and C17	Condenser, 45.75-mc. i-f trap	Part of Panel, filter
CD1	Crystal detector	34-8024
I1	Lamp, pilot, UHF	34-2064
I2	Lamp, pilot, VHF	34-2068
L1	Inductor, r-f, l.h.	Part of C3A Stator
L2	Inductor, r-f, r.h.	Part of C3B Stator
L3	Inductor, r-f, l.h.	Part of C3C Stator
L4	Inductor, r-f, r.h.	Part of C3D Stator
L5	Inductor, crystal mixer	Part of Board ass'y., mixer
L6	Inductor, crystal mixer	Part of Board ass'y., mixer
L7	Inductor, oscillator coupling	Part of Board ass'y., mixer
L8	Inductor, oscillator coupling	Part of Board ass'y., mixer
L9	Inductor, oscillator coupling	Part of Board ass'y., osc.
L10	Inductor, oscillator coupling	Part of Board ass'y., osc.
L11	Inductor, oscillator	Part of Tank ass'y., osc.
L12	Inductor, oscillator	Part of Tank ass'y., osc.
L13	Choke, r-f, heater decoupling	32-4556-3
L14	Choke, r-f., cathode decoupling	32-4556-4
L15	Choke, r-f, plate decoupling	32-4556-2
L16 and L17	Coils, 45.75-mc. i-f trap	Part of Panel, filter
L18	Coil, i-f output	32-4558
R1	Resistor, damping, 330 ohms	66-1338340
R2	Resistor, damping, 220 ohms	66-1228340
R3	Resistor, grid decoupling, 8200 ohms	66-2828340
R4	Resistor, filament decoupling, 220 ohms	Part of L13
R5	Resistor, plate decoupling, 10,000 ohms	Part of L15
R6 and R7	Resistor, damping, 470 ohms	66-1478340
R8 and R9	Resistor, B+ dropping, 150,000 ohms	66-4158340
R10	Resistor, filament dropping, 10 ohms	66-0108340
R11	Resistor, cathode decoupling, 1000 ohms	Part of L14
R12	Resistor, B+ dropping, 10,000 ohms, 10 watts	33-1336-58
	Board ass'y., mixer	76-7475-2
	Board ass'y., oscillator	76-7480
	Panel, filter, i-f trap	76-8078
	Tank ass'y., oscillator	76-7627

MISCELLANEOUS ELECTRICAL PARTS

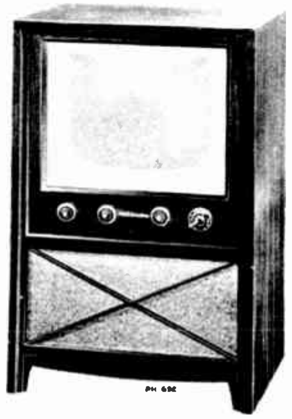
Description	*Service Part No.*
Adapter cable and pilot-light assembly	41-4171-1
Connector, twin-wire lead	54-5181
Padder, osc. (L11 and L12 tuning adjustment)	76-8193
Panel, antenna, UHF	76-7097
Plug, i-f cable	56-2027-3
Switch	42-1096

MECHANICAL PARTS

Tuner-shaft mounting:	
Ball, bearing (10)	W2510-5
Bearing, front	56-9593
Bearing, rear	56-9609
Nut, front bearing	56-9594
Nut, rear bearing	56-9599
Spring center (2)	56-9590
Spring, end (2)	56-9591
Switch mounting:	
Switch-actuator ass'y.	76-8189
Collar stud (2)	28-9126-1
Lock washer (2)	1W24515FA1
Nut, #8, special (2)	1W20506FA3
Spacer, ⅜" (2)	1W29158FA3
Washer, fiber (2)	27-4109-29
Planetary assembly:	
Ball, ⅛"	5W2017
Ball, 3/16"	56-8020
Ball, 7/32" (3)	56-8020-1
Bracket assembly	76-8303
Ring, retaining, shaft	1W60982FE7
Screw, adjusting	28-9094
Shaft, inner end	28-9176
Shaft, outer	28-9069-1
Shaft and pin ass'y., inner	76-8300
Spring	28-9174
Block, spring,	28-9175
Beam-of-light pointer assembly:	
Housing, lamp	28-9251
Lamp and lamp slide assembly	76-8299
Lens, lamp assembly	54-8908
Pivot, threaded	28-9276
Screw, pointer adjusting	1W12492FA3
Dial scale and bezel assembly	76-8293
Grommet, feed through	27-4707
Knob	76-8292
Pulley, tuner shaft	28-9090
Shield, tube	56-5629-9
Spring, drive cord (2)	28-9088
Spring, drive cord	28-9262
Tuner, and planetary ass'y., complete	76-7595-1
Planetary and bracket assembly	76-8302
Pulley (3)	12W29747
Pulley	28-9285
Stud (2)	28-9258-1
Stud	28-9258
Top plate and pulley assembly	76-8297
Screw (3)	1W32696FA3
Spacer (3)	28-8912
Washer	1W52005FA3



Model 17T250DE
"Brett"
Walnut, Mahogany
Shown on Base



Model 17T261DE
"Ainsworth"
Walnut, Mahogany, Blonde

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GENERAL DESCRIPTION

Models 17T250DE and 17T261DE are deluxe "17 inch" television receivers. The receivers are identical except for cabinets, and speakers.

Features of the television unit are: full twelve channel coverage; "totem" r-f amplifier; intercarrier FM sound system; ratio detector; 40 mc picture i-f; improved picture brilliance; pulsed picture A-G-C; A-F-C horizontal hold; stabilized vertical hold; compensated video gain control; noise saturation circuits; improved sync separator and clipper; four mc. band width for picture channel and reduced hazard high voltage supply. An auxiliary audio input jack is provided to permit the use of an external record playing attachment.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE......146 square inches on a 17QP4 Kinescope

TELEVISION R-F FREQUENCY RANGE
All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.
Picture I-F Carrier Frequency....................45.75 mc.
Sound I-F Carrier Frequency...........41.25 mc. and 4.5 mc.

VIDEO RESPONSE...............................To 4 mc.

SWEEP DEFLECTION...........................Magnetic

FOCUS...Magnetic

POWER SUPPLY RATING
KCS74......................115 volts, 60 cycles, 190 watts

AUDIO POWER OUTPUT RATING
KCS74....................................5.0 watts max.

CHASSIS DESIGNATIONS
KCS74 or KCS74M1.......In Models 17T250DE and 17T261DE
*KCS74 (V110-6CL6)-KCS74M1 (V110-6AG7)

LOUDSPEAKERS
Model 17T250DE........(971490-3) 8" PM Dynamic, 3.2 ohms
Model 17T261DE........(92569-12) 12" PM Dynamic, 3.2 ohms

WEIGHT

Model		Shipping Weight	Width Inches	Height Inches	Depth Inches
17T250DE	88 lbs.	105 lbs.	21⅝	22⅝	22¾
17T261DE	102 lbs.	126 lbs.	24	37¼	23¼

RECEIVER ANTENNA INPUT IMPEDANCE
Choice: 300 ohms balanced or 72 ohms unbalanced.

RCA TUBE COMPLEMENT

Tube Used	Function
(1) RCA 6BQ7	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer
(3) RCA 6AU6	1st Picture I-F Amplifier
(4) RCA 6CB6	2nd Picture I-F Amplifier
(5) RCA 6CB6	3rd Picture I-F Amplifier
(6) RCA 6CB6	4th Picture I-F Amplifier
(7) RCA 6CL6 (6AG7)	* Video Amplifier
(8) RCA 6AU6	1st Sound I-F Amplifier
(9) RCA 6AU6	2nd Sound I-F Amplifier
(10) RCA 6AL5	Ratio Detector
(11) RCA 6AV6	1st Audio Amplifier
(12) RCA 6AQ5	Audio Output
(13) RCA 6CB6	AGC Amplifier
(14) RCA 6SN7GT	Sync Separator
(15) RCA 6SN7GT	Vert. Sync Amplifier and Vert. Sweep Osc.
(16) RCA 6AQ5	Vertical Sweep Output
(17) RCA 6SN7GT	Horizontal Sync Amplifier
(18) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(19) RCA 6BQ6GT	Horizontal Sweep Output
(20) RCA 6W4GT	Damper
(21) RCA 1B3-GT/8016	High Voltage Rectifier
(22) RCA 17QP4	Kinescope

*(Refer to Figure 79)

ELECTRICAL AND MECHANICAL SPECIFICATIONS

(Continued)

PICTURE INTERMEDIATE FREQUENCIES
Picture Carrier Frequency........................45.75 mc.
Adjacent Channel Sound Trap...................47.25 mc.
Accompanying Sound Traps.......................41.25 mc.
Adjacent Channel Picture Carrier Trap............39.25 mc.

SOUND INTERMEDIATE FREQUENCIES
Sound Carrier Frequency............41.25 mc. and 4.5 mc.

VIDEO RESPONSE...............................To 4 mc.

FOCUS...Magnetic

SWEEP DEFLECTION............................Magnetic

SCANNING............................Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY...............15,750 cps

VERTICAL SWEEP FREQUENCY....................60 cps

FRAME FREQUENCY (Picture Repetition Rate).........30 cps

OPERATING CONTROLS (Front Panel)
Channel Selector / Fine Tuning ....Dual Control Knobs
Picture / Brightness ....Dual Control Knobs
Picture Horizontal Hold / Picture Vertical Hold ....Dual Control Knobs
Sound Volume and On-Off Switch / Tone Control and Phono Switch ....Dual Control Knobs

NON-OPERATING CONTROLS (not including r-f and i-f adjustments)
Picture Centering....................top chassis adjustment
Width..............................rear chassis adjustment
Height..............................rear chassis adjustment
Horizontal Linearity......rear chassis screwdriver adjustment
Vertical Linearity...................rear chassis adjustment
Horizontal Drive..........rear chassis screwdriver adjustment
Horizontal Oscillator Frequency.......rear chassis adjustment
Horizontal Oscillator Waveform.....bottom chassis adjustment
Horizontal Locking Range............rear chassis adjustment
Focus..............................top chassis adjustment
Ion Trap Magnet.....................top chassis adjustment
Deflection Coil.............top chassis wing nut adjustment
AGC Control........................rear chassis adjustment

HIGH VOLTAGE WARNING

OPERATION OF THIS RECEIVER OUTSIDE THE CABINET OR WITH THE COVERS REMOVED, INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT. DO NOT OPERATE THE RECEIVER WITH THE HIGH VOLTAGE COMPARTMENT SHIELD REMOVED.

KINESCOPE HANDLING PRECAUTIONS

DO NOT REMOVE THE RECEIVER CHASSIS, INSTALL, REMOVE OR HANDLE THE KINESCOPE IN ANY MANNER UNLESS SHATTERPROOF GOGGLES ARE WORN. PEOPLE NOT SO EQUIPPED SHOULD BE KEPT AWAY WHILE HANDLING KINESCOPES. KEEP THE KINESCOPE AWAY FROM THE BODY WHILE HANDLING.

The kinescope bulb encloses a high vacuum and, due to its large surface area, is subjected to considerable air pressure. For this reason, the kinescope must be handled with more care than ordinary receiving tubes.

The large end of the kinescope bulb—particularly that part at the rim of the viewing surface—must not be struck, scratched or subjected to more than moderate pressure at any time. During service if the tube sticks or fails to slip smoothly into its socket, or deflecting yoke, investigate and remove the cause of the trouble. Do not force the tube. Refer to the Receiver Installation section for detailed instructions on kinescope installation. All RCA replacement kinescopes are shipped in special cartons and should be left in the cartons until ready for installation in the receiver.

OPERATING INSTRUCTIONS

The following adjustments are necessary when turning the receiver on for the first time.

1. See that the TV-PH tone switch is in a "TV" position.

2. Turn the receiver "ON" and advance the SOUND VOLUME control to approximately mid-position.

3. Set the STATION SELECTOR to the desired channel.

4. Adjust the FINE TUNING control for best pix and the SOUND VOLUME control for suitable volume.

5. Turn the BRIGHTNESS control fully counter-clockwise, then clockwise until a light pattern appears on the screen.

6. Adjust the VERTICAL hold control until the pattern stops vertical movement.

7. Adjust the HORIZONTAL hold control until a picture is obtained and centered.

8. Adjust the PICTURE and BRIGHTNESS controls for suitable picture contrast and brightness.

9. In switching from one channel to another, it may be necessary to repeat steps 4 and 8.

10. When the set is turned on again after an idle period it should not be necessary to repeat the adjustment if the positions of the controls have not been changed. If any adjustment is necessary, step number 4 is generally sufficient.

11. If the positions of the controls have been changed, it may be necessary to repeat steps 2 through 8.

12. To use a record player, plug the record-player output cable into the PHONO jack on the rear apron, and set the TV-PH tone switch to a "PH" position.

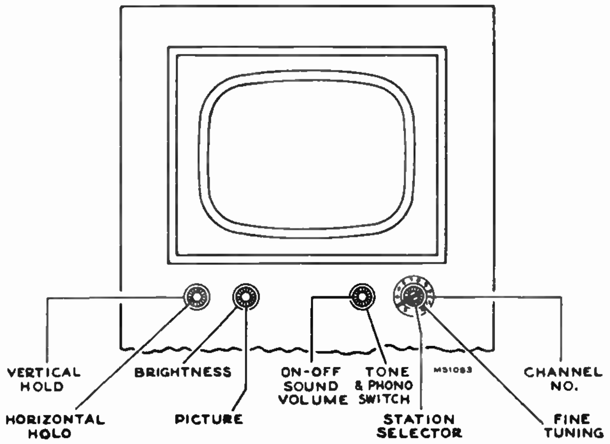


Figure 1—Receiver Operating Controls

INSTALLATION INSTRUCTIONS

UNPACKING.—These receivers are shipped complete in cardboard cartons. The kinescope is shipped in place in the receiver.

Take the receiver out of the carton and remove all packing material.

Make sure that all tubes are in place and are firmly seated in their sockets.

Check to see that the kinescope high voltage lead clip is in place.

Plug a power cord into the 115 volt a-c power source and into the receiver interlock receptacle. Turn the receiver power switch to the "on" position, the brightness control fully clockwise, and the picture control counter-clockwise.

ION TRAP MAGNET ADJUSTMENT. — Set the ion trap magnet approximately in the position shown in Figure 2. Starting from this position immediately adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Turn the focus control (shown in Figure 2) until the line structure of the raster is clearly visible. Readjust the ion trap magnet for maximum raster brilliance. The final touches of this adjustment should be made with the brightness control at the maximum clockwise position with which good line focus can be maintained.

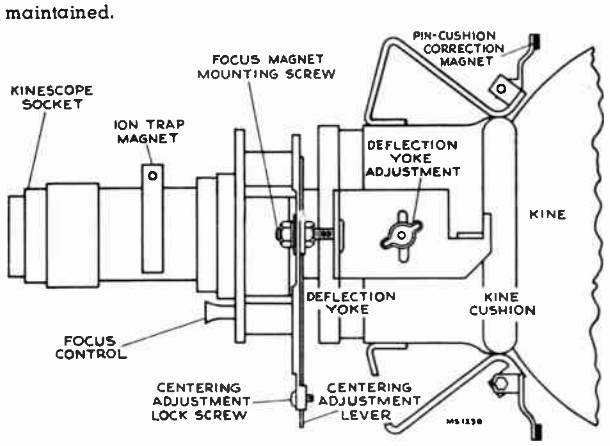


Figure 2—Yoke and Focus Magnet Adjustments

DEFLECTION YOKE ADJUSTMENT. — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

PICTURE ADJUSTMENTS. — It will now be necessary to obtain a test pattern picture in order to make further adjustments. Connect the antenna transmission line to the receiver.

If the Horizontal Oscillator and AGC System are operating properly, it should be possible to sync the picture at this point. However, if the AGC control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading, turn R181 on the rear apron (see Figure 3) counter-clockwise until the set operates normally and the picture can be synced.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT. — Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back. Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 2 or 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. Pull-in should occur before the control has been turned 120 degrees from the extreme counter-clockwise position. The picture should remain in sync for approximately 90 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should remain in sync and should not show a black bar in the picture.

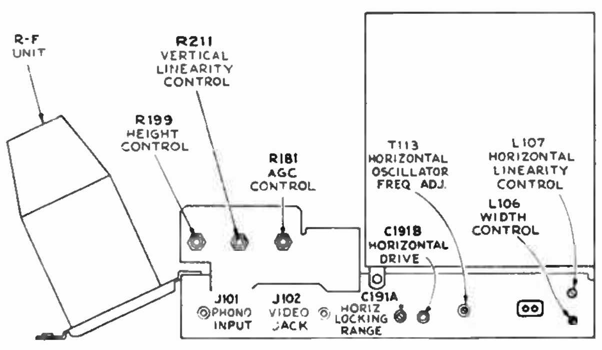


Figure 3—Rear Chassis Adjustments

INSTALLATION INSTRUCTIONS

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Alignment of Horizontal Oscillator" and proceed with "Focus Magnet Adjustment."

ALIGNMENT OF HORIZONTAL OSCILLATOR. — If in the above check the receiver failed to hold sync with the hold control at the extreme counter-clockwise position or failed to hold sync over 90 degrees of clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.

Horizontal Frequency Adjustment. — Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and adjust the T113 horizontal frequency adjustment at the rear of the chassis until the picture is just out of sync and the horizontal blanking appears as a vertical or diagonal black bar in the raster. Then turn the T113 core until the bar moves out of the picture leaving it in sync.

Horizontal Locking Range Adjustment. — Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T113 rear core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C191A slightly clockwise. If less than 2 bars are present, adjust C191A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the conditions specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If it is impossible to sync the picture at this point and the AGC system is in proper adjustment it will be necessary to adjust the Horizontal Oscillator by the method outlined in the alignment procedure on page 11. For field purposes paragraph "B" under Horizontal Oscillator Waveform Adjustment may be omitted.

FOCUS MAGNET ADJUSTMENT. — The focus magnet should be adjusted so that there is approximately three-eighths inch of space between the rear cardboard shell of the yoke and the flat of the front face of the focus magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the magnet should be parallel with the axis of the kinescope neck with the kinescope neck through the center of the opening.

PIN-CUSHION CORRECTION. — Two pin-cushion correction magnets are employed to correct a small amount of pin-cushion of the raster due to the lens effect of the face of the kinescope. These magnets are mounted on small arms, one on each side of the kinescope as shown in Figure 2. The arms hinge in one plane on self tapping screws which act both as a hinge and an adjustment locking screw. When the magnets are swung towards the tube, maximum correction is obtained. Minimum correction is obtained when the arms are swung away from the tube. To adjust the magnets, loosen the two self tapping screws and position the magnets until the sides of the raster appear straight. Tighten the screws without shifting the position of the magnets. In some cases it may be necessary to twist or bend the magnet support arms to obtain the appearance of straight raster edges.

CENTERING ADJUSTMENT. — No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet. The centering plates include a locking screw which must be loosened before centering. Up and down adjustment of the plate moves the picture side to side and sidewise adjustment moves the picture up and down.

If a corner of the raster is shadowed, check the position of the ion trap magnet. Reposition the magnet within the range of maximum raster brightness to eliminate the shadow and recenter the picture by adjustment of the focus magnet plate. In no case should the magnet be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the tube. In some cases it may be necessary to shift the position of the focus magnet in order to eliminate a corner shadow.

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS. — Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive trimmer C191B counter-clockwise until the picture begins to "wrinkle" in the middle then clockwise until the "wrinkle" disappears.

Turn the horizontal linearity control L107 clockwise until the picture begins to "wrinkle" on the right and then counter-clockwise until the "wrinkle" disappears and best linearity is obtained.

Adjust the width control L106 to obtain correct picture width.

A slight readjustment of these three controls may be necessary to obtain the best linearity.

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS. — Adjust the height control (R199 on chassis rear apron) until the picture fills the mask vertically. Adjust vertical linearity (R211 on rear apron), until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust centering to align the picture with the mask.

FOCUS. — Adjust the focus magnet for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

Check to see that the yoke thumbscrew and the focus magnet mounting screws are tight.

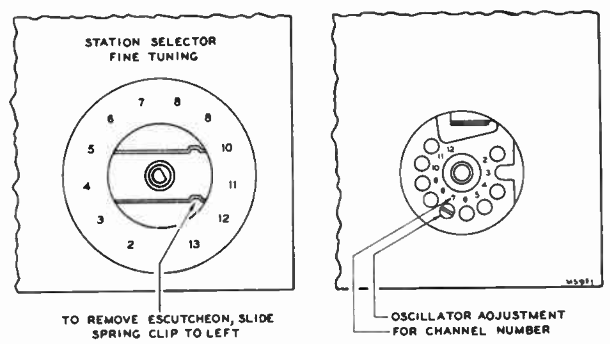


Figure 4—R-F Oscillator Adjustments

CHECK OF R-F OSCILLATOR ADJUSTMENTS. — Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 9. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 4. Adjustment for channel 13 is on top of the chassis.

AGC THRESHOLD CONTROL. — The AGC threshold control R181 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not overloading due to improper setting of R181. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R181 should be readjusted.

INSTALLATION INSTRUCTIONS

Turn R181 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R181 clockwise until there is a very, very slight bend or change of bend in the picture. Then turn R181 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R181 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

FM TRAP ADJUSTMENT. — In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the L58 core on top of the antenna matching transformer for minimum interference in the picture.

CAUTION. — In some receivers, the FM trap L58 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L58 to make sure that it does not affect sensitivity on these two channels.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding it are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

KINESCOPE SCREEN CLEANING. — The kinescope safety glass is held in place by four spring clips which may be removed from the back of the front panel. This permits removing the safety glass for cleaning without the necessity of removing the chassis and kinescope.

CHASSIS REMOVAL. — To remove the chassis from the cabinet for repair or installation of a new kinescope, remove the control knobs, the cabinet back, unplug the speaker cable, the kinescope socket, the antenna cable, the yoke and high voltage cable. Take out the chassis bolts under the cabinet. Withdraw the chassis from the back of the cabinet.

KINESCOPE HANDLING PRECAUTION. — Do not install, remove, or handle the kinescope in any manner, unless shatter-proof goggles and heavy gloves are worn. People not so equipped should be kept away while handling the kinescope. Keep the kinescope away from the body while handling.

REMOVAL OF KINESCOPE.—To remove the kinescope from the cabinet, loosen the two nuts and disengage the rods alongside the kinescope. Remove the wing screw which holds the yoke frame to the cabinet. Remove the kinescope, the yoke frame with yoke and focus magnet as an assembly.

Handle this tube by the portion at the edge of the screen. Do not cover the glass bell of the tube with fingermarks as it will produce leakage paths which may interfere with reception. If this portion of the tube has inadvertently been handled, wipe it clean with a soft cloth moistened with "dry" carbon tetrachloride.

INSTALLATION OF KINESCOPE. — Wipe the kinescope screen surface and front panel safety glass clean of all dust and fingermarks with a soft cloth moistened with "Windex" or similar cleaning agent.

Replace the kinescope and chassis by reversal of the removing process. The kinescope should be installed so that the high voltage contact is to the right when looking at it from the rear of the cabinet. The magnet of the ion trap magnet should be to the left.

CABINET ANTENNA.—A cabinet antenna is provided in these receivers and the leads are brought out near the antenna terminal board. The cabinet antenna may be employed in place of the outdoor antenna in areas where the signals are strong and no reflections are experienced.

ANTENNAS.—The finest television receiver built may be said to be only as good as the antenna design and installation. It is therefore important to select the proper antenna to suit the particular local conditions, to install it properly and orient it correctly.

If two or more stations are available and the two stations are in different directions, it may be possible to make a compromise orientation which will provide a satisfactory signal on all such channels.

If it is impossible to obtain satisfactory results on one or more channels, it may become necessary either to provide means for turning the antenna when switching channels or to install a separate antenna for one or more channels and to switch antennas when switching channels.

In some cases, the antenna should not be installed permanently until the quality of the picture reception has been observed on a television receiver. A temporary transmission line can be run between receiver and the antenna, allowing sufficient slack to permit moving the antenna. Then, with a telephone system connecting an observer at the receiver and an assistant at the antenna, the antenna can be positioned to give the most satisfactory results on the received signal. A shift of direction or a few feet in antenna position may effect a tremendous difference in picture reception.

REFLECTIONS. — Multiple images sometimes known as echoes or ghosts, are caused by the signal arriving at the antenna by two or more routes. The second or subsequent image occurs when a signal arrives at the antenna after being reflected off a building, a hill or other object. In severe cases of reflections, even the sound may be distorted. In less severe cases, reflections may occur that are not noticeable as reflections but that will instead cause a loss of definition in the picture.

Under certain extremely unusual conditions, it may be possible to rotate or position the antenna so that it receives the cleanest picture over a reflected path. If such is the case, the antenna should be so positioned. However, such a position may give variable results as the nature of reflecting surfaces may vary with weather conditions. Wet surfaces have been known to have different reflecting characteristics than dry surfaces.

Depending upon the circumstances, it may be possible to eliminate the reflections by rotating the antenna or by moving it to a new location. In extreme cases, it may be impossible to eliminate the reflection.

INTERFERENCE.—Auto ignition, street cars, electrical machinery and diathermy apparatus may cause interference which spoils the picture. Whenever possible, the antenna location should be removed as far as possible from highways, hospitals, doctors' offices and similar sources of interference. In mounting the antenna, care must be taken to keep the antenna rods at least ¼ wave length (at least 6 feet) away from other antennas, metal roofs, gutters or other metal objects.

Short-wave radio transmitting and receiving equipment may cause interference in the picture in the form of moving ripples. In some instances it may be possible to eliminate the interference by the use of a trap in the antenna transmission line. However, if the interfering signal is on the same frequency as the television station, a trap will provide no improvement.

WEAK PICTURE.—When the installation is near the limit of the area served by the transmitting station, the picture may be speckled, having a "snow" effect, and may not hold steady on the screen. This condition is due to lack of signal strength from the transmitter.

RECEIVER LOCATION.—The owner should be advised of the importance of placing the receiver in the proper location in the room.

The location should be chosen—

—Away from bright windows and so that no bright light will fall directly on the screen. (Some illumination in the room is desirable, however.)

—To give easy access for operation and comfortable viewing.

—To permit convenient connection to the antenna.

—Convenient to an electrical outlet.

—To allow adequate ventilation.

CHASSIS TOP VIEW

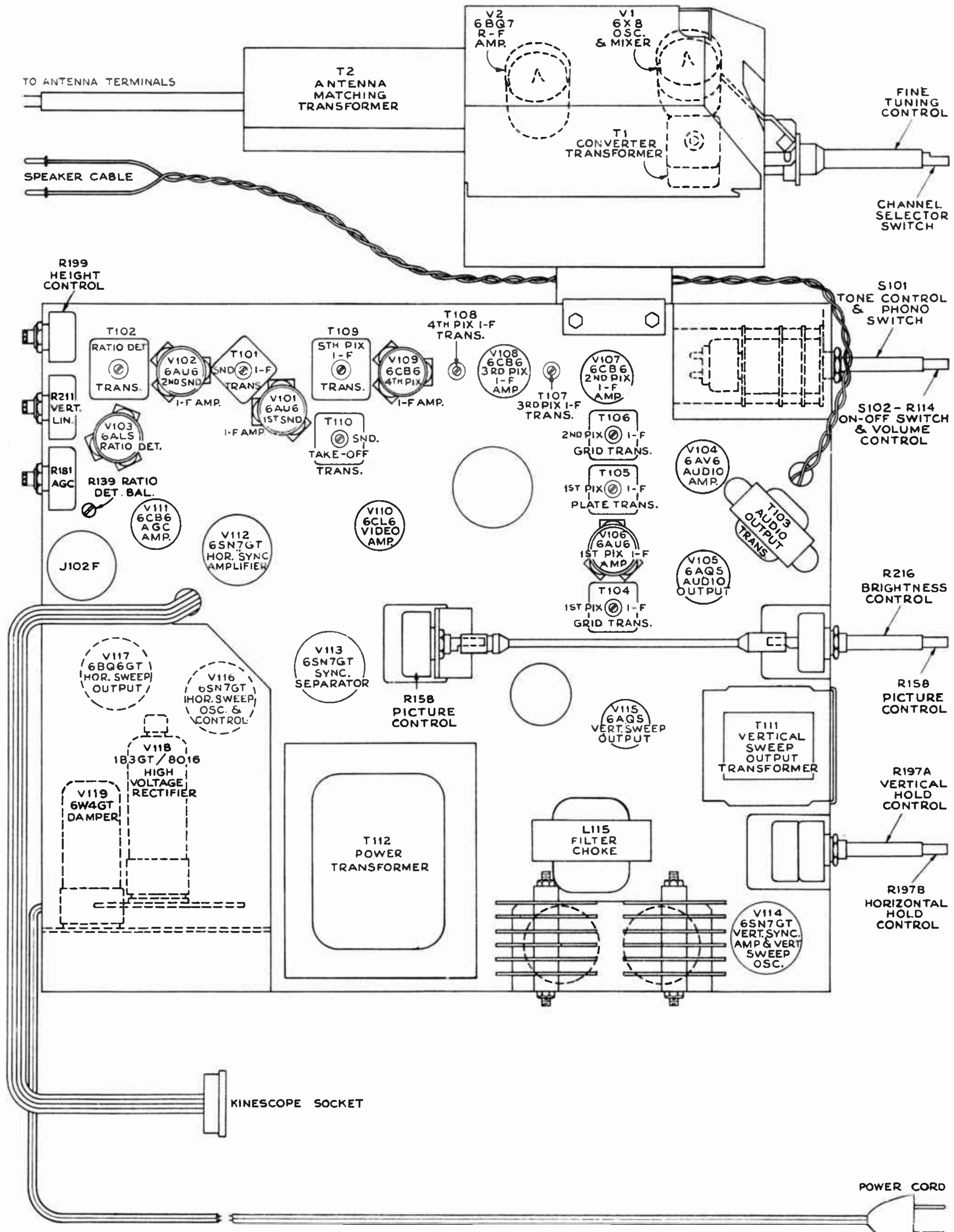


Figure 5—Chassis Top View

CHASSIS BOTTOM VIEW

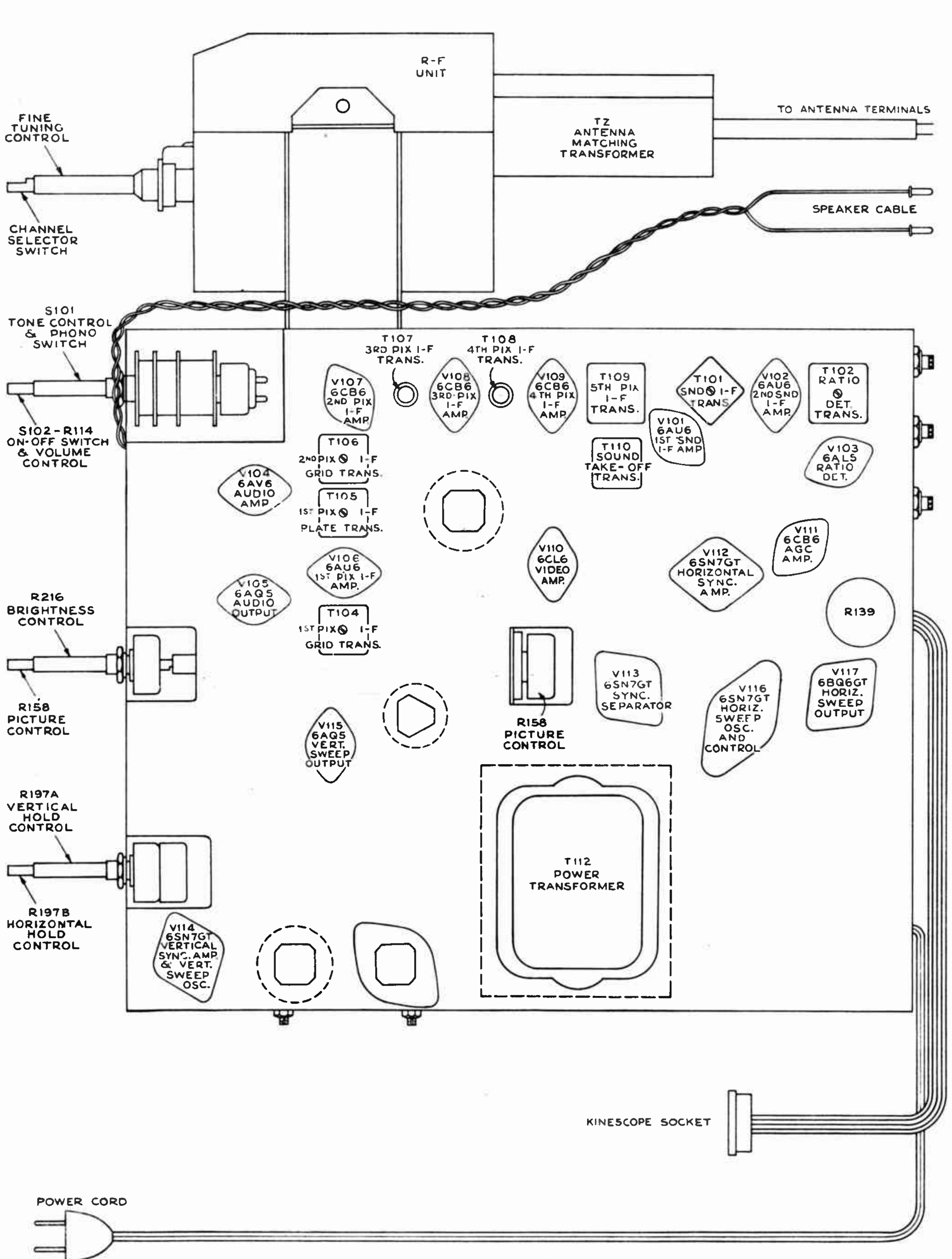


Figure 6—Chassis Bottom View

ALIGNMENT PROCEDURE

TEST EQUIPMENT. — To properly service the television chassis of this receiver, it is recommended that the following test equipment be available:

R-F Sweep Generator meeting the following requirements:

(a) Frequency Ranges

35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

Cathode-Ray Oscilloscope. — For alignment purposes, the oscilloscope employed must have excellent low frequency and phase response, and should be capable of passing a 60-cycle square wave without appreciable distortion.

For video and sync waveform observations, the oscilloscope must have excellent frequency and phase response from 10 cycles to at least two megacycles in all positions of the gain control.

Signal Generator to provide the following frequencies with crystal accuracy.

(a) Intermediate frequencies

4.5 mc., 39.25 mc., 41.25 mc., 45.75 mc., 47.25 mc.

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

Electronic Voltmeter of Junior or Senior "VoltOhmyst" type and a high voltage multiplier probe for use with this meter to permit measurements up to 20 kv.

ORDER OF ALIGNMENT. — When a complete receiver alignment is necessary, it can be most conveniently performed in the following order:

(1) Ant. Matching Unit
(2) R-F Unit
(3) Ratio Detector
(4) Sound I-F Trans.
(5) Sound Take-Off Trans.
(6) Picture I-F Traps
(7) Picture I-F Trans.
(8) Sweep Alignment of I-F
(9) Horizontal Oscillator
(10) Sensitivity Check

ANTENNA MATCHING UNIT ALIGNMENT. — The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M Trap L58 to the channel selector switch S5.

With a short jumper, connect the output of the matching unit through a 1000 mmf capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R193 and R194. Set the potentiometer to produce approximately −6.0 volts of bias at the junction of R193 and R194.

Connect an oscilloscope to pin 2 of V110 (pin 4 if 6AG7 used) and set the oscilloscope gain to maximum.

Connect a signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L59 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L60 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L58 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L58 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the r-f sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 11 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L61 and L62 to obtain the response shown in Figure 12. L61 is most effective in locating the position of the shoulder of the curve at 52 mc. and L62 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L58 and S5. Replace V106.

R-F UNIT ALIGNMENT. — An r-f unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset all adjustments to the approximate center of their range with the following exceptions: Set C18 so that the screw head is approximately three-eighths of an inch above chassis. Set C11 near maximum capacity (one-quarter turn from tight). Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

The r-f unit is aligned with zero AGC bias. To insure that the bias will remain constant, take a clip lead and short circuit the r-f unit power terminal board terminal 3 to ground.

Connect the oscilloscope to the test point TP1 on top of the r-f unit. Set the oscilloscope gain to maximum.

Turn the receiver channel selector switch to channel 2.

Connect the output of the signal generator to the grid of the r-f amplifier, V2. To do this, remove the tube from the socket and fashion a clip by twisting one end of a small piece of wire around pin number 7. Replace the tube in the socket leaving the end of the wire protruding from under the tube. Connect the signal generator to this wire through a 1,500 mmf. capacitor.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

ALIGNMENT PROCEDURE

Adjust L65 on top of the r-f unit for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to adjust it so as to reduce sensitivity on channel 2.

Remove the wire clip from pin 7 of V2 and replace the tube and tube shield.

Set the channel selector switch to channel 8.

Turn the fine tuning control 30 degrees clockwise from the center of its mechanical range now and at all times when adjusting the oscillator frequency.

Adjust C2 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the r-f unit through the hole provided for the adjustment for C11. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the r-f unit oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C2 to obtain an audio beat with the signal generator.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C2, switch to channel 13 and adjust L46 to obtain proper channel 13 oscillator frequency as indicated in the table on page 8. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8 adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C2 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and adjust L46 and back to channel 8 and adjust C2.

Set the T1 core for maximum inductance (core turned counter-clockwise.)

Connect the sweep generator through a suitable attenuator as shown in Figure 11 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a useable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C9, C11, C15 and C18 for approximately correct curve shape, frequency, and band width as shown in Figure 13.

The correct adjustment of C18 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C9 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C18 has been properly adjusted). C11 is the coupling adjustment and hence primarily affects the response band width.

Set the receiver channel switch to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Turn the fine tuning control 30 degrees clockwise from the center of its mechanical range.

Adjust L5 for an audible beat with the signal generator as before.

Set the sweep generator to channel 6.

From the signal generator, insert channel 6 sound and picture carrier markers, 83.25 mc. and 87.75 mc.

Adjust L48, L50 and L53 for proper response as shown in Figure 13.

L50 tunes the r-f amplifier plate circuit and primarily affects the frequency of the pass band. L53 tunes the r-f amplifier grid and is adjusted to give maximum amplitude of the curve between the markers. L48 affects the tilt of the curve but not quite the same as C9 adjustment. When the circuits are correctly adjusted and L48 is rocked on either side of its proper setting, the high frequency (sound carrier) end of the curve appears to remain nearly fixed in amplitude while the picture carrier end tilts above or below this point.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the r-f unit test point TP1.

Adjust the oscillator injection trimmer C8 for −3.5 volts or at maximum if −3.5 volts cannot be reached. This voltage should fall between −2.5 and −5.5 volts on all channels when the alignment of all circuits is completed.

Turn the sweep generator and signal generator back on and recheck channel 6 response. Readjust L48, L50 and L53 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C9, C11, C15 and C18 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 6 and check the oscillator injection voltage at TP1 if C9 was adjusted in the recheck of channel 8 response.

If the initial setting of oscillator injection trimmer C8 was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 6 and repeat the procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Set the fine tuning control 30 degrees clockwise from the center of its mechanical range.

Adjust L46 to obtain an audible beat. Slightly overshoot the adjustment of L46 by turning the slug a little more in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Check the response of channels 7 through 13 by switching the receiver channel switch, sweep generator and marker oscillator to each of these channels and observing the response and oscillator injection obtained. See Figure 13 for typical response curves. It should be found that all these channels have the proper shaped response with the markers above 80% response.

If the markers do not fall within this requirement, switch to channel 8 and readjust C9, C11, C15 and C18 as necessary.

Turn off the sweep generator and check the channel 8 oscillator frequency. If C2 has to be readjusted for channel 8, the principle of overshooting the adjustment and then correcting by adjusting L46 should be followed in order to establish the L/C ratio for the desired oscillator tracking.

Turn the receiver channel selector switch to channel 6. Adjust L5 for correct oscillator frequency, 129 mc.

Turn the sweep generator on and to channel 6 and observe the response curve. If necessary readjust L48, L50 and L53.

Switch the receiver, the sweep and signal generators to channel 2 and adjust T1 clockwise to a point where there is no change in the channel 2 response as T1 is turned.

Switch the receiver through channel 6 down through channel 2 and check for normal response curve shapes and oscillator injection voltage.

If excessive tilt in the same direction occurs on channels 2, 3 and 4, adjust C18 on channel 2 to overshoot the correction of this tilt, then switch to channel 6 and adjust L53 for maximum amplitude of curve between markers. This adjustment should produce "flat" response on the low channels if the other adjustments especially L48 are correct.

Likewise check channels 7 through 13, stopping on 13 for the next step.

With the receiver on channel 13, check the receiver oscillator frequency. Correct by adjustment of C2 if necessary.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator trimmer to obtain the audible beat. It should be possible to adjust the oscillator to the correct frequency on all channels with the fine tuning control in the middle third of its range. When employing WR39 calibrators to adjust the receiver oscillator, tune the calibrator to one-half the receiver oscillator frequency on channels 4, 5 and 6 and to one-fourth the receiver oscillator frequency on channels 11, 12 and 13.

ALIGNMENT PROCEDURE

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.	Channel Oscillator Adjustment
2	55.25	59.75	101	L1
3	61.25	65.75	107	L2
4	67.25	71.75	113	L3
5	77.25	81.75	123	L4
6	83.25	87.75	129	L5
7	175.25	179.75	221	L6
8	181.25	185.75	227	L7
9	187.25	191.75	233	L8
10	193.25	197.75	239	L9
11	199.25	203.75	245	L10
12	205.25	209.75	251	L11
13	211.25	215.75	257	C1

Remove the 39 ohm resistor from the link and reconnect the link to terminals "A" and "B" of T104.

RATIO DETECTOR ALIGNMENT. — Set the signal generator at 4.5 mc. and connect it to the second sound i-f grid, pin 1 of V102. Set the generator for 30% 400 cycle modulation.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. If used, connect its output cable to the grid of the 4th pix i-f amplifier, pin 1 of V109. Set the frequency of the calibrator to 45.75 (pix carrier) and modulate with 4.5 mc. crystal. Also turn on the internal AM audio modulation. The 4.5 mc. signal will be picked off at T110A and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to the junction of R110 and R150.

Connect the oscilloscope to the junction of R111 and C113.

Tune the ratio detector primary, T102 top core for maximum DC output on the "VoltOhmyst." Adjust the signal level from the signal generator for 10 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R111 and C113.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst."

Adjust R139 for minimum AM indication on the oscilloscope.

Retune the T102 bottom core to obtain zero d-c on the "VoltOhmyst."

Repeat the adjustment of T102 bottom core for zero d-c on the "VoltOhmyst" and R139 for minimum AM indication on the oscilloscope until both conditions are satisfied at the same settings of the adjustments. Final touches on these adjustments must be made with the input signal adjusted to produce 10 volts d-c on the "VoltOhmyst" at the junction of R110 and R150.

SOUND I-F ALIGNMENT. - Connect the sweep generator to the first sound i-f amplifier grid, pin 1 of V101. Adjust the generator for a sweep width of 1 mc. at a center frequency of 4.5 mc.

Insert a 4.5 mc. marker signal from the signal generator into the first sound i-f grid.

Connect the oscilloscope in series with a 10,000 ohm resistor to terminal A of T101.

Adjust T101 top and bottom cores for maximum gain and symmetry about the 4.5 mc. marker on the i-f response. The pattern obtained should be similar to that shown in Figure 14.

The output level from the sweep should be set to produce approximately 2.0 volt peak-to-peak at terminal A of T101 when the final touches on the above adjustment are made. It is necessary that the sweep output voltage should not exceed the specified values otherwise the response curve will be broadened, permitting slight misadjustment to pass unnoticed and possibly causing distortion on weak signals.

Connect the oscilloscope to the junction of R111 and C113 and check the linearity of the response. The pattern obtained should be similar to that shown in Figure 15.

SOUND TAKE-OFF ALIGNMENT. — Connect the 4.5 mc. generator in series with a 1,000 ohm resistor to terminal "C" of T110. The input signal should be approximately 0.5 volts.

Short the fourth pix i-f grid to ground, pin 1 V109, to prevent noise from masking the output indication.

As an alternate source of signal the RCA WR39B or WR39C calibrator may be used. In such a case, disregard the above two paragraphs. Connect calibrator across link circuit, T104 A, B, and modulate 45.75 carrier with 4.5 mc. crystal.

Connect the crystal diode probe of a "VoltOhmyst" to the plate of the video amplifier, pin 6 of V110 (pin 8 if 6AG7 used).

Adjust the core of T110 for minimum output on the meter.

Remove the short from pin 1 V109 to ground, if used.

PICTURE I-F TRAP ADJUSTMENT. — Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R193 and R194.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction of R193 and R194.

Set the bias pot to produce approximately −1.0 volt of bias at the junction of R193 and R194.

Connect the "VoltOhmyst" to pin 2 of V110 (pin 4 of 6AG7).

Set the signal generator to each of the following frequencies and adjust the corresponding circuit for minimum d-c output at pin 2 of V110. Use sufficient signal input to produce 1.0 volt of d-c on the meter when the final adjustment is made.

39.25 mc.	T104 top core
41.25 mc.	T105 bottom core
47.25 mc.	T106 bottom core

PICTURE I-F TRANSFORMER ADJUSTMENTS. — Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 2 of V110 with −1.0 volt of i-f bias at the junction of R193 and R194.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf ceramic capacitor. Shunt R136, R143 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to −1.0 volt at the junction of R193 and R194.

Connect the oscilloscope to pin 2 of V110 (pin 4 of 6AG7).

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 16. For final adjustments set the output of the sweep generator to produce 0.5 volts peak-to-peak at the oscilloscope terminals.

To align T1 and T104, connect the sweep generator to the mixer grid test point TP2. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable.

Set the channel selector switch to channel 4.

Connect a 180 ohm composition resistor from terminal B of T105 to the junction of R131 and C131. Connect the oscilloscope diode probe to terminal B of T105 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

C122 is variable and is provided as a band width adjustment. Preset C122 to minimum capacity.

Adjust T1 top and T104 bottom for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust C122 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 17.

Disconnect the diode probe, the 180 ohm and three 330 ohm resistors.

SWEEP ALIGNMENT OF PIX I-F. — Connect the oscilloscope to pin 2 of V110 (pin 4 where V110 is a 6AG7).

Adjust the bias potentiometer to obtain −6.0 volts of bias as measured by a "VoltOhmyst" at the junction of R193 and R194.

ALIGNMENT PROCEDURE

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible and with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T108 and T109 to obtain the response shown in Figure 18. Do not adjust T107 unless absolutely necessary. If T107 is adjusted too low in frequency it will raise the level of the 41.25 mc. sound i-f carrier and may create interference in the picture. It will also cause poor adjacent channel picture rejection. If T107 is tuned too high in frequency, the level of the 41.25 mc. sound i-f carrier will be too low and may produce noisy sound in weak signal areas.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

HORIZONTAL OSCILLATOR ADJUSTMENT.—Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R197B, then adjust the T113 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T113 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T113 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C191B, the width control L106 and the linearity control L107 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T113 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T113 frequency core (on the rear apron) until the picture falls out of sync and one diagonal black bar sloping down to the right appears on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T113 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture begins to fall out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin to motorboat. Retouch the adjustment of the T113 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T113. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 19. Adjust the waveform adjustment core of T113 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T113 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C191A slightly clockwise. If less than 2 bars are present, adjust C191A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T113 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves off the screen leaving the picture in synchronization.

SENSITIVITY CHECK.—A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions. This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad.

RESPONSE CURVES.—The response curves shown on page 14 are typical though some variations can be expected.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

NOTES ON R-F UNIT ALIGNMENT.—Because of the frequency spectrum involved and the nature of the device, many of the r-f unit leads and components are critical in some respects. Even the power supply leads form loops which couple to the tuned circuits, and if resonant at any of the frequencies involved in the performance of the tuner, may cause serious departures from the desired characteristics. In the design of the receiver these undesirable resonant loops have been shifted far enough away in frequency to allow reasonable latitude in their components and physical arrangement without being troublesome. When the r-f unit is aligned in the receiver, no trouble from resonant loops should be experienced. However, if the unit is aligned in a jig separate from the receiver, attention should be paid to insure that unwanted resonances do not exist which might present a faulty representation of r-f unit alignment.

A resonant circuit exists between the r-f tuner chassis and the outer shield box, which couples into the antenna and r-f plate circuits. The frequency of this resonance depends on the physical structure of the shield box, and the capacitance between the tuner chassis and the front plate. This resonance is controlled in the design by using insulating washers of proper thickness in the front plate to tuner chassis mounting. The performance of the tuner will be impaired if the proper washers are not used. Obviously then, if the r-f unit is removed for service, the washers should be replaced in the correct order when the unit is replaced.

ALIGNMENT PROCEDURE

THE DETAILED ALIGNMENT PROCEDURE BEGINNING ON PAGE 4 SHOULD BE READ BEFORE ALIGNMENT BY USE OF THE TABLE IS ATTEMPTED

Step No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT OSCILLOSCOPE TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
	ANTENNA MATCHING UNIT ALIGNMENT									
1	Do not adjust this unit unless fairly certain that it requires adjustment. Disconnect lead from L58 to S5. Connect output of matching unit through 1000 mmf. to pin 1 of V107. Replace cover on matching unit. Remove V106 from socket. Connect bias box to junction of R143 and R144 and set to produce —6 volts.									
2	Antenna terminals	45.75 mc. 30% mod.	Not used	—	Not used	—	TP102. Scope gain to max.	—	L59 for min. audio on scope	Fig. 7
3	"	41.25 mc. 30% mod.	"	—	"	—	"	—	L60 for min. audio on scope	Fig. 7
4	Antenna terminals loosely		Antenna terminals through pad	45 to 54 mc.	"	—	Scope a xtal probe to gnd.	Connect 300 ohms from L58 to gnd.	L61 and L62 to obtain response of Fig. 12	Fig. 7 Fig. 11 Fig. 12
	R-F UNIT ALIGNMENT									
5	If unit is completely out of adjustment, preset all adjustments to center of range with following exceptions. Set C18 so that head is 3/8" above chassis. Set T1 max. counterclockwise. Set C11 1/4 turn from max. clockwise. Disconnect link from T104 and terminate with 39 ohms. Short r-f unit power terminal 3 to ground. Set fine tuning 30 degrees clockwise from mechanical center of its range for all oscillator adjustments.									
6	Grid, pin 7 of V2 through 1500 mmf.	43.5 mc. 30% mod.	Not used	—	Not used	—	TP1. Gain to maximum	Set r-f unit on channel 2	L65 for min. indication on scope	Fig. 7 Fig. 10
7	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8	C1 for beat on het. freq. meter	Fig. 7
8	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	"	C9, C11, C15 and C18 for response shown in Fig. 13	Fig. 7 Fig. 13
9	Not used	—	Not used	—	Loosely to r-f unit oscillator	129 mc.	Not used	R-F unit on channel 6	L5 for beat on het. freq. meter	Fig. 8
10	Antenna terminals loosely	83.25 and 87.75	Antenna terminals through pad	Channel 6	Not used	—	TP1. Gain to maximum	"	L48, L50 and L53 for response shown in Fig. 13	Fig. 7 Fig. 13
11	Not used	—	Not used	—	Not used	—	Not used	On channel 6. Connect "VoltOhmyst" to TP1	C8 for —3.5 volts on meter	Fig. 7
12	Antenna terminals loosely	83.25 and 87.75	Antenna terminals through pad	Channel 6	Not used	—	TP1. Gain to maximum	R-F unit on channel 6	Check response. Readjust L48, L50 and L53 if necessary	Fig. 7 Fig. 13
13	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8	C1 for beat on het. freq. meter	Fig. 7
14	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	"	Check response adjust C9, C11, C15 and C18 if necessary	Fig. 7
15	If C9 was readjusted in step 14, repeat step 11, step 13 and step 14 until the conditions specified in each step are fulfilled without additional adjustments.									
16	Not used	—	Not used	—	Loosely to r-f unit oscillator	257 mc.	Not used	Rec. on channel 13	L46 for beat on het. freq. meter. Overshoot L46 slightly and adjust C1 for beat.	Fig. 7
17	Antenna terminals loosely	211.25 215.75	Antenna terminals through pad	Channel 13	Not used	—	TP1. Gain to maximum	Rec. on channel 13 "VoltOhmyst" on TP1	Check to see that response is correct and —3.0 volts of osc. injection is present	Fig. 13
18	"	205.25 209.75	"	Channel 12	Not used	—	"	Rec. on channel 12	"	Fig. 13
19	"	199.25 203.75	"	Channel 11	"	—	"	Rec. on channel 11	"	Fig. 13
20	"	193.25 197.75	"	Channel 10	"	—	"	Rec. on channel 10	"	Fig. 13
21	"	187.25 191.75	"	Channel 9	"	—	"	Rec. on channel 9	"	Fig. 13
22	"	181.25 185.75	"	Channel 8	"	—	"	Rec. on channel 8	"	Fig. 13
23	"	175.25 179.75	"	Channel 7	"	—	"	Rec. on channel 7	"	Fig. 13
24	If the response of any channel (steps 17 through 23) is below 80% at either marker, adjust C9, C11, C15 and C18 as necessary to pull response up on the low channel yet maintain correct response on channel 8.									
25	Repeat step 13. If the oscillator is off frequency overshoot the adjustment of C1 and correct by adjusting L46.									
26	Repeat steps 16 through 25 until all adjustments are obtained.									
27	Not used	—	Not used	—	Loosely to r-f unit oscillator	129 mc.	Not used	Rec. on channel 6	L5 for beat on het. freq. meter	Fig. 7
28	Antenna terminals loosely	83.25 87.75	Antenna terminals through pad	Channel 6	Not used	—	TP1. Gain to maximum	Rec. on channel 6 "VoltOhmyst" on TP1	Check to see that response is correct and —3.0 volts of osc. injection is present	Fig. 7 Fig. 13
29	"	77.25 81.75	"	Channel 5	"	—	"	Rec. on channel 5	"	Fig. 13
30	"	67.25 71.75	"	Channel 4	"	—	"	Rec. on channel 4	"	Fig. 13
31	"	61.25 65.75	"	Channel 3	"	—	"	Rec. on channel 3	"	Fig. 13

ALIGNMENT PROCEDURE

Step No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT OSCILLOSCOPE TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
32	"	55.25 59.75	"	Channel 2	"	—	"	Rec. on channel 2	"	Fig. 13
33	If excessive tilt in the same direction occurs on channels 2, 3 and 4, adjust C18 on channel 2 to overshoot the correction of this tilt then switch to channel 6 and adjust L53 for max. amplitude of response between carrier markers.									
34	Check r-f response and oscillator injection on channels 7 through 13 steps 23 back up through step 17 stopping on channel 13 for the next step.									
35	Not used	—	Not used	—	Loosely coupled to r-f oscillator	257 mc.	TP1. Gain to maximum	Rec. on channel 13	C1 for beat on het. freq. meter	Fig. 7
36	"	—	"	—	"	251 mc.	"	Rec. on channel 12	L11 as above	Fig. 7
37	"	—	"	—	"	245 mc.	"	Rec. on channel 11	L10 as above	Fig. 7
38	"	—	"	—	"	239 mc.	"	Rec. on channel 10	L9 as above	Fig. 7
39	"	—	"	—	"	233 mc.	"	Rec. on channel 9	L8 as above	Fig. 7
40	"	—	"	—	"	227 mc.	"	Rec. on channel 8	L7 as above	Fig. 7
41	"	—	"	—	"	221 mc.	"	Rec. on channel 7	L6 as above	Fig. 7
42	"	—	"	—	"	129 mc.	"	Rec. on channel 6	L5 as above	Fig. 7
43	"	—	"	—	"	123 mc.	"	Rec. on channel 5	L4 as above	Fig. 7
44	"	—	"	—	"	113 mc.	"	Rec. on channel 4	L3 as above	Fig. 7
45	"	—	"	—	"	107 mc.	"	Rec. on channel 3	L2 as above	Fig. 7
46	"	—	"	—	"	101 mc.	"	Rec. on channel 2	L1 as above	Fig. 7
47	Repeat steps 35 through 46 as a check. On completion, remove 39 ohm resistor and reconnect link to terminals A and B of T104.									
	RATIO DETECTOR, SOUND I-F AND SOUND TAKE-OFF ALIGNMENT									
48	Grid 2nd Snd. I-F (pin 1, V102) or WR39B or C connect to grid 4th pix I-F (pin 1, V109.)	4.5 mc. 400 cy. mod. or 45.75 mc. mod. by 4.5 mc. and 400 cy.	Not used	—	Not used	—	Across speaker voice coil. Volume control set for max. volume.	"VoltOhmyst" to junction of R110 and R114. Set C226 for min. capacity. Set signal gen. to give —10 V on meter.	T102 top core for max. d-c on meter. T102 bottom core for min. audio on the oscilloscope.	Fig. 9 Fig. 10
49	"	"	"	—	"	—	"	"VoltOhmyst" to junction R112 and C113. If the meter reads more than ±1.5 volts, adjust C226 for zero on the meter and readjust T102 (bot.) for min. output on scope. Repeat steps 48 and 49 until all conditions are satisfied.		Fig. 9 Fig. 10
50	Sig. Gen. to 1st Snd. I-F	4.5 mc.	1st Sound I-F grid (pin 1, V101)	4.5 mc.	"	—	In series with 10,000 ohms to terminal A, of T101.	Sweep output reduced to provide 2 v p-p on scope.	T101 top and bot. cores for max. gain and symmetry at 4.5 mc.	Fig. 9 Fig. 10 Fig. 14
51	"	"	"	"	"	—	Junction of R112 and C113	Check for symmetrical response wave form (positive and negative).		Fig. 15
52	Sig. Gen. in series with 1000 ohms to T110-C or WR39 across T104 A and B.	"	Not used	—	"	—		"VoltOhmyst" xtal probe to pin 8, V110. If sig. gen. is used short pin 1, V109 to ground.	Adjust T110 for minimum reading on "VoltOhmyst".	Fig. 9
	PICTURE I-F AND TRAP ADJUSTMENT									
53	Not used	—	Not used	—	Not used	—	Not used	Connect bias box to junction of R143 and R144 and to gnd. Adjust to give —1.0 v on "VoltOhmyst" at TP101.		
54	Sig. Gen. across T104 A and B	39.25 mc.	"	—	"	—	"	"VoltOhmyst" to TP102. Gen. output to give —1.0 volt d-c.	T104 top core to give min. d-c on meter.	Fig. 9
55	"	41.25 mc.	"	—	"	—	"	"	T105 bot. for min.	Fig. 10
56	"	47.25 mc.	"	—	"	—	"	"	T106 bot. for min.	Fig. 10
57	"	43.7 mc.	"	—	"	—	"	Sig. Gen. output to give —1.0 V d-c at TP102.	T109 for max.	Fig. 7
58	"	45.5 mc.	"	—	"	—	"	"	T108 for max.	Fig. 9
59	"	41.8 mc.	"	—	"	—	"	"	T107 for max.	Fig. 9
60	First pix i-f grid (pin 1, V106) loosely.	Various See Fig. 16	First pix i-f grid pin 1, V106 through 1000 mmf.	40 to 48 mc.	"	—	To test point TP102	Shunt R141, R149 and terminals A and F of T109 with 330 ohms, 0.5 v p-p on scope.	Adjust T105 and T106 top cores for max. gain and response shown in Fig. 16.	Fig. 9 Fig. 16
61	Connected loosely to diode probe.	Various See Fig. 17	Mixer grid test point TP2 with short lead.	40 to 48 mc.	"	—	Scope diode probe to T105-B and to gnd.	Rec. on chan. 4. Connect 180 ohms from T105-B to junction R135 and C132. Upon completion disconnect scope and shunting resistors.	Set C221 to min. Adjust T1 top and T104 bot. for max. gain at 43.5 mc. and 45.75 mc. at 70%. Adjust C221 until 41.25 mc. is at 80%.	Fig. 9 Fig. 17
62	Connected loosely to grid of 1st pix i-f.	Various See Fig. 18	"	"	"	—	Connect scope to TP102.	"VoltOhmyst" to TP101. Set bias box for —6.0 volts on the meter. Set sweep output to produce 3.0 volts p-p on scope.	Retouch T108 and T109 to obtain response shown in Fig. 18. Do not adjust T107 unless absolutely necessary.	Fig. 18

ALIGNMENT DATA

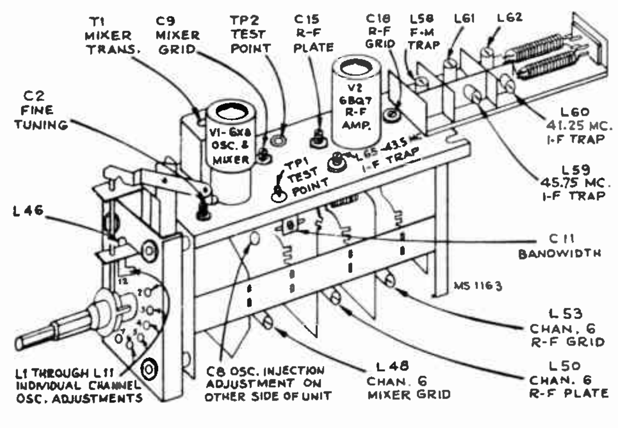


Figure 7—R-F Unit Adjustments

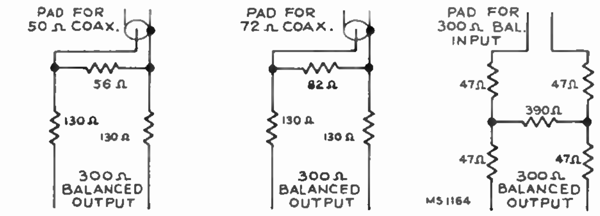


Figure 11—Sweep Attenuator Pads

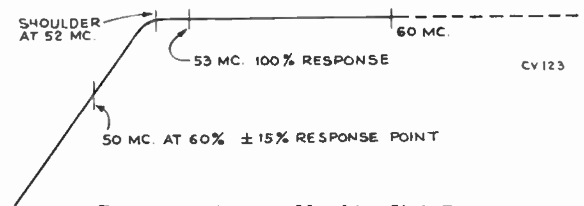


Figure 12—Antenna Matching Unit Response

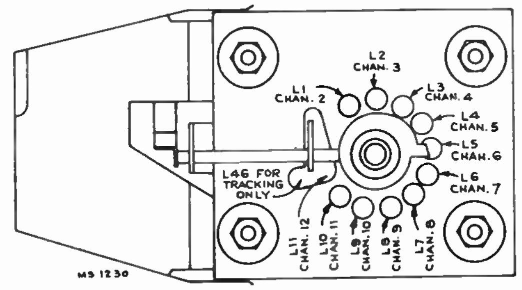


Figure 8—R-F Oscillator Adjustments

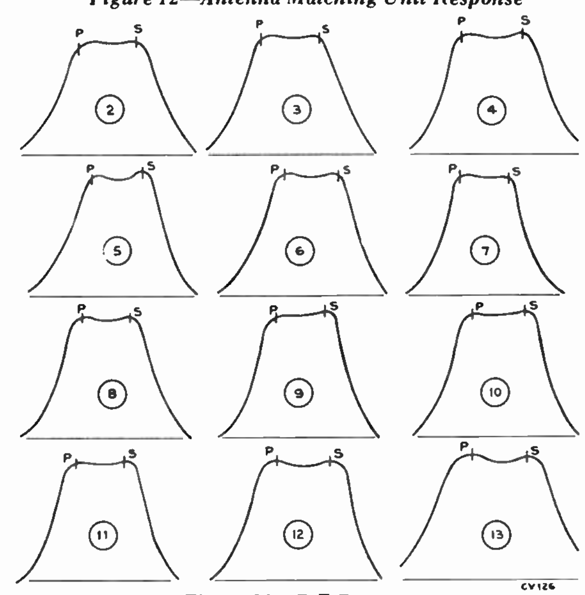


Figure 13—R-F Response

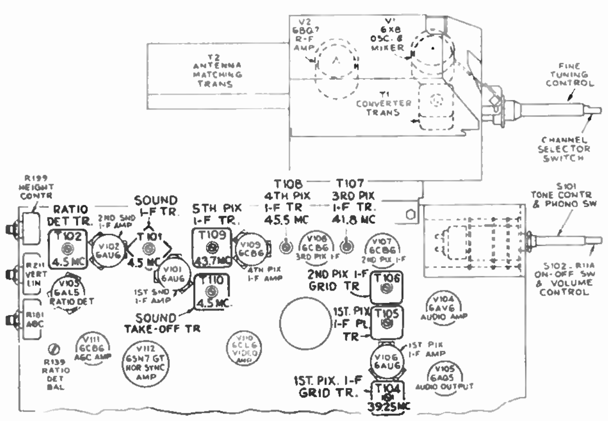


Figure 9—Top Chassis Adjustments

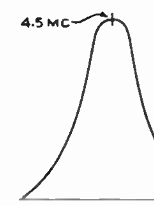


Figure 14
Sound I-F
Response

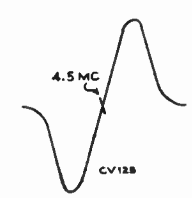


Figure 15
Ratio Det.
Response

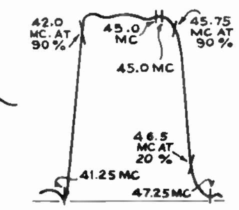


Figure 16
T105 and T106
Response

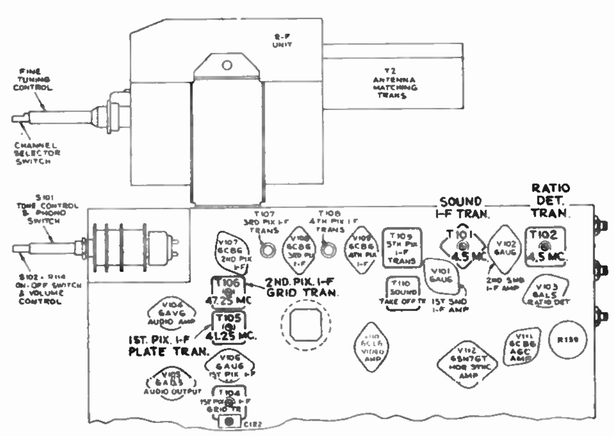


Figure 10—Bottom Chassis Adjustments

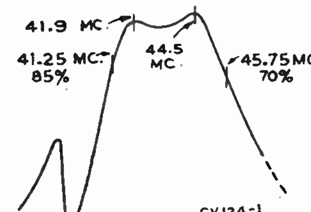


Figure 17
T1 and T104
Response

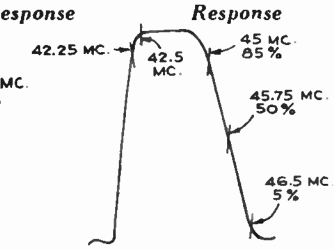


Figure 18
Over-all I-F
Response

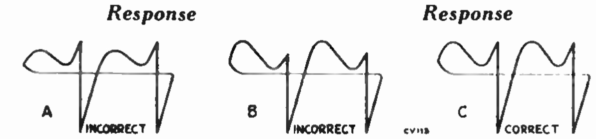


Figure 19—Horizontal Oscillator Waveforms

TEST PATTERN PHOTOGRAPHS

Figure 20—Normal Picture

Figure 21—Focus Magnet and Ion Trap Magnet Misadjusted

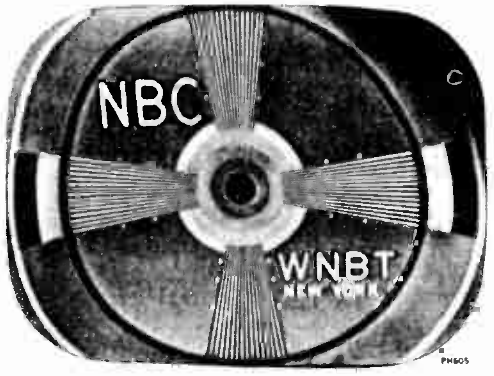
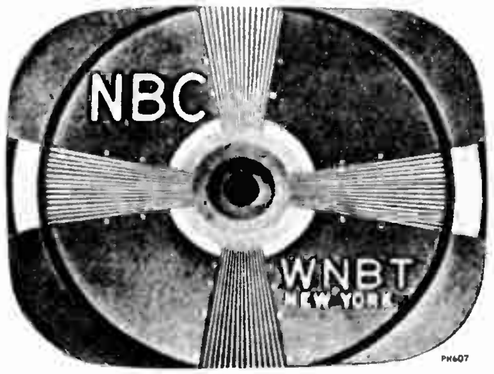


Figure 22—Horizontal Linearity Control Misadjusted (Picture Cramped in Middle)

Figure 23—Width Control Misadjusted



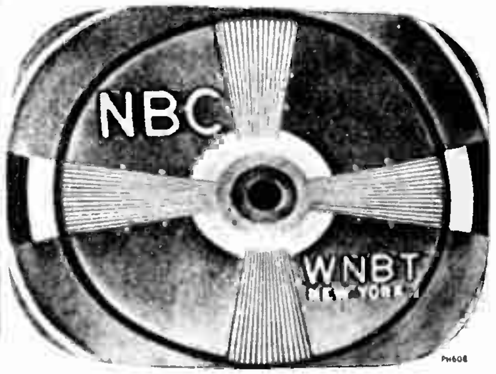


Figure 24—Horizontal Drive Control Misadjusted

Figure 25—Transients

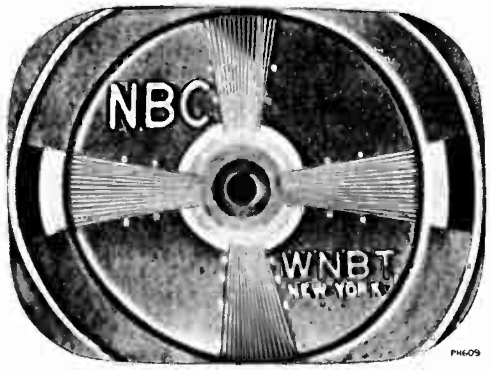
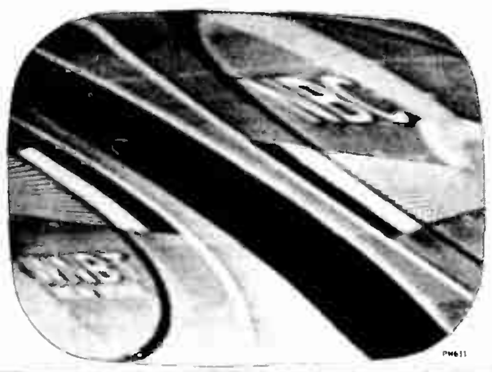


Figure 26—Test Pattern Showing Out of Sync Condition When Horizontal Hold Control Is in a Counter-clockwise Position—Just Before Pulling Into Sync

Figure 27—Test Pattern Showing Out of Sync Condition When Horizontal Hold Control Is at the Maximum Clockwise Position



SERVICE SUGGESTIONS

Following is a list of symptoms of possible failures and an indication of some of the possible faults:

NO RASTER ON KINESCOPE:

(1) Incorrect adjustment of ion trap magnet. Magnet reversed either front to back or top to bottom.

(2) V116 or V117 inoperative. Check waveforms on grids and plates.

(3) No high voltage—if horizontal deflection is operating as evidenced by the correct waveform on terminal 1 of high voltage transformer, the trouble can be isolated to the 1B3GT circuit. Either the T114 high voltage winding is open, the 1B3GT tube is defective or its filament circuit is open.

(4) V110 circuit inoperative—Refer to schematic and waveform chart.

(5) Damper tube (V119) inoperative.

(6) Defective kinescope.

(7) R216 open.

(8) No receiver plate voltage—filter capacitor shorted—or filter choke open.

NO VERTICAL DEFLECTION:

(1) V114B or V115 inoperative. Check voltage and waveforms on grids and plates.

(2) T111 open.

(3) Vertical deflection coils open.

SMALL RASTER:

(1) Low Plus B or low line voltage.

(2) V117 defective.

POOR VERTICAL LINEARITY:

(1) If adjustments cannot correct, change V115.

(2) Vertical output transformer T111 defective.

(3) V114B defective—check voltage and waveforms on grid and plate.

(4) C176, C180, C181, C178, C177 or C182 defective.

(5) Low plate voltage—check rectifiers and capacitors in supply circuits.

(6) If height is insufficient, try changing V114.

POOR HORIZONTAL LINEARITY:

(1) If adjustments do not correct, change V117, or V119.

(2) T114 or L107 defective.

(3) C205 or C206 defective.

WRINKLES ON SIDE OF RASTER:

(1) C208 defective.

(2) Defective yoke.

PICTURE OUT OF SYNC HORIZONTALLY:

(1) T113 incorrectly tuned.

(2) R226, R227 or R197B defective.

TRAPEZOIDAL OR NON SYMMETRICAL RASTER:

(1) Improper adjustment of centering of focus magnet or ion trap magnet.

(2) Defective yoke.

RASTER AND SIGNAL ON KINESCOPE BUT NO SOUND:

(1) T110 defective.

(2) Sound i-f, ratio detector or audio amplifier inoperative—check V101, V102, V103 and their socket voltages.

(3) Audio system defective.

(4) Speaker defective.

SIGNAL AT KINESCOPE GRID BUT NO SYNC:

(1) AGC control R181 misadjusted.

(2) V111 inoperative. Check voltage and waveforms at its grid and plate.

SIGNAL ON KINESCOPE GRID BUT NO VERTICAL SYNC:

(1) Check V114B and associated circuit.

(2) Integrating network inoperative—Check.

(3) V113 or V114A defective or associated circuit defective.

(4) Gas current, grid emission or grid cathode leakage in V114. Replace.

SIGNAL ON KINESCOPE GRID BUT NO HORIZONTAL SYNC:

(1) T113 misadjusted—readjust as instructed on page 11.

(2) V112 or V113 inoperative—check socket voltages and waveforms.

(3) T113 defective.

(4) C163, C191A, C190, C194, C195, C197, C196, C198 or C199 defective.

(5) If horizontal speed is completely off and cannot be adjusted check R226, R227, R197B, R228, R229, R230 and R232.

SOUND AND RASTER BUT NO PICTURE OR SYNC:

(1) Picture, detector or video amplifier defective—check CR101 and V110—check socket voltages.

(2) Bad contact to kinescope cathode.

PICTURE STABLE BUT POOR RESOLUTION:

(1) CR101 or V110 defective.

(2) Peaking coils defective—check resistance.

(3) Make sure that the focus control operates on both sides of proper focus.

(4) R-F and I-F circuits misaligned.

PICTURE SMEAR:

(1) R-F or I-F circuits misaligned.

(2) Open peaking coil.

(3) This trouble can originate at the transmitter—check on another station.

PICTURE JITTER:

(1) AGC control R181 misadjusted.

(2) If regular sections at the left picture are displaced change V117.

SERVICE SUGGESTIONS

(3) Vertical instability may be due to loose connections or noise.

(4) Horizontal instability may be due to unstable transmitted sync.

RASTER BUT NO SOUND, PICTURE OR SYNC:

(1) Defective antenna or transmission line.

(2) R-F oscillator off frequency.

(3) R-F unit inoperative—check V1, V2.

DARK VERTICAL LINE ON LEFT OF PICTURE:

(1) Reduce horizontal drive and readjust width and horizontal linearity.

(2) Replace V117.

LIGHT VERTICAL LINE ON LEFT OF PICTURE:

(1) V119 defective.

PICTURE I-F RESPONSE.—At times it may be desirable to observe the individual i-f stage response. This can be achieved by the following method:

For T107, T108 or T109, shunt all i-f transformers with a 330 ohm carbon resistor except the one whose response is to be observed.

Connect a wide band sweep generator to the second pix i-f grid and adjust it to sweep from 38 mc. to 48 mc.

Connect the oscilloscope to test point TP102 and observe the overall response. The response obtained will be essentially that of the unshunted stage.

To see the response of transformers T1, T104 and T105, T106, follow the instructions given on page 10.

Figures 28 through 36 show the response of the various stages obtained in the above manner. The curves shown are typical although some variation between receivers can be expected. Relative stage gain is not shown.

RESPONSE PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

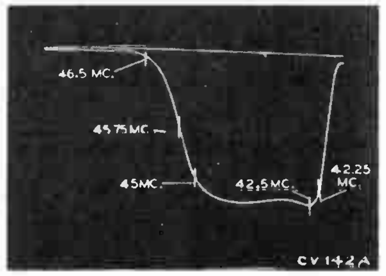


Figure 28—Overall Pix I-F Response

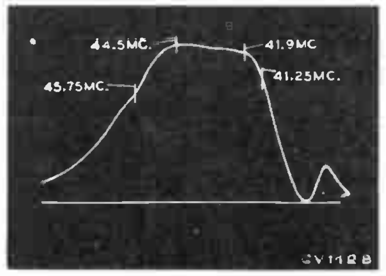


Figure 29—Response of T1-T104 Pix I-F Transformers

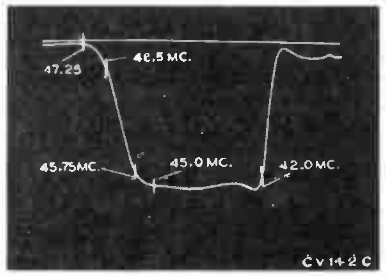


Figure 30—Response of T105-T106 Pix I-F Transformer

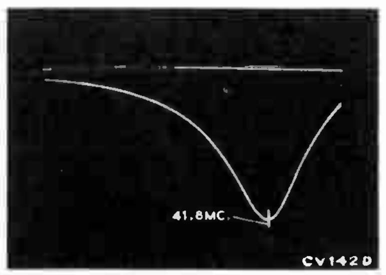


Figure 31—Response of T107 Pix I-F Transformer

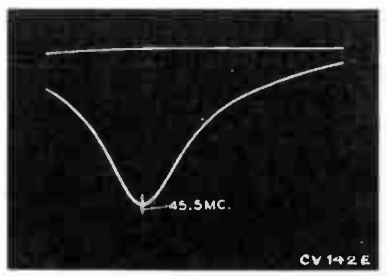


Figure 32—Response of T108 Pix I-F Coil

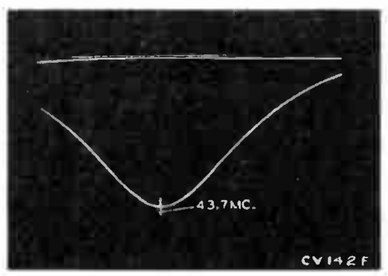


Figure 33—Response of T109 Pix I-F Coil

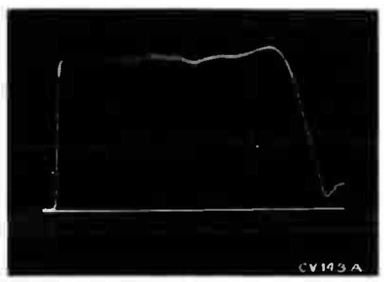


Figure 34—Video Response at Average Contrast

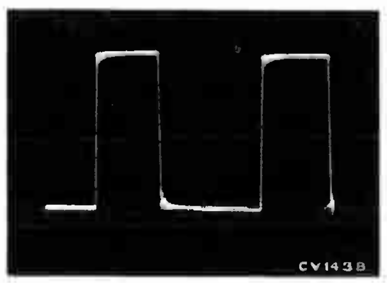


Figure 35—Video Response (100 KC Square Wave)

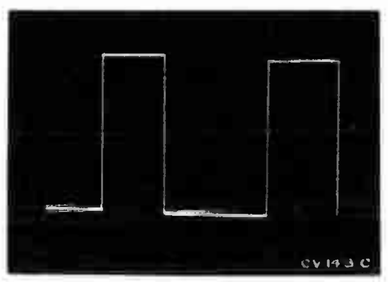


Figure 36—Video Response (60 Cycle Square Wave)

WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

Grid of Video Amplifier (Pin 2 of V110) (6CL6) (Pin 4 of V110) (6AG7)

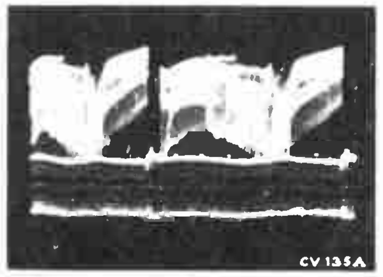


Figure 37—Vertical (Oscilloscope Synced to ½ of Vertical Sweep Rate) (6 Volts PP)

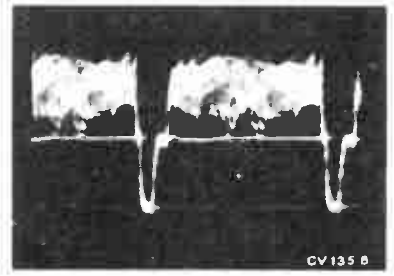


Figure 38—Horizontal (Oscilloscope Synced to ½ of Horizontal Sweep Rate) (6 Volts PP)

Plate of Video Amplifier (Pin 6 of V110) (6CL6) (Pin 8 of V110) (6AG7)

Voltage depends on picture

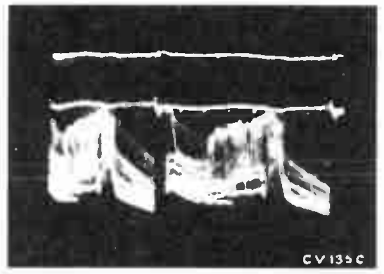


Figure 39—Vertical (105 Volts PP)

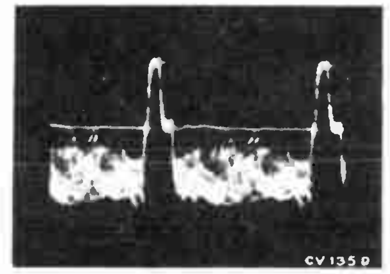


Figure 40—Horizontal (105 Volts PP)

Grid of Sync Separator (Pin 4 of V113) (6SN7)

Voltage depends on picture

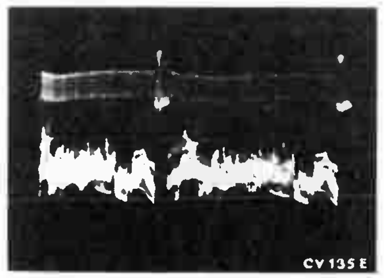


Figure 41—Vertical (30 Volts PP)

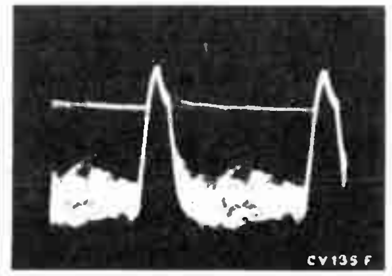


Figure 42—Horizontal (30 Volts PP)

Plate of Sync Separator (Pin 5 of V113) (6SN7)

Voltage depends on picture

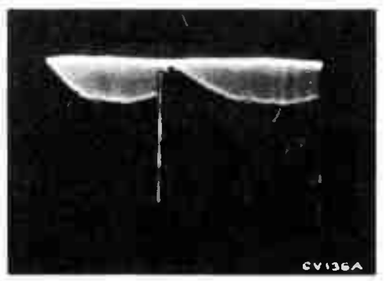


Figure 43—Vertical (33 Volts PP)

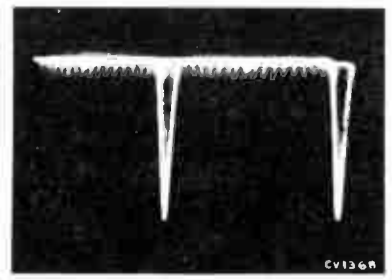


Figure 44—Horizontal (8 Volts PP)

Grid of Vertical Sync Amp. (Pin 4 of V114A) (6SN7)

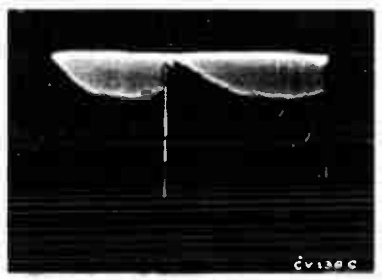


Figure 45—Vertical (12 Volts PP)

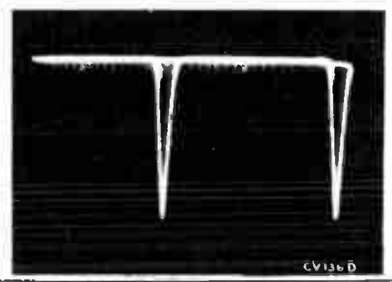


Figure 46—Horizontal (5 Volts PP)

WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

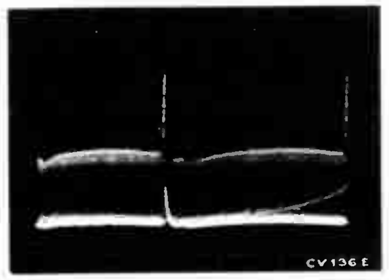
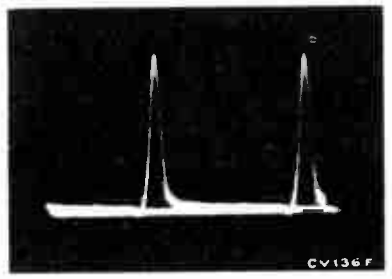


Plate of Vertical Sync Amp.
(Pin 5 of V114A) (6SN7)

Figure 47—Vertical (27 Volts PP)

Figure 48—Horizontal (16 Volts PP)



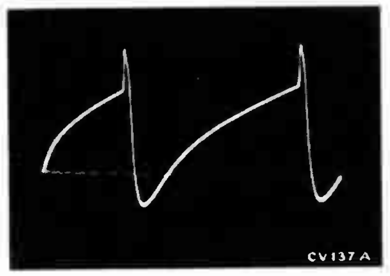
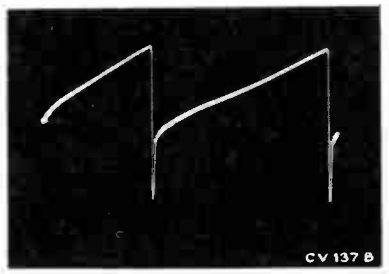


Figure 49—Grid of Vertical Sweep Osc. (Pin 1 of V114B) (6SN7) (25 Volts PP)

Figure 50—Plate of Vertical Sweep Osc. (Pin 2 of V114B) (30 Volts PP)



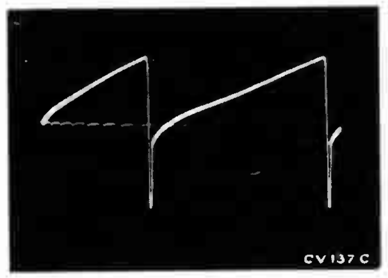
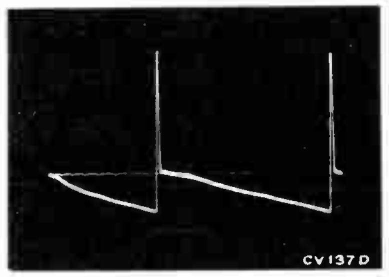
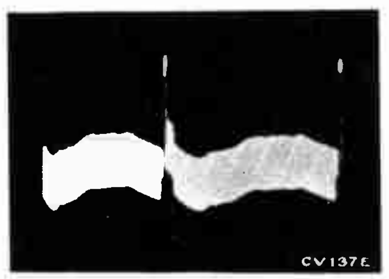


Figure 51—Grid of Vertical Sweep Output (Pin 1 of V115) (6AQ5) (35 Volts PP)

Figure 52—Plate of Vertical Sweep Output (Pin 5 of V115) (6AQ5) (800 Volts PP)

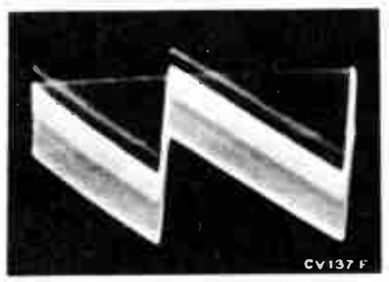




Cathode of Sync Separator
(Pin 3 of V113) (6SN7)

Figure 53—Vertical (11 Volts PP)

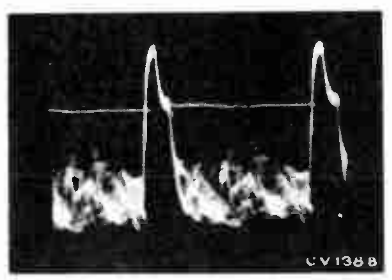
Figure 54—Horizontal (6 Volts PP)



Grid of Sync Separator
(Pin 1 of V113) (6SN7)

Figure 55—Vertical (40 Volts PP)

Figure 56—Horizontal (40 Volts PP)



WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

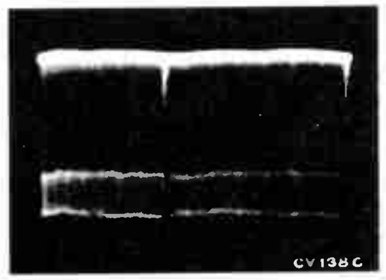
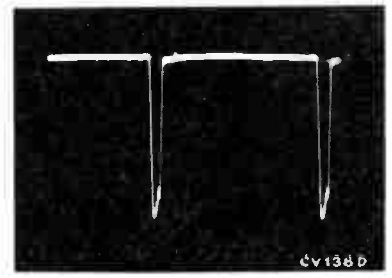
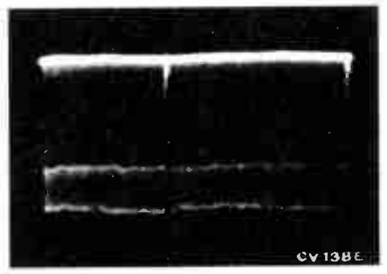


Plate of Sync Separator
(Pin 2 of V113)

Figure 57—Vertical (15 Volts PP)

Figure 58—Horizontal (15 Volts PP)

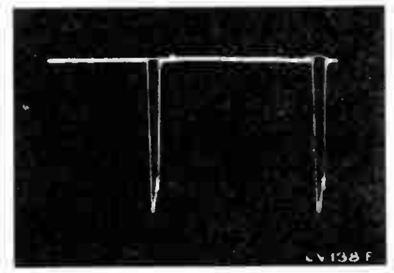




Grid of Hor Sync Amp
(Pin 4 of V112) (6SN7)

Figure 59—Vertical (15 Volts PP)

Figure 60—Horizontal (15 Volts PP)



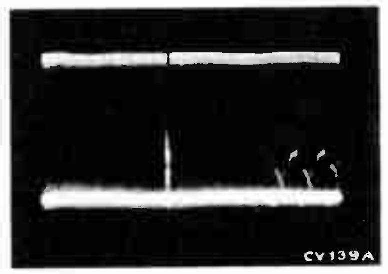
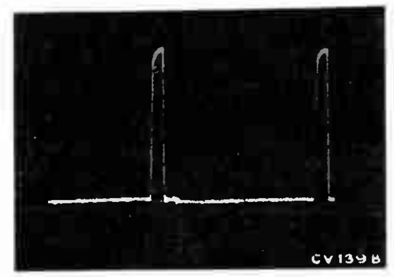
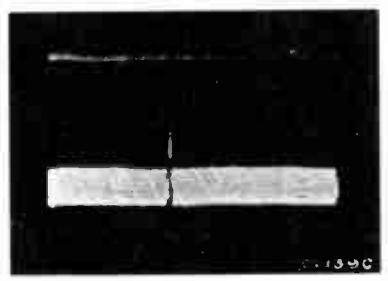


Plate of Hor Sync Amp
(Pin 5 of V112) (6SN7)

Figure 61—Vertical (70 Volts PP)

Figure 62—Horizontal (70 Volts PP)

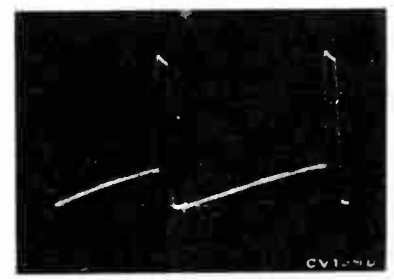


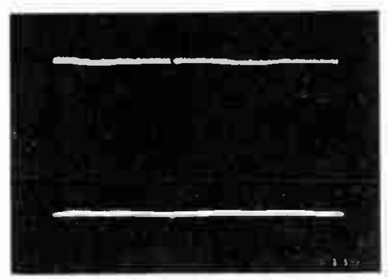


Grid of Hor Sync Amp
(Pin 1 of V112) (6SN7)

Figure 63—Vertical (65 Volts PP)

Figure 64—Horizontal (65 Volts PP)

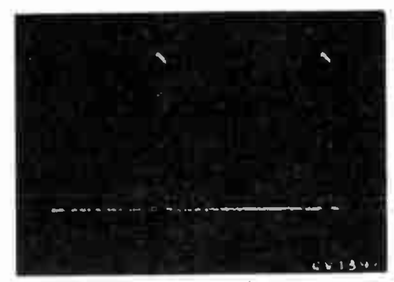




Cathode of Hor Sync Amp
(Pin 3 of V112) (6SN7)

Figure 65—Vertical (18 Volts PP)

Figure 66—Horizontal (18 Volts PP)



WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

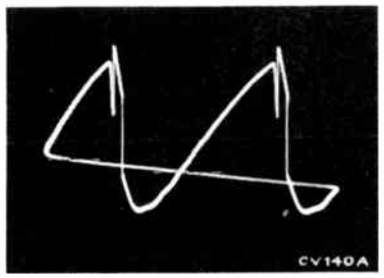


Figure 67—Grid of Horizontal Oscillator Control (22 Volts PP) (Pin 1 of V116) (6SN7GT)

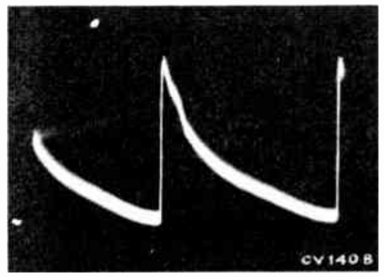


Figure 68 Cathode of Horizontal Oscillator Control (1.3 Volts PP) (Pin 3 of V116) (6SN7GT)

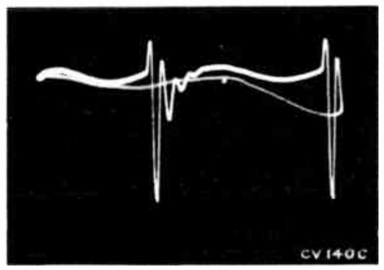


Figure 69—Grid of Horizontal Oscillator (390 Volts PP) (Pin 4 of V116) (6SN7GT)

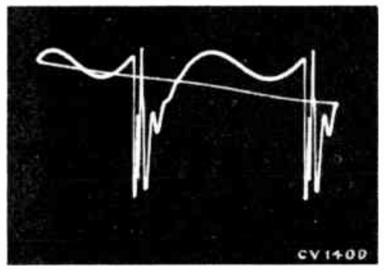


Figure 70—Plate of Horizontal Oscillator (140 Volts PP) (Pin 5 of V116) (6SN7GT)

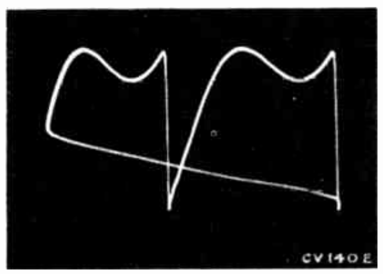


Figure 71—Terminal "C" of T114 (120 Volts PP)

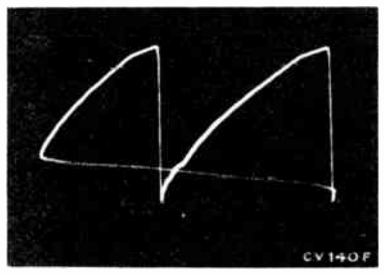


Figure 72—Grid of Horizontal Output Tube (95 Volts PP) (Pin 5 of V117) (6BQ6)

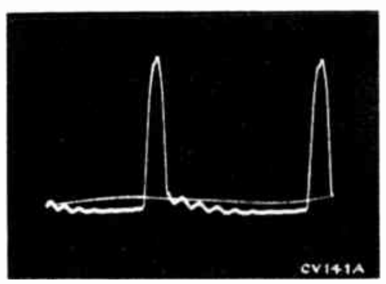


Figure 73—Plate of Horizontal Output (Approx. 4000 Volts PP) (Measured Through a Capacity Voltage Divider Connected from Top Cap of V117 to Ground)

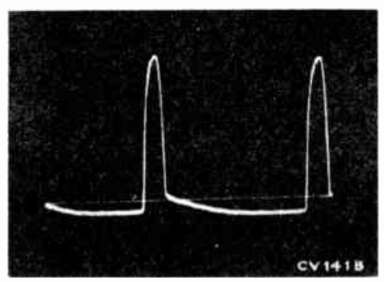


Figure 74—Cathode of Damper (2300 Volts PP) (Pin 3 of V119) (6W4GT)

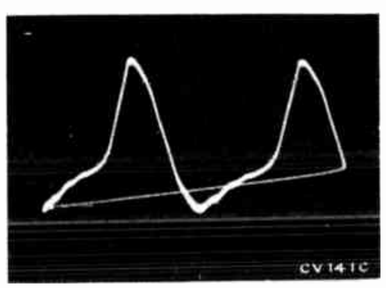


Figure 75—Plate of Damper (180 Volts PP) (Pin 5 of V119) (6W4GT)

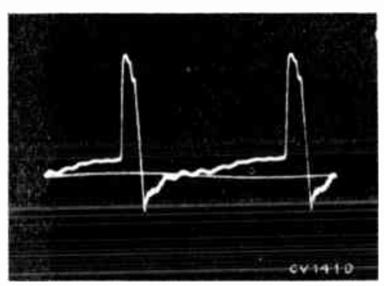


Figure 76—Plate of AGC Amplifier (Pin 5 of V111) (6CB6) (600 Volts PP)

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 5000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V1	6X8	Mixer	5000 Mu. V. Signal	9	—	8	—	6	0	7	—	
			No Signal	9	145 to 150	8	145 to 150	6	0	7	−2.8 to −3.5	Depending on channel
V1	6X8	R-F Oscillator	5000 Mu. V. Signal	3	—	—	—	6	0	2	—	
			No Signal	3	88 to 108	—	—	6	0	2	−3.0 to −5.1	Depending on channel
V2	6BQ7	R-F Amplifier	5000 Mu. V. Signal	6	—	—	—	8	—	7	—	
			No Signal	6	133 to 138	—	—	8	1.1	7	—	Depending on channel
V2	6BQ7	R-F Amplifier	5000 Mu. V. Signal	1	—	—	—	3	—	2	—	
			No Signal	1	260	—	—	3	133 to 138	2	—	Depending on channel
V101	6AU6	1st Sound I-F Amp.	5000 Mu. V. Signal	5	140	6	152	7	0.3	1	−3.8	
			No Signal	5	112	6	122	7	0.8	1	−0.2	
V102	6AU6	2d Sound I-F Amp.	5000 Mu. V. Signal	5	258	6	58	7	0.19	1	−21	
			No Signal	5	255	6	55	7	0.22	1	*−2.5	*Unreliable measuring point. Voltage depends on noise.
V103	6AL5	Ratio Detector	5000 Mu. V. Signal	7	0.4	—	—	1	16.8	—	—	7.5 kc deviation at 400 cycles
			No Signal	7	0.5	—	—	1	*9.35	—	—	*Unreliable measuring point. Voltage depends on noise.
V104	6AV6	1st Audio Amplifier	5000 Mu. V. Signal	7	95	—	—	2	0	1	−0.6	At min. volume
			No Signal	7	95	—	—	2	0	1	−0.6	At min. volume
V105	6AQ5	Audio Output	5000 Mu. V. Signal	5	263	6	273	2	18.2	7	0	At min. volume
			No Signal	5	262	6	272	2	18.2	7	0	At min. volume
V106	6AU6	1st Pix. I-F Amplifier	5000 Mu. V. Signal	5	242	6	279	7	0.06	1	-7.6	
			No Signal	5	140	6	135	7	1.03	1	*0	*Unreliable measuring point. Make measurement at T104-D.
V107	6CB6	2nd Pix. I-F Amplifier	5000 Mu. V. Signal	5	240	6	267	2	0.2	1	−7.6	
			No Signal	5	131	6	110	2	0.9	1	0	
V108	6CB6	3d Pix. I-F Amplifier	5000 Mu. V. Signal	5	127	6	112	2	0.92	1	0	
			No Signal	5	121	6	110	2	0.96	1	0	
V109	6CB6	4th Pix. I-F Amplifier	5000 Mu. V. Signal	5	194	6	159	2	2.4	1	0	
			No Signal	5	198	6	150	2	2.2	1	0	
V110	6CL6 *6AG7	Video Amplifier	5000 Mu. V. Signal	6	128	8	192	1	1.12	2	−3.5	*See Figure 79 for socket connections
			No Signal	6	72	8	142	1	1.48	2	†−0.9	†Depends on noise
V111	6CB6	AGC Amplifier	5000 Mu. V. Signal	5	−51	6	278	2	116	1	108	AGC control set for normal operation
			No Signal	5	0.9	6	282	2	100	1	54	AGC control set for normal operation

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 5000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V112	6SN7GT	Hor. Sync. Amplifier	5000 Mu. V. Signal	2	162	—	—	3	1.4	1	-40	
			No Signal	2	152	—	—	3	0.52	1	*-24	*Unreliable measurement point. Voltage depends on noise
			5000 Mu. V. Signal	5	84	—	—	6	0	4	-1.38	
			No Signal	5	98	—	—	6	0	4	*1.08	*Voltage depends on noise.
V113	6SN7GT	Hor. Sync. Separator	5000 Mu. V. Signal	2	290	—	—	3	95	1	50	
			No Signal	2	285	—	—	3	*56	1	*38	*Unreliable measurement points. Voltage depends on noise.
V113	6SN7GT	Vert. Sync. Separator	5000 Mu. V. Signal	5	115	—	—	6	0	4	-58	
			No Signal	5	59	—	—	6	0	4	-11	
V114A	6SN7GT	Vert. Sync. Amplifier	5000 Mu. V. Signal	5	45	—	—	6	0	4	0.03	
			No Signal	5	43	—	—	6	0	4	0	
V114B	6SN7GT	Vertical Oscillator	5000 Mu. V. Signal	2	*72	—	—	3	0	1	*-15.3	*Depends on setting of Vert. hold control. Voltages shown are synced pix adjustment.
			No Signal	2	*70	—	—	3	0	1	*-15	
V115	6AQ5	Vertical Output	5000 Mu. V. Signal	5	270	6	290	2	27	1	0	
			No Signal	5	267	6	285	2	26	1	0	
V116	6SN7GT	Horizontal Osc. Control	5000 Mu. V. Signal	2	237	—	—	3	-10	1	-28.5	
			No Signal	2	228	—	—	3	-18	1	-29.5	
			5000 Mu. V. Signal	2	104	—	—	3	-36.3	1	-44	Hor. hold counter-clockwise
			5000 Mu. V. Signal	2	246	—	—	3	-11.5	1	-26	Hor. hold clockwise
V116	6SN7GT	Horizontal Oscillator	5000 Mu. V. Signal	5	200	—	—	6	0	4	-75	
			No Signal	5	197	—	—	6	0	4	-78	
			5000 Mu. V. Signal	5	193	—	—	6	0	4	-93	Hor. hold counter-clockwise
			5000 Mu. V. Signal	5	198	—	—	6	0	4	-74	Hor. hold clockwise
V117	6BQ6GT	Horizontal Output	5000 Mu. V. Signal	Cap	*	4	190	8	19.2	5	-16	*High Voltage Pulse Present
			No Signal	Cap	*	4	190	8	19.2	5	-15.3	
V118	1B3GT /8016	H. V. Rectifier	5000 Mu. V. Signal	Cap	*	—	—	2 & 7	15,150	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	15,300	—	—	
V119	6W4GT	Damper	5000 Mu. V. Signal	5	287	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	280	—	—	3	*	—	—	
V120	17QP4	Kinescope	5000 Mu. V. Signal	Cone	15,150	10	568	11	178	2	117	At average Brightness
			No Signal	Cone	15,300	10	560	11	151	2	101	

R-F UNIT WIRING DIAGRAM

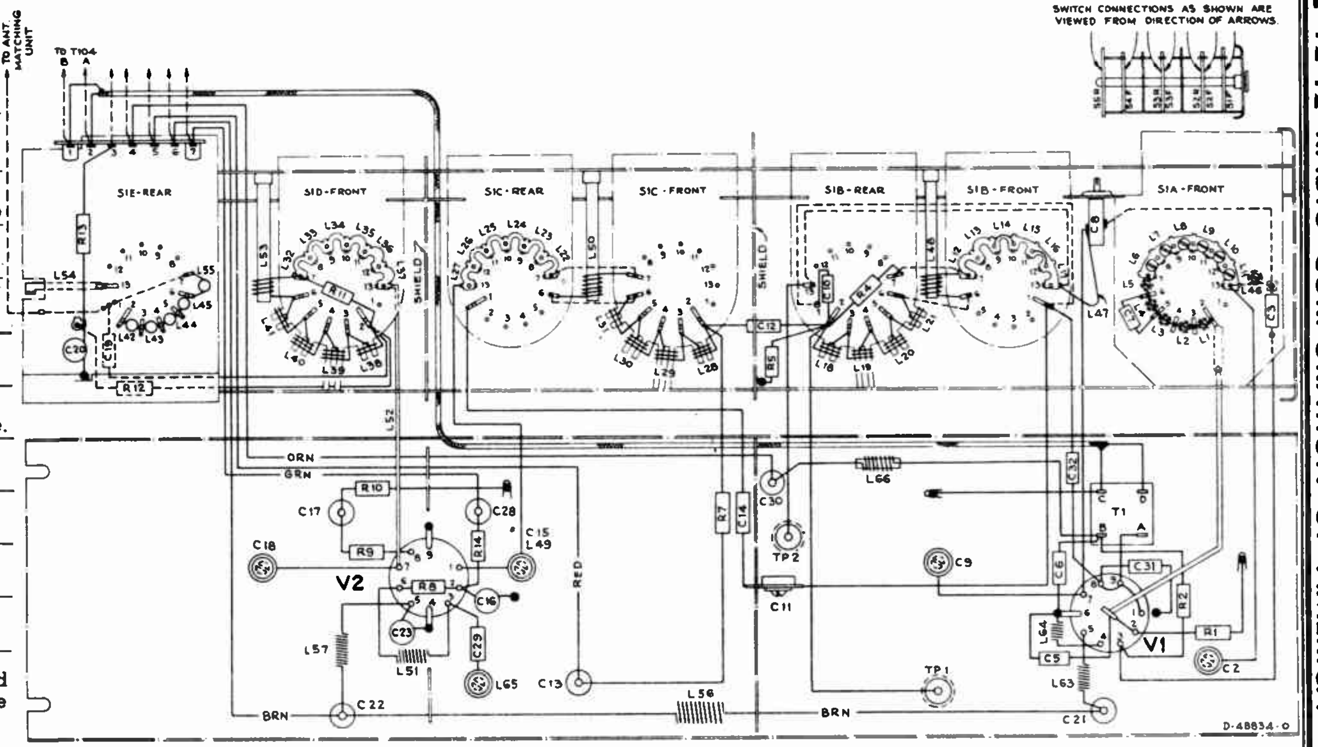


Figure 77—R-F Unit Wiring Diagram

CRITICAL LEAD DRESS

1. Keep all wiring in the pix i-f, sound i-f and video circuits as short as possible.
2. Keep the leads on C110, C111, C112, R108, R139, R150, R111, R109, R110 and R233 as short and direct as possible.
3. Do not change the bus wire connection to pin 2 of V101 and V102. Sleeving is used on these wires to insure length and to prevent shorting.
4. Dress C115 down between R114 (volume control) and wafer S101-B.
5. Ground R126 to pin 3 of V106 and R134 to pin 7 of V107.
6. Do not change the grounding of R136, R140 and R143.
7. Keep the bus wire from T109-A to C144 (plug in capacitor) short and direct.
8. Ground the filaments of sockets V107, V108 and V109 independently of the socket center pin. Use ground lances proved near each socket.
9. Dress C148 straight up to act as a shield between T101-A and V110-2.
10. Dress C155 and R160 (kine cathode) up in the air above the terminal board.
11. Keep the leads connected to T113-C and T113-D (synchoguide) down so that they will not short out when the chassis is placed in the cabinet.
12. Do not reroute any wires between T104 and the terminal board alongside it. Keep all leads on the foot side of the terminal board.
13. Dress all wires routed past T104, shielded wires W102 and W103 under the big lances near T104.
14. Dress all a-c leads to S102 under the large lances on the front apron.
15. Dress R113 close to the chassis with leads as short as possible.
16. Dress C158 and C122 up in the air and away from all other leads and components.
17. The lead from pin 5 of V111 to the terminal board under the high voltage cage should be routed between V117 socket and the rear apron.
18. Dress all 2 watt resistors away from each other and all other wires and components.
19. Dress all wires away from damper tube V119.
20. The wire from pin 5 V116 to T113-A should not be more than 5 inches long.
21. Dress all peaking coils up and away from the base.
22. Dress all leads in the high voltage compartment away from each other and away from the high voltage transformer.

STOCK No.	DESCRIPTION
	R-F UNIT ASSEMBLIES KRK11A
76539	Board—Antenna matching transformer terminal board less coils L58, L59, L60 and less capacitors C24, C25, C26, C27
76531	Board—Terminal board, 5 contact and ground
76845	Bracket—Vertical bracket for holding V1 tube shield
76965	Capacitor—Ceramic, variable, for fine tuning—plunger type (C2)
93056	Capacitor—Ceramic, 5 mmf. (C26, C32)
70597	Capacitor—Ceramic, 8 mmf. (C29)
55326	Capacitor—Ceramic, 10 mmf. (C3)
54207	Capacitor—Ceramic, 18 mmf. (C27)
76557	Capacitor—Ceramic, 22 mmf. (C19, C31)
76558	Capacitor—Ceramic, 22 mmf. (C5)
70935	Capacitor—Ceramic, 27 mmf. (C25)
76739	Capacitor—Ceramic, 33 mmf. (C24)
77460	Capacitor—Ceramic, 220 mmf. (C10)
75199	Capacitor—Ceramic, 270 mmf. (C12, C14)
75166	Capacitor—Ceramic, 1500 mmf. (stand-off) (C13, C17, C21, C22, C28, C30)
75610	Capacitor—Ceramic, 1500 mmf. (C6)
73748	Capacitor—Ceramic, 1500 mmf. (C16, C20, C23)
71088	Capacitor—Ceramic, 0.68 mmf. (C7)
77151	Capacitor—Tubular, steatite, adjustable, 0.8-3.0 mmf. (C8)
75184	Capacitor—Ceramic, adjustable, 0.80-3.8 mmf. complete with adjusting stud (C9)
76532	Capacitor—Adjustable trimmer, steatite, 1.-4. mmf. (C18)
76527	Capacitor—Mica trimmer, 55-80 mmf. (C11)
76143	Clip—Tubular clip for mounting stand-off capacitors
73591	Coil—Antenna matching coil (2 required)
73477	Coil—Choke coil (L57)
76763	Coil—Filament choke coil (L63, L64)
77206	Coil—Filament choke coil (L56)
76562	Coil—R-F amplifier coupling coil (L51)
77153	Coil—R-F choke coil (L66)
76537	Coil—Shunt coil complete with adjustable core (L61)
76538	Coil—Shunt coil complete with adjustable core (L62)
76529	Coil—Trimmer coil (3 turns) with adjustable inductance core and capacitor stud (screw adjustment) for r-f section (L49, C15)
38853	Connector—4 contact female connector—part of matching transformer (J1)
76559	Connector—Oscillator grid connector
76460	Contact—Test point contact
77202	Core—Adjustable core for fine tuning capacitor
76543	Core—Adjusting core for FM trap
76521	Detent—Detent mechanism and fibre shaft
73453	Form—Coil form for coils L48, L50, L53
77203	Link—Link assembly for fine tuning
76728	Nut—Speednut for mounting adjustable trimmer 76532
	Resistor—Fixed, composition:
503047	47 ohms, ±10%, ½ watt (R9)
503082	82 ohms, ±10%, ½ watt (R10)
503115	150 ohms, ±10%, ½ watt (R13)
503210	1000 ohms, ±10%, ½ watt (R7, R14)
503233	3300 ohms, ±10%, ½ watt (R4, R11, R12)
503247	4700 ohms, ±10%, ½ watt (R2)
503410	100,000 ohms, ±10%, ½ watt (R1, R5, R6)
503447	470,000 ohms, ±10%, ½ watt (R8)
14343	Retainer—Fine tuning shaft retaining ring
75164	Rod—Actuating plunger rod (fibre) for fine tuning link
76547	Screw—No. 4-40 x ¼" adjusting screw for coils L6, L7, L8, L9, L10, L11
76549	Screw—No. 4-40 x ⅜" adjusting screw for coil L5
76548	Screw—No. 4-40 x 5/16" adjusting screw for coils L1, L2, L3, L4, L46
76519	Shaft—Channel selector shaft and plate
76134	Shaft—Fine tuning shaft and cam
77147	Shield—Front shield complete with shaft bushing and bracket
76534	Shield—Tube shield
76530	Socket—Tube socket, 9 pin, miniature, ceramic, saddle-mounted for V1
76336	Socket—Tube socket, 9 pin, miniature, bakelite, saddle-mounted for V2
77149	Spacer—Metal spacer for front plate
75163	Spring—Friction spring (formed) for fine tuning cam
30340	Spring—Hairpin spring for fine tuning link
75068	Spring—Retaining spring for tube shield
77204	Spring—Return spring for fine tuning control
76554	Stator—Antenna stator complete with rotor, coils, capacitors and resistor (S5, C20, L42, L43, L44, L45, L54, L55, R13)
77353	Stator—Convertor stator complete with rotor, coils, capacitor and resistors (S2, C10, C12, L12, L13, L14, L15, L16, L17, L18, L19, L20, L21, L47, L48, R4, R5, R6)
77205	Stator—Oscillator stator complete with rotor, coils and capacitors (S1, C3, C7, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L46)
76553	Stator—R-F plate stator complete with rotor, coils, capacitor and resistor (S3, C14, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L50, R7)
76556	Stator—R-F grid stator complete with rotor, coils, capacitor and resistors (S4, C19, L32, L33, L34, L35, L36, L37, L38, L39, L40, L41, L53, R11, R12)
76561	Strap—Channel No. 13 r-f grid strap (L52)
76525	Strip—Coil segment mounting strip—RH center
76526	Strip—Coil segment mounting strip—LH lower
76544	Strip—Coil segment mounting strip — LH upper — less trimmer
75446	Stud—Capacitor stud for trimmer coil L49, C15 (uncoded and coded "ER")
75447	Stud—Capacitor stud for trimmer coil L49, C15 (coded numerically and "Hi Q")
76740	Stud—No. 6-32 x 1" adjusting stud for adjustable capacitor
77152	Terminal—Terminal for mounting C8 trimmer
76536	Transformer—Antenna matching transformer complete (T2, C24, C25, C26, C27, L58, L59, L60, L61, L62, J1)
77148	Transformer—Convertor transformer (T1, R3)
76540	Trap—FM trap complete with adjustable core (L58)
76535	Trap—I-F trap (L65)
76542	Trap—I-F trap (41.25 MC) complete with core (L60)
76541	Trap—I-F trap (45.75 MC) complete with core (L59)
75190	Washer—Insulating washer (neoprene) for adjustable capacitor
	CHASSIS ASSEMBLIES KCS74
76456	Bracket—Channel indicator lamp bracket
76454	Bracket—Mounting bracket complete with insulator for picture control
71496	Capacitor—Adjustable trimmer, 5-70 mmf. (C122)
75217	Capacitor—Mica trimmer, dual 10-160 mmf. (C191A, C191B)
33380	Capacitor—Ceramic, 12 mmf. (C193)
39044	Capacitor—Ceramic, 15 mmf. (C154)
73664	Capacitor—Ceramic, 39 mmf. (C153)
71924	Capacitor—Ceramic, 56 mmf. (C105)
76475	Capacitor—Mica, 68 mmf. (C192)
76474	Capacitor—Mica, 82 mmf. (C163)
39396	Capacitor—Ceramic, 100 mmf. (C114, C162)
75437	Capacitor—Ceramic, 100 mmf. (C152)
51416	Capacitor—Mica, 180 mmf. (C167)
76673	Capacitor—Ceramic, 220 mmf. (C184)
73091	Capacitor—Mica, 270 mmf. (C207)
47617	Capacitor—Ceramic, 270 mmf. (C118)
39640	Capacitor—Mica, 330 mmf. (C166)
76476	Capacitor—Mica, 330 mmf. (C198)
73094	Capacitor—Mica, 390 mmf. (C174)
54003	Capacitor—Mica, 470 mmf. (C110, C111)
75166	Capacitor—Ceramic, 1500 mmf. (stand-off) (C144)
73473	Capacitor—Ceramic, 4700 mmf. (C126, C127, C128, C129, C130, C131, C135, C136, C139, C142, C216)
76470	Capacitor—Ceramic, dual, 4700 mmf. (C123A, C123B, C137A, C137B, C140A, C140B, C141A, C141B, C156A, C156B)
73960	Capacitor—Ceramic, 10,000 mmf. (C145, C148)
75877	Capacitor—Ceramic, dual, 10,000 mmf. (C101A, C101B, C107A, C107B)
74521	Capacitor—Electrolytic, 5 mfd., 50 volts (C112)
28417	Capacitor—Electrolytic, 5 mfd., 450 volts (C183)
75218	Capacitor—Electrolytic, comprising 1 section of 10 mfd., 350 volts, 1 section of 5 mfd., 350 volts and 1 section of 150 mfd., 50 volts (C212A, C212B, C212C)
76451	Capacitor—Electrolytic, comprising 1 section of 100 mfd., 350 volts, 2 sections of 10 mfd., 350 volts and 1 section of 20 mfd., 50 volts (C211A, C211B, C211C, C211D)
75220	Capacitor—Electrolytic, 150 mfd., 200 volts (C209, C210)
76479	Capacitor—Tubular, moulded, oil impregnated, .00068 mfd., 600 volts (C200)
75249	Capacitor—Tubular, paper, oil impregnated, .001 mfd., 600 volts (C164, C172, C190)
76995	Capacitor—Tubular, moulded, oil impregnated, .0012 mfd., 600 volts (C201)
73802	Capacitor—Tubular, paper, oil impregnated, .0015 mfd., 600 volts (C159)
73595	Capacitor—Tubular, paper, oil impregnated, .0022 mfd., 600 volts (C113, C161, C173, C176, C177, C178)
73599	Capacitor—Tubular, paper, oil impregnated, .0027 mfd., 600 volts (C119)
73818	Capacitor—Tubular, paper, oil impregnated, .0027 mfd., 1600 volts (C121)
73795	Capacitor—Tubular, paper, oil impregnated, .0033 mfd., 600 volts (C160)
73920	Capacitor—Tubular, paper, oil impregnated, .0047 mfd., 600 volts (C115, C187)
73789	Capacitor—Tubular, paper, oil impregnated, .0068 mfd., 400 volts (C151)
73561	Capacitor—Tubular, paper, oil impregnated, .01 mfd., 400 volts (C116, C120, C165)
73594	Capacitor—Tubular, moulded, oil impregnated, .01 mfd., 600 volts (C199)
73562	Capacitor—Tubular, paper, oil impregnated, .022 mfd., 400 volts (C195)
73798	Capacitor—Tubular, paper, oil impregnated, .022 mfd., 600 volts (C179)
73810	Capacitor—Tubular, paper, oil impregnated, .022 mfd., 1000 volts (C206)
73811	Capacitor—Tubular, paper, oil impregnated, .027 mfd., 1000 volts (C205)
73596	Capacitor—Tubular, paper, oil impregnated, .033 mfd., 1000 volts (C180)
73790	Capacitor—Tubular, paper, oil impregnated, .039 mfd., 400 volts (C117)
73558	Capacitor—Tubular, paper, oil impregnated, .047 mfd., 200 volts (C171)
73553	Capacitor—Tubular, paper, oil impregnated, .047 mfd., 400 volts (C158, C197)
75071	Capacitor—Tubular, moulded, .047 mfd., 400 volts (C188, C189)
73592	Capacitor—Tubular, paper, oil impregnated, .047 mfd., 600 volts (C124)
73597	Capacitor—Tubular, paper, oil impregnated, .047 mfd., 1000 volts (C186)
73792	Capacitor—Tubular, paper, oil impregnated, .068 mfd., 400 volts (C182)
73784	Capacitor—Tubular, paper, oil impregnated, 0.1 mfd., 200 volts (C155, C175)
73551	Capacitor—Tubular, paper, oil impregnated, 0.1 mfd., 400 volts (C170, C185, C194)
73557	Capacitor—Tubular, paper, oil impregnated, 0.1 mfd., 600 volts (C181, C203)
73786	Capacitor—Tubular, paper, oil impregnated, 0.27 mfd., 200 volts (C202)
73787	Capacitor—Tubular, paper, oil impregnated, 0.47 mfd., 200 volts (C157, C168, C196)
76498	Choke—Filter choke (L115)
76143	Clip—Tubular clip to mount stand-off capacitor
73477	Coil—Choke coil (L101)
76442	Coil—Horizontal linearity coil complete with adjustable core (L107)
76441	Coil—Width coil complete with adjustable core (L106)
76640	Coil—R-F choke coil (1.5 muh) (L109)
77195	Coil—Peaking coil (120 muh) (L103, R149)
76647	Coil—Peaking coil (180 muh) (L108, R152)
71526	Coil—Peaking coil (250 muh) (L104)
77194	Coil—Peaking coil (1000 muh) (L110)
71789	Connector—Anode connector
35787	Connector—Phono input connector (J101)
75474	Connector—Single contact male connector for speaker cable (2 required)
75482	Connector—Video connector (J102)
74594	Connector—2 contact male connector for power cord
50367	Connector—6 contact female connector for yoke leads (J103)
75542	Connector—6 contact male connector—part of deflection yoke (P103)
77200	Control—AGC control (R181)
76444	Control—Brightness control (R216)
76448	Control—Height control (R199)
77201	Control—Horizontal and vertical hold control (R197A, R197B)
76445	Control—Picture control (R158)
77199	Control—Ratio detector balance control (R139)
76449	Control—Vertical linearity control (R211)
77010	Control—Volume control and power switch (R114, S102)
76986	Cover—Back cover for hi-voltage compartment
76985	Cover—Side cover for hi-voltage compartment
74956	Cushion—Rubber cushion for deflection yoke hood
74839	Fastener—Push fastener for mounting tube socket for V116 and tube socket 76453
73600	Fuse—0.25 amps. (F101)
76459	Grommet—Rubber grommet for 2nd anode lead exit
37396	Grommet—Rubber grommet for mounting tube socket for V116 and tube socket 76453
76830	Hood—Deflection yoke hood less rubber cushions
76168	Magnet—Focus magnet
76141	Magnet—Ion trap magnet (P.M. type)
76633	Magnet—Pin cushion correction magnet complete with support arm
18469	Plate—Bakelite mounting plate for electrolytic 75220
76464	Plate—Hi-voltage plate—bakelite—complete with tube socket and corona ring
77196	Printed Circuit—Consisting of 1 section of 22,000 ohms, 2 sections of 8200 ohms, 1 section of .002 mfd., and 2 sections of .005 mfd. PC101 (C213, C214, C215, R165, R166, R167)
76675	Rectifier—Picture detector crystal rectifier (CR101)
76452	Rectifier—Selenium rectifier (CR102, CR103)
76796	Resistor—Wire wound, 5.1 ohms, 1/3 watt (R237)
76639	Resistor—Wire wound, 180 ohms, 2 watts (R235)
77193	Resistor—Wire wound, 680 ohms, 1 watt (R119)
34473	Resistor—Wire wound, 2000 ohms, 10 watts (R128)
76390	Resistor—Wire wound, 5600 ohms, 5 watts (R138)

STOCK No.	DESCRIPTION
76642	Resistor—Wire wound, 6750 ohms, 10 watts (R156)
	Resistor—Fixed, composition:
503047	47 ohms, ±10%, ½ watt (R108, R154, R233)
502056	56 ohms, ±5%, ½ watt (R134)
34763	68 ohms, ±5%, ½ watt (R140)
502082	82 ohms, ±5%, ½ watt (R101)
502110	100 ohms, ±5%, ½ watt (R126)
503110	100 ohms, ±10%, ½ watt (R122, R129)
503118	180 ohms, ±10%, ½ watt (R144)
503122	220 ohms, ±10%, ½ watt (R153)
503133	330 ohms, ±10%, ½ watt (R213)
503147	470 ohms, ±10%, ½ watt (R123)
513147	470 ohms, ±10%, 1 watt (R120, R212)
503168	680 ohms, ±10%, ½ watt (R157)
502210	1000 ohms, ±5%, ½ watt (R150)
503210	1000 ohms, ±10%, ½ watt (R107, R121, R125, R131, R133, R137, R142, R145, R175)
503212	1200 ohms, ±10%, ½ watt (R178)
503222	2200 ohms, ±10%, ½ watt (R159)
523222	2200 ohms, ±10%, 2 watts (R164)
503233	3300 ohms, ±10%, ½ watt (R218)
513233	3300 ohms, ±10%, 1 watt (R102)
502239	3900 ohms, ±5%, ½ watt (R151)
503239	3900 ohms, ±10%, ½ watt (R225)
513247	4700 ohms, ±10%, 1 watt (R155)
502256	5600 ohms, ±5%, ½ watt (R136)
503256	5600 ohms, ±10%, ½ watt (R172)
14659	6800 ohms, ±5%, ½ watt (R109, R110)
513268	6800 ohms, ±10%, 1 watt (R147)
503282	8200 ohms, ±10%, ½ watt (R210)
503310	10,000 ohms, ±10%, ½ watt (R115, R205)
513310	10,000 ohms, ±10%, 1 watt (R141)
523310	10,000 ohms, ±10%, 2 watts (R236)
503312	12,000 ohms, ±10%, ½ watt (R171, R173)
513312	12,000 ohms, ±10%, 1 watt (R176)
503315	15,000 ohms, ±10%, ½ watt (R219)
503318	18,000 ohms, ±10%, ½ watt (R105, R184, R190, R228)
513322	22,000 ohms, ±10%, 1 watt (R227)
503333	33,000 ohms, ±10%, ½ watt (R132, R183, R192)
503339	39,000 ohms, ±10%, ½ watt (R111)
513339	39,000 ohms, ±10%, 1 watt (R180)
512343	43,000 ohms, ±5%, 1 watt (R209)
30787	47,000 ohms, ±5%, ½ watt (R193)
503347	47,000 ohms, ±10%, ½ watt (R103, R169)
513347	47,000 ohms, ±10%, 1 watt (R127, R135, R191, R232)
502356	56,000 ohms, ±5%, ½ watt (R143)
523356	56,000 ohms, ±10%, 2 watts (R106)
503368	68,000 ohms, ±10%, ½ watt (R195, R201, R202)
513368	68,000 ohms, ±10%, 1 watt (R226)
513382	82,000 ohms, ±10%, 1 watt (R224)
503410	100,000 ohms, ±10%, ½ watt (R203, R217)
512410	100,000 ohms, ±5%, 1 watt (R230)
30180	120,000 ohms, ±5%, ½ watt (R206)
503415	150,000 ohms, ±10%, ½ watt (R160, R179, R215, R220)
3046	200,000 ohms, ±5%, ½ watt (R194)
503422	220,000 ohms, ±10%, ½ watt (R214)
502427	270,000 ohms, ±5%, ½ watt (R162)
503427	270,000 ohms, ±10%, ½ watt (R185)
503433	330,000 ohms, ±10%, ½ watt (R116, R221)
512433	330,000 ohms, ±5%, 1 watt (R223)
503439	390,000 ohms, ±10%, ½ watt (R196)
503447	470,000 ohms, ±10%, ½ watt (R117, R148, R168, R234)
503456	560,000 ohms, ±10%, ½ watt (R198)

STOCK No.	DESCRIPTION
503482	820,000 ohms, ±10%, ½ watt (R188, R200, R222, R231)
503510	1 megohm, ±10%, ½ watt (R177)
11769	1.8 megohm, ±5%, ½ watt (R161)
39063	1.8 megohm, ±5%, 1 watt (R229)
503522	2.2 megohm, ±10%, ½ watt (R189, R204, R207)
503539	3.9 megohm, ±10%, ½ watt (R174)
503582	8.2 megohm, ±10%, ½ watt (R163)
503610	10 megohm, ±10%, ½ watt (R113)
71456	Screw—No. 8-32 x 7/16" wing screw for mounting deflection yoke
76455	Shaft—Connecting shaft (nylon) for picture and brightness controls
73584	Shield—Tube shield for V101, V102, V103, V106, V107, V109
75718	Socket—Channel indicator lamp socket
74834	Socket—Kinescope socket
75222	Socket—Tube socket, octal, ceramic, plate mounted for V116
31251	Socket—Tube socket, octal, wafer, for V112, V113, V114, V117
50367	Socket—Tube socket, 6 pin, moulded, saddle-mounted for V119
71508	Socket—Tube socket, 6 pin, moulded for V118
73117	Socket—Tube socket, 7 pin, wafer, miniature, for V101, V102, V103, V104, V105, V106, V107, V108, V109, V111
73115	Socket—Tube socket, 7 pin, moulded, miniature, plate-mounted for V115
76453	Socket—Tube socket, octal, moulded, saddle-mounted for V110 (6AG7) for KCS47M1
76971	Socket—Tube socket, 9 pin, wafer, miniature, for V110 (6CL6) for KCS74
76636	Stud—Adjusting stud complete with guard for focus magnet
76428	Support—Bakelite support only—part of hi-voltage shield
77215	Switch—Tone control and phono switch (S101)
76463	Terminal—Screw type grounding terminal
77198	Transformer—First pix i-f grid transformer complete with adjustable cores (T104, C125, R124)
77197	Transformer—First pix i-f plate transformer complete with adjustable cores (T105, C132, C133, R130)
76435	Transformer—Second pix i-f grid transformer complete with adjustable core (T106, C134)
76433	Transformer—Third or fourth pix i-f transformer (T107, T108)
76436	Transformer—Fifth pix i-f transformer (T109, C143, C146, L102, R146, CR101)
76795	Transformer—Hi-voltage transformer (T114)
76440	Transformer—Horizontal oscillator transformer complete with adjustable cores (T113)
76997	Transformer—Output transformer (T103)
76429	Transformer—Power transformer, 117 volt, 60 cycle (T112)
76438	Transformer—Sound i-f transformer complete with adjustable cores (T101, C103, C104)
76437	Transformer—Sound take-off transformer complete with adjustable cores (T110, C147)
76439	Transformer—Ratio detector transformer complete with adjustable cores (T102, C108, C109)
76431	Transformer—Vertical output transformer (T111)
77225	Trap—4.5 MC trap (L105, C149)
76616	Yoke—Deflection yoke complete with 6 contact male connector (L111, L112, L113, L114, C208, P103, R239, R240, R241)
	SPEAKER ASSEMBLIES
	971490-3W RL-105E6 RMA-274
	(For Model 17T250DE)
75024	Cone—Cone and voice coil (3.2 ohms)
75022	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)

STOCK No.	DESCRIPTION
	SPEAKER ASSEMBLIES
	92569-12W RL-111A1 RMA-274
	(For Model 17T261DE)
75682	Cone—Cone and voice coil (3.2 ohms)
76389	Speaker—12" P.M. speaker complete with cone and voice coil (3.2 ohms)
	NOTE: If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to model number of instrument, number stamped on speaker and full description of part required.
	MISCELLANEOUS
77213	Back—Cabinet back complete with terminal board and power cord for Model 17T250DE
77214	Back—Cabinet back complete with power cord for Model 17T261DE
76184	Board—Antenna terminal board
76590	Bracket—Hanger bracket for deflection yoke hood assembly
77028	Bracket—Support bracket ("L" shape) for kinescope masking panel (2 required)
76599	Bracket—"U" shape bracket for deflection yoke hood support rod
77029	Clip—Retaining clip (top or bottom) for safety glass retainer
77030	Clip—Retaining clip (sides) for safety glass retainer
X1756	Cloth—Grille cloth for mahogany or walnut instruments for Model 17T250DE
X3222	Cloth—Grille cloth for blonde mahogany instruments for Model 17T261DE
X3199	Cloth—Grille cloth for mahogany or walnut instruments for Model 17T261DE
75474	Connector—Single contact male connector for antenna cable
39153	Connector—4 contact male connector for antenna cable
71457	Cord—Power cord and plug
77031	Cushion—Adhesive cushion (sponge rubber—⅜" dia.) for masking panel
76638	Cushion—Rubber cushion for kinescope masking panel support bracket
77034	Decal—Control function decal for mahogany or walnut instruments
76512	Decal—Control function decal for blonde mahogany instruments
77244	Emblem—"Deluxe" emblem for mahogany or walnut instruments for Model 17T250DE
77245	Emblem—"Deluxe" emblem for blonde instruments for Model 17T250DE
77487	Emblem—"Deluxe" emblem for Model 17T261DE
77012	Emblem—"RCA Victor" emblem
75456	Escutcheon—Channel marker escutcheon
72113	Foot—Rubber foot (4 required) for Model 17T250DE
77026	Glass—Safety glass
37396	Grommet—Rubber grommet for mounting speaker for Model 17T261DE
76596	Knob—Brightness control or vertical hold control knob—beige—for blonde mahogany instruments (outer)
76595	Knob—Brightness control or vertical hold control knob—maroon—for mahogany or walnut instruments (outer)

STOCK No.	DESCRIPTION
76594	Knob—Channel selector knob—beige—for blonde mahogany instruments (inner)
76593	Knob—Channel selector knob—maroon—for mahogany or walnut instruments (inner)
76592	Knob—Fine tuning control knob—beige—for blonde mahogany instruments (outer)
76591	Knob—Fine tuning control knob—maroon—for mahogany or walnut instruments (outer)
74963	Knob—Picture control, horizontal hold control or volume control and power switch knob—maroon—for mahogany or walnut instruments (inner)
75464	Knob—Picture control, horizontal hold control or volume control and power switch knob—beige—for blonde mahogany instruments (inner)
76598	Knob—Tone control and phono switch knob—beige—for blonde mahogany instruments (outer)
76597	Knob—Tone control and phono switch knob—maroon—for mahogany or walnut instruments (outer)
11765	Lamp—Channel marker escutcheon lamp—Mazda 51
76589	Mask—Channel marker escutcheon light mask—beige—for blonde mahogany instruments
75459	Mask—Channel marker escutcheon light mask—burgundy—for mahogany or walnut instruments
77022	Mask—Polystyrene masking panel
77013	Nut—Speednut for fastening "RCA Victor" emblem to cabinet (3 required)
73634	Nut—Speednut for speaker mounting screws for Model 17T261DE
76177	Nut—No. 10-32 special nut for deflection yoke hood support rods
76601	Pad—Kinescope edge support pad (2 required)
77027	Retainer—Safety glass retainer
77024	Rod—"L" shape threaded rod to support deflection yoke hood assembly
76632	Screw—No. 8 x ⅝" hex head wood screw for mounting hanger bracket
76808	Sleeve—Polyethylene sleeve for insulating high voltage lead—on support rod
73643	Spring—Channel marker escutcheon spring clip
76020	Spring—Formed spring for glass retainer clips (6 required)
77025	Spring—Formed spring for kinescope masking panel
77006	Spring—Retaining spring (coil) for deflection yoke hood support rod nut
30330	Spring—Retaining spring for knobs 74963, 75464
72845	Spring—Retaining spring for knobs 76591, 76592
76837	Spring—Retaining spring for knobs 76593, 76594, 76595, 76596, 76597, 76598
77032	Spring—Suspension spring clip (formed) for ground braid
36580	Spring—Suspension spring (coil) for ground braid
76600	Strap—Grounding strap (upper strip—½" x 18")
77023	Washer—Cellulose washer—gold—for knobs
75500	Washer—Felt washer for masking panel or cabinet back mounting screws
75458	Washer—Felt washer—beige—between knob and channel marker escutcheon for blonde mahogany instruments
75457	Washer—Felt washer—dark brown—between knob and channel marker escutcheon for mahogany or walnut instruments

APPLY TO YOUR RCA DISTRIBUTOR FOR PRICES OF REPLACEMENT PARTS.

CHASSIS WIRING DIAGRAM KCS74, KCS74M1

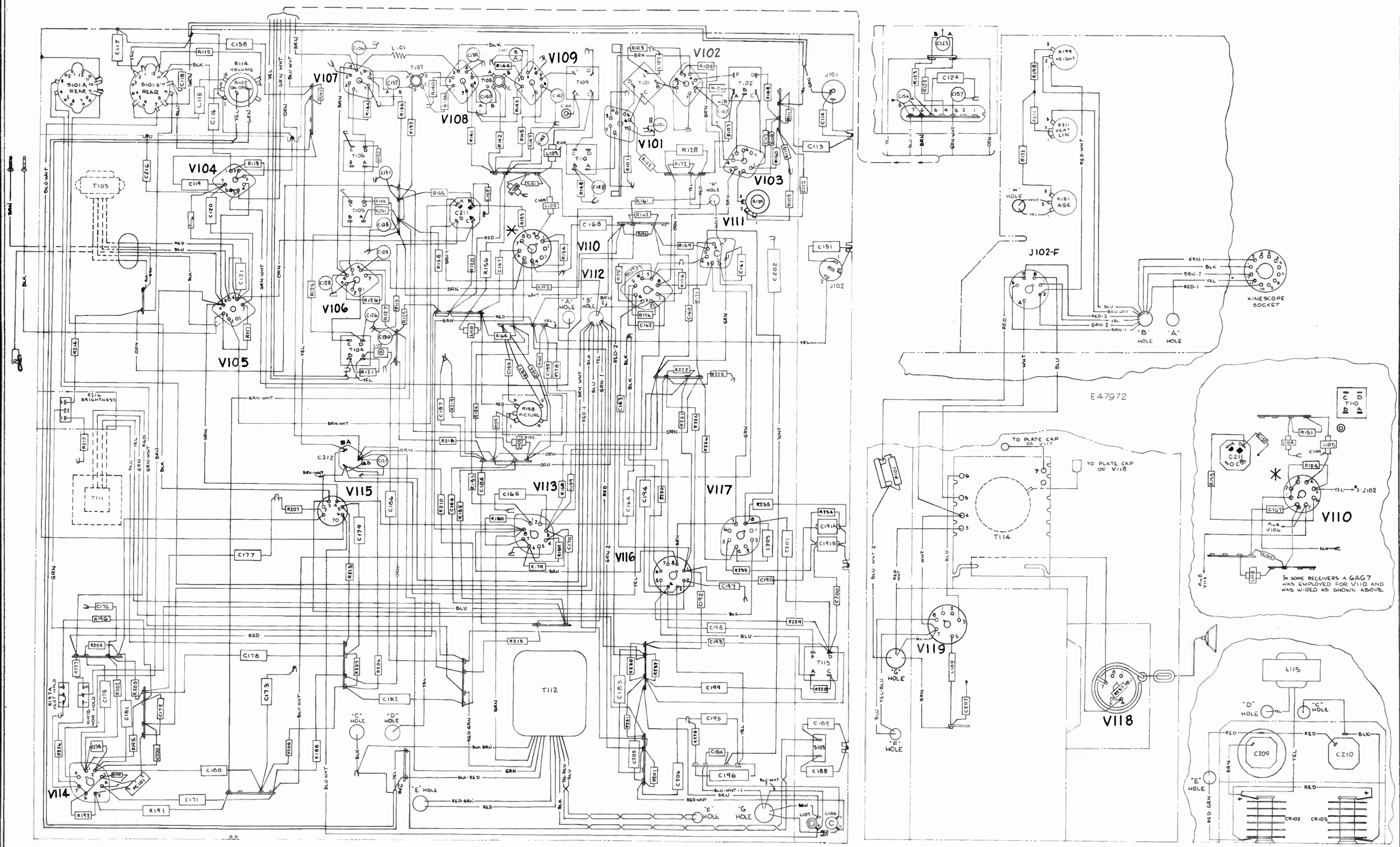
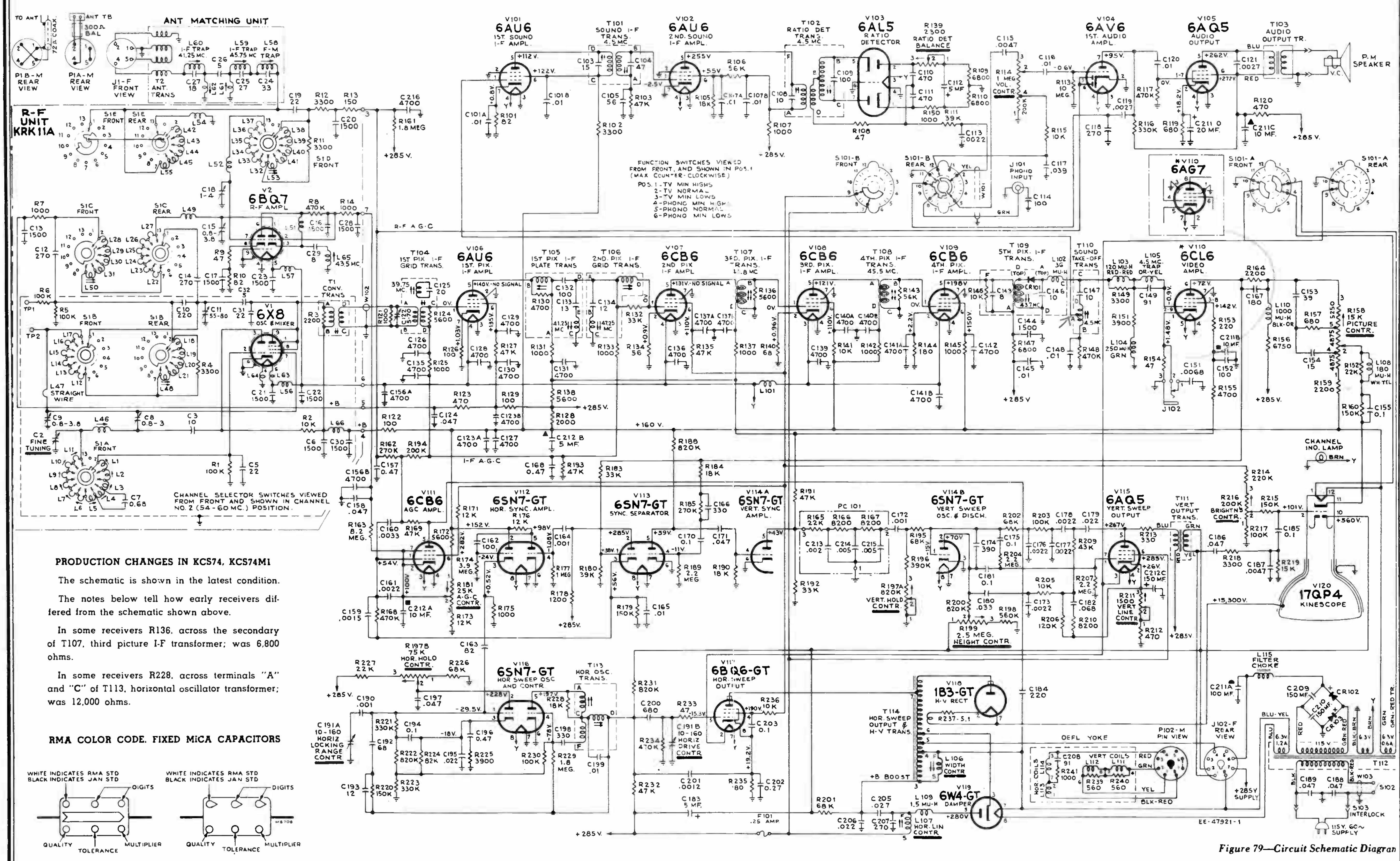


Figure 78—Chassis Wiring Diagram, KCS74, KCS74M1

KCS74 CIRCUIT SCHEMATIC DIAGRAM (*KCS74M1)



PRODUCTION CHANGES IN KCS74, KCS74M1

The schematic is shown in the latest condition.

The notes below tell how early receivers differed from the schematic shown above.

In some receivers R136, across the secondary of T107, third picture I-F transformer; was 6,800 ohms.

In some receivers R228, across terminals "A" and "C" of T113, horizontal oscillator transformer; was 12,000 ohms.

RMA COLOR CODE, FIXED MICA CAPACITORS

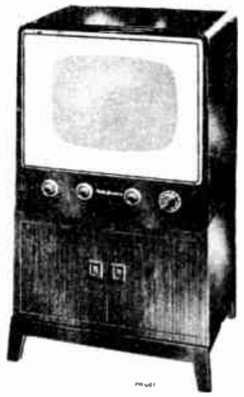
Figure 79—Circuit Schematic Diagran

All resistance values in ohms. K = 1000. All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

* In some receivers, a 6AG7 tube was employed in place of the 6CL6 video amplifier and was connected as shown in inset above.



Model 17T200 "Shelly" Ebony
Model 17T201 "Hadley" Maroon
(Shown on base)

Model 17T202 "Kentwood" Mahogany, Grained
(Shown on base)

Model 17T211 "Ashton" Walnut, Mahogany, Blonde

Model 17T220 "Albury" Walnut, Mahogany

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GENERAL DESCRIPTION

Models 17T200, 17T201, 17T202, 17T211, and 17T220 are "17 inch" television receivers. The receivers are identical except for cabinets, and speakers.

Features of the television unit are: full twelve channel coverage; intercarrier FM sound system; ratio detector; improved picture brilliance; pulsed picture A-G-C; A-F-C horizontal hold; stabilized vertical hold; noise saturation circuits; improved sync separator and clipper; 3.2 mc. band width for picture channel and reduced hazard high voltage supply. An auxiliary audio input jack is provided to permit the use of an external record playing attachment.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE . . . 146 square inches on a 17QP4 Kinescope

TELEVISION R-F FREQUENCY RANGE
All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.
Picture I-F Carrier Frequency .... 25.50 mc.
Sound I-F Carrier Frequency .... 21.00 mc. and 4.5 mc.

POWER SUPPLY RATING . . 115 volts, 60 cycles, 190 watts

AUDIO POWER OUTPUT RATING .... 4.0 watts max.

VIDEO RESPONSE .... To 3.2 mc.

SWEEP DEFLECTION .... Magnetic

FOCUS .... Magnetic

LOUDSPEAKERS
In Models 17T200, 17T201 & 17T202
. . . 971636-1 5" PM Dynamic, 3.2 ohms
In Models 17T211 & 17T220
. . . (971490-3) 8" PM Dynamic, 3.2 ohms

WEIGHT AND DIMENSIONS

Model	Net Weight	Shipping Weight	Width Inches	Height Inches	Depth Inches
17T200	88 lbs.	103 lbs.	21½	22	21⅜
17T201	88 lbs.	103 lbs.	21½	22	21⅜
17T202	88 lbs.	103 lbs.	21½	22	21⅜
17T211	95 lbs.	116 lbs.	24½	35¼	21¾
17T220	106 lbs.	130 lbs.	23¾	35¼	23¾

RECEIVER ANTENNA INPUT IMPEDANCE
Choice: 300 ohms balanced or 72 ohms unbalanced.

RCA TUBE COMPLEMENT

Tube Used	Function
(1) RCA 6CB6	R-F Amplifier
(2) RCA 6J6	R-F Oscillator and Mixer
(3) RCA 6CB6	1st Picture I-F Amplifier
(4) RCA 6CB6	2nd Picture I-F Amplifier
(5) RCA 6CB6	3rd Picture I-F Amplifier
(6) RCA 12AU7	Picture 2nd Detector and Vert. Sync. Sep.
(7) RCA 6CL6 (6AC7) (6AG7)	*Video Amplifier
(8) RCA 6AU6	1st Sound I-F Amplifier
(9) RCA 6AU6	2nd Sound I-F Amplifier
(10) RCA 6AL5	Ratio Detector
(11) RCA 6AV6	1st Audio Amplifier
(12) RCA 6K6GT	Audio Output
(13) RCA 6AU6	AGC Amplifier
(14) RCA 6SN7GT	Horizontal Sync. Sep. and Sync. Output
(15) RCA 6J5	Vertical Sweep Oscillator
(16) RCA 6K6GT	Vertical Sweep Output
(17) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(18) RCA 6BQ6GT	Horizontal Sweep Output
(19) RCA 6W4GT	Damper
(20) RCA 1B3-GT/8016	High Voltage Rectifier
(21) RCA 17QP4	Kinescope
(22) RCA 5U4G	Rectifier
(23) RCA 5Y3GT	Rectifier

*(See Figure 67)

ELECTRICAL AND MECHANICAL SPECIFICATIONS (Continued)

PICTURE INTERMEDIATE FREQUENCIES
Picture I-F Carrier Frequency .... 25.50 mc
Adjacent Channel Sound Trap .... 27.00 mc.

SOUND INTERMEDIATE FREQUENCIES
Sound I-F Carrier Frequency .... 21.00 mc.
Sound I-F Frequency .... 4.5 mc.

VIDEO RESPONSE .... To 3.2 mc.

FOCUS .... Magnetic

SWEEP DEFLECTION .... Magnetic

SCANNING .... Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY .... 15,750 cps

VERTICAL SWEEP FREQUENCY .... 60 cps

FRAME FREQUENCY (Picture Repetition Rate) .... 30 cps

OPERATING CONTROLS (Front Panel)
Channel Selector, Fine Tuning .... Dual Control Knobs
Picture, Brightness .... Dual Control Knobs
Picture Horizontal Hold, Picture Vertical Hold .... Dual Control Knobs
Sound Volume and On-Off Switch, TV Tone & Phono Switch .... Dual Control Knobs

NON-OPERATING CONTROLS (not including r-f and i-f adjustments)
Picture Centering .... top chassis adjustment
Width .... rear chassis adjustment
Height .... rear chassis adjustment
Horizontal Linearity .... rear chassis screwdriver adjustment
Vertical Linearity .... rear chassis adjustment
Horizontal Drive .... rear chassis screwdriver adjustment
Horizontal Oscillator Frequency . . . rear chassis adjustment
Horizontal Oscillator Waveform . . bottom chassis adjustment
Horizontal Locking Range .... rear chassis adjustment
Focus .... top chassis adjustment
Ion Trap Magnet .... top chassis adjustment
Deflection Coil .... top chassis wing nut adjustment
AGC Control .... rear chassis adjustment

HIGH VOLTAGE WARNING

OPERATION OF THIS RECEIVER OUTSIDE THE CABINET OR WITH THE COVERS REMOVED, INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT. DO NOT OPERATE THE RECEIVER WITH THE HIGH VOLTAGE COMPARTMENT SHIELD REMOVED.

KINESCOPE HANDLING PRECAUTIONS

DO NOT REMOVE THE RECEIVER CHASSIS, INSTALL, REMOVE OR HANDLE THE KINESCOPE IN ANY MANNER UNLESS SHATTERPROOF GOGGLES, AND HEAVY GLOVES ARE WORN. PEOPLE NOT SO EQUIPPED SHOULD BE KEPT AWAY WHILE HANDLING KINESCOPES. KEEP THE KINESCOPE AWAY FROM THE BODY WHILE HANDLING.

The kinescope bulb encloses a high vacuum and, due to its large surface area, is subjected to considerable air pressure. For this reason, the kinescope must be handled with more care than ordinary receiving tubes.

The large end of the kinescope bulb—particularly that part at the rim of the viewing surface—must not be struck, scratched or subjected to more than moderate pressure at any time. During service if the tube sticks or fails to slip smoothly into its socket, or deflecting yoke, investigate and remove the cause of the trouble. Do not force the tube. Refer to the Receiver Installation section for detailed instructions on kinescope installation. All RCA replacement kinescopes are shipped in special cartons and should be left in the cartons until ready for installation in the receiver.

OPERATING INSTRUCTIONS

The following adjustments are necessary when turning the receiver on for the first time.

1. See that the TV-PH switch is in the "TV" position.

2. Turn the receiver "ON" and advance the SOUND VOLUME control to approximately mid-position.

3. Set the STATION SELECTOR to the desired channel.

4. Adjust the FINE TUNING control for best pix and the SOUND VOLUME control for suitable volume.

5. Turn the BRIGHTNESS control fully counter-clockwise, then clockwise until a light pattern appears on the screen.

6. Adjust the VERTICAL hold control until the pattern stops vertical movement.

7. Adjust the HORIZONTAL hold control until a picture is obtained and centered.

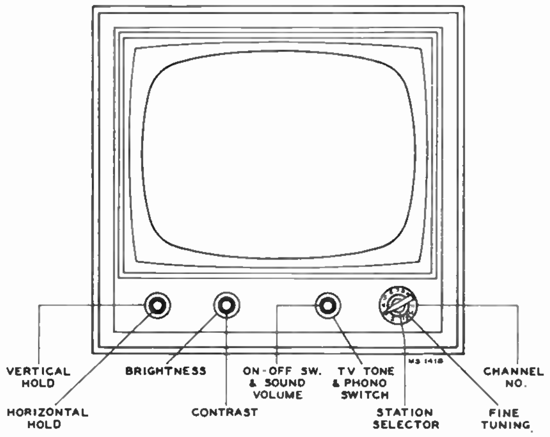


Figure 1—Receiver Operating Controls

8. Adjust the CONTRAST and BRIGHTNESS controls for suitable picture contrast and brightness.

9. In switching from one channel to another, it may be necessary to repeat steps 4 and 8.

10. When the set is turned on again after an idle period it should not be necessary to repeat the adjustment if the positions of the controls have not been changed. If any adjustment is necessary, step number 4 is generally sufficient.

11. If the positions of the controls have been changed, it may be necessary to repeat steps 2 through 8.

12. To use a record player, plug the record-player output cable into the PHONO jack on the rear apron, and set the TV-PH switch to "PH".

INSTALLATION INSTRUCTIONS

UNPACKING.—These receivers are shipped complete in cardboard cartons. The kinescope is shipped in place in the receiver.

Take the receiver out of the carton and remove all packing material.

Make sure that all tubes are in place and a firmly seated in their sockets.

Check to see that the kinescope high voltage lead clip is in place.

Plug a power cord into the 115 volt a-c power source and into the receiver interlock receptacle. Turn the receiver power switch to the "on" position, the brightness control fully clockwise, and the picture control counter-clockwise.

ION TRAP MAGNET ADJUSTMENT.—Set the ion trap magnet approximately in the position shown in Figure 2. Starting from this position immediately adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Turn the focus control (shown in Figure 2) until the line structure of the raster is clearly visible. Readjust the ion trap magnet for maximum raster brilliance. The final touches of this adjustment should be made with the brightness control at the maximum clockwise position with which good line focus can be maintained.

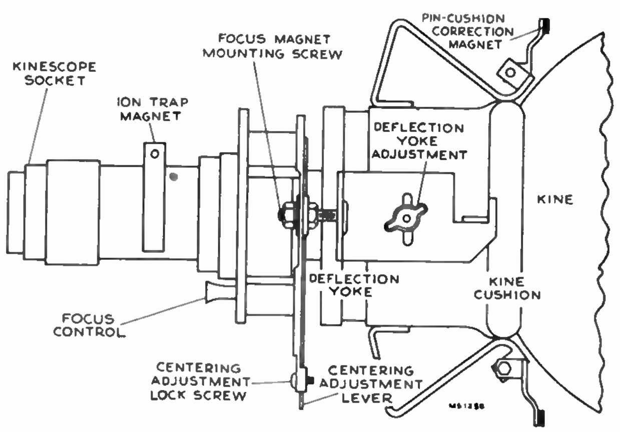


Figure 2—Yoke and Focus Magnet Adjustments

DEFLECTION YOKE ADJUSTMENT.—If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

PICTURE ADJUSTMENTS.—It will now be necessary to obtain a test pattern picture in order to make further adjustments. Connect the antenna transmission line to the receiver.

If the Horizontal Oscillator and AGC System are operating properly, it should be possible to sync the picture at this point. However, if the AGC control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading, turn R149 on the rear apron (see Figure 3) counter-clockwise until the set operates normally and the picture can be synced.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT.—Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back. Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 2 or 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. Pull-in should occur before the control has been turned 120 degrees from the extreme counter-clockwise position. The picture should remain in sync for approximately 90 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should remain in sync and should not show a black bar in the picture.

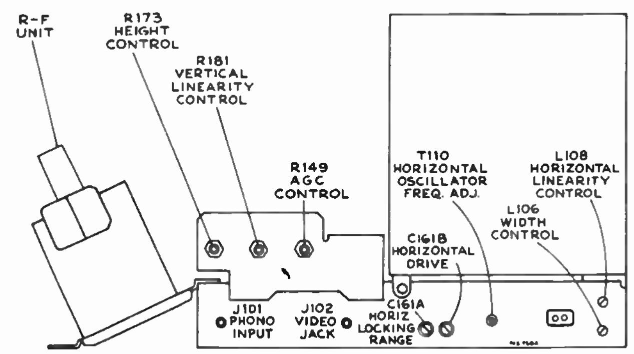


Figure 3—Rear Chassis Adjustments

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Alignment of Horizontal Oscillator" and proceed with "Focus Magnet Adjustment."

ALIGNMENT OF HORIZONTAL OSCILLATOR.—If in the above check the receiver failed to hold sync with the hold control at the extreme counter-clockwise position or failed to hold sync over 90 degrees of clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.

Horizontal Frequency Adjustment.—Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and adjust the T110 horizontal frequency adjustment at the rear of the chassis until the picture is just out of sync and the horizontal blanking appears as a vertical or diagonal black bar in the raster. Then turn the T110 core until the bar moves out of the picture leaving it in sync.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T110 rear core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C161A slightly clockwise. If less than 2 bars are present, adjust C161A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the conditions specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If it is impossible to sync the picture at this point and the AGC system is in proper adjustment it will be necessary to adjust the Horizontal Oscillator by the method outlined in the alignment procedure on page 11: For field purposes paragraph "B" under Horizontal Oscillator Waveform Adjustment may be omitted.

FOCUS MAGNET ADJUSTMENT.—The focus magnet should be adjusted so that there is approximately three-eighths inch of space between the rear cardboard shell of the yoke and the flat of the front face of the focus magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the magnet should be parallel with the axis of the kinescope neck with the kinescope neck through the center of the opening.

PIN-CUSHION CORRECTION.—Two pin-cushion correction magnets are employed to correct a small amount of pin-cushion of the raster due to the lens effect of the face of the kinescope. These magnets are mounted on small arms, one on each side of the kinescope as shown in Figure 2. The arms hinge in one plane on self tapping screws which act both as a hinge and an adjustment locking screw. When the magnets are swung towards the tube, maximum correction is obtained. Minimum correction is obtained when the arms are swung away from the tube. To adjust the magnets, loosen the two self tapping screws and position the magnets until the sides of the raster appear straight. Tighten the screws without shifting the position of the magnets. In some cases it may be necessary to twist or bend the magnet support arms to obtain the appearance of straight raster edges.

CENTERING ADJUSTMENT.—No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet. The centering plates include a locking screw which must be loosened before centering. Up and down adjustment of the plate moves the picture side to side and sidewise adjustment moves the picture up and down.

If a corner of the raster is shadowed, check the position of the ion trap magnet. Reposition the magnet within the range of maximum raster brightness to eliminate the shadow and recenter the picture by adjustment of the focus magnet plate. In no case should the magnet be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the tube. In some cases it may be necessary to shift the position of the focus magnet in order to eliminate a corner shadow.

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS.—Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive trimmer C161B counter-clockwise until the picture begins to "wrinkle" in the middle then clockwise until the "wrinkle" disappears.

Turn the horizontal linearity control L108 clockwise until the picture begins to "wrinkle" on the right and then counter-clockwise until the "wrinkle" disappears and best linearity is obtained.

Adjust the width control L106 to obtain correct picture width.

A slight readjustment of thes three controls may be necessary to obtain the best linearity

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control (R173 on chassis rear apron) until the picture fills the mask vertically. Adjust vertical linearity (R181 on rear apron), until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust centering to align the picture with the mask.

FOCUS.—Adjust the focus magnet for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

Check to see that the yoke thumbscrew and the focus magnet mounting screws are tight.

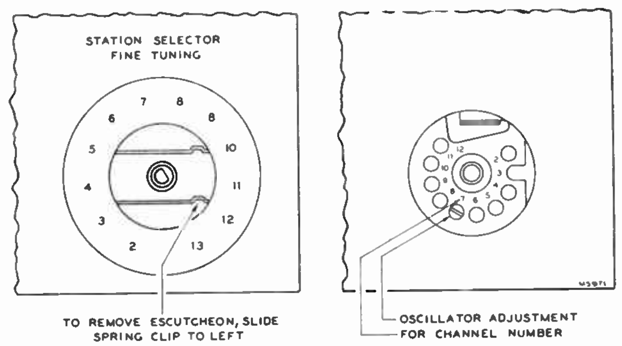


Figure 4—R-F Oscillator Adjustments

CHECK OF R-F OSCILLATOR ADJUSTMENTS.—Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 21. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 4. Adjustment for channel 13 is on top of the chassis.

AGC THRESHOLD CONTROL.—The AGC threshold control R149 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not overloading due to improper setting of R149. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R149 should be readjusted.

INSTALLATION INSTRUCTIONS

Turn R149 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R149 clockwise until there is a very, very slight bend or change of bend in the picture. Then turn R149 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R149 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

FM TRAP ADJUSTMENT.—In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the L203 core on top of the antenna matching transformer for minimum interference in the picture.

CAUTION.—In some receivers, the FM trap L203 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L203 to make sure that it does not affect sensitivity on these two channels.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding it are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

KINESCOPE SCREEN CLEANING.—The kinescope safety glass is held in place by four spring clips which may be removed from the back of the front panel. This permits removing the safety glass for cleaning without the necessity of removing the chassis and kinescope.

CHASSIS REMOVAL.—To remove the chassis from the cabinet for repair or installation of a new kinescope, remove the control knobs, the cabinet back, unplug the speaker cable, the kinescope socket, the antenna cable, the yoke and high voltage cable. Take out the chassis bolts under the cabinet. Withdraw the chassis from the back of the cabinet.

KINESCOPE HANDLING PRECAUTION.—Do not install, remove, or handle the kinescope in any manner, unless shatterproof goggles and heavy gloves are worn. People not so equipped should be kept away while handling the kinescope. Keep the kinescope away from the body while handling.

REMOVAL OF KINESCOPE.—To remove the kinescope from the cabinet, loosen the two nuts and disengage the rods alongside the kinescope. Remove the screw which holds the yoke frame to the cabinet. Remove the kinescope, the yoke frame with yoke and focus magnet as an assembly.

Handle this tube by the portion at the edge of the screen. Do not cover the glass bell of the tube with fingermarks as it will produce leakage paths which may interfere with reception. If this portion of the tube has inadvertently been handled, wipe it clean with a soft cloth moistened with "dry" carbon tetrachloride.

INSTALLATION OF KINESCOPE.—Wipe the kinescope screen surface and front panel safety glass clean of all dust and fingermarks with a soft cloth moistened with "Windex" or similar cleaning agent.

Replace the kinescope and chassis by reversal of the removing process. The kinescope should be installed so that the high voltage contact is to the right when looking at it from the rear of the cabinet. The magnet of the ion trap magnet should be to the left.

CABINET ANTENNA.—A cabinet antenna is provided in Models 17T211 and 17T220 and the leads are brought out near the antenna terminal board. The cabinet antenna may be employed in place of the outdoor antenna in areas where the signals are strong and no reflections are experienced.

ANTENNAS.—The finest television receiver built may be said to be only as good as the antenna design and installation. It is therefore important to select the proper antenna to suit the particular local conditions, to install it properly and orient it correctly.

If two or more stations are available and the two stations are in different directions, it may be possible to make a compromise orientation which will provide a satisfactory signal on all such channels.

If it is impossible to obtain satisfactory results on one or more channels, it may become necessary either to provide means for turning the antenna when switching channels or to install a separate antenna for one or more channels and to switch antennas when switching channels.

In some cases, the antenna should not be installed permanently until the quality of the picture reception has been observed on a television receiver. A temporary transmission line can be run between receiver and the antenna, allowing sufficient slack to permit moving the antenna. Then, with a telephone system connecting an observer at the receiver and an assistant at the antenna, the antenna can be positioned to give the most satisfactory results on the received signal. A shift of direction or a few feet in antenna position may effect a tremendous difference in picture reception.

REFLECTIONS.—Multiple images sometimes known as echoes or ghosts, are caused by the signal arriving at the antenna by two or more routes. The second or subsequent image occurs when a signal arrives at the antenna after being reflected off a building, a hill or other object. In severe cases of reflections, even the sound may be distorted. In less severe cases, reflections may occur that are not noticeable as reflections but that will instead cause a loss of definition in the picture.

Under certain extremely unusual conditions, it may be possible to rotate or position the antenna so that it receives the cleanest picture over a reflected path. If such is the case, the antenna should be so positioned. However, such a position may give variable results as the nature of reflecting surfaces may vary with weather conditions. Wet surfaces have been known to have different reflecting characteristics than dry surfaces.

Depending upon the circumstances, it may be possible to eliminate the reflections by rotating the antenna or by moving it to a new location. In extreme cases, it may be impossible to eliminate the reflection.

INTERFERENCE.—Auto ignition, street cars, electrical machinery and diathermy apparatus may cause interference which spoils the picture. Whenever possible, the antenna location should be removed as far as possible from highways, hospitals, doctors' offices and similar sources of interference. In mounting the antenna, care must be taken to keep the antenna rods at least 1/4 wave length (at least 6 feet) away from other antennas, metal roofs, gutters or other metal objects.

Short-wave radio transmitting and receiving equipment may cause interference in the picture in the form of moving ripples. In some instances it may be possible to eliminate the interference by the use of a trap in the antenna transmission line. However, if the interfering signal is on the same frequency as the television station, a trap will provide no improvement.

WEAK PICTURE.—When the installation is near the limit of the area served by the transmitting station, the picture may be speckled, having a "snow" effect, and may not hold steady on the screen. This condition is due to lack of signal strength from the transmitter.

RECEIVER LOCATION.—The owner should be advised of the importance of placing the receiver in the proper location in the room.

The location should be chosen—

—Away from bright windows and so that no bright light will fall directly on the screen. (Some illumination in the room is desirable, however.)

—To give easy access for operation and comfortable viewing.

—To permit convenient connection to the antenna.

—Convenient to an electrical outlet.

—To allow adequate ventilation.

CHASSIS TOP VIEW

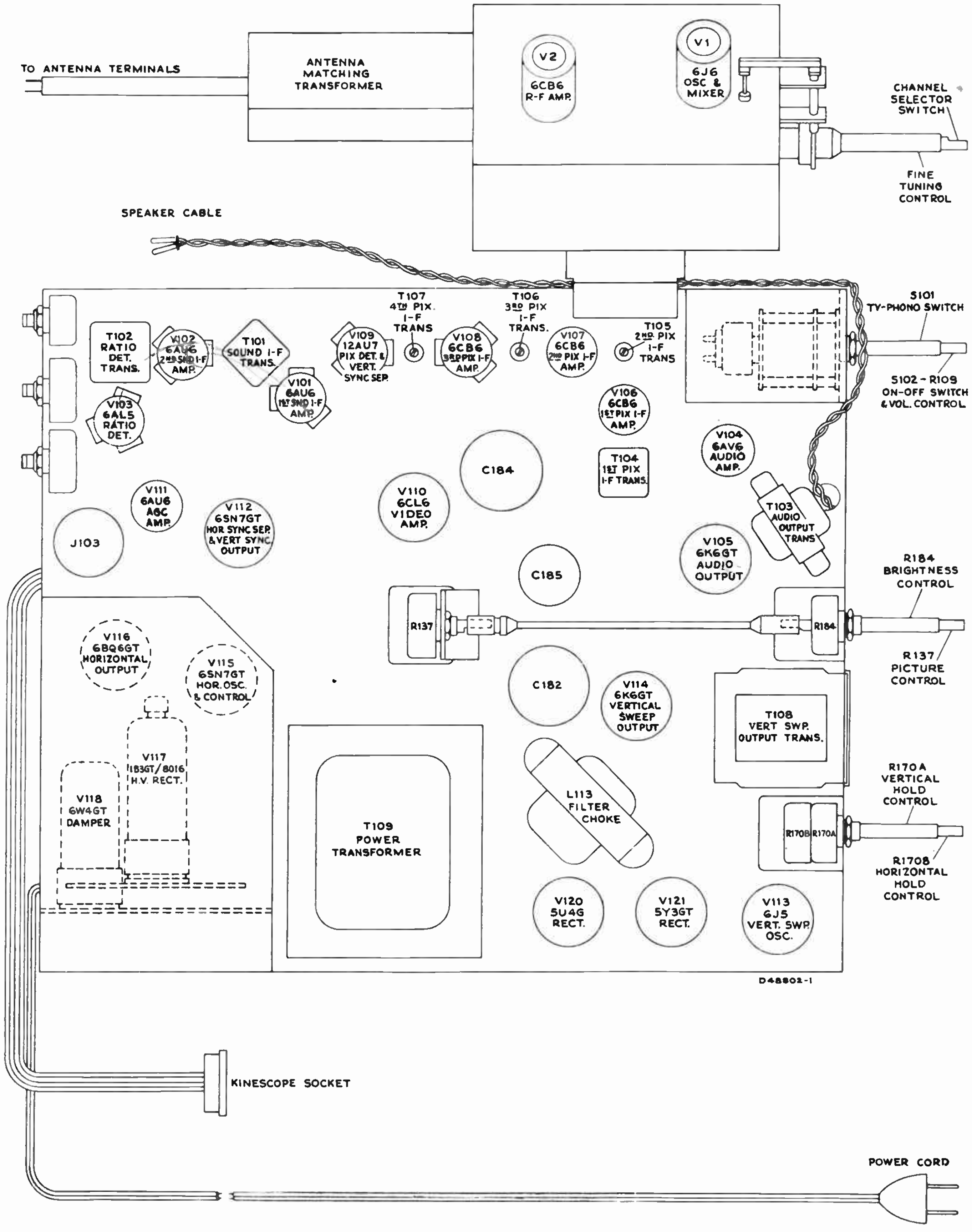


Figure 5—Chassis Top View

CHASSIS BOTTOM VIEW

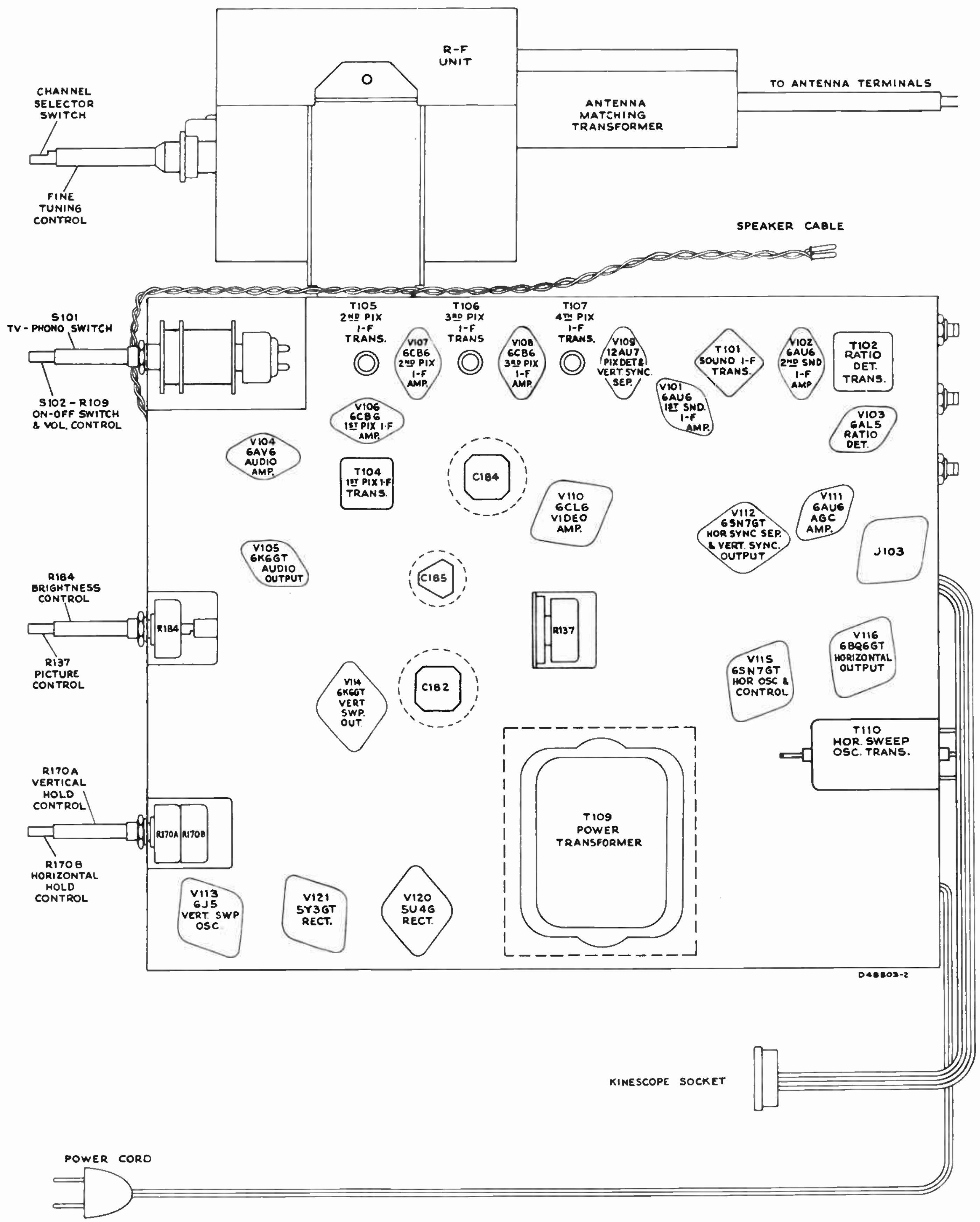


Figure 6—Chassis Bottom View

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of this receiver, it is recommended that the following test equipment be available:

R-F Sweep Generator meeting the following requirements:

(a) Frequency Ranges
 20 to 30 mc., 1 mc. and 10 mc. sweep width
 50 to 90 mc., 10 mc. sweep width
 170 to 225 mc., 10 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

Cathode-Ray Oscilloscope.—For alignment purposes, the oscilloscope employed must have excellent low frequency and phase response, and should be capable of passing a 60-cycle square wave without appreciable distortion.

For video and sync waveform observations, the oscilloscope must have excellent frequency and phase response from 10 cycles to at least two megacycles in all positions of the gain control.

Signal Generator to provide the following frequencies with crystal accuracy.

(a) Intermediate frequencies
 22.25 and 25.5 mc. conv. and first pix i-f trans.
 22.75 mc. second picture i-f transformer
 24.25 mc. fourth picture i-f transformer
 25.5 mc. third picture i-f transformer
 25.50 mc. picture carrier
 27.00 mc. adjacent channel sound trap
(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

Heterodyne Frequency Meter with crystal calibrator which covers the frequency range from 80 mc. to 109 mc. and from 200 mc. to 237 mc.

Electronic Voltmeter of Junior or Senior "VoltOhmyst" type and a high voltage multiplier probe for use with this meter to permit measurements up to 15 kv.

Service Precautions.—If possible, the chassis should be serviced without the kinescope. However, if it is necessary to view the raster during servicing, it would be a great convenience to have a bench mounted kinescope and speaker complete with a set of extension cables.

CAUTION: Do not short the kinescope second anode lead. Its short circuit current presents a considerable overload on the high voltage rectifier V117.

Adjustments Required.—Normally, only the r-f oscillator and mixer lines will require the attention of the service technician. All other circuits are either broad or very stable and hence will seldom require readjustment.

ORDER OF ALIGNMENT.—When a complete receiver alignment is necessary, it can be most conveniently performed in the following order:

(1) R-F unit
(2) Picture i-f transformers
(3) Picture i-f trap
(4) Sweep of picture i-f
(5) Ratio detector alignment
(6) Sound i-f alignment
(7) 4.5 Mc Trap Adjustment
(8) Check of overall response
(9) AGC control adjustment
(10) Horizontal oscillator alignment

R-F UNIT ALIGNMENT.—Disconnect the co-ax link from terminal 2 of the r-f unit terminal board and connect a 39 ohm composition resistor between lugs 1 and 2.

Detune T1 by backing the core all the way out of the coil.

Back the L44 core all the way out. Back the L203 core all the way out.

In order to align the r-f tuner, it will first be necessary to set the channel-13 oscillator to frequency. The shield over the bottom of the r-f unit must be in place when making any adjustments.

The oscillator may be aligned by adjusting it to beat with a crystal-calibrated heterodyne frequency meter. Couple the meter probe loosely to the receiver oscillator.

Set the channel selector switch to 13.

Adjust the heterodyne frequency meter to the correct frequency (236.75 mc).

Set the fine tuning control 30 degrees clockwise from the mechanical center of its range.

Adjust C1 for an audible beat on the heterodyne frequency meter.

Now that the channel-13 oscillator is set to frequency, we may proceed with the r-f alignment.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to terminal 3 of the r-f unit. Adjust the bias box potentiometer to produce −3.5 volts of bias at the r-f unit terminal board.

Connect the oscilloscope to the test point TP1 on top of the r-f unit.

Connect the r-f sweep oscillator to the receiver antenna terminals. The method of connection depends upon the output impedance of the sweep. The P300 connections for 300-ohm balanced or 72-ohm single-ended input are shown in the circuit schematic diagram. If the sweep oscillator has a 50-ohm or 72-ohm single-ended output, 300-ohm balanced output can be obtained by connecting as shown in Figure 9.

Connect the signal generator loosely to the receiver antenna terminals.

Set the receiver channel switch to channel 8.

Set the sweep oscillator to cover channel 8.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C9, C11, C16 and C22 for approximately correct curve shape, frequency, and band width as shown in Figure 11.

The correct adjustment of C22 is indicated by maximum amplitude of the curve midway between the markers. C16 tunes the r-f amplifier plate circuit and affects the frequency of the curve most noticeably. C9 tunes the converter grid circuit and affects the tilt of the curve most noticeably (assuming that C22 has been properly adjusted). C11 is the coupling adjustment and hence primarily affects the response band width.

Set the receiver channel switch to channel 6.

Adjust the heterodyne frequency meter to the correct frequency (108.75 mc.).

Set the fine tuning control 30 degrees clockwise from the mechanical center of its range.

Adjust L5 for an audible beat on the heterodyne frequency meter.

ALIGNMENT PROCEDURE

Set the sweep generator to channel 6.

From the signal generator, insert channel 6 sound and picture carrier markers, 83.25 mc. and 87.75 mc.

Adjust L42, L45 and L49 for proper response as shown in Figure 12.

L42 is adjusted to give maximum amplitude of the curve between the markers. L45 primarily affects the tilt of the curve. L49 primarily affects the frequency of response.

Connect the "VoltOhmyst" to the r-f unit test point TP1.

Adjust C7 for −3.0 volts at the test point.

Retouch L42, L45 and L49 for proper response if necessary. If necessary, retouch C11 for proper band width on channel 6. Continue these retouching adjustments until proper response is obtained and −3.0 volts of oscillator injection are present at the test point, TP1.

Set the receiver channel selector switch to channel 8 and readjust C1 for proper oscillator frequency.

Set the sweep oscillator and signal generator to channel 8.

Readjust C9, C16 and C22 for correct curve shape, frequency and band width. Readjust C11 only if necessary.

Switch the receiver, the sweep oscillator and signal generator to channel 13.

Adjust L52 for maximum amplitude of the curve midway between markers and then overshoot the adjustment by turning the slug in the same direction from the initial setting a little more than the amount of turning required to reach maximum amplitude of response.

Adjust C22 for maximum amplitude of response.

Turn off the sweep generator. Adjust the L43 core for correct channel 13 oscillator frequency, then overshoot the adjustment by turning the slug a little more in the same direction from the initial setting. Reset the oscillator to proper frequency by adjustment of C1.

Turn the sweep oscillator back on.

Check the response of channels 7 through 13 by switching the receiver channel switch, sweep oscillator and marker oscillator to each of these channels and observing the response and oscillator injection obtained. See Figure 11 for typical response curves. It should be found that all these channels have the proper shaped response with the markers above 80%, response.

If the markers do not fall within this requirement, switch to channel 8 and readjust C9, C11, C16 and C22 as necessary. If C22 required adjustment, the adjustment should be overshot a small amount and corrected by adjustment of L52 to give maximum amplitude of response between the sound and picture carrier markers. The antenna circuit (L52, C22) is broad so that tracking is not particularly critical.

If the valley in the top of the selectivity curves for the high channels is deeper than normal, the curve can be flattened somewhat by decreasing the inductance of L44 by turning the core stud in. Be sure to check for undesirable resonant suckouts on channels 7 and 8 if this is done.

Turn the sweep oscillator off and check the receiver channel 8 r-f oscillator frequency. If the oscillator is off frequency overshoot the adjustment of C1 and correct by adjusting L43.

Turn the receiver channel selector switch to channel 6. Adjust L5 for correct oscillator frequency.

Turn the sweep oscillator on and to channel 6 and observe the response curve. If necessary readjust L42, L45 and L49. It should not be necessary to touch C11.

Check the oscillator injection voltage at the test point TP1. If necessary adjust C7 to give −3 volts injection. If C7 is adjusted, switch to channel 8, and readjust C9 for proper curve shape, then recheck channel 6.

Switch the receiver through channel 6 down through channel 2 and check for normal response curve shapes and oscillator injection voltage.

Likewise check channels 7 through 13, stopping on 13 for the next step.

With the receiver on channel 13, check the receiver oscillator frequency. Correct by adjustment of C1 if necessary.

Adjust the oscillator to frequency on all channels by switching the receiver and the heterodyne frequency meter to each channel and adjusting the appropriate oscillator trimmer to obtain a beat on the freq. meter. It should be possible to adjust the oscillator to the correct frequency on all channels with the fine tuning control 30 degrees clockwise from the mechanical center of its range.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.	Channel Oscillator Adjustment
2	55.25	59.75	80.750	L1
3	61.25	65.75	86.750	L2
4	67.25	71.75	92.750	L3
5	77.25	81.75	102.750	L4
6	83.25	87.75	108.750	L5
7	175.25	179.75	200.750	L6
8	181.25	185.75	206.750	L7
9	187.25	191.75	212.750	L8
10	193.25	197.75	218.750	L9
11	199.25	203.75	224.750	L10
12	205.25	209.75	230.750	L11
13	211.25	215.75	236.750	C1

Switch to channel 8 and observe the response.

Adjust T1 clockwise while watching the change in response. When T1 is properly adjusted, the selectivity curve will be slightly wider with a slightly deeper valley in its top.

Switch through all channels and observe response, oscillator injection and r-f oscillator frequency. Minor touch-ups of adjustments may be made at this time. However, if C7 or C9 are changed appreciably, then a recheck of the oscillator frequency on all channels should be made.

Reconnect the link from T101 to terminal 2 of the r-f unit terminal board.

Since T1 was adjusted during the r-f unit alignment it will be necessary to sweep the overall i-f response.

R-F UNIT TUBE CHANGES.—Since most of the circuits are low capacitance circuits the r-f unit may require readjustments when the tubes are changed.

If the 6CB6 r-f amplifier tube is changed, it may be necessary to readjust C16 and C22.

If the 6J6 oscillator and mixer tube is changed, then more extensive adjustments are required.

For good conversion efficiency, the oscillator injection to a triode mixer must be held reasonably close to the optimum value. Although there is some latitude in this level, it is nearly expended in the normal variation in injection from channel to channel. Consequently, the adjustment of C7 is limited primarily to establishing the conditions for good conversion. Since changes in oscillator injection affect conversion gain, it also affects the input capacity of the mixer, thus also affecting tracking of the mixer grid circuit. These tube variations with their consequent effect on circuit alignment thereby require readjustment of the r-f unit if maximum conversion efficiency is to be retained after the 6J6 tube is changed. It may be possible, however, to try several 6J6 tubes and select one which gives satisfactory performance without realignment.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—Connect the "VoltOhmyst" to the junction of R142 and R143.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R142 and R143. Adjust the potentiometer for −5.0 volts indication on the "VoltOhmyst".

Set the channel switch to channel number 9, 10 or 11.

Connect the "VoltOhmyst" to pin 2 of V110 (Pin 4 if 6AC7 or 6AG7 is used) and to ground.

Connect the output of the signal generator to the mixer grid test point TP2 in series with a 1500 mmf ceramic capacitor.

Connect a separate −5 volt bias supply to TP1 with the positive terminal to ground.

Set the generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst". In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

ALIGNMENT PROCEDURE

Adjust the signal generator output to give 3 volts on the "VoltOhmyst" as the final adjustment is made.

(1) 24.25 mc.—T107
(2) 25.5 mc.—T106
(3) 22.75 mc.—T105

PICTURE I-F TRAP ADJUSTMENT.—With the same connections as above, tune the generator to 27.00 mc. and adjust the T104 top core for minimum d-c on the "VoltOhmyst". Set the generator output so that this minimum is about 3 volts when final adjustment is made. If necessary, the i-f bias may be reduced in order to obtain the 3 volt reading on the "VoltOhmyst".

SWEEP ALIGNMENT OF PIX I-F.—To align T1 and T104, connect the sweep generator to the mixer grid test point TP2. In series with a 1500 mmf ceramic capacitor use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the r-f unit outer shield.

Connect a separate −5.0 volt bias supply to TP1 with the positive terminal connected to ground and by-pass TP1 to ground with a 1500 mmf. ceramic capacitor.

Set the channel selector switch between channels 2 and 13.

Clip 330 ohm resistors across terminals A and B of T106 and T107.

Preset C115 to minimum capacity.

Adjust the bias box potentiometer to obtain −5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R142 and R143. Leave the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T105. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T1 (top) and T104 (bottom) for maximum gain and with 25.5 mc. at 70% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C115 until 22.25 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 12.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to pin 2 of V110 socket (or pin 4 of 6AC7 or 6AG7).

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T105, T106 and T107 to obtain the response shown in Figure 13.

It is especially important that the 22.4 mc. marker should fall at 55% on the overall i-f response curve. If the marker should fall appreciably higher than 55%, trouble may be experienced with sound in the picture. If the marker should fall appreciably below 55% response, the sound sensitivity may be reduced and may cause the sound to be noisy in weak signal areas.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first sound i-f grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix i-f amplifier, pin 1 of V108.

Set the frequency of the calibrator to 25.50 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at L102 and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst". Adjust the signal level from the signal generator for 6 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R106 and C108.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst".

Repeat adjustments of T102 top for maximum d-c at pin 2 of V103 and T102 bottom for zero d-c at the junction of R106 and C108. Make the final adjustments with the signal input level adjusted to produce 6 volts d-c on the "VoltOhmyst" at pin 2 of V103.

SOUND I-F ALIGNMENT.—Connect the signal generator to the first sound i-f amplifier grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the T101 top core for maximum d-c on the "VoltOhmyst".

The output from the signal generator should be set to produce approximately 6.0 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 1,000 ohm resistor to pin 2 of V109. Set the generator to 4.5 mc. and modulate it 30%, with 400 cycles. Set the output to approximately 0.5 volts.

Short the third pix i-f grid to ground, pin 1, V108, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video amplifier, pin 6 of V110 (pin 8 when 6AC7 or 6AG7 is used).

Adjust the core of L103 for minimum output on the oscilloscope.

Remove the short from pin 1, V108 to ground.

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L103 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L103 for minimum beat.

CHECK OF OVERALL RESPONSE.—If desired, the overall response of the receiver can be checked on each channel.

Connect the r-f sweep generator to the receiver antenna input terminals. If necessary, employ one of the pads shown in Figure 9 to match the sweep output cable to the r-f unit.

Connect the signal generator loosely to the first pix i-f amplifier grid.

Adjust the bias potentiometer to obtain −5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R142 and R143.

Connect the oscilloscope to pin 2 of V110 (or pin 4 if 6AC7 or 6AG7 is used).

Check the response of channels 2 through 13 by switching the receiver channel switch and sweep oscillator to each of these channels and observing the response obtained. On each channel, adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

I-F markers at 22.4 mc., 24.75 mc. and 25.5 mc. should be provided by the signal generator.

The response obtained in this manner should be very similar to that shown in Figure 13.

Some curves may show a 10% sag in the top between 22.75 mc. and 24.75 mc. while others may show a 10% peak in this region. This may be considered normal.

If the picture carrier is consistently high or low on all channels, T106 may be adjusted slightly. Do not adjust T105.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 6 of V110 (pin 8 when 6AC7 or 6AG7 is used).

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

ALIGNMENT PROCEDURE

HORIZONTAL OSCILLATOR ADJUSTMENT.—Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R170B, then adjust the T110 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T110 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T110 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C161B, the width control L106 and the linearity control L108 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T110 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T110 frequency core (on the rear apron) until the picture falls out of sync and three or four diagonal black bars sloping down to the right appear on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T110 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture falls out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin the motorboat. Retouch the adjustment of the T110 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T110. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 14. Adjust the waveform adjustment core of T110 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T110 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C161A slightly clockwise. If less than 2 bars are present, adjust C161A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T110 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves to the left side of the screen leaving the picture in synchronization.

SENSITIVITY CHECK.—A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is at the maximum clockwise position. Only carbon type resistors should be used to construct the pad.

RESPONSE CURVES.—The response curves shown on page 23 and referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, some variations can be expected.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

NOTE ON R-F UNIT ALIGNMENT.—Because of the frequency spectrum involved and the nature of the device, many of the r-f unit leads and components are critical in some respects. Even the power supply leads form loops which couple to the tuned circuits, and if resonant at any of the frequencies involved in the performance of the tuner, may cause serious departures from the desired characteristics. In the design of the receiver these undesirable resonant loops have been shifted far enough away in frequency to allow reasonable latitude in their components and physical arrangement without being troublesome. When the r-f unit is aligned in the receiver, no trouble from resonant loops should be experienced. However, if the unit is aligned in a jig separate from the receiver, attention should be paid to insure that unwanted resonances do not exist which might present a faulty representation of r-f unit alignment.

A resonant circuit exists between the r-f tuner chassis and the outer shield box, which couples into the antenna and r-f plate circuits. The frequency of this resonance depends on the physical structure of the shield box, and the capacitance between the tuner chassis and the front plate. In the KRK8 units, this resonance should fall between 120 and 135 mc. and is controlled in the design by using insulating washers of different thicknesses (in the front plate to tuner chassis mounting) to compensate for differences in the shield boxes of different models of receivers. The performance of the tuner, particularly on channels 7 and 8 will be impaired if the proper washers for the particular shield box involved are not used. Obviously then, if the r-f unit is removed for service, the washers should be replaced in the correct order when the unit is replaced.

ALIGNMENT TABLE

THE DETAILED ALIGNMENT PROCEDURE BEGINNING ON PAGE 20 SHOULD BE READ BEFORE ALIGNMENT BY USE OF THE TABLE IS ATTEMPTED

STEP. No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
	R-F UNIT ALIGNMENT									
1	Disconnect the co-ax link from terminal 2 of the r-f unit terminal board and connect a 39 ohm composition resistor between lugs 1 and 2. Detune T1 by backing the core all the way out of the coil. Back the L44 core all the way out. Back the L203 core all the way out. In order to align the r-f tuner, it will first be necessary to set the channel 13 oscillator to frequency. The shield over the bottom of the r-f unit must be in place when making any adjustments.									
2	Not used		Not used		Loosely coupled to r-f oscillator	236.75 MC.	Not used	Fine tuning 30 degrees clockwise from mechanical center of its range. Receiver on channel 13.	C1 for an audible beat on het. freq. meter	Fig. 7
3	"		"				Connect "Volt-Ohmyst" to terminal 3 of the r-f unit terminal board	Turn AGC control fully clockwise. Connect bias box to terminal 3 of r-f unit term. board	Adjust the bias box potentiometer for —3.5 volts.	
4	Antenna terminal (loosely)	181.25 185.75	Antenna terminals (see text for precaution)	Sweeping channel 8	Not used	—	Not used	Rec. on chan. 8. Connect oscilloscope to TP1. Adjust C9, C11, C16 and C22 for correct curve shape, frequency and band width. C22 is adjusted to give max. amplitude between markers. C9 affects tilt and C16 affects the frequency of response. C11 affects the response band width.		Fig. 7
5	Not used		Not used	Not used	Loosely coupled to r-f oscillator	108.75	"	Rec. on channel 6	L5 for audible beat on het. freq. meter.	Fig. 8
6	Antenna terminal (loosely)	83.25 87.75	Antenna terminals (see text for precaution)	Channel 6	Not used	—	"	Rec. on chan. 6. Adjust L42, L45 and L49 for proper response. L42 is adjusted to give max. amplitude between markers. L45 primarily affects tilt and L49 primarily affects freq. of response. If necessary, retouch C11 for proper width.		Fig. 11
7	Not used	—	Not used	—	Not used	—	Connect "Volt-Ohmyst" to r-f unit test point TP1	Rec. on channel 6	Adjust C7 for —3.0 volts at the test point	Fig. 7 Fig. 15
8	Repeat above steps until the specified conditions are obtained.									
9	Not used		Not used	—	Loosely coupled to r-f oscillator	206.75		Rec. on chan. 8	C1 for audible beat on het. freq. meter	Fig. 7
10	Antenna terminal (loosely)	181.25 185.75	Antenna terminals (see text for precaution)	Sweeping channel 8	Not used	—	Not used	Rec. on chan. 8. Readjust C9, C16 and C22 for correct curve shape, frequency and band width. Readjust C11 only if necessary.		Fig. 7 Fig. 11 (8)
11	"	211.25 215.75	"	Sweeping channel 13	Not used	—	Not used	Rec. on chan. 13. Adjust L52 for max. amplitude between markers, overshoot a little more than required to reach max. response. Adjust C22 to regain max. amplitude of response.		Fig. 7 Fig. 11 (13)
12	"	215.75	Not used	—	Loosely coupled to r-f oscillator	236.75		Receiver on chan. 13. channel 13 osc. freq. the osc. to proper freq	Adjust L43 for correct then overshoot. Reset by adjustment of C1.	Fig. 7 Fig. 8
13	"	205.25 209.75	Antenna terminals (see text for precaution)	channel 12	Not used	—	Connect "Volt-Ohmyst" to r-f unit test point TP1	Rec. on chan. 12	Check to see that response is correct and —3.0 volts of osc. injection is present	Fig. 11
14	"	199.25 203.75		channel 11	"	—	"	Rec. on chan. 11	"	Fig. 11 (11)
15	"	193.25 197.75	"	channel 10	"	—	"	Rec. on chan. 10	"	Fig. 11 (10)
16	"	187.25 191.75	"	channel 9	"	—	"	Rec. on chan. 9	"	Fig. 11 (9)
17	"	181.25 185.75	"	channel 8	"	—	"	Rec. on chan. 8	"	Fig. 11 (8)
18	"	175.25 179.75	"	channel 7	"	—	"	Rec. on chan. 7	"	Fig. 11 (7)
19	If the response of any channel (steps 13 through 18) is below 80% at either marker, repeat step 10 and adjust C9, C11, C16 and C22 as necessary to pull response up on the low channel yet maintain correct response on channel 8. If C22 required adjustment, the adjustment should be overshot a small amount and corrected by adjustment of L52 to give maximum amplitude of response between the sound and picture carrier markers.									
20	Repeat step 9. If the oscillator is off frequency overshoot the adjustment of C1 and correct by adjusting L43.									
21	Repeat steps 13 through 20 until all requirements are obtained.									
22	Not used	—	Not used	—	Loosely coupled to r-f oscillator	108.75		Rec. on chan. 6	L5 for zero beat on het. freq. meter	Fig. 8
23	Antenna terminals (loosely)	83.25 87.75	Antenna terminals (see text for precaution)	Sweeping channel 6	Not used	—	Not used	Observe response. If necessary readjust L42, L45 and L49. It should not be necessary to touch C11.		Fig. 7 Fig. 11
24	Not used	—	Not used	—	Not used	—	Connect "Volt-Ohmyst" to the r-f unit test point TP1	Check osc. injection. If necessary adjust C7 to give —3 volts. If C7 is adjusted, switch to channel 8, and readjust C9 for proper response then repeat step 23.		Fig. 7 Fig. 11
25	Antenna terminals (loosely)	77.25 81.75	Antenna terminals (see text for precaution)	channel 5	"	—	"	Rec. on chan. 5	Check to see that response is correct and —3.0 volts of osc. injection is present	Fig. 11 (5)

ALIGNMENT TABLE

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER	HET. FREQ. METER MC.	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
26	Antenna terminals (loosely)	67.25 71.75	Ant. terminals (see text for precaution)	channel 4	Not used	—	Connect "Volt-Ohmyst" to the r-f unit test point TP1	Rec. on chan. 4	Check to see that response is correct and —3.0 volts of osc. injection is present	Fig. 11 (4)
27	"	61.25 65.75	"	channel 3	"	—	"	Rec. on chan. 3	"	Fig. 11 (3)
28	"	55.25 59.75	"	channel 2	"	—	"	Rec. on chan. 2	"	Fig. 11 (2)
29	Likewise check channels 7 through 13, as outlined in steps 18 back through 13, stopping on channel 13 for next step.									
30	Antenna terminals	215.75	Not used	—	Loosely coupled to r-f oscillator	236.75	Not used	Fine tuning 30 degrees clockwise from mechanical center of its range. Receiver on channel 13	C1 for zero beat on het. freq. meter	Fig. 7
31	"	209.75	"	—	"	230.75	"	Rec. on chan. 12	L11 as above	Fig. 8
32	"	203.75	"	—	"	224.75	"	Rec. on chan. 11	L10 as above	Fig. 8
33	"	197.75	"	—	"	218.75	"	Rec. on chan. 10	L9 as above	Fig. 8
34	"	191.75	"	—	"	212.75	"	Rec. on chan. 9	L8 as above	Fig. 8
35	"	185.75	"	—	"	206.75	"	Rec. on chan. 8	L7 as above	Fig. 8
36	"	179.75	"	—	"	200.75	"	Rec. on chan. 7	L6 as above	Fig. 8
37	"	87.75	"	—	"	108.75	"	Rec. on chan. 6	L5 as above	Fig. 8
38	"	81.75	"	—	"	102.75	"	Rec. on chan. 5	L4 as above	Fig. 8
39	"	71.75	"	—	"	92.75	"	Rec. on chan. 4	L3 as above	Fig. 8
40	"	65.75	"	—	"	86.75	"	Rec. on chan. 3	L2 as above	Fig. 8
41	"	59.75	"	—	"	80.75	"	Rec. on chan. 2	L1 as above	Fig. 8
42	Repeat steps 30 through 41 as a check.									
43	Antenna terminals	181.25 185.75	Antenna terminals	Sweeping channel 8	Not used	—		Rec. on chan. 8. Oscilloscope at test point TP1. Adjust T1 clockwise. When properly adjusted, curve will be slightly wider with a slightly deeper valley in top.		Fig. 11 (8)
44	Switch through all channels and observe response, oscillator injection and r-f oscillator frequency. Minor touch-ups of adjustments may be made at this time. However, if C7 or C9 are changed appreciably, then a recheck of the oscillator frequency on all channels should be made.									
45	Remove 39 ohm resistor and reconnect link from T101 to terminal 2 of r-f unit terminal board.									

PICTURE I-F AND TRAP ADJUSTMENT

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
46	Not used		Not used	—	Not used	Junction of R142 & R143	Connect bias box to junction of R142 & R143 and to ground AGC fully clockwise	Adjust potentiometer for —5.0 volts on meter	Fig. 3
47	"		"	—	"	Test point TP1	Connect bias box to TP1 and to ground	"	Fig. 7
48	Mixer grid test point TP2 in series with 1500 mmf.	24.25	"	—	"	Pin 2 of V110 and to ground	Bias boxes connected as above	T107 (top) for max.	Fig. 15
49	"	25.5	"	—	"	"	"	T106 (top) for max.	Fig. 15
50	"	22.75	"	—	"	"	"	T105 (top) for max.	Fig. 15
51	"	27.00	"	—	"	"	"	T104 (top) for min.	Fig. 15
52	Connected loosely to diode probe	Various See Fig. 13	Mixer grid test point TP2 in series with 1500 mmf.	20 to 28 mc	Scope diode probe to pin 5 of V106 and to gnd. Connect a 180 ohm resistor from pin 5 of V106 to pin A of T105	Junction of R142 & R143	Shunt terminals A and B of T106 and T107 with 330 ohms. Bias boxes connected as above. .3v p-p on scope	Set C115 to min. Adjust T1 top and T104 bot. for max. gain with 25.5 mc. at 70%. C115 for 22.5 at 70%	Fig. 7 Fig. 16
53	Connected loosely to grid of 1st pix i-f. Adjust for small marker indication	Various See Fig. 14	"	"	Connect scope to pin 2 of V110. Remove shunt & diode probe used above		Remove shunts from T106 & T107	Retouch T105, T106 and T107 to obtain response shown in Fig. 13	Fig. 13

RATIO DETECTOR, SOUND I-F AND 4.5 MC TRAP ALIGNMENT

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
54	Grid 1st Snd. I-F (pin 1, V101) or WR39B or C connect to grid 3rd pix I-F (pin 1, V108)	25.50mc. mod. by 4.5 mc.	Not used	—	Not used	Pin 2 of V103	Set signal gen. to give 6V on meter	T102 top core for max. d-c on meter	Fig. 15
55	"	"	"	—	"	"	"VoltOhmyst" to junction R106 and C108. Adjust T102 bottom core for zero DC on meter. Repeat steps 54 and 55 until all conditions are satisfied.		Fig. 15 Fig. 16
56	Sig. Gen. to 1st Snd. I-F grid	4.5 mc.	"	—	"	"	Signal generator output adjusted to provide 6 v on meter	T101 top core for max. DC on meter	Fig. 15
57	Sig. Gen. in series with 1000 ohms to pin 2 of V109	4.5 mc. mod. 30% with 400 cy.	"	—	Diode probe to pin 6 of V110	Not used	Short pin 1 of V108 to ground	Adjust L103 for minimum output on oscilloscope	Fig. 15

ALIGNMENT DATA

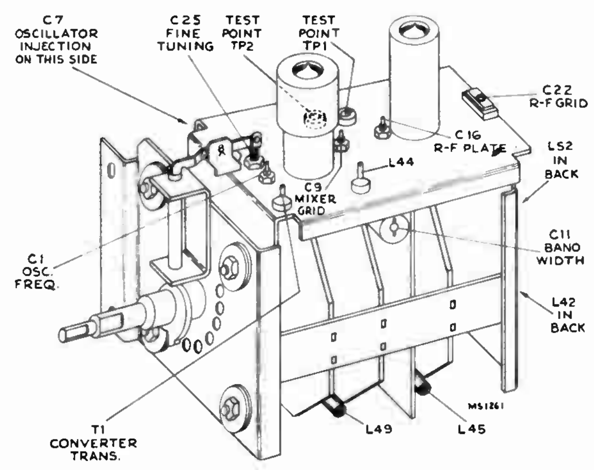


Figure 7—R-F Unit Adjustments

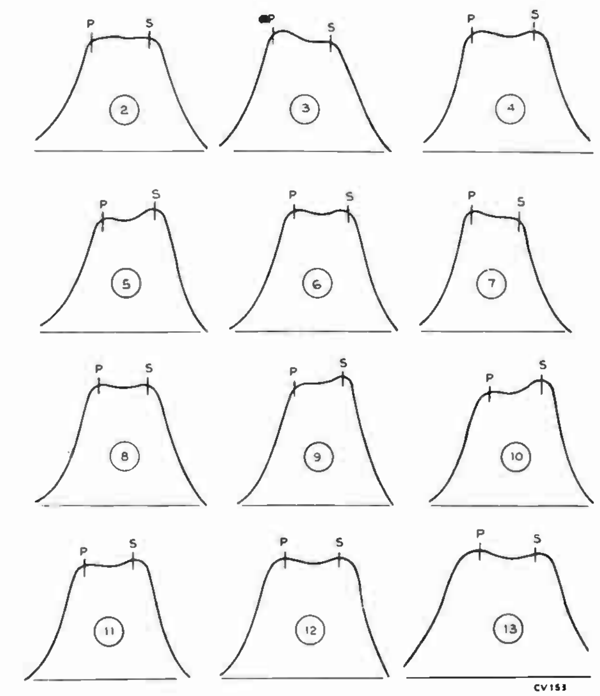


Figure 11—R-F Response

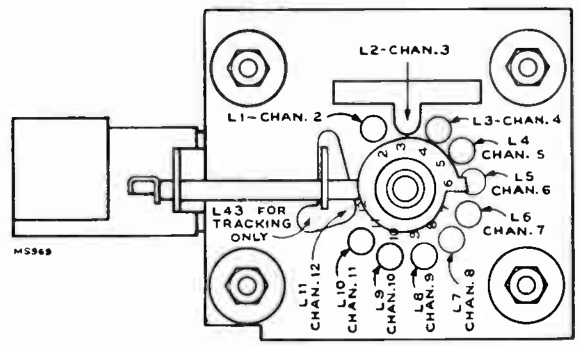


Figure 8—R-F Oscillator Adjustments

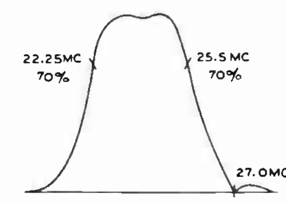


Figure 12 T1 and T104 Response

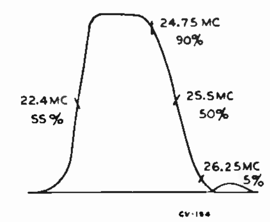


Figure 13 Over-all I-F Response

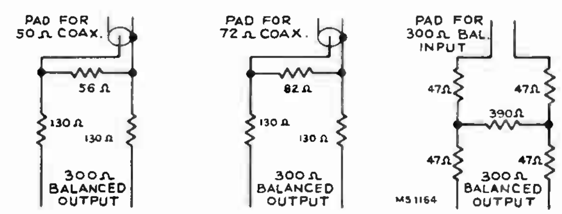


Figure 9—Sweep Attenuator Pads

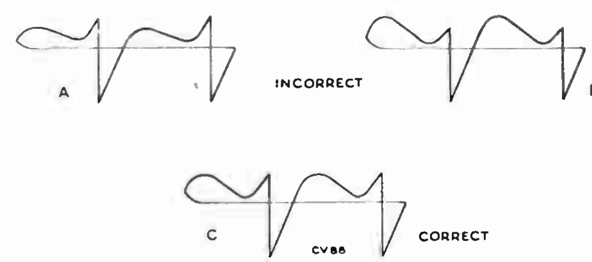


Figure 14—Horizontal Oscillator Wave Forms

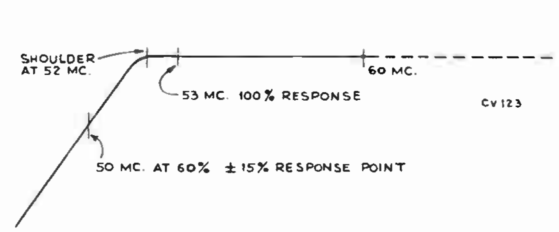


Figure 10—Antenna Matching Unit Response

ALIGNMENT DATA

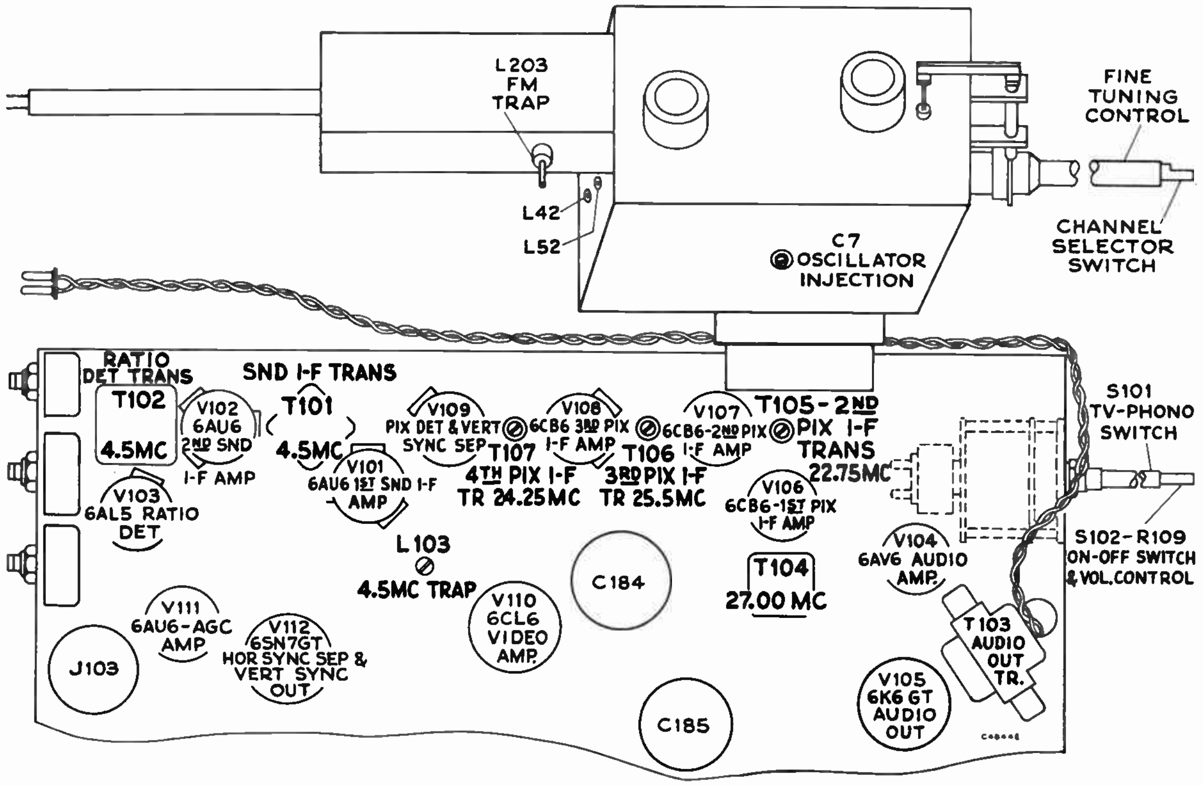


Figure 15—Top Chassis Adjustments

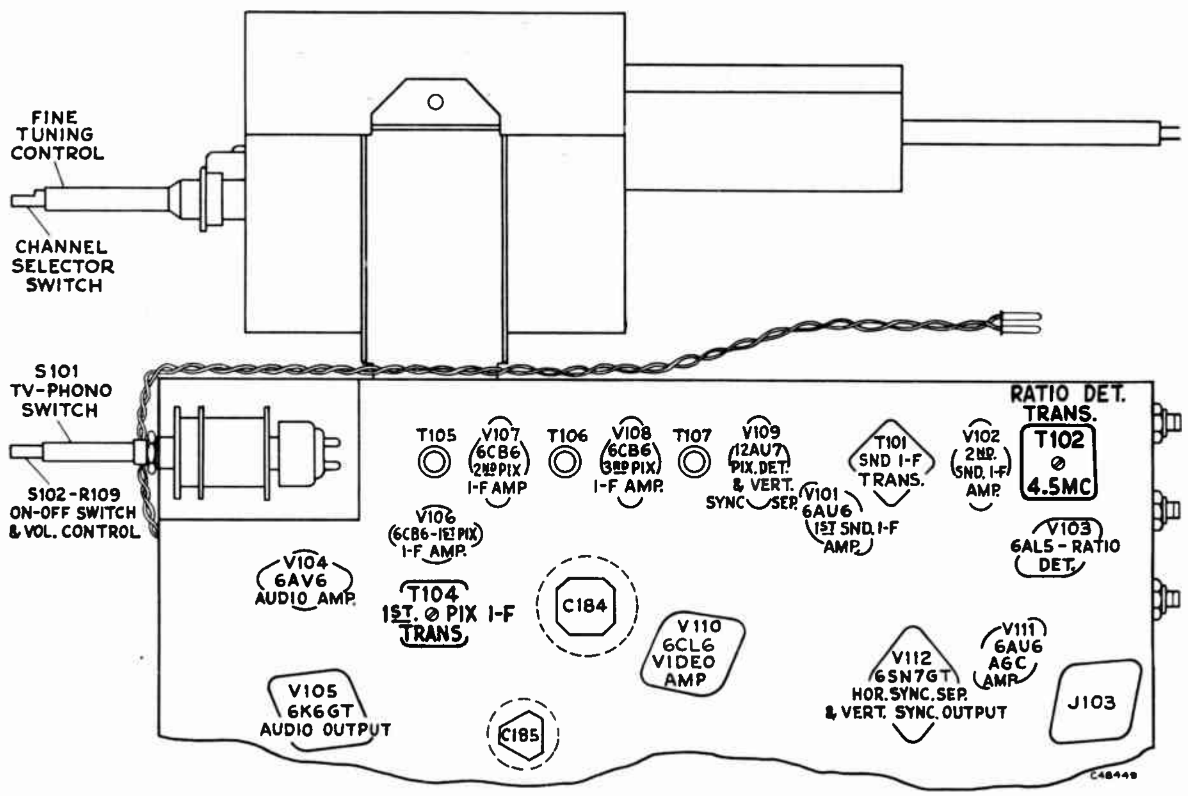


Figure 16—Bottom Chassis Adjustments

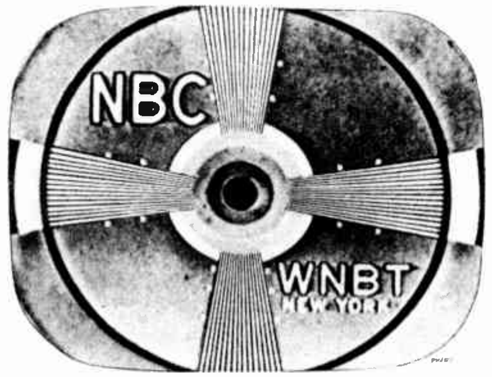
TEST PATTERN PHOTOGRAPHS

Figure 17—Normal Picture ←

Figure 18—Focus Magnet and Ion Trap Magnet Misadjusted →

Figure 19—Horizontal Linearity Control Misadjusted (Picture Cramped in Middle) ←

Figure 20—Width Control Misadjusted →



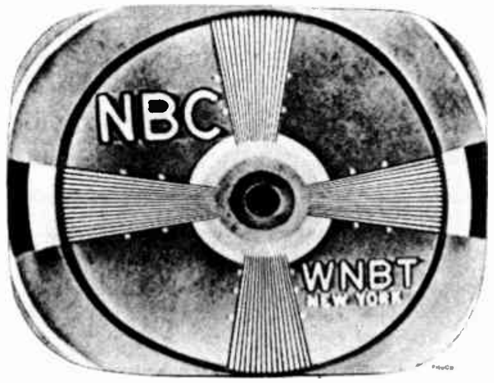
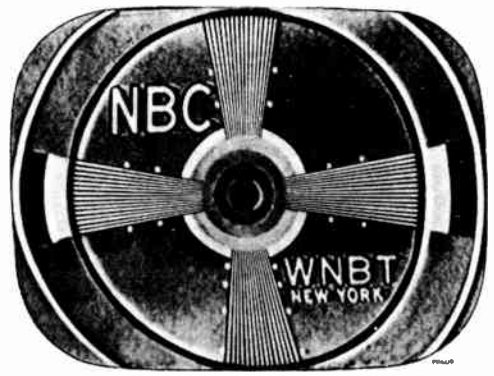


Figure 21—Horizontal Drive Control Misadjusted ←

Figure 22—Transients →



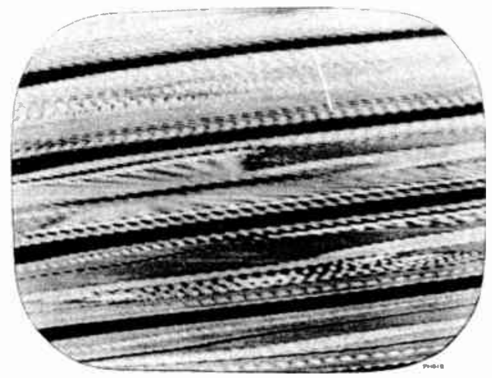
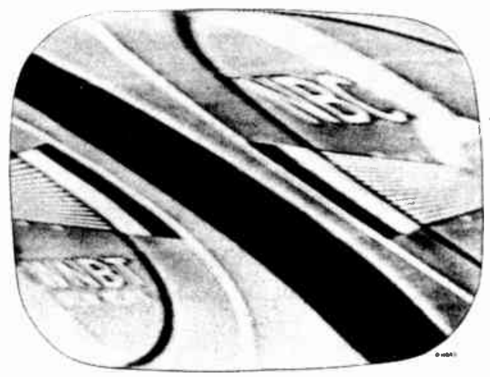


Figure 23—Test Pattern Showing Out of Sync Condition When Horizontal Hold Control Is in a Counter-clockwise Position—Just Before Pulling Into Sync ←

Figure 24—Test Pattern Showing Out of Sync Condition When Horizontal Hold Control Is at the Maximum Clockwise Position →



SERVICE SUGGESTIONS

Following is a list of symptoms of possible failures and an indication of some of the possible faults:

NO RASTER ON KINESCOPE:

(1) Incorrect adjustment of ion trap magnet. Magnet reversed either front to back or top to bottom.
(2) V115 or V116 inoperative. Check waveforms on grids and plates.
(3) No high voltage—if horizontal deflection is operating as evidenced by the correct waveform on terminal 1 of high voltage transformer, the trouble can be isolated to the 1B3GT circuit. Either the T111 high voltage winding is open, the 1B3GT tube is defective or its filament circuit is open.
(4) V110 circuit, inoperative—Refer to schematic and waveform chart.
(5) Damper tube (V118) inoperative.
(6) Defective kinescope.
(7) R184 open.
(8) No receiver plate voltage—filter capacitor shorted—or filter choke open.

NO VERTICAL DEFLECTION:

(1) V113 or V114 inoperative. Check voltage and waveforms on grids and plates.
(2) T108 open.
(3) Vertical deflection coils open

SMALL RASTER:

(1) Low Plus B or low line voltage.
(2) V116, V120 or V121 defective.

POOR VERTICAL LINEARITY:

(1) If adjustments cannot correct, change V114.
(2) Vertical output transformer T108 defective.
(3) V113 defective—check voltage and waveforms on grid and plate.
(4) C151, C152, C153, C155, or C156 defective.
(5) Low plate voltage—check rectifiers and capacitors in supply circuits.
(6) If height is insufficient, try changing V113.

POOR HORIZONTAL LINEARITY:

(1) If adjustments do not correct, change V116, or V118.
(2) T108 or L108 defective.
(3) C176 or C177 defective.

WRINKLES ON SIDE OF RASTER:

(1) C181 defective.
(2) Defective yoke.

PICTURE OUT OF SYNC HORIZONTALLY:

(1) T110 incorrectly tuned.
(2) R192, R193 or R170B defective.

TRAPEZOIDAL OR NON SYMMETRICAL RASTER:

(1) Improper adjustment of centering of focus magnet or ion trap magnet.
(2) Defective yoke.

RASTER AND SIGNAL ON KINESCOPE BUT NO SOUND:

(1) L102 defective.
(2) Sound i-f, ratio detector or audio amplifier inoperative—check V101, V102, V103 and their socket voltages.
(3) Audio system defective.
(4) Speaker defective.

SIGNAL AT KINESCOPE GRID BUT NO SYNC:

(1) AGC control R149 misadjusted.
(2) V111, inoperative. Check voltage and waveforms at its grid and plate.

SIGNAL ON KINESCOPE GRID BUT NO VERTICAL SYNC:

(1) Check V113 and associated circuit.
(2) Integrating network inoperative—Check.
(3) V109B or V112B defective or associated circuit defective.
(4) Gas current, grid emission or grid cathode leakage in V112. Replace.

SIGNAL ON KINESCOPE GRID BUT NO HORIZONTAL SYNC:

(1) T110 misadjusted—readjust as instructed on page 11.
(2) V112 inoperative—check socket voltages and waveforms.
(3) T110 defective.
(4) C142, C161A, C163, C165, C166, C167, C168, C169 or C170 defective.
(5) If horizontal speed is completely off and cannot be adjusted check R192, R193, R170B, R195, R196 and R198.

SOUND AND RASTER BUT NO PICTURE OR SYNC:

(1) Picture, detector or video amplifier defective—check V109A and V110—check socket voltages.
(2) Bad contact to kinescope cathode.

PICTURE STABLE BUT POOR RESOLUTION:

(1) V109A or V110 defective.
(2) Peaking coils defective—check resistance.
(3) Make sure that the focus control operates on both sides of proper focus.
(4) R-F and I-F circuits misaligned.

PICTURE SMEAR:

(1) R-F or I-F circuits misaligned.
(2) Open peaking coil.
(3) This trouble can originate at the transmitter—check on another station.

PICTURE JITTER:

(1) AGC control R149 misadjusted.
(2) If regular sections at the left picture are displaced change V116.
(3) Vertical instability may be due to loose connections or noise.
(4) Horizontal instability may be due to unstable transmitted sync.

RASTER BUT NO SOUND, PICTURE OR SYNC:

(1) Defective antenna or transmission line.
(2) R-F oscillator off frequency.
(3) R-F unit inoperative—check V1, V2.

DARK VERTICAL LINE ON LEFT OF PICTURE:

(1) Reduce horizontal drive and readjust width and horizontal linearity.
(2) Replace V116.

LIGHT VERTICAL LINE ON LEFT OF PICTURE:

(1) V118 defective.

RESPONSE AND WAVE FORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

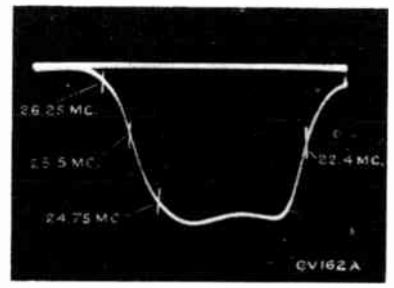
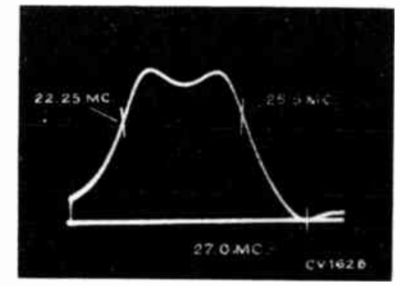


Figure 25—Overall Pix I-F Response ←

Figure 26—Response of T1-T104 Pix I-F Transformers →



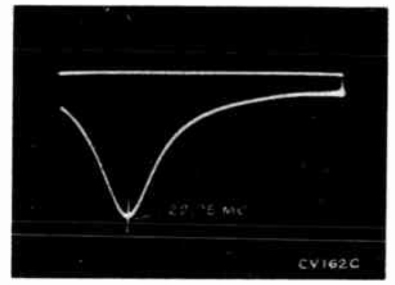
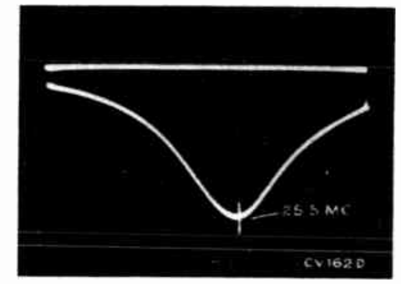


Figure 27—Response of T105 Pix I-F Transformer ←

Figure 28—Response of T106 Pix I-F Transformer →



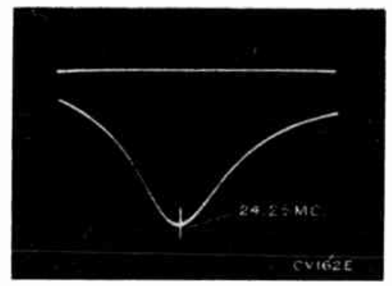
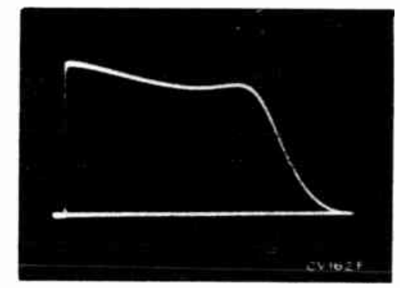
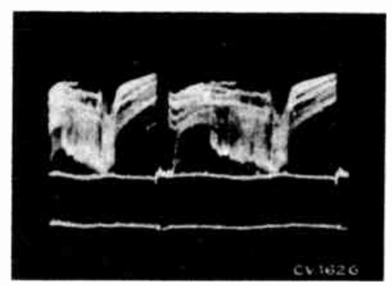


Figure 29—Response of T107 Pix I-F Transformer ←

Figure 30—Video Response at Average Contrast →

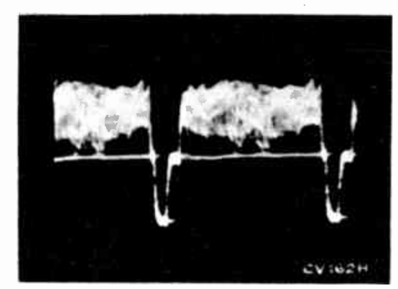




Grid of Video Amplifier (Pin 2 of V110) (6CL6) Voltage Depends on Picture

Figure 31—Vertical (Oscilloscope Synced to ½ of Vertical Sweep Rate) (1.5 Volts PP) ←

Figure 32—Horizontal (Oscilloscope Synced to ½ of Horizontal Sweep Rate) (1.5 Volts PP) →



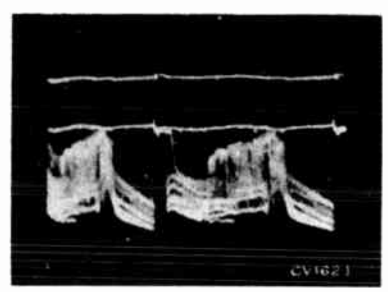
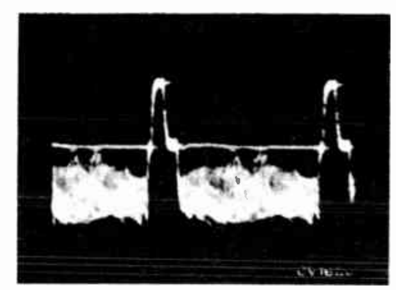


Plate of Video Amplifier (Pin 6 of V110) (6CL6) Voltage depends on picture

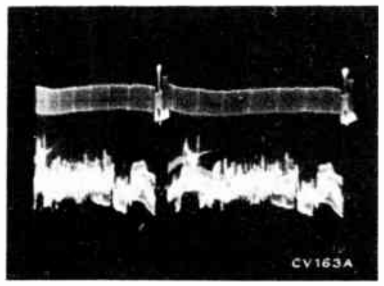
Figure 33—Vertical (85 Volts PP) ←

Figure 34—Horizontal (85 Volts PP) →



WAVEFORM PHOTOGRAPHS

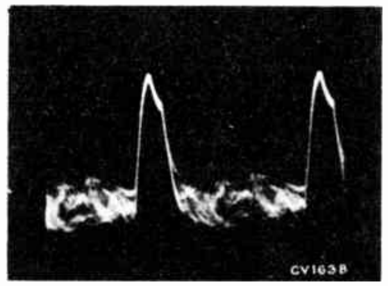
Taken from RCA WO58A Oscilloscope

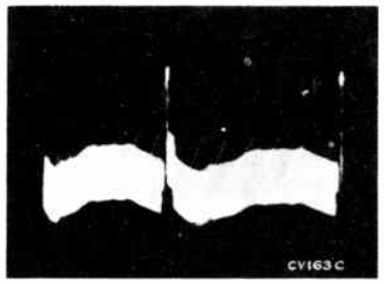


Grid of Horizontal Sync Separator (Pin 1 of V112A) (6SN7) Voltage depends on picture

Figure 35—Vertical (85 Volts PP) ◄◄◄——

Figure 36—Horizontal (85 Volts PP) ——►►►

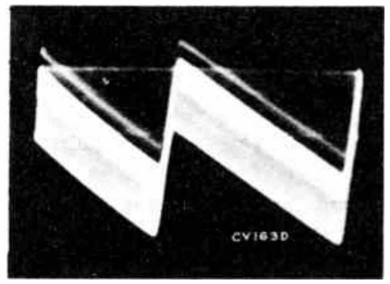




Cathode of Horizontal Sync Sep. (Pin 3 of V112A) (6SN7)

Figure 37—Vertical (7.5 Volts PP) ◄◄◄——

Figure 38—Horizontal (5 Volts PP) ——►►►



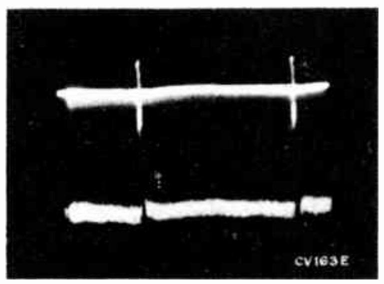
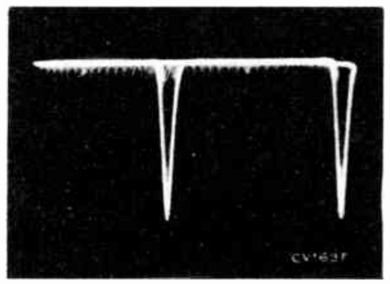
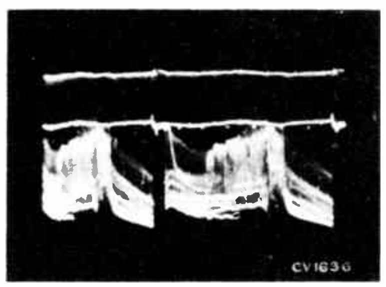


Plate of Horizontal Sync Separator (Pin 2 of V112A) (6SN7)

Figure 39—Vertical (45 Volts PP) ◄◄◄——

Figure 40—Horizontal (45 Volts PP) ——►►►

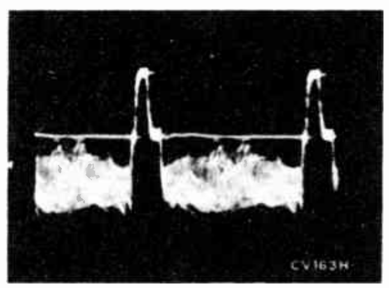




Grid of Vertical Sync Sep. (Pin 7 of V109B) (12AU7)

Figure 41—Vertical (55 Volts PP) ◄◄◄——

Figure 42—Horizontal (55 Volts PP) ——►►►



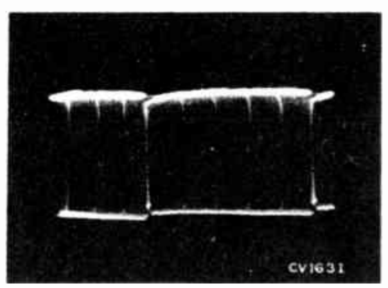
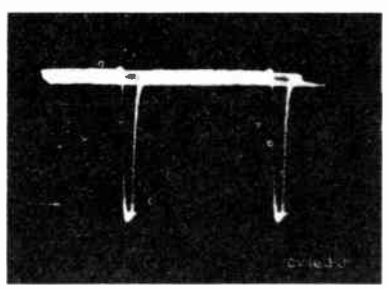


Plate of Vertical Sync Sep. (Pin 6 of V109B) (12AU7)

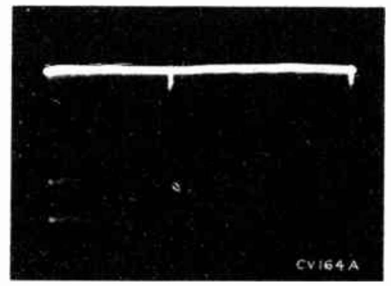
Figure 43—Vertical (65 Volts PP) ◄◄◄——

Figure 44—Horizontal (65 Volts PP) ——►►►



WAVEFORM PHOTOGRAPHS

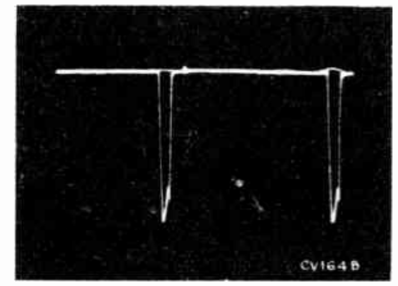
Taken from RCA WO58A Oscilloscope



Grid of Sync Output (Pin 4 V112B) (6SN7)

Figure 45—Vertical (40 Volts PP) ◄◄◄——

Figure 46—Horizontal (40 Volts PP) ——►►►



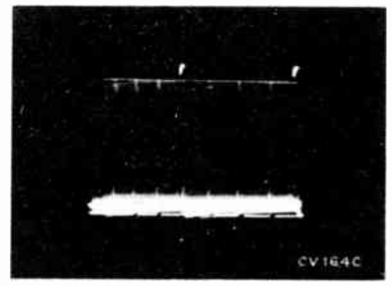
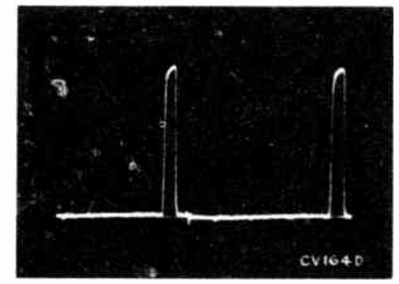


Plate of Sync Output (Pin 5 of V112) (6SN7)

Figure 47—Vertical (47 Volts PP) ◄◄◄——

Figure 48—Horizontal (47 Volts PP) ——►►►



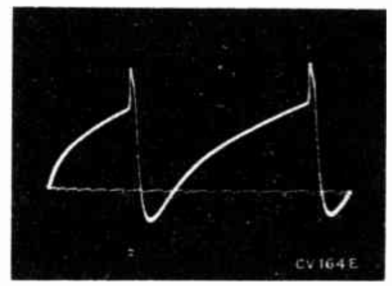


Figure 49—Grid of Vertical Sweep Osc. (Pin 5 of V113) (6J5) (30 Volts PP) ◄◄◄——

Figure 50—Plate of Vertical Sweep Osc. (Pin 3 of V113) (100 Volts PP) ——►►►

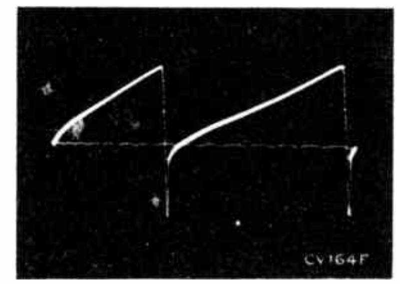
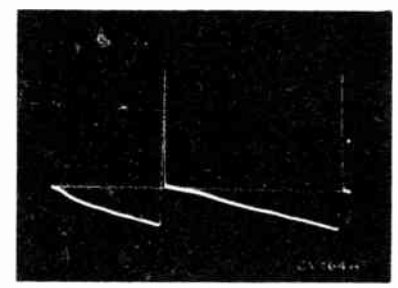
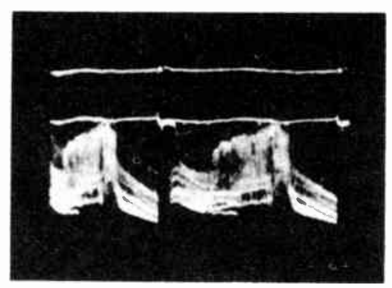


Figure 51—Grid of Vertical Sweep Output (Pin 5 of V114) (6K6) (100 Volts PP) ◄◄◄——

Figure 52—Plate of Vertical Sweep Output (Pin 3 of V114) (6K6) (715 Volts PP) ——►►►



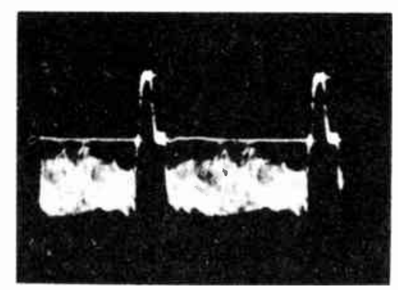


Cathode of Kinescope (Pin 11 of V119) (17QP4)

Voltage depends on picture

Figure 53—Vertical ◄◄◄——

Figure 54—Horizontal ——►►►



WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

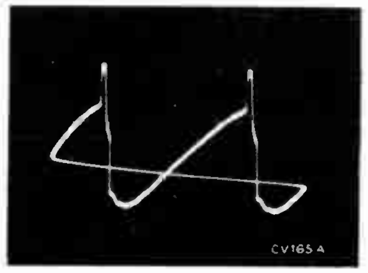
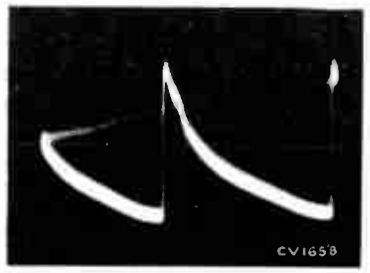


Figure 55—Grid of Horizontal Oscillator Control (Pin 1 of V115) (6SN7GT) (19 Volts PP)

Figure 56—Cathode of Horizontal Oscillator Control (Pin 3 of V115) (6SN7GT) (1.2 Volts PP)



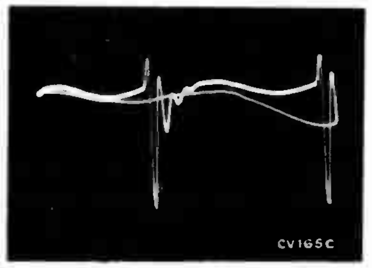
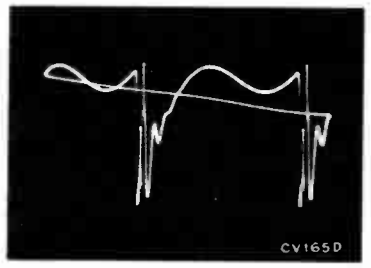


Figure 57—Grid of Horizontal Oscillator (Pin 4 of V115) (6SN7GT) (330 Volts PP)

Figure 58—Plate of Horizontal Oscillator (Pin 5 of V115) (6SN7GT) (140 Volts PP)



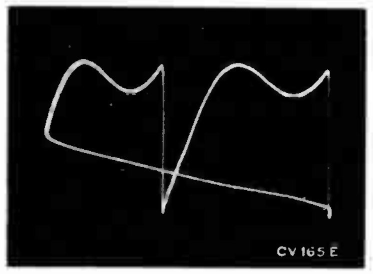
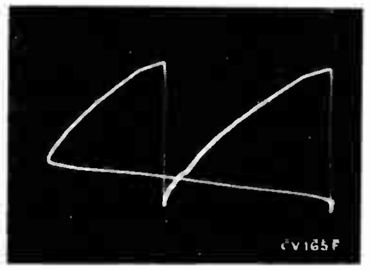


Figure 59—Terminal "C" of T110 (150 Volts PP)

Figure 60—Grid of Horizontal Output Tube (Pin 5 of V116) (6BQ6) (90 Volts PP)



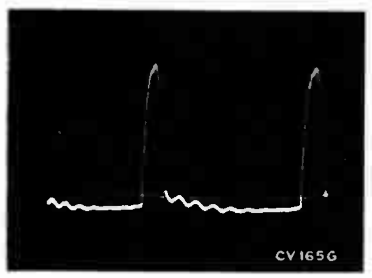
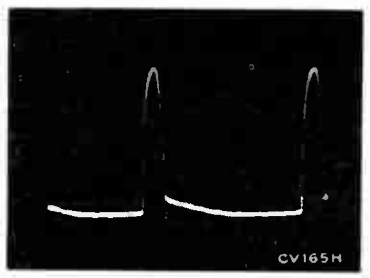


Figure 61—Plate of Horizontal Output (Approx. 4000 Volts PP) (Measured Through a Capacity Voltage Divider Connected from Top Cap of V116 to Ground)

Figure 62—Cathode of Damper (Pin 3 of V118) (6W4GT) (2350 Volts PP)



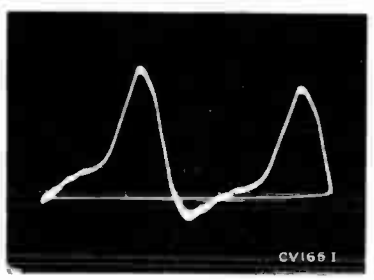
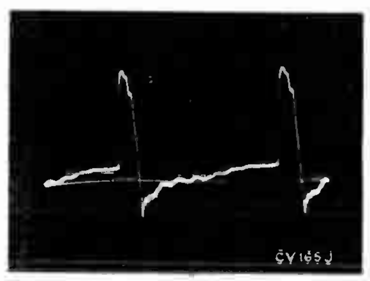


Figure 63—Plate of Damper (Pin 5 of V118) (6W4GT) (160 Volts PP)

Figure 64—Plate of AGC Amplifier (Pin 5 of V111) (6AU6) (560 Volts PP)



VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V1	6J6	Mixer	15000 Mu. V. Signal	2	153	—	—	7	0	5	*—3 to —5	*Depending on channel
			No Signal	2	135	—	—	7	0	5	*—3 to —5	*Depending on channel
V1	6J6	R-F Oscillator	15000 Mu. V. Signal	1	100	—	—	7	0	6	*—3 to —5	*Depending on channel
			No Signal	1	85	—	—	7	0	6	*—3 to —5	*Depending on channel
V2	6CB6	R-F Amplifier	15000 Mu. V. Signal	5	260	6	150	2	.1	1	—5.8	
			No Signal	5	220	6	100	2	1.0	1	—0.1	
V101	6AU6	1st Sound I-F Amp.	15000 Mu. V. Signal	5	130	6	142	7	0.8	1	0	
			No Signal	5	116	6	129	7	0.6	1	0	
V102	6AU6	2d Sound I-F Amp.	15000 Mu. V. Signal	5	131	6	148	7	0	1	—5.1	
			No Signal	5	110	6	120	7	0	1	*—0.3	*Unreliable measuring point. Voltage depends on noise.
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	0	—	—	1	12	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	0.7	—	—	1	*5.1	—	—	*Unreliable measuring point. Voltage depends on noise.
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	87	—	—	2	0	1	—0.7	At min. volume
			No Signal	7	76	—	—	2	0	1	—0.6	At min. volume
V105	6K6GT	Audio Output	15000 Mu. V. Signal	3	260	4	263	8	19	5	—0.7	At min. volume
			No Signal	3	250	4	251	8	18.5	5	—0.7	At min. volume
V106	6CB6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	246	6	258	2	<0.1	1	—8.6	
			No Signal	5	108	6	108	2	0.7	1	*—0.2	*Unreliable measuring point. Make measurement at T104-B
V107	6CB6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	242	6	255	2	<0.1	1	—8.6	
			No Signal	5	108	6	108	2	0.5	1	—0.2	
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	133	6	172	2	2.1	1	0	
			No Signal	5	115	6	162	2	1.9	1	0	
V109A	12AU7	Picture 2d Det.	15000 Mu. V. Signal	1	—8.4	—	—	3	0	2	—1.3	
			No Signal	1	—1.8	—	—	3	0	2	—0.6	
V109B	12AU7	Vert. Sync Separator	15000 Mu. V. Signal	6	71	—	—	8	0	7	—40	
			No Signal	6	*50 to 100	—	—	8	0	7	*—15	*Unreliable, depends on noise

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V110	6CL6	Video Amplifier	15000 Mu. V. Signal	6	130	8	149	1	0.2	4	−1.3	AGC control set for normal operation
	*(6AC7) *(6AG7)		No Signal	6	110	8	130	1	0.5	4	−0.6	*Refer to Fig. 67 for socket connections
V111	6AU6	AGC Amplifier	15000 Mu. V. Signal	5	−40	6	250	7	153	1	151	
			No Signal	5	+2.3	6	258	7	135	1	105	
V112A	6SN7GT	Hor. Sync Separator	15000 Mu. V. Signal	2	263	—	—	3	190	1	130	
			No Signal	2	258	—	—	3	138	1	110	
V112B	6SN7GT	Sync Output	15000 Mu. V. Signal	5	58	—	—	6	0	4	−2.1	
			No Signal	5	48	—	—	6	0	4	* +0.6	*Depends on noise
V113	6J5	Vertical Oscillator	15000 Mu. V. Signal	3	70	—	—	8	0	5	−15	*Depends on setting of Vert. hold control
			No Signal	3	68	—	—	8	0	5	−14	Voltages shown are synced pix adjustment
V114	6K6GT	Vertical Output	15000 Mu. V. Signal	3	265	4	270	8	30	5	−5	
			No Signal	3	253	4	260	8	28	5	−5	
V115	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	165	—	—	3	+1.5	1	−21	
			No Signal	2	160	—	--	3	−10	1	−24	
V115	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	185	—	—	6	0	4	−80	
			No Signal	5	170	—	—	6	0	4	−88	
V116	6BQ6GT	Horizontal Output	15000 Mu. V. Signal	Cap	*	4	180	8	21.2	5	−13	*High Voltage Pulse Present
			No Signal	Cap	*	4	170	8	21.0	5	−13	*High Voltage Pulse Present
V117	1B3GT /8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	14,000	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	13,600	—	—	*High Voltage Pulse Present
V118	6W4GT	Damper	15000 Mu. V. Signal	5	270	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	260	—	—	3	*	—	—	*High Voltage Pulse Present
V119	21AP4	Kinescope	15000 Mu. V. Signal	Cap	14,000	10	400	11	170	2	120	At average Brightness
			No Signal	Cap	13,600	10	385	11	150	2	115	At average Brightness
V120 V121	5U4G 5Y3GT	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	–	2 & 8	285	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	275	—	—	

R-F UNIT WIRING DIAGRAM

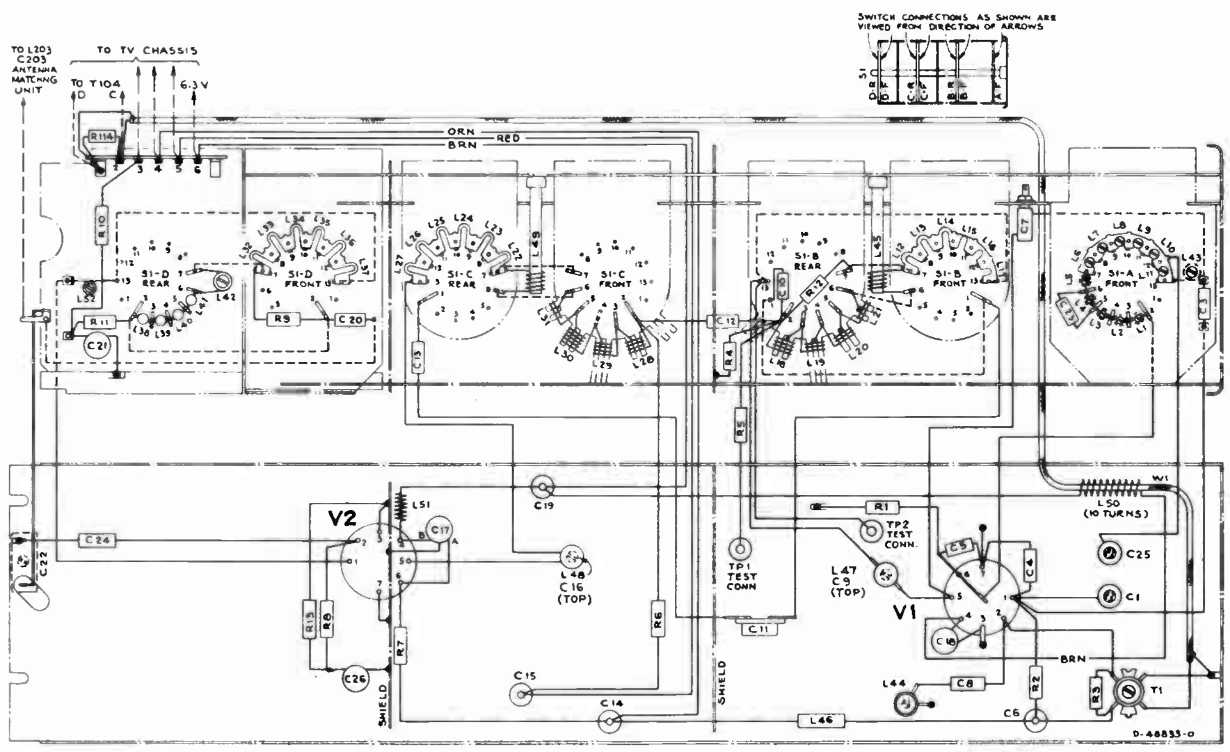


Figure 65—R-F Unit Wiring Diagram

CRITICAL LEAD DRESS:

1. Keep all wiring in the pix i-f, sound i-f and video circuits as short as possible.
2. Keep the leads on C118, C120, C122, C124, C126, R114, R121 and R123 as short and direct as possible.
3. Do not run any leads under C115 trimmer capacitor.
4. Dress C118 vertically parallel to terminals A and B of T104. Dress C135 parallel to terminals A and B of T104 close to the chassis.
5. Keep C127 away from chassis with no more than 1/4 inch leads at each end.
6. Dress the lead from T105(C) to the terminal board, close to the chassis.
7. Keep all filament leads dressed close to the chassis.
8. Ground filaments of V106, V107 and V108 independently of tube shields (pin 8). Use ground lances provided near pins of each socket.
9. Dress lead from pin 5 of V110 to J102-2 close to the chassis.
10. Keep leads to L103 as short as possible.
11. Dress C130, C132, L102, L104, L105, L114, R131, R133, R135 and R139 away from the chassis.
12. Do not tape kinescope cathode lead in with other kinescope leads.
13. Do not change the bus wire connections to pin 2 of V101 and V102. Sleeving is used to insure length and to prevent shorting.
14. Keep leads on C136 short and direct. Dress the lead from C136 to pin 5 of V111 as shown in wiring diagram.
15. Do not dress C170 in such a position that adjustment of T110 is inaccessible.
16. Keep the leads on R201 as short and direct as possible.
17. Dress the lead from pin 3 of V113 to C153 as shown in the wiring diagram.
18. Mount C183 directly on the terminal board provided keeping it as far away from T109 as possible.
19. Dress all leads in the high voltage compartment away from each other and away from the high voltage transformer.

CHASSIS WIRING DIAGRAM

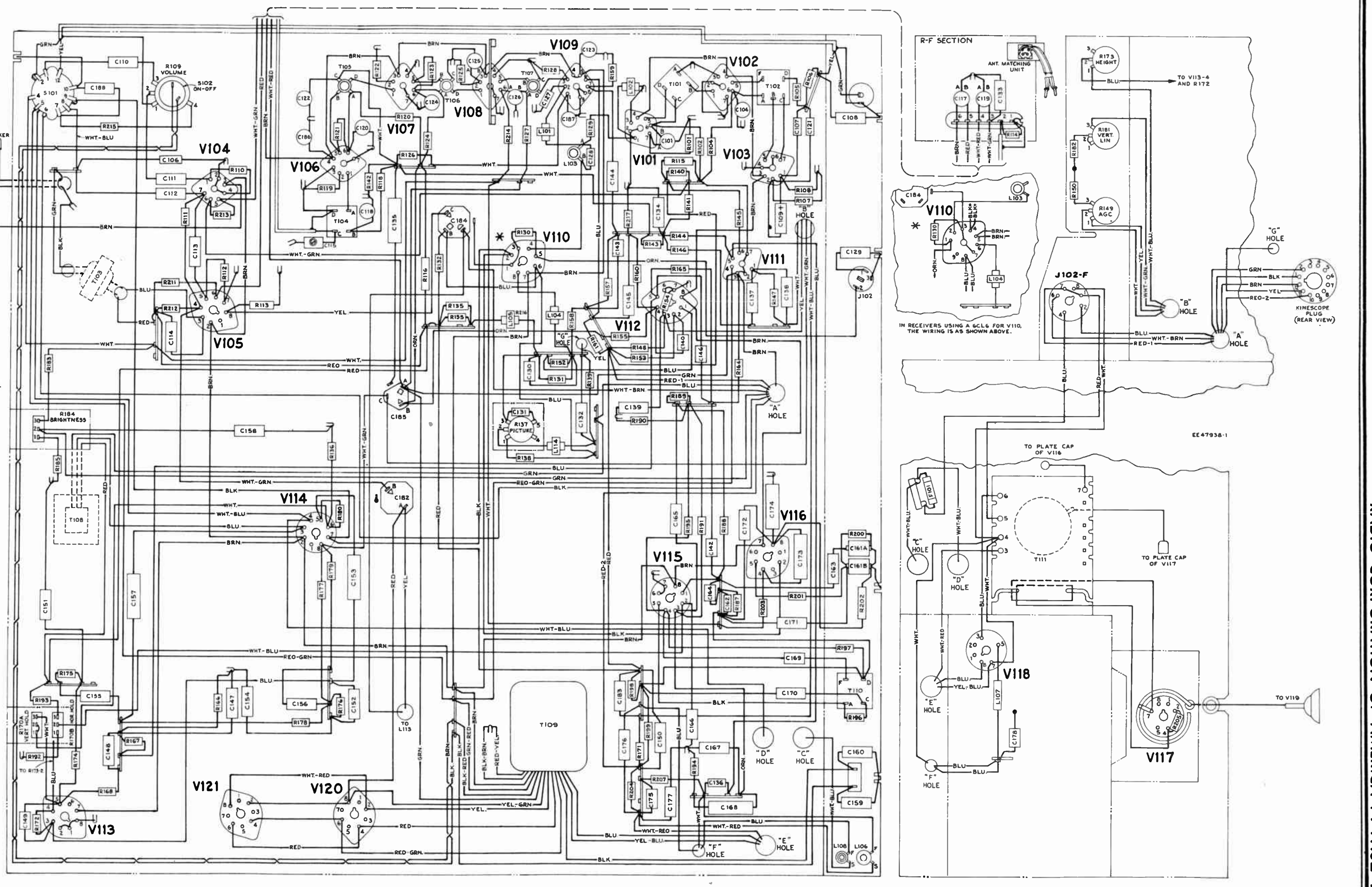
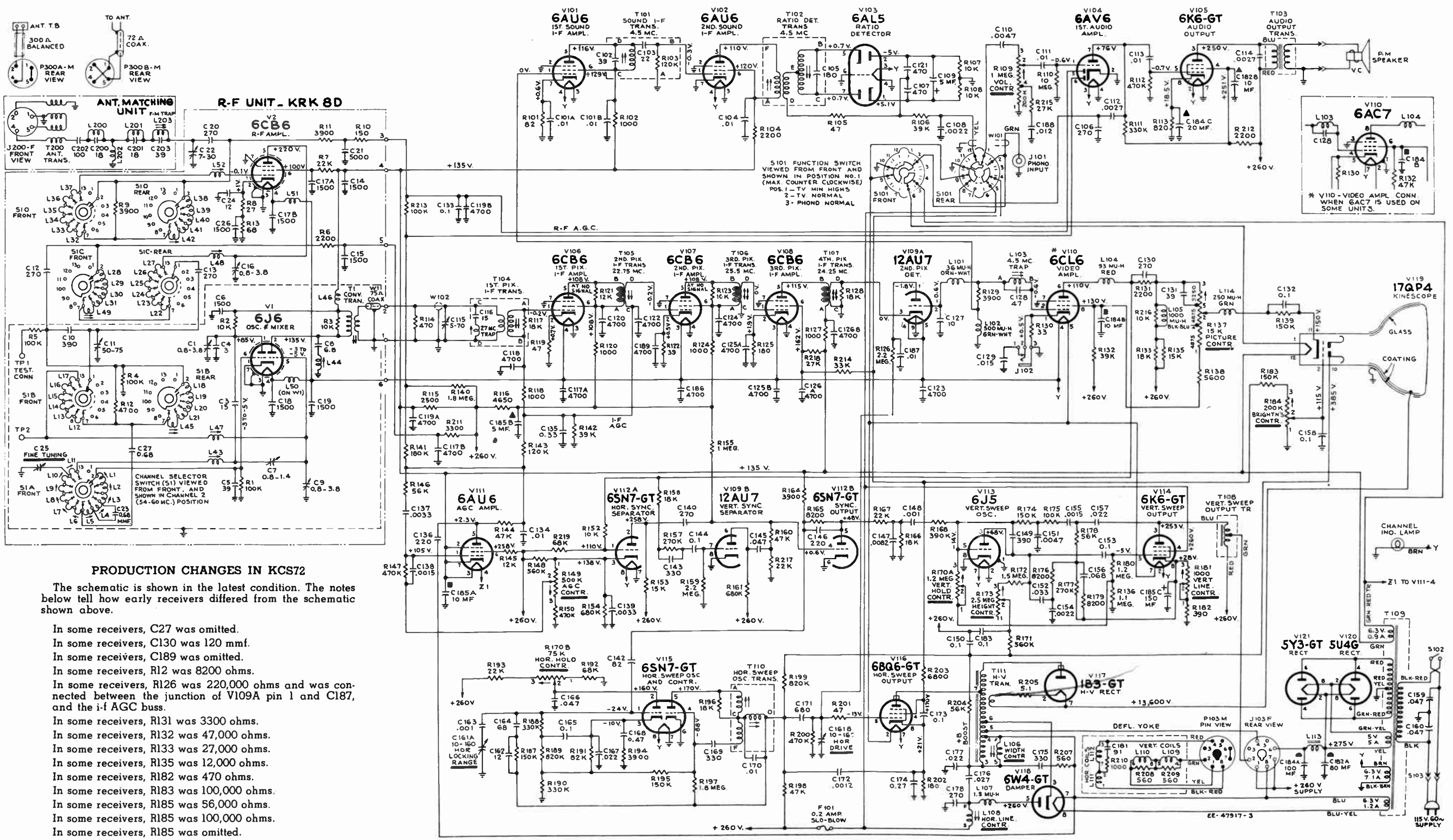


Figure 66—Chassis Wiring Diagram

CIRCUIT SCHEMATIC DIAGRAM KCS72M2



PRODUCTION CHANGES IN KCS72

The schematic is shown in the latest condition. The notes below tell how early receivers differed from the schematic shown above.

In some receivers, C27 was omitted.
In some receivers, C130 was 120 mmf.
In some receivers, C189 was omitted.
In some receivers, R12 was 8200 ohms.
In some receivers, R126 was 220,000 ohms and was connected between the junction of V109A pin 1 and C187, and the i-f AGC buss.
In some receivers, R131 was 3300 ohms.
In some receivers, R132 was 47,000 ohms.
In some receivers, R133 was 27,000 ohms.
In some receivers, R135 was 12,000 ohms.
In some receivers, R182 was 470 ohms.
In some receivers, R183 was 100,000 ohms.
In some receivers, R185 was 56,000 ohms.
In some receivers, R185 was 100,000 ohms.
In some receivers, R185 was omitted.
In some receivers, R218 was omitted.
In some receivers, R219 was omitted.
In some receivers, V119-10 was connected to the junction of R171 and C183.

All resistance values in ohms. K=1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

* In KCS72 V110 was a 6AC7.
In KCS72M1 V110 was a 6AG7 (same pin connections as 6AC7).

Figure 67—Circuit Schematic Diagram

PARTS

STOCK No.	DESCRIPTION
	R-F UNIT ASSEMBLIES
	KRK8D
75188	Board—Terminal board, 5 contact and ground
76845	Bracket—Vertical bracket for holding oscillator tube shield
75201	Cable—75 ohm coax cable (7¼") complete with coil (W1, L50)
76965	Capacitor—Ceramic, variable for fine tuning—plunger type (C25)
71088	Capacitor—Headed Lead, 0.68 mmf. (C27)
76968	Capacitor—Ceramic, 3 mmf. (C4)
75200	Capacitor—Ceramic, 12 mmf. (C24)
45465	Capacitor—Ceramic, 15 mmf. (C3)
75196	Capacitor—Ceramic, 39 mmf. (C5)
75199	Capacitor—Ceramic, 270 mmf. (C12, C13, C20)
75641	Capacitor—Ceramic, 390 mmf. (C10)
75166	Capacitor—Ceramic, 1500 mmf. (C6, C14, C15, C19)
73748	Capacitor—Ceramic, 1500 mmf. (C18, C26)
75089	Capacitor—Ceramic, dual 1500 mmf. (C17A, C17B)
73473	Capacitor—Ceramic, 5000 mmf. (C21)
75172	Capacitor—Tubular, steatite, adjustable, 0.65 - 1.2 mmf. (C7)
71504	Capacitor—Ceramic, 0.68 mmf. (C23)
75184	Capacitor—Ceramic, adjustable, 0.75 - 4 mmf., complete with adjusting stud (C1)
75197	Capacitor—Ceramic, 6.8 mmf. (C8)
75189	Capacitor—Adjustable, 7-30 mmf. (C22)
75174	Capacitor—Ceramic, trimmer, 50-75 mmf. (C11)
76143	Clip—Tubular clip for mounting stand-off capacitors
73477	Coil—Choke coil (L51)
75202	Coil—Choke coil, .56 muh (L46)
75185	Coil—Converter plate loading coil (L44)
75182	Coil—Trimmer coil (1½ turns) with adjustable inductance core and capacitor stud (screw adjustment) for converter section (C9, L47)
75183	Coil—Trimmer coil (3 turns) with adjustable inductance core and capacitor stud (screw adjustment) for r-f section (L48, C16)
76460	Contact—Test point contact
76966	Core—Adjustable core for fine tuning capacitor
75162	Detent—Detent mechanism and fibre shaft
73453	Form—Coil form for L45, L49
75165	Link—Link assembly for fine tuning
76518	Plate—Front plate and shaft bearing
	Resistor—Fixed, composition:—
503027	27 ohms, ±10%, ½ watt (R8)
503068	68 ohms, ±10%, ½ watt (R13)
504115	150 ohms, ±20%, ½ watt (R10)
503222	2200 ohms, ±10%, ½ watt (R6)
503239	3900 ohms, ±10%, ½ watt (R9, R11)
503247	4700 ohms, ±10%, ½ watt (R12)
502310	1000 ohms, ±5%, ½ watt (R3)
504310	10,000 ohms, ±20%, ½ watt (R2)
503322	22,000 ohms, ±10%, ½ watt (R7)
504410	100,000 ohms, ±20%, ½ watt (R1, R4, R5)
14343	Retainer—Fine tuning shaft retaining ring

STOCK No.	DESCRIPTION
75164	Rod—Actuating plunger rod (fibre) for fine tuning link
71476	Screw—#4-40 x ¼" adjusting screw for L6, L7, L8, L9, L10, L11
75177	Screw—#4-40 x ⅜" adjusting screw for L1, L2, L3, L4, L43
75176	Screw—#4-40 x 7/16" adjusting screw for L5
73640	Screw—#4-40 x 7/16" adjusting screw for L52
74575	Screw—#4-40 x .359" adjusting screw for L42
76519	Shaft—Channel selector shaft and plate
76134	Shaft—Fine tuning shaft and cam
76962	Shield—Oscillator and converter sections shield—snap-on type
76967	Shield—Tube shield for V1, V2
75088	Socket—Tube socket, 7 contact, miniature, ceramic, saddle-mounted
75191	Spacer—Insulating spacer for front plate
75163	Spring—Friction spring (formed) for fine tuning cam
30340	Spring—Hair pin spring for fine tuning link
74578	Spring—Retaining spring for adjusting screws
76961	Spring—Retaining spring for oscillator tube shield
73457	Spring—Return spring for fine tuning control
75180	Stator—Antenna stator complete with rotor, coils, capacitors (C20, C21) and resistors (R9, R10, R11) (S1-4, C20, C21, L32, L33, L34, L35, L36, L37, L38, L39, L40, L41, L42, L52, R9, R10, R11)
77459	Stator—Converter stator complete with rotor, coils, capacitors and resistors (S1-2, C10, C12, L12, L13, L14, L15, L16, L17, L18, L19, L20, L21, L45, R4, R5, R12)
76963	Stator—Oscillator section stator complete with rotor, segment, coils, adjusting screws and capacitors C3, C23 (S1-1, C3, C23, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L43)
76964	Stator—R-F amplifier stator complete with rotor, coils, capacitors (C13) and resistor (R6) (S1-3, C13, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L49, R6)
75170	Strip—Coil segment mounting strip—L.H. lower
75171	Strip—Coil segment mounting strip—L.H. upper—less trimmer C7
75169	Strip—Coil segment mounting strip—R.H. center
75446	Stud—Capacitor stud—brass—#4-40 x 3/16" with 3/64" screw driver slot for trimmer coils L47, L48 and capacitor C1 uncoded and coded "ER"
75447	Stud—Capacitor stud—brass—#4-40 x 3/16" with 3/64" screw driver slot for trimmer coils L47, L48 and capacitor C1 coded numerically and "Hi-Q"
75173	Stud—#6-32 x 13/16" adjusting stud for trimmer C7
75181	Transformer—Converter transformer (T1)
75607	Washer—Insulating washer (hex)
75190	Washer—Insulating washer (neoprene) for trimmer C7
	CHASSIS ASSEMBLIES
	KCS72
76456	Bracket—Channel indicator lamp bracket
76454	Bracket—Mounting bracket complete with insulator for picture control
71496	Capacitor—Adjustable, mica, 5-70 mmf. (C115)
33098	Capacitor—Ceramic, 10 mmf. (C127)
33380	Capacitor—Ceramic, 12 mmf. (C162)
75450	Capacitor—Ceramic, 39 mmf. (C203)
73664	Capacitor—Ceramic, 39 mmf. (C131)
76475	Capacitor—Mica, 68 mmf. (C164)
76474	Capacitor—Mica, 82 mmf. (C142)
75437	Capacitor—Ceramic, 100 mmf. (C202)

STOCK No.	DESCRIPTION
76673	Capacitor—Ceramic, 220 mmf. (C136)
75248	Capacitor—Mica, 220 mmf. (C146)
47617	Capacitor—Ceramic, 270 mmf. (C106)
39638	Capacitor—Mica, 270 mmf. (C130)
73091	Capacitor—Mica, 270 mmf. (C140, C178)
76476	Capacitor—Mica, 330 mmf. (C169, C175)
39640	Capacitor—Mica, 330 mmf. (C143)
73094	Capacitor—Mica, 390 mmf. (C149)
39644	Capacitor—Mica, 470 mmf. (C107, C121)
76990	Capacitor—Ceramic, dual 4700 mmf. (C117A, C117B, C119A, C119B, C125A, C125B, C126A, C126B)
73473	Capacitor—Ceramic, 4700 mmf. (C118, C120, C122, C123, C124, C186, C189)
73960	Capacitor—Ceramic, 10,000 mmf. (C104, C187)
76991	Capacitor—Ceramic, dual 10,000 mmf. (C101A, C101B)
74521	Capacitor—Electrolytic, 5 mfd., 50 volts (C109)
75218	Capacitor—Electrolytic, comprising 1 section of 10 mfd., 350 volts, 1 section of 5 mfd., 350 volts and 1 section of 150 mfd., 50 volts (C185A, C185B, C185C)
75217	Capacitor—Mica trimmer, dual 10-160 mmf. (C161A, C161B)
76987	Capacitor—Electrolytic, comprising 1 section of 80 mfd., 400 volts and 1 section of 10 mfd., 350 volts (C182A, C182B)
76970	Capacitor—Electrolytic comprising 1 section of 100 mfd., 400 volts, 1 section of 10 mfd., 350 volts and 1 section of 20 mfd., 50 volts (C184A, C184B, C184C)
76479	Capacitor—Tubular, moulded paper, oil impregnated, .00068 mfd., 600 volts (C171)
75643	Capacitor—Tubular, paper, oil impregnated, .001 mfd., 1000 volts (C148, C163)
76995	Capacitor—Tubular, moulded paper, oil impregnated, .0012 mfd., 600 volts (C172)
76508	Capacitor—Tubular, paper, oil impregnated, .0015 mfd., 600 volts (C138)
77123	Capacitor—Tubular, moulded paper, oil impregnated, .0015 mfd., 1000 volts (C155)
73595	Capacitor—Tubular, paper, oil impregnated, .0022 mfd., 600 volts (C108, C154)
73599	Capacitor—Tubular, paper, oil impregnated, .0027 mfd., 600 volts (C112)
73818	Capacitor—Tubular, paper, oil impregnated, .0027 mfd., 1600 volts (C114)
73795	Capacitor—Tubular, paper, oil impregnated, .0033 mfd., 600 volts (C137, C139)
73920	Capacitor—Tubular, paper, oil impregnated, .0047 mfd., 600 volts (C110, C151)
73808	Capacitor—Tubular, paper, oil impregnated, .0082 mfd., 1000 volts (C147)
73561	Capacitor—Tubular, paper, oil impregnated, .01 mfd., 400 volts (C111, C113, C134)
73594	Capacitor—Tubular, moulded paper, oil impregnated, .01 mfd., 600 volts (C170)
74938	Capacitor—Tubular, paper, oil impregnated, .012 mfd., 200 volts (C188)
73797	Capacitor—Tubular, paper, oil impregnated, .015 mfd., 600 volts (C129)
73562	Capacitor—Tubular, paper, oil impregnated, .022 mfd., 400 volts (C167)
73798	Capacitor—Tubular, paper, oil impregnated, .022 mfd., 600 volts (C157)
73810	Capacitor—Tubular, paper, oil impregnated, .022 mfd., 1000 volts (C177)
73811	Capacitor—Tubular, paper, oil impregnated, .027 mfd., 1000 volts (C176)
73596	Capacitor—Tubular, paper, oil impregnated, .033 mfd., 1000 volts (C152)

STOCK No.	DESCRIPTION
73553	Capacitor—Tubular, paper, oil impregnated, .047 mfd., 400 volts (C145, C166)
75071	Capacitor—Tubular, moulded paper, .047 mfd., 400 volts (C159, C160)
73792	Capacitor—Tubular, paper, oil impregnated, .068 mfd., 400 volts (C156)
73784	Capacitor—Tubular, paper, oil impregnated, 0.1 mfd., 200 volts (C132, C133)
73551	Capacitor—Tubular, paper, oil impregnated, 0.1 mfd., 400 volts (C144, C150, C158, C165, C183)
73557	Capacitor—Tubular, paper, oil impregnated, 0.1 mfd., 600 volts (C153, C173)
73786	Capacitor—Tubular, paper, oil impregnated, 0.27 mfd., 200 volts (C174)
76994	Capacitor—Tubular, paper, oil impregnated, 0.33 mfd., 200 volts (C135)
73787	Capacitor—Tubular, paper, oil impregnated, 0.47 mfd., 200 volts (C168)
76498	Choke—Filter choke (L113)
73591	Coil—Antenna matching coil (2 req'd) (Part of T200)
75241	Coil—Antenna shunt coil (L202)
76442	Coil—Horizontal linearity coil complete with adjustable core (L108)
76441	Coil—Width coil complete with adjustable core (L106)
76640	Coil—Peaking coil (1.5 muh) (L107)
76011	Coil—Peaking coil (36 muh) (L101)
71527	Coil—Peaking coil (93 muh) (L104)
71526	Coil—Peaking coil (250 muh) (L114)
75252	Coil—Peaking coil (500 muh) (L102)
77124	Coil—Peaking coil (1000 muh) (L105, R216)
71789	Connector—Anode lead connector complete
35787	Connector—Phono input connector (J101)
75474	Connector—Single contact male connector for speaker cable
75482	Connector—Video connector (J102)
74594	Connector—2 contact male connector for power cord
38853	Connector—4 contact female connector for antenna transformer (J200)
50367	Connector—6 contact female connector for yoke lead (J103)
75542	Connector—6 contact male connector—part of deflection yoke (P103)
76975	Control—AGC control (R149)
76444	Control—Brightness control (R184)
76448	Control—Height control (R173)
76974	Control—Horizontal and vertical hold control (R170A, R170B)
76445	Control—Picture control (R137)
76976	Control—Vertical linearity control (R181)
77010	Control—Volume control and power switch (R109, S102)
71498	Core—Adjustable core and stud for FM trap 75449
76986	Cover—Back cover for hi-voltage compartment
76985	Cover—Side cover for hi-voltage compartment
74956	Cushion—Rubber cushion for deflection yoke hood
74839	Fastener—Push fastener for mounting tube socket 76453
73600	Fuse—0.25 amps., 250 volts (F101)
37396	Grommet—Rubber grommet for mounting tube socket 76453
76459	Grommet—Rubber grommet for 2nd. anode lead exit
76830	Hood—Deflection yoke hood less rubber cushions
76168	Magnet—Focus magnet
76141	Magnet—Ion trap magnet (P.M. type)

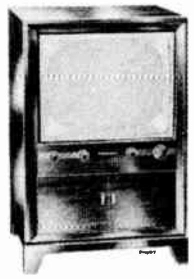
PARTS (Continued)

STOCK No.	DESCRIPTION
76633	Magnet—Pin cushion correction magnet complete with support arm
78464	Plate—Hi-voltage plate (bakelite) assembly complete with tube socket and corona ring
76796	Resistor—Wire wound, 5.1 ohms, 1/3 watt (R205)
76639	Resistor—Wire wound, 180 ohms, 2 watts (R202)
76988	Resistor—Wire wound, 820 ohms, 1 watt (R113)
76469	Resistor—Wire wound, 2500 ohms, 10 watts (R115)
76989	Resistor—Wire wound, 4650 ohms, 7 watts (R116)
	Resistor—Fixed, composition:—
503033	33 ohms, ±10%, ½ watt (R130)
502039	39 ohms, ±5%, ½ watt (R122)
502047	47 ohms, ±5%, ½ watt (R119)
503047	47 ohms, ±10%, ½ watt (R105)
504047	47 ohms, ±20%, ½ watt (R201)
503082	82 ohms, ±10%, ½ watt (R101)
502118	180 ohms, ±5%, ½ watt (R125)
503139	390 ohms, ±10%, ½ Watt (R162)
503147	470 ohms, ±10%, ½ watt (R114)
513156	560 ohms, ±10%, 1 watt (R207)
504210	1000 ohms, ±20%, ½ watt (R102, R118, R120, R124, R127)
503222	2200 ohms, ±10%, ½ watt (R104, R212)
523222	2200 ohms, ±10%, 2 watts (R131)
504233	3300 ohms, ±20%, ½ watt (R211)
523223	3300 ohms, ±10%, 2 watts (R131)
502239	3900 ohms, ±5%, ½ watt (R129, R164)
503239	3900 ohms, ±10%, ½ watt (R194)
503256	5600 ohms, ±10%, ½ watt (R138)
523268	6800 ohms, ±10%, 2 watts (R203)
503282	8200 ohms, ±10%, ½ watt (R176, R179)
513282	8200 ohms, ±10%, 1 watt (R165)
502310	10,000 ohms, ±5%, ½ watt (R107, R108, R123)
504310	10,000 ohms, ±20%, ½ watt (R152)
502312	12,000 ohms, ±5%, ½ watt (R121)
503312	12,000 ohms, ±10%, ½ watt (R145)
523312	12,000 ohms, ±10%, 2 watts (R135)
503315	15,000 ohms, ±10%, ½ watt (R153)
503318	18,000 ohms, ±10%, ½ watt (R128, R158, R166, R196)
523318	18,000 ohms, ±10%, 2 watts (R133)
503322	22,000 ohms, ±10%, ½ watt (R167, R217)
513322	22,000 ohms, ±10%, 1 watt (R193)
603327	27,000 ohms, ±10%, ½ watt (R215)
513327	27,000 ohms, ±10%, 1 watt (R218)
613333	33,000 ohms, ±10%, 1 watt (R214)
503339	39,000 ohms, ±10%, ½ watt (R106, R142)
513339	39,000 ohms, ±10%, 1 watt (R132)
503347	47,000 ohms, ±10%, ½ watt (R160)
504347	47,000 ohms, ±20%, ½ watt (R144)
512347	47,000 ohms, ±5%, 1 watt (R148)
513347	47,000 ohms, ±10%, 1 watt (R132)
503356	56,000 ohms, ±10%, ½ watt (R146, R165, R204)
512356	56,000 ohms, ±5%, 1 watt (R178)
503368	68,000 ohms, ±10%, ½ watt (R219)
513368	68,000 ohms, ±10%, 1 watt (R192)
513382	82,000 ohms, ±10%, 1 watt (R191)
504410	100,000 ohms, ±20%, ½ watt (R213)
513410	100,000 ohms, ±10%, 1 watt (R175)
30180	120,000 ohms, ±5%, ½ watt (R143)
503415	150,000 ohms, ±10%, ½ watt (R174, R183, R187)
504415	150,000 ohms, ±20%, ½ watt (R139)
512415	150,000 ohms, ±5%, 1 watt (R195)
502418	180,000 ohms, ±5%, ½ watt (R141)
502427	270,000 ohms, ±5%, ½ watt (R177)
503427	270,000 ohms, ±10%, ½ watt (R157)
503433	330,000 ohms, ±10%, ½ watt (R111, R168)
512433	330,000 ohms, ±5%, 1 watt (R190)
503439	390,000 ohms, ±10%, ½ watt (R168)
503447	470,000 ohms, ±10%, ½ watt (R150, R200)
504447	470,000 ohms, ±20%, ½ watt (R112, R147)
503456	560,000 ohms, ±10%, ½ watt (R148, R171)
503468	680,000 ohms, ±10%, ½ watt (R154, R181)
503482	820,000 ohms, ±10%, ½ watt (R189, R199)
503510	1 megohm, ±10%, ½ watt (R155)
502511	1.1 megohm, ±5%, ½ watt (R136)
503512	1.2 megohm, ±10%, ½ watt (R180)
503515	1.5 megohm, ±10%, ½ watt (R172)
11769	1.8 megohm, ±5%, ½ watt (R140)
39063	1.8 megohm, ±5%, 1 watt (R197)
503522	2.2 megohm, ±10%, ½ watt (R126, R159)
504610	10 megohm, ±20%, ½ watt (R110)
71456	Screw—#8-32 x 7/16″ wing screw to mount deflection yoke
76455	Shaft—Connecting shaft (nylon) for picture and brightness controls
73584	Shield—Tube shield for V101, V102, V103, V108
76972	Shield—Tube shield for V109
75718	Socket—Channel indicator lamp socket and leads
74834	Socket—Kinescope socket
31251	Socket—Tube socket, octal, wafer for V105, V110, V112, V113, V116, V120, V121 for KCS72 (KCS72 uses 6AC7 for V110)
71508	Socket—Tube socket, 6 pin, moulded—for V117
50367	Socket—Tube socket, 6 pin, moulded, saddle mounted for V118
73117	Socket—Tube socket, 7 pin, wafer miniature for V101, V102, V103, V104, V106, V107, V108, V111
76453	Socket—Tube socket, octal, moulded, saddle-mounted for V110 for KCS72-M1 (KCS72-M1 uses 6AG7 for V110)
50367	Socket—Tube socket, 8 pin, moulded saddle-mounted for V114
72627	Socket—Tube socket, 8 pin, steatite saddle mounted for V115
76971	Socket—Tube socket, 9 pin, wafer miniature for V109
77470	Socket—Tube socket, 9 pin, miniature, wafer for V110 for KCS72-M2 (KCS72-M2 uses 6CL6 for V110)
76636	Stud—Adjusting stud complete with guard for focus magnet
77011	Switch—Tone control and phono switch less volume control and power switch (S101)
76483	Terminal—Screw type grounding terminal
76977	Transformer—Antenna matching transformer complete (T200, C200, C201, C202, C203, L200, L201, L202, L203, J200)
76795	Transformer—Hi-voltage transformer (T111)
76440	Transformer—Horizontal oscillator transformer complete with adjustable cores (T110)
76982	Transformer—Output transformer (T103)
76984	Transformer—Power transformer, 117 volts 60 cycle (T109)
77112	Transformer—Ratio detector transformer (T102, C105)
76981	Transformer—Sound i-f transformer complete with adjustable core (T101, C102, C103, R103)
76976	Transformer—Vertical output transformer (T108)
76979	Transformer—First pix, i-f transformer complete with adjustable cores (T104, C116, R117)
76980	Transformer—Second, third or fourth pix i-f transformer complete with adjustable core (T105, T106, T107)
75449	Trap—FM trap complete with adjustable core and stud (L203, C203)
75242	Trap—I-F trap (L200, L201, C200, C201)
76983	Trap—4.5 MC trap (L103, C128)
76616	Yoke—Deflection yoke complete with 6 contact male connector (L109, L110, L111, L112, C161, P103, R208, R209, R210)
	SPEAKER ASSEMBLIES
	971636-1W RL-101C5 RMA-274
	(For Models 17T200, 17T201 & 17T202)
77000	Speaker—5″ P.M. speaker complete with cone and voice coil (3.2 ohms)
	SPEAKER ASSEMBLIES
	971490-3W RL-105E6 RMA-274
	(For Models 17T211 & 17T220)
75024	Cone—Cone and voice coil (3.2 ohms)
75022	Speaker—8″ P.M. speaker complete with cone and voice coil (3.2 ohms)
	NOTE: If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to model number of instrument, number stamped on speaker and full description of part required.
	MISCELLANEOUS
77189	Back—Cabinet back complete for Models 17T200, 17T201, 17T202
77190	Back—Cabinet back complete for Models 17T211, 17T220
76184	Board—"Antenna" terminal board
76811	Bracket—Hanger bracket for deflection yoke hood for Models 17T200, 17T201, 17T202
77001	Bracket—Hanger bracket for deflection yoke hood for Model 17T211
76812	Bracket—Hanger bracket for deflection yoke hood for Model 17T220
76814	Bracket—Stiffening bracket for kinescope cradle (4 req'd) for Models 17T200, 17T201, 17T202
76829	Bracket—Stiffening bracket for kinescope cradle for Models 17T211, 17T220
71892	Catch—Bullet catch and strike for Model 17T220
76823	Clip—Spring clip for spacing ground braid
X3128	Cloth—Grille cloth for Models 17T201, 17T202
X3199	Cloth—Grille cloth for mahogany cabinet for Model 17T211
X1756	Cloth—Grille cloth for mahogany and walnut instruments for Model 17T220
75474	Connector—Single contact male connector for antenna cable (2 req'd)
39153	Connector—4 contact male connector for antenna cable
71457	Cord—Power cord and plug
76818	Cushion—Rubber cushion (1/16″ x 1″ x ⅝″ x ¼″) for kinescope and cradle support (4 req'd)
77014	Decal—Control panel function decal for mahogany or walnut instruments for Models 17T201, 17T202, 17T211 & 17T220
71984	Decal—Trade mark decal for Model 17T220
77012	Emblem—"RCA Victor" emblem for Models 17T202, 17T211, 17T220
75456	Escutcheon—Channel marker escutcheon—gold
74889	Foot—Felt foot (4 req'd) for Models 17T200, 17T201 & 17T202
76806	Glass—Safety glass
74308	Hinge—Cabinet door hinge (1 set) for Model 17T220
76595	Knob—Brightness control or vertical hold control knob —maroon—(outer)
76593	Knob—Channel selector knob—maroon—(inner)
76591	Knob—Fine tuning control knob—maroon—(outer)
74963	Knob—Picture control, horizontal hold control or volume control and power switch knob—maroon—(inner)
76597	Knob—Tone control and phono switch knob—maroon—(outer)
76596	Knob—Brightness control or vertical hold control knob —beige—(outer)
76594	Knob—Channel selector knob—beige—(inner)
76592	Knob—Fine tuning control knob—beige—(outer)
75464	Knob—Picture control, horizontal hold control or volume control and power switch knob—beige—(inner)
76598	Knob—Tone control and phono switch knob—maroon—(outer)
77264	Knob—Brightness control or vertical hold control knob —ebony—(outer)
77261	Knob—Channel selector knob—ebony—(inner)
77262	Knob—Fine tuning control knob—ebony—(outer)
77265	Knob—Picture control, horizontal hold control or volume control and power switch knob—ebony—(inner)
77263	Knob—Tone control and phono switch knob—ebony—(outer)
11765	Lamp—Channel marker escutcheon lamp—Mazda #51
75459	Mask—Channel marker escutcheon light mask—burgundy
76589	Mask—Channel marker escutcheon light mask—beige
77267	Mask—Channel marker escutcheon light mask—ebony
78177	Nut—#10-32 special nut for deflection yoke hood support rods (2 req'd)
76822	Nut—Speed nut to lock flexible straps for kinescope
77013	Nut—Speed nut for fastening "RCA Victor" emblem on metal panel for Models 17T202, 17T211 & 17T220
73634	Nut—Speed nut for speaker mounting screws for Model 17T211
76825	Pad—Rubber pad (channel) mounted on cradle support to cushion Kinescope
76819	Pad—Rubber pad (channel) for flexible straps (2 req'd)
77005	Panel—Metal front panel for mahogany or walnut instruments for Models 17T211 & 17T220
77260	Panel—Metal front panel for blonde instruments for Model 17T211
77187	Pull—Door pull for television compartment doors for Model 17T220
77188	Pull—Door pull for false door (2 req'd) for Model 17T220
77002	Retainer—Safety glass retainer (2 req'd) for maroon, mahogany grain, mahogany or walnut instruments
76816	Retainer—Safety glass retainer (2 req'd) for blonde instruments
76809	Rod—"L" shape threaded rod to support deflection yoke hood assembly (2 req'd) for Models 17T200, 17T201 & 17T202
76810	Rod—"L" shape threaded rod to support deflection yoke hood assembly (2 req'd) for Models 17T211 & 17T220
76632	Screw—#8 x ⅝″ hex head screw for mounting front panel or hanger bracket for Models 17T211 & 17T220
74113	Screw—#8-32 x 1″ trimit head screw for door pull for Model 17T220
76821	Screw—#10 x 1⅜″ hex head screw to lock flexible straps for kinescope
76808	Sleeve—Polyethylene sleeve for insulating high voltage lead—on support rod
73643	Spring—Channel marker escutcheon spring clip
76820	Spring—Formed spring for safety glass retainers
77006	Spring—Retaining spring for deflection yoke hood support rods
30330	Spring—Retaining spring for knobs 74963, 75464, 77265
72845	Spring—Retaining spring for knobs 76591, 76592, 77262
76837	Spring—Retaining spring for knobs 76593, 76594, 76595, 76596, 76597, 76598, 77261, 77264, 77263
74938	Spring—Suspension spring for kinescope socket leads
36580	Spring—Suspension spring (coil) for ground braid
72936	Stop—Cabinet door stop for Model 17T220
76813	Strap—Flexible steel strap to secure kinescope
76600	Strap—Ground strap (.005″ x ½″ soft copper strip) for Models 17T211 & 17T220
77003	Support—Cradle support for kinescope
76836	Washer—Cellulose washer—gold—for knobs
75457	Washer—Felt washer—dark brown—between knob and channel marker escutcheon
75458	Washer—Felt washer—beige—between knob and channel marker escutcheon
77266	Washer—Felt washer—ebony—between knob and channel marker escutcheon
75500	Washer—Felt washer for cabinet back mounting screws

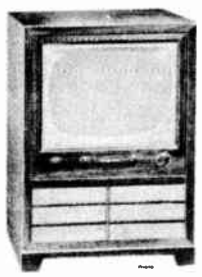
APPLY TO YOUR RCA DISTRIBUTOR FOR PRICES OF REPLACEMENT PARTS

Models 21T207, 21T207G "Crandall" Mahogany

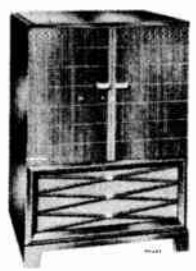
Model 21T208 "Lambert" Walnut, Mahogany



Model 21T217 "Brookfield" Walnut, Mahogany



Model 21T218 "Lansford" Walnut, Mahogany, Blonde



Model 21T227 "Lindale" Walnut, Mahogany, Blonde

Model 21T228 "Brandon" Walnut, Mahogany, Maple

Model 21T229 "Belgrove" Walnut, Mahogany, Limed Oak

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ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE..227 square inches on a 21AP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Picture I-F Carrier Frequency....................25.50 mc.

Sound I-F Carrier Frequency..........21.00 mc. and 4.5 mc.

POWER SUPPLY RATING..115 volts, 60 cycles, 190 watts

AUDIO POWER OUTPUT RATING......4.0 watts max.

VIDEO RESPONSE..........................To 3.2 mc.

SWEEP DEFLECTION.......................Magnetic

FOCUS..Magnetic

LOUDSPEAKERS

Models 21T207, 207G. (971636-1) 5" PM Dynamic, 3.2 ohms

Models 21T208, 217, 229. (971490-3) 8" PM Dynamic, 3.2 ohms

Models 21T218, 227, 228. (92569-12) 12" PM Dynamic, 3.2 ohms

WEIGHT AND DIMENSIONS (inches)

Model	Net Weight	Shipping Weight	Width	Height	Depth
21T207	94	115	28½	28¼	27½
21T207G	105	126	28⅝	28¼	28⅝
21T208	94	115	25⅛	24¾	25⅛
21T217	104	132	26	39⅜	25⅛
21T218	112	144	27⅝	39¼	24
21T227	130	162	27½	40⅛	27⅛
21T228	132	164	27⅝	39⅝	26⅝
21T229	139	173	27⅛	40	26⅞

RECEIVER ANTENNA INPUT IMPEDANCE

Choice: 300 ohms balanced or 72 ohms unbalanced.

RCA TUBE COMPLEMENT

Tube Used	Function
(1) RCA 6CB6	R-F Amplifier
(2) RCA 6J6	R-F Oscillator and Mixer
(3) RCA 6CB6	1st Picture I-F Amplifier
(4) RCA 6CB6	2nd Picture I-F Amplifier
(5) RCA 6CB6	3rd Picture I-F Amplifier
(6) RCA 12AU7	Picture 2nd Detector and Vert. Sync. Sep.
(7) RCA 6AG7 (6AC7, 6CL6)	Video Amplifier
(8) RCA 6AU6	1st Sound I-F Amplifier
(9) RCA 6AU6	2nd Sound I-F Amplifier
(10) RCA 6AL5	Ratio Detector
(11) RCA 6AV6	1st Audio Amplifier
(12) RCA 6K6GT	Audio Output
(13) RCA 6AU6	AGC Amplifier
(14) RCA 6SN7GT	Horizontal Sync. Sep. and Sync. Output
(15) RCA 6J5	Vertical Sweep Oscillator
(16) RCA 6K6GT	Vertical Sweep Output
(17) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(18) RCA 6BQ6GT	Horizontal Sweep Output
(19) RCA 6W4GT	Damper
(20) RCA 1B3-GT/8016	High Voltage Rectifier
(21) RCA 21AP4 (21EP4)	Kinescope
(22) RCA 5U4G	Rectifier
(23) RCA 5Y3GT	Rectifier

ELECTRICAL AND MECHANICAL SPECIFICATIONS
(Continued)

PICTURE INTERMEDIATE FREQUENCIES

Picture Carrier Frequency......................25.50 mc.

Adjacent Channel Sound Trap.................27.00 mc.

SOUND INTERMEDIATE FREQUENCIES

Sound Carrier Frequency.......................21.00 mc.

Sound I.F. Frequency.............................4.5 mc.

VIDEO RESPONSE..........................To 3.2 mc.

FOCUS..Magnetic

SWEEP DEFLECTION.........................Magnetic

SCANNING........................Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY........15,750 cps

VERTICAL SWEEP FREQUENCY...............60 cps

FRAME FREQUENCY (Picture Repetition Rate)..30 cps

OPERATING CONTROLS (Front Panel)

Channel Selector / Fine Tuning ....Dual Control Knobs

Picture / Brightness ....Dual Control Knobs

Picture Horizontal Hold / Picture Vertical Hold ....Dual Control Knobs

Sound Volume and On-Off Switch / TV Tone & Phono Switch ....Dual Control Knobs

NON-OPERATING CONTROLS (not including r-f and i-f adjustments)

Picture Centering...................top chassis adjustment

Width...........................rear chassis adjustment

Height.........................rear chassis adjustment

Horizontal Linearity....rear chassis screwdriver adjustment

Vertical Linearity.................rear chassis adjustment

Horizontal Drive.......rear chassis screwdriver adjustment

Horizontal Oscillator Frequency...rear chassis adjustment

Horizontal Oscillator Waveform..bottom chassis adjustment

Horizontal Locking Range..........rear chassis adjustment

Focus...............................top chassis adjustment

Ion Trap Magnet...................top chassis adjustment

Deflection Coil.............top chassis wing nut adjustment

AGC Control.......................rear chassis adjustment

Pin Cushion Correction Magnets (21T207G only) rear chassis adjustment

HIGH VOLTAGE WARNING

OPERATION OF THIS RECEIVER OUTSIDE THE CABINET OR WITH THE COVERS REMOVED, INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT. DO NOT OPERATE THE RECEIVER WITH THE HIGH VOLTAGE COMPARTMENT SHIELD REMOVED.

KINESCOPE HANDLING PRECAUTIONS

DO NOT REMOVE THE RECEIVER CHASSIS, INSTALL, REMOVE OR HANDLE THE KINESCOPE IN ANY MANNER UNLESS SHATTERPROOF GOGGLES ARE WORN. PEOPLE NOT SO EQUIPPED SHOULD BE KEPT AWAY WHILE HANDLING KINESCOPES. KEEP THE KINESCOPE AWAY FROM THE BODY WHILE HANDLING.

The kinescope bulb encloses a high vacuum and, due to its large surface area, is subjected to considerable air pressure. For this reason, the kinescope must be handled with more care than ordinary receiving tubes.

The large end of the kinescope bulb—particularly that part at the rim of the viewing surface—must not be struck, scratched or subjected to more than moderate pressure at any time. During service if the tube sticks or fails to slip smoothly into its socket, or deflecting yoke, investigate and remove the cause of the trouble. Do not force the tube. Refer to the Receiver Installation section for detailed instructions on kinescope installation. All RCA replacement kinescopes are shipped in special cartons and should be left in the cartons until ready for installation in the receiver.

The following adjustments are necessary when turning the receiver on for the first time.

1. See that the TV-PH switch is in the "TV" position.

2. Turn the receiver "ON" and advance the SOUND VOLUME control to approximately mid-position.

3. Set the STATION SELECTOR to the desired channel.

4. Adjust the FINE TUNING control for best pix and the SOUND VOLUME control for suitable volume.

5. Turn the BRIGHTNESS control fully counter-clockwise, then clockwise until a light pattern appears on the screen.

6. Adjust the VERTICAL hold control until the pattern stops vertical movement.

7. Adjust the HORIZONTAL hold control until a picture is obtained and centered.

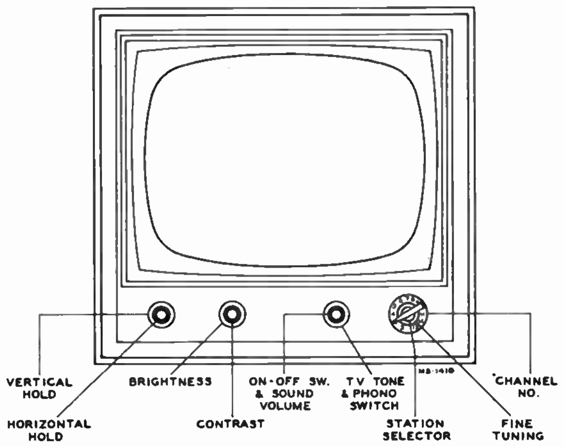


Figure 1—Receiver Operating Controls

8. Adjust the CONTRAST and BRIGHTNESS controls for suitable picture contrast and brightness.

9. In switching from one channel to another, it may be necessary to repeat steps 4 and 8.

10. When the set is turned on again after an idle period it should not be necessary to repeat the adjustment if the positions of the controls have not been changed. If any adjustment is necessary, step number 4 is generally sufficient.

11. If the positions of the controls have been changed, it may be necessary to repeat steps 2 through 8.

12. To use a record player, plug the record-player output cable into the PHONO jack on the rear apron, and set the TV-PH switch to "PH"

INSTALLATION INSTRUCTIONS

UNPACKING.—These receivers are shipped complete in cardboard cartons. The kinescope is shipped in place in the receiver.

Take the receiver out of the carton and remove all packing material.

Make sure that all tubes are in place and are firmly seated in their sockets.

Check to see that the kinescope high voltage lead clip is in place.

Plug a power cord into the 115 volt a-c power source and into the receiver interlock receptacle. Turn the receiver power switch to the "on" position, the brightness control fully clockwise, and the picture control counter-clockwise.

ION TRAP MAGNET ADJUSTMENT.—Set the ion trap magnet approximately in the position shown in Figure 2. Starting from this position immediately adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Turn the focus control (shown in Figure 2) until the line structure of the raster is clearly visible. Readjust the ion trap magnet for maximum raster brilliance. The final touches of this adjustment should be made with the brightness control at the maximum clockwise position with which good line focus can be maintained.

DEFLECTION YOKE ADJUSTMENT.—If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

PICTURE ADJUSTMENTS.—It will now be necessary to obtain a test pattern picture in order to make further adjustments. Connect the antenna transmission line to the receiver.

If the Horizontal Oscillator and AGC System are operating properly, it should be possible to sync the picture at this point. However, if the AGC control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading, turn R149 on the rear apron (see Figure 3) counter-clockwise until the set operates normally and the picture can be synced.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT.—Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back. Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 2 or 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. Pull-in should occur before the control has been turned 120 degrees from the extreme counter-clockwise position. The picture should remain in sync for approximately 90 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should remain in sync and should not show a black bar in the picture.

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Alignment of Horizontal Oscillator" and proceed with "Focus Magnet Adjustment."

ALIGNMENT OF HORIZONTAL OSCILLATOR.—If in the above check the receiver failed to hold sync with the hold control at the extreme counter-clockwise position or failed to hold sync over 90 degrees of clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.

Horizontal Frequency Adjustment.—Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and adjust the T110 horizontal frequency adjustment at the rear of the chassis until the picture is just out of sync and the horizontal blanking appears as a vertical or diagonal black bar in the raster. Then turn the T110 core until the bar moves out of the picture leaving it in sync.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T110 rear core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C161A slightly clockwise. If less than 2 bars are present, adjust C161A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the conditions specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If it is impossible to sync the picture at this point and the AGC system is in proper adjustment it will be necessary to adjust the Horizontal Oscillator by the method outlined in the alignment procedure on page 11: For field purposes paragraph "B" under Horizontal Oscillator Waveform Adjustment may be omitted.

FOCUS MAGNET ADJUSTMENT.—The focus magnet should be adjusted so that there is approximately three-eighths inch of space between the rear cardboard shell of the yoke and the flat of the front face of the focus magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the magnet should be parallel with the axis of the kinescope neck with the kinescope neck through the center of the opening.

PIN-CUSHION CORRECTION.—Two pin-cushion correction magnets are employed to correct a small amount of pin-cushion of the raster due to the lens effect of the face of the kinescope. These magnets are mounted on small arms, one on each side of the kinescope as shown in Figure 2. The arms hinge in one plane on self tapping screws which act both as a hinge and an adjustment locking screw. When the magnets are swung towards the tube, maximum correction is obtained. Minimum correction is obtained when the arms are swung away from the tube. To adjust the magnets, loosen the two self tapping screws and position the magnets until the sides of the raster appear straight. Tighten the screws without shifting the position of the magnets. In some cases it may be necessary to twist or bend the magnet support arms to obtain the appearance of straight raster edges.

CENTERING ADJUSTMENT.—No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet. The centering plates include a locking screw which must be loosened before centering. Up and down adjustment of the plate moves the picture side to side and sidewise adjustment moves the picture up and down.

If a corner of the raster is shadowed, check the position of the ion trap magnet. Reposition the magnet within the range of maximum raster brightness to eliminate the shadow and recenter the picture by adjustment of the focus magnet plate. In no case should the magnet be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the tube. In some cases it may be necessary to shift the position of the focus magnet in order to eliminate a corner shadow.

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS.—Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive trimmer C161B counter-clockwise until the picture begins to "wrinkle" in the middle then clockwise until the "wrinkle" disappears.

Turn the horizontal linearity control L108 clockwise until the picture begins to "wrinkle" on the right and then counter-clockwise until the "wrinkle" disappears and best linearity is obtained.

Adjust the width control L106 to obtain correct picture width.

A slight readjustment of these three controls may be necessary to obtain the best linearity.

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control (R173 on chassis rear apron) until the picture fills the mask vertically. Adjust vertical linearity (R181 on rear apron), until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust centering to align the picture with the mask.

FOCUS.—Adjust the focus magnet for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

Check to see that the yoke thumbscrew and the focus magnet mounting screws are tight.

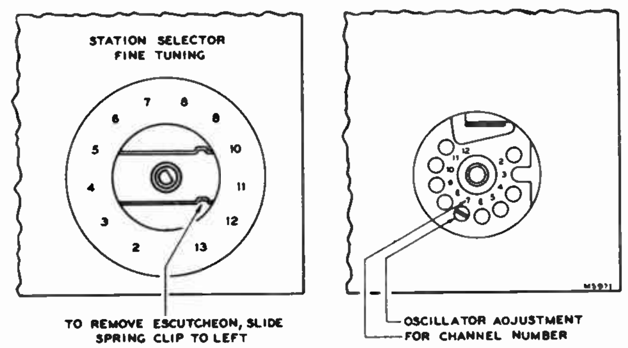


Figure 4—R-F Oscillator Adjustments

CHECK OF R-F OSCILLATOR ADJUSTMENTS.—Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 9. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 4. Adjustment for channel 13 is on top of the chassis.

AGC THRESHOLD CONTROL.—The AGC threshold control R149 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not overloading due to improper setting of R149. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R149 should be readjusted.

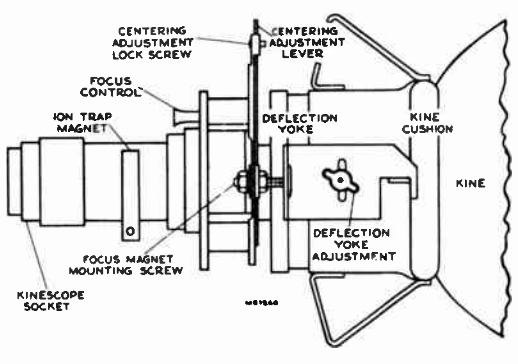


Figure 2—Yoke and Focus Magnet Adjustments

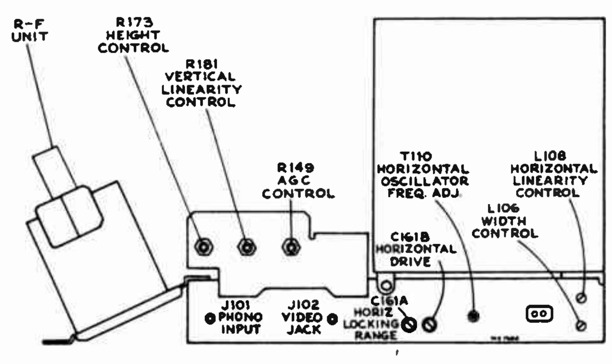


Figure 3—Rear Chassis Adjustments

Turn R149 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R149 clockwise until there is a very, very slight bend or change of bend in the picture. Then turn R149 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R149 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

FM TRAP ADJUSTMENT.—In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the L203 core on top of the antenna matching transformer for minimum interference in the picture.

CAUTION.—In some receivers, the FM trap L203 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L203 to make sure that it does not affect sensitivity on these two channels.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding it are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

KINESCOPE SCREEN CLEANING.—The kinescope safety glass is held in place by four spring clips which may be removed from the back of the front panel. This permits removing the safety glass for cleaning without the necessity of removing the chassis and kinescope.

CHASSIS REMOVAL.—To remove the chassis from the cabinet for repair or installation of a new kinescope, remove the control knobs, the cabinet back, unplug the speaker cable, the kinescope socket, the antenna cable, the yoke and high voltage cable. Take out the chassis bolts under the cabinet. Withdraw the chassis from the back of the cabinet.

KINESCOPE HANDLING PRECAUTION.—Do not install, remove, or handle the kinescope in any manner, unless shatterproof goggles and heavy gloves are worn. People not so equipped should be kept away while handling the kinescope. Keep the kinescope away from the body while handling.

REMOVAL OF KINESCOPE.—To remove the kinescope from the cabinet, loosen the two nuts and disengage the rods alongside the kinescope. Remove the screw which holds the yoke frame to the cabinet. Remove the kinescope, the yoke frame with yoke and focus magnet as an assembly.

Handle this tube by the portion at the edge of the screen. Do not cover the glass bell of the tube with fingermarks as it will produce leakage paths which may interfere with reception. If this portion of the tube has inadvertently been handled, wipe it clean with a soft cloth moistened with "dry" carbon tetrachloride.

INSTALLATION OF KINESCOPE.—Wipe the kinescope screen surface and front panel safety glass clean of all dust and fingermarks with a soft cloth moistened with "Windex" or similar cleaning agent.

Replace the kinescope and chassis by reversal of the removing process. The kinescope should be installed so that the high voltage contact is to the right when looking at it from the rear of the cabinet. The magnet of the ion trap magnet should be to the left.

CABINET ANTENNA.—A cabinet antenna is provided in some receiver models and the leads are brought out near the antenna terminal board. The cabinet antenna may be employed in place of the outdoor antenna in areas where the signals are strong and no reflections are experienced.

ANTENNAS.—The finest television receiver built may be said to be only as good as the antenna design and installation. It is therefore important to select the proper antenna to suit the particular local conditions, to install it properly and orient it correctly.

If two or more stations are available and the two stations are in different directions, it may be possible to make a compromise orientation which will provide a satisfactory signal on all such channels.

If it is impossible to obtain satisfactory results on one or more channels, it may become necessary either to provide means for turning the antenna when switching channels or to install a separate antenna for one or more channels and to switch antennas when switching channels.

In some cases, the antenna should not be installed permanently until the quality of the picture reception has been observed on a television receiver. A temporary transmission line can be run between receiver and the antenna, allowing sufficient slack to permit moving the antenna. Then, with a telephone system connecting an observer at the receiver and an assistant at the antenna, the antenna can be positioned to give the most satisfactory results on the received signal. A shift of direction or a few feet in antenna position may effect a tremendous difference in picture reception.

REFLECTIONS.—Multiple images sometimes known as echoes or ghosts, are caused by the signal arriving at the antenna by two or more routes. The second or subsequent image occurs when a signal arrives at the antenna after being reflected off a building, a hill or other object. In severe cases of reflections, even the sound may be distorted. In less severe cases, reflections may occur that are not noticeable as reflections but that will instead cause a loss of definition in the picture.

Under certain extremely unusual conditions, it may be possible to rotate or position the antenna so that it receives the cleanest picture over a reflected path. If such is the case, the antenna should be so positioned. However, such a position may give variable results as the nature of reflecting surfaces may vary with weather conditions. Wet surfaces have been known to have different reflecting characteristics than dry surfaces.

Depending upon the circumstances, it may be possible to eliminate the reflections by rotating the antenna or by moving it to a new location. In extreme cases, it may be impossible to eliminate the reflection.

INTERFERENCE.—Auto ignition, street cars, electrical machinery and diathermy apparatus may cause interference which spoils the picture. Whenever possible, the antenna location should be removed as far as possible from highways, hospitals, doctors' offices and similar sources of interference. In mounting the antenna, care must be taken to keep the antenna rods at least ¼ wave length (at least 6 feet) away from other antennas, metal roofs, gutters or other metal objects.

Short-wave radio transmitting and receiving equipment may cause interference in the picture in the form of moving ripples. In some instances it may be possible to eliminate the interference by the use of a trap in the antenna transmission line. However, if the interfering signal is on the same frequency as the television station, a trap will provide no improvement.

WEAK PICTURE.—When the installation is near the limit of the area served by the transmitting station, the picture may be speckled, having a "snow" effect, and may not hold steady on the screen. This condition is due to lack of signal strength from the transmitter.

RECEIVER LOCATION.—The owner should be advised of the importance of placing the receiver in the proper location in the room.

The location should be chosen—

—Away from bright windows and so that no bright light will fall directly on the screen. (Some illumination in the room is desirable, however.)

—To give easy access for operation and comfortable viewing.

—To permit convenient connection to the antenna.

—Convenient to an electrical outlet.

—To allow adequate ventilation.

CHASSIS TOP VIEW

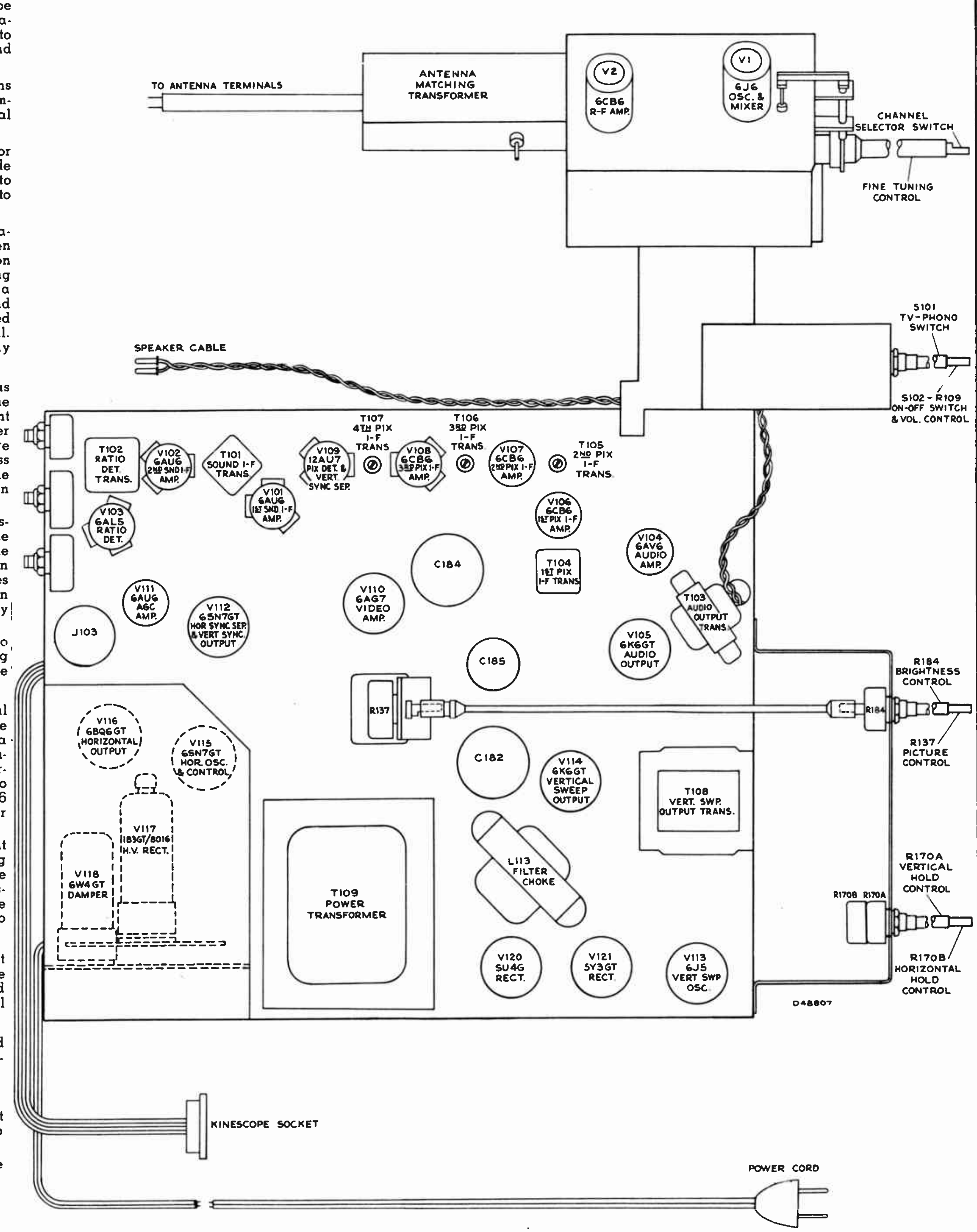


Figure 5—Chassis Top View

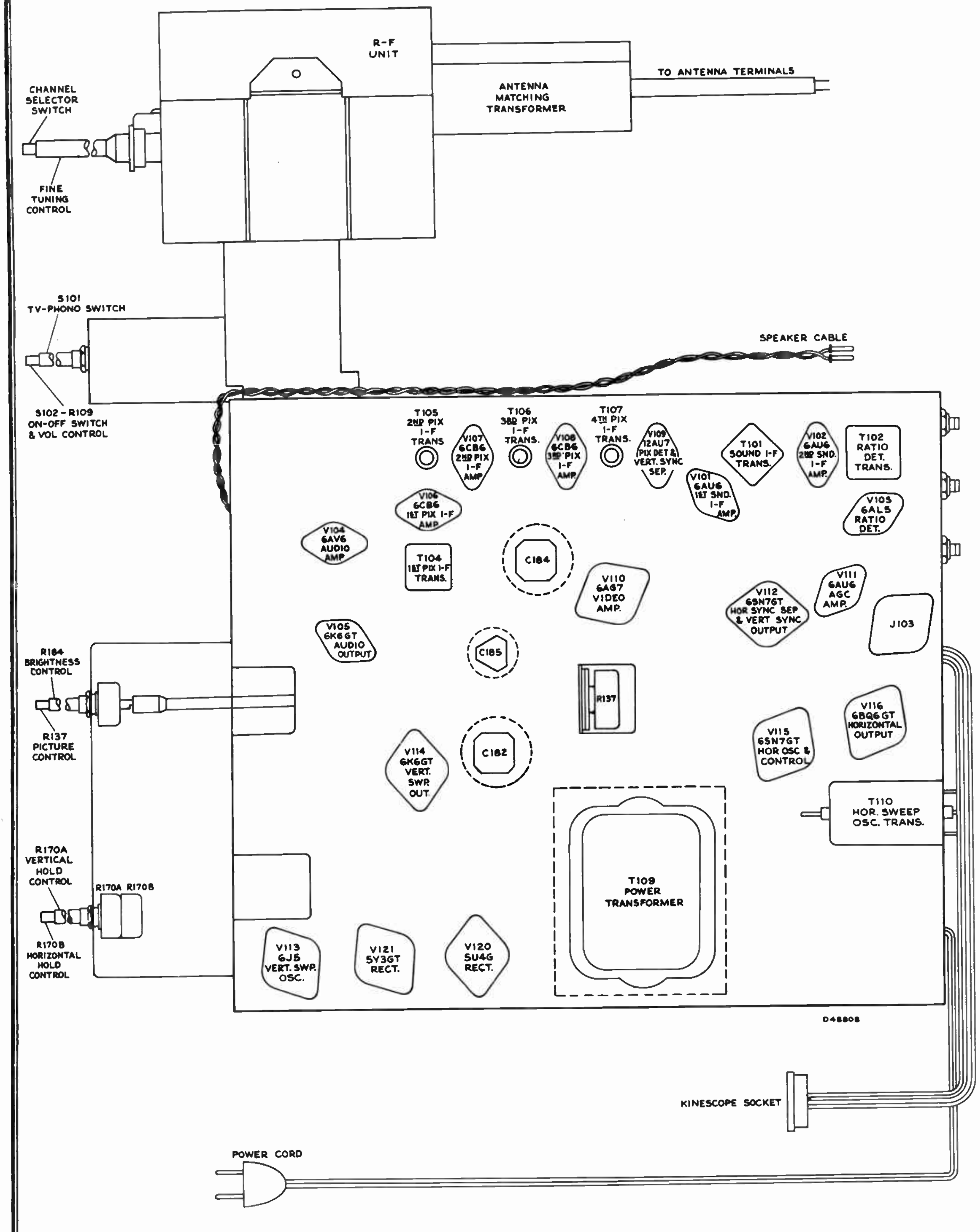


Figure 6—Chassis Bottom View

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of this receiver, it is recommended that the following test equipment be available:

R-F Sweep Generator meeting the following requirements:

(a) Frequency Ranges
- 20 to 30 mc., 1 mc. and 10 mc. sweep width
- 50 to 90 mc., 10 mc. sweep width
- 170 to 225 mc., 10 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

Cathode-Ray Oscilloscope.—For alignment purposes, the oscilloscope employed must have excellent low frequency and phase response, and should be capable of passing a 60-cycle square wave without appreciable distortion.

For video and sync waveform observations, the oscilloscope must have excellent frequency and phase response from 10 cycles to at least two megacycles in all positions of the gain control.

Signal Generator to provide the following frequencies with crystal accuracy.

(a) Intermediate frequencies
- 22.25 and 25.5 mc. conv. and first pix i-f trans.
- 22.75 mc. second picture i-f transformer
- 24.25 mc. fourth picture i-f transformer
- 25.5 mc. third picture i-f transformer
- 25.50 mc. picture carrier
- 27.00 mc. adjacent channel sound trap

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

Heterodyne Frequency Meter with crystal calibrator which covers the frequency range from 80 mc. to 109 mc. and from 200 mc. to 237 mc.

Electronic Voltmeter of Junior or Senior "VoltOhmyst" type and a high voltage multiplier probe for use with this meter to permit m asurements up to 15 kv.

Service Precautions.—If possible, the chassis should be serviced without the kinescope. However, if it is necessary to view the raster during servicing, it would be a great convenience to have a bench mounted kinescope and speaker complete with a set of extension cables.

CAUTION: Do not short the kinescope second anode lead. Its short circuit current presents a considerable overload on the high voltage rectifier V117.

Adjustments Required.—Normally, only the r-f oscillator and mixer lines will require the attention of the service technician. All other circuits are either broad or very stable and hence will seldom require readjustment.

ORDER OF ALIGNMENT.—When a complete receiver alignment is necessary, it can be most conveniently performed in the following order:

(1) R-F unit
(2) Picture i-f transformers
(3) Picture i-f trap
(4) Sweep of picture i-f
(5) Ratio detector alignment
(6) Sound i-f alignment
(7) 4.5 Mc Trap Adjustment
(8) Check of overall response
(9) AGC control adjustment
(10) Horizontal oscillator alignment

R-F UNIT ALIGNMENT.—Disconnect the co-ax link from terminal 2 of the r-f unit terminal board and connect a 39 ohm composition resistor between lugs 1 and 2.

Detune T1 by backing the core all the way out of the coil.

Back the L44 core all the way out. Back the L203 core all the way out.

In order to align the r-f tuner, it will first be necessary to set the channel-13 oscillator to frequency. The shield over the bottom of the r-f unit must be in place when making any adjustments.

The oscillator may be aligned by adjusting it to beat with a crystal-calibrated heterodyne frequency meter. Couple the meter probe loosely to the receiver oscillator.

Set the channel selector switch to 13.

Adjust the heterodyne frequency meter to the correct frequency (236.75 mc).

Set the fine tuning control 30 degrees clockwise from the mechanical center of its range.

Adjust C1 for an audible beat on the heterodyne frequency meter.

Now that the channel-13 oscillator is set to frequency, we may proceed with the r-f alignment.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to terminal 3 of the r-f unit. Adjust the bias box potentiometer to produce −3.5 volts of bias at the r-f unit terminal board.

Connect the oscilloscope to the test point TP1 on top of the r-f unit.

Connect the r-f sweep oscillator to the receiver antenna terminals. The method of connection depends upon the output impedance of the sweep. The P300 connections for 300-ohm balanced or 72-ohm single-ended input are shown in the circuit schematic diagram. If the sweep oscillator has a 50-ohm or 72-ohm single-ended output, 300-ohm balanced output can be obtained by connecting as shown in Figure 9.

Connect the signal generator loosely to the receiver antenna terminals.

Set the receiver channel switch to channel 8.

Set the sweep oscillator to cover channel 8.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C9, C11, C16 and C22 for approximately correct curve shape, frequency, and band width as shown in Figure 11.

The correct adjustment of C22 is indicated by maximum amplitude of the curve midway between the markers. C16 tunes the r-f amplifier plate circuit and affects the frequency of the curve most noticeably. C9 tunes the converter grid circuit and affects the tilt of the curve most noticeably (assuming that C22 has been properly adjusted). C11 is the coupling adjustment and hence primarily affects the response band width.

Set the receiver channel switch to channel 6.

Adjust the heterodyne frequency meter to the correct frequency (108.75 mc.).

Set the fine tuning control 30 degrees clockwise from the mechanical center of its range.

Adjust L5 for an audible beat on the heterodyne frequency meter.

ALIGNMENT PROCEDURE

Set the sweep generator to channel 6.

From the signal generator, insert channel 6 sound and picture carrier markers, 83.25 mc. and 87.75 mc.

Adjust L42, L45 and L49 for proper response as shown in Figure 12.

L42 is adjusted to give maximum amplitude of the curve between the markers. L45 primarily affects the tilt of the curve. L49 primarily affects the frequency of response.

Connect the "VoltOhmyst" to the r-f unit test point TP1.

Adjust C7 for −3.0 volts at the test point.

Retouch L42, L45 and L49 for proper response if necessary. If necessary, retouch C11 for proper band width on channel 6. Continue these retouching adjustments until proper response is obtained and −3.0 volts of oscillator injection are present at the test point, TP1.

Set the receiver channel selector switch to channel 8 and readjust C1 for proper oscillator frequency.

Set the sweep oscillator and signal generator to channel 8.

Readjust C9, C16 and C22 for correct curve shape, frequency and band width. Readjust C11 only if necessary.

Switch the receiver, the sweep oscillator and signal generator to channel 13.

Adjust L52 for maximum amplitude of the curve midway between markers and then overshoot the adjustment by turning the slug in the same direction from the initial setting a little more than the amount of turning required to reach maximum amplitude of response.

Adjust C22 for maximum amplitude of response.

Turn off the sweep generator. Adjust the L43 core for correct channel 13 oscillator frequency, then overshoot the adjustment by turning the slug a little more in the same direction from the initial setting. Reset the oscillator to proper frequency by adjustment of C1.

Turn the sweep oscillator back on.

Check the response of channels 7 through 13 by switching the receiver channel switch, sweep oscillator and marker oscillator to each of these channels and observing the response and oscillator injection obtained. See Figure 11 for typical response curves. It should be found that all these channels have the proper shaped response with the markers above 80% response.

If the markers do not fall within this requirement, switch to channel 8 and readjust C9, C11, C16 and C22 as necessary. If C22 required adjustment, the adjustment should be overshot a small amount and corrected by adjustment of L52 to give maximum amplitude of response between the sound and picture carrier markers. The antenna circuit (L52, C22) is broad so that tracking is not particularly critical.

If the valley in the top of the selectivity curves for the high channels is deeper than normal, the curve can be flattened somewhat by decreasing the inductance of L44 by turning the core stud in. Be sure to check for undesirable resonant suck-outs on channels 7 and 8 if this is done.

Turn the sweep oscillator off and check the receiver channel 8 r-f oscillator frequency. If the oscillator is off frequency overshoot the adjustment of C1 and correct by adjusting L43.

Turn the receiver channel selector switch to channel 6. Adjust L5 for correct oscillator frequency.

Turn the sweep oscillator on and to channel 6 and observe the response curve. If necessary readjust L42, L45 and L49. It should not be necessary to touch C11.

Check the oscillator injection voltage at the test point TP1. If necessary adjust C7 to give −3 volts injection. If C7 is adjusted, switch to channel 8, and readjust C9 for proper curve shape, then recheck channel 6.

Switch the receiver through channel 6 down through channel 2 and check for normal response curve shapes and oscillator injection voltage.

Likewise check channels 7 through 13, stopping on 13 for the next step.

With the receiver on channel 13, check the receiver oscillator frequency. Correct by adjustment of C1 if necessary.

Adjust the oscillator to frequency on all channels by switching the receiver and the heterodyne frequency meter to each channel and adjusting the appropriate oscillator trimmer to obtain a beat on the freq. meter. It should be possible to adjust the oscillator to the correct frequency on all channels with the fine tuning control 30 degrees clockwise from the mechanical center of its range.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.	Channel Oscillator Adjustment
2	55.25	59.75	80.750	L1
3	61.25	65.75	86.750	L2
4	67.25	71.75	92.750	L3
5	77.25	81.75	102.750	L4
6	83.25	87.75	108.750	L5
7	175.25	179.75	200.750	L6
8	181.25	185.75	206.750	L7
9	187.25	191.75	212.750	L8
10	193.25	197.75	218.750	L9
11	199.25	203.75	224.750	L10
12	205.25	209.75	230.750	L11
13	211.25	215.75	236.750	C1

Switch to channel 8 and observe the response.

Adjust T1 clockwise while watching the change in response. When T1 is properly adjusted, the selectivity curve will be slightly wider with a slightly deeper valley in its top.

Switch through all channels and observe response, oscillator injection and r-f oscillator frequency. Minor touch-ups of adjustments may be made at this time. However, if C7 or C9 are changed appreciably, then a recheck of the oscillator frequency on all channels should be made.

Reconnect the link from T101 to terminal 2 of the r-f unit terminal board.

Since T1 was adjusted during the r-f unit alignment it will be necessary to sweep the overall i-f response.

R-F UNIT TUBE CHANGES.—Since most of the circuits are low capacitance circuits the r-f unit may require readjustments when the tubes are changed.

If the 6CB6 r-f amplifier tube is changed, it may be necessary to readjust C16 and C22.

If the 6J6 oscillator and mixer tube is changed, then more extensive adjustments are required.

For good conversion efficiency, the oscillator injection to a triode mixer must be held reasonably close to the optimum value. Although there is some latitude in this level, it is nearly expended in the normal variation in injection from channel to channel. Consequently, the adjustment of C7 is limited primarily to establishing the conditions for good conversion. Since changes in oscillator injection affect conversion gain, it also affects the input capacity of the mixer, thus also affecting tracking of the mixer grid circuit. These tube variations with their consequent effect on circuit alignment thereby require readjustment of the r-f unit if maximum conversion efficiency is to be retained after the 6J6 tube is changed. It may be possible, however, to try several 6J6 tubes and select one which gives satisfactory performance without realignment.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—Connect the "VoltOhmyst" to the junction of R142 and R143.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R142 and R143. Adjust the potentiometer for −5.0 volts indication on the "VoltOhmyst".

Set the channel switch to channel number 9, 10 or 11.

Connect the "VoltOhmyst" to pin 4 of V110 (pin 2 if 6CL6 is used) and to ground.

Connect the output of the signal generator to the mixer grid test point TP2 in series with a 1500 mmf ceramic capacitor.

Connect a separate −5 volt bias supply to TP1 with the positive terminal to ground.

Set the generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst". In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

ALIGNMENT PROCEDURE

Adjust the signal generator output to give 3 volts on the "VoltOhmyst" as the final adjustment is made.

(1) 24.25 mc.—T107
(2) 25.5 mc.—T106
(3) 22.75 mc.—T105

PICTURE I-F TRAP ADJUSTMENT.—With the same connections as above, tune the generator to 27.00 mc. and adjust the T104 top core for minimum d-c on the "VoltOhmyst". Set the generator output so that this minimum is about 3 volts when final adjustment is made. If necessary, the i-f bias may be reduced in order to obtain the 3 volt reading on the "VoltOhmyst".

SWEEP ALIGNMENT OF PIX I-F.—To align T1 and T104, connect the sweep generator to the mixer grid test point TP2. In series with a 1500 mmf ceramic capacitor use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the r-f unit outer shield.

Connect a separate −5.0 volt bias supply to TP1 with the positive terminal connected to ground and by-pass TP1 to ground with a 1500 mmf. ceramic capacitor.

Set the channel selector switch between channels 2 and 13.

Clip 330 ohm resistors across terminals A and B of T106 and T107.

Preset C115 to minimum capacity.

Adjust the bias box potentiometer to obtain −5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R142 and R143. Leave the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T105. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T1 (top) and T104 (bottom) for maximum gain and with 25.5 mc. at 70% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C115 until 22.25 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 12.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to pin 4 (pin 2 if 6CL6 is used) of V110 socket.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T105, T106 and T107 to obtain the response shown in Figure 13.

It is especially important that the 22.4 mc. marker should fall at 55% on the overall i-f response curve. If the marker should fall appreciably higher than 55%, trouble may be experienced with sound in the picture. If the marker should fall appreciably below 55% response, the sound sensitivity may be reduced and may cause the sound to be noisy in weak signal areas.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first sound i-f grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix i-f amplifier, pin 1 of V108.

Set the frequency of the calibrator to 25.50 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at L102 and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst". Adjust the signal level from the signal generator for 6 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R106 and C108.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst".

Repeat adjustments of T102 top for maximum d-c at pin 2 of V103 and T102 bottom for zero d-c at the junction of R106 and C108. Make the final adjustments with the signal input level adjusted to produce 6 volts d-c on the "VoltOhmyst" at pin 2 of V103.

SOUND I-F ALIGNMENT.—Connect the signal generator to the first sound i-f amplifier grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the T101 top core for maximum d-c on the "VoltOhmyst".

The output from the signal generator should be set to produce approximately 6.0 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 1,000 ohm resistor to pin 2 of V109. Set the generator to 4.5 mc. and modulate it 30% with 400 cycles. Set the output to approximately 0.5 volts.

Short the third pix i-f grid to ground, pin 1, V108, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video amplifier, pin 8 (pin 6 if 6CL6 is used) of V110.

Adjust the core of L103 for minimum output on the oscilloscope.

Remove the short from pin 1, V108 to ground.

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L103 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L103 for minimum beat.

CHECK OF OVERALL RESPONSE.—If desired, the overall response of the receiver can be checked on each channel.

Connect the r-f sweep generator to the receiver antenna input terminals. If necessary, employ one of the pads shown in Figure 9 to match the sweep output cable to the r-f unit.

Connect the signal generator loosely to the first pix i-f amplifier grid.

Adjust the bias potentiometer to obtain −5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R142 and R143.

Connect the oscilloscope to pin 4 (pin 2 if 6CL6 is used) of V110.

Check the response of channels 2 through 13 by switching the receiver channel switch and sweep oscillator to each of these channels and observing the response obtained. On each channel, adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

I-F markers at 22.4 mc., 24.75 mc. and 25.5 mc. should be provided by the signal generator.

The response obtained in this manner should be very similar to that shown in Figure 13.

Some curves may show a 10% sag in the top between 22.75 mc. and 24.75 mc. while others may show a 10% peak in this region. This may be considered normal.

If the picture carrier is consistently high or low on all channels, T106 may be adjusted slightly. Do not adjust T105.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 8 (pin 6 if 6CL6 is used) of V110.

Connect an antenna to the receiver antenna terminals.

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

ALIGNMENT PROCEDURE

HORIZONTAL OSCILLATOR ADJUSTMENT.—Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R170B, then adjust the T110 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T110 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T110 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C161B, the width control L106 and the linearity control L108 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T110 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T110 frequency core (on the rear apron) until the picture falls out of sync and three or four diagonal black bars sloping down to the right appear on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T110 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture falls out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin the motorboat. Retouch the adjustment of the T110 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T110. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 14. Adjust the waveform adjustment core of T110 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T110 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C161A slightly clockwise. If less than 2 bars are present, adjust C161A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T110 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves to the left side of the screen leaving the picture in synchronization.

SENSITIVITY CHECK.—A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is at the maximum clockwise position. Only carbon type resistors should be used to construct the pad.

RESPONSE CURVES.—The response curves shown on page 14 and referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, some variations can be expected.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

NOTE ON R-F UNIT ALIGNMENT.—Because of the frequency spectrum involved and the nature of the device, many of the r-f unit leads and components are critical in some respects. Even the power supply leads form loops which couple to the tuned circuits, and if resonant at any of the frequencies involved in the performance of the tuner, may cause serious departures from the desired characteristics. In the design of the receiver these undesirable resonant loops have been shifted far enough away in frequency to allow reasonable latitude in their components and physical arrangement without being troublesome. When the r-f unit is aligned in the receiver, no trouble from resonant loops should be experienced. However, if the unit is aligned in a jig separate from the receiver, attention should be paid to insure that unwanted resonances do not exist which might present a faulty representation of r-f unit alignment.

A resonant circuit exists between the r-f tuner chassis and the outer shield box, which couples into the antenna and r-f plate circuits. The frequency of this resonance depends on the physical structure of the shield box, and the capacitance between the tuner chassis and the front plate. In the KRK8 units, this resonance should fall between 120 and 135 mc. and is controlled in the design by using insulating washers of different thicknesses (in the front plate to tuner chassis mounting) to compensate for differences in the shield boxes of different models of receivers. The performance of the tuner, particularly on channels 7 and 8 will be impaired if the proper washers for the particular shield box involved are not used. Obviously then, if the r-f unit is removed for service, the washers should be replaced in the correct order when the unit is replaced.

ALIGNMENT TABLE

THE DETAILED ALIGNMENT PROCEDURE BEGINNING ON PAGE 16 SHOULD BE READ BEFORE ALIGNMENT BY USE OF THE TABLE IS ATTEMPTED

STEP. No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
	R-F UNIT ALIGNMENT									
1	Disconnect the co-ax link from terminal 2 of the r-f unit terminal board and connect a 39 ohm composition resistor between lugs 1 and 2. Detune T1 by backing the core all the way out of the coil. Back the L44 core all the way out. Back the L203 core all the way out. In order to align the r-f tuner, it will first be necessary to set the channel 13 oscillator to frequency. The shield over the bottom of the r-f unit must be in place when making any adjustments.									
2	Not used		Not used		Loosely coupled to r-f oscillator	236.75 MC.	Not used	Fine tuning 30 degrees clockwise from mechanical center of its range. Receiver on channel 13.	C1 for an audible beat on het. freq. meter	Fig. 7
3	"		"				Connect "Volt-Ohmyst" to terminal 3 of the r-f unit terminal board	Turn AGC control fully clockwise. Connect bias box to terminal 3 of r-f unit term. board	Adjust the bias box potentiometer for —3.5 volts.	
4	Antenna terminal (loosely)	181.25 185.75	Antenna terminals (see text for precaution)	Sweeping channel 8	Not used	—	Not used	Rec. on chan. 8. Connect oscilloscope to TP1. Adjust C9, C11, C16 and C22 for correct curve shape, frequency and band width. C22 is adjusted to give max. amplitude between markers. C9 affects tilt and C16 affects the frequency of response. C11 affects the response band width.		Fig. 7 Fig. 8
5	Not used		Not used	Not used	Loosely coupled to r-f oscillator	108.75	"	Rec. on channel 6	L5 for audible beat on het. freq. meter.	Fig. 8
6	Antenna terminal (loosely)	83.25 87.75	Antenna terminals (see text for precaution)	Channel 6	Not used	—	"	Rec. on chan. 6. Adjust L42, L45 and L49 for proper response. L42 is adjusted to give max. amplitude between markers. L45 primarily affects tilt and L49 primarily affects freq. of response. If necessary, retouch C11 for proper width.		Fig. 12
7	Not used	—	Not used	—	Not used	—	Connect "Volt-Ohmyst" to r-f unit test point TP1	Rec. on channel 6	Adjust C7 for —3.0 volts at the test point	Fig. 7 Fig. 9
8	Repeat above steps until the specified conditions are obtained.									
9	Not used		Not used	—	Loosely coupled to r-f oscillator	206.75		Rec. on chan. 8	C1 for audible beat on het. freq. meter	Fig. 7
10	Antenna terminal (loosely)	181.25 185.75	Antenna terminals (see text for precaution)	Sweeping chonnel 8	Not used	—	Not used	Rec. on chan. 8. Readjust C9, C16 and C22 for correct curve shape, frequency and band width. Readjust C11 only if necessary.		Fig. 7 Fig. 12 (8)
11	"	211.25 215.75	"	Sweeping channel 13	Not used	—	Not used	Rec. on chan. 13. Adjust L52 for max. amplitude between markers, overshoot a little more than required to reach max. response. Adjust C22 to regain max. amplitude of response.		Fig. 7 Fig. 12 (13)
12	"	215.75	Not used	—	Loosely coupled to r-f oscillator	236.75		Receiver on chan. 13. Adjust L43 for correct channel 13 osc. freq. then overshoot. Reset the osc. to proper freq. by adjustment of C1.		Fig. 7 Fig. 8
13	"	205.25 209.75	Antenna terminals (see text for precaution)	channel 12	Not used	—	Connect "Volt-Ohmyst" to r-f unit test point TP1	Rec. on chan. 12	Check to see that response is correct and —3.0 volts of osc. injection is present	Fig. 8 Fig. 12
14	"	199.25 203.75		channel 11	"	—	"	Rec. on chan. 11	"	Fig. 12 (11)
15	"	193.25 197.75	"	channel 10	"	—	"	Rec. on chan. 10	"	Fig. 12 (10)
16	"	187.25 191.75	"	channel 9	"	—	"	Rec. on chan. 9	"	Fig. 12 (9)
17	"	181.25 185.75	"	channel 8	"	—	"	Rec. on chan. 8	"	Fig. 12 (8)
18	"	175.25 179.75	"	channel 7	"	—	"	Rec. on chan. 7	"	Fig. 12 (7)
19	If the response of any channel (steps 13 through 18) is below 80% at either marker, repeat step 10 and adjust C9, C11, C16 and C22 as necessary to pull response up on the low channel yet maintain correct response on channel 8. If C22 required adjustment, the adjustment should be overshot a small amount and corrected by adjustment of L52 to give maximum amplitude of response between the sound and picture carrier markers.									
20	Repeat step 9. If the oscillator is off frequency overshoot the adjustment of C1 and correct by adjusting L43.									
21	Repeat steps 13 through 20 until all requirements are obtained.									
22	Not used	—	Not used	—	Loosely coupled to r-f oscillator	108.75		Rec. on chan. 6	L5 for zero beat on het. freq. meter	Fig. 8
23	Antenna terminals (loosely)	83.25 87.75	Ant. terminals (see text for precaution)	Sweeping channel 6	Not used	—	Not used	Observe response. If necessary readjust L42, L45 and L49. It should not be necessary to touch C11.		Fig. 7 Fig. 12
24	Not used	—	Not used	—	Not used	—	Connect "Volt-Ohmyst" to the r-f unit test point TP1	Check osc. injection. If necessary adjust C7 to give —3 volts. If C7 is adjusted, switch to channel 8, and readjust C9 for proper response then repeat step 23.		Fig. 7 Fig. 12
25	Antenna terminals (loosely)	77.25 81.75	Ant. terminals (see text for precaution)	channel 5	"	—	"	Rec. on chan. 5	Check to see that response is correct and —3.0 volts of osc. injection is present	Fig. 12 (5)

ALIGNMENT TABLE

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER	HET. FREQ. METER MC.	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
26	Antenna terminals (loosely)	67.25 71.75	Ant. terminals (see text for precaution)	channel 4	Not used	—	Connect "VoltOhmyst" to the r-f unit test point TP1	Rec. on chan. 4	Check to see that response is correct and —3.0 volts of osc. injection is present	Fig. 12 (4)
27	"	61.25 65.75	"	channel 3	"	—	"	Rec. on chan. 3	"	Fig. 12 (3)
28	"	55.25 59.75	"	channel 2	"	—	"	Rec. on chan. 2	"	Fig. 12 (2)
29	Likewise check channels 7 through 13, as outlined in steps 18 back through 13, stopping on channel 13 for next step.									
30	Antenna terminals	215.75	Not used	—	Loosely coupled to r-f oscillator	236.75	Not used	Fine tuning 30 degrees clockwise from mechanical center of its range. Receiver on channel 13	C1 for zero beat on het. freq. meter	Fig. 7
31	"	209.75	"	—	"	230.75	"	Rec. on chan. 12	L11 as above	Fig. 8
32	"	203.75	"	—	"	224.75	"	Rec. on chan. 11	L10 as above	Fig. 8
33	"	197.75	"	—	"	218.75	"	Rec. on chan. 10	L9 as above	Fig. 8
34	"	191.75	"	—	"	212.75	"	Rec. on chan. 9	L8 as above	Fig. 8
35	"	185.75	"	—	"	206.75	"	Rec. on chan. 8	L7 as above	Fig. 8
36	"	179.75	"	—	"	200.75	"	Rec. on chan. 7	L6 as above	Fig. 8
37	"	87.75	"	—	"	108.75	"	Rec. on chan. 6	L5 as above	Fig. 8
38	"	81.75	"	—	"	102.75	"	Rec. on chan. 5	L4 as above	Fig. 8
39	"	71.75	"	—	"	92.75	"	Rec. on chan. 4	L3 as above	Fig. 8
40	"	65.75	"	—	"	86.75	"	Rec. on chan. 3	L2 as above	Fig. 8
41	"	59.75	"	—	"	80.75	"	Rec. on chan. 2	L1 as above	Fig. 8
42	Repeat steps 30 through 41 as a check.									
43	Antenna terminals	181.25 185.75	Antenna terminals	Sweeping channel 8	Not used	—		Rec. on chan. 8. Oscilloscope at test point TP1. Adjust T1 clockwise. When properly adjusted, curve will be slightly wider with a slightly deeper valley in top.		Fig. 12 (8)
44	Switch through all channels and observe response, oscillator injection and r-f oscillator frequency. Minor touch-ups of adjustments may be made at this time. However, if C7 or C9 are changed appreciably, then a recheck of the oscillator frequency on all channels should be made.									
45	Remove 39 ohm resistor and reconnect link from T101 to terminal 2 of r-f unit terminal board.									

PICTURE I-F AND TRAP ADJUSTMENT

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
46	Not used		Not used	—	Not used	Junction of R142 & R143	Connect bias box to junction of R142 & R143 and to ground AGC fully clockwise	Adjust potentiometer for —5.0 volts on meter	Fig. 3
47	"		"	—	"	Test point TP1	Connect bias box to TP1 and to ground	"	Fig. 7
48	Mixer grid test point TP2 in series with 1500 mmf.	24.25	"	—	"	Pin 4 of V110 and to ground	Bias boxes connected as above	T107 (top) for max.	Fig. 9
49	"	25.5	"	—	"	"	"	T106 (top) for max.	Fig. 9
50	"	22.75	"	—	"	"	"	T105 (top) for max.	Fig. 9
51	"	27.00	"	—	"	"	"	T104 (top) for min.	Fig. 9
52	Connected loosely to diode probe	Various See Fig. 13	Mixer grid test point TP2 in series with 1500 mmf.	20 to 28 mc	Scope diode probe to pin 5 of V106 and to gnd. Connect a 180 ohm resistor from pin 5 of V106 to pin A of T105	Junction of R142 & R143	Shunt terminals A and B of T106 and T107 with 330 ohms. Bias boxes connected as above. .3v p-p on scope	Set C115 to min. Adjust T1 top and T104 bot. for max. gain with 25.5 mc. at 70%. C115 for 22.5 at 70%	Fig. 7 Fig. 10
53	Connected loosely to grid of 1st pix i-f. Adjust for small marker indication.	Various See Fig. 14	"	"	Connect scope to pin 4 of V110. Remove shunt & diode probe used above		Remove shunts from T106 & T107	Retouch T105, T106 and T107 to obtain response shown in Fig. 14	Fig. 14

RATIO DETECTOR, SOUND I-F AND 4.5 MC TRAP ALIGNMENT

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
54	Grid 1st Snd. I-F (pin 1, V101) or WR39B or C connect to grid 3rd pix I-F (pin 1, V108)	25.50mc. mod. by 4.5 mc.	Not used	—	Not used	Pin 2 of V103	Set signal gen. to give 8V on meter	T102 top core for max. d-c on meter	Fig. 9
55	"	"	"	—	"	"	"VoltOhmyst" to junction R106 and C108. Adjust T102 bottom core for zero DC on meter. Repeat steps 54 and 55 until all conditions are satisfied.		Fig. 9 Fig. 10
56	Sig. Gen. to 1st Snd. I-F grid	4.5 mc.	"	—	"	"	Signal generator output adjusted to provide 6 v on meter	T101 top core for max. DC on meter	Fig. 9
57	Sig. Gen. in series with 1000 ohms to pin 2 of V109	4.5 mc. mod. 30% with 400 cy.	"	—	Diode probe to pin 8 of V110	Not used	Short pin 1 of V108 to ground	Adjust L103 for minimum output on oscilloscope	Fig. 9

ALIGNMENT DATA

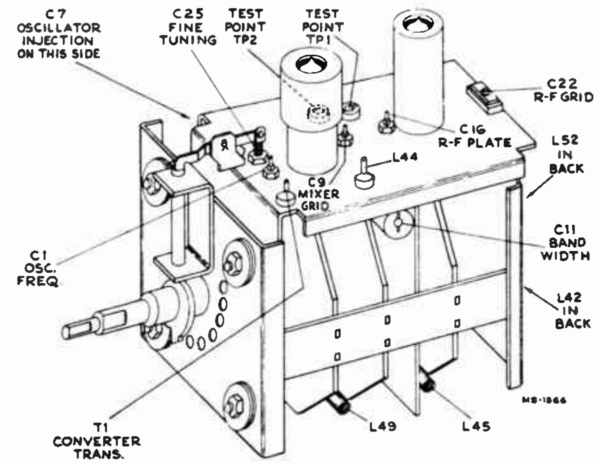


Figure 7—R-F Unit Adjustments

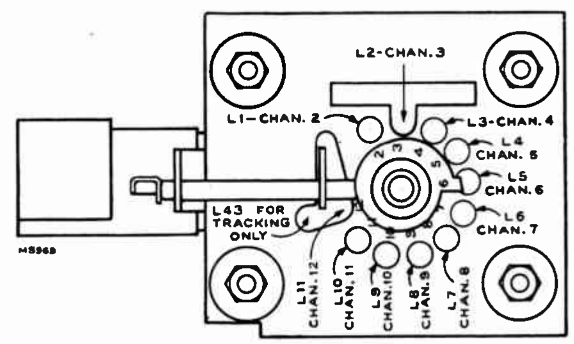


Figure 8—R-F Oscillator Adjustments

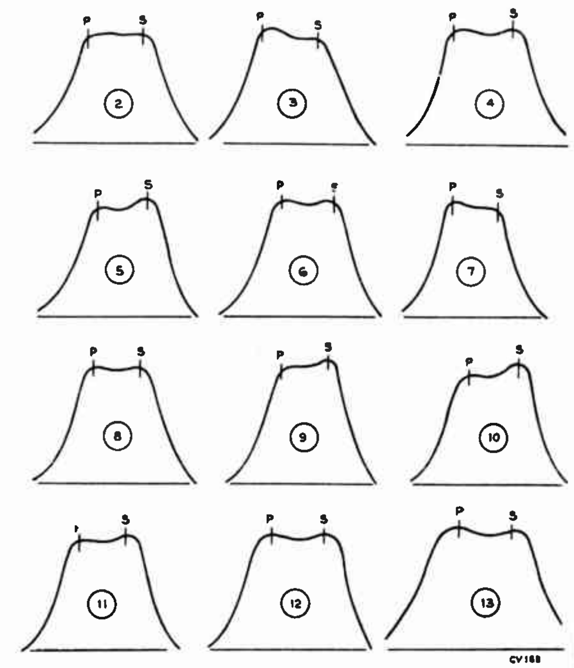


Figure 11—R-F Response

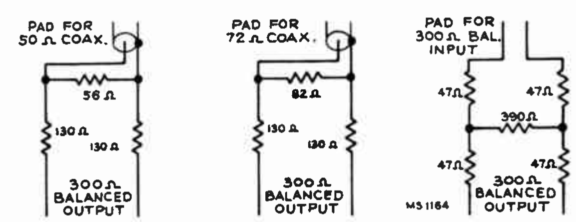


Figure 9—Sweep Attenuator Pads

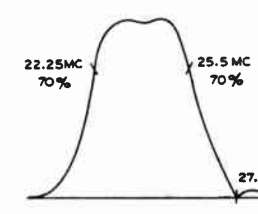


Figure 12
T1 and T104
Response

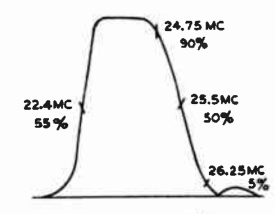


Figure 13
Over-all I-F
Response

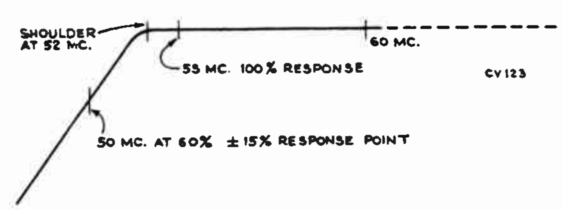


Figure 10—Antenna Matching Unit Response

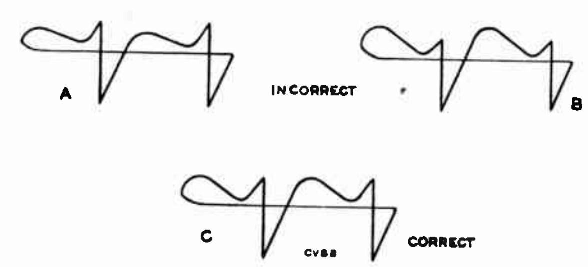


Figure 14—Horizontal Oscillator Wave Forms

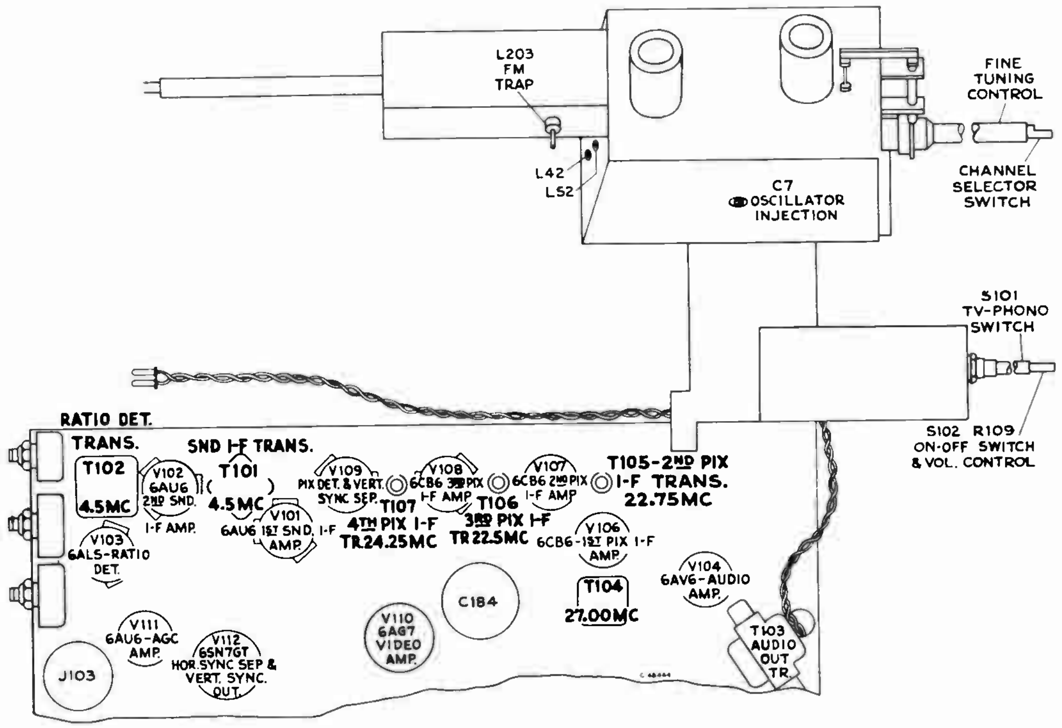


Figure 15—Top Chassis Adjustments

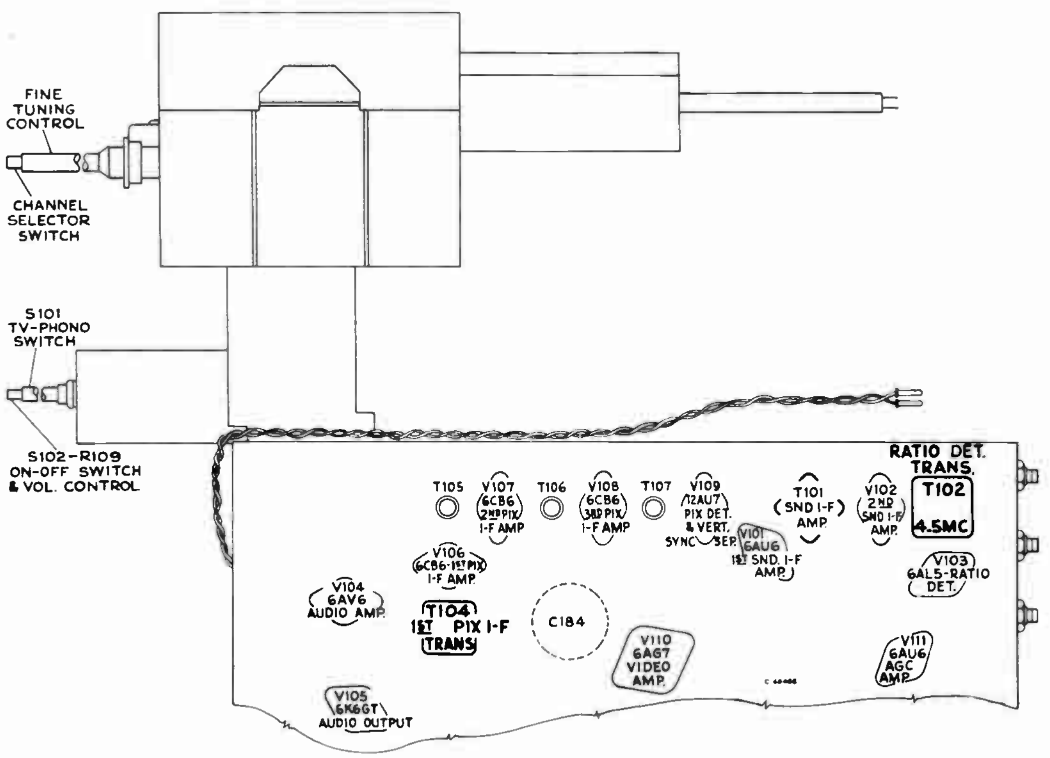


Figure 16—Bottom Chassis Adjustments

TEST PATTERN PHOTOGRAPHS

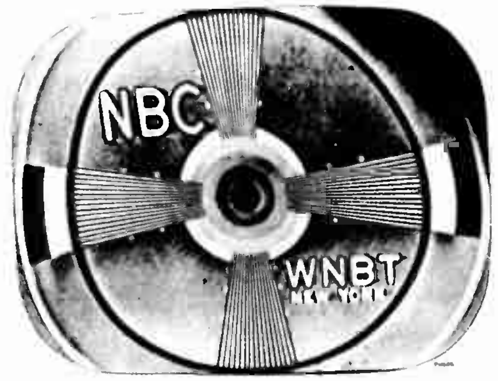


Figure 17—Normal Picture ←

Figure 18—Focus Magnet and Ion Trap Magnet Misadjusted →

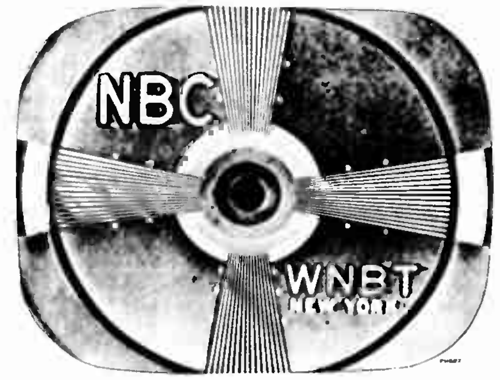
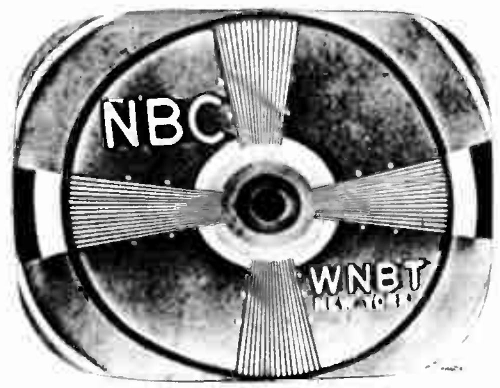


Figure 19—Horizontal Linearity Control Misadjusted (Picture Cramped in Middle) ←

Figure 20—Width Control Misadjusted →



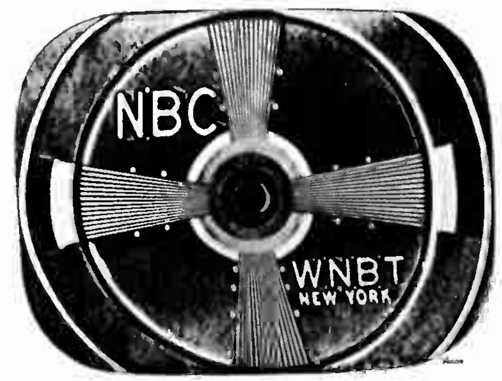


Figure 21—Horizontal Drive Control Misadjusted ←

Figure 22—Transients →

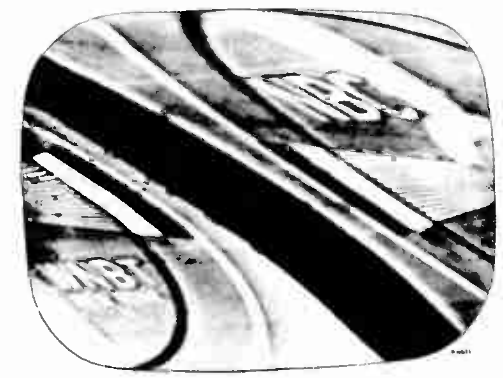


Figure 23—Test Pattern Showing Out of Sync Condition When Horizontal Hold Control Is in a Counter-clockwise Position—Just Before Pulling Into Sync ←

Figure 24—Test Pattern Showing Out of Sync Condition When Horizontal Hold Control Is at the Maximum Clockwise Position →

SERVICE SUGGESTIONS

Following is a list of symptoms of possible failures and an indication of some of the possible faults:

NO RASTER ON KINESCOPE:

(1) Incorrect adjustment of ion trap magnet. Magnet reversed either front to back or top to bottom.
(2) V115 or V116 inoperative. Check waveforms on grids and plates.
(3) No high voltage—if horizontal deflection is operating as evidenced by the correct waveform on terminal 1 of high voltage transformer, the trouble can be isolated to the 1B3GT circuit. Either the T111 high voltage winding is open, the 1B3GT tube is defective or its filament circuit is open.
(4) V110 circuit, inoperative—Refer to schematic and waveform chart.
(5) Damper tube (V118) inoperative.
(6) Defective kinescope.
(7) R184 open.
(8) No receiver plate voltage—filter capacitor shorted—or filter choke open.

NO VERTICAL DEFLECTION:

(1) V113 or V114 inoperative. Check voltage and waveforms on grids and plates.
(2) T108 open.
(3) Vertical deflection coils open.

SMALL RASTER:

(1) Low Plus B or low line voltage.
(2) V116, V120 or V121 defective.

POOR VERTICAL LINEARITY:

(1) If adjustments cannot correct, change V114.
(2) Vertical output transformer T108 defective.
(3) V113 defective—check voltage and waveforms on grid and plate.
(4) C151, C153, C152, C155, or C156 defective.
(5) Low plate voltage—check rectifiers and capacitors in supply circuits.
(6) If height is insufficient, try changing V113.

POOR HORIZONTAL LINEARITY:

(1) If adjustments do not correct, change V116, or V118.
(2) T108 or L108 defective.
(3) C176 or C177 defective.

WRINKLES ON SIDE OF RASTER:

(1) C181 defective.
(2) Defective yoke.

PICTURE OUT OF SYNC HORIZONTALLY:

(1) T110 incorrectly tuned.
(2) R192, R193 or R170B defective.

TRAPEZOIDAL OR NON SYMMETRICAL RASTER:

(1) Improper adjustment of centering of focus magnet or ion trap magnet.
(2) Defective yoke.

RASTER AND SIGNAL ON KINESCOPE BUT NO SOUND:

(1) L102 defective.
(2) Sound i-f, ratio detector or audio amplifier inoperative—check V101, V102, V103 and their socket voltages.
(3) Audio system defective.
(4) Speaker defective.

SIGNAL AT KINESCOPE GRID BUT NO SYNC:

(1) AGC control R149 misadjusted.
(2) V111, inoperative. Check voltage and waveforms at its grid and plate.

SIGNAL ON KINESCOPE GRID BUT NO VERTICAL SYNC:

(1) Check V113 and associated circuit.
(2) Integrating network inoperative—Check.
(3) V109B or V112B defective or associated circuit defective.
(4) Gas current grid emission or grid cathode leakage in V112. Replace.

SIGNAL ON KINESCOPE GRID BUT NO HORIZONTAL SYNC:

(1) T110 misadjusted—readjust as instructed on page 11.
(2) V112 inoperative—check socket voltages and waveforms.
(3) T110 defective.
(4) C142, C161A, C163, C165, C167, C166, C168, C187 or C188 defective.
(5) If horizontal speed is completely off and cannot be adjusted check R192, R193, R170B, R196, R195 and R198.

SOUND AND RASTER BUT NO PICTURE OR SYNC:

(1) Picture, detector or video amplifier defective—check V109A and V110—check socket voltages.
(2) Bad contact to kinescope cathode.

PICTURE STABLE BUT POOR RESOLUTION:

(1) V109A or V110 defective.
(2) Peaking coils defective—check resistance.
(3) Make sure that the focus control operates on both sides of proper focus.
(4) R-F and I-F circuits misaligned.

PICTURE SMEAR.

(1) R-F or I-F circuits misaligned.
(2) Open peaking coil.
(3) This trouble can originate at the transmitter—check on another station.

PICTURE JITTER:

(1) AGC control R149 misadjusted.
(2) If regular sections at the left picture are displaced change V116.
(3) Vertical instability may be due to loose connections or noise.
(4) Horizontal instability may be due to unstable transmitted sync.

RASTER BUT NO SOUND, PICTURE OR SYNC:

(1) Defective antenna or transmission line.
(2) R-F oscillator off frequency.
(3) R-F unit inoperative—check V1, V2.

DARK VERTICAL LINE ON LEFT OF PICTURE:

(1) Reduce horizontal drive and readjust width and horizontal linearity.
(2) Replace V116.

LIGHT VERTICAL LINE ON LEFT OF PICTURE:

(1) V118 defective.

WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

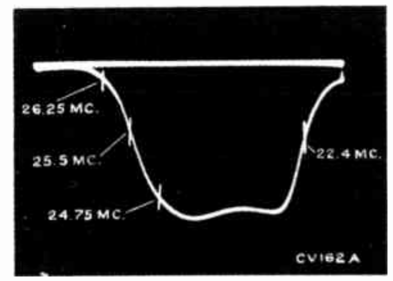
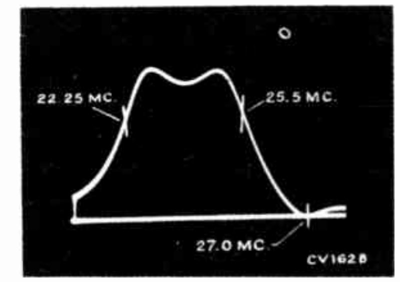


Figure 25—Overall Pix I-F Response

Figure 26—Response of T1-T104 Pix I-F Transformers



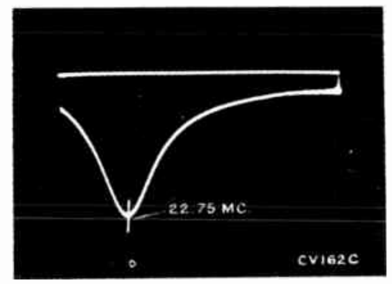
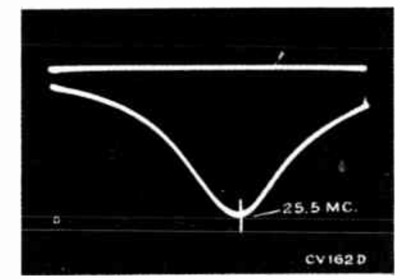


Figure 27—Response of T105 Pix I-F Transformer

Figure 28—Response of T106 Pix I-F Transformer



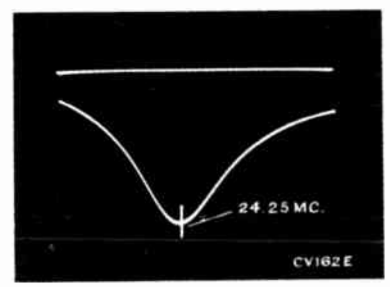
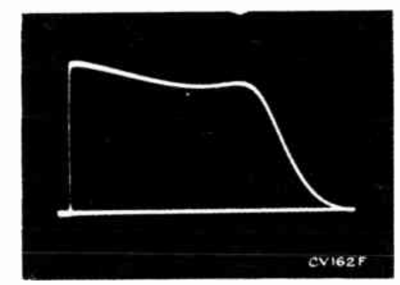
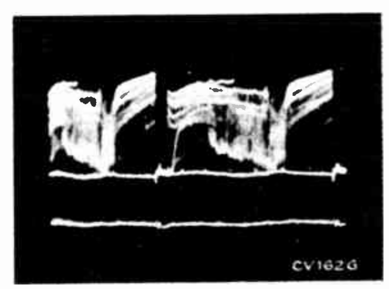


Figure 29—Response of T107 Pix I-F Transformer

Figure 30—Video Response at Average Contrast

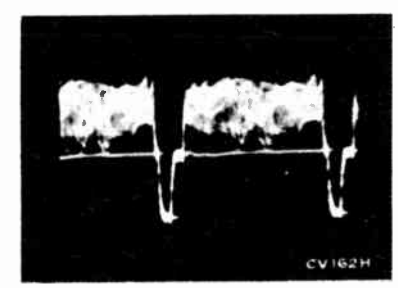




Grid of Video Amplifier (Pin 2 of V110) (6CL6) Voltage Depends on Picture

Figure 31—Vertical (Oscilloscope Synced to ½ of Vertical Sweep Rate) (1.5 Volts PP)

Figure 32—Horizontal (Oscilloscope Synced to ½ of Horizontal Sweep Rate) (1.5 Volts PP)



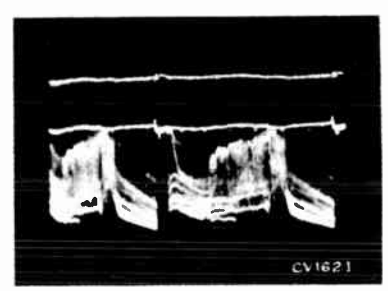


Plate of Video Amplifier (Pin 6 of V110) (6CL6)

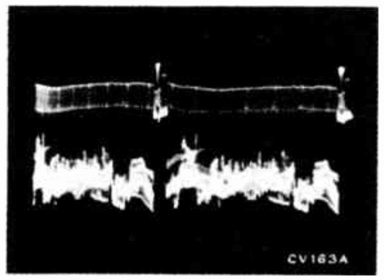
Voltage depends on picture

Figure 33—Vertical (85 Volts PP)

Figure 34—Horizontal (85 Volts PP)

WAVEFORM PHOTOGRAPHS

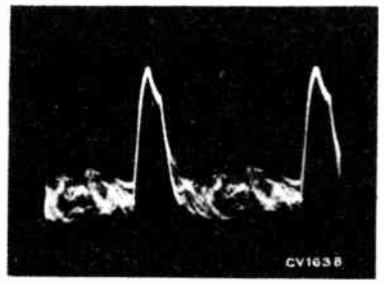
Taken from RCA WO58A Oscilloscope

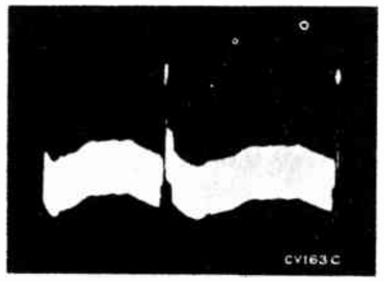


Grid of Horizontal Sync Separator (Pin 1 of V112A) (6SN7) Voltage depends on picture

Figure 35—Vertical (85 Volts PP)

Figure 36—Horizontal (85 Volts PP)

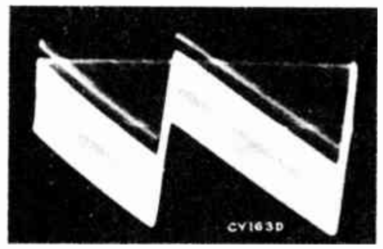




Cathode of Horizontal Sync Sep. (Pin 3 of V112A) (6SN7)

Figure 37—Vertical (7.5 Volts PP)

Figure 38—Horizontal (5 Volts PP)



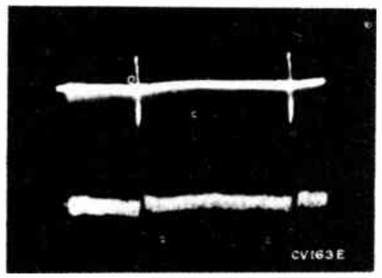
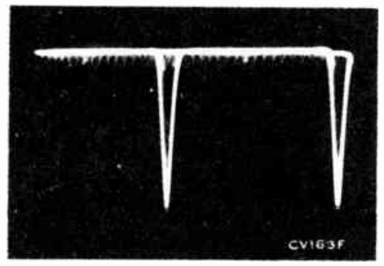
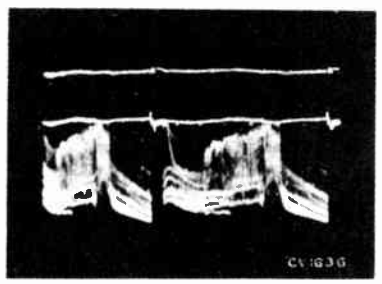


Plate of Horizontal Sync Separator (Pin 2 of V112A) (6SN7)

Figure 39—Vertical (45 Volts PP)

Figure 40—Horizontal (45 Volts PP)

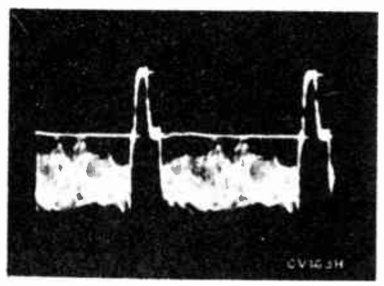




Grid of Vertical Sync Sep. (Pin 7 of V109B) (12AU7)

Figure 41—Vertical (55 Volts PP)

Figure 42—Horizontal (55 Volts PP)



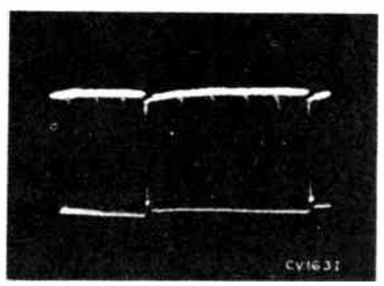
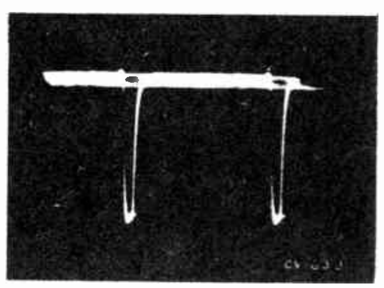


Plate of Vertical Sync Sep. (Pin 6 of V109B) (12AU7)

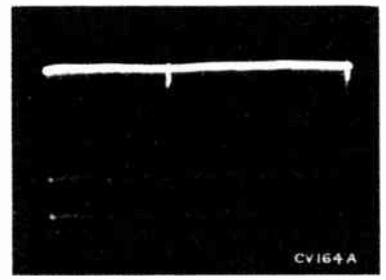
Figure 43—Vertical (65 Volts PP)

Figure 44—Horizontal (65 Volts PP)



WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope



Grid of Sync Output (Pin 4 V112B) (6SN7)

Figure 45—Vertical (40 Volts PP)

Figure 46—Horizontal (40 Volts PP)

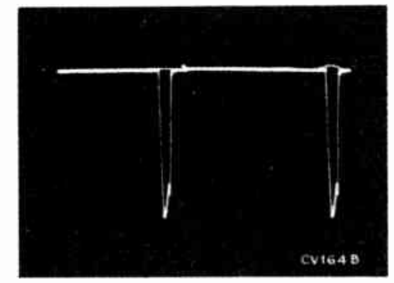
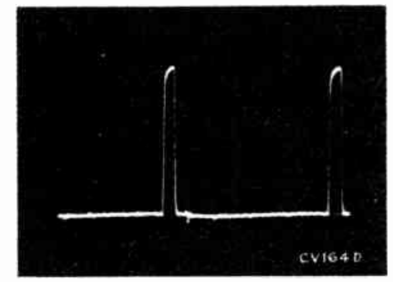


Plate of Sync Output (Pin 5 of V112) (6SN7)

Figure 47—Vertical (47 Volts PP)

Figure 48—Horizontal (47 Volts PP)



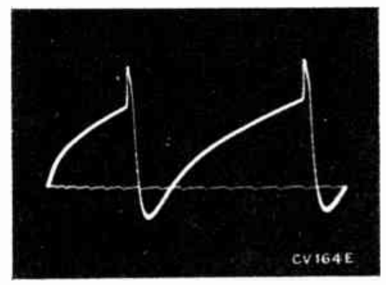
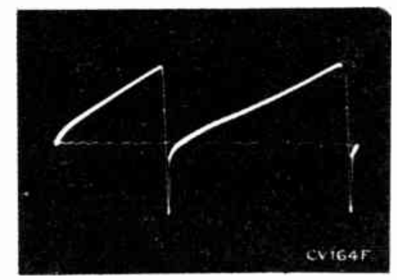


Figure 49—Grid of Vertical Sweep Osc. (Pin 5 of V113) (6J5) (30 Volts PP)

Figure 50—Plate of Vertical Sweep Osc. (Pin 3 of V113) (100 Volts PP)



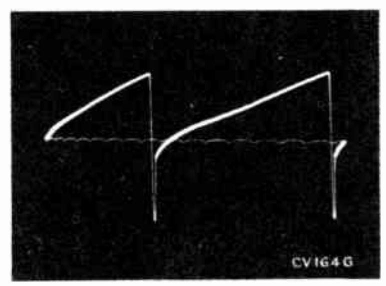
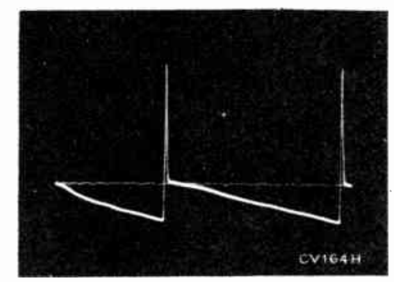
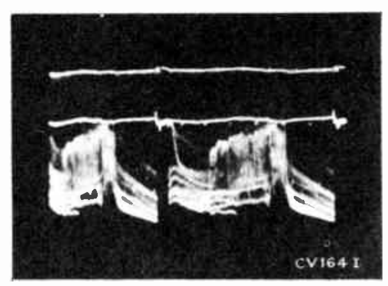


Figure 51—Grid of Vertical Sweep Output (Pin 5 of V114) (6K6) (100 Volts PP)

Figure 52—Plate of Vertical Sweep Output (Pin 3 of V114) (6K6) (715 Volts PP)



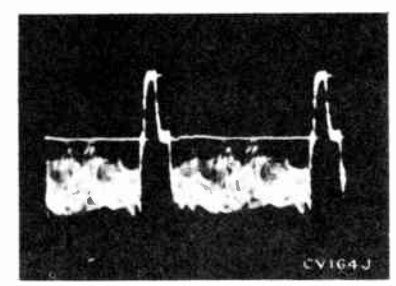


Cathode of Kinescope (Pin 11 of V119) (17QP4)

Voltage depends on picture

Figure 53—Vertical

Figure 54—Horizontal



WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

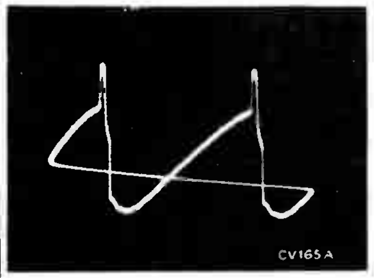
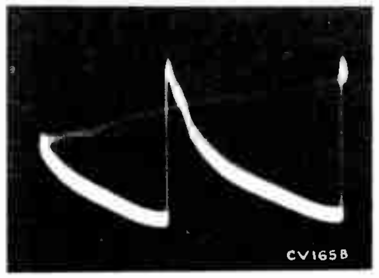


Figure 55—Grid of Horizontal Oscillator Control (Pin 1 of V115) (6SN7GT) (19 Volts PP)

←

Figure 56—Cathode of Horizontal Oscillator Control (Pin 3 of V115) (6SN7GT) (1.2 Volts PP)

→



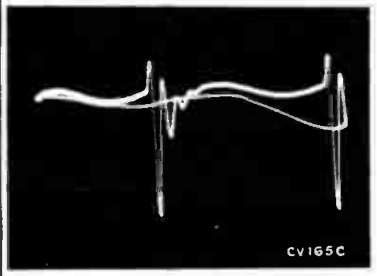
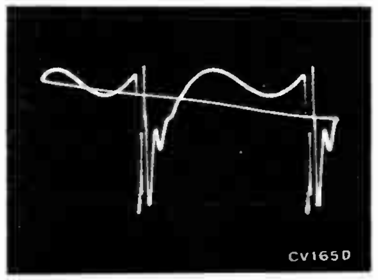


Figure 57—Grid of Horizontal Oscillator (Pin 4 of V115) (6SN7GT) (330 Volts PP)

←

Figure 58—Plate of Horizontal Oscillator (Pin 5 of V115) (6SN7GT) (140 Volts PP)

→



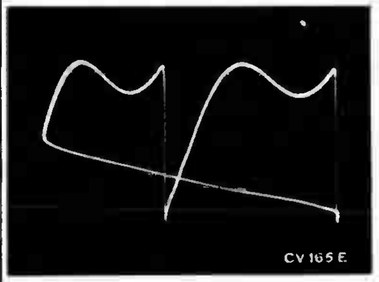
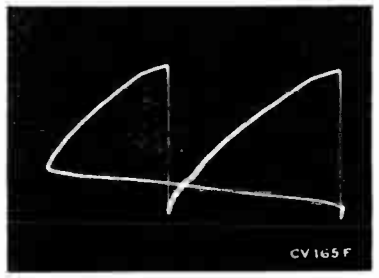


Figure 59—Terminal "C" of T110 (150 Volts PP)

←

Figure 60—Grid of Horizontal Output Tube (Pin 5 of V116) (6BQ6) (90 Volts PP)

→



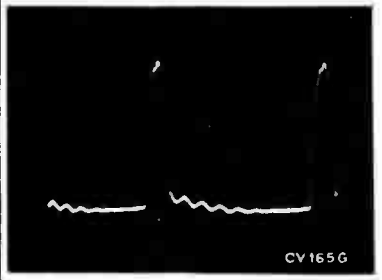
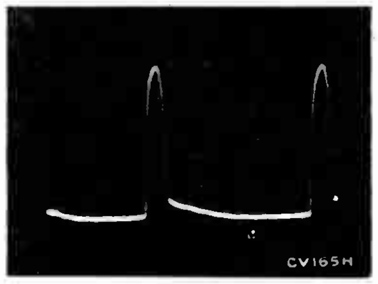


Figure 61—Plate of Horizontal Output (Approx. 4000 Volts PP) (Measured Through a Capacity Voltage Divider Connected from Top Cap of V116 to Ground)

←

Figure 62—Cathode of Damper (Pin 3 of V118) (6W4GT) (2350 Volts PP)

→



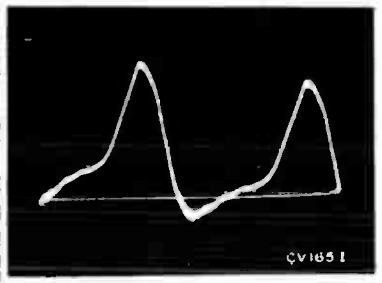
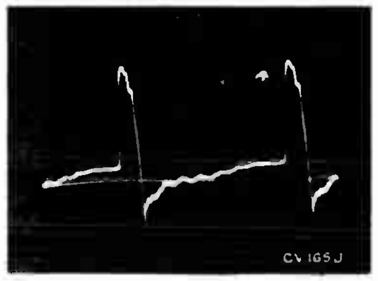


Figure 63—Plate of Damper (Pin 5 of V118) (6W4GT) (160 Volts PP)

←

Figure 64—Plate of AGC Amplifier (Pin 5 of V111) (6AU6) (560 Volts PP)

→



VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V1	6J6	Mixer	15000 Mu. V. Signal	2	153	—	—	7	0	5	*—3 to —5	*Depending on channel
			No Signal	2	135	—	—	7	0	5	*—3 to —5	*Depending on channel
V1	6J6	R-F Oscillator	15000 Mu. V. Signal	1	100	—	—	7	0	6	*—3 to —5	*Depending on channel
			No Signal	1	85	—	—	7	0	6	*—3 to —5	*Depending on channel
V2	6CB6	R-F Amplifier	15000 Mu. V. Signal	5	260	6	150	2	.1	1	—5.8	
			No Signal	5	220	6	100	2	1.0	1	—0.1	
V101	6AU6	1st Sound I-F Amp.	15000 Mu. V. Signal	5	130	6	142	7	0.8	1	0	
			No Signal	5	116	6	129	7	0.6	1	0	
V102	6AU6	2d Sound I-F Amp.	15000 Mu. V. Signal	5	131	6	148	7	0	1	—5.1	
			No Signal	5	110	6	120	7	0	1	*—0.3	*Unreliable measuring point. Voltage depends on noise.
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	0	—	—	1	12	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	0.7	—	—	1	*5.1	—	—	*Unreliable measuring point. Voltage depends on noise.
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	87	—	—	2	0	1	—0.7	At min. volume
			No Signal	7	76	—	—	2	0	1	—0.6	At min. volume
V105	6K6GT	Audio Output	15000 Mu. V. Signal	3	260	4	263	8	19	5	—0.7	At min. volume
			No Signal	3	250	4	251	8	18.5	5	—0.7	At min. volume
V106	6CB6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	246	6	258	2	<0.1	1	—8.6	
			No Signal	5	108	6	108	2	0.7	1	*—0.2	*Unreliable measuring point. Make measurement at T104-B
V107	6CB6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	242	6	255	2	<0.1	1	—8.6	
			No Signal	5	108	6	108	2	0.5	1	—0.2	
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	133	6	172	2	2.1	1	0	
			No Signal	5	115	6	162	2	1.9	1	0	
V109A	12AU7	Picture 2d Det.	15000 Mu. V. Signal	1	—8.4	—	—	3	0	2	—1.3	
			No Signal	1	—1.8	—	—	3	0	2	—0.6	
V109B	12AU7	Vert. Sync Separator	15000 Mu. V. Signal	6	71	—	—	8	0	7	—40	
			No Signal	6	*50 to 100	—	—	8	0	7	*—15	*Unreliable, depends on noise

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V110	6AG7 (6AC7, 6CL6)	Video Amplifier	15000 Mu. V. Signal	6	130	8	149	1	0.2	4	−1.3	AGC control set for normal operation
*	Refer to schematic for pin connections		No Signal	6	110	8	130	1	0.5	4	−0.6	*Refer to Fig. 67 for socket connections
V111	6AU6	AGC Amplifier	15000 Mu. V. Signal	5	−40	6	250	7	153	1	151	
			No Signal	5	+2.3	6	258	7	135	1	105	
V112A	6SN7GT	Hor. Sync Separator	15000 Mu. V. Signal	2	263	—	—	3	190	1	130	
			No Signal	2	258	—	—	3	138	1	110	
V112B	6SN7GT	Sync Output	15000 Mu. V. Signal	5	58	—	—	6	0	4	−2.1	
			No Signal	5	48	—	—	6	0	4	* +0.6	*Depends on noise
V113	6J5	Vertical Oscillator	15000 Mu. V. Signal	3	70	—	—	8	0	5	−15	*Depends on setting of Vert. hold control
			No Signal	3	68	—	—	8	0	5	−14	Voltages shown are synced pix adjustment
V114	6K6GT	Vertical Output	15000 Mu. V. Signal	3	265	4	270	8	30	5	−5	
			No Signal	3	253	4	260	8	28	5	−5	
V115	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	165	—	—	3	+1.5	1	−21	
			No Signal	2	160	—	—	3	−10	1	−24	
V115	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	185	—	—	6	0	4	−80	
			No Signal	5	170	—	—	6	0	4	−88	
V116	6BQ6GT	Horizontal Output	15000 Mu. V. Signal	Cap	*	4	180	8	21.2	5	−13	*High Voltage Pulse Present
			No Signal	Cap	*	4	170	8	21.0	5	−13	*High Voltage Pulse Present
V117	1B3GT 8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	14,000	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	13,600	—	—	*High Voltage Pulse Present
V118	6W4GT	Damper	15000 Mu. V. Signal	5	270	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	260	—	—	3	*	—	—	*High Voltage Pulse Present
V119	21AP4	Kinescope	15000 Mu. V. Signal	Cap	14,000	10	400	11	170	2	120	At average Brightness
			No Signal	Cap	13,600	10	385	11	150	2	115	At average Brightness
V120 V121	5U4G 5Y3GT	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	285	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	275	—	—	

R-F UNIT WIRING DIAGRAM

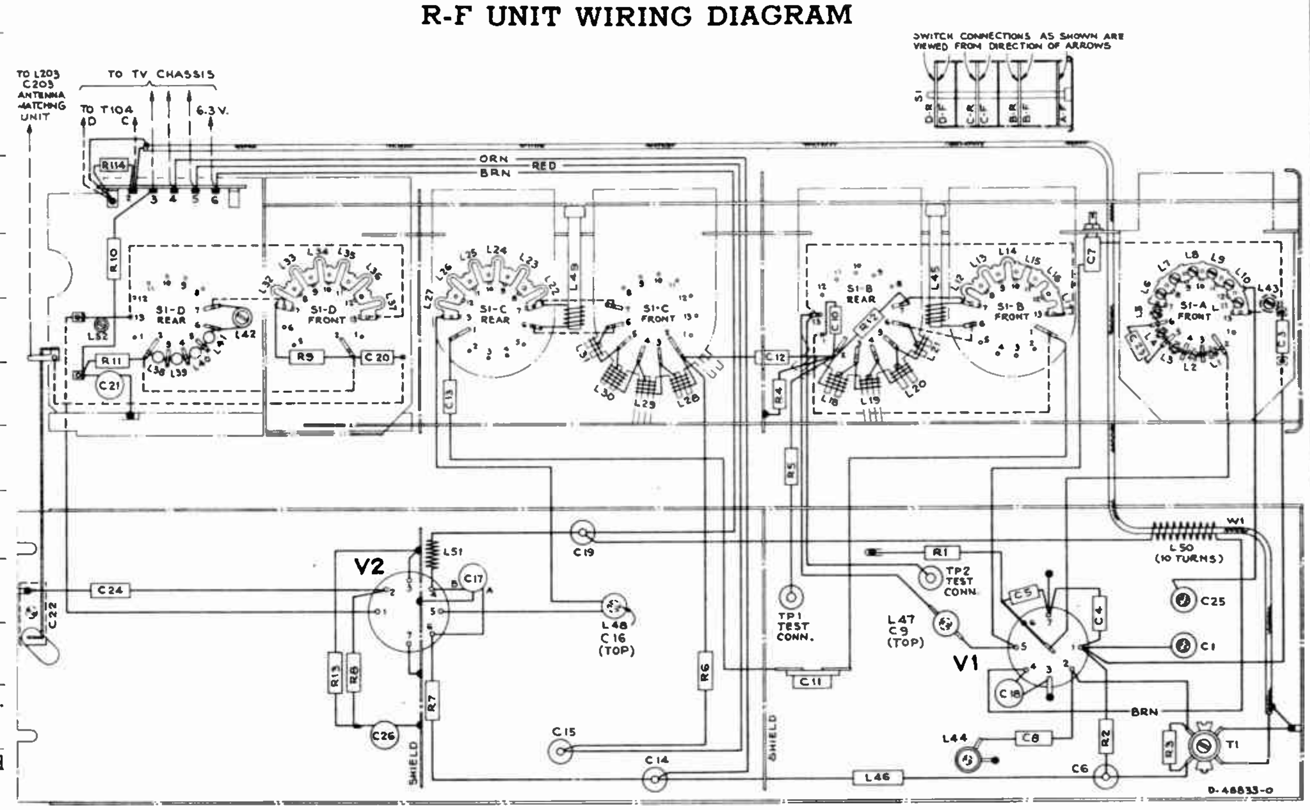


Figure 65—KRK-8D R-F Unit Wiring Diagram

CRITICAL LEAD DRESS:

1. Keep all wiring in the pix i-f, sound i-f and video circuits as short as possible.
2. Keep the leads on C118, C120, C122, C124, C126, R114, R121 and R123 as short and direct as possible.
3. Do not run any leads under C115 trimmer capacitor.
4. Dress C118 vertically parallel to terminals A and B of T104. Dress C135 parallel to terminals A and B of T104 close to the chassis.
5. Keep C127 away from chassis with no more than 1/4 inch leads at each end.
6. Dress the lead from T105(C) to the terminal board, close to the chassis.
7. Keep all filament leads dressed close to the chassis.
8. Ground filaments of V106, V107 and V108 independently of tube shields (pin 8). Use ground lances provided near pins of each socket.
9. Dress lead from pin 5 [illegible] to the chassis.
10. Keep le[illegible]
11. Dress L102, L104, L105, L114, C130, R131, R133, R135, R139 and C132 away from the chassis.
12. Do not tape kinescope cathode lead in with other kinescope leads.
13. Do not change the bus wire connections to pin 2 of V101 and V102. Sleeving is used to insure length and to prevent shorting.
14. Keep leads on C136 short and direct. Dress the lead from C136 to pin 5 of V111 as shown in wiring diagram.
15. Do not dress C170 in such a position that adjustment of T110 is inaccessible.
16. Keep the leads on R201 as short and direct as possible.
17. Dress the lead from pin 3 of V113 to C153 as shown in the wiring diagram.
18. Mount C183 directly on the terminal board provided keeping it as far away from T109 as possible.
19. Dress all leads in the high voltage compartment away from each other and away from the high voltage transformer.

CHASSIS WIRING DIAGRAM

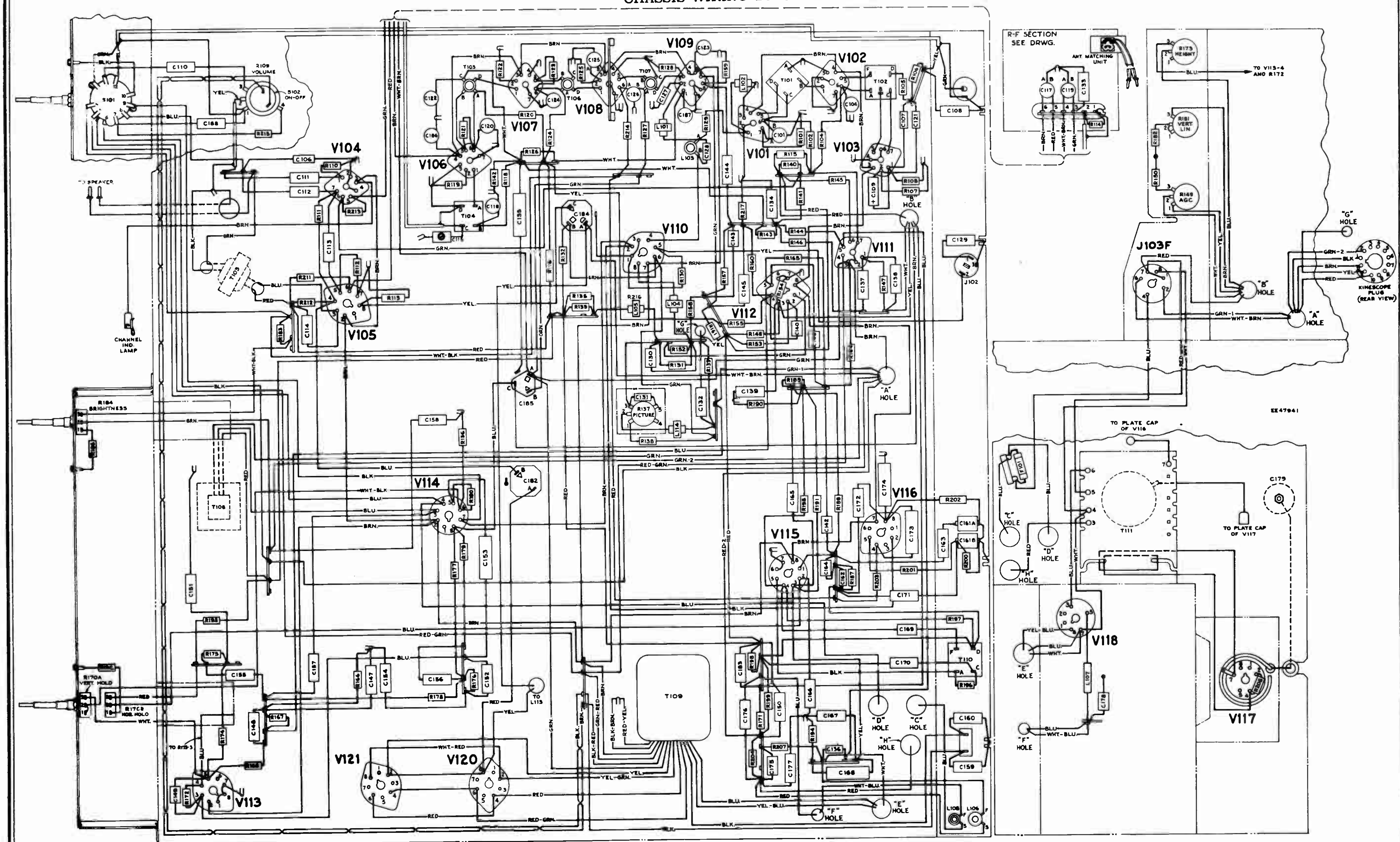
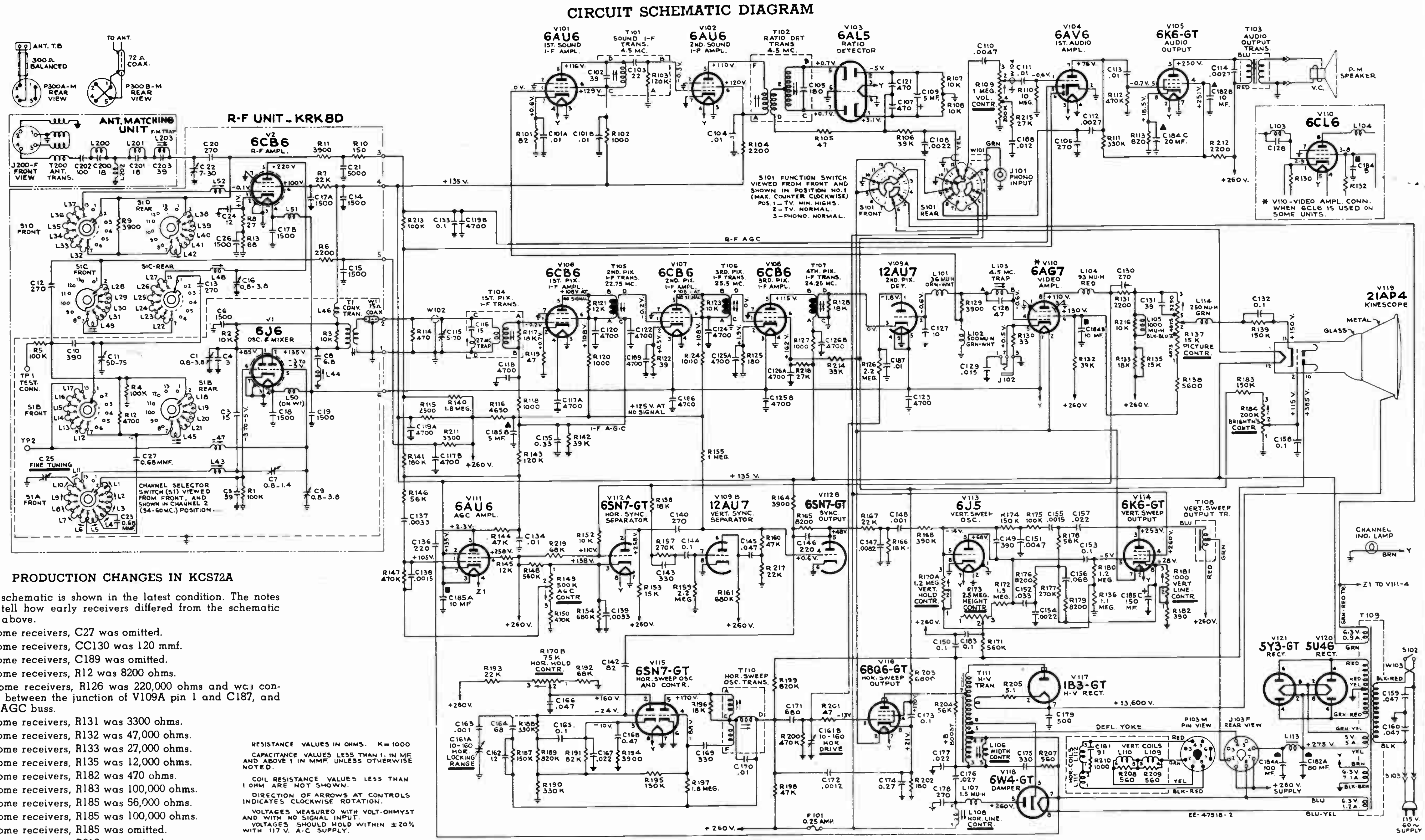


Figure 66—Chassis Wiring Diagram



PRODUCTION CHANGES IN KCS72A

The schematic is shown in the latest condition. The notes below tell how early receivers differed from the schematic shown above.

In some receivers, C27 was omitted.

In some receivers, CC130 was 120 mmf.

In some receivers, C189 was omitted.

In some receivers, R12 was 8200 ohms.

In some receivers, R126 was 220,000 ohms and was connected between the junction of V109A pin 1 and C187, and the i-f AGC buss.

In some receivers, R131 was 3300 ohms.

In some receivers, R132 was 47,000 ohms.

In some receivers, R133 was 27,000 ohms.

In some receivers, R135 was 12,000 ohms.

In some receivers, R182 was 470 ohms.

In some receivers, R183 was 100,000 ohms.

In some receivers, R185 was 56,000 ohms.

In some receivers, R185 was 100,000 ohms.

In some receivers, R185 was omitted.

In some receivers, R218 was omitted.

In some receivers, R219 was omitted.

In some receivers, V119-10 was connected to the junction of R171 and C183.

In some receivers, V110 used 6AC7 tube.

All resistance values in ohms. K = 1000.
KCS72A-M1 chassis uses 6AG7 video amplifier.
KCS72A-M2 chassis uses 6CL6 video amplifier.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.
Model 21T207G uses glass Kinescope 21EP4.

Directions of arrows at controls indicates clockwise rotation.

All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 67—Chassis KCS72A Circuit Schematic Diagram

STOCK No.	DESCRIPTION
	R-F UNIT ASSEMBLIES
	KRK8D
75188	Board—Terminal board, 5 contact and ground
76845	Bracket—Vertical bracket for holding oscillator tube shield
75201	Cable—75 ohm coax cable (7¼") complete with coil (W1, L50)
76965	Capacitor—Ceramic, variable, for fine tuning—plunger type (C2)
71088	Capacitor—Headed lead, 0.68 mmf. (C27)
76968	Capacitor—Ceramic, 3 mmf. (C4)
75200	Capacitor—Ceramic, 12 mmf. (C24)
45465	Capacitor—Ceramic, 15 mmf. (C3)
75196	Capacitor—Ceramic, 39 mmf. (C5)
75199	Capacitor—Ceramic, 270 mmf. (C12, C13, C20)
75641	Capacitor—Ceramic, 390 mmf. (C10)
75166	Capacitor—Ceramic, 1500 mmf. (C6, C14, C15, C19)
73748	Capacitor—Ceramic, 1500 mmf. (C18, C26)
75089	Capacitor—Ceramic, dual 1500 mmf. (C17A, C17B)
73473	Capacitor—Ceramic, 5000 mmf. (C21)
75172	Capacitor—Tubular, steatite, adjustable, 0.65—1.2 mmf. (C7)
71504	Capacitor—Ceramic, 0.68 mmf. (C23)
75184	Capacitor—Ceramic, adjustable, 0.75—4 mmf., complete with adjusting stud (C1)
75197	Capacitor—Ceramic, 6.8 mmf. (C8)
75189	Capacitor—Adjustable, 7-30 mmf. (C22)
75174	Capacitor—Ceramic, trimmer, 50-75 mmf. (C11)
76143	Clip—Tubular clip for mounting standoff capacitors
73477	Coil—Choke coil (L51)
75202	Coil—Choke coil, .56 muh (L46)
75185	Coil—Converter plate loading coil (L44)
75182	Coil—Trimmer coil (1½ turns) with adjustable inductance core and capacitor stud (screw adjustment) for converter section (C9, L47)
75183	Coil—Trimmer coil (3 turns) with adjustable inductance core and capacitor stud (screw adjustment) for r-f section (L48, C16)
76480	Contact—Test point contact
76966	Core—Adjustable core for fine tuning capacitor
75162	Detent—Detent mechanism and fibre shaft
73453	Form—Coil form for L45, L49
75165	Link—Link assembly for fine tuning
76518	Plate—Front plate and shaft bearing
	Resistor—Fixed, composition:—
503027	27 ohms, ±10%, ½ watt (R8)
503068	68 ohms, ±10%, ½ watt (R13)
504115	150 ohms, ±20%, ½ watt (R10)
503222	2200 ohms, ±10%, ½ watt (R6)
503239	3900 ohms, ±10%, ½ watt (R9, R11)
503247	4700 ohms, ±10%, ½ watt (R12)
502310	10,000 ohms, ±5%, ½ watt (R3)
504310	10,000 ohms, ±20%, ½ watt (R2)
503322	22,000 ohms, ±10%, ½ watt (R7)
504410	100,000 ohms, ±20%, ½ watt (R1, R4, R5)
14343	Retainer—Fine tuning shaft retaining ring
75164	Rod—Actuating plunger rod (fibre) for fine tuning link
71476	Screw—#4-40 x ¼" adjusting screw for L6, L7, L8, L9, L10, L11
75177	Screw—#4-40 x ⅜" adjusting screw for L1, L2, L3, L4, L43
75176	Screw—#4-40 x 7/16" adjusting screw for L5
73640	Screw—#4-40 x 7/16" adjusting screw for L52
74575	Screw—#4-40 x .359" adjusting screw for L42
76519	Shaft—Channel selector shaft and plate
76134	Shaft—Fine tuning shaft and cam
76962	Shield—Oscillator and converter sections shield—snap-on type
76967	Shield—Tube shield for V1, V2
75088	Socket—Tube socket, 7 contact, miniature, ceramic, saddle-mounted
75191	Spacer—Insulating spacer for front plate
75163	Spring—Friction spring (formed) for fine tuning cam
30340	Spring—Hair pin spring for fine tuning link
74578	Spring—Retaining spring for adjusting screws
76961	Spring—Retaining spring for oscillator tube shield
73457	Spring—Return spring for fine tuning control
75180	Stator—Antenna stator complete with rotor, coils, capacitors (C20, C21) and resistors (R9, R10, R11) (S1-4, L32, L33, L34, L35, L36, L37, L38, L39, L40, L41, L42, L52)
77459	Stator—Converter stator complete with rotor, coils, capacitors (C10, C12) and resistors (R4, R5, R12) (S1-2, L12, L13, L14, L15, L16, L17, L18, L19, L20, L21, L45)
76963	Stator—Oscillator section stator complete with rotor, segment, coils, adjusting screws and capacitors C3, C23 (S1-1, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L43)
76964	Stator—R-F amplifier stator complete with rotor, coils, capacitor (C13) and resistor (R6) (S1-3, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L49)
75170	Strip—Coil segment mounting strip—L.H. lower
75171	Strip—Coil segment mounting strip—L.H. upper—less trimmer C7
75169	Strip—Coil segment mounting strip—R.H. center
75446	Stud—Capacitor stud—brass—#4-40 x 3/16" with 3/64" screw driver slot for trimmer coils L47, L48 and capacitor C1 uncoded and coded "ER"
75447	Stud—Capacitor stud—brass—#4-40 x 3/16" with 3/64" screw driver slot for trimmer coils L47, L48 and capacitor C1 coded numerically an "Hi-Q"
75173	Stud—#6-32 x 13/16" adjusting stud for trimmer C7
75181	Transformer—Converter transformer (T1)
75607	Washer—Insulating washer (hex)
75190	Washer—Insulating washer (neoprene) for trimmer C7
	CHASSIS ASSEMBLIES
	KCS72-A
76456	Bracket—Channel indicator lamp bracket
76454	Bracket—Mounting bracket complete with insulator for picture control
71496	Capactor—Adjustable, mica, 5-70 mmf. (C115)
33098	Capacitor—Ceramic, 10 mmf. (C127)
33380	Capacitor—Ceramic, 12 mmf. (C162)
75450	Capacitor—Ceramic, 39 mmf. (C203)
73664	Capacitor—Ceramic, 39 mmf. (C131)
76475	Capacitor—Mica, 68 mmf. (C164)
76474	Capacitor—Mica, 82 mmf. (C142)
75437	Capacitor—Ceramic, 100 mmf. (C202)
76673	Capacitor—Ceramic, 220 mmf. (C136)
75248	Capacitor—Mica, 220 mmf. (C146)
47617	Capacitor—Ceramic, 270 mmf. (C106)
39638	Capacitor—Mica, 270 mmf. (C130)
73091	Capacitor—Mica, 270 mmf. (C140, C178)
76476	Capacitor—Mica, 330 mmf. (C169, C175)
39640	Capacitor—Mica, 330 mmf. (C143)
73094	Capacitor—Mica, 390 mmf. (C149)
39644	Capacitor—Mica, 470 mmf. (C107, C121)
76461	Capacitor—Ceramic, 500 mmf., 20,000 volts (C179)
76990	Capacitor—Ceramic, dual 4700 mmf. (C117A, C117B, C119A, C119B, C125A, C125B, C126A, C126B)
73473	Capacitor—Ceramic, 4700 mmf. (C118, C120, C122, C123, C124, C156, C189)
73960	Capacitor—Ceramic, 10,000 mmf. (C104, C187)
76991	Capacitor—Ceramic, dual 10,000 mmf. (C101A, C101B)
74521	Capacitor—Electrolytic, 5 mfd., 50 volts (C109)
75218	Capacitor—Electrolytic, comprising 1 section of 10 mfd., 350 volts, 1 section of 5 mfd., 350 volts and 1 section of 150 mfd., 50 volts (C185A, C185B, C185C)
75217	Capacitor—Mica trimmer, dual 10-160 mmf. (C161A, C161B)
76987	Capacitor—Electrolytic, comprising 1 section of 80 mfd., 400 volts and 1 section of 10 mfd., 350 volts (C182A, C182B)
76970	Capacitor—Electrolytic, comprising 1 section of 100 mfd., 400 volts, 1 section of 10 mfd., 350 volts and 1 section of 20 mfd., 50 volts (C184A, C184B, C184C)
76479	Capacitor—Tubular, moulded paper, oil impregnated, .00068 mfd., 600 volts (C171)
75643	Capacitor—Tubular, paper, oil impregnated, .001 mfd., 1000 volts (C148, C163)
76995	Capacitor—Tubular, moulded paper, oil impregnated, .0012 mfd., 600 volts (C172)
76508	Capacitor—Tubular, paper, oil impregnated, .0015 mfd., 600 volts (C138)
77123	Capacitor—Tubular, moulded paper, oil impregnated, .0015 mfd., 1000 volts (C155)
73595	Capacitor—Tubular, paper, oil impregnated, .0022 mfd., 600 volts (C108, C154)
73599	Capacitor—Tubular, paper, oil impregnated, .0027 mfd., 600 volts (C112)
73818	Capacitor—Tubular, paper, oil impregnated, .0027 mfd., 1600 volts (C114)
73795	Capacitor—Tubular, paper, oil impregnated, .0033 mfd., 600 volts (C137, C139)
73920	Capacitor—Tubular, paper, oil impregnated, .0047 mfd., 600 volts (C110, C151)
73808	Capacitor—Tubular, paper, oil impregnated, .0082 mfd., 1000 volts (C147)
73561	Capacitor—Tubular, paper, oil impregnated, .01 mfd., 400 volts (C111, C113, C134)
73594	Capacitor—Tubular, moulded paper, oil impregnated, .01 mfd., 600 volts (C170)
74938	Capacitor—Tubular, paper, oil impregnated, .012 mfd., 200 volts (C188)
73797	Capacitor—Tubular, paper, oil impregnated, .015 mfd., 600 volts (C129)
73562	Capacitor—Tubular, paper, oil impregnated, .022 mfd., 400 volts (C167)
73798	Capacitor—Tubular, paper, oil impregnated, .022 mfd., 600 volts (C157)
73610	Capacitor—Tubular, paper, oil impregnated, .022 mfd., 1000 volts (C177)
73811	Capacitor—Tubular, paper, oil impregnated, .027 mfd., 1000 volts (C176)
73596	Capacitor—Tubular, paper, oil impregnated, .033 mfd., 1000 volts (C152)
73553	Capacitor—Tubular, paper, oil impregnated, .047 mfd., 400 volts (C145, C166)
75071	Capacitor—Tubular, moulded paper, .047 mfd., 400 volts (C159, C160)
73792	Capacitor—Tubular, paper, oil impregnated, .068 mfd., 400 volts (C156)
73784	Capacitor—Tubular, paper, oil impregnated, 0.1 mfd., 200 volts (C132, C133)
73551	Capacitor—Tubular, paper, oil impregnated, 0.1 mfd., 400 volts (C144, C150, C158, C165, C183)
73557	Capacitor—Tubular, paper, oil impregnated, 0.1 mfd., 600 volts (C153, C173)
73788	Capacitor—Tubular, paper, oil impregnated, 0.27 mfd., 200 volts (C174)
76994	Capacitor—Tubular, paper, oil impregnated, 0.33 mfd., 200 volts (C135)
73787	Capacitor—Tubular, paper, oil impregnated, 0.47 mfd., 200 volts (C168)
76498	Choke—Filter choke (L113)
73591	Coil—Antenna matching coil (2 req'd) (Part of T200)
75241	Coil—Antenna shunt coil (L202)
76442	Coil—Horizontal linearity coil complete with adjustable core (L108)
76441	Coil—Width coil complete with adjustable core (L106)
76640	Coil—Peaking coil (1.5 muh) (L107)
76011	Coil—Peaking coil (36 muh) (L101)
71527	Coil—Peaking coil (93 muh) (L104)
71526	Coil—Peaking coil (250 muh) (L114)
75252	Coil—Peaking coil (500 muh) (L102)
77124	Coil—Peaking coil (1000 muh) (L105, R216)
76457	Connector—2nd. anode lead connector complete—mounted on hi-voltage capacitor
77008	Connector—Anode connector complete with terminal and contact
77677	Connector—Anode connector for Kinescope (Model 21T207G only)
35787	Connector—Phono input connector (J101)
75474	Connector—Single contact male connector for speaker cable
75482	Connector—Video connector (J102)
74594	Connector—2 contact male connector for power cord
38853	Connector—4 contact female connector for antenna transformer (J200)
50367	Connector—6 contact female connector for yoke lead (J103)
75542	Connector—6 contact male connector—part of deflection yoke (P103)
76975	Control—AGC control (R149)
76444	Control—Brightness control (R184)
76448	Control—Height control (R173)
76974	Control—Horizontal and vertical hold control (R170A, R170B)
76445	Control—Picture control (R137)
76976	Control—Vertical linearity control (R181)
77010	Control—Volume control and power switch (R109, S102)
71498	Core—Adjustable core and stud for FM trap 75449
76986	Cover—Back cover for hi-voltage compartment
76985	Cover—Side cover for hi-voltage compartment
74956	Cushion—Rubber cushion for deflection yoke hood
74839	Fastener—Push fastener for mounting tube socket 76453
73600	Fuse—0.25 amp., 250 volts
76459	Grommet—Rubber grommet for 2nd. anode lead exit
37396	Grommet—Rubber grommet for mounting tube socket 76453
77035	Hood—Deflection yoke hood less rubber cushions
76830	Hood—Deflection yoke hood, less rubber cushions (21T207G only)
76480	Lead—Anode lead complete with eyelet
76168	Magnet—Focus magnet
76141	Magnet—Ion trap magnet (P.M. type)
76633	Magnet—Pin cushion correction magnet complete with support arm (Model 21T207G only)
76464	Plate—Hi-voltage plate (bakelite) assembly complete with tube socket and corona ring
76796	Resistor—Wire wound, 5.1 ohms, ⅓ watt (R205)
76639	Resistor—Wire wound, 180 ohms, 2 watts (R202)
76988	Resistor—Wire wound, 820 ohms, 1 watt (R113)
76469	Resistor—Wire wound, 2500 ohms, 10 watts (R115)
76989	Resistor—Wire wound, 4650 ohms, 7 watts (R116)
	Resistor—Fixed, composition:—
503033	33 ohms, ±10%, ½ watt (R130)
502039	39 ohms, ±5%, ½ watt (R122)
502047	47 ohms, ±5%, ½ watt (R119)
503047	47 ohms, ±10%, ½ watt (R105)
504047	47 ohms, ±20%, ½ watt (R201)
503082	82 ohms, ±10%, ½ watt (R101)
502118	180 ohms, ±5%, ½ watt (R125)
503139	390 ohms, ±10%, ½ watt (R182)

STOCK No.	DESCRIPTION
503147	470 ohms, ±10%, ½ watt (R114)
513156	560 ohms, ±10%, 1 watt (R207)
504210	1000 ohms, ±20%, ½ watt (R102, R118, R120, R124, R127)
503222	2200 ohms, ±10%, ½ watt (R104, R212)
523222	2200 ohms, ±10%, 2 watts (R131)
504233	3300 ohms, ±20%, ½ watt (R211)
502239	3900 ohms, ±5%, ½ watt (R129, R164)
503239	3900 ohms, ±10%, ½ watt (R194)
503256	5600 ohms, ±10%, ½ watt (R138)
523268	6800 ohms, ±10%, 2 watts (R203)
503282	8200 ohms, ±10%, ½ watt (R176, R179)
513282	8200 ohms, ±10%, 1 watt (R165)
502310	10,000 ohms, ±5%, ½ watt (R107, R108, R123)
504310	10,000 ohms, ±20%, ½ watt (R152)
502312	12,000 ohms, ±5%, ½ watt (R121)
503312	12,000 ohms, ±10%, ½ watt (R145)
523315	15,000 ohms, ±10%, 2 watts (R135)
503315	15,000 ohms, ±10%, ½ watt (R153)
503318	18,000 ohms, ±10%, ½ watt (R128, R158, R166, R196)
523318	18,000 ohms, ±10%, 2 watts (R133)
503322	22,000 ohms, ±10%, ½ watt (R167, R217)
513322	22,000 ohms, ±10%, 1 watt (R193)
503327	27,000 ohms, ±10%, ½ watt (R215)
513327	27,000 ohms, ±10%, 1 watt (R218)
513333	33,000 ohms, ±10%, 1 watt (R214)
503339	39,000 ohms, ±10%, ½ watt (R106, R142)
513339	39,000 ohms, ±10%, 1 watt (R132)
503347	47,000 ohms, ±10%, ½ watt (R160)
504347	47,000 ohms, ±20%, ½ watt (R144)
512347	47,000 ohms, ±5%, 1 watt (R198)
503356	56,000 ohms, ±10%, ½ watt (R146, R204)
512356	56,000 ohms, ±5%, 1 watt (R178)
503368	68,000 ohms, ±10%, ½ watt (R219)
513068	68,000 ohms, ±10%, 1 watt (R192)
513382	82,000 ohms, ±10%, 1 watt (R191)
504410	100,000 ohms, ±20%, ½ watt (R213)
513410	100,000 ohms, ±10%, 1 watt (R175)
530180	120,000 ohms, ±5%, ½ watt (R143)
503415	150,000 ohms, ±10%, ½ watt (R174, R183, R187)
504415	150,000 ohms, ±20%, ½ watt (R139)
512415	150,000 ohms, ±5%, 1 watt (R195)
502418	180,000 ohms, ±5%, ½ watt (R141)
502427	270,000 ohms, ±5%, ½ watt (R177)
503427	270,000 ohms, ±10%, ½ watt (R157)
503433	330,000 ohms, ±10%, ½ watt (R111, R188)
512433	330,000 ohms, ±5%, 1 watt (R190)
503439	390,000 ohms, ±10%, ½ watt (R168)
503447	470,000 ohms, ±10%, ½ watt (R150, R200)
504447	470,000 ohms, ±20%, ½ watt (R112, R147)
503456	560,000 ohms, ±10%, ½ watt (R148, R171)
503468	680,000 ohms, ±10%, ½ watt (R154, R161)
503482	820,000 ohms, ±10%, ½ watt (R189, R199)
503510	1 megohm, ±10%, ½ watt (R155)
502511	1.1 megohm, ±5%, ½ watt (R136)
503512	1.2 megohm, ±10%, ½ watt (R180)
503515	1.5 megohm, ±10%, ½ watt (R172)
11769	1.8 megohm, ±5%, ½ watt (R140)
39063	1.8 megohm, ±5%, 1 watt (R197)
503522	2.2 megohm, ±10%, ½ watt (R126, R159)
504610	10 megohm, ±20%, ½ watt (R110)
71456	Screw—#8-32 x 7/16" wing screw to mount deflection yoke

STOCK No.	DESCRIPTION
76487	Shaft—Connecting shaft (nylon) for picture and brightness controls
73584	Shield—Tube shield for V101, V102, V103, V108
76972	Shield—Tube shield for V109
75718	Socket—Channel indicator lamp socket and leads
74834	Socket—Kinescope socket
31251	Socket—Tube socket, octal, wafer for V105, V110, V112, V113, V116, V120, V121 (KCS72A2 uses 6AC7 for V110)
76453	Socket—Tube socket, octal, moulded, saddle mounted for V110 for KCS72A1M1 (KCS72A1M1 uses 6AG7 for V110)
71508	Socket—Tube socket, 6 pin, moulded—for V117
50367	Socket—Tube socket, 6 pin, moulded, saddle mounted for V118
73117	Socket—Tube socket, 7 pin, wafer miniature for V101, V102, V103, V104, V106, V107, V108, V111
50367	Socket—Tube socket, 8 pin, moulded saddle-mounted for V114
72627	Socket—Tube socket, 8 pin, steatite saddle mounted for V115
76971	Socket—Tube socket, 9 pin, wafer miniature for V109
76636	Stud—Adjusting stud complete with guard for focus magnet
77011	Switch—Tone control and phono switch less volume control and power switch (S101)
76463	Terminal—Screw type grounding terminal
76977	Transformer—Antenna matching transformer complete (T200, C200, C201, C202, C203, L200, L201, L202, L203, J200)
76795	Transformer—Hi-voltage transformer (T111)
76440	Transformer—Horizontal oscillator transformer complete with adjustable cores (T110)
76997	Transformer—Output transformer (T103)
76984	Transformer—Power transformer, 115 volts 60 cycle (T109)
77112	Transformer—Ratio detector transformer (T102, C105)
76981	Transformer—Sound i-f transformer complete with adjustable core (T101, C102, C103, R103)
76978	Transformer—Vertical output transformer (T108)
76979	Transformer—First pix, i-f transformer complete with adjustable cores (T104, C116, R117)
76980	Transformer—Second, third or fourth pix i-f transformer complete with adjustable core (T105, T106, T107)
75449	Trap—FM trap complete with adjustable core and stud (L203, C203)
75242	Trap—i-f trap (L200, L201, C200, C201)
76983	Trap—4.5 MC trap (L103, C128)
76616	Yoke—Deflection yoke complete with 6 contact male connector (L109, L110, L111, L112, C181, P103, R208, R209, R210)
	SPEAKER ASSEMBLIES
	971490-3W, RL-105-E6, RMA-274 (For Models 21T208, 21T217, 21T229)
75024	Cone—Cone and voice coil (3.2 ohms)
75022	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)
	92569-12W, RL-111-A1, RMA-274 (For Models 21T218, 21T227, 21T228)
75682	Cone—Cone and voice coil (3.2 ohms)
76389	Speaker—12" P.M. speaker complete with cone and voice coil (3.2 ohms)
	971636-1, RMA-274 (For Models 21T207, 21T207G)
77000	Speaker—5" P.M. speaker complete with cone and voice coil (3.2 ohms)
	Note:—If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to model number of instrument, number stamped on speaker and full description of part required.

STOCK No.	DESCRIPTION
	MISCELLANEOUS
77211	Back—Back cover complete with power cord (21T208, 21T217, 21T218, 21T227, 21T228, 21T229)
77679	Back—Back cover complete with power cord and terminal board (Model 21T207G)
77568	Back—Back cover complete with power cord and terminal board (Model 21T207)
76184	Board—Antenna terminal board
76629	Bracket—Hanger bracket for deflection yoke hood for Models 21T218, 21T227, 21T228, 21T229
77009	Bracket—Hanger bracket for deflection yoke hood for Models 21T208, 21T217, 21T207
76697	Bracket—Masking panel support bracket (2 req'd)
76599	Bracket—"U" shape bracket for deflection yoke support rod
77680	Bracket—Mounting bracket for kinescope mounting straps (2 req'd) (Model 21T207G)
76699	Bumper—Rubber bumper for kinescope (as req'd)
71892	Catch—Bullet catch and strike for cabinet doors for Models 21T227, 21T228, 21T229
77018	Clip—Ornamental clip (metal) for wood grille bars for Model 21T227
X1756	Cloth—Grille cloth for mahogany instruments for Models 21T207, 21T208, 21T217 or walnut instruments for Model 21T217
X3199	Cloth—Grille cloth for mahogany or walnut instruments for Models 21T218, 21T227, 21T228, 21T229 or maple instruments for Model 21T228
X3222	Cloth—Grille cloth for blonde mahogany instruments for Models 21T218, 21T227 or for oak instruments for Model 21T229
75474	Connector—Single contact male connector for antenna cable
39153	Connector—4 contact male connector for antenna cable
71457	Cord—Power cord and plug
76698	Cushion—Rubber cushion for masking panel support brackets (2 req'd)
76627	Cushion—Rubber cushion for safety glass
76831	Cushion—Rubber cushion for dust sealing the kinescope
77268	Decal—Control function decal for blonde mahogany, maple, or oak instruments
77015	Decal—Control function decal for mahogany or walnut instruments
71984	Decal—"RCA Victor" decal for Models 21T227, 21T228, 21T229
77012	Emblem—"RCA Victor" emblem
75456	Escutcheon—Channel marker escutcheon
72113	Foot—Rubber foot (4 req'd) for Model 21T208
77684	Gasket—Gasket for kinescope mounting straps (Model 21T207G)
76622	Glass—Safety glass
37396	Grommet—Rubber grommet for speaker mounting for Models 21T218, 21T227, 21T228
74308	Hinge—Cabinet door hinge (1 set) for Models 21T227, 21T228, 21T229
76596	Knob—Brightness control or vertical hold control knob—beige—for blonde mahogany or oak instruments (outer)
76595	Knob—Brightness control or vertical hold control knob—maroon—for mahogany or walnut instruments (outer)
76625	Knob—Brightness control or vertical hold control knob—tan—for maple instruments (outer)
76594	Knob—Channel selector knob—beige—for blonde mahogany or oak instruments (inner)
76593	Knob—Channel selector knob—maroon—for mahogany or walnut instruments (inner)
76824	Knob—Channel selector knob—tan—for maple instruments (inner)
76592	Knob—Fine tuning control knob—beige—for blonde mahogany or oak instruments (outer)
76591	Knob—Fine tuning control knob—maroon—for mahogany or walnut instruments (outer)
76623	Knob—Fine tuning control knob—tan—for maple instruments (outer)

STOCK No.	DESCRIPTION
75464	Knob—Picture control, horizontal hold control or volume control and power switch knob—beige—for blonde mahogany or oak instruments (inner)
74963	Knob—Picture control, horizontal hold control or volume control and power switch knob—maroon—for mahogany or walnut instruments (inner)
74001	Knob—Picture control, horizontal hold control or volume control and power switch knob—tan—for maple instruments (inner)
76598	Knob—Tone control and phono switch knob—beige—for blonde mahogany or oak instruments (outer)
76597	Knob—Tone control and phono switch knob—maroon—for mahogany or walnut instruments (outer)
76626	Knob—Tone control and phono switch knob—tan—for maple instruments (outer)
11765	Lamp—Channel marker escutcheon lamp—Mazda #51
76589	Mask—Channel marker escutcheon light mask—beige—for blonde mahogany, maple or oak instruments
75459	Mask—Channel marker escutcheon light mask—burgundy—for mahogany or walnut instruments
77036	Mask—Polystyrene masking panel for kinescope
77567	Mask—Polystyrene masking panel for kinescope (Model 21T207)
77678	Mask—Polystyrene masking panel (Model 21T207G)
76177	Nut—#10-32 special nut for deflection yoke hood support rods (2 req'd)
77013	Nut—Speednut for fastening emblem to cabinet
73634	Nut—Speednut for speaker mounting screws for Models 21T218, 21T227, 21T228, 21T229
76601	Pad—Kinescope edge support pad (4 req'd)
77016	Pull—Cabinet door pull for Model 21T217
77017	Pull—Cabinet door pull for Model 21T227
77021	Pull—Cabinet door pull for Model 21T228
76628	Rod—"L" shape threaded rod to support deflection yoke hood assembly
77681	Rod—"L" shaped threaded rod for deflection yoke hood assembly (Model 21T207G)
76632	Screw—#8 x ⅝" hex head screw (wood) for kinescope support bracket or hanger bracket
74113	Screw—#8-32 x 1" trimit head screw for door pull for Model 21T227
74269	Screw—#8-32 x ¾" trimit head screw for door pull for Model 21T228
77682	Screw—#12 x 2" hex head Type "A" tapping screw (steel) for fastening kinescope mounting straps (Model 21T207G)
76808	Sleeve—Polyethlene sleeve for insulating hi-voltage lead (Model 21T207G)
73643	Spring—Channel marker escutcheon spring clip
76630	Spring—Formed spring for kinescope masking panel (6 req'd)
77006	Spring—Retaining spring for deflection yoke hood support rod nut
30330	Spring—Retaining spring for knobs #74001, 74963 and 75464
72845	Spring—Retaining spring for knobs #76591, 76592, 76623
76837	Spring—Retaining spring for knobs #76593, 76594, 76595, 76596, 76597, 76598, 76624, 76625 and 76626
74936	Spring—Suspension spring for kinescope socket lead
72936	Stop—Cabinet door stop for Models 21T227, 21T228, 21T229
77675	Strap—Top or bottom mounting strap for mounting kinescope (Model 21T207G)
77023	Washer—Cellulose washer—gold—for knobs
77569	Washer—Cellulose washer—maroon—for knobs (Models 21T207 and 21T207G)
75458	Washer—Felt washer—beige—between knob and channel marker escutcheon for blonde or oak instruments
75457	Washer—Felt washer—dark brown—between knob and channel marker escutcheon for mahogany or walnut instruments
75523	Washer—Felt washer—tan—between knob and channel marker escutcheon for maple instruments
75500	Washer—Felt washer for kinescope masking panel or back cover mounting screws

The system of employing an asterisk before the stock number of new items has been discontinued.

APPLY TO YOUR RCA DISTRIBUTOR FOR PRICES OF REPLACEMENT PARTS.

GENERAL DESCRIPTION

The KRK-22A R-F tuner is a 12 channel VHF unit which is independent of the receiver chassis. This unit is a four circuit, wafer switch type with incremental inductance tuning, using two tubes in a driven grounded-grid R-F amplifier circuit and a combination mixer-oscillator circuit. The twelve position switch tunes each of the four circuits to the proper frequency for reception on channels 2 to 13, inclusive. The antenna input circuit uses an elevator transformer with an associated high-pass M-derived filter contained in a common shield housing. An adjustable F-M trap is provided. The output circuit uses a link-coupled I-F transformer with low impedance coaxial cable to the receiver chassis I-F input. The extended-range fine tuning control is concentric with the channel selector detent mechanism.

ELECTRICAL SPECIFICATIONS

TELEVISION R-F FREQUENCY RANGE

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.
Picture I-F Carrier Frequency....................41.25 mc.
Sound I-F Carrier Frequency....................45.75 mc.

ANTENNA INPUT IMPEDANCE

Choice: 300 ohms balanced or 72 ohms unbalanced.

RCA TUBE COMPLEMENT

Tube Used	Function
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer

POWER SUPPLY RATING

Plate Supply............................270 volts, 25 ma.
Filament Supply........................6.3 volts, 0.85 amp.

INSTALLATION INFORMATION

The KRK-22A tuner is now being installed as original equipment in the models listed. Early production models use the KRK-11B tuner.

Model	Name	Chassis No.
17T301	"Wayne"	KCS-78A
17T302	"Glendale"	KCS-78A
17T310	"Hanley"	KCS-78A
21T303	"Kirby"	KCS-82A
21T313 (G)	"Jeffrey"	KCS-82A
21T314 (G)	"Prentiss"	KCS-82A
21T315	"Deauville"	KCS-82A
21T316	"Hilton"	KCS-82A
21T322	"Dobson"	KCS-82A
21T323	"Lexington"	KCS-82A
21T324	"Stockton"	KCS-82A
21D305	"Cabot"	KCS-81A
21D317	"Merritt"	KCS-81A
21D326	"Staunton"	KCS-81A
21D327	"Yorktown"	KCS-81A
21D328	"Kenbridge"	KCS-81A
21D329	"Southbridge"	KCS-81A
21D330	"Clermont"	KCS-81A

The following models had the KRK-22A tuner installed originally. Service Data on these models include information on the KRK-22A tuner.

Model	Name	Chassis No.
21T342	"Lawrence"	KCS-82D
21T344	"Montgomery"	KCS-82D
21D346	"Rutherford"	KCS-81D

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly align this tuner, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:
(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:
(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal calibrated.

Cathode-Ray Oscilloscope.—For alignment purposes, the oscilloscope employed must have excellent low frequency and phase response, and should be capable of passing a 60-cycle square wave without appreciable distortion.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

KRK-22A ANTENNA MATCHING UNIT ALIGNMENT.

The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L53 to the channel selector switch S1D.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R133 and C133B. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R133 and C133B.

Connect an oscilloscope to pin 9 of V110 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L54 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L57 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L53 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L53 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

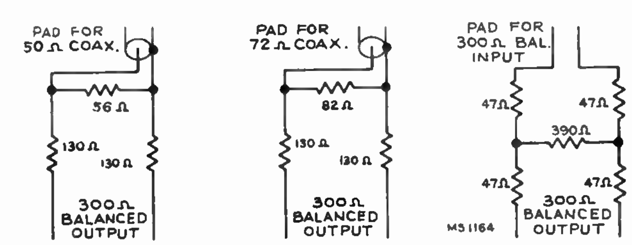


Figure 1—Sweep Attenuator Pads

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 1 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L55 and L56 to obtain the response shown in figure 2. L55 is most effective in locating the position of the shoulder of the curve at 52 mc. and L56 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L53 and S1D. Replace V106.

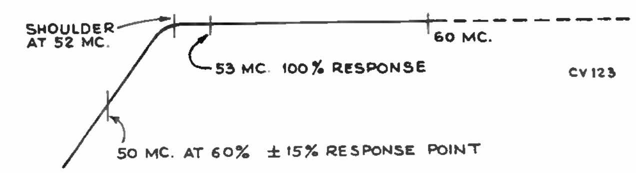


Figure 2—Antenna Matching Unit Response

KRK-22A TUNER ALIGNMENT

A tuner unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset C2 all the way out. Set channel 7 to 13 oscillator slugs one turn from tight. Turn T1 slug all the way out. Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

Turn the receiver channel selector switch to channel 2.

The 42.0 mc. trap is adjusted with zero bias. To insure that the bias will remain constant, take a clip lead and short circuit the AGC terminal of the tuner at the terminal board to ground.

Connect the oscilloscope to the test point TP1 on top of the tuner unit. Set the oscilloscope to maximum gain.

Connect the output of the VHF signal generator to the output of the antenna matching unit at the junction of L53 and C24 at the bottom of the F-M trap L53.

Tune the signal generator to 42.0 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust C19 on top of the tuner, for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to tune C19 into channel 2, thereby reducing sensitivity on channel 2.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce—3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the channel selector switch to channel 8.

Preset C5 to read —3.0 volts at the test point TP1, as read on the "VoltOhmyst". The limits for oscillator injection voltage are 2 volts minimum and not exceeding a maximum of 5.5 volts.

Turn the fine tuning control fully clockwise.

Adjust C3 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner unit through the hole provided for the adjustment of C10. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the tuner oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C3 to obtain an audible beat with the signal generator.

Turn C2 clockwise until the beat note just begins to change, then turn one full turn in the same clockwise direction.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C3, switch to channel 13 and adjust L42 to obtain proper channel 13 oscillator frequency as indicated in the table on page 11. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8, adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C3 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and readjust L42 and back to channel 8 and adjust C3.

Set the T1 core for maximum inductance (core turned counter-clockwise).

Return the fine tuning control to the mechanical center of its range.

Connect the sweep generator through a suitable attenuator, as shown in Figure 1, to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C7, C10, C15 and C20 for approximately correct curve shape, frequency, and band width as shown in Figure 6.

The correct adjustment of C20 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C7 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C20 has been properly adjusted). C10 is the coupling adjustment and hence primarily affects the response band width.

Connect the "VoltOhmyst" to test point TP1. Adjust C5 to read —3.0 volts dc on the "VoltOhmyst" at TP1. Readjust C2, C7, C10 and C15 for proper response. Adjust C20 for maximum gain at midpoint of the curve. Repeat if necessary until the proper response is obtained.

Set the receiver channel switch to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Turn the fine tuning control fully clockwise.

Adjust L42 to obtain an audible beat. Slightly overshoot the adjustment of L42 by turning the slug an additional turn in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Set the sweep generator to channel 13.

From the signal generator, insert channel 13 sound and picture carrier markers, 211.25 mc. and 215.75 mc.

Adjust L43 and L45 for proper response as shown in Figure 6.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the tuner test point TP1.

Check the oscillator injection voltage to be within limits as previously specified. Adjust if necessary to bring within range.

If it was necessary to readjust C5, turn the sweep and signal generators back on and recheck the channel 13 response. Readjust L43 and L45 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C7, C10, C15 and C20 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 13 and check the oscillator injection voltage at TP1 if C7 was adjusted in the recheck of channel 8 response.

If the initial setting of the oscillator injection trimmer was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 13 and repeat the tracking procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Set the fine tuning control to the center of its mechanical range.

Adjust L5 for an audible beat. Adjust L44, L46 and L41 for proper curve shape as shown in Figure 6. Recheck the oscillator injection voltage at TP1, to insure that it is within the limits specified. Readjust C5 if necessary.

If C5 required adjustment, switch the receiver and the signal generator to channel 8. Readjust C7 for correct curve shape and recheck C2 and C3 for proper oscillator frequency.

Check the response of channels 2 through 6 by switching the receiver channel switch, sweep generator and marker generator to each of these channels and observing the response and oscillator injection voltage obtained. See figure 6 for typical response curves. It should be found that all these channels have the proper response with the markers above 80% response.

If the markers fail to fall within this requirement readjust L44, L46 and L41 in order to obtain curves within the proper limits.

Switch the channel selector, signal generator and marker generator through channels 7 to 13 and observe the response curves, referring to Figure 6 for proper wave shape. Check the injection voltage at each channel to be within limits. If necessary readjust C15, C7, or C10 to obtain the proper response.

With the receiver and signal generator on channel 13 adjust L42 for an audible beat with the signal generator.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator slug to obtain the audible beat. It should be possible to adjust the oscillator to obtain the audible beat on each channel. Recheck the oscillator injection voltage on each channel to verify that the voltage is within the specified limits.

NOTE: I.F. Response Curves of receivers using the KRK-22A are the same as those using the KRK-11B tuner. Refer to Service Data for the specific model receiver concerned.

LAYOUT AND SCHEMATIC DIAGRAMS

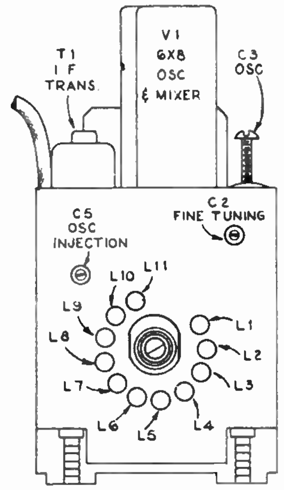


Figure 3—Front View

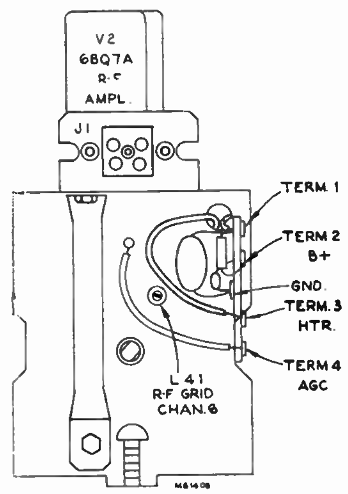


Figure 4—Rear View

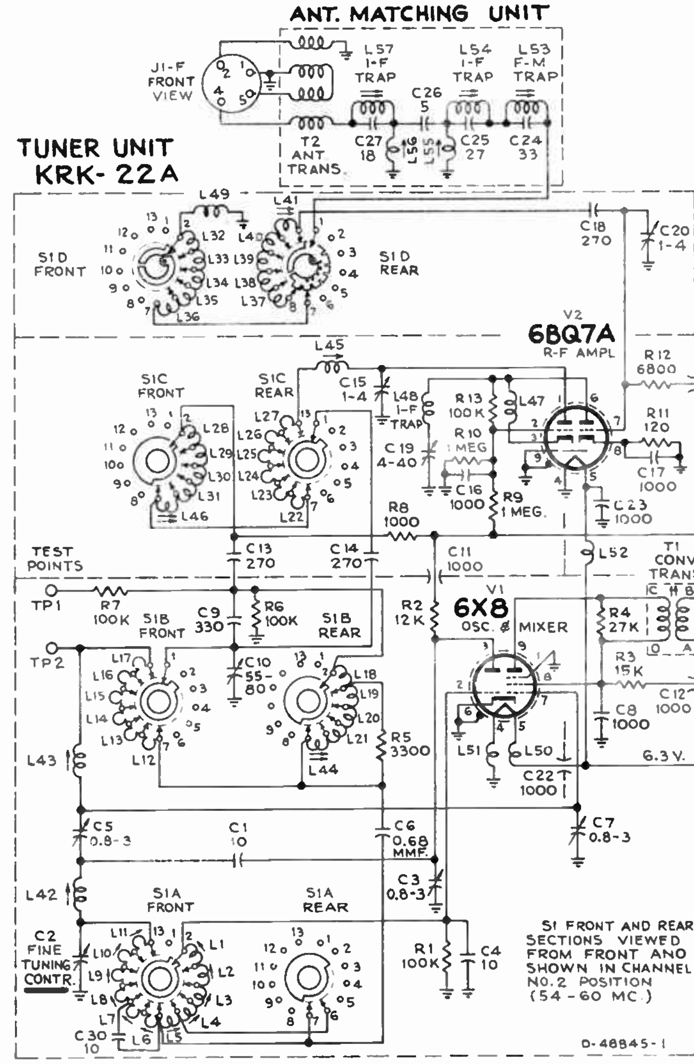


Figure 5—Schematic Diagram

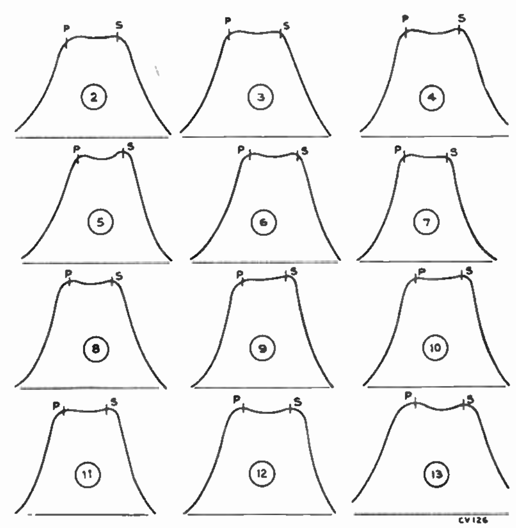


Figure 6—R-F Response

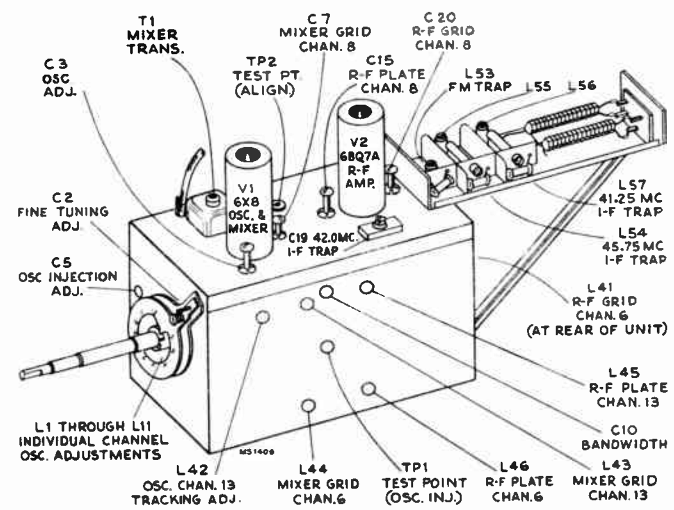


Figure 7—KRK-22A Tuner Adjustments

ILLUSTRATIONS

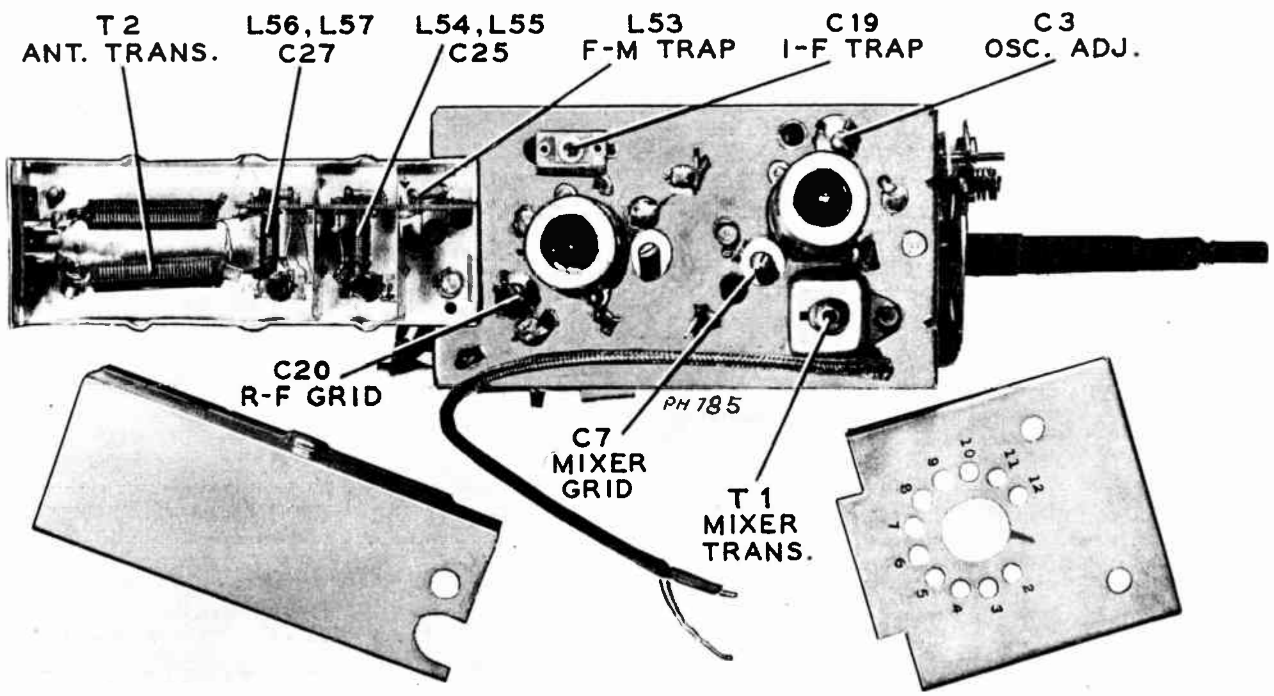


Figure 8—Top View of KRK-22A Tuner

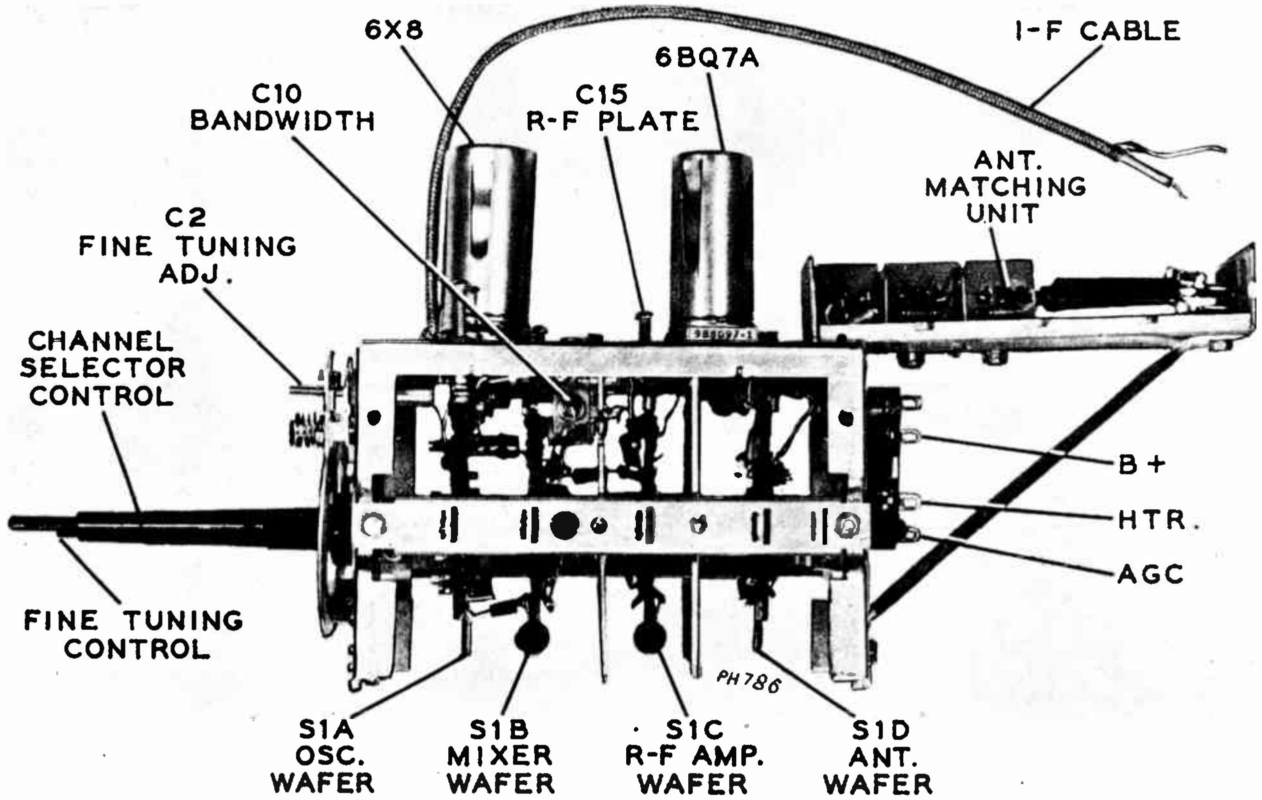


Figure 9—Side View and Wafer Switch Assemblies—KRK-22A Tuner

STOCK No.	DESCRIPTION
	R-F UNIT ASSEMBLIES KRK-22A
76539	Board—Antenna matching transformer terminal board —less coils and capacitors.
76270	Board—Terminal board—4 contact
77850	Bracket—Side bracket for mounting coil and stators
77855	Can—Shield can for convertor transformer
77853	Capacitor—Ceramic, variable, for fine tuning—plunger type (C2)
77913	Capacitor—Tubular, adjustable, steatite, 0.8—3.0 mmf. (C5)
70104	Capacitor—Fixed, headed-lead type, 0.68 mmf., ±20%, 500 volts DC (C6)
77151	Capacitor—Adjustable, steatite, 0.8—3.0 mmf., (C3, C7)
76532	Capacitor—Adjustable, steatite, 1-4 mmf., (C15, C20)
77616	Capacitor—Adjustable, mica, 4-40 mmf. (C19)
93056	Capacitor—Fixed, ceramic, non-insulated, 5 mmf., ±0.5 mmf., 500 volts DC, Temp. coef. =0 (C26)
77865	Capacitor—Fixed, ceramic, non-insulated, 10 mmf., ±1.0 mmf., 500 volts DC, Temp. coef. =0 (C1)
33098	Capacitor—Fixed, ceramic, non-insulated, 10 mmf., ±1.0 mmf., 500 volts DC, Temp. coef. = —750 (C4)
54207	Capacitor—Fixed, ceramic, non-insulated, 18 mmf., ±10%, 500 volts DC, Temp. coef. =0 (C27)
70935	Capacitor—Fixed, ceramic, non-insulated, 27 mmf., ±10%, 500 volts DC, Temp. coef. =0 (C25)
76739	Capacitor—Fixed, ceramic, non-insulated, 33 mmf., ±10%, 500 volts DC, Temp. coef. =0 (C24)
76527	Capacitor—Mica trimmer, 55-80 mmf. (C10)
75199	Capacitor—Fixed, ceramic, insulated, 270 mmf., ±20%, 500 volts DC, High "K" type (C13, C14, C18)
76552	Capacitor—Fixed, ceramic, insulated, 330 mmf., ±10%, 500 volts DC, High "K" type (C9)
77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, —0%, 500 volts DC, High "K" disc (C29)
77084	Capacitor—Ceramic, feed-thru, 1000 mmf. (C11, C12, C21, C22)
77252	Capacitor—Fixed, ceramic, 1000 mmf., +100%, —0%, 500 volts DC, High "K" disc (C8, C16, C17, C23)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, —0%, 500 volts DC, High "K" disc (C28)
77854	Clip—Mounting clip for fine tuning core
73591	Coil—Antenna matching coil (Part of T2)
73874	Coil—Channel #6 mixer coil (L44)
73460	Coil—Channel #6 R-F plate coil (L46)
77915	Coil—Channel #13 oscillator coil (L42)
77919	Coil—Channel #13 mixer coil (L43)
77921	Coil—Channel #13 R-F plate coil (L45)
77206	Coil—Filament choke coil (L52)
76763	Coil—Heater choke coil (L50, L51)
76562	Coil—R-F amplifier coupling coil (L47)
76537	Coil—Shunt coil complete with adjustable core (L55)
76538	Coil—Shunt coil complete with adjustable core (L56)
38853	Connector—4 contact female connector—part of antenna matching transformer (J1)
77860	Connector—Grounding strap connector
77859	Connector—R-F grid switch return connector (L49)
76460	Contact—Test point contact
77852	Core—Adjustable core for fine tuning capacitor
76543	Core—Adjusting core for FM trap
77918	Core—¼-20 x ½" adjusting core for L44, L46
77914	Core—#8-32 x 27/64" adjusting core for L42, L43
77846	Detent—Detent mechanism and fibre shaft
77917	Form—Channel #6 coil form complete with core
77912	Form—Channel #13 coil form complete with core
77861	Guide—Bakelite guide for fine tuning lever
77847	Lever—Fine tuning lever
76728	Nut—Speed nut for capacitor #76532
	Resistors—Fixed, composition:—
503112	120 ohms, ±10%, ½ watt (R11)
503147	470 ohms, ±10%, ½ watt (R14)
503210	1000 ohms, ±10%, ½ watt (R8)
503233	3300 ohms, ±10%, ½ watt (R5)
503268	6800 ohms, ±10%, ½ watt (R12)
523312	12,000 ohms, ±10%, 2 watts (R2)
523315	15,000 ohms, ±10%, 2 watts (R3)
502327	27,000 ohms, ±5%, ½ watt (R4)
503410	100,000 ohms, ±10%, ½ watt (R1, R6, R7, R13)
503510	1 megohm, ±10%, ½ watt (R9, R10)
14343	Retainer—Fine tuning shaft retainer ring
77849	Retainer—Retainer for fine tuning spring
75176	Screw—#4-40 x 7/16" adjusting screw for L5
76549	Screw—#4-40 x ⅜" adjusting screw for L1, L2, L3, L4
76547	Screw—#4-40 x ¼" adjusting screw for L6, L7, L8, L9, L10, L11
77848	Shaft—Fine tuning shaft and cam
77862	Shield—Front shield
76534	Shield—Tube shield
77851	Shield—"U" shape shield for underside of unit
76336	Socket—Tube socket, 9 pin, miniature, saddle mounted
77856	Spring—Fine tuning core spring Spring—Fine tuning lever spring
77916	Stator—Mixer stator complete with rotor, coils, capacitor and resistors (S2, C6, C9, C13, L12, L13, L14, L15, L16, L17, L18, L19, L20, L21, L43, L44, R5, R6, R7)
77911	Stator—Oscillator stator complete with rotor, coils and trimmer (S1, C5, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L42)
77910	Stator—R-F grid stator complete with rotor and coils (S4, L32, L33, L34, L35, L36, L37, L38, L39, L40, L41)
77920	Stator—R-F plate stator complete with rotor, coils, capacitor and resistor (S3, C14, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L45, L46, R8)
76740	Stud—#6-32 x 1" adjusting stud for adjustable capacitor C5
77858	Transformer—Antenna matching transformer complete (T2, C24, C25, C26, C27, J1, L53, L54, L55, L56, L57)
77857	Transformer—Convertor transformer (T1)
76540	Trap—F-M trap complete with adjustable core (L53)
77628	Trap—I.F. trap (L48)
76542	Trap—I.F. trap (41.25 MC) complete with core (L57)
76541	Trap—I.F. trap (45.75 MC) complete with core (L54)
75190	Washer—Insulating washer (Neoprene) for adjustable capacitor C5

APPLY TO YOUR RCA DISTRIBUTOR FOR PRICES OF REPLACEMENT PARTS

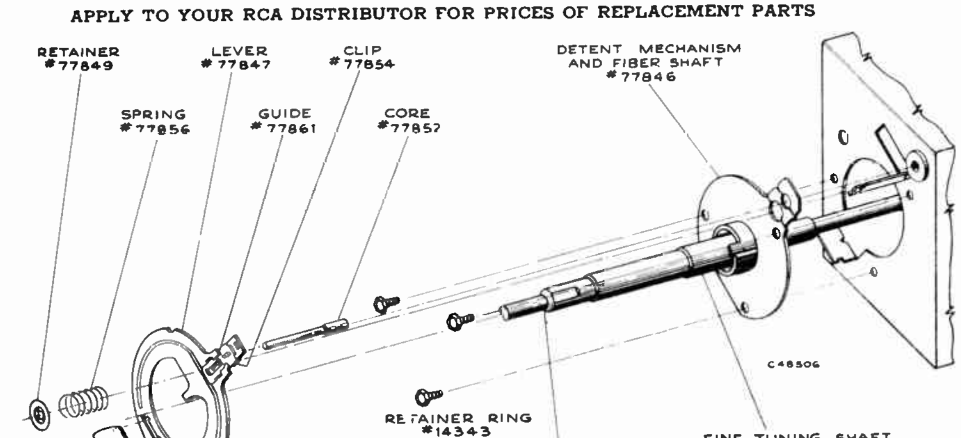


Figure 10—Exploded View of Detent Mechanism

GENERAL DESCRIPTION

UHF-VHF Tuner Kit KRK-25 includes a 16 Channel UHF-VHF tuner, mounting hardware, components for circuit modifications, coaxial link cable, FM trap, knobs for Walnut and Mahogany instruments, and instructions for installation. Knobs for Blond and Oak or Maple and Cherry instruments are available from RCA Victor Distributors (refer to parts list for proper part numbers).

The rotary type tuner is shipped with 12 pretuned VHF inserts covering Channels 2 through 13 inclusive. UHF inserts are available from RCA Victor Distributors.

The tuner employs four tubes plus a crystal rectifier. It is designed to be used with chassis Nos. KCS66, KCS66A, KCS66C, KCS66D—KCS68C, KCS68E, KCS68F, KCS68H —KCS74.

ELECTRICAL SPECIFICATIONS

TELEVISION R-F FREQUENCY RANGE

Any of 70 UHF channels .... 470 mc. to 890 mc.
Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.
(Any desired combination of 16 UHF and/or VHF channels may be used.)
Picture I-F Carrier Frequency .... 45.75 mc.
Sound I-F Carrier Frequency .... 41.25 mc.

WEIGHT AND DIMENSIONS

Net Weight	Shipping Weight	Width Inches	Height Inches	Depth Inches
7½ lbs.	11½ lbs.	5½	8	15

ANTENNA INPUT IMPEDANCE

UHF—Choice: 300 ohms balanced or 72 ohms unbalanced.
VHF—300 ohms balanced.

RCA TUBE COMPLEMENT

Tube Used	Function
(1) RCA 6BQ7A	R-F Amplifier (VHF only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6BQ7A	I-F Amplifier
(4) RCA 6S4	Voltage Control

A 1N82 crystal is used as a mixer.

INSTALLATION INSTRUCTIONS

The UHF-VHF Tuner Kit KRK-25 may be installed in the following receivers:

Model	Name	Chassis No.	Model	Name	Chassis No.
17T150	"Colby"	KCS66C	17T250DE	"Brett"	KCS74
17T151	"Glenside"	KCS66C	17T261DE	"Ainsworth"	KCS74
17T153	"Bristol"	KCS66	21T159	"Selfridge"	KCS68E
17T154	"Whitfield"	KCS66	21T159DE	"Selfridge"	KCS68F
17T155	"Preston"	KCS66	21T165	"Meredith"	KCS68E
17T160	"Hampton"	KCS66	21T166DE	"Farmington"	KCS68
17T162	"Caldwell"	KCS66A	21T174DE	"Bancroft"	KCS68F
17T163	"Crafton"	KCS66C	21T175DE	"Benton"	KCS68F
17T172	"Covington"	KCS66A	21T176	"Suffolk"	KCS68C
17T172K	"Covington"	KCS66D	21T177	"Donley"	KCS68C
17T173	"Calhoun"	KCS66A	21T178	"Rockingham"	KCS68C
17T173K	"Calhoun"	KCS66D	21T178DE	"Rockingham"	KCS68F
17T174	"Kendall"	KCS66A	21T179	"Clarendon"	KCS68C
17T174K	"Kendall"	KCS66D	21T179DE	"Clarendon"	KCS68F
			21T197DE	"Sunderland"	KCS68H

Determine that the receiver is in proper operating condition before proceeding with the tuner installation.

CABINET MODIFICATIONS

Remove the television chassis from the cabinet.

Locate and drill two ½ inch holes in the receiver chassis shelf using the template provided. For location see Fig. 1.

Remove the channel marker escutcheon from the cabinet. On metal cabinets also remove the inside ring and bend ring tabs flush against cabinet. Cut a semi-circular notch 9/16 inches in diameter for indicator lamp clearance as shown in Fig. 2. This notch must be undercut on the inside of wooden cabinets, also refer to Fig. 2.

A portion of the plastic front mask must be removed on 21 inch receivers to allow pilot light bracket clearance, see Fig. 3.

REMOVAL OF PRESENT TUNER

Remove the cable clamp from the side of the tuner.

Color of all leads removed should be noted for reference later.

Disconnect the shielded cable from ground and terminal "A" at T104 (1st. Pix. I-F Grid Transformer).

Disconnect the AGC lead coming from the receiver chassis, at terminal 3 of the tuner.

(On all 17 inch models except 17T250DE and 17T261DE.)

Disconnect the +B lead feeding terminal 4 of the tuner through a 100 ohm resistor, at the receiver chassis terminal board. Connect the 18000 ohm 2 watt resistor supplied with the kit, between this point on the chassis terminal board and a nearby ground lance.

(On Models 17T250DE and 17T261DE only.)

Disconnect the +B lead, feeding terminal 4 of the tuner through R122, at C212B. Connect the 18000 ohm 2 watt resistor supplied with the kit, from the junction of C212B and R188 on the terminal board, to the nearby ground lance.

(On 21 inch Models only.)

Disconnect +B lead feeding the 100 ohm resistor on terminal 4 of the tuner, from the small two-terminal board on the rear of the tuner. Pull the lead inside the receiver chassis and run to unused pin 7 of V123. Connect the 18000 ohm 2 watt resistor supplied with kit, between pin 7 of V123 and a nearby ground lance.

(All Models.)

Disconnect the (265 V.) +B lead at the small two-terminal board on the rear of the tuner.

Disconnect the heater lead at terminal 6 of the tuner.

Disconnect the +B lead, leading from terminal 7 of the tuner, at the receiver chassis terminal board.

Remove the transmission line connector from the tuner input jack.

Unclip the channel indicator lamp and discard the lamp cover.

Remove the tuner and its mounting bracket from the receiver chassis.

INSTALLATION OF THE KRK-25 TUNER

Remove the KRK-25 Tuner Kit from the shipping carton. Make sure that all tubes are in place and firmly seated in their sockets.

Remove the speaker cable clamp from the receiver chassis.

Locate the mounting holes for the tuner by using the templates supplied with the kit. The two large brackets are used with 21 inch receivers and the two small brackets with 17 inch receivers. On receivers using Chassis No. KCS74 these holes are already provided.

An alternate method for locating the mounting holes may be used if desired. This is accomplished by locating the position of the top mounting hole of the front bracket, see Fig. 5. On 17 inch Models this hole is located 4¼ inches from the chassis front and 5/16 inches in from the right side of the chassis. On 21 inch Models the hole is located 2⅜ inches from the chassis front and 5/16 inches in from the right side of the chassis. The remaining holes may be located by assembling the appropriate brackets on the tuner, placing the tuner in position with the top front hole as a guide, and spotting the other holes.

CAUTION: Check the position of components and cables under the chassis before drilling holes to avoid possible damage.

Drill all chassis holes using a #30 drill to fit the self-tapping screws provided.

(On 21 inch Models only.)

A chassis lance partially occupies the location of the hole for the top screw of the rear bracket. Bend the lance flush to the chassis. Drill the hole with a #8 drill and use the machine screw, washers and nut provided in the tuner kit for this mounting hole.

Mount the tuner on the receiver chassis. A flat surface should be used to support the tuner and receiver chassis to assure proper mechanical alignment.

Mount the three-lug terminal board, attached to the tuner leads, under the top front mounting bracket screw with the terminals facing the tuner as in Fig. 5.

Connect the link cable to T2 on the tuner as shown in Fig. 5, grounding the shield on the lance provided.

Connect the other end of the link cable to terminal "A" of T104 (1st Pix. I-F Grid Transformer), grounding the shield to the adjacent chassis lance. The link cable must be shunted with a 1000 ohm resistor and a 5-70 mmf. trimmer capacitor. Add these components from the kit at T104 if they are not part of the original circuit. Remove any existing fixed resistors and capacitors which shunt the link cable in some models.

Connect the AGC feed to the white-green lead from the tuner at the terminal board previously mounted on top front of the receiver chassis. See Fig. 5.

Connect the (265 V.) +B feed to the red lead from the tuner at the terminal board.

Connect the heater feed to the brown lead from the tuner at the terminal board.

(On 21 inch Models only.)

Connect the two 1800 ohm 2 watt resistors, supplied in kit, in series between the center lug of the terminal board holding the red lead from the tuner and the rear terminal (+373 V.) of R243 bleeder resistor mounted on the top right front corner of the receiver chassis. See Fig. 5.

Clip the channel indicator lamp on the tuner lamp bracket and install the lamp cover, supplied in kit, with the aperture facing to the front.

ANTENNA INPUT MODIFICATION

The existing antenna input connector may be used when modified. Cut off the two close-spaced jumpered pins close to the bakelite disc. Insert the connector in the tuner jack and fasten in position using the retainer plate and screw provided in the kit.

An FM trap is supplied with the kit. It consists of a 4⅜ inch length of flat 300 ohm transmission line with a 5-70 mmf. shunt trimmer at one end, the opposite end is shorted. Tape the trap securely to the receiver antenna cable at some convenient location between the receiver terminal board and the tuner as shown in Fig. 5. The exact position of the trap is not important except for convenience of trimmer adjustment.

When a common UHF-VHF antenna is used in fringe areas, the contact springs under the UHF coaxial input jack J1 must be bent upwards, to prevent contact with the buttons on the inserts. Remove the tuner cover. Rotate the channel selector knob until an empty drum compartment lies under the input jack J1. The two springs will now be accessible and may be bent upwards sufficiently to clear the insert buttons.

When coaxial cable is used for the UHF input, attach the ferrule supplied on the coaxial input jack J1, to the coaxial cable. The use of a separate UHF antenna, fed to the coaxial input jack J1, will require removal of the antenna coupling loop from all UHF inserts used. Cut the coupling loop wires at the contact buttons to which they are soldered. Remove the tape securing the loop to the insert. The loop is then removed by carefully rotating until it slips out easily.

KNOB ASSEMBLY

The proper order of knob assembly is shown in Fig. 4.

Place the fine tuning knob on the shaft and rotate until one of the slots engages the projection on the fine tuning cam. Push the knob in until seated firmly against the cam.

Place the channel selector knob on the shaft. Rotate the knob until the knob teeth mesh with the drive gear, at a point where a hole in the knob face is over the channel indicator lamp. Push the knob and retainer in until firmly seated.

Remove tabs from the tab disc corresponding to any UHF channels to be used. Mount the tab disc on the indicator disc. The proper position will be indicated by the keyway on the tab disc meshing with the key on the indicator disc. Remove the required UHF channel number tabs from the sheet supplied and mount on the indicator disc.

Assemble the indicator disc and cover by matching the projection on the disc to the smallest cover recess.

Mount the indicator assembly on the shaft, matching the flats on the assembly spring and the shaft. Push the assembly into position.

REMOVAL AND INSTALLATION OF INSERTS

INSERT REMOVAL.—Remove the tuner cover shield. Rotate the channel selector to the desired channel. The channel insert position may be identified by the stampings on the insert drum which are visible through the channel indicator apertures at each end of the tuner, see Figs. 5 and 13.

Rotate the channel selector two positions counter-clockwise. Three inserts will be clearly visible in the tuner cover opening. The second insert below the contact springs is the one desired.

Remove the insert by the insert buttons, do not grip the adjusting screws. Slide the insert to the rear until the notches on the insert clear the drum tabs. Lift the insert upward and remove.

INSERT INSTALLATION.—Identify the proper insert chamber in the manner previously described.

The insert has two fingers at each end. Place the longer insert fingers in the notch at the rear of the drum and lower the insert into the drum chamber. Push the insert back against the retaining spring until the notches clear the tabs on the sides of the chamber. Carefully press the insert down until seated over its entire length. Release the tension applied against the retaining spring allowing the insert to move forward under the tabs. The short fingers on the insert will enter the slot in the front drum disc when the insert is properly seated.

Replace the tuner cover shield.

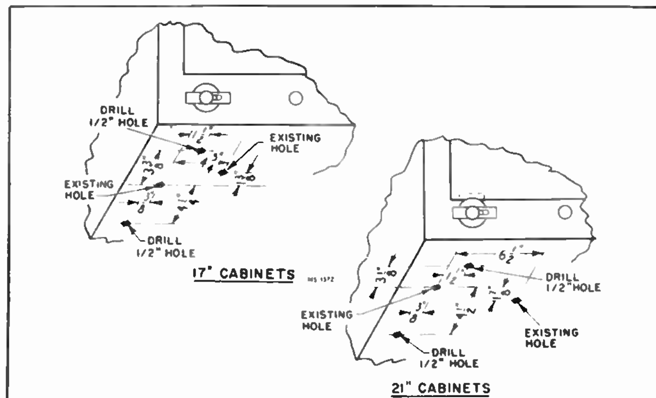


Figure 1—Cabinet Shelf Modification

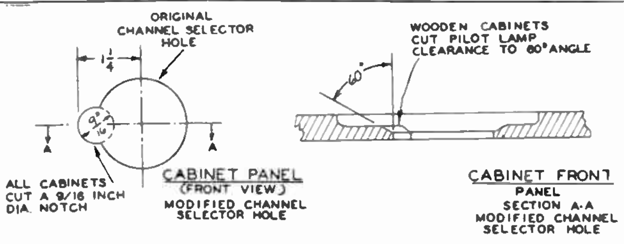


Figure 2—Cabinet Panel Modification

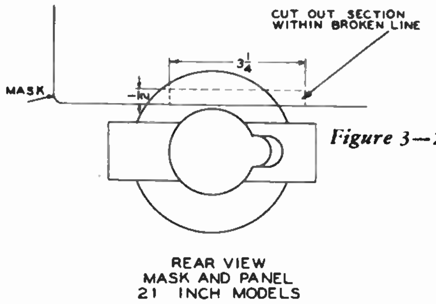


Figure 3—21" Mask Modification

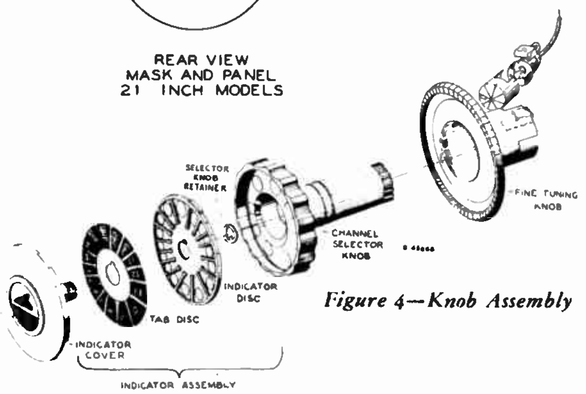


Figure 4—Knob Assembly

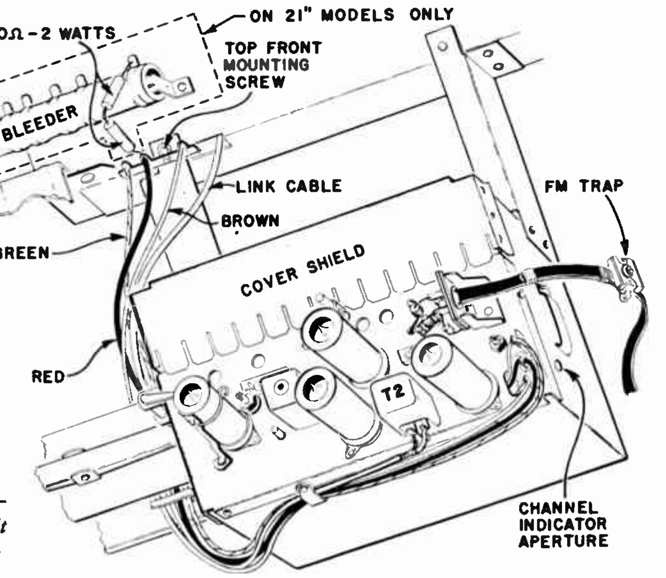


Figure 5—Tuner Kit Assembly

ALIGNMENT PROCEDURE

TUNER ADJUSTMENTS

INSERT ADJUSTMENTS.—Some factory prealigned UHF inserts may require minor adjustment when installed in the tuner. This can be accomplished by using the UHF station as a signal source.

CAUTION SHOULD BE TAKEN TO OBSERVE FOR REFERENCE, THE INITIAL POSITION OF ALL CORES BEFORE MAKING ANY ADJUSTMENTS.

Set the fine tuning control to the center of its range on the channel to be adjusted. Adjust the oscillator core for this channel to obtain maximum audio output without distortion. Adjustment of the triple-tuned circuit; UHF antenna, UHF link coupling and mixer cores may be made, if necessary, to obtain best picture and sound.

DETENT TENSION ADJUSTMENT.—The tension of the detent roller may be adjusted by the detent tension adjustment, see Figs. 6 and 13.

TEST EQUIPMENT.—To properly service the KRK-25 Tuner with receivers using the chassis indicated, it is recommended that the following test equipment be available:

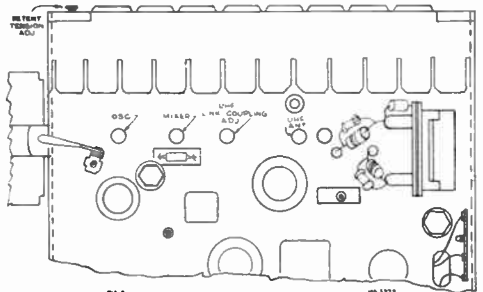


Figure 6—Tuner Adjustments

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy:

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

DC Milliammeter.—A milliammeter with a range of 0-50 milliamperes full scale.

Adapter Socket.—An adapter socket is required to meter the cathode current of the 6S4. Wiring of adapter is shown in Figure 7.

PICTURE I-F TRAP ADJUSTMENT.—Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R143 and R144. On KCS74 chassis, using a 6CL6 video amplifier, connect the "VoltOhmyst" to the junction of R193 and R194.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the positive terminal of one battery to the chassis and the potentiometer arm to the junction of R143 and R144. On KCS74 chassis with 6CL6 video amplifier, connect the battery positive terminal to the chassis and the potentiometer arm to the junction of R193 and R194.

The second bias supply will be used later.

Set the bias to produce approximately -1.0 volt of bias at the junction of R143 and R144 or R193 and R194 as noted above.

Connect the "VoltOhmyst" to pin 4 of V110, the 6AG7 video amplifier or to pin 2 of V110 if 6CL6 used as video amplifier.

Set the VHF signal generator to each of the following frequencies and adjust the corresponding circuit for minimum d-c output at pin 4 of V110 or at pin 2 if 6CL6 is used for V110. Use sufficient signal to produce 1.0 volt of d-c on the meter when the final adjustment is made.

39.25 mc. .... T104 top core
41.25 mc. .... T105 bottom core
47.25 mc. .... T106 bottom core

PICTURE I-F TRANSFORMER ADJUSTMENTS.—Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst". During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 4 of V110 (pin 2 of V110 if 6CL6 is used) with 1.0 volt of i-f bias at the junction of R143 and R144 or R193 and R194 whichever applies.

43.7 mc. T109
45.5 mc. T108
41.8 mc. T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1000 mmf. ceramic capacitor. Shunt R141, R149 (R136, R143 on KCS74 chassis as previously noted) and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to —1.0 volt at the junction of R143 and R144 or R193 and R194 as previously noted.

Connect the oscilloscope to pin 4 of V110 (pin 2 of V110 where 6CL6 is used).

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 8. For final adjustment set the output of the VHF sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

CRYSTAL MIXER PLATE CIRCUIT, T2 AND T104.—To align the crystal mixer plate circuit, T2 and T104, connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Set the Channel selector to Channel 5.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R135 and C132 (R131 and C131 on KCS74 chassis using 6CL6 for V110).

Connect the oscilloscope diode probe to terminal "B" of T105 and ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer across terminals A and B of T104 (C220 in KCS68, C221 in KCS66 or C122 in KCS74) is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust shunt trimmer (C220, C221 or C122) until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 0. Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see Fig. 9.

Disconnect the diode probe, the 180 ohm and the three 330 ohm resistors.

SWEEP ALIGNMENT OF PIX I-F.—Connect the oscilloscope to pin 4 of V110, or pin 2 of V110 where 6CL6 is used.

Adjust the bias potentiometer to obtain —6.0 volts of bias as measured by a "VoltOhmyst" at the junction of R143 and R144, or R193 and R194 as before.

Leave the sweep generator connected to the front terminal of the 1N82 crystal holder with the shortest leads possible and with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T108 and T109 to obtain the response shown in Figure 10. Do not adjust T107 unless absolutely necessary. If T107 is adjusted too low in frequency it will raise the level of the 41.25 mc. sound i-f carrier and may create interference in the picture. It will also cause poor adjacent channel picture rejection. If T107 is tuned too high in the frequency, the level of the 41.25 mc. sound i-f carrier will be too low and may produce noisy sound in weak signal areas.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

TUNER VHF ALIGNMENT.—Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert 6S4 in the adapter.

Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.

Remove the tuner cover shield.

Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front, with a finger.

(NOTE: The contacts are at zero d-c potential.) Should the plate current rise, keep finger on the contacts while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28 milliampere reading on the meter.

Replace the tuner cover shield.

Connect the VHF sweep generator to the antenna terminals.

Connect the VHF signal generator loosely to the antenna terminals.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to Channel 2.

Insert markers of Channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.

Adjust antenna T6, r-f amplifier plate L29 and mixer L30 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in Figure 11. If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Turn the AGC control fully clockwise.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the potentiometer arm of the second bias supply to the junction of R143 and R144 (R193 and R194 on KCS74 chassis with 6CL6 for V110), and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 4 of V110 (pin 2 of V110 where 6CL6 is used). Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to Channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to Channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

TUNER UHF ALIGNMENT.—To align the UHF inserts:

Turn off the adapter switch, removing plate voltage from the oscillator.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10 DB attenuator pad to assure proper alignment.

Connect the UHF signal generator loosely to the antenna terminals.

Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier for desired channel.

Adjust UHF antenna link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band.

The responses are shown in Figure 12. The curve shape will usually vary from Fig. 12 (a) to Fig. 12 (c) going higher in frequency, however any of these responses are acceptable.

Repeat the above steps for all UHF inserts used adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

Connect the potentiometer arm of the second bias supply to the junction of R143 and R144 (R193 and R194 on KCS74 chassis with 6CL6 for V110), and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 4 or V110 (pin 2 of V110 where 6CL6 is used). Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to the lowest UHF channel to be used.

Set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to the test point TP1 in series with a 100 mmf. capacitor and with the shortest leads possible. Insert a 45.75 mc. marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 marker on the response curve as in Fig. 9.

Set the UHF marker gen. to the picture carrier of the channel insert being adjusted and connect to TP1.

Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern.

Adjust mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt D.C. scale.

Set oscillator injection adjustment to read .1 volts on the "VoltOhmyst".

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volts. Adjust as necessary to read .3 volts or less at TP1.

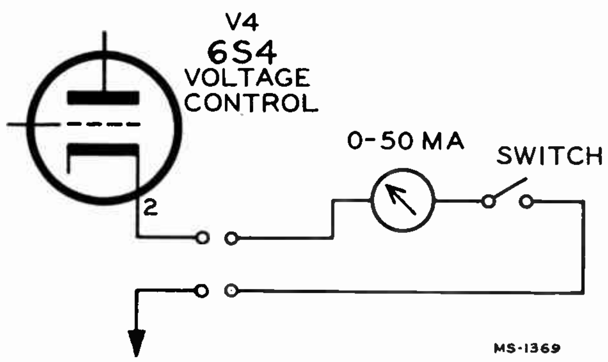


Figure 7—Voltage Control Adapter

STOCK No.	DESCRIPTION
	RF UNIT ASSEMBLIES
	KRK12
77580	Ball—Steel ball (.125" dia.) (12 req'd.)
77579	Ball—Steel ball (.187" dia.)
77575	Bracket—Drive mechanism mounting bracket
77589	Bracket—Lamp bracket
77619	Bracket—VHF input connector and bracket
76845	Bracket—Vertical bracket for oscillator tube shield
77591	Cam—Fine tuning cam
77691	Capacitor—Fixed, headed-lead type, .33 mmf., ±10%, 500 volts DC (C33, C35)
77689	Capacitor—Fixed, headed-lead type, .82 mmf., ±10%, 500 volts DC (C37)
77690	Capacitor—Fixed, headed-lead type, 1.0 mmf., ±10%, 500 volts DC (C39, C40, C42)
77210	Capacitor—Fixed, ceramic, non-insulated, 2 mmf., ±0.25 mmf., 500 volts DC Temp. coeff. =0 (C15)
77667	Capacitor—Fixed, ceramic, insulated, comprising 1 section of 2 mmf., and 1 section of 22 mmf. Temp. coeff. =—750 (C12, C13)
77616	Capacitor—Adjustable, mica, 4-40 mmf. (C16)
77688	Capacitor—Fixed, ceramic, non-insulated, 5 mmf., ±.5 mmf., 500 volts DC Temp. coeff. =0 (C34, C36, C38, C41)
74182	Capacitor—Fixed, ceramic, non-insulated, 6 mmf., ±0.5 mmf., 500 volts DC Temp. coeff. =0 (C5)
77621	Capacitor—Fixed, ceramic, crystal holder, 22 mmf., ±10%, Temp. coeff. —750 (C11)
71924	Capacitor—Fixed, ceramic, non-insulated, 56 mmf., ±10%, 500 volts DC Temp. coeff. —750 (C10)
77625	Capacitor—Fixed, ceramic, 220 mmf., +100%, —0%, 500 volts DC High "K" disc (C18)
77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, —0%, 500 volts DC High "K" disc (C43)
77624	Capacitor—Fixed, ceramic, 680 mmf., +100%, —0%, 500 volts DC High "K" disc (C4)
77084	Capacitor—Ceramic, feed-thru, 1000 mmf. (C21, C23, C25)
77615	Capacitor—Ceramic, stand-off, 1000 mmf. (C3, C19, C24, C26)
77252	Capacitor—Fixed, ceramic, 1000 mmf., +100%, —0%, 500 volts DC High "K" disc (C14, C20, C22, C27)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, —0%, 500 volts DC High "K" disc (C17)
77628	Coil—IF trap (L7)
77634	Coil—IF neutralizing coil (L12)
77629	Coil—Oscillator cathode coil (L9)
77632	Coil—Oscillator heater coil (L15)
77631	Coil—Oscillator heater coil (L14)
77630	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—RF plate coil (L8)
77633	Connector—Formed grounding connector
77623	Connector—UHF antenna input connector (J1)
77612	Contact—Bracket and spring contact assembly for grounding rotor—assembled to base
77618	Contact—Bracket and spring contact assembly for grounding rotor—assembled to oscillator shield
77606	Contact—Contact and support assembly—"L" shape—complete with two (2) contacts
77622	Contact—Contact and support assembly complete with two (2) contacts and UHF antenna input connector
77620	Contact—Contact and support assembly complete with four (4) contacts and holder for crystal rectifier
77607	Contact—Contact and support assembly complete with five (5) contacts—rear of chassis
77614	Control—Oscillator voltage control (R6)
77617	Control—UHF oscillator injection adjustment control
77583	Core—Fine tuning core
77593	Coupling—Indicator shaft coupling
77596	Ferrule—Ferrule for UHF antenna input cable
77588	Gear—Rotor drive gear—nylon
77602	Insert—VHF coil assembly insert for channels 2, 3 or 4 (Includes C40, C41, C42, L29, L30, L31, T6)
77603	Insert—VHF coil assembly insert for channels 5 or 6 (Includes C37, C38, C39, L26, L27, L28, T5)
77604	Insert—VHF coil assembly insert for channels 7, 8, 9 or 10 (Includes C35, C36, L23, L24, L25, T4)
77605	Insert—VHF coil assembly insert for channels 11, 12 or 13 (Includes C33, C34, L20, L21, L22, T3)
77590	Lever—Actuating lever for fine tuning link
77582	Link—Fine tuning link
77581	Plate—Front plate and ball race
77489	Rectifier—Silicon rectifier IN82 (CR1)
	Resistor—Fixed, composition:—
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1000 ohms, ±10%, ½ watt (R13, R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohm, ±10%, ½ watt (R3, R7)
30340	Retainer—Retainer ring for fine tuning actuating lever stud
77592	Ring—Contact ring
77599	Roller—Rotor detent roller and retainer
77574	Rotor—Rotor frame
77594	Screw—#8-32 x ¼" cup point set screw for indicator shaft coupling
77576	Shaft—Channel selector drive shaft complete with two (2) gears
77595	Shaft—Indicator shaft
77611	Shield—Oscillator shield and grounding spring assembly—underside of chassis
77577	Shield—Top shield
76967	Shield—Tube shield for V2
76534	Shield—Tube shield for V1, V3
77613	Sleeve—Insulating sleeve for fine tuning adjustable core
77274	Socket—Tube socket, 7 pin, miniature, saddle mounted, steatite for V2
77608	Socket—Tube socket, 9 pin, miniature, saddle mounted, moulded mica for V1, V3, V4
77578	Spring—Formed spring for holding rotor (on back of unit)
77584	Spring—Fine tuning link adjusting spring
76961	Spring—Retaining spring for oscillator tube shield
77598	Spring—Rotor detent spring and roller complete with mounting bracket
77599	Roller—Rotor detent roller and retainer
77587	Stud—Mounting stud for fine tuning link actuating lever

STOCK No.	DESCRIPTION
77693	Stud—#6-32 x 21/32" adjusting stud for trimmer capacitor C9
77692	Stud—#6-32 x 25/32" adjusting stud for trimmer capacitors C6, C7, C8, C29, C30, C31, C32
77694	Stud—#10-32 x ⅜" adjusting stud for coils L20, L21, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31 and transformers T3, T4, T5, T6
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer complete with adjustable cores (T2, R15)
77626	Trap—I.F. trap (L1, C1, L2, C2)
77585	Washer—"C" washer for drive and indicator shafts (3 req'd.)
77586	Washer—"C" washer for fine tuning link spring
	MISCELLANEOUS
71496	Capacitor—Mica trimmer, 5-70 mmf. (C60)
77755	Clamp—Bakelite clamp for antenna cable
77761	Cover—Cover assembly—browh—complete with spring for channel markers for maple, or natural cherry instruments
77759	Cover—Cover assembly—maroon—complete with spring for channel markers for mahogany, walnut or red cherry instruments
77760	Cover—Cover assembly—sand gray—complete with spring for channel markers for blonde mahogany or oak instruments
77758	Disc—Polystyrene indicator disc—brown—for channel selections for maple or natural cherry instruments
77756	Disc—Polystyrene indicator disc—maroon—for channel selections for mahogany, walnut or red cherry instruments
77757	Disc—Polystyrene indicator disc—sand gray—for channel selections for blonde mahogany or oak instruments
77751	Knob—Channel selection knob—maroon—for mahogany, walnut or red cherry instruments
77752	Knob—Channel selector knob—medium beige—for blonde mahogany or oak instruments
77753	Knob—Channel selector knob—tan—for maple or natural cherry instruments
77750	Knob—Fine tuning control knob
77766	Marker—UHF channel number markers for blonde mahogany or oak instruments
77765	Marker—UHF channel number markers for mahogany, any, walnut or red cherry instruments
77767	Marker—UHF channel number markers for maple, or natural cherry instruments
77763	Marker—VHF channel number markers for blonde mahogany or oak instruments
77762	Marker—VHF channel number markers for mahogany, walnut or red cherry instruments
77764	Marker—VHF channel number markers for maple or natural cherry instruments
	Resistor—Fixed, composition:—
503210	1000 ohms, ±10%, ½ watt
523218	1800 ohms, ±10%, 2 watts
523318	18,000 ohms, ±10%, 2 watts
77754	Shade—Channel marker lamp shade
74734	Spring—Retaining spring for channel markers cover

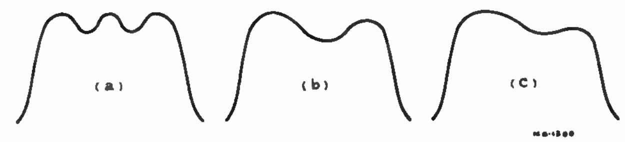


Figure 12—UHF Insert Responses

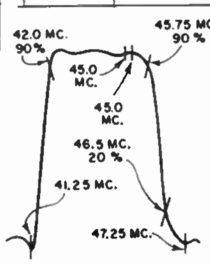


Figure 8—T105 and T106 Response

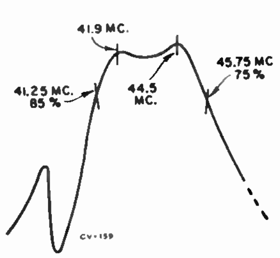


Figure 9—T2 and T104 Response

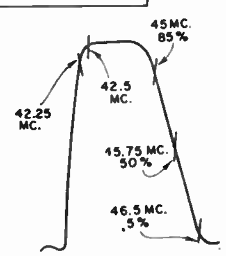


Figure 10—Over-all I-F Response

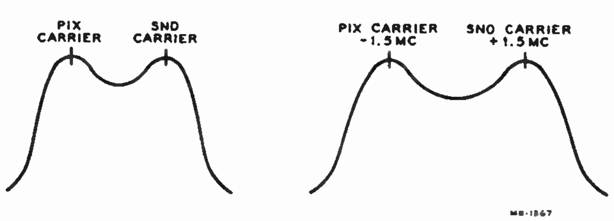


Figure 11—VHF Insert Responses

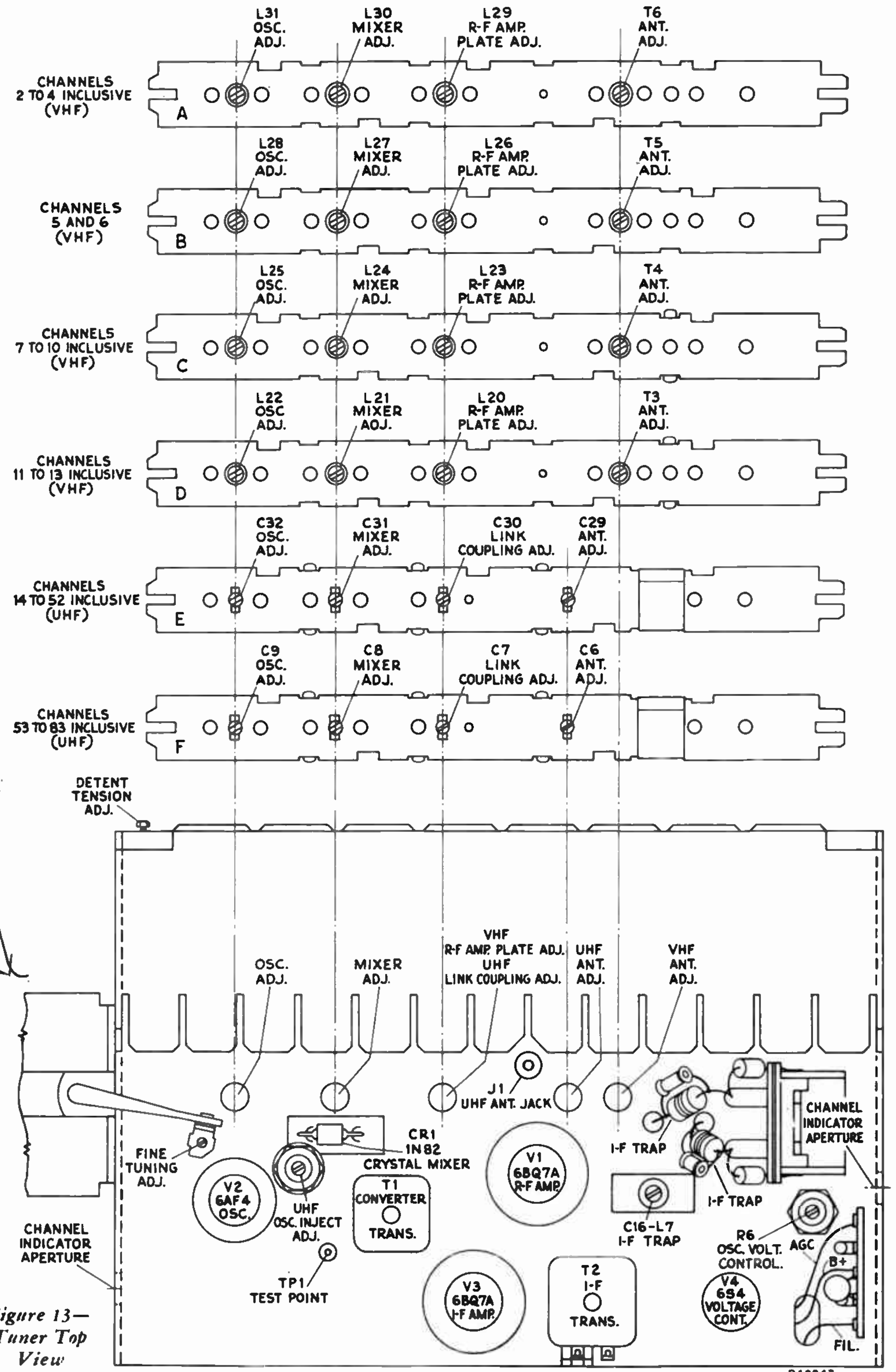


Figure 13—Tuner Top View

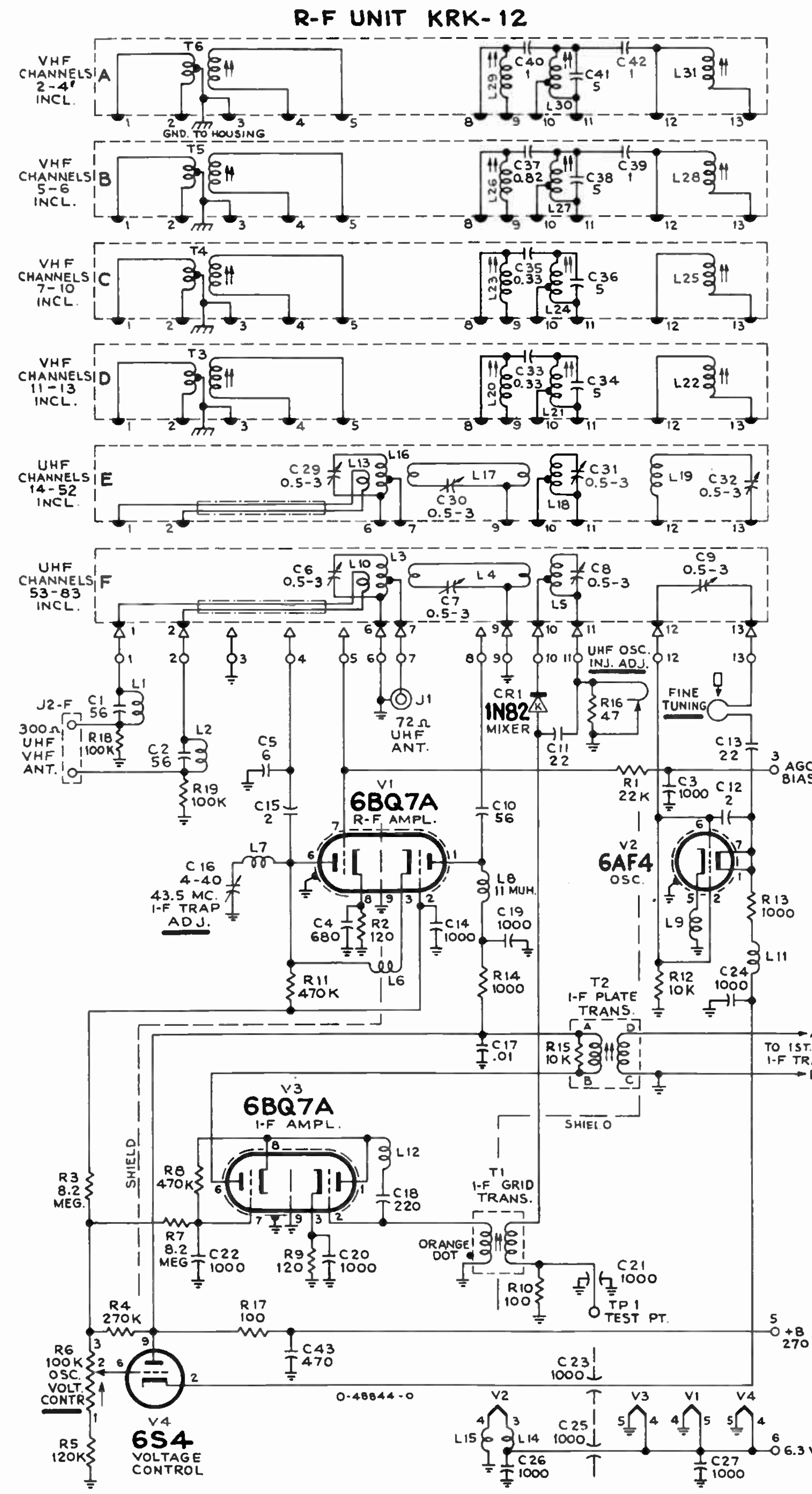


Figure 14—KRK-25 Schematic Diagram

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PARTS LIST	65	TOP VIEW — TUBE LAYOUT. . .	58
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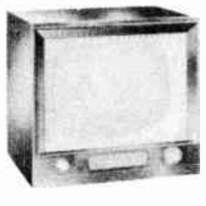
Models 21-D-326, 21-D-326 U
"Staunton"
Mahogany, Oak

Models 21-D-327, 21-D-327 U
"Yorktown"
Red Cherry

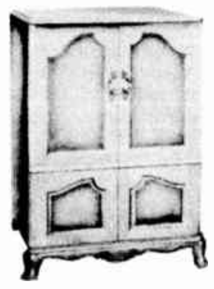


Models 21-D-305, 21-D-305 U
"Cabot"
Mahogany, Oak

Models 21-D-317, 21-D-317 U
"Merritt"
Mahogany, Oak

Models 21-D-328, 21-D-328 U
"Kenbridge"
Oak, Natural Walnut

Models 21-D-329, 21-D-329 U
"Southbridge"
Mahogany, Walnut



Models 21-D-330, 21-D-330 U
"Clermont"
Maple, Red Cherry

GENERAL DESCRIPTION

All models are "21 inch" television receivers. Models 21-D-305, 21-D-317, 21-D-326, 21-D-327, 21-D-328, 21-D-329 and 21-D-330 are identical except for cabinets and speakers. These models feature full 12 channel VHF coverage. Models 21-D-305U, 21-D-317U, 21-D-326U, 21-D-327U, 21-D-328U, 21-D-329U and 21-D-330U are identical except for cabinets and speakers. These models feature full 12 channel VHF coverage plus any 4 UHF channels desired. All models have an auxilary audio input jack to permit the use of an external record playing attachment.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE............227 square inches on a 21AP4 Kinescope

TELEVISION R-F FREQUENCY RANGE
Models 21-D-305 to 21-D-330 Incl.
All 12 VHF channels..........54 mc. to 88 mc., 174 mc. to 216 mc.
Models 21-D-305U to 21-D-330U Incl.
Any of 70 UHF channels.......................470 mc. to 890 mc.
Any of 12 VHF channels......54 mc. to 88 mc., 174 mc. to 216 mc.
(Any desired combination of 16 UHF and/or VHF channels may be used.)

INTERMEDIATE FREQUENCIES
Picture I-F Carrier Frequency..........................45.75 mc.
Sound I-F Carrier Frequency............................41.25 mc.

POWER RATING....................21-D-305 to 21-D-330 295 watts
21-D-305U to 21-D-330U 305 watts

AUDIO POWER OUTPUT RATING....................4 watts max.

SWEEP DEFLECTION AND FOCUS.......................Magnetic

ANTENNA INPUT IMPEDANCE
Models 21-D-305 to 21-D-330 Incl.
Choice: 300 ohms balanced or 72 ohms unbalanced.
Models 21-D-305U to 21-D-330U Incl.
UHF—Choice: 300 ohms balanced or 72 ohms unbalanced.
VHF—300 ohms balanced.

CHASSIS DESIGNATIONS
KCS81........................In models 21-D-305, 21-D-317, 21-D-326, 21-D-327, 21-D-328, 21-D-329, 21-D-330
KCS81B................In models 21-D-305U, 21-D-317U, 21-D-326U, 21-D-327U, 21-D-328U, 21-D-329U, 21-D-330U

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK11B (21-D-305 to 21-D-330 Incl.)	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer

RCA TUBE COMPLEMENT

Tube Used	Function
Tuner KRK12 (21-D-305U to 21-D-330U Incl.)	
(1) RCA 6BQ7A	R-F Amplifier (VHF only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6BQ7A	I-F Amplifier
(4) RCA 6S4	Voltage Control
A 1N82 crystal is used as a mixer.	
All Models	
(1) RCA 6AU6	1st Picture I-F Amplifier
(2) RCA 6CB6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 6CB6	4th Picture I-F Amplifier
(5) RCA 6CL6	Video Amplifier
(6) RCA 6AU6	1st Sound I-F Amplifier
(7) RCA 6AU6	2nd Sound I-F Amplifier
(8) RCA 6AL5	Ratio Detector
(9) RCA 6AV6	1st Audio Amplifier
(10) RCA 6AQ5	Audio Output
(11) RCA 12AU7	Vert. Sync Separator and AGC
(12) RCA 12AU7	Horiz. Sync Separator and Sync Amplifier
(13) RCA 6SN7GT	Vert. Sync Amplifier and Vert. Sweep Osc.
(14) RCA 6AQ5	Vertical Sweep Output
(15) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(16) RCA 6CD6G	Horizontal Sweep Output
(17) RCA 6W4GT (2 tubes)	Dampers
(18) RCA 1B3GT/8016	High Voltage Rectifier
(19) RCA 5U4G (2 tubes)	Rectifiers
(20) RCA 21AP4	Kinescope

INSTALLATION INSTRUCTIONS

UNPACKING. — These receivers are shipped complete in cardboard cartons. The kinescope is shipped in place in the receiver.

Take the receiver out of the carton and remove all packing material.

Install the control knobs on the proper control shafts.

Make sure that all tubes are in place and are firmly seated in their sockets.

Check to see that the kinescope high voltage lead clip is in place.

Plug a power cord into the 115 volt a-c power source and into the receiver interlock receptacle.

Turn the receiver power switch to the "on" position, the brightness control fully clockwise, and the picture control counter-clockwise.

ION TRAP MAGNET ADJUSTMENT. — Set the ion trap magnet approximately in the position shown in Figure 1. Starting from this position immediately adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen.

DEFLECTION YOKE ADJUSTMENT. — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

PICTURE ADJUSTMENTS. — It will now be necessary to obtain a test pattern picture in order to make further adjustments. Connect the antenna transmission line to the receiver.

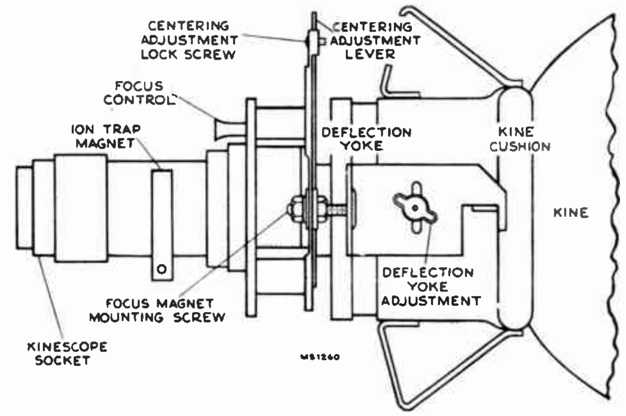


Figure 1—Yoke and Focus Magnet Adjustments

If the Horizontal Oscillator and AGC System are operating properly, it should be possible to sync the picture at this point. However, if the AGC control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading, turn R180 on the rear apron (see Figure 2) counter-clockwise until the set operates normally and the picture can be synchronized.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT. — Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back. Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 2 or 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. Pull-in should occur before the control has been turned 70 degrees from the extreme counter-clockwise position. The picture should remain in sync for approximately 90 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should just begin to show a black bar in the picture on the left side.

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Alignment of Horizontal Oscillator" and proceed with "Centering Adjustment."

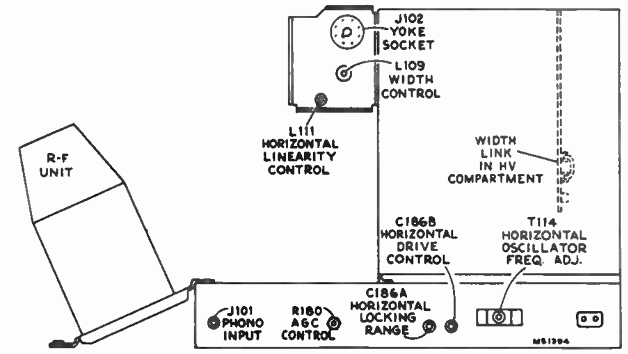


Figure 2—Rear Chassis Adjustments

ALIGNMENT OF HORIZONTAL OSCILLATOR. — If in the above check the receiver failed to hold sync with the hold control at the extreme counter-clockwise position or failed to hold sync over 90 degrees of clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.

Horizontal Frequency Adjustment. — Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and adjust the T114 horizontal frequency adjustment at the rear of the chassis until the picture is just out of sync and the horizontal blanking appears as a vertical or diagonal black bar in the raster. Then turn the T114 core until the bar is just visible at the extreme left side of the picture.

Horizontal Locking Range Adjustment. — Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 rear core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 2 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C186A slightly clockwise. If less than 2 bars are present, adjust C186A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the conditions specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If it is impossible to sync the picture at this point and the AGC system is in proper adjustment it will be necessary to adjust the Horizontal Oscillator by the method outlined in the alignment procedure on Page 11. For field purposes paragraph "B" under Horizontal Oscillator Waveform Adjustment may be omitted.

FOCUS MAGNET ADJUSTMENTS.—The focus magnet should be adjusted so that there is approximately three-eighths inch of space between the rear cardboard shell of the yoke and the flat of the front face of the focus magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the magnet should be parallel with the axis of the kinescope neck with the kinescope neck through the middle.

CENTERING ADJUSTMENT.—No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet. The centering plate includes a locking screw which must be loosened before centering. Up and down adjustment of the plate moves the picture side to side and sidewise adjustment moves the picture up and down.

If a corner of the raster is shadowed, check the position of the

INSTALLATION INSTRUCTIONS

ion trap magnet. Reposition the magnet within the range of maximum raster brightness to eliminate the shadow and re-center the picture by adjustment of the focus magnet plate. In no case should the ion trap magnet be adjusted to cause ony loss of brightness since such operation may cause immediate or eventual damage to the tube. In some cases it may be necessary to shift the position of the focus magnet in order to eliminate a corner shadow.

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS. — Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive trimmer C186B for maximum drive (minimum capacity) consistent with a linear raster. Compression of the raster due to excessive drive can be seen as a white vertical bar or bars in the right half of the picture. Besides compression caused by excessive drive, another item to watch for is the change in linearity at the extreme left with changes of brightness control setting. By proper adjustment of the linearity coil, the changes in linearity with changes in brightness can be made negligible. In general, to achieve this condition, the linearity coil should be set slightly on the high inductance side (core slightly clockwise) of the optimum position.

Preset the following adjustments as directed:

A.—Place the width plug P103 in the minimum width position (top).

B.—Set the width control coil L109 in approximately mid position.

C.—Set the linearity control coil L111 near minimum inductance (counter-clockwise).

D.—Set the drive capacitor C186B in the maximum drive position (counter-clockwise).

If the raster is cramped or shows compression bars on the right half of the picture turn C186B clockwise until this condition is just eliminated.

Adjust the linearity control coil L111 clockwise until best linearity and maximum deflection or best compromise are obtained then turn one quarter turn clockwise from this position.

Retouch the drive trimmer C186B if necessary to obtain best linearity and maximum width.

Check the horizontal linearity at various settings of the brightness control R114A. There should be no compression of the right half and no appreciable change of linearity especially at the extreme left of the picture. If objectional change does occur, turn linearity coil L111 slightly clockwise and repeat the test.

Adjust the width control L109 to fill the mask.

If the line voltage is low and it becomes impossible to fill the mask, move the width plug P103 to the bottom position. The width coil L109 is inoperative in this position.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS. — Adjust the height control (R190 behind front control panel) until the picture fills the mask vertically. Adjust vertical linearity (R197 behind front control panel), until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other.

FOCUS.—Adjust the focus magnet for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

If necessary readjust centering to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS. — ***(Models 21-D-305 to 21-D-330 incl. with KRK11B Tuner.)*** Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 8. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 3. Adjustment for channel 13 is on top of the chassis.

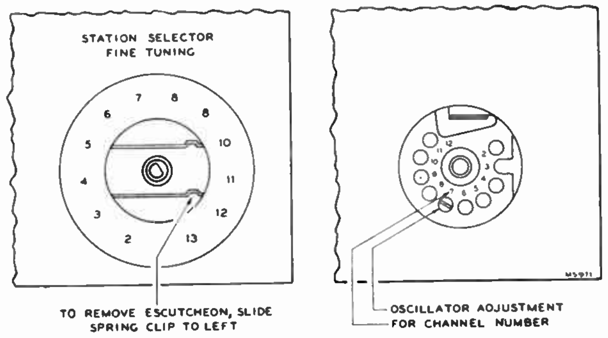


Figure 3—KRK11B R-F Oscillator Adjustments

(Models 21-D-305U to 21-D-330U incl. with KRK12 Tuner). Tune in all available VHF stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 60.

NOTE.—Some factory prealigned UHF inserts may require minor adjustment when installed in the tuner. This can be accomplished by using the UHF stations as a signal source.

CAUTION SHOULD BE TAKEN TO OBSERVE FOR REFERENCE, THE INITIAL POSITION OF ALL CORES BEFORE MAKING ANY ADJUSTMENTS.

Set the fine tuning control to the center of its range on each UHF channel to be adjusted. Adjust the oscillator core for each UHF channel to obtain maximum audio output without distortion.

AGC THRESHOLD CONTROL. — The AGC Threshold Control R180 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not over-loading due to improper setting of R180. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R180 should be readjusted.

Turn R180 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R180 clockwise until there is a very, very slight bend or change of bend in the picture. Then turn R180 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R180 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

FM TRAP ADJUSTMENT. — In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the L58 core on top of the antenna matching transformer for minimum interference in the picture.

CAUTION. — In some receivers, the FM trap L58 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L58 to make sure that it does not affect sensitivity on these two channels.

The FM trap on Models 21-D-305U to 21-D-330U is attached to the receiver antenna cable and should be adjusted in the same manner as L58 on Models 21-D-305 to 21-D-330.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding it are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

CHASSIS TOP VIEW

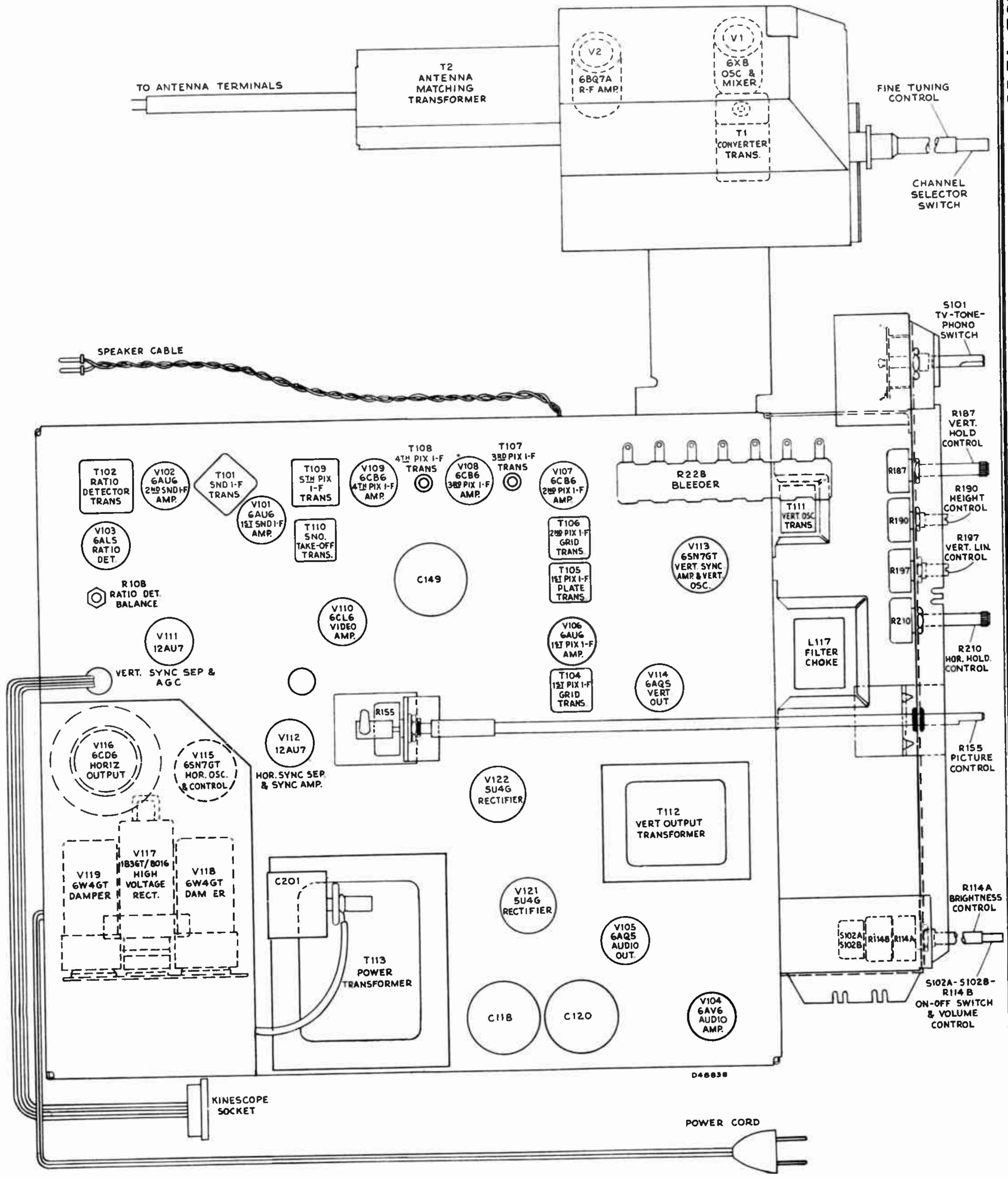


Figure 4—Chassis Top View (shown with KRK11B Tuner)

CHASSIS BOTTOM VIEW

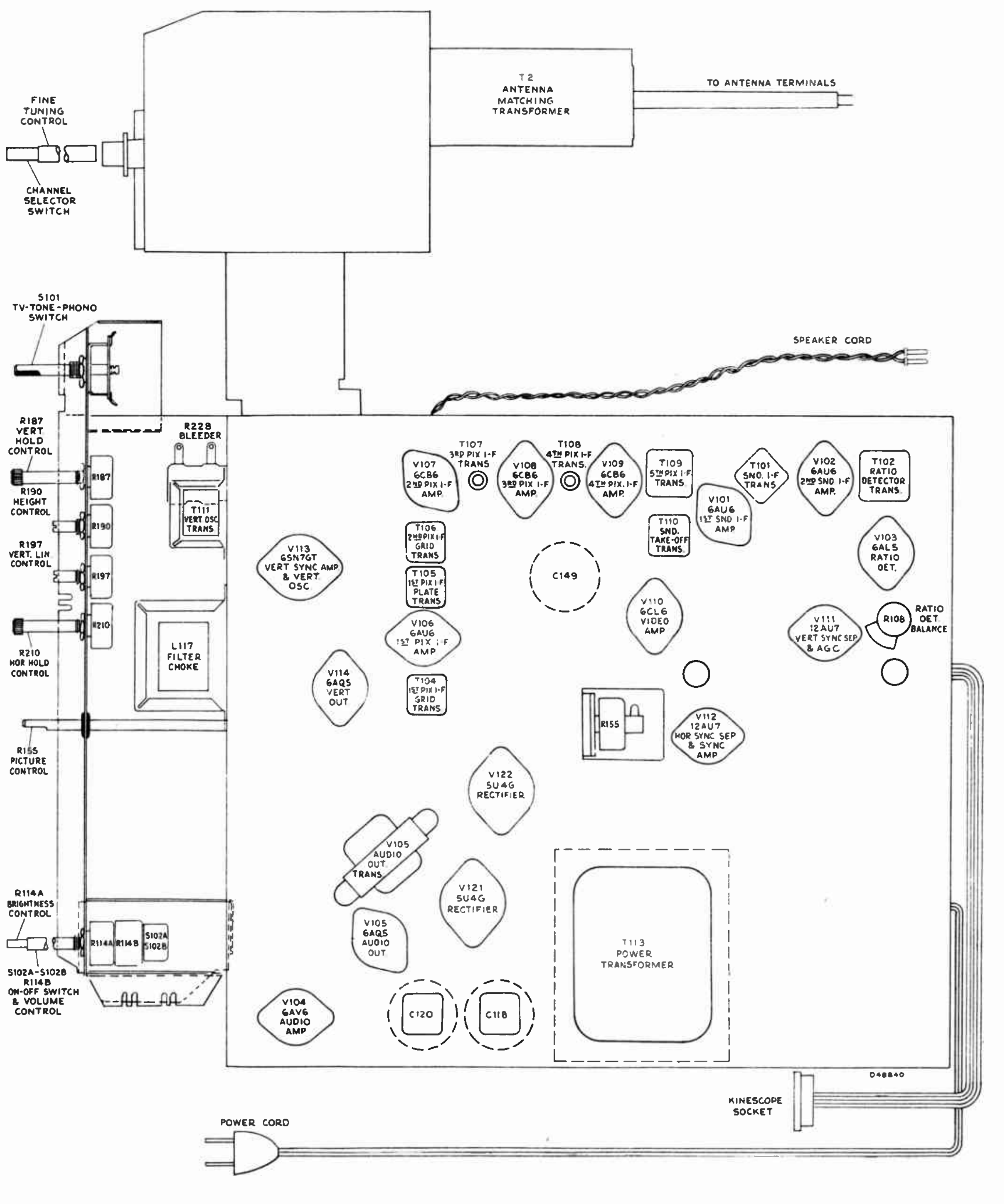


Figure 5—Chassis Bottom View (shown with KRK11B Tuner)

ALIGNMENT PROCEDURE

TEST EQUIPMENT. — To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	83.25	81.75	123
6	77.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope. — An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter. — A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

DC Milliammeter. — A milliammeter with a range of 0-50 milliamperes full scale.

Adapter Socket. — An adapter socket is required to meter the cathode current of the 6S4 voltage control tube of the KRK12 Tuner. Wiring of adapter is shown in Figure 13.

KRK11B ANTENNA MATCHING UNIT ALIGNMENT. — The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L58 to the channel selector switch S5.

With a short jumper, connect the output of the matching unit through a 1,000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R133 and C133B. Set the potentiometer to produce approximately –5.0 volts of bias at the junction of R133 and C133B.

Connect an oscilloscope to pin 9, V110 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L59 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L60 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

ALIGNMENT PROCEDURE

Connect a 300 ohm ½ watt composition resistor from L58 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L58 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 14 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L61 and L62 to obtain the response shown in Figure 15. L61 is most effective in locating the position of the shoulder of the curve at 52 mc. and L62 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L58 and S5. Replace V106.

PICTURE I-F TRAP ADJUSTMENT. — Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R133 and C133B.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the positive terminal of one battery to chassis and the potentiometer arm to the junction of R133 and C133B.

Set the bias to produce approximately −1.0 volt of bias at the junction of R133 and C133B.

Connect the "VoltOhmyst" to pin 9 of V110, the 6CL6 video amplifier.

Set the signal generator to each of the following frequencies and adjust the corresponding circuit for minimum d-c output at pin 9 of V110. Use sufficient signal input to produce 1.0 volt of d-c on the meter when the final adjustment is made.

39.25 mc.	T104 top core
41.25 mc.	T105 bottom core
47.25 mc.	T106 bottom core

PICTURE I-F TRANSFORMER ADJUSTMENTS. —
Models 21-D-305 to 21-D-330 Incl.

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with −1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to −1.0 volt at the junction of R133 and C133B.

Connect the oscilloscope to pin 9 of V110.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 19. For final adjustment set the output of the sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

To align T1 and T104, connect the sweep generator to the mixer grid test point TP2. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable.

Adjust C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 20.

Disconnect the diode probe, the 180 ohm and three 330 ohm resistors.

Models 21-D-305U to 21-D-330U Incl.

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 9 of V110 with −1.0 volt of i-f bias at the junction of R133 and C133B.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1,000 mmf. ceramic capacitor. Shunt R137, R141 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to −1.0 volt at the junction of R133 and C133B.

Connect the oscilloscope to pin 9 of V110, the 6CL6 video amplifier.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 19. For final adjustment set the output of the VHF sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

To align the crystal mixer and T2 and T104, connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1,500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor between terminal "B" of T105 and the junction of R131 and C133A.

Connect the oscilloscope diode probe to terminal "B" of T105 and ground. Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C121 across terminals A and B of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust the shunt trimmer C121 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 11. Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see Figure 11.

Disconnect the diode probe, the 180 ohm and the three 330 ohm resistors.

SWEEP ALIGNMENT OF PICTURE I.F.—

Connect the oscilloscope to pin 9 of V110.

Adjust the bias potentiometer to obtain −6.0 volts of bias as measured by a "VoltOhmyst" at the junction of R133 and C133B.

Leave the sweep generator connected to the mixer grid test point TP2 on KRK11B Tuner or to the front terminal of the 1N82 crystal holder on KRK12 Tuner. Use the shortest leads possible with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

ALIGNMENT PROCEDURE

Retouch T108 and T109 to obtain the response shown in Figure 21. Do not adjust T107 unless absolutely necessary. If T107 is adjusted too low in frequency it will raise the level of the 41.25 mc. sound i-f carrier and may create interference in the picture. It will also cause poor adjacent channel picture rejection. If T107 is tuned too high in frequency, the level of the 41.25 mc. sound i-f carrier will be too low and may produce noisy sound in weak signal areas.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

KRK11B TUNER ALIGNMENT
Models 21-D-305 to 21-D-330 Incl.

An r-f unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset all adjustments to the approximate center of their range with the following exceptions: Set C18 so that the screw head is approximately three-eighths of an inch above chassis. Set C11 near maximum capacity (one-quarter turn from tight). Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

The r-f unit is aligned with −3.5 AGC bias.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce −3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the oscilloscope to the test point TP1 on top of the r-f unit. Set the oscilloscope gain to maximum.

Turn the receiver channel selector switch to channel 2.

Connect the output of the VHF signal generator to the grid of the r-f amplifier, V2. To do this, remove the tube from the socket and fashion a clip by twisting one end of a small piece of wire around pin number 7. Replace the tube in the socket leaving the end of the wire protruding from under the tube. Connect the signal generator to this wire through a 1,500 mmf. capacitor.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust L65 on top of the r-f unit for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to adjust it so as to reduce sensitivity on Channel 2.

Remove the wire clip from pin 7 of V2 and replace the tube and tube shield.

Set the channel selector switch to channel 8.

Turn the fine tuning control 30 degrees clockwise from the center of its mechanical range now and at all times when adjusting the oscillator frequency.

Adjust C2 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the r-f unit through the hole provided for the adjustment for C11. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the r-f unit oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C2 to obtain an audio beat with the signal generator.

Note. — If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C2, switch to channel 13 and adjust L46 to obtain proper channel 13 oscillator frequency as indicated in the table on page 11. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8 adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C2 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and adjust L46 and back to channel 8 and adjust C2.

Set the T1 core for maximum inductance (core turned counterclockwise).

Connect the sweep generator through a suitable attenuator as shown in Figure 14 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a useable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C9, C11, C15 and C18 for approximately correct curve shape, frequency, and band width as shown in Figure 16.

The correct adjustment of C18 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C9 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C18 has been properly adjusted). C11 is the coupling adjustment and hence primarily affects the response band width.

Set the receiver channel switch to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Turn the fine tuning control 30 degrees clockwise from the center of its mechanical range.

Adjust L5 for an audible beat with the signal generator as before.

Set the sweep generator to channel 6.

From the signal generator, insert channel 6 sound and picture carrier markers, 83.25 mc. and 87.75 mc.

Adjust L48, L50 and L53 for proper response as shown in Figure 16.

L50 tunes the r-f amplifier plate circuit and primarily affects the frequency of the pass band. L53 tunes the r-f amplifier grid and is adjusted to give maximum amplitude of the curve between the markers. L48 affects the tilt of the curve but not quite the same as C9 adjustment. When the circuits are correctly adjusted and L48 is rocked on either side of its proper setting, the high frequency (sound carrier) end of the curve appears to remain nearly fixed in amplitude while the picture carrier end tilts above or below this point.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the r-f unit test point TP1.

Adjust the oscillator injection trimmer C8 for −3.5 volts or at maximum if −3.5 volts cannot be reached. This voltage should fall between −2.5 and −5.5 volts on all channels when the alignment of all circuits is completed.

Turn the sweep generator and signal generator back on and recheck channel 6 response. Readjust L48, L50 and L53 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C9, C11, C15 and C18 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 6 and check the oscillator injection voltage at TP1 if C9 was adjusted in the recheck of channel 8 response.

If the initial setting of oscillator injection trimmer C8 was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 6 and repeat the procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Set the fine tuning control 30 degrees clockwise from the center of its mechanical range.

Adjust L46 to obtain an audible beat. Slightly overshoot the adjustment of L46 by turning the slug a little more in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Check the response of channels 7 through 13 by switching the receiver channel switch, sweep generator and marker oscillator to each of these channels and observing the response and oscillator injection obtained. See Figure 16 for typical response curves. It should be found that all these channels have the proper shaped response with the markers above 80% response.

If the markers do not fall within this requirement, switch to channel 8 and readjust C9, C11, C15 and C18 as necessary.

Turn off the sweep generator and check the channel 8 oscillator frequency. If C2 has to be readjusted for channel 8, the principle of overshooting the adjustment and then correcting by adjusting L46 should be followed in order to establish the L/C ratio for the desired oscillator tracking.

Turn the receiver channel selector switch to channel 6. Adjust L5 for correct oscillator frequency, 129 mc.

Turn the sweep generator on and to channel 6 and observe the response curve. If necessary readjust L48, L50 and L53.

Switch the receiver, the sweep and signal generators to channel 2 and adjust T1 clockwise to a point where there is no change in the channel 2 response as T1 is turned.

Switch the receiver through channel 6 down through channel 2 and check for normal response curve shapes and oscillator injection voltage.

If excessive tilt in the same direction occurs on channels 2, 3 and 4, adjust C18 on channel 2 to overshoot the correction of this tilt, then switch to channel 6 and adjust L53 for maximum amplitude of curve between markers. This adjustment should produce "flat" response on the low channels if the other adjustments especially L48 are correct.

Likewise check channels 7 through 13, stopping on 13 for the next step.

With the receiver on channel 13, check the receiver oscillator frequency. Correct by adjustment of C2 if necessary.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator trimmer to obtain the audible beat. It should be possible to adjust the oscillator to the correct frequency on all channels with the fine tuning control in the middle third of its range. When employing WR39 calibrators to adjust the receiver oscillator, tune the calibrator to one-half the receiver oscillator frequency on channels 4, 5 and 6 and to one-fourth the receiver oscillator frequency on channels 11, 12 and 13.

KRK12 TUNER ALIGNMENT

Models 21-D-305U to 21-D-330U Incl.

TUNER VHF ALIGNMENT. — Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert the 6S4 in the adapter.

Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.

Remove the tuner cover shield.

Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front, with a finger.

(NOTE: The contacts are at zero d-c potential.) Should the plate current rise, keep finger on the contacts while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28 milliampere reading on the meter.

Replace the tuner cover shield.

Connect the VHF sweep generator to the antenna terminals.

Connect the VHF signal generator loosely to the antenna terminals.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to channel 2.

Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.

Adjust antenna T6, r-f amplifier plate L29 and mixer L30 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in Figure 9. If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Turn the AGC control fully clockwise and remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce −3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the potentiometer arm of the second bias supply to the junction R133 and C133B, and ground the positive battery terminal. Adjust the bias potentiometer to produce −5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 9 of V110. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to Channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum marker indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

ALIGNMENT PROCEDURE

TUNER UHF ALIGNMENT. — To align the UHF inserts:

Turn off the adapter switch, removing plate voltage from the oscillator.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10 DB attenuator pad to assure proper alignment.

Connect the UHF signal generator loosely to the antenna terminals.

Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier for desired channel.

Adjust the UHF antenna, link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band.

The responses are shown in Figure 10. The curve shape will usually vary from Figure 10 (a) to Figure 10 (c) going higher in frequency, however any of these responses are acceptable.

Repeat the above steps for all UHF inserts used adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce −3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

Connect the potentiometer arm of the second bias supply to the junction of R133 and C133B, and ground the positive battery terminal. Adjust the bias potentiometer to produce −5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to pin 9 of V110. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to the lowest UHF channel to be used, and set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to test point TP1 with the shortest leads possible. Insert a 45.75 mc. marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 marker on the response curve as in Figure 12.

Set the UHF marker gen. to the picture carrier of the channel insert being adjusted and connect to test point TP1.

Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern on the oscilloscope.

Adjust the mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt DC scale.

Set oscillator injection adjustment to read .1 volts on the "VoltOhmyst."

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volts. Adjust as necessary to read .3 volts or less at TP1.

RATIO DETECTOR ALIGNMENT. — In order to obtain good ratio detector alignment an AM modulated signal generator that is exceptionally free from FM modulation must be employed. Set the signal generator at 4.5 mc. and connect it to the second sound i-f grid, pin 1 of V102. Set the generator for 30% 400 cycle modulation.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. If used, connect it to the grid of the 4th pix i-f amplifier, pin 1, V109. Set the frequency of the calibrator to 45.75 (pix carrier) and modulate with 4.5 mc. crystal. Also turn on the internal AM audio modulation. The 4.5 mc. signal will be picked off at T110A and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to the junction of R111 and C111.

Connect the oscilloscope across the speaker voice coil and turn the volume control for maximum output.

Tune the ratio detector primary, T102 top core for maximum DC output on the "VoltOhmyst." Adjust the signal level from the signal generator for minus 10 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R110 and C110.

Adjust the T102 bottom core for zero d-c on the meter. Then, turn the core to the nearest minimum AM output on the oscilloscope.

Repeat adjustments of T102 top for maximum DC and T102 bottom for minimum output on the oscilloscope making final adjustment with the 4.5 mc. input level adjusted to produce 10 volts d-c on the "VoltOhmyst" at the junction of R111 and C111.

Connect the "VoltOhmyst" to the junction of R110 and C110 and note the amount of d-c present. If this voltage exceeds ±1.5 volts, adjust R108 by turning it in until zero d-c is obtained. Readjust the T102 bottom core for minimum output on the oscilloscope. Repeat adjustments of R108 and T102 bottom core until the voltage at R110 and C110 is less than ±1.5 volts when T102 bottom core is set for minimum output on the oscilloscope.

Connect the "VoltOhmyst" to the junction of R111 and C111 and repeak T102 top core for maximum d-c on the meter and again reset the generator so as to have −10 volts on the meter.

Repeat the adjustments in the above two paragraphs until the voltage at R110 and C110 is less than ±1.5 volts when the T102 top core is set for maximum d-c at the junction of R111 and C111 and the T102 bottom core is set for minimum indication on the oscilloscope.

SOUND I-F ALIGNMENT. — Connect the sweep generator to the first sound i-f amplifier grid, pin 1 of V101. Adjust the generator for a sweep width of 1 mc. at a center frequency of 4.5 mc.

Insert a 4.5 mc. marker signal from the signal generator into the first sound i-f grid. With the WR39B or WR39C calibrators the 4.5 mc. crystal signal may be obtained at the R-F out terminal by turning the variable osc. switch off, the calibrate switch to 4.5 mc. and the volume control with mod. off.

Connect the oscilloscope in series with a 10,000 ohm resistor to terminal A of T101.

Adjust T101 top and bottom cores for maximum gain and symmetry about the 4.5 mc. marker on the i-f response. The pattern obtained should be similar to that shown in Figure 17.

The output level from the sweep should be set to produce approximately 2.0 volt peak-to-peak at terminal A of T101 when the final touches on the above adjustment are made. It is necessary that the sweep output voltage should not exceed the specified values otherwise the response curve will be broadened, permitting slight misadjustment to pass unnoticed and possibly causing distortion on weak signals.

Connect the oscilloscope to the junction of R110 and C110 and check the linearity of the response. The pattern obtained should be similar to that shown in Figure 18.

ALIGNMENT PROCEDURE

SOUND TAKE-OFF ALIGNMENT. — Connect the 4.5 mc. generator in series with a 1,000 ohm resistor to terminal "C" of T110. The input signal should be approximately 0.5 volt.

Short the fourth pix i-f grid to ground, pin 1, V109, to prevent noise from masking the output indication.

As an alternate source of signal the RCA WR39B or WR39C calibrator may be used. In such a case, disregard the above two paragraphs. Connect calibrator across link circuit, T104 A, B, and modulate 45.75 with 4.5 mc. crystal.

Connect the crystal diode probe of a "VoltOhmyst" to the plate of the video amplifier, pin 6 of V110.

Adjust the core of T110 for minimum output on the meter.

Remove the short from pin 1 V109 to ground, if used.

HORIZONTAL OSCILLATOR ADJUSTMENT. — Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment. — Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R210, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C186B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment. — The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and one diagonal black bar sloping down to the right appears on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain one diagonal black bar on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture begins to fall out of sync with the diagonal bar sloping down to the right. Continue to turn the frequency core in the same direction. Additional bars should not appear on the screen. Instead, the horizontal oscillator should begin to motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 22. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment. — Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture [illegible] remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C186A slightly clockwise. If less than 2 bars are present, adjust C186A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves off the screen leaving the picture in synchronization.

SENSITIVITY CHECK. — A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is at the maximum clockwise position. Only carbon type resistors should be used to construct the pad.

RESPONSE CURVES. — The response curves shown on pages 14 and 15 and referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, some variations can be expected.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

NOTE ON TUNER ALIGNMENT. — Because of the frequency spectrum involved and the nature of the device, many of the tuner leads and components are critical in some respects. Even the power supply leads form loops which couple to the tuned circuits, and if resonant at any of the frequencies involved in the performance of the tuner, may cause serious departures from the desired characteristics. In the design of the receiver these undesirable resonant loops have been shifted far enough away in frequency to allow reasonable latitude in their components and physical arrangement without being troublesome. When the tuner is aligned in the receiver, no trouble from resonant loops should be experienced. However, if the tuner is aligned in a jig separate from the receiver, attention should be paid to insure that unwanted resonances do not exist which might present a faulty representation of tuner alignment.

A resonant circuit exists between the KRK11B r-f tuner chassis and the outer shield box, which couples into the antenna and r-f plate circuits. The frequency of this resonance depends on the structure of the shield box. This resonance is controlled by using insulating washers of proper thickness in the front plate to tuner chassis mounting. Obviously, if the tuner is removed for service, the washers should be replaced in the correct order.

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 5000 microvolt test pattern signal was fed into the receiver, the picture synchronized and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
VI	6X8	Mixer	5000 Mu. V. Signal	9	160	8	160	6	0	7	—2.4 to —3.0	—	—	
KRK11B			No Signal	9	145	8	145	6	0	7	—2.8 to —3.5	—	—	
		R-F Oscillator	5000 Mu. V. Signal	3	95	—	—	6	0	2	—3.8 to —5.5	—	—	
			No Signal	3	90	—	—	6	0	2	—3.0 to —5.1	—	—	
V2	6BQ7A	R-F Amplifier	5000 Mu. V. Signal	6	170	—	—	8	0.1	7		—	—	
KRK11B			No Signal	6	133	—	—	8	1.1	7	0	—	—	
		R-F Amplifier	5000 Mu. V. Signal	1	270	—	—	3	170	2	—	—	—	
			No Signal	1	260	—	—	3	133	2	—	—	—	
V101	6AU6	1st Sound I-F Amp.	5000 Mu. V. Signal	5	127	6	124	7	0.7	1	—0.4	6.0	3.0	
			No Signal	5	126	6	123	7	0.5	1	—1.2	5.0	3.0	
V102	6AU6	2nd Sound I-F Amp.	5000 Mu. V. Signal	5	132	6	60	7	0	1	—10	2.8	1.2	
			No Signal	5	131	6	65	7	0	1	—5	2.0	1.0	
V103	6AL5	Ratio Detector	5000 Mu. V. Signal	2 7	—9.2 1.0	—	—	5 1	1.0 9.2	—	—	—	—	
			No Signal	2 7	—8.0 0	—	—	5 1	0 8.0	—	—	—	—	
V104	6AV6	1st Audio Amplifier	5000 Mu. V. Signal	7	90	—	—	2	0	1	—0.7	0.65	—	At min. volume
			No Signal	7	88	—	—	2	0	1	—0.7	0.65	—	
V104	6AV6	R-F Bias Clamp	5000 Mu. V. Signal	5-6	—3.0	—	—	2	0	—	—	—	—	
			No Signal	5-6	0.3	—	—	2	0	—	—	—	—	
V105	6AQ5	Audio Output	5000 Mu. V. Signal	5	327	6	342	2	146	7	136	28	2.0	At min. volume
			No Signal	5	323	6	338	2	143	7	133	28	2.0	
V106	6AU6	1st Pix. I-F Amplifier	5000 Mu. V. Signal	5	160	6	215	7	0.17	1	—6.6	1.4	4	
			No Signal	5	85	6	115	7	0.98	1	0	6.5	3.3	
V107	6CB6	2nd Pix. I-F Amplifier	5000 Mu. V. Signal	5	227	6	225	2	0.1	1	—6.6	1.5	25	
			No Signal	5	209	6	115	2	0.8	1	0	10.9	3.3	
V108	6CB6	3rd Pix. I-F Amplifier	5000 Mu. V. Signal	5	138	6	132	2	1.02	1	0	11.4	3.5	
			No Signal	5	134	6	126	2	.98	1	0	10.4	3.1	
V109	6CB6	4th Pix. I-F Amplifier	5000 Mu. V. Signal	5	168	6	165	2	2.32	1	0	8.85	2.2	
			No Signal	5	156	6	161	2	2.07	1	0	8.6	2.1	

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	I Plate (ma.)	I Screen (ma.)	Notes on Measurements
V110	6CL6	Video Amplifier	5000 Mu. V. Signal	6	130	3-8	159	1	.84	2-9	*—5.0	22.5	5.5	*Depends on picture
			No Signal	6	130	3-8	80	1	0.7	2-9	*—2.0	15.0	4.0	*Depends on picture
V111A	12AU7	AGC Rectifier	5000 Mu. V. Signal	1	—30	—	—	3	142	—	—	0	—	AGC control set for normal operation
			No Signal	1	0	—	—	3	137	—	—	0	—	
V111B	12AU7	Vert. Sync. Separator	5000 Mu. V. Signal	6	110	—	—	8	0	7	—42	.25	—	
			No Signal	6	45	—	—	8	0	7	*—5	.35	—	*Depends on noise
V112A	12AU7	Hor. Sync. Separator	5000 Mu. V. Signal	1	323	—	—	3	192	2	116	.5	—	
			No Signal	1	320	—	—	3	132	2	112	.5	—	
V112B	12AU7	Sync. Amplifier	5000 Mu. V. Signal	6	78	—	—	8	0	7	—3.5	6.2	—	
			No Signal	6	78	—	—	8	0	7	—1.6	6.2	—	
V113A	6SN7GT	Vert. Sync. Amplifier	5000 Mu. V. Signal	2	140	—	—	3	19.2	1	—.35	0.1	—	
			No Signal	2	135	—	—	3	17.3	1	0	<0.1	—	
V113B	6SN7GT	Vert. Osc. & Dicharge	5000 Mu. V. Signal	5	203	—	—	6	0	4	—56	.2	—	
			No Signal	5	208	—	—	6	0	4	—55	.2	—	
V114	6AQ5	Vertical Output	5000 Mu. V. Signal	5	334	6	334	2	30	1	0	17.3	1.2	
			No Signal	5	332	6	332	2	29	1	0	17.3	1.2	
V115	6SN7GT	Horizontal Osc. Control	5000 Mu. V. Signal	2	188	—	—	3	—9	1	—28	0.37	—	Hor. hold at mid-range
			No Signal	2	0	—	—	3	0	1	0	0	—	
		Horizontal Oscillator	5000 Mu. V. Signal	5	184	—	—	6	0	4	—72	2.5	—	Hor. hold at mid-range
			No Signal	5	182	—	—	6	0	4	—73	2.5	—	
V116	6CD6G	Horizontal Output	5000 Mu. V. Signal	Cap	*700	8	165	3	12.5	5	—30	110	15.0	*High Voltage Pulse Present
			No Signal	Cap	*700	8	165	3	12.5	5	—30	110	15.0	
V117	1B3GT /8016	H. V. Rectifier	5000 Mu. V. Signal	Cap	*	—	—	2 & 7	17,500	—	—	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	17,500	—	—	—	—	
V118 V119	6W4GT	Dampers	5000 Mu. V. Signal	5	352	—	—	3	*640	—	—	57	—	*High Voltage Pulse Present
			No Signal	5	348	—	—	3	*640	—	—	57	—	
V120	21AP4	Kinescope	5000 Mu. V. Signal	Cone	16,000	10	525	11	140	2	*82	0.2	—	At average Brightness
			No Signal	Cone	16,400	10	520	11	132	2	*76	0.2	—	*0 voltage on Phono. position
V121 V122	5U4G	Rectifiers	5000 Mu. V. Signal	4 & 6	364	—	—	2 & 8	364	—	—	*145	—	*Per Tube
			No Signal	4 & 6	360	—	—	2 & 8	360	—	—	*150	—	

ALIGNMENT PROCEDURE

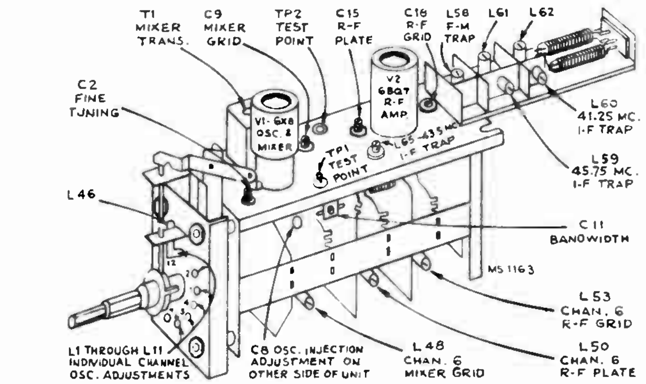


Figure 6—KRK11B R-F Unit Adjustments

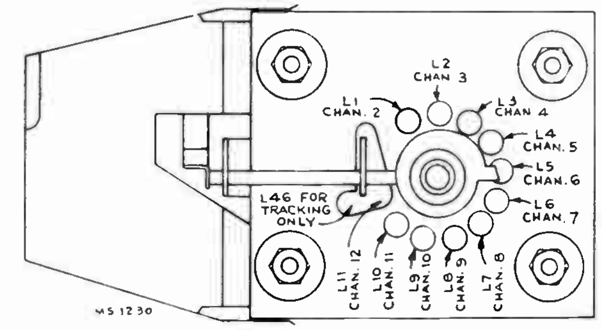


Figure 8—KRK11B R-F Oscillator Adjustments

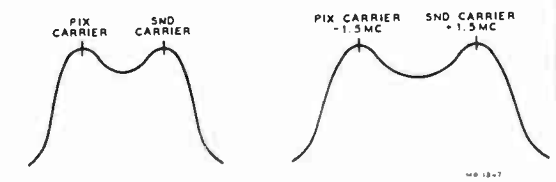


Figure 9—KRK12 VHF Insert Responses

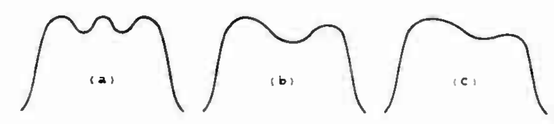


Figure 10—KRK12 UHF Insert Responses

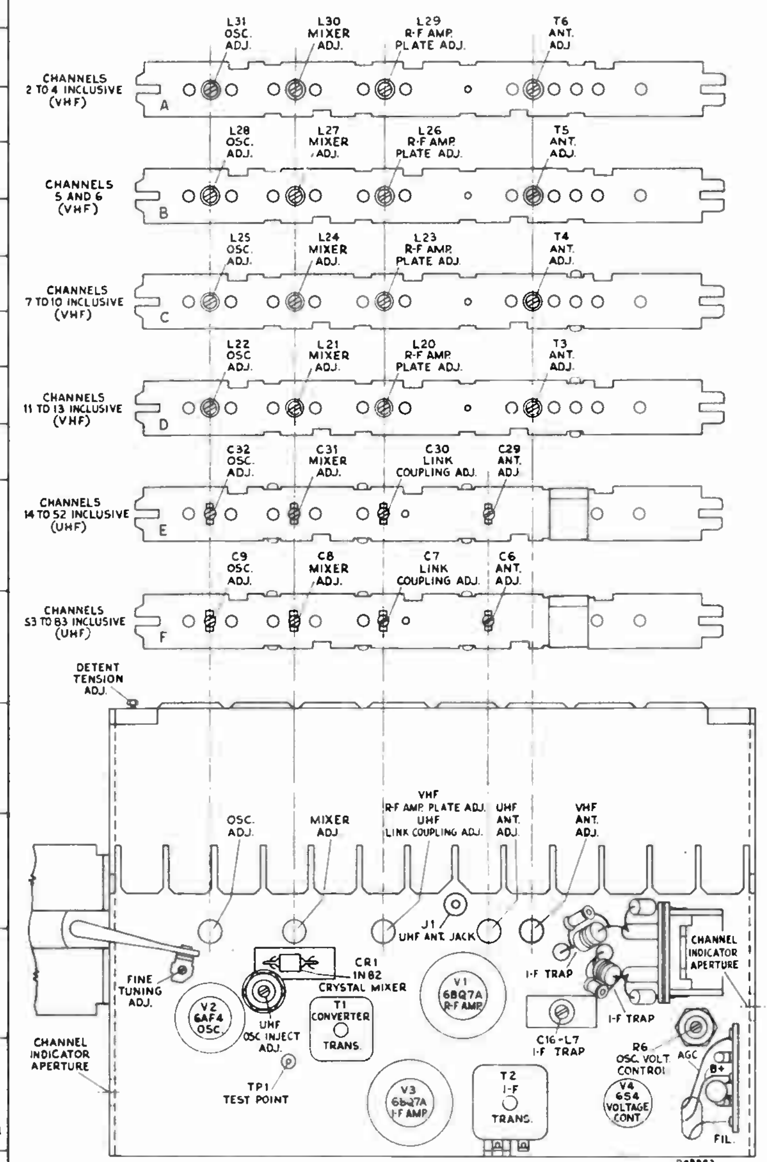


Figure 7—KRK12 Tuner Adjustments

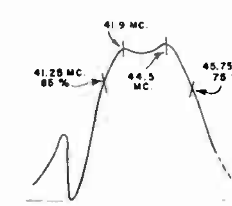


Figure 11—T2 and T104 Response with KRK12

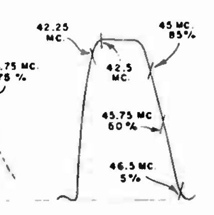


Figure 12—Over-all I-F Response with KRK12

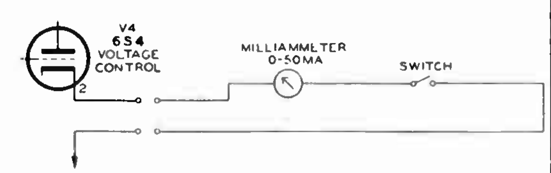


Figure 13—KRK12 Voltage Control Adapter

ALIGNMENT DATA

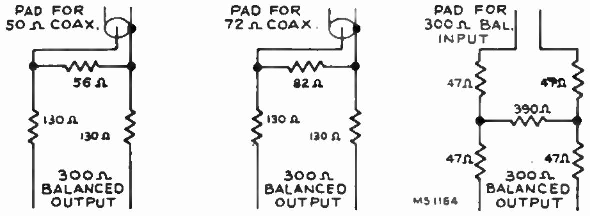


Figure 14—Sweep Attenuator Pads

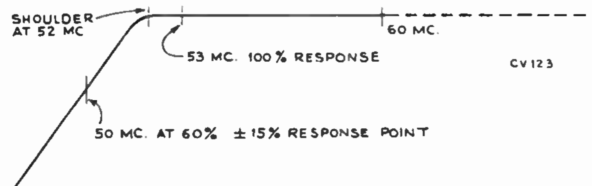


Figure 15—KRK11B Antenna Matching Unit Response

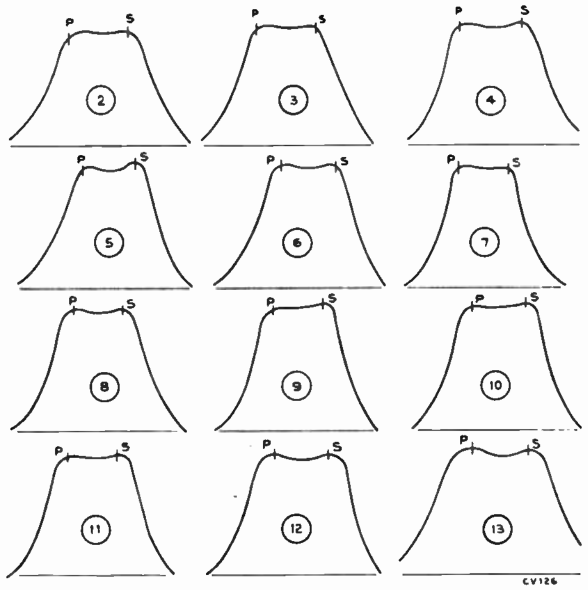


Figure 16—KRK11B R-F Response

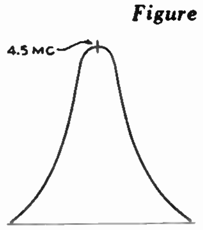


Figure 17 Sound I-F Response

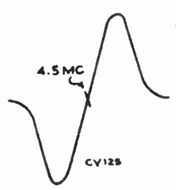


Figure 18 Ratio Det. Response

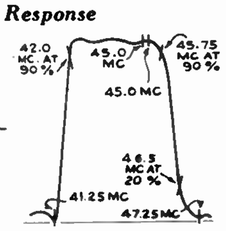


Figure 19 T105 and T106 Response

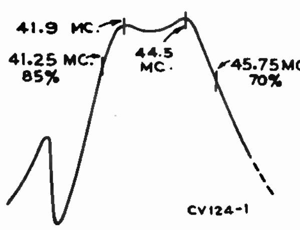


Figure 20 T1 and T104 Response with KRK11B

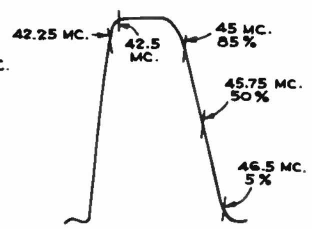


Figure 21 Over-all I-F Response with KRK11B

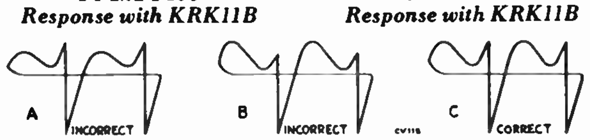


Figure 22—Horizontal Oscillator Waveforms

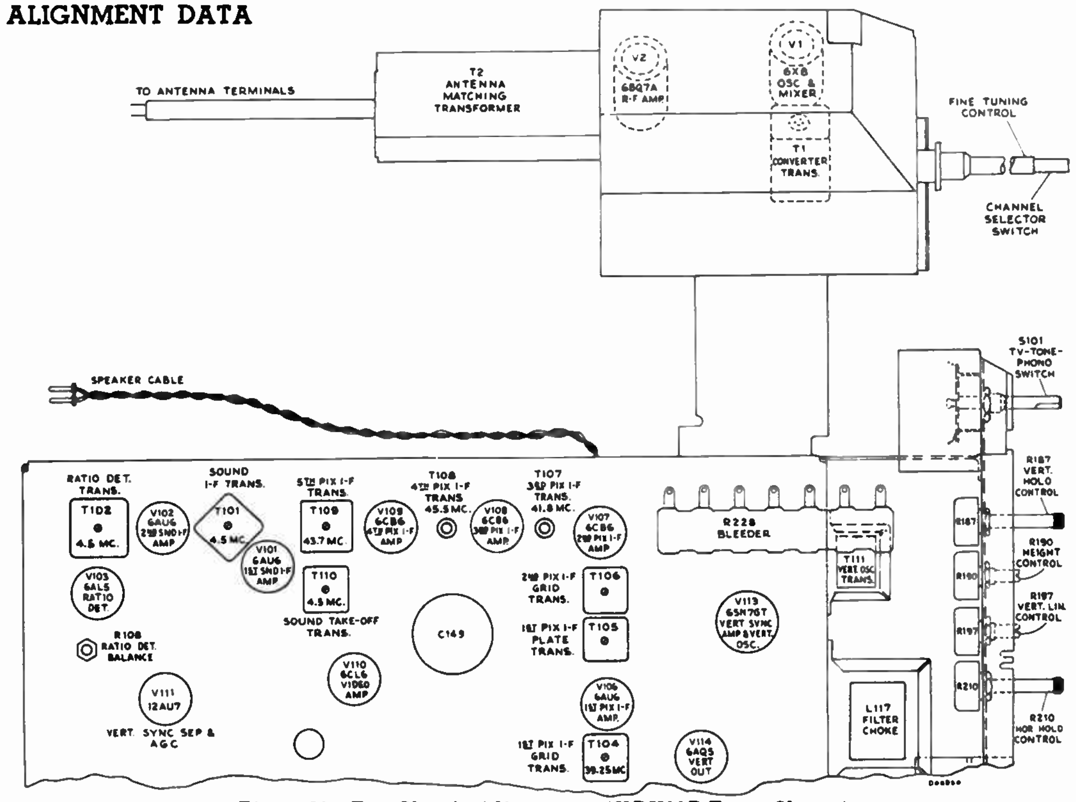


Figure 23—Top Chassis Adjustments (KRK11B Tuner Shown)

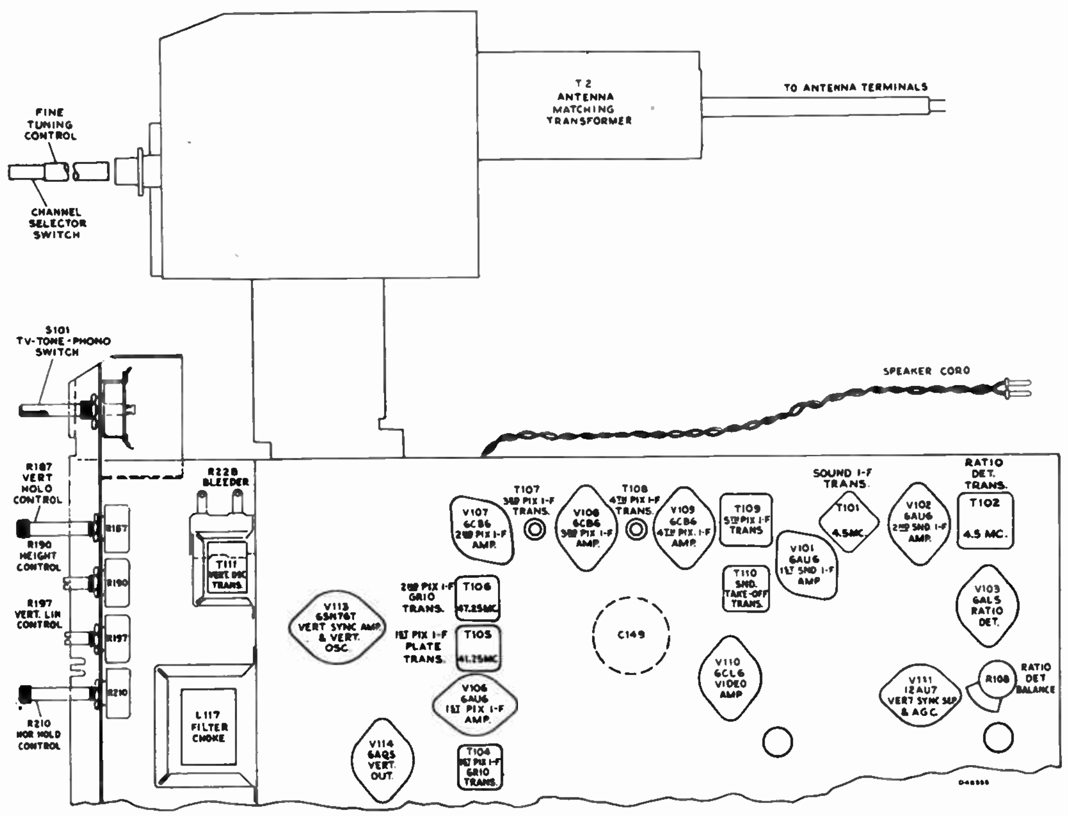


Figure 24—Bottom Chassis Adjustments (KRK11B Tuner Shown)

SCHEMATIC DIAGRAM

TUNER UNIT KRK-12

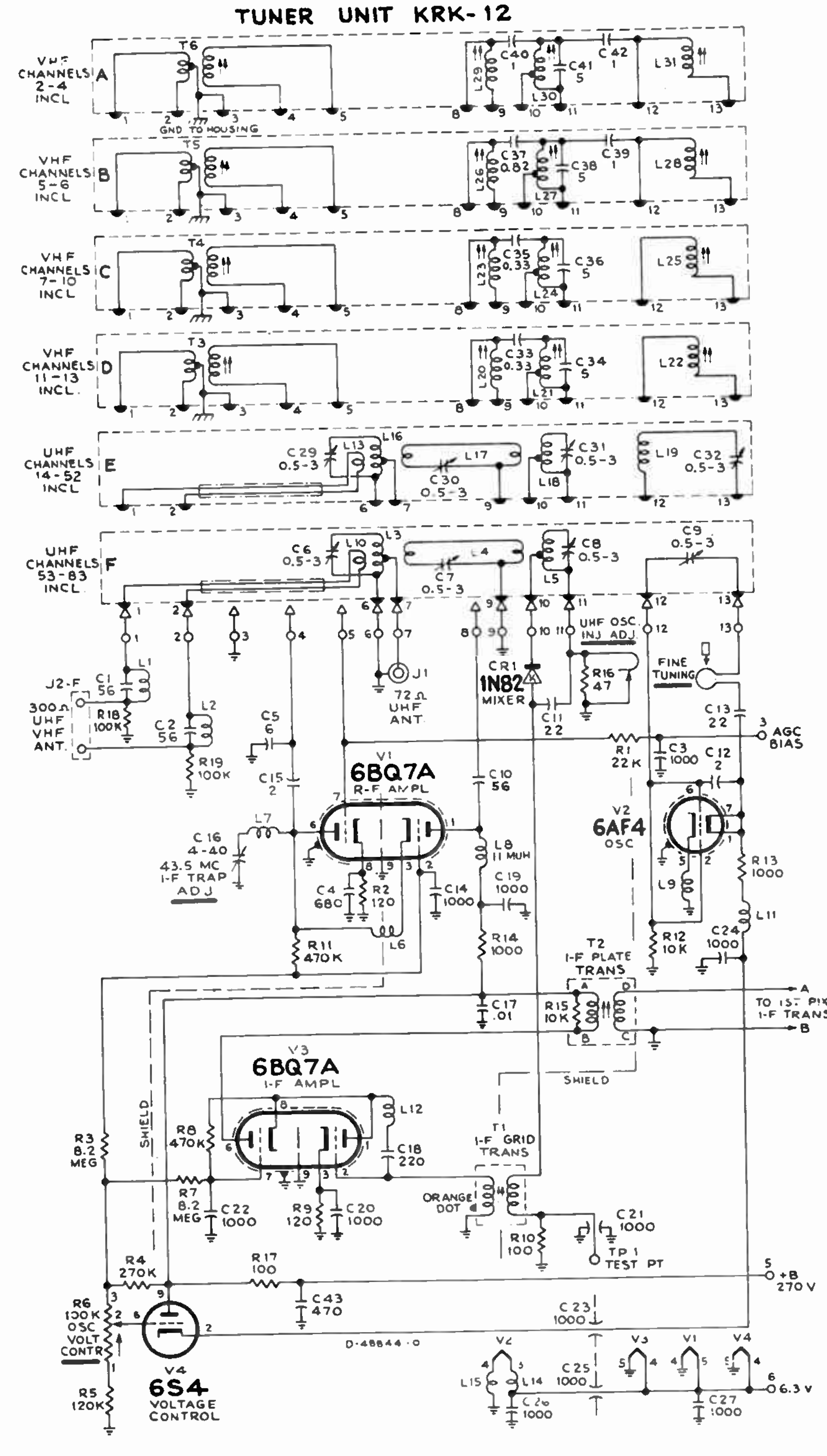


Figure 25—KRK12 Schematic Diagram

STOCK No.	DESCRIPTION
	RF UNIT ASSEMBLIES
	KRK 11B
	Models 21D305, 21D317, 21D326, 21D327, 21D328 21D329, 21D330
76539	Board—Antenna matching transformer terminal board less coils and less capacitors
76531	Board—Terminal board, 5 contact and ground
76845	Bracket—Vertical bracket for holding V1 tube shield
76965	Capacitor—Ceramic, variable, for fine tuning—plunger type (C2)
71504	Capacitor—Fixed, headed-lead type, 0.68 mmf., ±20%, 500 volts (C7)
77151	Capacitor—Tubular, adjustable, steatite, 0.8-3 mmf. (C8)
75184	Capacitor—Ceramic, adjustable, 0.8-3.8 mmf., complete with adjusting stud (C9)
76532	Capacitor—Adjustable trimmer, steatite, 1-4 mmf. (C18)
	Capacitors—Ceramic, fixed, non-insulated:
93056	5 mmf., ±0.5 mmf., 500 volts DC, Temp. coef. = 0 (C26)
70597	8 mmf., ±1 mmf., 500 volts DC, Temp. coef. = 0 (C29)
55326	10 mmf., ±1 mmf., 500 volts DC, Temp. coef. = -80 (C3)
54207	18 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C27)
76557	22 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C19)
76558	22 mmf., ±10%, 500 volts DC, Temp. coef. = -750 Special—copper coated (C5)
70935	27 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C25)
76739	33 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C24)
76527	Capacitor—Mica trimmer, 55-80 mmf. C11)
75199	Capacitor—Fixed, ceramic, insulated, 270 mmf., ±20%, 500 volts DC, High "K" type (C12, C14)
75641	Capacitor—Fixed, ceramic, insulated, 390 mmf., ±10%, 500 volts DC, High "K" type (C10)
75166	Capacitor—Ceramic, 1,500 mmf. (stand-off) (C13, C21, C22, C28, C30)
75610	Capacitor—Fixed, ceramic, insulated, 1,500 mmf., ±20%, 500 volts DC, High "K" type (C6)
73748	Capacitor—Fixed, ceramic, 1,500 mmf., ±100%, -0%, 500 volts DC, High "K" disc (C16, C17, C20, C23)
76143	Clip—Tubular clip for mounting stand-off capacitors
73591	Coil—Antenna matching coil (2 req'd)
73477	Coil—Choke coil (L57)
77206	Coil—Filament choke coil (L56)
76763	Coil—Filament choke coil (L63, L64)
76562	Coil—RF amplifier coupling coil (L51)
77153	Coil—RF choke coil (L66)
76537	Coil—Shunt coil complete with adjustable core (L61)
76538	Coil—Shunt coil complete with adjustable core (L62)
76529	Coil—Trimmer coil (3 turns) with adjustable inductance core and capacitor stud (screw adjustment) for r.f. section (L49, C15)
38853	Connector—4 contact female connector—part of antenna matching transformer (J1)
76559	Connector—Oscillator grid connector
76460	Contact—Test point contact
77202	Core—Adjustable core for fine tuning capacitor
76543	Core—Adjusting core for FM trap
76521	Detent—Detent mechanism and fibre shaft
73453	Form—Coil form for L48, L50, L53
77203	Link—Link assembly for fine tuning
76728	Nut—Speed nut for mounting adjustable trimmer 76532
	Resistors—Fixed, composition:
503112	120 ohms, ±10%, ½ watt (R9)
503115	150 ohms, ±10%, ½ watt (R13)
503210	1,000 ohms, ±10%, ½ watt (R7, R14)
503233	3,300 ohms, ±10%, ½ watt (R4, R11, R12)
503247	4,700 ohms, ±10%, ½ watt (R2)
503410	100,000 ohms, ±10%, ½ watt (R1, R5, R6)
503447	470,000 ohms, ±10%, ½ watt (R8)
14343	Retainer—Fine tuning shaft retaining ring
75164	Rod—Actuating plunger rod (fibre) for fine tuning link
76548	Screw—No. 4-40 x ¼" adjusting screw for coils L6, L7, L8, L9, L10, L11
75176	Screw—No. 4-40 x 7/16" adjusting screw for coil L5
76549	Screw—No. 4-40 x ⅜" adjusting screw for coils L1, L2, L3, L4, L46
76519	Shaft—Channel selector shaft and plate
76134	Shaft—Fine tuning shaft and cam
77147	Shield—Front shield complete with shaft bushing and bracket
76534	Shield—Tube shield
76530	Socket—Tube socket, 9 pin, miniature, ceramic, saddle mounted
76336	Socket—Tube socket, 9 pin, miniature, bakelite, saddle mounted
77149	Spacer—Metal spacer for front plate
75163	Spring—Friction spring (formed) for fine tuning cam
30340	Spring—Hairpin spring for fine tuning link
75068	Spring—Retaining spring for tube shield
77204	Spring—Return spring for fine tuning control
77664	Stator—Antenna stator complete with rotor, coils, capacitor and resistor (S5, C20, L42, L43, L44, L45, L54, L55, R13)
77922	Stator—Convertor stator complete with rotor, coils, capacitors and resistors (S2, C10, C12, L12, L13, L14, L15, L16, L17, L18, L19, L20, L21, L47, L48, R4, R5, R6)
77205	Stator—Oscillator stator complete with rotor, coils, and capacitors (S1, C3, C7, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L46)
76556	Stator—RF grid stator complete with rotor, capacitor and resistors (S4, C19, L32, L33, L34, L35, L36, L37, L38, L39, L40, L41, L53, R11, R12)

STOCK No.	DESCRIPTION
76553	Stator—RF plate stator complete with rotor, coils, capacitor and resistor (S3, C14, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L50, R7)
76561	Strap—Channel No. 13 RF grid strap (L52)
76525	Strip—Coil segment mounting strip—R.H. center
76526	Strip—Coil segment mounting strip—L.H. lower
76544	Strip—Coil segment mounting strip—L.H. upper—less trimmer
76740	Stud—No. 6-32 x 1" adjusting stud for adjustable capacitor C8
77152	Terminal—Terminal for mounting adjustable capacitor
76536	Transformer—Antenna matching transformer — complete (T2, C24, C25, C26, C27, L58, L59, L60, L61, L62, J1)
77663	Transformer—Convertor transformer complete with adjustable core (T1, R3)
76535	Trap—I.F. trap
76542	Trap—I.F. trap (41.25 MC) complete with core (L60)
76541	Trap—I.F. trap (45.75 MC) complete with core (L59)
76540	Trap—F.M. trap complete with adjustable core (L58)
75190	Washer—Insulating washer (neoprene) for adjustable capacitor
	RF UNIT ASSEMBLIES
	KRK12
	Models 21D305U, 21D317U, 21D326U, 21D327U, 21D328U, 21D329U, 21D330U
77580	Ball—Steel ball (.125" dia.) (12 req'd)
77579	Ball—Steel ball (.187" dia.)
77575	Bracket—Drive mechanism mounting bracket
77589	Bracket—Lamp bracket
77619	Bracket—VHF input connector and bracket
76845	Bracket—Vertical bracket for oscillator tube shield
77591	Cam—Fine tuning cam
77691	Capacitor—Fixed, headed-lead type, .33 mmf., ±10%, 500 volts DC (C33, C35)
77689	Capacitor—Fixed, headed-lead type, .82 mmf., ±10%, 500 volts DC (C37)
77690	Capacitor—Fixed, headed-lead type, 1.0 mmf., ±10%, 500 volts DC (C39, C40, C42)
77210	Capacitor—Fixed, ceramic, non-insulated, 2 mmf., ±0.25 mmf., 500 volts DC, Temp. coeff. = 0 (C15)
77667	Capacitor—Fixed, ceramic, insulated, comprising 1 section of 2 mmf., and 1 section of 22 mmf., Temp. coeff. = -750 (C12, C13)
77616	Capacitor—Adjustable, mica, 4-40 mmf. (C16)
77688	Capacitor—Fixed, ceramic, non-insulated, 5 mmf., ±.5 mmf., 500 volts DC, Temp. coeff. = 0 (C34, C36, C38, C41)
74182	Capacitor—Fixed, ceramic, non-insulated, 6 mmf., ±0.5 mmf., 500 volts DC, Temp. coeff. = 0 (C5)
77621	Capacitor—Fixed, ceramic, crystal holder, 22 mmf., ±10%, Temp. coeff. -750 (C11)
71924	Capacitor—Fixed, ceramic, non-insulated, 56 mmf., ±10%, 500 volts DC, Temp. coeff. = -750 (C10)
77625	Capacitor—Fixed, ceramic, 220 mmf., +100%, -0%, 500 volts DC, High "K" disc (C18)
77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, -0%, 500 volts DC, High "K" disc (C43)
77624	Capacitor—Fixed, ceramic, 680 mmf., +100%, -0%, 500 volts DC, High "K" disc (C4)
77084	Capacitor—Ceramic, feed-thru, 1,000 mmf. (C21, C23, C25)
77615	Capacitor—Ceramic, stand-off, 1,000 mmf. (C3, C19, C24, C26)
77252	Capacitor—Fixed, ceramic, 1,000 mmf., +100%, -0%, 500 volts DC, High "K" disc (C14, C20, C22, C27)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, -0%, 500 volts DC, High "K" disc (C17)
77628	Coil—IF trap (L7)
77634	Coil—IF neutralizing coil (L12)
77629	Coil—Oscillator cathode coil (L9)
77632	Coil—Oscillator heater coil (L15)
77631	Coil—Oscillator heater coil (L14)
77630	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—RF plate coil (L8)
77633	Connector—Formed grounding connector
77623	Connector—UHF antenna input connector (J1)
77612	Contact—Bracket and spring contact assembly for grounding rotor—assembled to base
77618	Contact—Bracket and spring contact assembly for grounding rotor—assembled to oscillator shield
77606	Contact—Contact and support assembly—"L" shape—complete with two (2) contacts
77622	Contact—Contact and support assembly complete with two (2) contacts and UHF antenna input connector
77620	Contact—Contact and support assembly complete with four (4) contacts and holder for crystal rectifier
77607	Contact—Contact and support assembly complete with five (5) contacts—rear of chassis
77614	Control—Oscillator voltage control (R6)
77617	Control—UHF oscillator injection adjustment control
77583	Core—Fine tuning core
77593	Coupling—Indicator shaft coupling
77596	Ferrule—Ferrule for UHF antenna input cable
77588	Gear—Rotor drive gear—nylon
77602	Insert—VHF coil assembly insert for channels 2, 3 or 4 (Includes C40, C41, C42, L29, L30, L31, T6)
77603	Insert—VHF coil assembly insert for channels 5 or 6 (Includes C37, C38, C39, L26, L27, L28, T5)

STOCK No.	DESCRIPTION
77604	Insert—VHF coil assembly insert for channels 7, 8, 9 or 10 (Includes C35, C36, L23, L24, L25, T4)
77605	Insert—VHF coil assembly insert for channels 11, 12 or 13 (Includes C33, C34, L20, L21, L22, T3)
77590	Lever—Actuating lever for fine tuning link
77582	Link—Fine tuning link
77581	Plate—Front plate and ball race
77489	Rectifier—Germanium rectifier IN82 (CR1)
	Resistors—Fixed, composition: -
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1,000 ohms, ±10%, ½ watt (R13, R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohm, ±10%, ½ watt (R3, R7)
30340	Retainer—Retainer ring for fine tuning actuating lever stud
77592	Ring—Contact ring
77599	Roller—Rotor detent roller and retainer
77574	Rotor—Rotor frame
77594	Screw—No. 8-32 x ¼" cup point set screw for indicator shaft coupling
77576	Shaft—Channel selector drive shaft complete with two (2) gears
77595	Shaft—Indicator shaft
77611	Shield—Oscillator shield and grounding spring assembly —underside of chassis
77577	Shield—Top shield
76967	Shield—Tube shield for V2
76534	Shield—Tube shield for V1, V3
77613	Sleeve—Insulating sleeve for fine tuning adjustable core
77274	Socket—Tube socket, 7 pin, miniature, saddle mounted, steatite for V2
77608	Socket—Tube socket, 9 pin, miniature, saddle mounted, moulded mica for V1, V3, V4
77578	Spring—Formed spring for holding rotor (on back of unit)
77584	Spring—Fine tuning link adjusting spring
76961	Spring—Retaining spring for oscillator tube shield
77598	Spring—Rotor detent spring and roller complete with mounting bracket
77599	Roller—Rotor detent roller and retainer
77587	Stud—Mounting stud for fine tuning link actuating lever
77693	Stud—No. 6-32 x 21/32" adjusting stud for trimmer capacitor C9
77692	Stud—No. 6-32 x 25/32" adjusting stud for trimmer capacitors C6, C7, C8, C29, C30, C31, C32
77694	Stud—No. 10-32 x ⅜" adjusting stud for coils L20, L21, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31 and transformers T3, T4, T5, T6
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer complete with adjustable cores (T2, R15)
77626	Trap—I.F. trap (L1, C1, L2, C2)
77585	Washer—"C" washer for drive and indicator shafts (3 req'd)
77586	Washer—"C" washer for fine tuning link spring
	CHASSIS ASSEMBLIES
	KCS 81 (KRK11B RF Unit)
	KCS 81B (KRK12 RF Unit)
76456	Bracket—Channel indicator lamp bracket for KCS81
76490	Bracket—Mouunting bracket complete with insulator for picture control
12118	Cap—Tube connector cap
71496	Capacitor—Mica trimmer, 5-70 mmf. (C121)
75217	Capacitor—Mica trimmer, dual 10-160 mmf. (C186A, C186B)
39044	Capacitor—Fixed, ceramic, non-insulated, 15 mmf., ±10%, 500 volts DC, Temp. coef = -750 (C152)
76577	Capacitor—Fixed, ceramic, 33 mmf., 6,000 volts (C198)
76574	Capacitor—Fixed, ceramic, 39 mmf., 3,500 volts (C180)
39042	Capacitor—Fixed, ceramic, non-insulated, 47 mmf., ±10%, 500 volts DC, Temp. coef. = -750 (C151)
71924	Capacitor—Fixed, ceramic, non-insulated, 56 mmf., ±10%, 500 volts DC, Temp. coef. = -750 (C104)
76474	Capacitor—Fixed, mica, 82 mmf., 1,000 volts DC (C165, C187)
39396	Capacitor—Fixed, ceramic, non-insulated, 100 mmf., ±10%, 500 volts DC, Temp. coef. = -750 (C168, C169, C172)
71614	Capacitor—Fixed, ceramic, non-insulated, 120 mmf., ±10%, 500 volts DC, Temp. coef. = -750 (C167)
76576	Capacitor—Fixed, ceramic, 150 mmf., 2,000 volts (C200)
76575	Capacitor—Fixed, ceramic, 180 mmf., 3,500 volts (C199)
75248	Capacitor—Fixed, mica, 220 mmf., 1,000 volts (C181)
47617	Capacitor—Fixed, ceramic, non-insulated, 270 mmf., ±10%, 500 volts DC, Temp. coef. = -750 (C115, C164)
39638	Capacitor—Fixed, mica, 270 mmf., 500 volts DC (C161)
76579	Capacitor—Fixed, mica, 270 mmf., 1,000 volts DC (C192)
39640	Capacitor—Fixed, mica, 330 mmf., 500 volts DC (C159)
39644	Capacitor—Fixed, mica, 470 mmf., 500 volts DC (C108, C109)
76488	Capacitor—Ceramic, 500 mmf., 30,000 volts (C201)
75166	Capacitor Ceramic, stand-off, 1,500 mmf. (C144)

STOCK No.	DESCRIPTION
73748	Capacitor—Fixed, ceramic, 1,500 mmf., +100%, -0%, 500 volts DC, High "K" disc (C209)
73473	Capacitor—Fixed, ceramic, 4,700 mmf., +100%, -0%, 500 volts DC, High "K" disc (C126, C128, C130, C136, C138, C141)
76470	Capacitor—Fixed, ceramic, dual 4,700 mmf., +100%, -0%, 500 volts DC, High "K" disc (C122A, C122B, C127A, C127B for KCS81) (C133A, C133B, C137A, C137B, C139A, C139B, C140A, C140B)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, -0%, 500 volts DC, High "K" disc (C145, C146)
75877	Capacitor—Fixed, ceramic, dual 10,000 mmf., +100%, -0%, 500 volts DC, High "K" disc (C101A, C101B, C105A, C105B)
74521	Capacitor—Electrolytic, 5 mfd., 50 volts (C111)
28417	Capacitor—Electrolytic, 5 mfd., 450 volts (C175)
76485	Capacitor—Electrolytic, comprising 2 sections of 35 mfd., 450 volts, 1 section of 10 mfd., 450 volts and 1 section of 10 mfd., 200 volts (C120A, C120B, C120C, C120D)
76486	Capacitor—Electrolytic comprising 1 section of 35 mfd., 450 volts, 1 section of 25 mfd., 450 volts, 1 section of 20 mfd., 200 volts and 1 section of 100 mfd., 50 volts (C118A, C118B, C118C, C118D)
77657	Capacitor—Electrolytic comprising 1 section of 70 mfd., 450 volts, 2 sections of 10 mfd., 450 volts and 1 section of 5 mfd., 450 volts (C149A, C149B, C149C, C149D)
	Capacitors—Fixed, tubular, oil impregnated:
75643	Paper, .001 mfd., 1,000 volts (C194)
77727	Moulded paper, .0013 mfd., 600 volts (C195)
73595	Paper, .0022 mfd., 600 volts (C110)
73803	Paper, .0022 mfd., 1,000 volts (C177)
73599	Paper, .0027 mfd., 600 volts (C116, C119, C156)
73920	Moulded paper, .0047 mfd., 600 volts (C112, C148, C158, C166, C171)
73789	Moulded paper, .0068 mf., 400 volts (C213)
73808	Paper, .0082 mfd., 1,000 volts (C162)
73561	Paper, .01 mfd., 400 volts (C114, C117, C170, C202)
73594	Moulded paper, .01 mfd., 600 volts (C184, C185, C193)
73562	Paper, .022 mfd., 400 volts (C113, C178, C179, C189)
73798	Paper, .022 mfd., 600 volts (C182)
73552	Paper, .033 mfd., 400 volts (C163)
73553	Paper, .047 mfd., 400 volts (C124 for KCS81) (C160, C188, C190)
73592	Paper, .047 mfd., 600 volts (C197)
73815	Paper, .068 mfd., 1,000 volts (C203, C205)
73551	Paper, 0.1 mfd., 400 volts (C183)
73557	Paper, 0.1 mfd., 600 volts (C173, C204)
73794	Paper, 0.22 mfd., 400 volts (C129, C153, C155, C157, C208, C210)
74957	Paper, 0.22 mfd., 600 volts (C176)
73787	Paper, 0.47 mfd., 200 volts (C191, C196)
77676	Choke—Filter choke (L117)
76143	Clip—Mounting clip for stand-off capacitor
73477	Coil—Choke coil (L101)
76672	Coil—Filament winding only for hi-voltage transformer (Part of T115)
76483	Coil—Horizontal linearity coil complete with adjustable core (L111)
76646	Coil—Peaking coil (72 muh) (L103, R149)
76647	Coil—Peaking coil (180 muh) (L107, R158)
75252	Coil—Peaking coil (500 muh) (L104, L106)
76640	Coil—RF choke coil (1.5 muh) (L110, L112)
76510	Coil—RF choke coil (4.7 muh) (L108)
76484	Coil—Width coil complete with adjustable core (L109)
76457	Connector—2nd anode lead connector
74594	Connector—2 contact male connector for power cord
50367	Connector—6 contact female connector for yoke leads (J102)
35787	Connector—Phono input connector (J101)
75474	Connector—Single contact male connector for speaker cable
77654	Control—AGC control (R180)
77655	Control—Brightness control, volume control and power switch (R114A, R114B, S102A, S102B)
77640	Control—Height control (R190)
76639	Control—Horizontal hold control (R210)
76445	Control—Picture control (R155)
77199	Control—Ratio detector balance control (R108)
77652	Control—Vertical hold control (R187)
77653	Control—Vertical linearity control (R197)
77647	Coupling—Coupling (nylon) for picture control
77136	Cover—Back cover for hi-voltage compartment
76985	Cover—Side cover for hi-voltage compartment
73600	Fuse—0.25 amp., 250 volts (F101)
76459	Grommet—Rubber grommet for 2nd anode lead exit
76480	Lead—Anode lead complete with eyelet
76500	Plate—Hi-voltage plate (bakelite) complete less transformer, socket and lead
76649	Radiator—Heat dissipating radiator for V116
76675	Rectifier—Picture detector crystal rectifier (CR101)
76468	Resistor—Wire wound, 1.5 ohms, 1/3 watt (R225)
74015	Resistor—Wire wound, 100 ohms, 2 watts (R221)
77651	Resistor—Wire wound comprising 1 section of 600 ohms, 16 watts, 1 section of 500 ohms, 6 watts, 1 section of 2,000 ohms, 5 watts, 1 section of 1,200 ohms, 1 watt, 1 section of 10,000 ohms, 5 watts and 1 section of 7,000 ohms, 5 watts (R228A, R228B, R228C, R228D, R228E, R228F)
76642	Resistor—Wire wound, 6,750 ohms, 10 watts (R153)
77668	Resistor—Wire wound, 4,000 ohms, 7 watts (R121 for KCS81)

STOCK No.	DESCRIPTION
77669	Resistor—Wire wound, 10,000 ohms, 5 watts (R231 for KCS81)
	Resistors—Fixed, composition:
503033	33 ohms, ±10%, ½ watt (R152)
503047	47 ohms, ±10%, ½ watt (R107, R218)
502056	56 ohms, ±5%, ½ watt (R134)
34763	68 ohms, ±5%, ½ watt (R138)
502082	82 ohms, ±5%, ½ watt (R101)
502110	100 ohms, ±5%, ½ watt (R128)
503110	100 ohms, ±10%, ½ watt (R127 for KCS81)
503118	180 ohms, ±10%, ½ watt (R142)
503122	220 ohms, ±10%, ½ watt (R151)
513133	330 ohms, ±10%, 1 watt (R118, R119)
503147	470 ohms, ±10%, ½ watt (R199)
503156	560 ohms, ±10%, ½ watt (R198)
503168	680 ohms, ±10%, ½ watt (R154)
503210	1,000 ohms, ±10%, ½ watt (R102, R104, R109, R120, R126, R131, R133, R136, R161)
502218	1,800 ohms, ±5%, ½ watt (R183)
503222	2,200 ohms, ±10%, ½ watt (R140)
502233	3,300 ohms, ±10%, ½ watt (R201)
502239	3,900 ohms, ±5%, ½ watt (R150)
503239	3,900 ohms, ±10%, ½ watt (R211)
503247	4,700 ohms, ±10%, ½ watt (R230)
502256	5,600 ohms, ±5%, ½ watt (R137)
513256	5,600 ohms, ±10%, 1 watt (R156)
14659	6,800 ohms, ±5%, ½ watt (R111, R112)
503268	6,800 ohms, ±10%, ½ watt (R176)
513268	6,800 ohms, ±10%, 1 watt (R147)
502282	8,200 ohms, ±5%, ½ watt (R191)
503282	8,200 ohms, ±10%, ½ watt (R145)
513282	8,200 ohms, ±10%, 1 watt (R182)
503310	10,000 ohms, ±10%, ½ watt (R139, R164, R200, R213, R229)
513310	10,000 ohms, ±10%, 1 watt (R157)
503315	15,000 ohms, ±10%, ½ watt (R115, R239)
523315	15,000 ohms, ±10%, 2 watts (R143)
503318	18,000 ohms, ±10%, ½ watt (R144)
503322	22,000 ohms, ±10%, ½ watt (R175)
522322	22,000 ohms, ±10%, 2 watts (R223)
503327	27,000 ohms, ±10%, ½ watt (R174, R178)
523327	27,000 ohms, ±10%, 2 watts (R222)
503333	33,000 ohms, ±10%, ½ watt (R106, R129, R132, R135, R235)
503339	39,000 ohms, ±10%, ½ watt (R110, R173, R212, R215)
503347	47,000 ohms, ±10%, ½ watt (R103) (R123 for KCS81)
502356	56,000 ohms, ±5%, ½ watt (R141)
503356	56,000 ohms, ±10%, ½ watt (R105, R209)
503368	68,000 ohms, ±10%, ½ watt (R208)
512368	68,000 ohms, ±5%, 1 watt (R193)
513368	68,000 ohms, ±10%, 1 watt (R216)
8064	82,000 ohms, ±5%, ½ watt (R167)
513382	82,000 ohms, ±10%, 1 watt (R214)
503410	100,000 ohms, ±10%, ½ watt (R166, R203, R238)
503412	120,000 ohms, ±10%, ½ watt (R124)
503415	150,000 ohms, ±10%, ½ watt (R159, R195, R202, R204)
503418	180,000 ohms, ±10%, ½ watt (R207)
502422	220,000 ohms, ±5%, ½ watt (R179)
503422	220,000 ohms, ±10%, ½ watt (R194, R233)
502427	270,000 ohms, ±5%, ½ watt (R163, R165)
503427	270,000 ohms, ±10%, ½ watt (R171, R226)
503433	330,000 ohms, ±10%, ½ watt (R116, R205, R220)
503439	390,000 ohms, ±10%, ½ watt (R219)
503447	470,000 ohms, ±10%, ½ watt (R117, R148, R160, R172, R184, R185, R189)
503468	680,000 ohms, ±10%, ½ watt (R169)
503482	820,000 ohms, ±10%, ½ watt (R206)
503510	1 megohm, ±10%, ½ watt (R181, R188, R217)
503512	1.2 megohm, ±10%, ½ watt (R186)
503533	3.3 megohm, ±10%, ½ watt (R196)
512536	3.6 megohm, ±5%, 1 watt (R162)
503539	3.9 megohm, ±10%, ½ watt (R168)
503547	4.7 megohm, ±10%, ½ watt (R170)
503582	8.2 megohm, ±10%, ½ watt (R122 for KCS81)
503610	10 megohm, ±10%, ½ watt (R113)
76650	Ring—Anchoring ring for radiator hold down spring
77660	Shaft—Extension shaft for picture control
77661	Shell—Mounting shell for hi-voltage capacitor
76489	Shield—Hi-voltage shield less side and back cover
73584	Shield—Tube shield for V101, V102, V103, V106, V107, V109
77659	Shield—Tube shield for V105
76741	Shield—Tube shield for V113
75718	Socket—Channel indicator lamp socket for KCS81
74834	Socket—Kinescope socket
71508	Socket—Tube socket, 6 pin, moulded for V117
50367	Socket—Tube socket, 6 pin, moulded, saddle mounted for V118, V119
71494	Socket—Tube socket, miniature, 7 pin, moulded, saddle mounted for V114
77658	Socket—Tube socket, miniature, 7 pin, moulded, saddle mounted for V105
73117	Socket—Tube socket, miniature, 7 pin, wafer for V101, V102, V103, V104, V106, V107, V108, V109
77645	Socket—Tube socket, octal, wafer for V115
31251	Socket—Tube socket, octal, wafer for V113, V116, V121, V122
76971	Socket—Tube socket, miniature, 9 pin, wafer for V110, V111, V112
76651	Spring—Hold down spring for heat dissipating radiator (3 req'd)
77656	Switch—Phono-tone switch (S101)

STOCK No.	DESCRIPTION
76463	Terminal—Screw type grounding terminal
77198	Transformer—1st pix I.F. grid transformer complete with adjustable cores (T104, C125, R125)
77197	Transformer—1st pix I.F. plate transformer complete with adjustable cores (T105, C131, C132, R130)
76435	Transformer—2nd pix I.F. grid transformer complete with adjustable cores (T106, C134)
76433	Transformer—3rd or 4th pix I.F. transformer (T107, T108)
76436	Transformer—5th pix I.F. transformer (T109, C142, C143, L102, R146, CR101)
76501	Transformer—Hi-voltage transformer (Part of T115)
76440	Transformer—Horizontal oscillator transformer complete with adjustable cores (T114)
76997	Transformer—Output transformer (T103)
77649	Transformer—Power transformer, 117 volts, 60 cycle (T113)
76439	Transformer—Ratio detector transformer complete with adjustable cores (T102, C106, C107)
76438	Transformer—Sound I.F. transformer complete with adjustable cores (T101, C102, C103)
76437	Transformer—Sound take-off transformer complete with adjustable cores (T110, C147)
77650	Transformer—Vertical oscillator transformer (T111)
76494	Transformer—Vertical output transformer (T112)
76482	Trap—4.5 MC trap (L105, C150)
77585	Washer—"C" washer for picture control extension shaft (2 req'd)

YOKE & MAGNET ASSEMBLIES

STOCK No.	DESCRIPTION
76863	Connector—Anode connector complete with contact and eyelet
75542	Connector—6 contact male connector—part of deflection yoke (P102)
74956	Cushion—Rubber cushion for deflection yoke hood
76654	Hood—Deflection yoke hood—less rubber cushions
76168	Magnet—Focus magnet
76141	Magnet—Ion trap magnet
71456	Screw—No. 8-32 x 7/16" wing screw for mounting deflection yoke
76636	Stud—Adjusting stud complete with guard for focus magnet
76653	Yoke—Deflection yoke complete with male connector (L113, L114, L115, L116, C206, C207, R227, P102)

SPEAKER ASSEMBLIES
971490-3W 971490-3R
RL 105E6 RMA 285
RMA 274
(For Table Models)

STOCK No.	DESCRIPTION
75024	Cone—Cone and voice coil for speakers stamped 971490-3W
77129	Cone—Cone and voice coil for speakers stamped 971490-3R
75022	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)

SPEAKER ASSEMBLIES
92569-12W
RL 111A1
RMA 274
(For Console Models)

STOCK No.	DESCRIPTION
75682	Cone—Cone and voice coil
76093	Speaker—12" P.M. speaker complete with cone and voice coil (3.2 ohms)

NOTE: If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to Model number of instrument, number stamped on speaker and full description of part required.

MISCELLANEOUS

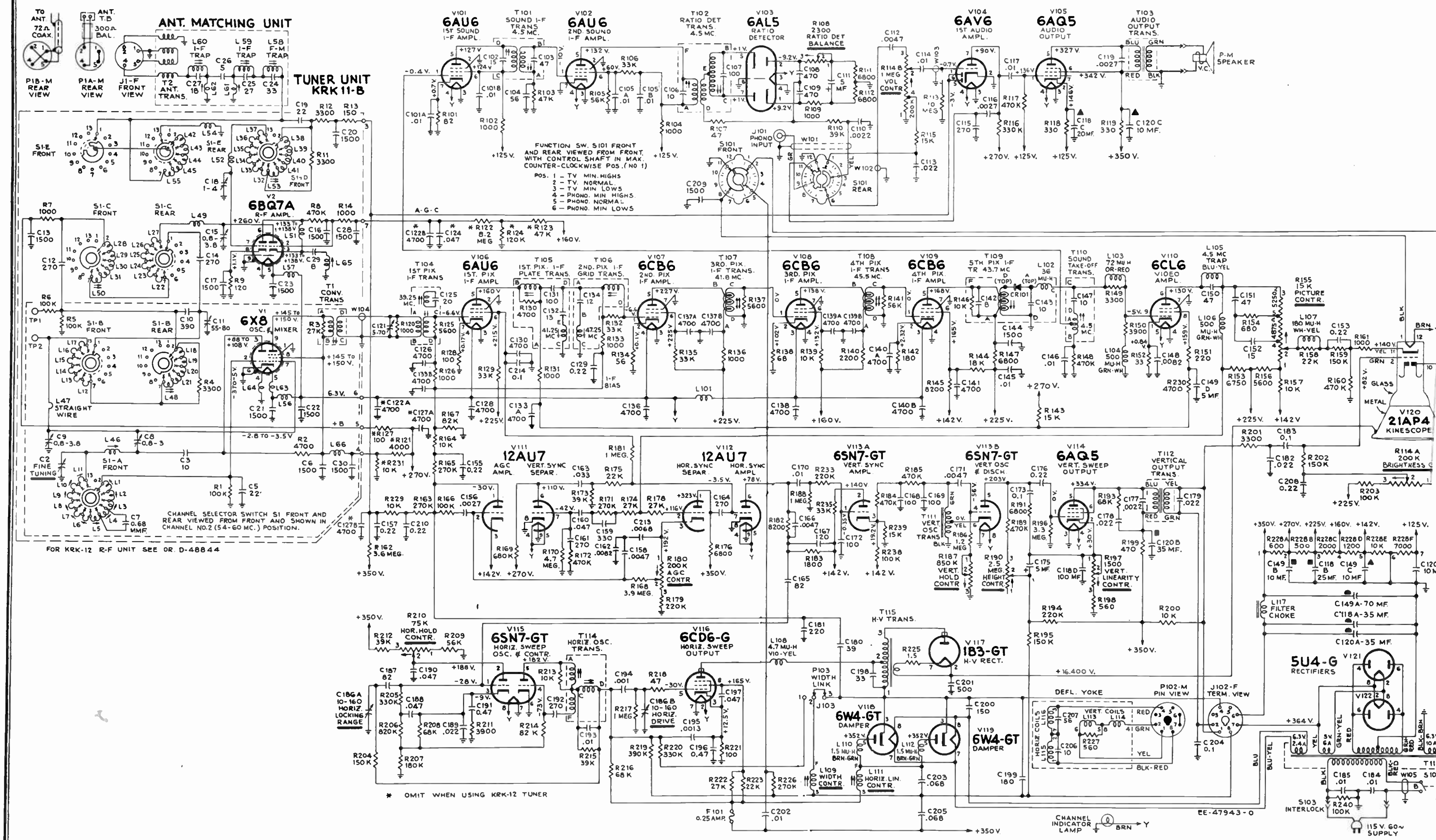
STOCK No.	DESCRIPTION
77771	Back—Cabinet back complete with terminal board and power cord for Models 21D305, 21D305U, 21D317, 21D317U
77790	Back—Cabinet back complete with power cord for Models 21D326, 21D326U, 21D327, 21D327U
77772	Back—Cabinet back complete with power cord for Models 21D328, 21D328U, 21D329, 21D329U
77773	Back—Cabinet back complete with power cord for Models 21D330, 21D330U
76184	Board—Antenna terminal board
76629	Bracket—Hanger bracket for deflection yoke hood assembly
76697	Bracket—Masking panel support bracket (2 req'd)
77748	Bracket—Mounting bracket for hidden controls cover and case assembly
76599	Bracket—"U" shape bracket for deflection yoke hood support rod
76699	Bumper—Rubber bumper for kinescope (as req'd)
71496	Capacitor—Mica trimmer, 5-70 mmf. (part of antenna cable and F.M. trap) for Models 21D305U, 21D317U, 21D326U, 21D327U, 21D328U, 21D329U, 21D330U
71892	Catch—Bullet catch and strike for Models 21D326, 21D326U, 21D327, 21D327U, 21D328, 21D328U, 21D329, 21D329U, 21D330, 21D330U
77755	Clamp—Polystyrene clamp for antenna cable and mount for F.M. trap for Models 21D305U, 21D317U, 21D326U, 21D327U, 21D328U, 21D329U, 21D330U
X1917	Cloth—Grille cloth for mahogany instruments for Model 21D305

STOCK No.	DESCRIPTION
X1918	Cloth—Grille cloth for oak instruments for Model 21D305
X3351	Cloth—Grille cloth for oak instruments for Models 21D317, 21D317U, 21D326, 21D326U, 21D328, 21D328U
X3349	Cloth—Grille cloth for natural cherry instruments for Models 21D327, 21D327U; for light walnut instruments for Models 21D328, 21D328U; for maple instruments for Models 21D330, 21D330U
X3350	Cloth—Grille cloth for mahogany instruments for Models 21D317, 21D317U, 21D326, 21D326U, 21D329, 21D329U; for red cherry instruments for Models 21D327, 21D327U, 21D330, 21D330U; for walnut instruments for Models 21D329, 21D329U
75474	Connector—Single contact male connector—part of antenna cable
77726	Connector—2 contact male connector—part of antenna cable—for 21D300U series
39153	Connector—4 contact male connector—part of antenna cable—for 21D300 series
71457	Cord—Power cord and plug
77774	Cover—Cover and case assembly—brown—for hidden controls for mahogany, walnut or red cherry instruments
77775	Cover—Cover and case assembly—medium beige—for hidden controls for oak instruments
77776	Cover—Cover and case assembly—tan—for hidden controls for maple or natural cherry instruments
77761	Cover—Cover assembly—brown—complete with spring for channel markers for maple or natural cherry instruments for 21D300U series
77759	Cover—Cover assembly—maroon—complete with spring for channel markers for mahogany, walnut or red cherry instruments for 21D300U series
77760	Cover—Cover assembly — sand gray — complete with spring for channel markers for oak instruments for 21D300U series
77770	Cushion—Adhesive cushion (1/32" x 13/32" x 15/16") for safety glass retainers
77749	Cushion—Rubber cushion for safety glass (4 req'd)
76698	Cushion—Rubber cushion for masking panel
76631	Cushion—Rubber cushion for dust sealing the kinescope
77782	Decal—Brightness, volume, fine tuning controls and channel selector switch function decal for mahogany, walnut or red cherry instruments
77781	Decal—Brightness, volume, fine tuning controls and channel selector switch function decal for oak, maple, light walnut or natural cherry instruments
77758	Disc—Polystyrene indicator disc—brown—for channel selections for maple or natural cherry instruments for 21D300U series
77756	Disc—Polystyrene indicator disc—maroon—for channel selections for mahogany, walnut or red cherry instruments for 21D300U series
77757	Disc—Polystyrene indicator disc—sand gray—for channel selections for oak instruments for 21D300U series
77783	Emblem—"Deluxe" emblem for Models 21D317, 21D317U, 21D326, 21D326U, 21D327, 21D327U, 21D328, 21D328U, 21D329, 21D329U, 21D330, 21D330U
77700	Escutcheon—Channel marker escutcheon for 21D300 series
77780	Foot—Rubber foot (4 req'd) for Model 21D305
77745	Glass—Safety glass
37396	Grommet—Rubber grommet for speaker mounting
74308	Hinge—Door hinge (1 set) for Models 21D326, 21D326U, 21D327, 21D327U, 21D328, 21D328U, 21D329, 21D329U, 21D330, 21D330U
77787	Hinge—Ornamental "H" hinge for natural cherry instruments for Models 21D327, 21D327U
77786	Hinge—Ornamental "H" hinge for red cherry instruments for Models 21D327, 21D327U
77709	Knob—Brightness control knob—brown—for mahogany, walnut or red cherry instruments (outer)
77718	Knob—Brightness control knob—medium biege—for oak instruments (outer)
77734	Knob—Brightness control knob — tan — for maple or natural cherry instruments (outer)
77751	Knob—Channel selector knob—brown—for mahogany, walnut or red cherry instruments for 21D300U series
77752	Knob—Channel selector knob—medium biege—for oak instruments for 21D300U series
77753	Knob—Channel selector knob—tan—for maple or natural cherry instruments
77708	Knob—Channel selector knob for 21D300 series (inner)
77707	Knob—Fine tuning control knob—brown—for mahogany, walnut or red cherry instruments for 21D300 series (outer)
77717	Knob—Fine tuning control knob—medium biege—for oak instruments for 21D300 series (outer)
77733	Knob—Fine tuning control knob—tan—for maple or natural cherry instruments for 21D300 series (outer)
77750	Knob—Fine tuning control knob for 21D300U series
77699	Knob—Picture control knob — brown — for mahogany, walnut or red cherry instruments
77719	Knob—Picture control knob—medium biege—for oak instruments
77738	Knob—Picture control knob—tan—for maple or natural cherry instruments
77735	Knob—Tone control and phono switch knob—brown—for mahogany, walnut or red cherry instruments
77736	Knob—Tone control and phono switch knob—medium biege—for oak instruments

STOCK No.	DESCRIPTION
77737	Knob—Tone control and phono switch knob—tan—for maple or natural cherry instruments
77710	Knob—Volume control and power switch knob (inner)
11765	Lamp—Channel marker escutcheon lamp—Mazda 51
77765	Marker—UHF channel number marker for mahogany, walnut or red cherry instruments for 21D300U series
77767	Marker—UHF channel number marker for maple or natural cherry instruments for 21D300U series
77766	Marker—UHF channel number marker for oak instruments for 21D300U series
77762	Marker—VHF channel number marker for mahogany, walnut or red cherry instruments for 21D300U series
77764	Marker—VHF channel number marker for maple or natural cherry instruments for 21D300U series
77763	Marker—VHF channel number marker for oak instruments for 21D300U series
77701	Mask—Channel marker escutcheon light mask—brown—for mahogany, walnut or red cherry instruments for 21D300U series
77720	Mask—Channel marker escutcheon light mask—medium beige—for oak instruments for 21D300 series
77739	Mask—Channel marker escutcheon light mask—tan—for maple or natural cherry instruments for 21D300 series
77768	Mask—Kinescope masking panel (tan) for mahogany, walnut or red cherry instruments
77769	Mask—Kinescope masking panel (sand) for oak, maple or natural cherry instruments
77784	Medallion—"His Master's Voice" medallion for Models 21D317, 21D317U, 21D326, 21D326U, 21D327, 21D327U, 21D328, 21D328U, 21D329, 21D329U, 21D330, 21D330U
76177	Nut—No. 10-32 special nut for deflection yoke hood support rod
73634	Nut—Speed nut for speaker mounting screws for Models 21D317, 21D317U, 21D326, 21D326U, 21D327, 21D327U, 21D328, 21D328U, 21D329, 21D329U, 21D330, 21D330U
74337	Nut—Speed nut to fasten "Deluxe" emblem for Models 21D317, 21D317U, 21D326, 21D326U, 21D327, 21D327U, 21D328, 21D328U, 21D329, 21D329U, 21D330, 21D330U
76601	Pad—Kinescope edge support pad (4 req'd)
77046	Pull—Door pull for Models 21D326, 21D326U
77785	Pull—Door pull for natural cherry instruments for Models 21D327, 21D327U
77021	Pull—Door pull for red cherry instruments for Models 21D327, 21D327U
77788	Pull—Door pull (upper) for Models 21D329, 21D329U (4 req'd)
77789	Pull—Door pull (lower) for Models 21D329, 21D329U (2 req'd)
77044	Pulls—Door pulls (1 set) for Models 21D330, 21D330U
77928	Retainer—Retainer for channel selector knob for Models 21D305U, 21D317U, 21D326U, 21D327U, 21D328U, 21D329U, 21D330U
77746	Retainer—Safety glass retainer for sides (2 req'd)
77747	Retainer—Safety glass retainer for top or bottom
76628	Rod—"L" shape threaded rod for supporting deflection yoke hood assembly
77712	Screw—No. 6 x ½" cross recessed pan head self-tapping screw (black) for fastening hidden controls cover and case to cabinet for mahogany, walnut or red cherry instruments
77725	Screw—No. 6 x ½" cross recessed pan head self-tapping screw (zinc) for fastening hidden controls cover and case to cabinet for oak, maple or natural cherry instruments
76632	Screw—No. 8 x ⅝" hex head wood screw for masking panel support bracket or hanger bracket
74279	Screw—No. 8-32 x ⅞" trimit head screw for door pulls 77044 for Models 21D330, 21D330U
74269	Screw—No. 8-32 x ¾" trimit head screw for door pulls 77021 and 77785 for Models 21D327, 21D327U and for door pull 77788 for Models 21D329, 21D329U
74113	Screw—No. 8-32 x 1" trimit head screw for door pull 77046 for Models 21D326, 21D326U
74307	Screw—No. 8-32 x 1⅛" trimit head screw for door pull 77789 for Models 21D329, 21D329U
77754	Shade—Channel marker escutcheon lamp shade for 21D300U series
73643	Spring—Channel marker escutcheon spring clip for 21D300 series
77929	Spring—Formed spring for fine tuning knob for Models 21D305U, 21D317U, 21D326U, 21D327U, 21D328U, 21D329U, 21D330U
76820	Spring—Formed spring for safety glass retainers
76630	Spring—Formed spring for kinescope masking panel
77006	Spring—Retaining spring for deflection yoke hood support rod nut
76837	Spring—Retaining spring for knobs 77699, 77708, 77709, 77718, 77719, 77734, 77735, 77736, 77737, 77738
72845	Spring—Retaining spring for knobs 77707, 77717, 77733 for 21D300 series
30330	Spring—Retaining spring for knob 77710
74734	Spring—Retaining spring for channel marker covers 77759, 77760, 77761
74936	Spring—Suspension spring for kinescope socket lead
72936	Stop—Cabinet door stop for Models 21D326, 21D326U, 21D327, 21D327U, 21D328, 21D328U, 21D329, 21D329U, 21D330, 21D330U
76600	Strap—Grounding strap (.005" soft copper strip)
75500	Washer—Felt washer for kinescope mask or cabinet back mounting screws

APPLY TO YOUR RCA DISTRIBUTOR FOR PRICES OF REPLACEMENT PARTS

KCS81 CIRCUIT SCHEMATIC DIAGRAM (KCS81B WITH KRK12 TUNER)



The schematic is shown in the latest condition at the time of printing.
All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

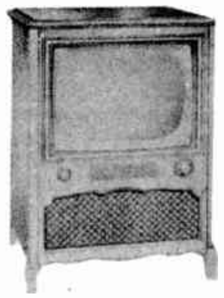
Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 26 Circuit Schematic Diagram

Models 21-T-303, 21-T-303U
"Kirby"
Antique Mahogany

Models 21-T-313, 21-T-313U
"Jeffrey"
Mahogany, Blond Mahogany



Models 21-T-314, 21-T-314U
"Prentiss"
Mahogany, Oak

Models 21-T-315, 21-T-315U
"Deauville"
Maple

Models 21-T-316, 21-T-316U
"Hilton"
Oak

Models 21-T-322, 21-T-322U
"Dobson"
Mahogany, Oak

Models 21-T-323, 21-T-323U
"Lexington"
Maple, Red Cherry

Models 21-T-324, 21-T-324U
"Stockton"
Mahogany, Walnut

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GENERAL DESCRIPTION

Models 21-T-303, 21-T-303U, 21-T-313, 21-T-313U, 21-T-314, 21-T-314U, 21-T-315, 21-T-315U, 21-T-316, 21-T-316U, 21-T-322, 21-T-322U, 21-T-323, 21-T-323U, 21-T-324 and 21-T-324U are "21 inch" television receivers. Models 21-T-303, 21-T-313, 21-T-314, 21-T-315, 21-T-316, 21-T-322, 21-T-323 and 21-T-324 are identical except for cabinets and speakers. These receivers feature full twelve channel VHF coverage. Models 21-T-303U, 21-T-313U, 21-T-314U, 21-T-315U, 21-T-316U, 21-T-322U, 21-T-323U and 21-T-324U are identical except for cabinets and speakers. These receivers feature full twelve channel VHF coverage plus any four UHF channels.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE ....227 square inches on a 21AP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

21-T-303, 313, 314, 315, 316, 322, 323, 324
Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

21-T-303U, 313U, 314U, 315U, 316U, 322U, 323U, 324U
Any desired combination of 16 VHF and/or UHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc., 470 mc. to 890 mc.

Picture Carrier Frequency .... 45.75 mc.
Sound Carrier Frequency .... 41.25 mc.

RCA TUBE COMPLEMENT

Tube Used	Function
Chassis KCS82 using KRK11B Tuner	
(1) RCA 6BQ7A	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer
Chassis KCS82B using KRK12 Tuner	
(1) RCA 6BQ7A	R-F Amplifier (VHF only)
(2) RCA 6AF4	R-F Oscillator
(3) RCA 6BQ7A	I-F Amplifier
(4) RCA 6S4	Voltage Control

A 1N82 crystal is used as a mixer.

Tube Used	Function
All Models	
(1) RCA 6CB6	1st Picture I-F Amplifier
(2) RCA 6CB6	2nd Picture I-F Amplifier
(3) RCA 6CB6	3rd Picture I-F Amplifier
(4) RCA 12AU7	Picture 2nd Detector and Vert. Sync. Sep.
(5) RCA 6CL6	Video Amplifier
(6) RCA 6AU6	1st Sound I-F Amplifier
(7) RCA 6AU6	2nd Sound I-F Amplifier
(8) RCA 6AL5	Ratio Detector
(9) RCA 6AV6	1st Audio Amplifier
(10) RCA 6K6GT	Audio Output
(11) RCA 12AU7	Horiz. Sync. Sep. & AGC
(12) RCA 12AU7	Vertical Osc. & Sync. Output
(13) RCA 6K6GT	Vertical Sweep Output
(14) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(15) RCA 6BQ6GT	Horizontal Sweep Output
(16) RCA 6W4GT	Damper
(17) RCA 1B3-GT/8016	High Voltage Rectifier
(18) RCA 21AP4	Kinescope
(19) RCA 5U4G	Rectifier
(20) RCA 5Y3GT	Rectifier

ELECTRICAL AND MECHANICAL SPECIFICATIONS

POWER SUPPLY RATING

KCS82 chassis .... *115 volts, 60 cycles, 215 watts*
KCS82B chassis .... *115 volts, 60 cycles, 230 watts*

RECEIVER ANTENNA INPUT IMPEDANCE

KCS82 chassis (KRK11B)
Choice: 300 ohms balanced or 72 ohms unbalanced.

KCS82B chassis (KRK12)
UHF—Choice: 300 ohms balanced or 72 ohms unbalanced.
VHF—300 ohms balanced.

LOUDSPEAKERS

Models 21-T-303, 21-T-303U (971636-1) 5" PM, 3.2 ohms.
Models 21-T-313, 21-T-313U (971490-3) 8" PM, 3.2 ohms.
Models 21-T-314, 21-T-314U, 21-T-315, 21-T-315U, 21-T-316, 21-T-316U, 21-T-322, 21-T-322U (971692-1) 10" PM, 3.2 ohms.
Models 21-T-323, 21-T-323U, 21-T-324, 21-T-324U (92569-12) 12" PM, 3.2 ohms.

AUDIO POWER OUTPUT RATING ....4.0 watts max.
VIDEO RESPONSE ....To 3.5 mc.
SWEEP DEFLECTION ....Magnetic
FOCUS ....Magnetic

INSTALLATION INSTRUCTIONS

UNPACKING.—These receivers are shipped complete in cardboard cartons. The kinescope is shipped in place in the receiver.

Take the receiver out of the carton and remove all packing material.

Make sure that all tubes are in place and are firmly seated in their sockets.

Check to see that the kinescope high voltage lead clip is in place.

Plug a power cord into the 115 volt a-c power source and into the receiver interlock receptacle. Turn the receiver power switch to the "on" position, the brightness control fully clockwise, and the picture control counter-clockwise.

ION TRAP MAGNET ADJUSTMENT.—Set the ion trap magnet approximately in the position shown in Figure 1. Starting from this position immediately adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Turn the focus control (shown in Figure 1) until the line structure of the raster is clearly visible. Readjust the ion trap magnet for maximum raster brilliance. The final touches of this adjustment should be made with the brightness control at the maximum clockwise position with which good line focus can be maintained.

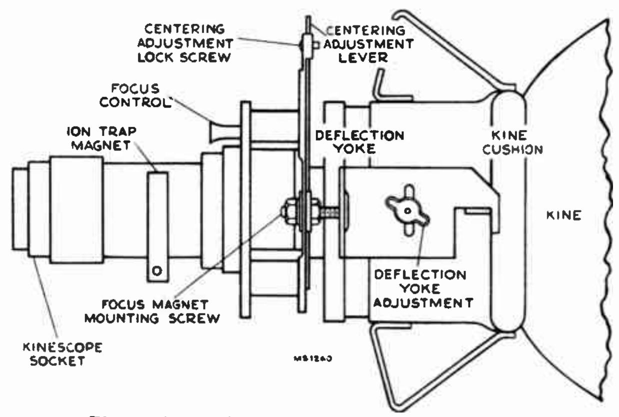


Figure 1—Yoke and Focus Magnet Adjustments

DEFLECTION YOKE ADJUSTMENT.—If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

PICTURE ADJUSTMENTS.—It will now be necessary to obtain a test pattern picture in order to make further adjustments. Connect the antenna transmission line to the receiver.

If the Horizontal Oscillator and AGC System are operating properly, it should be possible to sync the picture at this point. However, if the AGC control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading, turn R152 on the rear apron (see Figure 2) counter-clockwise until the set operates normally and the picture can be synced.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT.—Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back. Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 2 or 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. Pull-in should occur before the control has been turned 120 degrees from the extreme counter-clockwise position. The picture should remain in sync for approximately 90 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should remain in sync and should not show a black bar in the picture.

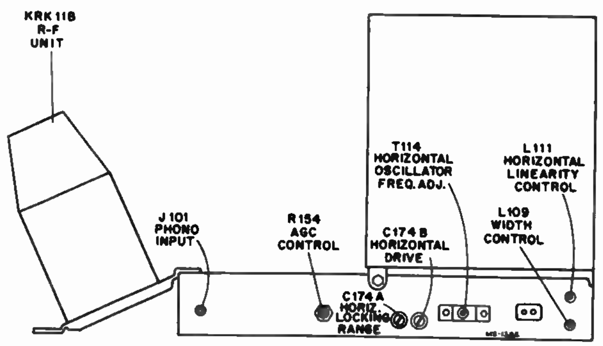


Figure 2—Rear Chassis Adjustments

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Alignment of Horizontal Oscillator" and proceed with "Focus Magnet Adjustment."

ALIGNMENT OF HORIZONTAL OSCILLATOR.—If in the above check the receiver failed to hold sync with the hold control at the extreme counter-clockwise position or failed to hold sync over 90 degrees of clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.

Horizontal Frequency Adjustment.—Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and adjust the T114 horizontal frequency adjustment at the rear of the chassis until the picture is just out of sync and the horizontal blanking appears as a vertical or diagonal black bar in the raster. Then turn the T114 core until the bar moves out of the picture leaving it in sync.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 rear core slightly and momentarily switch off channel. Repeat until

INSTALLATION INSTRUCTIONS

the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present, adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the conditions specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If it is impossible to sync the picture at this point and the AGC system is in proper adjustment it will be necessary to adjust the Horizontal Oscillator by the method outlined in the alignment procedure on page 11. For field purposes paragraph "B" under Horizontal Oscillator Waveform Adjustment may be omitted.

FOCUS MAGNET ADJUSTMENT.—The focus magnet should be adjusted so that there is approximately three-eighths inch of space between the rear cardboard shell of the yoke and the flat of the front face of the focus magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the magnet should be parallel with the axis of the kinescope neck with the kinescope neck through the center of the opening.

CENTERING ADJUSTMENT. — No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet. The centering plates include a locking screw which must be loosened before centering. Up and down adjustment of the plate moves the picture side to side and sidewise adjustment moves the picture up and down.

If a corner of the raster is shadowed, check the position of the ion trap magnet. Reposition the magnet within the range of maximum raster brightness to eliminate the shadow and recenter the picture by adjustment of the focus magnet plate. In no case should the magnet be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the tube. In some cases it may be necessary to shift the position of the focus magnet in order to eliminate a corner shadow.

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS.—Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive trimmer C174B counter-clockwise until the picture begins to "wrinkle" in the middle then clockwise until the "wrinkle" disappears.

Turn the horizontal linearity control L111 clockwise until the picture begins to "wrinkle" on the right and then counter-clockwise until the "wrinkle" disappears and best linearity is obtained.

Adjust the width control L109 to obtain correct picture width.

A slight readjustment of these three controls may be necessary to obtain the best linearity.

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control (R176 under front control panel) until the picture fills the mask vertically. Adjust vertical linearity (R186 under front control panel), until the test pattern is symmotrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust centering to align the picture with the mask.

FOCUS.—Adjust the focus magnet for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

Check to see that the yoke thumbscrew and the focus magnet mounting screws are tight.

KRK11B R-F OSCILLATOR ADJUSTMENTS. — Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 8. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 3. Adjustment for channel 13 is on top of the chassis.

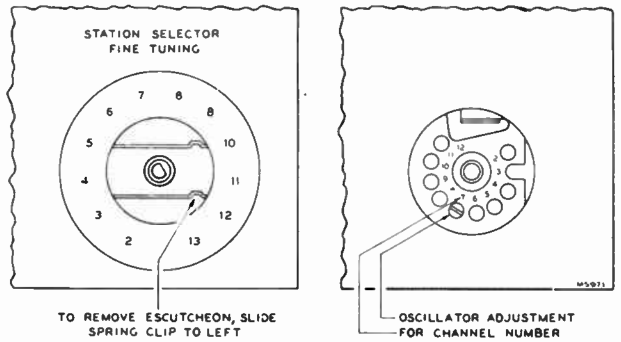


Figure 3—R-F Oscillator Adjustments

KRK12 R-F OSCILLATOR ADJUSTMENTS.—Set the fine tuning control to the center of its range on the channel to be adjusted. Adjust the oscillator core for this channel to obtain maximum audio output without distortion.

AGC THRESHOLD CONTROL.—The AGC threshold control R154 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not overloading due to improper setting of R154. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R154 should be readjusted.

Turn R154 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R154 clockwise until there is a very, very slight bend or change of bend in the picture. Then turn R154 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R154 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

FM TRAP ADJUSTMENT.—In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the L58 core on the antenna matching transformer for minimum interference in the picture.

CAUTION.—In some receivers, the FM trap L58 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L58 to make sure that it does not affect sensitivity on these two channels.

The FM trap on models using the KRK12 Tuner is fastened to the receiver antenna cable and is adjusted in the same manner as described above.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding it are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

CHASSIS TOP VIEW

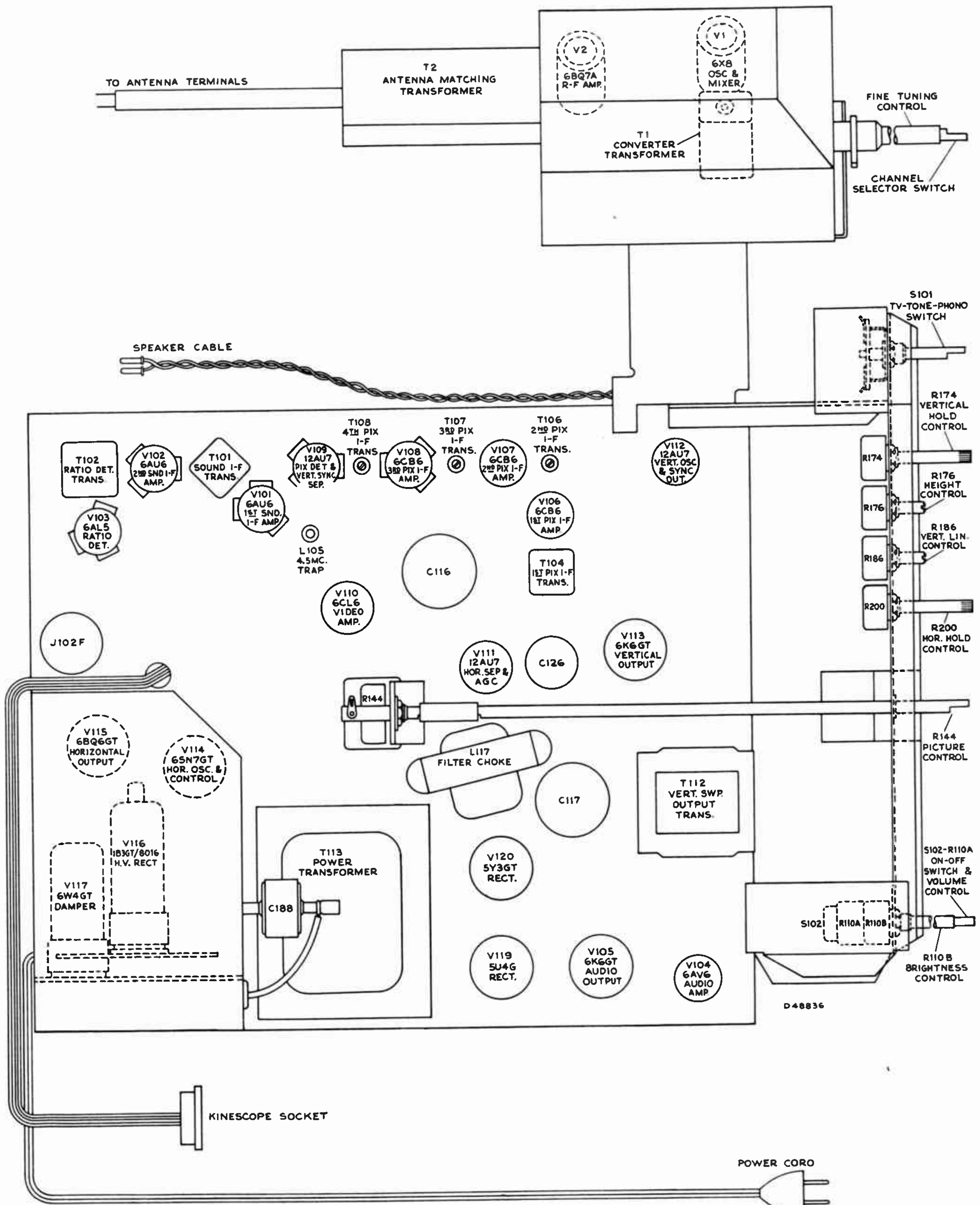


Figure 4—Chassis Top View (shown with KRK11B Tuner)

CHASSIS BOTTOM VIEW

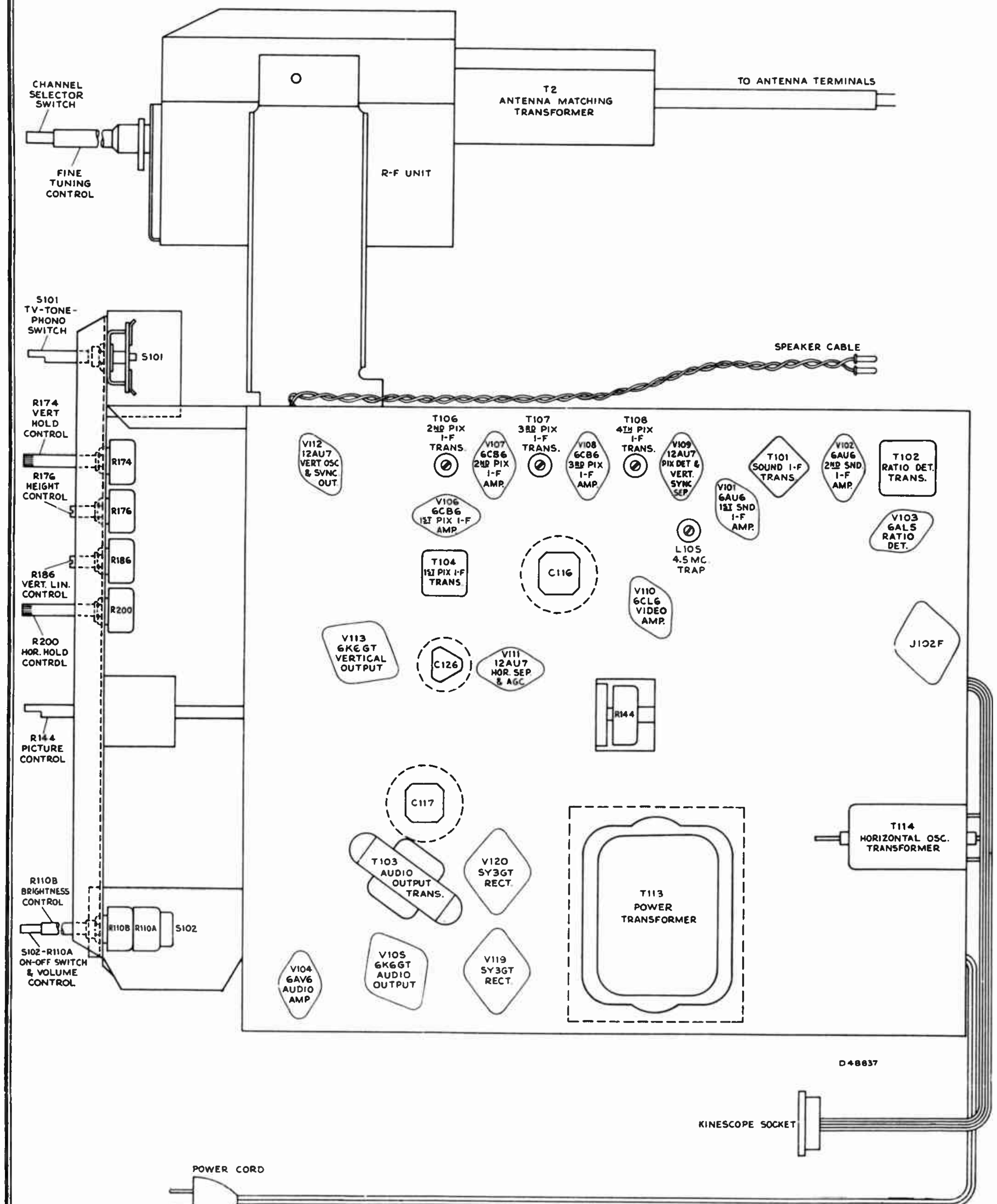


Figure 5—Chassis Bottom View (shown with KRK11B Tuner)

ALIGNMENT PROCEDURE

TEST EQUIPMENT. — To properly service the television chassis of these receivers, it is recommended that the following test equipment be available:

VHF Sweep Generator meeting the following requirements:

(a) Frequency Ranges
 35 to 90 mc., 1 mc. to 12 mc. sweep width
 170 to 225 mc., 12 mc. sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) "Flat" output on all attenuator positions.

VHF Signal Generator to provide the following frequencies with crystal accuracy:

(a) Intermediate frequencies
 4.5 mc., 39.25 mc., 41.25 mc., 43.5 mc., 45.75 mc., 47.25 mc.
(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	83.25	81.75	123
6	77.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types 40A or 41A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type 41A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Cathode Ray Oscilloscope.—An oscilloscope with a sensitivity of 1 millivolt per inch is required. A suitable pre-amplifier may be employed with oscilloscopes of lesser sensitivity.

Electronic Voltmeter.—A voltmeter with a 1.5 volt DC scale is required. RCA Senior "VoltOhmyst" or equivalent.

DC Milliammeter.—A milliammeter with a range of 0-50 milliamperes full scale.

Adapter Socket.—An adapter socket is required to meter the cathode current of the 6S4 voltage control tube of the KRK12 Tuner. Wiring of adapter is shown in Figure 13.

KRK11B ANTENNA MATCHING UNIT ALIGNMENT. — The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L58 to the channel selector switch S5.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R127 and R148. Set the potentiometer to produce approximately —5.0 volts of bias at the junction of R127 and R148.

Connect an oscilloscope to pin 2, V110 and set the oscilloscope gain to maximum.

Connect a VHF signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L59 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L60 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

ALIGNMENT PROCEDURE

Connect a 300 ohm ½ watt composition resistor from L58 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L58 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the VHF sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 00 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA Type WR59A sweep generators, this may be accomplished by returning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L61 and L62 to obtain the response shown in figure 15. L61 is most effective in locating the position of the shoulder of the curve at 52 mc. and L62 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L58 and S5. Replace V106.

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

Models 21-T-303 to 21-T-324 incl.

Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R147 and R148.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R147 and R148. The second battery will be used later.

Set the bias to produce approximately —5.0 volt of bias at the junction of R147 and R148.

Connect the "VoltOhmyst" to junction of R138 and L105 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst". During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R138 and L105 with —5.0 volts of i-f bias at the junction of R147 and R148.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R138, L105. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc.	T104 top core

Models 21-T-303U to 21-T-324U incl.

Connect the "VoltOhmyst" to the junction of R147 and R148. Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R147 and R148. Adjust the potentiometer for —5.0 volts indication on the "VoltOhmyst".

Connect the "VoltOhmyst" to the junction of R138 and L105 and to ground.

Connect the output of the signal generator to the front terminal of the crystal mixer in series with a 1500 mmf ceramic capacitor.

Set the VHF generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for maximum indication on the "VoltOhmyst". In each instance the generator should be checked against a crystal calibrator to insure that the generator is on frequency.

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R138 and L105 with —5.0 volts of i-f bias at the junction of R147 and R148.

44.5 mc.	T108
45.5 mc.	T107
43.0 mc.	T106

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at junction of R138 and L105. Use sufficient signal input to produce 3.0 volts of d-c on the meter when adjustment is made.

47.25 mc.	T104 top core

SWEEP ALIGNMENT OF PICTURE I-F.—

Models 21-T-303 to 21-T-324 incl.

To align T1 and T104, connect the sweep generator to the mixer grid test point TP2. In series with a 1500 mmf. ceramic capacitor use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the r-f unit outer shield.

Set the channel selector switch to channel 4.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Preset C119 to minimum capacity.

Adjust the bias box potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R147 and R148. Set the AGC control fully clockwise.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

Adjust T1 (top) and T104 (bottom) for maximum gain and with 45.75 mc. at 70% of maximum response.

Set the sweep output to give 0.3 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C119 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 19.

Disconnect the diode probe, the 180 ohm and two 330 ohm resistors.

Connect the oscilloscope to pin 2 of V110 socket.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 20.

Models 21-T-303U to 21-T-324U incl.

To align the crystal mixer circuit and T2 and T104 connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1500 mmf ceramic capacitor. Use the shortest leads possible, grounding the sweep generator to the tuner case.

Clip 330 ohm resistors across terminals A and B of T107 and T108.

Set the channel selector to channel 5.

Connect a 180 ohm composition resistor from pin 5 of V106 to terminal A of T106. Connect the oscilloscope diode probe to pin 5 of V106 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

The shunt trimmer C119 across terminals A and B of T104 is variable and is provided as a bandwidth adjustment. Preset the shunt trimmer to minimum capacity. Adjust T2 (top) and T104 (bottom) for maximum gain of 43.5 mc. and with 45.75 mc. at 70% of maximum response.

ALIGNMENT PROCEDURE

Adjust T1 for maximum gain. Readjust T2 and T104 if necessary to obtain proper wave shape, see Figure 11.

Disconnect the diode probe, the 180 ohm and the two 330 ohm resistors.

Connect the oscilloscope to the junction of R138 and L105.

Adjust the bias potentiometer to obtain —5.0 volts of bias as measured by a "VoltOhmyst" at the junction of R147 and R148.

Leave the sweep generator connected to the front terminal of the 1N82 crystal holder with the shortest leads possible and with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T106, T107 and T108 to obtain the response shown in Figure 12.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

KRK11B TUNER ALIGNMENT

Models 21-T-303 to 21-T-324 incl.

An r-f unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset all adjustments to the approximate center of their range with the following exceptions: Set C18 so that the screw head is approximately three-eighths of an inch above chassis. Set C11 near maximum capacity (one-quarter turn from tight). Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

The r-f unit is aligned with zero AGC bias. To insure that the bias will remain constant, take a clip lead and short circuit the r-f unit power terminal board terminal 3 to ground.

Connect the oscilloscope to the test point TP1 on top of the r-f unit. Set the oscilloscope gain to maximum.

Turn the receiver channel selector switch to channel 2.

Connect the output of the VHF signal generator to the grid of the r-f amplifier, V2. To do this, remove the tube from the socket and fashion a clip by twisting one end of a small piece of wire around pin number 7. Replace the tube in the socket leaving the end of the wire protruding from under the tube. Connect the signal generator to this wire through a 1,500 mmf capacitor.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust L65 on top of the r-f unit for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to adjust it so as to reduce sensitivity on channel 2.

Remove the wire clip from pin 7 of V2 and replace the tube and tube shield.

Set the channel selector switch to channel 8.

Turn the fine tuning control 30 degrees clockwise from the center of its mechanical range now and at all times when adjusting the oscillator frequency.

Adjust C2 for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the r-f unit through the hole provided for the adjustment for C11. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the r-f unit oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C2 to obtain an audio beat with the signal generator.

Note.—If on some units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C2, switch to channel 13 and adjust L46 to obtain proper channel 13 oscillator frequency as indicated in the table on page 11. Then, switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8 adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8, adjust C2 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and adjust L46 and back to channel 8 and adjust C2.

Set the T1 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator as shown in Figure 14 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the oscilloscope to maximum gain and use the minimum input signal which will produce a useable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the response as seen on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C9, C11, C15 and C18 for approximately correct curve shape, frequency, and band width as shown in Figure 16.

The correct adjustment of C18 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C9 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C18 has been properly adjusted). C11 is the coupling adjustment and hence primarily affects the response band width.

Set the receiver channel switch to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Turn the fine tuning control 30 degrees clockwise from the center of its mechanical range.

Adjust L5 for an audible beat with the signal generator as before.

Set the sweep generator to channel 6.

From the signal generator, insert channel 6 sound and picture carrier markers, 83.25 mc. and 87.75 mc.

Adjust L48, L50 and L53 for proper response as shown in Figure 16.

L50 tunes the r-f amplifier plate circuit and primarily affects the frequency of the pass band. L53 tunes the r-f amplifier grid and is adjusted to give maximum amplitude of the curve between the markers. L48 affects the tilt of the curve but not quite the same as C9 adjustment. When the circuits are correctly adjusted and L48 is rocked on either side of its proper setting, the high frequency (sound carrier) end of the curve appears to remain nearly fixed in amplitude while the picture carrier end tilts above or below this point.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the r-f unit test point TP1.

Adjust the oscillator injection trimmer C8 for —3.5 volts or at maximum if —3.5 volts cannot be reached. This voltage should fall between —2.5 and —5.5 volts on all channels when the alignment of all circuits is completed.

Turn the sweep generator and signal generator back on and recheck channel 6 response. Readjust L48, L50 and L53 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C2 for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C9, C11, C15 and C18 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 6 and check the oscillator injection voltage of TP1 if C9 was adjusted in the recheck of channel 8 response.

ALIGNMENT PROCEDURE

If the initial setting of oscillator injection trimmer C8 was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 6 and repeat the procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Set the fine tuning control 30 degrees clockwise from the center of its mechanical range.

Adjust L46 to obtain an audible beat. Slightly overshoot the adjustment of L46 by turning the slug a little more in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C2 to again obtain the beat.

Check the response of channels 7 through 13 by switching the receiver channel switch, sweep generator and marker oscillator to each of these channels and observing the response and oscillator injection obtained. See Figure 16 for typical response curves. It should be found that all these channels have the proper shaped response with the markers above 80% response.

If the markers do not fall within this requirement, switch to channel 8 and readjust C9, C11, C15 and C18 as necessary.

Turn off the sweep generator and check the channel 8 oscillator frequency. If C2 has to be readjusted for channel 8, the principle of overshooting the adjustment and then correcting by adjusting L46 should be followed in order to establish the L/C ratio for the desired oscillator tracking.

Turn the receiver channel selector switch to channel 6. Adjust L5 for correct oscillator frequency, 129 mc.

Turn the sweep generator on and to channel 6 and observe the response curve. If necessary readjust L48, L50 and L53.

Switch the receiver, the sweep and signal generators to channel 2 and adjust T1 clockwise to a point where there is no change in the channel 2 response as T1 is turned.

Switch the receiver through channel 6 down through channel 2 and check for normal response curve shapes and oscillator injection voltage.

If excessive tilt in the same direction occurs on channels 2, 3 and 4, adjust C18 on channel 2 to overshoot the correction of this tilt, then switch to channel 6 and adjust L53 for maximum amplitude of curve between markers. This adjustment should produce "flat" response on the low channels if the other adjustments especially L48 are correct.

Likewise check channels 7 through 13, stopping on 13 for the next step.

With the receiver on channel 13, check the receiver oscillator frequency. Correct by adjustment of C2 if necessary.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator trimmer to obtain the audible beat. It should be possible to adjust the oscillator to the correct frequency on all channels with the fine tuning control in the middle third of its range. When employing WR39 calibrators to adjust the receiver oscillator, tune the calibrator to one-half the receiver oscillator frequency on channels 4, 5 and 6 and to one-fourth the receiver oscillator frequency on channels 11, 12 and 13.

KRK12 TUNER ALIGNMENT

Models 21-T-303U to 21-T-324U incl.

TUNER VHF ALIGNMENT.—Remove the 6S4 voltage control tube from its socket and insert the adapter. Insert 6S4 in the adapter.

Connect the 0-50 milliampere meter to the adapter socket leads and turn the adapter switch on.

Remove the tuner cover shield.

Rotate the channel selector to a point midway between channels, disengaging the insert contacts, and observe the non-oscillating plate current. Some tubes may oscillate even with the tuned circuits disengaged. To be sure the oscillator is in a non-oscillatory state, short circuit the spring contacts 12 and 13, the two contacts nearest the tuner front, with a finger.

(NOTE: The contacts are at zero d-c potential.) Should the plate current rise, keep finger on the contacts while adjusting the oscillator plate current. Adjust R6, oscillator voltage control, for a 28 milliampere reading on the meter.

Replace the tuner cover shield.

Connect the VHF sweep generator to the antenna terminals.

Connect the VHF signal generator loosely to the antenna terminals.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Turn off the adapter switch, removing plate voltage from the oscillator. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to channel 2.

Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc. and 59.75 mc.

Adjust antenna T6, r-f amplifier plate L29 and mixer L30 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in Figure 9. If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Turn the AGC control fully clockwise.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Connect the potentiometer arm of the second bias supply to the junction R147 and R148, and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to the junction of R138 and L105. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 257 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to Channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

ALIGNMENT PROCEDURE

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain a beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc. and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

TUNER UHF ALIGNMENT.—To align the UHF inserts:

Turn off the adapter switch, removing plate voltage from the oscillator.

Ground the AGC bias at the tuner terminal board using a clip lead to insure that the bias will remain constant.

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10 DB attenuator pad to assure proper alignment.

Connect the UHF signal geenrator loosely to the antenna terminals.

Set the channel selector to the desired position and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier for desired channel.

Adjust UHF antenna, link coupling and mixer adjustments for a symmetrical curve, with maximum gain, centered about the pass band.

The responses are shown in Figure 10. The curve shape will usually vary from Figure 10 (a) to Figure 10 (c) going higher in frequency, however any of these responses are acceptable.

Repeat the above steps for all UHF inserts used adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve, with maximum gain, centered about the pass band.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Remove the clip lead grounding the AGC bias on the tuner terminal board.

Connect the potentiometer arm of one of the bias supplies to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.5 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal.

Connect the potentiometer arm of the second bias supply to the junction of R147 and R148, and ground the positive battery terminal. Adjust the bias potentiometer to produce —5 volts of i-f bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to junction of R138 and L105. Use 3 to 5 volts peak-to-peak output on the oscilloscope.

Turn the adapter switch on to apply plate voltage to the oscillator.

Turn the channel selector to the lowest UHF channel to be used.

Set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to test point TP1 with the shortest leads possible. Insert a 45.75 mc. marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 marker on the response curve as in Figure 12.

Set the UHF marker generator to the picture carrier of the channel insert being adjusted and connect to test point TP1.

Adjust the oscillator core until the markers for 45.75 mc. and the picture carrier coincide on the sweep pattern on the oscilloscope.

Adjust mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt D.C. scale.

Set oscillator injection adjustment to read .1 volt on the "VoltOhmyst."

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volt. Adjust as necessary to read .3 volt or less at TP1.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first sound i-f grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix i-f amplifier, pin 1 of V108.

Set the frequency of the calibrator to 45.75 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at L104 and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst". Adjust the signal level from the signal generator for 6 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R106 and C108.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst".

Repeat adjustments of T102 top for maximum d-c at pin 2 of V103 and T102 bottom for zero d-c at the junction of R106 and C108. Make the final adjustments with the signal input level adjusted to produce 6 volts d-c on the "VoltOhmyst" at pin 2 of V103.

SOUND I-F ALIGNMENT.—Connect the signal generator to the first sound i-f amplifier grid, pin 1 of V101.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 2 of V103.

Tune the T101 top core for maximum d-c on the "VoltOhmyst".

The output from the signal generator should be set to produce approximately 6.0 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 1,000 ohm resistor to pin 2 of V109. Set the generator to 4.5 mc. and modulate it 30% with 400 cycles. Set the output to approximately 0.5 volt.

Short the third pix i-f grid to ground, pin 1, V108, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video amplifier, pin 6 of V110.

Adjust the core of L103 for minimum output on the oscilloscope.

Remove the short from pin 1, V108 to ground.

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L103 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L103 for minimum beat.

AGC CONTROL ADJUSTMENT.—Disconnect all test equipment except the oscilloscope which should be connected to pin 6 of V110.

Connect an antenna to the receiver antenna terminals.

ALIGNMENT PROCEDURE

Turn the AGC control fully counter-clockwise.

Tune in a strong signal and adjust the oscilloscope to see the video waveform.

Turn the AGC control clockwise until the tips of sync begin to be compressed, then counter-clockwise until no compression is obtained.

HORIZONTAL OSCILLATOR ADJUSTMENT. — Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R200, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C174B, the width control L109 and the linearity control L111 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and three or four diagonal black bars sloping down to the right appear on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain three or four diagonal black bars on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture falls out of sync with the diagonal bars sloping down to the right. Continue to turn the frequency core in the same direction. No more than three or four bars should appear on the screen. Instead, the horizontal oscillator should begin the motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 21. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C174A slightly clockwise. If less than 2 bars are present, adjust C174A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves to the left side of the screen leaving the picture in synchronization.

SENSITIVITY CHECK.—A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is at the maximum clockwise position. Only carbon type resistors should be used to construct the pad.

RESPONSE CURVES.—The response curves shown on pages 14 and 15 and referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, some variations can be expected.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

NOTE ON TUNER ALIGNMENT.—Because of the frequency spectrum involved and the nature of the device, many of the tuner leads and components are critical in some respects. Even the power supply leads form loops which couple to the tuned circuits, and if resonant at any of the frequencies involved in the performance of the tuners, may cause serious departures from the desired characteristics. In the design of the receiver these undesirable resonant loops have been shifted far enough away in frequency to allow reasonable latitude in their components and physical arrangement without being troublesome. When the tuners are aligned in the receiver, no trouble from resonant loops should be experienced. However, if the tuners are aligned in a jig separate from the receiver, attention should be paid to insure that unwanted resonances do not exist which might present a faulty representation of tuner alignment.

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 15000 microvolt test pattern signal was fed into the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V1 KRK11B	6X8	Mixer	15000 Mu. V. Signal	9	160	8	160	6	0	7	—2.4 to —3.0	
			No Signal	9	145	8	145	6	0	7	—2.8 to —3.5	
		R-F Oscillator	15000 Mu. V. Signal	3	95	—	—	6	0	2	—3.8 to —5.5	
			No Signal	3	90	—	—	6	0	2	—3.0 to —5.1	
V2 KRK11B	6BQ7A	R-F Amplifier	15000 Mu. V. Signal	6	170	—	—	8	0.1	7		
			No Signal	6	133	—	—	8	1.1	7	0	
		R-F Amplifier	15000 Mu. V. Signal	1	270	—	—	3	170	2	—	
			No Signal	1	260	—	—	3	133	2	—	
V101	6AU6	1st Sound I-F Amp.	15000 Mu. V. Signal	5	127	6	140	7	1.0	1	0	
			No Signal	5	110	6	121	7	.9	1	0	
V102	6AU6	2d Sound I-F Amp.	15000 Mu. V. Signal	5	125	6	136	7	0	1	—13	
			No Signal	5	105	6	115	7	0	1	*—0.8	*Unreliable measuring point. Voltage depends on noise.
V103	6AL5	Ratio Detector	15000 Mu. V. Signal	7	0.3	—	—	1	7.2	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	0	—	—	1	*2.8	—	—	*Unreliable measuring point. Voltage depends on noise.
V104	6AV6	1st Audio Amplifier	15000 Mu. V. Signal	7	89	—	—	2	0	1	—0.8	At min. volume
			No Signal	7	87	—	—	2	0	1	—0.8	At min. volume
V105	6K6GT	Audio Output	15000 Mu. V. Signal	3	217	4	225	8	15.2	5	0	At min. volume
			No Signal	3	210	4	219	8	15.0	5	0	At min. volume
V106	6CB6	1st Pix. I-F Amplifier	15000 Mu. V. Signal	5	202	6	225	2	<0.1	1	—7.5	
			No Signal	5	100	6	112	2	0.9	1	*—0.1	*Unreliable measuring point. Make measurement at T104-B.
V107	6CB6	2nd Pix. I-F Amplifier	15000 Mu. V. Signal	5	205	6	225	2	<0.1	1	—7.5	
			No Signal	5	100	6	111	2	0.5	1	—0.1	
V108	6CB6	3rd Pix. I-F Amplifier	15000 Mu. V. Signal	5	140	6	155	2	2.1	1	0	
			No Signal	5	130	6	141	2	1.9	1	0	
V109A	12AU7	Picture 2d Det.	15000 Mu. V. Signal	1	—21	—	—	3	0	2	—3.8	
			No Signal	1	—10	—	—	3	0	2	—0.4	
V109B	12AU7	Vert. Sync Separator	15000 Mu. V. Signal	6	68	—	—	8	0	7	—58	
			No Signal	6	62	—	—	8	0	7	—5.6	

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate Pin No.	E. Plate Volts	E. Screen Pin No.	E. Screen Volts	E. Cathode Pin No.	E. Cathode Volts	E. Grid Pin No.	E. Grid Volts	Notes on Measurements
V110	6CL6	Video Amplifier	15000 Mu. V. Signal	6	82	3-8	180	1	1.1	2-9	−3.4	AGC control set for normal operation
			No Signal	6	73	3-8	99	1	0.9	2-9	−0.4	AGC control set for normal operation
V111A	12AU7	AGC Amplifier	15000 Mu. V. Signal	1	42	—	—	3	148	2	115	
			No Signal	1	0	—	—	3	125	2	82	
V111B	12AU7	Hor. Sync Separator	15000 Mu. V. Signal	6	267	—	—	8	171	7	101	
			No Signal	6	259	—	—	8	118	7	85	
V112A	12AU7	Sync Output	15000 Mu. V. Signal	1	60	—	—	3	0	2	−2.7	
			No Signal	1	58	—	—	3	0	2	−2.1	
V112B	12AU7	Vertical Oscillator	15000 Mu. V. Signal	6	76	—	—	8	0	7	−16	Depends on setting of Vert. hold control
			No Signal	6	75	—	—	8	0	7	−15	Voltages shown are synced pix adjustment
V113	6K6GT	Vertical Output	15000 Mu. V. Signal	3	260	4	270	8	15.9	5	−11	
			No Signal	3	250	4	260	8	15.5	5	−10	
V114A	6SN7GT	Horizontal Osc. Control	15000 Mu. V. Signal	2	172	—	—	3	−2.2	1	−25	
			No Signal	2	160	—	—	3	1.5	1	−16	
V114B	6SN7GT	Horizontal Oscillator	15000 Mu. V. Signal	5	180	—	—	6	0	4	−74	
			No Signal	5	178	—	—	6	0	4	−66	
V115	6BQ6GT	Horizontal Output	15000 Mu. V. Signal	Cap	*	4	180	8	18	5	−17.5	*High Voltage Pulse Present
			No Signal	Cap	*	4	175	8	17.5	5	−17	*High Voltage Pulse Present
V116	1B3GT /8016	H. V. Rectifier	15000 Mu. V. Signal	Cap	*	—	—	2 & 7	14,000	—	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	13,000	—	—	*High Voltage Pulse Present
V117	6W4GT	Damper	15000 Mu. V. Signal	5	270	—	—	3	*	—	—	*High Voltage Pulse Present
			No Signal	5	260	—	—	3	*	—	—	*High Voltage Pulse Present
V118	21AP4	Kinescope	15000 Mu. V. Signal	Cap	14,000	10	430	11	120	2	78	At average Brightness
			No Signal	Cap	13,000	10	415	11	100	2	58	At average Brightness
V119 V120	5U4G 5Y3GT	Rectifiers	15000 Mu. V. Signal	4 & 6	—	—	—	2 & 8	285	—	—	
			No Signal	4 & 6	—	—	—	2 & 8	274	—	—	

ALIGNMENT DATA

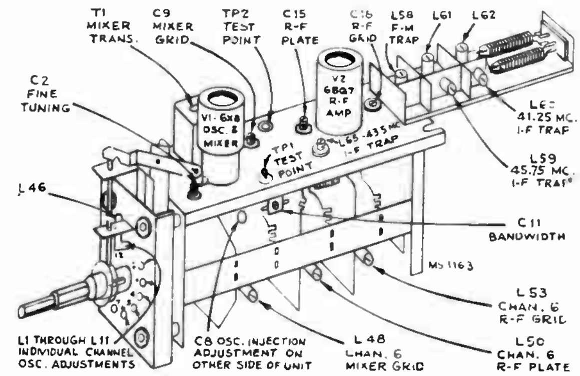


Figure 6—KRK11B Tuner Adjustments

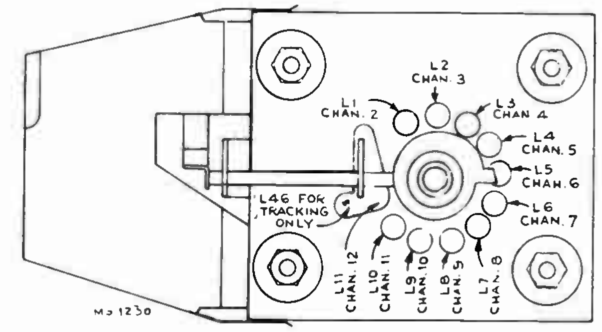


Figure 8—KRK11B R-F Oscillator Adjustments

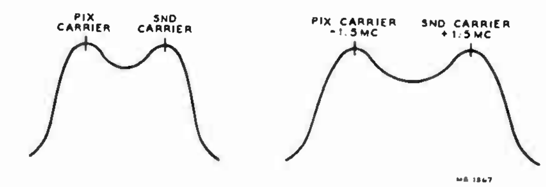


Figure 9—KRK12 VHF Insert Responses

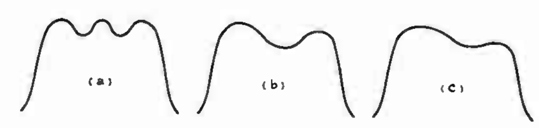


Figure 10—KRK12 UHF Insert Responses

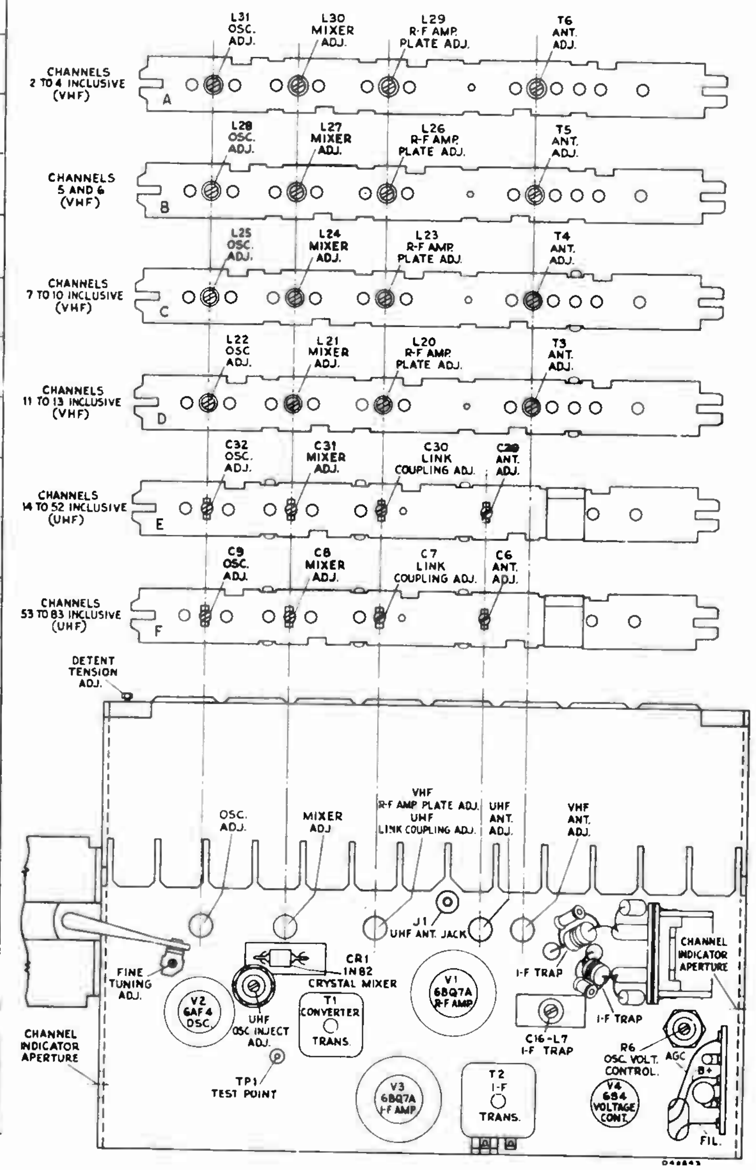


Figure 7—KRK12 Tuner Adjustments

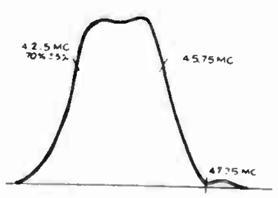


Figure 11—T2 and T104 Response with KRK12

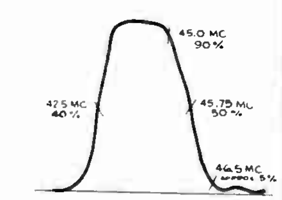


Figure 12—Over-all I-F Response with KRK12

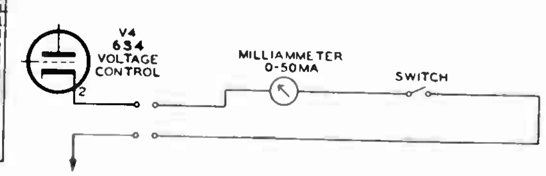


Figure 13—KRK12 Voltage Control Adapter

ALIGNMENT DATA

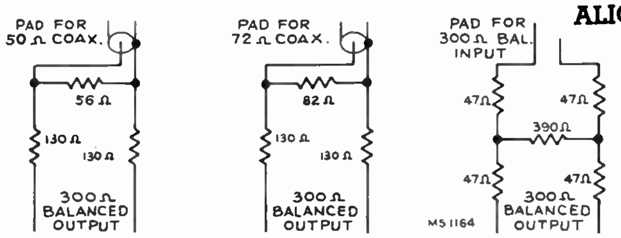


Figure 14—Sweep Attenuator Pads

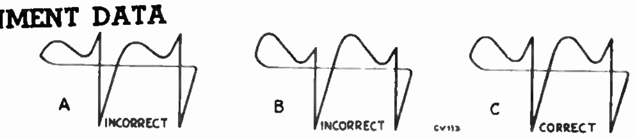


Figure 21—Horizontal Oscillator Waveforms

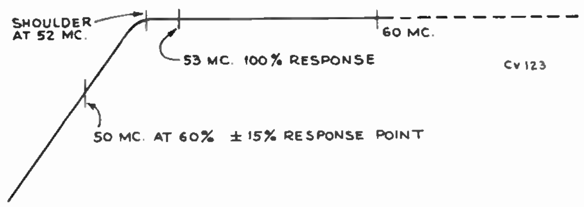


Figure 15—KRK11B Antenna Matching Unit Response

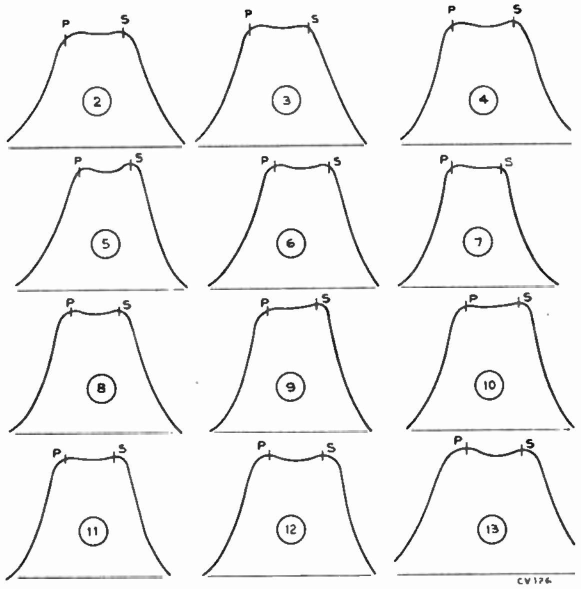


Figure 16—KRK11B R-F Response

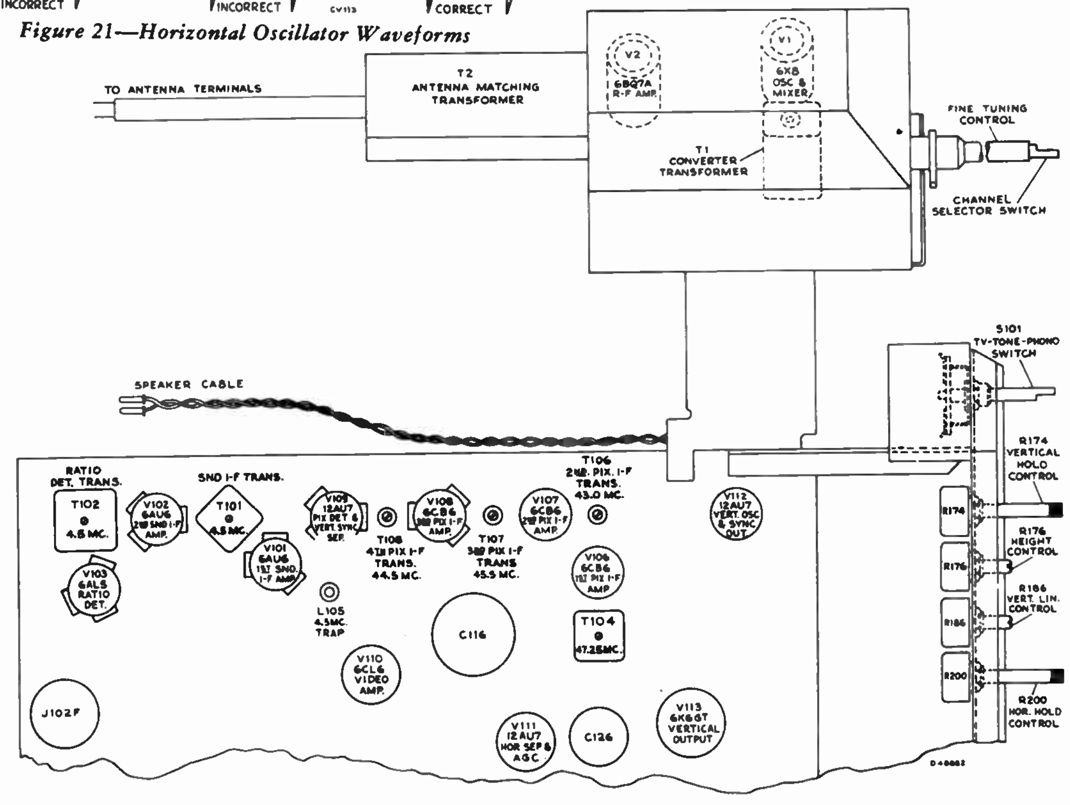


Figure 22—Top Chassis Adjustments

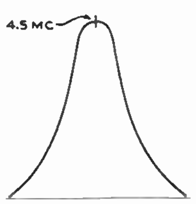


Figure 17—Sound I-F Response

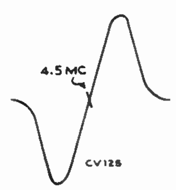


Figure 18—Ratio Det. Response

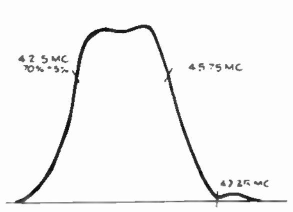


Figure 19—KRK11B T1 and T104 Response

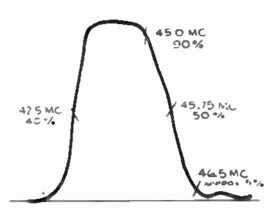


Figure 20—KRK11B Over-all I-F Response

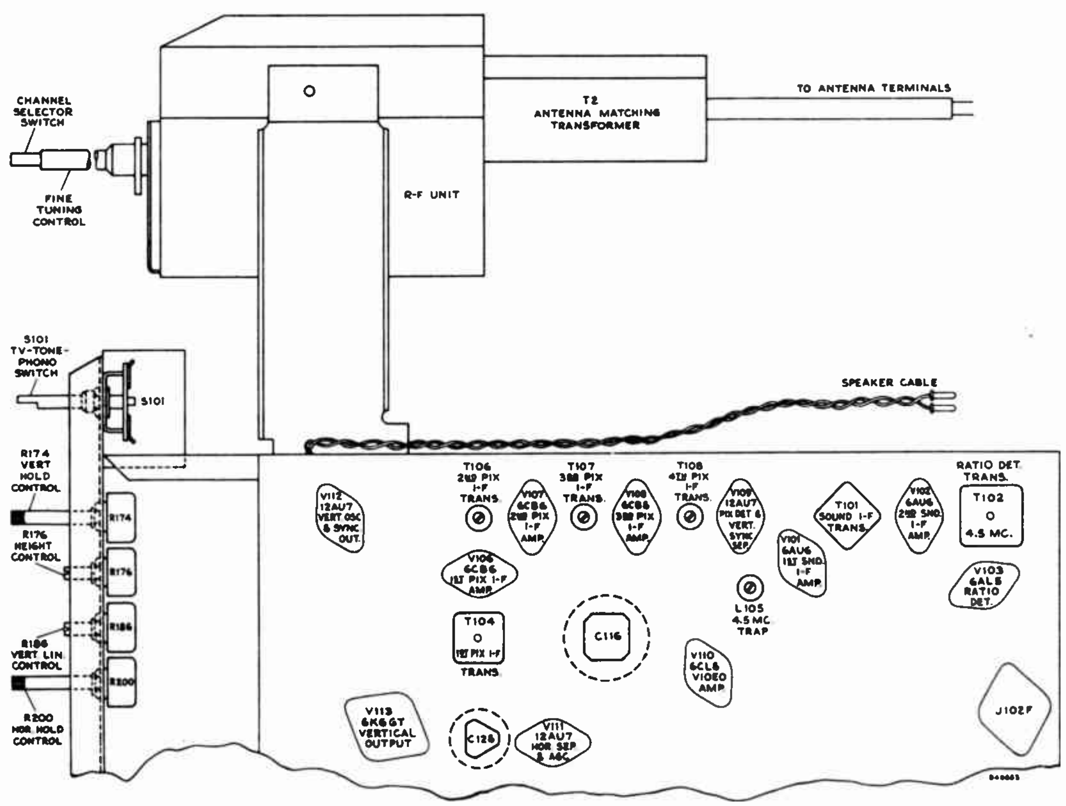


Figure 23—Bottom Chassis Adjustments

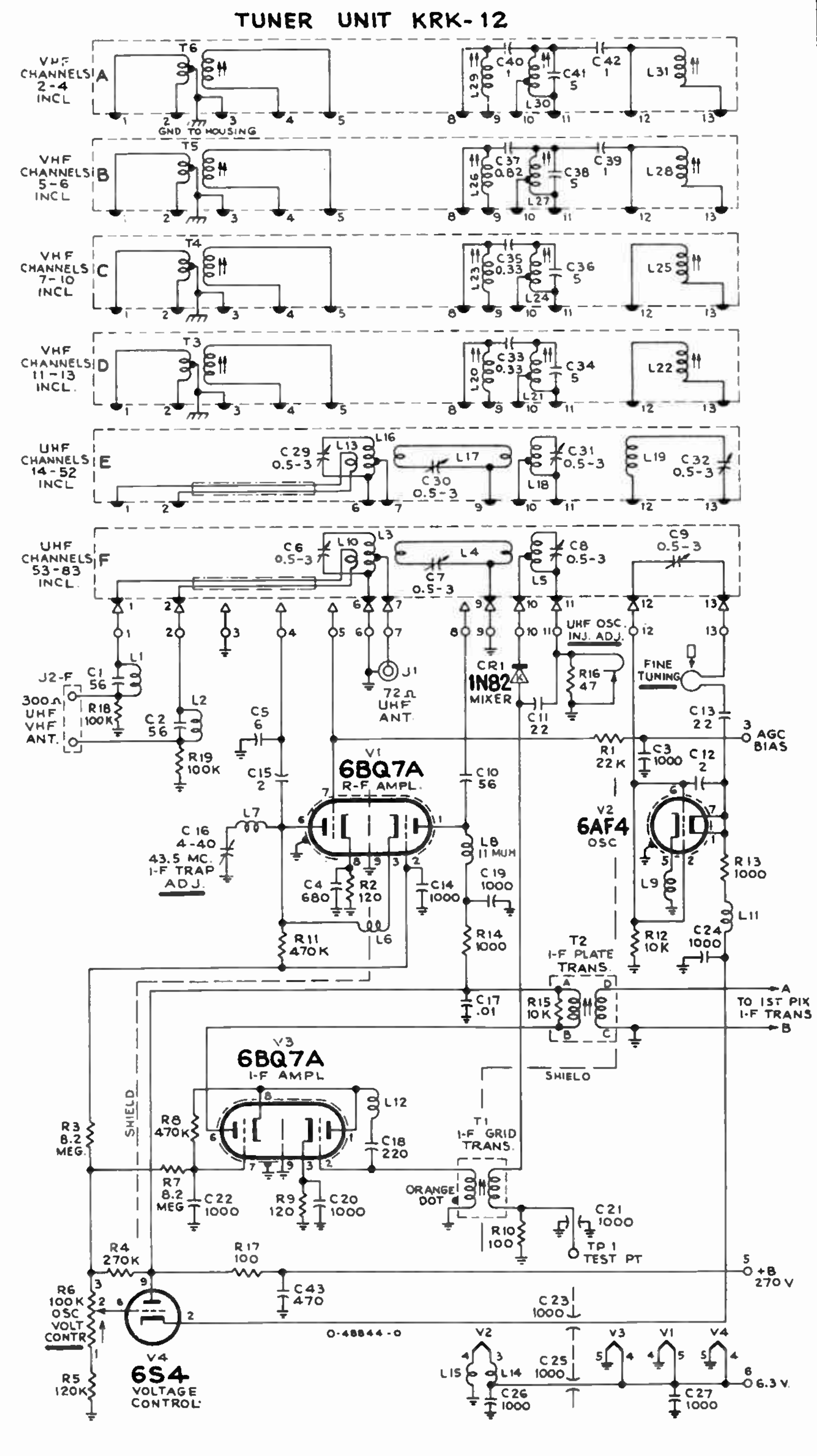


Figure 24—KRK12 Schematic Diagram

CIRCUIT SCHEMATIC DIAGRAM KCS82 (KCS82B with KRK12 Tuner)

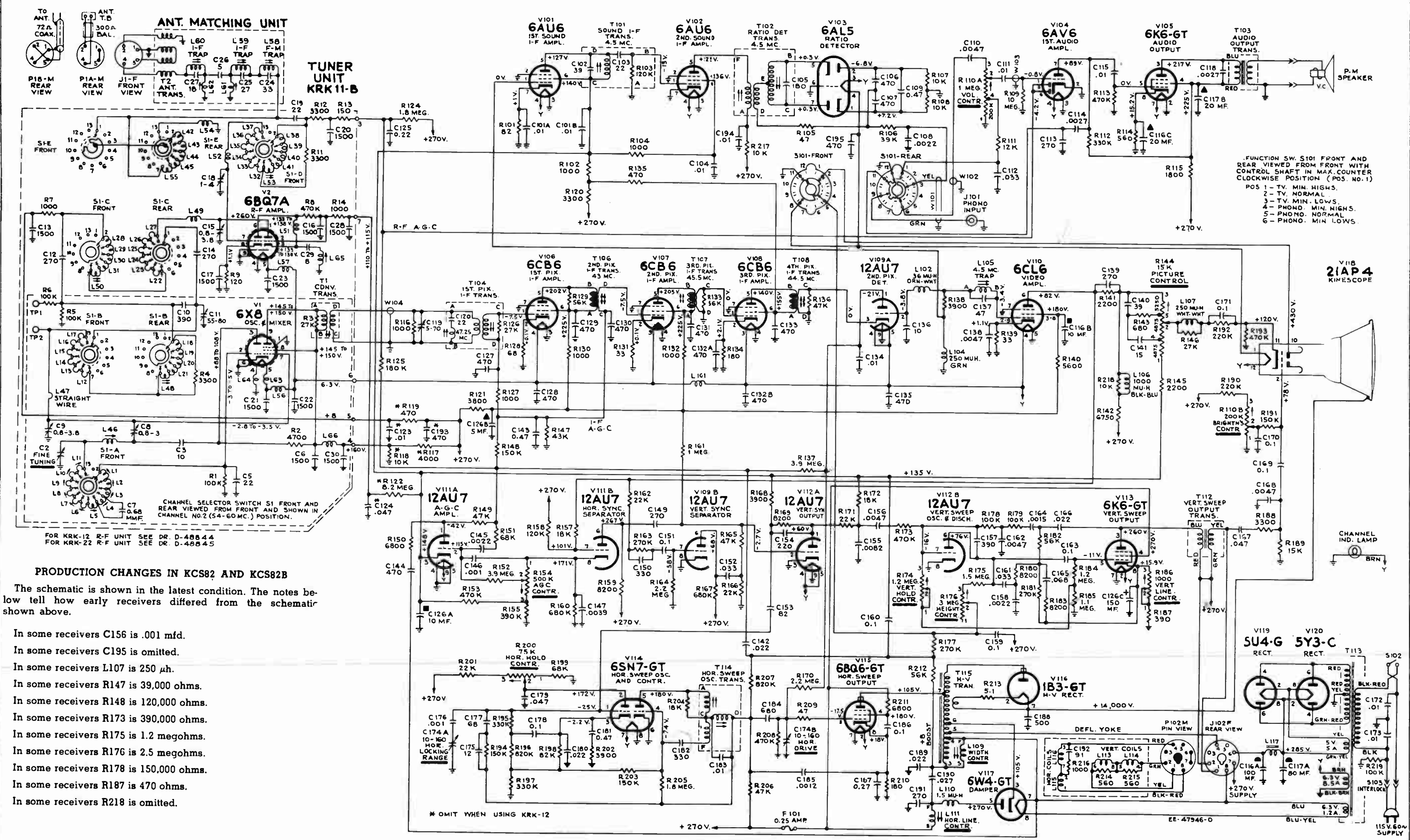


Figure 25—Circuit Schematic Diagram

PRODUCTION CHANGES IN KCS82 AND KCS82B

The schematic is shown in the latest condition. The notes below tell how early receivers differed from the schematic shown above.

In some receivers C156 is .001 mfd.
In some receivers C195 is omitted.
In some receivers L107 is 250 μh.
In some receivers R147 is 39,000 ohms.
In some receivers R148 is 120,000 ohms.
In some receivers R173 is 390,000 ohms.
In some receivers R175 is 1.2 megohms.
In some receivers R176 is 2.5 megohms.
In some receivers R178 is 150,000 ohms.
In some receivers R187 is 470 ohms.
In some receivers R218 is omitted.

The schematic is shown in the latest condition at the time of printing.
All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

PARTS

STOCK No.	DESCRIPTION
	TUNER UNIT ASSEMBLIES KRK 11B
	Models 21T303, 21T313, 21T314, 21T315, 21T316, 21T322, 21T323, 21T324
76539	Board—Antenna matching transformer terminal board—less coils and less capacitors
76531	Board—Terminal board, 5 contact and ground
76845	Bracket—Vertical bracket for holding V1 tube shield
76965	Capacitor—Ceramic, variable, for fine tuning—plunger type (C2)
71504	Capacitor—Fixed, headed-lead type, 0.68 mmf., ±20%, 500 volts (C7)
77151	Capacitor—Tubular, adjustable, steatite, 0.8–3 mmf. (C8)
75184	Capacitor—Ceramic, adjustable, 0.8–3.8 mmf., complete with adjusting stud (C9)
76532	Capacitor—Adjustable trimmer, steatite, 1–4 mmf. (C18)
	Capacitors—Ceramic, fixed, non-insulated:
93056	5 mmf., ±0.5 mmf., 500 volts DC, Temp coef. = 0 (C26)
70597	8 mmf., ±1 mmf., 500 volts DC, Temp. coef. = 0 (C29)
55326	10 mmf., ±1 mmf., 500 volts DC, Temp. coef. = −80 (C3)
54207	18 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C27)
76557	22 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C19)
76558	22 mmf., ±10%, 500 volts DC, Temp. coef. = −750. Special—copper coated (C5)
70935	27 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C25)
76739	33 mmf., ±10%, 500 volts DC, Temp. coef. = 0 (C24)
76527	Capacitor—Mica trimmer, 55–80 mmf. (C11)
75199	Capacitor—Fixed, ceramic, insulated, 270 mmf. ±20%, 500 volts DC, High "K" type (C12, C14)
75641	Capacitor—Fixed, ceramic, insulated, 390 mmf., ±10%, 500 volts DC, High "K" type (C10)
75166	Capacitor—Ceramic, 1500 mmf. (stand-off) (C13, C21, C22, C28, C30)
75610	Capacitor—Fixed, ceramic, insulated, 1500 mmf., ±20%, 500 volts DC, High "K" type (C6)
73748	Capacitor—Fixed, ceramic, 1500 mmf., +100%, −0%, 500 volts DC, High "K" disc (C16, C17, C20, C23)
76143	Clip—Tubular clip for mounting stand-off capacitors
73591	Coil—Antenna matching coil (2 req'd)
73477	Coil—Choke coil (L57)
77206	Coil—Filament choke coil (L56)
76763	Coil—Filament choke coil (L63, L64)
76562	Coil—RF amplifier coupling coil (L51)
77153	Coil—RF choke coil (L66)
76537	Coil—Shunt coil complete with adjustable core (L61)
76538	Coil—Shunt coil complete with adjustable core (L62)
76529	Coil—Trimmer coil (3 turns) with adjustable inductance core and capacitor stud (screw adjustment) for r.f. section (L49, C15)
38853	Connector—4 contact female connector—part of antenna matching transformer (J1)
76559	Connector—Oscillator grid connector
76460	Contact—Test point contact
77202	Core—Adjustable core for fine tuning capacitor
76543	Core—Adjusting core for FM trap
76521	Detent—Detent mechanism and fibre shaft
73453	Form—Coil form for L48, L50, L53
77203	Link—Link assembly for fine tuning
76728	Nut—Speed nut for mounting adjustable trimmer 76532
	Resistors—Fixed, composition:
503112	120 ohms, ±10%, ½ watt (R9)
503115	150 ohms, ±10%, ½ watt (R13)
503210	1000 ohms, ±10%, ½ watt (R7, R14)
503233	3300 ohms, ±10%, ½ watt (R4, R11, R12)
503247	4700 ohms, ±10%, ½ watt (R2)
503410	100,000 ohms, ±10%, ½ watt (R1, R5, R6)
503447	470,000 ohms, ±10%, ½ watt (R8)
14343	Retainer—Fine tuning shaft retaining ring
75164	Rod—Actuating plunger rod (fibre) for fine tuning link
76548	Screw—#4-40 x ¼" adjusting screw for coils L6, L7, L8, L9, L10, L11
75176	Screw—#4-40 x 7/16" adjusting screw for coil L5
76549	Screw—#4-40 x ⅜" adjusting screw for coils L1, L2, L3, L4, L46
76519	Shaft—Channel selector shaft and plate
76134	Shaft—Fine tuning shaft and cam
77147	Shield—Front shield complete with shaft bushing and bracket
76534	Shield—Tube shield
76530	Socket—Tube socket, 9 pin, miniature, ceramic, saddle—mounted
76336	Socket—Tube socket, 9 pin, miniature, bakelite, saddle—mounted
77149	Spacer—Metal spacer for front plate
75163	Spring—Friction spring (formed) for fine tuning cam
30340	Spring—Hairpin spring for fine tuning link
75068	Spring—Retaining spring for tube shield
77204	Spring—Return spring for fine tuning control
77664	Stator—Antenna stator complete with rotor, coils, capacitor and resistor (S5, C20, L42, L43, L44, L45, L54, L55, R13)
77922	Stator—Convertor stator complete with rotor, coils, capacitors, and resistors (S2, C10, C12, L12, L13, L14, L15, L16, L17, L18, L19, L20, L21, L47, L48, R4, R5, R6)
77205	Stator—Oscillator stator complete with rotor, coils, and capacitors (S1, C3, C7, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L46)
76556	Stator—RF grid stator complete with rotor, capacitor, and resistors (S4, C19, L32, L33, L34, L35, L36, L37, L38, L39, L40, L41, L53, R11, R12)
76553	Stator—RF plate stator complete with rotor, coils, capacitor, and resistor (S3, C14, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L50, R7)
76561	Strap—Channel #13 RF grid strap (L52)
76525	Strip—Coil segment mounting strip—R.H. center
76526	Strip—Coil segment mounting strip—L.H. lower
76544	Strip—Coil segment mounting strip—L.H. upper—less trimmer
76740	Stud—#6-32 x 1" adjusting stud for adjustable capacitor C8
77152	Terminal—Terminal for mounting adjustable capacitor
76536	Transformer—Antenna matching transformer complete (T2, C24, C25, C26, C27, L58, L59, L60, L61, L62, J1)
77663	Transformer—Convertor transformer complete with adjustable core (T1, R3)
76535	Trap—I.F. trap
76542	Trap—I.F. trap (41.25 MC) complete with core (L60)
76541	Trap—I.F. trap (45.75 MC) complete with core (L59)
76540	Trap—F.M. trap complete with adjustable core (L58)
75190	Washer—Insulating washer (neoprene) for adjustable capacitor
	TUNER UNIT ASSEMBLIES KRK12
	Models 21T303U, 21T313U, 21T314U, 21T315U, 21T316U, 21T322U, 21T323U, 21T324U
77580	Ball—Steel ball (.125" dia.) (12 req'd)
77579	Ball—Steel ball (.187" dia.)
77575	Bracket—Drive mechanism mounting bracket
77589	Bracket—Lamp bracket
77619	Bracket—VHF input connector and bracket
76845	Bracket—Vertical bracket for oscillator tube shield
77591	Cam—Fine tuning cam
77691	Capacitor — Fixed, headed-lead type, .33 mmf., ±10%, 500 volts DC (C33, C35)
77669	Capacitor — Fixed, headed-lead type, .82 mmf., ±10%, 500 volts DC (C37)
77690	Capacitor — Fixed, headed-lead type, 1.0 mmf., ±10%, 500 volts DC (C39, C40, C42)
77210	Capacitor—Fixed, ceramic, non-insulated, 2 mmf., ±0.25 mmf., 500 volts DC, Temp. coef. = 0 (C15)
77667	Capacitor—Fixed, ceramic, insulated, comprising 1 section of 2 mmf., and 1 section of 22 mmf., Temp. coef. = −750 (C12, C13)
77616	Capacitor—Adjustable, mica, 4–40 mmf. (C16)
77688	Capacitor—Fixed, ceramic, non-insulated, 5 mmf., ±0.5 mmf., 500 volts DC, Temp. coef. = 0 (C34, C36, C38, C41)
74182	Capacitor—Fixed, ceramic, non-insulated, 6 mmf., ±0.5 mmf., 500 volts DC, Temp. coef. = 0 (C5)
77621	Capacitor—Fixed, ceramic, crystal holder, 22 mmf., ±10%, Temp. coef. = −750 (C11)
71924	Capacitor—Fixed, ceramic, non-insulated, 56 mmf., ±10%, 500 volts DC, Temp. coef. = −750 (C10)
77625	Capacitor—Fixed, ceramic, 220 mmf., +100%, −0%, 500 volts DC, High "K" disc (C18)
77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, −0%, 500 volts DC, High "K" disc (C43)
77624	Capacitor—Fixed, ceramic, 680 mmf., +100%, −0%, 500 volts DC, High "K" disc (C4)
77084	Capacitor—Ceramic, feed-thru, 1000 mmf. (C21, C23, C25)
77615	Capacitor—Ceramic, stand-off, 1000 mmf. (C3, C19, C24, C26)
77252	Capacitor—Fixed, ceramic, 1000 mmf., +100%, −0%, 500 volts DC, High "K" disc (C14, C20, C22, C27)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +1000%, −0%, 500 volts DC, High "K" Disc (C17)
77628	Coil—IF trap (L7)
77634	Coil—IF neutralizing coil (L12)
77629	Coil—Oscillator cathode coil (L9)
77632	Coil—Oscillator heater coil (L15)
77631	Coil—Oscillator heater coil (L14)
77630	Coil—Oscillator plate coil (L11)
77627	Coil—Peaking coil (L6, R11)
77695	Coil—RF plate coil (L8)
77633	Connector—Formed grounding connector
77623	Connector—UHF antenna input connector (J1)
77612	Contact—Bracket and spring contact assembly for grounding rotor—assembled to base
77618	Contact—Bracket and spring contact assembly for grounding rotor—assembled to oscillator shield
77606	Contact—Contact and support assembly — "L" shape—complete with two (2) contacts
77622	Contact—Contact and support assembly complete with two (2) contacts and UHF antenna input connector
77620	Contact—Contact and support assembly complete with four (4) contacts and holder for crystal rectifier
77607	Contact—Contact and support assembly complete with five (5) contacts—rear of chassis
77614	Control—Oscillator voltage control (R6)
77617	Control — UHF oscillator injection adjustment control
77583	Core—Fine tuning core
77593	Coupling—Indicator shaft coupling
77596	Ferrule—Ferrule for UHF antenna input cable
77588	Gear—Rotor drive gear—nylon
77602	Insert—VHF coil assembly insert for channels 2, 3 or 4 (Includes C40, C41, C42, L29, L30, L31, T6)
77603	Insert—VHF coil assembly insert for channels 5 or 6 (Includes C37, C38, C39, L26, L27, L28, T5)
77604	Insert—VHF coil assembly insert for channels 7, 8, 9 or 10 (Includes C35, C36, L23, L24, L25, T4)
77605	Insert—VHF coil assembly insert for channels 11, 12 or 13 (Includes C33, C34, L20, L21, L22, T3)
	APPLY TO YOUR RCA DISTRIBUTOR FOR INFORMATION ON UHF COIL ASSEMBLY INSERTS
77590	Lever—Actuating lever for fine tuning link
77582	Link—Fine tuning link
77581	Plate—Front plate and ball race
77489	Rectifier—Germanium rectifier Type IN82 (CR1)
	Resistors—Fixed, composition:
503047	47 ohms, ±10%, ½ watt (R16)
503110	100 ohms, ±10%, ½ watt (R10, R17)
503112	120 ohms, ±10%, ½ watt (R2, R9)
503210	1000 ohms, ±10%, ½ watt (R13, R14)
503310	10,000 ohms, ±10%, ½ watt (R12)
503322	22,000 ohms, ±10%, ½ watt (R1)
503410	100,000 ohms, ±10%, ½ watt (R18, R19)
503412	120,000 ohms, ±10%, ½ watt (R5)
503427	270,000 ohms, ±10%, ½ watt (R4)
503447	470,000 ohms, ±10%, ½ watt (R8)
503582	8.2 megohms, ±10%, ½ watt (R3, R7)
30340	Retainer—Retainer ring for fine tuning actuating lever stud
77592	Ring—Contact ring
77599	Roller—Rotor detent roller and retainer
77574	Rotor—Rotor frame
77594	Screw—#8-32 x ¼" cup point set screw for indicator shaft coupling
77576	Shaft—Channel selector drive shaft complete with two (2) gears
77595	Shaft—Indicator shaft
77611	Shield—Oscillator shield and grounding spring assembly—underside of chassis
77577	Shield—Top shield
76967	Shield—Tube shield for V2
76534	Shield—Tube shield for V1, V3
77613	Sleeve—Insulating sleeve for fine tuning adjustable core
77274	Socket—Tube socket, 7 pin, miniature, saddle mounted, steatite for V2
77608	Socket—Tube socket, 9 pin, miniature, saddle mounted, moulded mica for V1, V3, V4
77578	Spring—Formed spring for holding rotor (on back of unit)
77584	Spring—Fine tuning link adjusting spring
76961	Spring—Retaining spring for oscillator tube shield
77598	Spring—Rotor detent spring and roller complete with mounting bracket
77599	Roller—Rotor detent roller and retainer
77587	Stud—Mounting stud for fine tuning link actuating lever
77693	Stud—#6-32 x 21/32" adjusting stud for trimmer capacitor C9
77692	Stud—#6-32 x 25/32" adjusting stud for trimmer capacitors C6, C7, C8, C29, C30, C31, C32
77694	Stud—#10-32 x ⅜" adjusting stud for coils L20, L21, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31 and transformers T3, T4, T5, T6
77609	Transformer—Mixer I.F. transformer complete with adjustable cores (T1)
77610	Transformer—Primary I.F. link transformer complete with adjustable cores (T2, R15)
77626	Trap—I.F. trap (L1, C1, L2, C2)
77585	Washer—"C" washer for drive and indicator shafts (3 req'd)
77586	Washer—"C" washer for fine tuning link spring
	CHASSIS ASSEMBLIES
	KCS 82 (KRK11B Tuner Unit)
	KCS 82B (KR12 Tuner Unit)
76456	• Bracket — Channel indicator lamp bracket for KCS82
76490	Bracket—Mounting bracket complete with insulator for picture control
71496	Capacitor—Mica trimmer, 5–70 mmf. (C119)
33098	Capacitor—Fixed, ceramic, non-insulated, 10 mmf., ±1.0 mmf., 500 volts DC, Temp. coef. = −750 (C136)

PARTS (Continued)

STOCK No.	DESCRIPTION
75217	Capacitor — Mica trimmer, dual 10–160 mmf. (C174A, C174B)
33380	Capacitor—Fixed, ceramic, non-insulated, 12 mmf., ±10%, 500 volts DC, Temp. coef. = —750 (C175)
39044	Capacitor—Fixed, ceramic, non-insulated, 15 mmf., ±10%, 500 volts DC, Temp. coef. = —750 (C141)
73664	Capacitor—Fixed, ceramic, non-insulated, 39 mmf., ±10%, 500 volts DC, Temp. coef. = —750 (C140)
76475	Capacitor — Fixed, mica, 68 mmf., 1000 volts (C177)
76474	Capacitor—Fixed, mica, 82 mmf., 1000 volts DC (C153)
39636	Capacitor—Fixed, mica, 220 mmf., 500 volts DC (C154)
39638	Capacitor—Fixed, mica, 270 mmf., 500 volts DC (C139)
47617	Capacitor — Fixed, ceramic, non-insulated, 270 mmf., ±10%, 500 volts DC, Temp. coef. = —750 (C113)
76579	Capacitor—Fixed, mica, 270 mmf., 1000 volts DC (C149, C191)
39640	Capacitor—Fixed, mica, 330 mmf., 500 volts DC (C150)
76476	Capacitor -- Fixed, mica, 330 mmf., 1000 volts (C182)
73094	Capacitor—Fixed, mica, 390 mmf., 1000 volts DC (C157)
77293	Capacitor—Fixed, ceramic, 470 mmf., +100%, —0%, 500 volts DC, High "K" disc (C127, C128, C129, C130, C131, C133, C135, C195, C193 for KCS82)
77672	Capacitor — Fixed, ceramic, dual 470 mmf., +100%, —0%, 500 volts DC, High "K" disc (C132A, C132B)
77673	Capacitor—Fixed, ceramic, insulated, 470 mmf., ±10%, 1500 volts DC, Special H.V. (C144)
39644	Capacitor—Fixed, mica, 470 mmf., 500 volts DC (C106, C107)
76461	Capacitor—Ceramic, 500 mmf., 20,000 volts (C188)
73960	Capacitor—Fixed, ceramic, 10,000 mmf., +100%, —0%, 500 volts DC, High "K" disc (C104, C134, C194, C123 for KCS82)
76991	Capacitor — Fixed, ceramic, dual 10,000 mmf., +100%, —0%, 500 volts DC, High "K" disc (C101A, C101B)
75218	Capacitor—Electrolytic, comprising 1 section of 10 mfd., 350 volts, 1 section of 5 mfd., 350 volts and 1 section of 150 mfd., 50 volts (C126A, C126B, C126C)
77644	Capacitor—Electrolytic, comprising 1 section of 80 mfd., 400 volts and 1 section of 20 mfd., 400 volts (C117A, C117B)
76970	Capacitor—Electrolytic, comprising 1 section of 100 mfd., 400 volts, 1 section of 10 mfd., 350 volts and 1 section of 20 mfd., 50 volts (C116A, C116B, C116C)
	Capacitors—Fixed, tubular, oil impregnated:
76479	Moulded, .00068 mfd., 600 volts (C184)
75643	Paper, .001 mfd., 1000 volts (C146, C176)
76995	Moulded, .0012 mfd., 600 volts (C185)
77123	Moulded, .0015 mfd., 1000 volts (C164)
73595	Paper, .0022 mfd., 600 volts (C108, C145, C158)
73599	Paper, .0027 mfd., 600 volts (C114)
73818	Paper, .0027 mfd., 1600 volts (C118)
73796	Paper, .0039 mfd., 600 volts (C147)
73920	Paper, .0047 mfd., 600 volts (C110, C138, C156, C162, C168)
73808	Paper, .0082 mfd., 1000 volts (C155)
73561	Paper, .01 mfd., 400 volts (C111, C115)
73594	Moulded, .01 mfd., 600 volts (C172, C173, C183)
73562	Paper, .022 mfd., 400 volts (C180)
73798	Paper, .022 mfd., 600 volts (C166)
73810	Paper, .022 mfd., 1000 volts (C142, C189)
73811	Paper, .027 mfd., 1000 volts (C190)
73552	Paper, .033 mfd., 400 volts (C112, C152)
73596	Paper, .033 mfd., 1000 volts (C161)
73553	Paper, .047 mfd., 400 volts (C124 for KCS82, C179)
73592	Paper, .047 mfd., 600 volts (C167)
73792	Paper, .068 mfd., 400 volts (C165)
73784	Paper, 0.1 mfd., 200 volts (C171)
73551	Paper, 0.1 mfd., 400 volts (C151, C159, C169, C170, C178)
73557	Paper, 0.1 mfd., 600 volts (C160, C163, C186)
73794	Paper, 0.22 mfd., 200 volts (C125)
73786	Paper, 0.27 mfd., 400 volts (C187)
73787	Paper, 0.47 mfd., 200 volts (C109, C143, C181)
77676	Choke—Filter choke (L117)
73477	Coil—Choke coil (L101)
76442	Coil—Horizontal linearity coil complete with adjustable core (L111)
76011	Coil—Peaking coil (36 muh) (L102)
71526	Coil—Peaking coil (250 muh) (L104)
77925	Coil—Peaking coil (220 muh) (L107, R146)
77124	Coil—Peaking coil (1000 muh) (L106, R218)
76640	Coil—RF choke coil (1.5 muh) (L110)
76441	Coil—Width coil complete with adjustable core (L109)
35787	Connector—Phono input connector (J101)
75474	Connector — Single contact male connector for speaker cable (2 req'd)
76457	Connector—2nd anode lead connector
74594	Connector—2 contact male connector for power cord
50367	Connector—6 contact female connector for yoke leads (J102)
76975	Control—AGC control (R154)
77655	Control—Brightness control, volume control and power switch (R110A, R110B, S102)
77924	Control—Height control (R176)
77639	Control—Horizontal hold control (R200)
76445	Control—Picture control (R144)
77642	Control—Vertical hold control (R174)
77643	Control—Vertical linearity control (R186)
77647	Coupling—Coupling (nylon) for picture control
76986	Cover—Back cover for hi-voltage compartment
76985	Cover—Side cover for hi-voltage compartment
73600	Fuse—0.25 amp., 250 volts (F101)
76459	Grommet—Rubber grommet for 2nd anode lead connector
76480	Lead—Anode lead complete with eyelet
76464	Plate—Hi-voltage plate (bakelite) complete with tube socket and corona ring
76796	Resistor—Wire wound, 5.1 ohms, 1/3 watt (R213)
76639	Resistor—Wire wound, 180 ohms, 2 watts (R210)
77670	Resistor—Wire wound, 3300 ohms, 7 watts (R120)
77671	Resistor—Wire wound, 3800 ohms, 7 watts (R121)
77668	Resistor—Wire wound, 4000 ohms, 7 watts (R117 for KCS82)
76642	Resistor — Wire wound, 6750 ohms, 10 watts (R142)
77669	Resistor—Wire wound, 10,000 ohms, 5 watts (R118 for KCS82)
	Resistors—Fixed, composition:
30789	33 ohms, ±5%, ½ watt (R131)
503033	33 ohms, ±10%, ½ watt (R139)
503047	47 ohms ±10%, ½ watt (R105, R209)
34763	68 ohms, ±5%, ½ watt (R128)
503082	82 ohms, ±10%, ½ watt (R101)
502118	180 ohms, ±5%, ½ watt (R134)
503139	390 ohms, ±10%, ½ watt (R187)
503147	470 ohms, ±10%, ½ watt (R119 for KCS82, R135)
513156	560 ohms, ±10%, 1 watt (R114)
503168	680 ohms, ±10%, ½ watt (R143)
503210	1000 ohms, ±10%, ½ watt (R104, R116, R127, R130, R132)
513210	1000 ohms, ±10%, 1 watt (R102)
523218	1800 ohms, ±10%, 2 watts (R115)
503222	2200 ohms, ±10%, ½ watt (R145)
523222	2200 ohms, ±10%, 2 watts (R141)
503233	3300 ohms, ±10%, ½ watt (R188)
502239	3900 ohms, ±5%, ½ watt (R138, R168)
503239	3900 ohms, ±10%, ½ watt (R202)
513256	5600 ohms, ±10%, 1 watt (R140)
513268	6800 ohms, ±10%, 1 watt (R150)
523268	6800 ohms, ±10%, 2 watts (R211)
503282	8200 ohms, ±10%, ½ watt (R159, R169, R180, R183)
502310	10,000 ohms, ±5%, ½ watt (R107, R108)
513310	10,000 ohms, ±10%, 1 watt (R217)
503312	12,000 ohms, ±10%, ½ watt (R111)
503315	15,000 ohms, ±10%, ½ watt (R189)
503318	18,000 ohms, ±10%, ½ watt (R157, R172, R204)
503322	22,000 ohms, ±10%, ½ watt (R162, R166, R171, R201)
503339	39,000 ohms, ±10%, ½ watt (R106)
502339	39,000 ohms, ±5%, ½ watt (R147)
503347	47,000 ohms, ±10%, ½ watt (R136, R149, R165)
512347	47,000 ohms, ±5%, 1 watt (R206)
502356	56,000 ohms, ±5%, ½ watt (R129, R133)
503356	56,000 ohms, ±10%, ½ watt (R212)
512356	56,000 ohms, ±5%, 1 watt (R182)
503368	68,000 ohms, ±10%, ½ watt (R151, R199)
503382	82,000 ohms, ±10%, ½ watt (R198)
503410	100,000 ohms, ±10%, ½ watt (R178, R219)
513410	100,000 ohms, ±10%, 1 watt (R179)
30180	120,000 ohms, ±5%, ½ watt (R148)
503412	120,000 ohms, ±10%, ½ watt (R158)
503415	150,000 ohms, ±10%, ½ watt (R191, R194)
512415	150,000 ohms, ±5%, 1 watt (R203)
502418	180,000 ohms, ±5%, ½ watt (R125)
503422	220,000 ohms, ±10%, ½ watt (R190, R192)
502427	270,000 ohms, ±5%, ½ watt (R181)
503427	270,000 ohms, ±10%, ½ watt (R163, R177)
503433	330,000 ohms, ±10%, ½ watt (R112, R195, R197)
503439	390,000 ohms, ±10%, ½ watt (R155)
503447	470,000 ohms, ±10%, ½ watt (R113, R153, R173, R193, R208)
503468	680,000 ohms, ±10%, ½ watt (R160, R167)
503482	820,000 ohms, ±10%, ½ watt (R196, R207)
503510	1 megohm, ±10%, ½ watt (R161)
502511	1.1 megohm, ±5%, ½ watt (R185)
503512	1.2 megohm, ±10%, ½ watt (R184)
503515	1.5 megohm, ±10%, ½ watt (R175)
11769	1.8 megohm, ±5%, ½ watt (R124)
39063	1.8 megohm, ±5%, 1 watt (R205)
503522	2.2 megohm, ±10%, ½ watt (R164, R170)
503539	3.9 megohm, ±10%, ½ watt (R137, R152)
503582	8.2 megohm, ±10%, ½ watt (R122)
503610	10 megohm, ±10%, ½ watt (R109)
77660	Shaft—Extension shaft for picture control
76969	Shield—Hi-voltage shield less side and back covers
73584	Shield—Tube shield for V101, V102, V103, V108
76972	Shield—Tube shield for V109
75718	Socket—Channel indicator lamp socket
74834	Socket—Kinescope socket
71508	Socket—Tube socket, 6 pin, moulded for V116
50367	Socket — Tube socket, 6 pin, moulded, saddle mounted for V117
73117	Socket—Tube socket, miniature, 7 pin, wafer for V101, V102, V103, V104, V106, V107, V108
31251	Socket—Tube socket, octal, wafer for V105, V115, V119, V120
50367	Socket — Tube socket, octal, moulded, saddle mounted for V113
77645	Socket—Tube socket, octal, wafer for V114
76971	Socket—Tube socket, miniature, 9 pin, wafer for V109, V110, V111, V112
77656	Switch—Phono-tone control switch (S101)
76463	Terminal—Screw type grounding terminal
76795	Transformer—Hi-voltage transformer (T115)
76440	Transformer — Horizontal oscillator transformer complete with adjustable core (T114)
76997	Transformer—Output transformer (T103)
77635	Transformer — Power transformer, 117 volt, 60 cycle (T113)
77112	Transformer—Ratio detector transformer (T102, C105)
76981	Transformer — Sound I.F. transformer complete with adjustable core (T101, C102, C103, R103)
77636	Transformer—Vertical output transformer (T112)
77637	Transformer—1st pix I.F. transformer complete with adjustable cores (T104, C120, R126)
77638	Transformer—2nd pix I.F. transformer complete with adjustable core (T106)
76433	Transformer—3rd or 4th pix I.F. transformer (T107, T108)
76983	Trap—4.5 MC trap (L105, C137)
77585	Washer—"C" washer for picture control extension shaft (2 req'd)

YOKE AND MAGNET ASSEMBLIES

STOCK No.	DESCRIPTION
77008	Connector—Anode connector complete with contact and eyelet
75542	Connector—6 contact male connector—part of deflection yoke (P102)
74956	Cushion—Rubber cushion for deflection yoke hood
76654	Hood — Deflection yoke hood — less rubber cushions
76168	Magnet—Focus magnet
76141	Magnet—Ion trap magnet
71456	Screw—#8-32 x 7/16" wing screw for mounting deflection yoke
76636	Stud—Adjusting stud complete with guard for focus magnet
77697	Yoke—Deflection yoke complete with male connector (L113, L114, L115, L116, C192, R214, R215, R216, P102)

SPEAKER ASSEMBLIES

971636-1W
RL101C5
RMA-274

(For Models 21T303, 21T303U)

STOCK No.	DESCRIPTION
77000	Speaker—5" P.M. speaker complete with cone and voice coil (3.2 ohms)

SPEAKER ASSEMBLIES

971490-3W / RL105E6 / RMA-274 — 971490-3R / RMA-285

(For Models 21T313, 21T313U)

STOCK No.	DESCRIPTION
75024	Cone—Cone and voice coil for speakers stamped 971490-3W
77129	Cone—Cone and voice coil for speakers stamped 971490-3R
75022	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms)

SPEAKER ASSEMBLIES

971692-1

(For Models 21T314, 21T314U, 21T315, 21T315U, 21T316, 21T316U, 21T322, 21T322U)

STOCK No.	DESCRIPTION
77777	Speaker—10" P.M. speaker complete with cone and voice coil (3.2 ohms)

SPEAKER ASSEMBLIES

92569-12W
RL111A1
RMA-274

(For Models 21T323, 21T323U, 21T324, 21T324U)

STOCK No.	DESCRIPTION
75682	Cone—Cone and voice coil
76093	Speaker—12" P.M. speaker complete with cone and voice coil (3.2 ohms)

NOTE: If stamping on speaker in instruments does not agree with above speaker number, order replacement parts by referring to Model number of instrument, number stamped on speaker and full description of part required.

PARTS (Continued)

STOCK No.	DESCRIPTION
	MISCELLANEOUS
77791	Back—Cabinet back complete with terminal board and power cord for Models 21T303, 21T303U
77743	Back—Cabinet back complete with power cord for Models 21T313, 21T313U, 21T323, 21T323U, 21T324, 21T324U
77744	Back—Cabinet back complete with power cord for Models 21T314, 21T314U, 21T315, 21T315U, 21T322, 21T322U
77792	Back—Cabinet back complete with power cord for Models 21T316, 21T316U
76184	Board—Antenna terminal board
76629	Bracket—Hanger bracket for deflection yoke hood assembly
76697	Bracket—Masking panel support bracket (2 req'd) for Models 21T314, 21T314U, 21T315, 21T315U, 21T322, 21T322U, 21T323, 21T323U, 21T324, 21T324U
77748	Bracket—Mounting bracket for hidden controls cover and case assembly
76599	Bracket—"U" shaped bracket for deflection yoke hood support rods
76699	Bumper—Rubber bumper for kinescope (as req'd)
71496	Capacitor—Mica trimmer, 5-70 mmf. (part of antenna cable and F-M trap) for Models using KRK-12 Tuner unit.
71892	Catch—Bullet catch and strike for Models 21T323, 21T323U, 21T324, 21T324U
73754	Catch—Bullet catch and strike for Models 21T322, 21T322U
77755	Clamp—Polystyrene clamp for antenna cable and mount for F-M trap for models using KRK-12 tuner unit
X3351	Cloth—Grille cloth for oak instruments for 21T316, 21T316U
X3349	Cloth—Grille cloth for maple instruments for Models 21T315, 21T315U, 21T323, 21T323U
X3350	Cloth—Grille cloth for mahogany instruments for Models 21T313, 21T313U, 21T314, 21T314U, 21T322, 21T322U, 21T324, 21T324U; for walnut instruments for Models 21T324, 21T324U; for red cherry instruments for Models 21T323, 21T323U
75474	Connector—Single contact male connector—part of antenna cable
77726	Connector—2 contact male connector—part of antenna cable—for models using KRK-12 tuner unit
39153	Connector—4 contact male connector—part of antenna cable—for models using KRK-11B tuner unit
71457	Cord—Power cord and plug
77740	Cover—Cover and case assembly—brown—for hidden controls for mahogany, walnut or red cherry instruments
77741	Cover—Cover and case assembly—medium beige —for hidden controls for blonde mahogany or oak instruments
77742	Cover—Cover and case asembly—tan—for hidden controls for maple instruments
77761	Cover—Cover assembly—brown—complete with spring for channel markers for maple instruments for models using KRK-12 tuner unit
77759	Cover—Cover assembly—maroon—complete with spring for channel markers for mahogany, walnut or red cherry instruments for models using KRK-12 tuner unit
77760	Cover — Cover assembly — sand gray — complete with spring for channel markers for blonde mahogany or oak instruments for models using KRK-12 tuner unit
77770	Cushion—Adhesive cushion (1/32" x 13/32" x 15/16") for safety glass retainers
77749	Cushion—Rubber cushion for safety glass (4 req'd)
76631	Cushion—Rubber cushion for dust sealing the kinescope
76698	Cushion—Rubber cushion for masking panel support bracket for Models 21T314, 21T314U, 21T315, 21T315U, 21T322, 21T322U, 21T323, 21T323U, 21T324, 21T324U
77781	Decal—Brightness, volume, fine tuning controls and channel selector switch function decal for blonde mahogany, oak or maple instruments
77782	Decal—Brightness, volume, fine tuning controls and channel selector switch function decal for mahogany, walnut or red cherry instruments
77758	Disc — Polystyrene indicator disc — brown — for channel selections for maple instruments for models using KRK-12 tuner unit
77756	Disc — Polystyrene indicator disc — maroon — for channel selections for mahogany, walnut or red cherry instruments for models using KRK-12 tuner unit
77757	Disc—Polystyrene indicator disc—sand gray—for channel selections for blonde mahogany or oak instruments for models using KRK-12 tuner unit
77700	Escutcheon—Channel marker escutcheon for models using KRK-11B tuner unit
72113	Foot—Rubber foot (4 req'd) for Models 21T303, 21T303U
77745	Glass—Safety glass
77793	Grille—Metal grille for Models 21T315, 21T315U
37396	Grommet—Rubber grommet for speaker mounting (3 req'd) for Models 21T323, 21T323U, 21T324, 21T324U
74308	Hinge—Door hinge (1 set) for Models 21T322, 21T322U, 21T323, 21T323U, 21T324, 21T324U
77709	Knob—Brightness control knob—brown—for mahogany, walnut or red cherry instruments (outer)
77718	Knob—Brightness control knob—medium beige—for blonde mahogany or oak instruments (outer)
77734	Knob—Brightness control knob—tan—for maple instruments (outer)
77708	Knob—Channel selector knob for models using KRK-11B tuner unit (inner)
77751	Knob — Channel selector knob — brown — for mahogany, walnut or red cherry instruments for models using KRK-12 tuner unit
77752	Knob—Channel selector knob—medium beige—for blonde mahogany or oak instruments for models using KRK-12 tuner unit
77753	Knob — Channel selector knob — tan — for maple instruments for models using KRK-12 tuner unit
77707	Knob — Fine tuning control knob — brown — for mahogany, walnut or red cherry instruments for models using KRK-11B tuner unit (outer)
77717	Knob—Fine tuning control knob—medium beige—for blonde mahogany or oak instruments for models using KRK-11B tuner unit (outer)
77733	Knob—Fine tuning control knob—tan—for maple instruments for models using KRK-11B tuner unit (outer)
77750	Knob—Fine tuning control knob for models using KRK-12 tuner unit (outer)
77699	Knob — Picture control knob — brown — for mahogany, walnut or red cherry instruments
77719	Knob—Picture control knob—medium beige—for blonde mahogany or oak instruments
77738	Knob—Picture control knob—tan—for maple instruments
77735	Knob — Tone and phono control switch knob — brown—for mahogany, walnut, or red cherry instruments
77736	Knob — Tone and phono control switch knob — medium beige — for blonde mahogany or oak instruments
77737	Knob — Tone and phono control switch knob — tan—for maple instruments
77710	Knob—Volume control and power switch knob (inner)
11765	Lamp—Channel marker escutcheon lamp—Mazda 51

PARTS (Continued)

STOCK No.	DESCRIPTION
77766	Marker — UHF channels numbers markers for blonde mahogany or oak instruments for models using KRK-12 tuner unit
77765	Marker—UHF channels numbers markers for mahogany, walnut or red cherry instruments for models using KRK-12 tuner unit
77767	Marker—UHF channel number markers for maple instruments for models using KRK-12 tuner unit
77763	Marker—VHF channel number markers for blonde mahogany or oak instruments for models using KRK-12 tuner unit
77762	Marker—VHF channel number markers for mahogany, walnut or red cherry instruments for models using KRK-12 tuner unit
77764	Marker—VHF channel number markers for maple instruments for models using KRK-12 tuner unit
77701	Mask—Channel marker escutcheon light mask—brown—for mahogany, walnut or red cherry instruments for models using KRK-11B tuner unit
77720	Mask—Channel marker escutcheon light mask—medium beige—for blonde mahogany or oak instruments for models using KRK-11B tuner unit
77739	Mask—Channel marker escutcheon light mask—tan—for maple instruments for models using KRK-11B tuner unit
73634	Nut—Speed nut for speaker mounting screws
76177	Nut—#10-32 special nut for deflection yoke hood support rods
76601	Pad—Kinescope edge support pad (4 req'd)
77732	Panel—Kinescope masking panel (light taupe) for blonde, oak or maple instruments
77731	Panel—Kinescope masking panel (mint green) for mahogany, walnut or red cherry instruments
77017	Pull—Door pull for Models 21T322, 21T322U
77794	Pull — Door pull (upper) for Models 21T323, 21T323U
77795	Pull — Door pull (lower) for Models 21T323, 21T323U
77796	Pull — Door pull (upper) for Models 21T324, 21T324U
77797	Pull — Door pull (lower) for Models 21T324, 21T324U
77746	Retainer—Safety glass retainer for sides (2 req'd)
77747	Retainer—Safety glass retainer for top or bottom
77928	Retainer—Retainer for channel selector Knob for models using KRK-12 tuner unit
76628	Rod—"L" shape threaded rod for supporting deflection yoke hood assembly
77712	Screw—#6 x ½" cross recessed pan head self-tapping screw (black) for fastening hidden controls cover and case to cabinet for mahogany, walnut or red cherry instruments
77725	Screw—#6 x ½" cross recessed pan head self-tapping screw (zinc) for fastening hidden controls cover and case to cabinet for blonde mahogany, oak or maple instruments
75623	Screw—#8-32 x ⅝" trimit head screw for door pull 77797 for Models 21T324, 21T324U
75676	Screw—#8-32 x 3/16" trimit head screw for door pull 77795 for Models 21T323, 21T323U
75626	Screw—#8-32 x 1¼" trimit head screw for door pull 77794 for Models 21T323, 21T323U
74113	Screw—#8-32 x 1" trimit head screw for door pull 77017 for Models 21T322, 21T322U and for door pull 77796 for Models 21T324, 21T324U
76632	Screw — #8 x ⅝" hex head wood screw for hanger bracket
77754	Shade—Channel marker escutcheon lamp shade for models using KRK-12 tuner unit
73643	Spring—Channel marker escutcheon spring clip for models using KRK-11B tuner unit
76630	Spring — Formed spring for kinescope masking panel
76820	Spring—Formed spring for safety glass retainers
76837	Spring—Retaining spring for knobs 77699, 77709, 77718, 77719, 77734, 77735, 77736, 77737, 77738
72845	Spring—Retaining spring for knobs 77707, 77717, 77733 for 21T300 series
30330	Spring—Retaining spring for knob 77710
74734	Spring—Retaining spring for channel markers covers 77759, 77760, 77761
77006	Spring—Retaining spring for deflection yoke hood support rod nut
77929	Spring—Formed spring for fine tuning Knob for models using KRK-12 tuner unit
72936	Stop—Cabinet door stop for Models 21T322, 21T322U, 21T323, 21T323U, 21T324, 21T324U
76600	Strap—Grounding strap (.005" soft copper)
75500	Washer—Felt washer for kinescope masking panel or back cover screws

APPLY TO YOUR RCA DISTRIBUTOR FOR PRICES OF REPLACEMENT PARTS

MODEL 21TW7

MODEL 621CW7

MODEL 21CW7

ALIGNMENT PROCEDURE

NOTE: Test-socket pins are numbered like tube-sockets, i.e. counterclockwise from the keyway at the lug side of the socket.

I. Video I. F. Spot Frequency Alignment

A. Connect 3 volts bias between pins 1 and 2 of the Test-Socket, with negative lead connected to pin 2.
B. Set tuner on a low band channel which does not have a strong local station. Short the antenna input terminal. Set contrast control at maximum clockwise position.
C. Feed the output of an audio-modulated signal generator through a condenser to the tuner test point.
D. Connect the high side of an AC Voltmeter to the Test-Socket, pin no 4, and the low side of the meter to pin no. 1. If necessary, the kinescope lead may be removed.
E. Control output of the signal generator so that the reading on the AC voltmeter goes no higher than 20 volts.
F. Use the proper alignment tool--an internal male screwdriver for the coil studs, and proceed as follows:

Step Number	Signal Generator Frequency	Adjust	Remarks
1	25.7 MC	T3-Top	Adjust for maximum reading of voltmeter
2	25.7 MC	T1-Top	Same
3	23.6 MC	T2-Top	Same
4	23.6 MC	Tuner Top Slug	Same

II. Intercarrier Sound I. F. Alignment.

A. Remove the 6AL5 video detector from its socket. Set contrast control at maximum clockwise.
B. Connect the high side of the signal generator, through a condenser, to pin 7 of this tube socket. Connect the low side to the chassis. (NOTE: Pins are numbered from the lug side of the socket.)
C. Connect a DC voltmeter or VTVM to the Test-Socket, the negative lead to pin 1 and the positive lead to pin 6.
D. Set the signal generator to 4.5 MC, unmodulated, and adjust output of generator so the DC meter reads no higher than 10 volts.
E. Use proper alignment tool: one internal male tool for stud; one external male tool for K-tran Ratio Detector.

Proceed as follows:

Step Number	Signal Generator Frequency	Adjust	Remarks
5	4.5 MC	T4-Top	Adjust for maximum reading of voltmeter
6	Same	T5-Bottom	Same

F. Now disconnect voltmeter from Test-Socket, and replace with a matched pair of resistors. (NOTE: These resistors should be around 270K each, and should be connected in series between pins 6 and 1 of the test-socket.)

G. Connect the positive lead of the voltmeter to the mid-point of these resistors, and the negative lead to pin 7 of the test-socket.

H. Use 5-volt range of meter, and proceed as follows:

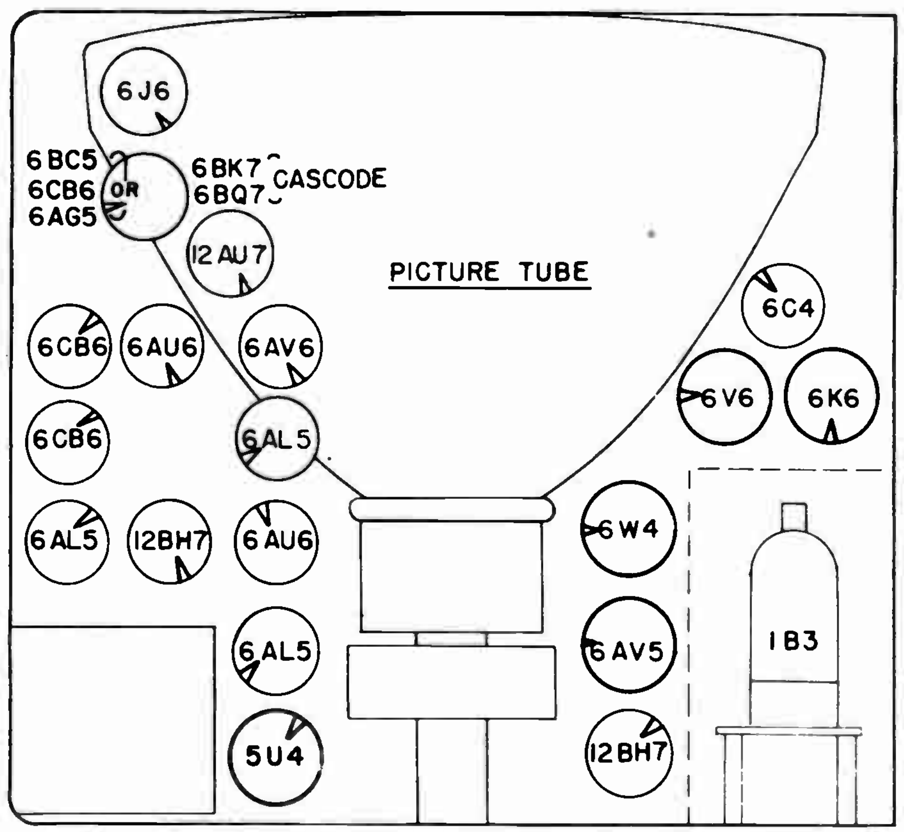
Step Number	Signal Generator Frequency	Adjust	Remarks
7	4.5MC	T5-Top	Adjust for zero which occurs between a maximum negative and a maximum positive feeding

III. Tuner Oscillator Alignment.

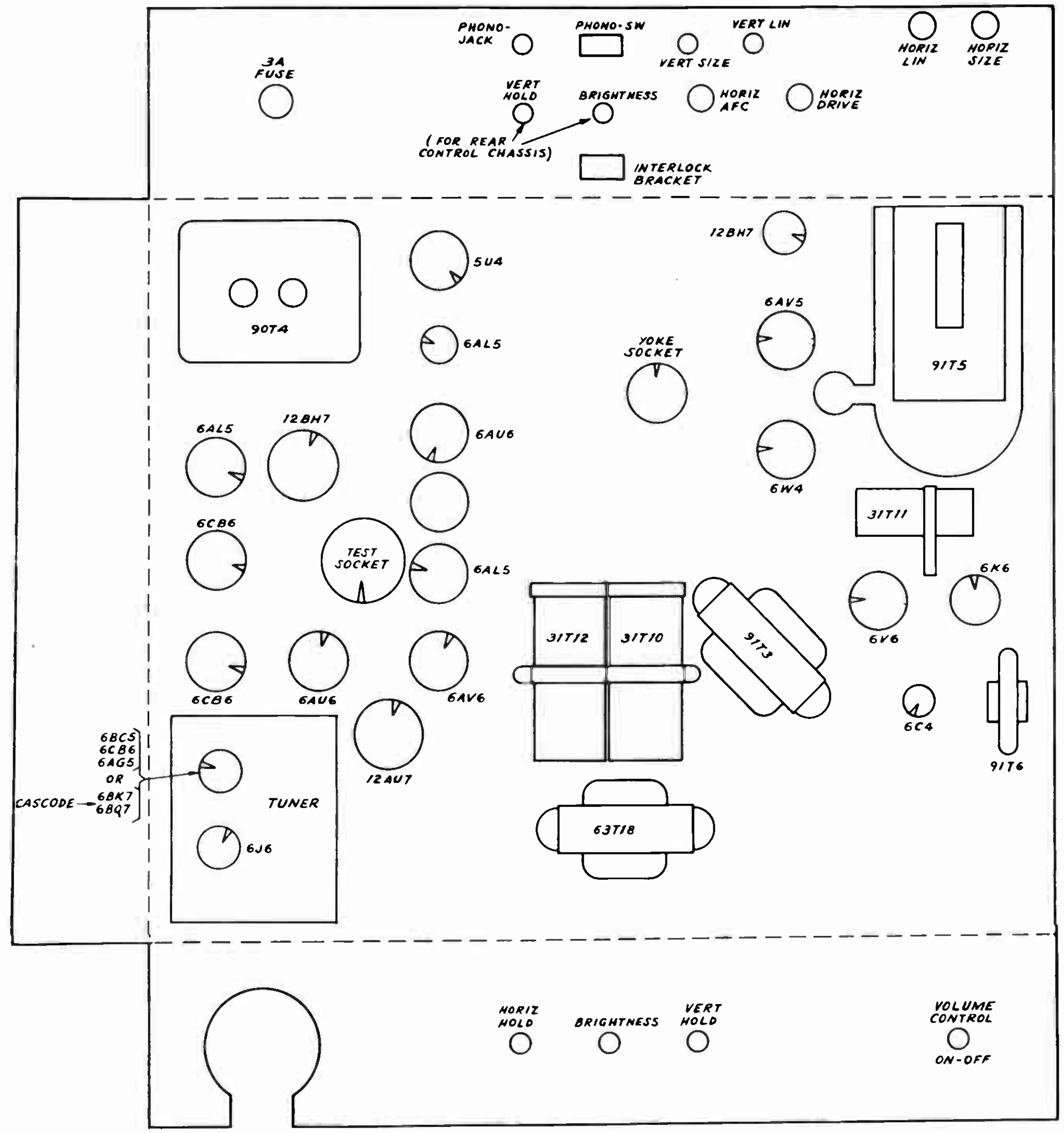
(A) Set fine-tuning in mid-position of its range.

(B) Align all twelve channels with either an "off the air" station or a monoscope modulated local transmitter.

(C) Procedure: Tune oscillator screws until 4.5 MC sound "wiggles" are just visible at all vertical edges.



TOP VIEW
TUBE LAYOUT



BOTTOM VIEW
TUBE & COMPONENT PARTS LAYOUT

RESISTANCE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	50K	0	.1	0	30K	30K	100		
V2	1.5M	1.5M	0	0	30K	0	0		
V3	7M	0	.1	0	0	0	500K		
V4	0	0	30K	30K	500K	30K	.1		
V5	1.1M	0	0	.1	30K	30K	80		
V6	1.1M	50	.1	0	30K	30K	0		
V7	.8	150	.1	0	30K	30K	0		
V8	.2	200K	.1	0	2K	0	5K		
V9	40K	1M	0	.5	.5	30K	5K	0-2K	0
V11	40K	1.5M	3K	0	0	1.5M	55K	200K	.1
V12	∞	.5-3M	0	.1	.5-3M	0			
V13	300-5K	.1	30K	500M	7M	12K	0	.2K-5K	
V14	.1	30K	.5M	20	∞	20	.5M	30K	
V15	400	400	.1	0	3M	0	3M		
V16	.2M	.2M	2K	.1	.1	35K	35M	2K	0
V17	.5M	.1	0	∞	.5M	∞	0	40K	
V18	30K	∞	.5M	30K	30K	∞	.5M	.5M	
V19	∞	∞	∞	∞	∞	∞	∞	∞	
CRT V10	400K	30K				∞	Pin 10 = ∞ Pin 11 = 400K Pin 12 = 400K		

Resistance values are in ohms.
K=1 Thousand
M=1 Million

Symbol No.	Part No.	Description
R-1	20T472-32	4.7KΩ ±10% 1/2w, carbon
R-2	20T820-32	82Ω ±10% 1/2w, carbon
R-3	20T101-32	100Ω ±10% 1/2w, carbon
R-4	20T331-32	330Ω ±10% 1/2w, carbon
R-5	20T103-32	10KΩ ±10% 1/2w, carbon
R-6	20T470-32	47Ω ±10% 1/2w, carbon
R-7	20T101-32	100Ω ±10% 1/2w, carbon
R-8	20T331-32	330Ω ±10% 1/2w, carbon
R-9	20T101-32	100Ω ±10% 1/2w, carbon
R-10	20T223-32	22KΩ ±10% 1/2w, carbon
R-11	20T824-32	820KΩ ±10% 1/2, carbon
R-12	20T151-32	150Ω ±10% 1/2w, carbon
R-13	20T101-32	100Ω ±10% 1/2w, carbon
R-14	20T333-32	33KΩ ±10% 1/2w, carbon
R-15	20T101-32	100Ω ±10% 1/2w, carbon
R-16	20T224-32	220KΩ ±10% 1/2w, carbon
R-17	20T101-32	100Ω ±10% 1/2w, carbon
R-18	20T472-32	4.7KΩ ±10% 1/2w, carbon
R-19	50T10	2K 1/2w, carbon, Pot. Contrast
R-20	50T10	1 Meg. Volume, On-Off
R-21	20T332-42	3.3KΩ ±10% 1w, carbon
R-22	20T822-32	8.2KΩ ±10% 1/2w, carbon
R-23	20T105-32	1 Meg. ±10% 1/2w, carbon
R-24	20T822-32	8.2KΩ ±10% 1/2w, carbon
R-25	20T182-42	1.8KΩ ±10% 1w, carbon
R-26	20T104-42	100KΩ ±10% 1w, carbon
R-27	20T332-32	3.3KΩ ±10% 1/2w, carbon
R-28	20T332-52	3.3KΩ ±10% 2w, carbon
R-29	20T152-42	1.5KΩ ±10% 1w, carbon
R-30	20T334-32	330KΩ ±10% 1/2w, carbon
R-31	50T16	25KΩ 1/2w, carbon pot., Brightness Control
R-32	20T392-32	3.9KΩ ±10% 1/2w, carbon
R-33	20T822-32	8.2KΩ ±10% 1/2w, carbon
R-34	20T473-32	47KΩ ±10% 1/2w, c arbon
R-35	20T101-32	100Ω ±10% 1/2w, carbon
R-36	20T473-32	47KΩ ±10% 1/2w, carbon
R-37	20T473-42	47KΩ ±10% 1w, carbon
R-38	20T102-32	1KΩ ±10% 1/2w, carbon
R-39	20T153-32	15KΩ ±10% 1/2w, carbon
R-40	20T333-32	33KΩ ±10% 1/2w, carbon
R-41	20T685-32	6.8 Meg. ±10% 1/2w, carbon
R-42	20T474-32	470KΩ ±10% 1/2w, carbon
R-43	20T474-32	470KΩ ±10% 1/2w, carbon
R-44	20T561-42	560Ω ±10% 1w, carbon
R-45	20T471-42	470Ω ±10% 1w, carbon
R-46	20T10	2750Ω ±10% 10w, wirewound
R-47	20T155-32	1.5 Meg. ±10% 1/2w, carbon
R-48	20T224-32	220KΩ ±10% 1/2w, carbon
R-49	20T563-32	56KΩ ±10% 1/2w, carbon
R-50	20T272-32	2.7KΩ ±10% 1/2w, carbon

VOLTAGE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	-.5	0	AC 6.3	0	195	80	.5		
V2	18	10	0	AC 6.3	48	0	0		
V3	-.8	0	AC 6.3	0	0	0	75		
V4	0	0	210	225	0	240	AC 6.3	17	
V5	-2.8	0	0	AC 6.3	130	130	.25		
V6	-2.8	.3	AC 6.3	0	135	135	0		
V7	0	2.3	AC 6.3	0	135	135	0		
V8	0	-3.3	AC 6.3	0	5	0	-4.5		
V9	155	-7.2	0	AC 6.3	AC 6.3	120	-4.5	5	0
V11	86	18	16	0	0	18	-2.5	12	AC 6.3
V12	155	155	0	AC 6.3	155	-82	0		
V13	36	AC 6.3	240	380	0	36	0	36	
V14	AC 6.3	260	150	-20	0	-20	150	260	
V15	0	0	AC 6.3	0	12	0	-12		
V16	110	-4.2	10	AC 6.3	AC 6.3	210	.3	10	0
V17	-28	AC 6.3	0	0	620	0	0	-130	
V18	240	0	540	230	200	0	150	150	
V19	DO NOT MEASURE!!								
CRT V10	160	110				540	Pin 10 = 540 Pin 11 = 160 Pin 12 = 160		

All voltages are with respect to chassis.
Measurements were made with receiver controls set for normal picture with 117 volts line voltage. Normal signal applied to antenna terminals. VTVM used for all readings.

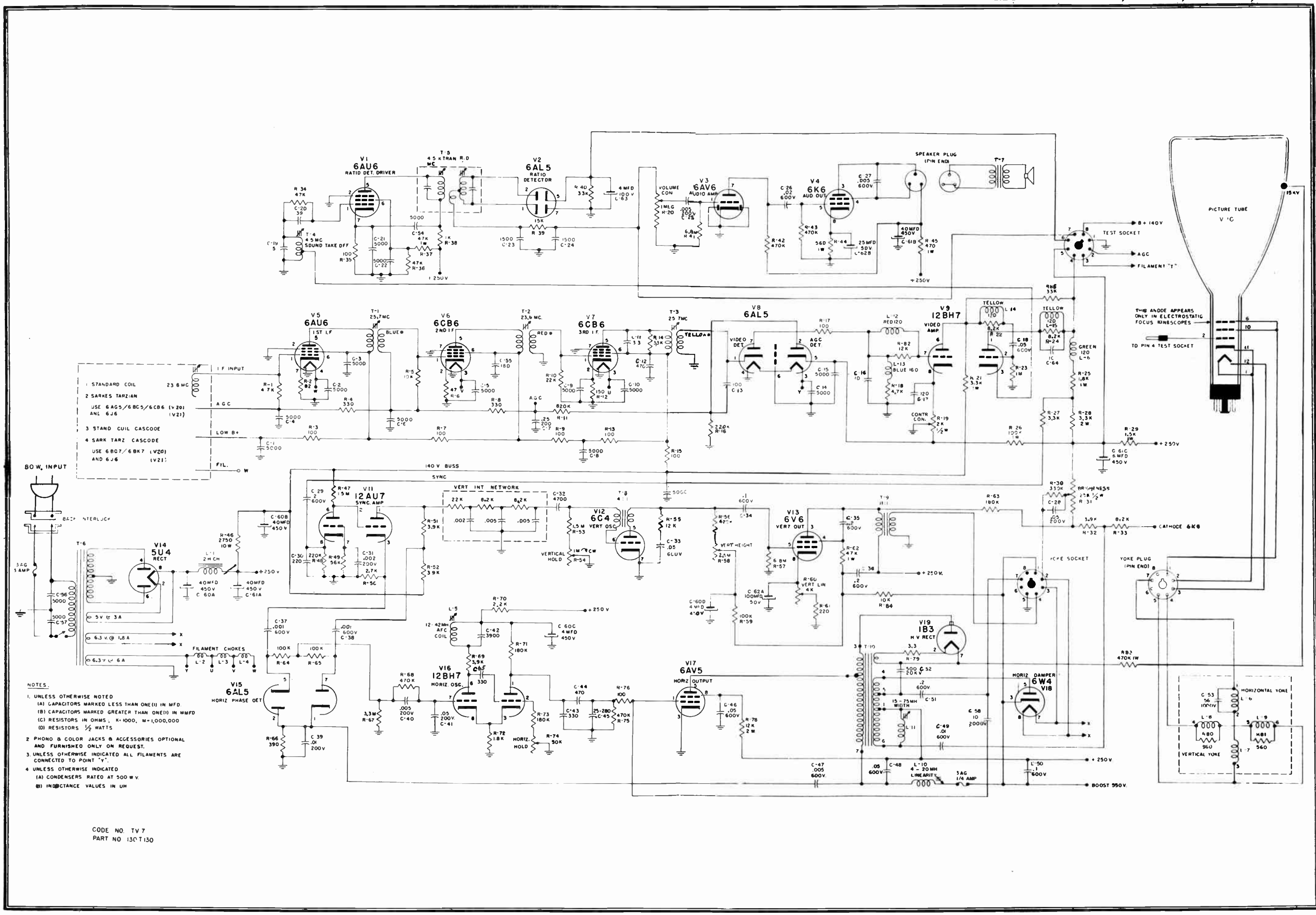
Symbol No.	Part No.	Description
R-51	20T392-32	3.9KΩ ±10% 1/2w, carbon
R-52	20T392-32	3.9KΩ ±10% 1/2w, carbon
R-53	20T155-32	1.5 Meg. ±10% 1/2w, carbon
R-54	50T13	1 Meg. 1/4w, carbon pot., Vert. Hold
R-55	20T123-32	12KΩ ±10% 1/2w, carbon
R-56	20T474-32	470KΩ ±10% 1/2w, carbon
R-57	20T685-32	6.8 Meg. ±10% 1/2w, carbon
R-58	50T2	2.5 Meg. 1/4w, carbon pot. Vert. Height
R-59	20T104-32	100KΩ ±10% 1/2w, carbon
R-60	50T3	4KΩ 1/2w, carbon, Vert. Linearity
R-61	20T221-32	220Ω ±10% 1/2w, carbon
R-62	20T473-42	47KΩ 1w, 10%, carbon
R-63	20T184-32	180KΩ ±10% 1/2w, carbon
R-64	20T104-32	100KΩ ±10% 1/2w, carbon
R-65	20T104-32	100KΩ ±10% 1/2w, carbon
R-66	20T391-32	390Ω ±10% 1/2w, carbon
R-67	20T335-32	3.3 Meg. ±10% 1/2w, carbon
R-68	20T474-32	470KΩ ±10% 1/2w, carbon
R-69	20T392-32	3.9KΩ ±10% 1/2w, carbon
R-70	20T222-32	2.2KΩ ±10% 1/2w, carbon
R-71	20T184-32	180KΩ ±10% 1/2w, carbon
R-72	20T182-32	1.8KΩ ±10% 1/2w, carbon
R-73	20T184-32	180KΩ ±10% 1/2w, carbon
R-74	50T14	50KΩ 1/4w, carbon pot., Horiz. Hold
R-75	20T474-32	470KΩ ±10% 1/2w, carbon
R-76	20T101-32	100Ω ±10% 1/2w, carbon
R-78	20T123-52	12KΩ ±10% 2w, carbon
R-79	20T3	3.3Ω 1/2w, ±10%, wirewound
R-80	20T561-32	560Ω ±10% 1/2w, carbon
R-81	20T561-32	560Ω ±10% 1/2w, carbon
R-82	20T123-32	12KΩ ±10% 1/2w, carbon
R-83	20T474-42	470KΩ 1w 10%, carbon
R-84	20T103-32	10KΩ 1/2w,10%, carbon
R-85	20T12	100Ω 10w 10%, w.w.
R-86	20T333-32	33KΩ 1/2w,10%, carbon

CAPACITORS

Symbol No.	Part No.	Description
C-1		
C-2	35T27	2X5000mmf 500V -0% +100%, ceramic disc
C-3		
C-4	35T27	2X5000mmf 500V -0% +100%, ceramic disc
C-5		
C-6	35T27	2X5000mmf 500V -0% +100%, ceramic disc
C-7	33T15	0.25mf 200V, paper
C-8	35T16	5000mmf, 500V -0 +100%, ceramic disc
C-9		
C-10	35T27	2X5000mmf 500V -0% +100%, ceramic disc
C-11		3.3mmf 500V ±10%, tubular ceramic
C-12	35T32	470mmf 500V ±10%, mica
C-13	35T15	100mmf 500V ±10%, tubular ceramic

Symbol No.	Part No.	Description
C-14		
C-15	35T27	2X5000mmf 500V -0% +100%, ceramic disc
C-16	35T23	10mmf 500V 10%, ceramic tubular
C-17	35T24	120mmf 500V ±10%, ceramic tubular
C-18	33T6	0.05mf 600V, paper tubular
C-19	35T4	5mmf 500V ±10%, ceramic tubular
C-20	35T14	39mmf 500V ±10%, ceramic tubular
C-21		
C-22	35T27	2X5000mmf 500V -0% +100%, ceramic disc
C-23		
C-24	35T30	1500mmf 500V -0% +100%, ceramic disc
C-25	33T19	0.005mf 200V, paper tubular
C-26	33T12	0.02mf 600V, paper tubular
C-27	33T20	0.005mf 600V, paper tubular
C-28	33T23	0.05mf 200V, paper tubular
C-29	33T27	0.2mf 600V, paper tubular
C-30	35T25	220mf 500V ±10%, ceramic tubular
C-31	33T26	0.002mf 200V, paper tubular
C-32	35T21	4700mmf 500V ±10%, mica
C-33	33T6	0.05mf 600V, paper tubular
C-34	33T7	0.1mf 600V, paper tubular
C-35	33T27	0.2mf 600V, paper tubular
C-36	33T27	0.2mf 600V, paper tubular
C-37	33T18	0.001mf 600V, paper tubular
C-38	33T18	0.001mf 600V, paper tubular
C-39	33T21	0.01mf 200V, paper tubular
C-40	33T19	0.005mf 200V, paper tubular
C-41	33T23	0.05mf 200V, paper tubular
C-42	35T20	3900mmf 500V ±5%, silver mica
C-43	35T19	330mmf 500V ±10%, mica
C-44	35T3	470mmf 500V ±10%, mica
C-45	36T2	25-280mmf Trimmer, Drive Control
C-46	33T6	0.05mf 600V, paper tubular
C-47	33T20	0.005mf 600V, paper tubular
C-48	33T6	0.05mf 600V, paper tubular
C-49	33T29	0.01mf 600V, paper tubular
C-50	33T7	0.1mf 600V, paper tubular
C-51	33T27	0.2mf 600V, paper tubular
C-52	35T11	500mmf 20KV, Hi-voltage, stud terminals
C-53	35T18	56mmf 1000V ±10%, mica
C-54	35T16	5000mmf 500 V -0% +100%, ceramic tubular
C-55	35T31	180mmf 500V ±10%, ceramic tubular
C-56		
C-57	35T27	2X5000mmf 500V -0% +100%, ceramic tubular
C-58	35T33	10mmf 2000V
C-64	35T23	10mmf 500V 10%, ceramic tubular
C-65	35T19	330mmf 500V 10%, mica
C-66	33T19	0.005mf 200V, paper

Symbol No.	Part No.	Description
ELECTROLYTIC CAPACITORS		
C-60A, B, C, D	31T10	40-40-4-4mf 450V, electrolytic
C-61A, B, C	31T12	40-40-8mf 450V, electrolytic
C-62A, B	31T11	100mf 50V; 25mf 50V, electrolytic
C-63	31T15	4mf 100V, tubular electrolytic
TRANSFORMERS		
T-1	61T3	1st Video IF transformer 25.7MC (blue dot)
T-2	61T5	2nd Video IF transformer 23.6MC (red dot)
T-3	61T4	3rd Video IF transformer 25.7MC(yellow dot)
T-4	63T12	Sound take-off coil 4.5MC
T-5	63T23	Ratio detector transformer 4.5MC
T-6	90T4	Power transformer
T-7	91T4	Audio output transformer
T-8	91T6	Vertical oscillator transformer
T-9	91T3	Vertical output transformer
T-10	91T5A	Horizontal output transformer
INDUCTANCES		
L-1	63T18	Filter choke 2h
L-2	63T1	Filament RF choke
L-3	63T1	Filament RF choke
L-4	63T1	Filament RF choke
L-5	60T1	Horizontal AFC coil 12-42mh
L-6	64T4	Horizontal Deflection coil
L-7	64T4	Horizontal Deflection coil
L-8	64T4	Vertical Deflection coil
L-9	64T4	Vertical Deflection coil
L-11	63T20	Width coil 0.15-0.75mh
L-10	63T22	Linearity coil 4-20mh
L-12	63T14	Peaking coil red 120mh on 12KΩ 1/2w Res
L-13	63T16	Peaking coil blue 160mh
L-14	63T13	Peaking coil yellow 120mh on 8.2KΩ 1/2w Res
L-15	63T13	Peaking coil yellow 120mh on 8.2KΩ 1/2w Res
L-16	63T15	Peaking coil green 120mh
	80T3	5" Speaker
	80T2	10" Speaker
	5LT4X	Standard tuner
	56T5	Sarkes tuner


V1
6AU6
RATIO DET. DRIVER
V2
6AL5
RATIO DETECTOR
V3
6AV6
AUDIO AMP
V4
6K6
AUD OUT
SPEAKER PLUG
(PIN END)
TEST SOCKET
PICTURE TUBE
V5
6AU6
1ST I.F.
V6
6CB6
2ND I.F.
V7
6CB6
3RD I.F.
V8
6AL5
VIDEO DET.
AGC DET.
V9
12BH7
VIDEO AMP.
THIS ANODE APPEARS ONLY IN ELECTROSTATIC FOCUS KINESCOPES
TO PIN 4 TEST SOCKET
1 STANDARD COIL 23.6 MC
2 SARKES TARZIAN
USE 6AG5/6BC5/6CB6 (V20) AND 6J6 (V21)
3 STAND COIL CASCODE
4 SARK TARZ CASCODE
USE 6BQ7/6BK7 (V20) AND 6J6 (V21)
80 W. INPUT
BACK INTERLOCK
140 V BUSS
SYNC
V11
12AU7
SYNC. AMP
VERT INT NETWORK
V12
6C4
VERT OSC
VERTICAL HOLD
V13
6V6
VERT OUT
VERT HEIGHT
VERT LIN
YOKE SOCKET
YOKE PLUG
(PIN END)
BRIGHTNESS
CATHODE 6K6
V14
5U4
RECT
FILAMENT CHOKES
V15
6AL5
HORIZ PHASE DET
V16
12BH7
HORIZ. OSC.
HORIZ. HOLD
V17
6AV5
HORIZ OUTPUT
V19
1B3
H V RECT
HORIZ DAMPER
6W4
V18
WIDTH
LINEARITY
HORIZONTAL YOKE
VERTICAL YOKE
BOOST 550 V.
NOTES.
1. UNLESS OTHERWISE NOTED
(A) CAPACITORS MARKED LESS THAN ONE(1) IN MFD.
(B) CAPACITORS MARKED GREATER THAN ONE(1) IN MMFD
(C) RESISTORS IN OHMS; K=1000, M=1,000,000
(D) RESISTORS 1/2 WATTS
2 PHONO & COLOR JACKS & ACCESSORIES OPTIONAL AND FURNISHED ONLY ON REQUEST.
3. UNLESS OTHERWISE INDICATED ALL FILAMENTS ARE CONNECTED TO POINT "Y".
4 UNLESS OTHERWISE INDICATED
(A) CONDENSERS RATED AT 500 W.V.
(B) INDUCTANCE VALUES IN UH
CODE NO. TV 7
PART NO 130T130

CHASSIS MODELS

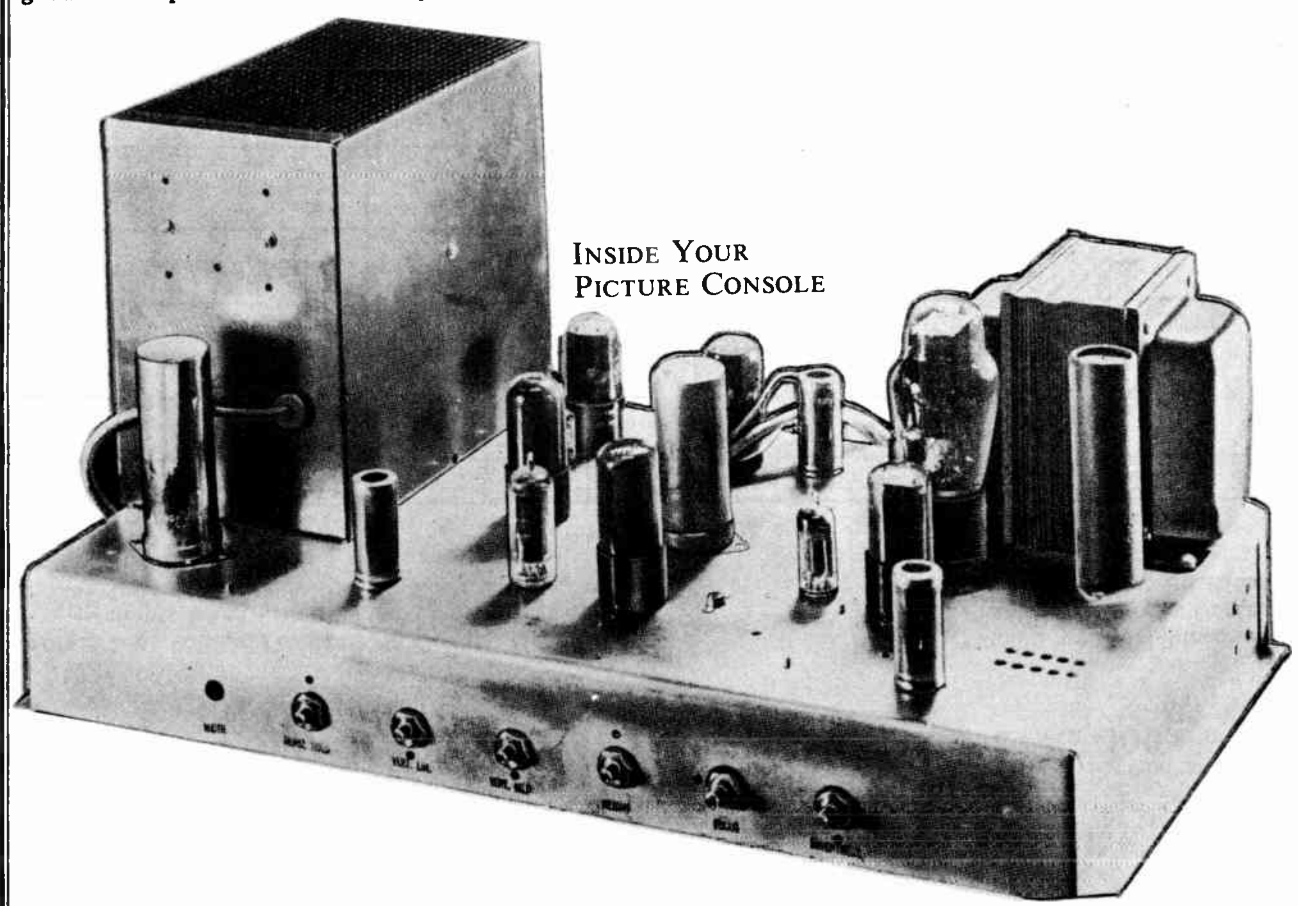
The following table lists current models of Douglas Chairside Control Television Receivers identifying the Tuner Chassis, Sweep Chassis, and picture tube used with each model.

MODEL	TUNER CHASSIS MODEL	*SWEEP CHASSIS MODEL	PICTURE TUBE TYPE
24-100 Mahogony	T-100	S-100	24BP4
24-100 Maple	T-100	S-100	24BP4
24-100 Blonde	T-100	S-100	24BP4
24-200 Mahogony	T-100	S-100	24BP4
24-200 Maple	T-100	S-100	24BP4
24-200 Blonde	T-100	S-100	24BP4
21-100 Mahogony	T-100	AS-100	21FP4A
21-200 Mahogony	T-100	AS-100	21FP4A

* The only difference between Sweep Chassis models S-100 and AS-100 is as follows:

1. The high-voltage lead on model S-100 is designed for a 24-inch picture tube but on model AS-100 it is made for a 21-inch picture tube.

2. The yoke assembly on model AS-100 has an additional lead which grounds the picture tube assembly.



INSIDE YOUR PICTURE CONSOLE

ALIGNMENT CHART

STEP NO.	CW SIG. GEN. FREQ. (MC)	CONNECT SIGNAL TO	OUTPUT INDICATOR	ADJUST	PROCEDURE	SPECIAL CONNECTIONS & SETTINGS
			SOUND I-F & RATIO DETECTOR			
1	21.6	Conv. grid, pin 5 of 6J6.	VTVM between junction of R7, C7, C8, C9, & pin 7 of V3 & ground.	L2 & primary T2 (bottom).	Tune for max. reading on VTVM.	Use 10 K resistor in series with VTVM lead. Signal level should be low enough to obtain approx. 6.0 volts deflection.
2	21.6	"	VTVM between junction of R7 & R8 and junction of R10, C10 & C11 (ground side of meter)	Secondary T2 (top).	Tune for zero meter reading. Use same signal level as in step 1.	Repeat tuning of T2 primary and secondary, until reading does not vary.
			SOUND TRAPS, ADJACENT CHANNEL TRAPS & VIDEO I-F			
3	21.6	Conv. grid, pin 5 of 6J6	VTVM between junction of L5 & R20 & ground.	L7	Tune for min. reading on VTVM.	Set tuner between channels; contrast at min; keep sig. gen. level low.
4	21.6	"	"	L11 (top)	"	"
5	20.1	"	"	L9	"	"
6	27.6	"	"	L13 (top)	"	"
7	25.9	"	"	L6	Tune for max. reading on VTVM.	Set tuner between channels; contrast at min; adjust signal level throughout I-F alignment, so that a 1.0 VDC output is maintained at the video det.
8	25.9	"	"	L12 (bottom)	"	"
9	23.4	"	"	L8	"	"
10	22.5	"	"	L10 (bottom)	"	"
11	23.7	"	"	L14	"	Tune conv. plate coil on tuner to 23.7 mc by turning slug in, before making this adjustment.
12	23.5	"	"	Conv. plate coil	Tune for max. reading.	Conv. plate coil located on tuner.
13	REPEAT STEPS 3 THROUGH 12 UNTIL ADJUSTMENTS DO NOT CHANGE.					
14	10 MC sweep width. Center freq. approx. 25.0 MC	Conv. grid, pin 5 of 6J6.	High gain scope between junction of L5 & R20 to ground.	Conv. plate coil & L14 first. Other coils only if necessary.	Set 26.1 MC marker at 50% point with conv. plate coil. Eliminate tilt with L14.	Use markers to determine band pass at 50% points. Band pass should be between 4.1 MC & 3.9 MC wide. Adjust other I-F coils to obtain proper curve only when absolutely necessary.
15	READJUST L7, L11, L9, AND L13.					

VOLTAGE CHART - SWEEP CHASSIS S-100 & AS-100

Note: Line voltage 117 vac. No signal. Measurements taken with a 20,000 ohms per volt meter. Unless otherwise specified, all voltages listed are dc.

*Varies with Brightness Control
+Varies with Focus Control
#In FM or Phono Position

FUNCTION & TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V101 & V109, Video Ampl & Remote Brightness Control, 12AT7	240	1.5	3.5	6.3 vac	6.3 vac	105 #35	-0.7	-	-
V102, Video Ampl, 6CB6	-	2.5	6.3 vac	-	190	175	-		
V103, Sync Sep., 6AU6	-0.7	-	6.3 vac	-	15	45	-		
V104 & V108, Sync Sep. & D-C Rest., 6SN7GT	60	280	110	15	160	25	6.3 vac	-	
V105, Horiz. Phase Det., 6AL5	5.8	-8	6.3 vac	-	-	-	-		
V106, Horiz. M.V., 6SN7GT	-0.1	250	10	-4	130	10	6.3 vac	-	
V107, Horiz. Output, 6BQ6GT	-17	-	-	160	-17	-17	6.3 vac	13	
V110, Vert. Output, 6S4	-	26	-	6.3	-	25	26	-	480
V111, Vert. M.V., 6SN7GT	-	75	2.5	-40	185	2.5	6.3 vac	-	
V113, Damper, 6W4GT	-	-	520	-	375	-	DO NOT MEASURE		
V114, Rectifier, 5U4G	-0.7	380	-	380 vac	-6	380 vac	-0.4		
V115, Audio Ampl, 6AV6	-0.5	-	6.3 vac	-	-	-	70		
V116, Audio Output, 6V6GT	-	-	230	260	-	145	6.3 vac	22	
							PIN 10	PIN 11	PIN 12
V117, C.R.T., 24BP4	280	*110 #35	-	-	-	+520	350	*135 #115	280

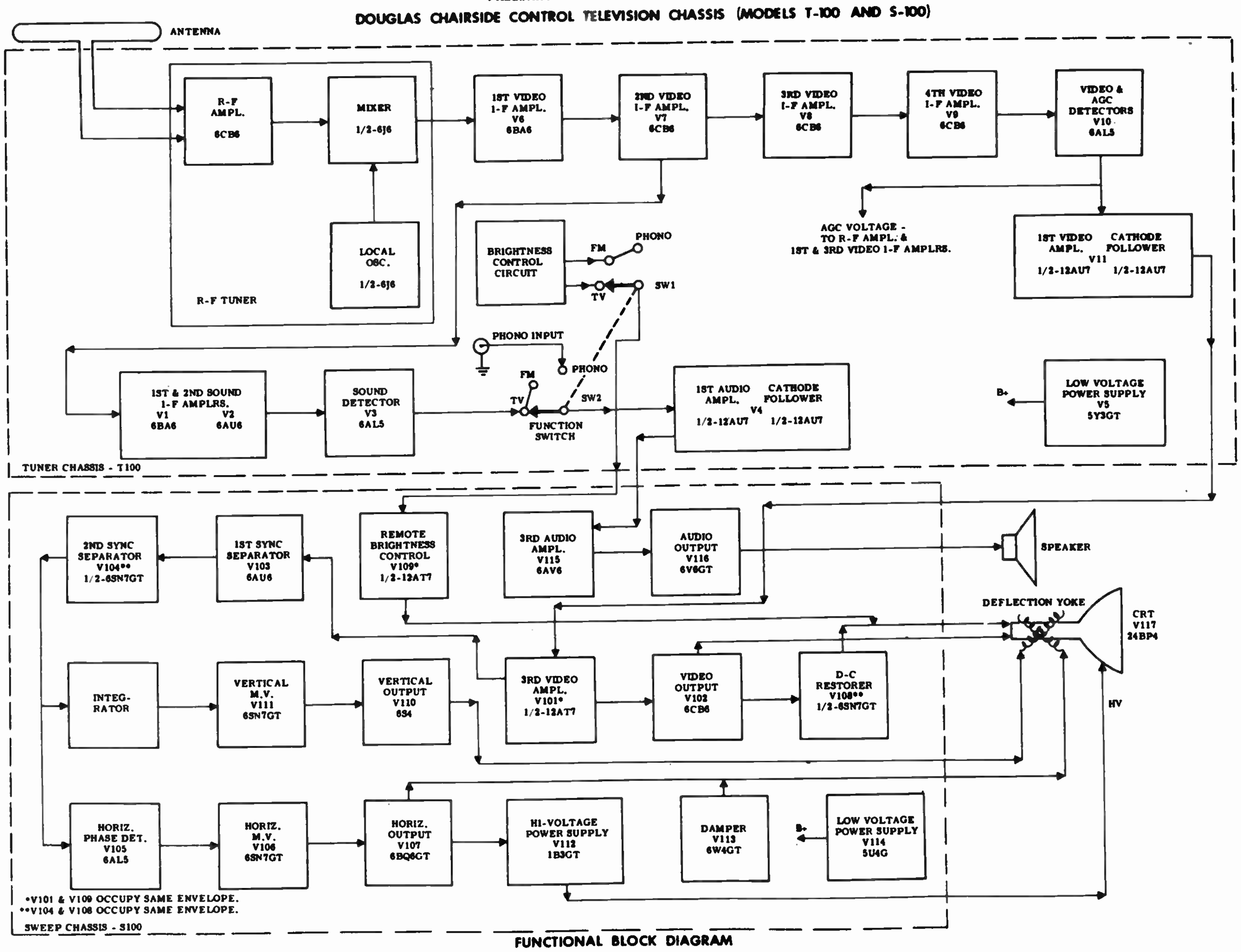
VOLTAGE CHART - TUNER CHASSIS T-100

Note: Line voltage 117 vac. No. signal. Measurements taken with a 20,000 ohms per volt meter. Unless otherwise specified, all voltages listed are dc.

FUNCTION & TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
V1, 1st Sound I-F Ampl., 6BA6	-	0	6.3 vac	-	130	130	2	
V2, 2nd Sound I-F Ampl., 6AV6	-	0	6.3 vac	-	135	135	0.8	
V3, Sound Det., 6AL5	-0.3	-0.3	6.3 vac	-	-	-	-0.5	
V4, Audio Ampl., 12AU7	22	-0.45	-	6.3 vac	6.3 vac	120	-	3.5
V5, Rectifier, 5Y3	-	180	6.3 vac	210 vac	-	210 vac	-	180
V6, 1st Video I-F Ampl., 6BA6	-0.35	-	6.3 vac	-	95	100	0.5	
V7, 2nd Video I-F Ampl., 6CB6	-	0.7	6.3 vac	-	100	100	-	
V8, 3rd Video I-F Ampl., 6CB6	-0.3	0.6	6.3 vac	-	65	108	-	
V9, 4th Video I-F Ampl., 6CB6	-	1.5	6.3 vac	-	100	115	-	
V10, Video Det. & AGC Det., 6AL5	-	-0.5	6.3 vac	-	-	-	-0.4	
V11, Video Ampl., 12AU7	145	0	1.5	6.3 vac	6.3 vac	115	-	3

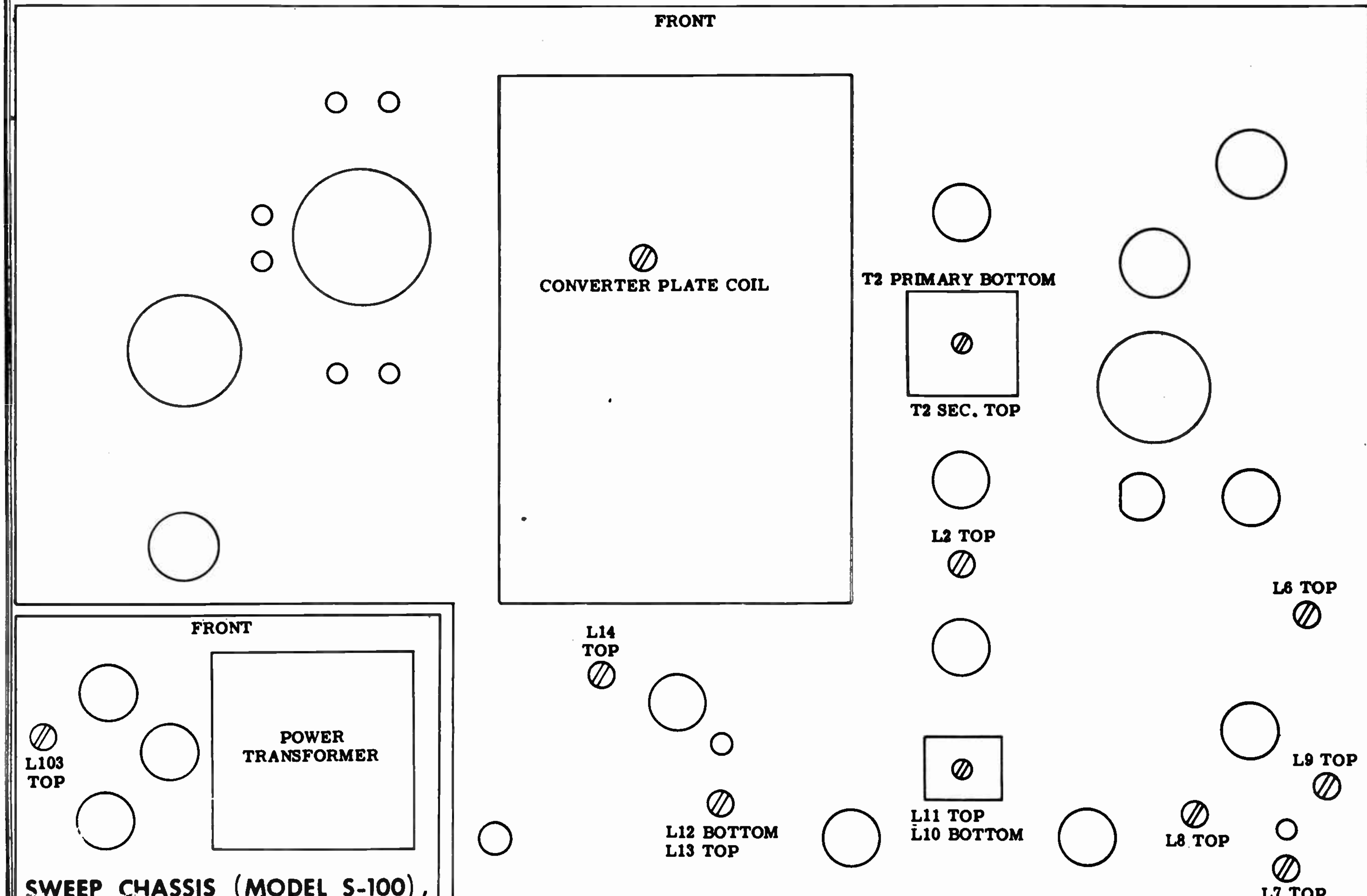
PRELIMINARY SERVICE INFORMATION

DOUGLAS CHAIRSIDE CONTROL TELEVISION CHASSIS (MODELS T-100 AND S-100)



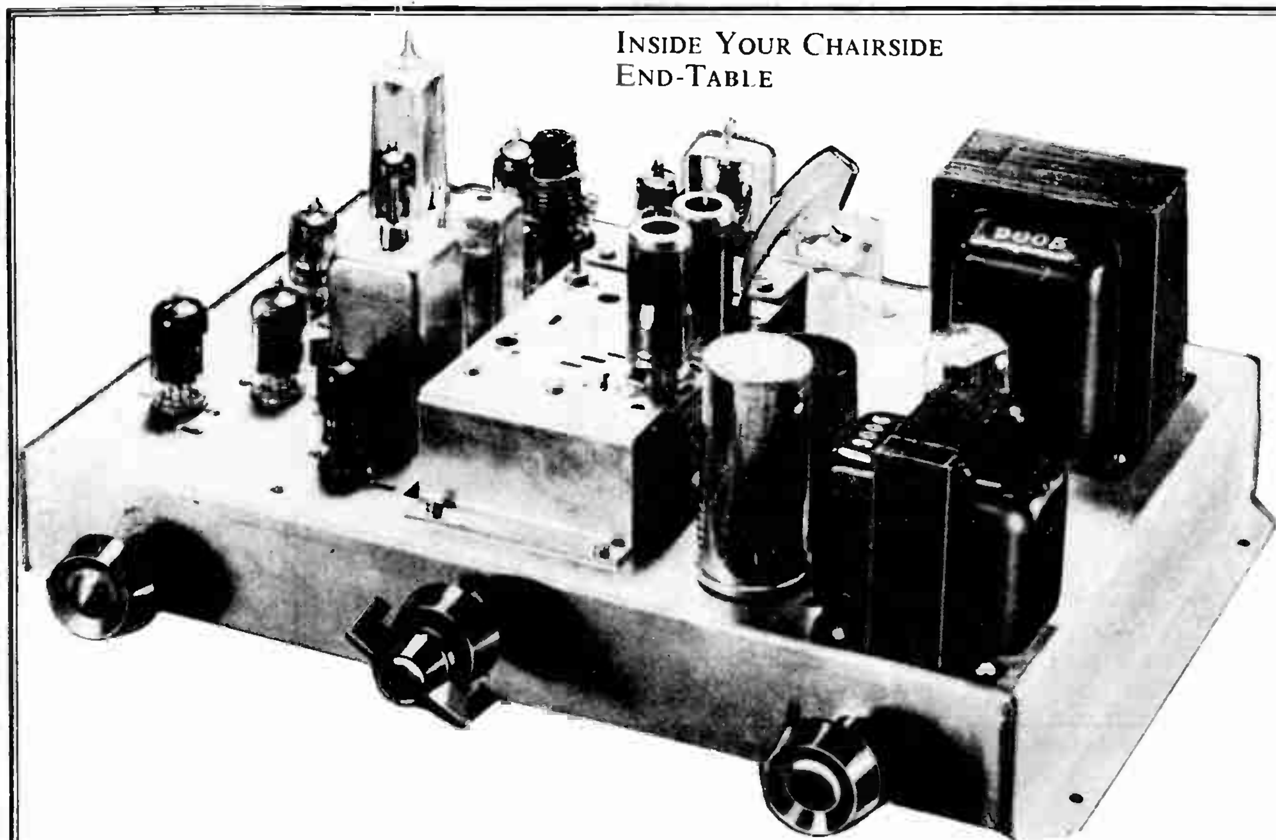
FUNCTIONAL BLOCK DIAGRAM

LOCATION OF ALIGNMENT ADJUSTMENTS



SWEEP CHASSIS (MODEL S-100), TOP VIEW

TUNER CHASSIS (MODEL T-100), TOP VIEW



DETAILED ALIGNMENT INSTRUCTIONS
FOR TUNER CHASSIS T-100

This procedure describes detailed Alignment Instructions for the sound i-f amplifier stages and the stagger-tuned video i-f amplifier stages. The following discussion also includes recommended methods and equipment to be used and precautions to be observed during the alignment procedure. The Alignment Chart on page 1 offers a ready reference alignment guide, to be followed after studying these more detailed Alignment Instructions.

In order to obtain satisfactory results it is recommended that alignment be performed on a metal-topped bench with a good common ground connection between all instruments and equipment. All leads should be as short as is practicable, particularly in the input and output circuits. Allow about fifteen minutes for the test equipment and receiver to warm-up before beginning the alignment. The input and output connections should be made through isolation circuits. Composition resistors (1/2-watt), and disc-type ceramic capacitors should be used in the isolation networks, so that a minimum amount of external inductance is added to the tuned circuits being adjusted.

The following equipment will be required in order to properly align the sound and video i-f stages:

1. An accurate cw signal generator (marker generator) covering the following frequencies:

20.1 mc
21.6 mc (Sound I-F)
22.1 mc
26.1 mc (Video I-F)
27.6 mc

The cw signal generator must have an attenuation control which will vary the output signal level.

2. A sweep-frequency generator with a sweep center-frequency of approximately 25.0 mc and a 10-mc sweep-width.

3. A cathode-ray oscilloscope with at least a moderately high vertical gain. It should have an external sweep input or internal sweep-frequency equal to the sweep generator sweep-frequency and capable of phase control.

4. A d-c voltmeter with sensitivity of 20,000 ohms-per-volt, or higher, and voltage scale ranges which include approximately 10 volts and 3 volts (full-scale deflection). A VTVM with zero-center scale adjustment is an ideal type.

5. A 0.005 mfd cw signal generator isolating capacitor.

6. A 10-K, 1/2-watt composition resistor and a 0.001 mfd r-f filter capacitor for the detection-isolation network.

Before alignment is begun, turn the tuner to an off-channel position by turning the channel-selector shaft so that the detent roller rests on one of the high points of the drum disc.

ORDER OF ALIGNMENT

1. Sound I-F and Ratio Detector Primary.
2. Ratio Detector secondary.
3. 21.6-mc Traps.
4. 20.1-mc Trap.
5. 27.6-mc Trap.
6. 25.9-mc 4th Video I-F Coil.
7. 25.9-mc 1st Video I-F Plate Coil.
8. 23.4-mc 3rd Video I-F Coil.
9. 22.5-mc 2nd Video I-F Coil.
10. 23.7-mc 1st Video I-F Grid Coil.
11. 23.5-mc Converter-Plate Coil.

Since there is a slight amount of interaction between stages, it is strongly recommended that the alignment procedure be followed exactly as outlined here. Steps 13 and 15, of the Alignment Chart on page 1, must be performed with special care.

NOTE

It is NOT necessary to connect either Sweep Chassis S-100 or AS-100 to the Tuner Chassis while performing this alignment procedure.

SOUND I-F ALIGNMENT

1. Connect the "hot" lead of the cw signal generator to the converter grid, pin 5, of the 6J6 in r-f tuner through a 0.005 mfd isolating capacitor. Tune the generator frequency to 21.6 mc, unmodulated. If the generator does not have a low-impedance output, it is suggested that a 1/2-watt composition resistor, of about 75 ohms resistance, be shunted across its output terminals. Connect the negative voltmeter lead in series with a 10-K isolating resistor to pin 7 of V3 (sound detector, 6AL5). It is important that the 10-K isolating resistor be at the very end of the meter lead to avoid regeneration. Connect the positive voltmeter lead to ground.

2. Adjust the primary (bottom) of T2, and L2 to obtain maximum voltmeter readings. The maximum voltage reading should be held at about 6.0 to 6.5 volts by decreasing the generator output while tuning the coils to resonance.

With the generator connected as in the preceding step and the input at the same level that produced 6.0 to 6.5 volts in the preceding step connect the voltmeter between the junction of R7 and R8 and R10, C10 and C11; polarity will depend upon which side of resonance the secondary winding of T2 is tuned. If a VTVM is being used, set the zero-voltage point up scale so that both plus and minus readings may be observed without changing the polarity selector switch on the VTVM. Start with one of the higher scales of the meter and decrease the scale setting as the null point is obtained.

3. Tune the secondary (top) of T2 for a zero reading on the voltmeter. Do not change the generator output level from that which produced the 6.0 to 6.5 volts in the first step. Repeat tuning of T2 primary and secondary until adjustments do not change.

TUNING TRAPS

1. Connect the "hot" lead of the cw signal generator to the converter grid, pin 5, of the 6J6 in the r-f tuner through a 0.005 mfd isolating capacitor. Another method of coupling is to pull the 6J6 tube shield up on the tube until it is not grounded. Clip the "hot" lead of the generator directly to the tube shield. The tube shield and tube electrodes form a capacitor which couples the signal to the mixer grid. A much higher level of generator output will be required if the latter method is utilized.

2. Connect the negative lead of the voltmeter to pin 7 of V10 (video detector, 6AL5), using the 10-K isolating resistor at the end of the lead. Connect the positive voltmeter lead to ground.

3. Turn the contrast control to its minimum position (extreme counterclockwise) for the remainder of the alignment procedure.

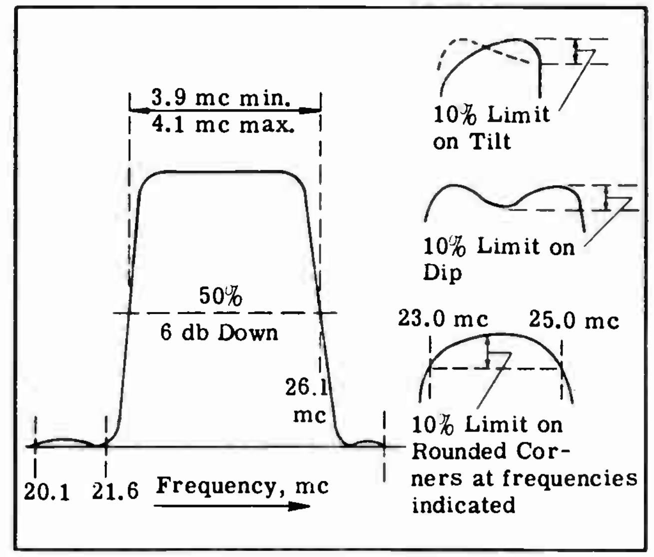
4. Tune the traps by setting the trap frequency on the cw generator and adjusting each trap slug for a minimum voltmeter reading. The order of tuning the traps is given in steps 3 through 7 in the Alignment Chart on page 1.

VIDEO I-F COILS

1. Instruments and set-up remain the same as for trap alignment during the first part of the procedure. For final adjustment the sweep-frequency generator is also used and the voltmeter is replaced by an oscilloscope.

2. Tune each i-f coil by setting the coil frequency on the cw signal generator and adjusting the coil for a maximum voltmeter reading in each case. The cw signal generator output must be attenuated so that the d-c output voltage of the video detector (indicated on the voltmeter), remains at 1-volt as the i-f coils are tuned. The order of tuning is from the last i-f stage toward the tuner. (See steps 8 through 12, page 1.) Before tuning the grid coil of the 1st i-f stage, temporarily tune the converter plate coil for a minimum voltmeter reading at 23.7 mc. After the 1st video i-f grid coil has been tuned, tune the converter plate coil to 23.5 mc and repeat the trap and i-f alignment procedure until no additional change in adjustment is necessary.

3. When no further change takes place, replace the voltmeter with the oscilloscope and replace the cw signal



Video I.F. Bandpass Curve

generator with the sweep-frequency generator. Use the same isolating capacitor and input connection to the converter grid. Loosely clip or connect the cw signal generator "hot" lead to the unshielded insulated end of the sweep-frequency generator "hot" lead. This will afford a small amount of capacitive coupling. If the cw and sweep-frequency generators are both part of the same instrument it will only be necessary to switch on the sweep-frequency generator in order to continue the procedure. Tune the sweep-frequency generator to a center frequency of approximately 25 mc. Use a sweep width of 10 mc, so that the base of both response curve shirts is well within the ends of the oscilloscope trace. Check the over-all bandwidth, position of the video carrier, dip in bandpass, and trappage by using the marker pip to locate frequency points on the response curve. (Refer to the accompanying curve.) Tune the cw signal generator to 26.1 mc. The marker pip should appear at approximately the 50% point on the curve skirt. Adjust the 1st i-f grid coil (L14) to eliminate any tilt of the response curve and adjust the converter-plate coil to set the picture carrier at the 50% response point.

4. It should not be necessary to readjust the other video i-f coils. Once the picture carrier has been correctly positioned, tune the cw signal generator so that the marker pip moves to the 50% response point on the opposite skirt. Note the frequency calibration of the cw signal generator dial and subtract this value from 26.1 mc. The difference should be between 3.9 and 4.1 mc. If the bandpass does not lie within these limits, touch up the other i-f coils until correct curve is obtained. If other coils than the converter plate coil and the 1st i-f grid coil (L14) have to be readjusted to obtain the correct bandpass it will be necessary to go back and realign the traps.

ADJUSTMENT OF CONTROLS ON SWEEP CHASSIS S-100 & AS-100

The controls on Sweep Chassis S-100 and AS-100 have been carefully adjusted at the factory. These adjustments should be checked in the customer's home by the dealer or his service representative at the time of installation or during a service call. Once adjusted correctly, these controls need not be changed over long periods of time or unless a specific service problem developes. The location of the controls is clearly marked on the front flange of the chassis below each control. The ion-trap magnet and centering magnet are located on the neck of the picture tube. The horizontal linearity control is located in the high-voltage cage and is accessable from the rear of the chassis.

ION-TRAP MAGNET

The effects produced by the orientation of the focus control, ion-trap magnet, and centering magnet are slightly interacting. Consequently one or two compensating adjustments of each control may be necessary to obtain optimum results. Set the brightness and contrast controls to about mid-range, NEVER at their maximum settings! Move the ion-trap magnet over the "flags" of the picture tube first anode. Rotate the ion-trap magnet on the picture tube neck until light appears on the screen. After the initial light has been obtained, move the ion-trap magnet back and forth and rotate it until you obtain the brightest possible picture raster.

WARNING

Final adjustment of ion-trap magnet must be made after the centering magnet has been properly adjusted.

FOCUS

The picture tube in these chassis type uses electrostatic focusing. In addition to the usual number of electrodes, the picture tube employs a focusing electrode very similar to that used by most cathode-ray tubes used in oscilloscopes. This additional focusing electrode is connected to pin six. The tube is designed for optimum focus at some fixed potential relative to its cathode, the value depending chiefly on the tube type, but there is a very slight variation of focus with several hundred volts change in focus potential. The focus control in these chassis types is a 2-megohm potentiometer connected between the B-boost voltage (approximately 600 volts) and ground. The arm of the potentiometer is connected to pin 6 of the picture tube.

With a picture on the cathode-ray tube screen, turn the focus control until the sharpest picture is obtained at the center of the picture tube.

BRIGHTNESS ADJUSTMENT

The brightness control sets the average background illumination of the picture.

1. Be sure the band switch on the tuner is in the TV position.

2. Temporarily turn the contrast control to its minimum setting (extreme counterclockwise).

3. Turn the brightness control so that a minimum usable picture is visible on the screen.

This setting produces a picture with average background characteristics at about half-contrast setting. For individual tastes that vary from this recommendation, the brightness control may be set so the picture is most pleasing to the customer.

HORIZONTAL DRIVE

Turn the horizontal-drive control counterclockwise until a drive bar (thin, light vertical line) appears near the center of the raster. Turn the control clockwise until the drive bar just disappears. If no drive bar is obtained, set control at maximum counterclockwise position.

HORIZONTAL HOLD

The horizontal-frequency control, L103, is a coarse frequency adjustment relative to the horizontal-hold control. Set the horizontal-hold control at mid-range and turn the horizontal-frequency control until vertical lines appearing near the top portion of the picture appear to be straight (no "hook"). At this setting the picture should either hold syncronization at either end of the hold control setting, or appear with an equal number of diagonal bars at either end of the hold control setting after the channel selector is switched off channel and returned to the same channel.

HORIZONTAL WIDTH

Adjust the picture width by turning the width control, L109. Clockwise rotation of control increases the width. Counterclockwise rotation produces a decrease in width.

NOTE

When adjusting the width, remember to take the line voltage into account. If the line voltage differs by more than several volts from the value usually existing when and/or where the receiver is to be operated, make allowance for the voltage difference when adjusting the width. Remember, the width increases for higher line voltages. It is usually best to adjust for a slightly wider raster, which will automatically compensate for reductions in line voltage and component aging.

HORIZONTAL LINEARITY

Turn the horizontal-linearity control, L106, for best horizontal linearity as determined with a test pattern. It may be necessary to re-set the horizontal-drive and horizontal-hold controls after the linearity adjustment has been made.

VERTICAL HOLD

The vertical-hold control has a hold-in range over which the picture will stay in vertical sync. Turn the control so the picture is brought up just into synchronization from a downward moving picture.

VERTICAL HEIGHT & VERTICAL LINEARITY

The vertical height and linearity controls operate together to adjust the vertical height and proportion the picture. The height control effects the height of the entire picture but not in a linear manner. When the height control is turned the bottom portion of the picture is expanded at a greater rate than the top portion, and the center of the picture tends to move toward the top of the tube.

Turn the height control counterclockwise to increase the height of the picture and clockwise to decrease picture height.

The vertical-linearity control affects the upper portion of the picture and compensates for non-linearity created by changes made by the height control.

Turn the vertical-linearity control clockwise to expand the upper portion of the picture and counterclockwise to compress the upper portion of the picture.

The height of the picture is effected by line voltage fluctuations in much the same manner as the width of the picture as previously described. Consequently, it is wise to adjust the picture for slightly greater height and width (approximately one inch) to compensate for possible "shrinkage" due to line voltage variations or tube and component aging.

CENTERING

It is best to adjust the picture linearity and size using a test pattern, before centering the picture. If picture tilt exists, temporarily loosen the screw at the top of the deflection yoke and rotate the yoke until the tilt is eliminated. Make certain the deflection yoke is seated as far forward on the picture tube neck as possible.

Bear in mind that picture non-linearity and poor centering are not always due to misadjustment in the receiver. Occasionally the fault originates at the transmitter. It is advisable to look at as many test patterns as are available when making receiver adjustments, and compromise the adjustment if necessary.

Raster centering is accomplished by adjusting two permanent-magnet rings that are part of a centering assembly which is placed on the neck of the picture tube just behind the yoke. The centering assembly should be positioned as near as possible to the deflection yoke. The effects produced by the two magnets are interacting, and it will be necessary to rotate both to obtain correct centering in most instances.

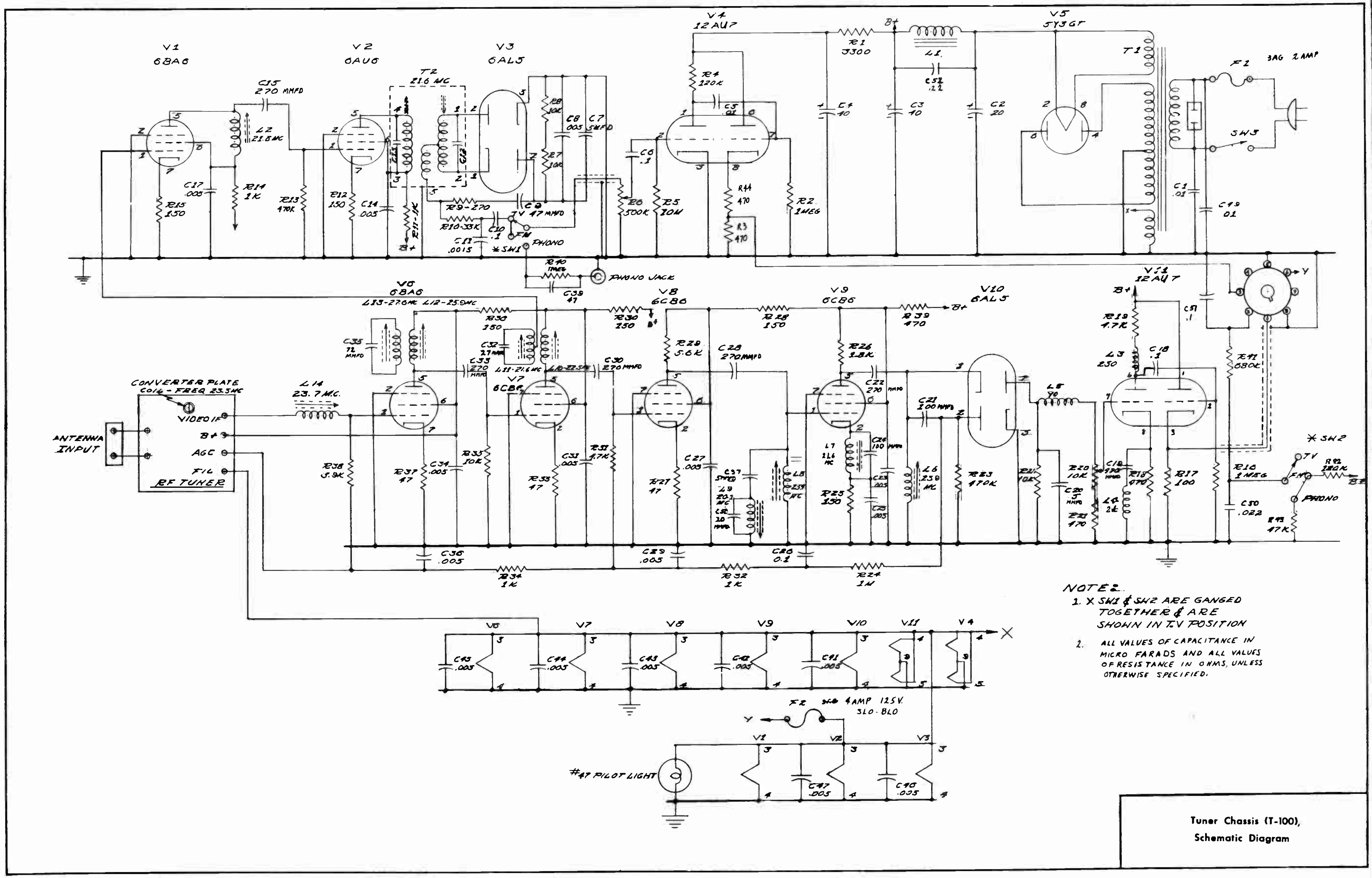
WARNING

Never attempt to center the picture by misadjusting the ion-trap magnet. After the picture has been properly centered the ion-trap magnet should be readjusted as previously prescribed.

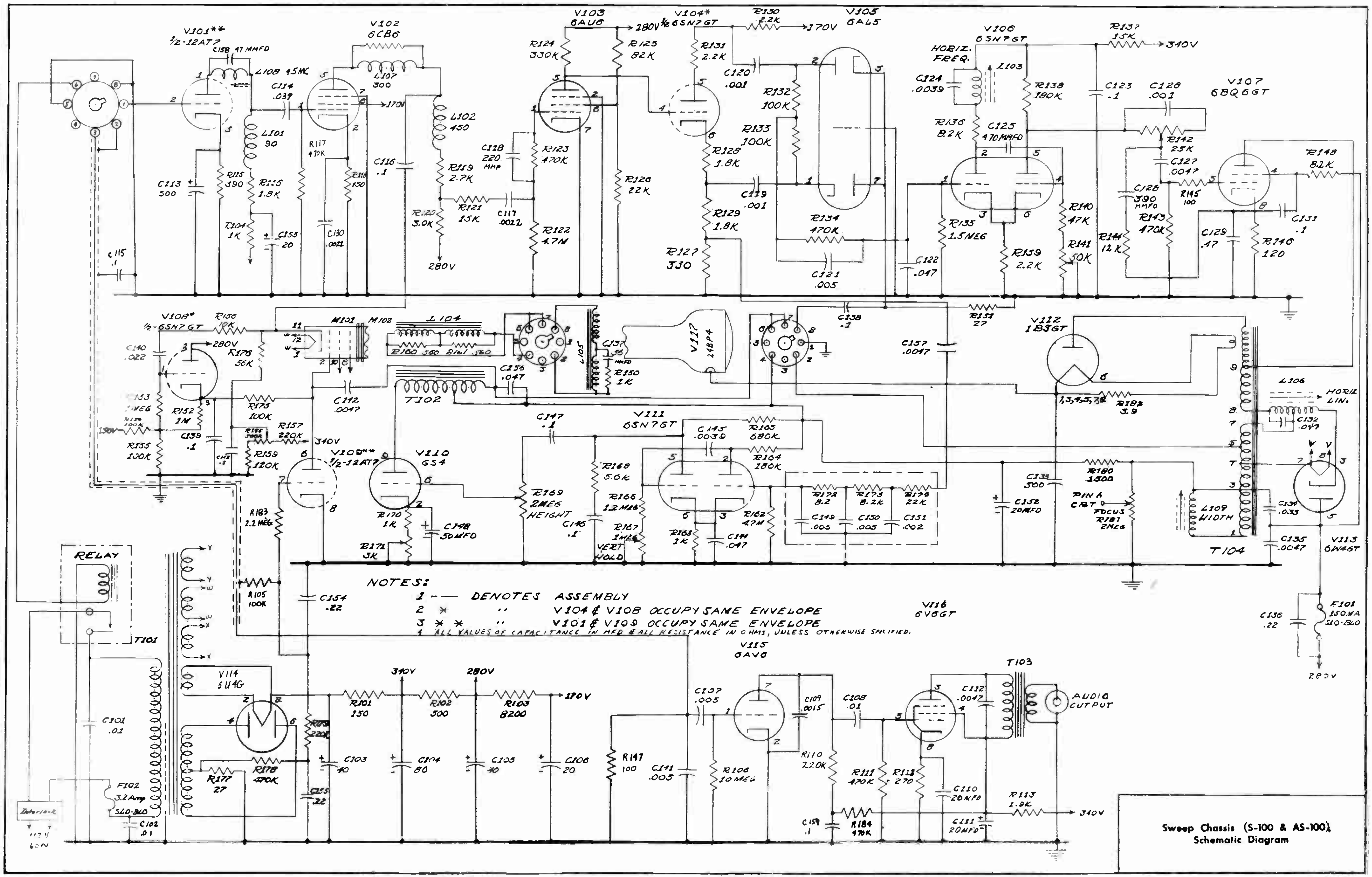
4.5-MC TRAP ALIGNMENT

Detune the picture, by means of the fine-tuning control on the tuner chassis, until slight sound bars are present in the picture. Under this condition the horizontal sweep lines will have an appearence of tweed cloth. This tweed effect is the 4.5-mc beat between the video and sound carriers.

With the 4.5-mc trap, L108, slug all the way out, tune the slug in until the 4.5-mc beat just disappears or is noticeably reduced.



Tuner Chassis (T-100), Schematic Diagram


V101**
1/2-12AT7
V102
6CB6
V103
6AU6
V104*
1/2 6SN7GT
V105
6AL5
V106
6SN7GT
V107
6BQ6GT
V108*
1/2-6SN7GT
V109**
1/2-12AT7
V110
6S4
V111
6SN7GT
V112
1B3GT
V113
6W4GT
V114
5U4G
V115
6AV6
V116
6V6GT
V117
21BP4
RELAY
T101
T102
T103
T104
L104
L105
L106
HORIZ. LIN.
L109
WIDTH
HORIZ. FREQ.
R169
2MEG
HEIGHT
VERT HOLD
PIN 6 CRT
FOCUS
R181
2MEG
AUDIO OUTPUT
F101
150MA
8AG
F102
3.2 Amp
8AG
Interlock
117 V
60~
NOTES:
1 — — DENOTES ASSEMBLY
2 * " V104 & V108 OCCUPY SAME ENVELOPE
3 ** " V101 & V109 OCCUPY SAME ENVELOPE
4 ALL VALUES OF CAPACITANCE IN MFD & ALL RESISTANCE IN OHMS, UNLESS OTHERWISE SPECIFIED.
Sweep Chassis (S-100 & AS-100)
Schematic Diagram

PARTS LIST

SWEEP CHASSIS S-100 & AS-100

NOTE: Unless otherwise specified: all resistors are rated at 1/2 W, and are composition type; all values of resistance are in ohms; all values of capacitance are in micromicrofarads. K equals 1,000. Meg equals 1,000,000.

Ref. Symbol	Part No.	Value	Tol (±%)	Rating & Type
R101	4702	150	10	10 W, Wire Wound
R102	4703	500	10	10 W, Wire Wound
R103	RC40AE822K	8200	10	2 W
R104	RC20AE102M	1 K	20	
R105	RC20AE104K	100 K	10	
R106	RC20AE106M	10 Meg	20	
R107, R108, R109	Not Used			
R110	RC20AE224K	220 K	10	
R111	RC20AE474K	470 K	10	
R112	RC30AE271K	270	10	1 W
R113	4704	1900	10	5 W, Wire Wound
R114	Not Used			
R115	RC20AE391K	390	10	
R116	RC30AE182K	1.8 K	10	1 W
R117	RC20AE474K	470 K	10	
R118	RC20AE151K	150	10	
R119	RC20AE272J	2.7 K	5	
R120	RC20AE302J	3 K	5	
R121	RC20AE153K	15 K	10	
R122	RC20AE475M	4.7 Meg	20	
R123	RC20AE474K	470 K	10	
R124	RC20AE334K	330 K	10	
R125	RC20AE823K	82 K	10	
R126	RC20AE223K	22 K	10	
R127	RC20AE331K	330	10	
R128	RC20AE182J	1.8 K	5	
R129	RC20AE182K	1.8 K	10	
R130	RC20AE222K	2.2 K	10	
R131	RC20AE222J	2.2 K	5	
R132	RC20AE104K	100 K	10	
R133	RC20AE104K	100 K	10	
R134	RC20AE474M	470 K	20	
R135	RC20AE155M	1.5 Meg	20	
R136	RC20AE822K	8.2 K	10	
R137	RC30AE153K	15 K	10	1 W
R138	RC20AE184K	180 K	10	
R139	RC20AE222J	2.2 K	5	
R140	RC20AE473K	47 K	10	
R141, R142	See Controls			
R143	RC20AE474K	470 K	10	
R144	RC20AE123K	12 K	10	
R145	RC20AE101K	100	10	
R146	RC40AE121K	120	10	2 W
R147	RC20AE101K	100	10	
R148	RC40AE822K	8200	10	2 W
R149	Not Used			

Ref. Symbol	Part No.	Value	Tol (±%)	Rating & Type
R150	RC20AE102M	1 K	20	
R151	RC40AE270K	27	10	2 W
R152	RC20AE105K	1 Meg	10	
R153	RC20AE105K	1 Meg	10	
R154	RC20AE104K	100 K	10	
R155	RC20AE104K	100 K	10	
R156	RC20AE103K	10 K	10	
R157	RC20AE224K	220 K	10	
R158	See Controls			
R159	RC20AE124K	120 K	10	
R160	RC20AE561K	560	10	
R161	RC20AE561K	560	10	
R162	RC20AE475M	4.7 Meg	20	
R163	RC20AE102K	1 K	10	
R164	RC30AE184K	180 K	10	1 W
R165	RC30AE684K	680 K	10	1 W
R166	RC20AE125K	1.2 Meg	10	
R167	See Controls			
R168	RC20AE562K	5.6 K	10	
R169	See Controls			
R170	RC30AE102K	1 K	10	1 W
R171	See Controls			
R172, R173, R174	Part of Part No. 9513			
R175	RC20AE104K	100 K	10	
R176	RC20AE563K	56 K	10	
R177	RC40AE270K	27	10	2 W
R178	RC20AE474M	470 K	20	
R179	RC20AE224M	220 K	20	
R180	RC30AE152K	1.5 K	10	1 W
R181	See Controls			
R182	4501	3.9	10	
R183	RC20AE225K	2.2 Meg	10	
R184	RC20AE474M	470 K	20	
C101	4101-6103M	.01 Mfd	20	600 V, Molded
C102	4101-6103M	.01 Mfd	20	600 V, Molded
C103, C104, C105, C106	See Electrolytics			
C107	4001	.005 Mfd		HI-K Ceramic
C108	4101-6103M	.01 Mfd	20	600 V, Molded
C109	4005	1500		HI-K Ceramic
C110, C111	See Electrolytics			
C112	4101-6472M	.0047 Mfd	20	600 V, Molded
C113	See Electrolytics			
C114	4101-6393K	.039 Mfd	10	600 V, Molded
C115	4101-2104M	.1 Mfd	20	200 V, Molded
C116	4101-4104M	.1 Mfd	20	400 V, Molded
C117	4101-4222K	.0022 Mfd	10	400 V, Molded

Ref. Symbol	Part No.	Value	Tol (±%)	Rating & Type
C118	CC25SL221M	220	20	G P Ceramic
C119	4101-6102K	.001 Mfd	10	600 V, Molded
C120	4101-6102K	.001 Mfd	10	600 V, Molded
C121	4001	.005 Mfd		HI-K Ceramic
C122	4101-2473K	.047 Mfd	10	200 V, Molded
C123	4101-6104M	.1 Mfd	20	600 V, Molded
C124	4004	3900	10	500 V, Silver Mica
C125	4008	470	10	500 V, Silver Mica
C126	4101-6102K	.001 Mfd	10	600 V, Molded
C127	4101-6472K	.0047 Mfd	10	600 V, Molded
C128	4007	390	10	500 V, Silver Mica
C129	4101-2474K	.47 Mfd	10	200 V, Molded
C130	4101-4222K	.0022 Mfd	10	400 V, Molded
C131	4101-6104M	.1 Mfd	20	600 V, Molded
C132	4101-6473M	.047 Mfd	20	600 V, Molded
C133	4002	500		20 K V, Ceramic
C134	4101-6333K	.033 Mfd	10	600 V, Molded
C135	4101-6472M	.0047 Mfd	20	600 V, Molded
C136	4101-4224M	.22 Mfd	20	400 V, Molded
C137	4006	56	20	1500 V, Ceramic

Ref. Symbol	Part No.	Value	Tol (±%)	Rating & Type
C138	4101-6104M	.1 Mfd	20	600 V, Molded
C139	4101-2104M	.1 Mfd	20	200 V, Molded
C140	4101-4223M	.022 Mfd	20	400 V, Molded
C141	4001	.005 Mfd		HI-K Ceramic
C142	4101-6472M	.0047 Mfd	20	600 V, Molded
C143	4101-2104M	.1 Mfd	20	200 V, Molded
C144	4101-2473K	.047 Mfd	10	200 V, Molded
C145	4004	.0039 Mfd	10	600 V, Silver Mica
C146	4101-6104K	.1 Mfd	10	600 V, Molded
C147	4101-6104M	.1 Mfd	20	600 V, Molded
C148	See Electrolytics			
C149, C150, C151	Part of Item 9513			
C152, C153	See Electrolytics			
C154	4101-2224M	.22 Mfd	20	200 V, Molded
C155	4101-2224M	.22 Mfd	20	200 V, Molded
C156	4101-6473M	.047 Mfd	20	600 V, Molded
C157	4101-6472M	.0047 Mfd	20	600 V, Molded
C158	Not Used			
C159	4101-6104M	.1 Mfd	20	600 V, Molded

ELECTROLYTICS

Ref. Symbol	Part No.	Value	Rating
C103, C104, C106	4201	40 Mfd, 80 Mfd, 20 Mfd	450 V, 450 V, 450 V
C105, C111, C110	4202	40 Mfd, 20 Mfd, 25 Mfd	450 V, 450 V, 25 V
C113	4208	500 Mfd	6 V
C148, C152, C153	4209	50, 20, 20	50 V, 450 V, 450 V

COILS

Ref. Symbol	Part No.	Description
L101	5205	Coil - Peaking - 90 Microhenry
L102	5212	Coil - Peaking - 450 Microhenry
L103	5208	Coil - Horiz Frequency
L104, L105	5211	Deflection Yoke
L106	5210	Coil - Linearity
L107	5206	Coil - Peaking - 300 Microhenry
L108	5215	Coil - 4.5 MC Trap
L109	5209	Coil - Width

CONTROLS

Ref. Symbol	Part No.	Value	Description
R141	4803-6	50 K	Horiz Hold
R142	4803-1	25 K	Horiz Drive
R158	4803-5	500 K	Brightness
R169	4803-4	2 Meg	Height
R171	4803-2	3 K	Vert Linearity
R181	4803-4	2 Meg	Focus
R167	4803-7	1 Meg	Vert Hold

MISCELLANEOUS

Ref. Symbol	Part No.	Description
F101	9508	Fuse - 3 AG, 150 MA, Slo-Blo
F102	9509	Fuse - 3 AG, 3 AMP, Slo-Blo
	9512	Relay
R172, R173, R174, C149, C150, C151	9513	Integrator
	6101	Socket - Yoke & Control Cable
M101	9511	Ion Trap - 36 Gauss
M102	9510	Centering Magnet
	9001	Speaker
	6107	Kinescope Socket and Leads
	3106	High Voltage Anode Lead (S-100 Chassis Only)
	6202	Plug - Anode Connector with Lead (AS-100 Chassis Only)

TRANSFORMERS

Ref. Symbol	Part No.	Description
T101	5002	Transformer - Power
T102	5101	Transformer - Vert Output
T103	5102	Transformer - Audio Output
T104	5103	Transformer - Horiz Output

TUBES		
Ref. Symbol	Part No.	Description
V101**	12AT7	Video Amp
V102	6CB6	Video Output
V103	6AU6	1st Sync. Separator
V104*	1/2 6SN7GT	2nd Sync. Separator
V105	6AL5	Horiz Phase Detector
V106	6SN7 GT	Horiz M. V.
V107	6BQ6GT	Horiz Output
V108*	1/2 6SN7GT	D.C. Restorer
V109**	1/2 12AT7	Remote Brightness Control
V110	6S4	Vert Output
V111	6SN7GT	Vert M.V.
V112	1B3GT	High Voltage Rectifier

TUBES (Cont)		
Ref. Symbol	Part No.	Description
V113	6W4GT	Damper
V114	5U4G	Low Voltage Rectifier
V115	6AV6	Audio Amplifier
V116	6V6GT	Audio Output
V117	24BP4	Picture Tube (S-100 Chassis Only)
	21FP4A	Picture Tube (AS-100 Chassis Only)

* V104 & V108 occupy same envelope
**V101 & V109 occupy same envelope

PARTS LIST
TUNER CHASSIS T-100

NOTE: Unless otherwise specified: all resistors are rated at 1/2 W, and are composition type; all values of resistance are in ohms; all values of capacitance are in micromicrofarads. K equals 1,000. Meg equals 1,000,000.

Ref. Symbol	Part No.	Value	Tol (±%)	Rating & Type
RESISTORS				
R1	RC30AE332K	3300	10	1 W
R2	RC20AE105M	1 Meg	20	
R3	RC20AE471K	470	10	
R4	RC20AE124K	120 K	10	
R5	RC20AE106M	10 Meg	20	
R6	See Controls			
R7	RC20AE103K	10 K	10	
R8	RC20AE103K	10 K	10	
R9	RC20AE271K	270	10	
R10	RC20AE333M	33 K	20	
R11	RC20AE102M	1000	20	
R12	RC20AE151K	150	10	
R13	RC20AE474M	470 K	20	
R14	RC20AE102M	1000	20	
R15	RC20AE151K	150	10	
R16	RC20AE105M	1 Meg	20	
R17	RC20AE101K	100	10	
R18	RC20AE471K	470	10	
R19	RC20AE472K	4.7 K	10	
R20	See Controls			
R21	RC20AE471K	470	10	
R22	RC20AE103K	10 K	10	
R23	RC20AE474M	470 K	20	
R24	RC20AE105M	1 Meg	20	
R25	Part of Item 5213			
R26	RC20AE182J	1.8 K	5	
R27	RC20AE470K	47	10	
R28	RC20AE151K	150	10	
R29	RC20AE562J	5.6 K	5	
R30	RC20AE151K	150	10	

Ref. Symbol	Part No.	Value	Tol (±%)	Rating & Type
RESISTORS (Cont)				
R31	RC20AE472J	4.7 K	5	
R32	RC20AE102M	1000	20	
R33	RC20AE470K	47	10	
R34	RC20AE102M	1000	20	
R35	RC20AE103J	10 K	5	
R36	RC20AE151K	150	10	
R37	RC20AE470K	47	10	
R38	RC20AE392J	3.9 K	5	
R39	RC40AE471K	470	10	2 W
R40	RC20AE105M	1 Meg	20	
R41	RC20AE684K	680 K	10	
R42	RC20AE124K	120 K	10	
R43	RC20AE473K	47 K	10	
R44	RC20AE471K	470	10	
CAPACITORS				
C1	4101-6103M	.01 Mfd	20	600 V. Molded
C2, C3, C4	See Electrolytics			
C5	4101-4103M	.01 Mfd	20	400 V, Molded
C6	4101-2104M	.1 Mfd	20	200 V, Molded
C7	See Electrolytics			
C8	4001	.005 Mfd		HI-K Ceramic
C9	CC20SL470M	47	20	Ceramic
C10	4101-2104M	.1 Mfd	20	200 V, Molded
C11	4005	1500	20	HI-K Ceramic
C12, C13	Part of T2			

Ref. Symbol	Part No.	Value	Tol (±%)	Rating & Type
C14	4001	.005 Mfd		HI-K Ceramic
C15	CC25SL271M	270	20	G.P. Ceramic
C16	Not Used			
C17	4001	.005 Mfd		HI-K Ceramic
C18	4101-4104M	.1 Mfd	20	400 V, Molded
C19	CC25SL471K	470	10	G.P. Ceramic
C20	CC20SL5R0M	5	20	G.P. Ceramic
C21	CC25SL101M	100	20	G.P. Ceramic
C22	CC25SL271M	270	20	G.P. Ceramic
C23	4001	.005 Mfd		HI-K Ceramic
C24, C25	Part of Item 5213			
C26	4101-2104M	.1 Mfd	20	200 V, Molded
C27	4001	.005 Mfd		HI-K Ceramic
C28	CC25SL271M	270	20	G.P. Ceramic
C29	4001	.005 Mfd		HI-K Ceramic
C30	CC25SL271M	270	20	G.P. Ceramic
C31	4001	.005 Mfd		HI-K Ceramic
C32	Part of L11			
C33	CC25SL271M	270	20	G.P. Ceramic

Ref. Symbol	Part No.	Value	Tol (±%)	Rating & Type
C34	4001	.005 Mfd		HI-K Ceramic
C35	Part of L13			
C36	4001	.005 Mfd		HI-K Ceramic
C37	CC20SL5R0M	5	20	G.P. Ceramic
C38	Not Used			
C39	CC20SL470M	47	20	G.P. Ceramic
C40	Not Used			
C41	4001	.005 Mfd		HI-K Ceramic
C42	4001	.005 Mfd		HI-K Ceramic
C43	4001	.005 Mfd		HI-K Ceramic
C44	4001	.005 Mfd		HI-K Ceramic
C45	4001	.005 Mfd		HI-K Ceramic
C46	4001	.005 Mfd		HI-K Ceramic
C47	4001	.005 Mfd		HI-K Ceramic
C48	Not Used			
C49	4101-6103M	.01 Mfd	20	600 V, Molded
C50	4101-4223M	.022 Mfd	20	400 V, Molded
C51	4101-2104M	.1 Mfd	20	200 V, Molded
C52	4101-2224M	.22 Mfd	20	200 V, Molded

ELECTROLYTICS			
Ref. Symbol	Part No.	Value	Rating
C2, C3, C4	4205	40 Mfd 40 Mfd 20 Mfd	400 V 400 V 400 V
C7	4206	5 Mfd	50 V

COILS		
Ref. Symbol	Part No.	Description
L1	5104	Choke - Filter
L2	5201	Coil - I-F Interstage
L3	5216	Coil - Peaking, 250 uH
L4	5207	Coil - Peaking, 2.6 uH
L5	5205	Coil - Peaking, 90 uH
L6	5201	Coil - I-F Interstage
L7	5213	Cathode Trap 21.6 MC (R25, C24, C25)
L8	5201	Coil - I-F Interstage
L9	5214	Coil - Trap, 20.1 MC
L10	5203	Sound Take Off Trap
L11	5203	2nd I-F Coil
L12	5202	1st I-F Coil
L13	5202	27.6 MC Trap
L14	5201	Coil I-F Interstage
TRANSFORMERS		
T1	5001	Power Transformer
T2	5204	Ratio Det. Transformer

CONTROLS & SWITCHES		
Ref. Symbol	Part No.	Description
R6, R20, SW3	4804-2	Control - Volume, 500 K Control - Contrast, 10 K Switch - On-Off
SW1, SW2	6001	Switch - Function TV, FM, Phonograph

MISCELLANEOUS		
F1	9502	Fuse 2 AMP - 3 AG
F2	9501	Fuse 4 AMP - 3 AG - Slo-Blo
	9514	Lamp - Mazda #47 6-8 V Bayonet Base, White Bead
	9505	Tuner - Low Radiation
	6201	Plug - 8 Contact - with Cover

TUBES		
V1	6BA6	1st Sound I-F Ampl.
V2	6AU6	2nd Sound I-F Ampl.
V3	6AL5	Sound Detector
V4	12AU7	Audio Amplifier
V5	5Y3GT	Low-Voltage Rectifier
V6	6BA6	1st Video I-F Ampl.
V7	6CB6	2nd Video I-F Ampl.
V8	6CB6	3rd Video I-F Ampl.
V9	6CB6	4th Video I-F Ampl.
V10	6AL5	Video and AGC Detector
V11	12AU7	Video Ampl.

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TUBES (17, plus 2 rectifiers)

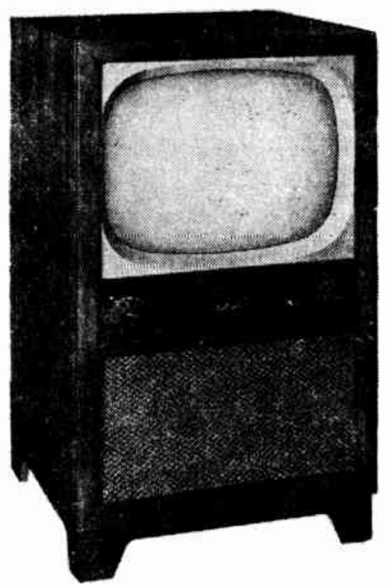
Function	Type	Function	Type
R.F. Amplifier	6BC5 or 6AG5 (V17)	Sync Separator & Sync Amplifier	12AU7 (V11)
Oscillator/Mixer	6J6 (V18)	Phase Detector	6AL5 (V10)
First I.F. Amplifier	6CB6 (V1)	Horizontal Oscillator	6SN7 (V13)
Second I.F. Amplifier	6CB6 (V2)	Horizontal Output	6BG6 (V14)
Third I.F. Amplifier	6CB6 (V3)	Diode Damper	6W4 (V16)
Video Amplifier	6AC7 (V4)	Vertical Blocking Oscillator	6SN7 (V9)
Sound I.F.	6AU6 (V8)	Vertical Output	6S4 (V19)
F.M. Detector & 1st Audio	6T8 (V7)	Picture Tube	20CP4 (V5)
Audio Output	6AQ5 (V6)		
Low Voltage Rectifier	5U4G (V12)	High Voltage Rectifier	1B3 (V15)

TELEVISION CHANNEL vs CARRIER AND I.F. AMPLIFIER FREQUENCIES

Channel No.	Channel Freq. (mc)	Picture Carrier Freq. (mc)	Sound Carrier Freq. (mc)	Receiver Osc. Freq. (mc)	Picture IF Freq. (mc)	Sound IF Freq. (mc)	Picture IF less Sound IF (mc)
2	54-60	55.25	59.75	81	25.75	21.25	4.5
3	60-66	61.25	65.75	87	25.75	21.25	4.5
4	66-72	67.25	71.75	93	25.75	21.25	4.5
5	76-82	77.25	81.75	103	25.75	21.25	4.5
6	82-88	83.25	87.75	109	25.75	21.25	4.5
7	174-180	175.25	179.75	201	25.75	21.25	4.5
8	180-186	181.25	185.75	207	25.75	21.25	4.5
9	186-192	187.25	191.75	213	25.75	21.25	4.5
10	192-198	193.25	197.75	219	25.75	21.25	4.5
11	198-204	199.25	203.75	225	25.75	21.25	4.5
12	204-210	205.25	209.75	231	25.75	21.25	4.5
13	210-216	211.25	215.75	237	25.75	21.25	4.5

GENERAL DESCRIPTION

1184-20 television receiver is a direct view console model using a 20″ rectangular picture tube. Full twelve channel station coverage is provided by a turret type channel selector which has separate coils for each channel. A stagger tuned intermediate frequency amplifier system carries both picture and sound intermediate frequencies, using the inter-carrier sound system. Picture adjustments which are not normally made by the operator are located at the rear of the receiver chassis.

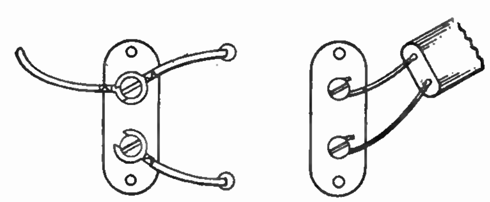


SPECIFICATIONS

Power Supply
These models operate from a 105-125 volts 50 to 60 cycle AC source. Power consumption is 210 watts.

Frequency Range
Channels 2 through 13. For specific channel frequencies, see table on page .

Antenna Equipment
This receiver has a built-in antenna system and may also be connected to an external antenna system using 300-ohm ribbon type lead-in. The receiver is shipped with the built-in antenna leads connected to the antenna terminal strip at the rear of the cabinet. If an external antenna system is to be used, the built-in antenna leads must be disconnected. When connecting the 300-ohm lead-in, either wire may be connected to either terminal, since the antenna input system is balanced.



BUILT-IN ANTENNA CONNECTIONS

ANTENNA CONNECTIONS USING 300-OHM RIBBON TYPE LEAD-IN

Fig. 1. Antenna Connections

COLOR TELEVISION

The internal wiring of the chassis covered by this RL has been modified to provide for reception of color television signals. The circuit points affected (see schematic diagram) are connected to the color adapter socket on the rear panel (see Fig. 4,).

For normal operation a plug with an insulated jumper wire connecting pins 2 and 3 is inserted into the color adapter socket.

When the color adapter made to receive color television programs, transmitted in accordance with the standards established by the FCC on October 10, 1950, is available, it can be connected to this television receiver in two simple steps: 1. Remove the plug from the color adapter socket; 2. Plug-in the color adapter at the color adapter socket.

CIRCUIT DESCRIPTION

This television receiver operates with sixteen tubes, plus one high voltage rectifier, one low voltage rectifier and a rectangular picture tube. (See list above.) There are two dual operating controls on the front panel. On the left-hand side: OFF-ON-VOLUME (outer knob) and PICTURE (inner knob); on the right-hand side: CHANNEL SELECTOR (outer knob) and FINE TUNING (inner knob).

For convenience in tracing the circuit a block diagram of the complete receiver is shown in Fig. 2.

The antenna input system is designed to operate from either the built-in antenna or from an external antenna installation.

The built-in antenna system permits satisfactory local reception in most areas. It consists of three leads. Connect them two at a time first, in various combinations; then try all three at the same time. Observe the picture quality obtained and leave the leads connected in whichever position gives the best results. The best position will vary according to local reception conditions.

This receiver is designed to operate with an external antenna installation using a 300-ohm transmission line. This transmission line connects to the same antenna terminals (at the back of the cabinet) as the built-in antenna system. When an external antenna system is used, the leads of the built-in antenna system MUST BE DISCONNECTED from the antenna terminal strip.

The received signal is fed to the input of the RF tuner. The tuner is the turret type which switches in a separate set of coils for each channel. A description of the R.F. tuner and its operation will be found in a separate section of this manual

The unity coupled, stagger tuned I.F. amplifier stages amplify both video and sound carriers. At the video detector stage the video intermediate frequencies and the 4.5 mc. beat frequency, which is the difference between the picture carrier intermediate frequency (25.75 mc.) and the sound carrier intermediate frequency (21.25 mc.), are detected and passed on to the video amplifier stage. Note that the 4.5 mc. beat still contains the FM modulation at this point.

At the video amplifier plate, the 4.5 mc. signal containing the FM carrier is taken off and fed to one stage of IF amplification before being detected at the FM detector stage. The audio frequency signal is then fed through one stage of voltage amplification to the power output stage and speaker.

The video amplifier plate also carries the video signal which is fed to the cathode of the picture tube.

Automatic gain control voltage is obtained from the rectified diode current flowing in the AGC detector stage (pins 6 and 7, V7). This negative voltage which is a function of signal level is applied to the grid of the RF amplifier in the tuner and to the first and second IF amplifier stages to control the over-all gain over large variations in received signal levels.

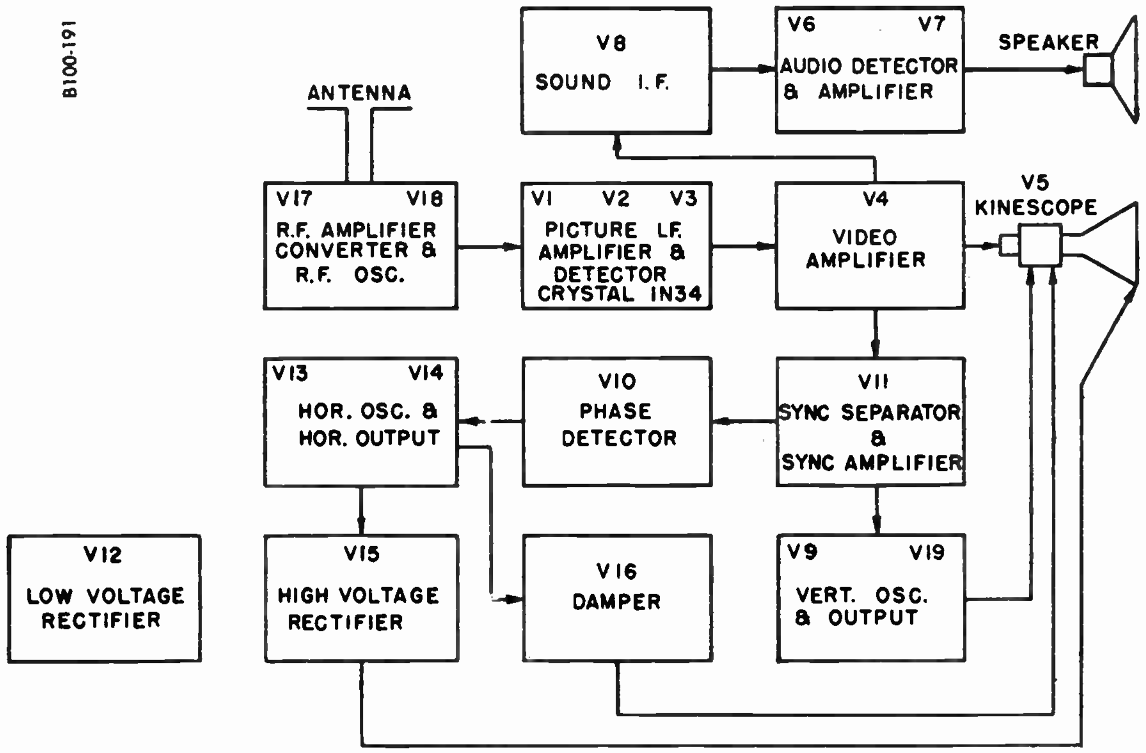


Fig. 2. Circuit Block Diagram

The synchronizing pulses transmitted by the TV station are carried along through the IF amplifier, video detector and video amplifier stage and they are separated from the video signal by the sync separator and DC restorer (right half of 12AU7-V11). The grid and cathode form a diode that clips the sync signal from the composite signal. The voltage developed across the resistor connected between cathode (pin 3, V11) and ground is a function of the average applied signal and thus provides the required DC restoration. A small positive voltage is applied to the plate of this tube. During conduction, electrons are first drawn to the plate because it is positive with respect to the grid until its voltage drops to approximately that of the grid. At this point the excess electrons go to the grid thus holding the plate to approximately zero potential. This clips the sync on the other side and prevents noise pulses from exceeding the peak amplitude of the sync signal.

The left half of the 12AU7 tube (V11) is used to amplify and reverse the phase of the vertical sync pulses that are taken from the plate in positive phase and fed through an integrating network to the vertical sweep oscillator.

The horizontal pulses are also taken from the plate and cathode in both positive and negative form of equal amplitude and fed to the horizontal phase detector.

A 6AL5 tube is used as a phase detector to compare the phase of the horizontal sync pulses with the phase of the saw tooth voltage derived from the pulses across the secondary of the horizontal output transformer. The D.C. voltage developed by the difference in phase of the above two pulses is used to control the frequency of the horizontal oscillator.

A 6SN7 tube is used as a Horizontal oscillator. The output of the oscillator which is a sawtooth with a peaking component is fed to the grid of a 6BG6 Horizontal output tube.

The horizontal output stage is coupled to the horizontal deflection coils of the picture tube by the horizontal output transformer. The output transformer serves the dual purpose of matching the output of V14 (6BG6) to the horizontal deflection coils of the picture tube and supplying high voltage for the second anode potential required by the picture tube.

When each horizontal sweep line is completed, the sweep voltage in the primary of T9 drops. The collapsing magnetic field thus produced generates a voltage of T9 which is stepped up by autotransformer action by the upper part of the primary winding (the section between the blue and red leads). This high voltage is rectified by V15 (1B3) and applied to the high voltage anode of the picture tube. V15 also receives its filament voltage from a secondary winding on T9.

The vertical sync pulses taken from the plate of V11 are fed to the Vertical oscillator (right half of V9) through the blocking transformer T6. The blocking oscillator is tripped by the incoming sync signal. The oscillator is brought into sync by adjusting the grid resistor R42 (V. Hold). The left half of this tube is the vertical amplifier. The height control in the plate circuit of this tube varies the amplitude of the signal by changing the load resistance. The signal is then fed to the Vertical output tube. Vertical linearity is controlled in this stage by adjusting the bias on the vertical sweep output tube. The plate of the vertical output tube is connected to a transformer which in turn is connected to the vertical coils in the yoke and provides them with a saw tooth current.

Focusing is accomplished magnetically by an electro-magnet. The load current of the receiver flows through the focusing control and focus coil winding so that the amount of focus coil current is controlled by the setting of the focus control.

FUSE PROTECTION

There are two fuses in this receiver. The 5 ampere fuse on the primary side of the power transformer protects the power transformer and associated components against damage from overload. For example, if either C42 or C43 should short circuit, the overload on the 5U4G rectifier tube and the power transformer would destroy both components. However, such a short circuit will blow the fuse before any damage is done. The 1/8 ampere fuse in the B plus lead to T9 protects that transformer and associated tubes from injury in case of overload caused by a short circuit. If either fuse blows, the circuit should be examined to determine the cause and correct it before inserting a new fuse.

CAUTION

HIGH VOLTAGES are used in the operation of this receiver. The back cover, while in place, prevents accidental contact with this voltage and therefore should not be removed by anyone except a qualified television serviceman.

THE HIGH VOLTAGE LEAD, which supplies 12 to 16 kilovolts to the picture tube, should be momentarily shorted to the chassis whenever it is disconnected for service purposes. This discharges the high voltage filter condenser and prevents a shock hazard when working on the receiver after it has been turned off.

THE PICTURE TUBE is highly evacuated and if broken, glass fragments will be violently expelled. Scratching, chipping, undue pressure, or careless handling such as lifting the tube by its neck is dangerous and should be avoided. If it is necessary to handle the picture tube, use safety goggles and heavy gloves. Be sure to discharge the voltage developed across the capacitor formed by the inner and outer coating of the picture tube. This can be done by connecting the high voltage socket on the tube to the outer coating.

PICTURE TUBE INSTALLATION

DISMANTLING

Remove the two front panel control knobs by pulling them straight from their shafts. They are dual control knobs and must be removed in two pieces, removing the outer unit first.

Remove the back cover, speaker plug and antenna leads.

Remove the four chassis bolts holding the receiver chassis in the cabinet and slide the entire assembly from the cabinet.

REMOVING THE PICTURE TUBE

READ ALL WARNING NOTICES.

Disconnect the picture tube socket at the base of the picture tube.

Slip the ion trap from the neck of the picture tube past the picture tube base connector.

Remove the rubber sleeve around the neck of the tube under the focus coil.

Loosen the three thumb screws on the yoke mounting.

Remove the steel band at the front rim of the picture tube and carefully slip the neck of the picture tube out of the focus coil and deflection yoke. If the tube fails to slip out smoothly, investigate and remove the cause of the trouble. **DO NOT USE FORCE.**

INSTALLING THE PICTURE TUBE

Position the tube so that the anode contact is to the left as viewed from the screen.

Slip the neck of the picture tube through the deflection yoke and focus coil. The flare of the tube should seat firmly against the rubber guard on the yoke mounting. The front edge of the tube should be against the turned-up edge of the front support brackets. If the tube fails to slip smoothly into place, investigate and remove the cause of the trouble. **DO NOT FORCE THE TUBE.**

Temporarily tighten the two outside thumb screws on the yoke mounting so that the yoke mounting is held in position with the rubber guards against the flare of the tube.

Replace the rubber sleeve on the neck of the tube under the focus coil.

Slip the ion trap over the neck of the tube. The arrow points toward the screen of the tube.

Reconnect the picture tube socket and anode connector.

Check the grounding springs mounted on the chassis under the tube. Be sure that they are making contact with the outside coating of the tube.

Make the adjustments outlined under "Television Service Adjustments" before reassembling the chassis in the cabinet.

TELEVISION SERVICE ADJUSTMENTS

HIGH VOLTAGE WARNING

Operation of this receiver outside the cabinet or with covers removed involves a shock hazard from the receiver power supplies. Work on the receiver should not be attempted by personnel not thoroughly familiar with the precautions necessary when working on high-voltage equipment. Do not operate the television receiver with its compartment cover removed.

ION TRAP MAGNET ADJUSTMENT

If the ion trap has an arrow stamped on its frame, the arrow should point toward the picture tube screen and approximately in line with the second anode contact. Turn the brightness control clockwise and start with the ion trap placed over the small ion trap flags in the picture tube. The ion trap flags are small, rectangular plates in the neck of the picture tube about one inch from the base of the tube. The new "bent gun" tubes do not have ion trap flags. The single magnet ion trap is intended for use with such tubes.

Starting from this position, adjust the trap by moving it forward or backward until the raster (Illuminated area of picture tube) is observed. Rotate it slightly about the axis of the tube as well as back and forth along the neck of the tube until the raster is the brightest. Back off the brightness control adjustment as required. With the brightness control set for slightly above average brilliance, adjust the focus control until the line structure of the raster is clearly visible. Readjust the ion trap for maximum raster brilliance. The final touches on this adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained.

DEFLECTION YOKE ADJUSTMENT

If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Push the yoke as far forward toward the tube flare as possible. Tighten the yoke adjustment screw.

PICTURE ADJUSTMENTS

A test pattern picture will be required to make the following adjustments. Normal picture contrast and brightness should be maintained during the adjustment for best results.

FOCUS COIL ADJUSTMENT

If a corner of the raster is shadowed, it indicates that the electron beam is striking the neck of the tube. Adjust the three focus coil adjustment screws for a centered evenly illuminated test pattern. Corner-cutting or shadows at the corners may be caused by misadjustment of either the ion trap magnet or the focus coil, and the two may require simultaneous adjustment to secure the brightest, yet evenly distributed light on the screen. Four self-tapping screws on the focus coil U-bracket are provided to permit vertical movement of the focus coil when necessary.

CAUTION: While adjusting the focus coil, make sure that there is no strain exerted by the focus coil on the neck of the picture tube.

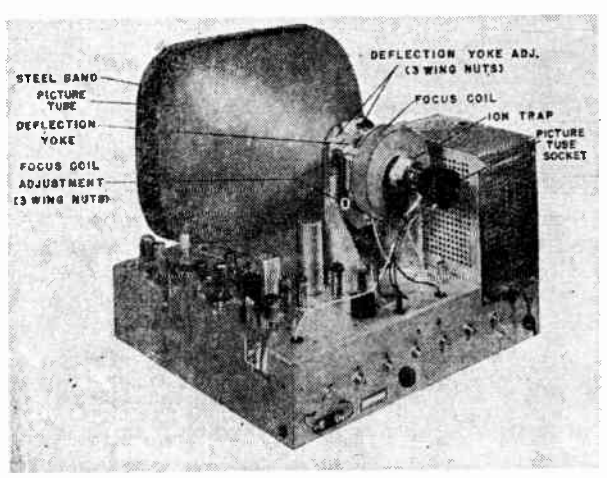


Fig. 3. Picture Tube Mounting Detail

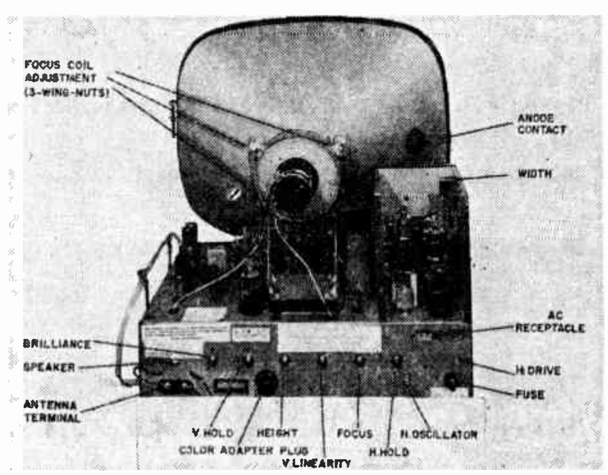


Fig. 4. Rear Chassis View

HORIZONTAL OSCILLATOR ALIGNMENT

If the horizontal hold control fails to restore sync. the horizontal oscillator adjustment should be reset. To re set this screwdriver adjustment (see Fig. 4,) set the horizontal hold control in the center of its range and sync. the picture with the adjustment screw. Check the control action on various stations and alter the screw adjustment as required to provide positive sync. on all channels with these two controls.

HORIZONTAL DRIVE ADJUSTMENT

Adjust the HORIZONTAL DRIVE control counter clockwise (Fig. 4,). as far as possible without causing fold over of the test pattern. (Vertical white line). Insufficient horizontal drive will cause low second anode voltage with consequent loss of picture brilliance. After this adjustment is completed a minor readjustment of the horizontal oscillator may be required.

HORIZONTAL LINEARITY ADJUSTMENT

Set the HORIZONTAL LINEARITY control (see L13, Fig. 13,) for a symmetrical pattern from left to right.

WIDTH ADJUSTMENT

Set the WIDTH control (Fig. 4,) so that the test pattern fits the horizontal dimension of the picture tube escutcheon.

HEIGHT ADJUSTMENT

Set the HEIGHT control (Fig. 4,) so that the test pattern fits the vertical dimension of the picture tube escutcheon. A minor adjustment of the focus coil position may be required to recenter the pattern.

VERTICAL LINEARITY ADJUSTMENT

Set the VERTICAL LINEARITY control (Fig. 4) for a symmetrical test pattern in the vertical dimension. A slight readjustment of the height control may be required when making this adjustment.

FOCUS

Carefully adjust the receiver for best picture definition and set the picture and brightness controls for normal picture brilliance. Adjust the FOCUS control (Fig. 4,) for maximum picture definition watching the wedges of the test pattern. An alternate method for focusing consists of switching to an unused TV channel and with the brightness control turned up so that the raster is illuminated, set the focus control for well defined scanning lines.

TELEVISION ALIGNMENT PROCEDURE

PRELIMINARY

This alignment is an exacting procedure and should be undertaken only when necessary. Before fully deciding that alignment is necessary and before removing the chassis from the customer's home:

1. Be sure of the antenna installation.
2. Check all operating controls and adjustments including the channel selector.
3. Check reception on all channels.
4. Check tubes by substitution of known good tubes.

In the repair shop.

5. Substitute a known good picture tube.
6. If the picture is still inadequate, observe the overall IF response curve of the receiver. (See Fig. 5).

TEST EQUIPMENT REQUIRED

1. Signal generator (with an output variable and at least 0.1 volt max.) to provide the following frequencies:

   (a) 4.5 mc Sound IF
   (b) 21.25 mc Trap (L14)
   (c) 22.8 mc 1st IF (L15)
   (d) 25.6 mc 2nd IF (T1)
   (e) 23.3 mc 3rd IF (T2)
   (f) 24.6 mc 4th IF (T3)

2. R.F. Sweep Generator with a frequency range from 40 to 220 megacycles with a sweep width of 10 megacycles and an adjustable output of at least 0.1 volts.
3. Crystal controlled or crystal calibrated markers for the sound carrier of each channel. Picture carrier markers are desirable but not necessary.
4. Cathode ray oscilloscope, preferably with a wide band vertical amplifier and an input calibrating source.
5. Vacuum tube voltmeter (VTVM).

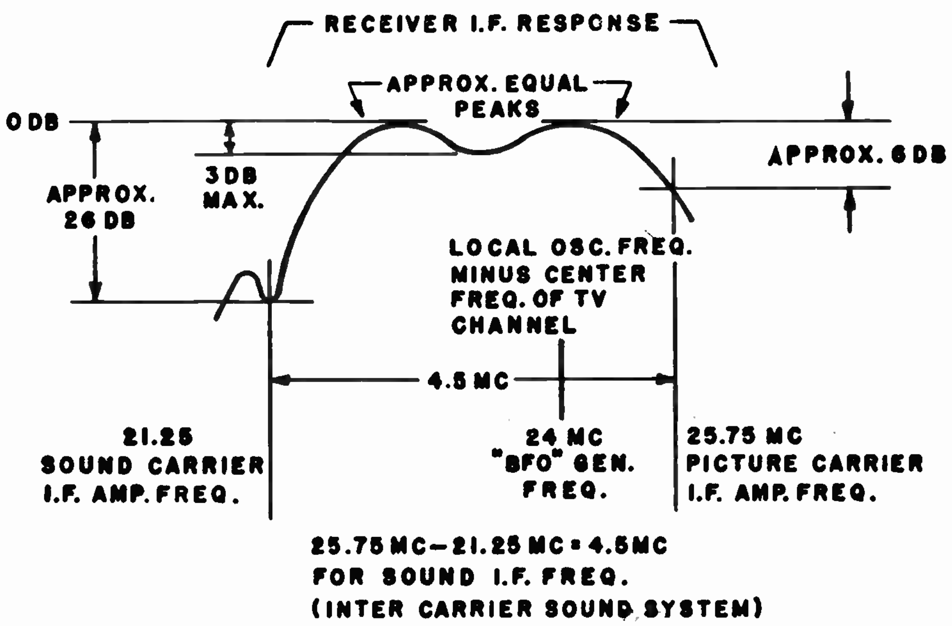


Fig. 5. I.F. Amplifier Response

ALIGNMENT TABLE

DISCRIMINATOR AND SOUND I-F ALIGNMENT

Step No.	Connect Signal Generator to	Signal Gen. Freq. Mc.	Connect Voltmeter to	Miscellaneous Connections and Instructions	Adjust
1	Video Grid (pin 1, V-4)	4.5 .1 volt output	Pin 2 V-7	Meter on 10 Volt scale	T4 (bottom) and L6 for max. on meter. L7 for min.
2	Video Grid (pin 1, V-4)	4.5 .1 volt output	See Note 1	Meter on 3 volt scale	T4 (top) for zero on meter

NOTE 1: Connect two 100 K resistors in series. Connect one end to pin 2 of V-7 (6T8) and the other end to ground. Connect the hot side of the VTVM to center of the two 100 K resistors and ground side to junction of R29 (150 ohms) and R28 (47K ohms).

ALIGNMENT PROCEDURE

I-F ADJUSTMENTS

Step No.	Connect Signal Generator to	Signal Gen. Freq. Mc.	Connect Voltmeter to	Miscellaneous Connections and Instructions	Adjust
3	Raise tube shield on V18 (tuner-oscillator), so that it is not grounded, then clip the "hot" lead of the signal generator to the tube shield.	24.6	Junction R13 and L2	Disconnect the antenna. Set channel selector to channel on which there is no signal and no interference (such as harmonics of I.F.).	T3 (top) maximum
4		23.3			T2 (top) maximum
5		25.6			T1 (top) maximum
6		22.8			L15 maximum
7		21.25			L14 minimum

R. F. TUNER

DESCRIPTION

The R. F. Tuner is a separate sub-chassis of the receiver. On this sub-chassis are located the R.F. amplifier, R.F. converter, R.F. oscillator, fine tuning control, channel drum, sound channel trap, converter transformer, and all R.F., converter, and oscillator adjustments. This tuner operates on all the television channels number two thru number thirteen. Its function is to select the desired picture and sound carriers, amplify and convert to the proper I.F. frequency. See Fig. 14.

TUBE COMPLEMENT

No.	Tube	Function
V17	6AG5 or 6BC5	R.F. Amplifier
V18	6J6	Converter and Oscillator

R.F. AMPLIFIER — CONVERTER

Referring to the Schematic diagram L20 is the center tapped primary coil inductively coupled, (by being wound on the same form) to L19. L19 is the grid coil of V17. It is series tuned to the desired channel by C59 fixed condenser and C65 variable condenser. It is also shunt tuned by the input capacitance of V17. The band-pass response of L19 is increased by shunting it with a 3900 ohm resistor R76.

In the plate circuit of the R.F. amplifier there is a coil L18 that is shunt tuned by the output capacitance of the tube and the variable capacitor C60. This coil is tuned to the same frequency as L19 and its band-pass is broadened by the 10,000 ohm shunt resistor R77.

The coil L18 is inductively coupled (by being wound on the same form) to coil L17 in the grid of the converter tube. Coil L17 is shunt tuned to the same frequency as L18 by the input capacitance of V18 and by the variable capacitor C61.

OSCILLATOR

The oscillator coil L16 is inductively coupled to L17 (by being wound on the same form). This provides the proper injection voltage. The coil is series tuned to its proper frequency by means of the variable capacitor C62 shunted by the fine tuning capacitor C63. The coil is also shunt tuned by the fixed capacitor C64 and its inductance is varied by means of an adjustable brass core.

BAND SWITCHING

This tuner is switched from channel to channel by means of a rotating drum. This provides a different set of coils, L16, L17, L18, L19 and L20 for each channel. The oscillator tuning coil (L16) for each channel is individually tuned by its brass core. This is indicated on the schematic diagram by the arrow through L16. The other coils (L17, L18, L19 and L20) for each channel are fixed inductances. For each channel, these fixed inductances are tuned to the proper frequency by capacitors C59, C60, C61, C65 and the tube and wiring capacitances, as explained above. Since each set of coils must tune to its proper frequency in conjunction with only one set of tuning capacitances, the coil inductances must be very accurately adjusted at the factory. For this reason, it is important that the coils be handled with great care. When working on the tuner, do not do anything which will disturb these coils or change their inductance.

TUNER ALIGNMENT PROCEDURE

Before attempting to align the R.F. tuner it is necessary that the I.F. amplifier be correctly aligned. It is desirable that all adjustments of the trimmers be made at channel No. 12. To align the tuner proceed as follows:—

(1) Connect an R.F. sweep generator to the antenna terminals

(2) If the generator is not provided with internal crystal controlled or crystal calibrated markers connect a marker generator to the antenna terminals.

(3) Connect a Cathode Ray Oscilloscope across the picture detector diode load resistor R13. (8200 ohms)

(4) Adjust the R.F. generator for a 10MC. sweep width with a center frequency at approximately 207MC.

(5) Adjust the marker generator for the sound carrier of channel 12 (209.75 MC.).

(6) Set the range switch to channel 12 with the fine tuning in the middle of its range.

(7) Set the PICTURE control for one volt measured from pin "7" to chassis. (V4-6AC7).

(8) Turn the receiver on and allow it about 15 minutes for the receiver to warm up and stabilize.

(9) Align C65, C60 and C61 for a curve similar to that shown in FIGURE 7.

(10) Adjust C62 until the sound carrier marker is at the base of the curve.

(11) Change the Station selector to the various channels and using the correct setting of the R.F. generator to center it in the channel and the correct marker frequency for the sound carrier, adjust the brass core in L16 so that the sound marker will be in the correct position on the curve. FIGURE 7.

NOTE: Each core is independent of the one in another channel. This enables you to adjust any channel without changing the adjustment of all other channels.

(12) This completes the alignment of the R.F. tuner with the exception of the converter transformer and sound channel trap which you have aligned when you aligned the I.F.

Channel No.	Channel Frequency	Sound Carrier
2	54 - 60	59.75
3	60 - 66	65.75
4	66 - 72	71.75
5	76 - 82	81.75
6	82 - 88	87.75
7	174 - 180	179.75
8	180 - 186	185.75
9	186 - 192	191.75
10	192 - 198	197.75
11	198 - 204	203.75
12	204 - 210	209.75
13	210 - 216	215.75

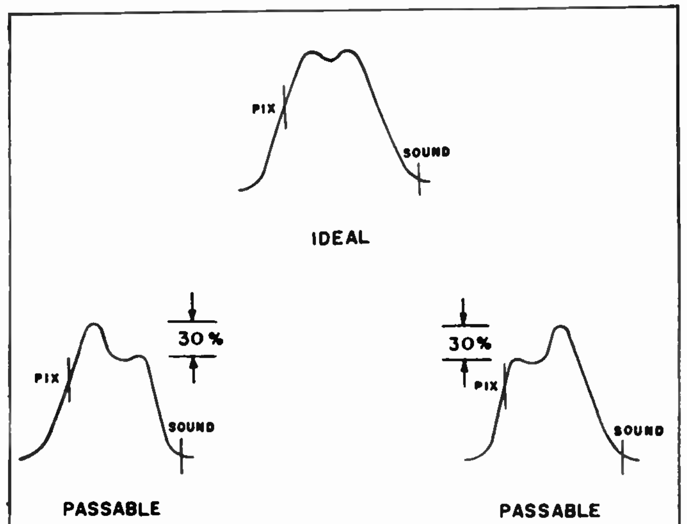


Fig. 7. Overall Response—Antenna to Picture Detector

SERVICE NOTES

READJUSTMENT OF R.F. OSCILLATOR WITHOUT EQUIPMENT

(1) Tune the receiver to the channel you wish to align.

(2) Turn the fine tuning control to the center position.

(3) Adjust the oscillator brass core, located in the hole on the upper right side of the front of the tuner chassis, for the best picture.

(4) Proceed to the next channel you wish to adjust and repeat the operation above, etc. Each adjustment is independent so that you may adjust any one or all channels as desired.

CHANGING TUBES

Due to the high frequencies at which the receiver operates the adjustments are critical and may be affected by a tube change. In replacement, if an old tube can be matched for frequency by trying several new ones, this practice is recommended. At best, however, it will probably be necessary to adjust the oscillator slug for each active channel, when changing the oscillator tube.

REMOVING BOTTOM COVER OF TUNER

The R.F. Tuner used with this receiver has a bottom cover plate. The cover plate is attached to the tuner at the rear by means of two tabs which fit into slots in the back apron of the tuner. At the front it is held in place by two screws which fasten to threaded holes in the front apron of the tuner. To take off the bottom cover, remove the two screws securing it at the front, pull down slightly at the front, then slide the cover backward to disengage the tabs and the cover will come off. It is not necessary to remove the tuner from the chassis to take the bottom cover off. To facilitate removal, two screwdriver access holes have been provided in the front apron of the receiver chassis. Insert a screwdriver through these holes to remove the screws at the front. It is, of course, necessary to remove the "V-shaped" shaft supporting bracket first. It is fastened to the chassis by means of two self-tapping screws.

Unfortunately the utility of the screwdriver access holes was not realized at the beginning of production and some chassis were made without them. It is suggested that servicemen in the field will find it more practical to drill the holes in such chassis than to remove the tuner from the chassis (each time the tuner is serviced) in order to get the bottom cover off. Therefore, the data for the location of the holes is given in Fig. 9.

The third hole shown in Fig. 9 (at the top) permits removal of the screw which holds the Fine Tuning ground plate in place.

The tuners used in later production do not use screws at the front to fasten the bottom cover. Instead, two dimples (or detent bumps) are stamped into the bottom cover at the same position that the screw holes occupy in the earlier model tuners. These dimples engage matching holes in the front apron of the tuner chassis. To remove this type of bottom cover, press down on the front edge with a screwdriver until the dimples are disengaged. Otherwise, removal is the same as before.

REMOVING CHANNEL COIL UNITS

To remove a channel coil unit insert a screwdriver blade between the coil retainer spring (on the outside end of each unit) and the turret plate. Twist the blade away from the turret and lift the end of the coil upward and remove. Do not lift the spring any more than is necessary.

OSCILLATOR SLUG IN TOO FAR

If the oscillator slug is tuned in too far it will become disengaged with its retaining spring and fall into the coil. To correct this condition proceed as follows:—

(1) Remove the channel coil unit as described above.

(2) Move the slug retaining spring to one side.

(3) Tap the coil assembly until the slug slips forward.

(4) Set the slug retaining spring into position. It should rest firmly against the slug.

(5) Replace the channel coil unit.

REMOVING THE TURRET ASSEMBLY

To remove the turret assembly proceed as follows:—

(1) Remove the screw holding the fine tuning control grounded stator plate.

(2) Slide the fine tuning rotor, spring, and bushing from the turret shaft.

(3) Remove the shaft retainer spring from the front and rear of the tuner.

(4) Grasp the turret shaft and slip the turret from the tuner chassis being careful not to loosen the detent roller.

(5) Reassemble by reversing the above operations.

RESETTING THE DETENT SPRING

(1) Loosen the detent mounting screw.

(2) Grasp the turret and the roller end of the detent spring while observing the contacts on the contact plate. Rotate the drum slightly in both directions until a point is reached where the contacts appear to have the greatest rise.

(3) Check to see that the detent roller is setting in the center of the depression in the turret detent plate.

(4) Tighten the detent spring mounting screw.

(5) Rotate the turret and check the contacts on all channels.

TUBE VOLTAGES

All voltages are measured with a D.C. Vacuum Tube Voltmeter and with the PICTURE Control and BRIGHTNESS Control in the minimum position, unless otherwise specified. No incoming signals are being received at the time the measurements are being made. The following voltages were taken on a production receiver with 117 volts 60 cycle AC input. A variation of 10% in the voltages should be considered normal.

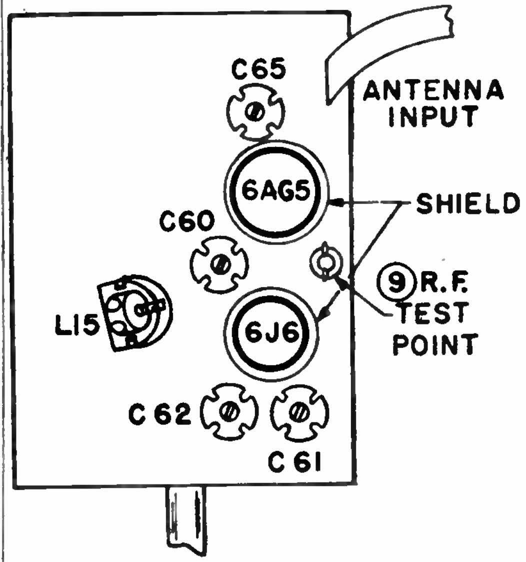
Tube No.	Tube Type	Function	Element	Pin No.	Voltage	Notes
V17	6AG5	R.F.	Plate	5	140	
	or	Amplifier	Screen	6	140	
	6BC5		Grid	1	-.8	
			Cathode	2	0	
V18	½ 6J6	Converter	Plate	2	100	The cathode is common to
			Grid	5	-1.5	both the converter and
			Cathode	7	0	oscillator
	½ 6J6	Oscillator	Plate	1	100	
			Grid	6	-2	

RESISTANCE CHART

SCHEMATIC LOCATION	TUBE FUNCTION	TUBE	PIN NUMBERS 1	2	3	4	5	6	7	8	9
V1	1st I F.	6CB6	1.5 M	68	0	0	50K	50K	0		
V2	2nd I. F.	6CB6	1.5 M	68	0	0	50K	50K	0		
V3	3rd I. F.	6CB6	.2	82	0	0	50K	50K	0		
V4	Video Amp.	6AC7	0	0	0	500K	150	50K	0	520K	
V6	Audio Output	6AQ5	280K	50K	50K	50K	510K	510K	280K		
V7	Ratio Detector & 1st Audio	6T8	Inf.	12K	Inf.	0	0	600K	0	5 M	320K
V8	Sound I. F.	6AU6	150K	50K	50K	50K	530K	530K	50K		
V9	Vertical Oscillator	6SN7	2 M	530K	0	2 M	*	0	0	0	
V10	Phase Detector	6AL5	5 M	5 M	0	0	15K	0	15K		
V11	Sync Separator-Amplifier	12AU7	700K	1.2 M	22K	0	0	56K	700K	2.2K	0
V12	Low V. Rectifier	5U4G	Inf.	510K	Inf.	25	Inf.	25	Inf.	510K	
V13	Horizontal Oscillator	6SN7	5 M	570K	1.5K	130K	*	1.5K	0	0	
V14	Horizontal Output	6BG6	*	0	50	*	1 M	Inf.	0	*	
V15	High V. Rectifier	1B3		Inf.		Inf.		Inf.	Inf.		
V16	Damper	6W4	Inf.	Inf.	*	*	510K	Inf.	Inf.	Inf.	
V19	Vertical Output	6S4	Inf.	1K	2 M	0	0	2 M	Inf.	Inf.	510K

Conditions: 1. All readings taken with a vacuum tube voltmeter. 3. Switch OFF; line cord disconnected.
2. All controls at "normal" setting. 4. All tubes left in sockets.

*These tube pins do not have a DC path to ground, therefore there is no resistance reading given. With the circuit in normal operating condition (i.e. no shorts, no open circuits), the ohmmeter will give a gradually increasing reading because the battery in the ohmmeter is charging up the condensers in the circuit. If the ohmmeter is left connected long enough, it will eventually give a reading which is the leakage resistance of all the condensers. The foregoing reading would be correct, of course, only if the ohmmeter is connected in the current polarity with respect to any electrolytic condensers in the circuit. If the ohmmeter *immediately* gives a definite resistance reading (either infinite resistance or zero or very low resistance), it is an indication of an open circuit (infinite resistance) or of a short circuit (very low resistance).



See chassis voltage chart.

Fig. 8. Tuner—Top View

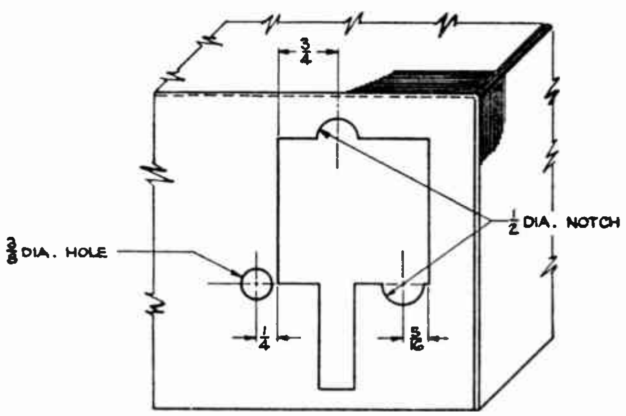


Fig. 9. See "Removing Bottom Cover of Tuner" Page

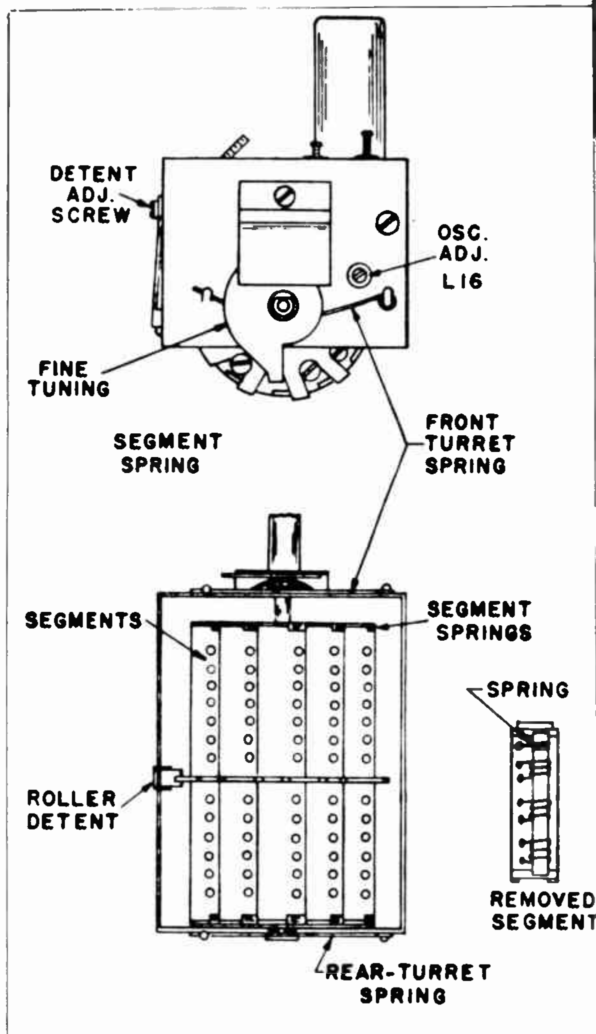


Fig. 10. Tuner—Detail

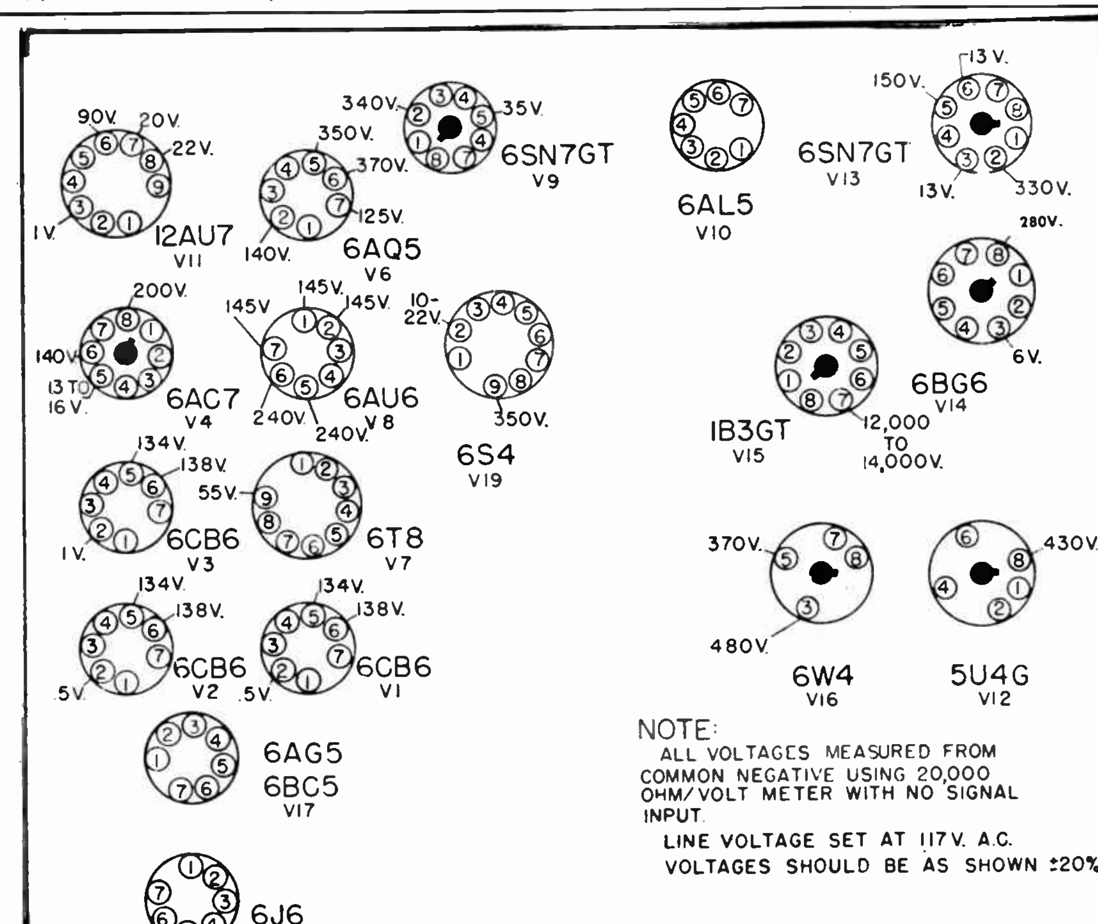


Fig. 11. Bottom Socket View

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE—If raster cannot be obtained, check below for possible causes.

1. Ion trap magnet adjustment is incorrect.
2. Check 1/8 amp. fuse in plate circuit of V14.
3. No high voltage—check V14 (6BG6) and V15 (1B3-GT) tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct waveform measured on terminal 1 of horizontal output transformer (T9), the trouble can be isolated to the high voltage rectifier circuit (V15). Either the high voltage winding (between red and blue leads) on T9 is open, tube V15 is defective or its filament circuit is open.
4. Damper tube V16 (6W4) defective. Plate voltage supply for V14 (6BG6) horizontal output tube is obtained through the damper tube. Check tube and heater winding on power transformer (T7).
5. Defective picture tube. Heater open, cathode return circuit open.
6. No plate voltage. Electrolytic capacitor shorted. All B voltages are accessible for measurement underneath the chassis.

HORIZONTAL DEFLECTION ONLY — If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:

1. Vertical oscillator V9 (6SN7-GT) inoperative. Check voltages on grid and plate.
2. Vertical output transformer (T5) open.
3. Yoke vertical coils (L7) open.
4. Vertical blocking transformer (T6) open or shorted.
5. Vertical output tube V19 (6S4) defective.

POOR VERTICAL LINEARITY—If adjustment of the vertical height and linearity controls will not correct this condition, any of the following may be the cause:

1. Vertical output transformer (T5), capacitors C30, C31, C32, or resistor R38.
2. V9 (6SN7GT) defective; check voltages.
3. Low plate and bias voltages. Check rectifier tube and capacitors in B supply.

POOR HORIZONTAL LINEARITY—Check the following:

1. V14 (6BG6) screen voltage.
2. Horizontal drive (C56) for incorrect adjustment.
3. Horizontal output tube V14 (6BG6).
4. Damper tube V16 (6W4).

TRAPEZOIDAL OR NON-SYMMETRICAL RASTER—Check for:

1. Improper adjustment of focus coil or ion trap magnet.
2. Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER—This condition can be caused by incorrect adjustment of the horizontal drive C56.

SMALL RASTER—This condition can be caused by:

1. Low B or line voltage.
2. Insufficient output from horizontal output tube V14 (6BG6). Replace tube.
3. Insufficient output from vertical output tube V19 (6S4) or V9 (6SN7GT). Replace tube.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND—This condition can be caused by:

1. No signal on picture tube cathode. Check for open coupling condenser C13.
2. Bad contact to picture tube or lead to socket broken.

SIGNAL APPEARS ON PICTURE TUBE CATHODE BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE HORIZONTALLY AND VERTICALLY—A condition of this nature can be caused by:

1. Defective sync limiter V11 (12AU7) or phase detector V10 (6AL5).
2. If tubes are O.K. check voltages and associated circuits.

SIGNAL ON PICTURE TUBE CATHODE AND HORIZONTAL SYNC ONLY—Check:

1. Vertical integrating network capacitors C31, C34, C35, and resistors R44, R45, R46.

PICTURE STABLE BUT WITH POOR RESOLUTION—If the picture resolution is not up to standard, it may be caused by any of the following:

1. Defective picture detector (crystal 1N34) or video amplifier V4 (6AC7).
2. Open video peaking coil. Check coils L1, L2, L3, L4 and L5 for continuity. Note that L3 and L5 have shunting resistors. L4 is 4.5 MC trap.
3. Leakage in V4 (6AC7) grid capacitor C11, or C13 on V5 (picture tube).

If the above components are not found to be defective, check the following:

A. Check all potentials in video circuits.
B. Check the picture tube grid for poor or dirty contacts.
C. Check adjustment of focus control R58. It should be effective on either side of proper focus.
D. Check and re-align if necessary, the picture I.F. and the local oscillator.
E. Check for proper coils in turret switch.

PICTURE SMEAR:

1. Normally, smear can be attributed to phase shift at the low frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits.
2. This trouble can also originate at the transmitter. Check reception from another station.

PICTURE JITTER:

1. Vertical instability may be due to loose connections or noise received with the signal.
2. Horizontal instability may be due to unstable transmitted sync or to noise.

TELEVISION RECEIVER

ALTERNATE TUBES FOR VIDEO AMPLIFIER STAGE

The 6AC7 Video Amplifier tube (V4) may be replaced by either a 6AH6 or a 6CB6. When either tube substitution is made, coils L3 and L5 must be changed as well as the socket and the socket wiring. When the 6CB6 is used, resistor R15 must be changed in addition to the coils.

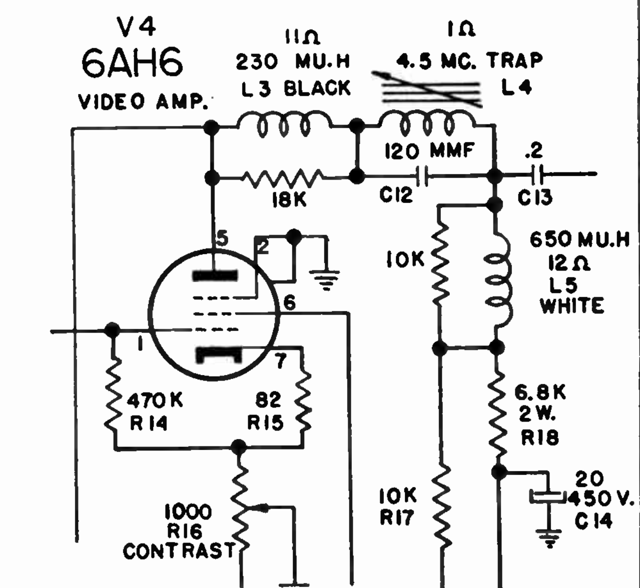
SUBSTITUTION OF THE 6AH6

REMOVE:

L3	10-566	Coil, peaking, 186 uh (gray) (on 12K resistor)
L5	10-565	Coil, peaking, 380 uh (purple) (on 10K resistor)

ADD:

L3	10-559	Coil, peaking, 230 uh (black) (on 18K resistor)
L5	10-548	Coil, peaking, 650 uh (white) (on 10K resistor)
	68-49	Socket, miniature, 7 pin



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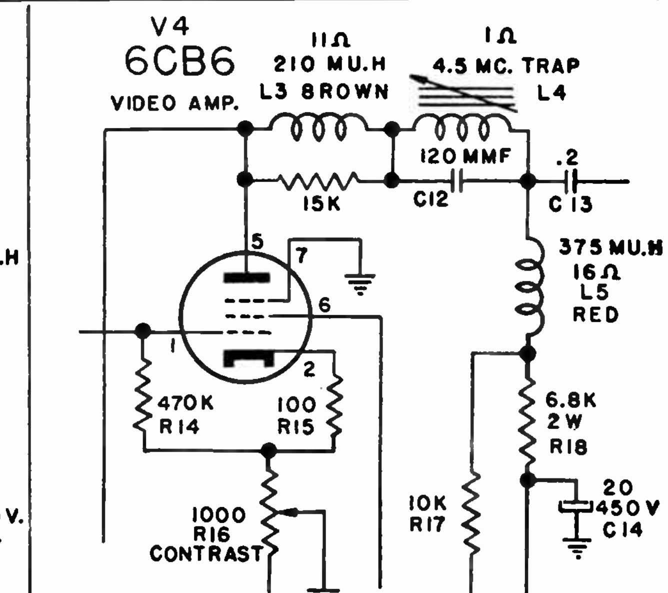


A100-207

SUBSTITUTION OF THE 6CB6

REMOVE:

L3	10-566	Coil, peaking, 186 uh (gray) (on 12K resistor)
L5	10-565	Coil, peaking, 380 uh (purple) (on 10K resistor)
R15	60-776	Resistor, carbon, 82 ohm, ½ w. 10%
	68-18	Socket, octal

ADD:

L3	10-567	Coil, peaking, 210 uh (brown) (on 15K resistor)
L5	10-558	Coil, peaking, 375 uh (red)
R15	60-752	Resistor, carbon, 100 ohm, ½ w. 10%
	68-49	Socket, miniature, 7 pin

ALTERNATE TUBES FOR THE No. 3 I. F. STAGE

The 6CB6 I.F. Amplifier Tube may be replaced by a 6AG5 or 6BC5. When this substitution is made, the ground connection on pin 7 of the socket will be removed.

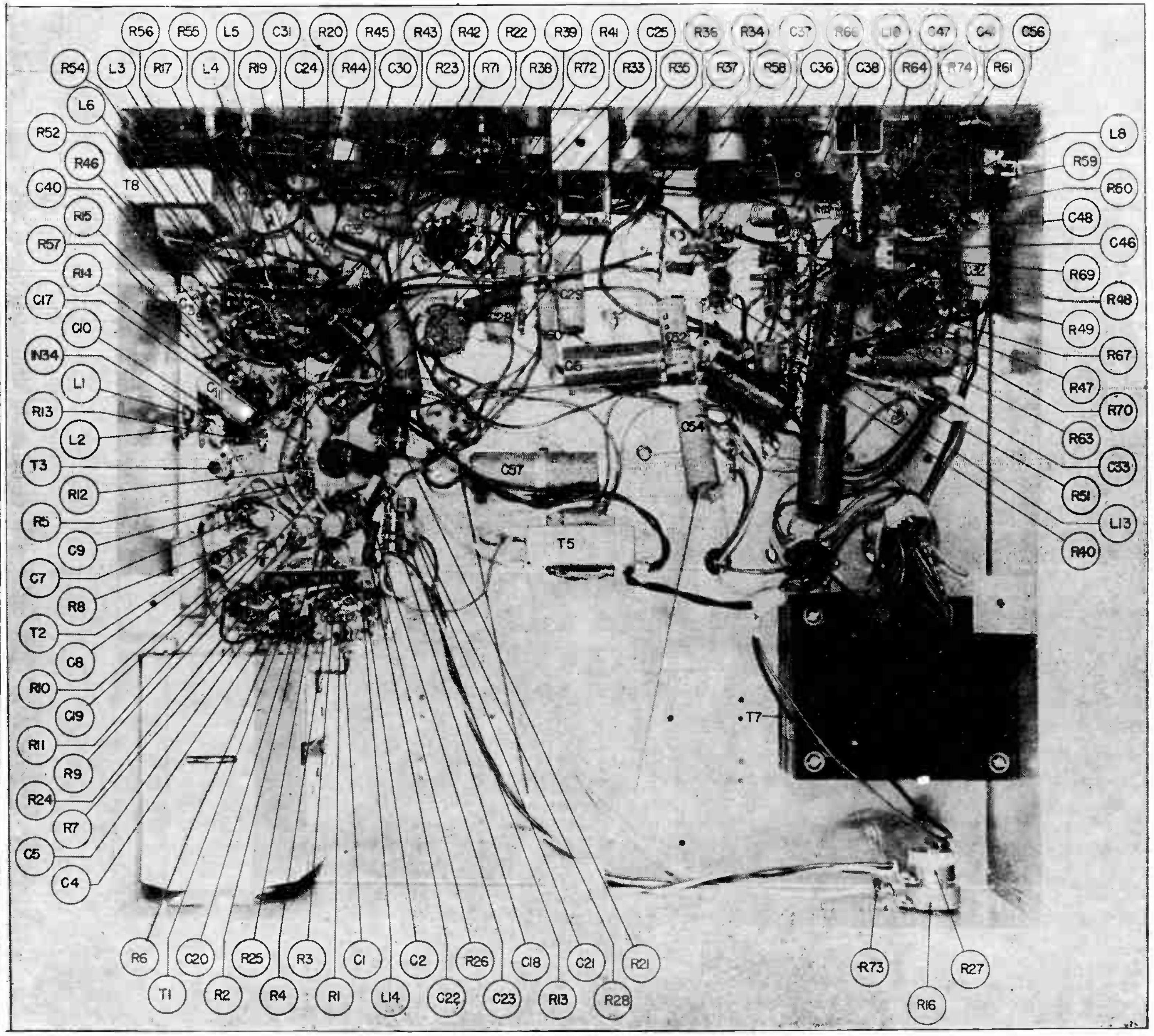


Fig. 12. Bottom View of Chassis

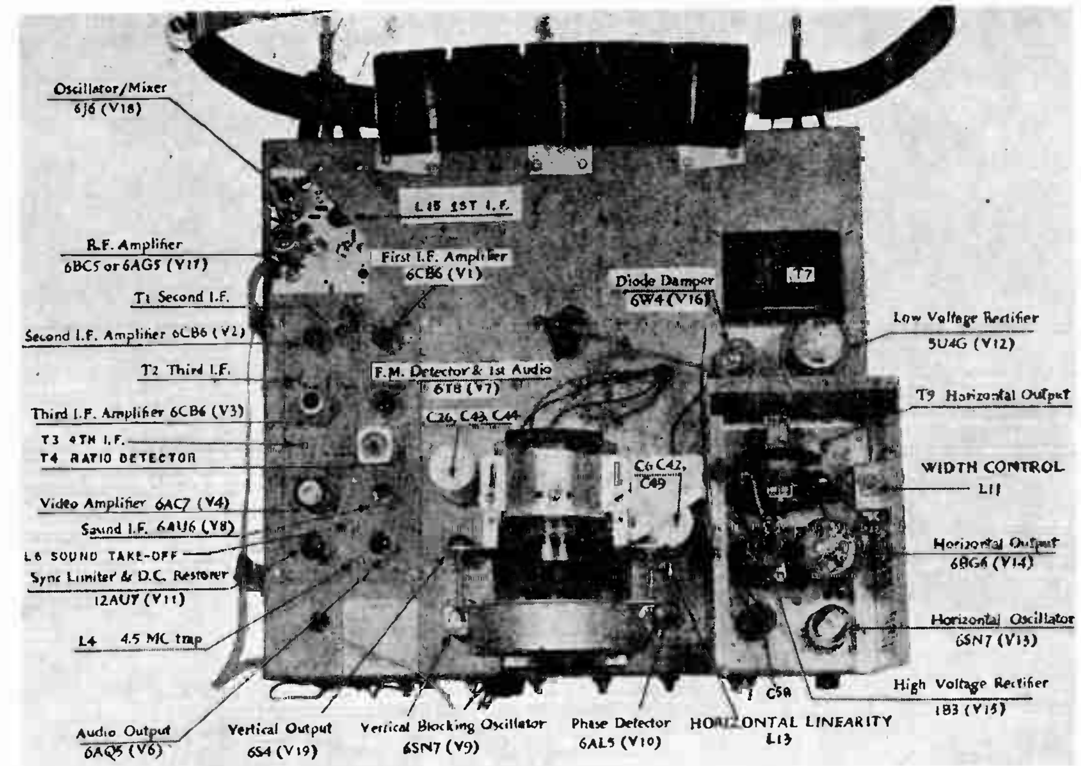


Fig. 13. Top View of Chassis

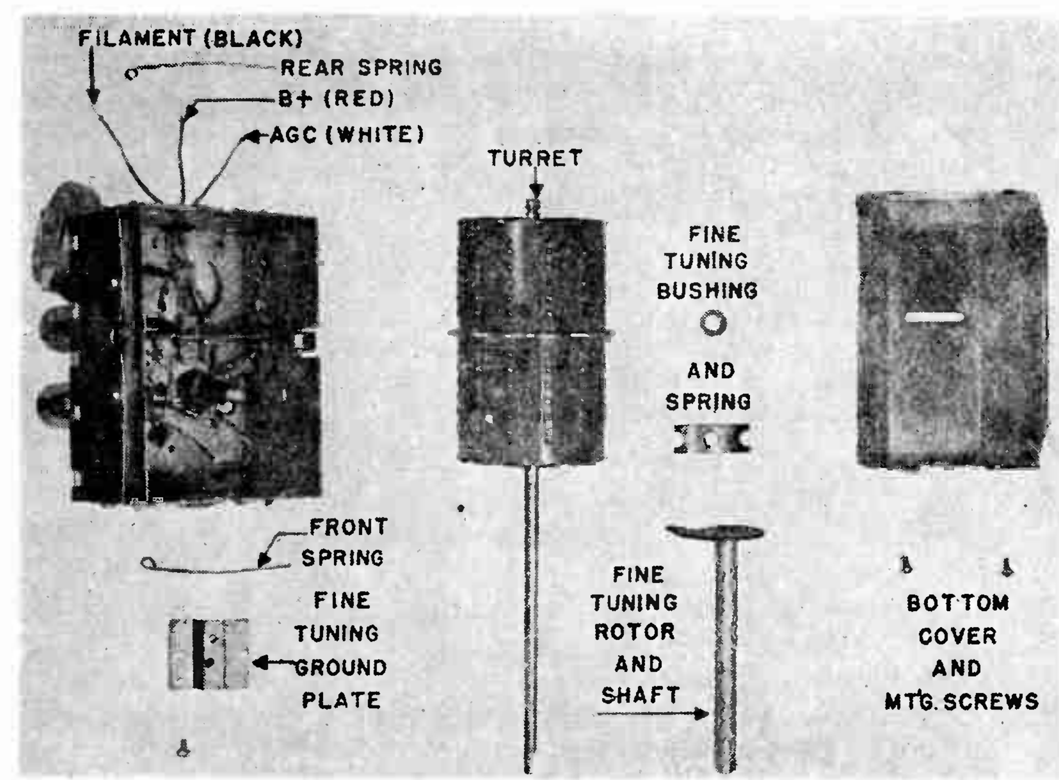


Fig. 14. Disassembled R.F. Tuner

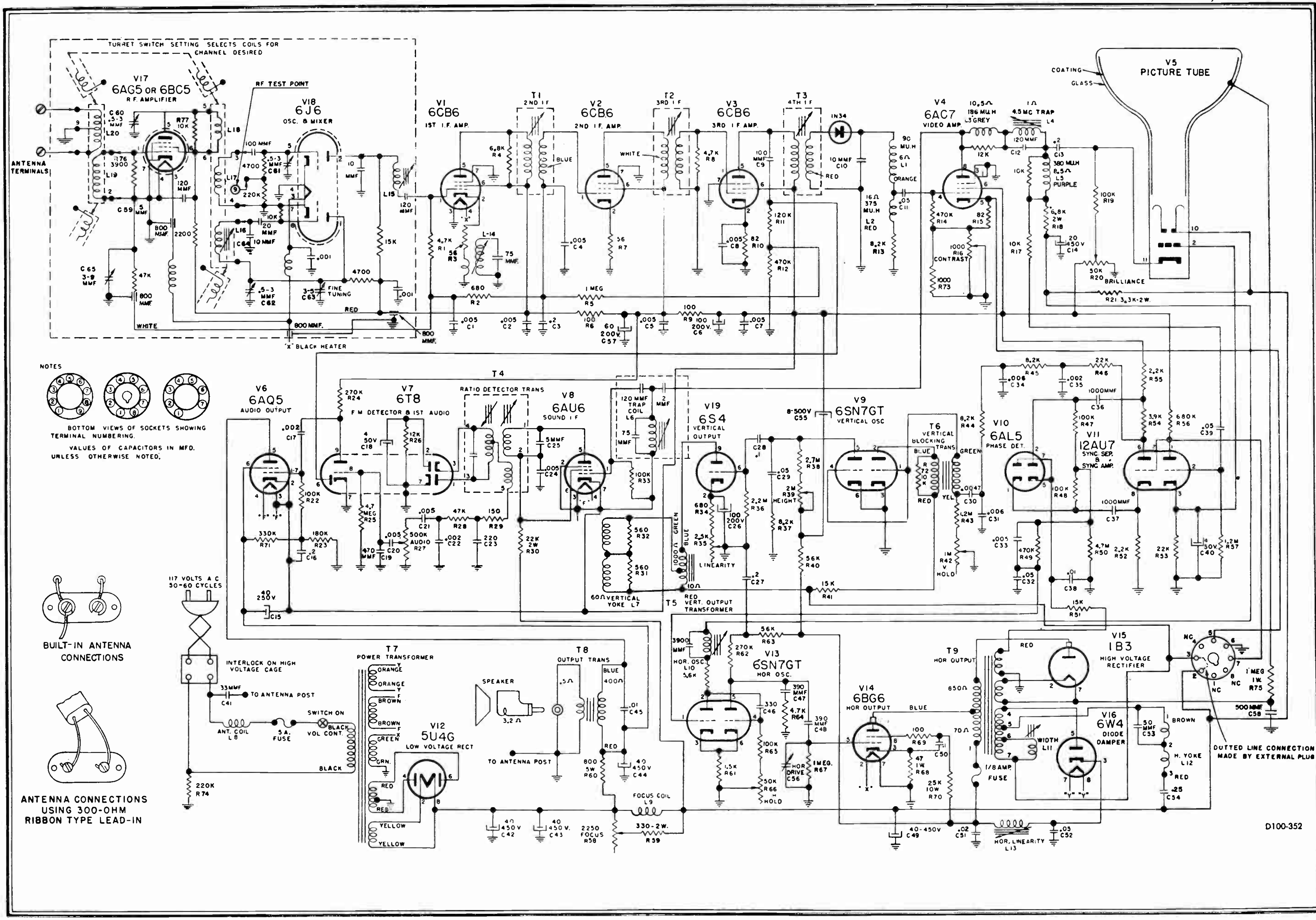
HOW TO ORDER REPAIR PARTS

1. Use Correct Order Form.
2. On the Purchase Order always give the following information:
   (1) PART NUMBER (number printed on the part if differeot from that shown in this list) and DESCRIPTION for each part ordered. When no part number is assigned, order by description and rating. Also give PRICE of part (indicate if no selling).
   (2) The CHASSIS NUMBER, which is 528.631 is found on a metal plate at the rear of the chassis.

REPAIR PARTS & PRICE LIST

Ref. Number	Part Number	Description
		CAPACITORS
C1, C2, C4, C5, C7, C8, C20, C21, C24	T16-177	Capacitor, ceramic; 5000 mmfd.
C3, C16	T16-188	Capacitor, tubular; .2-400 v. 85°C
C6, C26; C42, C43, C44, C49	T18-295	Capacitor, electrolytic; 100 mfd. 200 v. 40-40 mfd. 450 v.
C9	T15-196	Capacitor, ceramic; 100 mmfd.
C10	T15-223	Capacitor, ceramic; 10 mmfd.
C11, C39	T16-189	Capacitor, tubular; .05-400 v. 85°C
C12		Part of L4—capacitor, ceramic; 120 mmfd.
C13	T16-212	Capacitor, tubular; .2-600 v. 85°C
C14	T18-276	Capacitor, electrolytic; 20 mfd. 450 v.
C15	T18-299	Capacitor, electrolytic; 40 mfd. 250 v.
C17, C35	T16-198	Capacitor, tubular; .002-600 v. 85°C.
C18, C40	T18-292	Capacitor, electrolytic; 4 mfd. 50 v.
C19	T15-200	Capacitor, mica; 470 mmfd.
C22	T15-228	Capacitor, ceramic; 2000 mmfd.
C23	T15-230	Capacitor, mica; 220 mmfd.
C25	T15-222	Capacitor, ceramic; 5 mmfd.
C27	T16-218	Capacitor, molded tubular; .22-600 v.
C28, C50	T16-208	Capacitor, tubular; .1-600 v. 85°C
C29, C32	T16-193	Capacitor, tubular; .05-600 v. 85°C
C30	T16-220	Capacitor, molded tubular; .0047-600 v.
C31, C34	T16-209	Capacitor, tubular; .006-600 v. 85°C
C33	T16-190	Capacitor, tubular; .005-600 v. 85°C
C36, C37	T15-220	Capacitor, ceramic; 1000 mmfd.
C38, C45	T16-201	Capacitor, tubular; .01-600 v. 85°C
C41	T15-210	Capacitor, ceramic; 33 mmfd.
C46	T15-226	Capacitor, silver mica; 330 mmfd.
C47, C48	T15-231	Capacitor, mica; 390 mmfd.
C51	T16-219	Capacitor, tubular; .02-1000 v. 85°C
C52	T16-216	Capacitor, tubular; .05-1000 v. 85°C
C53	T15-233	Capacitor, mica; 50 mmfd. 800 v.
C54	T16-217	Capacitor, tubular; .25-400 v. 85°C
C55	T18-298	Capacitor, electrolytic; 8 mfd. 500 v.
C56	T20-145	Capacitor, trimmer; HORIZONTAL DRIVE
C57	T18-302	Capacitor, electrolytic; 60 mfd. 200 v.
C58	T15-234	Capacitor, ceramic; 500 mmfd. 20,000 v.
		RESISTORS
R1, R8, R64	T60-759	Resistor, carbon; 4.7K ohm, ½ w. 10%
R2, R34	T60-708	Resistor, carbon; 680 ohm, ½ w. 10%
R3, R7	T60-806	Resistor, carbon; 56 ohm, ½ w. 10%
R4	T60-786	Resistor, carbon; 6.8K ohm, ½ w. 10%
R5, R67	T60-668	Resistor, carbon; 1 megohm, ½ w.
R6, R9, R69	T60-752	Resistor, carbon; 100 ohm, ½ w. 10%
R10, R15	T60-776	Resistor, carbon; 82 ohm, ½ w. 10%
R11	T60-817	Resistor, carbon; 120K ohm, ½ w. 10%
R12, R14, R49	T60-731	Resistor, carbon; 470K ohm, ½ w.
R13, R37, R44, R45	T60-778	Resistor, carbon; 8.2K ohm, ½ w. 10%
R16, R27	T24-197	Resistor, variable; (dual); VOLUME 500K, CONTRAST 1000 ohm
R17, R72	T60-760	Resistor, carbon; 10K ohm, ½ w. 10%
R18	T60-808	Resistor, carbon; 6.8K ohm, 2 w. 10%
R19, R22, R33, R47, R48, R65	T60-801	Resistor, carbon; 100K ohm, ½ w. 10%
R20, R66	T25-10	Resistor, variable; 50K ohm, BRILLIANCE and HORIONTAL HOLD
R21	T60-816	Resistor, carbon; 3.3K ohm, 2 w. 10%
R23	T60-788	Resistor, carbon; 180K ohm, ½ w. 5%
R24, R62	T60-747	Resistor, carbon; 270K ohm, ½ w. 10%
R25, R50	T60-779	Resistor, carbon; 4.7 megohm, ½ w.
R26	T60-811	Resistor, carbon; 12K ohm, ½ w. 10%
R28	T60-730	Resistor, carbon; 47K ohm, ½ w.
R29	T60-767	Resistor, carbon; 150 ohm, ½ w. 10%
R30	T60-810	Resistor, carbon; 22K ohm, 2 w. 10%
R31, R32	T60-758	Resistor, carbon; 560 ohm, ½ w. 10%
R35	T25-13	Resistor, variable; 2.5K ohm, VERTICAL LINEARITY
R36	T60-726	Resistor, carbon; 2.2 megohm, ½ w.
R38	T60-872	Resistor, carbon; 2.7 megohm, ½ w.
R39	T25-15	Resistor, variable; 2 megohm, HEIGHT

Ref. Number	Part Number	Description
R40, R63	T60-802	Resistor, carbon; 56K ohm, ½ w. 10%
R46, R53	T60-744	Resistor, carbon; 22K ohm, ½ w. 10%
R42	T25-17	Resistor, variable; 1 megohm, VERTICAL HOLD
R43	T60-780	Resistor, carbon; 1.5 megohm, ½ w.
R41, R51	T60-783	Resistor, carbon; 15K ohm, ½ w. 10%
R52, R55	T60-714	Resistor, carbon; 2.2K ohm, ½ w. 10%
R54	T60-710	Resistor, carbon; 3.9K ohm, ½ w. 10%
R56	T60-807	Resistor, carbon; 680K ohm, ½ w. 10%
R57	T60-782	Resistor, carbon; 1.2 megohm, ½ w. 10%
R58	T25-14	Resistor, variable; 2250 ohm, FOCUS
R59	T60-814	Resistor, carbon; 330 ohm, 2 w. 10%
R60	T60-800	Resistor, wirewound; 800 ohm, 5 w. 10%
R61	T60-729	Resistor, carbon; 1.5K ohm, ½ w. 10%
R68	T60-805	Resistor, carbon; 47 ohm, 1 w. 10%
R70	T60-853	Resistor, wirewound; 25K ohm, 10 w. 10%
R71	T60-787	Resistor, carbon; 330K ohm, ½ w. 5%
R73	T60-675	Resistor, carbon; 1000 ohm, ½ w.
R74	T60-667	Resistor, carbon; 220K ohm, ½ w.
R75	T60-877	Resistor, carbon; 1 megohm, 1 w.
		TRANSFORMERS AND COILS
T1	T10-541	Transformer, 2nd I.F. (blue)
T2	T10-542	Transformer, 3rd I.F. (white)
T3	T10-543	Transformer, 4th I.F. (red)
T4	T10-552	Transformer, ratio detector, 4.5 MC
T5	T80-261	Transformer, vertical output
T6	T80-257	Transformer, vertical blocking
T7	T80-264	Transformer, power
T8	T80-253	Transformer, output (audio)
T9	T80-265	Transformer, horizontal output
	T80-263	Transformer, horizontal output (alternate)
L1	T10-557	Coil, peaking; 90 uh (orange)
L2	T10-558	Coil, peaking; 375 uh (red)
L3	T10-566	Coil, peaking; 186 uh (grey) (on 12K resistor)
L4	T10-571	Coil, 4.5 trap (includes C12)
L5	T10-565	Coil, peaking; 380 uh (purple) (on 10K resistor)
L6	T10-556	Coil, sound take-off; (includes 3 condensers)
L7, L12	T83-694	Coil, deflection yoke
L8	T10-550	Coil, line antenna choke
L9	T10-560	Coil, focus
L10	T10-555	Coil, horiz. osc. (includes 3900 mmfd. and 5.6K)
L11	T10-551	Coil, WIDTH CONTROL
L13	T10-561	Coil, HORIZONTAL LINEARITY
L14	T10-574	Coil, wave trap, 21.25MC (includes 75 mmfd.)
		MISCELLANEOUS CHASSIS PARTS
	T22-165	Connector, high voltage
	T21-161	Cover, high voltage cage
	T48-45	Crystal, 1N34
	T43-14	Fuse, ⅛ amp., 250 v.
	T43-12	Fuse, 5 amp., 250 v.
	T83-670	Ion trap, double magnet
	T83-684	Ion trap, single magnet
	T37-122	Insulator, ceramic socket support
	T22-133	Jack, speaker
	T23-161	Line cord
	T84-447	Line cord and cover assembly
	T45-125	Plug, speaker
	T45-130	Plug, color socket
	T95-28	R. F. Tuner (Standard Coil Co.)
	T87-43	Receptacle, AC line
	T87-44	Receptacle, fuse holder
	T83-661	Retainer, tube shield
	T71-42	Shield, tube
	T68-18	Socket, octal molded
	T68-43	Socket, miniature, 7 pin
	T68-48	Socket, miniature, 9 pin (V19)
	T68-44	Socket, miniature, 9 pin (V7 & V11)
	T68-50	Socket, picture tube
	T68-53	Socket, octal, wafer (V15) (4 pins only)
	T70-153	Spring, tube retainer
	T27-24	Strap, picture tube support
	T79-389	Speaker, 10 in. P. M.
	T83-693	Yoke mounting hood
		CABINET PARTS
	T32-19	Back
	T42-511	Cabinet (includes grille cloth)
	T21-170	Cover (tube cup)
	T48-57	Glass, TV safety
	T98-28	Grille cloth
	T52-351	Knob, CHANNEL SELECTOR
	T52-352	Knob, FINE TUNING
	T52-353	Knob, OFF-VOLUME
	T52-354	Knob, PICTURE
	T31-183	Mask
	T36-126	Wire screen



TURRET SWITCH SETTING SELECTS COILS FOR CHANNEL DESIRED
V17 6AG5 OR 6BC5 R.F. AMPLIFIER
V18 6J6 OSC. & MIXER
RF TEST POINT
ANTENNA TERMINALS
FINE TUNING
"X" BLACK HEATER
V1 6CB6 1ST I.F. AMP.
V2 6CB6 2ND I.F. AMP.
V3 6CB6 3RD I.F. AMP.
T1 2ND I.F
T2 3RD I.F
T3 4TH I.F
1N34
V4 6AC7 VIDEO AMP.
4.5MC TRAP
V5 PICTURE TUBE
COATING
GLASS
CONTRAST
BRILLIANCE
V6 6AQ5 AUDIO OUTPUT
V7 6T8 F M DETECTOR & 1ST AUDIO
T4 RATIO DETECTOR TRANS
V8 6AU6 SOUND I.F
120 MMF TRAP COIL L6
V19 6S4 VERTICAL OUTPUT
V9 6SN7GT VERTICAL OSC
T6 VERTICAL BLOCKING TRANS
V10 6AL5 PHASE DET.
V11 12AU7 SYNC SEP. & SYNC AMP.
HEIGHT
LINEARITY
V HOLD
60Ω VERTICAL YOKE L7
T5 VERT. OUTPUT TRANSFORMER
NOTES
BOTTOM VIEWS OF SOCKETS SHOWING TERMINAL NUMBERING.
VALUES OF CAPACITORS IN MFD. UNLESS OTHERWISE NOTED.
117 VOLTS A C 50-60 CYCLES
INTERLOCK ON HIGH VOLTAGE CAGE
TO ANTENNA POST
ANT. COIL L8
5A. FUSE
SWITCH ON VOL CONT.
BUILT-IN ANTENNA CONNECTIONS
ANTENNA CONNECTIONS USING 300-OHM RIBBON TYPE LEAD-IN
T7 POWER TRANSFORMER
V12 5U4G LOW VOLTAGE RECT
T8 OUTPUT TRANS
SPEAKER
FOCUS COIL L9
FOCUS R58
V13 6SN7GT HOR OSC.
HOR. OSC. L10
HOR DRIVE C56
HOLD
V14 6BG6 HOR OUTPUT
T9 HOR OUTPUT
1/8 AMP. FUSE
WIDTH L11
V15 1B3 HIGH VOLTAGE RECTIFIER
V16 6W4 DIODE DAMPER
H. YOKE L12
HOR. LINEARITY L13
DOTTED LINE CONNECTION MADE BY EXTERNAL PLUG
D100-352

CAUTION

HIGH VOLTAGES are used in the operation of this receiver. The back cover, while in place, prevents accidental contact with this voltage and therefore should not be removed by anyone except a qualified television serviceman.

THE HIGH VOLTAGE LEAD, which supplies 12 to 16 kilovolts to the picture tube, should be momentarily shorted to the chassis whenever it is disconnected for service purposes. This discharges the high voltage filter condenser and prevents a shock hazard when working on the receiver after it has been turned off.

THE PICTURE TUBE is highly evacuated and if broken, glass fragments will be violently expelled. Scratching, chipping, undue pressure, or careless handling such as lifting the tube by its neck is dangerous and should be avoided. If it is necessary to handle the picture tube, use safety goggles and heavy gloves. Be sure to discharge the voltage developed across the capacitor formed by the inner and outer coating of the picture tube. This can be done by connecting the high voltage socket on the tube to the outer coating.

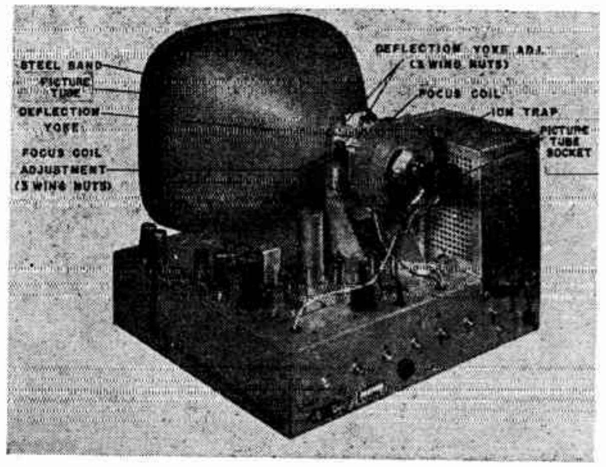


Fig. 4. Side View of Chassis.

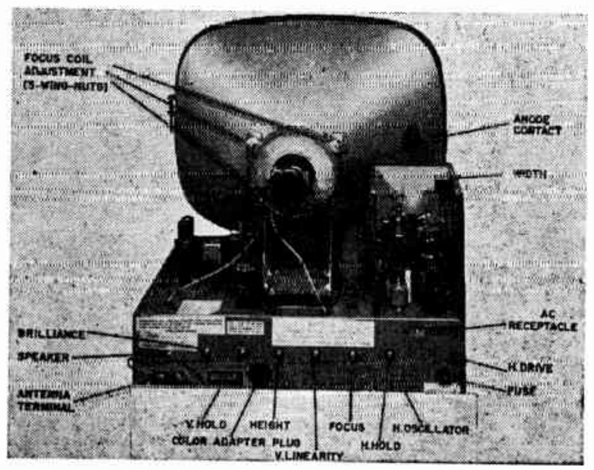


Fig. 5. Rear View of Chassis.

HORIZONTAL OSCILLATOR ALIGNMENT

If the Horizontal Hold control fails to maintain sync, the horizontal oscillator should be reset. To reset this screwdriver adjustment, set the horizontal hold control in the center of its range and sync the picture with the horizontal oscillator adjustment screw. Check the control action on various channels and alter the screw adjustment as required to provide sync on all channels with these two controls.

DEFLECTION YOKE, ION TRAP AND FOCUS ADJUSTMENT

Following is the proper procedure for adjusting the Deflection Yoke, Ion Trap and Focus.

The receiver should be turned on but *not* connected to an antenna. These steps should then be taken in the following order:

1. The Deflection Yoke should be moved as far forward as possible on the neck of the CRT.
2. The Brilliance control should be turned to maximum (clockwise) and the Picture control should be turned to minimum (counterclockwise).
3. The Ion Trap should be rotated and at the same time moved forward and backward to find the position which produces the brightest raster on the screen.
4. The Deflection Yoke should be rotated so that the top and bottom edges of the raster are parallel to the top of the chassis.
5. The Brilliance control should now be reduced (ccw) to a point where the raster is slightly above normal brilliance.
6. Center the picture within the opening of the mask and eliminate shaded corners by adjusting the three positioning wing-nuts on the focus coil. Corner-cutting or shadows at the corners may be caused by mis-adjustment of either the ion trap magnet or the Focus coil, and the two may require simultaneous adjustment to secure the brightest, yet evenly distributed light on the screen. Four self-tapping screws on the focus coil U-bracket are provided to permit vertical movement of the focus coil when necessary.
7. With Brilliance and Picture controls at normal positions, adjust the Focus control (rear of chassis) for well-defined scanning lines.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a test pattern transmitted from a local station be used. Linearity adjustments, particularly, cannot be accurately made on moving transmissions. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area delineated by the mask.

The Width control (in the H.V. cage) should be adjusted to give a picture that will fill the mask horizontally.

The Height and Vertical Linearity controls (both rear of chassis) should then be adjusted for a linear picture that will fill the mask vertically. At this point the Focus adjustment previously set, should be retouched for maximum definition of the lines in the vertical wedge of the test pattern. Proper adjustment and alignment of the receiver should result in clear and sharp definition.

TELEVISION ALIGNMENT PROCEDURE

PRELIMINARY

This alignment is an exacting procedure and should be undertaken only when necessary. Before fully deciding that alignment is necessary and before removing the chassis from the customer's home:

1. Be sure of the antenna installation.
2. Check all operating controls and adjustments including the channel selector.
3. Check reception on all channels.
4. Check tubes by substitution of known good tubes.

TEST EQUIPMENT REQUIRED

1. Signal generator (with an output variable and at least 0.1 volt max.) to provide the following frequencies:

   (a) 4.5 mc Sound IF
   (b) 21.75 mc Trap (L14)
   (c) 24.0 mc 1st IF (L15)
   (d) 25.5 mc 2nd IF (T1)
   (e) 23.8 mc 3rd IF (T2)
   (f) 26.1 mc 4th IF (T3)

2. R.F. Sweep Generator with a frequency range from 40 to 220 megacycles with a sweep width of 10 megacycles and an adjustable output of at least 0.1 volts.
3. Crystal controlled or crystal calibrated markers for the sound carrier of each channel. Picture carrier markers are desirable but not necessary.
4. Cathode ray oscilloscope, preferably with a wide band vertical amplifier and an input calibrating source.
5. Vacuum tube voltmeter (VTVM).

ALIGNMENT PROCEDURE

I-F ADJUSTMENTS

Step No.	Connect Signal Generator to	Signal Gen. Freq. Mc.	Connect Voltmeter to	Miscellaneous Connections and Instructions	Adjust
3	Raise tube shield on V18 (tuner-oscillator), so that it is not grounded, then clip the "hot" lead of the signal generator to the tube shield.	26.1	Junction R13 and L2	Disconnect the antenna. Set channel selector to channel on which there is no signal and no interference (such as harmonics of I.F.).	T3 (top) maximum
4		23.8			T2 (top) maximum
5		25.5			T1 (top) maximum
6		24.0			L15 maximum
7		21.75			L14 minimum

ALIGNMENT TABLE

DISCRIMINATOR AND SOUND I-F ALIGNMENT

Step No.	Connect Signal Generator to	Signal Gen. Freq. Mc.	Connect Voltmeter to	Miscellaneous Connections and Instructions	Adjust
1	Video Grid (pin 1, V-4)	4.5 .1 volt output	Pin 2 V-7	Meter on 10 Volt scale	T4 (bottom) and L6 for max. on meter. L4 for min.
2	Video Grid (pin 1, V-4)	4.5 .1 volt output	See Note 1	Meter on 3 volt scale	T4 (top) for zero on meter

NOTE 1: Connect two 100 K resistors in series. Connect one end to pin 2 of V-7 (6T8) and the other end to ground. Connect the hot side of the VTVM to center of the two 100 K resistors and ground side to junction of R29 (150 ohms) and R28 (47K ohms).

	DESCRIPTION
2110A	Brown Leatherette Table Model Television Receiver with Built-in Antenna
2111	Black Leatherette Table Model Television Receiver with Built-in Antenna
2112	Blonde Leatherette Table Model Television Receiver with Built-in Antenna
2115B	Mahogany Table Model Television Receiver with Built-in Antenna
2150B	Mahogany Consolette Model Television Receiver with Built-in Antenna
2160	Mahogany Consolette Model Television Receiver with Built-in Antenna
2162	Blonde Wood Consolette Model Television Receiver with Built-in Antenna

R.F. TUNER

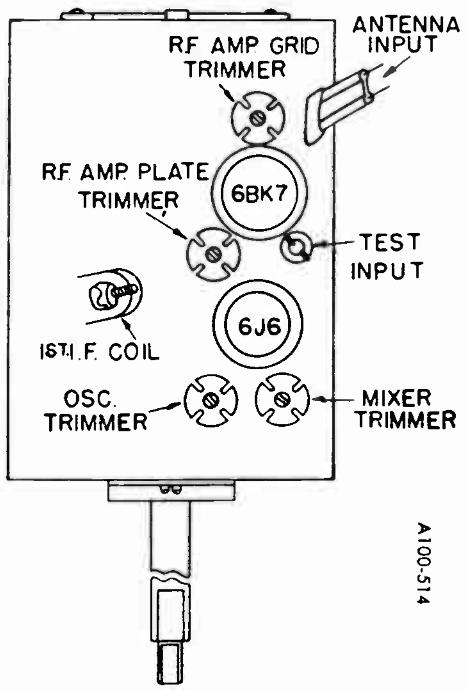


Fig. 1 Top View of Cascode Tuner T95-29.

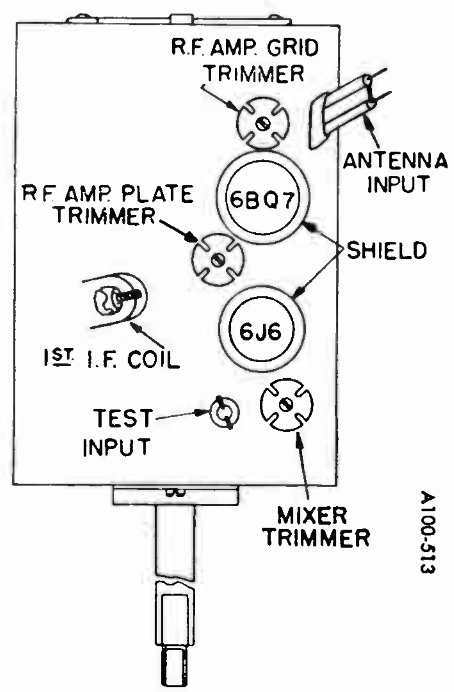


Fig. 2 Top View of Cascode Tuner T95-30.

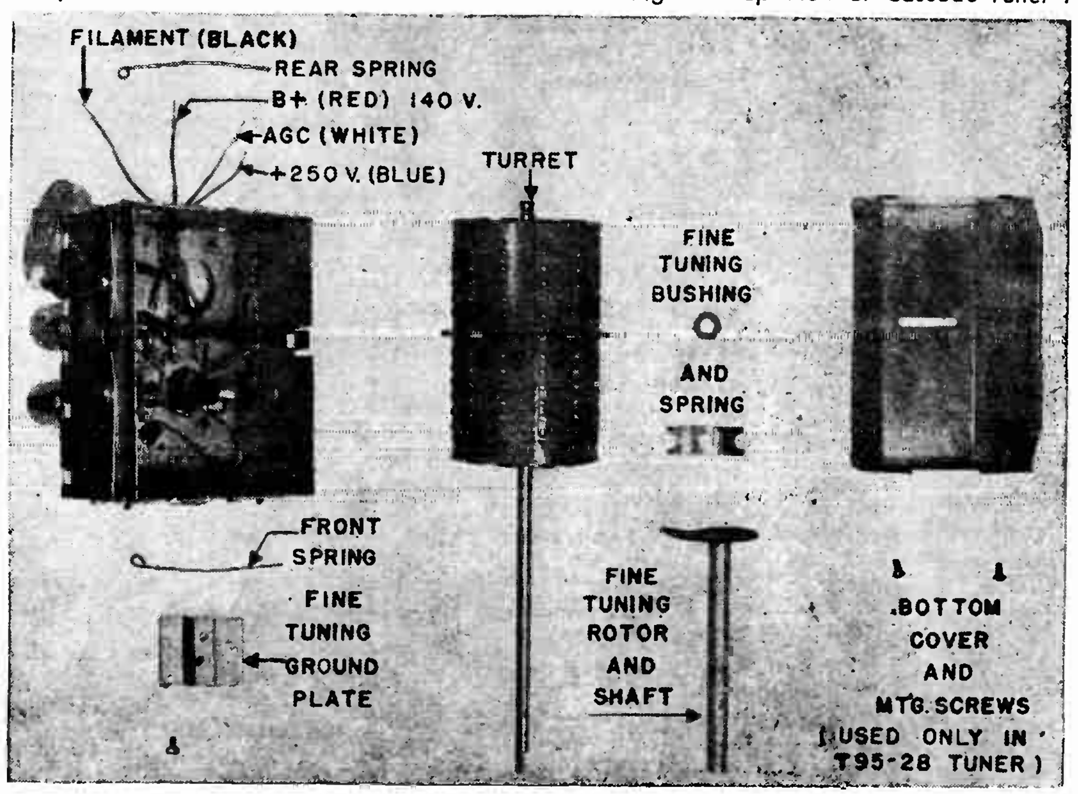


Fig. 3 Disassembled View of T95-29 and T95-30 R.F. (Cascode) Tuners.

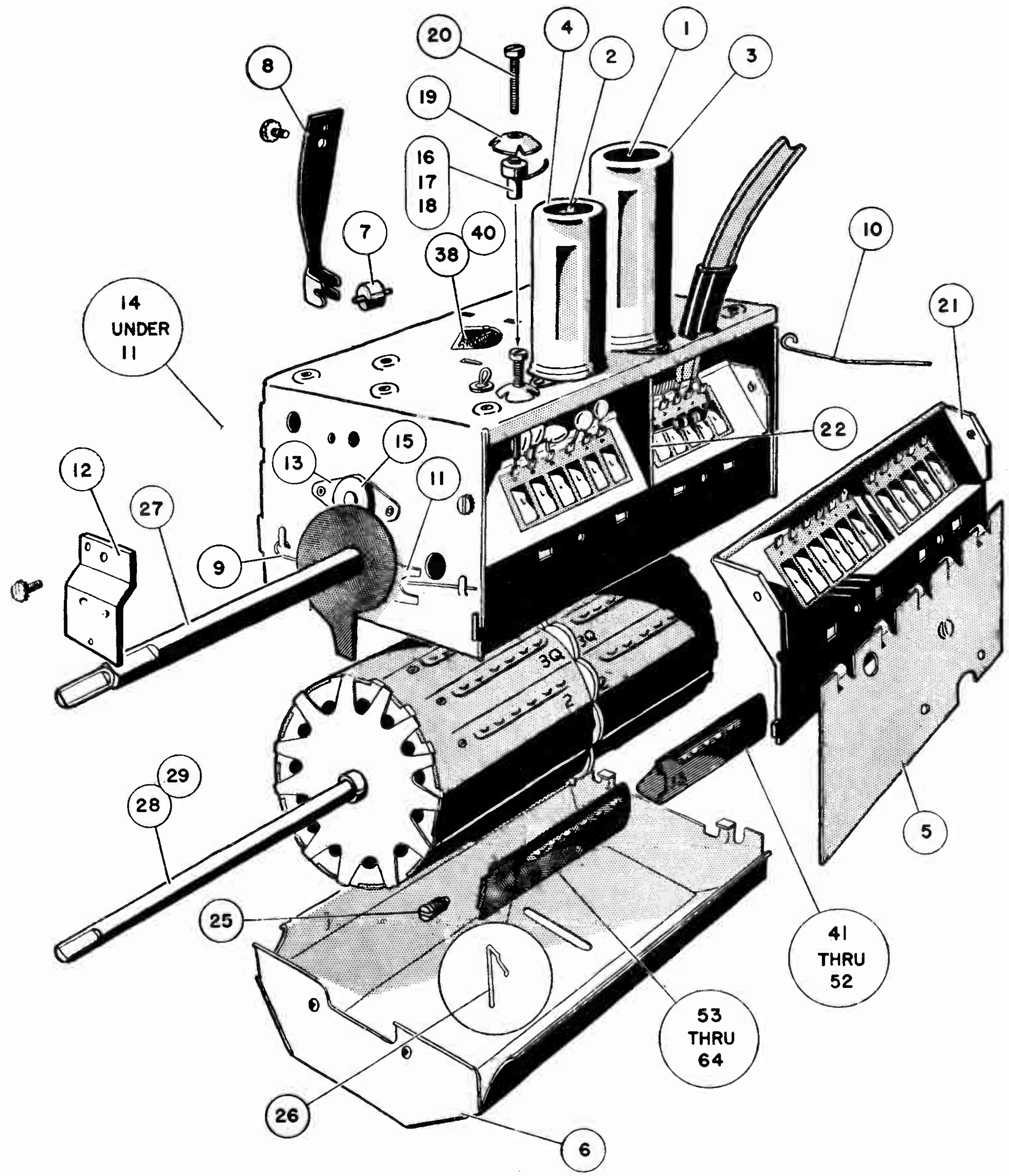


Fig. 4 Exploded View Showing Location of Parts on T95-28, T95-29 and T95-30 R.F. Cascode Tuners.

PARTS LIST — R.F. CASCODE TUNERS

Item	Description	T95-28 Tuner "G"	T95-29 Tuner "K"	T95-30 Tuner "O"
	Coding of Drum Segments (Specify strips by channel number, followed by letter)			
1	Tube, R.F.	6AG5	6BK7	6BQ7
2	Tube, Mixer—Oscillator	6J6	6J6	6J6
3	Shield, Tube—R.F.	T16S-006	T16S-004	T16S-004
4	Shield, Tube—Mixer Osc	T16S-006	T16S-006	T16S-006
5	Shield, Side	T31B-143	T31B-143	T31B-143
6	Shield, Bottom Cover	T31B-103	T31B-103	T31B-103
7	Roller, Detent	T31B-016	T31B-016	T31B-016
8	Spring, Detent	T31B-005	T31B-005	T31B-005
9	Spring, Shaft Retaining Front	T31B-030	T31B-030	T31B-030
10	Spring, Shaft Retaining Rear	T31A-109	T31A-109	T31A-109
11	Spring, Fine Tuner Ground	T31B-008	T31B-008	T31B-008
12	Plate, Fine Tuner Ground	T31B-012	T31B-012	T31B-012
14	Washer, Fibre	T11D-022	T11D-022	T11D-022
15	Fine Tuner Hot Plate and Lead	T31B-252	T31B-252	T31B-252
16	Trimmer, Ceramic and Lead—Ant	T31A-079	T31A-079	T31A-079
17	Trimmer, Ceramic and Lead—R.F	T31A-056	T31A-056	T31A-056
18	Trimmer, Ceramic and Lead—Osc	T31A-069	T31A-069	
19	Nut, Trimmer Spring	T10E-401	T10E-401	T10E-401
20	Screw, Trimmer	T9A-410-7	T9A-410-7	T9A-410-7
21	Contact Bracket Assembly	T31B-278	T31B-278	T31B-278
25	Slug, Oscillator Tuning	T31B-015	T31B-015	T31B-015
26	Spring, Slug Retaining	T31A-010	T31A-010	T31A-010
27	Choke, R.F. Heater	T34A-546	T34A-546	T34A-546
28	Fine Tuner	T31A-066-67	T31A-066-67	T31A-066-67
29	Drum, Less Coils	T31B-203-67	T31B-203-67	T31B-203-67
31	Choke, Osc. Heater	T34A-575	T34A-575	T34A-575
32	Choke, Cascode Coupling—L7		T31B-629	T31B-629
33	Choke, Mixer plate—L10			T31B-638
34	Choke, Neutralizing—L9			
35	Trap, Pretuned 45 mc.—L12, C12			
36	Trap, Pretuned 44 mc			
37	Terminal Board, Antenna			
38	Core, I.F. Tuning	T20C-055	T20C-055	T20C-055
39	Choke, Mixer Plate Feed—L9			T31B-230
40	I.F. Coil and Core	T31A-078	T31A-078	T31A-078

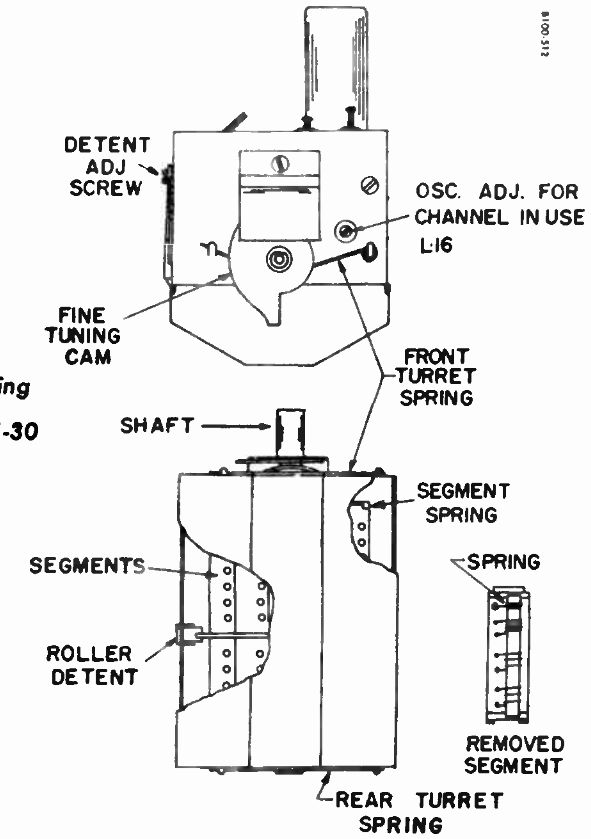
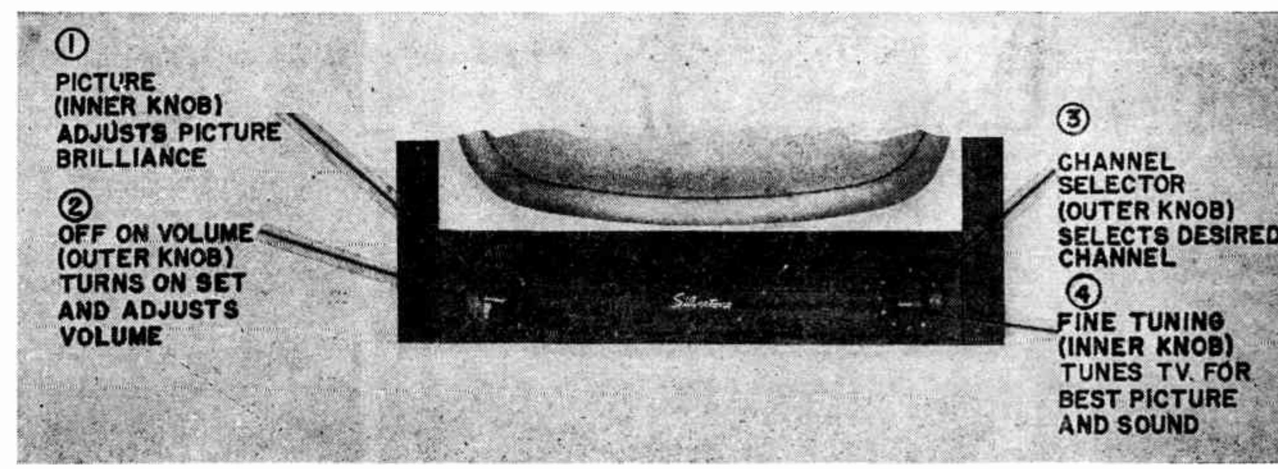
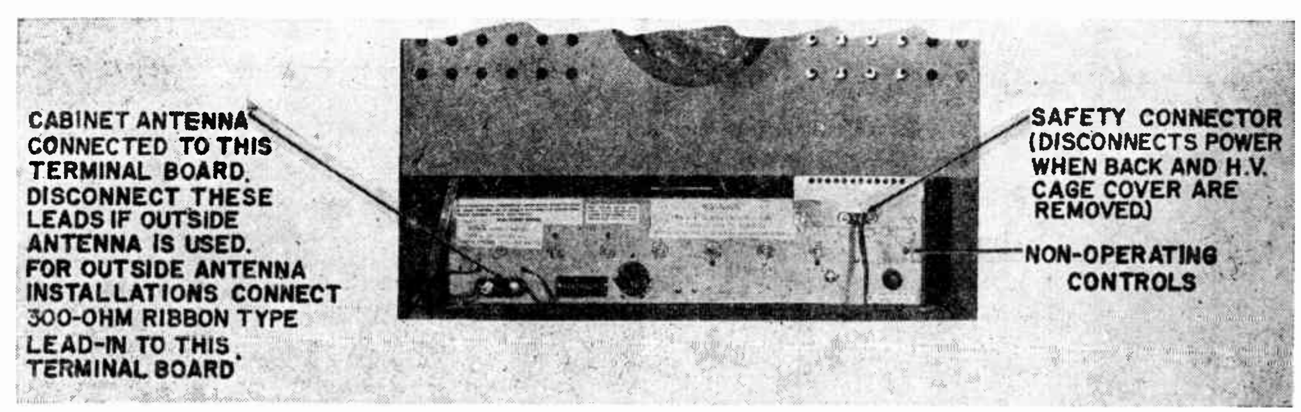


Fig. 5 Detail Illustration Showing Adjustments on T95-29 and T95-30 R.F. Cascode Tuners.



Front Cabinet View Showing Controls.



Rear View of Cabinet Showing Controls.

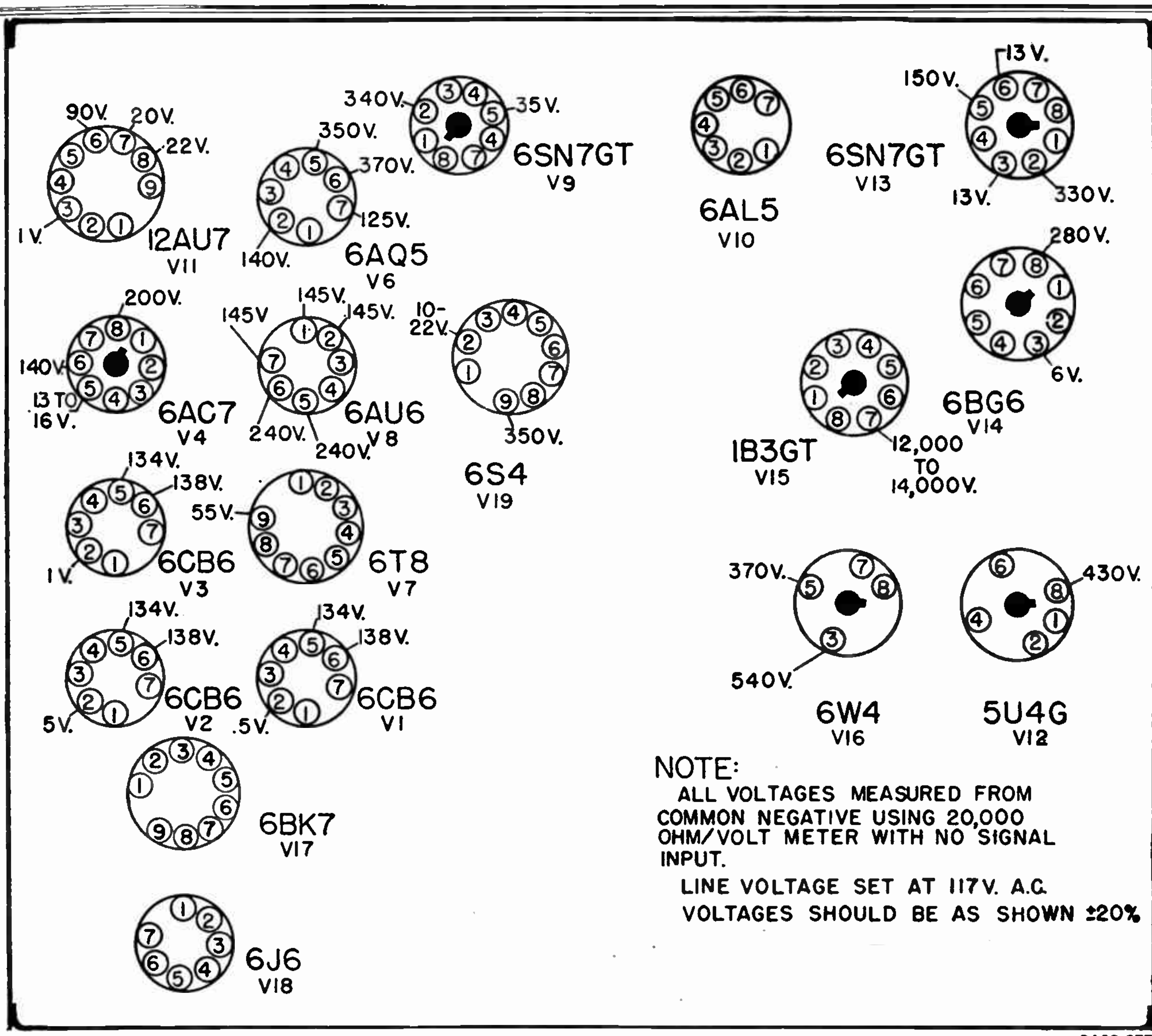


Fig. 6 BOTTOM SOCKET VIEW for Chassis Nos. 528.632, 528.632A, 528.632-1, 528.632A-1, 528.632-2 and 528.632A-2.

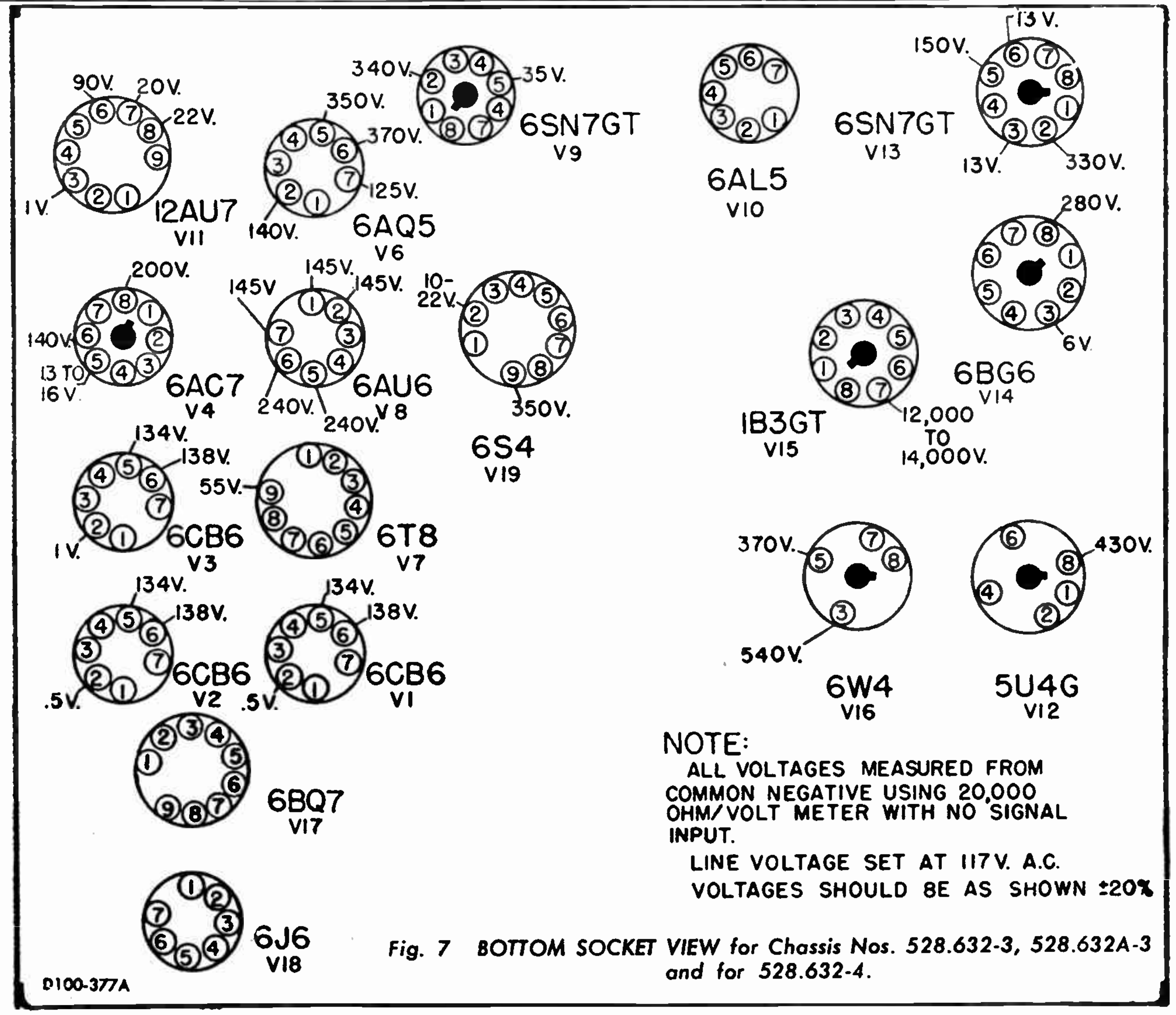


Fig. 7 BOTTOM SOCKET VIEW for Chassis Nos. 528.632-3, 528.632A-3 and for 528.632-4.

RESISTANCE CHART

SCHEMATIC LOCATION	TUBE FUNCTION	TUBE	PIN NUMBERS 1	2	3	4	5	6	7	8	9
V1	1st I F.	6CB6	1.5 M	68	0	0	50K	50K	0		
V2	2nd I. F.	6CB6	1.5 M	68	0	0	50K	50K	0		
V3	3rd I. F.	6CB6	.2	82	0	0	50K	50K	0		
V4	Video Amp.	6AC7	0	0	0	500K	150	50K	0	520K	
V6	Audio Output	6AQ5	280K	50K	50K	50K	510K	510K	280K		
V7	Ratio Detector & 1st Audio	6T8	Inf.	12K	Inf.	0	0	600K	0	5 M	320K
V8	Sound I. F.	6AU6	150K	50K	50K	50K	530K	530K	50K		
V9	Vertical Oscillator	6SN7	2 M	530K	0	2 M	*	0	0	0	
V10	Phase Detector	6AL5	5 M	5 M	0	0	15K	0	15K		
V11	Sync Separator-Amplifier	12AU7	700K	1.2 M	22K	0	0	56K	700K	2.2K	0
V12	Low V. Rectifier	5U4G	Inf.	510K	Inf.	25	Inf.	25	Inf.	510K	
V13	Horizontal Oscillator	6SN7	5 M	570K	1.5K	130K	*	1.5K	0	0	
V14	Horizontal Output	6BG6	*	0	50	*	1 M	Inf.	0	*	
V15	High V. Rectifier	1B3		Inf.		Inf.		Inf.	Inf.		
V16	Damper	6W4	Inf.	Inf.	*	*	510K	Inf.	Inf.	Inf.	
V19	Vertical Output	6S4	Inf.	1K	2 M	0	0	2 M	Inf.	Inf.	510K

Conditions: 1. All readings taken with a vacuum tube voltmeter. 2. All controls at "normal" setting. 3. Switch OFF; line cord disconnected. 4. All tubes left in sockets.

*These tube pins do not have a DC path to ground, therefore there is no resistance reading given. With the circuit in normal operating condition (i.e. no shorts, no open circuits), the ohmmeter will give a gradually increasing reading because the battery in the ohmmeter is charging up the condensers in the circuit. If the ohmmeter is left connected long enough, it will eventually give a reading which is the leakage resistance of all the condensers. The foregoing reading would be correct, of course, only if the ohmmeter is connected in the current polarity with respect to any electrolytic condensers in the circuit. If the ohmmeter *immediately* gives a definite resistance reading (either infinite resistance or zero or very low resistance), it is an indication of an open circuit (infinite resistance) or of a short circuit (very low resistance).

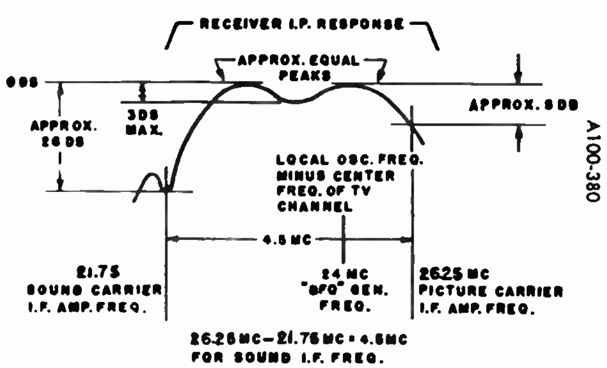


Fig. 8 I.F. AMPLIFIER RESPONSE for All Chassis Numbers Covered

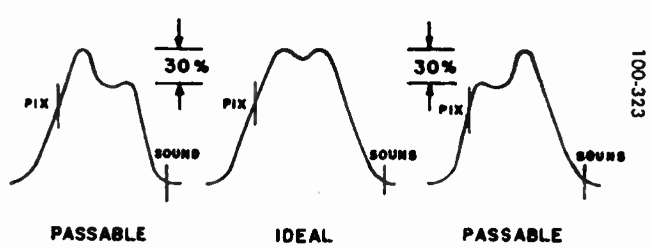


Fig. 9 OVERALL RESPONSE—ANTENNA TO PICTURE DETECTOR for All Chassis Numbers Covered

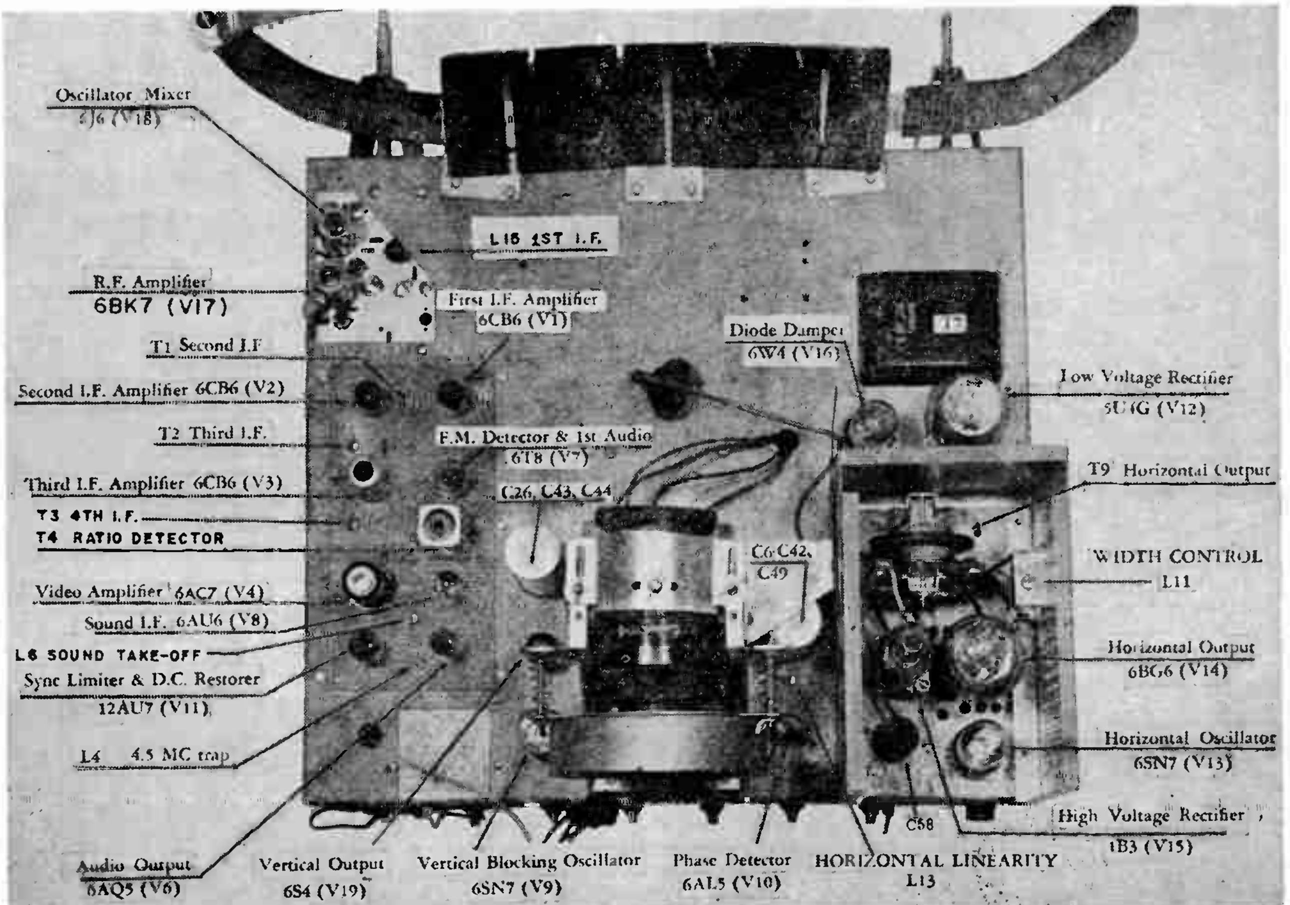


Fig. 10
Top View of Chassis Nos.:
528.632
528.632A
528.632-1
528.632A-1
528.632-2
528.632A-2

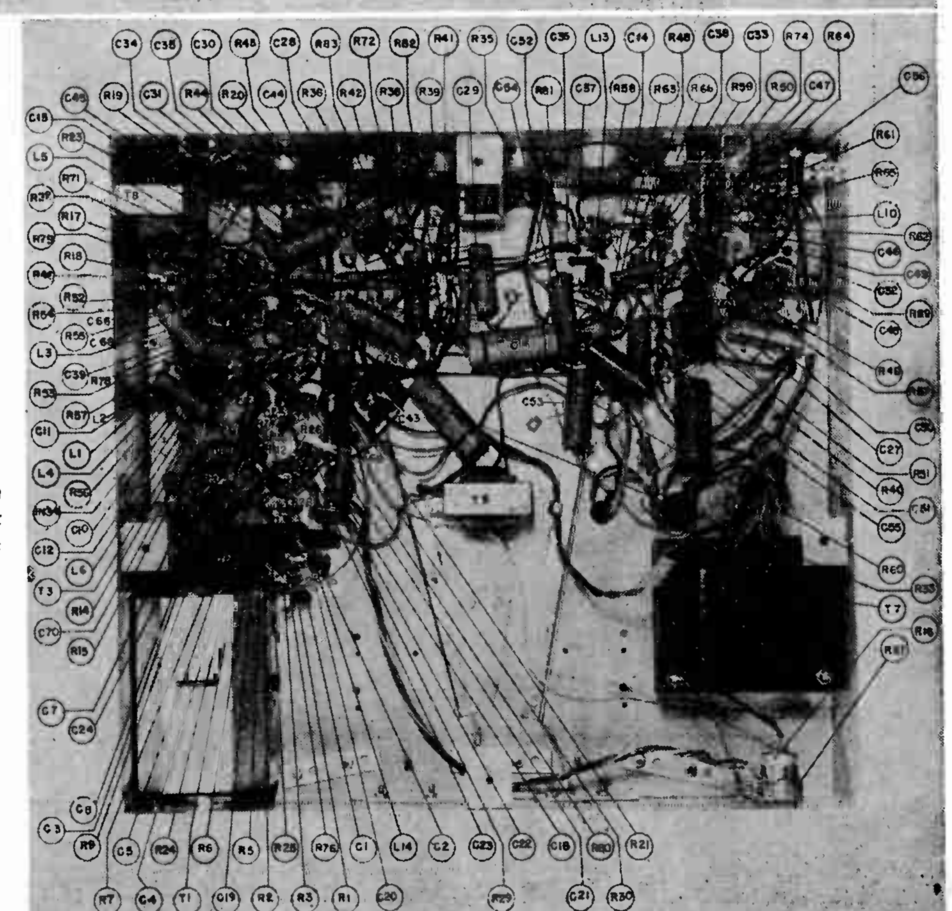


Fig. 11
Bottom View of Chassis with Parts Identified by Schematic Location for Chassis Nos.:
528.632
528.632A
528.632-1
528.632A-1
528.632-2
528.632A-2

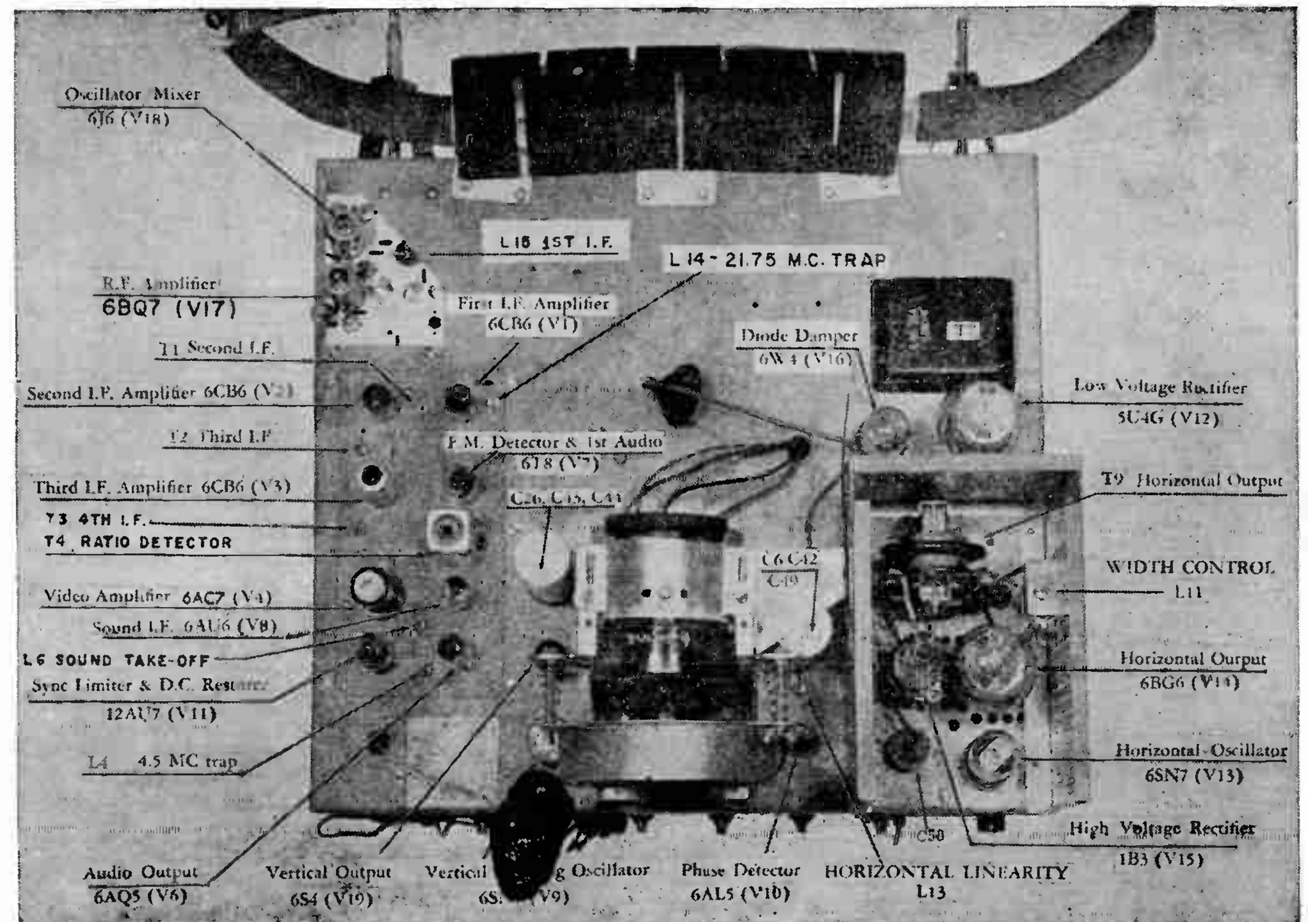


Fig. 12
Top View of Chassis Nos.:
528.632-3
528.632A-3
528.632-4

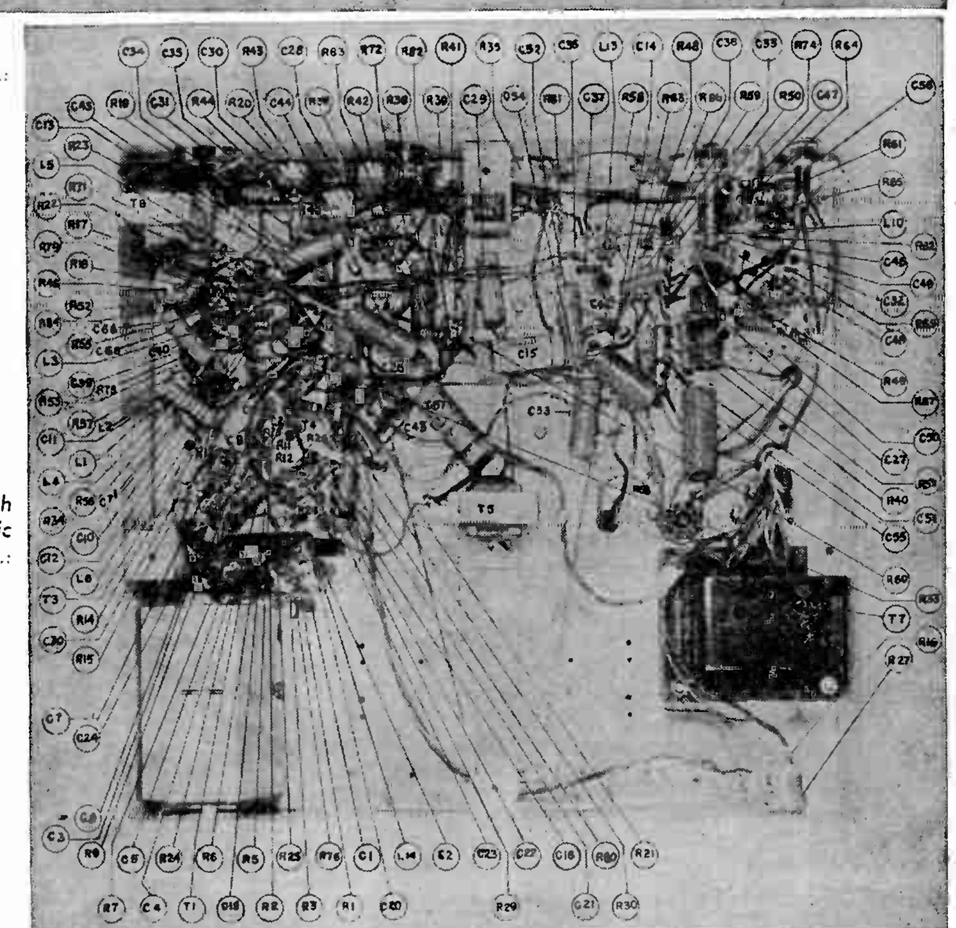


Fig. 13
Bottom View of Chassis with Parts Identified by Schematic Location for Chassis Nos.:
528.632-3
528.632A-3
528.632-4

REPAIR PARTS LIST

HOW TO ORDER REPAIR PARTS

1. Use Correct Order Form.
2. On the Purchase Order always give the following information:
   (1) PART NUMBER (number printed on the part if different from that shown in this list) and DESCRIPTION for each part ordered. When no part number is assigned, order by description and rating. Also give PRICE of part (indicate if no selling).
   (2) The CHASSIS NUMBER. This number is found on a metal plate (pictured on page one) at the rear of the chassis.

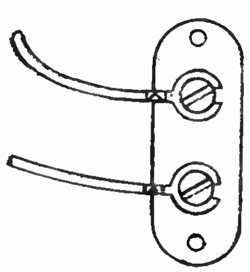
The Parts List for Chassis 528.631-1 is the same as 528.631 except for the parts listed below:

OMIT THE FOLLOWING PARTS:

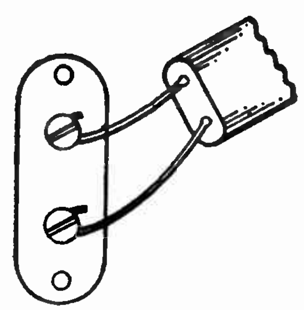
Schematic Location	Part Number	Part Description
		CAPACITORS
C48	T15-231	Capacitor, 390 mmfd.
C51	T16-219	Capacitor, .02 mfd., 1000 v.
		RESISTORS
R64	T60-759	Resistor, 4700 ohm, 10%
R68	T60-805	Resistor, 47 ohm, 1 w., 10%

ADD THE FOLLOWING PARTS:

Schematic Location	Part Number	Part Description
		CAPACITORS
C48	T15-236	Capacitor, 180 mmf., 10%
C51	T16-222	Capacitor, .025 mfd., 1000 v., 10%
		RESISTORS
R64	T60-703	Resistor, carbon, 1K ohm, 1/2 w., 10%
R68	T60-804	Resistor, wirewound, 15K ohm, 5 w., 10% (from pin 3 of 6W4 tube to pin of color socket
R77	T60-664	Resistor, 15 megohm, 1/2 w., (from Junction of R11 and R12 to Junction of R6 and R24)



BUILT-IN ANTENNA CONNECTIONS



ANTENNA CONNECTIONS USING 300-OHM RIBBON TYPE LEAD-IN

Beginning with production of chassis 528.632 and 528.632A, the antenna connection was changed to the type illustrated at left in order to provide an improvement in built-in antenna performance. The use of this connection was continued through all other chassis numbers covered

Fig. 14 Antenna Connections.

COMPLETE REPAIR PARTS LIST — CHASSIS 528.632 and 528.632A

SEE SCHEMATIC DIAGRAM

Schematic Location	Part Number	Description
		CAPACITORS
C1, C2, C4, C5, C7, C8, C20, C21, C24, C65, C69, C70	T16-177	Capacitor, ceramic, .005 mfd
C3, C16, C68	T16-188	Capacitor, tubular, .2 mfd., 400 v
C6, C26, C42, C43, C44, C49	T18-295	Capacitor, electrolytic, 100 mfd., 200 v. 40-40 mfd., 450 v
C9	T15-196	Capacitor, ceramic, 100 mmfd
C10	T15-223	Capacitor, ceramic, 10 mmfd
C11, C39	T16-189	Capacitor, tubular, .05 mfd., 400 v
C12		Part of L4-Capacitor, ceramic, 120 mmfd
C13	T16-212	Capacitor, tubular, .2 mfd., 600 v
C14	T18-276	Capacitor, electrolytic, 20 mfd., 450 v
C15	T18-299	Capacitor, electrolytic, 40 mfd., 240 v
C17, C38, C45	T16-201	Capacitor, tubular, .01 mfd., 600 v
C18, C40	T18-292	Capacitor, electrolytic, 4 mfd., 50 v
C19	T15-200	Capacitor, mica, 470 mmfd
C22	T15-228	Capacitor, ceramic, .002 mfd
C23	T15-230	Capacitor, mica, 220 mmfd
C25	T15-222	Capacitor, ceramic, 5 mmfd
C27	T16-218	Capacitor, molded tubular, .22 mfd., 600 v
C28, C50	T16-208	Capacitor, tubular, .1 mfd., 600 v
C29	T16-229	Capacitor, molded paper tubular, .05 mfd., 600 v. —5%, +30%
C30	T16-220	Capacitor, molded tubular, .0047 mfd., 600 v
C31, C34	T16-209	Capacitor, tubular, .006 mfd., 600 v
C32	T16-193	Capacitor, tubular, .05 mfd., 600 v
C33	T16-190	Capacitor, tubular, .005 mfd., 600 v
C35	T16-198	Capacitor, tubular, .002 mfd., 600 v
C36, C37	T15-220	Capacitor, ceramic, .001 mfd
C46	T15-226	Capacitor, silver mica, 330 mmfd
C47	T15-231	Capacitor, mica, 390 mmfd
C48	T15-236	Capacitor, ceramic, 180 mmfd
C51	T16-223	Capacitor, tubular, .025 mfd., 1000 v
C52	T16-216	Capacitor, tubular, .05 mfd., 1000 v
C53	T15-233	Capacitor, mica, 50 mmfd., 800 v
C54	T16-217	Capacitor, tubular, .25 mfd., 400 v
C55	T18-298	Capacitor, electrolytic, 8 mfd., 500 v
C56	T20-145	Capacitor, trimmer, HORIZONTAL DRIVE
C57	T18-302	Capacitor, electrolytic, 60 mfd., 200 v
C58	T15-234	Capacitor, ceramic, 500 mmfd., 20,000 v
C66	T16-213	Capacitor, tubular, .03 mfd., 600 v
C67	T15-235	Capacitor, mica, 150 mmfd
		RESISTORS
R1, R8, R82, R83	T60-759	Resistor, 4.7K ohm, 1/2 w. 10%
R2	T60-708	Resistor, 680 ohm, 1/2 w. 10%
R3, R7	T60-806	Resistor, 56 ohm, 1/2 w. 10%
R5, R67	T60-668	Resistor, 1 megohm, 1/2 w
R6, R9, R69	T60-752	Resistor, 100 ohm, 1/2 w. 10%
R10, R15	T60-776	Resistor, 82 ohm, 1/2 w. 10%
R11	T60-817	Resistor, 120K ohm, 1/2 w. 10%
R12, R14, R49	T60-731	Resistor, 470K ohm, 1/2 w
R13, R44, R45	T60-778	Resistor, 8.2K ohm, 1/2 w. 10%
R16, R27	T24-197	Resistor, variable (dual) VOLUME 500K ohm, CONTRAST 1K ohm
R17, R72	T60-760	Resistor, 10K ohm, 1/2 w. 10%
R18	T60-808	Resistor, 6.8K ohm, 2 w. 10%
R19, R22, R33, R47, R48, R65	T60-801	Resistor, 100K ohm, 1/2 w. 10%
R20, R66	T25-10	Resistor, variable, 50K ohm, BRILLIANCE and HORIZONTAL HOLD

COMPLETE REPAIR PARTS LIST — CHASSIS 528.632 and 528.632A — (Cont'd)

Schematic Location	Part Number	Description
R21	T60-816	Resistor, 3.3K ohm, 2 w. 10%
R23	T60-788	Resistor, 180K ohm, 1/2 w. 5%
R24, R62, R79	T60-747	Resistor, 270K ohm, 1/2 w. 10%
R25, R50	T60-779	Resistor, 4.7 megohm, 1/2 w
R26	T60-811	Resistor, 12K ohm, 1/2 w. 10%
R28	T60-730	Resistor, 47K ohm, 1/2 w
R29	T60-767	Resistor, 150 ohm, 1/2 w. 10%
R30	T60-810	Resistor, 22K ohm, 2 w. 10%
R31, R32	T60-758	Resistor, 560 ohm, 1/2 w. 10%
R35	T25-13	Resistor, variable, 2.5K ohm VERTICAL LINEARITY
R36	T60-726	Resistor, 2.2 megohm, 1/2 w
R38	T60-872	Resistor, 2.7 megohm, 1/2 w
R39	T25-15	Resistor, variable, 2 megohm, HEIGHT
R40, R63	T60-802	Resistor, 56K ohm, 1/2 w. 10%
R41, R76	T60-783	Resistor, 15K ohm, 1/2 w. 10%
R42	T25-17	Resistor, variable, 1 megohm, VERTICAL HOLD
R43, R57	T60-782	Resistor, 1.2 megohm, 1/2 w. 10%
R46, R53	T60-744	Resistor, 22K ohm, 1/2 w. 10%
R51	T60-716	Resistor, 15K ohm, 1 w. 10%
R52, R55	T60-714	Resistor, 2.2K ohm, 1/2 w. 10%
R54	T60-710	Resistor, 3.9K ohm, 1/2 w. 10%
R56	T60-807	Resistor, 680K ohm, 1/2 w. 10%
R58	T25-14	Resistor, variable, 2250 ohm, 4 w. FOCUS
R59	T60-814	Resistor, 330 ohm, 2 w. 10%
R60	T60-800	Resistor, wirewound, 800 ohm, 5 w. 10%
R61	T60-729	Resistor, 1.5K ohm, 1/2 w. 10%
R64	T60-703	Resistor, 1K ohm, 1/2 w. 10%
R68	T60-804	Resistor, wirewound, 15K ohm, 5 w. 10%
R70	T60-853	Resistor, wirewound, 25K ohm, 10 w. 10%
R71	T60-787	Resistor, 330K ohm, 1/2 w. 5%
R74	T60-667	Resistor, 220K ohm, 1/2 w
R75	T60-877	Resistor, 1 megohm, 1 w
R77	T60-664	Resistor, 15 megohm, 1/2 w
R78	T60-727	Resistor, 100K ohm, 1/2 w
R80	T60-878	Resistor, 8.2K ohm, 2 w. 10%
R81	T60-665	Resistor, 390 ohm, 1/2 w. 10%
		TRANSFORMERS AND COILS
T1	T10-541	Transformer, 2nd I.F. (blue)
T2	T10-542	Transformer, 3rd I.F. (white)
T3	T10-543	Transformer, 4th I.F. (red)
T4	T10-552	Transformer, ratio detector, 4.5 MC
T5	T80-261	Transformer, vertical output
T6	T80-257	Transformer, vertical blocking
T7	T80-264	Transformer, power
T8	T80-253	Transformer, output (audio)
	T80-265	Transformer, horizontal output
T9	T80-263	Transformer, horizontal output (alternate)
L1	T10-557	Coil, peaking, 90 uh (orange)
L2	T10-558	Coil, peaking, 375 uh (red)
L3	T10-566	Coil, peaking, 186 uh (grey) (on 12K 1/2 w. resistor)
L4	T10-571	Coil, 4.5 trap (includes C12)
L5	T10-565	Coil, peaking, 380 uh (purple) (on 10K 1 w. resistor)
L6	T10-556	Coil, 4.5 MC sound take-off, (includes 3 condensers)
L7, L12	T83-694	Coil, deflection yoke
L9	T10-560	Coil, focus
L10	T10-555	Coil, horizontal oscillating (includes 3900 mmfd. and 5.6 K)

COMPLETE REPAIR PARTS LIST — CHASSIS 528.632 and 528.632A —

Schematic Location	Part Number	Description
L11	T10-551	Coil, WIDTH CONTROL
L13	T10-561	Coil, HORIZONTAL LINEARITY
L14	T10-574	Coil, wave trap, 21.75 MC (includes 75 mmfd.)
		MISCELLANEOUS CHASSIS PARTS
	T22-165	Connector, high voltage
	T84-447	Cover assembly
	T21-161	Cover, high voltage cage
	T48-45	Crystal, 1N34
	T43-14	Fuse, 1/8 amp., 250 v. (Slo Blo) 3 AG type
	T43-12	Fuse, 5 amp., 250 v.
	T83-684	Ion trap, single magnet
	T37-122	Insulator, ceramic socket support
	T22-133	Jack, speaker
	T23-161	Line cord (8 ft.) and plug
	T45-130	Plug, color socket
	T95-29	R.F. Tuner (Cascode)
	T87-43	Receptacle, AC line
	T87-44	Receptacle, fuse holder
	T83-661	Retainer, tube shield
	T71-42	Shield, tube
	T68-18	Socket, octal molded
	T68-43	Socket, miniature, 7 pin
	T68-48	Socket, miniature, 9 pin (V19)
	T68-44	Socket, miniature, 9 pin (V7 & V11)
	T68-50	Socket, picture tube
	T68-53	Socket, octal, wafer (V15) 4 pins only
	T70-153	Spring, tube grounding (2 Req.)
	T27-24	Strap, picture tube support
	T83-693	Yoke mounting hood

CHASSIS 528.632-1 and 528.632A-1

SEE SCHEMATIC DIAGRAM ON INSERT AT END OF RL.

The parts list for chassis 528.632-1 and 528.632A-1 is the same as for chassis 528.632 and 528.632A. The difference between these models was a change in the I.F. frequencies, which were changed to the following:

1st IF	24.0 Mc.	3rd IF	23.8 Mc.
2nd IF	25.5 Mc.	4th IF	26.1 Mc.

The sound trap frequency has been changed to 21.75 Mc.

CHASSIS 528.632-2 and 528.632A-2

SEE SCHEMATIC DIAGRAM

The Parts List for Chassis 528.632-2 and 528.632A-2 is the same as for 528.632 and 528.632A except for the parts listed below:

OMIT THE FOLLOWING PARTS:

Schematic Location	Part Number	Part Description
		CAPACITORS
C17, C38, C45	T16-201	Capacitor, tubular, .01 mfd., 600 v.
C39	T16-189	Capacitor, tubular, .05 mfd., 400 v.
C28, C50	T16-208	Capacitor, tubular, .1 mfd., 600 v.
C29	T16-229	Capacitor, molded paper tubular, .05 mfd., 600 v. —5% 30%
C48	T15-236	Capacitor, ceramic, 180 mmfd.
C51	T16-223	Capacitor, tubular, .025 mfd., 1000 v.
C52	T16-216	Capacitor, tubular, .05 mfd., 1000 v.
C54	T16-217	Capacitor, tubular, .25 mfd., 400 v.
C32	T16-193	Capacitor, tubular, .05 mfd., 600 v.
		RESISTORS
R43	T60-782	Resistor, 1.2 megohm, 1/2 w., 10%
R64	T60-703	Resistor, 1K ohm, 1/2 w., 10%
R82	T60-759	Resistor, 4.7K ohm, 1/2 w., 10%
		MISCELLANEOUS CHASSIS PARTS
	T43-14	Fuse, 1/8 amp., 250 v. (Slo-Blo) 3 AG Type

CHASSIS 528.632-2 and 528.632A-2 — (Cont'd)

ADD THE FOLLOWING PARTS:

Schematic Location	Part Number	Part Description
		CAPACITORS
C17, C38, C45	T16-225	Capacitor, tubular, .01 mfd., 600 v.
C39, C32	T16-224	Capacitor, tubular, .05 mfd., 600 v.
C28, C50	T16-227	Capacitor, .1 mfd., tubular, 600 v.
C29	T16-230	Capacitor, molded paper tubular, .06 mfd., 600 v. 10%
C48	T15-232	Capacitor, mica, 120 mmfd
C51	T16-222	Capacitor, tubular, .025 mfd., 1000 v. 10%
C52	T16-228	Capacitor, molded tubular, .05 mfd., 1000 v.
C54	T16-226	Capacitor, tubular, .25 mfd., 400 v.
		RESISTORS
R43	T60-880	Resistor, 1.5 megohm, 1/2 w., 10%
R64	T60-675	Resistor, 1K ohm, 1/2 w.
R82	T60-756	Resistor, 1.2K ohm, 1/2 w., 10%
		MISCELLANEOUS CHASSIS PARTS
	T43-13	Fuse, 1/4 amp., 250 v., 3 AG type

CHASSIS 528.632-3 and 528.632A-3

SEE SCHEMATIC DIAGRAM

The Parts List for Chassis 528.632-3 and 528.632A-3 is the same as for 528.632-2 and 528.632A-2 except for the parts listed below:

OMIT THE FOLLOWING PARTS:

Schematic Location	Part Number	Part Description
C25	T15-222	Capacitor, ceramic, 5 mmfd.
	T95-29	R.F. tuner (Cascode)

ADD THE FOLLOWING PARTS:

Schematic Location	Part Number	Part Description
C25	T15-238	Capacitor, ceramic, 3.3 mmfd
C71	T16-177	Capacitor, ceramic, .005 mfd
	T95-30	R.F. Tuner (Cascode)

CHASSIS 528.632-4

SEE SCHEMATIC DIAGRAM

The Parts List for Chassis 528.632-4 is the same as for 528.632-3 and 528.632A-3 except for the parts listed below:

OMIT THE FOLLOWING PARTS:

Schematic Location	Part Number	Part Description
C53	T15-233	Capacitor, mica, 50 mmfd., 800 v.
C58	T15-234	Capacitor, ceramic, 500 mmfd., 20,000 v.
R31, R32	T60-758	Resistor, 560 ohm, 1/2 w., 10%
R51	T60-716	Resistor, 15K ohm, 1 w., 10%
T9	T80-265	Transformer, horizontal output
	T80-263	Transformer, horizontal output (alternate)
	T37-122	Insulator, ceramic socket support
	T45-130	Plug, color socket
	T68-53	Socket, octal, wafer (V15) (4 pins only)

ADD THE FOLLOWING PARTS:

Schematic Location	Part Number	Part Description
C53		Part of deflection yoke (T-83-694)
C58	T15-239	Capacitor, ceramic, 500 mmfd., 20,000 v.
R4	T60-881	Resistor, 2.2 ohm, 1/2 w., 10%
R31, R32		Part of deflection yoke (T-83-694)
R51	T60-887	Resistor, 15K ohm, 1 w., 10%
T9	T80-279	Transformer, horizontal output
	T37-139	Insulator, resistor support
	T68-56	Shell, Corona
	T68-55	Socket, Ring Mounting (Corona Shell)

CHASSIS 528.632-5 and 528.632A-5

The Parts List for Chassis 528.632-5 and 528.632A-5 is the same as for 528.632-2 and 528.632A-2 except for the parts listed below.

The improved Cascode Tuner (Part No. T95-30) was substituted for Part No. T95-29 in some receivers built with this chassis number.

OMIT THE FOLLOWING PARTS:

Schematic Location	Part Number	Part Description
C58	T15-234	Capacitor, ceramic, 500 mmfd., 20,000 v.
T9	T80-265	Transformer, horizontal output
	T37-122	Insulator, ceramic socket support
	T68-53	Socket, octal, wafer (V15) (4 pins only)

ADD THE FOLLOWING PARTS:

Schematic Location	Part Number	Part Description
C58	T15-239	Capacitor, 500 mmfd., ceramic
R4	T60-881	Resistor, 2.2 ohm, 1/2 w., 10%
T9	T80-279	Transformer, horizontal output
	T37-139	Insulator, resistor support
	T68-55	Socket, Ring Mounting (Corona Shell)
	T68-56	Shell, Corona

CABINET REPAIR PARTS LIST

Part Number	Description
	Sears No. 2110-A
T32-21	Back
T42-515	Cabinet
T21-170	Cover
T48-58	Glass, TV, Safety
T52-351	Knob, Channel Selector
T52-352	Knob, fine tuning
T52-353	Knob, Off-volume
T52-354	Knob, contrast
T31-197	Mask
T36-126	Wire Screen (2 req.)
T45-125	Plug Speaker
T79-397 5″ P.M.	Speaker
	Sears No. 2111
T32-21	Back
T42-524	Cabinet
T21-170	Cover
T48-58	Glass, TV, Safety
T52-373	Knob, Channel Selector
T52-374	Knob, fine tuning
T52-375	Knob, off-volume
T52-376	Knob, contrast
T31-197	Mask
T36-126	Wire Screen (2 req.)
T45-125	Plug speaker
T79-397	Speaker 5″ P.M.
	Sears No. 2112
T32-21	Back
T42-525	Cabinet
T21-170	Cover
T48-58	Glass, TV, Safety
T52-360	Knob, channel selector
T52-378	Knob, fine tuning
T52-361	Knob, off-volume
T52-379	Knob, contrast
T31-197	Mask
	Sears No. 2160
T32-22	Back
T42-516	Cabinet
T21-170	Cover
T48-60	Glass, TV, Safety
T52-360	Knob, channel sel
T52-352	Knob, fine tuning
T52-361	Knob, off-volume
T52-354	Knob, contrast
T31-196	Mask
T36-126	Wire Screen (2 req.)
T45-125	Plug speaker
T79-399	Speaker 8″ P.M.

Part Number	Description
T36-126	Wire Screen (2 req.)
T45-125	Plug speaker
T79-397 5″ P.M.	Speaker
	Sears No. 2115-B
T32-21	Back
T42-518	Cabinet
T21-170	Cover
T48-61	Glass, TV, Safety
T52-360	Knob, channel Sel
T52-352	Knob, fine tuning
T52-361	Knob, off-volume
T52-354	Knob, contrast
T31-199	Mask
T36-126	Wire Screen (2 req.)
T45-125	Plug speaker
T79-398	Speaker 6″ P.M.
	Sears No. 2150-B
T32-21	Back
T42-517	Cabinet
T21-170	Cover
T48-59	Glass, TV, Safety
T52-351	Knob, channel Sel
T52-352	Knob, fine tuning
T52-353	Knob, off-volume
T52-354	Knob, contrast
T31-198	Mask
T36-126	Wire Screen (2 req.)
T45-125	Plug speaker
T79-398 6″ P.M.	Speaker
	Sears No. 2162
T32-22	Back
T42-526	Cabinet
T21-170	Cover
T48-60	Glass, TV, Safety
T52-360	Knob, channel sel.
T52-378	Knob, fine tuning
T52-361	Knob, off-volume
T52-379	Knob, contrast
T31-196	Mask
T36-126	Wire Screen (2 req.)
T45-125	Plug speaker
T79-399	Speaker 8″ P.M.

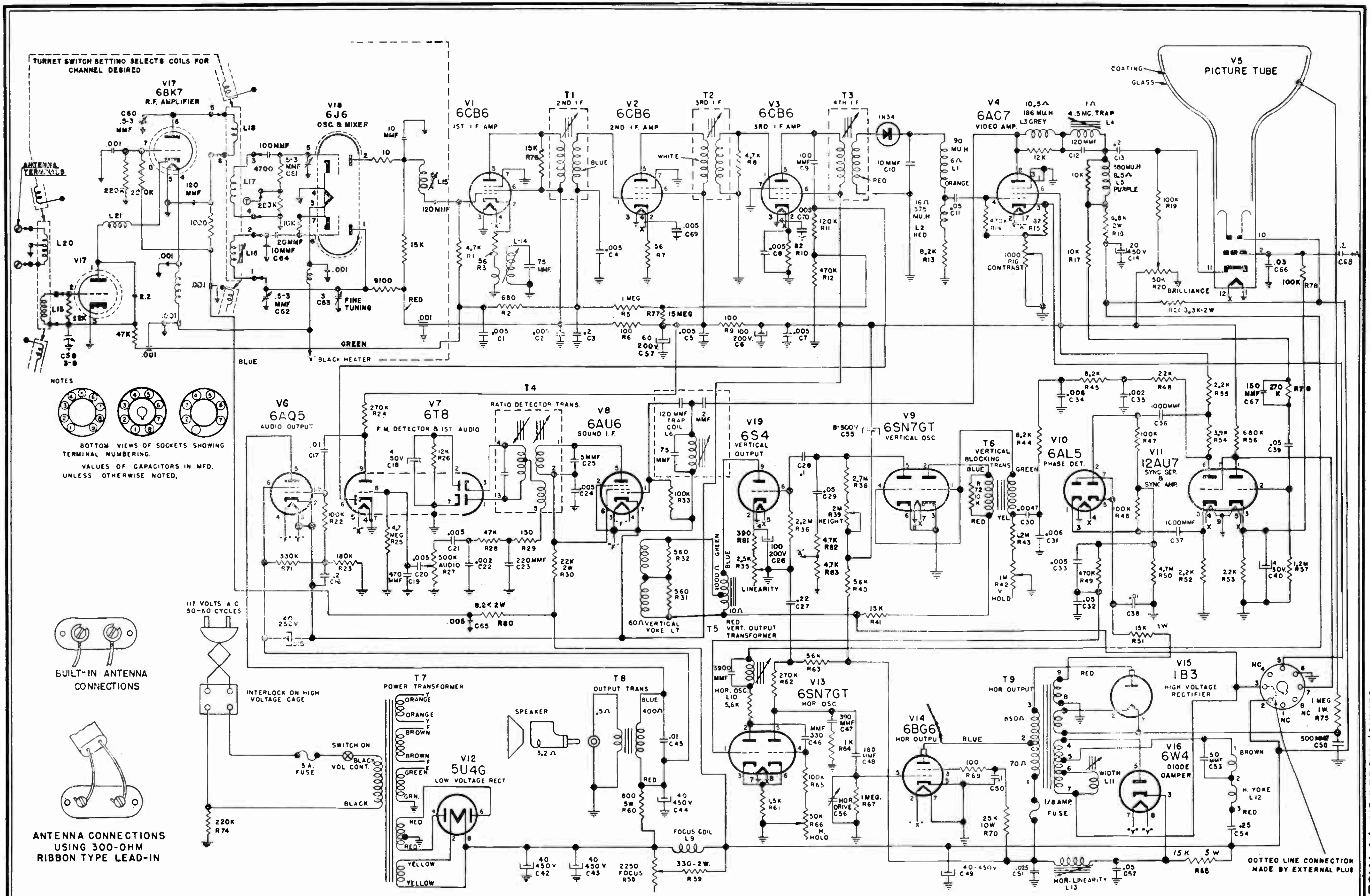


Fig. 15 Schematic Diagram for Chassis Nos. 528.632 and 528.632A.
This Diagram is Also for Chassis Nos. 528.632-1 and 528.632A-1.

D100-375

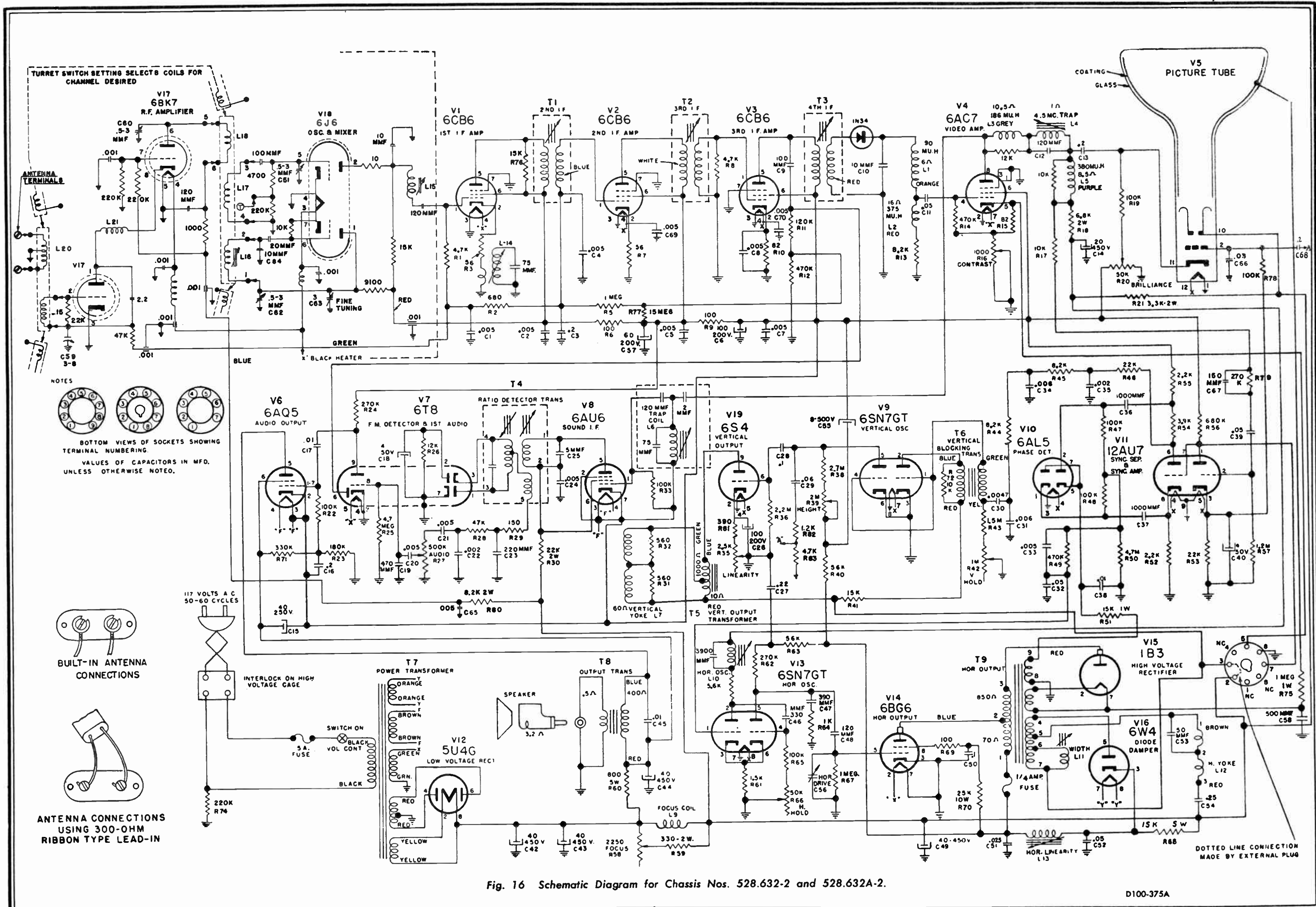


Fig. 16 Schematic Diagram for Chassis Nos. 528.632-2 and 528.632A-2.

D100-375A

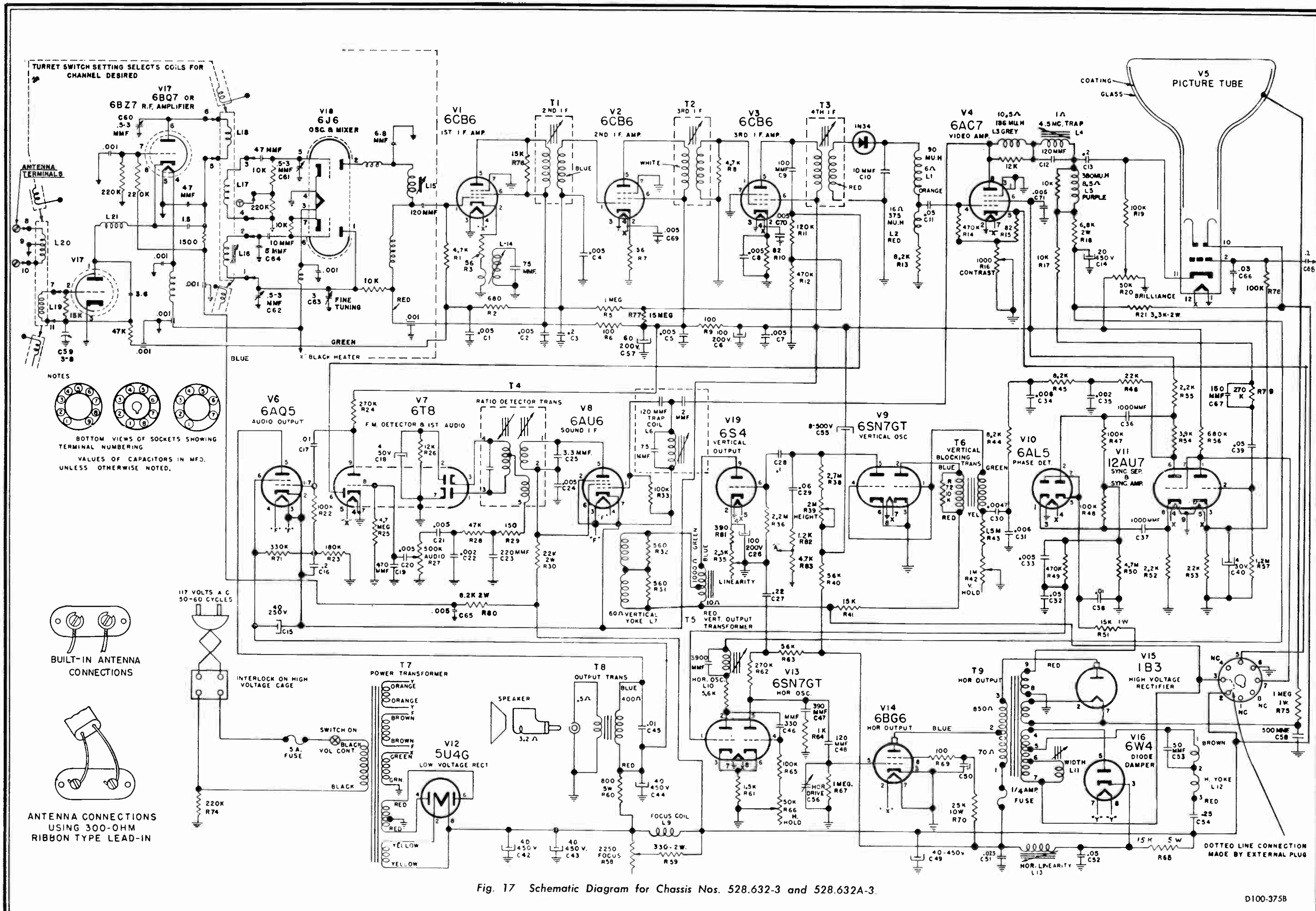


Fig. 17 Schematic Diagram for Chassis Nos. 528.632-3 and 528.632A-3.

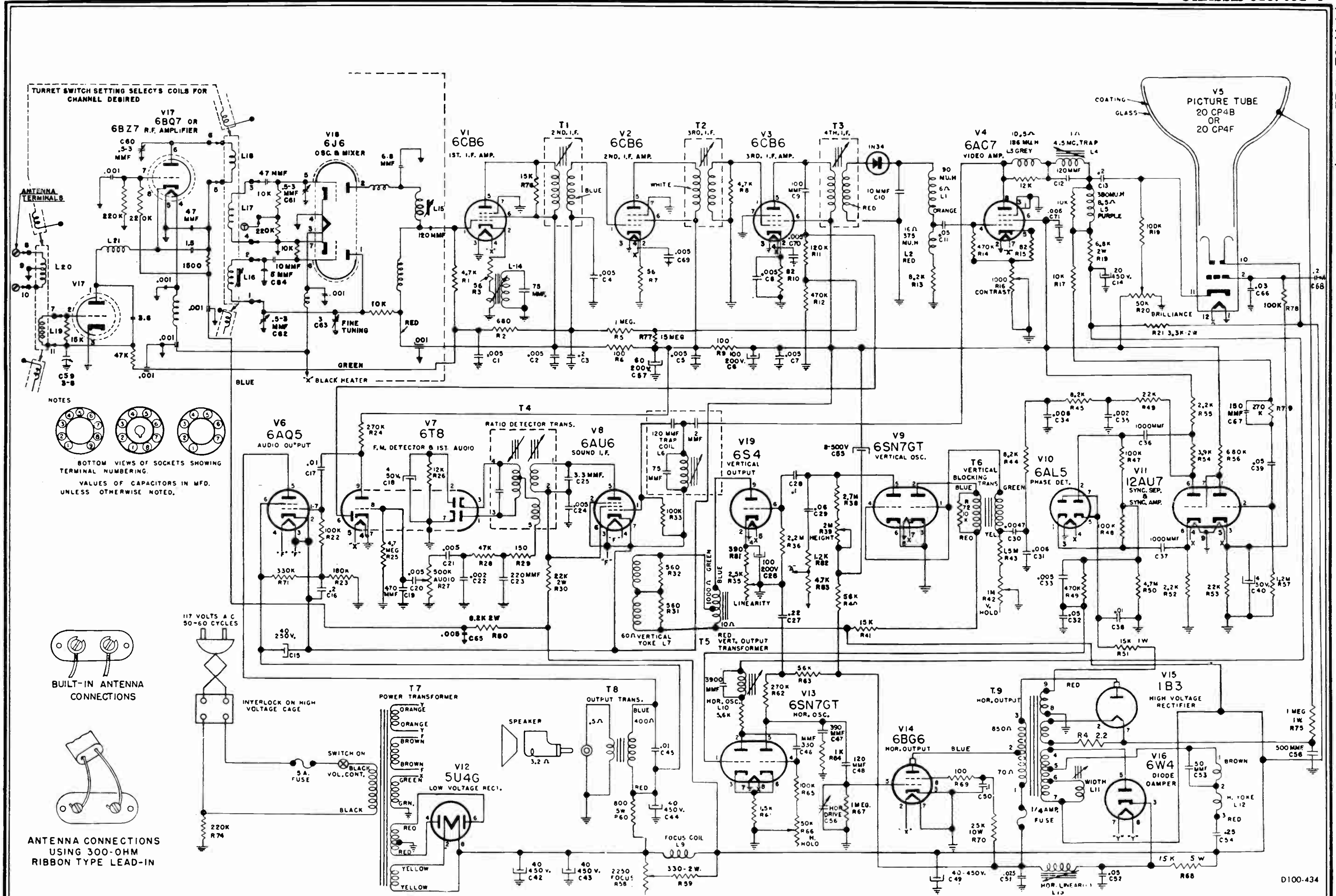


Fig. 18 Schematic Diagram for Chassis No. 528.632-4.

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SPECIFICATIONS

POWER REQUIREMENTS

117 volts 60 cycles 200 watts

PICTURE SIZE

21" Rectangular

SPEAKER

	Type	Size	V.C. Imped.
1176-21	P.M. Dynamic	6"	3.2 ohms
1186-21	P.M. Dynamic	6" x 9"	3.2 ohms

ANTENNA INPUT IMPEDANCE

Balanced input for ribbon type transmission line—300 ohms.

BUILT-IN ANTENNA

Broad band dipole.

R. F. TUNER

Turret type construction; individually removable coil assemblies for all channels. All components are easily accessible for servicing.

INTERMEDIATE FREQUENCIES

Sound Carrier—22.25 Mc.
Picture Carrier—26.75 Mc.

I.F. SYSTEM

Three Stages—stagger tuned—for composite signal. One additional stage for sound channel.

VIDEO AMPLIFIER

Broad band.

RETRACE LINE SUPPRESSOR

Eliminates retrace lines thruout the normal range of picture brightness and contrast.

FOCUS

Electromagnetic with an auxiliary control on the front panel.

DEFLECTION

Magnetic

DETECTOR

Sound—Ratio Type
Picture—Germanium Crystal Type

HORIZONTAL SYNCHRONIZATION

Automatic frequency control A.G.C. provides excellent picture stability and noise immunity.

HIGH VOLTAGE POWER SUPPLY

"Fly-back" type. Completely enclosed in a shielded compartment.

GENERAL DESCRIPTION

SILVERTONE 1176-21
(21" RECTANGULAR PICTURE TUBE)

The information contained in this service RL covers numbers 1176-21 and 1186-21. Both receivers utilize the same chassis 100.208 and differ only as to cabinet design, one being a table model while the other is a console model.

Seventeen tubes are used solely for reproduction of the visual and aural portions of the television broadcast. In addition, a heavy duty transformer and two rectifier tubes provide power for operation of all stages.

Outstanding circuit features of the receivers include a high gain R.F. tuner which is noted for its stability and rugged mechanical construction, an inter-carrier sound system which is free from distortion normally caused by oscillator drift, automatic frequency control of horizontal sync system, automatic gain control, and retrace line suppression.

Exceptional sensitivity is achieved by a thoroughly stable and A.G.C. controlled R.F. amplifier and three stages of I.F. amplification followed by a broad-band video amplifier. Another important feature is the compactly designed built-in antenna.

SILVERTONE 1186-21
(21" RECTANGULAR PICTURE TUBE)

Suppression of retrace lines by an ingenious circuit arrangement contributes to ease of operation of the receiver. This highly desirable performance feature permits a wide variety of picture brightness and contrast control settings without appearance of retrace lines.

Orderly and well spaced arrangement of all components on a generously proportioned chassis pan permits easy access to all circuits for measurements and analysis.

TUBE COMPLEMENT

TUBE NO.	TUBE TYPE	FUNCTION
V1	6AU6	1st Sound Amplifier—Limiter
V2	6T8	Sound Discriminator — Sound Amplifier
V3	6AS5	Sound Output
V4	6BK7	RF Amplifier
V5	6J6	Oscillator — Mixer
V6	6CB6	1st IF Amplifier
V7	6CB6	2nd IF Amplifier
V8	6CB6	3rd IF Amplifier
V9	6SN7GT	A.G.C. — Sync Amplifier
V10	6AC7	Video Amplifie
V11	21AP4	Picture Tube
V12	12AU7	Sync Clipper — Phase Splitter
V13	6AL5	Horizontal AFC — Phase Detector
V14	6SN7GT	Horizontal Scanning Multivibrator
V15	6BQ6GT	Horizontal Scanning Output
V16	1X2A	High Voltage Rectifier
V17	6W4GT	Horizontal Damping
V18	5U4G	Rectifier
V19	6BL7GT	Vertical Blocking Oscillator— Vertical Scanning Output

TELEVISION CHANNELS & FREQUENCIES

CHANNEL NO.	FREQ. MC.	PICTURE CARRIER MC.	SOUND CARRIER MC.	HETERODYNE OSC. FREQ. MC.
2	54 — 60	55.25	59.75	82.00
3	60 — 66	61.25	65.75	88.00
4	66 — 72	67.25	71.75	94.00
5	76 — 82	77.25	81.75	104.00
6	82 — 88	83.25	87.75	110.00
7	174 — 180	175.25	179.75	202.00
8	180 — 186	181.25	185.75	208.00
9	186 — 192	187.25	191.75	214.00
10	192 — 198	193.25	197.75	220.00
11	198 — 204	199.25	203.75	226.00
12	204 — 210	205.25	209.75	232.00
13	210 — 216	211.25	215.75	238.00

RECEIVER OPERATING CONTROLS

The various controls on the receiver may be divided into two classes, Operating and Pre-Set. Operating controls are those which control program selection as well as sound and picture quality.

All the operating controls of the receiver are located on the front panel and the name and use of each are described in Figure 1. More detailed instructions on the application of the operating controls are given in the following section, while a description and function of each of the Pre-set controls will be found in the section entitled "Control Adjustment Procedure."

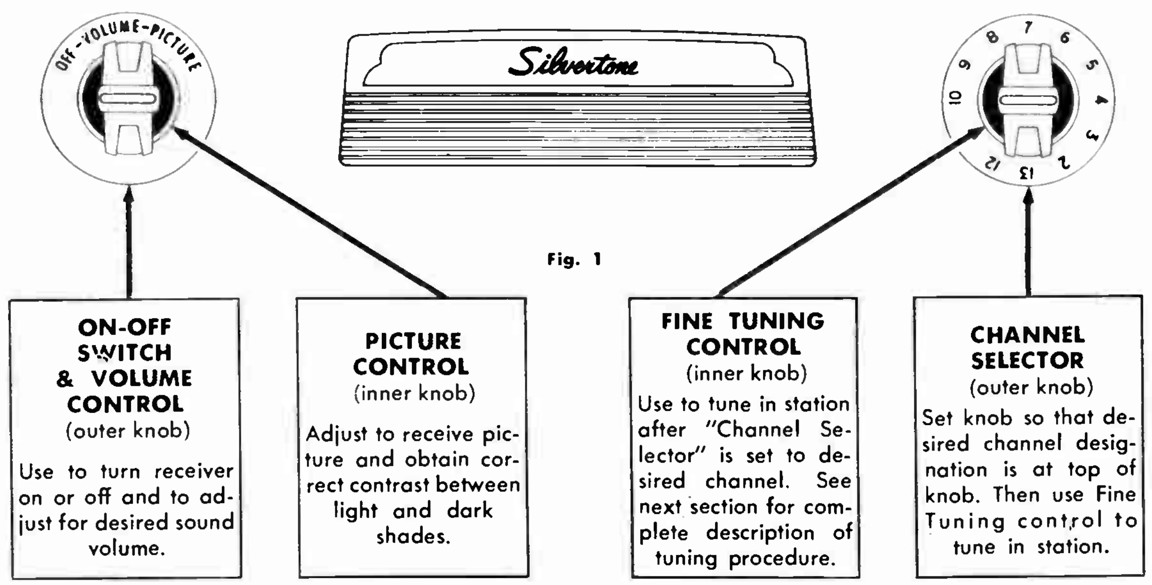


Fig. 1

HOW TO TUNE THE RECEIVER

This receiver is designed to be used for reception of sight and sound programs from local television transmitting stations operating on any of the twelve commercial television channels assigned by the Federal Communications Commission.

In order to select a particular station and adjust the various operating controls for correct picture and accompanying aural reception, proceed as follows:

1. Check to be sure that a television station is on the air at the time you wish to operate the receiver. Program schedules are usually published in daily newspapers and many stations will mail copies of their weekly broadcast schedule to set owners upon request.

2. Rotate the "On-Off Switch and Volume" knob approximately ½ turn clockwise to turn set on and obtain sufficient sound volume during the tuning process. Allow several minutes for all tubes in the receiver to warm up and for circuits to stabilize before attempting to obtain a picture on the screen.

3. Turn the "Picture" control knob approximately ¾ turn clockwise.

4. Set "Channel Selector" by turning this knob so that the desired television channel is at the top of the knob. Channel numbers for all television stations operating in your area will be found in your local newspaper.

5. After "Channel Selector" knob has been set, then use the "Television Fine Tuning" control to obtain the correct tuning point for both picture and sound. That is accomplished as follows:

   a. Turn "Television Fine Tuning" control in either direction until sound volume is maximum—if sound cannot be heard, advance the volume control and repeat fine tuning.

   b. When the point of maximum sound volume has been reached it will be noted that the picture has a "ragged" or "saw-tooth" appearance or is partially obscured by "sound bars" (dark horizontal bars of varying width—see Fig. 2).

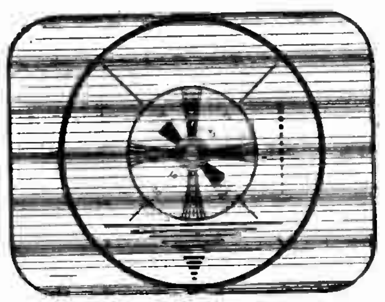


Fig. 2—SOUND INTERFERENCE CAUSED BY INCORRECT TUNING

THE CORRECT SETTING OF THE TELEVISION FINE TUNING CONTROL is now obtained by turning it away from the maximum volume position only far enough to eliminate the "sound bar" interference and permit sharp reproduction of the picture.

6. Readjust the setting of the "Volume" control until the sound accompanying the television broadcast is received at a satisfactory level.

7. The Setting of the "Picture" control should now be adjusted for the most pleasing picture. This control adjusts the black and white contrast between the various picture elements. Too much contrast is apparent when the picture is lacking in gradations between black and white or the picture loses form (see Fig. 3). Too little contrast (or a very weak signal from the station) causes the picture to appear faded as illustrated in Fig. 4.

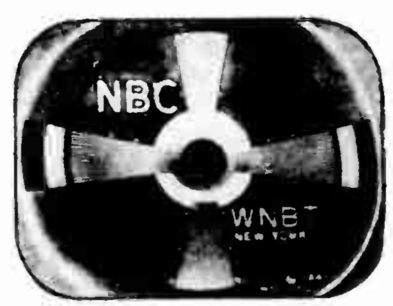


Fig. 3—REDUCE CONTRAST; ADJUST PICTURE CONTROL

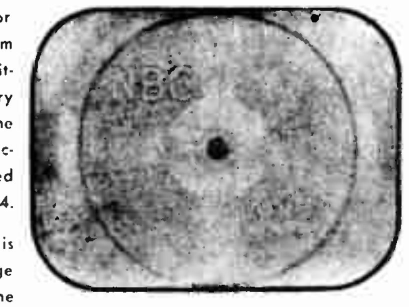


Fig. 4—INCREASE CONTRAST; ADJUST PICTURE CONTROL

If picture brightness is not as desired, change the position of the pre-set "Brightness" control located under the Name Plate on the front panel. This plate is hinged at the bottom; to gain access to the control, merely tilt plate forward.

8. After all of the aforementioned controls have been correctly adjusted, the picture should be clear and steady and all shades between black and white will be readily discernible. It is preferable to adjust the "Picture" control during the test pattern transmission which usually precedes the regular telecast as use of the test pattern permits much finer adjustment than can be made with ordinary pictorial scenes.

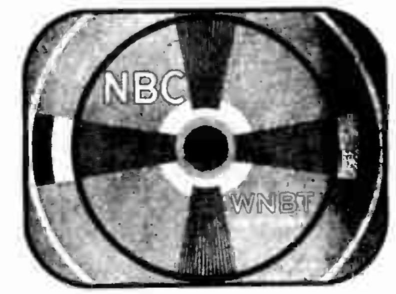


Fig. 5
CORRECTLY ADJUSTED PICTURE

9. During intervals in which stations are only televising their test patterns, the sound will be a sustained note. These test patterns (Fig. 5) and special sound transmissions are used by television installation men to adjust certain pre-set controls at the time a receiver is installed.

ANTENNA REQUIREMENTS

USE OF BUILT-IN ANTENNA—This television receiver is equipped with the new built-in antenna intended to provide satisfactory reception in locations where fairly strong signals may be obtained from local transmitting stations and where electrical interference is not excessive.

To insure maximum performance of the built-in antenna it will be necessary to properly orient the entire receiver. A trial will reveal the position of best reception with the least interference. Avoid locating the receiver near large metal objects such as a radiator or too close to a wall which is known to contain metal lath or steel beams.

USE OF AN OUTDOOR ANTENNA—In cases where station signals are very weak, or reflections prove troublesome, and the built-in antenna does not provide satisfactory reception, then an outdoor antenna will be required. Use of the outdoor type antenna is particularly desirable in weak signal or "fringe" areas as it can be located at greater height above the ground (where signals are stronger) and free of surrounding obstructions.

The outdoor antenna should have a broad frequency response characteristic whose impedance closely matches the 300 ohm input impedance of the receiver.

Before connecting the lead-in from an outdoor antenna to the receiver's terminal strip, it first will be necessary to disconnect the receiver's built-in antenna leads from this strip.

CONTROL ADJUSTMENT PROCEDURE

The various controls on the receiver may be divided into two classes, Operating and Pre-set. Operating controls are those which control program selection as well as sound and picture quality and their functions are indicated in Fig. 1.

There are nine Pre-set controls, two of which are located at the back of the chassis (see Figure 16). Six controls are located under the Name Plate on the front panel. This plate is hinged at the bottom; to obtain access to controls, merely tilt plate forward. The Auxiliary Fine Tuning Screw can be reached by removing the "Channel Selector" and "Television Fine Tuning" knobs.

To gain access to the centering adjustments and ion trap, it will be necessary to remove the back of the cabinet by taking out the screws around edges.

Operate the receiver according to the instructions given in the section of this manual entitled "How To Tune The Receiver" and make the following adjustments as required.

1. **ADJUST ION TRAP**—If screen remains dark or is only dimly illuminated when "Brightness" control is turned clockwise, the ion trap may require adjustment.

   The ion trap is located on the neck of the picture tube as shown in Figure 16 and consists of a magnet held in position by metal bands. With "Brightness" control (located behind Name Plate) set approximately ½ turn clockwise, rotate the entire ion trap assembly while sliding it back and forth until picture tube screen is illuminated to maximum brilliance. Reduce "Brightness" control setting and repeat this operation to assure accurate positioning of ion trap.

   Do not turn "Brightness" control to its maximum clockwise position until ion trap is correctly adjusted—failure to observe this precaution may result in damage to the picture tube.

   CAUTION: There is only ONE correct setting of the ion trap. This position is attained when maximum brilliancy occurs on the picture tube screen. If defocusing of picture or neck shadow results, DO NOT adjust position of ion trap—see instructions located elsewhere in this manual for removing these aforementioned faults. Failure to observe this precaution will result in an ion burn (brown spot) on the face of the picture tube. Since this condition is brought about by lack of proper ion trap adjustment at time of receiver installation, the picture tube will not be eligible for warranty adjustment.

2. **AUXILIARY FINE TUNING ADJUSTMENT**—If it is found that the tuning range of the "Fine Tuning" control is inadequate to permit correct tuning of a station in its assigned channel, then adjustment of the "Auxiliary Fine Tuning" screw will be necessary. This special screw is accessible after removal of the "Channel Selector" and "Fine Tuning" knobs. They may be removed by merely pulling them forward.

   Adjustment of the "Auxiliary Fine Tuning" screw may be undertaken in accordance with the following procedure.

   a. Set "Channel Selector" to desired channel; then remove this knob.

   b. Set "Fine Tuning" knob to the center of its range; then remove this knob. The flat portion of the main tuning shaft (outer shaft) should now be in the uppermost position. Note the location of the "Auxiliary Fine Tuning" adjustment screw on receiver chassis—see Fig. 13

c. Using a thin screwdriver (preferably non-metallic), adjust the setting of "Auxiliary Fine Tuning" screw for correct tuning of the desired television station—**CAUTION: Do not attempt to rotate this screw more than two full turns in either direction, as further rotation may release it from the thread clip within the tuning mechanism and the coil for that channel (located in R.F. Tuner Unit) would then have to be removed in order to restore the screw to the correct position.** If a metal screwdriver is used, detuning occurs when the screwdriver is removed but it will be noted that this degree of detuning can now be compensated by resetting the "Television Fine Tuning" control (outer shaft). Thus the range of the "Television Fine Tuning" control (after knob is replaced on the shaft) will be adequate to tune in the station.

d. This completes the adjustment of the "Auxiliary Fine Tuning" screw for one channel. Identical screws are provided on each channel and they are all accessible thru the same opening in the tuning mechanism as each successively moves into position when the "Channel Selector" knob is rotated.

3. **HORIZONTAL HOLD**—Should the picture appear to move horizontally across the screen or break up into a series of light and dark streaks as shown in Figure 6 adjust the "Horizontal Hold" control (located behind Name Plate) until the picture remains stationary and does not slip horizontal sync when operating "Channel Selector" knob.

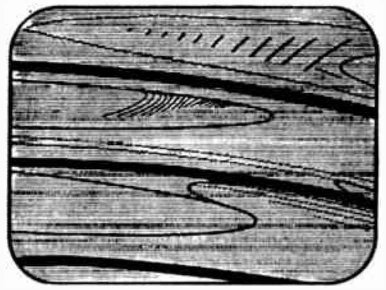


Fig. 6—HORIZONTAL MOVEMENT; ADJUST HORIZ. HOLD CONTROL

4. **VERTICAL HOLD**—Should the picture appear to roll by in a vertical direction or cause multiple vertical images as shown in Figure 7, it will be necessary to adjust the "Vertical Hold" control located behind the Name Plate (see Figure 13).

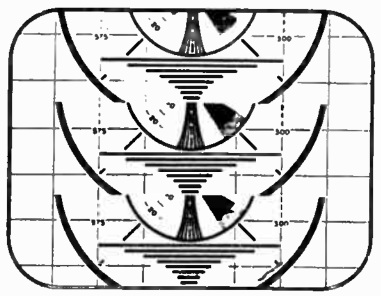


Fig. 7—VERTICAL MOVEMENT; ADJUST VERTICAL HOLD CONTROL

After this adjustment is made, reduce contrast until picture is barely visible and check setting of "Vertical Hold" control for proper picture synchronization.

5. **INITIAL FOCUS**—Adjust the "Focus" control, located behind name plate, until picture is clearly defined. Fuzzy picture may also be due to reproduction of poor quality film when station is televising a motion picture. Incorrect tuning of receiver produces a similar effect. Check for proper tuning point as described in step 5 of section entitled "How To Tune the Receiver."

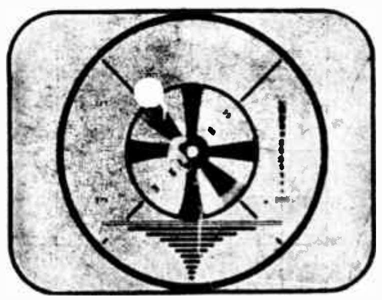


Fig. 8—BLURRED APPEARANCE; ADJUST FOCUS CONTROL

The following adjustments should be made while the station is transmitting its circular test pattern.

6. **STRAIGHTENING TILTED RASTER**—if the pattern should appear on the screen in a tilted position as shown in Figure 9, loosen the deflection yoke locking screw labeled A in Fig. 16 and rotate the yoke sufficiently to correct this condition. Be sure to re-tighten the screw securely.

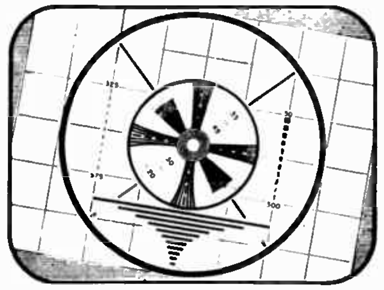


Fig. 9—TILTED PICTURE; ADJUST YOKE POSITION

7. **CENTERING**—To center the test pattern on the screen, position focus coil by adjusting the three nuts labeled B in Fig. 16.

NOTE: If a decrease in picture tube brilliance is noted when making the centering adjustment readjust ion trap as explained in step #1.

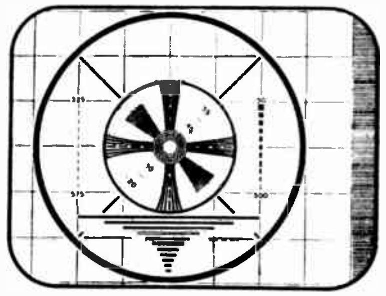


Fig. 10—OFF CENTER; ADJUST FOCUS COIL POSITION

8. **HEIGHT** — Control of picture size in the vertical direction is accomplished by means of the "Height" control located behind the Name Plate. Height and width adjustments should be checked for all transmitting stations to be sure that picture properly fills the viewing area. It may be necessary to change the setting of the "Height" control after the "Vertical Linearity" control is adjusted.

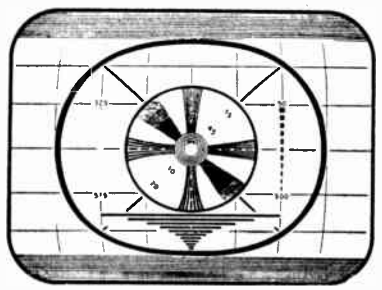


Fig. 11—TOO SHORT; ADJUST HEIGHT CONTROL

9. **WIDTH** — Control of picture size in the horizontal direction is accomplished by means of the "Width" control located on the rear of H. V. power supply (see Fig. 16).

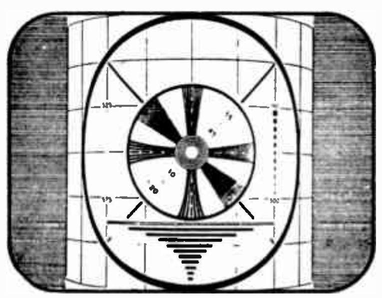


Fig. 12—TOO NARROW; ADJUST WIDTH CONTROL

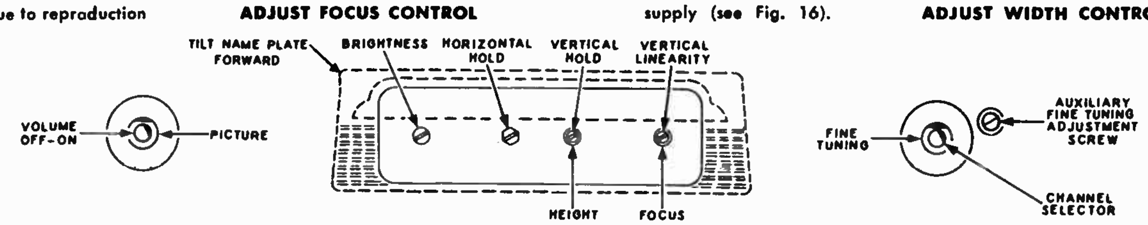


Fig. 13—LOCATIONS OF PRE-SET CONTROLS

If abnormally low line voltage makes it difficult to obtain sufficient picture width when using the "Width" control, then the setting of the "Horizontal Drive" control may be incorrect. The method of adjusting this control is explained in paragraph # 12.

10. **VERTICAL LINEARITY** — Improper vertical linearity causes the circular test pattern to appear condensed on the upper edge of the screen and extended on the lower edge or vice versa. This effect is illustrated in Figure 14. Adjust for proper linearity by using "Vertical Linearity" control located behind Name Plate. It may be necessary to readjust the "Height" control if an appreciable change is made in the linearity control setting.

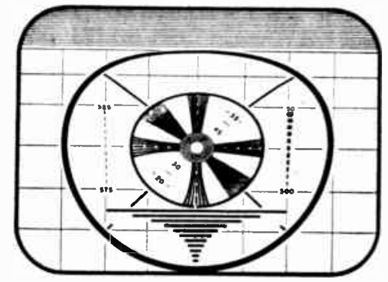


Fig. 14—VERTICAL DISTORTION; ADJUST VERTICAL LINEARITY CONTROL

11. **ELIMINATING SEMI-CIRCULAR SHADOW** — This shadow is caused by the electron stream striking the neck of the tube and it can generally be corrected by applying one or a combination of the following procedures:

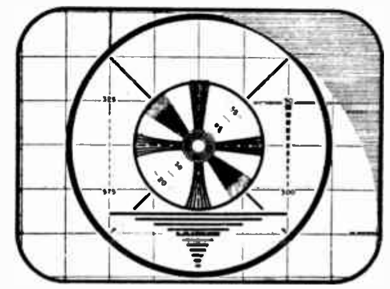


Fig. 15 SEMI-CIRCULAR SHADOW

a. Make sure deflection yoke is symmetrically positioned with respect to the neck of the picture tube by loosening the three wing nuts labeled C in Fig. 16 and adjusting yoke position.

Should a change in height of the defection yoke be required to obtain symmetry of yoke around neck of picture tube, it will be necessary to loosen the four wing nuts labeled D in Fig. 16 (two nuts located on each leg of mounting frame) and raise or lower yoke as required. After adjustment has been completed be sure to retighten nuts securely.

b. Shift deflection yoke as far forward as possible after loosening the yoke locking screw labeled A in Fig. 16. If raster becomes tilted during this adjustment refer to step #6.

12. **HORIZONTAL DRIVE** — The "Horizontal Drive" control located at rear of chassis (see Fig. 16) should be rotated clockwise to the point where any vertical bars near the left side of the picture are eliminated. As width and linearity of the picture are affected by the setting of "Horizontal Drive" control, it may be necessary to adjust this control in conjunction with the Width control to obtain desired picture width and linearity.

13. **BRIGHTNESS**—The "Brightness" control (located behind the Name Plate) should be initially adjusted in conjunction with the "Picture" control for the brightness level desired by set owner—check all active station channels. Too much brightness will have the same effect as too little contrast, and vice versa, therefore, it is necessary to strike a proper balance between contrast and brilliance.

14. **FINAL ADJUSTMENTS**—With all controls set for normal reception of a television station, recheck setting of "Focus" control for best picture focus.

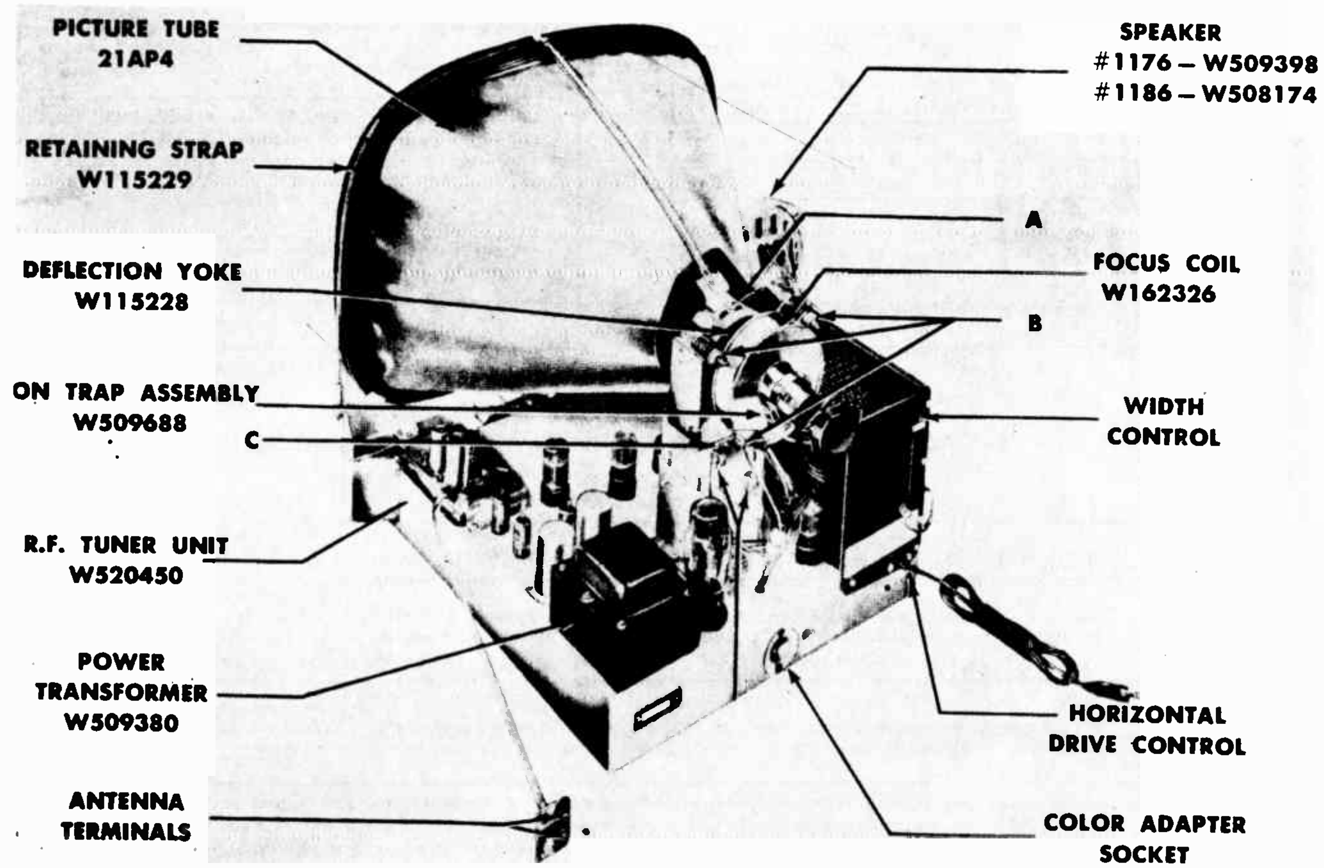


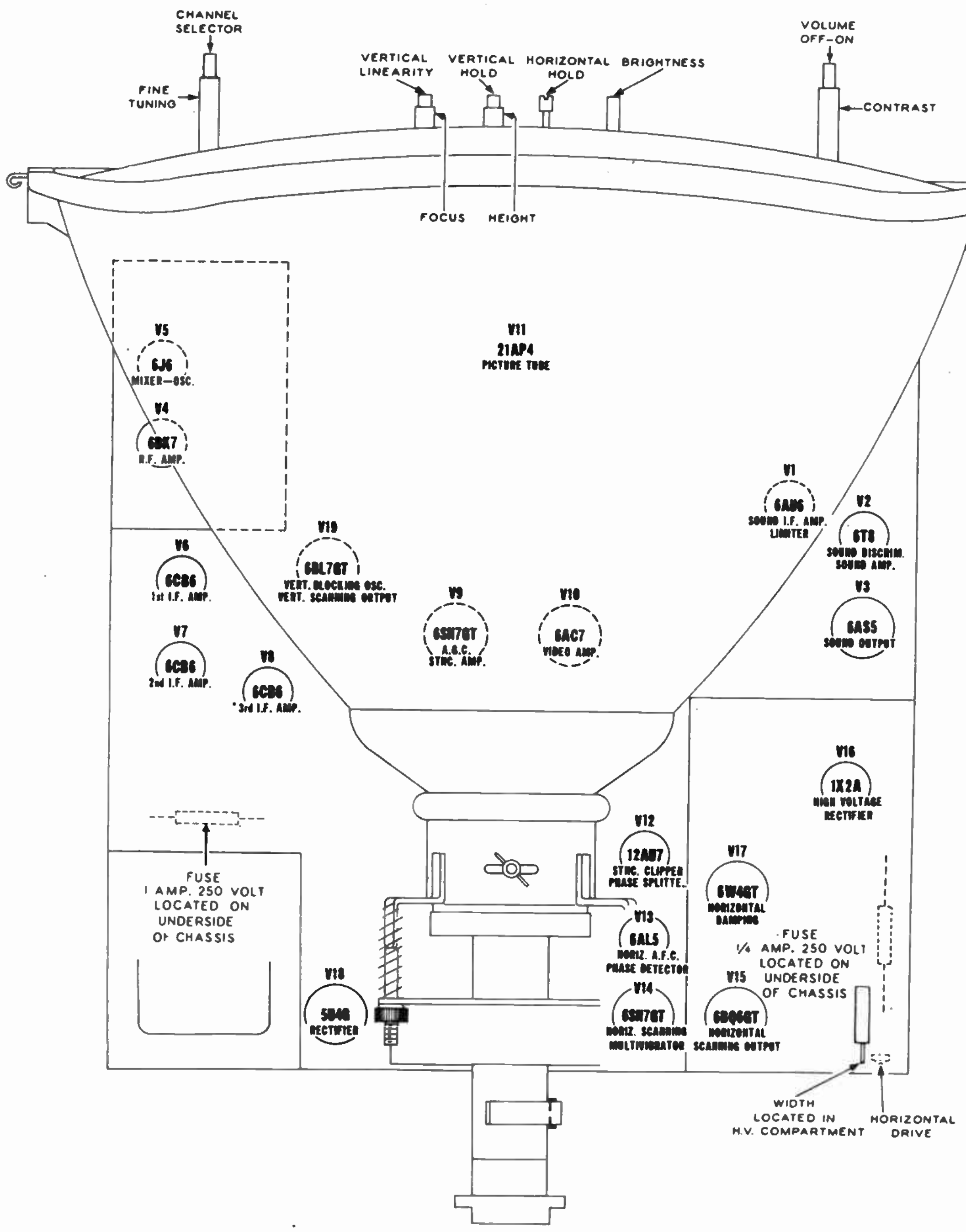
Fig. 16—CHASSIS AND PICTURE TUBE ASSEMBLY

CLEANING GLASS WINDOW AND PICTURE TUBE FACE

Should an accumulation of dust be noted on the inside of the glass window or on the face of the picture tube, it can be removed in the following manner:

1. Remove power cord from wall outlet.
2. Take off the gold colored picture frame or escutcheon by taking out the six cross-slotted screws located around edge of frame while at the same time supporting the glass window to keep it from falling forward.
3. Carefully remove the glass window avoiding any possibilit of scratching or chipping it.
4. Using a slightly dampened lint free soft cloth, carefully wipe t inside of the glass window and the face of the picture tube. Avoi any scratching, scraping, or chipping that might impair the glas surface.
5. When replacing the glass window and re-installing the escutcheon be sure that the cross-slotted screws are securely tightened.

TUBE LOCATIONS AND FUNCTIONS



SOCKET VOLTAGES

CAUTION

THE PICTURE TUBE is highly evacuated and if broken, glass fragments will be violently expelled. Scratching, chipping, undue pressure, or careless handling such as lifting the tube by its neck is dangerous and should be avoided. If it is necessary to handle the picture tube, use safety goggles and heavy gloves.

HIGH VOLTAGE (10 to 13 kilovolts) is produced in a supply circuit of this receiver. Exercise care to avoid contact with elements of this circuit and particularly the tube terminals which are labeled "CAUTION" in the adjoining voltage chart.

THE HIGH VOLTAGE LEAD, which supplies approximately 10 to 13 kilovolts to the picture tube, should be momentarily shorted to the chassis whenever it is disconnected for service purposes. This discharges the high voltage filter condenser and prevents a shock hazard when working on the receiver after it has been turned off.

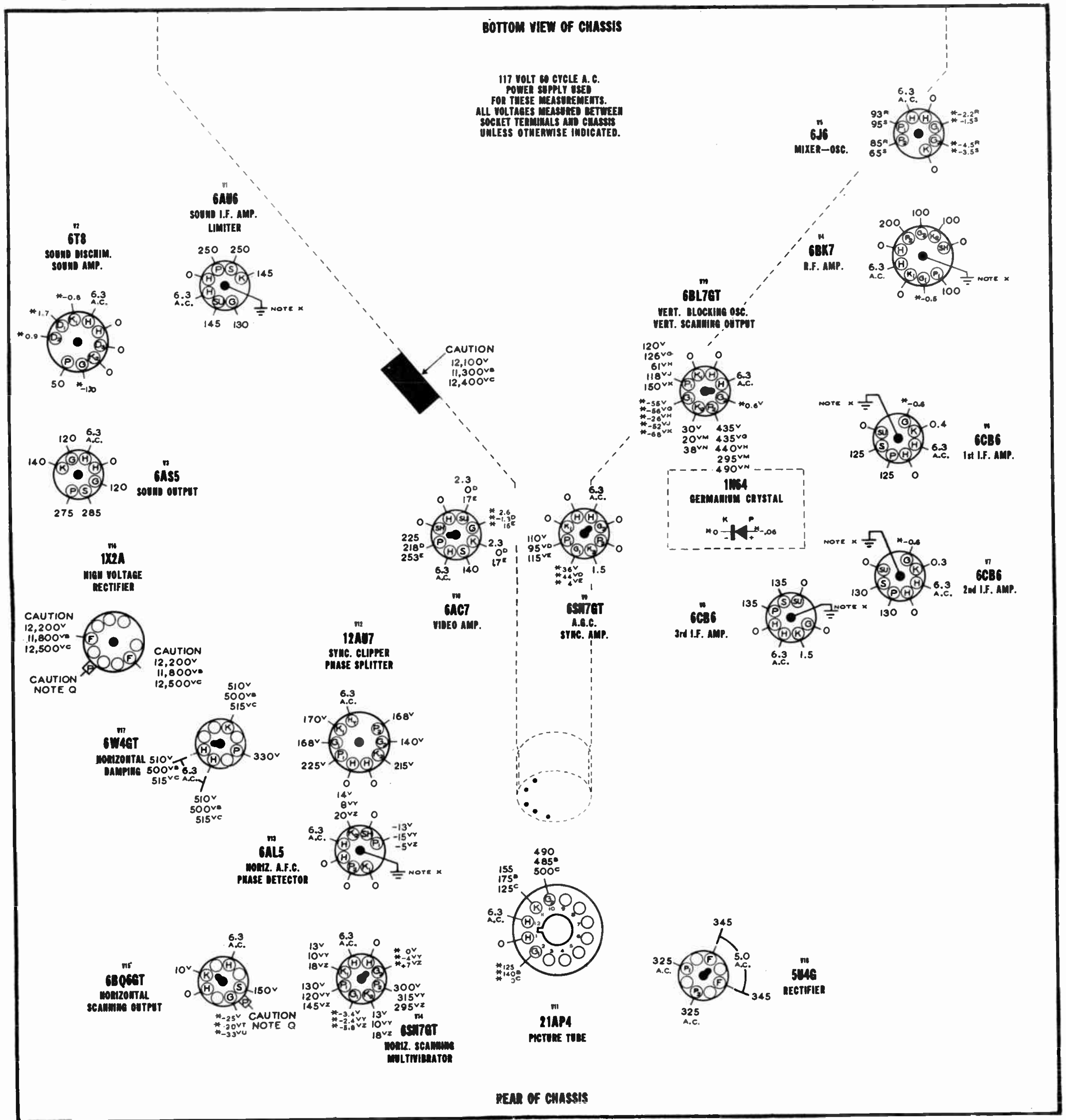
INTERMEDIATE B+ VOLTAGES, are dangerous and caution should be observed when the receiver chassis components are exposed for service purposes.

THE VOLTAGES SHOWN IN THE ADJOINING CHART WERE MEASURED UNDER THE FOLLOWING CONDITIONS

1.	Power Supply—117 volts 60 cycle AC.
2.	All voltages are measured between socket terminals and chassis unless otherwise indicated on adjoining chart.
3.	* Measurements made with voltmeter having sensitivity of 20,000 ohms per volt except where indicated by (*). The (*) symbol designates a vacuum tube voltmeter measurement.
4.	Channel Selector and Fine Tuning Controls set for normal reception of a local station.
5.	All controls are set for normal reception of the transmitted signal unless the voltage shown on the chart is followed by a letter or letters indicating a special condition of measurement as explained in subsequent notes.
6.	The external or built-in antenna should remain connected to the receiver only when taking voltage measurements in the sweep and sync circuits—for all other measurements, disconnect antenna, short antenna terminals together and connect them to ground.
7.	Certain voltages were measured with two different settings of specific controls. It should therefore be understood that in these instances all controls, with the exception of one or two, were set for normal reception—letters following the voltage shown on the chart indicate the exceptions and are explained below.

EXPLANATION OF NOTES

B.	Brightness Control max. clockwise
C.	Brightness Control max. counter-clockwise
D.	Contrast Control max. clockwise
E.	Contrast Control max. counter-clockwise
G.	Height Control max. clockwise
H.	Height Control max. counter-clockwise
J.	Vertical Hold Control max. clockwise
K.	Vert. Hold Control max. counter-clockwise
M.	Vertical Linearity Control max. clockwise.
N.	Vertical Linearity Control max. counter-clockwise.
Q.	Do not attempt to measure the voltage at the tube cap. There is a high R. F. potential at this point.
R.	Channel Selector set to channel #4
S.	Channel Selector set to channel #9
T.	Horiz. Drive Control max. clockwise
U.	Horiz. Drive Control max. counter-clockwise.
V.	Before measuring this voltage, connect external antenna and adjust controls for normal reception of station signal.
W.	The measurement should be made with a vacuum tube voltmeter. The voltage reading will fluctuate in the vicinity of 0.1 volts.
X.	Grounding of center stud on tube socket is necessary to reduce capacity coupling between other pins. Oscillation may result if this ground is omitted.
Y.	Horiz. Hold Control turned in a clockwise direction until picture approaches loss of sync.
Z.	Horiz. Hold Control turned in a counter-clockwise direction until picture approaches loss of sync.


BOTTOM VIEW OF CHASSIS
117 VOLT 60 CYCLE A.C. POWER SUPPLY USED FOR THESE MEASUREMENTS. ALL VOLTAGES MEASURED BETWEEN SOCKET TERMINALS AND CHASSIS UNLESS OTHERWISE INDICATED.
6J6 MIXER—OSC.
6BK7 R.F. AMP.
6AU6 SOUND I.F. AMP. LIMITER
6T8 SOUND DISCRIM. SOUND AMP.
CAUTION 12,100V 11,300VB 12,400VC
6BL7GT VERT. BLOCKING OSC. VERT. SCANNING OUTPUT
6CB6 1st I.F. AMP.
6AS5 SOUND OUTPUT
1N64 GERMANIUM CRYSTAL
6AC7 VIDEO AMP.
6SN7GT A.G.C. SYNC. AMP.
6CB6 2nd I.F. AMP.
6CB6 3rd I.F. AMP.
1X2A HIGH VOLTAGE RECTIFIER
CAUTION 12,200V 11,800VB 12,500VC
CAUTION NOTE Q
12AU7 SYNC. CLIPPER PHASE SPLITTER
6W4GT HORIZONTAL DAMPING
6AL5 HORIZ. A.F.C. PHASE DETECTOR
NOTE X
6BQ6GT HORIZONTAL SCANNING OUTPUT
6SN7GT HORIZ. SCANNING MULTIVIBRATOR
21AP4 PICTURE TUBE
5U4G RECTIFIER
REAR OF CHASSIS

ALIGNMENT PROCEDURE

Alignment of all RF and IF tuned circuits in this receiver may be accomplished by utilizing the procedures described in the following charts.

SEQUENCE OF ALIGNMENT: These procedures should preferably be applied in the order in which they are presented, however, alignment of the Sound Channel or IF Channel may be accomplished individually if desired.

The RF Amplifier and Mixer alignment may also be accomplished independent of Sound or IF Channel alignment, but oscillator calibration can only be done after IF Channel has been correctly aligned. Proper IF band pass characteristic is necessary for Oscillator alignment as results of RF circuit tuning are observed by means of an oscilloscope connected to the output of the crystal detector.

REMOVAL OF CHASSIS: The receiver chassis must be removed from the cabinet in order to accomplish alignment of all tuned circuits as there are adjustment points located on the underside of the unit.

This can be accomplished by first removing all knobs and disconnecting the receiver "built-in" antenna and speaker. The chassis may then be removed by releasing the hold-down screws located on the underside of the cabinet chassis mounting board.

CAUTION

The picture tube is highly evacuated and if broken, glass fragments will be violently expelled. Handle with care, using safety goggles and gloves.

INSTRUMENTS: The following instruments will be required as signal sources and output indicators during the alignment process. Since accurate alignment of a television receiver is heavily dependent upon the performance of your instruments, it is imperative that they meet the essential specifications described here.

1. **STANDARD SIGNAL GENERATOR** to provide unmodulated (pure RF) signals at the following frequencies. Maximum output on all ranges should be at least .1 volt with provision for attenuation as desired. This instrument must have good frequency stability and be accurately calibrated. Generators which incorporate a separate crystal controlled oscillator and heterodyne circuit are self calibrating and therefore capable of providing the accuracy of frequency calibration required for television circuit alignment.

   a. IF Frequencies:
      - 4.5 Mc. Sound Channel
      - 22.25 Mc. Sound IF marker
      - 23.5 Mc. Converter and 1st IF stages
      - 25.9 Mc. 2nd and 3rd IF stages
      - 26.75 Mc. Picture IF marker

   b. RF Frequencies:
      - 54 to 88 Mc.
      - 174 to 216 Mc.

2. **RF SWEEP GENERATOR** to provide frequency modulated signals at the following frequencies:
   - 20 to 30 Mc. with 10 Mc. sweep width.
   - 54 to 88 Mc. with 10 Mc. sweep width.
   - 174 to 216 Mc. with 10 Mc. sweep width.

   Output adjustable with at least .1 volt maximum.

   Output should be "flat" (no amplitude variation) for all settings of the sweep width control.

   Provision for connection of generator sweep modulating voltage to horizontal deflection system of an oscilloscope.

   Provision for blanking the output signal on each return sweep so that oscillogram will not show retrace.

3. **CATHODE RAY OSCILLOSCOPE,** preferably a unit with vertical amplifier having wide range frequency response and low capacity pick-up probe.

4. **VACUUM TUBE VOLTMETER.** The lowest voltage range of this instrument should preferably permit a 1.0 volt reading to be indicated at not less than one third of full scale deflection.

INSTRUMENT CONNECTIONS: The method of connection, including details of matching and coupling networks, for instruments used in this alignment procedure is given in several illustrations on subsequent pages. Specific instructions for each instrument application will be found in various sections of the alignment charts.

GENERAL INSTRUCTIONS: When aligning IF and RF circuits it is necessary to apply a fixed bias voltage to the AGC system of the receiver. This fixed bias is obtained by using a 3 volt battery and connecting it as described in Fig. 15.

IMPORTANT

When observing the receiver band pass characteristic on an oscilloscope, it is exceedingly important to avoid distortion of that characteristic which would occur when using a large input signal from the sweep generator or standard generator (marker signal). Always set attenuator on sweep generator so that the reading on the vacuum tube voltmeter does not exceed one-half volt (when meter is connected from high side of video detector load, symbol 122, to receiver chassis). The sweep width should never be set greater than that needed to fully display the receiver band pass characteristics on the oscilloscope. Standard generator output should also be attenuated so that marker signal does not pull or tear the band pass characteristic as shown on the 'scope.

SOUND CHANNEL ALIGNMENT PROCEDURE

1. Short antenna terminals together with a jumper wire.
2. Set receiver Channel Selector to any inactive television channel and contrast control to its maximum counter-clockwise position; other controls may be left at any desired setting.
3. No special aligning tool is required to adjust the cores in the Sound IF and discriminator transformers. The blade of a small screwdriver will fit the slot in these cores, however, the screwdriver should be of a non-metallic or insulated type to prevent detuning when inserted in the transformer con.

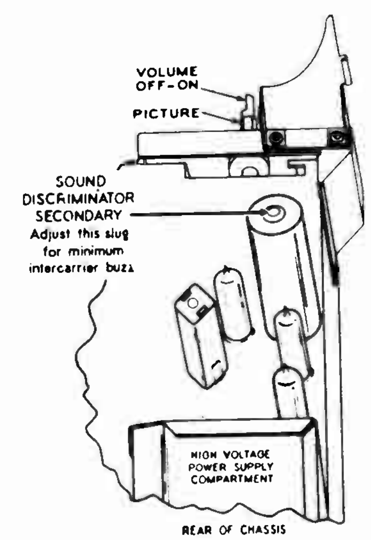
STANDARD SIGNAL GENERATOR		VTVM CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY				
Connect as shown in Fig. 1.	**4.5 MC.** unmodulated IMPORTANT This signal must be accurate within ¼ of 1% of 4.5 Mc. Check generator calibration against a crystal controlled signal source by "zero beating" (heterodyning) with harmonics of the crystal frequency.	Connect as shown in Fig. 2.	1. Set Contrast control to its maximum clockwise position. 2. A special detector must be utilized when aligning the 4.5 Mc. Sound Trap Coil. This unit can be constructed in accordance with the information contained in the circuit shown below. If a VTVM containing a high frequency A.C. probe is available, this probe can be utilized in place of the crystal detector shown in Fig. 2. 3. During this adjustment only, remove one of the three 6CB6 IF amplifier tubes (V6, V7 or V8). This will prevent noise in the RF stages from effecting the voltage reading while adjusting the sound trap.	#1 4.5 MC Sound Trap	Adjust for minimum reading on VTVM.
		Connect as shown in Fig. 3.	A "swishing" sound may be heard in the speaker during Sound Channel Alignment. This spurious oscillation is caused by horizontal sweep voltage being picked up in the audio system thru stray coupling of instrument leads; it should be disregarded as it will have no effect on alignment of the sound channel.	#2 Discriminator Secondary	Adjust for maximum reading on VTVM.
				#3 Discriminator Primary	Adjust for maximum reading on VTVM.
				#4 Sound JF Transformer	Adjust for maximum reading on VTVM.
Same as above.	Same as above.	Connect as shown in Fig. 4.	To obtain zero balance of the discriminator circuit, two 68,000 ohm resistors will be required. These resistors must be matched so that their respective resistances do not differ by more than 1%—the accuracy of the total resistance is not critical. Connect the two resistors in series from pin 2 of the 6T8 tube to chassis ground as shown in Fig. 4.	#2 Discriminator Secondary	Note that as slug #2 is rotated, a point will be found where the voltmeter will swing rather sharply from a positive to a negative reading or vice versa. The correct setting of slug #2 is obtained when the meter reads zero as the slug is moved thru this point.

REDUCTION OF INTERCARRIER BUZZ

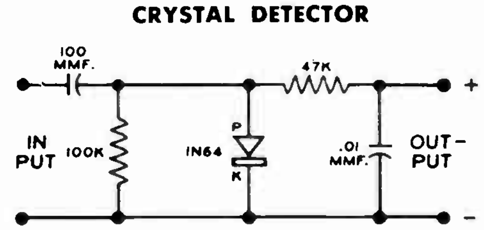
Slight "dynamic" unbalance of the discriminator secondary can emphasize intercarrier buzz due to incomplete amplitude modulation rejection. Therefore it is vitally important to obtain an accurate setting of the discriminator secondary slug under actual reception conditions.

Disconnect all instruments (be sure that I.F. tube removed for the adjustment of Sound Trap has been replaced) and then connect an antenna to the receiver to obtain program reception from a local station. If intercarrier buzz is prominent, a slight readjustment of the discriminator secondary slug (#2) should be made to obtain the "dip" point for the buzzing sound. Note that program sound will be clear and free from distortion at this point. Buzz should now be at an acceptable minimum if station transmission is not at fault.

LOCATION OF DISCRIMINATOR SECONDARY SLUG



CIRCUIT DIAGRAM FOR CRYSTAL DETECTOR



INSTRUMENT CONNECTIONS FOR SOUND CHANNEL ALIGNMENT

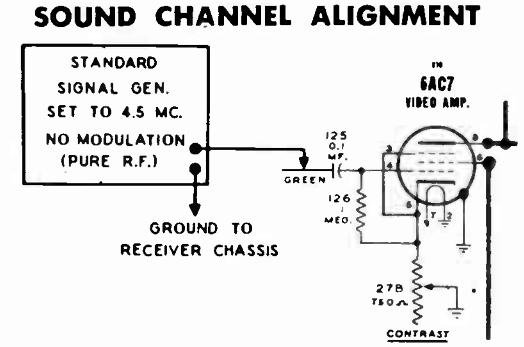


FIG. 1
Generator Connections for Sound Channel and 4.5 Mc. Sound Trap Alignment

IF CHANNEL ALIGNMENT PROCEDURE

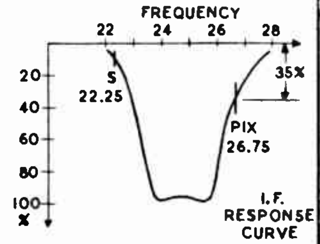
1. A special aligning tool designed to fit the stems on adjustable cores of the IF and Trap coils (see points 5, 6, 7 and 8 in Fig. 14) is available and may be obtained from Sears and Roebuck by requesting IF Alignment Tool #W507479.

2. Turn receiver Channel Selector to television channel #12 and short antenna terminals together with a jumper wire.

3. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to the AGC line and positive terminal of battery connects to receiver chassis. See Fig. 15 for convenient point of connection.

4. If the IF channel is badly misaligned, oscillation may occur. Such oscillation shows up as an excessive voltage across the video detector load, symbol 122, and is indicated by the VTVM that is connected to this point during alignment. It should be noted that voltage due to IF oscillation is unaffected by strength of signal from the generator.

Where IF oscillation is encountered, it is generally possible to correct the condition by detuning the IF coils in different directions. If that does not have the desired effect, increase fixed bias on AGC line by using a 4½ volt battery instead of the 3 volt battery referred to in instruction #3. After stopping the oscillation in this manner it will then be possible to align all IF stages using the following procedure, however, the AGC bias battery must be changed back to 3 volts when using the oscilloscope to observe band pass characteristics. Once all stages have been aligned using the 4½ volt bias, the IF channel should be stable with reduced bias.

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
Use a 330 Mmf. Isolating condenser and connect as shown in Fig. 5.	23.5 MC.	Connect as shown in Fig. 5 but keep generator power switch turned off during this step.	—	Connect as shown in Fig. 6.	Not used.	—	#5 Converter plate coil	Adjust for maximum reading on VTVM.
							#6 1st I.F.	Adjust for maximum reading on VTVM.
Same as above.	25.9 MC.	Same as above.	—	Same as above.	Not used.	—	#7 2nd I.F.	Adjust for maximum reading on VTVM.
							#8 3rd I.F.	Adjust for maximum reading on VTVM.
Same as above.	26.75 MC.	With connections made as shown in Fig. 5, turn on this generator and set controls for operation as specified in next column.	25 MC. Sweeping ± 5 Mc.	Same as above.	Connect as shown in Fig. 6	IMPORTANT: 1. Adjust output attenuator on sweep generator so that reading on VTVM is approximately one-half volt. 2. Set attenuator on standard signal generator so that marker signal does not distort the pattern on the oscilloscope. 3. Be sure that a 3 volt battery is connected to AGC line as specified in instruction #3 at the head of this chart. Do not use a battery of any other voltage.	The IF band pass characteristic now displayed on the 'scope should be compared with the curve shown in Fig. 7. If top of curve is not properly shaped, make a slight readjustment of slug #7. Should that adjustment fail to yield the desired result, then note whether the curve has a peak on the high or low frequency side. Slugs #7 and #8 control high frequency response (25.9 Mc.) and slugs #5 and #6 affect the low frequency response (23.5 Mc.); by making a small change in the settings of the high or low frequency slugs, it will be possible to obtain correct band pass curve.  FIG. 7 The 26.75 Mc. picture IF carrier marker should now appear at the 35% amplitude position on side of the band pass characteristic (see Fig. 7). If position of the marker appears too high or too low, slight readjustment of slugs #7 and/or 8 is required.	
Same as above.	22.25 MC.	Same as above.	Same as above.	Same as above.	Same as above.	Same as above.	Adjust the vertical gain control on the 'scope in order to magnify the sound portion of the response curve. The 22.25 Mc. sound IF carrier marker should appear at the position indicated in Fig. 7. If the position of the sound marker is incorrect, readjustment of slugs #5 and/or 6 is required.	

IF CHANNEL ALIGNMENT PROCEDURE

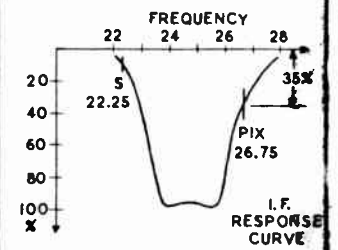
1. A special aligning tool designed to fit the stems on adjustable cores of the IF and Trap coils (see points 5, 6, 7 and 8 in Fig. 14) is available and may be obtained from Sears and Roebuck by requesting IF Alignment Tool #W507479.

2. Turn receiver Channel Selector to television channel #12 and short antenna terminals together with a jumper wire.

3. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to the AGC line and positive terminal of battery connects to receiver chassis. See Fig. 15 for convenient point of connection.

4. If the IF channel is badly misaligned, oscillation may occur. Such oscillation shows up as an excessive voltage across the video detector load, symbol 122, and is indicated by the VTVM that is connected to this point during alignment. It should be noted that voltage due to IF oscillation is unaffected by strength of signal from the generator.

Where IF oscillation is encountered, it is generally possible to correct the condition by detuning the IF coils in different directions. If that does not have the desired effect, increase fixed bias on AGC line by using a 4½ volt battery instead of the 3 volt battery referred to in instruction #3. After stopping the oscillation in this manner it will then be possible to align all IF stages using the following procedure, however, the AGC bias battery must be changed back to 3 volts when using the oscilloscope to observe band pass characteristics. Once all stages have been aligned using the 4½ volt bias, the IF channel should be stable with reduced bias.

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
Use a 330 Mmf. Isolating condenser and connect as shown in Fig. 5.	23.5 MC.	Connect as shown in Fig. 5 but keep generator power switch turned off during this step.	—	Connect as shown in Fig. 6.	Not used.	—	#5 Converter plate coil	Adjust for maximum reading on VTVM.
							#6 1st I.F.	Adjust for maximum reading on VTVM.
Same as above.	25.9 MC.	Same as above.	—	Same as above.	Not used.	—	#7 2nd I.F.	Adjust for maximum reading on VTVM.
							#8 3rd I.F.	Adjust for maximum reading on VTVM.
Same as above.	26.75 MC.	With connections made as shown in Fig. 5, turn on this generator and set controls for operation as specified in next column.	25 MC. Sweeping ± 5 Mc.	Same as above.	Connect as shown in Fig. 6	IMPORTANT: 1. Adjust output attenuator on sweep generator so that reading on VTVM is approximately one-half volt. 2. Set attenuator on standard signal generator so that marker signal does not distort the pattern on the oscilloscope. 3. Be sure that a 3 volt battery is connected to AGC line as specified in instruction #3 at the head of this chart. Do not use a battery of any other voltage.	The IF band pass characteristic now displayed on the 'scope should be compared with the curve shown in Fig. 7. If top of curve is not properly shaped, make a slight readjustment of slug #7. Should that adjustment fail to yield the desired result, then note whether the curve has a peak on the high or low frequency side. Slugs #7 and #8 control high frequency response (25.9 Mc.) and slugs #5 and #6 affect the low frequency response (23.5 Mc.); by making a small change in the settings of the high or low frequency slugs, it will be possible to obtain correct band pass curve.  FIG. 7 The 26.75 Mc. picture IF carrier marker should now appear at the 35% amplitude position on side of the band pass characteristic (see Fig. 7). If position of the marker appears too high or too low, slight readjustment of slugs #7 and/or 8 is required.	
Same as above.	22.25 MC.	Same as above.	Same as above.	Same as above.	Same as above.	Same as above.	Adjust the vertical gain control on the 'scope in order to magnify the sound portion of the response curve. The 22.25 Mc. sound IF carrier marker should appear at the position indicated in Fig. 7. If the position of the sound marker is incorrect, readjustment of slugs #5 and/or 6 is required.	

(Continued from preceding page)

STANDARD SIGNAL GENERATOR CONNECTIONS	STANDARD SIGNAL GENERATOR FREQUENCY	SWEEP GENERATOR CONNECTIONS	SWEEP GENERATOR FREQ.	VTVM CONNECTIONS	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
OSCILLATOR ALIGNMENT								
1. **IMPORTANT:** Before undertoking oscillator alignment be sure IF circuits ore correctly aligned for band pass characteristic illustrated in Fig. 7.				2. During oscilloting olignment, it is necessory to set the Fine Tuning control so thot the tooth on the bokelite fine tuning cam points downward (correct position for this control is shown in Fig. 9).				
Connect as shown in Fig. 12.	*209.75 MC. ‡205.25 MC.	Connect as shown in Fig. 12 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #12	Connect as shown in Fig. 13	Connect as shown in Fig. 13.	Set Channel Selector to #12 Be sure that Fine Tuning control has been properly positioned (tooth on the cam pointing down—see Fig. 9). During this step and thru-out all succeeding steps it is necessary to: 1. Keep output of sweep generator at a level that does not allow reading on VTVM to exceed one-half volt. 2. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.	#12 Oscillator	Adjust height of Oscillator trimmer #12 to be approximately 3/8" from the top of trimmer screw to the top surfoce of RF tuner unit (see Fig. 9). NOTE: Before making the following adjustment, advance the verticol gain control on the 'scope in order to magnify the sound portion of the response curve. Then, use o non-metollic screwdriver to odjust channel #12 oscillator slug (accessible thru hole on front of RF Tuner Unit—see Fig. 9) and shift response curve so that sound carrier marker is located at the position indicoted in Fig. 14. Now, reduce goin control setting of 'scope to restore pattern to normol omplitude ond observe position of picture carrier marker. This marker should appear at the 50% omplitude position on the low frequency side of the chorocteristic curve (see Fig. 14).
Some os above.	*215.75 MC. ‡211.25 MC.	Same as above.	CHANNEL #13	Same as above.	Same os above.	Set Chonnel Selector to #13		Adjust the RF sweep generotor and morker generotor for operotion on the other television chonnels; set morker generotor to sound corrier frequency. After setting Chonnel Selector to corresponding channel, odjust oscillotor slug thru hole on front of RF Tuner Unit (see Fig. 9). This permits response curve to be shifted so thot sound corrier marker will appear ot the position indicoted in Fig. 14. The picture corrier morker for the corresponding channel should then appear at the 50% amplitude position on the opposite side of the band poss chorocteristic curve. NOTE: Moke sure that com on fine tuning control shoft remains properly positioned during this step (tooth on the com pointing downword—see Fig. 9).
	*203.75 MC. ‡199.25 MC.		CHANNEL #11			Set Chonnel Selector to #11		
	*197.75 MC. ‡193.25 MC.		CHANNEL #10			Set Chonnel Selector to #10		
	*191.75 MC. ‡187.25 MC.		CHANNEL #9			Set Chonnel Selector to #9		
	*185.75 MC. ‡181.25 MC.		CHANNEL #8			Set Chonnel Selector to #8		
	*179.75 MC. ‡175.25 MC.		CHANNEL #7			Set Chonnel Selector to #7		
	* 87.75 MC. ‡ 83.25 MC.		CHANNEL #6			Set Chonnel Selector to #6		
	* 81.75 MC. ‡ 77.25 MC.		CHANNEL #5			Set Chonnel Selector to #5		
	* 71.75 MC. ‡ 67.25 MC.		CHANNEL #4			Set Chonnel Selector to #4		
	* 65.75 MC. ‡ 61.25 MC.		CHANNEL #3			Set Chonnel Selector to #3		
	* 59.75 MC. ‡ 55.25 MC.		CHANNEL #2			Set Chonnel Selector to #2		

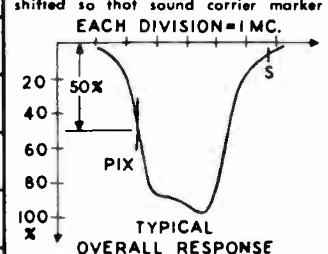


FIG. 10 TYPICAL OVERALL RESPONSE CURVE

If an oscillotor slug "falls into" its coil form during odjustment, remove the Chonnel Coil from the turret assembly ond lift the Slug Retaining Spring oside. By topping the coil form it should be possible to make the slug move toword the end so that its threods will be engoged by the Slug Retoining Spring when thot spring is returned to its normol position.

If an unsatisfoctory overall response is obtoined for o porticular channel, observe RF Amp. and Mixer response curve for that chonnel (os described on page 16). If choracteristic does not conform reasonobly well within the typicol curve shown in Fig. 8, then, (1) ottempt to obtain o better compromise for RF response on oll channels by reoligning RF Amp. ond Mixer circuits, or (2) try replocing Antenna, RF ond Oscillotor coils for the porticulor channels.

*Sound Carrier Marker
‡Picture Carrier Marker

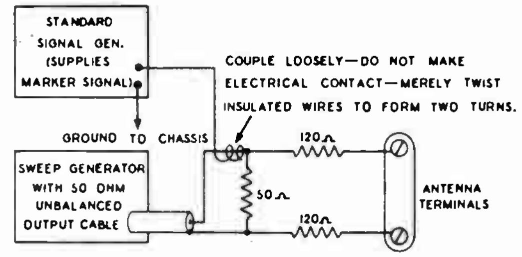


FIG. 11
Generator Connections for RF Channel Alignment

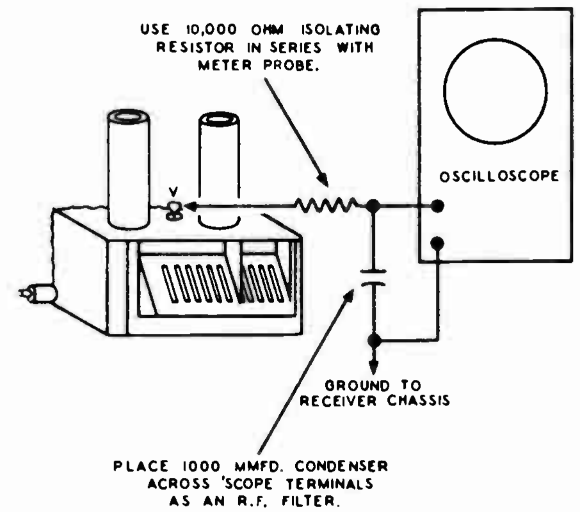


FIG. 12
Oscilloscope Connections for RF Amp. and Mixer Alignment

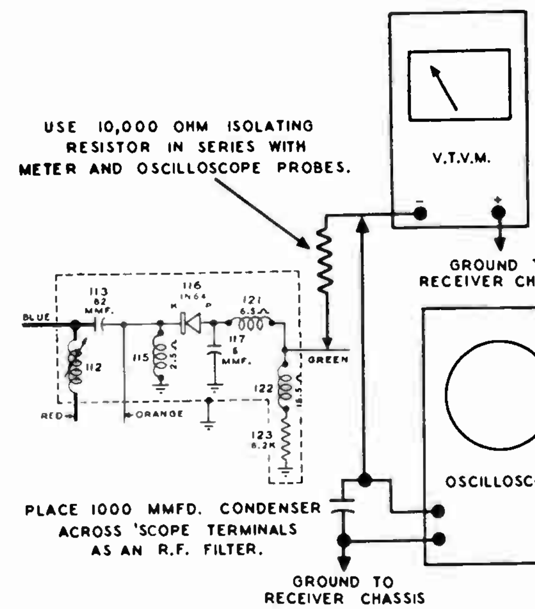
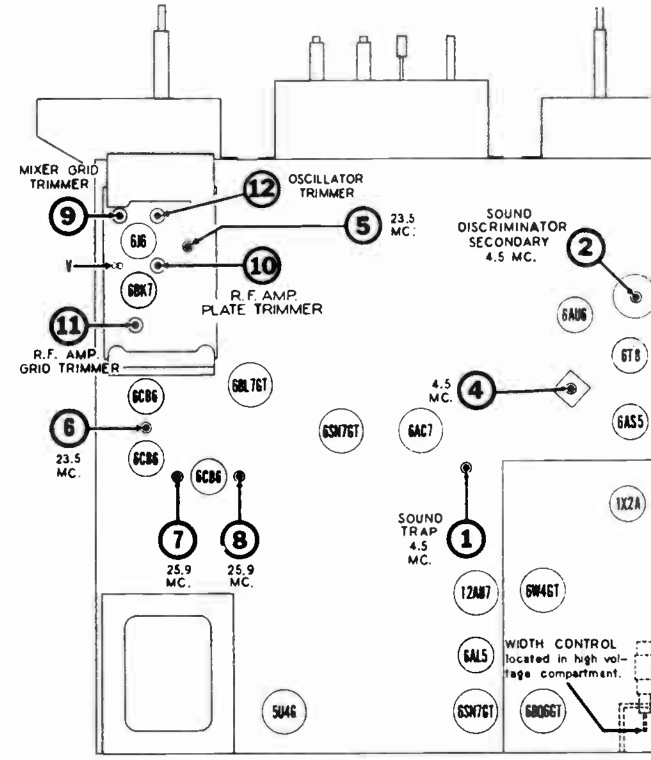
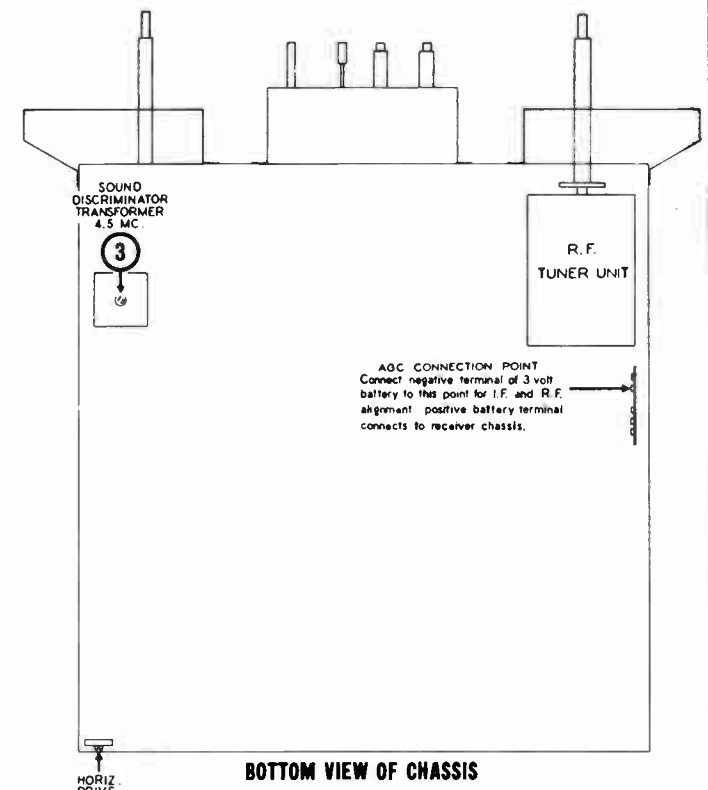


FIG. 13
VTVM and Oscilloscope Connections for Oscillator Alignment



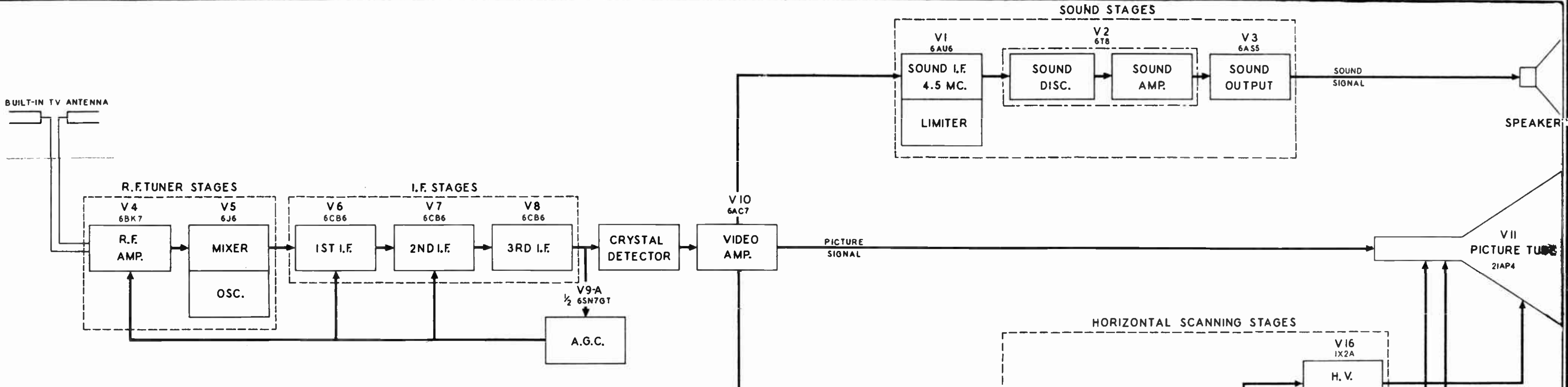
TOP VIEW OF CHASSIS

FIG. 14



BOTTOM VIEW OF CHASSIS

FIG. 15



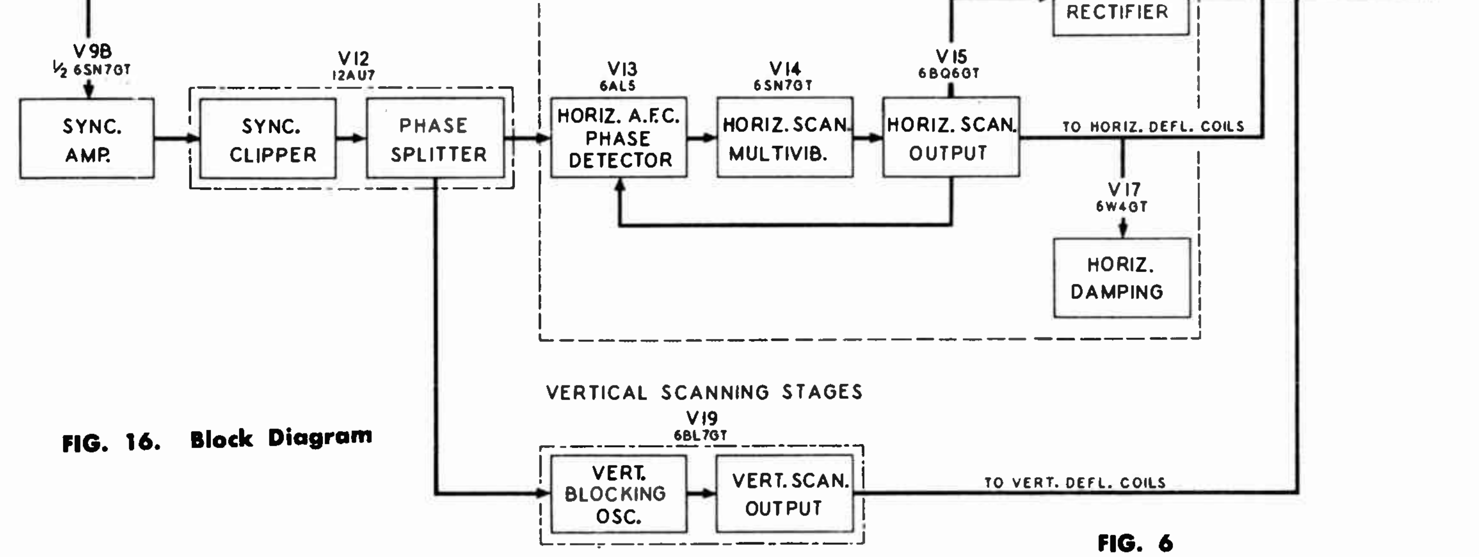


FIG. 16. Block Diagram

INSTRUMENT CONNECTIONS FOR IF CHANNEL ALIGNMENT

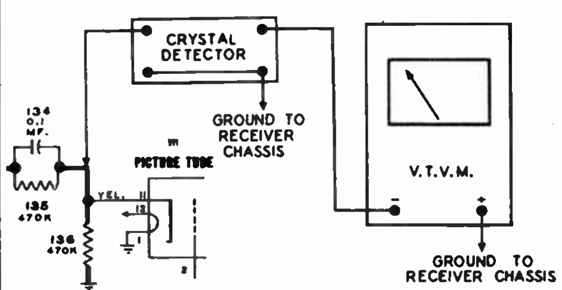


FIG. 2
Crystal Detector and VTVM Connections for 4.5 Mc. Sound Trap Alignment

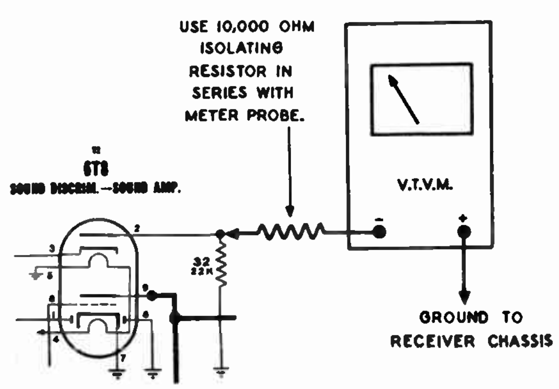


FIG. 3
VTVM Connections for Sound IF Alignment

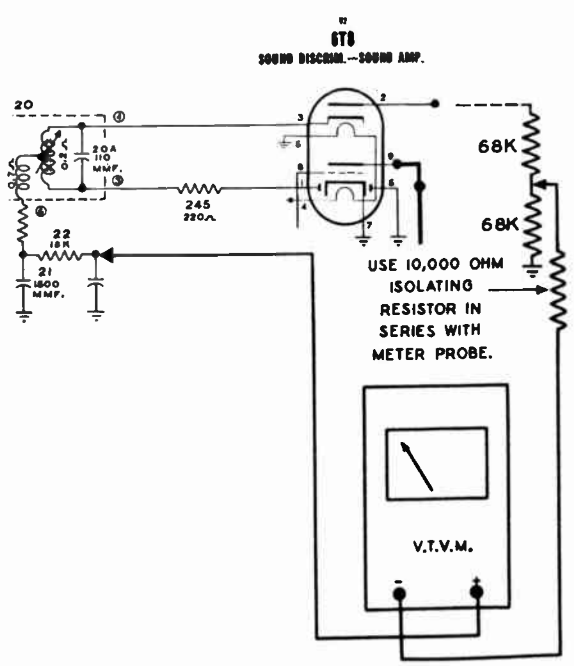


FIG. 4
VTVM Connections for Sound Discriminator Alignment

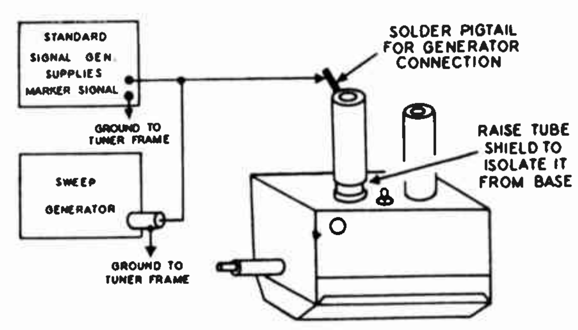
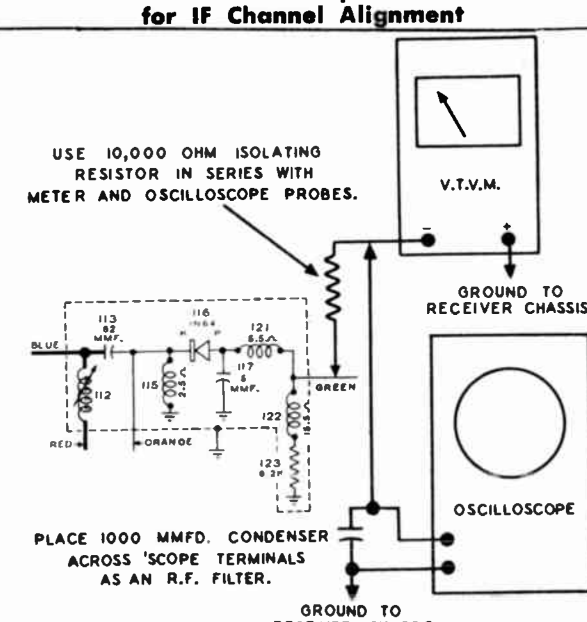


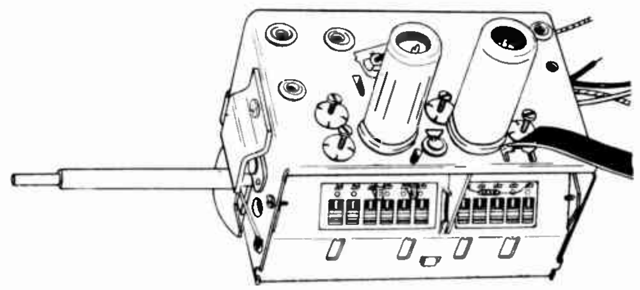
FIG. 5
Generator Connections for IF Channel Alignment

FIG. 6
VTVM and Oscilloscope Connections for IF Channel Alignment



REPAIR DATA FOR W520450 RF TUNER UNIT

All replacement parts for the RF Tuner Unit are included in the complete receiver parts list



R.F. TUNER CIRCUIT DESCRIPTION

The turret type tuner W520450 is of the latest design and incorporates a 6BK7 tube (V4) as the R.F. Amplifier and a 6J6 tube (V5) as the Mixer-Oscillator.

Channel selection is accomplished by rotation of the turret containing two sets of easily removable coil assemblies for each channel. The individual antenna coil sections consist of a balanced primary to minimize noise pick-up on the transmission line and an R.F. grid coil which couples the incoming signal to the grid of the first section of the 6BK7 R.F. Amplifier tube. The inductance and amount of coupling of the tuned antenna input circuit are changed for each channel so that a constant input impedance of 300 ohms is maintained. This provides maximum transfer of energy to the R.F. Amplifier stage, particularly when interconnection between an outdoor antenna and the receiver is made with 300 ohm transmission line.

The 6BK7 R.F. Amplifier is a dual-triode tube and is connected in the circuit as a direct coupled grounded-grid type amplifier. This circuit was developed to meet the demand for an R.F. Amplifier that would provide more nearly equal gain on both the low and high Television Channels, while keeping inherent tube noise to a minimum. The circuit can be thought of very simply as two triode tubes in series, the first or driver unit acting not as an amplifier, but rather as an antenna impedance matching device and also as a variable cathode impedance, or bias source, for the second, or grounded-grid unit. In addition the first unit of the 6BK7 acts as a power amplifier due to its extremely low plate impedance, which is in reality the cathode circuit of unit two, and converts the weak signal voltage from the antenna to a low voltage-high current signal which is then applied to the cathode of unit number two. The signal coupling unit between the first and second units is a series peaking coil, symbol 406, similar to that found in a video amplifier circuit. Its purpose is to form a series resonant circuit with the input capacity of the second unit. The coil is so made as to resonate at a frequency slightly higher than channel 13. In a standard pentode type amplifier, the gain falls off rapidly as progressively higher channels are selected. With the use of the plate to cathode peaking coil an almost equal gain can be realized for all channels.

The 6BK7 tube has inherently low interelectrode capacity due to physical design and this factor in conjunction with the low output impedance of the first section is responsible for the low noise factor at this stage. While neutralization of the first unit is not necessarily due to its low plate to grid capacity, additional noise reduction has been realized, with only a slight decrease in gain, by the addition of a neutralizing condenser, item 405. Due to the low output impedance of the stage, it is not necessary that the neutralizing condenser be tunable.

Because of the circuits' excellent internal shielding, low input impedance and radiation rejection, the second section of the 6BK7 is connected as a driven grounded-grid amplifier. While this might not be apparent at first glance due to the fact that grid has no direct D.C. return, it will be found upon further examination that any high frequency A.C. potentials are by-passed to ground through condenser 407.

The second section of turret coils includes the tuned R.F. amplifier plate coil, tuned mixer grid coil, and oscillator coil. The output of the R.F. amplifier stage is coupled to the grid of the mixer stage, which utilizes one triode section of a 6J6 tube (V5). The other half of the 6J6 is connected as a modified Colpitts oscillator which injects oscillator voltage into the mixer stage through coupling between the oscillator coil and the mixer grid coil. Course oscillator tuning is accomplished by adjusting the positions of the slugs in the individual oscillator coils, while Fine Tuning is obtained when using condenser #417 in the oscillator plate circuit. This Fine Tuning condenser is composed of two fixed plates, and its capacitance is changed by the insertion of a bakelite cam between these plates.

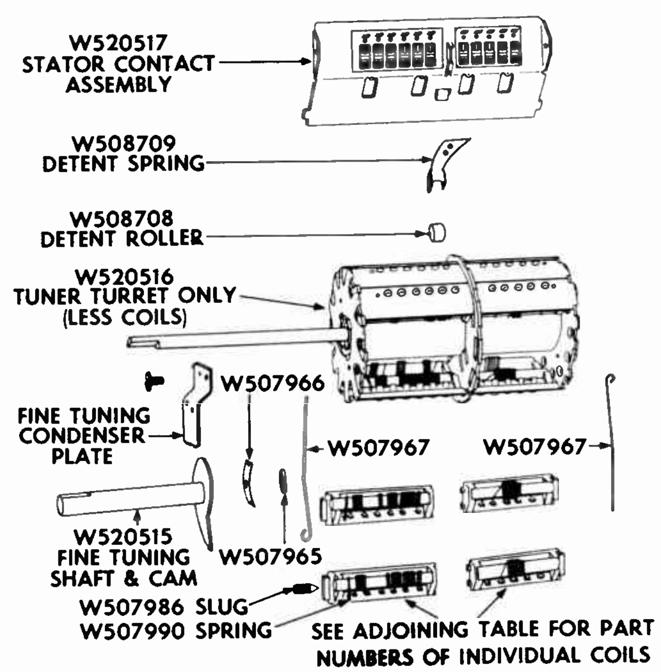
Signal output from the mixer stage is coupled to the IF amplifiers through the converter plate I.F. coil, diagram #427, located on the tuner unit.

SERVICE PRECAUTIONS

SUBJECT	PRECAUTIONS
ELECTRICAL COMPONENTS	The high frequencies used in the RF section of a television receiver make it necessary that considerable care be exercised in servicing the tuner. Lead dress and location of components are very critical at these frequencies. When replacing parts, it is important to use components of identical electrical characteristics and physical size. Always reconnect the replacement item in the same location and position in the tuner as the original component.
TUBES	Replacement of tubes in the Tuner Unit may cause slight detuning of RF circuits due to inherent differences in inter-electrode capacitances. When replacing tubes (especially 6J6 mixer-oscillator tube) make sure that Fine Tuning control will tune in television stations at approximately the middle of its range. It may be necessary to change the setting of the individual oscillator coil slugs for some channels to accomplish this.
CHANNEL COILS AND SLUGS	Channel Coils must be handled with care. **Do not disturb coil windings.** If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.
FINE TUNING CONTROL	Rubbing of the bakelite Fine Tuning Cam against the Fine Tuning Condenser Plate is intentional in order to avoid vibration with resulting microphonics. However, the Fine Tuning Cam should **not** rub or contact the small circular plate located on the body of the tuner.

REMOVAL AND REPLACEMENT OF PARTS

ITEM	PROCEDURE
RF TUNER UNIT	To remove the Tuner Unit from receiver chassis, proceed as follows: 1. Remove screws which hold tuner to front and rear support brackets. 2. Disconnect the leads from the tuner to the main chassis. See illustration on circuit diagram page showing tuner connections. 3. Tuner unit may now be withdrawn from underside of chassis.
CHANNELS COILS	It is not necessary to remove entire tuner unit to replace a snap-in channel coil but removal of bottom shield will be required. This may be accomplished by grasping the front end of the shield and pulling downward and unhooking it from rear of tuner frame. Insert a screwdriver blade between Coil Retainer Spring and the end of the Tuner Turret. Twist the blade to pull spring away from the molded body of Channel Coil. Lift this end of coil body upward and remove individual coil assembly from tuner. When replacing Channel Coils, be sure they are reinstalled in their correct positions. Coil numbers should increase consecutively in a counter-clockwise direction when tuner is viewed from the front. If all the Channel Coils have been removed from the Tuner Turret, rotate turret until flat surface on end of tuner shaft points down. Install #3 Channel Coils into bottom position on turret. Then follow the correct sequence indicated above to replace other coils.
TUNER TURRET ASSEMBLY	To remove turret from RF Tuner Unit, remove complete tuner and bottom shield as described in section entitled "Channel Coils" and proceed as follows: 1. Remove rear Turret Shaft Retaining Spring by disengaging straight end of spring from projection on tuner frame. 2. Remove Fine Tuning Condenser Plate from front of Tuner Unit. This plate forms one side of Fine Tuning control condenser and is held in place by one screw. 3. Slide Fine Tuning Cam and Shaft off of main Channel Selector Shaft. 4. Remove Spring Contactor Washer and Fiber Spacer Washer from Channel Selector Shaft. 5. Remove Shaft Retaining Spring at front of tuner by disengaging straight end of spring from projection on frame. 6. Remove turret assembly from frame. To replace turret, reverse the above procedure. Tooth on bakelite Fine Tuning Cam should point downward during assembly so that it does not become locked between the stops on the Fine Tuning Condenser Plate. Also be sure to replace bottom shield.
STATOR CONTACT ASSEMBLY	To remove this assembly, remove complete tuner as described in section entitled "Channel Coils" and proceed as follows: 1. Remove side shield by taking out the two retaining screws and unsolder shield at one point. Now, disengage shield from upper edge of tuner frame. 2. Remove the two screws at the front and rear of the Stator Contact Assembly. 3. Unsolder all electrical connections to contact plate. 4. Unsolder five soldered joints between Stator Contact Assembly and Tuner Unit. 5. Contact Assembly may now be withdrawn from frame. To reinstall this assembly: 1. Place Stator Contact Assembly in position and replace, but do not tighten, the two screws at the front and rear of the assembly. 2. Remove 3 consecutive pairs of Channel Coils from the turret (for example, the antenna and rf-osc. coils for channels #5, 6 and 7). 3. Position Tuner Turret so that the edges of the next highest Channel Coils (in this case, the coils for channel #8) just pass the row of 11 contacts on the Stator Contact Assembly. 4. Adjust position of the Stator Contact Assembly so that there are a few thousandths of an inch spacing between the contacts on the contact plate and the molded body of the Channel Coils. 5. The Contact Assembly is now correctly positioned and screws at front and rear may be tightened. 6. Solder Stator Contact Assembly to tuner frame at same points that were used previously. 7. Make all electrical connections to contact plate. 8. Replace Channel Coils. 9. Replace side shield.



CHANNEL NUMBER	ANTENNA COIL PART NUMBER	RF & OSC COIL PART NUMBER
2	520502	520522
3	520503	520523
4	520504	520524
5	520505	520525
6	520506	520526
7	520507	520527
8	520508	520528
9	520509	520529
10	520510	520530
11	520511	520531
12	520512	520532
13	520513	520533

HOW TO ORDER PARTS

1. Use Correct Order Form.
2. On the Purchase Order always give the following information:
   (a) PART NUMBER (number printed on the part if different from that shown in this list) and DESCRIPTION for each part ordered. When no part number is assigned, order by description and rating. Also give PRICE of part (indicate if no selling).
   (b) The CHASSIS NUMBER, which is 100.208, will be found on a metal plate at the rear of the chassis.

In all correspondence relating to cabinets, always mention the source code letter stamped into the bottom of table models, and the CATALOG NUMBER shown on the sticker on the back, bottom or inside of cabinet.

PARTS LIST FOR CHASSIS

Notice: Some parts listed below have special characteristics. Do not use substitutes for replacement purposes.

CONDENSERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
11	W513001	Condenser—ceramic 2.2 Mmfd. 500 volt	$ .16
13	W513002	Condenser—ceramic 47 Mmfd. 500 volt	.24
16, 17	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
20-A	W509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
20-B	W509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
21	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
23	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
24	W512027	Condenser—.05 Mfd. 200 volt	.40
26	W512007	Condenser—.005 Mfd. 600 volt	.25
28	W512007	Condenser—.005 Mfd. 600 volt	.25
30	W513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
34	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
35	W505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
36	W512011	Condenser—.01 Mfd. 400 volt	.25
39	W512007	Condenser—.005 Mfd. 600 volt	.25
92	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
94	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
97	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
99	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
101	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
104	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
107	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
110	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
111	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
113, 114	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
117	W513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)	.30
119	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
125	W512033	Condenser—.1 Mfd. 200 volt	.30
128	W513438	Condenser—ceramic 47 Mmfd. ±5% 500 volt (Temperature compensating)	.45

CONDENSERS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
134	W512035	Condenser—.1 Mfd. 400 volt	$ .30
143	W512019	Condenser—.02 Mfd. 600 volt	.30
144	W512031	Condenser—.05 Mfd. 600 volt	.35
148	W513027	Condenser—ceramic 56 Mmfd. ±10% 1500 volt	.45
151	W513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
153	W512013	Condenser—.01 Mfd. 600 volt	.30
156	W512029	Condenser—.05 Mfd. 400 volt	.35
162	W512001	Condenser—.001 Mfd. 600 volt	.22
165	W512001	Condenser—.001 Mfd. 600 volt	.22
166	W512009	Condenser—.01 Mfd. 200 volt	.25
169	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
171	W512027	Condenser—.05 Mfd. 200 volt	.40
173	W512540	Condenser—mica 3900 Mmfd. ±5% 500 volt	.60
174	W512535	Condenser—mica 390 Mmfd. ±10% 500 volt	.35
178	W512535	Condenser—mica 390 Mmfd. ±10% 500 volt	.35
179	W512515	Condenser—mica 1000 Mmfd. ±10% 500 volt	.40
180	W520127	Condenser—trimmer 25-280 Mmfd. (Horizontal Drive Control)	.50
181	W512049	Condenser—.25 Mfd. ±10% 600 volt	.60
186	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
188, 189	W512031	Condenser—.05 Mfd. 600 volt	.35
194	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
195	W508888	Condenser—ceramic 500 Mmfd. 20,000 volt	2.00
197	W508680	Condenser—electrolytic 10 Mfd. 600 volt	2.55
198	W512255	Condenser—.01 Mfd. 400 volt	.25
200	W512255	Condenser—.01 Mfd. 400 volt	.25
203	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
205	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
207	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36

*—This part is not supplied as a Service replacement item.

CONDENSERS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
208-A, B, C	W509001	Condenser—electrolytic A—40 Mfd. 450 volt B—40 Mfd. 450 volt C—10 Mfd. 450 volt	$ 4.00
211	W160095	Condenser—electrolytic 40 Mfd. 300 volt	2.00
212-A, B	W509002	Condenser—electrolytic A—80 Mfd. 250 volt B—100 Mfd. 50 volt	3.00
213	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
220-A	W508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
220-C	W508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
220-E	W508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
220-G	W508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
222	W512533	Condenser—mica 4700 Mmfd. ±5% 1000 volt	1.40
229	W512308	Condenser—.05 Mfd. ±10% 600 volt	.30
230	W512037	Condenser—.1 Mfd. 600 volt	.45
236	W513026	Condenser—ceramic 5.1 Mmfd. ±10% 1500 volt	.40
237	W512019	Condenser—.02 Mfd. 600 volt	.30
241	W512027	Condenser—.05 Mfd. 200 volt	.40
242	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
247	W512019	Condenser—.02 Mfd. 600 volt	.30
320	W508888	Condenser—500 Mmfd. 20,000 volt	2.00
324	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
402	W509064	Condenser—trimmer 3-9 Mmfd.	.50
405	W513001	Condenser—ceramic 2.2 Mmfd. 500 volt	.16
407	*	Condenser—ceramic 800 Mmfd. (part of center shield)	—
410	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
412	W513439	Condenser—ceramic 120 Mmfd. ± 5% 500 volt (Temperature compensating)	.30
414	W513446	Condenser-ceramic 100 Mmfd. ± 5% 500 volt (Temperature compensating)	.35
415	W509063	Condenser—trimmer 0.5-3 Mmfd.	.40
416	W513440	Condenser—ceramic 100 Mmfd. ± 10% 500 volt (Temperature compensating)	.30
417	*	Condenser—ceramic 3-5 Mmfd. (Fine Tuning)	
423	W513441	Condenser—ceramic 20 Mmfd. ± 10% 500 volt (Temperature compensating)	.30
421	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
425	W513444	Condenser—ceramic 10 Mmfd. ± 5% 500 volt (Temperature compensating)	.50
432	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
428	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
429	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
430	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
431	W513029	Condenser—ceramic 120 Mmfd. ± 10% 500 volt	.35
433	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
435	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28

RESISTORS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
14	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
15	W510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
19	W510249	Resistor—carbon 4700 Ohms 1 watt	.16
22	W510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
25	W510170	Resistor—carbon 68,000 Ohms ½ watt	.12
27	W510197	Resistor—carbon 10 Meg. ½ watt	.12
31	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
32	W510160	Resistor—carbon 22,000 Ohms ±10% ½ watt	.12
37	W510746	Resistor—carbon 680,000 Ohms ±5% ½ watt	.20
38	W510747	Resistor—carbon 820,000 Ohms ±5% ½ watt	20
91	W510723	Resistor—carbon 12,000 Ohms ±5% ½ watt	.16
93	W510116	Resistor—carbon 68 Ohms ½ watt	.12
95	W510129	Resistor—carbon 390 Ohms ±10% ½ watt	.12

RESISTORS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
98	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	$ .12
100	W510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
102	W510119	Resistor—carbon 100 Ohms ½ watt	.12
106	W510150	Resistor—carbon 5600 Ohms ±10% ½ watt	.12
108	W510119	Resistor—carbon 100 Ohms ½ watt	.12
109	W510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
118	W510153	Resistor—carbon 8,200 Ohms ±10% ½ watt	.12
120	W510186	Resistor—carbon 560,000 Ohms ±10% ½ watt	.12
123	W510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
124	W510119	Resistor—carbon 100 Ohms ½ watt	.12
126	W510191	Resistor—carbon 1 Meg. ½ watt	.12
130	W510745	Resistor—carbon 18,000 Ohms ±5% ½ watt	.20
131	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
133	W510753	Resistor—wire wound 4000 Ohms ±10% 5 watt	1.00
135, 136	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
139	W510160	Resistor—carbon 22,000 Ohms ±10% ½ watt	.12
145	W510142	Resistor—carbon 2200 Ohms ±10% ½ watt	.12
149, 150	W510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
152	W510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
154	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12
155	W510169	Resistor—carbon 68,000 Ohms ±10% ½ watt	.12
157	W510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
158	W510187	Resistor—carbon 680,000 Ohms ±10% ½ watt	.12
159	W510748	Resistor—carbon 3900 Ohms ±5% ½ watt	.20
160	W510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
161	W510750	Resistor—carbon 4700 Ohms ±5% ½ watt	.20
163, 164	W510751	Resistor—carbon 100,000 Ohms ±5% ½ watt	.20
167	W510162	Resistor—carbon 27,000 Ohms ±10% ½ watt	.12
168	W510195	Resistor—carbon 4.7 Meg. ½ watt	.12
170	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
175	W510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
176	W510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
177	W510187	Resistor—carbon 680,000 Ohms ±10% ½ watt	.12
182	W510357	Resistor—carbon 15,000 Ohms ±10% 2 watt	.35
183	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
184	W510116	Resistor—carbon 68 Ohms ½ watt	.12
185	W510218	Resistor—carbon 100 Ohms ±10% 1 watt	.16
187	W510248	Resistor—carbon 4700 Ohms ±10% 1 watt	.16
190	W510758	Resistor—wire wound 12,000 Ohms ±10% 5 watts	1.20
196	W510390	Resistor—carbon 1 Meg. ±10% 2 watt	.30
199	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
210	W510741	Resistor—wire wound 600 Ohms ±10% 10 watt	.90
219	W510162	Resistor—carbon 27,000 Ohms ± 10% ½ watt	.12
220-B	W508062	Resistor—carbon 22,000 Ohms ⅕ watt (part of Integrator Unit)	1.40
220-D	W508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
220-F	W508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
223	W510769	Resistor—carbon 2 Meg. ±5% ½ watt	.20
225	W510766	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
226	W510768	Resistor—carbon 4.7 Meg. ±10% ½ watt	.12
227	W510767	Resistor—carbon 1.5 Meg. ±10% ½ watt	.20
228	W510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
231	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12
234	W510344	Resistor—carbon 2700 Ohms ±10% 2 watt	.35
235	W510145	Resistor—carbon 3300 Ohms ±10% ½ watt	.12
238	W510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
243	W510134	Resistor—carbon 680 Ohms ½ watt	.12
244, 245	W510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
246	W510134	Resistor—carbon 680 Ohms ½ watt	.12
248	W510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
322, 323	W510356	Resistor—carbon 12,000 Ohms ± 10% 2 watt	.24
325	W510263	Resistor—carbon 33,000 Ohms ± 10% 1 watt	.16
403	W510160	Resistor—carbon 22,000 Ohms ± 10% ½ watt	.12
404	W510167	Resistor—carbon 47,000 Ohms ½ watt	.12
408	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
409	W510177	Resistor—carbon 180,000 Ohms ± 10% ½ watt	.12
411	W510137	Resistor—carbon 1000 Ohms ½ watt	.12

*—This part is not supplied as a Service replacement item.

PARTS LIST FOR CHASSIS (Contd.)

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		RESISTORS—Continued	
418	W510148	Resistor—carbon 4700 Ohms ± 10% ½ watt	$ .12
419	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
422,423	W510154	Resistor—carbon 10,000 Ohms ± 10% ½ watt	.12
424	W510101	Resistor—carbon 10 Ohms ½ watt	.12
426	W510158	Resistor—carbon 15,000 Ohms ½ watt	.12
		COILS AND TRANSFORMERS	
12	W509378	Transformer—audio take-off	1.50
20	W509706	Transformer—TV sound discriminator (includes condensers 20-A and 20-B)	3.00
40	W509376	Transformer—audio output	1.85
96	W507343	Coil—1st video I.F. (less slug)	.70
	W507357	Slug core for 1st video I.F. coil	.20
103	W507367	Coil—choke	.70
105	W507343	Coil—2nd video I.F. (less slug)	.70
	W507357	Slug core for 2nd video I.F. coil	.20
112	W509613	Coil—3rd video I.F. (less slug)	.60
	W507357	Slug core for 3rd video I.F. coil	.20
115	W507367	Coil—choke	.70
121	W509340	Coil—peaking	.55
122	W509342	Coil—peaking	.60
127	W509603	Coil—4.5 Mc. trap (includes slug and condenser #128)	1.20
	W507357	Slug core for 4.5 Mc. trap	.20
129	W509341	Coil—peaking	.60
132	W509342	Coil—peaking	.60
142	W162326	Coil—focus (includes cable and plug)	14.00
146	W115228	Yoke—picture tube deflection (includes cable and plug)	12.50
172	W508967	Coil—Horizontal Hold (includes slug and clip)	1.10
	W508963	Slug core for Horizontal Hold coil	.15
192	W509384	Transformer—horizontal sweep	12.50
193	W509361	Coil—Width (includes slug and clip)	2.00
	W507429	Slug core for Width coil	.60
201	W509380	Transformer—power	17.00
202	W507584	Coil—choke	.28
204	W507584	Coil—choke	.28
206	W507584	Coil—choke	.28
209	W508341	Choke—filter	3.60
214	W507584	Coil—choke	.28
221	W508076	Transformer—vertical blocking oscillator	1.90
233	W509375	Transformer—vertical output	4.00
401	W520502	Coil-antenna; channel #2 (coded "2K")	1.40
	W520503	Coil-antenna; channel #3 (coded "3K")	1.40
	W520504	Coil-antenna; channel #4 (coded "4K")	1.40
	W520505	Coil antenna; channel #5 (coded "5K")	1.40
	W520506	Coil-antenna; channel #6 (coded "6K")	1.40
	W520507	Coil-antenna; channel #7 (coded "7K")	1.15
	W520508	Coil-antenna; channel #8 (coded "8K")	1.15
	W520509	Coil-antenna; channel #9 (coded "9K")	1.15
	W520510	Coil-antenna; channel #10 (coded "10K")	1.15
	W520511	Coil-antenna; channel #11 (coded "11K")	1.15
	W520512	Coil-antenna; channel #12 (coded "12K")	1.15
	W520513	Coil-antenna; channel #13 (coded "13K")	1.15
406	W520514	Coil-cathode coupling	—
413	W520522	Coil-R.F. and osc.; channel #2 (coded "2K")	1.85
	W520523	Coil-R.F. and osc.; channel #3 (coded "3K")	1.85
	W520524	Coil-R.F. and osc.; channel #4 (coded "4K")	1.85
	W520525	Coil-R.F. and osc.; channel #5 (coded "5K")	1.85
	W520526	Coil-R.F. and osc.; channel #6 (coded "6K")	1.85
	W520527	Coil-R.F. and osc.; channel #7 (coded "7K")	1.70
	W520528	Coil-R.F. and osc.; channel #8 (coded "8K")	1.70
	W520529	Coil-R.F. and osc.; channel #9 (coded "9K")	1.70
	W520530	Coil-R.F. and osc.; channel #10 (coded "10K")	1.70
	W520531	Coil-R.F. and osc.; channel #11 (coded "11K")	1.70
	W520532	Coil-R.F. and osc.; channel #12 (coded "12K")	1.70
	W520533	Coil-R.F. and osc.; channel #13 (coded "13K")	1.70
	W507986	Slug for osc. coil; auxiliary fine tuning adj.	.05

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		COILS AND TRANSFORMERS—Continued	
427	W520501	Coil-converter plate (I.F.) (includes slug and clip)	$ .55
	W509062	Slug core for converter plate coil	.12
434	W520518	Coil-choke	.10
436	W520520	Coil-choke	.10
		CONTROLS	
27-A,B,C	W520292	Volume and Contrast control (includes OFF-ON switch) A—Volume control; 1 Meg ¼ watt B—Contrast control; 750 Ohms 2 watt C—Off-On switch	3.50
138	W509893	Brightness potentiometer (100,000 Ohms)	1.00
172	W508967	Horizontal Hold coil (includes slug and clip)	1.10
	W508963	Slug core for Horizontal Hold coil	.15
180	W520127	Horizontal Drive trimmer condensor (25-280 Mmfd.)	.50
193	W509361	Width coil (includes slug and clip)	2.00
	W507429	Slug core for Width coil	.60
224-A, B	W508893	Height and Vertical Hold potentiometers A—Vertical Hold control; 1 Meg. B—Height control; 2.5 Meg.	1.75
232-A,B	W509302	Vertical Linearity and Focus potentiometers A—Vertical Linearity control; 5,000 Ohms ½ watt B—Focus control; 10,000 Ohms ±10% 4 watt	3.75
417	*	Fine Tuning condenser (3.5 Mmfd)	—
		OTHER ELECTRICAL PARTS	
41	W509398	Speaker—P.M. Dynamic (6") for Model 1176-21	4.50
	W508174	Speaker—P.M. Dynamic (6" x 9"); for Model 1186-21	8.40
116	W509386	Crystal detector	2.00
141	W509688	Ion trap	.85
191	W508063	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt	.30
220-A to G	W508062	Integrator Coupling Unit A—Condenser—ceramic .01 Mfd. 450 volt B—Resistor—carbon 22,000 Ohms ⅓ watt C—Condenser—ceramic 2000 Mmfd. 450 volt D—Resistor—carbon 8200 Ohms ⅓ watt E—Condenser—ceramic 5000 Mmfd. 450 volt F—Resistor—carbon 8200 Ohms ⅓ watt G—Condenser—ceramic 5000 Mmfd. 450 volt	1.40
240	W509517	Fuse; 1 Amp.; 250 volt	.25
400	W509695	Built-in antenna	1.00
		MECHANICAL PARTS OF R.F. TUNER (for electrical parts see preceding classified listings of condensers, resistors and coils)	
	W520450	R.F. tuner complete with coils and tubes	37.50
	W508081	Bracket for mounting R.F. tuner (front)	.16
	W520233	Bracket for mounting R.F. tuner (rear)	.25
	W507339	Clip for mounting video converter plate coil	.10
	W520515	Fine Tuning cam and shaft	.70
	W508708	Roller—detent	.10
	W520535	Shield, bottom cover	.50
	W520536	Shield, side cover	.35
	W520534	Shield-tube; miniature for 6J6 tube	.15
	W520519	Shield-tube; miniature for 68K7 tube	.20
	W509062	Slug core for converter plate coil	.12
	W507986	Slug for osc. coil; auxiliary fine tuning adj.	.05
	W507987	Socket—miniature (7 pin) for 6J6 (includes base for mounting shield)	.45
	W520521	Socket—miniature (9 pin) for 6BK7 (includes base for mounting shield)	.50
	W507966	Spring—contactor washer (on front turret shaft)	.08
	W508709	Spring—detent	.08
	W507990	Spring—retains osc. fine tuning slug	.10

*—This part is not supplied as a Service replacement item.

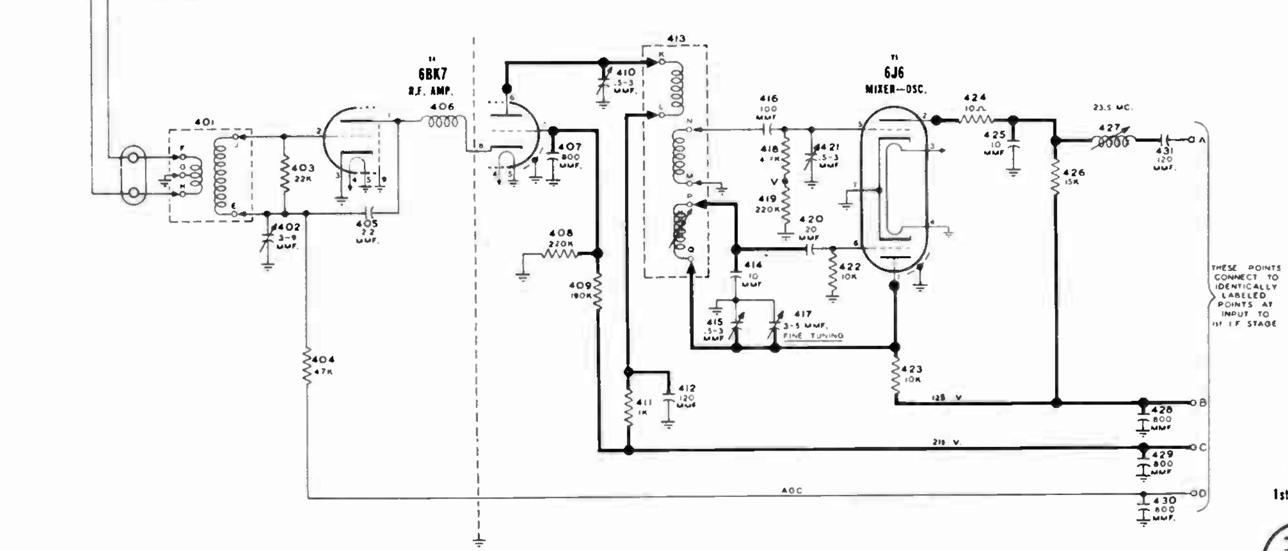
SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		MECHANICAL PARTS OF R.F. TUNER—Continued	
	W507967	Spring—turret shaft retaining	$ .03
	W520517	Stator contact assembly (includes 11 contacts and metal frame)	3.75
	W520516	Tuner turret and shaft assembly (less coils)	3.00
	W507965	Washer, fiber spacer (on turret shaft)	.01
		CABINET PARTS	
	W115226	Back for cabinet on Model 1176-21	3.00
	W115225	Back for cabinet on Model 1186-21	3.00
	W520460	Cabinet for Model 1176-21 (Table model)	55.00
	W520400	Cabinet for Model 1186-21 (Console model)	90.00
	W520437	Escutcheon for glass window	10.00
	W520435	Glass window	10.00
	W520454	Hinge bracket for name plate	.60
	W520441	Knob, channel selector	1.00
	W520440	Knob, Fine Tuning	.30
	W520439	Knob, "OFF-VOLUME-PICTURE"	1.00
	W520438	Knob, Picture	.30
	W520436	Mask for picture tube	8.00
	W520455	Name plate (less hinges and springs)	2.00
	W170986	Screw—#6-32 Philips oval brass head; retains escutcheon	.02
	W18796	Screw—#10 x 1"; mounts TV chassis	.02
	W520453	Spring for hinge on name plate	.15
	W162163	Terminal strip for TV antenna connections	.22
		MISCELLANEOUS PARTS	
	W301270	Base for mounting electrolytic condenser	.06
	W508153	Bracket base for support of yoke and focus coil (left or right hand)	.25
	W520425	Bracket, chassis extension (left hand)	1.50
	W520426	Bracket, chassis extension (right hand)	1.50
	W520312	Bracket for mounting picture tube (left hand)	1.00
	W520311	Bracket for mounting picture tube (right hand)	1.00
	W520424	Bracket for mounting pre-set controls	.75
	W508081	Bracket for mounting R.F. tuner (front)	.16
	W520233	Bracket for mounting R.F. tuner (rear)	.25
	W509005	Bracket mounts yoke and focus coil	2.75
	W508154	Bracket ("U" shaped) for support of yoke and focus coil	.55
	W508964	Clip for mounting Horizontal Hold or Width coil	.04
	W505101	Clip for mounting sound take-off transformer	.05
	W507339	Clip for mounting video converter plate, 1st video I.F., 2nd video I.F., 3rd video I.F., or 4.5 Mc. trap coil	.10
	W520428	Connector for H.V. terminal (includes cap and lead)	1.00

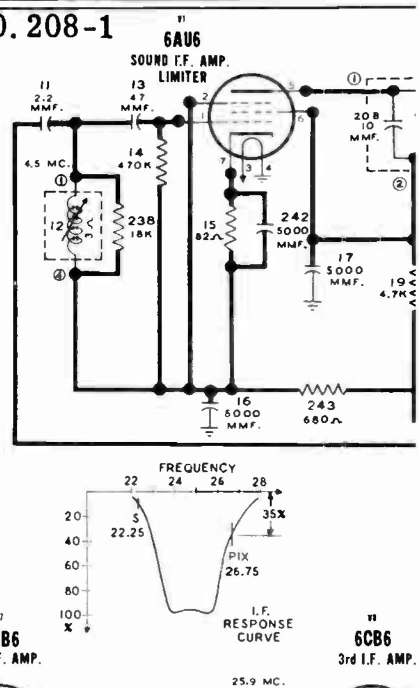
SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		MISCELLANEOUS PARTS—Continued	
	W509688	Ion trap	$ .85
	*	Jumper for color socket—1¼" of #11 wire	—
	W508617	Nut for retaining focus coil	.12
	W508962	Nut on end of Horizontal Hold control slug	.10
	W508878	Plug (3 pin) for focus coil leads	.25
	W508515	Plug (8 pin) for yoke cable	.70
	W507699	Power cord assembly (includes plugs at both ends)	1.00
	W509383	Ring—corona shield	.10
	W520313	Ring, insulating for mounting picture tube	3.50
	W507422	Rubber sleeve between neck of picture tube and focus coil	.30
	W507793	Rubber spacer support between flared neck of picture tube and yoke bracket	.15
	W18796	Screw—#10 x 1"; mounts TV chassis	.02
	W162353	Shield for 3rd I.F. coil and crystal detector	.30
	W162138	Shield—H.V. supply (front section)	2.70
	W508088	Shield—H.V. supply (rear section)	2.10
	W520534	Shield—tube; miniature for 6J6 tube	.15
	W520519	Shield—tube; miniature for 68K7 tube	.20
	W520429	Sleeve, insulating for picture tube (includes H.V. contact)	3.00
	W509062	Slug core for converter plate coil	.12
	W507357	Slug core for 1st, 2nd or 3rd video I.F. coil or 4.5 Mc. trap coil	.20
	W508963	Slug core for Horizontal Hold coil	.15
	W507429	Slug core for Width coil	.60
	W520097	Socket and cable assembly for picture tube	1.20
	W162334	Socket assembly for 1X2A tube (includes mounting frame)	1.25
	W508879	Socket (3 pin) for focus coil leads	.35
	W508419	Socket (8 pin) for yoke cable	.70
	W507932	Socket—male, power cord interlock	.25
	W507364	Socket—miniature (7 pin)	.24
	W507987	Socket—miniature (7 pin) for 6J6 (includes base for mounting shield)	.45
	W508044	Socket—miniature (9 pin)	.35
	W509507	Socket—miniature (9 pin) (for 12AU7 tube)	.25
	W520521	Socket—miniature (9 pin) for 6BK7 (includes base for mounting shield)	.50
	W508703	Socket—octal	.15
	W508703	Socket—octal (for color TV adapter)	.15
	W506469	Socket—octal (for 6W4 tube)	.18
	W509320	Spring—tension for focus coil mounting	.10
	W520444	Strap, anchor for picture tube	.65
	W115229	Strap, tube retaining	1.50
	W520443	Support for tuner shaft (plastic)	.04
	W520488	Tab, U.H.F., for Selector knob	.15
	W162163	Terminal strip for TV antenna connection	.22
	W170195	Wing nut—#8-32; for mounting yoke and focus coil	.10
	W170817	Wing screw—#10-24; for height adj. of yoke and focus coil	.05
	W170741	Wing screw—#10-32; for mounting or forward adj. of yoke	.10

*—This part is not supplied as a Service replacement item.

MODEL 2195-21, Ch. 100. 208-1

TELEVISION CHASSIS 100.208-1





PRODUCTION CHANGES

The following tabulation furnishes complete details on circuit changes which occurred during early television chassis production. The circuit shown on this page includes all of these changes.

1. The following change was incorporated so that proper centering can be obtained without introducing neck shadow and chassis that incorporate this change are coded "SERIES A" which is stamped on rear surface of chassis.
   a. Yellow lead of focus coil 142 was disconnected from 315 volt supply and reconnected to pin 7 of deflection yoke socket.

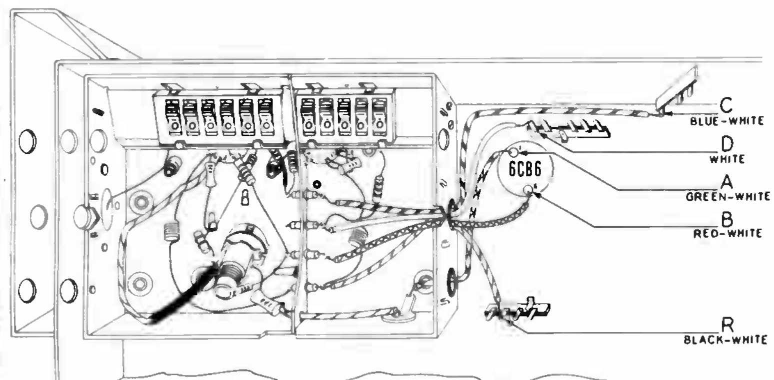
OSCILLOGRAMS

All oscillograms taken with ground lead of 'scope connected to receiver chassis (unless otherwise indicated) and with receiver controls set for normal reception of a station transmitting its standard test pattern.

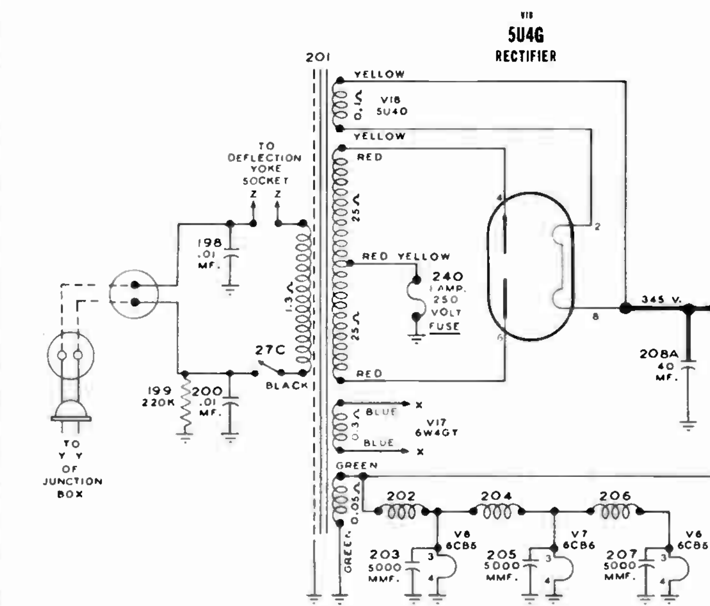
Number appearing below asterisk specifies setting of horizontal sweep frequency control on 'scope.

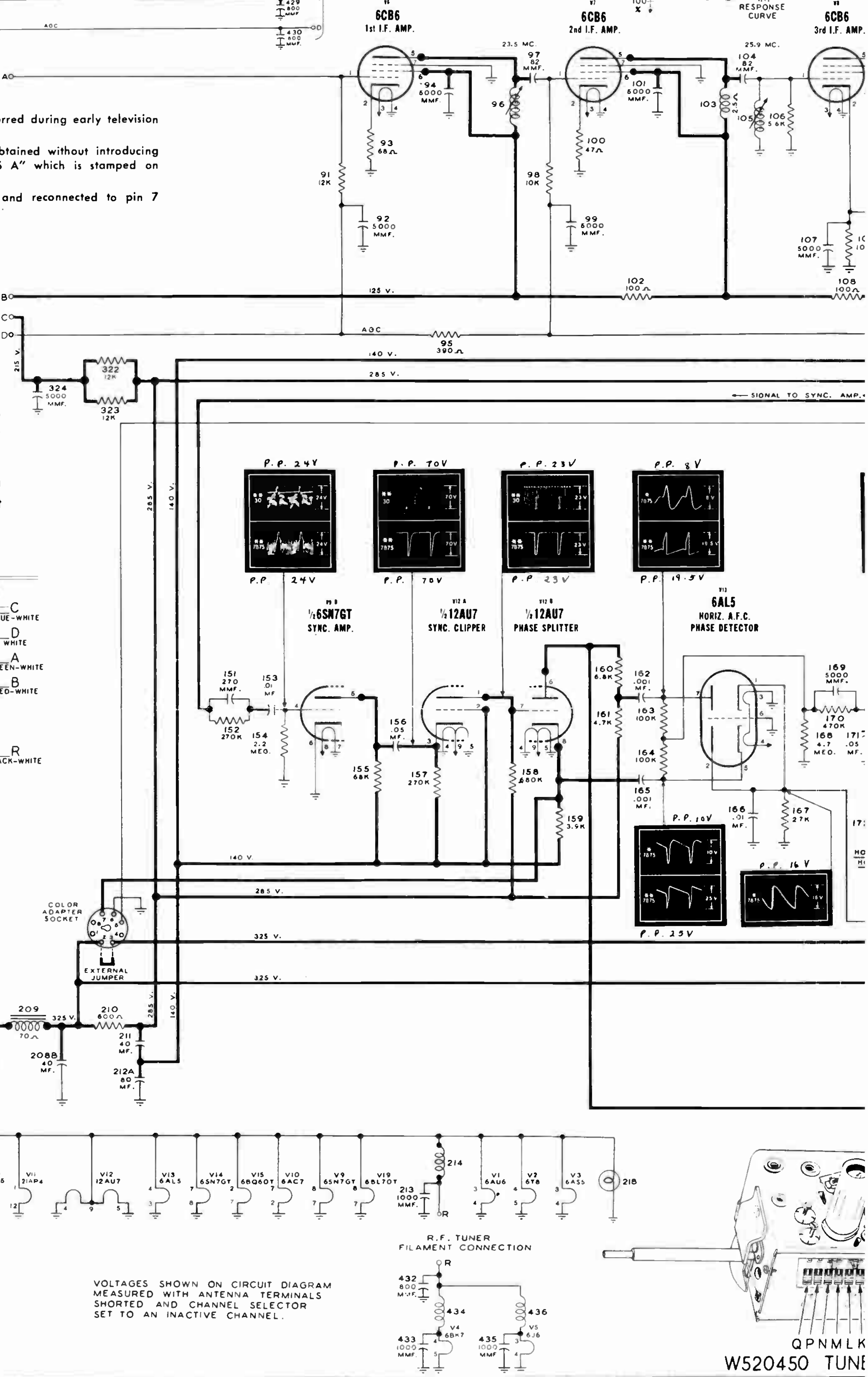
*—This symbol on illustration indicates that wave form was observed on a 'scope whose vertical amplifier had very limited high frequency response (50 to 100 Kc).

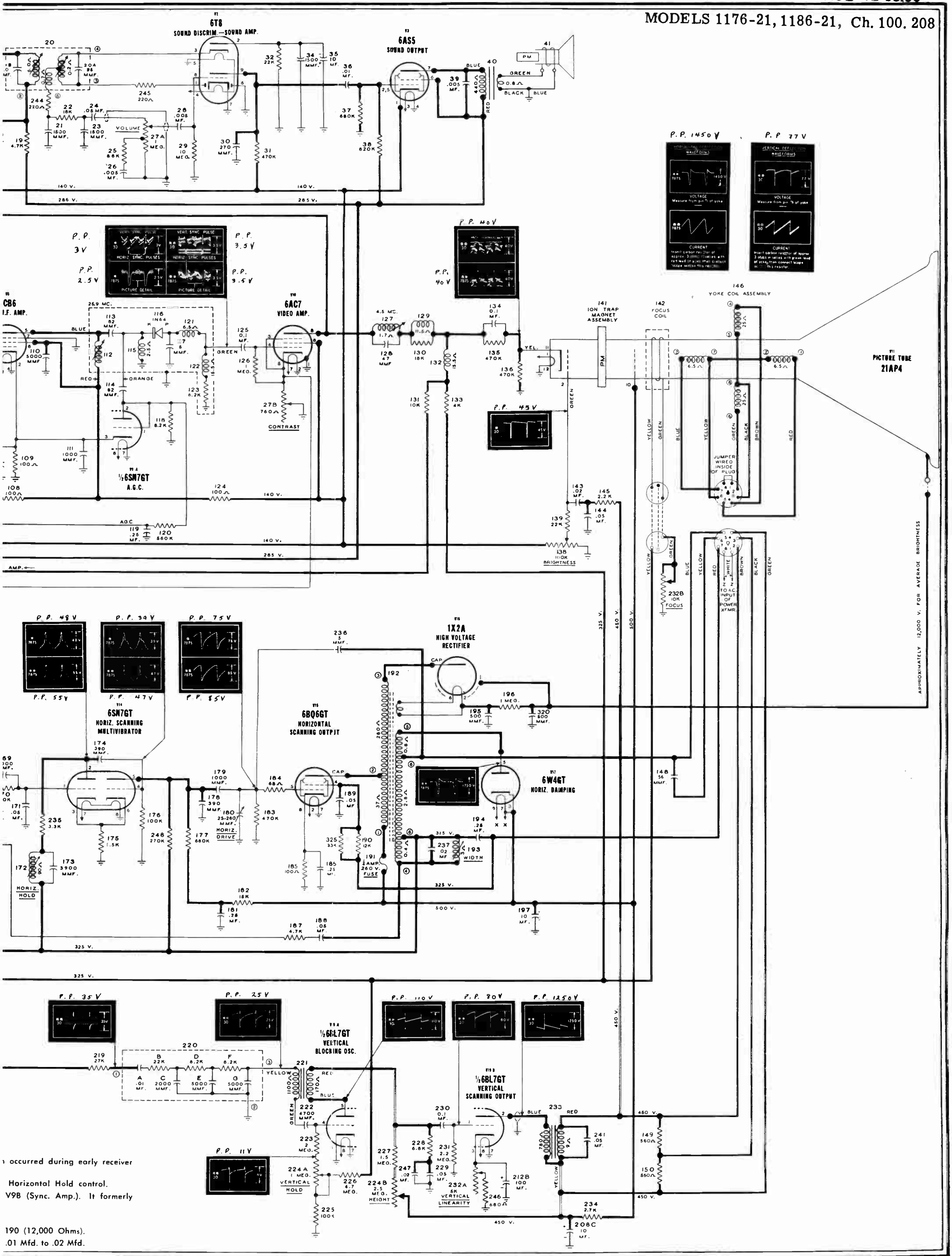
**—This symbol indicates that wave form was observed on a 'scope whose vertical amplifier frequency response was flat to within 20% up to 2 Mc.



BOTTOM VIEW OF CHASSIS SHOWING CONNECTIONS TO RF TUNER UNIT



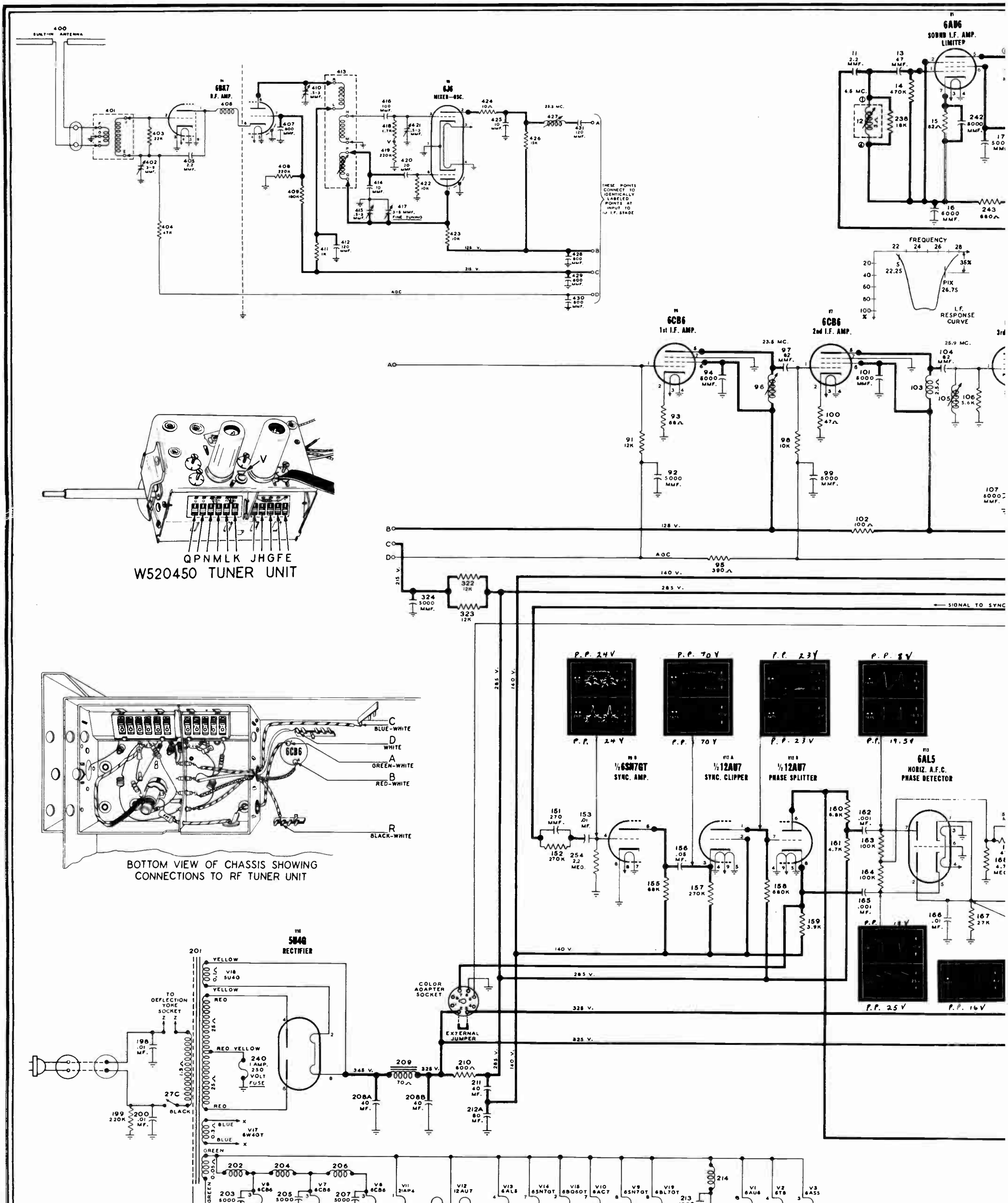




occurred during early receiver

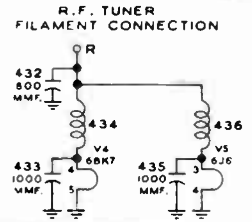
Horizontal Hold control.
V9B (Sync. Amp.). It formerly

190 (12,000 Ohms).
.01 Mfd. to .02 Mfd.



QPNMLK JHGFE
W520450 TUNER UNIT

BOTTOM VIEW OF CHASSIS SHOWING CONNECTIONS TO RF TUNER UNIT

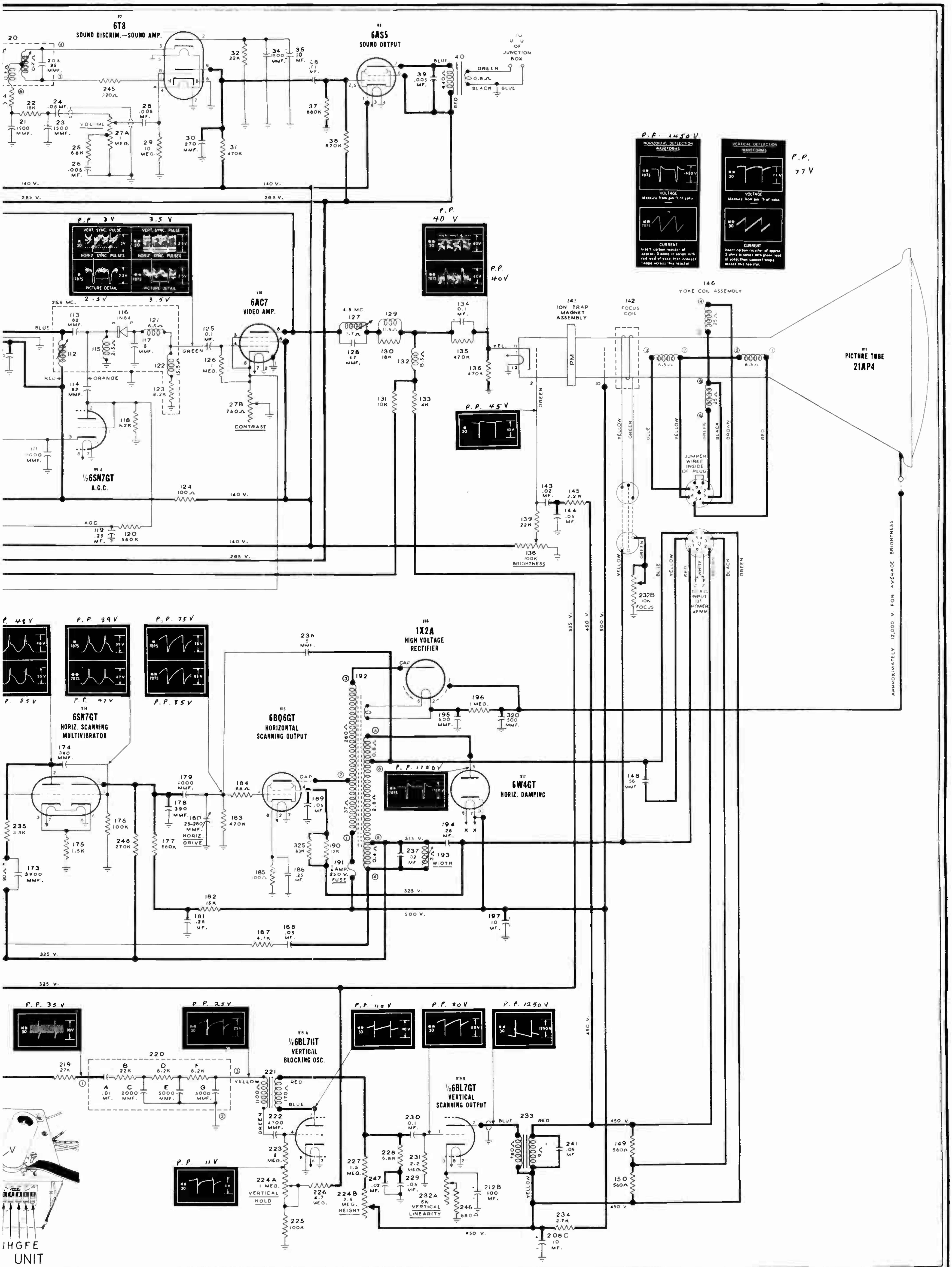


VOLTAGES SHOWN ON CIRCUIT DIAGRAM MEASURED WITH ANTENNA TERMINALS SHORTED AND CHANNEL SELECTOR SET TO AN INACTIVE CHANNEL.

PRODUCTION CHANGES

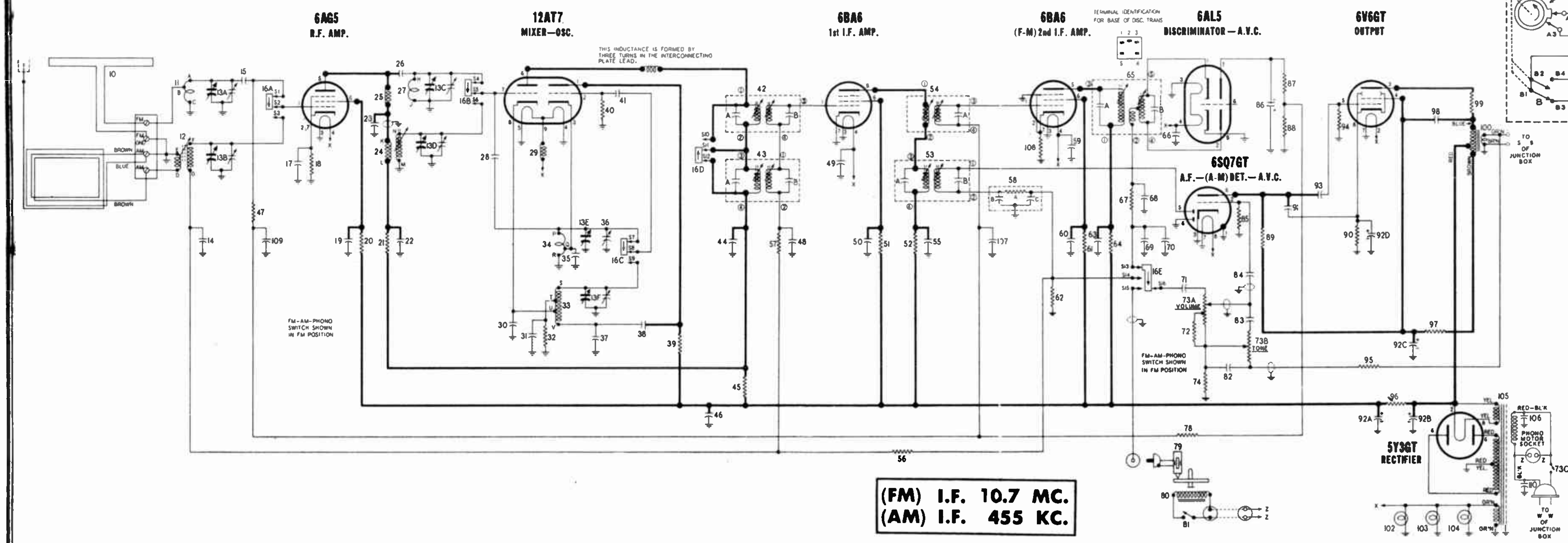
The following tabulation furnishes complete details on circuit changes whic production. The circuit shown on this page includes all of these changes.

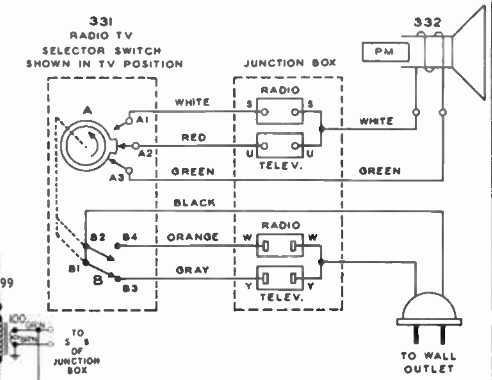
1. The following change was incorporated to improve the stability of the
   a. Resistor 321 (10 Meg.) was removed from the grid circuit of tube was connected from pin 4 of tube V9B to 140 volt supply.
2. The following changes were incorporated to provide increased width.
   a. Resistor 325 (33,000 Ohms) was connected in parallel across resistor
   b. Condenser 235, connected across the width coil 237, was changed from



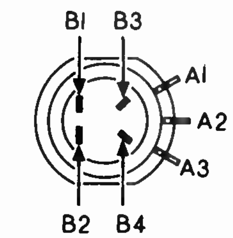
6T8
SOUND DISCRIM.—SOUND AMP.
6AS5
SOUND OUTPUT
JUNCTION BOX
VOL. ME
140 V.
285 V.
6AC7
VIDEO AMP.
CONTRAST
½6SN7GT
A.G.C.
AGC
BRIGHTNESS
ION TRAP MAGNET ASSEMBLY
FOCUS COIL
YOKE COIL ASSEMBLY
PICTURE TUBE
21AP4
HORIZONTAL DEFLECTION WAVEFORMS
VERTICAL DEFLECTION WAVEFORMS
JUMPER WIRE INSIDE OF PLUG
FOCUS
APPROXIMATELY 12,000 V. FOR AVERAGE BRIGHTNESS
1X2A
HIGH VOLTAGE RECTIFIER
6SN7GT
HORIZ. SCANNING MULTIVIBRATOR
6BQ6GT
HORIZONTAL SCANNING OUTPUT
6W4GT
HORIZ. DAMPING
HORIZ. DRIVE
WIDTH
FUSE
325 V.
500 V.
450 V.
½6BL7GT
VERTICAL BLOCKING OSC.
½6BL7GT
VERTICAL SCANNING OUTPUT
VERTICAL HOLD
HEIGHT
VERTICAL LINEARITY
UNIT

CIRCUIT DIAGRAM FOR SILVERTONE RADIO CHASSIS 100.202-1





(FM) I.F. 10.7 MC.
(AM) I.F. 455 KC.



RADIO-TV SELECTOR SWITCH 520545

GENERAL DESCRIPTION

MODEL 2195-21

The information contained in this service RL Supplement covers number 2195-21. This is a combination receiver containing a 21" picture tube, an A.C. operated AM-FM radio receiver and a three speed, inter-mix type, phonograph.

The television section of this combination utilizes chassis 100.208-1 which is basically the same as chassis 100.208 The differences are a change in the size of speaker, the length of the A.C. line cord, and a addition of a junction box and selector switch to facilitate the changing from television to radio or phono operation. A complete circuit diagram and parts list, including production changes, for the 100.208-1 television chassis is furnished with this Supplement.

NOTE: For additional service data, see Chassis 100.208

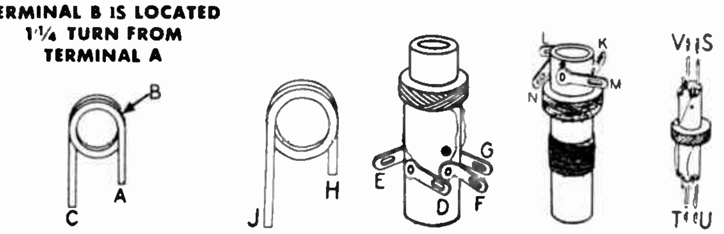
PRODUCTION CHANGES

The following tabulation furnishes complete details on circuit changes which occurred during early radio chassis production. The circuit shown on this page includes all of these changes.

1. The following change was incorporated to reduce hum. Radio receiver chassis that incorporates this change are coded "SERIES A" which is stamped on rear surface of chassis.
   a. Condenser 110 (.01 Mfd.) was added to one side of the A. C. power supply.

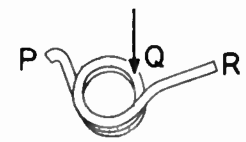
Lettered terminals in illustrations correspond to similarly lettered terminals on the circuit diagram.

TERMINAL B IS LOCATED 1¼ TURN FROM TERMINAL A

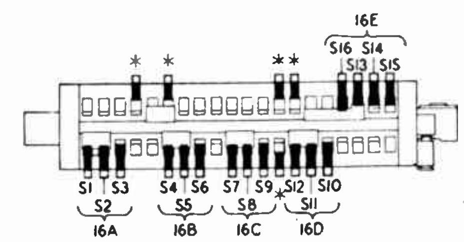


FM ANT. COIL 506353 | **FM R.F. COIL 506351** | **AM ANT. COIL 506354** | **AM R.F. COIL 506345** | **AM OSC. COIL 506335**

TERMINAL Q IS LOCATED ⅞ TURN FROM TERMINAL R



FM OSC. COIL 506352



★ Not used; may serve as wiring junction point.

BAND SWITCH 506347

HOW TO ORDER PARTS FOR YOUR SILVERTONE TELEVISION RECEIVER

These authorized replacement parts may be ordered through any Sears Retail Store or the Mail Order Store which serves the territory in which you live. Prices upon application from Sears, Roebuck and Co. The parts are shipped prepaid. When ordering parts, always give:

1. The PART NUMBER (number printed on the part if different from that shown in this list) and the DESCRIPTION. When no number is assigned order by description and rating.
2. The CHASSIS and CATALOG NUMBERS. The chassis number will be found on a metal plate at the rear of the chassis. This plate is pictured below. The catalog number will be found on a sticker on the back, inside or bottom of the cabinet.

PARTS LIST FOR TELEVISION CHASSIS 100.208-1

Notice: Some parts listed below have special characteristics. Do not use substitutes for replacement purposes.

CONDENSERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
11	W513001	Condenser—ceramic 2.2 Mmfd. 500 volt	$ .16
13	W513002	Condenser—ceramic 47 Mmfd. 500 volt	.24
16, 17	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
20-A	W509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
20-B	W509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
21	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
23	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
24	W512027	Condenser—.05 Mfd. 200 volt	.40
26	W512007	Condenser—.005 Mfd. 600 volt	.25
28	W512007	Condenser—.005 Mfd. 600 volt	.25
30	W513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
34	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
35	W505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
36	W512011	Condenser—.01 Mfd. 400 volt	.25
39	W512007	Condenser—.005 Mfd. 600 volt	.25
92	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
94	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
97	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
99	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
101	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
104	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
107	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
110	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
111	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
113, 114	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
117	W513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)	.30
119	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
125	W512033	Condenser—.1 Mfd. 200 volt	.30
128	W513438	Condenser—ceramic 47 Mmfd. ±5% 500 volt (Temperature compensating)	.45

CONDENSERS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
134	W512035	Condenser—.1 Mfd. 400 volt	.30
143	W512019	Condenser—.02 Mfd. 600 volt	.30
144	W512031	Condenser—.05 Mfd. 600 volt	.35
148	W513027	Condenser—ceramic 56 Mmfd. ±10% 1500 volt	.45
151	W513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
153	W512013	Condenser—.01 Mfd. 600 volt	.30
156	W512029	Condenser—.05 Mfd. 400 volt	.35
162	W512001	Condenser—.001 Mfd. 600 volt	.22
165	W512001	Condenser—.001 Mfd. 600 volt	.22
166	W512009	Condenser—.01 Mfd. 200 volt	.25
169	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
171	W512027	Condenser—.05 Mfd. 200 volt	.40
173	W512540	Condenser—mica 3900 Mmfd. ±10% 500 volt	.60
174	W512535	Condenser—mica 390 Mmfd. ±10% 500 volt	.35
178	W512535	Condenser—mica 390 Mmfd. ±10% 500 volt	.35
179	W512515	Condenser—mica 1000 Mmfd. ±10% 500 volt	.40
180	W520127	Condenser—trimmer 25-280 Mmfd. (Horizontal Drive Control)	.50
181	W512049	Condenser—.25 Mfd. ±10% 600 volt	.60
186	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
188, 189	W512031	Condenser—.05 Mfd. 600 volt	.35
194	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
195	W508888	Condenser—ceramic 500 Mmfd. 20,000 volt	2.00
197	W508680	Condenser—electrolytic 10 Mfd. 600 volt	2.55
198	W512255	Condenser—.01 Mfd. 400 volt	.25
200	W512255	Condenser—.01 Mfd. 400 volt	.25
203	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
205	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
207	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36

*—This part is not supplied as a Service replacement item.

CONDENSERS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
208-A, B, C	W509001	Condenser—electrolytic A—40 Mfd. 450 volt B—40 Mfd. 450 volt C—10 Mfd. 450 volt	4.00
211	W160095	Condenser—electrolytic 40 Mfd. 300 volt	2.00
212-A, B	W509002	Condenser—electrolytic A— 80 Mfd. 250 volt B—100 Mfd. 50 volt	3.00
213	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
220-A	W508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
220-C	W508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
220-E	W508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
220-G	W508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
222	W512533	Condenser—mica 4700 Mmfd. ±5% 1000 volt	1.40
229	W512308	Condenser—.05 Mfd. ±10% 600 volt	.30
230	W512037	Condenser—.1 Mfd. 600 volt	.45
236	W513026	Condenser—ceramic 5.1 Mmfd. ±10% 1500 volt	.40
237	W512019	Condenser—.02 Mfd. 600 volt	.30
241	W512027	Condenser—.05 Mfd. 200 volt	.40
242	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
247	W512019	Condenser—.02 Mfd. 600 volt	.30
320	W508888	Condenser—500 Mmfd. 20,000 volt	2.00
324	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
402	W509064	Condenser—trimmer 3-9 Mmfd.	.50
405	W513001	Condenser—ceramic 2.2 Mmfd. 500 volt	.16
407	*	Condenser—ceramic 800 Mmfd. (part of center shield)	—
410	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
412	W513439	Condenser—ceramic 120 Mmfd. ± 5% 500 volt (Temperature compensating)	.30
414	W513446	Condenser-ceramic 100 Mmfd. ±10% 500 volt (Temperature compensating)	.35
415	W509063	Condenser—trimmer 0.5-3 Mmfd.	.40
416	W513440	Condenser—ceramic 100 Mmfd. ± 10% 500 volt (Temperature compensating)	.30
417	*	Condenser—ceramic 3-5 Mmfd. (Fine Tuning)	—
420	W513441	Condenser—ceramic 20 Mmfd. ± 10% 500 volt (Temperature compensating)	.30
421	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
425	W513444	Condenser—ceramic 10 Mmfd. ± 5% 500 volt (Temperature compensating)	.50
428	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
429	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
430	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
431	W513029	Condenser—ceramic 120 Mmfd. ± 10% 500 volt	.35
432	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
433	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
435	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28

RESISTORS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
14	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
15	W510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
19	W510249	Resistor—carbon 4700 Ohms 1 watt	.16
22	W510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
25	W510170	Resistor—carbon 68,000 Ohms ½ watt	.12
29	W510197	Resistor—carbon 10 Meg. ½ watt	.12
31	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
32	W510160	Resistor—carbon 22,000 Ohms ±10% ½ watt	.12
37	W510746	Resistor—carbon 680,000 Ohms ±5% ½ watt	.20
38	W510747	Resistor—carbon 820,000 Ohms ±5% ½ watt	.20
91	W510723	Resistor—carbon 12,000 Ohms ±5% ½ watt	.16
93	W510116	Resistor—carbon 68 Ohms ½ watt	.12
95	W510129	Resistor—carbon 390 Ohms ±10% ½ watt	.12

RESISTORS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
98	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
100	W510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
102	W510119	Resistor—carbon 100 Ohms ½ watt	.12
106	W510150	Resistor—carbon 5600 Ohms ±10% ½ watt	.12
108	W510119	Resistor—carbon 100 Ohms ½ watt	.12
109	W510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
118	W510153	Resistor—carbon 8,200 Ohms ±10% ½ watt	.12
120	W510186	Resistor—carbon 560,000 Ohms ±10% ½ watt	.12
123	W510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
124	W510119	Resistor—carbon 100 Ohms ½ watt	.12
126	W510191	Resistor—carbon 1 Meg. ½ watt	.12
130	W510745	Resistor—carbon 18,000 Ohms ±5% ½ watt	.20
131	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
133	W510753	Resistor—wire wound 4000 Ohms ±10% 5 watt	1.00
135, 136	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
139	W510160	Resistor—carbon 22,000 Ohms ±10% ½ watt	.12
145	W510142	Resistor—carbon 2200 Ohms ±10% ½ watt	.12
149, 150	W510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
152	W510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
154	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12
155	W510169	Resistor—carbon 68,000 Ohms ±10% ½ watt	.12
157	W510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
158	W510187	Resistor—carbon 680,000 Ohms ±10% ½ watt	.12
159	W510748	Resistor—carbon 3900 Ohms ±5% ½ watt	.20
160	W510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
161	W510750	Resistor—carbon 4700 Ohms ±5% ½ watt	.20
163, 164	W510751	Resistor—carbon 100,000 Ohms ±5% ½ watt	.20
167	W510162	Resistor—carbon 27,000 Ohms ±10% ½ watt	.12
168	W510195	Resistor—carbon 4.7 Meg. ½ watt	.12
170	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
175	W510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
176	W510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
177	W510187	Resistor—carbon 680,000 Ohms ±10% ½ watt	.12
182	W510357	Resistor—carbon 15,000 Ohms ±10% 2 watt	.35
183	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
184	W510116	Resistor—carbon 68 Ohms ½ watt	.12
185	W510218	Resistor—carbon 100 Ohms ±10% 1 watt	.16
187	W510248	Resistor—carbon 4700 Ohms ±10% 1 watt	.16
190	W510758	Resistor—wire wound 12,000 Ohms ±10% 5 watts	1.20
196	W510390	Resistor—carbon 1 Meg. ±10% 2 watt	.30
199	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
210	W510741	Resistor—wire wound 600 Ohms ±10% 10 watt	.90
219	W510162	Resistor—carbon 27,000 Ohms ± 10% ½ watt	.12
220-B	W508062	Resistor—carbon 22,000 Ohms ⅕ watt (part of Integrator Unit)	1.40
220-D	W508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
220-F	W508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
223	W510769	Resistor—carbon 2 Meg. ±5% ½ watt	.20
225	W510766	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
226	W510768	Resistor—carbon 4.7 Meg. ±10% ½ watt	.12
227	W510767	Resistor—carbon 1.5 Meg. ±10% ½ watt	.20
228	W510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
231	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12
234	W510344	Resistor—carbon 2700 Ohms ±10% 2 watt	.35
235	W510145	Resistor—carbon 3300 Ohms ±10% ½ watt	.12
238	W510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
243	W510134	Resistor—carbon 680 Ohms ½ watt	.12
244, 245	W510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
246	W510134	Resistor—carbon 680 Ohms ½ watt	.12
248	W510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
322,323	W510356	Resistor—carbon 12,000 Ohms ± 10% 2 watt	.24
325	W510263	Resistor—33 Ohms ±10% 1 watt	.16
403	W510160	Resistor—carbon 22,000 Ohms ± 10% ½ watt	.12
404	W510167	Resistor—carbon 47,000 Ohms ½ watt	.12
408	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
409	W510177	Resistor—carbon 180,000 Ohms ± 10% ½ watt	.12
411	W510137	Resistor—carbon 1000 Ohms ½ watt	.12

*—This part is not supplied as a Service replacement item.

PARTS LIST FOR TELEVISION CHASSIS 100.208-1 (Contd.)

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		RESISTORS—Continued	
418	W510148	Resistor—carbon 4700 Ohms ± 10% ½ watt	.12
419	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
422,423	W510154	Resistor—carbon 10,000 Ohms ± 10% ½ watt	.12
424	W510101	Resistor—carbon 10 Ohms ½ watt	.12
426	W510158	Resistor—carbon 15,000 Ohms ½ watt	.12
		COILS AND TRANSFORMERS	
12	W509378	Transformer—audio take-off	1.50
20	W509706	Transformer—TV sound discriminator (includes condensers 20-A and 20-B)	3.00
40	W509376	Transformer—audio output	1.85
96	W507343	Coil—1st video I.F. (less slug)	.70
	W507357	Slug core for 1st video I.F. coil	.20
103	W507367	Coil—choke	.70
105	W507343	Coil—2nd video I.F. (less slug)	.70
	W507357	Slug core for 2nd video I.F. coil	.20
112	W509613	Coil—3rd video I.F. (less slug)	.60
	W507357	Slug core for 3rd video I.F. coil	.20
115	W507367	Coil—choke	.70
121	W509340	Coil—peaking	.55
122	W509342	Coil—peaking	.60
127	W509603	Coil—4.5 Mc. trap (includes slug and condenser #128)	1.20
	W507357	Slug core for 4.5 Mc. trap	.20
129	W509341	Coil—peaking	.60
132	W509342	Coil—peaking	.60
142	W162326	Coil—focus (includes cable and plug)	14.00
146	W115228	Yoke—picture tube deflection (includes cable and plug)	12.50
172	W508967	Coil—Horizontal Hold (includes slug and clip)	1.10
	W508963	Slug core for Horizontal Hold coil	.15
192	W509384	Transformer—horizontal sweep	12.50
193	W509361	Coil—Width (includes slug and clip)	2.00
	W507429	Slug core for Width coil	.60
201	W509380	Transformer—power	17.00
202	W507584	Coil—choke	.28
204	W507584	Coil—choke	.28
206	W507584	Coil—choke	.28
209	W508341	Choke—filter	3.60
214	W507584	Coil—choke	.28
221	W508076	Transformer—vertical blocking oscillator	1.90
233	W509375	Transformer—vertical output	4.00
401	W520502	Coil-antenna; channel #2	1.40
	W520503	Coil-antenna; channel #3	1.40
	W520504	Coil-antenna; channel #4	1.40
	W520505	Coil-antenna; channel #5	1.40
	W520506	Coil-antenna; channel #6	1.40
	W520507	Coil-antenna; channel #7	1.15
	W520508	Coil-antenna; channel #8	1.15
	W520509	Coil-antenna; channel #9	1.15
	W520510	Coil-antenna; channel #10	1.15
	W520511	Coil-antenna; channel #11	1.15
	W520512	Coil-antenna; channel #12	1.15
	W520513	Coil-antenna; channel #13	1.15
406	W520514	Coil-cathode coupling	—
413	W520522	Coil-R.F. and osc.; channel #2	1.85
	W520523	Coil-R.F. and osc.; channel #3	1.85
	W520524	Coil-R.F. and osc.; channel #4	1.85
	W520525	Coil-R.F. and osc.; channel #5	1.85
	W520526	Coil-R.F. and osc.; channel #6	1.85
	W520527	Coil-R.F. and osc.; channel #7	1.70
	W520528	Coil-R.F. and osc.; channel #8	1.70
	W520529	Coil-R.F. and osc.; channel #9	1.70
	W520530	Coil-R.F. and osc.; channel #10	1.70
	W520531	Coil-R.F. and osc.; channel #11	1.70
	W520532	Coil-R.F. and osc.; channel #12	1.70
	W520533	Coil-R.F. and osc.; channel #13	1.70
	W507986	Slug for osc. coil; auxiliary fine tuning adj.	.05

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		COILS AND TRANSFORMERS—Continued	
427	W520501	Coil-converter plate (I.F.) (includes slug and clip)	.55
	W509062	Slug core for converter plate coil	.12
434	W520518	Coil-choke	.10
436	W520520	Coil-choke	.10
		CONTROLS	
27-A,B,C	W520292	Volume and Contrast control (includes OFF-ON switch) A—Volume control; 1 Meg ¼ watt B—Contrast control; 750 Ohms 2 watt C—Off-On switch	3.50
138	W509893	Brightness potentiometer (100,000 Ohms)	1.00
172	W508967	Horizontal Hold coil (includes slug and clip)	1.10
	W508963	Slug core for Horizontal Hold coil	.15
180	W520127	Horizontal Drive trimmer condensor (25-280 Mmfd.)	.50
193	W509361	Width coil (includes slug and clip)	2.00
	W507429	Slug core for Width coil	.60
224-A, B	W508893	Height and Vertical Hold potentiometers A—Vertical Hold control; 1 Meg. B—Height control; 2.5 Meg.	1.75
232-A,B	W509302	Vertical Linearity and Focus potentiometers A—Vertical Linearity control; 5,000 Ohms ½ watt B—Focus control; 10,000 Ohms ±10% 4 watt	3.75
417	*	Fine Tuning condenser (3.5 Mmfd)	—
		OTHER ELECTRICAL PARTS	
116	W509386	Crystal detector	2.00
141	W509688	Ion trap	.85
191	W508063	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt	.30
218	W118921	TV Channel Lite (Mazda #47) 6-8 v. 150 Ma.	.15
220-A to G	W508062	Integrator Coupling Unit A—Condenser—ceramic .01 Mfd. 450 volt B—Resistor—carbon 22,000 Ohms ⅓ watt C—Condenser—ceramic 2000 Mmfd. 450 volt D—Resistor—carbon 8200 Ohms ⅓ watt E—Condenser—ceramic 5000 Mmfd. 450 volt F—Resistor—carbon 8200 Ohms ⅓ watt G—Condenser—ceramic 5000 Mmfd. 450 volt	1.40
240	W509517	Fuse; 1 Amp.; 250 volt	.25
400	W509695	Built-in antenna	1.00
		MECHANICAL PARTS OF R.F. TUNER (for electrical parts see preceding classified listings of condensers, resistors and coils)	
	W520450	R.F. tuner complete with coils and tubes	37.50
	W508081	Bracket for mounting R.F. tuner (front)	.16
	W520233	Bracket for mounting R.F. tuner (rear)	.25
	W507339	Clip for mounting video converter plate coil	.10
	W520515	Fine Tuning cam and shaft	.70
	W508708	Roller—detent	.10
	W520535	Shield, bottom cover	.50
	W520536	Shield, side cover	.35
	W520534	Shield-tube; miniature for 6J6 tube	.15
	W520519	Shield-tube; miniature for 6BK7 tube	.20
	W509062	Slug core for converter plate coil	.12
	W507986	Slug for osc. coil; auxiliary fine tuning adj.	.05
	W507987	Socket—miniature (7 pin) for 6J6 (includes base for mounting shield)	.45
	W520521	Socket—miniature (9 pin) for 6BK7 (includes base for mounting shield)	.50
	W507966	Spring—contactor washer (on front turret shaft)	.08
	W508709	Spring—detent	.08
	W507990	Spring—retains osc. fine tuning slug	.10

*—This part is not supplied as a Service replacement item.

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		MECHANICAL PARTS OF R.F. TUNER—Continued	
	W507967	Spring—turret shaft retaining	.03
	W520517	Stator contact assembly (includes 11 contacts and metal frame)	3.75
	W520516	Tuner turret and shaft assembly (less coils)	3.00
	W507965	Washer, fiber spacer (on turret shaft)	.01
		MISCELLANEOUS PARTS	
	W301270	Base for mounting electrolytic condenser	.06
	W508153	Bracket base for support of yoke and focus coil (left or right hand)	.25
	W520425	Bracket, chassis extension (left hand)	1.50
	W520426	Bracket, chassis extension (right hand)	1.50
	W520312	Bracket for mounting picture tube (left hand)	1.00
	W520311	Bracket for mounting picture tube (right hand)	1.00
	W520424	Bracket for mounting pre-set controls	.75
	W508081	Bracket for mounting R.F. tuner (front)	.16
	W520233	Bracket for mounting R.F. tuner (rear)	.25
	W509005	Bracket mounts yoke and focus coil	2.75
	W508154	Bracket ("U" shaped) for support of yoke and focus coil	.55
	W508681	Clip for mounting electrolytic condenser #197	.10
	W508964	Clip for mounting Horizontal Hold or Width coil	.04
	W505101	Clip for mounting sound take-off transformer	.05
	W507339	Clip for mounting video converter plate, 1st video I.F., 2nd video I.F., 3rd video I.F., or 4.5 Mc. trap coil	.10
	W520428	Connector for H.V. terminal (includes cap and lead)	1.00
	W509688	Ion trap	.85
	*	Jumper for color socket—1¼" of #11 wire	—
	W508617	Nut for retaining focus coil	.12
	W508962	Nut on end of Horizontal Hold control slug	.10
	W508878	Plug (3 pin) for focus coil leads	.25
	W508515	Plug (8 pin) for yoke cable	.70
	W507699	Power cord assembly (includes plugs at both ends)	1.00
	W509383	Ring—corona shield	.10
	W520313	Ring, insulating for mounting picture tube	3.50

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		MISCELLANEOUS PARTS—Continued	
	W507422	Rubber sleeve between neck of picture tube and focus coil	.30
	W507793	Rubber spacer support between flared neck of picture tube and yoke bracket	.15
	W18796	Screw—#10 x 1"; mounts TV chassis	.02
	W162353	Shield for 3rd I.F. coil and crystal detector	.30
	W162138	Shield—H.V. supply (front section)	2.70
	W508088	Shield—H.V. supply (rear section)	2.10
	W520534	Shield—tube; miniature for 6J6 tube	.15
	W520519	Shield—tube; miniature for 6BK7 tube	.20
	W520429	Sleeve, insulating for picture tube (includes H.V. contact)	3.00
	W509062	Slug core for converter plate coil	.12
	W507357	Slug core for 1st, 2nd or 3rd video I.F. coil or 4.5 Mc. trap coil	.20
	W508963	Slug core for Horizontal Hold coil	.15
	W507429	Slug core for Width coil	.60
	W509761	Socket and cable assembly for picture tube	1.05
	W162334	Socket assembly for 1X2A tube (includes mounting frame)	1.25
	W508879	Socket (3 pin) for focus coil leads	.35
	W520571	Socket for TV Channel Lite	.35
	W508419	Socket (8 pin) for yoke cable	.70
	W507932	Socket—male, power cord interlock	.25
	W507364	Socket—miniature (7 pin)	.24
	W507987	Socket—miniature (7 pin) for 6J6 (includes base for mounting shield)	.45
	W508044	Socket—miniature (9 pin)	.35
	W509507	Socket—miniature (9 pin) (for 12AU7 tube)	.25
	W520521	Socket—miniature (9 pin) for 6BK7 (includes base for mounting shield)	.50
	W508703	Socket—octal	.15
	W508703	Socket—octal (for color TV adapter)	.15
	W506469	Socket—octal (for 6W4 tube)	.18
	W509320	Spring—tension for focus coil mounting	.10
	W520444	Strap, anchor for picture tube	.65
	W520623	Strap, tube retaining	.50
	W520443	Support for tuner shaft (plastic)	.04
	W162163	Terminal strip for TV antenna connection	.22
	W170195	Wing nut—#8-32; for mounting yoke and focus coil	.10
	W170817	Wing screw—#10-24; for height adj. of yoke and focus coil	.05
	W170741	Wing screw—#10-32; for mounting or forward adj. of yoke	.10

*—This part is not supplied as a Service replacement item.

PARTS LIST FOR JUNCTION BOX CHASSIS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
331	W520545	Switch, Radio-TV Selector	$ 2.50
332	W505512	Speaker—P. M. Dynamic (12 inch)	15.75
	W520546	Cover for switch	.10
	W520262	Socket (2 pin) for A. C. power	$ .35
	W520541	Socket (2 pin) for Speaker leads	.15

*—This part is not supplied as a Service replacement item.

PARTS LIST FOR RADIO CHASSIS 100.202-1

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		CONDENSERS	
13-A to F	W506348	Condenser—variable gang (with drum)	$ 9.50
14	W512027	Condenser—.05 Mfd. 200 volt	.40
15	W513406	Condenser—ceramic 22 Mmfd. 500 volt (Temperature compensating)	.30
17	W513002	Condenser—ceramic 47 Mmfd. 500 volt	.24
19	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
22	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
23	W513002	Condenser—ceramic 47 Mmfd. 500 volt	.24
26	W513401	Condenser—ceramic 5 Mmfd. ± 10% 500 volt (Temperature compensating)	.50
28	W513000	Condenser—ceramic 1.0 Mmfd. 500 volt	.15
30	W513007	Condenser—ceramic 330 Mmfd. 500 volt	.25
31	W512009	Condenser—.01 Mfd. 200 volt	.25
35	W513429	Condenser—ceramic 10 Mmfd. ± 10% 500 volt (Temperature compensating)	.30
36	W506336	Condenser—trimmer; 3 to 30 Mmfd.	.75
37	W513442	Condenser—ceramic 10 Mmfd. ± 10% 500 volt (Temperature compensating)	.40
38	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
41	W513409	Condenser—ceramic 39 Mmfd. ± 5% 500 volt (Temperature compensating)	.30
42-A, B	W506080	Condenser—ceramic 33 Mmfd. (part of 1st FM I.F. transformer)	2.05
43-A, B	W506333	Condenser—ceramic 330 Mmfd. (part of 1st AM I.F. transformer)	2.15
44	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
46	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
48, 49, 50	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
53-A	W505797	Condenser—ceramic 107 Mmfd. (part of 2nd AM I.F. transformer)	2.15
53-B	W505797	Condenser—ceramic 86 Mmfd. (part of 2nd AM I.F. transformer)	2.15
54-A	W505905	Condenser—ceramic 83 Mmfd. (part of 2nd FM I.F. transformer)	2.05
55	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
58-B, C	W506338	Condenser—ceramic 100 Mmfd. (part of diode filter unit)	.45
59, 60	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
63	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
65-A	W506332	Condenser—ceramic 8 Mmfd. (part of discriminator transformer)	4.20
65-B	W506332	Condenser—ceramic 47 Mmfd. (part of discriminator transformer)	4.20
66	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
68	W513007	Condenser—ceramic 330 Mmfd. 500 volt	.25
69	W512005	Condenser—.003 Mfd. 600 volt	.25
70	W513003	Condenser—ceramic 100 Mmfd. 500 volt	.24
71	W512027	Condenser—.05 Mfd. 200 volt	.40
82	W512033	Condenser—.1 Mfd. 200 volt	.30
83	W512001	Condenser—.001 Mfd. 600 volt	.22
84	W512009	Condenser—.01 Mfd. 200 volt	.25
86	W504937	Condenser—electrolytic 5 Mfd. 50 volt	.80
91	W513008	Condenser—ceramic 470 Mmfd. 350 volt	.30
92-A,B,C,D	W505908	Condenser—electrolytic A—30 Mfd. 450 volt B—40 Mfd. 450 volt C—10 Mfd. 450 volt D—20 Mfd. 25 volt	3.75
93	W512009	Condenser—.01 Mfd. 200 volt	.25
98	W512001	Condenser—.001 Mfd. 600 volt	.22
106	W512256	Condenser—.01 Mfd. 600 volt	.30
107	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
109	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
110	W512256	Condenser—.01 Mfd. 600 volt	.30

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		RESISTORS	
18	W510117	Resistor—carbon 82 Ohms ± 10% ½ watt	$ .12
20	W510164	Resistor—carbon 33,000 Ohms ½ watt	.12
21	W510237	Resistor—carbon 1000 Ohms 1 watt	.16
32	W510141	Resistor—carbon 1800 Ohms ± 10% ½ watt	.12
39	W510249	Resistor—carbon 4700 Ohms 1 watt	.16
40	W510155	Resistor—carbon 10,000 Ohms ½ watt	.12
45	W510237	Resistor—carbon 1000 Ohms 1 watt	.16
47	W510167	Resistor—carbon 47,000 Ohms ½ watt	.12
51	W510165	Resistor—carbon 39,000 Ohms ± 10% ½ w.	.12
52	W510237	Resistor—carbon 1000 Ohms 1 watt	.16
56	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12
57	W510173	Resistor—carbon 100,000 Ohms ½ watt	.12
58-A	W506338	Resistor—carbon 47,000 Ohms (part of diode filter unit)	.45
61	W510165	Resistor—carbon 39,000 Ohms ± 10% ½ w.	.12
62	W510185	Resistor—carbon 470,000 Ohms ½ watt	.12
64	W510237	Resistor—carbon 1000 Ohms 1 watt	.16
67	W510159	Resistor—carbon 18,000 Ohms ± 10% ½ w.	.12
72	W510170	Resistor—carbon 68,000 Ohms ½ watt	.12
73-A,B,C	W508483	Volume and tone control A—2 Meg. B—2 Meg. C—"ON-OFF" switch	2.50
74	W510128	Resistor—carbon 330 Ohms ½ watt	.12
78	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12
85	W510195	Resistor—carbon 4.7 Meg. ½ watt	.12
87, 88	W510153	Resistor—carbon 8200 Ohms ± 10% ½ watt	.12
89	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
90	W510128	Resistor—carbon 330 Ohms ½ watt	.12
94	W510185	Resistor—carbon 470,000 Ohms ½ watt	.12
95	W510148	Resistor—carbon 4700 Ohms ± 10% ½ watt	.12
96	W510732	Resistor—wire wound 2000 Ohms ± 10% 10 watts	.95
97	W510261	Resistor—carbon 22,000 Ohms 1 watt	.16
99	W510113	Resistor—carbon 47 Ohms ½ watt	.12
108	W510115	Resistor—carbon 68 Ohms ± 10% ½ watt	.12
		TRANSFORMERS AND COILS	
10	W508395	Antenna—built-in (FM)	.50
11	W506353	Coil—FM Antenna	.15
12	W506354 W506349	Coil—AM Antenna Slug core for AM antenna coil	2.20 .18
24	W506345 W506344	Coil—AM R.F. Slug core for AM R.F. coil	2.25 .18
25	W507935	Coil—choke	.40
27	W506351	Coil—FM R.F.	.15
29	W507586	Coil—choke	.28
33	W506335	Coil—AM Oscillator	1.30
34	W506352	Coil—FM Oscillator	.15
42	W506080	Transformer—1st FM I.F.	2.05
43	W506333	Transformer—1st AM I.F.	2.15
53	W505797	Transformer—2nd AM I.F.	2.15
54	W505905	Transformer—2nd FM I.F.	2.05
65	W506332 W508841	Transformer—discriminator Slug core for primary or secondary of discriminator transformer	4.20 .20
100	W508486	Transformer—output	2.60
105	W506709	Transformer—power	11.00

*—This part is not supplied as a Service replacement item.

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		OTHER ELECTRICAL PARTS	
16-A to E	W506347	Switch—FM-AM-Phono	$ 2.40
58-A,B,C	W506338	Diode filter unit A—Resistor-carbon 47,000 Ohms ⅓ watt B—Condenser-ceramic 100 Mmfd. 400 volt C—Condenser-ceramic 100 Mmfd. 400 volt	.45
79	W509160	Cartridge	8.60
80	W509301	Motor—115 volt 60 cycle	12.40
81	W509205	Switch—"ON-OFF" for record changer	.65
102	W118921	ON-OFF Indicator Lite (Mazda #47) 6-8 v. 150 Ma.	.15
103, 104	W118921	Radio Dial Lite (Mazda #47) 6-8 v. 150 Ma.	.15
		MISCELLANEOUS PARTS	
	W508986	Background for dial (foil)	.50
	W301270	Base for mounting electrolytic condenser	.06
	W505165	"C" washer for tuning shaft or pointer shaft	.02
	W508488	Clamp—retains dial scale	.10
	W506343	Clip for mounting AM antenna or R.F. coil	.08
	W505101	Clip for mounting I.F. transformer	.05
	W160326	Clip—retains dial background	.02
	W114955	Clip—retainer on end of dial cord	.01
	W117057	Cord—dial drive (3 ft. required) per ft.	.05

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		MISCELLANEOUS PARTS—Continued	
	W508985	Dial scale—glass	$ 2.20
	W501031	Plug for phono, motor cable	.15
	W500966	Plug for phono, pick-up cable	.10
	W506370	Pointer	.15
	W119087	Ring for dial cord	.01
	W38501	Rubber bushing for band switch	.03
	W116584	Rubber spacer for mounting dial scale	.04
	W503588	Shaft and drum for dial	.20
	W162148	Shaft and link assembly; Band switch	.65
	W508485	Shaft—tuning	.25
	W506349	Slug core for AM antenna coil	.18
	W506344	Slug core for AM R.F. coil	.18
	W508841	Slug core for primary or secondary of discriminator transformer	.20
	W505307	Socket and phono motor cable	.50
	W506372	Socket—dial lamp; pair (with lead)	.50
	W505497	Socket for ON-OFF Indicator Lite at base of cabinet	.65
	W504597	Socket—miniature (7 pin)	.30
	W506331	Socket—miniature (9 pin)	.60
	W116690	Socket—octal base	.15
	W160392	Socket—octal (rectifier)	.16
	W160039	Socket—phono. plug	.12
	W505161	Spring—dial cord tension	.08
	W505924	Terminal strip (FM-FM-AM-AM)	.25
	W111456	Washer—spring washer for tuning shaft or pointer shaft	.01

*—This part is not supplied as a Service replacement item.

PARTS LIST FOR CABINET PARTS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
	W520549	Back for cabinet; radio compartment	$ 1.40
	W115238	Back for cabinet; TV compartment	2.25
	W508217	Bracket for mounting ON-OFF Indicator Lite at base of cabinet	.10
	W117131	Bulls eye for ON-OFF Indicator Lite at base of cabinet	.12
	W520547	Cabinet for Stock No. 2195-21	155.00
	W508499	Catch for door	.65
	W520581	Door, radio compartment (upper right hand)	24.00
	W520582	Door, record storage compartment (lower right hand)	15.50
	W520580	Door, TV compartment (left hand)	30.00
	W508493	Escutcheon for AM FM dial	2.80
	W506380	Fastener for AM loop antenna	.02
	W520499	Glass window	10.00
	W520583	Handle for door	1.35
	W520584	Handle for drawer	.95
	W520454	Hinge bracket for name plate	.60
	W509307	Hinge for door per pair	.70
	W520632-A	Knob, Channel Selector (TV)	.65
	W520568	Knob, "PHO-AM-FM" (Radio)	.65
	W520634-A	Knob, Fine Tuning (TV)	.30

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
	W520633-A	Knob, "OFF-VOLUME-PICTURE" (TV)	$ .65
	W520635-A	Knob, Picture (TV)	.30
	W520569	Knob, "RADIO-TV" Selector (Radio)	.50
	W509044	Knob, "TONE" (Radio)	.30
	W520567	Knob, "TUNE" (Radio)	.65
	W520565	Knob, "VOL-ON" (Radio)	.45
	W520496-B	Mask for picture tube	7.00
	W520455	Name plate	2.00
	W508408	Rail for drawer per set	8.40
	W508531	Record Adapter for 45 R.P.M. records..pk. of 12	1.00
	W520579	Record changer drawer assembly (less hardware)	25.00
	W160496	Rubber pad for mounting radio chassis	.08
	W520578	Screw #6 x ¾ oval head wood screw; mounts glass window retaining strip	.05
	W170167	Screw #8-32 x ⅞"; mounts radio chassis	.02
	W18796	Screw #10 x 1"; mounts TV chassis	.02
	W520452	Spring for hinge on nameplate	.15
	W520585	Strip, retains glass window (wood)	1.50
	W520488	Tab, U.H.F., for Channel Selector Knob (TV)	.15
	W505924	Terminal strip for Radio antenna connections (FM-FM-AM-AM)	.25
	W162163	Terminal strip for TV antenna connections	.22

*—This part is not supplied as a Service replacement item.

SILVERTONE 2170-C
(21" RECTANGULAR PICTURE TUBE)

GENERAL DESCRIPTION

The information contained in this service Supplement cover number 2170-C.

This television receiver utilizes chassis 100.209 which is basically the same as chassis 100.208 The differences between the two chassis is that the 100.209 utilizes a 1B3GT type tube for H.V. Rectification. The associated Horizontal Sweep Transformer was also changed. In addition the 100.209 chassis uses a new Power Transformer.

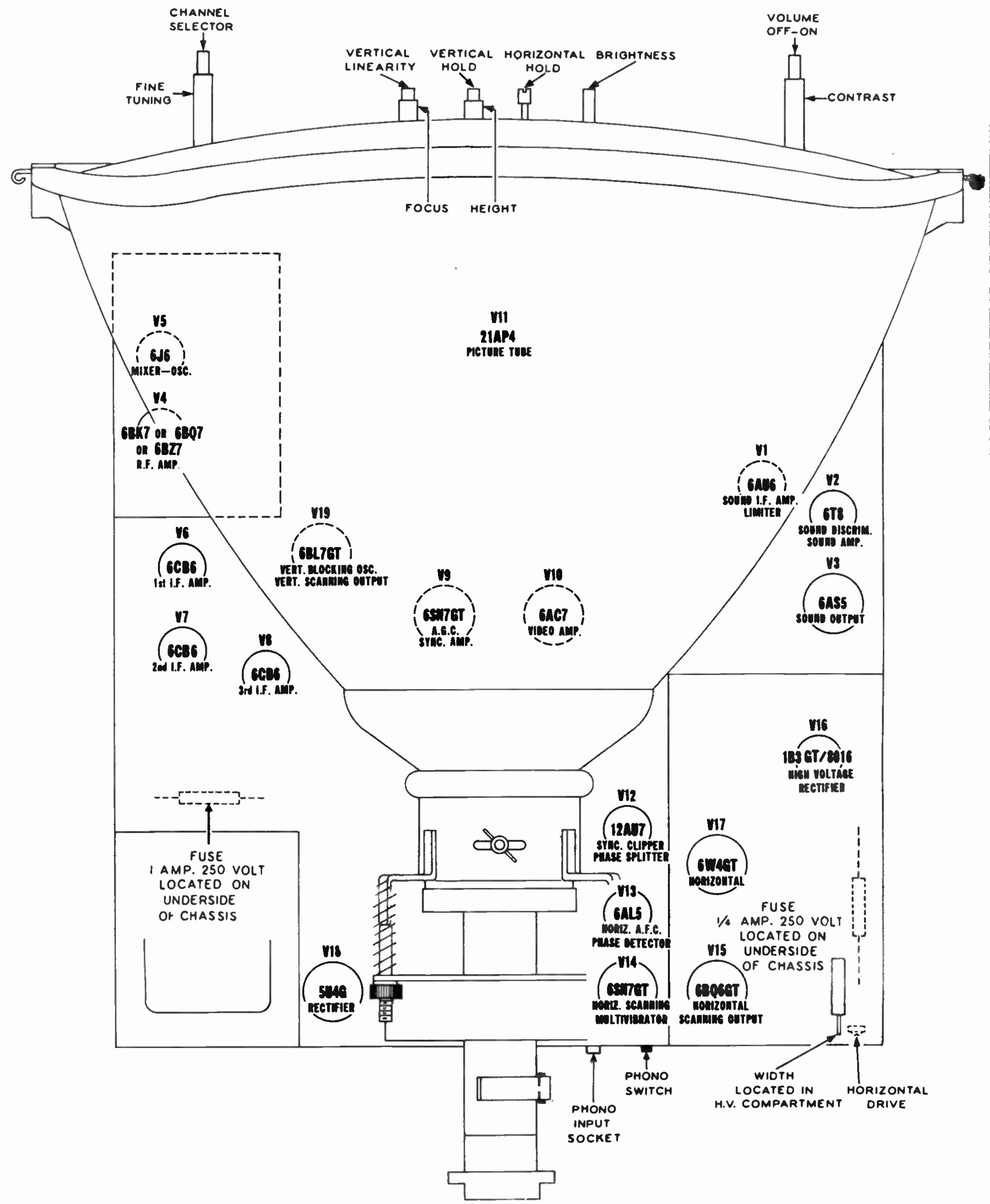
The correct Tube Location and Function Chart for the 100.209 chassis, and a new Socket Voltage Measurement Chart, are included in this Supplement.

When performing Oscillator Alignment on a 100.209 chassis which utilizes a W520645 R.F. Tuner (SERIES F or G) it will be noted that Oscillator Trimmer #12 has been omitted and therefore this step should be eliminated in the alignment procedure. On the W520645 R.F. Tuner instrument connection, point "V", shown in Fig. 12, has been moved to the location formerly occupied by trimmer #12.

The complete Schematic and Parts List for the 100.209 chassis is included with this RL Supplement. All production changes except for SERIES H are included on the schematic page. The SERIES H change is itemized in a subsequent section entitled Additional Production Changes.

For additional data, see Chassis 100.208.

TUBE LOCATIONS AND FUNCTIONS



PRODUCTION CHANGES

For a complete description of the changes as well as an explanation of the SERIES coding, refer to the heading "Production Changes," pg 47.

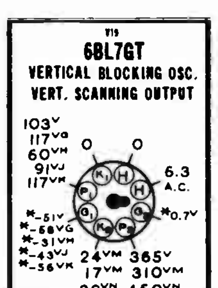
LETTER INCLUDED IN SERIES DESIGNATION	LOCATION OF VOLTAGE INFORMATION OR EFFECT OF CHANGE ON MEASUREMENT
"A"	Voltage readings token on a chassis thot incorporotes the letter "A" will be lower than those shown in the large chart by approximately 10%.
"B"	SERIES B Change does not affect circuit voltages.
"C"	Voltage readings taken on affected tube V26-6BL7 is shown in small chart below under the heading "SERIES C CHART."
"D"	No chassis were produced with the SERIES D designation.
"E"	No chassis were produced with the SERIES E designation.
"F" & "G"	Although R.F. tuner 520645 uses a 6BQ7 R.F. tube and tuner 520450 uses a 6BK7 R.F. tube, all tuner voltages are identical with the following exception. Pin 7 6BQ7 .... 150L Volts.
"H"	SERIES H Change does not affect circuit voltages.

ADDITIONAL PRODUCTION CHANGES

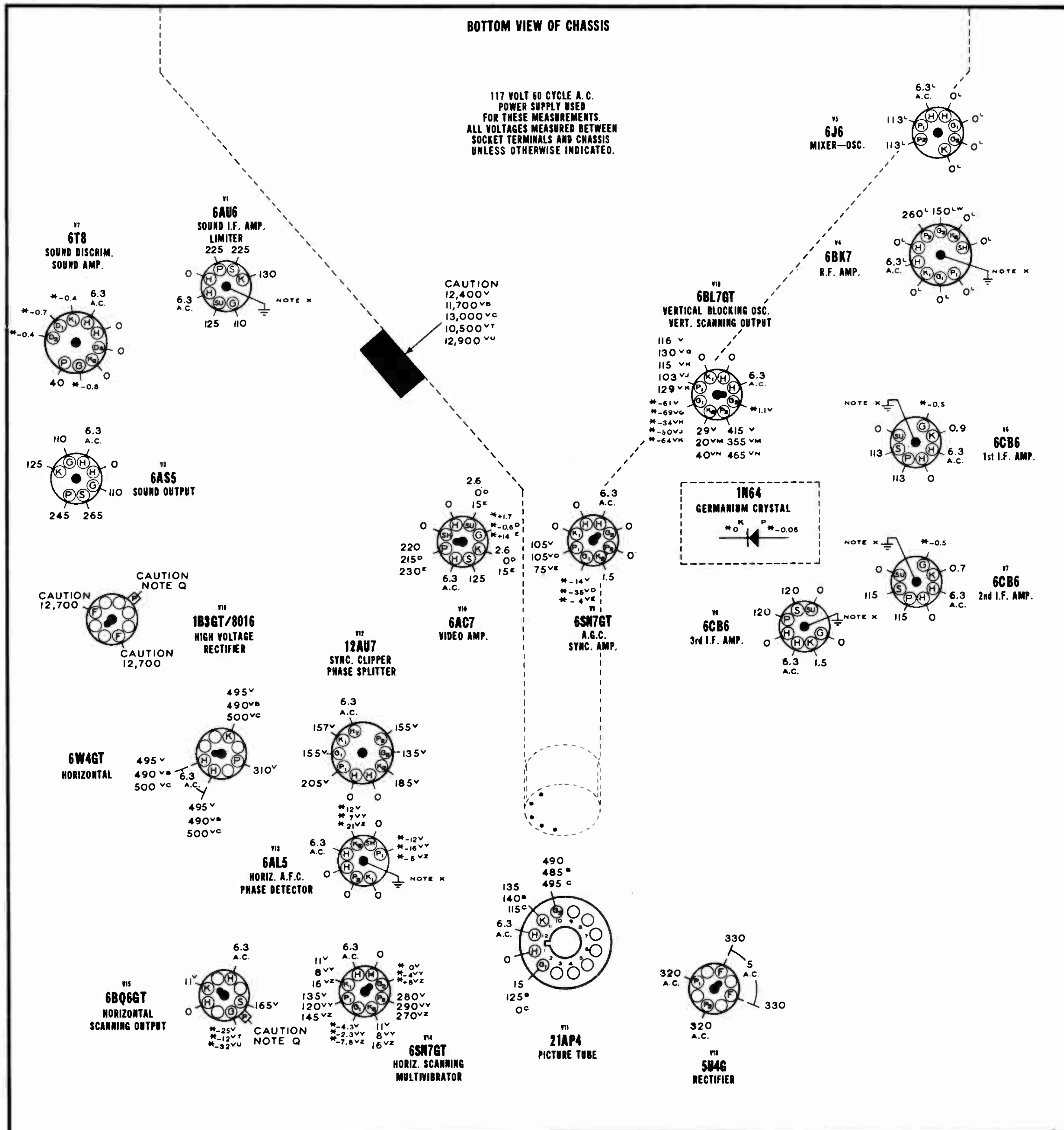
See schematic page for complete explanation of the SERIES coding as well as details on all previous changes.

LETTER DESIGNATION	DESCRIPTION OF CHANGE
"H"	The following change was incorporated to provide increase width when operating receiver at a line voltage that is below normal. 1. Condenser 235, connected across the width coil 237, was changed from .01 Mfd. to .02 Mfd. The above change is **not** to be undertaken if the SERIES coding at rear of chassis includes a letter "A".

SERIES "C" CHART



BOTTOM VIEW OF CHASSIS



REAR OF CHASSIS

SOCKET VOLTAGES

CAUTION

THE PICTURE TUBE is highly evacuated and if broken, glass fragments will be violently expelled. Scratching, chipping, undue pressure, or careless handling such as lifting the tube by its neck is dangerous and should be avoided. If it is necessary to handle the picture tube, use safety goggles and heavy gloves.

HIGH VOLTAGE (10 to 13 kilovolts) is produced in a supply circuit of this receiver. Exercise care to avoid contact with elements of this circuit and particularly the tube terminals which are labeled "CAUTION" in the adjoining voltage chart.

THE HIGH VOLTAGE LEAD, which supplies approximately 10 to 13 kilovolts to the picture tube, should be momentarily shorted to the chassis whenever it is disconnected for service purposes. This discharges the high voltage filter condenser and prevents a shock hazard when working on the receiver after it has been turned off.

INTERMEDIATE B+ VOLTAGES, are dangerous and caution should be observed when the receiver chassis components are exposed for service purposes.

THE VOLTAGES SHOWN IN THE ADJOINING CHART WERE MEASURED UNDER THE FOLLOWING CONDITIONS

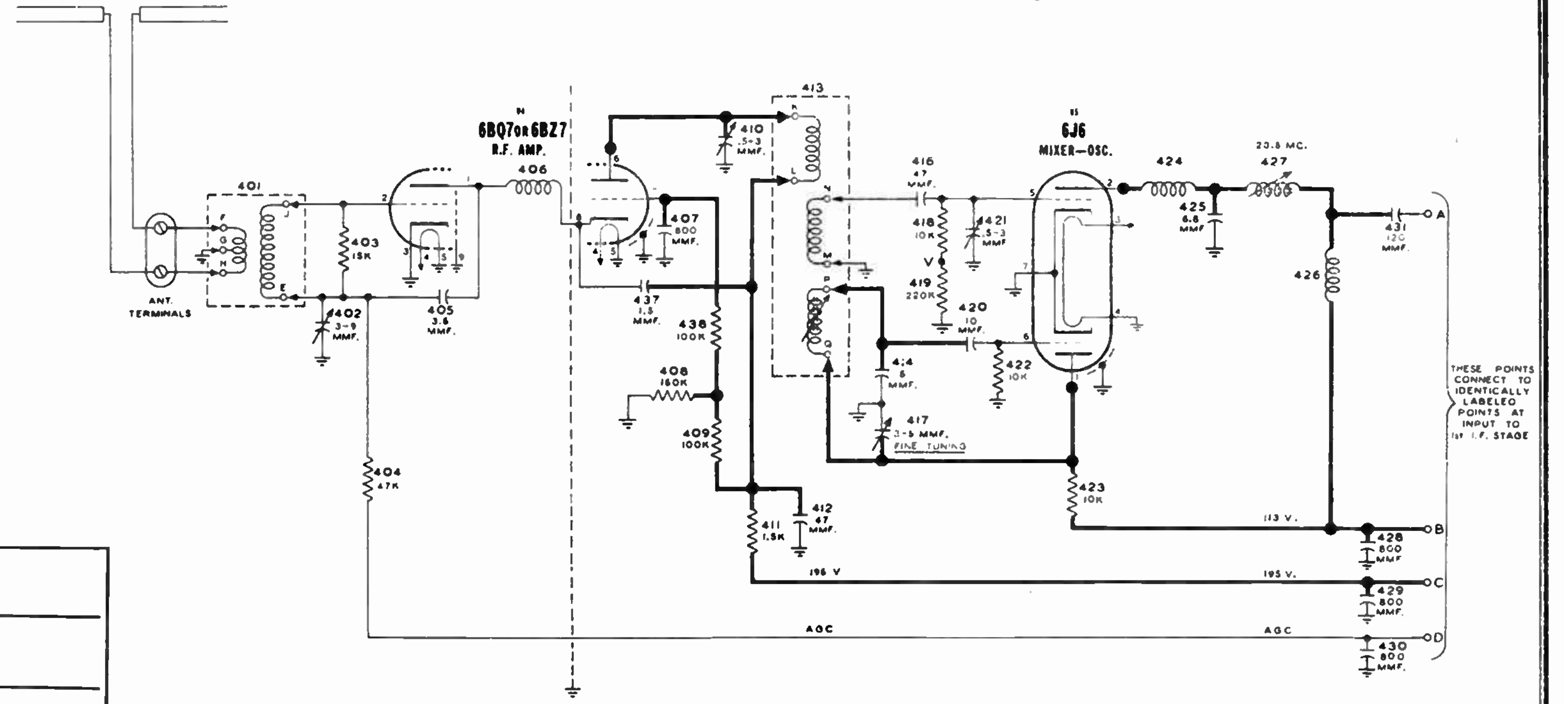
1.	Power Supply—117 volts 60 cycle AC.
2.	All voltages are measured between socket terminals and chassis unless otherwise indicated on adjoining chart.
3.	* Measurements made with voltmeter having sensitivity of 20,000 ohms per volt except where indicated by (*). The (*) symbol designates a vacuum tube voltmeter measurement.
4.	Channel Selector and Fine Tuning Controls set for normal reception of a local station.
5.	All controls are set for normal reception of the transmitted signal unless the voltage shown on the chart is followed by a letter or letters indicating a special condition of measurement as explained in subsequent notes.
6.	The external or built-in antenna should remain connected to the receiver only when taking voltage measurements in the sweep and sync circuits—for all other measurements, disconnect antenna, short antenna terminals together and connect them to ground.
7.	Certain voltages were measured with two different settings of specific controls. It should therefore be understood that in these instances all controls, with the exception of one or two, were set for normal reception—letters following the voltage shown on the chart indicate the exceptions and are explained below.

EXPLANATION OF NOTES

B.	Brightness Control max. clockwise
C.	Brightness Control max. counter-clockwise
D.	Contrast Control max. clockwise
E.	Contrast Control max. counter-clockwise
G.	Height Control max. clockwise
H.	Height Control max. counter-clockwise

J.	Vertical Hold Control max. clockwise
K.	Vert. Hold Control max. counter-clockwise
L.	This voltage measurement was taken from the top of the tuner chassis with the tube removed from its socket.
M.	Vertical Linearity Control max. clockwise.
N.	Vertical Linearity Control max. counter-clockwise.
Q.	Do not attempt to measure the voltage at the tube cap. There is a high R. F. potential at this point.
R.	Channel Selector set to channel #4
S.	Channel Selector set to channel #9
T.	Horiz. Drive Control max. clockwise
U.	Horiz. Drive Control max. counter-clockwise.
V.	Before measuring this voltage, connect external antenna and adjust controls for normal reception of station signal.
W.	On early production tuners, the value of resistor 409 was 220,000 Ohms and consequently the voltage measured at pin 7 of tube V4 6BK7 R.F. Amp., may be reduced as low as 125 volts.
X.	Grounding of center stud on tube socket is necessary to reduce capacity coupling between other pins. Oscillation may result if this ground is omitted.
Y.	Horiz. Hold Control turned in a clockwise direction until picture approaches loss of sync.
Z.	Horiz. Hold Control turned in a counter-clockwise direction until picture approaches loss of sync.

SCHEMATIC DIAGRAM FOR W520645 R.F. TUNER



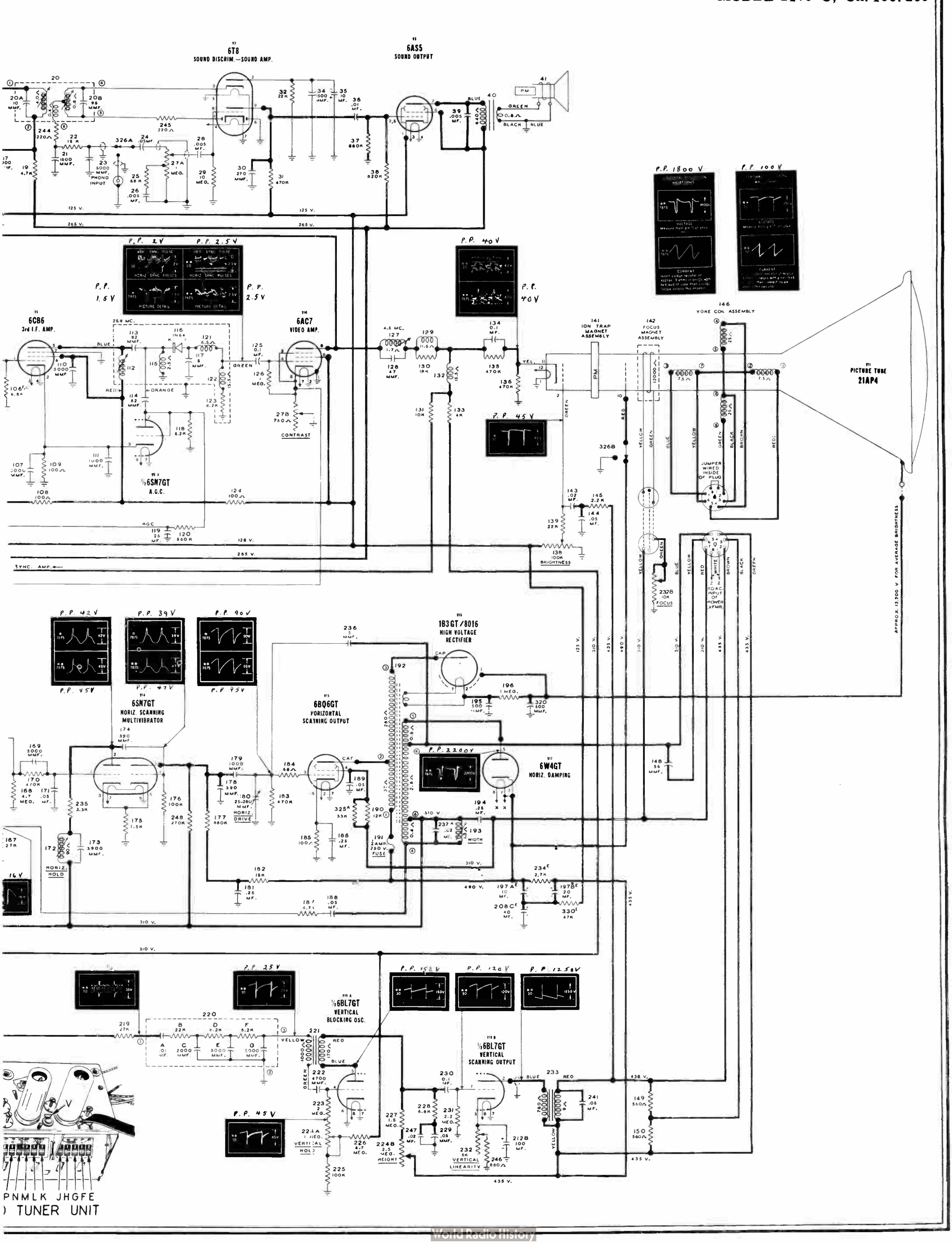
PRODUCTION CHANGES

The following tabulation furnishes complete details on changes which occurred during receiver production. The receivers incorporating these changes are identified by coding stamped on rear surface of chassis. This coding consists of one or more letters following the word SERIES, as SERIES B, SERIES AC, etc., and corresponds to similarly lettered changes shown below. Chassis incorporate only that change indicated by letter designation; i.e., chassis stamped "SERIES BE" does not include changes "A" or "C" or "D"

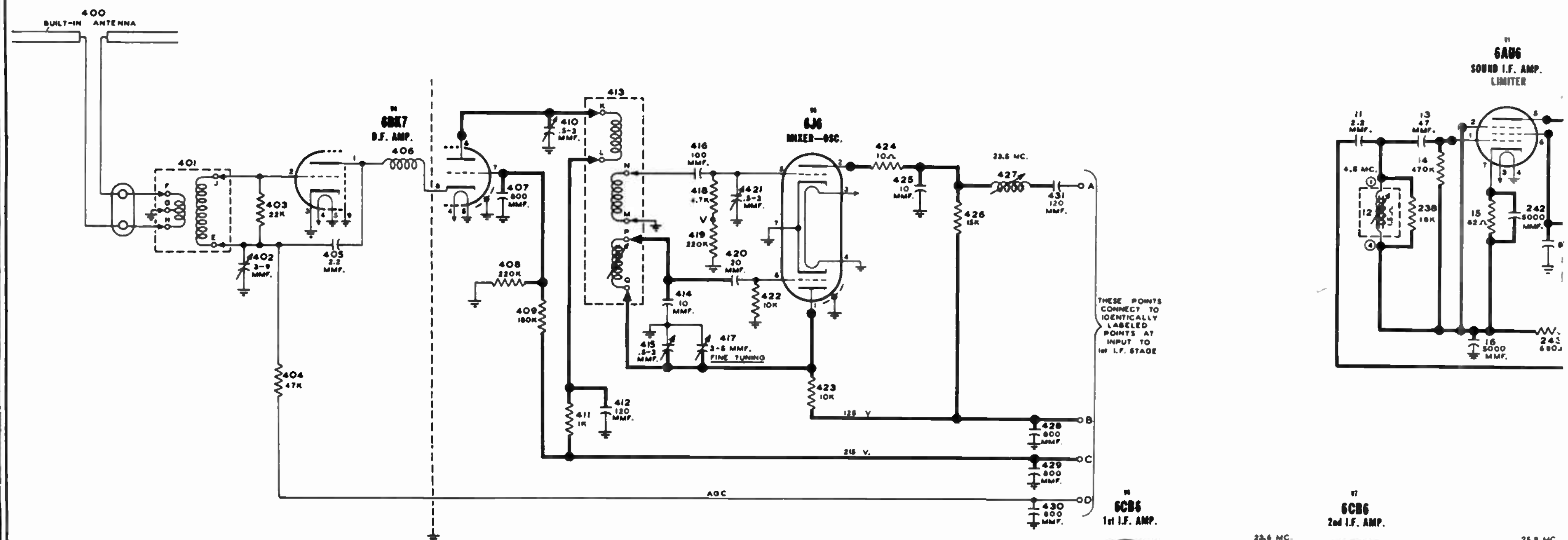
The circuit shown on this page applies to "SERIES A B E F G" chassis.

LETTER DESIGNATION	DESCRIPTION OF CHANGE
A	This change was incorporated to provide for use of an alternate type power transformer W509380. Both transformers are wired in the same manner as shown on circuit diagram. 1. Add resistor 325 (33,000 Ohms) in parallel across resistor 190 (12,000 Ohms.) 2. Change condenser 237, connected across the width coil 193, from .01 Mfd. to .02 Mfd. The "SERIES C" change, as itemized in this column, must **not** be incorporated when the above power transformer (W509380) is used.
B	This change was incorporated so that proper centering can be obtained without introducing neck shadow. 1. Disconnect yellow lead of focus coil 142 from 310 volt supply and reconnect it to pin 7 of deflection yoke socket.
C	This change was incorporated to prevent a breakdown of electrolytic condenser 208-C due to the boost voltage exceeding the rating of the condenser under certain operating conditions. 1. Add resistor 329 (2700 Ohms) in series with resistor 234. The above change is **not** to be undertaken if the SERIES coding at rear of the chassis includes a letter "A".
D	No chassis were produced with this series designation.
E	The following change was incorporated to prevent a breakdown of electrolytic condenser 208-C and still provide sufficient voltage for the operation of the vertical system. It is intended to replace the "SERIES C" change described previously. 1. Remove resistor 329 (2700 Ohms) on those chassis that incorporate a letter "C" in their SERIES designation. 2. Change condenser 197 from a single section (10 Mfd.) condenser to a dual section condenser 197-A (10 Mfd.) and 197-B (20 Mfd.) part number W520641. Connect low potential side of condenser 197-A and 197-B to resistor 330 (47,000 Ohms). The low potential side of the single section condenser formerly was connected to chassis ground. 3. Change condenser 208-C from 10 Mfd. to 40 Mfd. As the present condenser is a part of a tri-section electrolytic the part number for the new condenser is W520434. Connect 208-C (40 Mfd.) from resistor 330 (47,000 Ohms) to chassis ground. 208-C (10 Mfd.) was formerly connected to chassis ground. 4. Add resistor 330 (47,000 Ohms) from junction of condenser 197-A and 197-B and condenser 208-C to 125 volt supply.
F	This change was incorporated to accommodate an alternate type R.F. Tuner W520645. 1. Chassis that include the letter "F" in series designation utilize converter plate coil (item 427) W520501. 2. Add condenser 333 (5 Mmfd.) in the grid circuit of the tube V6 (6CB6) 1st I.F. Amp. from pin 1 to chassis ground. 3. Change condenser 213, in the tuner filament supply circuit, from 1000 Mmfd. to 82 Mmfd. 4. Change resistor 98, in the grid circuit of tube V7 (6CB6) 2nd I.F. Amp., from 10,000 Ohms to 6800 Ohms. 5. Change resistor 106, in the grid circuit of tube V8 (6CB6) 3rd I.F. Amp., from 5600 Ohms to 6800 Ohms.
G	This change was incorporated to accommodate an alternate type R.F. Tuner W520645. 1. Chassis that include the letter "G" in the series designation utilize converter plate coil (item 427) W520734. There is a red identification dot on the tuner frame adjacent to this converter plate coil. 2. Condenser 333, described in step 2 of the "SERIES F" change, is omitted. 3. Change condenser 213, in the tuner filament supply circuit, from 1000 Mmfd. to 82 Mmfd. 4. Change resistor 98, in the grid circuit of tube V7 (6CB6) 2nd I.F. Amp., from 10,000 Ohms to 6800 Ohms. 5. Change resistor 106, in the grid circuit of tube V8 (6CB6) 3rd I.F. Amp., from 5600 Ohms to 6800 Ohms.

MODEL 2170-C, Ch. 100. 209



SCHEMATIC DIAGRAM FOR W520450 R.F. TUNER



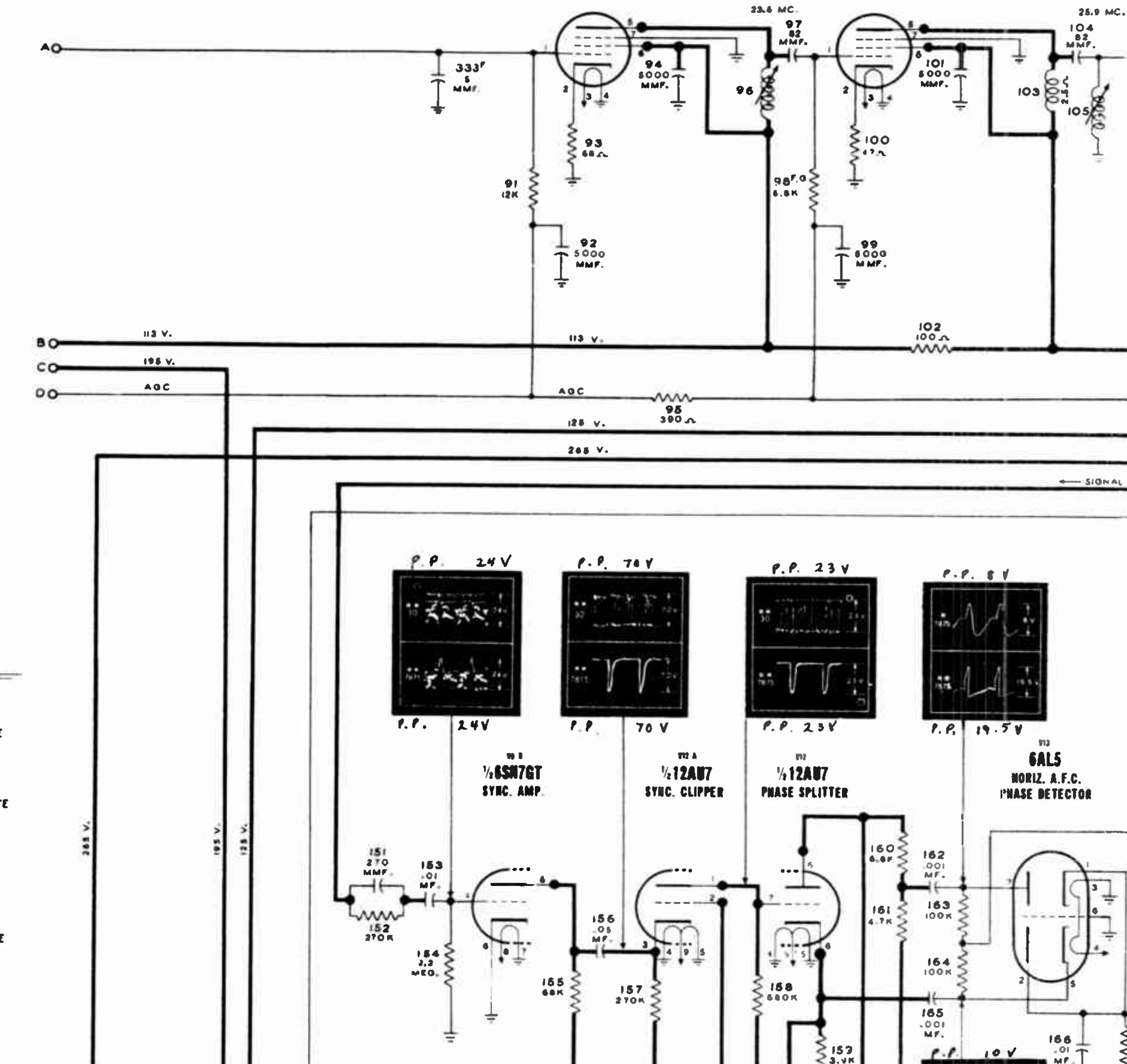
OSCILLOGRAMS

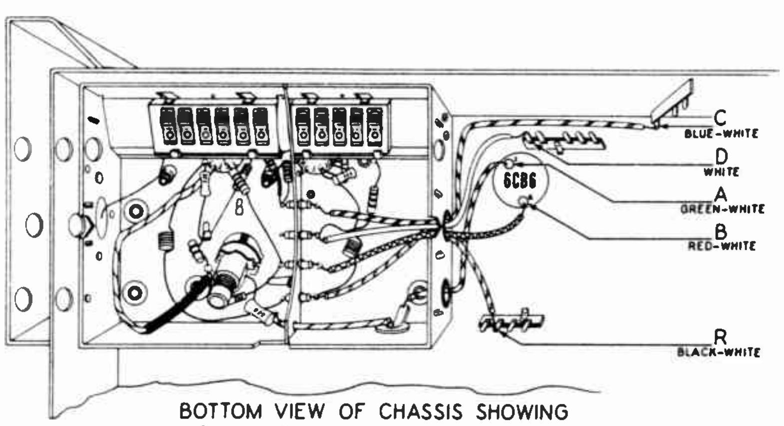
All oscillograms taken with ground lead of 'scope connected to receiver chassis (unless otherwise indicated) and with receiver controls set for normal reception of a station transmitting its standard test pattern.

Number appearing below asterisk specifies setting of horizontal sweep frequency control on 'scope.

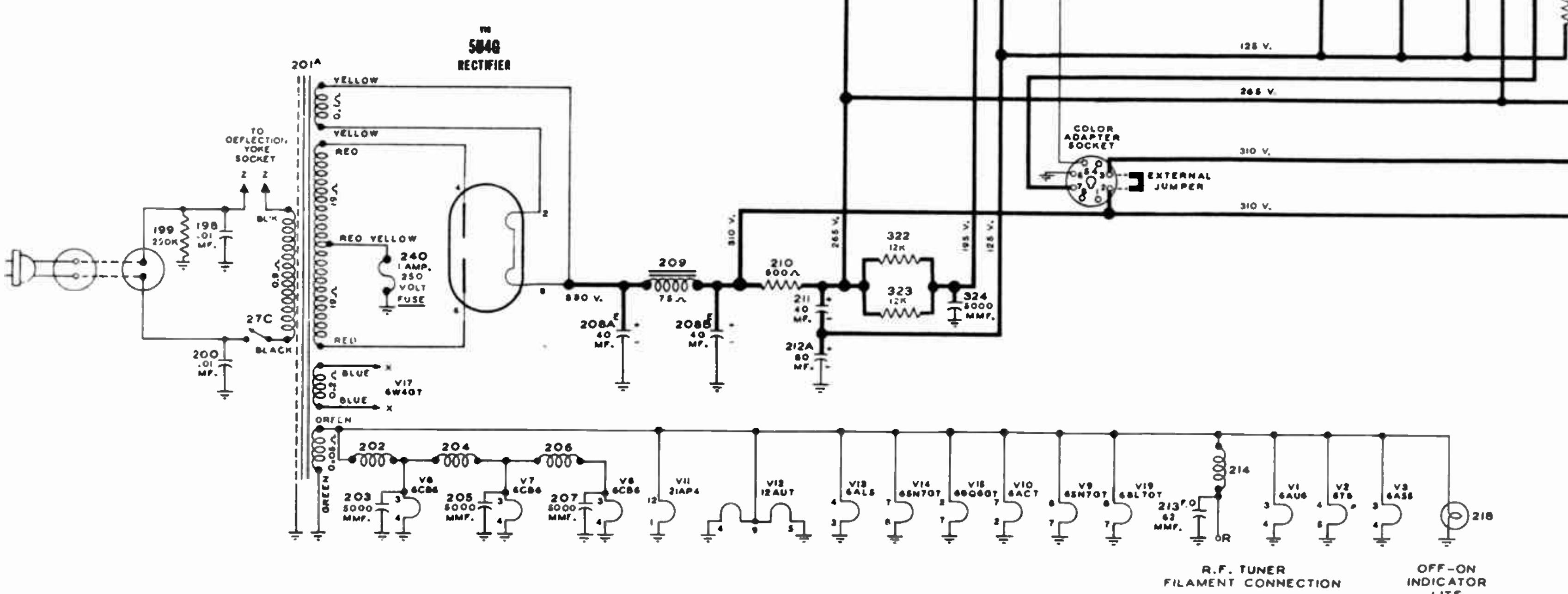
*—This symbol on illustration indicates that wave form was observed on a 'scope whose vertical amplifier had very limited high frequency response (50 to 100 Kc).

**—This symbol indicates that wave form was observed on a 'scope whose vertical amplifier frequency response was flat to within 20% up to 2 Mc.



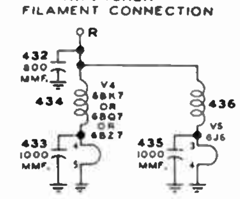


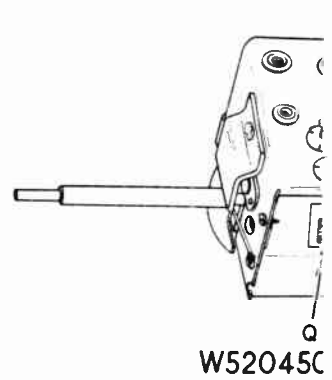
BOTTOM VIEW OF CHASSIS SHOWING
CONNECTIONS TO RF TUNER UNIT



VOLTAGES SHOWN ON CIRCUIT DIAGRAM WERE MEASURED WITH ANTENNA TERMINALS SHORTED TO GROUND AND CHANNEL SELECTOR SET TO AN INACTIVE CHANNEL. MEASUREMENTS WERE TAKEN ON A CHASSIS THAT DOES NOT INCLUDE THE LETTER "A" IN THE "SERIES" DESIGNATION.

READINGS TAKEN ON A CHASSIS THAT INCORPORATES THE LETTER "A" WILL BE LOWER THAN THOSE SHOWN BY APPROXIMATELY 10%





W52045C

HOW TO ORDER PARTS FOR YOUR SILVERTONE TELEVISION RECEIVER

These authorized replacement parts may be ordered through any Sears Retail Store or the Mail Order Store which serves the territory in which you live. Prices upon application from Sears, Roebuck and Co. The parts are shipped prepaid. When ordering parts, always give:

1. The PART NUMBER (number printed on the part if different from that shown in this list) and the DESCRIPTION. When no number is assigned order by description and rating.
2. The CHASSIS and CATALOG NUMBERS. The chassis number will be found on a metal plate at the rear of the chassis. This plate is pictured below. The catalog number will be found on a sticker on the back, inside or bottom of the cabinet.

PARTS LIST FOR CHASSIS

Notice: Some parts listed below have special characteristics. Do not use substitutes for replacement purposes.

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
		CONDENSERS	
11	W513001	Condenser—ceramic 2.2 Mmfd. 500 volt	$ .16
13	W513002	Condenser—ceramic 47 Mmfd. 500 volt	.24
16	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
17	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
20-A	W509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
20-B	W509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
21	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
23	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
24	W512027	Condenser—.05 Mfd. 200 volt	.40
26	W512007	Condenser—.005 Mfd. 600 volt	.25
28	W512007	Condenser—.005 Mfd. 600 volt	.25
30	W513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
34	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
35	W505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
36	W512011	Condenser—.01 Mfd. 400 volt	.25
39	W512007	Condenser—.005 Mfd. 600 volt	.25
92	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
94	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
97	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
99	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
101	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
104	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
107	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
110	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
111	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
113, 114	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
117	W513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)	.30
119	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
125	W512033	Condenser—.1 Mfd. 200 volt	.30
128	W513438	Condenser—ceramic 47 Mmfd. ±5% 500 volt (Temperature compensating)	.45
134	W512035	Condenser—.1 Mfd. 400 volt	.30
143	W512019	Condenser—.02 Mfd. 600 volt	.30
144	W512031	Condenser—.05 Mfd. 600 volt	.35
148	W513027	Condenser—ceramic 56 Mmfd. ±10% 1500 volt	.45
151	W513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
153	W512013	Condenser—.01 Mfd. 600 volt	.30
156	W512029	Condenser—.05 Mfd. 400 volt	.35
162	W512001	Condenser—.001 Mfd. 600 volt	.22
165	W512001	Condenser—.001 Mfd. 600 volt	.22
166	W512009	Condenser—.01 Mfd. 200 volt	.25
169	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
171	W512027	Condenser—.05 Mfd. 200 volt	.40
173	W512540	Condenser—mica 3900 Mmfd. ±10% 500 volt	.60
174	W512535	Condenser—mica 390 Mmfd. ±10% 500 volt	.35
178	W512535	Condenser—mica 390 Mmfd. ±10% 500 volt	.35
179	W512515	Condenser—mica 1000 Mmfd. ±10% 500 volt	.40
180	W520127	Condenser—trimmer 25-280 Mmfd. (Horizontal Drive Control)	.50
181	W512049	Condenser—.25 Mfd. ±10% 600 volt	.60
186	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
188, 189	W512031	Condenser—.05 Mfd. 600 volt	.35
194	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
195	W508888	Condenser—ceramic 500 Mmfd. 20,000 volt	2.00
197	W520641	Condenser—electrolytic A—10 Mfd. 450 volt B—20 Mfd. 450 volt (Used when letter "E" is included in series designation at rear of chassis.)	2.50
	W508680	Condenser—electrolytic 10 Mfd. 600 volt (used when letter "E" is not included in series designation at rear of chassis)	2.55
198	W512255	Condenser—.01 Mfd. 400 volt	.25
200	W512255	Condenser—.01 Mfd. 400 volt	.25
203	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
205	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
207	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
208-A, B,C	W520434	Condenser—electrolytic A—40 Mfd. 450 volt B—40 Mfd. 450 volt C—40 Mfd. 250 volt (Used when letter "E" is included in series designation at rear of chassis)	3.75
	W509001	Condenser—electrolytic A—40 Mfd. 450 volt B—40 Mfd. 450 volt C—10 Mfd. 450 volt (Used when letter "E" is not included in series designation at rear of chassis)	4.00
211	W160095	Condenser—electrolytic 40 Mfd. 300 volt	2.00
212-A, B	W509002	Condenser—electrolytic A—80 Mfd. 250 volt B—100 Mfd. 50 volt	3.00
213	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt (used when letter "F" or "G" is included in series designation at rear of chassis)	.25
	W513009	Condenser—ceramic 1000 Mmfd. 500 volt (used when letter "F" or "G" is not included in series designation at rear of chassis)	.28
220-A	W508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
220-C	W508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
220-E	W508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
220-G	W508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
222	W512533	Condenser—mica 4700 Mmfd. ±5% 1000 volt	1.40
229	W512308	Condenser—.05 Mfd. ±10% 600 volt	.30
230	W512037	Condenser—.1 Mfd. 600 volt	.45
236	W513026	Condenser—ceramic 5.1 Mmfd. ±10% 1500 volt	.40
237	W512019	Condenser—.02 Mfd. 600 volt (used when letter "A" is included in series designation at rear of chassis)	.30
	W512013	Condenser—.01 Mfd. 600 volt (used when letter "A" is not included in series designation at rear of chassis)	.30
241	W512027	Condenser—.05 Mfd. 200 volt	.40
242	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
247	W512019	Condenser—.02 Mfd. 600 volt	.30
320	W508888	Condenser—500 Mmfd. 20,000 volt	2.00
324	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
333	W513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating) (used when letter "F" is included in series designation at rear of chassis)	.30

CONDENSERS FOR R.F. TUNER

The following condensers are used only in the W520645 R.F. Tuner and this tuner is incorporated when the letter "F" or "G" is included in the series designation stamped on rear of chassis.

402	W509064	Condenser—trimmer 3-9 Mmfd.	.50
405	W520721	Condenser—ceramic 3.6 Mmfd. ±10% 500 volt	.35
407	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
410	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
412	W520719	Condenser—ceramic 47 Mmfd. ±10% 500 volt (Temperature compensating)	.40
414	W520717	Condenser—ceramic 5 Mmfd. ±5% 500 volt (Temperature compensating)	.35
416	W520719	Condenser—ceramic 47 Mmfd. ±10% 500 volt (Temperature compensating)	.40
417	*	Condenser—ceramic 3-5 Mmfd. (Fine Tuning)	—
420	W520718	Condenser—ceramic 10 Mmfd. ±10% 500 volt (Temperature compensating)	.30
421	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
425	W520716	Condenser—ceramic 6.8 Mmfd. ±5% (Temperature compensating)	$ .35
428	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
429	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
430	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
431	W513029	Condenser—ceramic 120 Mmfd. ±10% 500 volt	.35
432	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
433	W520735	Condenser—ceramic 1000 Mmfd. 500 volt	.30
435	W520735	Condenser—ceromic 1000 Mmfd. 500 volt	.30
437	W520720	Condenser—ceramic 1.5 Mmfd. 500 volt	.35

The following condensers are used only in the W520450 R.F. Tuner and this tuner is incorporated when the letter "F" or "G" is not included in the series designation stamped on rear of chassis.

402	W509064	Condenser—trimmer 3-9 Mmfd.	.50
405	W513001	Condenser—ceromic 2.2 Mmfd. 500 volt	.16
407	*	Condenser—ceramic 800 Mmfd. (part of center shield)	—
410	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
412	W513439	Condenser—ceramic 120 Mmfd. ±5% 500 volt (Temperature compensating)	.30
414	W513446	Condenser—ceramic 10 Mmfd. ±5% 500 volt (Temperature compensating)	.35
415	W509063	Condenser—trimmer 0.5-3 Mmfd.	.40
416	W513440	Condenser—ceramic 100 Mmfd. ±10% 500 volt (Temperature compensating)	.30
417	*	Condenser—ceramic 3-5 Mmfd. (Fine Tuning)	—
420	W513441	Condenser—ceramic 20 Mmfd. ±10% 500 volt (Temperature compensating)	.30
421	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
425	W513444	Condenser—ceramic 10 Mmfd. ±5% 500 volt (Temperoture compensating)	.50
428	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
429	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
430	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
431	W513029	Condenser—ceramic 120 Mmfd. ±10% 500 volt	.35
432	*	Condenser—ceromic 800 Mmfd. (Feed thru type) (part of center shield)	—
433	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
435	W513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28

RESISTORS

14	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
15	W510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
19	W510249	Resistor—carbon 4700 Ohms 1 watt	.16
22	W510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
25	W510170	Resistor—carbon 68,000 Ohms ½ watt	.12
29	W510197	Resistor—carbon 10 Meg. ½ wott	.12
31	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
32	W510160	Resistor—corbon 22,000 Ohms ±10% ½ watt	.12
37	W510746	Resistor—carbon 680,000 Ohms ±5% ½ watt	.20
38	W510747	Resistor—carbon 820,000 Ohms ±5% ½ watt	.20
91	W510723	Resistor—carbon 12,000 Ohms ±5% ½ watt	.16
93	W510116	Resistor—carbon 68 Ohms ½ watt	.12
95	W510129	Resistor—carbon 390 Ohms ±10% ½ watt	.12
98	W510151	Resistor—carbon 6800 Ohms ±10% ½ watt (used when letter "F" or "G" is included in series designation at rear of chassis)	.12
	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt (used when letter "F" or "G" is not included in series designation at rear of chassis)	.12
100	W510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
102	W510119	Resistor—carben 100 Ohms ½ watt	.12
106	W510151	Resistor—carbon 6800 Ohms ±10% ½ watt (used when letter "F" or "G" is included in series designation at rear of chassis)	.12
	W510150	Resistor—carbon 5600 Ohms ±10% ½ watt (used when letter "F" or "G" is not included in series designation at rear of chassis)	.12
108	W510119	Resistor—corbon 100 Ohms ½ watt	.12
109	W510118	Resistor—corbon 100 Ohms ±10% ½ watt	.12
118	W510153	Resistor—corbon 8,200 Ohms ±10% ½ watt	.12
120	W510186	Resistor—carbon 560,000 Ohms ±10% ½ wott	.12
123	W510153	Resistor—corbon 8200 Ohms ±10% ½ watt	.12
124	W510119	Resistor—carbon 100 Ohms ½ watt	.12
126	W510191	Resistor—corbon 1 Meg. ½ watt	.12
130	W510745	Resistor—carbon 18,000 Ohms ±5% ½ watt	.20
131	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
133	W510753	Resistor—wire wound 4000 Ohms ±10% 5 watt	1.00
135, 136	W510184	Resistor—corbon 470,000 Ohms ±10% ½ watt	.12
139	W510160	Resistor—carbon 22,000 Ohms ±10% ½ watt	.12
145	W510142	Resistor—carbon 2200 Ohms ±10% ½ watt	.12
149, 150	W510132	Resistor—carbon 560 Ohms ±10% ½ wott	.12
152	W510180	Resistor—carbon 270,000 Ohms ±10% ½ wott	.12
154	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12
155	W510169	Resistor—carbon 68,000 Ohms ±10% ½ watt	.12
157	W510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
158	W510187	Resistor—carbon 680,000 Ohms ±10% ½ watt	.12
159	W510748	Resistar—carbon 3900 Ohms ±5% ½ watt	.20
160	W510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
161	W510750	Resistor—carbon 4700 Ohms ±5% ½ watt	.20
163, 164	W510751	Resistor—carbon 100,000 Ohms ±5% ½ watt	.20
167	W510162	Resistor—carbon 27,000 Ohms ±10% ½ watt	.12
168	W510195	Resistor—carbon 4.7 Meg. ½ watt	.12
170	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
175	W510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
176	W510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
177	W510187	Resistor—carbon 680,000 Ohms ±10% ½ watt	.12
182	W510357	Resistor—carbon 15,000 Ohms ±10% 2 watt	.35
183	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
184	W510116	Resistor—carbon 68 Ohms ½ watt	.12
185	W510218	Resistor—carbon 100 Ohms ±10% 1 watt	.16
187	W510248	Resistor—carbon 4700 Ohms ±10% 1 watt	.16
190	W510758	Resistor—wire wound 12,000 Ohms ±10% 5 watt	1.20
196	W510390	Resistor—carbon 1 Meg. ±10% 2 watt	.30
199	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
210	W510741	Resistor—wire wound 600 Ohms ±10% 10 watt	.90
219	W510162	Resistor—carbon 27,000 Ohms ± 10% ½ watt	.12
220-B	W508062	Resistor—carbon 22,000 Ohms ⅕ watt (part of Integrator Unit)	1.40
220-D	W508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
220-F	W508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
223	W510769	Resistor—carbon 2 Meg. ±5% ½ watt	.20
225	W510766	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
226	W510768	Resistor—carbon 4.7 Meg. ±10% ½ watt	.12
227	W510767	Resistor—carbon 1.5 Meg. ±5% ½ watt	.20
228	W510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
231	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12
234	W510344	Resistor—corbon 2700 Ohms ±10% 2 watt	.35
235	W510145	Resistor—carbon 3300 Ohms ±10% ½ watt	.12
238	W510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
243	W510134	Resistor—corbon 680 Ohms ½ watt	.12
244, 245	W510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
246	W510134	Resistor—carbon 680 Ohms ½ watt	.12
248	W510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
322,323	W510356	Resistor—carbon 12,000 Ohms ± 10% 2 watt	.24

*—This part is not supplied as a Service replacement item.

PARTS LIST FOR CHASSIS (Contd.)

RESISTORS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
325	W510263	Resistor—Carbon, 33,000 Ohms ±10% 1 watt (used only when letter "A" is incorporated in series designation at rear of chassis)	$ .16
329	W510344	Resistor—carbon 2700 Ohms ±10% 2 watt (used when letter "C" is included in series designation at rear of chassis)	.35
330	W510366	Resistor—carbon 47,000 Ohms ±10% 2 watt (used when letter "E" is included in series designation at rear of chassis)	.35

RESISTORS FOR R.F. TUNER

The following resistors are used only in the W520645 R.F. Tuner and this tuner is incorporated when the letter "F" or "G" is included in the series designation stamped on rear of chassis.

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
403	W510157	Resistor—carbon 15,000 Ohms ±10% ½ watt	.12
404	W510167	Resistor—carbon 47,000 Ohms ½ watt	.12
408	W510774	Resistor—carbon 160,000 Ohms ±5% ½ watt	.16
409	W510751	Resistor—carbon 100,000 Ohms ±5% ½ watt	.20
411	W510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
418	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
419	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
422, 423	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
438	W510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12

The following resistors are used only in the W520450 R.F. Tuner and this tuner is incorporated when the letter "F" or "G" is not included in the series designation stamped on rear of chassis.

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
403	W510160	Resistor—carbon 22,000 Ohms ±10% ½ watt	.12
404	W510167	Resistor—carbon 47,000 Ohms ½ watt	.12
408	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
409	W510177	Resistor—carbon 180,000 Ohms ±10% ½ watt	.12
411	W510137	Resistor—carbon 1000 Ohms ½ watt	.12
418	W510148	Resistor—carbon 4700 Ohms ± 10% ½ watt	.12
419	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
422, 423	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
424	W510101	Resistor—carbon 10 Ohms ½ watt	.12
426	W510158	Resistor—carbon 15,000 Ohms ½ watt	.12

COILS AND TRANSFORMERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
12	W509378	Transformer—audio take-off	1.50
20	W509706	Transformer—TV sound discriminator (includes condensers 20-A and 20-B)	3.00
40	W509376	Transformer—audio output	1.85
96	W507343	Coil—1st video I.F. (less slug)	.70
	W507357	Slug core for 1st video I.F. coil	.20
103	W507367	Coil—choke	.70
105	W507343	Coil—2nd video I.F. (less slug)	.70
	W507357	Slug core for 2nd video I.F. coil	.20
112	W509613	Coil—3rd video I.F. (less slug)	.60
	W507357	Slug core for 3rd video I.F. coil	.20
115	W507367	Coil—choke	.70
121	W509340	Coil—peaking	.55
122	W509342	Coil—peaking	.60
127	W509603	Coil—4.5 Mc. trap (includes slug and condenser #128)	1.20
	W507357	Slug core for 4.5 Mc. trap	.20
129	W509341	Coil—peaking	.60
132	W509342	Coil—peaking	.60
142	W162326	Coil—focus (includes cable and plug)	14.00
146	W115228	Yoke—picture tube deflection (includes cable and plug)	12.50
172	W508967	Coil—Horizontal Hold (includes slug and clip)	1.10
	W508963	Slug core for Horizontal Hold coil	.15
192	W520489	Transformer—horizontal sweep	12.50
193	W509361	Coil—Width (includes slug and clip)	2.00
	W507429	Slug core for Width coil	.60
201	W520487	Transformer—power (used when letter "A" is not included in series designation at rear of chassis)	17.00
	W509380	Transformer—power (used when letter "A" is included in series designation)	17.00
202	W507584	Coil—choke	.28
204	W507584	Coil—choke	.28
206	W507584	Coil—choke	.28
209	W508341	Choke—filter	3.60
214	W507584	Coil—choke	.28
221	W508076	Transformer—vertical blocking oscillator	1.90
233	W509375	Transformer—vertical output	4.00

COILS FOR R.F. TUNER

The following coils are used only in the W520645 R.F. Tuner and this tuner is incorporated when the letter "F" or "G" is included in the series designation stamped on rear of chassis. See special note on item 427 Converter Plate Coil.

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
401	W520702	Coil-antenna; channel #2 (coded "2Q")	1.40
	W520703	Coil-antenna; channel #3 (coded "3Q")	1.40
	W520704	Coil-antenna; channel #4 (coded "4Q")	1.40
	W520705	Coil-antenna; channel #5 (coded "5Q")	1.40
	W520706	Coil-antenna; channel #6 (coded "6Q")	1.40
	W520707	Coil-antenna; channel #7 (coded "7Q")	1.15
	W520708	Coil-antenna; channel #8 (coded "8Q")	1.15
	W520709	Coil-antenna; channel #9 (coded "9Q")	1.15
	W520710	Coil-antenna; channel #10 (coded "10Q")	1.15
	W520711	Coil-antenna; channel #11 (coded "11Q")	1.15
	W520712	Coil-antenna; channel #12 (coded "12Q")	1.15
	W520713	Coil-antenna; channel #13 (coded "13Q")	1.15
406	W520701	Coil-cathode coupling	.15
413	W520722	Coil-R.F. and osc; channel #2 (coded "2Q")	1.85
	W520723	Coil-R.F. and osc; channel #3 (coded "3Q")	1.85
	W520724	Coil-R.F. and osc; channel #4 (coded "4Q")	1.85
	W520725	Coil-R.F. and osc; channel #5 (coded "5Q")	1.85
	W520726	Coil-R.F. and osc; channel #6 (coded "6Q")	1.85
	W520727	Coil-R.F. and osc; channel #7 (coded "7Q")	1.70
	W520728	Coil-R.F. and osc; channel #8 (coded "8Q")	1.70
	W520729	Coil-R.F. and osc; channel #9 (coded "9Q")	1.70
	W520730	Coil-R.F. and osc; channel #10 (coded "10Q")	1.70
	W520731	Coil-R.F. and osc; channel #11 (coded "11Q")	1.70
	W520732	Coil-R.F. and osc; channel #12 (coded "12Q")	1.70
	W520733	Coil-R.F. and osc; channel #13 (coded "13Q")	1.70
	W507986	Slug for osc coil; auxiliary fine tuning adj.	.05
424	W520714	Coil-choke	.15
426	W520715	Coil-choke	.45
427	W520734	Coil—converter plate (I.F.) (includes slug and clip) (used when letter "G" is included in the series designation at rear of television chassis and these tuners have a red identification dot on the tuner frame adjacent to coil)	.75
	W520501	Coil converter plate (I.F.) (includes slug and clip) (used when letter "F" is included in the series designation at rear of television chassis)	.55
	W509062	Slug core for either converter plate coil	.12
434	W520518	Coil-choke	.10
436	W520520	Coil-choke	.10

The following coils are used only in the W520450 R.F. Tuner and this tuner is incorporated when the letter "F" or "G" is not included in the series designation stamped on rear of chassis.

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
401	W520502	Coil-antenna; channel #2 (coded "2K")	1.40
	W520503	Coil-antenna; channel #3 (coded "3K")	1.40
	W520504	Coil-antenna; channel #4 (coded "4K")	1.40
	W520505	Coil antenna; channel #5 (coded "5K")	1.40
	W520506	Coil-antenna; channel #6 (coded "6K")	1.40
	W520507	Coil-antenna; channel #7 (coded "7K")	1.15
	W520508	Coil-antenna; channel #8 (coded "8K")	1.15
	W520509	Coil-antenna; channel #9 (coded "9K")	1.15
	W520510	Coil-antenna; channel #10 (coded "10K")	1.15
	W520511	Coil-antenna; channel #11 (coded "11K")	1.15
	W520512	Coil-antenna; channel #12 (coded "12K")	1.15
	W520513	Coil-antenna; channel #13 (coded "13K")	1.15
406	W520514	Coil-cathode coupling	.10
413	W520522	Coil-R.F. and osc.; channel #2 (coded "2K")	1.85
	W520523	Coil-R.F. and osc.; channel #3 (coded "3K")	1.85
	W520524	Coil-R.F. and osc.; channel #4 (coded "4K")	1.85
	W520525	Coil-R.F. and osc.; channel #5 (coded "5K")	1.85
	W520526	Coil-R.F. and osc.; channel #6 (coded "6K")	1.85
	W520527	Coil-R.F. and osc.; channel #7 (coded "7K")	1.70
	W520528	Coil-R.F. and osc.; channel #8 (coded "8K")	1.70
	W520529	Coil-R.F. and osc.; channel #9 (coded "9K")	1.70
	W520530	Coil-R.F. and osc.; channel #10 (coded "10K")	1.70
	W520531	Coil-R.F. and osc.; channel #11 (coded "11K")	1.70
	W520532	Coil-R.F. and osc.; channel #12 (coded "12K")	1.70
	W520533	Coil-R.F. and osc.; channel #13 (coded "13K")	1.70
	W507986	Slug for osc. coil; auxiliary fine tuning adj.	.05
427	W520501	Coil-converter plate (I.F.) (includes slug and clip)	.55
	W509062	Slug core for converter plate coil	.12
434	W520518	Coil-choke	.10
436	W520520	Coil-choke	.10

CONTROLS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
27-A,B,C	W520292	Volume and Contrast control (includes OFF-ON switch) A—Volume control; 1 Meg ¼ watt B—Contrast control; 750 Ohms 2 watt C—Off-On switch	3.50

CONTROLS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
138	W509893	Brightness potentiometer (100,000 Ohms)	1.00
172	W508967	Horizontal Hold coil (includes slug and clip)	1.10
	W508963	Slug core for Horizontal Hold coil	.15
180	W520127	Horizontal Drive trimmer condensor (25-280 Mmfd.)	.50
193	W509361	Width coil (includes slug and clip)	2.00
	W507429	Slug core for Width coil	.60
224-A, B	W508893	Height and Vertical Hold potentiometers A—Vertical Hold control; 1 Meg. ¼ watt B—Height control; 2.5 Meg. ¼ watt	$ 1.75
232-A,B	W509302	Vertical Linearity and Focus potentiometers A—Vertical Linearity control; 5,000 Ohms ½ watt B—Focus control; 10,000 Ohms ±10% 4 watt	3.75
417	*	Fine Tuning condenser (3.5 Mmfd)	—

OTHER ELECTRICAL PARTS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
41	W508174	Speaker—P. M. Dynamic (6" x 9")	8.40
116	W509386	Crystal detector	2.00
141	W509688	Ion trap	.85
191	W508063	Fuse for horizontal sweep circuit; ¼ Amp.	.30
218	W118921	TV Channel Lite (Mazda 47 6-8 V. 150 Ma.)	.15
220-A to G	W508062	Integrator Coupling Unit A—Condenser—ceramic .01 Mfd. 450 volt B—Resistor—carbon 22,000 Ohms ⅛ watt C—Condenser—ceramic 2000 Mmfd. 450 volt D—Resistor—carbon 8200 Ohms ⅛ watt E—Condenser—ceramic 5000 Mmfd. 450 volt F—Resistor—carbon 8200 Ohms ⅛ watt G—Condenser—ceramic 5000 Mmfd. 450 volt	1.40
240	W509517	Fuse; 1 Amp.; 250 volt	.25
326-A,B	W520563	Switch, "PHONO-TELEV."	.55
400	W509353	Built-in antenna	1.85

MECHANICAL PARTS OF R.F. TUNER

(for electrical parts see preceding classified listings of condensers, resistors and coils)

PART NO.	DESCRIPTION	LIST PRICE
W520645	R.F. Tuner complete with coils and tubes (used when letter "F" or "G" is included in the series designation stamped on rear surface of chassis)	37.50
W520450	R.F. Tuner complete with coils and tubes (used when letter "F" or "G" is not included in the series designation stamped on rear surface of chassis)	37.50
W508081	Bracket for mounting R.F. tuner (front)	.16
W520233	Bracket for mounting R.F. tuner (rear)	.25
W507339	Clip for mounting video converter plate coil	.10
W520515	Fine Tuning cam and shaft	.70
W508708	Roller—detent	.10
W520535	Shield, bottom cover	.50
W520536	Shield, side cover	.35
W520534	Shield-tube; miniature for 6J6 tube	.15
W520519	Shield-tube; miniature for 6BK7, 6BQ7 or 6BZ7 tube	.20
W509062	Slug core for converter plate coil	.12
W507986	Slug for osc. coil; auxiliary fine tuning adj.	.05
W507987	Socket—miniature (7 pin) for 6J6 (includes base for mounting shield)	.45
W520521	Socket—miniature (9 pin) for 6BK7, 6BQ7 or 6BZ7 (includes base for mounting shield)	.50
W507966	Spring—contactor washer (on front turret shaft	.08
W508709	Spring—detent	.08
W507990	Spring—retains osc. fine tuning slug	.10
W507967	Spring—turret shaft retaining	.03
W520517	Stator contact assembly (includes 11 contacts and metal frame)	3.75
W520516	Tuner turret and shaft assembly (less coils)	3.00
W507965	Washer, fiber spacer (on turret shaft)	.01

CABINET PARTS

PART NO.	DESCRIPTION	LIST PRICE
W115225	Back for cabinet	3.00
W520630-A	Cabinet for Catalog #2170-C (Mahogany)	75.00
W520437	Escutcheon for glass window	10.00
W520454	Hinge bracket for nameplate	.60
W520435	Glass window	10.00
W520632-A	Knob, Channel Selector	.65
W520634-A	Knob, Fine Tuning	.30
W520633-A	Knob, "OFF-VOLUME-PICTURE"	.65
W520635-A	Knob, Picture	.30
W520436	Mask for picture tube	8.00
W520455	Name plate (less hinges and springs)	2.00
W18796	Screw—#10 x 1"; mounts TV chassis	.02
W520453	Spring for hinge on nameplate	.15
W520488	Tab, U. H. F., for Selector knob	.15
W162163	Terminal strip for TV antenna connection	.22

MISCELLANEOUS PARTS

PART NO.	DESCRIPTION	LIST PRICE
W301270	Base for mounting electrolytic condenser	.06
W508153	Bracket base for support of yoke and focus coil (left or right hand)	.25
W520425	Bracket, chassis extension (left hand)	1.50
W520426	Bracket, chassis extension (right hand)	1.50
W520312	Bracket for mounting picture tube (left hand)	1.00
W520311	Bracket for mounting picture tube (right hand)	1.00
W520424	Bracket for mounting pre-set controls	.75
W508081	Bracket for mounting R.F. tuner (front)	.16
W520233	Bracket for mounting R.F. tuner (rear)	.25
W509005	Bracket mounts yoke and focus coil	2.75
W508154	Bracket ("U" shaped) for support of yoke and focus coil	.55
W508681	Clip for mounting electrolytic condenser #197	.10
W508964	Clip for mounting Horizontal Hold or Width coil	.04
W505101	Clip for mounting sound take-off transformer	.05
W507339	Clip for mounting video converter plate, 1st video I.F., 2nd video I.F., 3rd video I.F., or 4.5 Mc. trap coil	.10
W520428	Connector for H.V. terminal (includes cap and lead)	1.00
W509688	Ion trap	.85
*	Jumper for color socket—1¼" of #11 wire	—
W508617	Nut for retaining focus coil	.12
W508962	Nut on end of Horizontal Hold control slug	.10
W508878	Plug (3 pin) for focus coil leads	.25
W500966	Plug (1 pin) for phono pick-up cable	.10
W508515	Plug (8 pin) for yoke cable	.70
W507699	Power cord assembly (includes plugs at both ends)	1.00
W509290	Ring—corona shield for 1B3GT/8016 tube	.10
W520313	Ring, insulating for mounting picture tube	3.50
W520133	Rubber gasket between mask and picture tube	.75
W507422	Rubber sleeve between neck of picture tube and focus coil	.30
W507793	Rubber spacer support between flared neck of picture tube and yoke bracket	.15
W18796	Screw—#10 x 1"; mounts TV chassis	.02
W162353	Shield for 3rd I.F. coil and crystal detector	.30
W162324	Shield for TV channel lite	.20
W162138	Shield—H.V. supply (front section)	2.70
W508088	Shield—H.V. supply (rear section)	2.10
W520534	Shield—tube; miniature for 6J6 tube	.15
W520519	Shield—tube; miniature for 6BK7, 6BQ7 or 6BZ7 tube	.20
W520429	Sleeve, insulating for picture tube (includes H.V. contact)	3.00
W509062	Slug core for converter plate coil	.12
W507357	Slug core for 1st, 2nd or 3rd video I.F. coil or 4.5 Mc. trap coil	.20
W508963	Slug core for Horizontal Hold coil	.15
W507429	Slug core for Width coil	.60
W509761	Socket and cable assembly for picture tube	1.05
W520571	Socket and mounting bracket for TV channel lite	.35
W162259	Socket assembly for 1B3GT/8016 tube (includes mounting frame)	1.20
W508879	Socket (3 pin) for focus coil leads	.35
W160039	Socket—(1 pin) for Phono. pick-up cable	.12
W508419	Socket—(8 pin) for yoke cable	.70
W507932	Socket—male, power cord interlock	.25
W507364	Socket—miniature (7 pin)	.24
W507987	Socket—miniature (7 pin) for 6J6 (includes base for mounting shield)	.45
W508044	Socket—miniature (9 pin)	.35
W509507	Socket—miniature (9 pin) (for 12AU7 tube)	.25
W520521	Socket—miniature (9 pin) for 6BK7, 6BQ7 or 6BZ7 (includes base for mounting shield)	.50
W508703	Socket—octal	.15
W508703	Socket—octal (for color TV adapter)	.15
W506469	Socket—octal (for 6W4 tube)	.18
W509320	Spring—tension for focus coil mounting	.10
W520444	Strap, anchor for picture tube	.65
W520623	Strap, tube retaining	.50
W520443	Support for tuner shaft (plastic)	.04
W162163	Terminal strip for TV antenna connection	.22
W170195	Wing nut—#8-32; for mounting yoke and focus coil	.10
W170817	Wing screw—#10-24; for height adj. of yoke and focus coil	.05
W170741	Wing screw—#10-32; for mounting or forward adj. of yoke	.10

*—This part is not supplied as a Service replacement item.

SILVERTONE 2130
(21" RECT. PICTURE TUBE)

SILVERTONE 2170-D
SILVERTONE 2170-E
(21" RECT. PICTURE TUBE)

SILVERTONE 3170-B
(21" RECT. PICTURE TUBE)

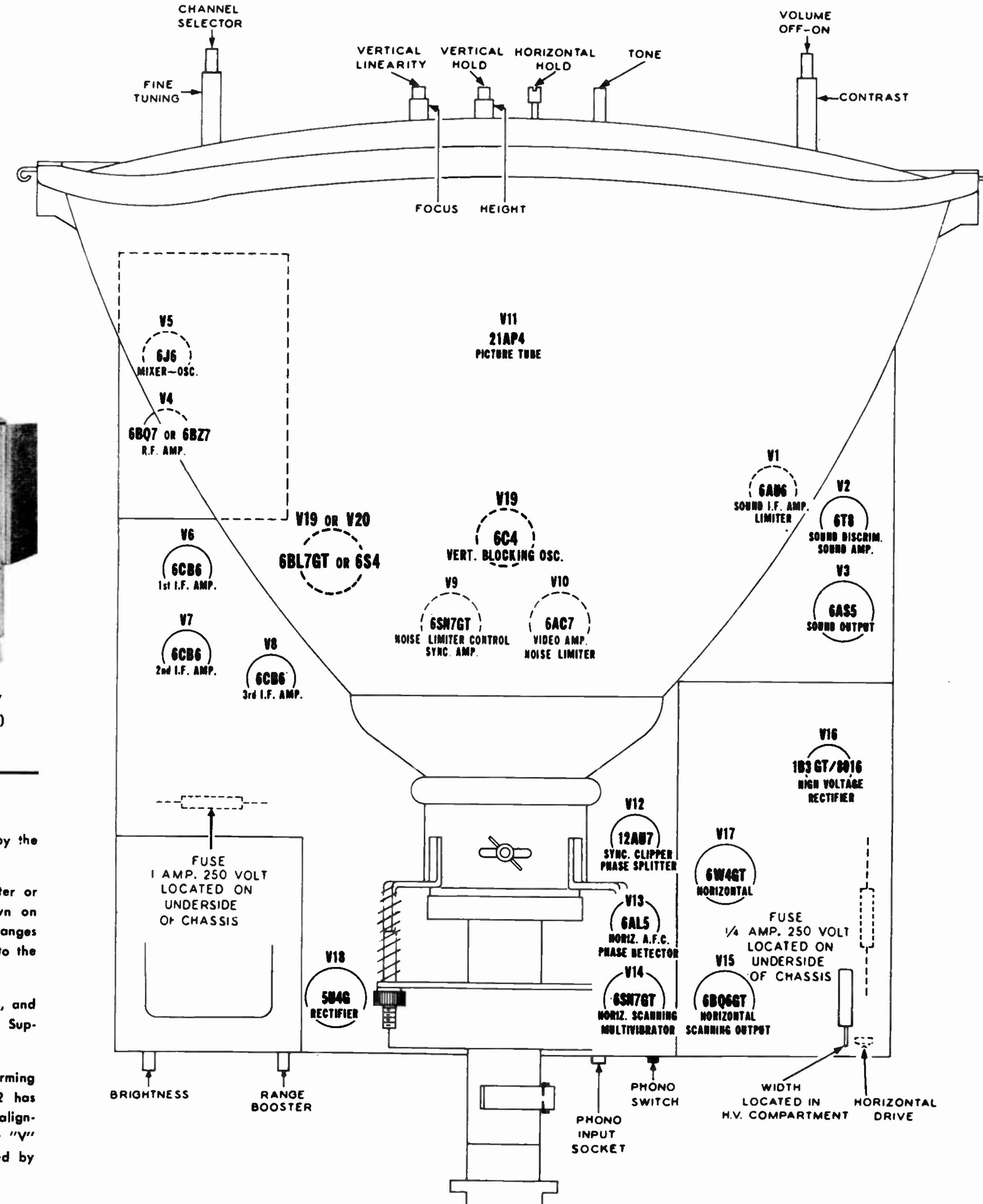
SILVERTONE 3127
(21" RECT. PICTURE TUBE)

SILVERTONE 2172
(21" RECT. PICTURE TUBE)

SILVERTONE 3177
(21" RECT. PICTURE TUBE)

SILVERTONE 3187
(21" RECT. PICTURE TUBE)

TUBE LOCATIONS AND FUNCTIONS



* Two different types of vertical systems are used on this series of receivers.

Chassis that do not have a letter "E" included in the SERIES designation at rear of chassis use a 6BL7GT tube (V19) for both the Vertical Blocking Oscillator and Vertical Scanning Output stages.

Chassis that have the letter "E" included in the SERIES designation utilize a 6C4 tube (V19) as a Verticle Blocking Oscillator and a 6S4 tube (V20) as the Vertical Scanning Output.

For a complete explanation of this change as well as a description of the SERIES coding refer to the "Production Change" column of the circuit diagram.

GENERAL DESCRIPTION

The information contained in this service Supplement covers numbers 2130, 2170-D, 2170-E, 2172, 3127, 3170-B, 3177 and 3187.

These television receivers utilize chassis 100.210 series which is basically the same as chassis 100.208

For technical information relating to the 100.210 series chassis, refer to the 100.208 series service data However, due to the differences between the 100.208 and the 100.210 series chassis, it is necessary to first read the 100.210 series service data before referring to the 100.208 series service literature. Important information, indicating the differences existing between chassis, will be discussed in the succeeding paragraphs.

The differences between the two chassis are that the 100.210 utilizes a 1B3GT type tube for H.V. Rectification, the associated Horizontal Sweep Transformer was changed, a new Power Transformer was used, a Range Booster Control (located at back of chassis) was added, a Tone Control was also added and is accessible from the front of receiver, the Brightness Control was relocated to the back of the receiver to make provision for the Tone Control, the function of tube V9A was changed from A.G.C. to a Noise Limiter Control, and the Video Amplifier, tube V10, was modified to also serve as a Noise Limiter.

Chassis 100.210-1 is identical to the basic chassis 100.210. In chassis 100.210-3, the Vertical Blocking Oscillator and Vertical Scanning Output, tube V19, 6BL7GT—a duo-triode, was removed and replaced by two sepatate triode type tubes—a 6C4 and a 6S4. This change is also indicated by the series coding letter "E".

Any production changes on the 100.210 chassis indicated by a letter or letters stamped on the rear surface of the chassis pan and shown on 100.210 series schematic page, are entirely different from those changes on the 100.208 series chassis that has a similar letter. Always refer to the 100.210 series schematic.

The correct Tube Location and Function Chart for the 100.210 chassis, and a new Socket Voltage Measurement Chart, are included in this Supplement.

100.210 chassis utilizes a W520645 R.F. tuner and when performing Oscillator Alignment, it will be noted that Oscillator Trimmer #12 has been omitted and therefore this step should be eliminated in the alignment procedure. On this R.F. tuner, the instrument connection, point "V" shown in Fig. 12, has been moved to the location formerly occupied by trimmer #12.

The complete schematic and chassis parts list covering the 100.210, 100.210-1 and 100.210-3 chassis is included with this Supplement. All production changes are shown in the schematic. A complete cabinet parts and accessories list, arranged numerically by the catalog number of the receiver and also alphabetically according to the name of the part, will be found on page 53

SOCKET VOLTAGES

CAUTION

THE PICTURE TUBE is highly evacuated and if broken, glass fragments will be violently expelled. Scratching, chipping, undue pressure, or careless handling such as lifting the tube by its neck is dangerous and should be avoided. If it is necessary to handle the picture tube, use safety goggles and heavy gloves.

HIGH VOLTAGE (10 to 13 kilovolts) is produced in a supply circuit of this receiver. Exercise care to avoid contact with elements of this circuit and particularly the tube terminals which are labeled "CAUTION" in the adjoining voltage chart.

THE HIGH VOLTAGE LEAD, which supplies approximately 10 to 13 kilovolts to the picture tube, should be momentarily shorted to the chassis whenever it is disconnected for service purposes. This discharges the high voltage filter condenser and prevents a shock hazard when working on the receiver after it has been turned off.

INTERMEDIATE B+ VOLTAGES, are dangerous and caution should be observed when the receiver chassis components are exposed for service purposes.

THE VOLTAGES SHOWN IN THE ADJOINING CHART WERE MEASURED UNDER THE FOLLOWING CONDITIONS

1.	Power Supply—117 volts 60 cycle AC.
2.	All voltages are measured between socket terminals and chassis unless otherwise indicated on adjoining chart.
3.	* Measurements made with voltmeter having sensitivity of 20,000 ohms per volt except where indicated by (*). The (*) symbol designates a vacuum tube voltmeter measurement.
4.	Channel Selector and Fine Tuning Controls set for normal reception of a local station.
5.	All controls are set for normal reception of the transmitted signal unless the voltage shown on the chart is followed by a letter or letters indicating a special condition of measurement as explained in subsequent notes.
6.	The external or built-in antenna should remain connected to the receiver only when taking voltage measurements in the sweep and sync circuits—for all other measurements, disconnect antenna, short antenna terminals together and connect them to ground.
7.	Certain voltages were measured with two different settings of specific controls. It should therefore be understood that in these instances all controls, with the exception of one or two, were set for normal reception—letters following the voltage shown on the chart indicate the exceptions and are explained below.

EXPLANATION OF NOTES

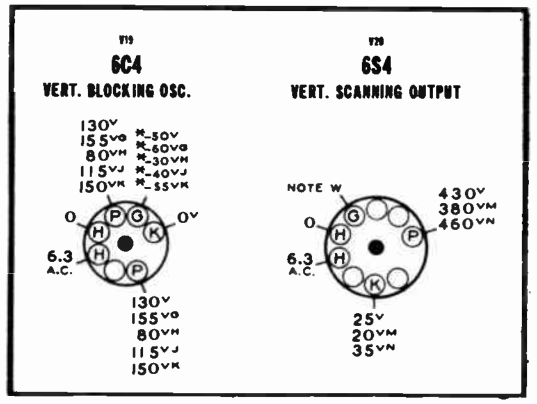
A.	Range Booster control max. clockwise
B.	Brightness Control max. clockwise
C.	Brightness Control max. counter-clockwise
D.	Contrast Control max. clockwise
DD.	Contrast control set to max. voltage reading but not necessarily max. clockwise setting of control
E.	Contrast Control max. counter-clockwise
F.	Range Booster control max. counter-clockwise.
G.	Height Control max. clockwise
H.	Height Control max. counter-clockwise
J.	Vertical Hold Control max. clockwise
K.	Vert. Hold Control max. counter-clockwise
L.	This voltage measurement was taken from the top of the tuner chassis with the tube removed from its socket.
M.	Vertical Linearity Control max. clockwise.
N.	Vertical Linearity Control max. counter-clockwise.
Q.	Do not attempt to measure the voltage at the tube cap. There is a high R. F. potential at this point.
T.	Horiz. Drive Control max. clockwise
U.	Horiz. Drive Control max. counter-clockwise.
V.	Before measuring this voltage, connect external antenna and adjust controls for normal reception of station signal.
W.	This measurement should be made with a vacuum tube voltmeter. This voltage reading will fluctuate in the vicinity of 0.15 volts.
X.	Grounding of center stud on tube socket is necessary to reduce capacity coupling between other pins. Oscillation may result if this ground is omitted.
Y.	Horiz. Hold Control turned in a clockwise direction until picture approaches loss of sync.
Z.	Horiz. Hold Control turned in a counter-clockwise direction until picture aproaches loss of sync.

PRODUCTION CHANGES

For a complete description of the changes as well as an explanation of the SERIES coding, refer to the circuit diagram page 9, under the heading "Production Changes."

LETTER INCLUDED IN SERIES DESIGNATION	LOCATION OF VOLTAGE INFORMATION OR EFFECT OF CHANGE ON MEASUREMENT
"A"	SERIES "A" change does not affect circuit voltages.
"B"	SERIES "B" change does not affect circuit voltages.
"C"	SERIES "C" change does not affect circuit voltages.
"D"	SERIES "D" change does not affect circuit voltages.
"E"	Chassis incorporating this change have V19-6BL7GT replaced by V19-6C4 and V20-6S4. Voltage measurement readings taken on these two latter tubes are shown in the small chart below headed "SERIES E CHART."
"F"	No chassis were produced with this series designation.
"G"	SERIES "G" change does not affect circuit voltages.

SERIES "E" CHART



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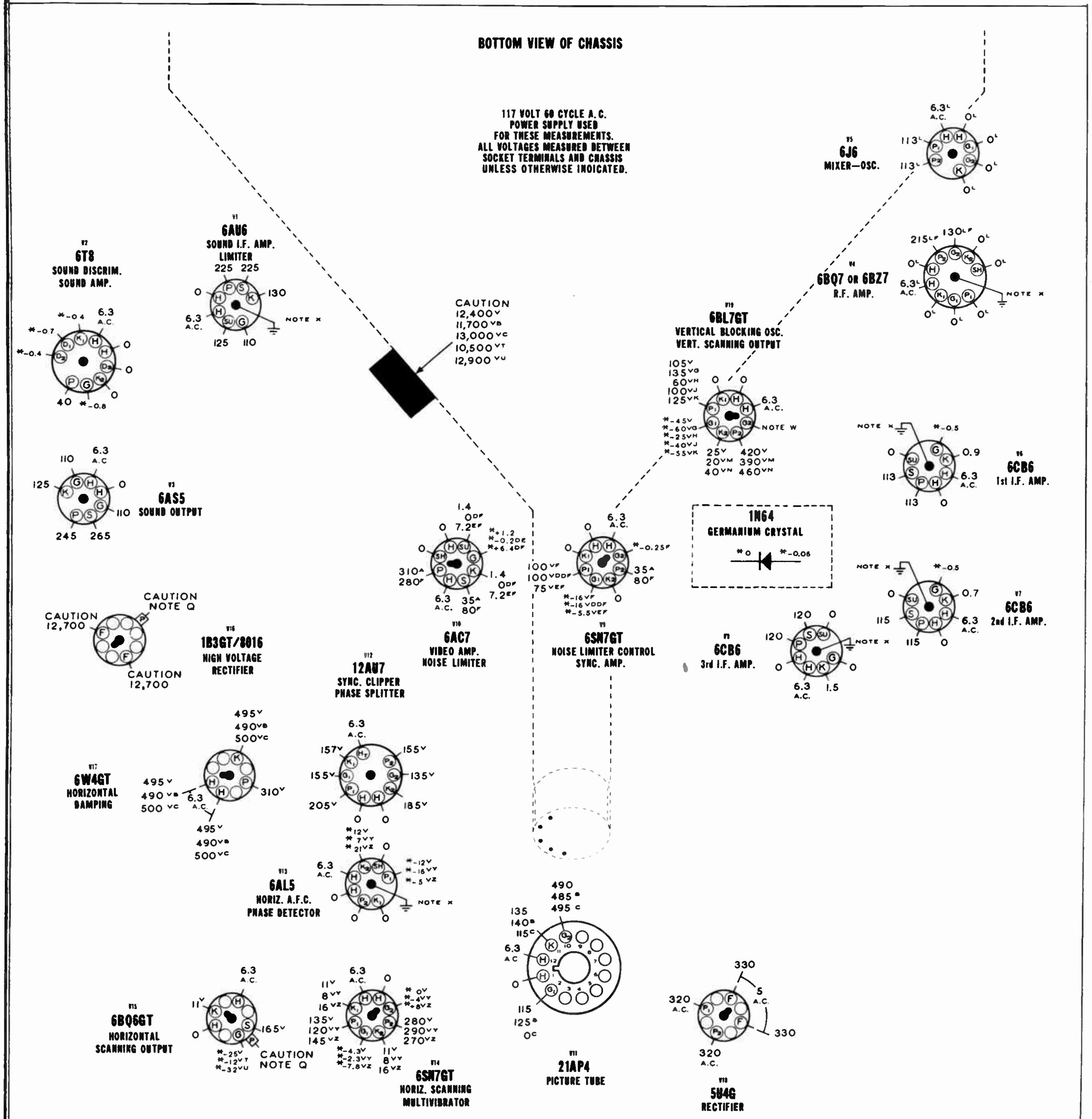


PRODUCTION CHANGES

The following tabulation furnishes complete details on changes which occurred during receiver production. The receivers incorporating these changes are identified by coding stamped on rear surface of chassis. This coding consists of one or more letters following the word SERIES, as SERIES B. SERIES AC, etc., and corresponds to similarly lettered changes shown below. Chassis incorporate only that change indicated by letter designation; i.e., chassis stamped "SERIES BE" does not include changes "A" or "C" or "D".

The circuit shown on this page applies to "SERIES ACDE" chassis.

A letter following the component circuit diagram number thus—201A, indicates that this particular item was affected by a circuit change. The letter corresponds to the series code letter listed in the production change column, from which complete change information can be obtained.

LETTER DESIGNATION	DESCRIPTION OF CHANGE
UNCODED	**INITIAL PRODUCTION**
"A"	This change was incorporated to improve the response characteristic of the video amplifier. 1. Change peaking coil 129 in plate circuit of tube V10 (6AC7) Video Amp. from part W509341 to part W520689. 2. Change resistor 130 in plate circuit of tube V10 (6AC7) Video Amp. from 18,000 Ohms to 12,000 Ohms. 3. Change peaking coil 132 in plate circuit of tube V10 (6AC7) Video Amp. from part W509342 to part W509340.
"B"	No chassis were produced with this series designation.
"C"	The following change was incorporated to allow vertical hold control to operate in the center of its range. 1. Resistor 223 in grid circuit of V19A (Vertical Blocking Oscillator) was changed from 2 Meg. to 1.8 Meg.
"D"	The following change was incorporated only to facilitate production in bringing about a more consistent I.F. response curve. 1. Resistor 106 in grid circuit of V8 (3rd. I.F. Amp.) was changed from 6800 Ohms ± 10% to 4700 Ohms ± 5%.
"E"	This change was incorporated due to the unavailability of type 6BL7GT tube. 1. Tube V19 (Vert. Blocking Oscillator and Vert. Scanning Output) 6BL7GT, a duo-triode, was removed and replaced by two separate triode type tubes—V19, a 6C4 which is utilized as the Vert. Blocking Oscillator and V20, a 6S4 which is used for the Vertical Scanning Output stage. 2. Resistor 223 in grid circuit of V19 (Vert. Blocking Oscillator) was changed to 1.5 Meg. 3. Resistor 226 (4.7 Meg.) in grid circuit of V19-A—6BL7GT (Vert. Blocking Oscillator) was omitted. 4. The value of all the other components as well as their schematic location, utilized in the two stages remain the same.
"F"	No chassis were produced with this series designation.
"G"	This change was incorporated to improve the response characteristic of the video amplifier. 1. Change peaking coil 121 in plate circuit of diode detector from part W509340 to part W520620. 2. Change peaking coil in plate circuit of diode detector from part W509342 to part W520985. 3. Change peaking coil in plate circuit of tube V10 (6AC7) Video Amp. from part W520340 to part W520342.

PARTS LIST FOR CABINETS

CABINET PARTS— 2130

PART NO.	DESCRIPTION	LIST PRICE
W115225	Back for cabinet	$ 3.00
W520460-A	Cabinet	55.00
W520437	Escutcheon for glass window	10.00
W520435	Glass window	10.00
W520454	Hinge for nameplate	.60
W520632-A	Knob, Channel Selector (Maroon)	.65
W520634-A	Knob, Fine Tuning (Gold)	.30
W520633-A	Knob, "OFF-VOLUME-PICTURE" (Maroon)	.65
W520635-A	Knob, Picture (Gold)	.30
W520436	Mask for picture tube	8.00
W520455	Nameplate (less spring and hinge) (Maroon)	2.00
W170986	Screw—#6-32, Phillips oval brass head; retains escutcheon	.02
W18796	Screw—#10x1"; mounts TV chassis	.02
W520453	Spring for nameplate	.15
W520488	Tab, U.H.F., for selector knob	.15

CABINET PARTS— 2170-D

PART NO.	DESCRIPTION	LIST PRICE
W115225	Back for cabinet	3.00
W520630-A	Cabinet	75.00
W520437	Escutcheon for glass window	10.00
W520435	Glass window	10.00
W520454	Hinge for nameplate	.60
W520632-A	Knob, Channel Selector (Maroon)	.65
W520634-A	Knob, Fine Tuning (Gold)	.30
W520633-A	Knob, "OFF-VOLUME-PICTURE" (Maroon)	.65
W520635-A	Knob, Picture (Gold)	.30
W520436	Mask for picture tube	8.00
W520455	Nameplate (less spring and hinge) (Maroon)	2.00
W170986	Screw—#6-32, Phillips oval brass head; retains escutcheon	.02
W18796	Screw—#10x1"; mounts TV chassis	.02
W520453	Spring for nameplate	.15
W520488	Tab, U.H.F., for selector knob	.15

CABINET PARTS— 2170-E

PART NO.	DESCRIPTION	LIST PRICE
W115225	Back for cabinet	3.00
W520700-A	Cabinet	85.00
W520492	Caster for cabinet	.50
W520437	Escutcheon for glass window	10.00
W520435	Glass window	10.00
W520454	Hinge for nameplate	.60
W520632-A	Knob, Channel Selector (Maroon)	.65
W520634-A	Knob, Fine Tuning (Gold)	.30
W520633-A	Knob, "OFF-VOLUME-PICTURE" (Maroon)	.65
W520635-A	Knob, Picture (Gold)	.30
W520436	Mask for picture tube	8.00
W520455	Nameplate (less spring and hinge) (Maroon)	2.00
W170986	Screw—#6-32, Phillips oval brass head; retains escutcheon	.02
W18796	Screw—#10x1"; mounts TV chassis	.02
W520453	Spring for nameplate	.15
W520488	Tab, U.H.F., for selector knob	.15

CABINET PARTS— 2172

PART NO.	DESCRIPTION	LIST PRICE
W115225	Back for cabinet	3.00
W520640-A	Cabinet	90.00
W520437	Escutcheon for glass window	10.00
W520435	Glass window	10.00
W520454	Hinge for nameplate	.60
W520632-B	Knob, Channel Selector (Beige)	.65
W520634-A	Knob, Fine Tuning (Gold)	.30
W520633-B	Knob, "OFF-VOLUME-PICTURE" (Beige)	.65
W520635-A	Knob, Picture (Gold)	.30
W520436	Mask for picture tube	8.00
W520637	Nameplate (less spring and hinge) (Beige)	2.00
W170986	Screw—#6-32, Phillips oval brass head; retains escutcheon	.02
W18796	Screw—#10x1"; mounts TV chassis	.02
W520453	Spring for nameplate	.15
W520488	Tab, U.H.F., for selector knob	.15

CABINET PARTS— 3127

PART NO.	DESCRIPTION	LIST PRICE
W115238	Back for cabinet	$ 2.25
W520810-A	Cabinet	65.00
W520818	Frame for glass window (wooden)	3.75
W520806	Glass window	8.75
W520684-B	Knob, Channel Selector (Green)	.85
W520686-A	Knob, Fine Tuning (Clear)	.75
W520685-B	Knob, Off-On-Volume (Green)	.70
W520687-A	Knob, Picture (Clear)	.45
W520817	Leg for cabinet	4.00
W520805-B	Mask for picture tube	5.75
W520678-B	Nameplate (includes spring and hinge) (Beige)	3.00
W18796	Screw—#10x1"; mounts TV chassis	.02
W520754-A	Tab, U.H.F., for selector knob	.15

CABINET PARTS— 3170-B

PART NO.	DESCRIPTION	LIST PRICE
W115225	Back for cabinet	3.00
W520700-B	Cabinet	85.00
W520492	Caster for cabinet	.50
W520437	Escutcheon for glass window	10.00
W520435	Glass window	10.00
W520684-A	Knob, Channel Selector (Maroon)	.85
W520686-A	Knob, Fine Tuning (Clear)	.75
W520685-A	Knob, Off-On-Volume (Maroon)	.70
W520687-A	Knob, Picture (Clear)	.45
W520436	Mask for picture tube	8.00
W520678-A	Nameplate (includes spring and hinge) (Maroon)	3.00
W170986	Screw—#6-32, Phillips oval brass head; retains escutcheon	.02
W18796	Screw—#10x1"; mounts TV chassis	.02
W520754-A	Tab, U.H.F., for selector knob	.15

CABINET PARTS— 3177

PART NO.	DESCRIPTION	LIST PRICE
W115225	Back for cabinet	3.00
W520811-A	Cabinet	85.00
W520492	Caster for cabinet	.50
W520437	Escutcheon for glass window	10.00
W520435	Glass window	10.00
W520684-B	Knob, Channel Selector (Green)	.85
W520686-A	Knob, Fine Tuning (Clear)	.75
W520685-B	Knob, Off-On-Volume (Green)	.70
W520687-A	Knob, Picture (Clear)	.45
W520436	Mask for picture tube	8.00
W520678-B	Nameplate (includes spring and hinge) (Beige)	3.00
W170986	Screw—#6-32, Phillips oval brass head; retains escutcheon	.02
W18796	Screw—#10x1"; mounts TV chassis	.02
W520754-A	Tab, U.H.F., for selector knob	.15

CABINET PARTS— 3187

PART NO.	DESCRIPTION	LIST PRICE
W115225	Back for cabinet	3.00
W520800-A	Cabinet	115.00
W508499	Catch for door	.65
W520492	Caster for cabinet	.50
W520814	Door for cabinet (left hand)	10.00
W520815	Door for cabinet (right hand)	10.00
W520437	Escutcheon for glass window	10.00
W520435	Glass window	10.00
W520816	Handle for door	1.50
W520812	Hinge for door per pr.	.65
W520684-B	Knob, Channel Selector (Green)	.85
W520686-A	Knob, Fine Tuning (Clear)	.75
W520685-B	Knob, Off-On-Volume (Green)	.70
W520687-A	Knob, Picture (Clear)	.45
W520436	Mask for picture tube	8.00
W520678-B	Nameplate (includes spring and hinge) (Beige)	3.00
W170986	Screw—#6-32, Phillips oval brass head; retains escutcheon	.02
W18796	Screw—#10x1"; mounts TV chassis	.02
W520754-A	Tab, U.H.F., for selector knob	.15

PARTS LIST FOR CHASSIS

Notice: Some parts listed below have special characteristics. Do not use substitutes for replacement purposes.

CONDENSERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
11	W513001	Condenser—ceramic 2.2 Mmfd. 500 volt	$ .16
13	W513002	Condenser—ceramic 47 Mmfd. 500 volt	.24
17	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
20-A	W509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
20-B	W509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
21	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
23	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
24	W512027	Condenser—.05 Mfd. 200 volt	.40
26	W512007	Condenser—.005 Mfd. 600 volt	.25
28	W512007	Condenser—.005 Mfd. 600 volt	.25
30	W513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
34	W513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
35	W505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
36	W512011	Condenser—.01 Mfd. 400 volt	.25
39	W512007	Condenser—.005 Mfd. 600 volt	.25
92	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
94	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
97	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
99	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
101	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
104	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
107	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
110	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
113	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
117	W513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)	.30
119	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
125	W512033	Condenser—.1 Mfd. 200 volt	.30
128	W513438	Condenser—ceramic 47 Mmfd. ±5% 500 volt (Temperature compensating)	.45
134	W512035	Condenser—.1 Mfd. 400 volt	.30
143	W512019	Condenser—.02 Mfd. 600 volt	.30
144	W512031	Condenser—.05 Mfd. 600 volt	.35
148	W513027	Condenser—ceramic 56 Mmfd. ±10% 1500 volt	.45
151	W513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
153	W512013	Condenser—.01 Mfd. 600 volt	.30
156	W512029	Condenser—.05 Mfd. 400 volt	.35
162	W512001	Condenser—.001 Mfd. 600 volt	.22
165	W512001	Condenser—.001 Mfd. 600 volt	22
166	W512009	Condenser—.01 Mfd. 200 volt	.25
169	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
171	W512027	Condenser—.05 Mfd. 200 volt	.40
173	W512540	Condenser—mica 3900 Mmfd. ±10% 500 volt	.60
174	W512535	Condenser—mica 390 Mmfd. ±10% 500 volt	.35
178	W512535	Condenser—mica 390 Mmfd. ±10% 500 volt	.35
179	W512515	Condenser—mica 1000 Mmfd. ±10% 500 volt	.40
180	W520127	Condenser—trimmer 25-280 Mmfd. (Horizontal Drive Control)	.50
181	W512049	Condenser—.25 Mfd. ±10% 600 volt	.60
186	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
188, 189	W512031	Condenser—.05 Mfd. 600 volt	.35
194	W512045	Condenser—.25 Mfd. ±10% 200 volt	.36
195	W508888	Condenser—ceramic 500 Mmfd. 20,000 volt	2.00
197-A, B	W520641	Condenser—electrolytic A—10 Mfd. 450 volt, B—20 Mfd. 450 volt	2.50
198	W512255	Condenser—.01 Mfd. 400 volt	.25
200	W512255	Condenser—.01 Mfd. 400 volt	.25
203	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
205	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
207	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
208-A, B,C	W520434	Condenser—electrolytic A—40 Mfd. 450 volt, B—40 Mfd. 450 volt, C—40 Mfd. 250 volt	3.75
211	W160095	Condenser—electrolytic 40 Mfd. 300 volt	2.00
212-A, B	W509002	Condenser—electrolytic A— 80 Mfd. 250 volt, B—100 Mfd. 50 volt	3.00
213	W513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
220-A	W508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
220-C	W508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
220-E	W508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
220-G	W508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
222	W512533	Condenser—mica 4700 Mmfd. ±5% 1000 volt	1.40
229	W512308	Condenser—.05 Mfd. ±10% 600 volt	.30
230	W512037	Condenser—.1 Mfd. 600 volt	.45
236	W513026	Condenser—ceramic 5.1 Mmfd. ±10% 1500 volt	.40
237	W512019	Condenser—.02 Mfd. 600 volt	.30
241	W512027	Condenser—.05 Mfd. 200 volt	.40
242	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
247	W512019	Condenser—.02 Mfd. 600 volt	.30
320	W508888	Condenser—500 Mmfd. 20,000 volt	2.00
324	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
334	W512009	Condenser—.01 Mfd. 200 volt	.25
337	W513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature Compensating)	.30
338	W513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
339	W512223	Condenser—.25 Mfd. 400 volt	.60

CONDENSERS FOR W520645 R.F. TUNER

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
402	W509064	Condenser—trimmer 3-9 Mmfd.	.50
405	W520721	Condenser—ceramic 3.6 Mmfd. ±10% 500 volt	.35
407	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
410	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
412	W520719	Condenser—ceramic 47 Mmfd. ±10% 500 volt (Temperature compensating)	.40
414	W520717	Condenser—ceramic 5 Mmfd. ±5% 500 volt (Temperature compensating)	.35
416	W520719	Condenser—ceramic 47 Mmfd. ±10% 500 volt (Temperature compensating)	.40
417	*	Condenser—ceramic 3-5 Mmfd. (Fine Tuning)	—
420	W520718	Condenser—ceramic 10 Mmfd. ±10% 500 volt (Temperature compensating)	.30
421	W507968	Condenser—trimmer 0.5-3 Mmfd.	.40
425	W520716	Condenser—ceramic 6.8 Mmfd. ±5% (Temperature compensating)	.35
428	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
429	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
430	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
431	W513029	Condenser—ceramic 120 Mmfd. ±10% 500 volt	.35
432	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
433	W520735	Condenser—ceramic 1000 Mmfd. 500 volt	.30
435	W520735	Condenser—ceramic 1000 Mmfd. 500 volt	.30
437	W520720	Condenser—ceramic 1.5 Mmfd. 500 volt	.35

RESISTORS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
14	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	$ .12
15	W510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
19	W510249	Resistor—carbon 4700 Ohms 1 watt	.14
22	W510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
25	W510170	Resistor—carbon 68,000 Ohms ½ watt	.12
29	W510197	Resistor—carbon 10 Meg. ½ watt	.12
31	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
32	W510160	Resistor—carbon 22,000 Ohms ±10% ½ watt	.12
37	W510746	Resistor—carbon 680,000 Ohms ±5% ½ watt	.20
38	W510747	Resistor—carbon 820,000 Ohms ±5% ½ watt	.20
91	W510723	Resistor—carbon 12,000 Ohms ±5% ½ watt	.16
93	W510116	Resistor—carbon 68 Ohms ½ watt	.12
95	W510129	Resistor—carbon 390 Ohms ±10% ½ watt	.12
98	W510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
100	W510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
102	W510119	Resistor—carbon 100 Ohms ½ watt	.12
106	W510750	Resistor—carbon 4,700 Ohms ±5% ½ watt (used when letter "D" is included in series designation at rear of chassis)	.20
106	W510151	Resistor—carbon 6,800 Ohms ±10% ½ watt (used when letter "D" is not included in series designation at rear of chassis)	.12

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE

RESISTORS—Continued

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
108	W510119	Resistor—carbon 100 Ohms ½ watt	.12
109	W510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
120	W510186	Resistor—carbon 560,000 Ohms ±10% ½ watt	.12
123	W510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
124	W510119	Resistor—carbon 100 Ohms ½ watt	.12
126	W510191	Resistor—carbon 1 Meg. ½ watt	.12
130	W510723	Resistor—carbon 12,000 Ohms ±5% ½ watt (used when letter "A" is included in series designation at rear of chassis)	.16
	W510745	Resistor—carbon 18,000 Ohms ±5% ½ watt (used when letter "A" is not included in series designation at rear of chassis)	.20
131	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
133	W510753	Resistor—wire wound 4000 Ohms ±10% 5 watt	1.00
135, 136	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
139	W510160	Resistor—carbon 22,000 Ohms ±10% ½ watt	.12
145	W510142	Resistor—carbon 2200 Ohms ±10% ½ watt	.12
149, 150	W510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
152	W510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
154	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12
155	W510169	Resistor—carbon 68,000 Ohms ±10% ½ watt	.12
157	W510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
158	W510187	Resistor—carbon 680,000 Ohms ±10% ½ watt	.12
159	W510748	Resistor—carbon 3900 Ohms ±5% ½ watt	.20
160	W510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
161	W510750	Resistor—carbon 4700 Ohms ±5% ½ watt	.20
163, 164	W510751	Resistor—carbon 100,000 Ohms ±5% ½ watt	.20
167	W510162	Resistor—carbon 27,000 Ohms ±10% ½ watt	.12
168	W510195	Resistor—carbon 4.7 Meg. ½ watt	.12
170	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
175	W510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
176	W510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
177	W510187	Resistor—carbon 680,000 Ohms ±10% ½ watt	.12
182	W510357	Resistor—carbon 15,000 Ohms ±10% 2 watt	.35
183	W510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
184	W510116	Resistor—carbon 68 Ohms ½ watt	.12
185	W510218	Resistor—carbon 100 Ohms ±10% 1 watt	.16
187	W510248	Resistor—carbon 4700 Ohms ±10% 1 watt	.16
190	W510758	Resistor—wire wound 12,000 Ohms ±10% 5 watt	1.20
196	W510390	Resistor—carbon 1 Meg. ±10% 2 watt	.30
199	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
210	W510741	Resistor—wire wound 600 Ohms ±10% 10 watt	.90
219	W510162	Resistor—carbon 27,000 Ohms ± 10% ½ watt	.12
220-B	W508062	Resistor—carbon 22,000 Ohms ⅕ watt (part of Integrator Unit)	1.40
220-D	W508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
220-F	W508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
223	W510767	Resistor—carbon 1.5 Meg. ±5% ½ watt (used when letter "E" is included in series designation at rear of chassis)	.20
	W510775	Resistor—carbon 1.8 Meg. ±5% ½ watt (used when letter "C" is included in series designation at rear of chassis)	.15
	W510769	Resistor—carbon 2 Meg. ±5% ½ watt (used when both letters "C" and "E" are not included in series designation at rear of chassis)	.20
225	W510766	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
226	W510768	Resistor—carbon 4.7 Meg. ±10% ½ watt (used when letter "E" is not included in series designation at rear of chassis)	.12
227	W510767	Resistor—carbon 1.5 Meg. ±5% ½ watt	.20
228	W510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
231	W510193	Resistor—carbon 2.2 Meg. ½ watt	.12
234	W510344	Resistor—carbon 2700 Ohms ±10% 2 watt	.35
235	W510145	Resistor—carbon 3300 Ohms ±10% ½ watt	.12
238	W510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
244, 245	W510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
246	W510134	Resistor—carbon 680 Ohms ½ watt	.12
248	W510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
339	W510167	Resistor—carbon 47,000 Ohms ½ watt	.12
336	W510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
341	W510354	Resistor—carbon 10,000 Ohms ±10% 2 watt	.25
342	W510773	Resistor—wire wound 4000 Ohms ±10% 3 watt	1.80

RESISTORS FOR W520645 R.F. TUNER

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
403	W510157	Resistor—carbon 15,000 Ohms ±10% ½ watt	.12
404	W510167	Resistor—carbon 47,000 Ohms ½ watt	.12
408	W510774	Resistor—carbon 160,000 Ohms ±5% ½ watt	.16
409	W510751	Resistor—carbon 100,000 Ohms ±5% ½ watt	.20
411	W510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
418	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
419	W510179	Resistor—carbon 220,000 Ohms ½ watt	.12
422, 423	W510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
438	W510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12

COILS AND TRANSFORMERS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
12	W509378	Transformer—audio take-off	1.50
20	W509706	Transformer—TV sound discriminator (includes condensers 20-A and 20-B)	3.00
40	W509376	Transformer—audio output	1.85
96	W507343	Coil—1st video I.F. (less slug)	.70
	W507357	Slug core for 1st video I.F. coil	.20
103	W507367	Coil—choke	.70
105	W507343	Coil—2nd video I.F. (less slug)	.70
	W507357	Slug core for 2nd video I.F. coil	.20
112	W507343	Coil—3rd video I.F. (less slug)	.70
	W507357	Slug core for 3rd video I.F. coil	.20
115	W507367	Coil—choke	.70
121	W520620	Coil—peaking (used when letter "G" is included in series designation at rear of chassis)	.60
	W509340	Coil—peaking (used when letter "G" is not included in series designation at rear of chassis)	.55
122	W520985	Coil—peaking (used when letter "G" is included in series designation at rear of chassis)	.65
	W509342	Coil—peaking (used when letter "G" is not included in series designation at rear of chassis)	.60
127	W509603	Coil—4.5 Mc. trap (includes slug and condenser #128)	1.20
	W507357	Slug core for 4.5 Mc. trap	.20
129	W520689	Coil—peaking (used when letter "A" is included in series designation at rear of chassis)	.65
	W520341	Coil—peaking (used when letter "A" is not included in series designation at rear of chassis)	.60
132	W520342	Coil—peaking (used when letter "G" is included in series designation at rear of chassis)	.60
	W509340	Coil—peaking (used when letter "A" is included but letter "G" is not included in series designation at rear of chassis)	.55
	W509342	Coil—peaking (used when chassis have no series letter coding)	.60
142	W162326	Coil—focus (includes cable and plug)	14.00
146	W115228	Yoke—picture tube deflection (includes cable and plug)	12.50
172	W508967	Coil—Horizontal Hold (includes slug and clip)	1.10
	W508963	Slug core for Horizontal Hold coil	.15
192	W520489	Transformer—horizontal sweep	12.50
193	W509361	Coil—Width (includes slug and clip)	2.00
	W507429	Slug core for Width coil	.60
201	W520487	Transformer—power	17.00
202	W507584	Coil—choke	.28
204	W507584	Coil—choke	.28
206	W507584	Coil—choke	.28
209	W508341	Choke—filter	3.60
214	W507584	Coil—choke	.28
221	W508076	Transformer—vertical blocking oscillator	1.90
233	W509375	Transformer—vertical output	4.00

COILS FOR W520645 R.F. TUNER

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
401	W520702	Coil-antenna; channel #2 (coded "2Q")	1.40
	W520703	Coil-antenna; channel #3 (coded "3Q")	1.40
	W520704	Coil-antenna; channel #4 (coded "4Q")	1.40
	W520705	Coil-antenna; channel #5 (coded "5Q")	1.40
	W520706	Coil-antenna; channel #6 (coded "6Q")	1.40
	W520707	Coil-antenna; channel #7 (coded "7Q")	1.15
	W520708	Coil-antenna; channel #8 (coded "8Q")	1.15
	W520709	Coil-antenna; channel #9 (coded "9Q")	1.15
	W520710	Coil-antenna; channel #10 (coded "10Q")	1.15
	W520711	Coil-antenna; channel #11 (coded "11Q")	1.15
	W520712	Coil-antenna; channel #12 (coded "12Q")	1.15
	W520713	Coil-antenna; channel #13 (coded "13Q")	1.15
406	W520701	Coil-cathode coupling	.15
413	W520722	Coil-R.F. and osc; channel #2 (coded "2Q")	1.85
	W520723	Coil-R.F. and osc; channel #3 (coded "3Q")	1.85
	W520724	Coil-R.F. and osc; channel #4 (coded "4Q")	1.85
	W520725	Coil-R.F. and osc; channel #5 (coded "5Q")	1.85
	W520726	Coil-R.F. and osc; channel #6 (coded "6Q")	1.85
	W520727	Coil-R.F. and osc; channel #7 (coded "7Q")	1.70
	W520728	Coil-R.F. and osc; channel #8 (coded "8Q")	1.70
	W520729	Coil-R.F. and osc; channel #9 (coded "9Q")	1.70
	W520730	Coil-R.F. and osc; channel #10 (coded "10Q")	1.70
	W520731	Coil-R.F. and osc; channel #11 (coded "11Q")	1.70
	W520732	Coil-R.F. and osc; channel #12 (coded "12Q")	1.70
	W520733	Coil-R.F. and osc; channel #13 (coded "13Q")	1.70
	W507986	Slug for osc coil; auxiliary fine tuning adj.	.05
424	W520714	Coil-choke	.15
426	W520715	Coil-choke	.45
427	W520734	Coil—converter plate I.F. (includes slug and clip)	.75
	W509062	Slug core for converter plate coil	.12
434	W520518	Coil-choke	.10
436	W520520	Coil-choke	.10

CONTROLS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
27-A,B,C	W520292	Volume and Contrast control (includes OFF-ON switch) A—Volume control; 1 Meg ¼ watt B—Contrast control; 750 Ohms 2 watt C—Off On switch	3.50
138	W520652	Brightness potentiometer (100,000 Ohms)	1.00
172	W508967	Horizontal Hold coil (includes slug and clip)	1.10
	W508963	Slug core for Horizontal Hold coil	.15
180	W520127	Horizontal Drive trimmer condensor (25-280 Mmfd.)	.50
193	W509361	Width coil (includes slug and clip)	2.00
	W507429	Slug core for Width coil	.60
224-A, B	W508893	Height and Vertical Hold potentiometers A—Vertical Hold control; 1 Meg. ¼ watt B—Height control; 2.5 Meg. ¼ watt	1.75
232-A,B	W509302	Vertical Linearity and Focus potentiometers A—Vertical Lineority control; 5,000 Ohms ½ watt B—Focus control; 10,000 Ohms ±10% 4 watt	3.75
335	W520651	Tone potentiometer (500,000 Ohms)	1.00
340-A, B	W520653	Range Booster potentiometer A—30,000 Ohms ½ watt B—30,000 Ohms ½ watt	1.25
417	*	Fine Tuning condenser (3.5 Mmfd)	—

OTHER ELECTRICAL PARTS

SCHEMATIC LOCATION	PART NO.	DESCRIPTION	LIST PRICE
41	W508157	Speaker—P.M. Dynamic (6"); Catalog #2130	7.40
	W509398	Speaker—P.M. Dynamic (6"); Catalog #3127	4.50
	W508174	Speaker—P.M. Dynamic (6"x9"); Catalog #2170-D and 2172	8.40
	W506464	Speaker—P.M. Dynamic (10"); Catalog #2170-E, 3170-B, 3177 and 3187	11.30
116	W509386	Crystal detector	2.00
141	W509688	Ion trap	.85
191	W508063	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt	.30
218	W118921	TV Channel Lite (Mazda 47 6-8 V. 150 Ma.)	.15
220-A to G	W508062	Integrator Coupling Unit A—Condenser—ceramic .01 Mfd. 450 volt B—Resistor—carbon 22,000 Ohms ⅕ watt C—Condenser—ceramic 2000 Mmfd. 450 volt D—Resistor—carbon 8200 Ohms ⅕ watt E—Condenser—ceramic 5000 Mmfd. 450 volt F—Resistor—carbon 8200 Ohms ⅕ watt G—Condenser—ceramic 5000 Mmfd. 450 volt	1.40
240	W509517	Fuse; 1 Amp.; 250 volt	.25
326-A,B	W520563	Switch, "PHONO-TELEV."	.55
400	W509353	Built-in antenna	1.85

MECHANICAL PARTS OF R.F. TUNER

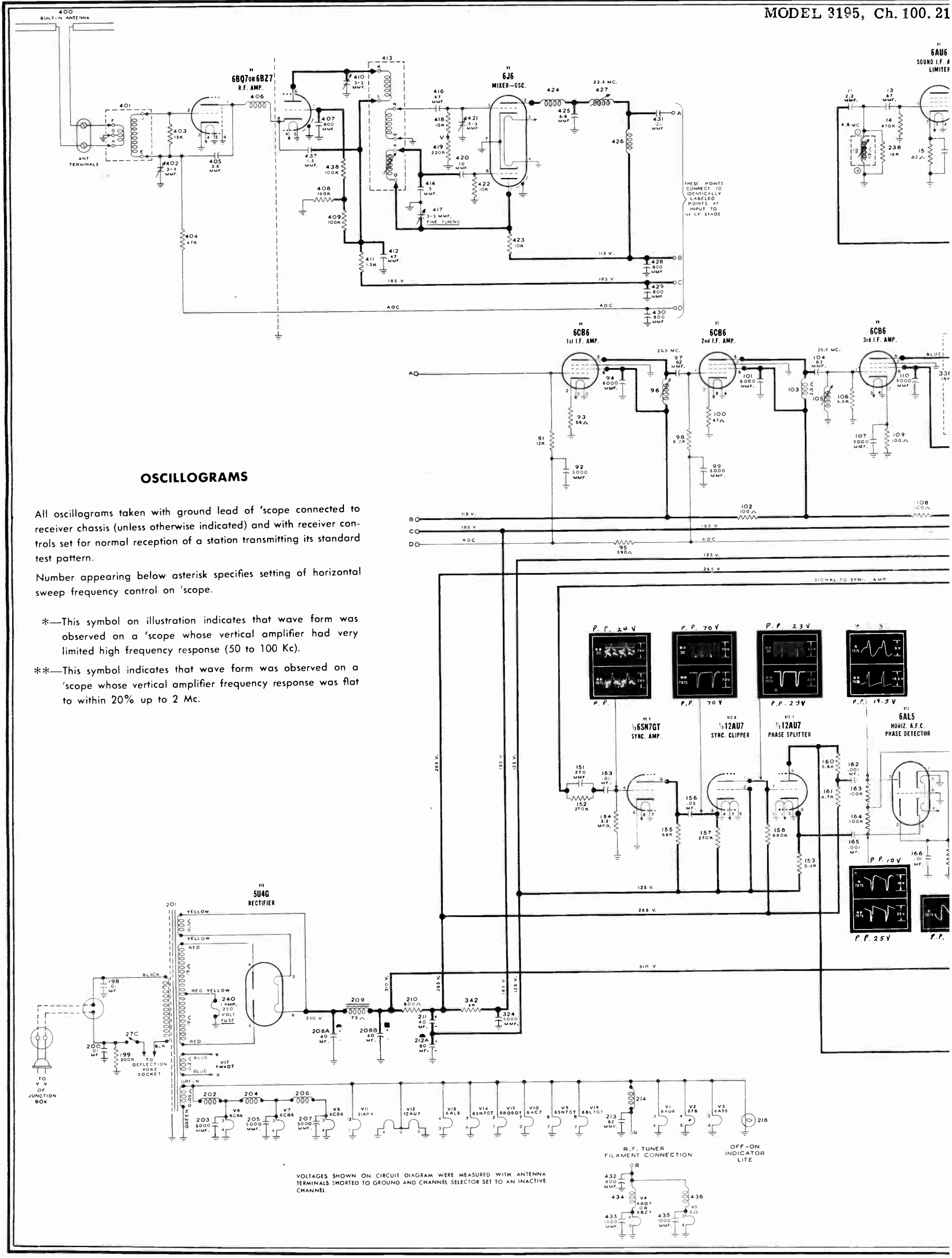
(for electrical parts see preceding classified listings of condensers, resistors and coils)

PART NO.	DESCRIPTION	LIST PRICE
W520645	R.F. Tuner complete with coils and tubes	37.50
W508081	Bracket for mounting R.F. tuner (front)	.16
W520233	Bracket for mounting R.F. tuner (rear)	.25
W507339	Clip for mounting video converter plate coil	.10
W520515	Fine Tuning cam and shaft	.70
W508708	Roller—detent	.10
W520535	Shield, bottom cover	.50
W520536	Shield, side cover	.35
W520534	Shield—tube; miniature for 6J6 tube	.15
W520519	Shield—tube; miniature for 6BQ7 or 6BZ7 tube	.20
W509062	Slug core for converter plate coil	.12
W507986	Slug for osc. coil; auxiliary fine tuning adj.	.05
W507987	Socket—miniature for 6J6 tube (includes base for mounting shield)	.45
W520521	Socket—miniature (9 pin) for 6BQ7 or 6BZ7 tube (includes base for mounting shield)	.50
W507966	Spring—contactor washer (on front turret shaft	.08
W508709	Spring—detent	.08
W507990	Spring—retains osc. fine tuning slug	.10
W507967	Spring—turret shaft retaining	.03
W520517	Stator contact assembly (includes 11 contacts and metal frame)	3.75
W520516	Tuner turret and shaft assembly (less coils)	3.00
W507965	Washer, fiber spacer (on turret shaft)	.01

MISCELLANEOUS PARTS

PART NO.	DESCRIPTION	LIST PRICE
W301270	Base for mounting electrolytic condenser	.06
W508153	Bracket base for support of yoke and focus coil (left or right hand)	.25
W520425	Bracket, chassis extension (left hand)	1.50
W520426	Bracket, chassis extension (right hand)	1.50
W520312	Bracket for mounting picture tube (left hand)	1.00
W520311	Bracket for mounting picture tube (right hand)	1.00
W520424	Bracket for mounting pre-set controls	.75
W508081	Bracket for mounting R.F. tuner (front)	.16
W520233	Bracket for mounting R.F. tuner (rear)	.25
W509005	Bracket mounts yoke and focus coil	2.75
W508154	Bracket ("U" shaped) for support of yoke and focus coil	.55
W508681	Clip for mounting electrolytic condenser #197	.10
W508964	Clip for mounting Horizontal Hold or Width coil	.04
W505101	Clip for mounting sound take-off transformer	.05
W507339	Clip for mounting video converter plate, 1st video I.F., 2nd video I.F., 3rd video I.F., or 4.5 Mc. trap coil	.10
W520428	Connector for H.V. terminal (includes cap and lead)	1.00
W509688	Ion trap	.85
W508617	Nut for retaining focus coil	.12
W508962	Nut on end of Horizontal Hold control slug	.10
W500966	Plug (1 pin) for phono pick-up cable	.10
W508878	Plug (3 pin) for focus coil leads	.25
W508515	Plug (8 pin) for yoke cable	.70
W507699	Power cord assembly (includes plugs at both ends)	1.00
W509290	Ring—corona shield for 1B3GT/8016 tube	.10
W520313	Ring, insulating for mounting picture tube	3.50
W507422	Rubber sleeve between neck of picture tube and focus coil	.30
W507793	Rubber spacer support between flared neck of picture tube and yoke bracket	.15
W18796	Screw—#10 x 1"; mounts TV chassis	.02
W162353	Shield for 3rd I.F. coil and crystal detector	.30
W162138	Shield—H.V. supply (front section)	2.70
W508088	Shield—H.V. supply (rear section)	2.10
W520534	Shield—tube; miniature for 6J6 tube	.15
W520519	Shield—tube; miniature for 6BQ7 or 6BZ7 tube	.20
W520429	Sleeve, insulating for picture tube (includes H.V. contact)	3.00
W509062	Slug core for converter plate coil	.12
W507357	Slug core for 1st, 2nd or 3rd video I.F. coil or 4.5 Mc. trap coil	.20
W508963	Slug core for Horizontal Hold coil	.15
W507429	Slug core for Width coil	.60
W509761	Socket and cable assembly for picture tube	1.05
W520571	Socket and mounting bracket for TV channel lite	.35
W162259	Socket assembly for 1B3GT/8016 tube (includes mounting frame)	1.20
W160039	Socket—(1 pin) for Phono. pick-up cable	.12
W508879	Socket—(3 pin) for focus coil leads	.35
W508419	Socket—(8 pin) for yoke cable	.70
W507932	Socket—male, power cord interlock	.25
W507364	Socket—miniature (7 pin)	.24
W507987	Socket—miniature for 6J6 tube (includes base for mounting shield)	.45
W508044	Socket—miniature (9 pin)	.35
W509507	Socket—miniature (9 pin) (for 12AU7 tube)	.25
W520521	Socket—miniature (9 pin) for 6BQ7 or 6BZ7 tube (includes base for mounting shield)	.50
W508703	Socket—octal	.15
W506469	Socket—octal (for 6W4 tube)	.18
W509320	Spring—tension for focus coil mounting	.10
W520444	Strap, anchor for picture tube	.65
W520623	Strap, tube retaining	.50
W520443	Support for tuner shaft (plastic)	.04
W162163	Terminal strip for TV antenna connection	.22
W170195	Wing nut—#8-32; for mounting yoke and focus coil	.10
W170817	Wing screw—#10-24; for height adj. of yoke and focus coil	.05
W170741	Wing screw—#10-32; for mounting or forward adj. of yoke	.10

*—This part is not supplied as a Service replacement item.



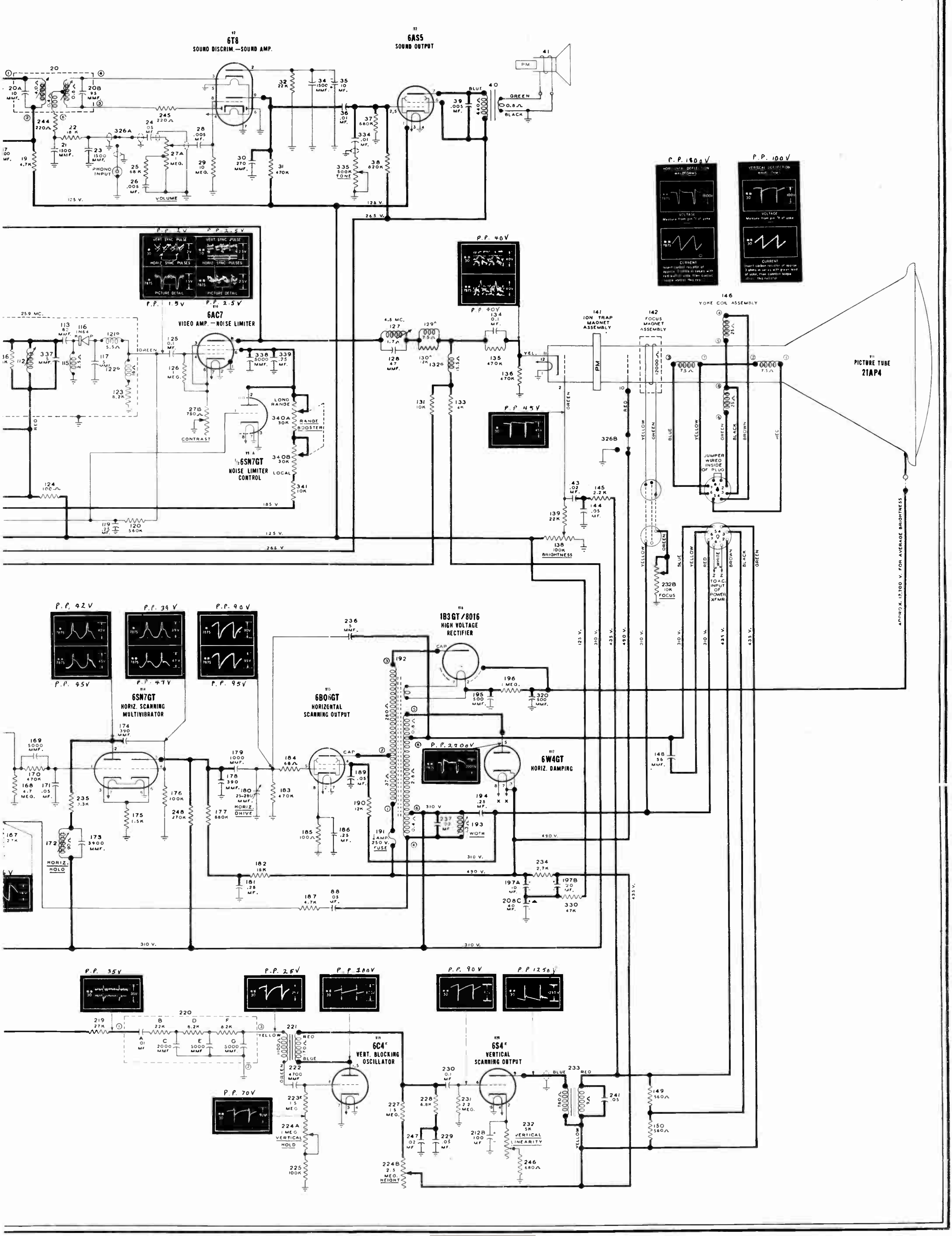
OSCILLOGRAMS

All oscillograms taken with ground lead of 'scope connected to receiver chassis (unless otherwise indicated) and with receiver controls set for normal reception of a station transmitting its standard test pattern.

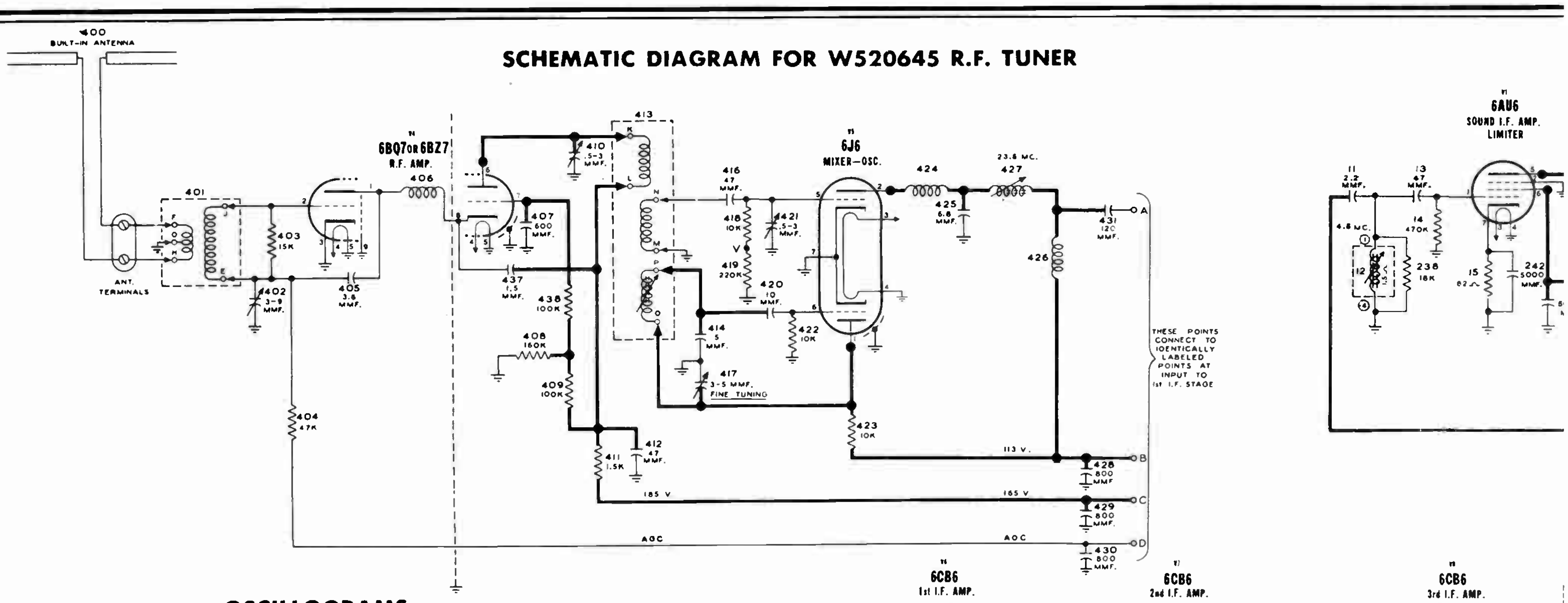
Number appearing below asterisk specifies setting of horizontal sweep frequency control on 'scope.

*—This symbol on illustration indicates that wave form was observed on a 'scope whose vertical amplifier had very limited high frequency response (50 to 100 Kc).

**—This symbol indicates that wave form was observed on a 'scope whose vertical amplifier frequency response was flat to within 20% up to 2 Mc.


6T8
SOUND DISCRIM.—SOUND AMP.
6AS5
SOUND OUTPUT
6AC7
VIDEO AMP.—NOISE LIMITER
½6SN7GT
NOISE LIMITER CONTROL
6SN7GT
HORIZ. SCANNING MULTIVIBRATOR
6BQ6GT
HORIZONTAL SCANNING OUTPUT
1B3GT/8016
HIGH VOLTAGE RECTIFIER
6W4GT
HORIZ. DAMPING
6C4
VERT. BLOCKING OSCILLATOR
6S4
VERTICAL SCANNING OUTPUT
PICTURE TUBE
21AP4
YOKE COIL ASSEMBLY
ION TRAP MAGNET ASSEMBLY
FOCUS MAGNET ASSEMBLY
VOLUME
CONTRAST
BRIGHTNESS
FOCUS
HORIZ. DRIVE
HORIZ. HOLD
WIDTH
VERTICAL HOLD
VERTICAL LINEARITY
HEIGHT
PHONO INPUT
TONE
RANGE BOOSTER
LONG RANGE
LOCAL
JUMPER WIRED INSIDE OF PLUG
TO A.C. INPUT OF POWER XFMR
APPROX. 15,200 V. FOR AVERAGE BRIGHTNESS

SCHEMATIC DIAGRAM FOR W520645 R.F. TUNER



OSCILLOGRAMS

All oscillograms taken with ground lead of 'scope connected to receiver chassis (unless otherwise indicated) and with receiver controls set for normal reception of a station transmitting its standard test pattern.

Number appearing below asterisk specifies setting of horizontal sweep frequency control on 'scope.

*—This symbol on illustration indicates that wave form was observed on a 'scope whose vertical amplifier had very limited high frequency response (50 to 100 Kc).

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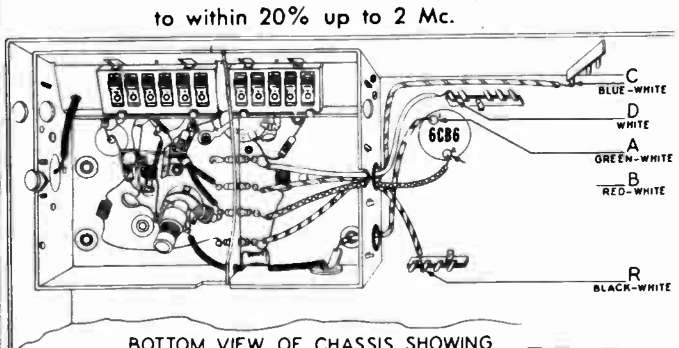
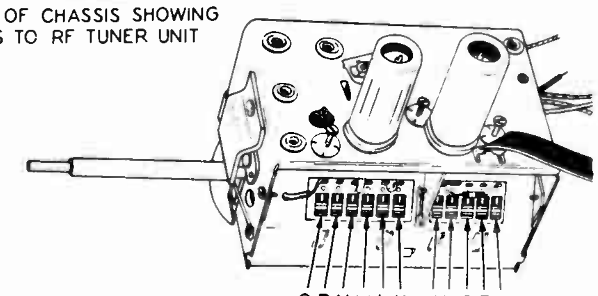
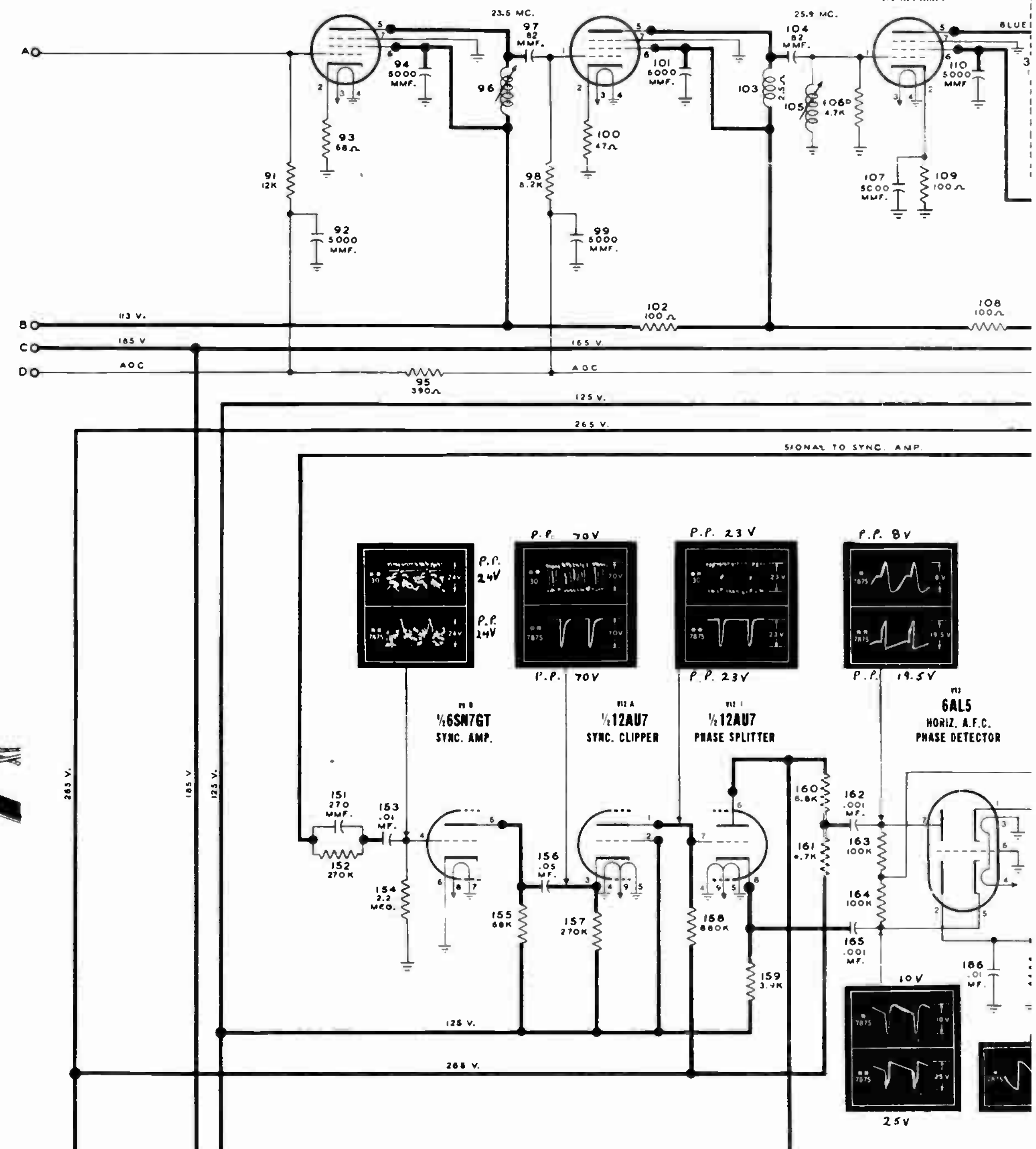
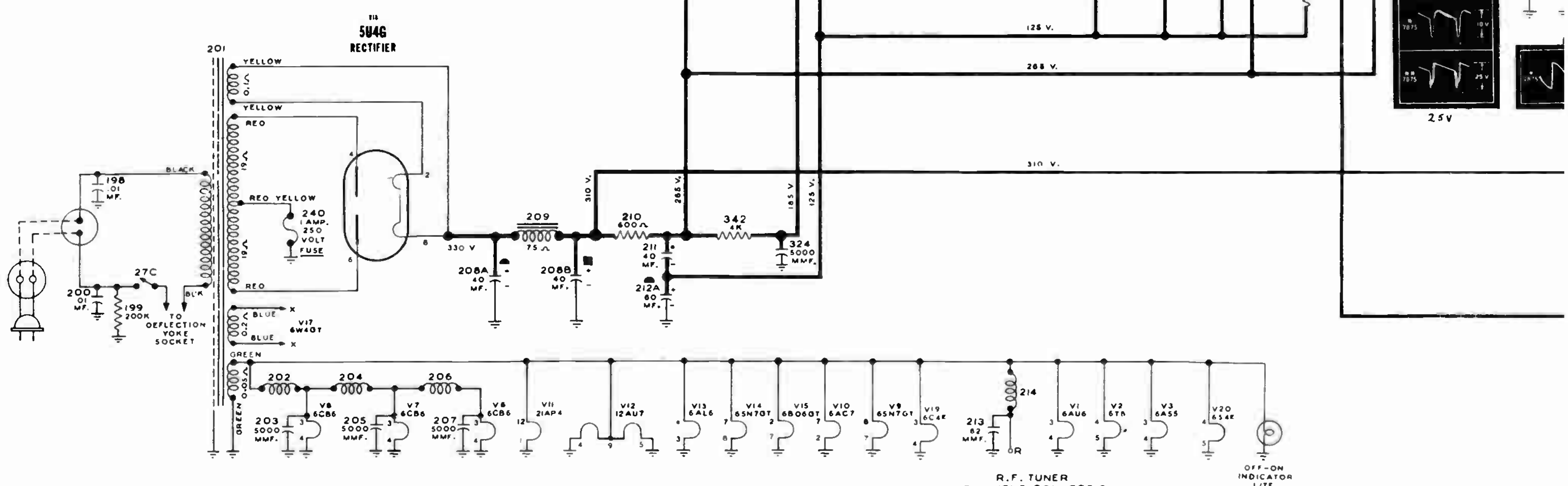


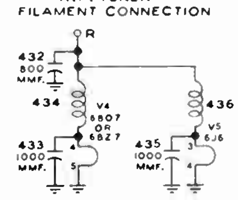
BOTTOM VIEW OF CHASSIS SHOWING CONNECTIONS TO RF TUNER UNIT



W520645 R.F. TUNER UNIT
(SHOWN WITH SIDE SHIELD REMOVED)

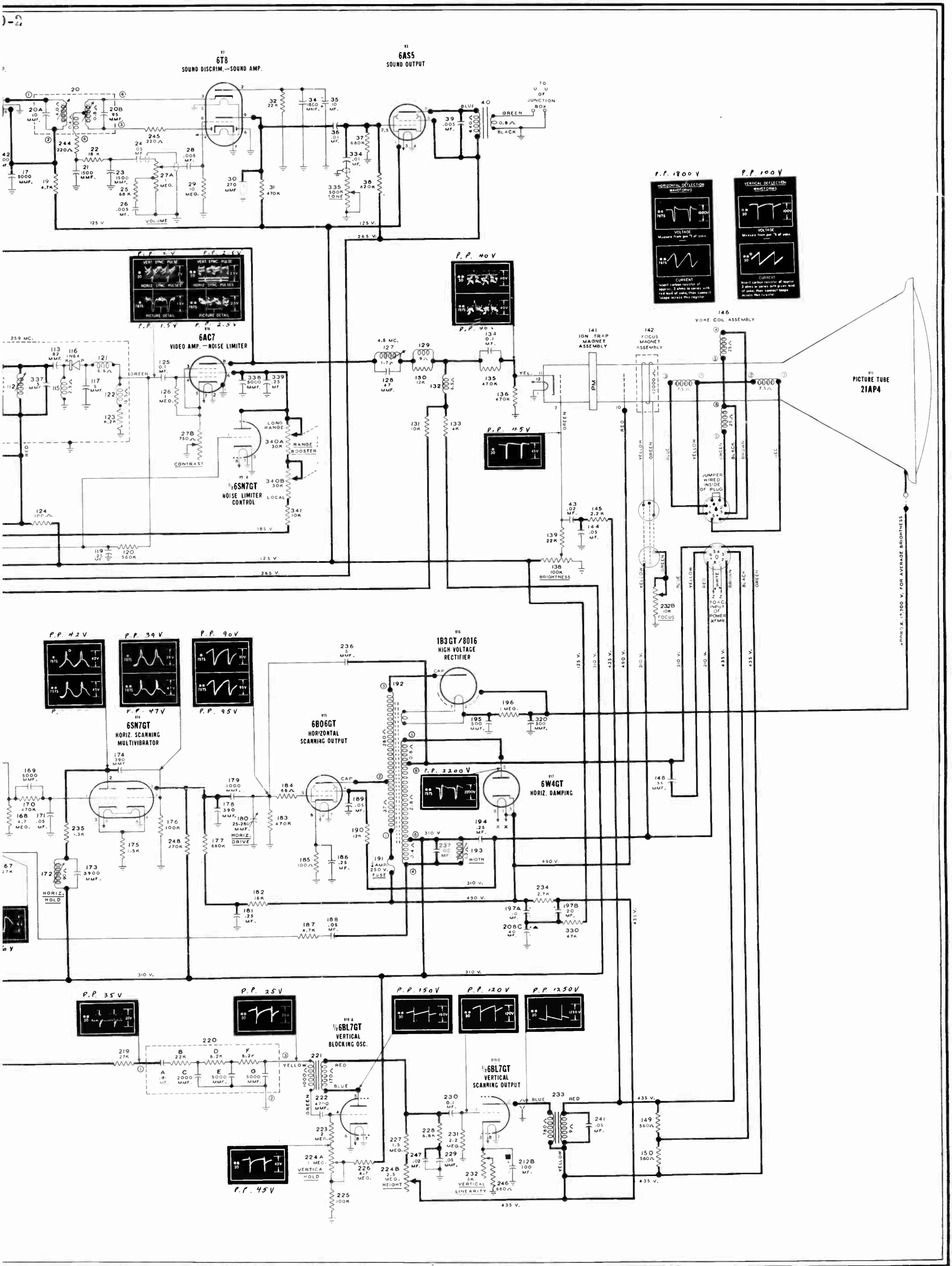






R.F. TUNER FILAMENT CONNECTION

VOLTAGES SHOWN ON CIRCUIT DIAGRAM WERE MEASURED WITH ANTENNA TERMINALS SHORTED TO GROUND AND CHANNEL SELECTOR SET TO AN INACTIVE CHANNEL. ALL CONTROLS ARE SET FOR NORMAL OPERATION EXCEPT FOR RANGE BOOSTER CONTROL WHICH WAS SET TO MAXIMUM COUNTER-CLOCKWISE POSITION (LOCAL).


6T8
SOUND DISCRIM.—SOUND AMP.
6AS5
SOUND OUTPUT
TO V.U. OF JUNCTION BOX
GREEN
BLACK
BLUE
VOLUME
TONE
125 V.
265 V.
VERT. SYNC. PULSE
HORIZ. SYNC. PULSES
PICTURE DETAIL
6AC7
VIDEO AMP.—NOISE LIMITER
CONTRAST
LONG RANGE
RANGE BOOSTER
LOCAL
½6SN7GT
NOISE LIMITER CONTROL
185 V.
P.P. 1800 V
HORIZONTAL DEFLECTION WAVEFORMS
P.P. 100 V
VERTICAL DEFLECTION WAVEFORMS
VOLTAGE
CURRENT
YOKE COIL ASSEMBLY
ION TRAP MAGNET ASSEMBLY
FOCUS MAGNET ASSEMBLY
PICTURE TUBE
21AP4
JUMPER WIRED INSIDE OF PLUG
BRIGHTNESS
FOCUS
TO A.C. INPUT OF POWER XFMR
APPROX. 19,200 V. FOR AVERAGE BRIGHTNESS
1B3GT/8016
HIGH VOLTAGE RECTIFIER
6SN7GT
HORIZ. SCANNING MULTIVIBRATOR
6BQ6GT
HORIZONTAL SCANNING OUTPUT
6W4GT
HORIZ. DAMPING
HORIZ. DRIVE
HORIZ. HOLD
WIDTH
FUSE
310 V.
490 V.
435 V.
½6BL7GT
VERTICAL BLOCKING OSC.
½6BL7GT
VERTICAL SCANNING OUTPUT
VERTICAL HOLD
HEIGHT
VERTICAL LINEARITY
YELLOW
RED
BLUE

No.	Description	Chassis No.
121-17	17" Table Model Receiver Mahogany cabinet	647.021
122-20	20" Table Model Receiver Mahogany Cabinet	647.022
123-20	20" Console TV Receiver Mahogany Veneer Cab.	647.022
122-20A	20" Table Model TV same as 122-20 with Meteor name	647.022
123-20A	20" Console TV same as 123-20 with Meteor name	647.022
2101	14" Table Model TV Gum Faced Mah. Cab.	647.023
2101A	14" Table Model TV same as 2101 except for knobs & escutcheon	647.023

SPECIFICATIONS

Power Supply - 105 to 125 Volts - 60 Cycle AC

Power Consumption - 200 Watts

Power Output (Audio) - 2 Watts (Undistorted)

Input Impedance - 300 Ohms

Speaker - Voice Coil - 3.2 Ohms

Vertical Scanning Frequency - 60 Cycles Per Second

FREQUENCY CHART

Sound IF - 21.6 MC

Picture IF - 26.1 MC

Channel	Frequency	Picture Frequency	Sound Frequency	RF Osc. Frequency
2	54-60	55.25	59.75	81.35
3	60-66	61.25	65.75	87.35
4	66-72	67.25	71.75	93.35
5	76-82	77.25	81.75	103.35
6	82-88	83.25	87.75	109.35
7	174-180	175.25	179.75	201.35
8	180-186	181.25	185.75	207.35
9	186-192	187.25	191.75	213.35
10	192-198	193.25	197.75	219.35
11	198-204	199.25	203.75	225.35
12	204-210	205.25	209.75	231.35
13	210-216	211.25	215.75	237.35

TUBE COMPLEMENT

1. 6J6 RF Oscillator & Mixer
2. 6BC5 RF Amplifier
3. 6AU6 1st Video IF Amplifier
4. 6AU6 2nd Video IF Amplifier
5. 6CB6 3rd Video IF Amplifier
6. 6CB6 4th Video IF Amplifier
7. IN60 Video Detector
8. 6AC7 Video Amplifier
9. 6AU6 Audio IF Amplifier
10. 6AL5 Ratio Detector
11. 6V6 Audio Output
12. 6AV6 Audio Amplifier
13. 12AU7 Sync. Amplifier & Sync. Clipper
14. 6AL5 Horizontal Phase Detector
15. 6SN7GT Vert. Osc. & Sync. Splitter
16. 6SN7GTA Vertical Output
17. 6SN7GT Horizontal Oscillator & Discharge
18. 6BG6 Horizontal Output
19. 6W4 Horizontal Damper
20. IB3 High Voltage Rectifier

INDOOR ANTENNA

Silvertone indoor antennas have a length of cable or transmission line attached to the base. This line ends with two terminal lugs. Connect these legs to the terminals after disconnecting the Built-In Antenna. In using the Silvertone Indoor Antenna No. 6738, lower the aerial arms to a wide "V" or horizontal position as shown in Fig. 2. Extend arms fully -- pull out all the way -- for reception on Television Channels Numbers 1 to 4. Shorten arms approximately 7 inches for best reception on Television Channels 5 and 6. Shorten arms -- push in all the way -- for Television Channels Numbers 7 to 13.

The antenna will work best when the arms are placed broadside toward the Television Transmitting Station. However, the antenna should be rotated and the reception observed for best results. In checking the antenna, keep hands away from the metal part of the antenna. It is desirable to keep the antenna above the floor and provision is made on the base for hanging to the wall, if that position is favorable to reception. It may be necessary to try different positions of the antenna until the most satisfactory results are obtained. A little experience will determine the best location, length and position of the antenna for each channel.

OUTDOOR ANTENNA:

In certain cases improved reception can be obtained by the use of an outdoor television antenna such as No. 6724, "piggy-back" straight dipole; 6713, single conical; 6714, stacked conical; 6715, folded in-line; 6716, stacked in-line. This will be true when:

1. Improved reception is desired on stations with signals of insufficient power and more than 15 miles distant from your home.
2. Your home is in a particularly bad location for television reception, that is, near heavy automobile traffic, in a valley surrounded by hills or tall buildings, etc.
3. Your receiver is operating inside a building with steel frame construction, which diverts television signals, or in a basement location below street level.

BRIEF CIRCUIT ANALYSIS:

This receiver uses the Inter-carrier sound system. In this system the R.F. section of the receiver receives both the picture and sound carriers which are converted by the Mixer and then fed into the I.F. No separation takes place until after the video amplifier. At this point the sound component of the dual signal is picked off by the 4.5 MC transformer and fed through the audio I.F. amplifier, ratio detector, audio amplifier and the audio output stage. The picture I.F. frequency is 26.1 MC and the sound I.F. is 21.6 MC.

VIDEO AMPLIFIER:

A 6AC7 is used in this section of the receiver. The output of the detector is fed to the grid of the 6AC7 and ultimately taken off the plate of the tube. It is at this point the three basic components of the received signal are separated and fed to their respective circuits. The picture intelligence is fed to the cathode of the picture tube, and the synchronization pulses to the grid of the 1st sync amplifier. At this point the 4.5 MC sound carrier is also taken off.

SOUND SYSTEM:

The carrier is taken off the plate of the video amplifier by a 4.5MC take-off coil and fed thru audio I.F. amplifier to the ratio detector, and then to the sound amplifier, audio output and speaker.

SWEEP SYSTEM - VERTICAL:

One triode section of a 6SN7 serves as the vertical oscillator. The vertical sweep amplifier is also a 6SN7. The plate circuit of the vertical sweep amplifier is transformer coupled to the vertical windings of the deflection yoke.

SWEEP SYSTEM - HORIZONTAL:

The horizontal system is cathode coupled sine wave multivibrator combination, using one-half of a 6SN7 as a horizontal osc. and the other triode section as a discharge tube.

A. G. C.:

This receiver uses an A.G.C. circuit operating on the first two I. F. stages and the R. F. amplifier which proves quite effective.

HIGH VOLTAGE POWER SUPPLY:

This receiver used the "fly-back" type of high voltage power supply. The horizontal output tube is a 6BG6 with a 1B3 as a rectifier.

LOW VOLTAGE POWER SUPPLY:

The low voltage power supply is conventional, consisting of a center tapped power transformer used in conjunction with a 5U4 full wave rectifier. After power dissipations for filtering, approximately 360 volts are available for application to the deflection circuits. It is interesting to note that the I. F. -R. F. portions and the sound-audio portions of the receiver are in series across 360 volt supply, 220 volts being used for sound supply and the remaining 140 volts for I. F. and R. F. supply, supply potential. See Fig. 1.

CONTROL FUNCTIONS - FRONT PANEL CONTROLS:

On-Off-Sound:

The volume control is an audio control only and has no effect on the picture. It is connected in the grid circuit of the audio amplifier. The power on and off switch is combined with the volume control.

Picture:

The contrast control is virtually a tone control for the picture. When set too low, it will give a weak, washy picture and when set too high, it will produce a stark black and white picture.

Vertical:

The vertical hold control should be adjusted in the event of picture roll. Slight readjustment will cause the picture to lock vertically.

Horizontal:

The horizontal hold control should be set in the center of its range. The control will be used only if the picture should resolve into a series of heavy, oblique black and white lines. A slight readjustment of the control will then cause the picture to correct itself.

Station Selector:

The inner knob will activate the fine tuning control, which is a corrector for the R. F. oscillator. The (outer) indicator knob of this control will operate the station selector.

RECEIVER REAR CHASSIS CONTROLS:

Brightness:

This control operates by varying the D. C. potential on the cathode of the kinescope.

Vertical Size or Height:

This control is a variable resistor operating in the plate circuit of the vertical sweep oscillator. Since changes in height will affect picture linearity, this height control must be adjusted in conjunction with the vertical linearity control.

Note: The height control will affect mainly the bottom half of the picture, and the vertical linearity control will affect mainly the top portion of the picture.

Vertical Linearity Control:

This is a variable resistor control in the cathode of the vertical sweep amplifier. This control is to be adjusted as height control is adjusted.

RECEIVER REAR CHASSIS CONTROLS:

P. M. Focus Coil Adjustment:

This receiver uses a permanent magnet type focus unit. This unit provides an easy method for both focusing and centering adjustments. The unit is spring mounted for ease of positioning. A brass, screw driver slotted rod, is located to the right of the CR tube socket at the rear of the set, and may be adjusted for best focus. If the focusing ring (outer ring) is drawn completely to the rear and a focus is approached, but not obtained, the entire assembly should be moved to the rear. This may be accomplished by loosening all three wing nuts on the spring mounted assembly. Conversely, if focus is approached with the focus ring completely forward, tighten the three wing nuts. The raster may be centered by movement of the positioning ring (inside the focusing ring) with the "Wobble Stick" which is taped to an electrolytic condenser on the top of the chassis.

Horizontal Size:

The horizontal size adjustment should be attempted only when it is possible to receive a test pattern.

Horizontal Linearity:

The horizontal linearity control is adjusted to give best linearity between the left and right wedges of the test pattern consistant with good width.

Check of AFC Control:

The AFC control is located on the rear portion of the chassis under the yoke riser bracket. Set the horizontal hold control midway of its range. Tune in a station, then adjust the AFC coil until the picture is "locked in" on the screen.

If at a later time, the horizontal size controls are changed it may be necessary to repeat the above.

Height, Width, Linearity Alignment:

To adjust the overall size and linearity of the picture it is mandatory that a test pattern transmitted from a local station be used. Linearity adjustments, particularly, cannot be made accurately on moving transmissions. In an area where more than one station is being received, the pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the mask opening.

1. The horizontal hold control should be set at the center of its range and the AF coil adjusted until the picture locks in.

2. The horizontal linearity coil should be adjusted until the left and right wedges of the test pattern are as nearly equal as possible consistant with good width.

3. If the center of the picture is compressed horizontally or if a white line is evident on the left side, adjust the horizontal drive trimmer.

4. The height and vertical linearity controls should now be adjusted for a linear picture that will fill the mask vertically. The focus adjustment should also be checked for maximum definition of lines in the vertical wedge of the test pattern.

Deflection Yoke Adjustment:

The deflection yoke should be placed in position closest to the "bell" of the picture tube, as far forward as possible. The yoke riser mounting should also be as far forward as possible.

If the lines of the raster are not horizontal or squared with the picture mask, loosen the deflection yoke adjusting screw and rotate yoke until this condition is remedied. Tighten yoke adjustment screw.

INSTALLATION AND ADJUSTMENT

BUILT-IN ANTENNA--This receiver is equipped with a built-in antenna which should provide favorable reception of television signals within the primary service area, and where local interferences are not excessive. Do not locate the receiver near a large metal surface such as a radiator or metal partition, or a serious reduction of signal will result.

RECEIVER INSTALLATION--The receiver was shipped from the factory with all components pre-adjusted for normal operation. However, if in checking receiver performance, it becomes evident that one or more of the installation controls are out of adjustment, due to handling, it is necessary to re-adjust the affected controls. A complete adjustment of installation controls is outlined in the step by step procedure which follows. It will be noted that adjustment of some of the controls will interact on one or more of the others. These controls should be adjusted alternately, and in the given sequence of the procedure. Power should never be applied to the receiver for any great length of time, prior to the installation, without checking the ion trap adjustment for best screen illumination.

SEQUENCE OF ADJUSTMENTS

Ion Trap Adjustment

1. Remove the cabinet back cover. (In some cases, this will open circuit the A. C. interlock, and another line cord with appropriate fittings must be used temporarily until the necessary adjustments have been completed). With power applied to the receiver, and after allowing adequate warm-up time, set the brightness control in the center of its range and rotate the ion trap, or beam bender magnet, until light appears on the screen. After initial screen illumination is obtained, move the magnet forward or backward, and further rotate it to obtain the brightest raster. If two positions are noted which seem to give equal screen brightness, the setting closest to the picture tube base should be used. This is the only setting of the ion trap that is correct. NEVER ATTEMPT TO COMPENSATE FOR NECK SHADOWS OR FOCUS WITH THE ION TRAP OR BEAM BENDER ADJUSTMENT, IF BY SUCH ADJUSTMENT THE SCREEN BRIGHTNESS IS DECREASED.

Horizontal Drive Adjustment

2. Check the horizontal drive setting by turning the drive trimmer several turns counter-clockwise until one or more vertical white lines are observed on the left side of the screen. Then, turn the trimmer just far enough clockwise to eliminate these "drive lines".

In the event that no drive lines are observed on the picture tube face, leave the trimmer set to the position of minimum capacity consistent with sufficient trimmer screw pressure and good horizontal linearity.

Vertical Sweep Adjustments

3. Adjust the vertical size and the vertical linearity controls on the rear of the chassis for correct height and best vertical linearity. Do not attempt this adjustment unless a test pattern is available.

Width Adjustment

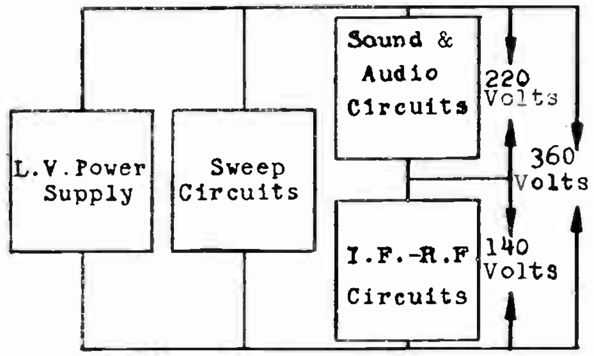
4. Check the width coil for proper setting, and correct if necessary.

Caution

5. Re-Adjust the beam bender or ion trap if necessary.

GENERAL CIRCUIT DESCRIPTION

THE LOW VOLTAGE POWER SUPPLY is conventional, consisting of a center tapped power transformer used in conjunction with a 5U4 full wave rectifier. This supply provides a filtered output of approximately 360 volts for application to the sweep or deflection circuits. It is interesting to note that the I. F. - R. F. portions and the sound-audio portions of the receiver are in series across the 360 volt supply. This arrangement provides 220 volts for application to the sound and audio circuits, and the remaining 140 volts is available for I. F. - R. F. supply potential. The audio power amplifier tube (6V6) is also used as a series voltage regulator. Its grid is returned to a high impedance voltage divider, tapped at approximately 130 volts, while its cathode is wired directly to the 140 volt line. Any change in the 140 volt drain due to A. G. C. fluctuations thus changes the grid to cathode voltage of the 6V6 almost instantaneously, and the resulting cathode current change in this tube acts to maintain the 140 volt supply substantially constant. It should, therefore, become apparent that if the 140 volt supply measures considerably higher than 140 volts, a short exists across the sound-audio circuits. If this voltage is considerably lower than the nominal 140 volts, and the 390 ohm resistor (R80) in the plate supply circuit of the 6V6 is observed to overheat, a short exists across the 140 volt supply. If the 140 volt supply is measured considerably lower than its nominal value, and the 390 ohm resistor does not overheat, an open circuit is indicated in the 200 volt sound-audio portion of the receiver. (See Diagram.)



SYNC CLIPPER - AMPLIFIER--Half of a 12AU7 dual triode is used as the sync separator or sync clipper. This tube is biased approximately to cut-off at the pedestal level, and therefore, will conduct only on positive going sync pulses. The grid of this tube, by means of RC time constants, is rendered relatively immune to noise pulses of either long or short duration. The output of this triode is coupled to the cathode of the second triode section. The output of this section can never exceed the plate voltage, approximately 30 volts. Thus additional sync clipping is obtained.

Sets employing a vertical blocking oscillator, will be found to contain a 6AL5 horizontal phase detector, while those using a vertical multivibrator will have a 12AX7 phase detector. A brief outline of the operation of both circuits will be described below. The wiring diagrams and wave forms of both systems are included in this manual.

12AX7 HORIZONTAL PHASE DETECTOR--The clipped, negative going horizontal sync pulses from the plate of the 12AU7 are coupled by C53 to the cathode of one section of a 12AX7 phase detector. In the absence of a signal this triode is held at approximately xxxx bias by virtue to its cathode. The negative going sync pulses cause this tube to draw grid current, which will vary with changes in plate voltage. Thus, the horizontal reference sawtooth which is applied to this triode plate (25 to 30 volts peak to peak amplitude is compared as to phase and frequency with the incoming sync pulses. The changing grid current of the tube acts to correct the firing time of the horizontal oscillator, due to the D. C. connection between the grids of the two tubes.

6AL5 HORIZONTAL PHASE DETECTOR--The clipped sync pulses are coupled to the grid of one section of the 6SN7 vert. osc. This triode provides amplification of the vertical sync pulses, and serves as a phase splitter for the horizontal pulses. The output of this phase inverter provides pulses of equal amplitude and 180 phase defference, which are applied to the 6AL5 phase detector for phase and frequency comparison with sawtooth pulses from the horizontal deflection system. Any difference in phase or frequency results in the production of a small correction bias which is applied to the horizontal oscillator, thus, maintaining correct horizontal frequency.

ALIGNMENT PROCEDURE

Necessary Equipment:

- Television Sweep Generator
- Marker Frequency Generator
- Vacuum Tube Voltmeter
- 4.5MC Crystal Generator, or equivalent, Oscilloscope

SOUND I. F. ALIGNMENT

1. Connect 4.5MC generator to the grid of the video amplifier tube. Low signal level is important here. Metering may be accomplished at the sound take-off point of the ratio detector (at the juncture of R-155 and C-160) with the meter ground connected to pin eight of the 6V6.

2. Adjust the slug of L-18 (sound take-off coil) for maximum negative meter indication. Attenuate the output of the generator so that not more than five volts is measured on the meter, as the alignment progresses.

3. Adjust the top slug of T-5 (ratio det. primary) for the maximum negative reading.

4. Move the meter ground to the juncture of R-156 and R-157 (6800 ohm resistors) in the sound detector circuit, and adjust the bottom slug of T-5 (Ratio Det.) for zero voltage. The other meter lead remains connected as in Step 1. No 4.5MC trap adjustment is necessary. The trap consists of a coil L-17 which is self-resonant at 4.5MC

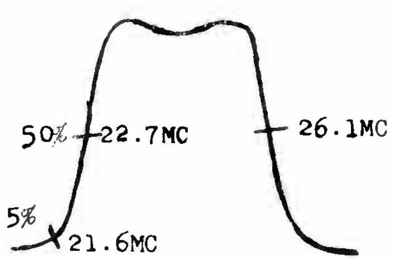
VIDEO I. F. ALIGNMENT -- The I. F. amplifier contains five tuned circuits, no traps being necessary. The video carrier is passed through the I. F. at a freq. of 26.1 MC, and the sound carrier at 21.6 MC. Extreme care must be taken in alignment to assure that the sound carrier is attenuated substantially below the level of the video carrier. This is necessary to assure that the slight AM modulation on the sound carrier due to picture modulation, will be sufficiently low to be removed by the detector, and not produce spurious phase modulation of the sound I. F.

A band width of 3.4 MC (6DB. Down) with a stage gain of from 12 to 15 times is attained. Earlier sets employed a staggered quintuple, which resulted in a different order of stagger of the I. F. coils. (See peaking frequencies below.) These sets may be identified by the values of the grid load resistors on the last two I. F. amplifier tubes, (R-109 and R-113) 6800 ohms. In the later sets, employing a staggered triple followed by a staggered double, the third I. F. grid resistor, R-109, is 10,000 ohms, while the fourth, R-113, remains 6800. Another difference which will serve to help identify the quintuple stagger, lies in the wiring of the A. G. C. to the second I. F. amplifier. In the staggered quintuple alignment, the grid return of this tube is wired directly to the .1 mfd. AGC filter capacitor (C-106). In the staggered triple-staggered double alignment, a 470 ohm resistor (R-106) and a .005 mfd. capacitor (C-105) have been added as additional A. G. C. decoupling.

PEAKING FREQUENCIES -

Peak	at Quintuple	Triple-Double
L-10	25.9MC	25.8MC
L-11	25.6MC	24.4MC
L-12	23.1MC	22.8MC
L-13	22.9MC	23.2MC
L-14	24.4MC	25.4MC

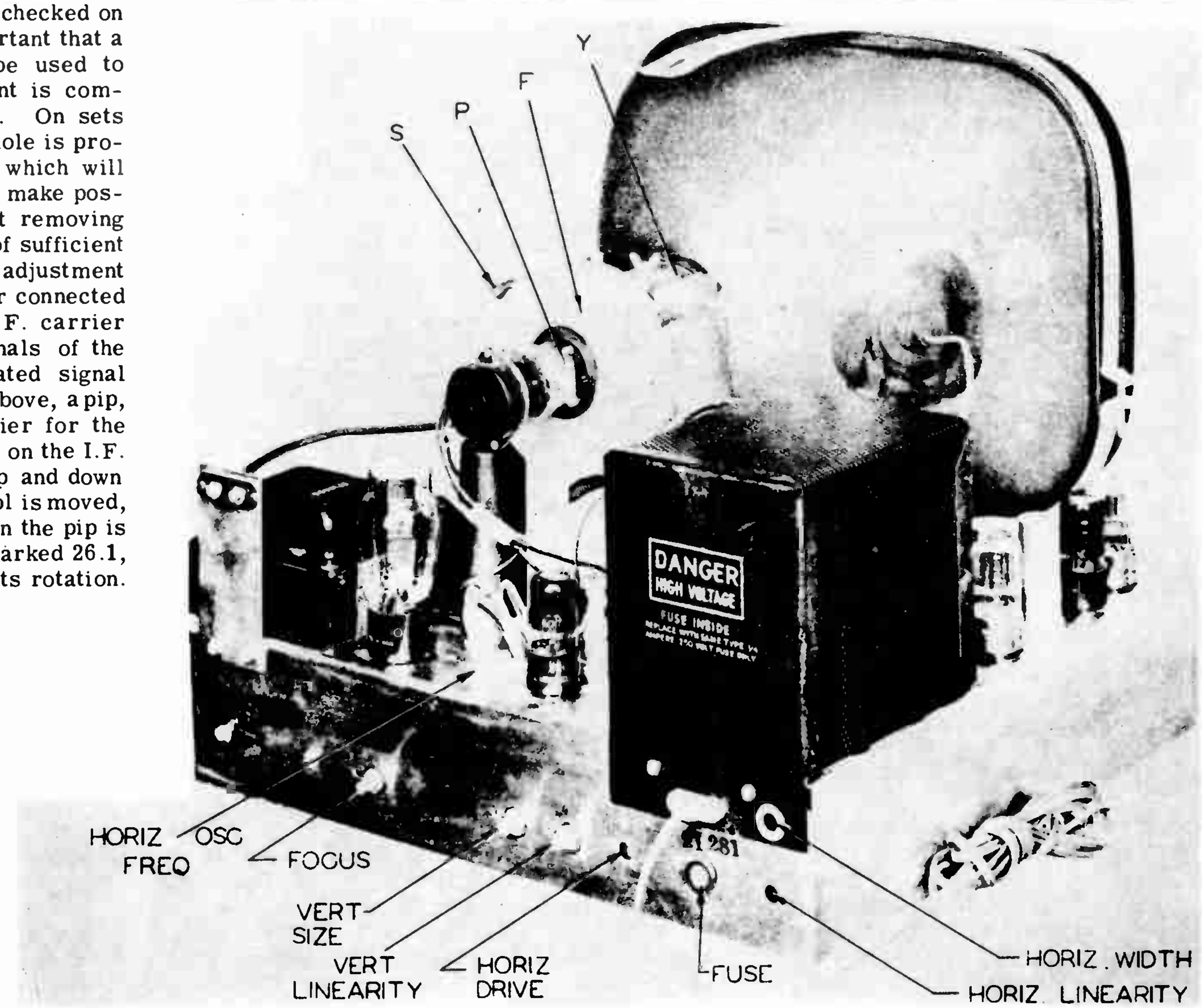
An I. F. alignment signal is best introduced to the chassis by means of a suitable cup, or tube shield floated over the mixer tube to capacity couple the signal to the plate circuit. It may be necessary to disable the local oscillator* to prevent R.F. harmonics from distorting the trace on the scope screen. The oscilloscope is connected to the grid of the video amplifier, through a 100,000 ohm isolating resistor. Metering is done on the A.G.C. line, keeping the input attenuated to produce no more than a negative 1 volt reading. The resulting



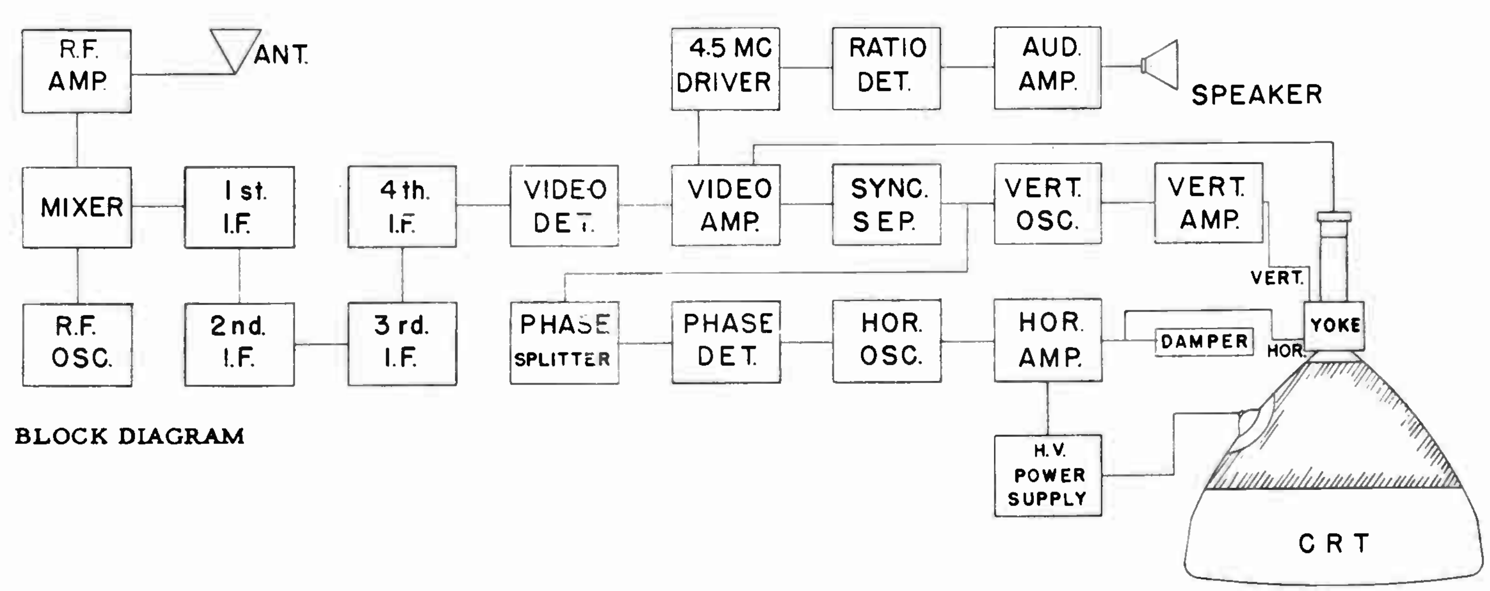
overall response should coincide with the curve shown above.

*A dummy 6J6 may be substituted for the mixer tube with the #1 pin removed, to facilitate alignment.

R. F. ALIGNMENT
The R. F. tuner in the receiver has been prealigned by the manufacturer and adjustment in the field is not recommended. It may be necessary on occasional sets, however, to reset the local oscillator tuning slug. This may be accomplished without test equipment, if it is possible to receive a signal of good quality, and if the I. F. and R. F. portions of the set are functioning correctly. Simply set the fine tuning in the center of its range and adjust the oscillator slug for best picture detail. The oscillator adjustment is recessed in a hole in the tuner front, directly to the right of the tuner shaft. This adjustment must be checked on each channel to be received. It is important that a non-metalic alignment screwdriver be used to prevent de-tuning when the adjustment is completed and the screwdriver withdrawn. On sets using a wooden front panel, a small hole is provided under the flanged tuner knob, which will accommodate this alignment tool, and make possible re-setting the osc. slug without removing the set from its cabinet. If a signal of sufficient strength is not available, oscillator adjustment may be made with the sweep generator connected as for I. F. alignment, and the video R. F. carrier frequency applied to the antenna terminals of the receiver from an accurately calibrated signal generator. With the hook-up outlined above, a pip, or marker indicating the video carrier for the particular channel being set will appear on the I.F. response curve. This pip will ride up and down on the curve when the fine tubing control is moved, and the oscillator is correctly set when the pip is passing through the point on the curve marked 26.1, with the fine tuning at the center of its rotation.



S — Centering Springs
P — Ion Trap
F — Focus Coil
Y — Yoke



BLOCK DIAGRAM

TROUBLE SHOOTING

DEFECTS OF THE I. F. AND R. F. CIRCUITS

A. NO PICTURE, NO SOUND, RASTER NORMAL
1. Check tuner, and all I.F. and R.F. Tubes.
2. Check crystal detector.
3. Check video amplifier tube V-30 and circuit.

B. SNOW IN THE PICTURE
1. Open or shorted antenna input circuit.
2. Defective antenna installation or transmission line.
3. Antenna orientation.

C. LACK OF PICTURE DETAIL (FOCUS SATISFACTORY)
1. Misalignment of I. F.
2. Misalignment of R. F.
3. Mismatch of antenna input impedances at antenna input terminals.

D. SOUND BARS IN THE PICTURE
1. Check fine tuning setting.
2. Microphonic I. F. R. F. or video amplifier tubes.
3. C-84 open.

DEFECTS OF THE VIDEO AMPLIFIER

A. NO PICTURE, SOUND AND RASTER SATISFACTORY
1. Open capacitor C-133 -- L-17 open.
2. Picture tube defective.

B. LACK OF PICTURE DETAIL (FOCUS SATISFACTORY)
1. Open or shorted peaking coils L-15 or L-16.

DEFECTS OF SYNC SECTION

A. NO VERTICAL SYNC, OR WEAK VERTICAL SYNC (HORIZONTAL SYNC SATISFACTORY
1. Check integrator network.
2. Check capacitor C-10 for leakage.

B. WEAK OR NO HORIZONTAL OR VERTICAL SYNC
1. Check V-9.
2. Open capacitor C-50 or C-52.
3. Improper B/ on tube V-9.

C. WEAK OR NO HORIZONTAL SYNC (VERTCAL SYNC SATISFACTORY)
1. Check V-9 and V-10.
2. Check horizontal osc. coil L-3 for short.
3. Check capacitors C-54, C-30 for short.
4. Check capacitor C-53 for open circuit.
5. Check value of R-60 and C-54. Check continuity of reference pulse winding on the horizontal output transformer.

DEFECTS OF VERTICAL SWEEP

A. NO VERTICAL DEFLECTION
1. Open vertical yoke winding.
2. Open vertical output transformer.
3. Open height or linearity control.
4. Check V-2 and V-3.
5. Open or shorted vertical oscillator transformer.
6. Shorter Capacitor C-15B. (Resistor R-20 will overheat)

B. INSUFFICIENT HEIGHT
1. High resistance of R-20 or R-15.
2. Incorrect voltage on V-2 or V-3.
3. Open C-15A.
4. Shorted turns on yoke or vertical output trans.
5. Defective V-2 or V-3.

C. POOR VERTICAL LINEARITY
1. Defective V-2 or V-3.
2. Shorted capacitor C-15A.
3. Inadequate drive voltage from V-2.

D. FOLDOVER AT BOTTOM OF PICTURE
1. C-14 leaky.
2. V-3 defective.
3. R-17 off value.

DEFECTS OF THE HORIZONTAL SWEEP

A. INSUFFICIENT SWEEP WIDTH
1. Low B/ boost voltage.
2. Defective V-5 or V-6.
3. Shorted turns of width coil.
4. Width coil partially effective, check for broken off slug.

B. TOO GREAT A SWEEP WIDTH
1. Open width coil.
2. Low picture tube anode voltage.

DEFECTS OF THE HORIZONTAL SWEEP (Cont'd.)

C. POOR HORIZONTAL LINEARITY
1. Check capacitors C-40, C-39 and C-36.
2. Check horizontal drive adjustment.

D. KEYSTONE RASTER
1. Deflection yoke.

E. HALF SPEED OSCILLATION OF THE HORIZONTAL OSCILLATOR
1. Check V-10 and V-4.
2. Resistor R-31, R-32 or R-33 off value, capacitor C-31 off value.
3. Horizontal osc. coil shorted turns.

DEFECTS OF THE AUDIO SYSTEM

A. NO SOUND, PICTURE NORMAL
1. This indicates a defect in the circuits of V-40, V-41, V-10, V-11, or the speaker.
2. Misalignment of L-18 or T-5 will cause weak sound to be received.
3. Check for shorted capacitors C-80, or C-83.

B. SYNC BUZZ
1. Check A.G.C. and all I. F. -R. F. Tubes.
2. Check alignment of L-18 and T-5.
3. Check ground connection of picture tube aquadag.
4. Check germanium diode by substitution.
5. Shorted cathode bypass on last IF stage.
6. Check IF alignment.

PRODUCTION CHANGES

1. Resistor R-59 was changed from 1 meg. to 680 K and capacitor C-53 was changed from 430 mmf. to prevent "S" distortion.

2. Capacitor C-11 was added to prevent vertical jitter.

3. Resistor R-15 was changed to 820 K and capacitor C-13 was changed to .1 mfd. to extend the range of the vertical size control.

4. Capacitor C-16 was changed from 3900 mmf. to 5000 mmf. to increase bass response.

DC RESISTANCE MEASUREMENTS

DC RESISTANCE

	Primary	Secondary	Notes
Horizontal Oscillator Coil	58 or 95 ohms		
Vert. Blocking Osc. Trans.	230 ohms	1000 ohms	
Horiz. Output Trans.	450 ohms tapped at 80 ohms	#1-12.5 ohm tapped @ .5 ohms & 3 ohms #2--.1 ohms #3-- 2 ohms	
Vertical Output Trans.	560 ohms	6 ohms	
Deflection Yoke Horiz.	17 ohms		
Deflection Yoke Vertical	68 ohms		
Audio Output Trans.	295 ohms	.4 ohms	Secondary Impedance 3.5 ohms Primary Impedance 5200 ohms
Yellow Dot Peaking Coil	7 ohms		120 Microhenries approx.
Green Dot Peaking Coil	18 ohms		300 Microhenries approx.
4.5 MC Self Resonant Trap	9 ohms		
Sound Take-Off Coil	2 ohms		
Ratio Detector 4 ohms	4 ohms	.2 ohms	
Horiz. Size Coil	.4 ohms		

NO SIGNAL VOLTAGE MEASUREMENTS

1. Where Readings May Vary According To Control Settings, Min. And Max. Readings Are Given.
2. Measurements Are From Socket Pin To Chassis, Unless Otherwise Stated.
3. All Measurements Taken With Line Voltage Maintained At 117 A.C.

Symbol	Type	Application	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V-20	6BK7 or 6CB6	R. F. Amp.	Voltages May Vary According To Type Tuner Used								
V-21	6J6	Converter	Voltages May Vary According To Type Tuner Used								
V-22	6AU6	1st. I. F. Amp.	-.1	0	0	6.3AC	+140	+140	+.75		
V-23	6AU6	2nd I. F. Amp.	-.1	0	00	6.3AC	+140	+140	+.75		
V-24	6CB6	3rd I. F. Amp.	0	+2.2	0	6.3AC	+140	+140	0		
V-25	6CB6	4th I. F. Amp.	0	+2.5	0	6.3AC	+140	+140	0		
V-30	6AC7 or 6AG7	Video Amp.	Shell	0	+2 to +12	0 to +8	+2 to +12	+140	6.3AC	+190	
V-40	*6AU6	Sound I. F. Amp.	+7	+7.5	0	0	+220	+55	+7.5		
V-41	6AL5	Ratio Detector	-.5	-.5	6.3AC	0	0	NC	+1		
V-9	12AU7	Sync. Amp.-Clipper	+18	0	+2.5	6.3AC	6.3AC	100	-.5	0	0
	#6AL5	Horiz. Phase Det.	+9 to +15	-10	6.3AC	0	0	NC	0		
V-10	12AX7	Horiz. Phase Det. 1st Audio	+110	-1	0	6.3AC	6.3AC	+9	+2	+3	0
V-4	6SN7	Horiz. Osc.	+1.6	+330	+12	-8 to -13	+120	+12	0	6.3AC	
V-5	6BG6	Horiz. Out.	NC	0	0	NC	-10 to -20	NC	6.3AC	+280	Cap Do Not Measure
V-6	6W4	Damper	NC	NC	+500 to +575	NC	+360	NC	+140	+140	
	#6SN7	Vert. Osc. & Syn. Split.	+24	+85	+23	-7 to -60	+60 to +200	0	6.3AC	0	
V-2	6SN7	Vert. Multivibrator	-20 to -25	+50 to +100	+1.5	0	+30	+1.5	6.3AC	0	
V-3	6SN7	Vert. Out.	+.2	+390 to +450	0 to +30	+.2	+390 to +450	0 to +30	6.3AC	0	
	#6AV6	Audio Amp.	-1	0	0	0	0	0	+150		
V-11	*6V6	Audio Out.	NC	0	190	200	-4	NC	0	0	
V-1	5U4	L.V. Rect.	NC	+400	NC	360AC	NC	360AC	NC	+400	
V-7	IB3	H. V. Rect.		Do Not Measure							

* Readings Taken From Pin Socket With +140 As Common Negative Reference.
#Alternate Sync And Audio Circuit -- See Diagram

HOW TO ORDER PARTS

1. Use Correct Order Form.
2. On the Purchase Order always give the following information:

(1) PART NUMBER (number printed on the part if different from that shown in this list) and DESCRIPTION for each part ordered. When no part number is assigned, order by description and rating.

(2) SELLING PRICE of part. Indicate if no selling price is given.

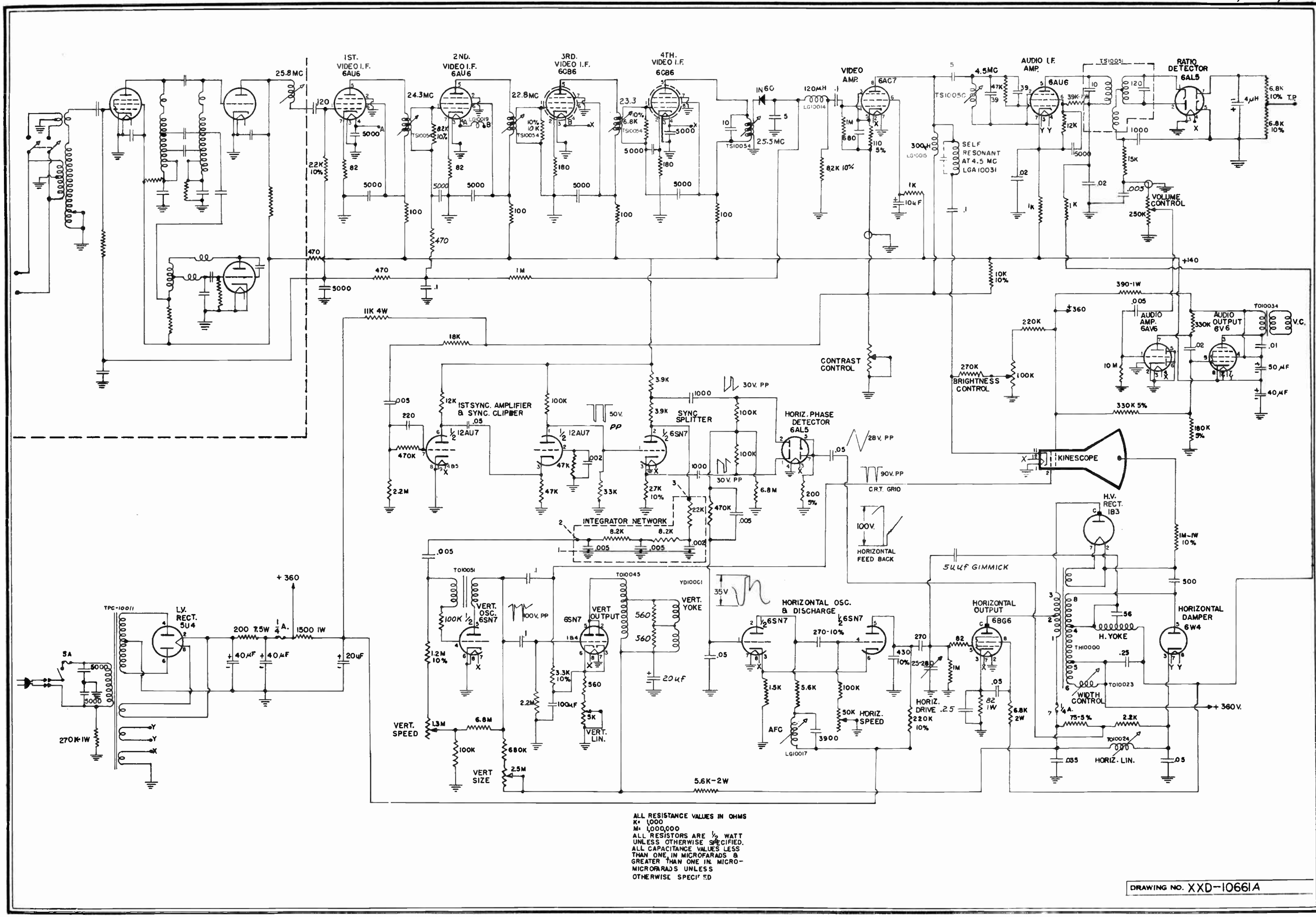
(3) The CHASSIS NUMBER. This is the number found on the metal plate at the rear of the chassis

REPAIR PARTS LIST

Part No.	Description	Selling Price Each
CC-15030	3 uuf 500V.	$0.34
CC-15050	5 uuf 500V	.26
CC-15100	10 uuf 500V	.26
CC-15401	400 uuf 500V.	.26
CC-15681	680 uuf 500V.	.26
CC-15102	1000 uuf 500V	.26
CC-15202	2000 uuf 500V	.26
CC-15221	220 mmf 500V	.26
CC-15392	3900 uuf 500V	1.03
CC-15502	5000 uuf 500V	1.03
CCXA-10001A	500 uuf 20 KV	.26
CLA-10089	20 - 450V	2.05
CLA-10027&A	4uf 50V Pigtail	1.28
CLA-10039A	40-40-40- uf 450V can	4.58
CLC-10050	20-450V 100-20V	3.50
CLC-10068B	50/50/10 uf 5/350/250V.	3.82
CLC-10069	10-10-uf 450V can	2.57
CLC-10076	40-40 450V	3.47
CLC-10070	20 uf 450V & 100 uf 20V can	2.82
CLC-10075	40-20-40 450V	4.26
CLA-10087A	50 uf 350V strap.	2.74
CLC-10074&A	40-10 350-250V	3.50
CM-15390	39 uuf 500V	.26
CM-15560	56 uuf 500V	.34
CM-15121	120 uuf 500V.	.26
CM-15521	220 uuf 500V.	.26
CM-15271	270 uuf 500V.	.34
CM-15331A	330 uuf 500V 10%.	1.03
CM-15431A	439 uuf 500V 10%.	.26
CM-15392BS	3900 uuf 500V 5% silver.	1.62
CMX-10002	Ceramic Disc	.26
CMX-10010A	Cond. Mica 10 uuf 1500V 10%	.34
CMX-10012	Integrator Network	1.28
CPA-14402B	.004 mfd 400V 5%	.26
CP-16502	.005 uf 600V.	.26
CP-16103	.001 uf 600V.	.43
CP-16203	.02 uf 600V	.26
CP-16353	.035 uf 600V.	.43
CP-16503	.05 uf 600V	.43
CP-12104	0.1 mfd 200V	.34
CP-16104	0.1 uf 600V	$0.43
CP-16254	0.25 uf 600V	.51
CTA-10005	Cer. base w/ mtg. brkt. 25-280 uuf trimmer	.60
FA-10001	1/4 amp Pigtail	.34
FA-10002	5 amp.	.26
FCB-10004	P.M. Focus Unit	6.66
FCB-10005	P.M. Focus Unit	6.84
GD-10000	Germanium Diode	2.57
ITA-10002&3	Ion Trap-single magnet	1.03
LGA-10014	120 uh.	.51
LGA-10015	300 uh.	.51
LGA-10017A&B	Horizontal AFC	1.11
LGA-10019A	Filament 15T-E20	.26
LGA-10020A	37 uh	.26
LGA-10021A	1.5 H 32DC ohm @ 200 ma.	----
LGA-10025	150 uh.	.26
LGA-10031	170 uh.	.68
RC-30080B	8 ohm 1/2 watt 5%	.43
RC-40680	68 ohm 1 Watt	----
RC-30680	68 ohm 1/2 watt	.17
RC-30750B	75 ohm 1/2 watt 5%	.26
RC-40820	82 ohm 1 watt	.17
RC-30820	82 ohm 1/2 watt	.17
TC-31000	100 ohm 1/2 watt	.17
RC-31100B	110 ohm 1/2 watt 5%	.26
RC-31800	180 ohm 1/2 watt	.17
RC-3200B	200 ohm 1/2 watt 5%	.26
RC-43900	390 ohm 1 watt	.17
RC-34700	470 ohm 1/2 watt	.17
RC-35600	560 ohm 1/2 watt	.17
RC-31001	1K 1/2 watt	.17
RC-31501	1.5K 1/2 watt	.17
RC-41501	1500 ohm 1 watt	.17
RC-32201	2.2K 1/2 watt	.17
RC-42703	270K 1 watt	.17
RC-33303	330K 1/2 watt	.17
RC-33303B	330K 1/2 watt 5%	.26
RC-34703	470K 1/2 watt	.17
RC-36803	680K 1/2 watt	.17
RC-31004	1 Meg 1/2 watt	.17
RC-41004	1 Meg 1 watt (allen bradley)	.17
RC-32701A	2.7K 1/2 watt 10%	$0.17
RC-33301	3.3K 1/2 watt	.17
RC-33301A	3.3K 1/2 watt 10%	.17
RC-33901	3.9K 1/2 watt	.17
RC-34701	4.7K 1/2 watt	.17
RC-35601	5.6K 1/2 watt	.17
RC-55601	5.6K 2 watt	.77
RC-36801A	6.8K 1/2 watt 10%	.17
RC-56801	6.8K 2 watt	.26
RC-38201A	8.2K 1/2 watt 10%	.17
RC-31002A	10K 1/2 watt 10%	.17
RC-51002	10K 2 Watt	.26
RC-31202	12K 1/2 watt	.17
RC-31502	15K 1/2 watt	.17
RC-31802	18K 1/2 watt	.17
RC-32202A	22K 1/2 watt 10%.	.17
RC-42202	22K 1 watt.	.17
RC-52202	22K 2 watt	.26
RC-33302	33K 1/2 watt.	.17
RC-43902	39K 1 watt	.17
RC-34702	47K 1/2 watt.	.17
RC-54702	47K 2 watt	.26
RC-31003	100K 1/2 watt	.17
RC-31803B	180K 1/2 watt 5%	.26

Part No.	Description	Selling Price Each
RC-32203	220K 1/2 watt	.17
RC-32203A	220K 1/2 watt 10% . . .	.17
RC-32703	270K 1/2 watt	.17
RC-32204	2.2 Meg 1/2 watt. . . .	.17
RC-34704	4.7 Meg 1/2 watt. . . .	.17
RC-36804	6.8 Meg 1/2 watt. . . .	.17
RC-31204A	1.2 Meg 1/2 watt 10%. .	.17
RC-31005	10 Meg 1/2 watt	.17
RXA-10019	Resistor, wire wound 200 ohm 10W Pigtail FCB-10004	$0.51
THC-10000A	H-V Transformer	10.10
THC-10002	H-V Transformer	10.10
THC-10003E	H-V Transformer	9.24
TOA-10023&C	Width Control	1.11
TOA-10024	Linearity Control	1.03
TOC-10034&C	Output Transformer . . .	1.71
TOB-10045D&E	Output Vertical	4.27
TOA-10051A	Vertical block, osc. trans.	2.62
TOA-10053	Width Control	1.11
TPC-10018	Power Trans	16.82
TPC-10005A	Power Transformer . . .	17.52
TSA-10054	IF Coil	.94
TSA-10030B	IF Coil	.77
TSA-10050B&C	Sound Driver Coil	.77
TDB-10051&A	Ratio Detector	3.52
TTA-10007B&C	ST Tuner	40.10
VCA-12120B	5K slotted shaft	1.03
VCA-12120C	5K Slotted Shaft	1.03
VCA-12121C&D	2.5 Meg Slotted Shaft . . .	1.03
VCA-12127B&C	250K SW Dual 750 tapped 250 front	3.00
VCA-12130C	100K	1.11
VCA-12132CD&E	50K.	1.11
VCA-12132CD&E	1.30 Meg	1.11
VCA-12135A	100K	1.03
YDB-10000A	Deflection yoke 10.5 MM 70° Horizontal & Vertical Sweep	10.05

DESCRIPTION	PART NO.		PART NO.	
	MODEL 2101	MODEL 2101A	MODEL 122-20A	MODEL 123-20A
Safety Glass	DWC-10042	DWC-10042	DWC-10136	DWC-10136
Selling Price . . .	$ 4.15	$ 4.15	$ 8.40	$ 8.40
M. U. Code	B5	B5	B5	B5
Knob - Fine Tuning	KA-10085	KB-10104	KB-10104	KB-10104
Selling Price Each	.26	.77	.77	.77
Knob-Channel Indicator	KA-10128	KB-10103A	KB-10103A	KB-10103A
Selling Price Each	.60	.77	.77	.77
Knob - Picture	KA-10086	KB-10106	KB-10106	KB-10106
Selling Price Each	.26	.26	.26	.26
Knob - Volume	KA-10087A	KB-10105	KB-10105	KB-10105
Selling Price Each	.77	.77	.77	.77
Knob - Vertical & Horizontal Hold . . .	KA-10117	KA-10117	KA-10117	KA-10117
Selling Price Each	.17	.17	.17	.17
Mask	MRD-10138	MRD-10138	MRD-10111	MRD-10111
Selling Price Each	4.32	4.32	5.45	5.45
M. U. Code	AO	AO	B5	B5
Escutcheon - Knob	NC-10092	NB-10074A	NB-10074A	NB-10074A
Selling Price Each	2.57	.43	.43	.43
Sears Name Plate - Chassis	NA-10105	NA-10105	NA-10105	NA-10105
Speaker	SRC-10026	SRC-10026	SRC-10026	SRC-10026
Selling Price Each	3.76	3.76	3.76	3.76
M. U. Code	A5	A5	A5	A5
Interlock Line Cord	WPA-10009A	WPA-10009A	WPA-1009A	WPA-10009A
Selling Price Each	1.28	1.28	1.28	1.28
Instruction Book Kit	XXA-10654	XXA-10654A	XX-10692	XX-10692
Wood Cabinet.				
Selling Price Each	35.40	35.40	36.80	60.60
M. U. Code	B5	B5	B5	B5



ALL RESISTANCE VALUES IN OHMS
K= 1,000
M= 1,000,000
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
ALL CAPACITANCE VALUES LESS THAN ONE IN MICROFARADS & GREATER THAN ONE IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED

DRAWING NO. XXD-10661A

No. 1182-21

No. 1175-21

No. 1189-21

FREQUENCY CHART

CHANNEL NO.	CHANNEL FREQUENCY	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY	RECEIVER OSCILLATOR FREQUENCY	PICTURE IF FREQUENCY	SOUND IF FREQUENCY	PICTURE IF less SOUND IF
2	54-60	55.25	59.75	92.55	37.3	32.8	4.5
3	60-66	61.25	65.75	98.55	37.3	32.8	4.5
4	66-72	67.25	71.75	104.55	37.3	32.8	4.5
5	76-82	77.25	81.75	114.55	37.3	32.8	4.5
6	82-88	83.25	87.75	120.55	37.3	32.8	4.5
7	174-180	175.25	179.75	212.55	37.3	32.8	4.5
8	180-186	181.25	185.75	218.55	37.3	32.8	4.5
9	186-192	187.25	191.75	224.55	37.3	32.8	4.5
10	192-198	193.25	197.75	230.55	37.3	32.8	4.5
11	198-204	199.25	203.75	236.55	37.3	32.8	4.5
12	204-210	205.25	209.75	242.55	37.3	32.8	4.5
13	210-216	211.25	215.75	248.55	37.3	32.8	4.5

SPECIFICATIONS

Power Supply — 105-125 volts, 60 cycle AC

Power Consumption — 225 watts

Power Output (Audio) — 2 watts undistorted
3.5 watts maximum

Input Impedance — 300 ohms
(some receivers may have a matching network at the antenna terminal strip to permit the use of either 72 ohm coaxial lead-in or 300 ohm flat twin lead-in.)

Picture Tube Size — 21" rectangular

Picture Size — 13-15/16" x 18⅜"

Speaker — 1175-21 5 inch round
1182-21 & 1189-21 10 inch round
Permanent Magnet type, 3.2 ohms voice coil impedance

Vertical Scanning Frequency — 60 cycles per second

Horizontal Scanning Frequency — 15,750 cycles per second

Dimensions —
1175-21 22" high x 23¾" wide x 19½" deep
1182-21 38" high x 26¾" wide x 20" deep
1189-21 28" high x 25" wide x 19⅛" deep
(depth of tube cup not included)

Shipping Weight — 1175-21 Approx. 104 lbs.
1182-21 & 1189-21 Approx. 125 lbs.

TUBE COMPLEMENT

1	6BC5	V18	RF Amplifier
2	6J6	V19	RF Oscillator and Mixer
3	6CB6	V1	1st Video IF Amplifier
4	6CB6	V2	2nd Video IF Amplifier
5	6CB6	V3	3rd Video IF Amplifier
6	6AL5	V4A	Video Detector
		V4B	AGC Detector
7	12AU7	V5	1st and 2nd Video Amplifier
8	6AU6	V14	4.5 mc Amplifier
9	6AL5	V15	Ratio Detector
10	6AT6	V16	1st Audio Amplifier
11	6K6-GT	V17	Audio Output
12	6SN7-GT	V7	Sync Separator
13	6SR7	V6A	Sync Limiter
		V6B	Vertical Sweep Oscillator
14	6S4	V8	Vertical Sweep Amplifier
15	6SN7-GT	V9	Horizontal Sweep Oscillator and Sync Guide
16	6BG6-G	V10	Horizontal Sweep Output
17	6W4-GT	V16	Damper
18	IB3-GT	V11	High Voltage Rectifier
19	5U4-G	V13	Power Rectifier
20	21AP4	V20	Picture Tube

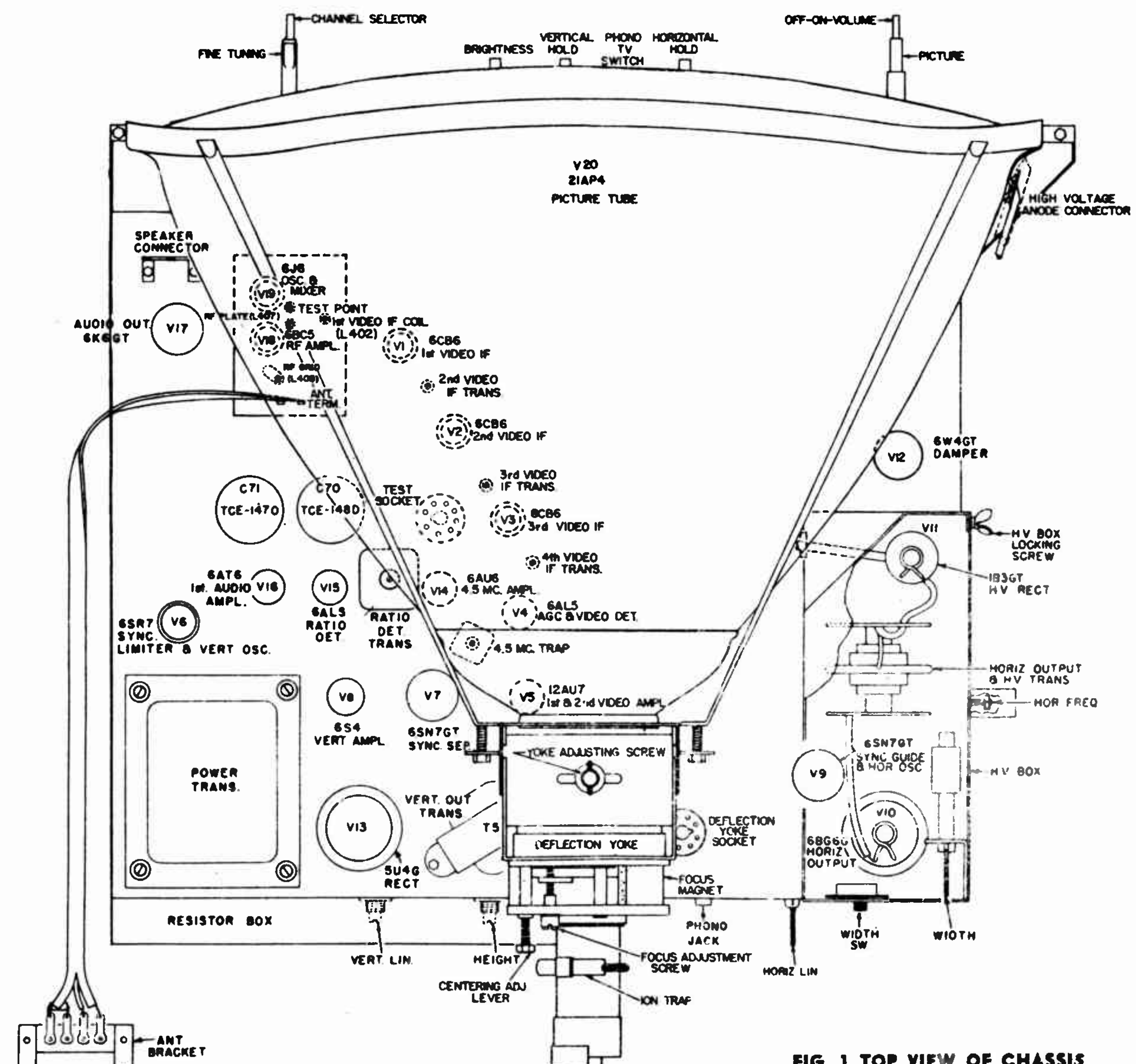


FIG. 1 TOP VIEW OF CHASSIS

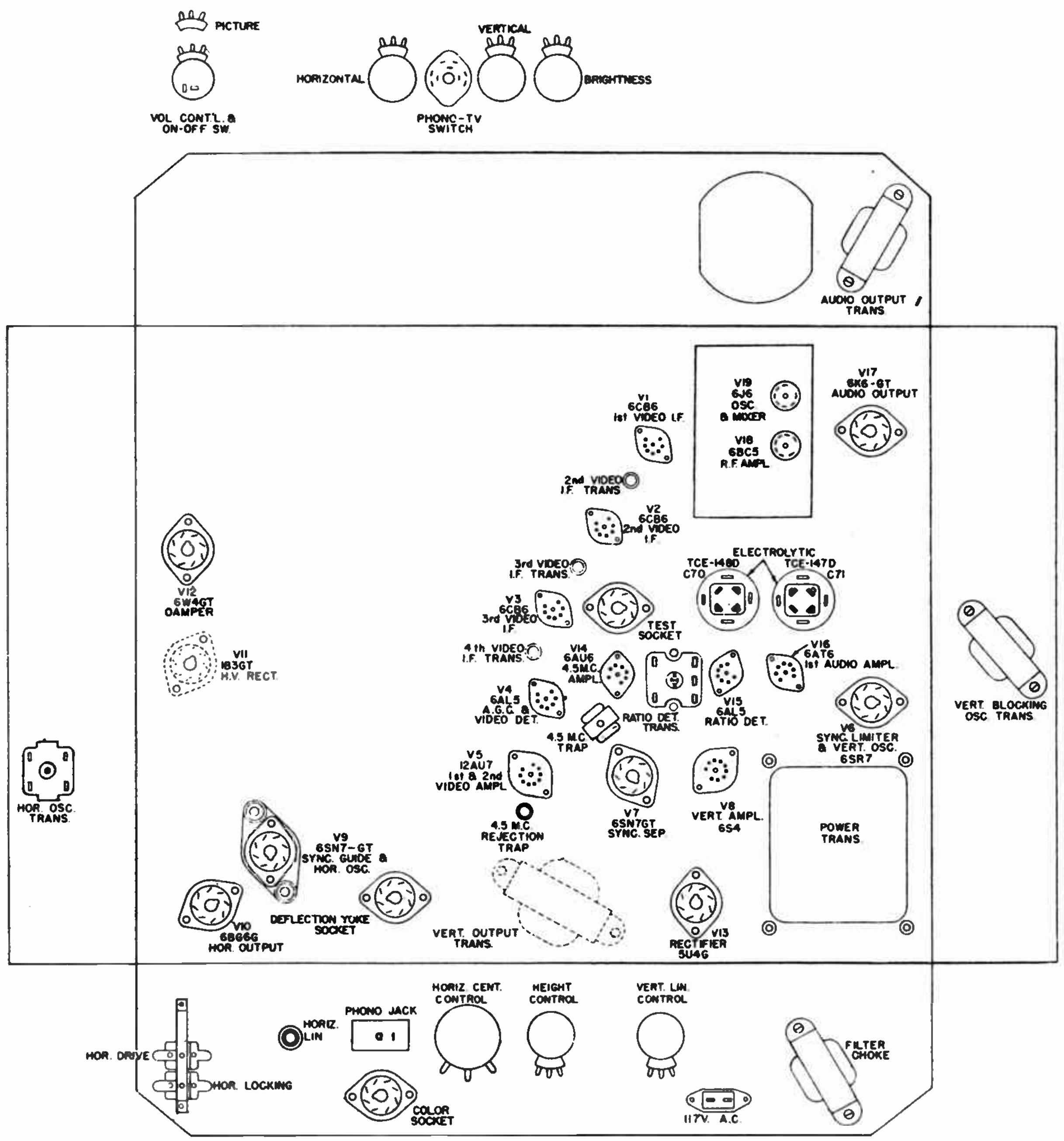


FIG. 2 BOTTOM VIEW OF CHASSIS

RESISTANCE CHECK CHART

SCHEMATIC LOCATION	TUBE FUNCTION	TUBE	PIN NUMBERS								
			1	2	3	4	5	6	7	8	9
V 1	1st Vid. I.F.	6CB6	700K	47	0	Fil.	10K	10K	0		
V 2	2nd Vid. I.F.	6CB6	700K	47	0	Fil.	10K	10K	0		
V 3	3rd Vid. I.F.	6CB6	0	100	0	Fil.	10K	10K	0		
V 4	Vid.Detector & A.G.C.	6AL5	0	120K	Fil.	0	1.1K		3.9K		
V 5	1st & 2nd Vid. Ampl.	12AU7	12K	1 Meg	5K	Fil.	Fil.	13K	1 Meg	47	0
V 14	4.5 M.C. Ampl.	6AU6	1.5	0	0	Fil.	10K	10K	180		
V 15	Ratio Detector	6AL5	15K	15K	0	Fil.	Inf.	0	Inf.		
V 16	1st Audio Ampl.	6AT6	10 Meg	0	0	Fil.	0	0	400K		
V 17	Audio Output	6K6		0	13K	13K	470K		Fil.	0	
V 7	Sync. Separator	6SN7	1.2 Meg	27K	0	5 Meg	10K	6.8K	Fil.	0	
V 6	Sync. Limiter and Vertical Oscillator	6SR7	0	1.8 Meg	0	4.7 Meg	4.7 Meg	600K	Fil.	0	
V 8	Vertical Amplifier	6S4		3K		Fil.	0	2.7 Meg			120K
V 9	Hor. Oscillator and Sync. Guide	6SN7	1.6 Meg	60K	450K	500K	100K	800	Fil.	0	
V 10	Horizontal Output	6BG6		Fil.	950		1 Meg		0	16K	
V 12	Damper	6W4			330K		10K		8K	8K	
V 13	Power Rectifier	5U4		10K		850		850		10K	

Conditions:
1. Readings may be taken with a VTVM type multimeter, a Simpson meter or any reliable resistance measuring device.
2. All controls at "Normal Setting."
3. Switch off-line cord disconnected.
4. All tubes left in sockets.
Note: Filament resistance too low to read.

VOLTAGE CHECK CHART

SCHEMATIC LOCATION	TUBE FUNCTION	TUBE	PIN NUMBERS								
			1	2	3	4	5	6	7	8	9
V 1	1st Vid. I.F.	6CB6	-.5	1	0	6.3 A.C.	110	110	0		
V 2	2nd Vid. I.F.	6CB6	-.5	1	0	6.3 A.C.	110	110	0		
V 3	3rd Vid. I.F.	6CB6	0	1.2	0	6.3 A.C.	110	110	0		
V 4	Vid.Detector & A.G.C.	6AL5	0	-.2	6.3 A.C.	0	1.2		-.5		
V 5	1st & 2nd Vid. Ampl.	12AU7	120*	-3.5	3.5*	6.3 A.C.	6.3 A.C.	160	-1*	.8	0
V 14	4.5 M.C. Ampl.	6AU6	0	0	0	6.3 A.C.	110	110	1.2		
V 15	Ratio Detector	6AL5	.4	-.4	1 A.C.	6.3 A.C.	0	0	0		
V 16	1st Audio Ampl.	6AT6	-0.9	0	0	6.3 A.C.	0	0	50		
V 17	Audio Output	6K6		0	120	130	-14		6.3 A.C.	0	
V 7	Sync. Separator	6SN7	-3.5	0	0	-15*	235	4	6.3 A.C.	0	
V 6	Sync. Limiter and Vertical Oscillator	6SR7	0	-45+	0	-15*	-15*	150++	6.3 A.C.	0	
V 8	Vertical Amplifier	6S4		-58		6.3 A.C.	0	-70		410	
V 9	Hor. Oscillator and Sync. Guide	6SN7	-100	35**	-125	180	110	-105	6.3 A.C.	0	
V 10	Hor. Output	6BG6		6.3 A.C.	-95		-110		0	190	
V 12	Damper	6W4			475		280		120	120	
V 13	Power Rectifier	5U4		300		-90		-90		300	

Conditions:
1. Switch on - set connected to 117 Volt 60 cycle AC.
2. No antenna connected and set tuned to unused channel.
3. All controls at "Normal Setting".
4. Measurements taken with a Vacuum tube Voltmeter.

Notes:
* Reading will vary with setting of Picture Control.
** Reading will vary with setting of Horizontal Hold Control.
+ Reading will vary with setting of Vertical Hold Control.
++Reading will vary with setting of Height Control.

PARTS REMOVAL

TO REMOVE THE CHASSIS FROM THE CABINET:

1 — Remove the knobs on the front panel by pulling them straight forward, in line with the shafts on which they are mounted.
2 — Remove the screws holding the masonite back to the cabinet and remove the back.
3 — Loosen the screws holding the antenna terminal strip to the cabinet and slide out the antenna terminal strip.
4 — Reach into the cabinet from the rear and remove the speaker plug from the front of the chassis.
5 — Remove the six chassis mounting screws from the bottom of the cabinet.
6 — Slide the chassis straight out, being careful not to hit the picture tube.

CAUTION:

THE PICTURE TUBE ENCLOSES A HIGH VACUUM, AND DUE TO ITS LARGE AREA, IS SUBJECTED TO CONSIDERABLE AIR PRESSURE. THEREFORE, PICTURE TUBES MUST BE HANDLED WITH EXTREME CARE.

THE LARGE END OF THE PICTURE TUBE, PARTICULARLY THAT PART AT THE RIM OF THE VIEWING SURFACE, MUST NOT BE SUBJECTED TO ANY IMPACT, SCRATCH, OR MORE THAN MODERATE PRESSURE AT ANY TIME.

IN INSTALLATION OR REMOVING, IF THE TUBE STICKS OR FAILS TO SLIP SMOOTHLY INTO ITS MOUNTING OR DEFLECTION YOKE, INVESTIGATE AND REMOVE THE CAUSE OF THE TROUBLE. DO NOT FORCE THE TUBE.

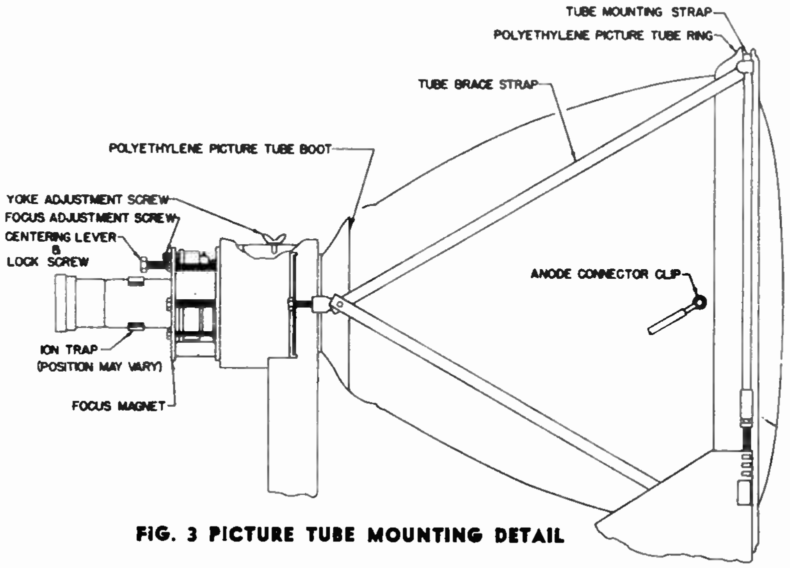


FIG. 3 PICTURE TUBE MOUNTING DETAIL

TO REMOVE THE PICTURE TUBE FROM THE CHASSIS:

1 — Remove the chassis from the cabinet by following procedure outlined.

2 — Discharge the tube and filter capacitor by touching a screwdriver from chassis ground to the metal jacket of the picture tube (NOT from the picture tube to chassis ground).

3 — Disconnect the anode lead by unsnapping the fastener on the side of the polyethylene picture tube boot.

4 — Remove the tube socket at the base of the tube by pulling the socket straight back.

5 — Slip the ion trap from the neck of the tube.

6 — Loosen the tube brace straps by unfastening the screws on either side of the deflection yoke support.

7 — Remove the mounting strap from the front rim of the picture tube by removing the screws to the front brackets on both sides of the tube. The bottom tube brace straps should remain fastened to the front brackets.

8 — Lift the picture tube slightly so as to clear the front brackets and slide the tube straight forward until the neck is clear of the deflection yoke and focus magnet.

CAUTION: If the tube sticks or fails to slip out smoothly, investigate and remove the cause of the trouble. DO NOT FORCE THE TUBE.

9 — Remove band on rim of tube holding the polyethylene ring and boot in place and remove the ring and boot.

10 — To replace the picture tube reverse the above operations making sure that the picture tube rests firmly on the front support brackets and that the deflection yoke is as far forward on the tube as possible. The joint of the polyethylene picture tube ring should be at the top and the high voltage connector on the boot should be at the right side (looking from the rear of the chassis), and clipped to the front rim of the picture tube. The second connector is used for positioning the boot and is clipped to the bottom of the front rim of the picture tube.

PICTURE ADJUSTMENTS

DEFLECTION YOKE, ION TRAP AND FOCUS MAGNET ADJUSTMENTS

If it should become necessary to readjust the picture tube adjustments (i.e. — after replacing the picture tube), proceed as follows:

1 — Turn the Off-On-Volume control to the On position.

2 — Turn the Brightness control to maximum (clockwise).

3 — Turn the Picture control to minimum (counterclockwise).

4 — Rotate the Ion Trap on neck of the picture tube and at the same time move it backward and forward until the brightest raster is obtained.

5 — The Deflection Yoke should be moved as far forward on the neck of the picture tube as possible and rotated so that the top and bottom edges of the raster are parallel to the mask.

6 — Reduce the Brightness control (counterclockwise) until the raster is slightly above normal brilliance.

7 — Adjust the Focus Adjustment Screw for clearest definition of the horizontal sweep lines in the raster. It is recommended that a brass screwdriver be used for this operation, as contact between this screw and a steel object will affect the focus of the picture. Shaded corners are eliminated at a later adjustment.

8 — Turn the Horizontal Centering control until it is at approximately the center of its range of rotation.

9 — Move the Centering Adjustment Lever (or Centering Arm) on the Focus Magnet in any direction necessary to eliminate shaded corners.

10 — Readjust the Ion Trap for maximum brilliance. Steps, 7, 8, and 9 may be repeated for final touch-up.

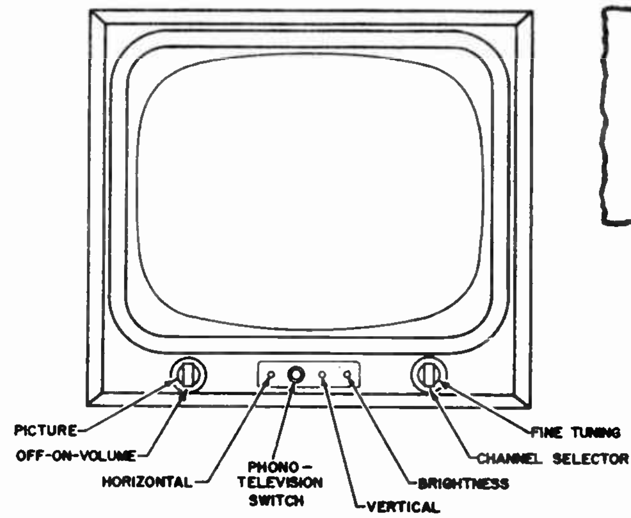
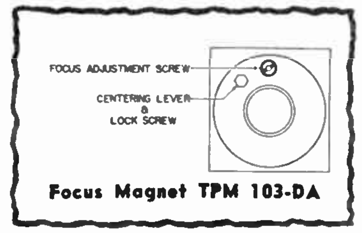


FIG. 4 FRONT PANEL CONTROLS



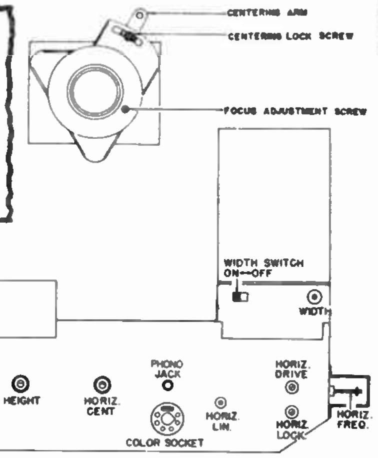


FIG. 5 RECEIVER REAR CHASSIS CONTROLS

(Using Focus Magnet TPM 110-D)

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture, it is necessary to use a test pattern transmitted from a local station. Linearity adjustments, particularly, cannot be made from moving transmissions. It will be noted that patterns transmitted from different stations will vary slightly in size. The smallest test pattern should be used, and made to fill the area delineated by the mask.

1 — Turn the Width control all the way in (clockwise).

2 — Turn the Horizontal Drive trimmer in either direction until the greatest width is obtained without a vertical line or tear. The setting of this control should be at least ½ turn from its maximum clockwise position. This control will mainly affect the left side of the picture.

3 — The Horizontal Linearity control should then be adjusted so that both horizontal wedges are of the same length, and the center test pattern circles are horizontally symmetrical. This control will affect the right side of the picture primarily.

4 — Turn the Horizontal Centering control so that the picture is horizontally centered within the mask opening.

5 — Readjust the Width control to achieve a picture that will fill the mask horizontally. The picture may be made larger by use of the Width Switch which disconnects the width coil. In that case, the Width control will have no affect on the picture, as the width coil is no longer in the circuit.

6 — Adjust the Height control until the picture fills the mask.

7 — Adjust the Vertical Linearity Control until the test pattern is symmetrical from top to bottom and the center test pattern circles are round. Note that the Height control primarily affects the bottom half of the picture while the Vertical Linearity control primarily affects the top half of the picture. However, the Height and Vertical Linearity controls are interdependent and an adjustment of either control usually requires a slight readjustment of the other.

8 — The setting of the Horizontal Centering control and the Centering Lever of the focus magnet may be readjusted so that proper centering and vertical and horizontal linearity are obtained.

9 — Retouch the Focus Adjustment Screw, previously set, for maximum definition of the lines in the vertical wedges of the test pattern.

RF TUNER

(SARKES-TARZIAN TT5 TUNER, SILVERTONE PART NO. TTU 109-D)

TUNER CIRCUIT DESCRIPTION

The signal from the antenna is brought through a transformer network which couples the lead-in line to the single ended RF Amplifier (V18-6BC5). The input circuit to this stage consists of a high and low band transformer feeding a switch controlled single tuned circuit (S1, see schematic), in addition to a switch controlled shunt loading (S2) on the low band to improve the match. The output circuit is a double tuned, switch controlled (S3 and S4) overcoupled stage which, in conjunction with the input stage characteristic, gives the proper uniform RF bandpass on all channels. An AGC voltage is also introduced at the grid of this stage.

The amplified signal is fed into the grid of the Mixer section of the RF Oscillator and Mixer tube (V19-6J6). The second section of this tube is a modified Colpitts oscillator. The output of this local oscillator is capacitive-coupled (C417) to the Mixer grid where it is heterodyned with the amplified RF signal to generate the IF output at the Mixer plate. The Channel Selector switch functions in this circuit (S5) to select suitable fixed tank circuit elements so that the local oscillator frequency is always above the RF frequencies by an amount equal to the desired IF frequencies. The front panel Fine Tuning control is mechanically connected to a variable capacitor (C414) in this oscillator tank circuit to provide vernier adjustment of the local oscillator frequency.

RF TUNER ALIGNMENT

The alignment of the RF tuner has been carefully checked at the factory to give best possible performance. Do not tamper with the adjustments inasmuch as much of the alignment procedure consists of moving or spreading coils. If any major adjustment of the tuner must be made, it is recommended that the entire tuner unit be replaced, and the defective tuner returned to the source for repair.

The following instructions are given for your information and in the event that some slight adjustment may be necessary after tubes or parts are changed.

NOTE: BEFORE ATTEMPTING TO ALIGN THE TUNER, IT IS NECESSARY THAT THE IF AMPLIFIER STRIP BE CORRECTLY ALIGNED SINCE A FREQUENCY SHIFT OF THE IF RESPONSE WILL APPEAR AS AN EQUIVALENT LOCAL OSCILLATOR ERROR. BE CERTAIN THAT IT IS THE TUNER AND NOT THE IF STRIP THAT NEEDS ALIGNMENT.

CONDITIONS OF ADJUSTMENTS:

1 — Tube shields and the tuner cover are on.

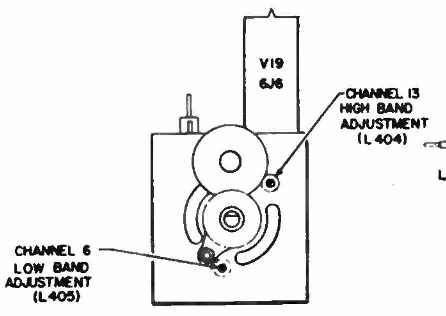
2 — The receiver should have been operating for about 15 minutes prior to adjustment to allow it to warm up and stabilize.

3 — The Fine Tuning control should be at approximately the center of its range of rotation for all measurements and adjustments.

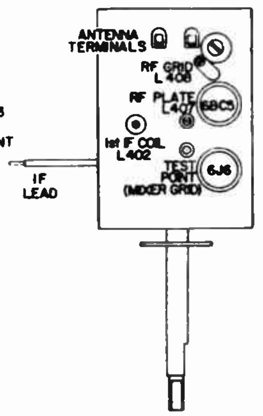
4 — A non-metallic screwdriver is used for the actual adjustment.

5 — Proper power supply voltages should be fed to the tuner from the receiver.

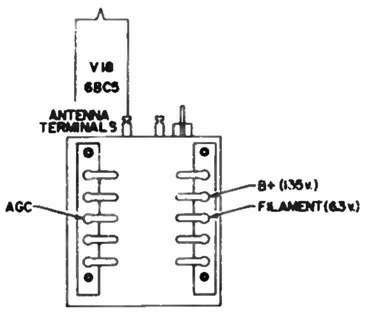
These are: B+ — 135-160 volts.
Filament — 6.3 volts.



FRONT VIEW
TRIMMER LOCATIONS
FIG. 6A



TOP VIEW
FIG. 6B



REAR VIEW
TERMINAL LOCATIONS
FIG. 6C

PROCEDURE — LOCAL OSCILLATOR ALIGNMENT

1 — Connect the RF sweep generator to the antenna terminals. Put 3 volts negative bias across an AGC terminal (across C12 to chassis).

2 — If the sweep generator is not provided with internally crystal-controlled or crystal-calibrated markers, loosely couple a marker generator to the antenna terminal lead.

3 — Connect the cathode ray oscilloscope between Test Point B (of the Test Socket on the receiver chassis) and ground, through a 47,000 ohm isolating resistor.

4 — Adjust the RF sweep generator for at least 6 mc sweep width, with center frequency at approximately 213 mc.

5 — Adjust the marker generator for the picture carrier frequency of channel 13 (211.25 mc).

6 — Set the Channel Selector switch of the tuner to channel 13, with the fine tuning control at approximately the center of its rotation range.

7 — The picture carrier marker (211.25mc) should fall at about the center of the picture carrier slope on the response curve as seen on the oscilloscope. (See Fig.7A). If it is necessary to make any adjustments, rotate the slug in the channel 13 oscillator coil (L404, front of tuner, Fig. 6A) until the picture carrier marker falls at about the center of the picture carrier slope on the response curve. This will bring all the high band channels 7 to 13 into adjustment. Do not back-up the screw more than 8 turns from tight. At that point the electrical effect has ceased and further backing-up will cause the screw to drop out. Clockwise rotation of the screw will increase the frequency of the local oscillator.

8 — Set the Channel Selector switch of the tuner to channel 6, with the fine tuning control at approximately the center of its rotation range.

9 — Adjust the sweep generator to channel 6 center frequency (85mc) and the marker generator to the picture carrier frequency of channel 6 (83.25mc).

10 — Again the picture carrier marker should fall at about the center of the picture carrier slope on the response curve as seen on the oscilloscope. (See Fig. 7). If it is necessary to make any adjustment, rotate the slug in the channel 6 oscillator coil (L405, front of tuner, Fig. 6A) until the picture carrier marker falls at about the center of the picture carrier slope on the response curve. This will bring all the low band channels (2 to 6) into adjustment. Again, do not back the screen more than 8 turns from tight. Clockwise rotation of the screw increases the frequency of the local oscillator.

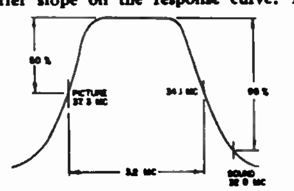


FIG. 7A IDEAL WAVEFORM

ACCEPTABLE VARIATIONS

FIG. 7B

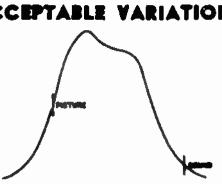


FIG. 7C

FIG. 7D

FIELD PROCEDURE

It is possible to adjust the local oscillator of this tuner in the field by connecting the television receiver to a working antenna and, using the highest channel in each band operating in that particular area, adjust the high band (L404) and low band (L405) adjustments for the best picture and sound. The Channel Selector switch should be set to the channel on which the adjustment is made, with the Fine Tuning control at the approximate center of its range of rotation. These two adjustments will provide sufficient range for the other channels on each band in addition to the ones on which the actual adjustments were made.

RF TUNER BANDPASS ALIGNMENT

Tuner bandpass alignment should never be attempted in the field. It is not even recommended that this type of adjustment be made in the service shop. When a tuner is found to be badly misaligned in a receiver and the local oscillator adjustments cannot bring it back into range, then the entire tuner should be removed and returned to the source for repair. Following is the procedure to be followed in the event of a situation arising where replacement of the tuner is not feasible. It should be attempted only if proper equipment is available.

If it is suspected that the RF Tuner bandpass is out of alignment, it may be checked in the following manner:

1 — Set the Channel Selector switch of the tuner to channel 2, with the fine tuning control at approximately the center of its rotation range.

2 — Connect the cathode ray oscilloscope between the Test Point on the tuner chassis (see Fig. 6B) and ground through a 47,000 ohm isolation resistor.

3 — Adjust the RF sweep generator for at least 12mc sweep width, with a center frequency at approximately 57mc.

4 — Adjust the marker generator for the picture carrier frequency of channel 2 (55.25mc.) and then for the sound carrier frequency of channel 2 (59.75mc.).

5 — Carefully observe the response curve at this Test Point. The bandpass should include both carriers and have steep sides. The bandwidth should be at least 4.5 mc. wide at the 70% points. The maximum allowable tilt and peak to valley distance shall not be more than 30% of the maximum response.

PROCEDURE — RF TUNER BANDPASS ALIGNMENT

1 — Connect the RF Sweep Generator, Marker Generator, and Oscilloscope as described above in the tuner bandpass check. Use frequencies for channel 13 as in chart below. Note that the Test Point used is still the one on the tuner chassis (Fig. 6B).

2 — Align channel 13 RF Plate (L407) and channel 13 RF Grid (L408) end inductances (top of tuner, Fig. 6B) for proper RF response curve as descibed above in the tuner bandpass check. The RF Grid inductance should be adjusted for maximum output combined with best overall bandpass characteristics.

3 — Channel 13 Mixer Grid end inductance (L406) may be adjusted if necessary. This coil is inside the tuner chassis, connected to pin 5 of the Oscillator-Mixer tube (V19, 6J6). It is adjusted by spreading or compressing its turns. Again, the RF bandpass response curve should include both carriers, have steep sides, and have maximum gain. Since the RF Amplifier output circuit is double-tuned, the RF Plate (L407) and Mixer Grid (L406) end inductances are interdependent, and an adjustment of one usually necessitates an adjustment of the other. Normally the adjustment of these three end inductances on channel 13 will bring all the other channels into alignment and no further bandpass adjustments should be necessary.

4 — If the end inductances have been properly adjusted for channel 13 and the RF response curves are still unsatisfactory for the other channels, then the response curve for each individual channel may be made to approach the desired form by either spreading or compressing the particular coils in the tuner circuits at the particular channel setting. Referring to the five decks of the tuner switch, note that the deck nearest the front (shaft) end of the tuner contains those coils regulating the local oscillator, and these should NOT be touched during any bandpass adjustments. On the second, third, fourth and fifth decks of the tuner switch are the coils for the Mixer Grid, the RF Amplifier Plate, low band shunt loading, and RF Grid input respectively. On these rear decks are the coils which should be compressed or expanded to achieve the desired RF bandpass characteristic, however, the switch section containing the shunt loadings for the low band should not be touched.

5 — Proceed with the Channel Selector switch at channel 12, and with the sweep and marker generators set per the chart below align the incremental loops of the RF plate, RF grid, and Mixer Grid in that order for a bandpass which should include both carriers, have steep sides, and have maximum gain. Note that too broad a curve results in deterioration of both sensitivity and rejection.

6 — Repeat if necessary for channels 11, 10, 9, 8, 7, in that order, using the proper frequencies and the proper Channel Selector switch setting.

7 — Align channel 6 RF plate, RF grid and Mixer grid to obtain a flat RF response with maximum gain. Spreading the coils increases the frequency.

8 — If necessary align the incremental coils of the RF plate, RF grid and the Mixer grid for channels 5, 4, 3, 2 in that order, using the proper frequencies and Channel Selector switch settings. Spreading the coils increases the frequency.

RF TUNER ALIGNMENT FREQUENCIES

Channel Selector Switch	2	3	4	5	6	7	8	9	10	11	12	13
R.F. Sweep Generator Setting	57 mc	63	69	79	85	177	183	189	195	201	207	213
Marker Generator Setting (Sound)	59.75 mc	65.75	71.75	81.75	87.75	179.75	185.75	191.75	197.75	203.75	209.75	215.75
Marker Generator Setting (Picture)	55.25 mc	61.25	67.25	77.25	83.25	175.25	181.25	187.25	193.25	199.25	205.25	211.25

ALIGNMENT PROCEDURE

The alignment of this receiver can be broken down into three basic parts.

1 — Video IF Alignment (including Mixer output)

2 — RF Alignment

3 — Sound Alignment

TEST EQUIPMENT

CATHODE RAY OSCILLOSCOPE — The tube size is relatively unimportant, however, anything under 5" usually makes fine adjustment quite difficult.

SWEEP GENERATOR — The sweep generator used should have linear frequency coverage from a center range of 30 to 220 megacycles. The output should be fairly flat over the maximum sweep width, which should be at least 10 mc. It should be capable of an adjustable output of about 0.1 volt maximum. It is preferable that the generator provide the horizontal sweep for the test oscilloscope with provision for phase adjustment.

AM SIGNAL GENERATOR—This generator should have a frequency range of from 4.5 to 220 megacycles. As this generator is used occasionally as a marker generator, accuracy is an important factor. It should be capable of an adjustable output of 0.1 volt maximum.

VACUUM TUBE VOLTMETER—Almost any standard make VTVM will do. It should preferably have a polarity switch so that both positive and negative voltages can be measured.

WAVE TRAP — 32.8 mc.

TEST SOCKET

In this model a Test Socket is provided which gives convenient access to the various points where either a vacuum tube voltmeter or an oscilloscope should be inserted for proper alignment. A letter diagram in the margin of the schematic will locate these points by means of corresponding letters in the schematic proper. A typical octal socket is used and it should be noted that the diagram shows a *top* view. Two ground points are supplied on separate pins of the test socket for easy metering. Reference is made, in the following alignment procedures, to the pins on this Test Socket.

VIDEO IF ALIGNMENT

An adequate signal can be fed through the video IF string by feeding the output of the signal generator into a tube shield placed over the Oscillator-Mixer tube (6J6) (V19). Care should be taken that this shield is *not* grounded. The ground side of the generator output can be conveniently grounded to the shield of the adjacent RF Amplifier tube.

The vacuum tube voltmeter should be connected across the 3900 ohm detector load resistor (R14, Pin B Test Socket) and should be set on the *minus* 3 volt scale. Set the channel selector to an unused low band channel.

The signal generator should be set to a frequency of 36.9 mc. The output of the generator should be adjusted to the point where the reading on the VTVM is between —1 to —1.5 volts.

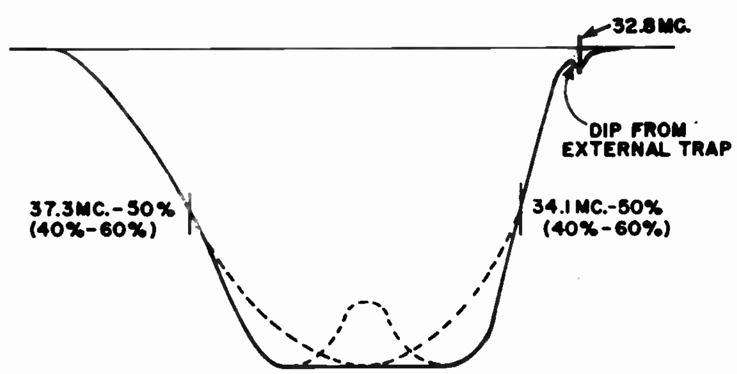
The first and third IF coils should be peaked for a maximum reading on the VTVM. As the voltage reading increases with tuning, the generator should be attenuated to maintain a maximum of —1.5 volts.

Set the signal generator to a frequency of 34.8 mc and tune the second and fourth IF coils in the same manner. The generator should now be shut off (or tuned to a different band) and the VTVM should read approximately —.5 volt.

To look at the overall response curve including both the RF section and the IF Amplifier section connect the sweep generator to the antenna terminals and loosely couple the AM signal generator to the antenna by clipping the signal generator leads to the insulated portion of the antenna lead.

Then connect the "hot" or "high" side of the oscilloscope to Pin B of the Test Socket. The "low" or ground side should be connected to the nearest convenient ground point. Care should be taken to separate the oscilloscope leads from the generator leads.

The sweep generator is set at the approximate mid-frequency of the unused low channel and the signal generator is set at the RF sound carrier frequency of the channel used. The sweep generator amplitude is set so that a VTVM will read —1.5 volts DC at Test Point B. Loosely couple a wave trap tuned to 32.8 mc into one of the IF coils until a small dip is noticed on the trace (see Fig. 8). The fine tuning control on the tuner should now be adjusted to make the signal generator marker coincide with the trap valley. The signal generator can now be tuned to the RF picture carrier frequency and the position of the picture carrier on the response curve noted. It should be between the 40% and 60% points on the slope of the curve. The band width between 50% points should be approximately 3.2 mc. Slight readjustment of the IF transformers may be necessary to obtain the desired response. Small variations from the ideal are acceptable as shown in Fig. 8.



IDEAL VIDEO IF RESPONSE CURVE
DOTTED LINES INDICATE ACCEPTABLE VARIATIONS

FIG. 8

SOUND ALIGNMENT

Sound alignment on these receivers is best accomplished by using an actual transmission received on an antenna and fed in the normal manner to the antenna terminals. A vacuum tube voltmeter should first be inserted between the output plate of the Ratio Detector Diode (pin 2, V 15) and ground. This point may be reached through pin C of the Test Socket. The meter should be set on the *minus* 10 volt scale. With the equipment so placed the 4.5 mc pick-off coil (T8) and the primary of the ratio detector transformer (bottom adjustment, T9) should be adjusted for a maximum deflection of the meter, using a relatively weak signal. The "hot" lead of the meter should now be moved to the junction point of R71, C60 and C61 (Pin A, Test Socket), and the secondary of the ratio detector transformer should be adjusted for a ZERO reading. (Note: There are 3 points at which the meter will zero. Only one of these is correct. At the proper setting the meter should swing negative on one side and positive on the other side of zero. See "S" curve, Fig. 10).

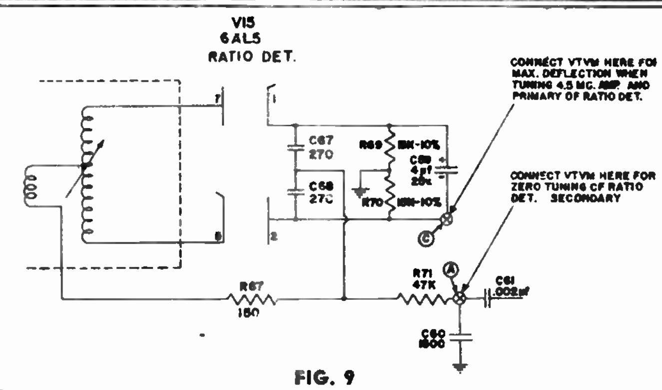


FIG. 9

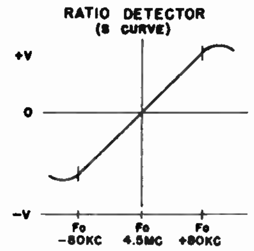
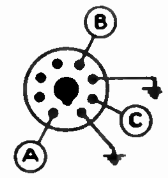


FIG. 10



TEST SOCKET
(BOTTOM VIEW)

FIG. 11

In cases where it is necessary to align the sound section when no station transmission is available, a single frequency signal generator tuned to 4.5 mc may be fed into the output circuit of the Video Detector (Pin B Test Socket) through a 2200 ohm isolating resistor. The receiver should then be aligned in the same manner as described above. The disadvantage of this method is that any inaccuracy in the signal generator will show up as misalignment when the set is in actual operation since proper adjustment is extremely critical. This method is not recommended and should only be used when no alternative method is available.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT

Turn the Horizontal Hold control (on the front panel) to the extreme counterclockwise position. The picture should remain in sync. Momentarily remove the signal by switching to another channel and then switching back again. The picture should break horizontal sync and the picture will be resolved into a series of black bars sloping down to the left.

Turn the Horizontal Hold control clockwise, slowly bringing the picture into sync again. At the extreme clockwise position the picture will again show a tendency to break sync as indicated by anything from a shimmy to 2-1/2 black diagonal bars sloping down to the right.

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is adjusted and need not be aligned.

HORIZONTAL OSCILLATOR ALIGNMENT

1 — The Horizontal Hold Control should be set at approximately the center of its mechanical range. The Horizontal Locking Range and the Horizontal Drive trimmers should be set at two full turns counterclockwise from maximum capacity.

2 — Turn the Horizontal Drive trimmer clockwise until any bright vertical bars in the picture are eliminated. If, in so doing, the picture should fall out of sync it should be brought back by readjusting the Horizontal Oscillator Coil. This is the long screw adjustment which extends through the side of the chassis.

3 — Rotate the Horizontal Hold control (front panel) to the maximum clockwise position. The Horizontal Oscillator Coil should now be adjusted to a point where the black horizontal blanking bar starts to come into the picture from the left side.

4 — The Horizontal Hold control should now be rotated to its maximum counterclockwise position. The picture should stay in sync. However, shorting the antenna terminals or rapidly switching to an unused channel and back should cause the picture to fall out of sync. If this condition does not exist, readjust in accordance with step 3 above.

5 — When the Horizontal Hold control is rotated to maximum clockwise position it is acceptable for the picture to vary in sync from a horizontal flutter to 2-1/2 bars sloping downward to the right. The picture should stay locked, however, through approximately 3/4 of the mechanical rotation of the Horizontal Hold control.

6 — If the Horizontal Drive trimmer must be re-adjusted at this time for improved width or linearity, steps 3, 4 and 5 should be rechecked.

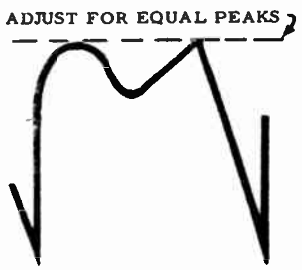
HORIZONTAL OSCILLATOR STABILIZING COIL ADJUSTMENT

NOTE: In the foregoing Horizontal Oscillator Alignment procedure the Horizontal Oscillator Coil is mentioned several times. The adjustment referred to is the long screw which extends from the Horizontal Oscillator Coil (T6) through the side of the chassis below the high voltage cage (labeled "Hor Freq" in Fig. 1, Top View of chassis). This is adjusted from outside the chassis. There is an adjustment at the other (inside) end of the same coil can. This is the Horizontal Phase control, used in the stabilizing circuit of the horizontal oscillator. It is important to note that this latter adjustment is a factory adjustment and should not be attempted in the service shop. If this circuit is suspected of being defective or detuned the entire assembly, including C43, the .01 mfd 600 volt molded paper condenser, should be removed and returned to the source as a defective part. The following procedure is given in the event that replacement of the entire Horizontal Oscillator Coil is not feasible. It should be attempted only if proper equipment is available.

It is important that an oscilloscope with a bandwidth of at least 150 kc be used. The oscilloscope must also have a minimum input impedance of 1 megohm, and a maximum input capacitance of 10 mmfd. In cases where the bandwidth is ample but the input capacitance is large, a 10 mmfd condenser should be used in series with the oscilloscope lead. When this is done, a 200 mmfd condenser should be placed from the oscilloscope to ground to insure equal attenuation at all frequencies. Using an oscilloscope that meets these specifications, the following procedure should be used:

1 — Connect the 10 mmfd condenser going to the vertical input lead of the oscilloscope to terminal pin C of the Horizontal Oscillator Transformer.

2 — Adjust the Horizontal Phase control (horizontal oscillator frequency stabilizing adjustment, bottom adjustment of the Horizontal Oscillator Transformer) until the broad and narrow peaks of the waveform on the scope are of equal height as indicated in Fig. 12A below. If necessary during adjustment, the Horizontal Oscillator Frequency (top adjustment) and the Horizontal Hold control may be reset to keep the picture in sync. Once set, realignment of any other component in the circuit will not affect this adjustment.



PROPER ADJUSTMENT

FIG. 12 A

STABILIZING COIL FREQUENCY TOO LOW

FIG. 12 B

STABILIZING COIL FREQUENCY TOO HIGH

FIG. 12 C

HOW TO ORDER PARTS

1 — Use Correct Order Form.
2 — On the Purchase Order always give the following information:
(1) PART NUMBER (number printed on the part if different from that shown on this list) and DESCRIPTION for each part ordered. When no part number is assigned, order by description and rating. Also give PRICE of part (indicate if no selling).
(2) The CHASSIS NUMBER, which is found on a metal plate at the rear of the chassis.

REPAIR PARTS LIST

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
		RESISTORS
		Carbon ± 20% Unless Noted
TRC 33A-1	R 90	3.3 Ohms 1/2 Watt
TRC 330-5	R 82	33 Ohms 1 Watt 10%
TRC 470-1	R 20, 60	47 Ohms 1/2 Watt
TRC 470-2	R 2, 6	47 Ohms 1/2 Watt 10%
TRC 820-8	R 81	82 Ohms 2 Watt 10%
TRC 101-1	R 95	100 Ohms 1/2 Watt (Use with 4 lug Terminal Strip)
TRC 101-2	R 9	100 Ohms 1/2 Watt 10%
TRC 101-8	R 61	100 Ohms 2 Watt 10%
TRC 151-2	R 67	150 Ohms 1/2 Watt 10%
TRC 181-1	R 65	180 Ohms 1/2 Watt
TRC 391-5	R 77	390 Ohms 1 Watt 10%
TRC 561-2	R 42, 43	560 Ohms 1/2 Watt 10% (part of L 8A)
TRC 821-2	R 22, 40	820 Ohms 1/2 Watt 10%
TRC 102-1	R 7, 10, 38, 66	1,000 Ohms 1/2 Watt
TRC 102-2	R 3	1,000 Ohms 1/2 Watt 10%
TRC 332-5	R 18, 21	3,300 Ohms 1 Watt 10%
TRC 392-2	R 14, 50	3,900 Ohms 1/2 Watt 10%
TRC 472-2	R 35	4,700 Ohms 1/2 Watt 10%
TRC 682-1	R 92	6,800 Ohms 1/2 Watt 20% (part of L 8B) (used on 478.380-1 and 478.381-1 chassis)
TRC 682-2	R 30	6,800 Ohms 1/2 Watt 10%
TRC 822-2	R 16, 28, 32	8,200 Ohms 1/2 Watt 10%
TRC 822-3	R 53	8,200 Ohms 1/2 Watt 5%
TRC 103-2	R 58, 63	10,000 Ohms 1/2 Watt 10%
TRC 123-2	R 4	12,000 Ohms 1/2 Watt 10%
TRC 123-8	R 68	12,000 Ohms 2 Watt 10%
TRC 153-2	R 64, 69, 70	15,000 Ohms 1/2 Watt 10%
TRC 153-8	R 27	15,000 Ohms 2 Watt 10%
TRC 223-1	R 31, 79, 88	22,000 Ohms 1/2 Watt
TRC 223-2	R 1, 8	22,000 Ohms 1/2 Watt 10%
TRC 333-5	R 87	33,000 Ohms 1 Watt 10%
TRC 473-1	R 23, 71	47,000 Ohms 1/2 Watt
TRC 823-5	R 57	82,000 Ohms 1 Watt 10%
TRC 823-6	R 49,54	82,000 Ohms 1 Watt 5%
TRC 104-1	R 25	100,000 Ohms 1/2 Watt
TRC 104-5	R 55, 72	100,000 Ohms 1 Watt 10%
TRC 104-7	R 86	100,000 Ohms 2 Watt
TRC 124-1	R 13	120,000 Ohms 1/2 Watt
TRC 154-2	R 46	150,000 Ohms 1/2 Watt 10%
TRC 154-6	R 52	150,000 Ohms 1 Watt 5%
TRC 224-1	R 91	220,000 Ohms 1/2 Watt
TRC 334-1	R 75	330,000 Ohms 1/2 Watt
TRC 334-2	R 47	330,000 Ohms 1/2 Watt 10%
TRC 334-6	R 51	330,000 Ohms 1 Watt 5%
TRC 474-1	R 37, 76	470,000 Ohms 1/2 Watt
TRC 564-2	R 12	560,000 Ohms 1/2 Watt 10%
TRC 824-2	R 48	820,000 Ohms 1/2 Watt 10%

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
		RESISTORS (continued)
TRC 105-1	R 19, 26, 33, 44	1 Megohm 1/2 Watt
TRC 105-2	R 59	1 Megohm 1/2 Watt 10%
TRC 105-7	R 85	1 Megohm 2 Watt 20% (Speer)
TRC 185-1	R 97, 98	1.8 Megohm 1/2 Watt
TRC 225-2	R 39	2.2 Megohm 1/2 Watt 10%
TRC 395-1	R 15	3.9 Megohm 1/2 Watt
TRC 395-2	R 29	3.9 Megohm 1/2 Watt 10%
TRC 106-1	R 74	10 Megohm 1/2 Watt
		Special Resistors
TRP 50-D	R 80 A	1,125 Ohms 20 Watts } 2 Section W.W.
	R 80 B	8,200 Ohms 5 Watts }
TRW 251-SP	R 83	250 Ohms 10 Watts 10% W. W.
TRP 51	R 89	650 Ohms 20 Watts W. W.
TRP 24	R 78	3,500 Ohms 5 Watts 10% W. W.
TRW 472-7	R 62	4,700 Ohms 2 Watts W. W.
TRP 42	R 45	10,000 Ohms 5 Watts 10% W. W.
		Variable Resistors
TVC 504-D	R 36	Height Control (2.5 Meg)
TVC 540-D	R 56	Horizontal Hold Control (50K)
TVC 541-D	R 34	Vertical Hold Control (1.5 Meg)
TVC 539-D	R 24	Brightness Control (500K)
TVC 538-D	R 17	Dual Control, Picture (5K)
	R 73	Volume Control (1 Meg) & Switch
TVC 503-D	R 41	Vertical Linearity (5K) W.W.
TVC 542-1-D	R 84	Centering Control (50 Ohms)
		CONDENSERS
		Electrolytic
TCE 104-D	C 59	4 Mfd. 25 Volts
TCE 147-D	C 71 A	10 Mfd. 475 Volts } 4 Section
	C 71 D	30 Mfd. 400 Volts
	C 71 B	60 Mfd. 450 Volts
	C 71 C	125 Mfd. 50 Volts
TCE 148-D	C 70 A	80 Mfd. 450 Volts } 4 Section
	C 70 D	40 Mfd. 150 Volts
	C 70 B	30 Mfd. 300 Volts
	C 70 C	10 Mfd. 400 Volts
TCE 154-D	C 66 A	25 Mfd. 25 Volts } 2 Section
	C 66 B	20 Mfd. 400 Volts
		Paper Tubular
TCP 102-10	C 63	.001 Mfd. 600 Volts
TCP 202-10	C 24, 61	.002 Mfd. 600 Volts
TCP 502-4	C 18	.005 Mfd. 400 Volts
TCP 103-4	C 62, 64	.01 Mfd. 400 Volts
TCP 203-1	C 55	.02 Mfd. 200 Volts
TCP 353-13	C 74	.035 Mfd. 1,000 Volts Oil Impregnated
TCP 503-13	C 75	.05 Mfd. 1,000 Volts Oil Impregnated
TCP 254-1	C 12	.25 Mfd. 200 Volts
		Molded Paper Tubular
TCPM 331-SP	C 72	330 Mmfd. 12,500 Volts
TCPM 102-14-SP	C 44, 73	.001 Mfd. 1,000 Volts
TCPM 202-10	C 26, 77	.002 Mfd. 600 Volts
TCPM 502-10	C 27, 32, 65	.0047 Mfd. 600 Volts
TCPM 502-11-SP	C 28	.0047 Mfd. 600 Volts
TCPM 103-4-SP	C 79, 80	.01 Mfd. 400 Volts

PART NUMBER	SCHEMATIC LOCATION	DESCRIPTION
		Molded Paper Tubular (continued)
TCPM 103-10	C 29	.01 Mfd. 600 Volts
TCPM 103-10-SP	C 43	.01 Mfd. 600 Volts
TCPM 103-13	C 76	.01 Mfd. 1,000 Volts
TCPM 203-4	C 41	.022 Mfd. 400 Volts
TCPM 503-1	C 16	.047 Mfd. 200 Volts
TCPM 503-4	C 39	.047 Mfd. 400 Volts
TCPM 503-4-SP	C 17, 21	.047 Mfd. 400 Volts
TCPM 503-10	C 30, 45	.047 Mfd. 600 Volts
TCPM 503-11	C 49	.047 Mfd. 600 Volts
TCPM 254-4	C 19	.22 Mfd. 400 Volts
TCPM 254-10	C 31, 46	.22 Mfd. 600 Volts
TCPM 474-1	C 40, 50, 82	.47 Mfd. 200 Volts
		Mica & Ceramic
TCC 22-7	C 54	2.2 Mmfd. 500 Volts Ceramic
TCC 050-8	C 14	5 Mmfd. 500 Volts Ceramic
TCM 056-20	C 78	56 Mmfd. 1,500 Volts Mica (part of L 8B)
TCM 075-14	C 78	75 Mmfd. 1,500 Volts Mica (part of L 8B)
TCM 082-8	C 36, 37	82 Mmfd. 500 Volts Mica
TCC 101-7	C 5	100 Mmfd. 500 Volts Ceramic
TCM 101-7	C 85	100 Mmfd. 500 Volts Mica
TCM 101-8	C 22	100 Mmfd. 500 Volts Mica
TCSM 181-29	C 42	180 Mmfd. 1,000 Volts Silver Mica
TCM 271-7	C 47, 67, 68	270 Mmfd. 500 Volts Mica
TCM 391-7	C 23	390 Mmfd. 500 Volts Mica
TCC 471-7	C 13	470 Mmfd. 500 Volts Ceramic
TCC 152-SP	C 2,4,6,9,11,60,87	1,500 Mmfd. 500 Volts Ceramic G.M.V.
TCC 502-SP	C 7,8,15,56,86	.005 Mfd. 500 Volts Ceramic Disk. Type G. M. V.
		TRIMMERS
TAS 541-D	C 38A, 38B	Trimmer Strip Assembly (Hor. Locking, Hor. Drive)
		INDUCTANCES
TLF 114-D	T 8	Sound Take-Off Trap
TLF 568-D	T 2	I. F. Coil
TLF 567-D	T 1	I. F. Coil
TLF 567-1-D	T 3	I. F. Coil
TLF 619-D	L 11	Horizontal Linearity Coil
TLF 570-D	L 6	4.5 M.C. Rejection Trap
TLF 520-D	L 13,14,15	Filament Choke
TLF 531-D	T 9	Ratio Detector Transformer
TLF 135-D	L 3	Peaking Coil
TLF 590-D	L 2,4	Peaking Coil
TLF 562-D	L 5	Peaking Coil
TLF 502-D	L 7	Peaking Coil (on 22K Resistor)
TLF 146-D	L 1	I. F. Choke
TLF 566-D	T 6	Synchro Guide Transformer
TTR 106-2-D	L 9	Filter Choke
TTV 254-D	T 5	Vertical Output Transformer
TTP 188-D	T 11	Power Transformer
TTH 253-D-1	T 7	Horizontal Output Transformer
TTR 242-D	L 8A, 8B	Deflection Yoke, or
TTR 224-D	L 8A, 8B	Deflection Yoke (used on 478.380-1 and 478.381-1 chassis) or
TTR 227-D	L 8A, 8B	Deflection Yoke (used on 478.380-1 and 478.381-1 chassis)
TLF 618-D	L 10	Width Control Coil
TTR 161-2-D	T 4	Blocking Osc. Transformer (Vertical)
TTR 179-D	T 10	Sound Output Transformer

PART NUMBER	DESCRIPTION
	HARDWARE
TSO 187-D	C.R.T. Socket Assembly
TSO 173	Deflection Yoke Plug
TFU 1	Fuse 1/4 Amp., 250 Volts, 3 A.G.
TWI 513-D	Color Socket Jumper
TSW 212-D	TV - Phono Switch
KN 20-3	TV - Phono Switch Knob
TSO 199-D	Phono Socket
TSW 201	Width Switch
TLF 583-1-D	Ion Trap
TPM 103-DA	Focus Magnet or
TPM 110-D	Focus Magnet
TTS 403	Speaker Connector, Male
TTS 404	Speaker Connector, Female
TPL 150	Interlock Plug
TMS 127	Miniature Tube Shield
TAS 584	C.R.T. Anode Clip and Lead
TIM 524-D	Tube Cap, High Voltage Clip Insulator
TMS 1280-D	Front Picture Tube Strap
TMS 1281-D	Side Picture Tube Brace Strap
TIM 595-D	Polyethylene Picture Tube Boot, with Female Anode Clip
TIM 596-D	Polyethylene Picture Tube Ring
	CABINET & ACCESSORIES
TAS 579-D	Front Trap Door Assembly (1175-21, 1182-21)
TAS 585-D	Front Trap Door Assembly (1189-21)
TMS 1289-D	Bezel
SC 620-P-20B	6-32 x 1-1/4 Phillips Head Screws, Brass Plated
TMP 194-D	Plastic Mask
TGL 184-D	Safety Glass Panel
TMS 520-DA	Perforated Bottom Cover
TBK 228-D	Cabinet Back
TMS 1286-D	Tube Cup
TLD 101	Interlock Cord
TBP 542-D	Built-in-Antenna
TTS 408-D	4 Lug Antenna Terminal Strip (used on earlier models) or
TTS 407-D	3 Lug Antenna Terminal Strip
TKN 279-D	Off-On Sound Knob
TKN 278-D	Picture Knob, Brown (1175-21, 1182-21)
TKN 283-D	Picture Knob, Tan (1189-21)
TKN 280-D	Channel Selector Knob (with UHF Plate)
TKN 281-D	Fine Tuning Knob, Brown (1175-21, 1182-21)
TKN 284-D	Fine Tuning Knob, Tan (1189-21)
TIB 192-D	Customer Instruction Book
TCB 317-D	Cabinet (Catalog No. 1175-21, Table Model)
TSP 466	5" P.M. Speaker (Catalog No. 1175-21, Table Model)
TCB 316-D	Cabinet (Catalog No.1182-21, Console)
TCB 320-D	Cabinet (Catalog No.1189-21, Limed Oak Console)
TSP 465-D	10" P.M. Speaker (Catalog Nos. 1182-21, 1189-21 Console Models)
	TUNER
TTU 109-D	COMPLETE TUNER ASSEMBLY (with tubes) (Sarkes-Tarzian TT5 Tuner.5-13/16" Shaft Length)
TAS 583	Fine Tuning Fibre Disk Assembly

SPECIAL NOTES

The following changes were made to further reduce vertical buzz & hum pickup in the audio circuits.

A—To reduce buzz:

1—Return R28, (8.2K) in picture tube cathode-vertical retrace suppression network circuit, to +235 volts instead of to +140 volts.

2—Return C32, (.01mfd) in vertical retrace suppression circuit, to pin 6 of deflection yoke socket instead of to ground.

3—Add tube shields to V15, 6AL5 (Ratio Detector), and to V16, 6AT6 (1st Audio Amplifier).

B—To reduce hum:

1—Return R79, (22K) from center tap of volume control to low end of control instead of to chassis.

2—Disconnect wire shields from chassis at Phono-TV switch, (front of chassis) clip short and tape up exposed ends.

3—Disconnect cable shield from jack at Phono Jack (rear of chassis).

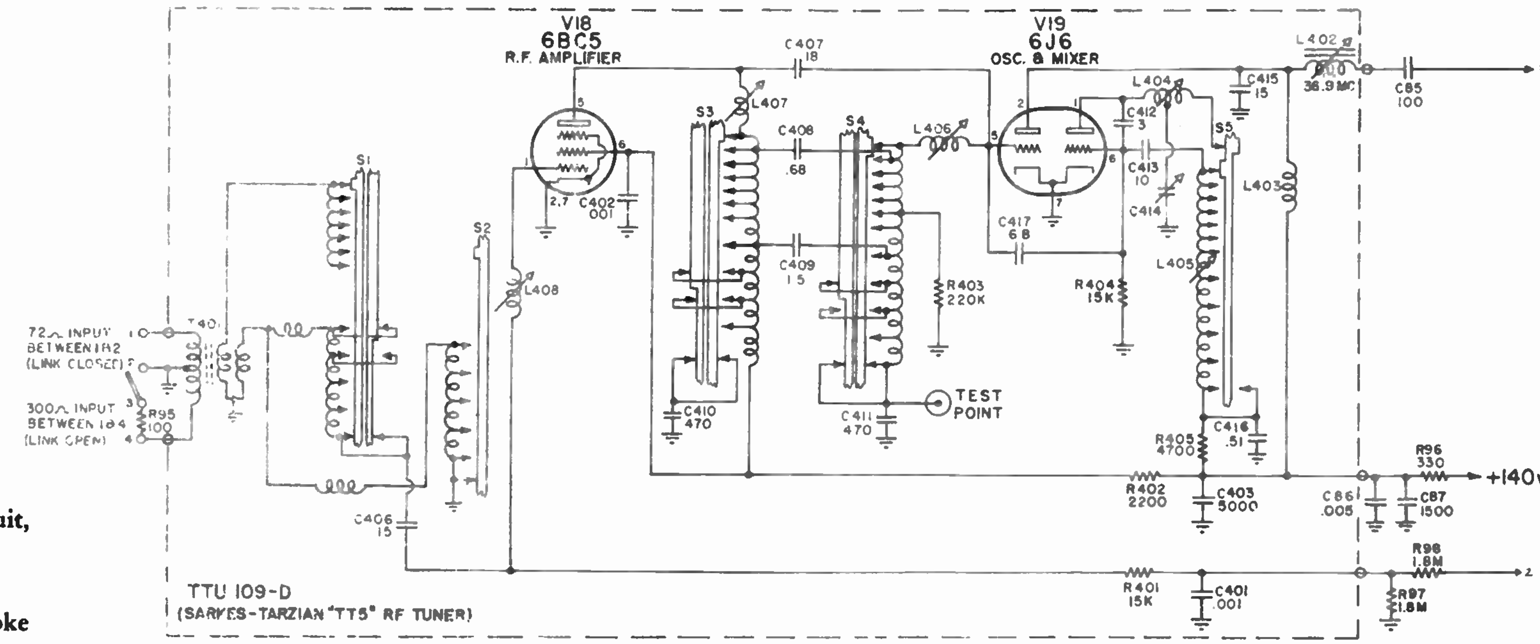
C—The following are critical lead dress items which should be watched closely when servicing in order that vertical buzz and hum may be eliminated:

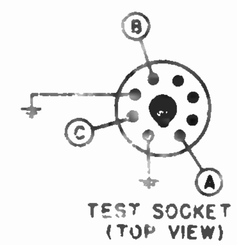
1—All audio condensers should be behind the shield and as close to the chassis as possible.

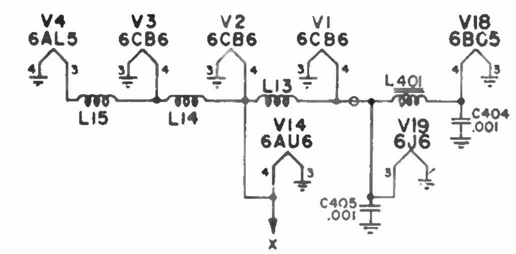
2—C28, (.0047mfd) Vertical Oscillator coupling condenser and circuitry should be as close to the side of chassis as possible and as far away from the audio circuitry as possible.

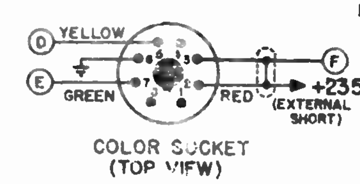
3—V8, 6S4 Vertical Amplifier plate lead should be as short as possible and as close to the chassis as possible.

4—C31, .22mfd Vertical Amplifier grid coupling condenser should be pushed as close to the chassis as possible and as far away as possible from audio circuitry.









NOTES

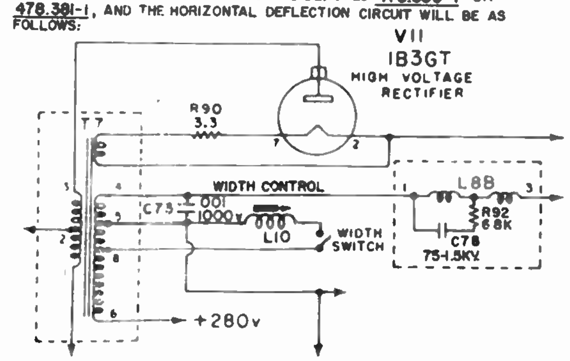
1 UNLESS OTHERWISE NOTED ALL CARBON RESISTORS ARE 1/2 WATT 20% & CONDENSER VALUES ARE IN μμf WITH 500V RATINGS

2. ⊕=MOLDED PAPER, K=1,000, M=1,000,000

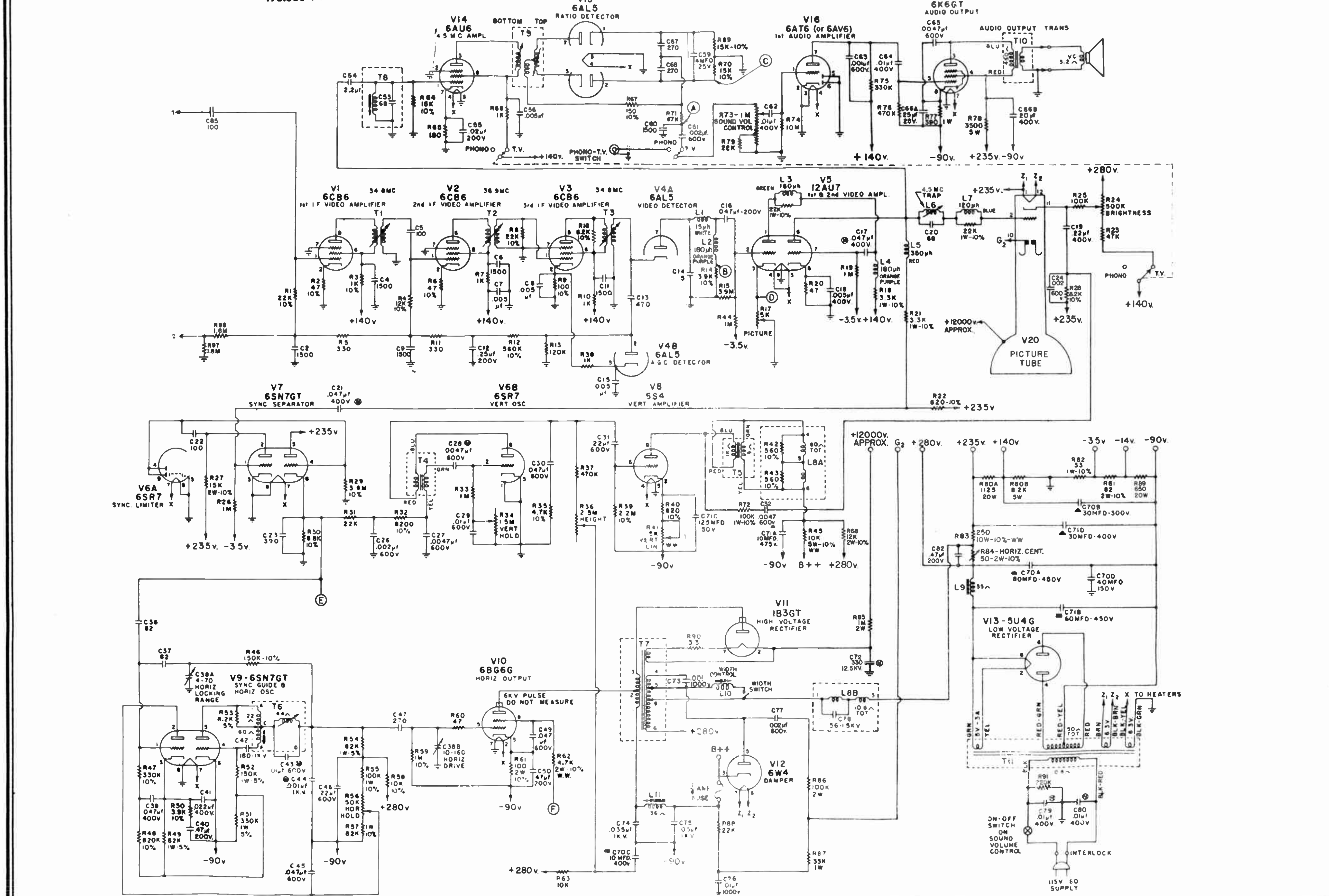
3. VOLTAGES MEASURED WITH A VACUUM TUBE VOLTMETER.

4. RESISTANCE READINGS OF WINDINGS ARE APPROXIMATE AND MAY VARY ±15%.

5 IN SOME RECEIVERS A 30 mh. DEFLECTION YOKE (TTR 224-D) MAY HAVE BEEN USED INSTEAD OF THE 8.3 mh. DEFLECTION YOKE (TTR 242-D). IN THESE RECEIVERS THE CHASSIS ARE DENOTED 478.380-1 OR 478.381-1, AND THE HORIZONTAL DEFLECTION CIRCUIT WILL BE AS FOLLOWS:



478.380 and 478.381 CHASSIS



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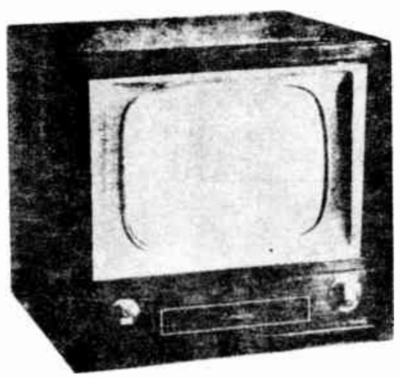
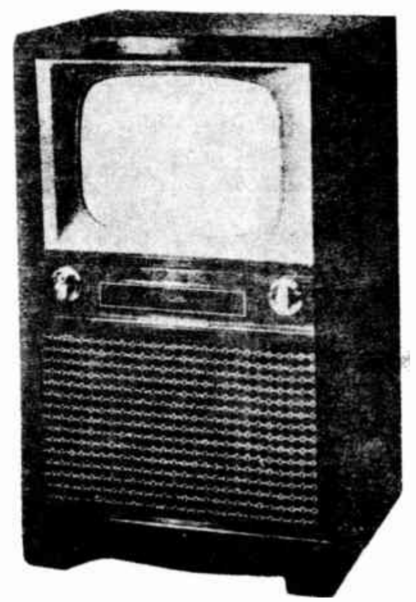
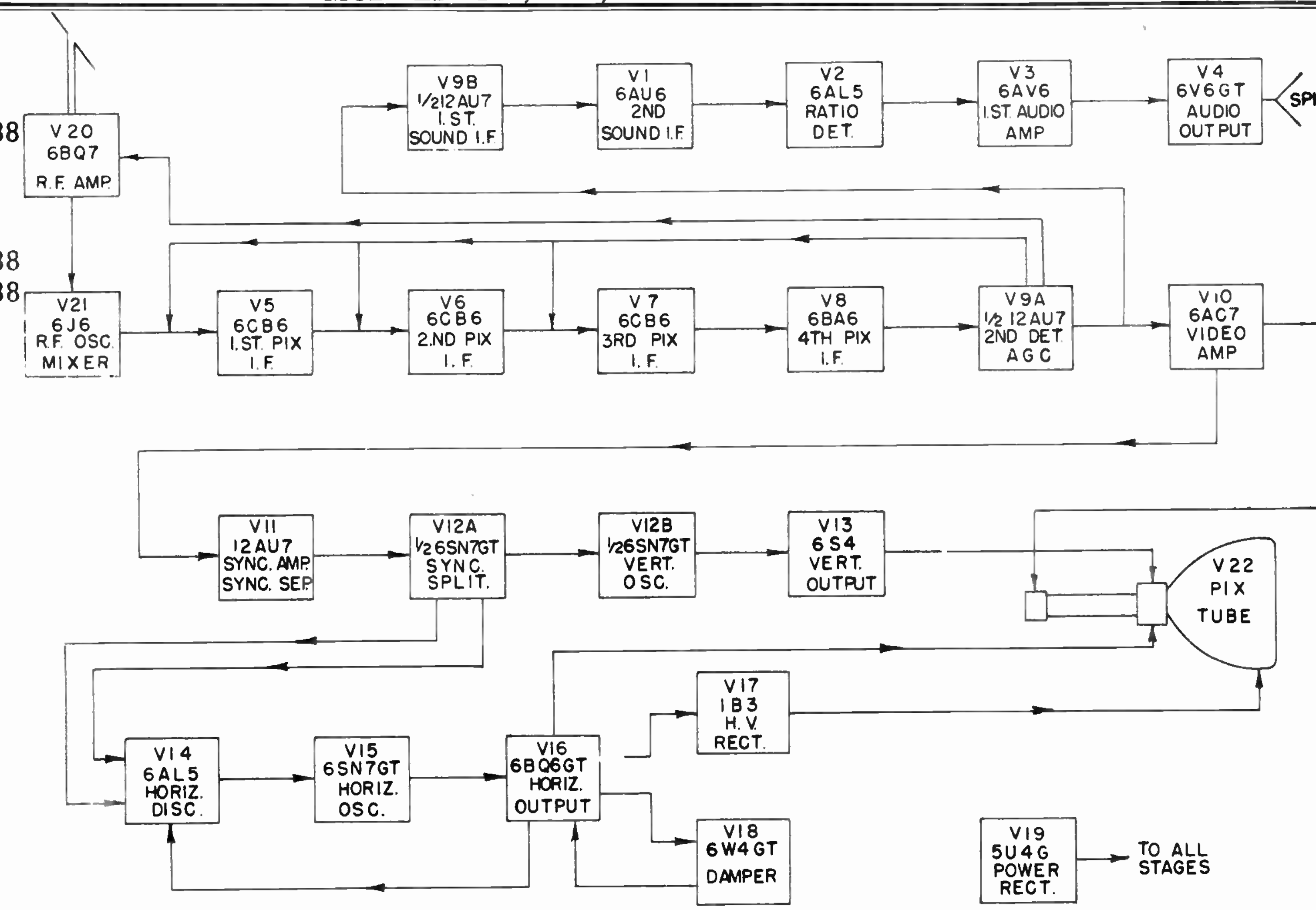


No. 2105 and No. 2105A are 17" Table Model Television Receivers having a twenty-two tube chassis using an automatic focus, rectangular picture tube.



No. 2145 and No. 2145A are 17" Console Model Television Receivers having a twenty-two tube chassis using an automatic focus, rectangular picture tube.



BLOCK DIAGRAM.

TUBE COMPLEMENT

V20	6J6	Oscillator-Mixer	V10	6AC7	Video Amplifier
V21	6BQ7	RF Amplifier	V11	12AU7	Sync Amplifier and Sync Separator
V1	6AU6	Limiter	V12A	6SN7GT	Sync Splitter
V2	6AL5	Ratio Detector	V12B		Vertical Oscillator
V3	6AV6	1st Audio Amplifier	V13	6S4	Vertical Output
V4	6V6GT	Audio Output	V14	6AL5	Horizontal Discriminator
V5	6CB6	1st Pix IF Amplifier	V15	6SN7GT	Horizontal Oscillator
V6	6CB6	2nd Pix IF Amplifier	V16	6BQ6GT	Horizontal Output
V7	6CB6	3rd Pix IF Amplifier	V17	1B3GT	Hi-Voltage Rectifier
V8	6BA6	4th Pix IF Amplifier	V18	6W4GT	Damper
V9A	12AU7	2nd Detector and A.G.C.	V19	5U4G	Power Rectifier
V9B		1st Sound IF Amplifier	V22	17HP4A	Picture Tube

SPECIFICATIONS

Power Supply Rating	105-120 Volt, 270 Watts, 60 Cycle, AC
Audio Power Rating	3.2 Watts
Antenna Input Impedance	300 ohms
Video Response	4 M.C.
Focus	Electrostatic
Sweep Deflection	Magnetic
Picture Carrier	45.75 M.C.
Sound Carrier	41.25 M.C.
Adjacent Channel Sound Traps	47.25 M.C.
Adjacent Channel Picture Traps	39.75 M.C.
Accompanying Sound Trap Shelf	41.6 M.C.
Rejection Trap	4.5 M.C.

BLOCK DIAGRAM CIRCUIT DESCRIPTION

BLOCK V20, V21

The 6BQ7 (V20) is operated as a cascode type RF amplifier which is characteristically an extremely "low-noise" circuit. The plate (pin 6) of one triode is connected to the cathode (pin 3) of the other triode resulting in a low-plate circuit impedance for the input-triode section. The input-triode has no voltage amplification but acts as an impedance transformer changing the low-current high-impedance signal on the grid to a high-current low-impedance signal in the cathode of the succeeding triode. This high signal current overrides the inherent circuit noise-level and since the second triode section does have voltage gain, the overall result of the cascode circuit is good sensitivity combined with less noise or "snow".

V21A serves as the RF oscillator and V21B as the RF mixer.

The oscillator operates 45.75 mc above the received picture carrier. The fine-tuning-control of the receiver is mechanically connected to a variable capacitor (C12) to provide tuning of the oscillator.

The picture and sound carrier are fed to the grid of the mixer — beating with the oscillator to convert to the IF frequency. The picture carrier is converted to 45.75 mc and the sound carrier to 41.25 mc.

BLOCKS V5—V6—V7—V8

The picture carrier has been converted down to 45.75 mc and the sound carrier to 41.25 mc. A wide band width is accomplished by stagger tuning the IF stages — each to a different frequency of the band from 41.25 to 45.75 mc. This wide flat band width is obtained by 6 tuned poles, L8, T103, T104, T105, T106 and T108, and is essential for good picture detail. The sound carrier is passed through at about 5% of the level of the picture carrier. This is done to insure that there will be no amplitude modulation on the 4.5 mc sound carrier at the 2nd detector.

The IF response curve is adjusted to have a sound-porch at the 5% level for the 41.25 mc sound-carrier. This sound porch is formed by traps T103 and T107. The sound porch is tilted so that on weak signal, when the picture carrier (by fine tuning) is tuned higher on the response curve to give a better picture, the sound will also ride higher on the tilted sound porch — thus giving greater sound sensitivity. This insures simultaneous good sound and picture at all operating levels.

The alignment of the IF strip is critical and the Video Alignment Chart should be carefully followed. The IF strip has 6 traps. Traps T105 and T108 are adjacent-channel sound-traps (47.25 mc). Traps T104 and T106 are adjacent-channel picture-traps (39.75 mc). It should be noted that the screen-by-pass capacitors used in each IF stage are to be replaced with exact values since they serve effectively to "neutralize" plate-to-grid interelectrode coupling at 41 mc IF frequencies. Factory lead-dress and lengths should also be duplicated when repairs are necessary.

BLOCK V9A

V9A is used as a twin diode in this circuit.

The 2nd det uses ½ of a 12AU7. The grid (Pin 2) performs the operation of a diode plate for detection of the Video information. The plate (Pin 1) is used as another diode plate, detecting the IF signal for use as an AGC Voltage.

Delay of the AGC Voltage is accomplished by raising the cathode to a +2.4 volts. The plate (Pin 1) is returned to ground through R144. The cathode (Pin 3) is +2.4 volts above ground (bias developed across R148.) This 2.4 volts serves as a "delay" — meaning that an IF signal of 2.4 volts must be developed before the AGC diode will conduct.

The grid (video diode) has no bias and will conduct current on a very low signal for video detection.

BLOCK V10

The video amplifier (V10) is a 6AC7 television amplifier pentode.

The video signal from the 2nd detector is capacity coupled to the grid of the 6AC7.

This stage amplifies the composite picture signal which is composed of horizontal and vertical synchronizing pulses and picture information.

The 4.5 mc sound present in the plate circuit could produce interfering herringbone pattern in the picture. A trap L111 is tuned to 4.5 mc which traps out this interference.

The composite video signal from this stage is applied to the cathode of the picture tube (V22).

BLOCK V14

An automatic frequency control (AFC) is used in this receiver to maintain stable horizontal framing. Two 180° displaced horizontal sync pulses from V12A are fed to the 6AL5 (V14) phase discriminator. A pulse is taken from the secondary winding on the width coil which is made into a sawtooth wave shape by integration through R194 and C171. Since pin 5 and pin 7 of V14 are tied together, both sections of the diode are controlled by this sawtooth on which the two 180° out-of-phase sync pulses ride. The phase discriminator then is so designed that if the sawtooth arrives late relative to the sync pulses, a positive voltage will be fed to the horizontal oscillator to raise the frequency causing the horizontal oscillator to come back in sync. Conversely, if the sawtooth arrives early, a negative voltage is developed which in turn reduces the oscillator frequency. Any phase displacement between the sync pulses and the sawtooth will result in a DC voltage change at the junction of R190 and R191. This voltage is the control voltage for the Horizontal Oscillator.

This voltage which is fed to the horizontal oscillator is essentially a well filtered DC voltage. Thus, ignition noise or other types of electrical interference will not cause lines to tear out because it is filtered out before it gets to the oscillator.

BLOCK V15

V15 operates as a cathode-coupled multivibrator utilizing a ringing tank-circuit, L113. This circuit allows for more positive frequency control than is available from conventional multivibrator circuits. The frequency of the oscillator is controlled manually by the Horizontal Hold Control, R198, and the Horizontal Lock, L113. The frequency is controlled automatically by the DC voltage on pin 1, V14 as developed by V14. The output of the oscillator is a sawtooth which is used to drive the horizontal output tube. C180, drive trimmer, controls the amplitude of the sawtooth fed to the horizontal output tube.

If this sawtooth voltage is too high, the horizontal output tube will be overdriven and a vertical white line will show up on the raster. If the sawtooth input to the horizontal output is too low, the raster will be narrow and the high voltage will be low.

BLOCK V16—V17—V18

The Horizontal output stage, V16, supplies a current waveform through T111 to the yoke (L117-L118) shaped to produce linear horizontal sweep. T112 serves as a width-control. By turning its "slug" in, its inductance will be increased — reducing the loading on T111 and increasing the horizontal scan (width). V17 is the Hi-V Rectifier and V18 is the Damper Tube. V18 serves effectively to damp-out the parasitic-oscillations occurring at the end of the "retrace" part of each horizontal sweep-cycle. The energy from these damped-oscillations is conveniently utilized to "boost" the nominal 300V B+ voltage to approximately 515V as seen on the schematic on one side of R177.

BLOCK V9B-V1-V2

At the second detector (V9A) the picture carrier (45.75 mc) and sound carriers (41.25 mc) beat to give a 4.5 mc "intercarrier" beat frequency difference. This frequency modulated 4.5 mc carrier is fed to V9B and amplified. V1 serves as a combination amplifier and limiter to clip off noise and other forms of amplitude modulation. V2 operates as a balanced ratio detector. The output is the audio portion of the transmitted TV signal.

BLOCK V3-V4

From the output of the balanced ratio-detector the audio signal is fed through the phono-jack to the volume control. The phono-jack itself acts as its own "switch". For TV operation the phono-plug must be pulled out. V3 is the 1st Audio Amplifier and V4 is the audio output stage with a maximum output of 3 watts. The B+ circuit for V4 is isolated from the other chassis B+ circuits by L114 minimizing the effects of audio on the picture.

BLOCK V11-V12A

V11 operates as a sync amplifier and separator. The sharp cut-off characteristics of its two triode sections combined with the grid-bias developed on pin 2 and the cathode-bias developed on pin 8 result in amplified sync-pulses completely separated from video. The operating voltages on V11 determine the waveforms illustrated on the schematic and both voltages and waveforms should be carefully checked when troubleshooting this circuit. V12A serves as a sync splitter. From the junction of R161 and R162 positive horizontal sync pulses are fed to V14, pin 2. From V12A, pin 6, negative horizontal sync-pulses are fed to V14, pin 1. These out-of-phase sync pulses are used in the "phase-comparator" circuit of V14 for Automatic Frequency control of the Horizontal Oscillator. From the plate, pin 5, of V12A the sync pulses are coupled through a vertical integrating network, CP-1, the output of which controls the vertical oscillator, V12B.

VERTICAL RETRACE BLANKING

Vertical retrace blanking is accomplished by cutting the picture tube off during vertical retrace time. This is done by feeding a negative voltage pulse to the grid of the picture tube during vertical retrace. This pulse is taken off the vertical output choke and is shaped by pulse shaping network C166 - C168 - R185. No diagonal vertical retrace lines will appear in the picture.

BLOCK V12B

Vertical sync pulses from the output of the sync splitter are separated from the horizontal sync pulses by an integrating network (CP-1) composed of R168, R167, R166, C160, C159 and C158. These vertical sync pulses are used to control the frequency of a conventional type Blocking Oscillator. This oscillator utilizes one triode section of a 6SN7 tube V12B and its free-running frequency is determined by the resistance and capacity time constant (including the vertical hold control) in the grid circuit. The sync pulses are impressed at the tube grid just before the oscillator would normally trigger and are of sufficient amplitude to drive the tube to conduction and cause the oscillator to lock in at the sync frequency. The output amplitude of this stage is controlled by the height control.

BLOCK (V13)

The Blocking Oscillator drives 6K6 triode, connected as a vertical scanning output stage. Adjustment of vertical-linearity is accomplished in the cathode of this stage by varying the bias and thus changing the plate-current operating-point of the tubes non-linear characteristic curve. Sawtooth current output is applied to the vertical deflection coils through the vertical output transformer T110.

YOKE ADJUSTMENTS

The picture tube cone should fit snugly into the large front hole rimmed in rubber in the Yoke Mount Frame. The "Yoke Mount Feet Adjustment" allows the frame to be properly positioned.

The Yoke Radial Adjustment allows the yoke to be rotated right or left --- rotating the picture right or left.

The Yoke Vertical Adjustment allows centering of the yoke coaxially with the tube neck.

Proper positioning of the yoke is important so that picture corner-cutting and side-shadows can be readily removed by the Centering-Ring.

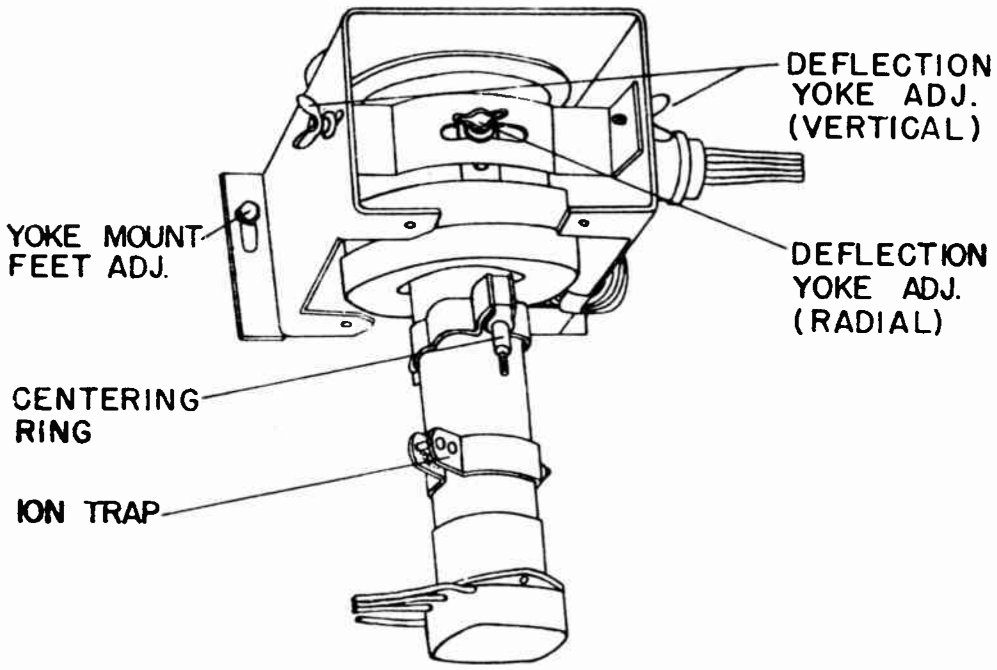
ION-TRAP (BEAM BENDER)

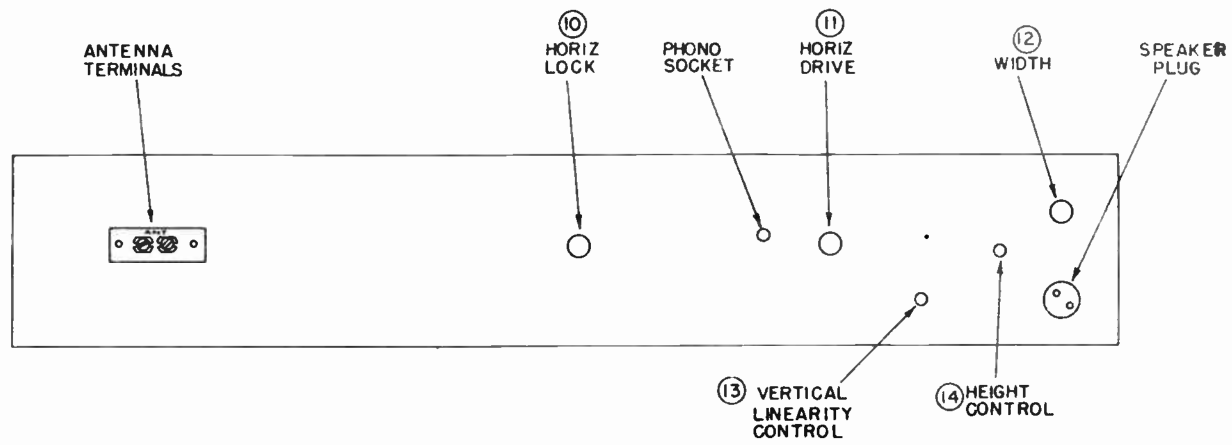
A single magnet -- "Beam-Bender" is used with the 17HP4A picture tube. The magnet should adjust to the left side of the tube neck (looking from the rear). The smooth heads of the rivets should be on top. Carefully rotate and slide the trap for brightest raster. It should adjust to be approximately one-half inch forward from the bakelite base of the tube. A new trap should be used if it adjusts too far back to the bakelite.

CENTERING

The Centering Ring should be positioned one-fourth inch to one-half inch from the yoke. Center the raster by turning the knurled knob on the Centering Ring and at the same time rotating the Ring around the tube neck. After the picture is centered, check the Ion Trap setting.

The Horizontal Hold Control will move the picture horizontally and should be set first to the middle of its range of movement of the picture. The Centering-Ring should then be used to center the picture within the mask and remove corner-shadows. If corner-shadows persist, check to see that the Yoke and Mounting Frame are as far forward onto the cone of the picture tube as possible. When the Yoke and Ion-Trap are positioned properly, the ring will readily center the picture without corner-shadows.





HORIZONTAL LOCK ADJUSTMENT (11)

1. Set the Horizontal Hold Control (6) to the center of its range.
2. Adjust the Horizontal Lock (11) until picture is in sync. Then turn the Horizontal Lock (11) right until the picture goes out of sync. Next turn the Horizontal Lock (11) to the left until the picture just pulls into sync.
3. Turn the Horizontal Hold Control (6) full left. Switch the Channel Selector (4) off station then on again. The picture should go out of sync. Turn the Horizontal Hold Control (6) full right. Switch the Channel Selector (4) off station then on again. The picture should go out of sync.
4. Adjust the Horizontal Lock (11) until the number of diagonal bars are the same for both the right and left out of sync positions.

WIDTH (13)

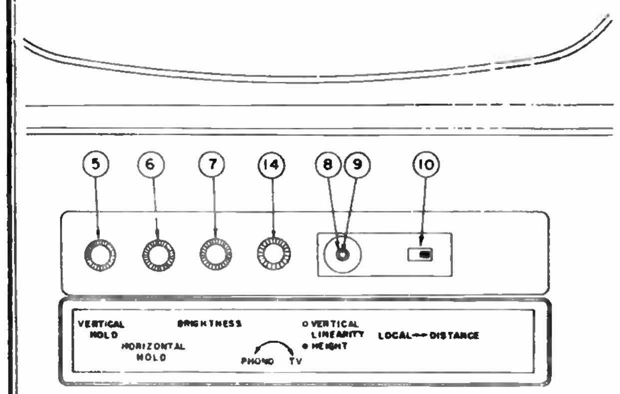
This control regulates the amount of deflection current flowing in the Horizontal Deflection Coils controlling the horizontal dimension or width of the picture. Maximum width occurs when the screw protrudes about 1/2" from the coil mounting clip.

HORIZONTAL DRIVE (12)

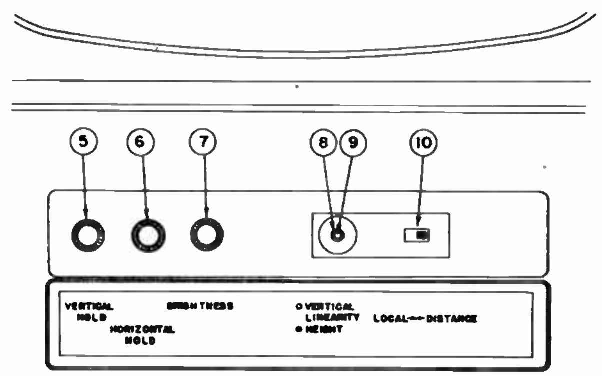
Adjust HORIZONTAL DRIVE TRIMMER (12) slightly beyond the point where "overdrive" lines just disappear. "Overdrive" lines appear as a vertical white line in the left portion of the picture. The Horizontal Drive Trimmer is located in the control grid circuit of the Horizontal Output Tube (6BQ6) controlling the operating characteristics of the tube. Turning the HORIZONTAL DRIVE TRIMMER (12) to the right reduces the horizontal drive.

PHONO CONNECTION

This receiver employs a Phono Jack on the back of the receiver chassis (see Rear View). To play records, plug the shielded phono lead from the record player into the phono jack. The VOLUME CONTROL (1) will control the volume. The phono lead must be removed from the phono jack for television sound reception. During phono operation the light will remain on the screen. The Brightness Control (7) should be turned full left to darken the screen. For Chassis 132.024-3 only the TV-Phono switch (14) behind the control door must be turned to the left.



132.024-3,-31



132.024-1 & -2

VERTICAL LINEARITY (8)

This control, located in the cathode of the Vertical Output Stage, changes the operating characteristics of this tube affecting vertical linearity of the top of the picture.

HEIGHT (9)

This control, located in the plate circuit of the Vertical Oscillator Stage, determines the amplitude of the vertical sweep which governs the vertical dimension of the picture. This control affects overall picture height and the vertical linearity of the bottom of the picture.

LOCAL-DISTANCE SWITCH (10)

In the "Local" position AGC voltage is connected to the grid of the R.F. Amplifier - - preventing overload on strong signal input. In the "Distance" position the AGC voltage is removed from the R.F. grid allowing the receiver to operate at maximum gain for weaker signal areas. For "fringe" areas there will be no noticeable affect of the switch in either position, since there will be insufficient signal to develop AGC voltage.

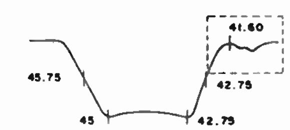
TELEVISION CHANNELS AND RECEIVER OPERATING FREQUENCIES

CHANNEL NO.	CHANNEL FREQ. (mc)	PICTURE CARRIER FREQ. (mc)	SOUND CARRIER FREQ. (mc)	RECEIVER OSC. FREQ. (mc)	PICTURE IF FREQ. (mc)	SOUND IF FREQ. (mc)	INTERCARRIER SOUND (PICTURE IF LESS SOUND IF) (mc)
2	54-60	55.25	59.75	101	45.75	41.25	4.5
3	60-66	61.25	65.75	107	45.75	41.25	4.5
4	66-72	67.25	71.75	113	45.75	41.25	4.5
5	76-82	77.25	81.75	123	45.75	41.25	4.5
6	82-88	83.25	87.75	129	45.75	41.25	4.5
7	174-180	175.25	179.75	221	45.75	41.25	4.5
8	180-186	181.25	185.75	227	45.75	41.25	4.5
9	186-192	187.25	191.75	233	45.75	41.25	4.5
10	192-198	193.25	197.75	239	45.75	41.25	4.5
11	198-204	199.25	203.75	245	45.75	41.25	4.5
12	204-210	205.25	209.75	251	45.75	41.25	4.5
13	210-216	211.25	215.75	257	45.75	41.25	4.5

VIDEO I.F. AND TRAP ALIGNMENT

1. SET TUNER TO CHANNEL 9 - 10 OR 11.
2. SET LOCAL-DISTANCE SWITCH IN LOCAL POSITION.
3. CONNECT A 3V BIAS TO THE JUNCTION OF R141 & R143 AND GROUND.
4. MAKE SURE THE T.V. RECEIVER, SIGNAL GENERATORS AND SCOPE ARE BONDED BY A COMMON GROUND.

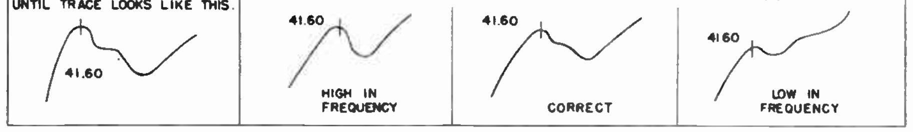
STEP	EQUIPMENT	CONNECTION	FREQUENCIES	ADJUSTMENT	INSTRUCTIONS
1.	V.T.V.M.	ACROSS R147			ISOLATE V.T.V.M. LEAD WITH 18K RESISTOR SET ON LOWEST SCALE.
2.	R.F. SIGNAL GENERATOR	TUNER TEST POINT	39.75	T104 1ST I.F. T106 3RD I.F. { TUNE BOTTOM FOR MINIMUM	
3.	SAME	SAME	41.6	T103 CONVERTER I.F. T107 CATHODE TRAP { TUNE BOTTOM FOR MINIMUM	
4.	SAME	SAME	47.25	T105 2ND I.F. T108 4TH I.F. { TUNE BOTTOM FOR MINIMUM	
5.	SAME	SAME	45.3	T1 CONVERTER COIL ON TUNER { TUNE TOP FOR MAXIMUM	START WITH CORE ALL THE WAY IN AND TUNE OUT.
6.	SAME	SAME	45.	T108 4TH. I.F. { TUNE TOP FOR MAXIMUM	
7.	SAME	SAME	43.1	T106 3RD. I.F. { TUNE TOP FOR MAXIMUM	
8.	SAME	SAME	45.75	T105 2ND. I.F. { TUNE TOP FOR MAXIMUM	
9.	SAME	SAME	42.25	T103 CONVERTER I.F. T104 1ST. I.F. { TUNE TOP FOR MAXIMUM	
10.	SAME	TO CHASSIS NEAR 1ST. I.F. TUBE V8	45.75 45 41.6 42.75 42.25		USED AS A MARKER GENERATOR
11.	OSCILLOSCOPE	JUNCTION C149 & L120			ISOLATE SCOPE LEAD WITH 18K RESISTOR
12.	SWEEP GENERATOR	ANTENNA TERMINALS	CHANNEL 10	TOUCH UP TOP CORES FOR DESIRED RESPONCE CURVE	RECEIVER TUNER SET TO CHANNEL 10
13.	SAME	SAME	MARKER 41.6	T107 CATHODE TRAP	SEE CURVES BELOW
14.	SAME	SAME	ALL CHANNELS	CHECK CURVE ON ALL CHANNELS	



A. T105 AND TUNER COIL AFFECT SLOPE ON LEFT SIDE.
B. T106 AND T108 AFFECT TILT OF CURVE.
C. T103 AND T104 AFFECT WIDTH OF CURVE AND SLOPE OF RIGHT SIDE.

INCREASE SCOPE GAIN TUNE T107 UNTIL TRACE LOOKS LIKE THIS.

POSSIBLE POSITIONS OF CURVE AFFECTED BY CATHODE TRAP T107

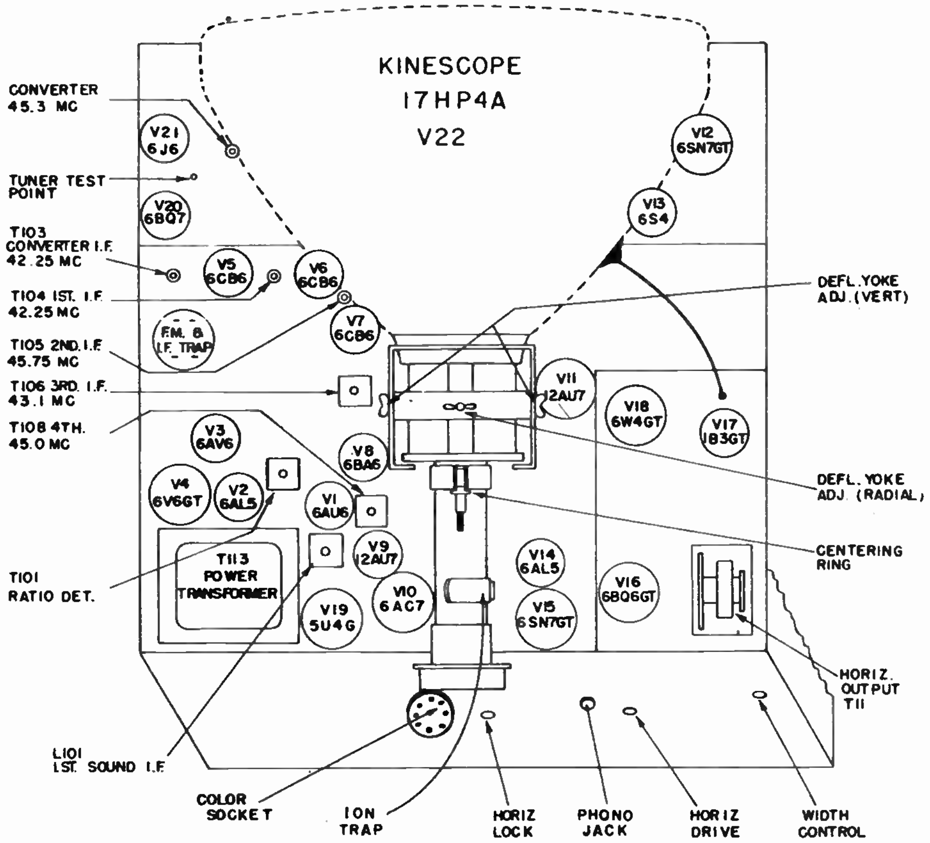


USE OF MARKER SIGNALS

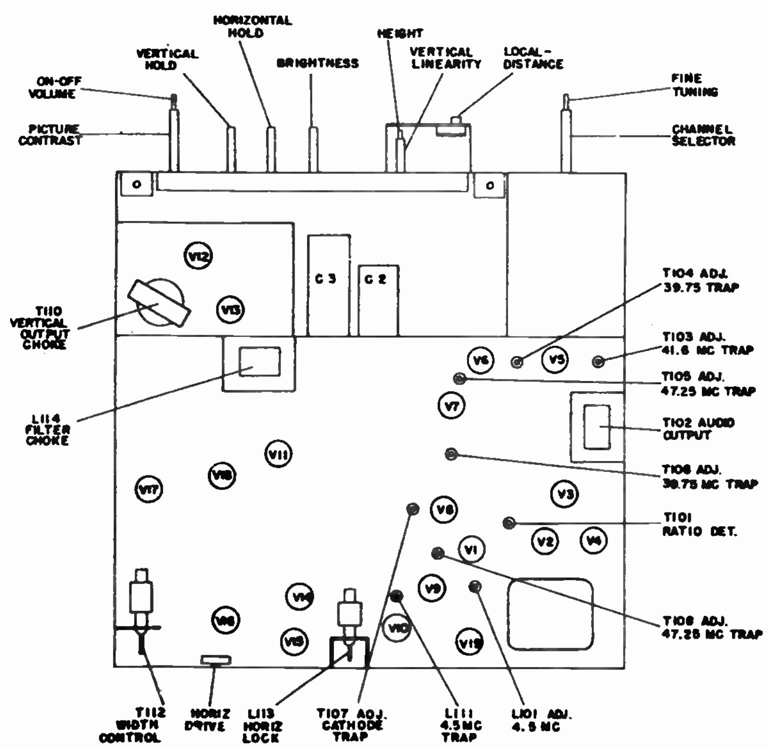
The illustrated response curves show where markers fall. For sweep generators that do not have built-in marker signals, calibrated signals from an R.F. generator must be used. The "hot-side" of the generator output lead hooked to the chassis near the 1st I.F. input will spray enough signal into the circuit to be seen on the scope. Marker beats will show best when the sweep-input is low and the scope gain set high.

SOUND I.F. ALIGNMENT AND 4.5 TRAP ALIGNMENT

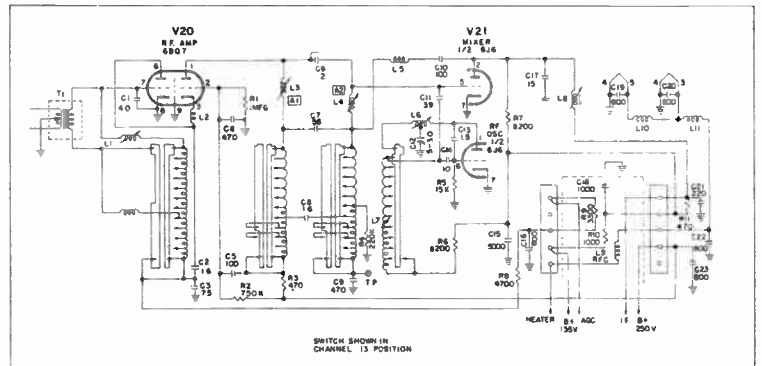
STEP	EQUIPMENT	CONNECTION	FREQUENCIES	ADJUSTMENT	INSTRUCTIONS
1.	V. T. V. M.	PIN 1 V2 TO GROUND RATIO DETECTOR			SET ON 10 VOLT SCALE
2.	SIGNAL GENERATOR	JUNCTION OF L120 AND C149	4.5 MC	BOTTOM T101 RATIO DET. TOP L101 1ST. SOUND I.F. TUNE FOR MAX. ON VTVM	SET GENERATOR OUTPUT TO READ APPROX. 5 VOLT ON V.T.V.M.
3.	V. T. V. M.	JUNCTION OF R110 AND C108		TUNE TOP OF T101 RATIO DET. FOR ZERO.	SET METER ON LOWEST SCALE TUNING T101 SHOULD SWING METER ABOVE & BELOW ZERO
4.	SAME	SAME	SAME	CHECK { TUNE GENERATOR ABOVE AND BELOW 45MC	POSITIVE AND NEGATIVE PEAKS SHOULD READ WITHIN 30 %
5.	V.T.V.M.	PIN 1 V2 TO GROUND RATIO DETECTOR			SET ON 10 VOLT SCALE
6.	SIGNAL GENERATOR	JUNCTION OF L112 AND R153 USE .01 ISOLATING CAP	4.5 MC	TUNE 4.5 TRAP L111 FOR MINIMUM ON VTVM	REMOVE VIDEO AMP V10 CONNECT 200μμf CAPACITOR BETWEEN PIN 8 AND PIN 4



·TOP VIEW — CHASSIS



BOTTOM VIEW — CHASSIS



TUNER UNIT

TUNER OSCILLATOR ADJUSTMENT

A High-Channels adjustment, A3, and a Low-Channels adjustment, A4, of the R.F. oscillator is accessible when the channel tuning knobs are removed. These two adjustments are shown on the Tuner Unit View.

HIGH-CHANNELS

1. Set the Channel Selector Switch to the highest available station between channels 7 and 13.

2. Set the Fine Tuning to mid-position.

3. Adjust A3 for best picture definition.

4. The remaining lower "High-Channels" should be within the range of the Fine-Tuning.

LOW-CHANNELS

1. Set the Channel Selector Switch to the highest available station between channels 2 and 6.

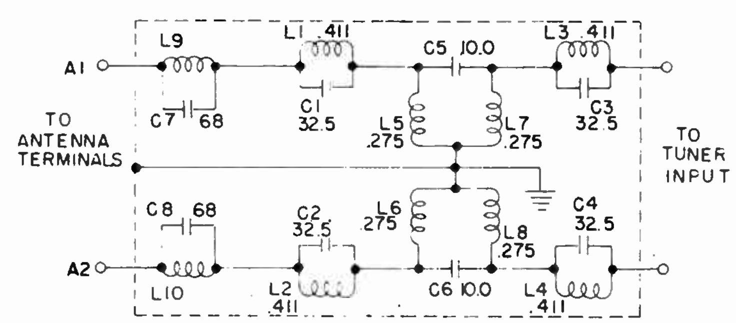
2. Set the Fine-Tuning to mid-position.

3. Adjust A4 for best picture definition.

4. The remaining lower "Low-Channels" should be within the range of the Fine-Tuning.

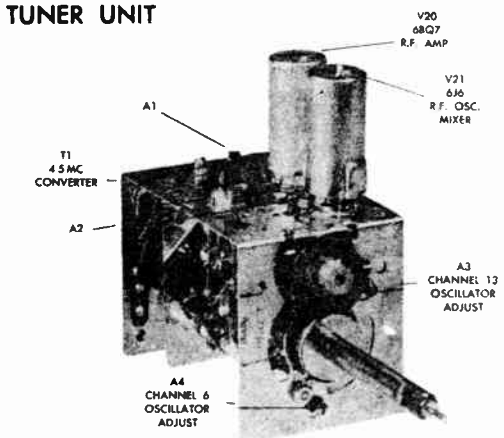
NOTE: The design purpose of A3 and A4 is to provide adjustment for channel 13 and channel 6 --- for optimum High and Low channels coverage. The above procedure, therefore, gives optimum adjustment for any available stations.

I.F. AND F.M. TRAP ASSY



COILS "L" ARE IN UH; CONDENSERS "C" ARE IN UUF

TUNER UNIT



HOW TO ORDER PARTS

1. Use correct order form.
2. On the Purchase Order always give the following information:
   (1) PART NUMBER (number printed on the part if different from that shown in this list) and DESCRIPTION for each part ordered. When no part number is assigned, order by description and rating. Also give PRICE of part (indicate if no selling).
   (2) The CHASSIS NUMBER, which is 132.024. This number is found on a metal plate at the rear of the chassis.
3. MARK-UP: Selling prices in the following list produce a MARK-UP of AA5, unless otherwise noted in the M. U. Code Column.
4. In all correspondence relating to cabinets, always mention the source code letter stamped into the upper rear rail of consoles or on sticker on the back, bottom or inside of cabinet.

REPAIR PARTS LIST --- CHASSIS 132.024-1

SCHEMATIC LOCATION	PART NUMBER	DESCRIPTION	SELLING PRICE EA.
	N25520	Antenna Terminal Board	.15
	N25471	Cap Tube Top (6BQ6)	.06
C180	N24528	Capacitor, 40 uuf to 370 uuf Trimmer	.43
C137		Capacitor, 2.2 uuf ± 0.5 uuf 500V Ceramic	.34
C117, C143		Capacitor, 8.2 uuf 10% Ceramic	.26
C122, C128, C134		Capacitor, 47 uuf 10% Ceramic	.31
C111		Capacitor, 47 uuf 20% 500V Mica	.23
C142, C146, C101		Capacitor, 68 uuf 10% Disc	.23
C176		Capacitor, 100 uuf 10% 500V Mica	.26
C152, C179		Capacitor, 270 uuf 10% 500V Mica	.26
C177, C174		Capacitor, 330 uuf 10% 500V Mica	.26
C183		Capacitor, 500 uuf Hi Volt	2.00
C107		Capacitor, 500 uuf 10% 500V Mica	.26
C120, C126, C132, C138		Capacitor, 610 uuf 10% 500V Temp Coeff	.31
C104, C118, C145, C119, C123, C190, C124, C125, C129, C130, C131, C136, C139, C141		Capacitor, 1000 uuf Min 500 DCWV Disc	.23
C155, C156		Capacitor, .001 mfd 20% 600V Paper Tubular	.23
C161		Capacitor, .0015 mfd 20% 600V Paper Tubular	.23
C108		Capacitor, .0033 mfd 20% 600V Paper Tubular	.23
C175		Capacitor, 3900 uuf 5% 500V Mica	1.25
C110, C114		Capacitor, .0047 mfd 20% 600V Molded Paper	.23
C103, C105, C116, C144		Capacitor, 5000 uuf Min 500 DCWV Disc	.23
C162		Capacitor, .0047 mfd 5% 600V Min Oil Impregnated	.46
C113, C171		Capacitor, .01 mfd 20% 400V Paper Tubular	.23
C172		Capacitor, .01 mfd 20% 600V Paper Tubular	.23
C186, C187		Capacitor, .01 mfd 20% 600V Paper Tubular	.31
C165		Capacitor, .033 mfd 20% 200V Paper Tubular	.23
C151, C179, C173, C154		Capacitor, .047 mf 20% 400 V. Paper Tubular	.26
C109		Capacitor, .047 mf 20% 200 V. Paper Tubular	.23
C163, C169, C184		Capacitor, .047 mf 20% 600 V. Paper Tubular	.26
C112, C153, C168, C185		Capacitor, .1 mf 20% 400 V. Paper Tubular	.31
C148, C149		Capacitor, .1 mf 20% 200 V. Paper Tubular	.29
C164, C182		Capacitor, .1 mf 20% 600 V. Paper Tubular	.43
C166		Capacitor, .1 mf 20% 1000 V. Paper Tubular	.34
C178		Capacitor, .22 mfd. 20% 600 V. Paper Tubular	.51
C189		Capacitor, .22 mf 20% 400 V. Paper Tubular	.43
C188, C147		Capacitor, .22 mf 20% 200 V. Paper Tubular	.37
C157, C181		Capacitor, .47 mf 20% 200 V. Paper Tubular	.51
C1	N25453	Capacitor, 4 mfd. 150 V. Electrolytic	1.05
C5	N25452	Capacitor, 20 mfd. 450 V. Tubular with Leads Electrolytic	1.65
C4	N25454	Capacitor, 100 mfd. 25 V. Tubular with Leads Electrolytic	1.43
C2	N22422-13	Capacitor, 20-25 50-350 60-400 5-450 F. P. Electrolytic	3.45
C3	N22422-14	Capacitor, 100-50 20-450 80-350 50-350 F. P. Electrolytic	3.35
L102, L104	N23095	Choke Filament	.17
L114	N23087-1	Choke Filter	.20
T110	N24990-1	Choke Vert. Output	3.35
L113	N23449	Coil Horizontal Oscillator	.94
L101	N25543	Coil - Sound Pick Off	1.50
L119, L103	N22500-19	Coil, Video Peaking 20 uh	.66
L106	N22500-8	Coil, Video Peaking 20 uh	.66
L108	N25468-6	Coil, Video Peaking 40 uh	.66
L109	N25468-5	Coil, Video Peaking 100 uh	.66
L112	N25468-1	Coil, Video Peaking 185 uh	.66
L110	N25468-8	Coil, Video Peaking 250 uh	.66
L120	N25916	Coil, Peaking 1.7 uh	.66
L111	N25609	Coil, Video Trap	1.14
T112	N24991	Coil, Width	1.85
	N25626	Control, Beam Centering	1.25
R189	N22464-34	Control, Brightness	.74
R198	N22464-38	Control, Horizontal Hold	.74
R170	N22464-36	Control, Vert. Hold	.74
R176, R181	N22464-20	Control, Vert. Linearity & Height	1.62
R113, R150, SW102	N22464-27	Control, Volume Contrast - On-Off	2.56
C158, C159, C160, R166, R167, R168	N24166	Couplate, CP-1 Vert. Integrating	.85
	N25598-1	Cover, Cabinet Rear Assy.(Cat.#2105)	2.42
	N25598-2	Cover, Cabinet Rear Assy. (Cat.#2145)	2.42
	N25628-1	Door, Controls	3.50
	N25330	Door, Mounting Bracket	.07
	N25331	Door Spring	.11
	N25121-2	Dust Seal Vinyl Tube	.63
	N22493	Fuse, 4 A mp With Leads	.29
	N25537	Glass, Safety	4.65
	N24277-4	Grommet, Rubber, Yoke & Anode Leads	.06
SW104	N22489	Interlock, Plug	.23
	N25662-1	Ion Trap	.77
	N24739-1	Knob, Channel Indicator	1.05
	N24741-2	Knob, Contrast	.23
	N24740-2	Knob, Fine Tuning	.23
	N24742-1	Knob, Volume	1.00
	N24699-2	Knob, Behind Control Door	.17
	N25683	Knob Tab UHF	.06
	N25596	Mask, Plastic	4.60

SCHEMATIC LOCATION	PART NUMBER	DESCRIPTION	SELLING PRICE EA.
R208		Resistor, 3.9 ohm 10% 1/2 W.,Wire Wound	.15
R202		Resistor, 47 ohm 20% 1/2 W.	.15
R121, R126, R132		Resistor, 47 ohm 10% 1/2 W.	.15
R146		Resistor, 100 ohm 10% 1/2 W.	.15
R136		Resistor, 120 ohm 10% 1/2 W.	.15
R125, R129, R138, R103		Resistor, 150 ohm 20% 1/2 W.	.15
R151		Resistor, 150 ohm 10% 1/2 W.	.15
R204		Resistor, 220 ohm 10% 5 W.	.15
R109		Resistor, 390 ohm 5% 1/2 W.	.15
R118		Resistor, 470 ohm 10% 1 W.	.15
R162		Resistor, 820 ohm 10% 1/2 W.	.15
R123, R128, R130, R133, R137		Resistor, 1000 ohm 20% 1/2 W.	.15
R104		Resistor, 1000 ohm 10% 1/2 W.	.15
R164		Resistor, 1100 ohm 5% 1/2 W.	.15
R196		Resistor, 1200 ohm 10% 1/2 W.	.15
R180		Resistor, 1500 ohm 20% 1/2 W.	.15
R161		Resistor, 1800 ohm 10% 1/2 W.	.15
R177		Resistor, 1800 ohm 10% 2 W.	.15
R214		Resistor, 2200 ohm 10% 20 W.	1.08
R119		Resistor, 2200 ohm 20% 2 W.	.15
R122, R127		Resistor, 3300 ohm 20% 1/2 W.	.15
R147		Resistor, 3300 ohm 5% 1/2 W.	.15
R148, R165		Resistor, 4700 ohm 10% 1/2 W.	.15
R153		Resistor, 4700 ohm 5% 2 W.	.15
R101		Resistor, 4700 ohm 10% 1 W.	.15
R185, R199		Resistor, 8200 ohm 10% 1/2 W.	.15
R195		Resistor, 8200 ohm 10% 1 W.	.15
R178		Resistor, 10 K. 10% 1/2 W.	.15
R155		Resistor, 10 K. 20% 1/2 W.	.15
R111, R112		Resistor, 10 K. 5% 1/2 W.	.15
R107		Resistor, 12 K. 10% 1 W.	.15
R194		Resistor, 12 K. 10% 2 W.	.15
R120, R213		Resistor, 15 K. 10% 1/2 W.	.15
R201		Resistor, 15 K. 10% 1 W.	.15
R124		Resistor, 18 K. 5% 1/2 W.	.15
R108		Resistor, 22 K. 10% 1 W.	.15
R135, R169, R186		Resistor, 22 K. 10% 1/2 W.	.15
R205, R206, R207		Resistor, 27 K. 10% 2 W.	.15
R110, R116, R163		Resistor, 47 K. 10% 1/2 W.	.15
R159		Resistor, 47 K. 10% 1 W.	.15
R197		Resistor, 91 K. 5% 1/2 W.	.15
R144, R171		Resistor, 100 K. 10% 1/2 W.	.15
R190, R191		Resistor, 100 K. 5% 1/2 W.	.15
R200		Resistor, 120 K. 20% 1/2 W.	.15
R102		Resistor, 120 K. 10% 1/2 W.	.15
R115		Resistor, 150 K. 10% 1/2 W.	.15
R145, R212		Resistor, 220 K. 20% 1/2 W.	.15
R141, R143, R154, R187		Resistor, 220 K. 10% 1/2 W.	.15
R158		Resistor, 270 K. 10% 1/2 W.	.15
R156		Resistor, 270 K. 20% 1/2 W.	.15
R174, R193, R203		Resistor, 470 K. 10% 1/2 W.	.15
R160		Resistor, 560 K. 10% 1/2 W.	.15
R142, R140		Resistor, 560 K. 20% 1/2 W.	.15
R106		Resistor, 680 K. 20% 1/2 W.	.15
R117, R149		Resistor, 1 meg. 20% 1/2 W.	.15
R175		Resistor, 1 meg. 5% 1/2 W.	.15
R173		Resistor, 1.5 meg. 5 % 1/2 W.	.15
R157, R179		Resistor, 2.2 meg. 10% 1/2 W.	.15
R192		Resistor, 4.7 meg. 10% 1/2 W.	.15
R114		Resistor, 10 meg. 20% 1/2 W.	.15
R172		Resistor, 10 meg. 10% 1/2 W.	.15
	N25532	Rail, Top Retainer	1.00

SCHEMATIC LOCATION	PART NUMBER	DESCRIPTION	SELLING PRICE EA.
	N22572	Shield, Miniature Tube	.15
	N25002	Socket and Corona Ring "IB3"	.60
	N22820-1	Socket Color, Octal	.17
	N24911-1	Socket, Kinescope, With Leads	.41
	N22820	Socket, Molded Octal "6W4"	.17
	N25619	Socket, Phono	.51
	N20389	Socket, Octal Wafer	.15
	N19579	Socket, Speaker	.11
	N20310-3	Socket, 7 Pin Min. Wafer	.15
	N20274	Socket, 9 Pin Miniature	.17
	N21677-1	Socket, 9 Pin Min. "Vert Output Tube"	.26
	N24690-4	Socket, Yoke & Lead Assembly	.70
	N25607-1	Speaker & Plug Assy. (Cat. #2105)	3.90
	N25597-1	Speaker & Plug Assy. (Cat. #2145)	5.00
SW101	N25525	Switch, Local-Distance	.23
T102	N24776-1	Transformer, Audio Output	2.65
T107	N25415	Transformer, Cathode Trap	1.31
T103	N25410	Transformer, Converter I.F.	1.40
T104	N25411	Transformer, 1st Pix I.F.	1.54
T105	N25412	Transformer, 2nd Pix I.F.	1.54
T106	N25413	Transformer, 3rd Pix I.F.	1.68
T108	N25474	Transformer, 4th Pix I.F.	1.68
T111	N24989	Transformer, Horizontal Output	6.20
T113	N25433	Transformer, Power	13.25
T109	N22446-1	Transformer, Vert. Oscillator	2.52
T101	N25322	Transformer, Ratio Detector	2.88
	N25255	Trap, I.F.	3.12
	N25919	I.F. and F.M. Trap Assy. NOTE: Early production had same sets with I.F. and F.M. Traps in separate cans, as follows:	
	N25907	F.M. Trap	
	N25255	I.F. Trap	
	N25548-1	TUNER - TT6-B	31.00
	N22456	Choke, Filament	.20
		Resistor, 1000 ohm 20% 1/2 W.	.15
		Resistor, 3300 ohm 20% 1/2 W.	.15
		Capacitor, 1000 uufd Disc	.20
		Grommet, Rubber	.06
	N24807	YOKE, DEFLECTION	6.75
C167		Capacitor, 82 uuf 10% 1500 V.	.23
R183, R182		Resistor, 560 ohm 10% 1/2 W.	.15
R184		Resistor, 10 K. ohm 10% 1/2 W.	.15

PARTS LIST CHANGE -- CHASSIS 132.024

PARTS DELETED

C171	Capacitor, .01 mfd 20% 400V	
R194	Resister, 12K 10% 2 W	
R204	Resister, 220 ohm 10% 5 W	

PARTS ADDED

C171-1	Capacitor, .022 mfd 20% 400V	.25
R194-1	Resister, 15K 10% 2 W	.15
R204-1	Resister, 300 ohm 10% 7 W	
R216	Resister, 68 ohm 20% 1/2 W	.15
C192	Capacitor, 1000 uuf Disc	.23
R217	Resister, 220K 10% 1/2 W	.15

PARTS LIST CHANGE 132.024-2

PARTS DELETED

			SELLING PRICE EA.
L112	N24991	Width Control	
R215		Resistor, 68K ohm 10% ½w	
R161		Resistor, 1800 ohm 10% ½w	
R162		Resistor, 820 ohm 10% ½w	
R194-1		Resistor, 15K ohm 10% 2w	
C171-1		Capacitor, .022ufd 20% 400V	
R161-1		Resistor, 1500 ohm 10% ½w	
R162-1		Resistor, 1500 ohm 10% ½w	
R193		Resistor, 470K ohm 10% ½w	
C172		Capacitor, .01 ufd 20% 600V	
	N25548-1	Tuner	

PARTS ADDED

L112-1	N40027	Width Control	1.35
R215-1		Resistor, 22K ohm 10% ½w	.15
R161-1		Resistor, 1500 ohm 10% ½w	.15
R162-1		Resistor, 1500 ohm 10% ½w	.15
R194-2		Resistor, 12K ohm 10% 2w	.15
C171-2		Capacitor, .01 20% 400V	.23
R161-2		Resistor, 1800 ohm 10% ½w	.15
R162-2		Resistor, 820 ohm 10% ½w	.15
R193-1		Resistor, 1 meg 20% ½w	.15
C172-1		Capacitor, .0047 ufd 20% 600V	.23
	N25731-1	Tuner	31.00

PARTS LIST CHANGE 132.024-3

PARTS DELETED

A21677-1		Phono Socket	
R186		Resistor 22K ohm 10% ½w	

PARTS ADDED

N19552		Phono Jack	.11
R186-1		Resistor, 680K ohm 10% ½w	.15
	N40131-1	Phono-TV Switch	

PARTS LIST CHANGE 132.024-31

PARTS DELETED

	N22820-1	Color Socket	
	N24406	Color Plug	
R216		Resistor, 68 ohm 20% ½w	
R116		Resistor, 47K ohm 10% ½w	
	N25596	Mask, Pix Tube	

PARTS ADDED

R116-1		Resistor, 100K 10% ½w	.15
	N40211	Mask, Pix Tube	4.60

PRODUCTION CHANGES

132.024-1 Chassis is the initial production run, and is an earlier chassis than 132.024.

132.024 Chassis Incorporates the Following Production Changes:

1. C171 changed from .01 mfd. to .022 mfd.
2. R194 changed from 12K. to 15K.
3. R204 changed from 220 ohm to 300 ohm.
4. R216, 68 ohm, added from pin 5 of V10 to junction of R151 and C4.
5. Color socket wired in and color plug added.

Color socket wired as follows:

a. Pin 2 to B+ source.
b. Pin 3 to B+ load.
c. Pin 4 to junction of R151 and R216.
d. Pin 5 to Pin 5 of V10.
e. Pin 6 to ground
f. Pin 7 to pin 5 of V12A.
g. Pins 8 and 1 not wired.

Color plug wired as follows:

a. Pins 4 and 5 shorted together.
b. Pins 2 and 3 shorted together.

6. C192, 1000 uuf, added from RF AGC (in parallel with C188) to ground.
7. R217, 220 K., added from junction of R154 and C153 to ground.
8. R153, 4700 ohm, wired from junction of L112 and R155 to +300 V. instead of to +130 V.
9. R189 wired to +300 V. through 100 K. (R218).

132.024-2 Chassis Incorporates the Following Production Changes:

1. T112 Width Control (N24991) changed to T112-1 Width Control (N40027).
2. R215, 68K resistor changed to R215-1, 22K resistor to reduce horizontal jitter.
3. R161, 1800 ohm resistor changed to R161-1, 1500 ohm resistor.
4. R162, 820 ohm resistor changed to R162-1, 1500 ohm resistor.
5. R194-1, 15K resistor changed to R194-2, 12K resistor to improve horizontal stability (132.024-1 only).
6. C161-1, .022 capacitor changed to C171-2, .01 capacitor to improve horizontal stability (132.024-1 only).

Additional changes not shown on dash 2 schematic, but which were made before production of 132.024-2 chassis are as follows:

1. R161-1, 1500 ohm resistor changed back to R161-2, 1800 ohm resistor.
2. R162-1, 1500 ohm resistor changed back to R162-2, 820 ohm resistor.
3. R193, 470K resistor changed to R193-1, 1 megohm resistor.
4. C172, .01 capacitor changed to C172-1, .005 capacitor to remove vertical twist in picture.

132.024-3 Chassis Incorporates the Following Production Changes:

1. Phono-TV switch added to chassis.
2. Make-break phono socket changed to phono jack.

Additional changes not shown on dash 3 schematic but which were made before production of 132.024-3 chassis are as follows:

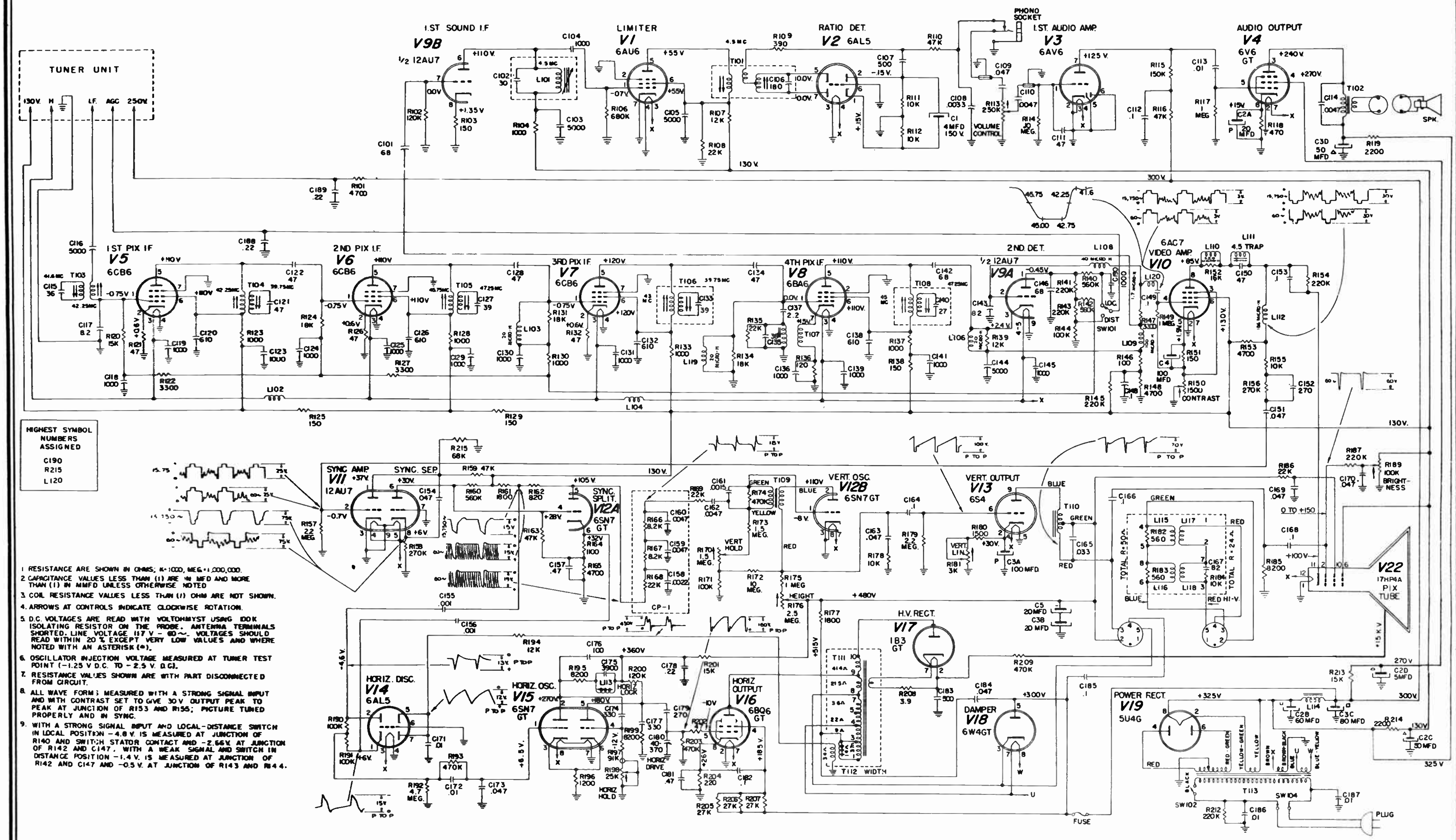
1. R186-1, 680K was R186, 22K.
2. R186-1 rewired from TV contact of Ph-TV Switch to tap of T110.
3. C169 rewired from junction of R186-1 and TV contact of Ph-TV Switch to ground.

132.024-31 Chassis Incorporates the Following Production Changes:

1. R216 removed from Pin 5 of V10 and junction of C4 and R151.
2. R116 changed from 47K to R116-1, 100K.
3. Color socket and color plug removed
   a. B+ source connected to B+ load.
   b. Lead from Pin 5 of V12A removed
   c. Pin 5 of V10 connected directly to junction of C4 and R151.
4. Picture tube mask changed from N25596 to N50211.

Note —— Later production of chassis 132.024-3 also incorporated this new mask. Masks are not interchangeable. The new mask has N40211 stamped on the back side for identification.

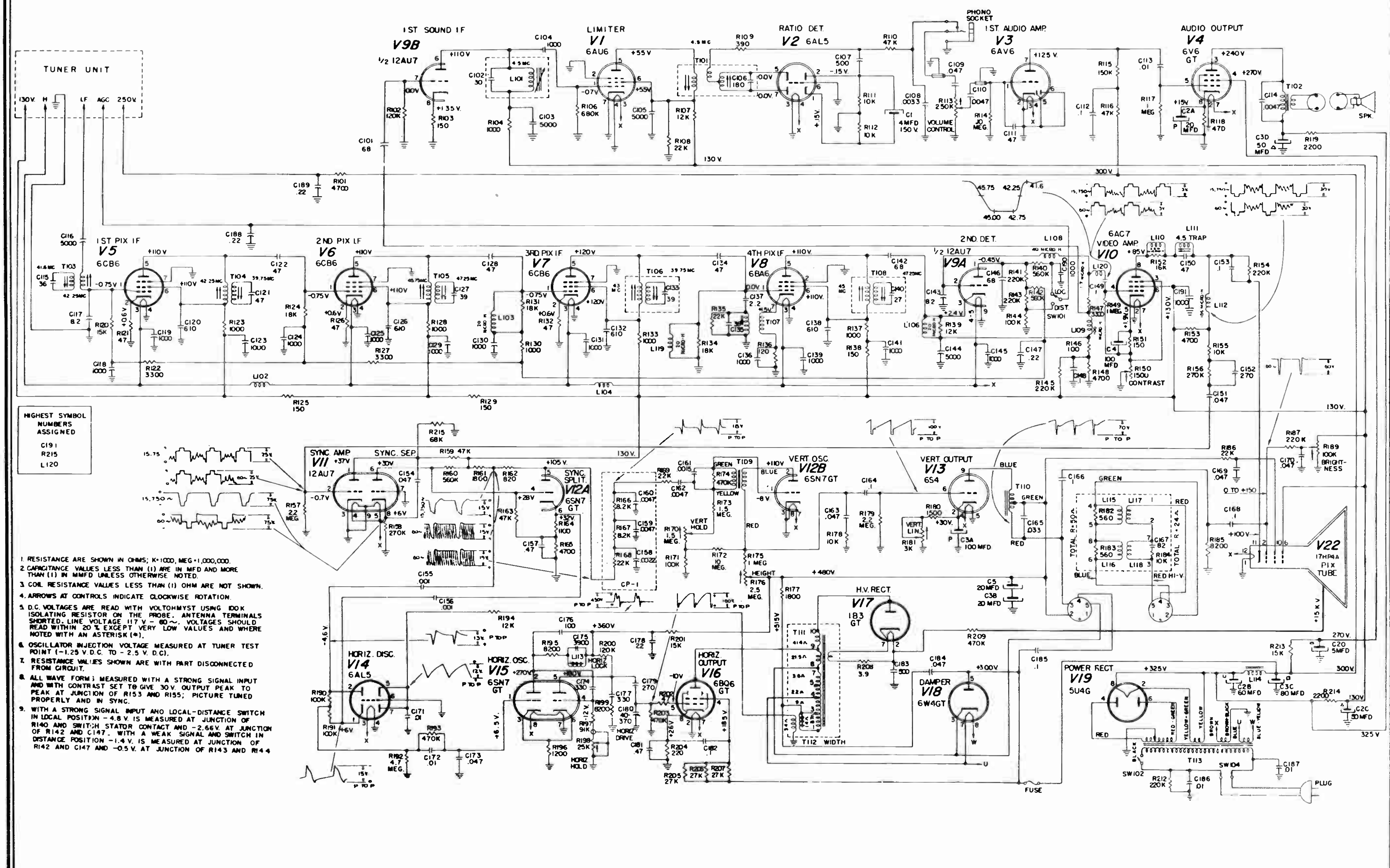
CHASSIS 132.024



HIGHEST SYMBOL NUMBERS ASSIGNED
C190
R215
L120

1. RESISTANCE ARE SHOWN IN OHMS; K=1000, MEG=1,000,000.
2. CAPACITANCE VALUES LESS THAN (1) ARE IN MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED
3. COIL RESISTANCE VALUES LESS THAN (1) OHM ARE NOT SHOWN.
4. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.
5. D.C. VOLTAGES ARE READ WITH VOLTOHMYST USING 100K ISOLATING RESISTOR ON THE PROBE. ANTENNA TERMINALS SHORTED. LINE VOLTAGE 117 V - 60~. VOLTAGES SHOULD READ WITHIN 20 % EXCEPT VERY LOW VALUES AND WHERE NOTED WITH AN ASTERISK (*).
6. OSCILLATOR INJECTION VOLTAGE MEASURED AT TUNER TEST POINT (−1.25 V D.C. TO − 2.5 V. D.C.).
7. RESISTANCE VALUES SHOWN ARE WITH PART DISCONNECTED FROM CIRCUIT.
8. ALL WAVE FORMS MEASURED WITH A STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE 30 V OUTPUT PEAK TO PEAK AT JUNCTION OF R153 AND R155; PICTURE TUNED PROPERLY AND IN SYNC.
9. WITH A STRONG SIGNAL INPUT AND LOCAL-DISTANCE SWITCH IN LOCAL POSITION −4.8 V. IS MEASURED AT JUNCTION OF R140 AND SWITCH STATOR CONTACT AND −2.66 V. AT JUNCTION OF R142 AND C147. WITH A WEAK SIGNAL AND SWITCH IN DISTANCE POSITION −1.4 V. IS MEASURED AT JUNCTION OF R142 AND C147 AND −0.5 V. AT JUNCTION OF R143 AND R144.

CHASSIS 132.024-1

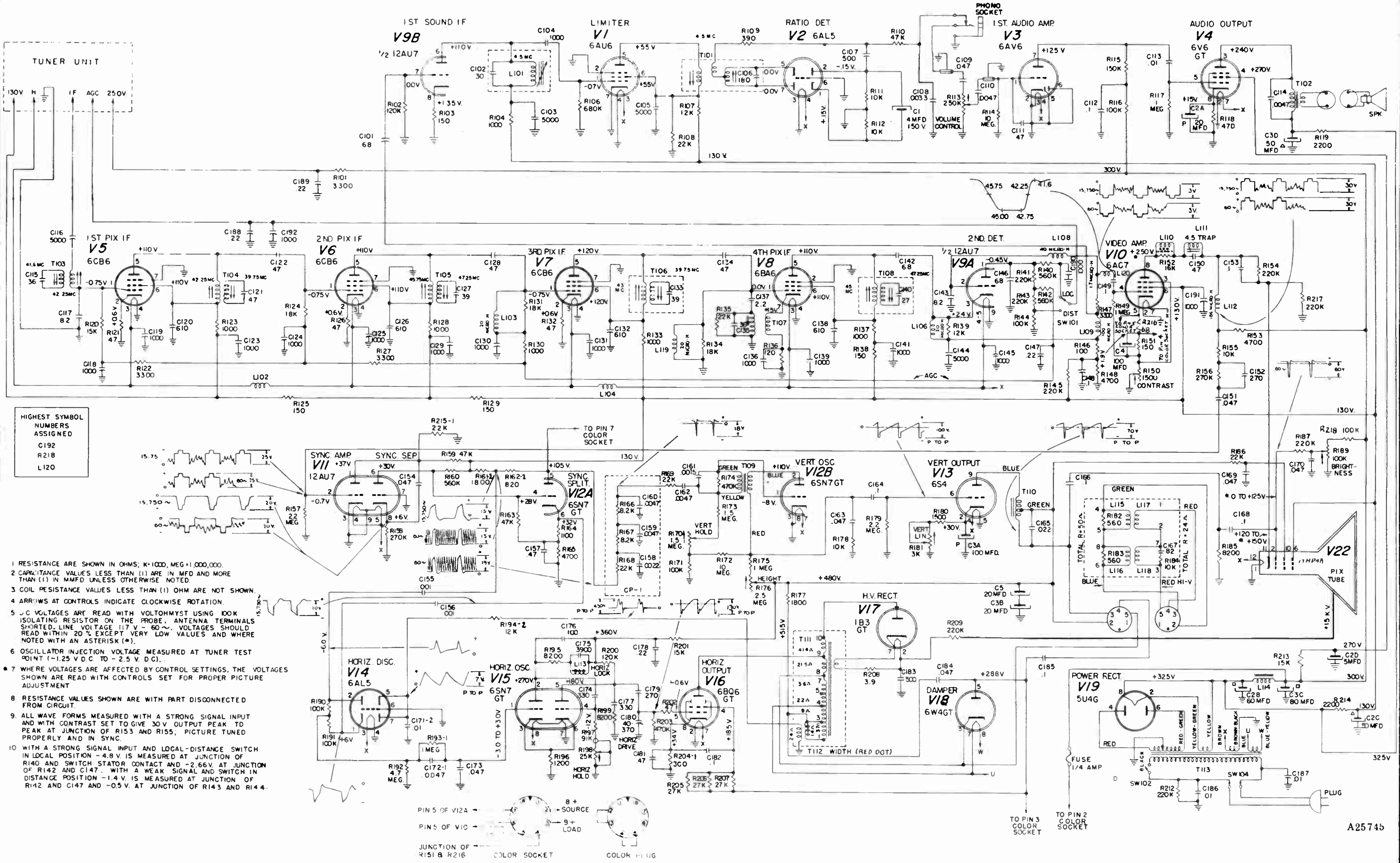


HIGHEST SYMBOL NUMBERS ASSIGNED

C191
R215
L120

1. RESISTANCE ARE SHOWN IN OHMS; K=1000, MEG=1,000,000.
2. CAPACITANCE VALUES LESS THAN (1) ARE IN MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED.
3. COIL RESISTANCE VALUES LESS THAN (1) OHM ARE NOT SHOWN.
4. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.
5. D.C. VOLTAGES ARE READ WITH VOLTOHMYST USING 100K ISOLATING RESISTOR ON THE PROBE. ANTENNA TERMINALS SHORTED. LINE VOLTAGE 117 V - 60~. VOLTAGES SHOULD READ WITHIN 20% EXCEPT VERY LOW VALUES AND WHERE NOTED WITH AN ASTERISK (*).
6. OSCILLATOR INJECTION VOLTAGE MEASURED AT TUNER TEST POINT (-1.25 V.D.C. TO - 2.5 V. D.C).
7. RESISTANCE VALUES SHOWN ARE WITH PART DISCONNECTED FROM CIRCUIT.
8. ALL WAVE FORMS MEASURED WITH A STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE 30V. OUTPUT PEAK TO PEAK AT JUNCTION OF R153 AND R155; PICTURE TUNED PROPERLY AND IN SYNC.
9. WITH A STRONG SIGNAL INPUT AND LOCAL-DISTANCE SWITCH IN LOCAL POSITION -4.8 V. IS MEASURED AT JUNCTION OF R140 AND SWITCH STATOR CONTACT AND -2.66V. AT JUNCTION OF R142 AND C147. WITH A WEAK SIGNAL AND SWITCH IN DISTANCE POSITION -1.4 V. IS MEASURED AT JUNCTION OF R142 AND C147 AND -0.5 V. AT JUNCTION OF R143 AND R144

SCHEMATIC DIAGRAM FOR 132.024-2



1 RESISTANCE ARE SHOWN IN OHMS; K=1000, MEG=1,000,000.

2 CAPACITANCE VALUES LESS THAN (1) ARE IN MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED.

3 COIL RESISTANCE VALUES LESS THAN (1) OHM ARE NOT SHOWN.

4 ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.

5 DC VOLTAGES ARE READ WITH VOLTOHMYST USING 100K ISOLATING RESISTOR ON THE PROBE. ANTENNA TERMINALS SHORTED. LINE VOLTAGE 117 V - 60 ~. VOLTAGES SHOULD READ WITHIN 20 % EXCEPT VERY LOW VALUES AND WHERE NOTED WITH AN ASTERISK (*).

6 OSCILLATOR INJECTION VOLTAGE MEASURED AT TUNER TEST POINT (-1.25 V D.C. TO - 2.5 V. D.C).

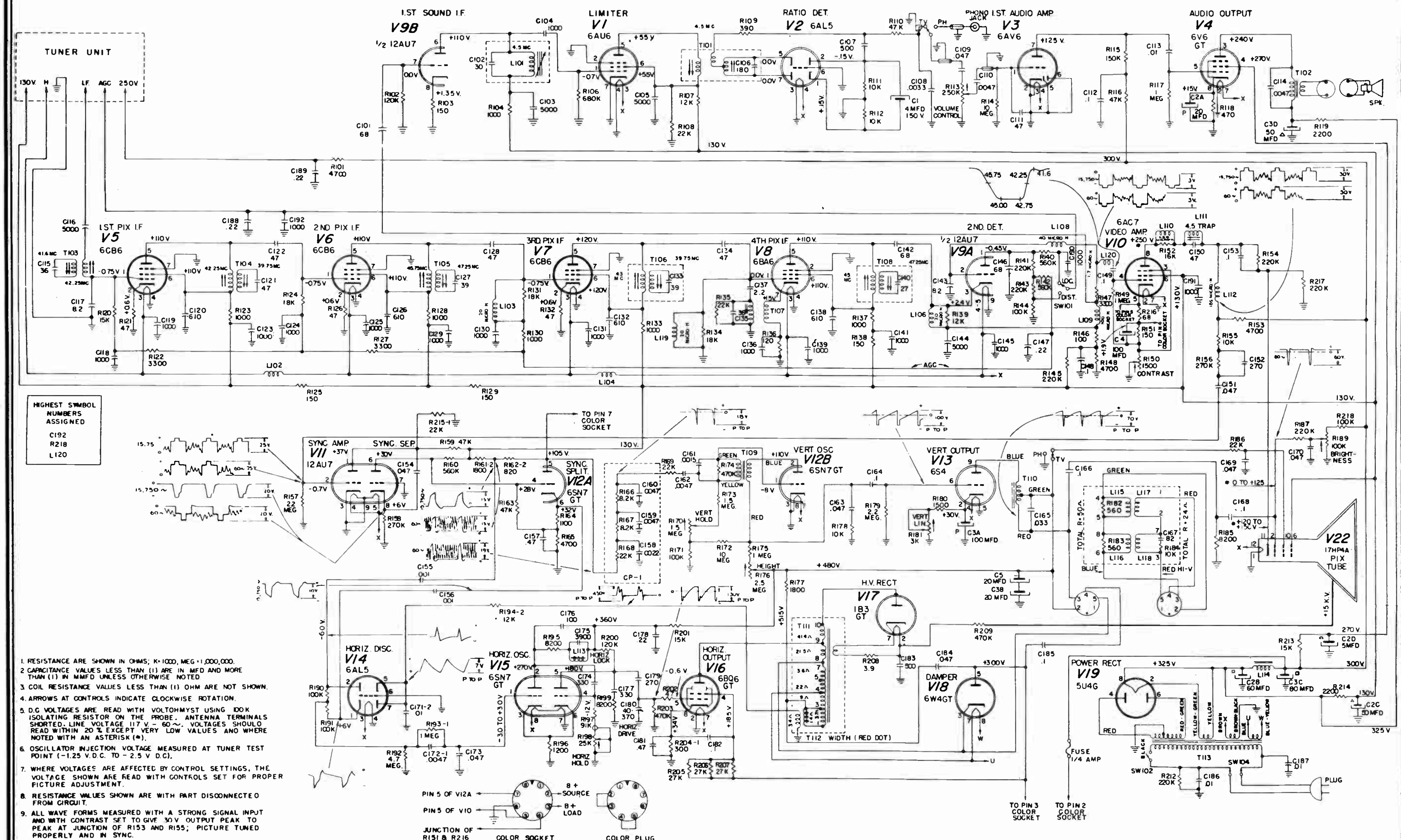
* 7 WHERE VOLTAGES ARE AFFECTED BY CONTROL SETTINGS, THE VOLTAGES SHOWN ARE READ WITH CONTROLS SET FOR PROPER PICTURE ADJUSTMENT

8 RESISTANCE VALUES SHOWN ARE WITH PART DISCONNECTED FROM CIRCUIT.

9. ALL WAVE FORMS MEASURED WITH A STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE 30 V OUTPUT PEAK TO PEAK AT JUNCTION OF R153 AND R155; PICTURE TUNED PROPERLY AND IN SYNC.

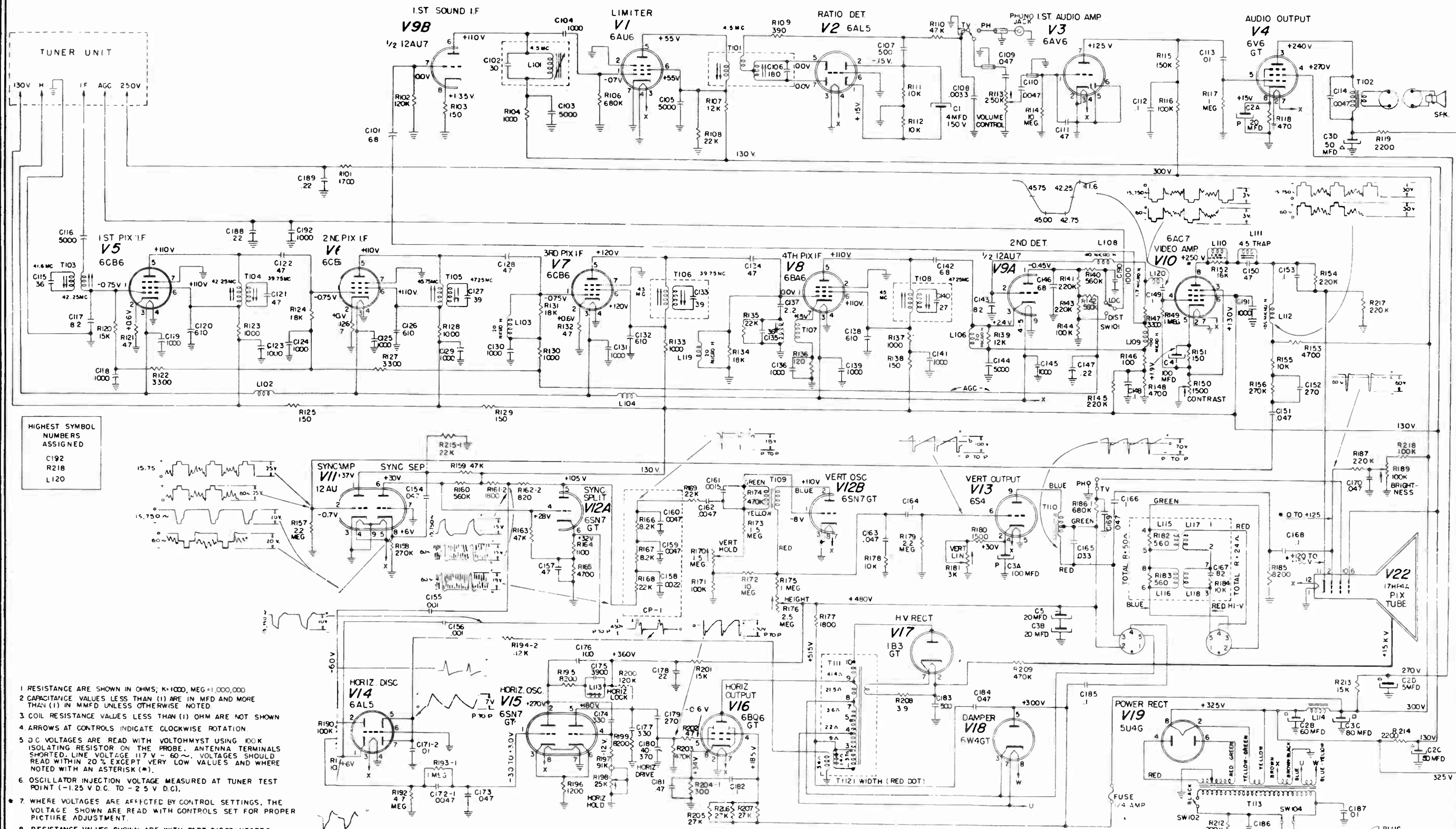
10 WITH A STRONG SIGNAL INPUT AND LOCAL-DISTANCE SWITCH IN LOCAL POSITION -4.8 V. IS MEASURED AT JUNCTION OF R140 AND SWITCH STATOR CONTACT AND -2.66 V. AT JUNCTION OF R142 AND C147. WITH A WEAK SIGNAL AND SWITCH IN DISTANCE POSITION -1.4 V. IS MEASURED AT JUNCTION OF R142 AND C147 AND -0.5 V. AT JUNCTION OF R143 AND R144.

CHASSIS 132.024-3



1. RESISTANCE ARE SHOWN IN OHMS; K=1000, MEG=1,000,000.
2. CAPACITANCE VALUES LESS THAN (1) ARE IN MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED
3. COIL RESISTANCE VALUES LESS THAN (1) OHM ARE NOT SHOWN.
4. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.
5. D.C VOLTAGES ARE READ WITH VOLTOHMYST USING 100K ISOLATING RESISTOR ON THE PROBE. ANTENNA TERMINALS SHORTED. LINE VOLTAGE 117 V. - 60 ~. VOLTAGES SHOULD READ WITHIN 20 % EXCEPT VERY LOW VALUES AND WHERE NOTED WITH AN ASTERISK (*).
6. OSCILLATOR INJECTION VOLTAGE MEASURED AT TUNER TEST POINT (-1.25 V.D.C. TO - 2.5 V D.C).
7. WHERE VOLTAGES ARE AFFECTED BY CONTROL SETTINGS, THE VOLTAGE SHOWN ARE READ WITH CONTROLS SET FOR PROPER PICTURE ADJUSTMENT.
8. RESISTANCE VALUES SHOWN ARE WITH PART DISCONNECTED FROM CIRCUIT.
9. ALL WAVE FORMS MEASURED WITH A STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE 30 V OUTPUT PEAK TO PEAK AT JUNCTION OF R153 AND R155; PICTURE TUNED PROPERLY AND IN SYNC.
10. WITH A STRONG SIGNAL INPUT AND LOCAL-DISTANCE SWITCH IN LOCAL POSITION -4.8 V. IS MEASURED AT JUNCTION OF R140 AND SWITCH STATOR CONTACT AND -2.66 V. AT JUNCTION OF R142 AND C147. WITH A WEAK SIGNAL AND SWITCH IN DISTANCE POSITION -1.4 V. IS MEASURED AT JUNCTION OF R142 AND C147 AND -0.5 V. AT JUNCTION OF R143 AND R144.

CHASSIS 132.024-31



1 RESISTANCE ARE SHOWN IN OHMS; K=1000, MEG=1,000,000
2 CAPACITANCE VALUES LESS THAN (1) ARE IN MFD AND MORE THAN (1) IN MMFD UNLESS OTHERWISE NOTED
3 COIL RESISTANCE VALUES LESS THAN (1) OHM ARE NOT SHOWN
4. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.
5 D.C VOLTAGES ARE READ WITH VOLTOHMYST USING 100 K ISOLATING RESISTOR ON THE PROBE. ANTENNA TERMINALS SHORTED. LINE VOLTAGE 117 V - 60 ~. VOLTAGES SHOULD READ WITHIN 20 % EXCEPT VERY LOW VALUES AND WHERE NOTED WITH AN ASTERISK (*).
6. OSCILLATOR INJECTION VOLTAGE MEASURED AT TUNER TEST POINT (-1.25 V D.C. TO -2.5 V D.C).
* 7. WHERE VOLTAGES ARE AFFECTED BY CONTROL SETTINGS, THE VOLTAGE SHOWN ARE READ WITH CONTROLS SET FOR PROPER PICTURE ADJUSTMENT.
8. RESISTANCE VALUES SHOWN ARE WITH PART DISCONNECTED FROM CIRCUIT.
9. ALL WAVE FORMS MEASURED WITH A STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE 30 V OUTPUT PEAK TO PEAK AT JUNCTION OF R153 AND R155; PICTURE TUNED PROPERLY AND IN SYNC.
10. WITH A STRONG SIGNAL INPUT AND LOCAL-DISTANCE SWITCH IN LOCAL POSITION -4.8 V IS MEASURED AT JUNCTION OF R140 AND SWITCH STATOR CONTACT AND -2.66 V. AT JUNCTION OF R142 AND C147. WITH A WEAK SIGNAL AND SWITCH IN DISTANCE POSITION -1.4 V. IS MEASURED AT JUNCTION OF R142 AND C147 AND -0.5 V AT JUNCTION OF R143 AND R144.

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DESCRIPTION OF CHASSIS

CHASSIS NO.	DESCRIPTION
110.817-1	21 Tube Television Receiver Chassis including retifiers and 17" Glass Rectangular Electrostatic Focused Picture Tube.
110.820-1	21 Tube Television Receiver Chassis including rectifiers and 20" Glass Rectangular Electrostatic Focused Picture Tube.

NO.	DESCRIPTION	CHASSIS NUMBER
2100A	17" Wood, Leatherette Covered, Table Model Television Receiver with Built-in Antenna.	110. 817-1
2140	17" Wood, Mahogany Open Face Console Television Receiver with Built-in Antenna.	110.817-1
2150A	20" Wood, Mahogany Open Face Console Television Receiver with Built-in Antenna.	110.820-1

TUBE COMPLEMENT FOR CHASSIS

CHASSIS 110.817-1, 110.820-1

FUNCTION		TYPE	FUNCTION		TYPE
RF AMPLIFIER	V1	6BC5	PHASE INVERTER	V12B	1/2 12BH7
RF CONVERTER	V2	6J6	SYNC SEPARATOR	V13	12BZ7
1ST IF AMPLIFIER	V3	6CB6	VERTICAL SWEEP OSCILLATOR	V14A	1/2 12BH7
2ND IF AMPLIFIER	V4	6CB6	VERTICAL SWEEP OUTPUT	V14B	1/2 12BH7
3RD IF AMPLIFIER	V5	6CB6	HORIZONTAL PHASE DETECTOR	V15	6AL5
VIDEO DETECTOR	V6	6AL5	HORIZONTAL SWEEP OSCILLATOR	V16	12BH7
1ST VIDEO AMPLIFIER	V7A	1/2 12BH7	HORIZONTAL SWEEP OUTPUT	V17	6BQ6GT
2ND VIDEO AMPLIFIER	V7B	1/2 12BH7	HI-VOLTAGE RECTIFIER	V18	1AX2
RATIO DETECTOR DRIVER	V8	6AU6	HORIZONTAL DAMPER	V19	6W4GT
RATIO DETECTOR(AUDIO)	V9	6AL5	POWER SUPPLY RECTIFIER	V20	5U4G
AUDIO AMPLIFIER	V10	6SQ7GT	PICTURE TUBE	V21	**
AUDIO OUTPUT	V11	6V6GT	**V21 For 110.817-1		17HP4
SYNC AMPLIFIER	V12A	1/2 12BH7	110.820-1		20HP4A

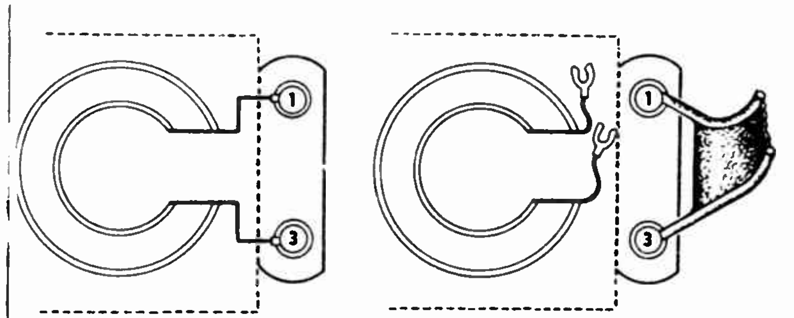
FIG. 1

GENERAL SPECIFICATIONS

MODEL	2100A	2140	2150A
CHASSIS	110.817-1	110.817-1	110.820-1
TYPE	Table	Open Face Console	Open Face Console
PICTURE TUBE	17" Rect.	17" Rect.	20" Rect.
CABINET	Leatherette	Wood Mah.	Wood Mah.
BUILT-IN ANTENNA	Yes	Yes	Yes
ANTENNA IMPUT IMPEDENCE	300 Ohm	300 Ohm	300 Ohm
SPEAKER	5" PM	5" PM	6" PM
TOTAL POWER CONSUMPTION 117V 60 CYCLE	210W	210W	210W
AUDIO OUTPUT MAX. WATTS	2.5w	2.5w	2.5w
PACKED WEIGHT	70 lbs.	94 lbs.	112 lbs.
CABINET WIDTH	18	18	21-15/16
CABINET DEPTH	18-1/2	19	19
CABINET HEIGHT	16-15/16	35	36-9/16

ANTENNA SYSTEM

All models covered in this manual feature a built-in antenna which is shipped connected to the receiver input. In those installations where an external antenna is desired, it will be necessary to disconnect the built-in antenna from terminals shown in Fig. 2 and connect the external antenna lead-in to these terminals.



CONNECTION FOR BUILT- IN ANTENNA · CONNECTION FOR 300 OHM ANTENNA LEAD-IN WIRE

CONNECTING ANTENNA TO RECEIVER

FOR 300 Ω TWIN LEAD

FIG. 2

FRONT PANEL OPERATING CONTROLS

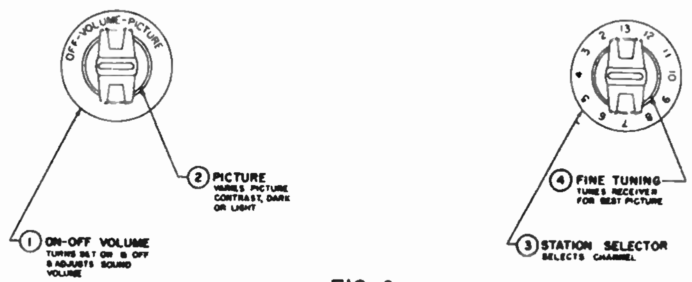
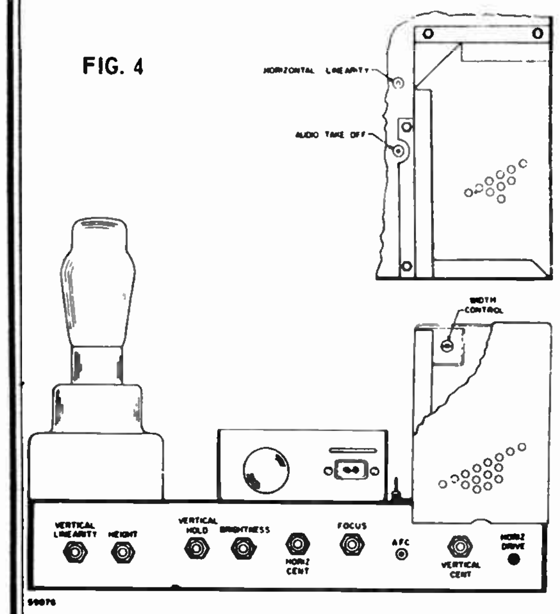


FIG. 3

650

REAR OF CHASSIS

FIG. 4



T. V. BLOCK DIAGRAM

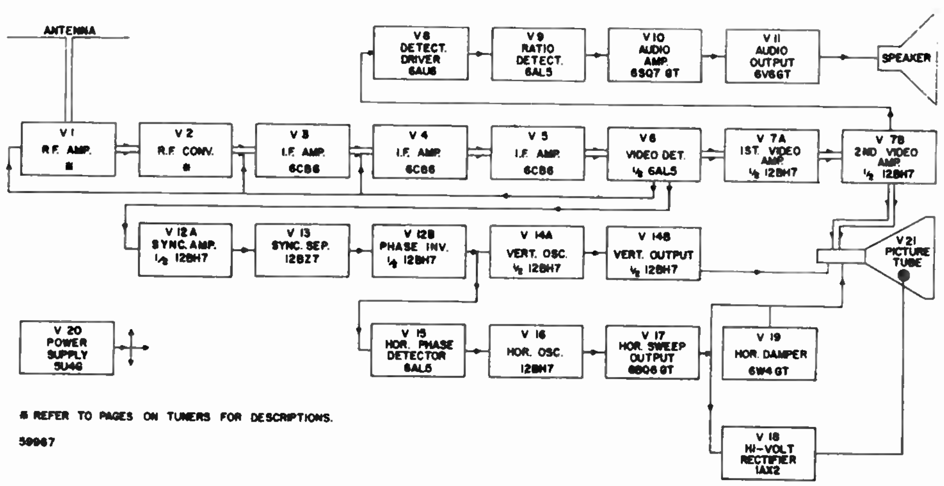


FIG. 5

CIRCUIT DESCRIPTION

TUNER CIRCUIT DESCRIPTION IS GIVEN IN SECTION ON TUNERS.

INTERMEDIATE FREQUENCY AMPLIFIERS — BLOCKS V3, V4, AND V5:

The I. F. picture and sound signals are amplified by 3 stages of wide-band I. F. amplification, V3, V4, and V5. A stagger-tuned I. F. system is utilized in this receiver, and correct response is obtained by aligning the R. F. converter plate load inductance to 22.8 mc., the plate load inductance of the 1st I. F. stage to 25.4 mc., the inductance coupling the 2nd and 3rd I. F. stages to 22.8 mc., and the inductance in the video detector plate to 25.4 mc.

VIDEO DETECTOR AND AUTOMATIC GAIN CONTROL V6:

This Stage detects the video signal and acts as a converter for sound information in producing the 4.5 mc. difference frequency between the 25.75 mc. and 21.25 mc. carrier frequencies. A portion of the demodulated signal from this stage is properly filtered and of proper polarity for effecting the grid bias on the R. F. amplifier of the tuner and the first two I. F. stages to accomplish Automatic Gain Control.

VIDEO AMPLIFIER V7:

The output of the video detector is directly-coupled to the grid of the first triode amplifier. The signal is amplified and capacity-coupled to the grid of the second amplifier. The output of this triode amplifier is capacity-coupled to the grid of the picture tube. In the plate circuit of the second video amplifier is the tuned sound trap which is adjusted to attenuate the 4.5 mc. beat pattern appearing on the screen. Contrast control setting regulates the amount of degenerative cathode feedback in the second video amplifier.

SOUND DETECTOR DRIVER — BLOCK V8:

The frequency-modulated 4.5 mc. difference between the 25.75 mc. picture intermediate frequency and the 21.25 mc. sound intermediate frequency is separated from the composite video amplifier output by means of a tuned take-off coil, the voltage across which is applied to the grid of the Detector driver, V8. This stage amplifies the 4.5 mc. frequency-modulated signal for delivery to the following ratio detector stage. Plate limiting to clip unwanted AM interference is also provided in this detector driver stage.

SOUND RATIO DETECTOR — BLOCK V9:

The amplified and clipped 4.5 mc. frequency-modulated sound information is coupled through a tuned transformer to the twin diodes of V9, the sound detector. This is a conventional ratio-type FM sound detector, wherein the frequency modulated 4.5 mc. information is converted to audio.

AUDIO VOLTAGE AMPLIFIER — BLOCK V10:

The previously detected audio is taken from the tertiary winding of the discriminator transformer and delivered through a voltage dropping potentiometer (front panel Volume control) to the grid of the audio voltage amplifier. A 6SQ7 is used as the audio voltage amplifier. The diode section of the 6SQ7 is grounded.

AUDIO TUBE — BLOCK V11:

The previously amplified audio is fed to the grid of 6V6-GT tube, which is used as a conventional single-ended power amplifier. The output of this stage is coupled to the voice coil of the permanent magnet speaker through a speaker transformer.

SYNC AMP. — BLOCK V12A:

To provide a sync signal which is independent of contrast control settings, the composite signal to be used for sync is taken-off at the video detector, (V6) and is fed sync negative to the sync amplifier, (V12A). Here it is amplified, inverted, and then fed through a noise-immune double-time-constant coupling network to the grids of the Sync Separator.

SYNC SEPARATOR — BLOCK V13:

The positive-going composite signal appearing at the grids of the sync separator is of such magnitude that only the sync information is permitted to be amplified by this stage V13; the video information being driven below cut-off of V13, and therefore not amplified. Note that the two halves of V13 are connected essentially in parallel, forming a "dual-channel" sync separator to provide superior impulse-noise-immunity.

PHASE INVERTER — BLOCK V12B:

The negative sync pulses supplied to the grid of this stage from the previous stage are distributed to provide equal amplitude but out-of-phase horizontal pulses for delivery to the horizontal phase detector, as well as single-ended vertical pulses to the vertical Sweep Oscillator. The two out-of-phase horizontal pulses result from taking balanced outputs from both the cathode and plate of this stage. The long duration vertical pulses are taken from the plate circuit only, and are passed through a suitable integrating network for delivery to the vertical oscillator.

VERTICAL SWEEP BLOCKING OSCILLATOR — BLOCK V14A:

This is a conventional Blocking Oscillator wherein the integrated vertical pulse is used to trigger the grid of the oscillator. This oscillator frequency is controlled from the rear chassis (Vertical Hold), which is a potentiometer affecting the time constant (discharge rate) of this grid.

VERTICAL SWEEP OUTPUT — BLOCK V14B:

The oscillations from the Vertical Oscillator are coupled to the grid of this stage for amplification and delivery to the vertical output transformer. There is a control in the plate circuit of V14A (rear chassis "Height Control") which is a potentiometer affecting the plate voltage of the blocking oscillator. There is also a control in the cathode of V14B (rear chassis Vertical Linearity) which affects the gain of the stage.

HORIZONTAL PHASE DETECTOR — BLOCK V15:

The balanced, but out-of-phase horizontal sync pulses from the phase inverter above are delivered to the plate of one section of this twin diode, and to the cathode of the other section. In this stage these two pulses (negative and positive) are compared with a portion of the output saw-tooth horizontal sweep. If the subsequent horizontal sweep oscillator tends to drift, there will result in this phase detector a phase change in the relationship of the sync pulses to the saw-tooth sweep, which is converted into a D. C. bias delivered to the grid of the horizontal sweep oscillator, thus correcting the frequency of the horizontal oscillator.

HORIZONTAL SWEEP OSCILLATOR — BLOCK V16:

This oscillator is a conventional cathode-coupled multivibrator with control voltage derived from V15, the Horizontal phase detector. There is a rear chassis AFC control which provides frequency adjustment of this oscillator. This control is a tunable inductance which affects a resonant tank circuit in one of the plates of this stage.

HORIZONTAL SWEEP OUTPUT — BLOCK V17:

The sawtooth output of the horizontal oscillator is fed through the adjustable voltage-dropping horizontal drive network to the grid of the Horizontal Sweep Output tube. The amount of drive applied to this grid can be adjusted on the rear of the chassis by varying a capacitance in the voltage dividing network. The output of this stage is applied to the horizontal deflection coils through the impedance-matching Horizontal Output Transformer. A portion of the secondary of this transformer is shunted by a variable inductance (rear chassis "WIDTH" control) which offers an adjustment on the width of the picture.

HORIZONTAL DAMPER — BLOCK V19:

The 6W4 Horizontal Damping tube is connected across the transformer secondary to damp out oscillations created during rapid retrace of the sawtooth current wave. This circuit provides control of horizontal linearity and also uses some of the inductive kickback voltage to supply additional B+ for the horizontal and vertical sweep systems.

POWER SUPPLY — BLOCK V20:

This is a conventional power supply providing D. C. potential to all stages of the chassis with the exception of the picture tube 2nd Anode, the High Voltage rectifier and the Horizontal damper. In addition to providing 6.3 volt filament supply for all stages, there is a separate 6.3 volt filament winding for the heater of the horizontal damper tube. Filter networks in the 117 volt 60 cycle supply, in the D. C. plate supply, and in the filament supply, minimize unwanted interference, interaction and fluctuation.

PARTS REMOVAL

TO REMOVE THE CHASSIS FROM THE CABINET:

1 - Remove the screws holding the back to the cabinet and interlock bracket.
2 - Remove the screws holding the antenna terminal strip to the cabinet.
3 - Reach into the cabinet from the rear and remove the speaker plug from the speaker socket. (In some table models it may be necessary to remove the speaker.)
4 - Remove all the knobs from the front of the cabinet by pulling them straight out.
5 - Remove the mounting screws from the base of the chassis. These screws will be found under the cabinet in the table models and under the chassis mounting board in the console models.
6 - Slide the chassis straight out being careful not to hit the picture tube.
7 - To replace the chassis reverse the operations listed above.

TO REMOVE THE PICTURE TUBE FROM THE CHASSIS:

1 - Remove the socket from the base of the tube by sliding the socket straight back.
2 - Slide ion trap magnet straight back off the neck of the tube.
3 - Remove the screw holding the strap around the face of the picture tube.
4 - Lift the picture tube slightly so as to clear the front brackets and slide the tube straight forward.
5 - To replace reverse the above operations making sure that the picture tube rests against its front stop bracket and that the yoke is as far forward on the tube as possible.

ADJUSTMENTS OF PICTURE TUBE CONTROLS

IF IT SHOULD BECOME NECESSARY TO READJUST THE PICTURE TUBE CONTROLS PROCEED AS FOLLOWS:

ION TRAP MAGNET ADJUSTMENT:

1 - Turn the OFF-ON switch to the ON position.
2 - Turn the PICTURE control fully counterclockwise.
3 - Turn the BRIGHTNESS control fully clockwise. (This control will be found on the rear apron of the chassis.)
4 - The ion trap magnet should be approximately 1/2 inch from the top edge of the picture tube base. Starting from this position adjust the ion trap magnet by moving it forward and backward, at the same time rotating it slightly around the neck of the tube for the brightest raster on the screen.
5 - Reduce the Brightness control until the raster is slightly above average brilliance.
6 - The final touches on this adjustment should be made with the brightness control at the maximum position in which good line focus can be maintained. THIS ADJUSTMENT SHOULD BE MADE ONLY AFTER THE PICTURE IS PROPERLY CENTERED, FOCUSED, AND FRAMED AS DESCRIBED IN THE FOLLOWING PARAGRAPHS.

NOTE: THE RECEIVER SHOULD BE TUNED TO A TEST PATTERN FOR ALL OF THE FOLLOWING ADJUSTMENTS:

A recommended sequence for the following operations is that the serviceman, set the horizontal and vertical controls for a picture lock-in position. Then adjust the focus, horizontal and vertical centering controls. Next adjust the horizontal and vertical size controls in conjunction with the respective linearity controls.

The serviceman should then go back and make the final adjustments so that the picture holds on all channels. The sequence of steps of the following operations is not significant.

CENTERING PICTURE AND REMOVAL OF NECK SHADOW:

1 - Adjust the vertical and horizontal centering control located on the rear apron of the chassis Figure 5, to the center of their range.
2 - Place the yoke as far forward as possible on the neck of the tube. BE SURE THAT IT IS NOT CATCHING ON THE MOUNTING HOOD. THE YOKE WINDING MUST BE IN CONTACT WITH THE FLARE OF THE PICTURE TUBE. Tighten the yoke in position by means of its adjusting thumb screw. BE SURE THAT THE PICTURE IS NOT TILTED. IF IT IS, ROTATE THE YOKE UNTIL THE PICTURE IS STRAIGHT BEFORE TIGHTENING THE THUMB SCREW, FIGURE 5.
3 - Center the picture by adjusting the horizontal and vertical centering controls on the rear apron of the chassis.

FOCUS ADJUSTMENT:

THE PICTURE TUBE EMPLOYED IN THIS TELEVISION RECEIVER IS CONSTRUCTED TO PROVIDE PREFIXED FOCUSING. THE FOCUS CONTROL ON THE REAR CHASSIS APRON IS PROVIDED IF ADJUSTMENT IS REQUIRED.

HORIZONTAL AFC ADJUSTMENT

1 - Adjust the AFC control screw on the rear of the chassis so that the picture locks into horizontal sync.
2 - Turn The Channel Selection Switch through the various stations and make sure that it always lock into horizontal sync. If it should fail to do this readjust the AFC control screw until this condition is obtained.

HEIGHT AND VERTICAL LINEARITY:

1 - Adjust the height control, located on the rear of the chassis, until the picture fills the mask.
2 - Adjust the vertical linearity control on the rear of the chassis, until the test pattern is symmetrical from top to bottom.

NOTE: AN ADJUSTMENT OF EITHER CONTROL MAY REQUIRE READJUSTMENT OF THE OTHER CONTROL.

VERTICAL HOLD CONTROL:

1 - Adjust the vertical hold control, on the rear apron of the chassis Figure 5, until the picture locks in vertically.
2 - Switch the "Channel Selector" through the various stations and make sure that the picture always locks into vertical sync. If it should fail to do this readjust the vertical hold control until this condition is obtained.

WIDTH, HORIZONTAL DRIVE AND LINEARITY:

1 - Turn the horizontal drive control on the rear of the chassis Figure 5, in either direction until you obtain the greatest width without a vertical line or tear. Make sure this control is at least 3/4 of a turn from its maximum clockwise position to prevent damage to output tube and transformer.

2 - Adjust the width control until the picture fills the mask horizontally. The width control is located in the rear of the high voltage shield. Figure 5.

3 - Adjust the horizontal linearity coil, located on top of the chassis near the high voltage shield, for the best picture. Figure 16.

NOTE: AN ADJUSTMENT OF THE HORIZONTAL DRIVE MAY AFFECT THE ADJUSTMENT OF THE HORIZONTAL AFC CONTROL.

TELEVISION ALIGNMENT PROCEDURE

Aligning a television receiver is an exacting procedure and involves tying up bench space, test equipment and skilled personnel at the service shop, as well as the cost of making two trips to the user's home. Before deciding that the chassis must be pulled and aligned at the shop, the serviceman should check these very common sources of trouble;

1 - The antenna and installation.
2 - Front panel and rear chassis controls, including Picture Tube adjustments.
3 - Reception on all available channels.
4 - Tube failures. Substitute from your kit of known good replacements.
5 - Visual inspection of under side of chassis for obvious faults, such as loose connections, etc.

CAUTION: THE SECOND ANODE LEAD TO THE PICTURE TUBE HAS A POTENTIAL OF APPROXIMATELY 12,000 VOLTS. DURING THIS ALIGNMENT IT IS ADVISABLE TO REMOVE THE 6BQ6 TUBE FROM ITS SOCKET, THUS ELIMINATING THIS HIGH VOLTAGE HAZARD.

SEQUENCE OF ALIGNMENT:

It is recommended that the ratio detector driver be aligned first, followed by the ratio detector, I. F., and tuner alignments in that order unless the location of the misalignment is known.

AIDS IN SERVICING:

In addition to step-by-step alignment procedures following, see the instrument connection figures, and voltages and waveshapes charts.

TELEVISION CHANNEL VS CARRIER AND I-F AMPLIFIER

CHANNEL NO.	CHANNEL Freq. (mc.)	PICTURE CARRIER Freq. (mc.)	SOUND CARRIER Freq. (mc.)	RECEIVER OSC. Freq. (mc.)	PICTURE IF Freq. (mc.)	SOUND IF Freq.(mc.)	PICTURE IF less SOUND IF (mc.)
2	54-60	55.25	59.75	81.0	25.75	21.25	4.5
3	60-66	61.25	65.75	87.0	25.75	21.25	4.5
4	66-72	67.25	71.75	93.0	25.75	21.25	4.5
5	76-82	77.25	81.75	103.0	25.75	21.25	4.5
6	82-88	83.25	87.75	109.0	25.75	21.25	4.5
7	174-180	175.25	179.75	201.0	25.75	21.25	4.5
8	180-186	181.25	185.75	207.0	25.75	21.25	4.5
9	186-192	187.25	191.75	213.0	25.75	21.25	4.5
10	192-198	193.25	197.75	219.0	25.75	21.25	4.5
11	198-204	199.25	203.75	225.0	25.75	21.25	4.5
12	204-210	205.25	209.75	231.0	25.75	21.25	4.5
13	210-216	211.25	215.75	267.0	25.75	21.25	4.5

FIG. 6

RATIO DETECTOR DRIVER, RATIO DETECTOR, AND 4.5 MC TRAP ALIGNMENT

In aligning this section of the television receiver, the sound take-off must be resonated at 4.5 mc. to separate the sound from the picture information, and the ratio detector transformer must be adjusted to complete balance in the secondary winding for maximum AM rejection. The sound take-off coil is L113, located between the video amplifier V7 and the detector driver V8. The discriminator transformer is T100, located between the detector driver V8 and the ratio detector V9. A 4.5 mc. signal is fed into the video amplifier, and the sound trap and ratio detector are adjusted in proper sequence to obtain VTVM readings across the detector load resistor R126. To reduce visibility of 4.5 mc. beat pattern on screen, L110 is adjusted to attenuate the 4.5 mc. signal.

1 - Connect the VTVM across R126 with the positive lead from the meter to the chassis, and the negative lead to the other side of R126. This connection will be at pin 7 of the 6AL5, V9. See Figure 7A showing connection.
2 - Connect the signal generator output through a .001 mfd mica capacitor to pin 2 of the 12BH7 Video Amp. (input to the first video amplifier, V7A): Ground the other side of the generator to the chassis.
3 - Set the signal generator to precisely 4.5 mc. and adjust its output to provide about 10 volts reading on the VTVM.
4 - Adjust sound take-off coil L113 for maximum reading on the VTVM. This coil can be peaked at two points, and the peak point selected should be the one closest to the full counter-clockwise position of the slug. This setting minimizes the possibility of intercarrier buzz.
5 - Adjust the bottom slug on the discriminator transformer T100 for maximum reading on the VTVM.
6 - Connect signal generator to either side of C116, picture tube coupling capacitor; ground side to chassis.
7 - Adjust L110 for minimum reading on VTVM.
8 - Connect two 100K resistors across R126 as shown in figure 7B.
9 - Reconnect the VTVM, running one lead to the junction point of these two 100K resistors, and the other lead to the tertiary winding center lug of the discriminator transformer T100. See Figure 7B for these connections.
10 - Reconnect Signal Generator as in step 2, and adjust the top slug on T100. Note that during this adjustment, a point will be found where the VTVM will swing rather sharply from positive to negative, or vice versa. The correct setting of this adjustment is obtained when the VTVM pointer reads zero, as the slug is passed through this point.

INTERMEDIATE FREQUENCY ALIGNMENT

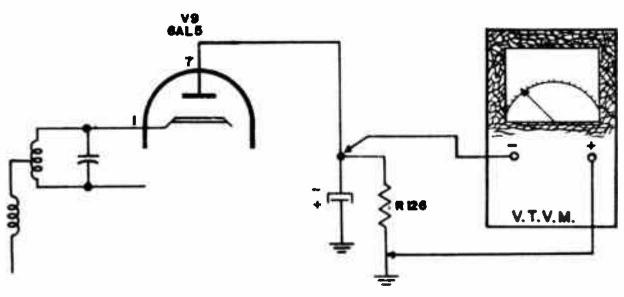
The IF alignment of the models covered in this manual is based on peaking one set of IF coils at 22.8 mc. and the other set of IF coils at 25.4 mc. A signal generator feeds these frequencies to the IF strip, and a VTVM connected across the video detector load resistor R113 in proper polarity, serves as a measuring device for this peaking operation. The 22.8 mc. coils are on the tuner sub-chassis, and L103, located between the second and third IF stages. The 25.4 mc. coils are L101, located between the first and second IF stages, and L104, located between the third IF and the video detector. A recommended step-by-step procedure is given below:

1 - Set front panel "CONTRAST" control 1/4 turn clockwise.
2 - Connect the VTVM in proper polarity across the video detector (V6) load resistor R113. Connect positive lead to the chassis, and negative to the junction of shunt peaking coil L107 and R113. See Figure 8B.
3 - Connect the signal generator through a .001 mfd capacitor to the test loop located between the two tubes on top of the tuner sub-chassis. See Figure 8A.
4 - Inject minus 3 volt bias to AGC terminal on tuner. (Refer to tuner descriptions for location of AGC terminal.)
5 - Set the signal generator to 22.8 mc. and adjust its output so that the VTVM shows a reading of 2.5 volts maximum.
6 - Adjust L103 and 22.8 mc. coil on tuner for maximum reading on the VTVM.
7 - Reset the signal generator to 25.4 mc. and adjust its output so that the VTVM shows a reading of 2.5 volts maximum.
8 - Adjust L101 and L104 for maximum VTVM reading.
9 - Reset the signal generator to 21.25 mc. and adjust its output so that the VTVM reads 5 volts maximum.
10 - Adjust L114 for minimum VTVM reading.

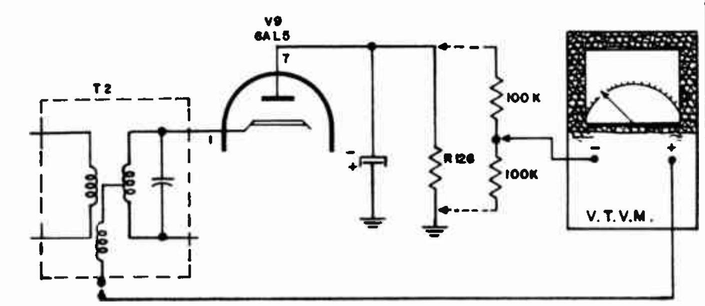
NOTE: In early production receivers, the 21.25 mc. IF trap (L114) was not incorporated. The alignment procedure described above remains unchanged, except that reference to the IF trap is ignored. However, the following components differ:

	WITH L114 IF TRAP	WITHOUT L114 IF TRAP
R100	3.9K 1/2w	5.6K 1/2w
R101	33 Ohm 1/2w	47 Ohm 1/2w
R103	47K 1/2w	22K 1/2w
R104	47 Ohm 1/2w	56 Ohm 1/2w

TEST INSTRUMENT CONNECTIONS FOR RATIO DETECTOR ALIGNMENT



V.T.V.M. CONNECTION FOR DETECTOR DRIVER AND SOUND TAKE-OFF ALIGNMENT.
FIG. 7A



VTVM CONNECTION FOR RATIO DETECTOR ALIGNMENT.
FIG. 7B

TEST INSTRUMENT CONNECTIONS FOR I. F. ALIGNMENT

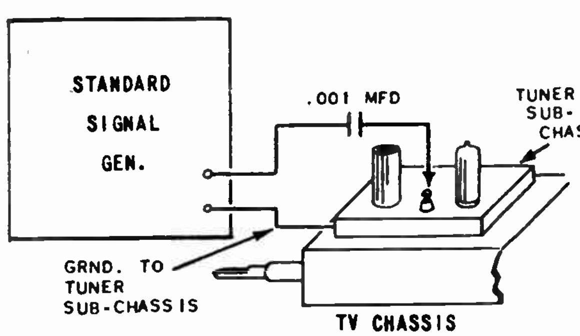


FIG. 8A

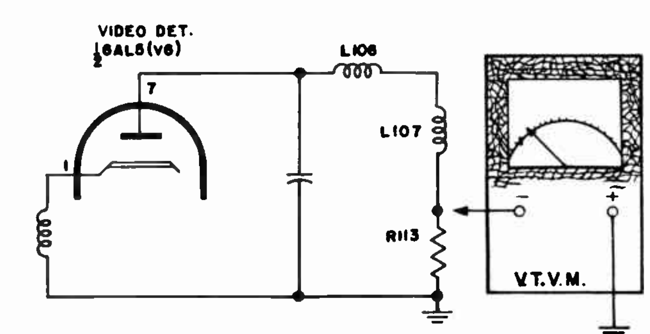


FIG. 8B

TUNER ALIGNMENT - GENERAL INFORMATION

DO NOT TOUCH TUNER ALIGNMENT UNLESS ABSOLUTELY NECESSARY. BEFORE ATTEMPTING TUNER ALIGNMENT CHECK I.F. ALIGNMENT AND THE ANTENNA TO BE SURE THAT THE TUNER IS AT FAULT.

EQUIPMENT NEEDED FOR ALIGNMENT OF TUNERS

1 - SWEEP GENERATOR
2 - STANDARD SIGNAL GENERATOR (MARKER GENERATOR)
3 - OSCILLOSCOPE
4 - VACUUM TUBE VOLTMETER
5 - 3 VOLT DRY CELL
6 - SLEEVE TYPE TUBE SHIELD
7 - INSULATED ALIGNMENT TOOLS
8 - METAL GROUND PLATE. ALL EQUIPMENT AND T.V. SET TO BE PUT ON THIS PLATE TO PREVENT SPURIOUS SIGNALS PICK UP AND STANDING WAVES ON CONNECTIONS.

TEST INSTRUMENT CONNECTIONS FOR TUNER RF BANDPASS ALIGNMENT

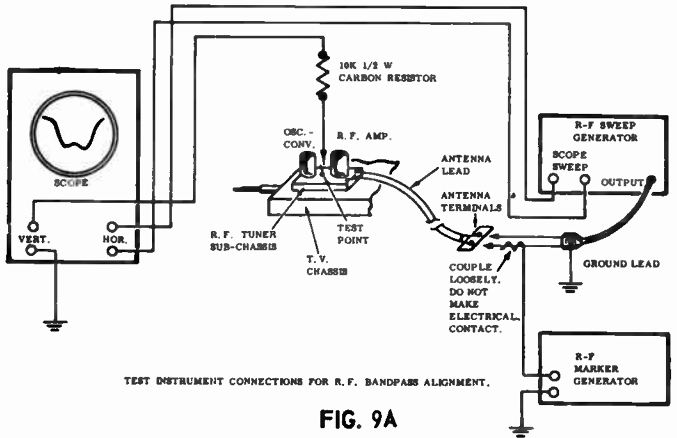


FIG. 9A

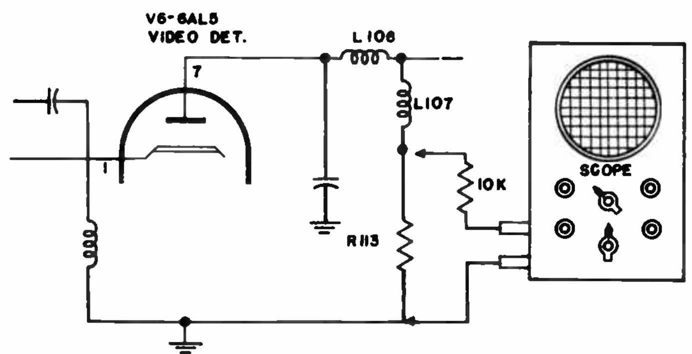
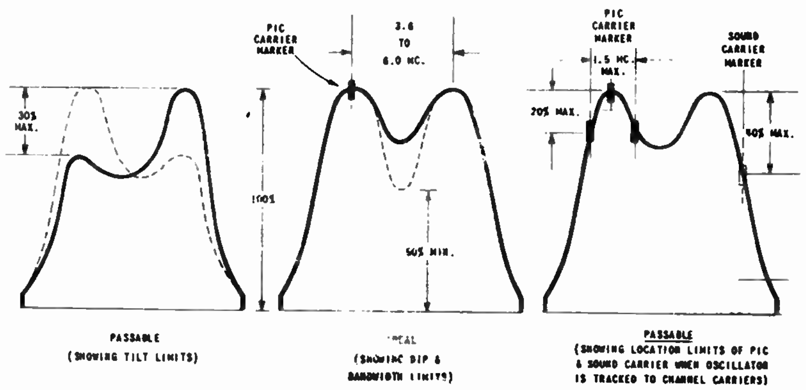


FIG. 9B

R-F BANDPASS SWEEP-RESPONSE LIMITS

FIG. 10



Channel Selector Switch	2	3	4	5	6	7	8	9	10	11	12	13
R.F. Sweep Generator Setting	57	63	69	79	85	177	183	189	195	201	207	213
Marker Generator Setting (Sound)	59.75	65.75	71.75	81.75	87.75	179.75	185.75	191.75	197.75	203.75	209.75	215.75
Marker Generator Setting (Picture)	55.25	61.25	67.25	77.25	83.25	175.25	181.25	187.25	193.25	199.25	205.25	211.25

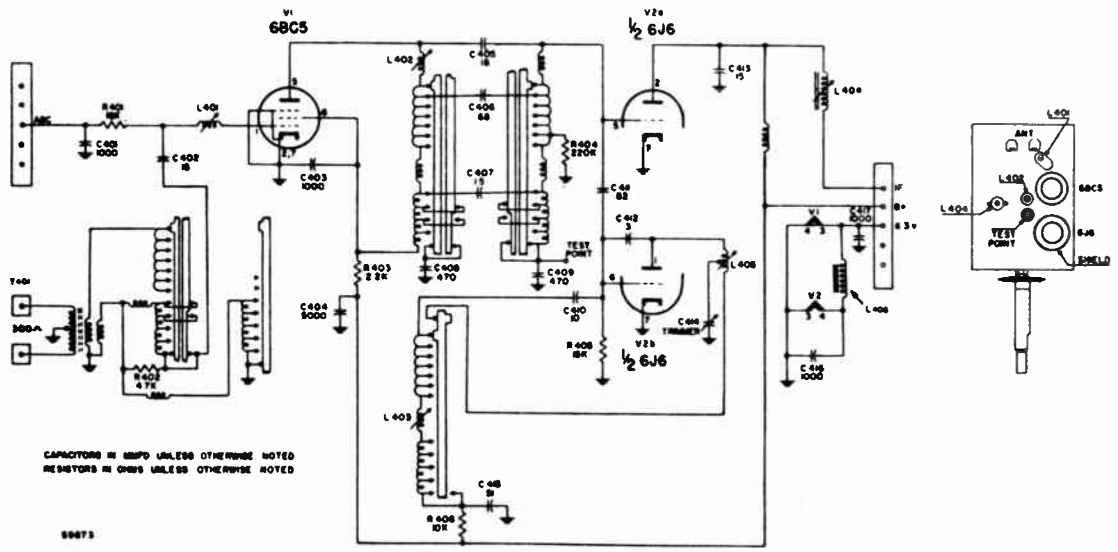
FIG. 11

SWITCH TYPE TUNER

PART NO. 541114

R. F. AMPLIFIER

The signal from the Television receiving antenna is brought into the single-ended R.F. amplifier through a coupling transformer which couples the balanced-to-ground twin-lead transmission line to the unbalanced single-ended grid drive of this stage. The channel switch picks out suitable lumped resonant elements in the plate circuit of this stage to permit selective amplification of the desired frequency. A.G.C. is introduced at the grid of this stage also. The values of the shunt loading, the degree of the transformer coupling, and the values of the tuning inductances are chosen by the selector switch to provide uniform bandpass on all channels.



TUNER SCHEMATIC & TUBE LOCATION
TUNER TT5AL PART NO. PC541114

FIG. 12

R. F. CONVERTER

The amplified signals from the previous R.F. stage are delivered to the input grid of V2. The 2nd section of the V2 is a modified Hartley oscillator, and the output of this local oscillator is heterodyned with the amplified R.F. in the mixer load. The channel selector functions in this circuit to select suitable fixed tank circuit elements so that the local oscillator frequency is always above the R.F. frequencies by an amount equal to the desired I.F. frequencies. The front panel "Fine Tuning" is mechanically connected to a variable capacitor in this oscillator tank circuit to provide vernier adjustment on the local oscillator frequency.

TUNER RF BANDPASS ALIGNMENT

NOTE: DO NOT ATTEMPT RF BANDPASS ALIGNMENT UNTIL THE IF AMPLIFIERS ARE PROPERLY ALIGNED.

1 - Connect the R.F. Sweep Generator, Marker Generator, and Oscilloscope as shown in Fig. 9a. Refer to Fig. 11 for instruments setting for each channel alignment. Put minus 3 volt bias between ground and AGC by means of the 3 volt battery.

2 - Set the RF sweep generator for 10mc. sweep width, and its center frequency at 213 mc.

3 - Set the CHANNEL SELECTOR switch to channel 13, and the fine tuning control at the middle of its rotation range.

4 - Turn on the television receiver and test equipment and allow about 15 minutes for the set to warm up and stabilize.

5 - Set the oscilloscope gain control for a maximum gain and the sweep attenuator for minimum output necessary to give a convenient size trace.

6 - (See Note 1). See permissible response curves, Figure 10. If the response curve on the oscilloscope does not fall within these limits, the picture on the oscilloscope can be made to approach the desirable form by either spreading or compressing the particular coils in the tuner circuit at channel 13 setting. Referring to the 5 decks on the master switch in the tuner, note that the deck nearest the front (shaft) end of the tuner contains those coils regulating the local oscillator, and these should NOT be touched during any bandpass adjustments. On the second, third and fourth decks of the master switch are the coils for the mixer grid, the RF amplifier plate, and the antenna coupling transformer, respectively, and the particular coils connected in the circuit for channel 13, on these three rear decks are the ones that should be compressed or expanded to achieve the desired bandpass characteristics. Note that too broad a curve results in loss of sensitivity, and rejection.

7 - Proceed with Channel Selector switch at 12, and with Sweep and marker generators set per Figure 11, repeat 6 above to achieve proper curve. Repeat for channel 11, then 10, 9, etc. When completion of channel 2 is reached, the bandpass alignment is finished.

Note #1 - Late model switch type tuners part #541114 have an additional screw adjustment on the top of the tuner. These adjustments are in the end inductance of the RF and antenna coil. Before adjusting any individual coil, use these adjustments for aligning channel 13. It is likely that after this adjustment is made, it will not be necessary to touch the other coils. This is especially true in the misalignment developed because of a change in tubes as these adjustments will compensate for the interelectrode capacitance variations in tubes. Refer to the diagram for the location of the above mentioned screw adjustments.

TUNER RF LOCAL OSCILLATOR ALIGNMENT

1 - Connect the RF sweep generator to the antenna terminals as in figure 9A. Put minus 3 volt bias between ground and an AGC terminal by means of the 3 volt battery.

2 - If the sweep generator is not provided with internal crystal-controlled or crystal-calibrated markers, connect a marker generator to the antenna terminals as in figure 9A.

3 - Connect the cathode ray oscilloscope across the video detector load resistor R113. See figure 9B.

4 - Adjust the R.F. sweep generator for 10 mc. sweep width, with center frequency at approximately 213 mc.

5 - Adjust the marker generator for the picture carrier of channel 13 (211.25 mc.)

6 - Set the Channel Selector switch to channel 13, with the fine tuning control at the middle of its rotation range.

7 - Turn on the receiver and test equipment and allow about 15 minutes for it to warm up and stabilize.

8 - Set the oscilloscope gain control for a convenient size picture on the oscilloscope.

9 - Adjust the slug in channel 13 oscillator coil until the oscillator pip is at the middle of the picture side of the response curve on the oscilloscope.

10 - Set the channel Selector switch to channel 12, and using the frequencies shown in figure 11, adjust by displacing the channel 12 increment loop until the oscillator pip is at the middle of the picture side of the response curve on the oscilloscope.

11 - Repeat operation 10 above using the appropriate frequencies and increment loops for channel Selector switch settings of 11, 10, 9, 8, and 7 in that order. This completes the high band oscillator alignment.

12 - Set Channel Selector switch to 6, and proceed as in 9 above, using the proper slug and frequencies.

RESISTANCE MEASUREMENTS ON 110.817-1 & 110.820-1 CHASSIS

TUBE LOC.	TUBE TYPE	PIN NUMBERS 1	2	3	4	5	6	7	8	9
V1	6BC5	150K	0	0	0	25K	25K	0		
V2	6J6	33K	23K	0	0	220K	15K	0		
V3	6CB6	132K	47	0.3	0	23K	23K	0		
V4	6CB6	148K	56	0.3	0	23K	23K	0		
V5	6CB6	0.2	150C	0.2	0	23K	23K	0		
V6	6AL5	2.5	0	0	0	0	0	4.7K		
V7	12BH7	26K	4.7K	220	0	0	31K	1M	0 to 5K^{A}	0
V8	6AU6	100K	0	0	0	25K	125K	0		
V9	6AL5	∞	∞	0.6	0	0	0	47K		
V10	6SQ7GT	0	10M	0	0	0	500K	0	0	
V11	6V6GT	X	0	29K	29K	470K	X	0	330	
V12	12BH7	31K	0.5M	2.7K	0	0	91K	11.5K	0	0
V13	12BZ7	20K	2.2M	0	0	0	20K	4.7M	0	0
V14	12BH7	216K	1.5M	3.3K	0	0	1.7M^{E}	2.1M^{F}	0	0
V15	6AL5	3.4M	3.4M	0	0.6	22K	0	22K		
V16	12BH7	32K	3.8M	1.8K	0.0	0.0	246K	100 to 105K^{G}	1.8K	0
V17	6BQ6GT	XX	0	X	36K	470K	X	0	220	Plate = 204K
V18	1X2A	Hi-Voltage Rectifier Plate = 204K								
V19	6W4GT	XX	X	204K	X	26K	X	204K	204K	
V20	5U4G	X	26K	X	100	X	100	X	26K	
V21	17HP4^{B}	Pin 1:0; Pin2: 1M; Pin10:500K; Pin11: 370K to 270K^{C}; Pin12: 0; Pin6: 210K								

NOTE: Resistances measured from Pin to ground with Phono-TV Switch, if any, in TV position.
X. Indicates that pin is not used as terminal post for another part of the Circuit.
XX. Indicates that pin is used as terminal post for another part of the Circuit.
^{A} Varies with contrast (picture) Setting.
^{B} On 820 and 820-1 tube type is 20HP4A and Pin 6 = 210K
^{C} Varies with brightness setting.
^{D} Varies with linearity setting; reading given is nominal.
^{E} Varies with height setting; reading given is nominal.
^{F} Varies with vertical speed setting; reading given is nominal.
^{G} Varies with Horizontal Hold Control Setting.

FIG. 13

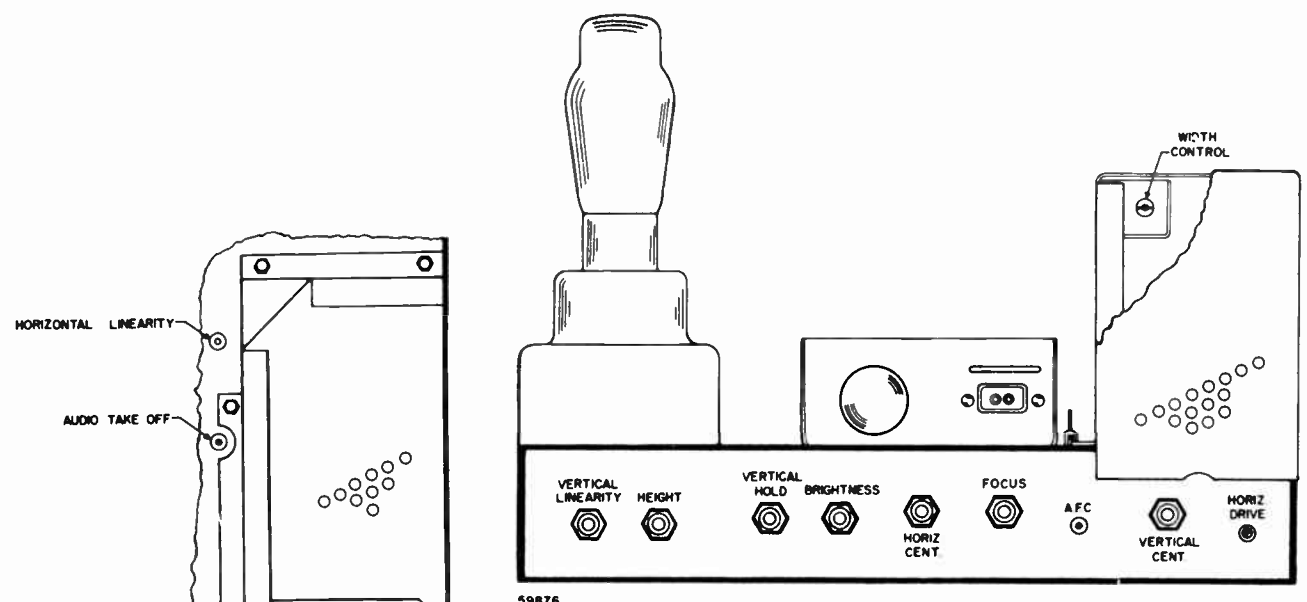
TUBE SOCKET VOLTAGES ON 110.817-1 & 110.820-1 CHASSIS

TUBE LOC.	TUBE TYPE	PIN NUMBERS 1	2	3	4	5	6	7	8	9
V1	6BC5	-1	0	0	6.2 ac	105	105	0		
V2	6J6	120	75	0	6.2 ac	-2.5	-4	0		
V3	6CB6	-0.4	0.6	6.0 ac	0	120	120	0		
V4	6CB6	-0.4	0.6	6.0 ac	0	120	120	0		
V5	6CB6	0	1.0	6.1 ac	0	120	120	0		
V6	6AL5	0	0	0	6.3 ac	0	0	-0.4		
V7	12BH7	90	-0.4	2.0	6.3 ac	6.3 ac	165 to 175^{A}	0.5 to 40^{A}	3.5 to 70^{A}	0
V8	6AU6	-0.5	0	0	6.3 ac	120	50	0		
V9	6AL5	-0.5	-0.5	5.5 ac	0	0	0	-1.5		
V10	6SQ7GT	0	-1	0	0	0	85	6.3 ac	0	
V11	6V6GT	0	0	200	210	0	0	6.3ac	10	
V12	12BH7	60	20	20	0	0	20	-0.4	0	6.3 ac
V13	12BZ7	90	-0.8	0	0	0	90	-0.9	0	6.3 ac
V14	12BH7	420	-.3^{D}	22^{D}	0	0	100^{G}	-30	0	6.3 ac
V15	6AL5	12	-12	0	5.5 ac	0.1	0	0.1		
V16	12BH7	290	0.1	15	6.3 ac	6.3 ac	120	-5	15	0
V17^{E}	6BQ6GT	-20	0	0	155	-20	0	6.3 ac	15	
V18	1X2A	High – Voltage Rectifier								
V19	6W4GT	320	0	525	0	310	0	525^{F}	525^{F}	
V20	5U4G		340		320 ac		320 ac		340	
V21	17HP4^{B}	Pin 1:0; Pin 2:3 to 6;^{A} Pin 10: 515; Pin 11: 40 to 150; Pin12: 6.3 ac;								

NOTE: All voltages measured with V.T.V.M. from pin to ground with line voltage of 117V ac and antenna terminals shorted. Values are DC unless otherwise noted. The Phono-TV switch, if provided, is in the TV position.
^{A} Varies with contrast (picture) setting.
^{B} On 820 and 820-1 tube type is 20HP4A and Pin 6 = 515V
^{C} Varies with brightness setting.
^{D} Varies with linearity setting.
^{E} Varies with Horizontal Hold setting.
^{F} Pins 7 and 8 are filament terminals.
^{G} Varies with height setting.
^{H} Above voltages apply only when vertical output transformer is marked PC10152. If vertical output transformer is marked PC19115, the following voltages apply:

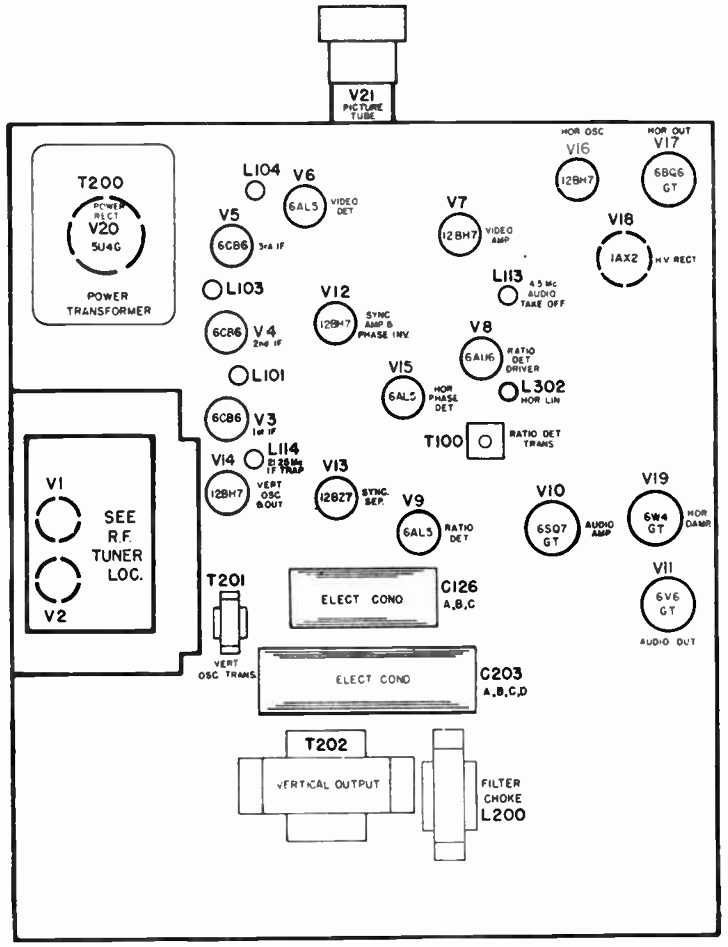
V14	12BH7	410^{D}	0.2^{D}	20^{D}	0	0	200^{G}	-80	0	6.3 ac

FIG. 14



REAR CONTROLS
CHASSIS 110.817–1; 820–1

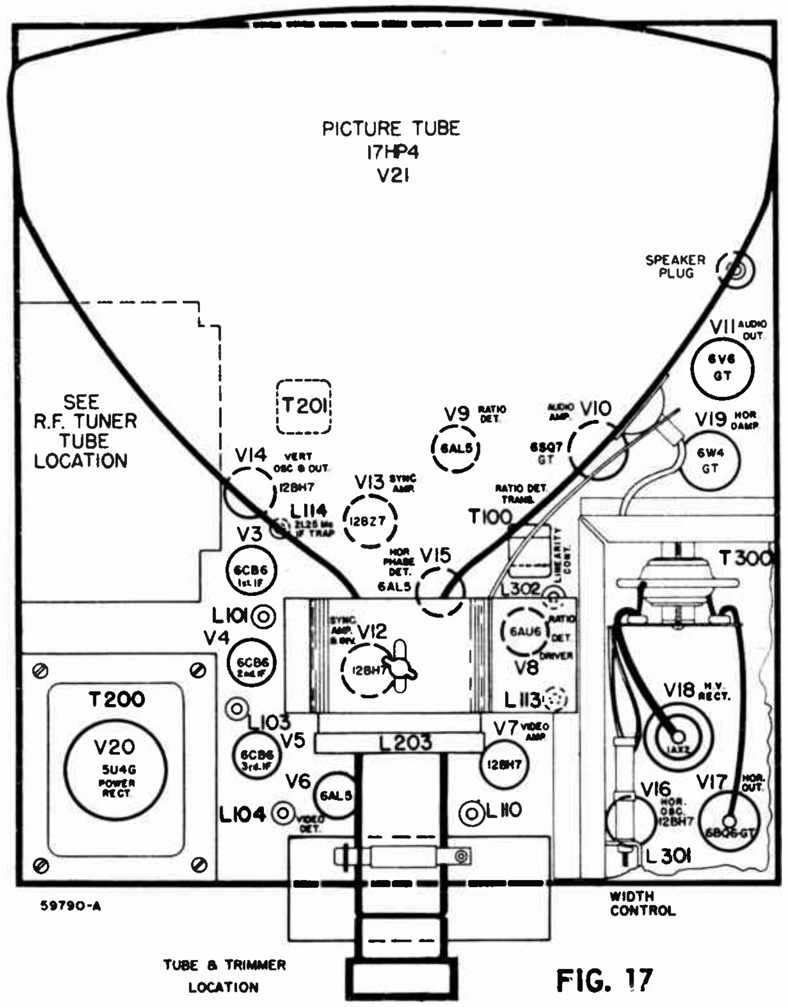
FIG. 15



BOTTOM VIEW

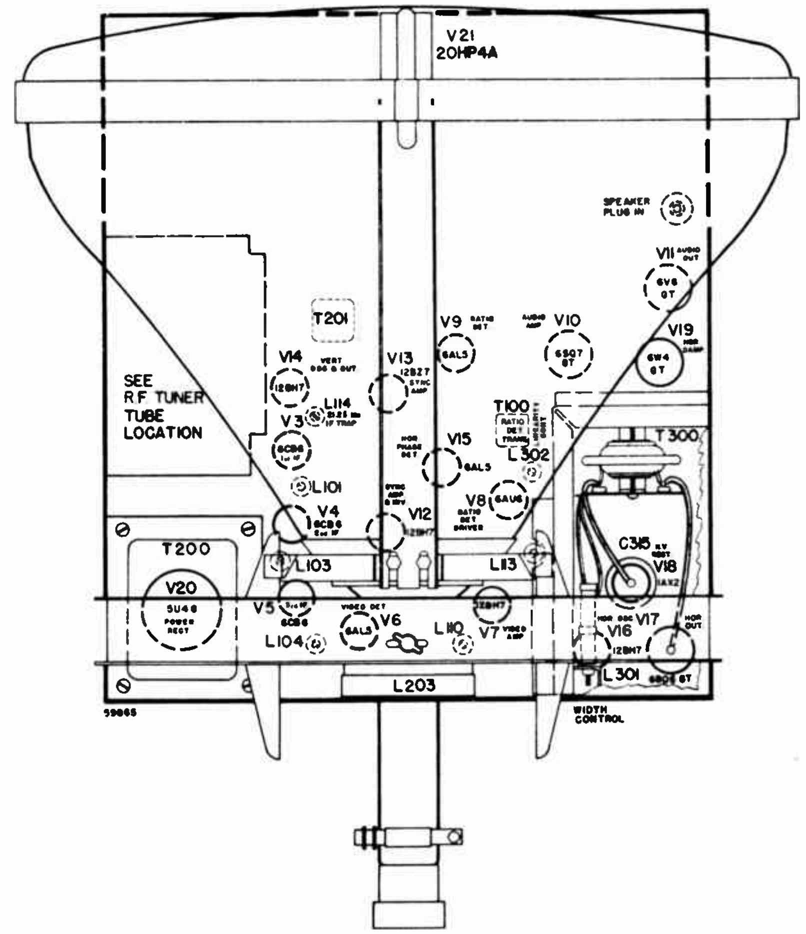
800 SERIES

FIG. 16



TUBE & TRIMMER LOCATION

FIG. 17



TUBE & TRIMMER LOCATION

FIG. 18

HOW TO ORDER PARTS

1. Use Correct Order Form.
2. On the Purchase Order always give the following information:
   (1) PART NUMBER (number printed on the part if different from that shown on this list) and DESCRIPTION for each part ordered. When no part is assigned, order by description and rating. Also give PRICE of part (indicate if no selling).

   (2) The CHASSIS NUMBER, is this tound on a metal plate at the rear of the Chassis.

TELEVISION REPAIR PARTS LIST

SCHEM. LOCATION	CHASSIS*	PART NO.	DESCRIPTION	SELLING PRICE
			CAPACITORS (All Chassis)	
C 100		PE190-133	Mica, 270mmf 500V ±10%	$ .17
C 101		PA17147	Ceramic, Shielded Dual disc, 1500mmf GMV	.46
C 102		PE556-234	Ceramic Tubular, 680mmf 350V ±10% (Insul).	.29
C 103		PE190-133	Mica, 270mmf 500V ±10%	.17
C 104		PE190-133	Mica, 270mmf 500V ±10%	.17
C 105		PA19148	Ceramic, Single Disc 1500mmf GMV	.40
C 106		PA20138	Electrolytic, 1mfd 50V	1.74
C 107		PP19163	Ceramic, Shielded Dual Disc 5000mmf GMV	.74
C 108		PE190-140	Mica, 510mmf 500V ±10%	.19
C 109		PE190-107	Mica, 22mmf 500V ±10%	.20
C 110		PE555-101	Ceramic Tubular, 10mmf 500V ±20% (Unins).	.29
C 111		PE555-136	Ceramic Tubular, 1000mmf 350V ±20% (Unins).	.29
C 112		PE194-160	Paper, .05mfd 600V ±20%	.29
C 113		PP19201	Ceramic Tubular, 820mmf 350V ±10% (Unins).	.29
C 114		PE555-100	Ceramic Tubular, 5mmf 500V ±20% (Unins.)	.20
C 115		PE555-113-2	Ceramic Tubular, 47mmf 500V ±20% NPO	.40
C 116		PE194-160	Paper, .05mfd 600V ±20%	.29
C 117		PE194-151	Paper, .005mfd 600V ±20%	.29
C 118		PA19148	Ceramic, Single Disc 1500mmf GMV	.40
C 119		PE556-236	Ceramic Tubular, 1000mmf 350V ±10% (Insul.)	.29
C 120		PE194-160	Paper, .05mfd 600V ±20%	.29
C 121		PA20138	Electrolytic, 1mfd 50V	1.74
C 122		PE194-156	Paper, .02mfd 600V ±20%	.29
C 123		PE194-160	Paper, .05mfd 600V ±20%	.29
C 124		PE194-155	Paper, .01mfd 600V ±20%	.29
C 125		PE194-151	Paper, .005mfd 600V ±20%	.29
C 126		PA20135	Electrolytic, 10-10-10mfd 450V	4.38
C 127		PE194-145	Paper, .001mfd 600V ±20%	.20
C 128		PP19177	Ceramic Tubular, 6.8mmf 500V ±10% (Insul.)	.20
C 200		PP19198	Ceramic, Shielded Dual Disc .01mfd 500V GMV	.74
C 202		PA19109	Ceramic, Single Disc 5000mmf GMV	.43
C 203		PA20144	Electrolytic, 40-40-20-20mfd 450V	4.70
C 204		PA19109	Ceramic, Single Disc 5000mmf GMV	.43

*Used on all chassis unless otherwise specified in this column. If specified, the part is used only on the chassis indicated.

REPAIR PARTS LIST

SCHEM. LOCATION	CHASSIS*	PART NO.	DESCRIPTION	SELLING PRICE
			CAPACITORS (Cont'd)	
C 205		PA19109	Ceramic, Single Disc 5000mmf GMV	$ .43
C 206		PA19109	Ceramic, Single Disc 5000mmf GMV	.43
C 207		PE194-156	Paper, .02mfd 600V ±20%	.29
C 208		PE190-137	Mica, 390mmf 500V ±10%	.17
C 209		PE190-133	Mica, 270mmf 500V ±10%	.17
C 210		PE194-155	Paper, .01mfd 600V ±20%	.29
C 211		PE194-155	Paper, .01mfd 600V ±20%	.29
C 212		PE192-163	Mica, 4700mmf 500V ±10%	.17
C 213		PE194-159	Paper, .035mfd 600V ±20%	.29
C 214		PE194-156	Paper, .02mfd 600V ±20%	.29
C 215		PE194-160	Paper, .05mfd 600V ±20%	.29
C 216		PA20145	Electrolytic, 10mfd 250V	3.00
C 217		PA20130	Electrolytic, 100mfd 25V	2.42
C 218		PE194-160	Paper, .05mfd 600V ±20%	.29
C 219		PE194-160	Paper, .05mfd 600V ±20%	.29
C 220		PE194-155	Paper, .01mfd 600V ±20%	.29
C 221		PE194-151	Paper, .005mfd 600V ±20%	.29
C 222		PE194-151	Paper, .005mfd 600V ±20%	.29
C 223		PE194-155	Paper, .01mfd 600V ±20%	.29
C 300		PE194-145	Paper, .001mfd 600V ±20%	.20
C 301		PE194-145	Paper, .001mfd 600V ±20%	.20
C 302		PE194-151	Paper, .005mfd 600V ±20%	.29
C 303		PE194-151	Paper, .005mfd 600V ±20%	.29
C 304		PE194-160	Paper, .05mfd 600V ±20%	.29
C 305		PE195-261	Mica, Silver, 3900mmf 500V ±5%	.83
C 306		PE190-137	Mica, 390mmf 500V ±10%	.23
C 307		PE190-133	Mica, 270mmf 500V ±10%	.17
C 308	110.817-1	PE190-125	Mica, 120mmf 500V ±10%	.23
C 308	110.820-1	PE190-137	Mica, 390mmf 500V ±10%	.17
C 309		PA1772	Trimmer, 25-280mmf	.51
C 310		PA20137	Electrolytic, 10mfd 25V	2.08
C 311	110.820-1	PP19146	Mica, 10mmf 2500V ±20% GMV	.34
C 312		PE194-160	Paper, .05mfd 600V ±20%	.29
C 313	110.820-1	PP19146	Mica, 10mmf 2500V ±10% GMV	.40
C 314		PE194-160	Paper, .05mfd 600V ±20%	.29
C 315		PA1998-3	Ceramic; 500mmf 20kv	2.51
C 316		PE194-162	Paper, .1mfd 600V ±20%	.34
C 317		PA20147	Electrolytic 25mfd 12V	.46
C 318		PP19180	Mica, 220mmf 1000V ±10%	.29
C 320	110.817-1	PE190-133	Mica, 270mmf 500V ±10%	.17
C 321				
C 322				
C 323				
			RESISTORS	
R 100		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%	.14
R 101		PE231-1113	Carbon, 33 Ohm 1/2W ±10%	.14
R 102		PE231-1137	Carbon, 330 Ohm 1/2W ±10%	.14
R 103		PE231-1189	Carbon, 47k Ohm 1/2W ±10%	.14
R 104		PE331-1117	Carbon, 47 Ohm 1/2W ±10%	.14
R 105		PE231-1123	Carbon, 82 Ohm 1/2W ±10%	.14
R 106		PE231-1171	Carbon, 8200 Ohm 1/2W ±10%	.14
R 107		PE231-1133	Carbon, 220 Ohm 1/2W ±10%	.14
R 108		PE231-1133	Carbon, 220 Ohm 1/2W ±10%	.14
R 109		PE231-1129	Carbon, 150 Ohm 1/2W ±10%	.14
R 110		PE231-1197	Carbon, 100k Ohm 1/2W ±10%	.14
R 111		PE231-1177	Carbon, 15k Ohm 1/2W ±10%	.14
R 113		PE231-1165	Carbon, 4700 Ohm 1/2W ±10%	.14
R 114		PE231-1133	Carbon, 220 Ohm 1/2W ±10%	.14
R 115		PE231-1165	Carbon, 4700 Ohm 1/2W ±10%	.14
R 116		PE232-1161	Carbon, 3300 Ohm 1W ±10%	.20
R 117		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%	.14
R 118		PE231-1131	Carbon, 180 Ohm 1/2W ±10%	.14
R 120		PE233-74	Carbon, 11k Ohm 2W ±5%	.33
R 121		PE233-1179	Carbon, 18k Ohm 2W ±10%	.29
R 122		PE231-1173	Carbon, 10k Ohm 1/2W ±10%	.14
R 123		PE231-1197	Carbon, 100k Ohm 1/2W ±10%	.14
R 124		PE231-1197	Carbon, 100k Ohm 1/2W ±10%	.14
R 125		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%	.14
R 126		PE231-1189	Carbon, 47k Ohm 1/2W ±10%	.14

*Used on all chassis unless otherwise specified in this column. If specified, the part is used only on the chassis indicated.

SCHEM. LOCATION	CHASSIS*	PART NO.	DESCRIPTION	SELLING PRICE
			RESISTORS (Cont'd)	
R 127		PE231-1245	Carbon, 10 Megohm 1/2W ±10%	$ .14
R 128		PE231-1213	Carbon, 470k Ohm 1/2W ±10%	.14
R 129		PE231-1213	Carbon, 470k Ohm 1/2W ±10%	.14
R 130		PE232-1137	Carbon, 330 Ohm 1W ±10%	.20
R 131		PC21134-4	Wirewound, 3250 Ohm 7W ±10%	.63
R 200		PE23151	Wirewound, 1.2 Ohm 1W ±10%	.20
R 201		PC21134-2	Wirewound, 60Ohm 10W ±10%	.63
R 202		PE231-1183	Carbon, 27k Ohm 1/2W ±10%	.14
R 203		PE231-1175	Carbon, 12k Ohm 1/2W ±10%	.14
R 204		PE231-1193	Carbon, 68k Ohm 1/2W ±10%	.14
R 205		PE231-1213	Carbon, 470k Ohm 1/2W ±10%	.14
R 206		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%	.14
R 207		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%	.14
R 208		PE232-1181	Carbon, 22k Ohm 1W ±10%	.20
R 209		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%	.14
R 210		PE231-1171	Carbon, 8200 Ohm 1/2W ±10%	.14
R 211		PE231-1181	Carbon, 22k Ohm 1/2W ±10%	.14
R 212		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%	.14
R 213		PE231-1159	Carbon, 2700 Ohm 1/2W ±10%	.14
R 214		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%	.14
R 215		PE231-1163	Carbon, 3900 Ohm 1/2W ±10%	.14
R 217		PE231-1169	Carbon, 6800 Ohm 1/2W ±10%	.14
R 218		PE232-127	Carbon, 1.8 Megohm 1W ±5%	
R 219		PE231-1189	Carbon, 47k Ohm 1/2W ±10%	.14
R 220		PE231-1213	Carbon, 470k Ohm 1/2W ±10%	.14
R 221		PE231-1225	Carbon, 1.5 Megohm 1/2W ±10%	.14
R 222		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%	.14
R 223		PE232-1189	Carbon, 47k Ohm 1W ±10%	.20
R 224		PE232-1201	Carbon, 150k Ohm 1W ±10%	.20
R 225		PE233-1161	Carbon, 3300 Ohm 2W ±10%	.29
R 226		PE233-1161	Carbon, 3300 Ohm 2W ±10%	.29
R 227		PE231-1229	Carbon, 2.2 Megohm 1/2W ±10%	.14
R 228		PE231-1185	Carbon, 33k Ohm 1/2W ±10%	.14
R 229		PE231-1207	Carbon, 270k Ohm 1/2W ±10%	.14
R 230		PE231-1221	Carbon, 1.0 Megohm 1/2W ±10%	.14
R 231		PE231-1181	Carbon, 22k Ohm 1/2W ±10%	.14
R 232		PE231-1181	Carbon, 22k Ohm 1/2W ±10%	.14
R 233		PE231-1171	Carbon, 8200 Ohm 1/2W ±10%	.14
R 234		PE231-1189	Carbon, 47k Ohm 1/2W ±10%	.14
R 300		PC21134-16	Wirewound, 2250 Ohm 15W ±10%	
R 301		PE233-1165	Carbon, 4700 Ohm 2W ±10%	.29
R 302		PE233-1169	Carbon, 6800 Ohm 2W ±10%	.29
R 303		PE231-1197	Carbon, 100k Ohm 1/2W ±10%	.14
R 304		PE231-1197	Carbon, 100k Ohm 1/2W ±10%	.14
R 305		PE231-1213	Carbon, 470k Ohm 1/2W ±10%	.14
R 306		PE231-1233	Carbon, 3.3 Megohm 1/2W ±10%	.14
R 307		PE232-1181	Carbon, 22k Ohm 1W ±10%	.20
R 308		PE231-1167	Carbon, 5600 Ohm 1/2W ±10%	.14
R 309		PE231-1155	Carbon, 1800 Ohm 1/2W ±10%	.14
R 310		PE231-1205	Carbon, 220k Ohm 1/2W ±10%	.14
R 311		PE231-1213	Carbon, 470k Ohm 1/2W ±10%	.14
R 312		PE231-1197	Carbon, 100k Ohm 1/2W ±10%	.14
R 313		PE231-1123	Carbon, 82 Ohm 1/2W ±10%	.14
R 314		PE233-1133	Carbon, 220 Ohm 2W ±10%	.29
R 315		PE23163	Carbon, 0.56 Ohm 1/2W ±10%	
R 316	110.820-1	PE233-2321	Carbon, 1.0 Megohm 2W ±20% (Allen Bradley)	
R 317	110.817-1	PE231-1167	Carbon, 5600 Ohm 1/2W ±10%	.14
R 318		PE232-1177	Carbon, 15k Ohm 1W ±10%	.20
			CHOKES & COILS	
L 101		A3392	Coil, Pix IF	1.14
L 102		A28253	Choke, RF	.51
L 103		A3392	Coil, Pix IF	1.14
L 104		A3392	Coil, Pix IF	1.14
L 105		A28253	Choke, RF	.51
L 106		A28255-2	Coil, Peaking (White)	.51
L 107		A28255-1	Coil, Peaking (Red)	.51
L 108		A28255-2	Coil, Peaking (White)	.51
L 109		A28255-1	Coil, Peaking (Red)	.51
L 110		A28286	Coil 4.5Mc Trap	1.14
L 111		A28255-1	Coil, Peaking (Red)	.51
L 112		A28255-4	Coil, Peaking (Green)	.51

*Used on all chassis unless otherwise specified in this column. If specified, the part is used only on the chassis indicated.

Above prices subject to change without notice.

SCHEM. LOCATION	CHASSIS*	PART NO.	DESCRIPTION	SELLING PRICE
			CHOKES & COILS (Cont'd)	
L 113		A28286	Coil 4.5Mc Audio Take off	$ 1.14
L 114		A28314	Coil 21.25Mc IF Trap	
L 200		A1406	Coil Filter Choke	3.66
L 201		A28276	Choke, Filament	.46
L 202		A28276	Choke, Filament	.46
L 203	110.817-1	A28278-3	Coil, Deflection Yoke	8.19
L 203	110.820-1	A28322-1	Coil, Deflection Yoke	
L 300		A28263	Coil Horiz. Freq. Control	1.43
L 301		A28279-1	Coil, Width Control	1.31
L 302		A28292	Coil Horiz. Linearity	1.34
			CONTROLS	
P 100		A24142	Contrast-Volume 5k-250k Ohm	
P 200		A24112	Vertical Hold, 1.0 Megohm	2.65
P 201		A24111	Vertical Size, 5.0 Megohm	2.83
P 202		A24114	Vertical Linearity, 3k Ohm Wirewound	2.75
P 203		A24118	Vertical Centering, 20 Ohm C.T. Wirewound	2.75
P 204		A24110	Brightness 100k Ohm	3.25
P 206		A24112	Focus Control 1.0 Megohm	2.65
P 301		A24116	Hor. Centering, 100 Ohm Wirewound	2.65
			TRANSFORMERS	
T 100		A1201 or 1202	Ratio Detector	3.55
T 200		A10109	Power	22.02
T 201		A10106	Vertical Oscillator	2.75
T 202		A10152-1	Vertical Output	
T 300		A10136	Horizontal Output	
			TT5AL RF-TUNER PARTS (ALL CHASSIS)	
R 401		A231-1179	AGC Resistor 18K Ohm 1/2W ±10%	.15
R 402		A231-1165	R.F. Grid Resistor 4.7K Ohm, 1/2W ±10%	.15
R 403		A231-1157	R.F. Screen Resistor 2.2K Ohm, 1/2W ±10%	.15
R 404		A231-1205	High Band 220K Ohm 1/2W ±10%	.15
R 405		A231-2277	Oscillator Grid Resistor 15K Ohm, 1/2W ±20%	.15
R 406		A231-1173	Oscillator Plate Resistor 10K Ohm, 1/2W ±10%	.15
C 401		A19132	AGC by-pass Capacitor 1000 mmf, GMV Disc	.25
C 402		A556-203	R.F. Grid Coupling Capacitor 15 mmf, ±10% Ceramic	.31
C 403		A19132	R.F. Screen by-pass Capacitor 1000 mmf, GMV Disc	.25
C 404		A19109	Decoupling Capacitor 5000 mmf GMV Disc	.35
C 405		A19181	Coupling Capacitor 0.18 mmf ±10%	.25
C 406		A19182	Coupling Capacitor 0.68 mmf ±10%	.25
C 407		A19183	Coupling Capacitor 1.5 mmf ±10%	.25
C 408		A19139	Decoupling Capacitor 470 mmf, ±20% Ceramic	.29
C 409		A19139	Decoupling Capacitor 470 mmf, ±20% Ceramic	.29
C 410		A556-201-2	Coupling Capacitor 10 mmf ±10% Ceramic	.25
C 411		A19184	Coupling Capacitor 0.82 mmf ±10%	.25
C 412		A19154	Coupling Capacitor 3 mmf ±5%	.25
C 413		A556-203	Mixer Plate Capacitor 15 mmf, ±10% Ceramic	.25
C 414		A19155	Oscillator Trimmer Capacitor	.95
C 415		A19152	Oscillator Plate by-pass Capacitor, 0.51 mmf ±10%	.25
C 416		A19132	Decoupling Capacitor 1000 mmf GMV Disc	.25
C 417		A19132	Decoupling Capacitor 1000 mmf GMV Disc	.25
L 401		A28280-20	R.F. Grid Coil	.20
L 402		A28280-21	R.F. Plate Coil	.20
L 403		A28280-3	Oscillator Coil (Ch. 6)	.20
L 404		A28280-19	I.F. Converter Coil	.90
L 405		A28280-22	Oscillator Coil (Ch. 13)	.20

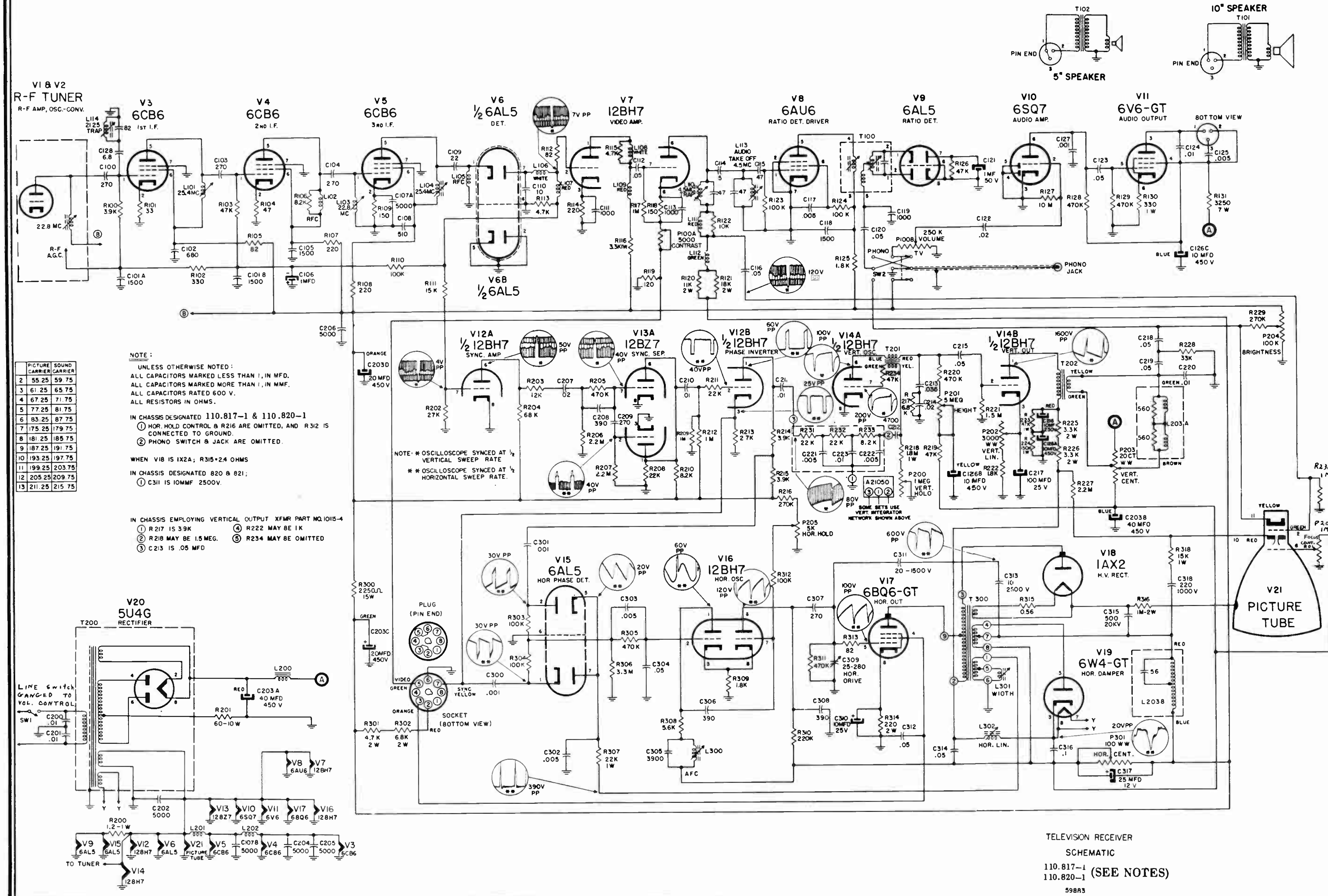
*Used on all chassis unless otherwise specified in this column. If specified, the part is used only on the chassis indicated.

Above prices subject to change without notice.

SCHEM. LOCATION	CHASSIS*	PART NO.	DESCRIPTION	SELLING PRICE
			MISC. CHASSIS ACCESS. & PARTS – ALL CHASSIS	
L 406		A28280-23	Filament Choke	$ .40
T 401		A28280-24	Input Transformer	
		A541114	Tuner, (less Tubes)	20.93
		A65100K	Chassis	
		A5355	Shield, H.V. Supply	2.55
		A5356	Cover, H.V. Supply Shield	2.42
		A54609	Bracket, Horiz. Freq. Control Coil	.54
		A541059	Bracket, Combination Interlock & Color Socket	
		A18177 or A18179	Dummy Plug Assembly, Male Octal (Color Socket)	.51
		A541242	Grounding Spring CRT Coating	
		A540-62	Terminal Strip, AAEAAAEAA	.17
		A540-67	Terminal Strip, AAAEAA	.11
		A540-44	Terminal Strip, AAEAA	.11
		A540-19	Terminal Strip, AEA	.06
		A540-34	Terminal Strip, AAEA	.09
		A18155	Socket, Octal Moulded	.29
		A18210	Socket, Octal Moulded Bakelite Saddle	
		A18173	Socket, 9 Pin Moulded	.34
		A18171	Socket, 9 Pin Moulded No Saddle	.29
		A18157	Socket, 9 Pin Wafer	.29
		A18147	Socket, 7 Pin Wafer	.23
		A18101	Socket, Speaker-Plug	.31
		A541131	Socket, H.V. Cond.	
		A562-6	Capacitor Clips; 1-3/8	
		A562-3	Capacitor Clips; 3/4	
		A54618-1	Tube Shield	.17
		A3206	Iron Trap	2.06
		A18174	Socket, Phono	.26
			MISC. CHASSIS ACCESS. & PARTS – 17" TUBE	
		A54851	Bracket, Yoke Hood & Support	1.42
		A541084-1	Channel, CRT Front Support; Left	
		A541084-2	Channel, CRT Front Support; Right	.14
		A54827	Strap, CRT; Right	.40
		A54828	Strap, CRT; Left	.40
		A541086	Bracket, CRT Stop	
		A55141-1	Anode Connector Assembly	
		A54943	Anode Lead Holder	.06
		A541085	Cushion, Rubber; CRT Channel	.40
		A541110-2	Cushion, Sponge Rubber; CRT Strap, Right	
		A541110-1	Cushion, Sponge Rubber; CRT Strap, Left	
		A54971-18	Cushion, Cork; CRT Stop Bkt.	.06
		A18197-3	Socket, Kinescope	1.08
			MISC. CHASSIS ACCESS. & PARTS – 20" TUBE	
		A54983-4	Bridge Bkt., Focus Coil & Yoke Support	
		A541000	CRT Rubber Grommet	
		A541023	Bracket, CRT Rubber Grommet Support	
		A541002	Upper CRT Support	1.78
		A541018-1	CRT Front Support, Left	
		A541018-2	CRT Front Support, Right	
		A54999	Rubber Channel, CRT Front Support, Left	.14
		A54998	Rubber Channel, CRT Front Support, Right	.14
		A54997	Rubber Channel, CRT Front Supports (Rear)	.14
		A541003	Strap, CRT	1.08
		A541004-1	Spade Bolt, CRT Strap Assembly	.06
		A55141-2	Anode Connector Assembly	
		A541239	Anode Lead Holder	
		A54971-14	Cushion, Cork, Upper CRT Support	.06
		A54971-15	Cushion, Cork, CRT Stop Bkts.	.06
		A541102-4	Cushion, Rubber, CRT Strap	
		A18197-4	Socket, Kinescope	1.08

*Used on all chassis unless otherwise specified in this column. If specified, the part is used only on the chassis indicated.

Above prices subject to change without notice.



NOTE:

UNLESS OTHERWISE NOTED:
ALL CAPACITORS MARKED LESS THAN 1, IN MFD.
ALL CAPACITORS MARKED MORE THAN 1, IN MMF.
ALL CAPACITORS RATED 600 V.
ALL RESISTORS IN OHMS.

IN CHASSIS DESIGNATED 110.817-1 & 110.820-1
1. HOR. HOLD CONTROL & R216 ARE OMITTED, AND R312 IS CONNECTED TO GROUND.
2. PHONO SWITCH & JACK ARE OMITTED.

WHEN V18 IS 1X2A; R315=2.4 OHMS

IN CHASSIS DESIGNATED 820 & 821;
1. C311 IS 10MMF 2500V.

IN CHASSIS EMPLOYING VERTICAL OUTPUT XFMR PART NO. 10115-4
1. R217 IS 3.9K
2. R218 MAY BE 1.5 MEG.
3. C213 IS .05 MFD
4. R222 MAY BE 1K
5. R234 MAY BE OMITTED

	PICTURE CARRIER	SOUND CARRIER
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

TELEVISION RECEIVER
SCHEMATIC
110.817-1
110.820-1 (SEE NOTES)
59883

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MODEL 511-521

MODEL 552-562

MODEL 512-522

MODEL 513-523

MODELS 500, 510, 511, 512, 513, 515, 520, 521, 522, 523, 525

TUBE COMPLEMENT

6BQ7 or 6BZ7	R.F. Amplifier
6J6	VHF Oscillator, Modulator
6CB6	Video I.F. Amplifier
6CL6	Video Amplifier
6AU6	Sound I.F. Amplifier
6AL5	Sound Detector
6SN7GT	A.F. Amplifier, Horizontal AFC Control
6W6GT	Audio Amplifier
6SN7GT	Sync Separator, Phase Splitter
6SN7GT	Horizontal Oscillator
1B3GT	H.V. Rectifier
6BQ6GT	Horizontal Output
6W4GT	Horizontal Damper
12BH7	Vertical Oscillator, Vertical Amplifier
5U4G	Power Rectifier
17HP4A	17" Picture Tube Model 500 Electrostatic Focus
or 21FP4A	21" Picture Tube Electrostatic Focus
or 21YP4A	21" Picture Tube Models 510, 520 Electrostatic Focus
6AF4	UHF Oscillator

ELECTRICAL SPECIFICATIONS

Power Supply..................110 to 120 Volts 60 Cycle AC

Power Consumption ....225 Watts

Power Output ....Undistorted 2.2 Watts
Maximum 4.0 Watts

Antenna Input Imp......................300 Ohms Balanced

Tuning Range ....12 Channel

MODELS 520, 521, 522, 523, 525

Tuning Range ....82 Channel

Loud Speaker .... 6" PM Models 500, 510, 511, 520, 521
10" PM Models 512, 513, 515, 522, 523, 525

Voice Coil Impedance............3.2 Ohm at 400 Cycles

I.F. CIRCUIT Inter-Carrier Sound

R.F. STAGE One

I.F. STAGES Three "Combined Picture and Sound" and one "Sound"
41.25 M.C. Sound Carrier
45.75 M.C. Video Carrier
4.5 M.C. Inter-Carrier Sound

GENERAL INSTALLATION INSTRUCTIONS

While each receiver is correctly aligned at the factory rough handling in transit, ageing, drift, etc., may throw the receiver off, so we suggest that the proper oscillator trimmers, ratio detector, and rear panel controls (see pages 4 and 5) be checked for correct adjustment with a transmitted television pattern, in the customer's home at the time of installation. Be sure to have the receiver operating for one-half hour before making these adjustments. Listed below is the correct procedure to follow in making these adjustments.

(A) Check all operating channels, using FINE TUNING CONTROL for best picture detail. (See paragraph PEAKING THE INDIVIDUAL OSCILLATOR TRIMMERS.)

(B) Check LOCALITY ADJUSTER CONTROL located on back of chassis for proper setting.

NOTE: The signal strength (too strong or too weak) will be affected by location and distance from the station, type of antenna used, terrain obstructions such as tall buildings, electrical disturbances.

PEAKING THE INDIVIDUAL VHF OSCILLATOR TRIMMERS

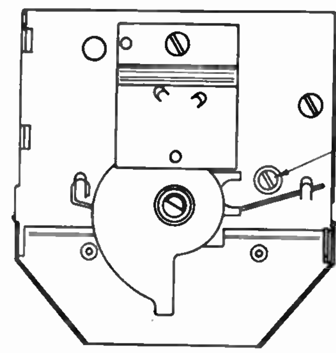
(A) Set channel selector knob to the desired channel.

(B) Set the FINE TUNING CONTROL to the center position.

(C) Remove the channel and fine tuning knobs. This will expose the individual channel adjustment screw opening just to right of the channel shaft. See Fig. 1.

(D) Use a non-metallic screwdriver such as polysterene or nylon.

Adjust the individual oscillator screw for best picture detail. A slight adjustment in either direction is all that is necessary. CAUTION: DO NOT ADJUST INDISCRIMINATELY, this may cause the adjustment screw to fall from its locking position.



THE PROPER ADJ. SCREW FOR THE CHANNEL TUNED TO WILL APPEAR HERE

FIG. I

ADJUSTMENT FOR STATION BUZZ

If station buzz is excessive and is NOT DUE to "contrast control" being advanced too far in a clockwise direction or the locality adjuster control in the incorrect position, adjust the ratio detector secondary adjustment screw located on top of the ratio detector for minimum buzz. MAKE SURE THAT THIS POSITIOIN IS BETWEEN the two MAXIMUM buzz peaks that will be noticed when adjustment screw is turned to the right or left of the minimum buzz position.

MODELS 532, 542, 552, 554, 562, 564

TUBE COMPLEMENT

6BQ7 or 6BZ7	R.F. AMPLIFIER
6J6	VHF OSCILLATOR, MODULATOR
6CB6	VIDEO I.F. AMPLIFIER
6CL6	VIDEO AMPLIFIER
6AU6	SOUND I.F. AMPLIFIER
6AL5	RATIO DETECTOR
6SN7GT	A.F. AMPLIFIER, HORIZONTAL AFC CONTROL
6W6GT	AUDIO OUTPUT
6SN7GT	SYNC SEPARATOR, PHASE SPLITTER
6SN7GT	HORIZONTAL OSCILLATOR
1B3GT	HIGH VOLTAGE RECTIFIER
6CD6G	HORIZONTAL OUTPUT
6V3	HORIZONTAL DAMPERS
12BH7	VERTICAL OSCILLATOR, SYNC AMPLIFIER
6BL7GT	VERTICAL AMPLIFIER
5U4G	POWER RECTIFIERS
27EP4A	27" PICTURE TUBES MODELS 542, 562, 564
24CP4A	24" PICTURE TUBE MODELS 532, 542
24TP4A	24" PICTURE TUBE MODELS 532A, 542A
6AF4	UHF OSCILLATOR

ELECTRICAL SPECIFICATIONS

Power Supply................110 to 120 Volts 60 Cycle AC

Power Consumption..250 Watts

Power Output ....Undistorted 2.2 Watts
Maximum 4.0 Watts

Antenna Input Imp......................300 Ohms Balanced

Tuning Range...12 Channel

MODELS 542, 562, 564

Tuning Range...82 Channel

Loud Speaker...12" P.M.

Loud Speaker.......................Models 532, 542, 10" P.M.

Voice Coil Impedance............3.2 Ohm at 400 Cycles

I.F. CIRCUIT Inter-Carrier Sound

R.F. STAGE One

I.F. STAGES Three "Combined Picture and Sound" and one "Sound"
41.25 M.C. Sound Carrier
45.75 M.C. Video Carrier
4.5 M.C. Intercarrier Sound

27" PICTURE TUBE HANDLING PRECAUTIONS

EXTREME CARE MUST BE EXERCISED WHEN HANDLING OR SERVICING THE PICTURE TUBE. ACCIDENTS ARE ONLY CAUSED BY CARELESSNESS.

Listed below are precautions which must be taken when removing the picture tube.

1. To remove the picture tube mounting assembly.
   (a) Disconnect the second anode lead, the picture tube socket assembly, and the deflection yoke plug.
   (b) Remove the main chassis and the four picture tube support braces.
   (c) Remove the wood screws holding the picture tube mounting board assembly to the cabinet.
   (d) Slide picture tube assembly out. Because of its size and weight two persons are required to handle this assembly. The balance or center of weight is at the face of the picture tube.
2. Always wear goggles when handling picture tube.
3. Never hold the picture tube close to the body.
4. Never handle the picture tube by its neck.
5. Never bump or scratch the picture tube.
6. Always clean the neck of the picture tube before adjusting the ion trap.
7. If it becomes necessary to remove the picture tube from its mounting board, always place on a clean soft cloth face down.

HIGH VOLTAGE AND CORONA

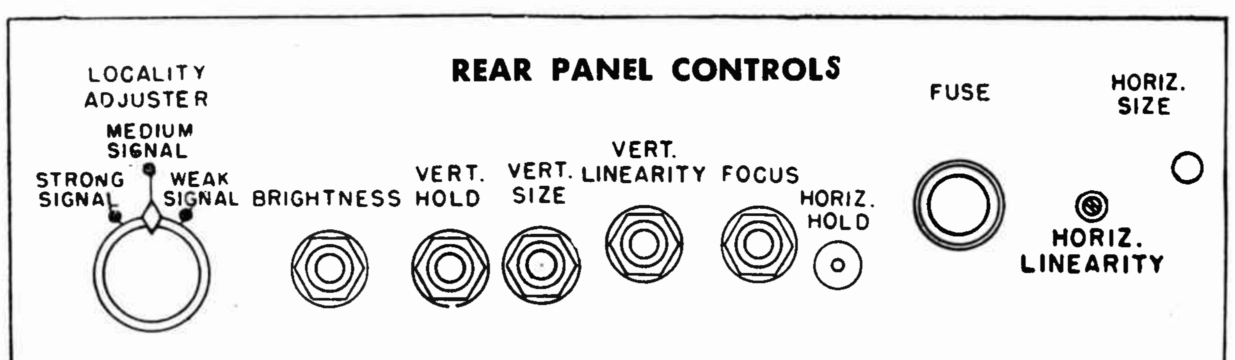
WARNING: HIGH VOLTAGE DEVELOPED IN THIS RECEIVER IS IN EXCESS OF 18,000 VOLTS.

Increased high voltage not only presents the problem of safety precautions, it also increases the problems of arcing and corona.

When servicing or replacing any part of the high voltage compartment of this receiver the following precautions and suggestions should be followed.

1. All connections to the high voltage transformer, condenser, and socket terminal should be made mechanically tight and all excessive wire clipped off, leaving no sharp points from these terminals.
2. A clean, round and smooth solder connection should be made, covering all sharp points. (Do not use excessive solder.)
3. All lead dresses in the high voltage compartment are critical.
   B+ leads or leads of ground or near ground potential too close to any high voltage leads will cause corona and/or arcing to the extent it may cause the insulation of the wires to burn.
4. All insulating wax when removed around the high voltage socket and condenser must be replaced. Insulating wax may be procured through the Sentinel Service Department.
5. Repairing high voltage transformers is not recommended. Always replace the defective transformer with a new one.
6. Before replacing the high voltage shield cover make a careful inspection of wire dress, soldered connections, and wax insulated parts.

REAR PANEL CONTROLS



The UHF TUNER has been aligned for optimum operation by special factory equipment and should never require alignment.

The 6AF4 OSCILLATOR and 1N82 CRYSTAL are readily accessible through the bottom panel. The 1N82 crystal is a snap-in type and no soldering is required.

In the UHF position the 6BQ7 is used as an additional IF stage.

Great care should be taken that parts location and lead dress are not altered in the UHF TUNER.

FOR VHF ALIGNMENT SEE ALIGNMENT DATA LISTED ON PAGES 17 and 18.

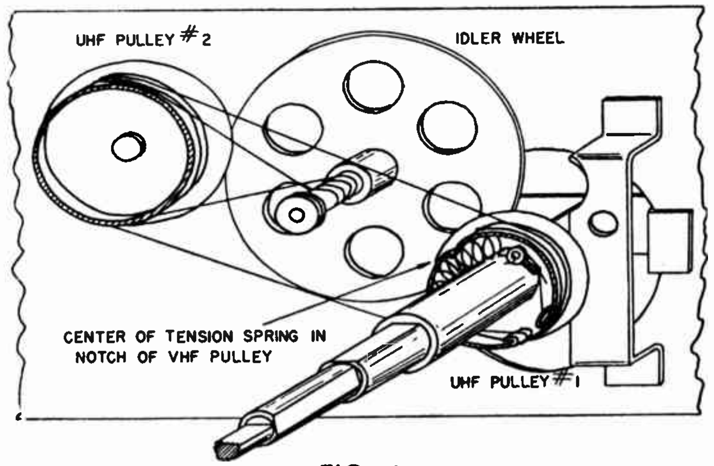


FIG. 6

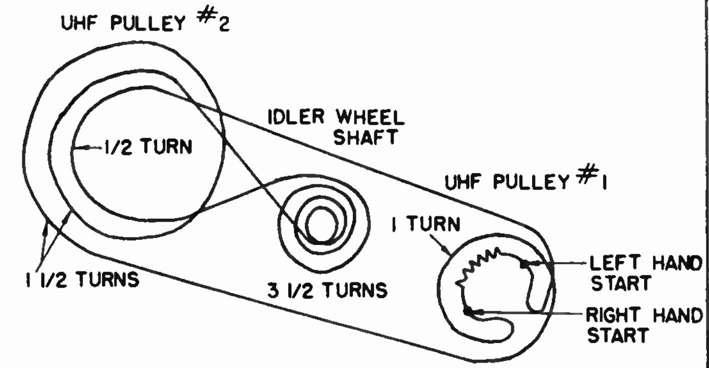


FIG. 7

STRINGING OF UHF PULLEYS

BOTH UHF pulleys must be in the extreme counter-clockwise position before stringing pulley.

The string should be fastened to the ends of the spring so that it measures 28½ inches end to end with no tension on spring.

Stringing is simplified by using both hands. Place center of tension spring into notch of UHF pulley No. 1. Bring string out of opening of pulley. Grasp the string with right and left hand as indicated in figure 7.

With the right hand make a complete turn around UHF pulley No. 1 in a clockwise direction. With the left hand make a half turn around UHF pulley No. 2 in a counter-clockwise direction, then continue in a clockwise direction around the idler wheel shaft making 3½ turns, follow back around the UHF pulley No. 2 in a counter-clockwise direction making 1½ turns, to complete the stringing.

Turn the FINE TUNING SHAFT only until the strings are properly seated.

If the UHF pulleys do not come to a stop in the opposite directions simultaneously, turn the UHF pulley No. 2 until it does so.

UHF IDLER OR CLUTCH ADJUSTMENT

1. If the fine tuning shaft turns when the UHF channel selector is operated the brass hex head adjustment screw part of idler wheel shaft is too tight. Loosen brass adjustment screw very slightly.
2. If by operating the fine tuning control and it does not turn the UHF tuner, the brass hex head adjustment screw part of idler wheel shaft is too loose. Tighten brass adjustment screw very slightly.

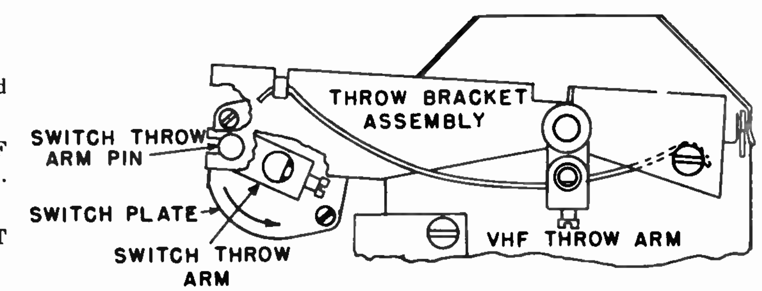
UHF SWITCH POSITIONING

The switch must be positioned carefully to avoid damage to the switch and switch assembly.

1. Set VHF and UHF position (roller on VHF throw arm engaging throw bracket assembly).
2. Loosen switch mounting nut.

NOTE: LOCATING PIN ON SWITCH IS NOT USED.

3. Move switch as shown by arrow in fig. 8 gently, until stop is reached. Set detent stop of switch so that a space of 1/64 inch is between detent stop and switch plate stop. Tighten switch mounting nut.
4. Turn channel selector ON and OFF of UHF position. Recheck stops. Detent stop must not touch switch plate stop or have more than 1/64 inch space between stops when in the UHF position.



REAR VIEW OF SWITCH ASSEMBLY IN UHF POSITION

FIG. 8

5. If switch is properly positioned the switch throw arm pin will not bind in slot of throw bracket at any setting of VHF tuner.

UHF TUNER PARTS LIST

20E863 VHF TUNER PARTS LIST

Illus. No.	Part No.	Description	List Price
CU-1	CD8X-102Z	Fixed Ceramic, 1,000 MMF GMV	.27
CU-2	13L8D121K	Fixed Ceramic, 120 MMF ± 10% N750	.32
CU-3	31B-206	Trimmer, RF .5-3 MMF	.75
CU-4	13L8C6R8C	Fixed Ceramic, 6.8 MMF ± .25 MMF NPO	.81
CU-5	13XR1-30U101J	Fixed Ceramic, 100 MMF ± 5% N750	
CU-6	CD8Q-470K	Fixed Ceramic, 47 MMF ± 10% N1400	.27
CU-7	31B-206	Trimmer, RF .5-3 MMF	.75
CU-8	CD8C-030C	Fixed Ceramic, 3 MMF ± .25 MMF NPO	.27
CU-9	31B-611	Feed Thru 800*MMF GMV (Part of Center Shield Assembly)	.36
CU-10	CD8X-102Z	Fixed Ceramic, 1000 MMF GMV	.27
CU-11	CD8C1R5M	Fixed Ceramic, 1.5 MMF ± 20%	.27
CU-12	31B-167	Trimmer Antenna, 3-9 MMF	.66
CU-13	CD8X-102Z	Fixed Ceramic, 1000 MMF GMV	.27
CU-14	CD10C-100K	Fixed Ceramic, 10 MMF ± 10% NPO	.22
CU-15		Fixed Ceramic, 68 MMF	
CU-16	CD8UA-050C	Fixed Ceramic, 5 MMF ± .25 MMF N900	.24
CU-17	31B-252	Fine Tuning, Ceramic Bushing and Lead Assembly	.40
CU-18A	31B-611	Feed Thru 800 MMF (Part of Center Shield Assembly)	.36
CU-18B	31B-611	Feed Thru 800 MMF (Part of Center Shield Assembly)	.36
CU-18C	31B-611	Feed Thru 800 MMF (Part of Center Shield Assembly)	.36
CU-18D	31B-611	Feed Thru 800 MMF (Part of Center Shield Assembly)	.36

RESISTORS

Illus. No.	Part No.	Description	List Price
RU-1	27E153-2	Carbon, 15,000 OHM ½ W. ± 10%	.08
RU-2	27E153-2	Carbon, 15,000 OHM ½ W. ± 10%	.08
RU-3	27E224-2	Carbon, 220,000 OHM ½ W. ± 20%	.08
RU-4	27E1009-24	Carbon, 330,000 OHM ½ W. ± 10%	.08
RU-5	27E103-2	Carbon, 10,000 OHM ½ W. ± 10%	.08
RU-6	27E473-2	Carbon, 47,000 OHM ½ W. ± 10%	.08
RU-7	27E1009-6	Carbon, 220,000 OHM ½ W. ± 10%	.08
RU-8	27E471-2	Carbon, 470 OHM ½ W. ± 10%	.08
RU-9	27E223-3	Carbon, 22,000 OHM 1 W. ± 10%	.12
LU-1	31B-638-1	R.F. Choke	.72
LU-2	31B-230	Feedback Choke	.30
LU-3	31B-629	Cathode Choke	.24
LU-4	34A-546	R.F. Filament Choke	.08
LU-5	34A575	Oscillator Filament Choke	.08
LU-6	34A-680	Mixer, Choke	.72
TU-1	31B-682	Mixer, I.F.	.72
	31B-655-6	Fine Tuning Assembly	.76
	31M-012	Antenna Strips, Channels 2 Thru 6, Code Q, Green	1.20
	31M-012	Antenna Strips, Channels 7 Thru 13, Code Q Green	1.00
	31M-112	R.F. and Oscillator Strips, Channel 2 Thru 6, Code R, Green	1.60
	31M-112	R.F. and Oscillator Strips, Channel 7, Thru 13, Code R, Green	1.50

Note: When ordering channel strips specify required channel number

Illus. No.	Part No.	Description	List Price
	31M-113-1Q	Strip for UHF 13th Position Antenna Code Q, Green	1.00
	31M-113-1R	Strip for UHF 13th Position R.F. and Oscillator Code R, Green	1.00

All mechanical parts for the above listed tuner are the same as listed on Page 20 except for fine tuning assembly and drum and shaft assembly.

20E867 UHF TUNER PARTS LIST

Illus. No.	Part No.	Description	List Price
CU-21	M-210	Fixed Ceramic, 2.2 MMF	
CU-22	M-211	Fixed Ceramic, 1 MMF	
CU-24	M-212	Fixed Ceramic, 2.2 MMF	
CU-25	M-213	Fixed Ceramic, 2.7 MMF	
CU-26	M-214	Fixed Ceramic, 2.5 MMF	
CU-27	M-215	Feed Thru, 250 MMF	
CU-28	M-216	Fixed Ceramic, 1 MMF	
CU-29	M-217	Fixed Ceramic, .25 MMF	
CU-30	M-218	Trimmer, Ceramic Tubular .8-6.5 MMF	
CU-31	M-219	Trimmer, Ceramic Tubular .8-6.5 MMF	
CU-32	M-220	Trimmer, Ceramic Tubular 3-10 MMF	
CU-33	M-221	Fixed Ceramic, 68 MMF	
CU-34	M-222	Fixed Ceramic, .42 MMF	
CU-35	M-223	Fixed Ceramic, 68 MMF	

RESISTORS

Illus. No.	Part No.	Description	List Price
RU-11	27E220-2	Carbon, 22 OHM ½ W.	
RU-12	27E220-2	Carbon, 22 OHM ½ W.	
RU-13	27E474-2	Carbon, 470,000 OHM ½ W.	.07
RU-14	27E474-2	Carbon, 470,000 OHM ½ W.	.07
RU-15	27E123-2	Carbon, 12,000 OHM ½ W.	.08

CHOKES

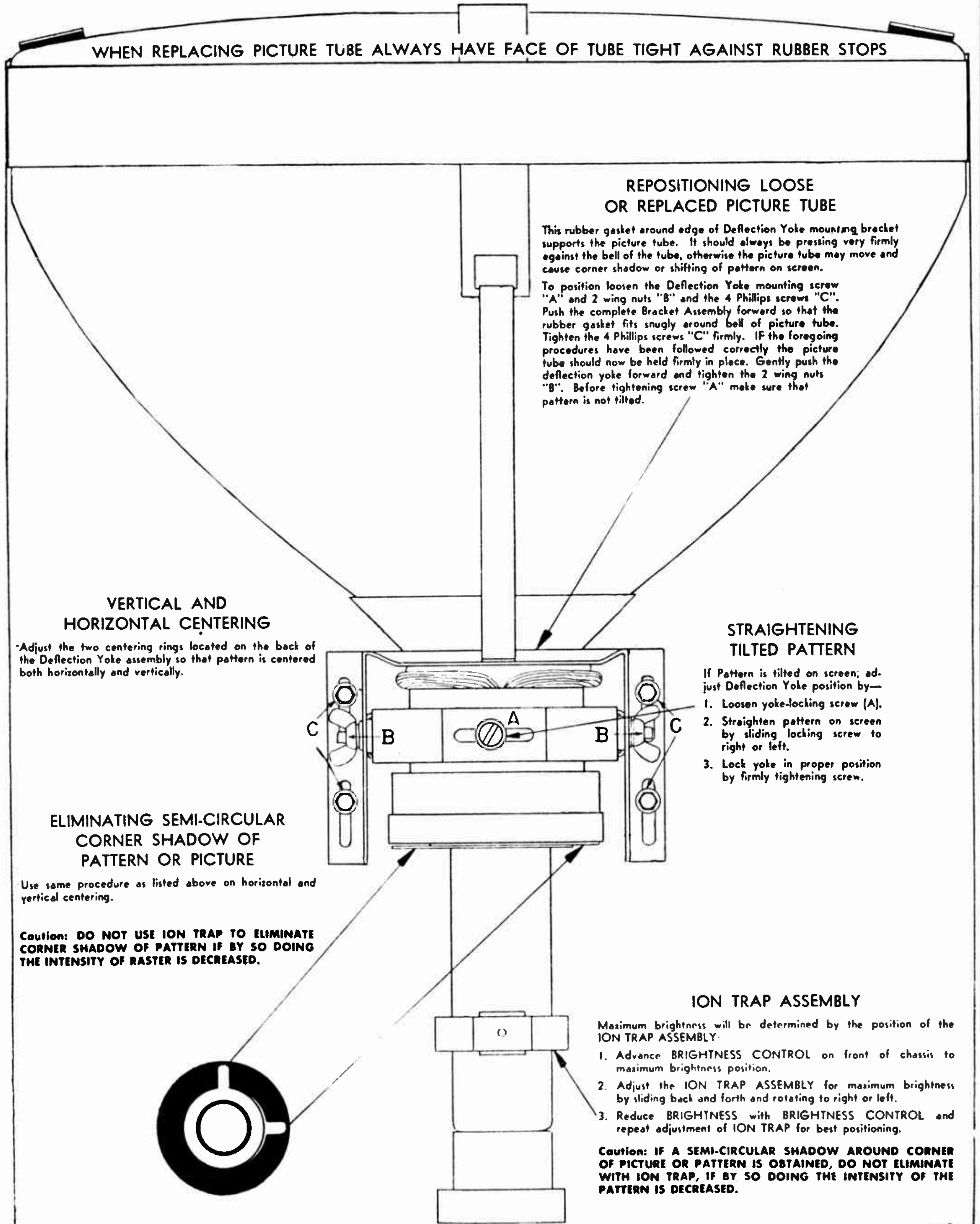
Illus. No.	Part No.	Description	List Price
LU-7	M-224	R.F. Choke	
LU-8	M-225	R.F. Choke	
LU-9	M-226	R.F. Choke	
LU-10	M-227	R.F. Choke	
LU-11	M-228	R.F. Choke	
TU-4	M-229	Output Transformer	

MISCELLANEOUS PARTS

Illus. No.	Part No.	Description	List Price
CU-19		68 MMF (Part of TU-2)	
CU-20		68 MMF (Part of TU-3)	
TU-2	20E889	Trap, 44 MC	1.49
TU-3	20E890	Trap, 45 MC	1.27
RU-10	27E332-5	Resistor Carbon, 3300 OHM 2 W. ± 10%	.24
	1N82	Crystal Diode	
	29E31	Switch Wafer	2.00
	20E864	Switch Throw Arm	.42
	20E864-2	VHF Tuner Throw Arm	.63

Part No.	Description	List Price
20E865	Throw Bracket Assembly	1.35
65E56	Spring Throw Bracket Return	.11
20E868	Pulley, UHF	.70
10E103	Stud Idler Pulley	1.37
20E869	Clutch or Idler Assembly	1.37
20E870	Drive Disc Assembly	1.03
20E871	Sleeve and Pulley Assembly	1.45
20E253-41	Dial Cord Assembly with Eyelets 28-1/16" inches	.17
65E2	Tension Spring	.06

ADJUSTMENT PROCEDURE FOR ELECTROSTATIC FOCUS PICTURE TUBES, DEFLECTION YOKE, ION TRAP, HORIZONTAL AND VERTICAL CENTERING, CORNER SHADOW, AND PICTURE TUBE ALIGNMENT.



REPOSITIONING LOOSE OR REPLACED PICTURE TUBE

This rubber gasket around edge of Deflection Yoke mounting bracket supports the picture tube. It should always be pressing very firmly against the bell of the tube, otherwise the picture tube may move and cause corner shadow or shifting of pattern on screen.

To position loosen the Deflection Yoke mounting screw "A" and 2 wing nuts "B" and the 4 Phillips screws "C". Push the complete Bracket Assembly forward so that the rubber gasket fits snugly around bell of picture tube. Tighten the 4 Phillips screws "C" firmly. If the foregoing procedures have been followed correctly the picture tube should now be held firmly in place. Gently push the deflection yoke forward and tighten the 2 wing nuts "B". Before tightening screw "A" make sure that pattern is not tilted.

VERTICAL AND HORIZONTAL CENTERING

Adjust the two centering rings located on the back of the Deflection Yoke assembly so that pattern is centered both horizontally and vertically.

STRAIGHTENING TILTED PATTERN

If Pattern is tilted on screen, adjust Deflection Yoke position by—

1. Loosen yoke-locking screw (A).
2. Straighten pattern on screen by sliding locking screw to right or left.
3. Lock yoke in proper position by firmly tightening screw.

ELIMINATING SEMI-CIRCULAR CORNER SHADOW OF PATTERN OR PICTURE

Use same procedure as listed above on horizontal and vertical centering.

Caution: DO NOT USE ION TRAP TO ELIMINATE CORNER SHADOW OF PATTERN IF BY SO DOING THE INTENSITY OF RASTER IS DECREASED.

ION TRAP ASSEMBLY

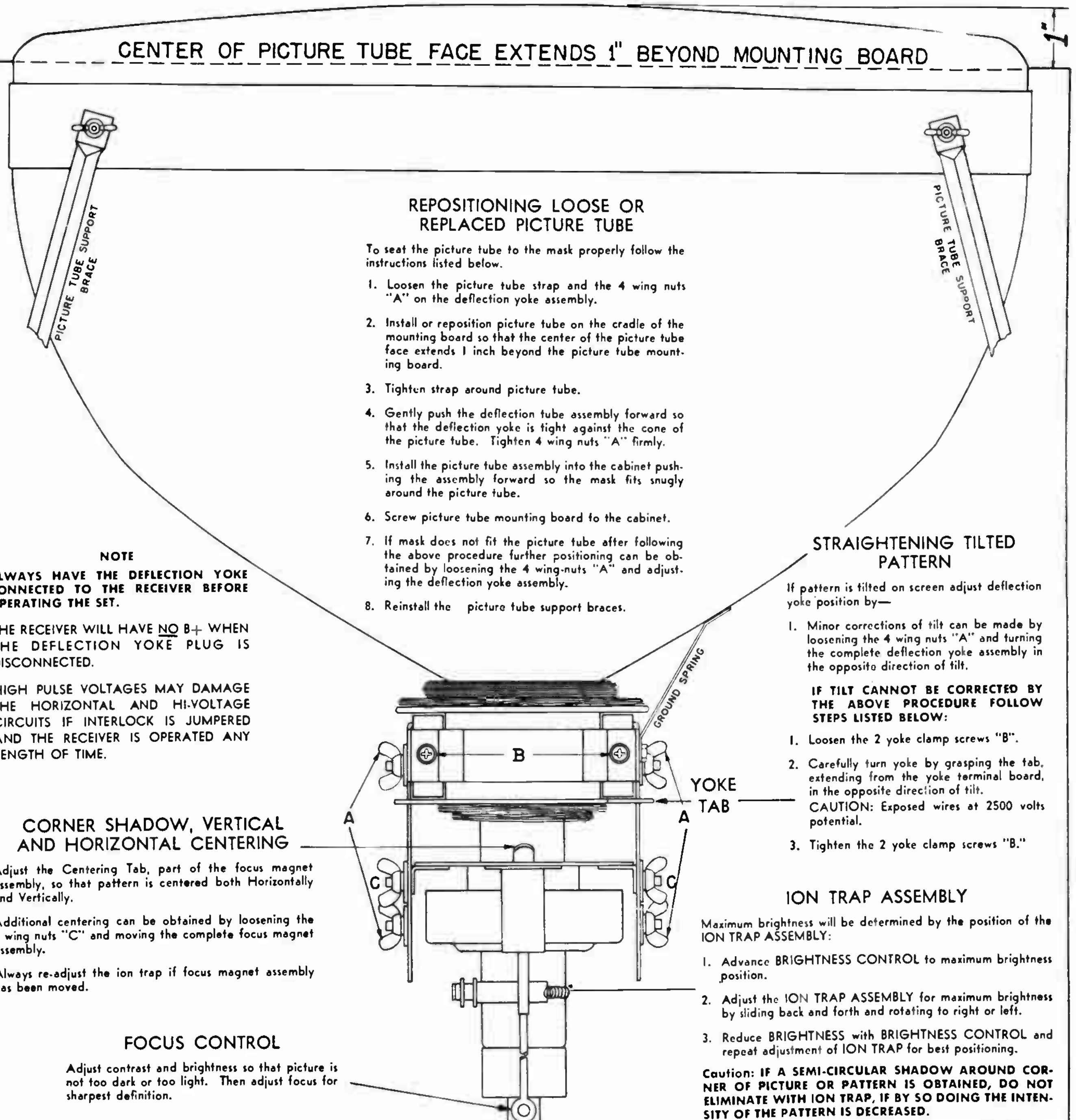
Maximum brightness will be determined by the position of the ION TRAP ASSEMBLY.

1. Advance BRIGHTNESS CONTROL on front of chassis to maximum brightness position.
2. Adjust the ION TRAP ASSEMBLY for maximum brightness by sliding back and forth and rotating to right or left.
3. Reduce BRIGHTNESS with BRIGHTNESS CONTROL and repeat adjustment of ION TRAP for best positioning.

Caution: IF A SEMI-CIRCULAR SHADOW AROUND CORNER OF PICTURE OR PATTERN IS OBTAINED, DO NOT ELIMINATE WITH ION TRAP, IF BY SO DOING THE INTENSITY OF THE PATTERN IS DECREASED.

SM-1002

24" AND 27" PICTURE TUBE
ADJUSTMENT PROCEDURE FOR FOCUS, DEFLECTION YOKE, ION TRAP, HORIZONTAL AND VERTICAL CENTERING, CORNER SHADOW, AND PICTURE TUBE ALIGNMENT.



REPOSITIONING LOOSE OR REPLACED PICTURE TUBE

To seat the picture tube to the mask properly follow the instructions listed below.

1. Loosen the picture tube strap and the 4 wing nuts "A" on the deflection yoke assembly.
2. Install or reposition picture tube on the cradle of the mounting board so that the center of the picture tube face extends 1 inch beyond the picture tube mounting board.
3. Tighten strap around picture tube.
4. Gently push the deflection tube assembly forward so that the deflection yoke is tight against the cone of the picture tube. Tighten 4 wing nuts "A" firmly.
5. Install the picture tube assembly into the cabinet pushing the assembly forward so the mask fits snugly around the picture tube.
6. Screw picture tube mounting board to the cabinet.
7. If mask does not fit the picture tube after following the above procedure further positioning can be obtained by loosening the 4 wing-nuts "A" and adjusting the deflection yoke assembly.
8. Reinstall the picture tube support braces.

NOTE

ALWAYS HAVE THE DEFLECTION YOKE CONNECTED TO THE RECEIVER BEFORE OPERATING THE SET.

THE RECEIVER WILL HAVE NO B+ WHEN THE DEFLECTION YOKE PLUG IS DISCONNECTED.

HIGH PULSE VOLTAGES MAY DAMAGE THE HORIZONTAL AND HI-VOLTAGE CIRCUITS IF INTERLOCK IS JUMPERED AND THE RECEIVER IS OPERATED ANY LENGTH OF TIME.

STRAIGHTENING TILTED PATTERN

If pattern is tilted on screen adjust deflection yoke position by—

1. Minor corrections of tilt can be made by loosening the 4 wing nuts "A" and turning the complete deflection yoke assembly in the opposite direction of tilt.

IF TILT CANNOT BE CORRECTED BY THE ABOVE PROCEDURE FOLLOW STEPS LISTED BELOW:

1. Loosen the 2 yoke clamp screws "B".
2. Carefully turn yoke by grasping the tab, extending from the yoke terminal board, in the opposite direction of tilt. CAUTION: Exposed wires at 2500 volts potential.
3. Tighten the 2 yoke clamp screws "B."

CORNER SHADOW, VERTICAL AND HORIZONTAL CENTERING

Adjust the Centering Tab, part of the focus magnet assembly, so that pattern is centered both Horizontally and Vertically.

Additional centering can be obtained by loosening the 2 wing nuts "C" and moving the complete focus magnet assembly.

Always re-adjust the ion trap if focus magnet assembly has been moved.

ION TRAP ASSEMBLY

Maximum brightness will be determined by the position of the ION TRAP ASSEMBLY:

1. Advance BRIGHTNESS CONTROL to maximum brightness position.
2. Adjust the ION TRAP ASSEMBLY for maximum brightness by sliding back and forth and rotating to right or left.
3. Reduce BRIGHTNESS with BRIGHTNESS CONTROL and repeat adjustment of ION TRAP for best positioning.

Caution: **IF A SEMI-CIRCULAR SHADOW AROUND CORNER OF PICTURE OR PATTERN IS OBTAINED, DO NOT ELIMINATE WITH ION TRAP, IF BY SO DOING THE INTENSITY OF THE PATTERN IS DECREASED.**

FOCUS CONTROL

Adjust contrast and brightness so that picture is not too dark or too light. Then adjust focus for sharpest definition.

ADJUSTMENTS FOR CORNER SHADOW, VERTICAL AND HORIZONTAL CENTERING CAN BE MADE WITHOUT REMOVING THE CABINET BACK. THE CENTERING TAB CAN BE REACHED BY REMOVING THE 4 SCREWS HOLDING CUP TO THE CABINET BACK.

24" PICTURE TUBES

Except for repositioning and mounting of picture tube the above listed adjustments are used for 24" picture tubes.

VHF ALIGNMENT DATA

ALIGNMENT PROCEDURE

All circuits are very stable and will seldom require adjustment. Only when major parts of the tuner or the video I-F strip have been replaced or tampered with will it be necessary to realign the receiver.

Generally under normal conditions only the INDIVIDUAL CHANNEL TRIMMERS in the tuner unit may require adjustment by the service technician.

RATIO DETECTOR AND SOUND I-F ALIGNMENT

In most cases only the secondary of the ratio detector coil will require adjustment. This can be done simply by adjusting the top adjustment screw of the ratio detector for minimum buzz with the sound carrier of a TV station. For complete alignment use steps 1, 2, and 3 in the alignment table.

PICTURE I-F ALIGNMENT

Receiver should be run for at least ½ hour before proceeding with alignment.

EQUIPMENT REQUIRED

VACUUM TUBE VOLTMETER
For video IF alignment maintain readings in middle of low volt scale.

SIGNAL GENERATOR supplying a 4.5 MC. (within .25%) 40 to 216 MC. (within 1%) signal. With output adjustable to at least .1 volt maximum.

CATHODE-RAY OSCILLOSCOPE. Must have good frequency and phase response from 10 cycles to at least 2 MC.

SWEEP GENERATOR. Capable of covering 40 to 270 MC. with a 10 MC. sweep with output adjustable to at least .1 volt maximum.

3 VOLT "A" BATTERY to provide fixed bias during video I-F and R-F alignment.

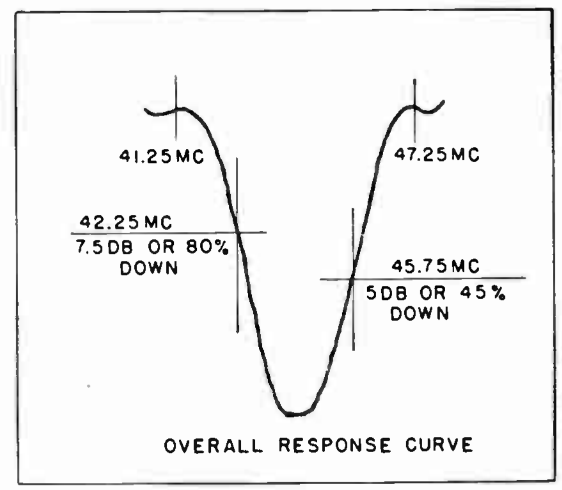


FIG. 2

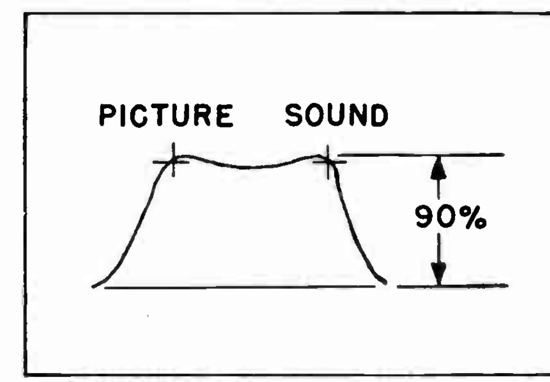


FIG. 3

VHF ALIGNMENT TABLE

RATIO DETECTOR AND SOUND ALIGNMENT

Step No.	Connect Signal Generator to	Sig. Gen. Freq.	Connect Voltmeter to	Miscellaneous Instructions	Adjust
1	In series with .001 Mfd. Cond. to junction of C-97 and L-13 terminal 3 of 4th I.F. See fig. 5	4.5 MC.	In series with 47,000 ohm res. across C-23 a 10 Mfd. cond. See fig. 5	Maintain reading on 10 volt scale contrast at maximum. Remove 3rd video IF tube 6CB6.	T-7 (top) and T-8 (bottom) for max. reading. See fig. 4 & 5
2	In series with .001 Mfd. Cond. to junction of C-97 and L-13 terminal 3 of 4th I.F. See fig. 5	4.5 MC.	In series with 47,000 ohm res. to junction of R-30 and C-44. See fig. 5	Maintain reading on 10 volt scale contrast at maximum. Remove 3rd video IF tube 6CB6.	T-8 (top) for zero reading. See fig. 4
3	In series with .001 Mfd. Cond. to cathode of picture tube yellow lead. See fig. 5	4.5 MC.	In series with 47,00 ohm res. across C-23 a 10 Mfd. cond. See fig. 5	Maintain reading on low volt scale. Remove 3rd video IF tube 6CB6.	T-6 (top) for minimum reading. See fig. 4

NOTE 1: For **minimum buzz** always adjust T-8 (top) with the sound carrier of a TV station.
NOTE 2: Alternate 4.5 MC. trap alignment: Adjust T-6 (top) for minimum 4.5 MC. beat on picture with a strong station signal.

PICTURE I-F ALIGNMENT

Step No.	Connect Signal Generator to	Sig. Gen. Freq.	Connect Voltmeter to	Miscellaneous Instructions	Adjust
4	Ungrounded converter tube (6J6) shield	44.0 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-5 (top) for maximum reading. See fig. 4
5	Ungrounded converter tube (6J6) shield	43.0 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-4 (top) for maximum reading. See fig. 4
6	Ungrounded converter tube (6J6) shield	41.25 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5 Repeat Steps 5 & 6	T-4 (bottom) for maximum reading. See fig. 5
7	Ungrounded converter tube (6J6) shield	45.4 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-3 (top) for maximum reading. See fig. 4
8	Ungrounded converter tube (6J6) shield	47.25 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5 Repeat Steps 7 & 8	T-3 (bottom) for maximum reading. See fig. 5
9	Ungrounded converter tube (6J6) shield	44.6 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5 **NOTE:** Detune T-2 by turning slug out as far as possible.	T-1 (top) or minimum reading. See fig. 4
10	Ungrounded converter tube (6J6) shield	45.75MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5	Tuner on channel 3, 3 volts bias across C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-2 (top) for minimum reading See fig. 4

NOTE 3: For visual check of IF response curve (see fig. 2) connect signal and sweep generator to ungrounded converter tube shield (6J6). Connect oscilloscope in series with 47,000 ohm resistor to junction of R-37 and L-7.

TUNER R.F. ALIGNMENT

NOTE 4: NEVER ADJUST C-3, C-7 and C-12 UNLESS ABSOLUTELY NECESSARY. THEY ARE FACTORY PRESET BY SPECIAL EQUIPMENT.

Step No.	Connect Marker Generator to	Marker Gen. Freq.	Connect Sweep Gen. to	Sweep Gen. Chan.	Connect Oscilloscope to	Miscellaneous Connections	Adjust
11	Loosely couple to sweep gen. leads.	205.25 MC. and 209.75 MC.	300 ohm antenna terminals.	12	Lead extending from top of tuner. See fig. 4	Tuner on channel 12 3 volt bias to junction of C-51 locality switch in strong position.	C-3, C7 and C-12 for max. response having linear peaks with picture and sound markers at 90% maximum response. See fig. 3
12	OBSERVE RESPONSE CURVE FOR ALL CHANNELS USING CORRECT FREQUENCIES AND CHANNELS. A SLIGHT COMPROMISE SHOULD BE MADE WITH C-3, C-7 and C-12 IF MARKERS ARE BELOW 70%.						

NOTE 5: FOR RF OSCILLATOR ALIGNMENT, SET FINE TUNING CONTROL IN CENTER POSITION. ADJUST INDIVIDUAL CHANNEL TRIMMERS FOR BEST PICTURE DETAIL WITH THE PATTERNS OF A TV STATION. NOTE: USE A NON-METALLIC SCREW-DRIVER.

NOTE 6: C-18 (See fig. 4) part of a 40 MC. tuned trap need only be adjusted when local interferences from 40 thru 45 MC. affect the picture. Adjust C-18 for minimum 40 MC. beat on picture with a station signal. Not used in Models with UHF Tuner.

TRIMMER LOCATION AND ALIGNMENT CONNECTION POINTS

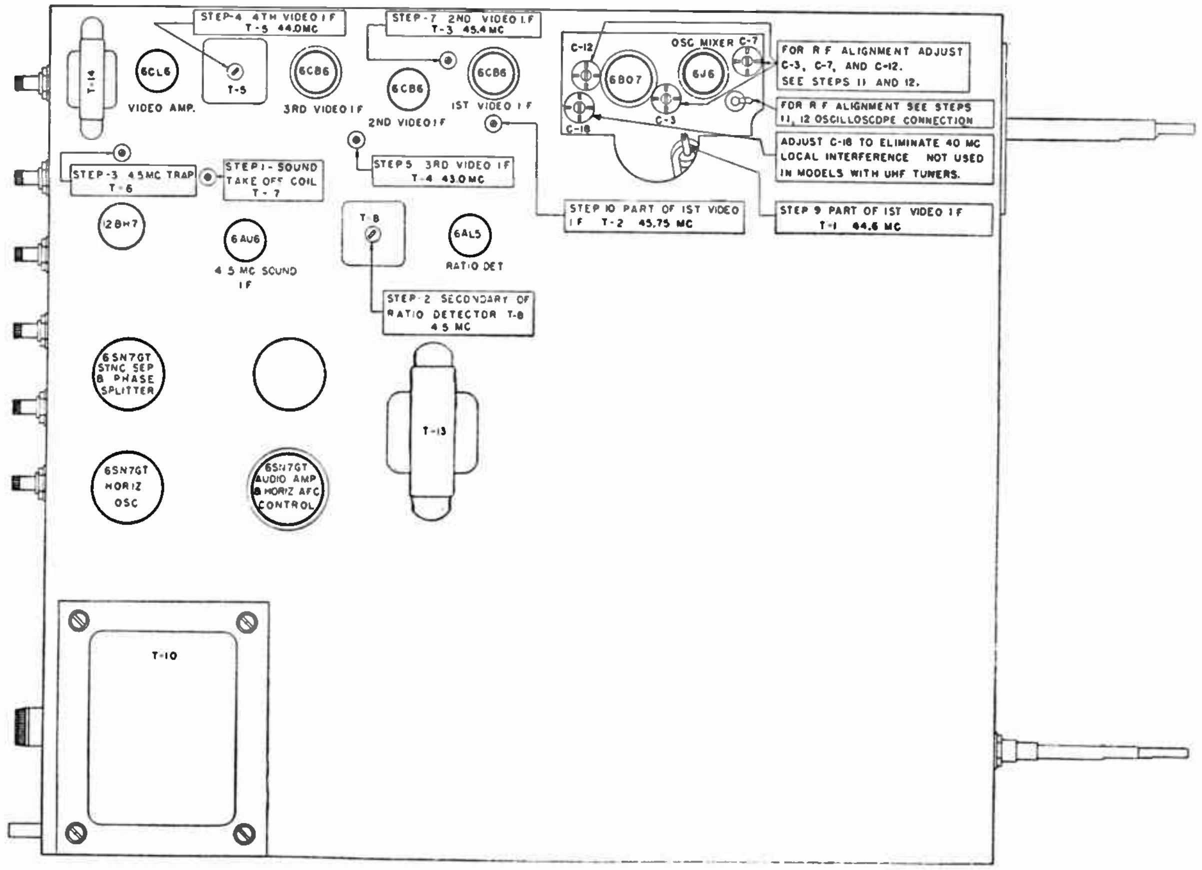


FIG. 4

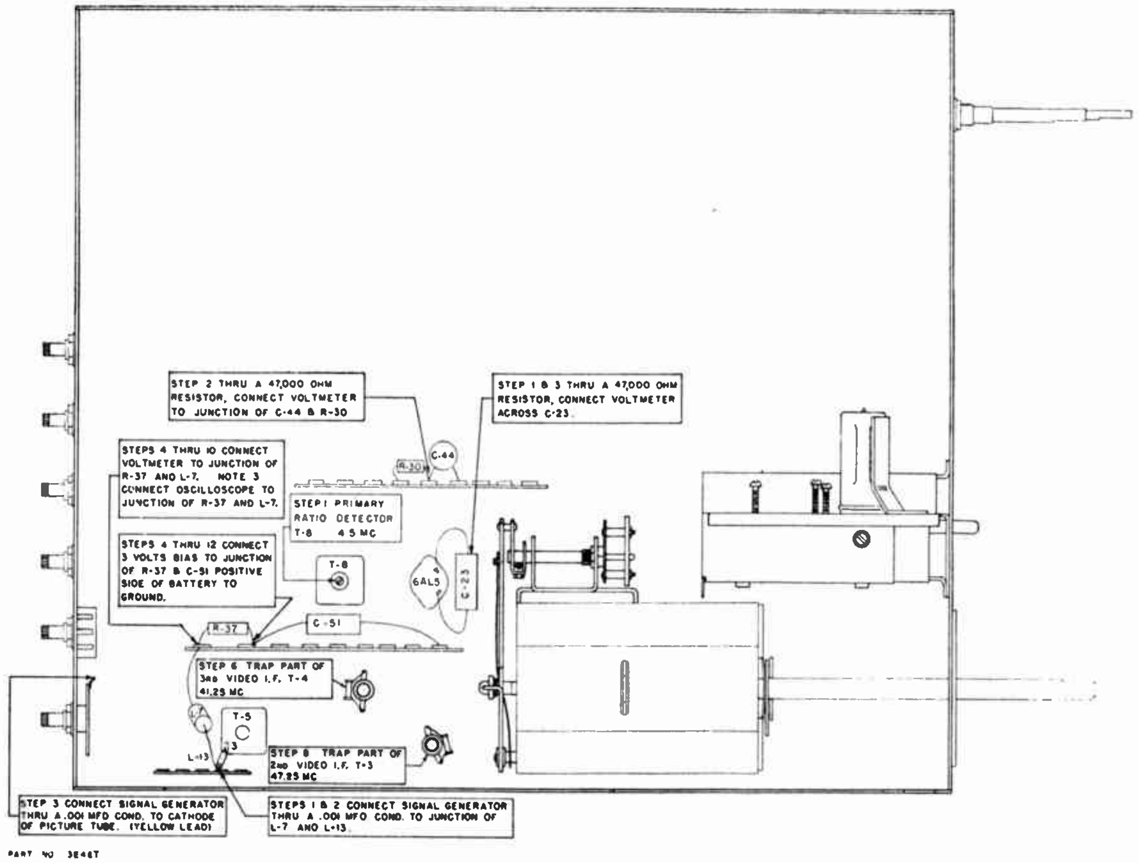


FIG. 5

VHF TUNER PARTS LIST FOR MODELS 500, 510, 511, 512, 513, 515, 532, 552, 554

When Ordering Parts Give The Complete Part Number, Model Number and Description

TUNER UNIT CAPACITORS

Illus. No.	Part No.	Description	List Price
C-1	CD8X-102Z	Fixed Ceramic, 1000 MMF GMV	$ .27
C-2	13L8D121K	Fixed Ceramic, 120 MMF ± 10% N750	.32
C-3	31B-206	Trimmer R.F., .5-3 MMF	.75
C-4	13L8C6R8C	Fixed Ceramic, 6.8 MMF ± .25 MMF NPO	.81
C-5	13XR1-30U101J	Fixed Ceramic, 100 MMF ± 5% N750	
C-6	CD8Q-470K	Fixed Ceramic, 47 MMF ± 10% N1400	.27
C-7	31B-206	Trimmer R.F., .5-3 MMF	.75
C-8	CD8C-030C	Fixed Ceramic, 3 MMF ± .25 MMF NPO	.27
C-9	31B-611	Feed Thru Condenser 800 MMF GMV (Part of Center Shield Assembly)	.36
C-10	CD8C-030C	Fixed Ceramic, 3 MMF ± .25 MMF NPO	.27
C-11	CD8X-102Z	Fixed Ceramic, 1000 MMF GMV	.27
C-12	31B-167	Trimmer Antenna 3-9 MMF	.75
C-13	CD8X-102Z	Fixed Ceramic, 1000 MMF GMV	.27
C-14	CD8D-121K	Fixed Ceramic, 120 MMF ± 10%	.32
C-15	CD10C-100K	Fixed Ceramic, 10 MMF ± 10% NPO	.22
		68 MMF Part of 40 MC Trap T-15	
		68 MMF Part of 40 MC Trap T-17	
C-17	CD8UA-050C	Fixed Ceramic, 5 MMF ± .25 MMF N900	.27
C-18	31B-167	Trimmer Antenna 3-9 MMF	.75
C-19	31B-252	Ceramic Bushing and Lead Assembly, Fine Tuning	.45
C-20A	31B-611	Feed Thru Condenser (Part of Center Shield Assembly) 800 MMF	.36
C-20B	31B-611	Feed Thru Condenser (Part of Center Shield Assembly) 800 MMF	.36
C-20C	31B-611	Feed Thru Condenser (Part of Center Shield Assembly) 800 MMF	.36
C-20D	31B-611	Feed Thru Condenser (Part of Center Shield Assembly) 800 MMF	.36

TUNER UNIT RESISTORS

Illus. No.	Part No.	Description	List Price
R-1	27E153-2	Carbon, 15,000 Ohm ½ W. ± 10%	.08
R-2	27E1009-6	Carbon, 220,000 Ohm ½ W. ± 10%	.08
R-3	27E153-2	Carbon, 15,000 Ohm ½ W. ± 10%	.08
R-4	27E224-2	Carbon, 220,000 Ohm ½ W. ± 10%	.08
R-5	27E473-2	Carbon, 47,000 Ohm ½ W. ± 10%	.08
R-6	27E1009-24	Carbon, 330,000 Ohm ½ W. ± 10%	.08
R-7	27E103-2	Carbon, 10,000 Ohm ½ W. ± 10%	.08
R-8	27E471-2	Carbon, 470 Ohm ½ W. ± 10%	.08
R-9	27E223-3	Carbon, 22,000 Ohm 1 W. ± 10%	.12

CHOKES AND COILS

Illus. No.	Part No.	Description	List Price
L-1	31B-638-1	R.F. Choke	.81
L-2	31B-230	Feed Back Choke	.34
L-3	31B-629	Cathode Choke	.27
L-4	34A-546	R.F. Filament Choke	.08
L-5	34A-575	Osc. Filament Choke	.08
L-15	34A-680	Mixer Choke	.81
T-1	31B-682	Mixer I.F.	.81
T-15	31B-649	40 MC Trap (Code White)	1.89
T-16	31B-289	40 MC Trap	
T-17	31B-601	40 MC Trap (Code Black)	1.89

CHOKES AND COILS—(Cont.)

Part No.	Description	List Price
31M-012-2R	Antenna Coil Assembly, Channel 2, Code R	1.35
31M-012-3R	Antenna Coil Assembly, Channel 3, Code R	1.35
31M-012-4R	Antenna Coil Assembly, Channel 4, Code R	1.35
31M-012-5R	Antenna Coil Assembly, Channel 5, Code R	1.35
31M-012-6R	Antenna Coil Assembly, Channel 6, Code R	1.35
31M-012-7R	Antenna Coil Assembly, Channel 7, Code R	1.15
31M-012-8R	Antenna Coil Assembly, Channel 8, Code R	1.15
31M-012-9R	Antenna Coil Assembly, Channel 9, Code R	1.15
31M-012-10R	Antenna Coil Assembly, Channel 10, Code R	1.15
31M-012-11R	Antenna Coil Assembly, Channel 11, Code R	1.15
31M-012-12R	Antenna Coil Assembly, Channel 12, Code R	1.15
31M-012-13R	Antenna Coil Assembly, Channel 13, Code R	1.15
31M-112-2R	R.F. and Oscillator Coil Assembly, Channel 2, Code R	1.80
31M-112-3R	R.F. and Oscillator Coil Assembly, Channel 3, Code R	1.80
31M-112-4R	R.F. and Oscillator Coil Assembly, Channel 4, Code R	1.80
31M-112-5R	R.F. and Oscillator Coil Assembly, Channel 5, Code R	1.80
31M-112-6R	R.F. and Oscillator Coil Assembly, Channel 6, Code R	1.80
31M-112-7R	R.F. and Oscillator Coil Assembly, Channel 7, Code R	1.65
31M-112-8R	R.F. and Oscillator Coil Assembly, Channel 8, Code R	1.65
31M-112-9R	R.F. and Oscillator Coil Assembly, Channel 9, Code R	1.65
31M-112-10R	R.F. and Oscillator Coil Assembly, Channel 10, Code R	1.65
31M-112-11R	R.F. and Oscillator Coil Assembly, Channel 11, Code R	1.65
31M-112-12R	R.F. and Oscillator Coil Assembly, Channel 12, Code R	1.65
31M-112-13R	R.F. and Oscillator Coil Assembly, Channel 13, Code R	1.65

MISCELLANEOUS TUNER PARTS

Part No.	Description	List Price
31B-613-113	Fine Tuning Assembly	
31B-203-113	Drum & Shaft Assembly, Less Coils	4.60
31B-016	Roller Detent	.18
31B-005	Spring Detent	.18
31B-124	Ground Plate, Fine Tuning	.22
31B-008	Ground Spring, Fine Tuning	.18
31B-021	Mounting Strap, Ceramic Bushing	.18
11D-022	Fiber Washer	.09
31B-030	Spring, Shaft Retaining	.18
31B-278	Stator Contact Bracket Assembly	3.38
16S-004	Shield for 6BQ7	.18
16S-006	Shield for 6J6	.18
31B-103	Shield (Bottom Cover)	1.35
31B-143	Shield (Side)	1.35

Kits containing the necessary strips to convert to any UHF channel are available. When ordering please be sure to: Give required UHF channel number, model number, and code letter "R."

MAIN CHASSIS PARTS LIST

FOR MODELS 500, 510, 511, 512, 513, 515, 520, 521, 522, 523, 525

CAPACITORS

Illus. No.	Part No.	Description	List Price
C-22	23E21	Fixed Ceramic, 2.2 MMF 500 V.	.84
C-23	25E66	Dry Electrolytic, 10 MFD 50 V.	1.14
C-24	23E3216	Molded Tubular, .1 MFD 200 V.	.34
C-25	23E23	Fixed Ceramic, 30 MMF 500 V.	.29
C-26	23E22	Fixed Ceramic, 20 MMF 500 V.	.29
C-27	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-28	25E66	Dry Electrolytic, 10 MFD 50 V.	1.14
C-29	23E3423	Molded Tubular, .039 MFD 400 V. (Not used in Models 500, 510, 520)	.34
C-30	23E3408	Molded Tubular, .0047 MFD 400 V. (Not used in Models 500, 510, 520)	.27
	or		
C-30	23E3410	Molded Tubular, .01 MFD 400 V. (Used in Models 500, 510, 520 only)	.28
C-31	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-32	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-33	23E2027-14	Fixed Ceramic, 470 MMF 500 V.	.21
C-34	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-35	23E2027-14	Fixed Ceramic, 470 MMF 500 V.	.21
C-36	23E2027-11	Fixed Ceramic, 680 MMF 500 V.	.30
C-37	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-38	23E2027-11	Fixed Ceramic, 680 MMF 500 V.	.30
C-40	23E2027-14	Fixed Ceramic, 470 MMF 500 V.	.21
C-41	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-42	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-43	23E3500-40	Fixed Mica, 470 MMF 500 V. ± 10%	.32
C-44	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-45	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-46	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-47	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-48	23E2027-9	Fixed Ceramic, .001 MFD 500 V. (Tubular)	.22
C-49	23E3407	Molded Tubular, .0033 MFD 400 V.	.28
C-50	23E3416	Molded Tubular, .1 MFD 400 V.	.38
C-51	23E122	Fixed Paper .25 MFD 100 V.	.42
C-52	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-53	23E2027-10	Fixed Ceramic, 150 MMF 500 V.	.19
C-54	23E3408	Molded Tubular, .0047 MFD 400 V.	.27
C-55	23E3410	Molded Tubular, .01 MFD 400 V.	.28
C-56	23E3610	Molded Tubular, .01 MFD 600 V.	.30
C-57	23E2030-15	Fixed Ceramic, 47 MMF 500 V.	.27
C-58	23E3500-85	Fixed Mica, 680 MMF 500 V. ± 5%	.42
C-59	23E2025	Fixed Ceramic, .005 MFD 500 V.	.31
C-60	23E3608	Molded Tubular, .0047 MFD 600 V.	.29
C-61	23E3414	Molded Tubular, .047 MFD 400 V.	.33
C-62	23E3500-40	Fixed Mica, 470 MMF 500 V. ± 10%	.32
C-63	23E3500-39	Fixed Mica, 390 MMF 500 V. ± 10%	.29
C-64	23E23	Fixed Ceramic, 30 MMF 500 V.	.29
C-65	23E3416	Molded Tubular, .1 MFD 400 V.	.38
C-66	23E3500-40	Fixed Mica, 470 MMF 500 V. ± 10%	.32
C-67	23E3408	Molded Tubular, .0047 MFD 400 V.	.27
C-68	23E3407	Molded Tubular, .0033 MFD 400 V.	.28
C-69	23E3410	Molded Tubular, .01 MFD 400 V.	.28
C-70	23E2033-4	Silver Mica, 3900 MMF 500 V ± 5%	1.35
C-71	23E3410	Molded Tubular, .01 MFD 400 V.	.28
C-72	23E3616	Molded Tubular, .1 MFD 600 V.	.52
C-73	23E2025-5	Fixed Ceramic, 47 MFD 2000 V. (Disc)	.32
C-74	23E3500-40	Fixed Mica, 470 MMF 500 V. ± 10%	.32
C-75	23E3404	Molded Tubular, .001 MFD 400 V.	.27
C-76	23E3414	Molded Tubular, .047 MFD 400 V.	.33
C-77	23E3408	Molded Tubular, .0047 MFD. 400 V.	.27
C-78	23E3414	Molded Tubular, .047 MFD. 400 V.	.33
C-79	23E3424	Molded Tubular, .01 MFD 400 V. ± 10%	.42
C-80	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-81	25E64	Dry Electrolytic, 20 MFD 450 V.	1.88
C-82	25E63	Dry Electrolytic, 30 MFD 200 V., 10 MFD 350 V.	2.07
C-83	25E62	Dry Electrolytic, 5-60 MFD 250 V.	2.19
C-84	25E65	Dry Electrolytic, 100 MFD 200 V. 40-40 MFD 350 V.	4.72
C-85	23E3608	Molded Tubular, .0047 MFD 600 V.	.29
C-87	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-88	23E2027-12	Fixed Ceramic, 1000 MMF 500 V. (Not used in Models 500, 510, 520)	.22

CAPACITORS—(Cont.)

Illus. No.	Part No.	Description	List Price
C-89	23E3406	Molded Tubular, .0022 MFD 400 V. (Not used in Models 500, 510, 520)	.28
C-90	23E2027-12	Fixed Ceramic, 1000 MFD 500 V. (Not used in Models 500, 510, 520)	.22
C-91	23E3406	Molded Tubular, .0022 MFD 400 V. (Not used in Models 500, 510, 520)	.28
C-92	23E3610	Molded Tubular, .01 MFD 600 V.	.30
C-93		Fixed Ceramic, 15 MMF 500 V. Part of 2nd IF Transformer	
C-94		Fixed Ceramic, 15 MMF 500 V. Part of 3rd IF Transformer	
C-95	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-97	23E20	Fixed Ceramic, 3 MMF 500 V.	.25

RESISTORS

Illus. No.	Part No.	Description	List Price
R-11	27E1009-35	Carbon, 10,000 OHM ½ W. ± 5%	.16
R-13	27E1009-8	Carbon, 5,600 OHM ½ W. ± 5%	.10
R-14	27E1009-35	Carbon, 10,000 OHM ½ W. ± 5%	.16
R-15	27E223-2	Carbon, 22,000 OHM ½ W. ± 10%	.10
R-16	27E470-2	Carbon, 47 OHM ½ W. ± 10%	.08
R-17	27E183-2	Carbon, 18,000 OHM ½ W. ± 10%	.07
R-18	27E560-2	Carbon, 56 OHM ½ W. ± 10%	.09
R-19	27E183-2	Carbon, 18,000 OHM ½ W. ± 10%	.07
R-20	27E122-2	Carbon, 1,200 OHM ½ W. ± 10%	.08
R-21	27E333-3	Carbon, 33,000 OHM 1 W. ± 10%	.12
R-22	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.07
R-23	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.07
R-25	27E121-2	Carbon, 120 OHM ½ W. ± 10%	.08
R-27	27E151-2	Carbon, 150 OHM ½ W. ± 10%	.08
R-28	28E99	Contrast Control, 1500 OHM (Dual See R-31)	2.91
R-29	27E471-2	Carbon, 470 OHM ½ W. ± 10%	.08
R-30	27E333-2	Carbon, 33,000 OHM ½ W. ± 10%	.07
R-31	28E99	Off-On-Volume Control, 1 Megohm (Dual See R-28)	2.91
R-32	28E100	Tone Control 1 Megohm (Part of SW-2) (Not used in Models 500, 510, 520)	3.67
R-33	27E1022	Wirewound, 4,000 OHM 5 W.	1.27
R-34	27E683-2	Carbon, 68,000 OHM ½ W. ± 10%	.08
R-35	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.07
R-37	27E155-2	Carbon, 1.5 Megohm ½ W. ± 20%	.07
R-38	27E1009-8	Carbon, 5,600 OHM ½ W. ± 5%	.10
R-39	27E474-2	Carbon, 470,000 OHM ½ W. ± 20%	.07
R-40	27E183-5	Carbon, 18,000 OHM 2 W. ± 10%	.24
R-41	27E103-2	Carbon, 10,000 OHM ½ W. ± 10%	.08
R-42	27E182-2	Carbon, 1,800 OHM ½ W. ± 10%	.08
R-43	27E223-2	Carbon, 22,000 OHM ½ W. ± 10%	.07
R-44	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.07
R-45	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.07
R-46	27E103-2	Carbon, 10,000 OHM ½ W. ± 10%	.08
R-47	27E103-3	Carbon, 10,000 OHM 1 W. ± 10%	.10
R-48	27E1009-10	Carbon, 100,000 OHM ½ W. ± 10%	.08
R-49	27E684-2	Carbon, 680,000 OHM ½ W. ± 20%	.07
R-50	28E87	Brightness Control, 5 Megohm	.91
R-51	27E474-2	Carbon, 470,000 OHM ½ W. ± 20%	.07
R-52	27E682-2	Carbon, 6,800 OHM ½ W. ± 10%	.07
R-53	27E223-2	Carbon, 22,000 OHM ½ W. ± 10%	.10
R-54	27E333-2	Carbon, 33,000 OHM ½ W. ± 10%	.07
R-55	27E1016-13	Wirewound, 15,000 OHM 5 W.	.86
R-56	27E225-2	Carbon, 2.2 Megohm ½ W. ± 20%	.08
R-57	27E223-2	Carbon, 22,000 OHM ½ W. ± 10%	.10
R-58	27E332-2	Carbon, 3,300 OHM ½ W. ± 10%	.07
R-59	27E823-2	Carbon, 82,000 OHM ½ W. ± 10%	.08
R-60	27E682-3	Carbon, 6,800 OHM 1 W. ± 10%	.12
R-61	27E1009-46	Carbon, 150,000 OHM ½ W. ± 10%	.16
R-62	27E1009-8	Carbon, 5,600 OHM ½ W. ± 5%	.10
R-63	27E823-2	Carbon, 82,000 OHM ½ W. ± 10%	.08
R-64	27E1009-22	Carbon, 8,200 OHM ½ W. ± 5%	.14
R-65	27E475-2	Carbon, 4.7 Megohm ½ W. ± 20%	.07
R-66	23E1015-2	Wirewound, 2.2 OHM ½ W. ± 5%	.14
R-67	27E224-2	Carbon, 220,000 OHM ½ W. ± 20%	.08
R-68	27E222-2	Carbon, 2,200 OHM ½ W. ± 10%	.08
R-69	27E1009-11	Carbon, 560,000 OHM ½ W. ± 10%	.08
R-70	27E103-2	Carbon, 10,000 OHM ½ W. ± 10%	.08
R-71	27E823-2	Carbon, 82,000 OHM ½ W. ± 10%	.08
R-72	27E122-2	Carbon, 1,200 OHM ½ W. ± 10%	.08
R-73	27E474-2	Carbon, 470,000 OHM ½ W. ± 20%	.07

MAIN CHASSIS PARTS LIST

FOR MODELS 500, 510, 511, 512, 513, 515, 520, 521, 522, 523, 525—(Cont.)

RESISTORS—(Cont.)

Illus. No.	Part No.	Description	List Price
R-74	28E89	Focus Control, 1 Megohm	.77
R-75	27E1009-10	Carbon, 100,000 OHM ½ W. ± 10%	.08
R-76	27E682-3	Carbon, 6,800 OHM 1 W. ± 10%	.12
R-77	27E222-2	Carbon, 2,200 OHM ½ W. ± 10%	.08
R-78	27E121-2	Carbon, 120 OHM ½ W. ± 10%	.08
R-79	28E88	Vertical Size Control, 5 Megohm	.89
R-80	27E182-2	Carbon, 1,800 OHM ½ W. ± 10%	.08
R-81	27E182-2	Carbon, 1,800 OHM ½ W. ± 10%	.08
R-82	28E90	Vertical Hold Control, 850,000 OHM	.89
R-83	27E1016-20	Wirewound, 8,700 OHM 5 W.	.51
R-84	28E86	Vertical Linearity Control, 750 OHM	.78
R-85	27E271-2	Carbon, 270 OHM ½ W. ± 10%	.07
R-86	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.07
R-87	27E224-2	Carbon, 220,000 OHM ½ W. ± 20%	.08
R-88	27E474-2	Carbon, 470,000 OHM ½ W. ± 20%	.07
R-89	27E225-2	Carbon, 2.2 Megohm ½ W. ± 20%	.08
R-90	27E225-2	Carbon, 2.2 Megohm ½ W. ± 20%	.08
R-91	27E684-2	Carbon, 680,000 OHM ½ W. ± 20%	.07
R-93	27E102-2	Carbon, 1,000 OHM ½ W. ± 10%	.07

CHOKES AND COILS

Illus. No.	Part No.	Description	List Price
L-6	20E363-25	Video Series Choke	.78
L-7	20E363-19	Diode Shunt Choke	.78
L-9	20E363-26	Video Shunt Choke	.78
L-10	20E831	Horizontal Hold	1.95
L-11	22E73	Filter Choke	3.05
L-12	2E92	R.F. Choke	.40
L-13	20E883	Tweet Trap	.19
T-2	20E857	Transformer, 1st Video IF	.84
T-3	20E858	Transformer, 2nd Video IF	1.94
T-4	20E859	Transformer, 3rd Video IF	1.92
T-5	20E860	Transformer, 4th Video IF	3.29
T-6	20E785	Transformer, 4.5 MC Trap	1.25
T-7	20E785	Transformer, Sound IF	1.25
T-8	20E783	Transformer, Ratio Detector	3.73
T-9	22E71	Transformer, Audio Output	1.95
T-10	22E74	Transformer, Power	23.76
T-11	22E75	Transformer, Horizontal Output	13.88
T-12	20E788-2	Transformer, Deflection Yoke	13.66
T-13	22E72	Transformer, Vertical Output	3.83
T-14	22E70	Transformer, Vertical Blocking Osc.	2.16

MAIN CHASSIS PARTS LIST FOR MODELS 532, 542, 552, 554, 562, 564

CAPACITORS

Illus. No.	Part No.	Description	List Price
C-22	23E21	Fixed Ceramic 2.2 MMF 500 V.	$0.84
C-23	25E66	Dry Electrolytic, 10 MFD, 50 V.	1.14
C-24	23E3216	Molded Tubular, .1 MFD 200 V.	.34
C-25	23E23	Fixed Ceramic, 30 MMF 500 V.	.29
C-26	23E22	Fixed Ceramic, 20 MMF 500 V.	.29
C-27	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-28	25E66	Dry Electrolytic, 10 MFD 50 V.	1.14
C-29	23E3423	Molded Tubular, .039 MFD 400 V.	.34
C-30	23E3408	Molded Tubular, .0047 MFD 400 V.	.27
C-31	23E2025	Fixed Ceramic, .005 MFD, 500V, (Disc)	.31
C-32	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-33	23E2027-14	Fixed Ceramic, 470 MMF, 500 V.	.21
C-34	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-35	23E2027-14	Fixed Ceramic, 470 MMF, 500 V.	.21
C-36	23E2027-11	Fixed Ceramic, 680 MMF, 500V.	.30
C-37	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-38	23E2027-11	Fixed Ceramic, 680 MMF, 500V.	.30
C-40	23E2027-14	Fixed Ceramic, 470 MMF, 500 V.	.21
C-41	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-42	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-43	23E3500-40	Fixed Mica, 470 MMF ± 10% 500 V.	.32
C-44	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-45	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-46	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-47	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-48	23E2027-9	Fixed Ceramic, .001 MFD 500 V.	.22
C-49	23E3407	Molded Tubular, .0033 MFD 400 V.	.28
C-50	23E3416	Molded Tubular, .1 MFD 400 V.	.38
C-51	23E122	Molded Tubular, .25 MFD 100 V.	.42
C-52	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-53	23E3404	Molded Tubular, .001 MFD 400 V.	.27
C-54	23E3408	Molded Tubular, .0047 MFD 400 V.	.27
C-56	23E3610	Molded Tubular, .01 MFD, 600 V.	.30
C-57	23E2030-15	Fixed Ceramic, 47 MMF 500 V.	.27
C-58	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.27
C-59	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-60	23E2027-10	Fixed Ceramic, 150 MMF 500 V.	.19
C-62	23E3500-40	Fixed Mica, 470 MMF ± 10% 500 V.	.32
C-63	23E3500-39	Fixed Mica, 390 MMF ± 10% 500 V.	.29
C-64	23E3500-40	Fixed Mica, 470 MMF ± 10% 500 V.	.32
C-65	23E3414	Molded Tubular, .047 MFD 400 V.	.33
C-66	23E3500-40	Fixed Mica, 470 MMF ± 10% 500 V.	.32
C-67	23E3408	Molded Tubular, .0047 MFD 400 V.	.27
C-68	23E3407	Molded Tubular, .0033 MFD 400 V.	.28
C-69	23E3410	Molded Tubular, .01 MFD 400 V.	.28
C-70	23E2033-4	Silver Mica, 3900 MMF ± 5% 500 V.	1.35
C-71	23E3410	Molded Tubular, .01 MFD 400 V.	.28
C-74	23E3500-40	Fixed Mica, 470 MMF ± 10% 500 V.	.32
C-75	23E3404	Molded Tubular, .001 MFD 400 V.	.27
C-76	23E3414	Molded Tubular, .047 MFD 400 V.	.33
C-77	23E3408	Molded Tubular, .0047 MFD 400 V.	.27
C-78	23E23	Fixed Ceramic, 30 MMF 500 V.	.29

CAPACITORS—(Cont.)

Illus. No.	Part No.	Description	List Price
C-79	23E3425	Molded Tubular, .015 MFD ± 10% 400 V.	.27
C-81	25E64	Electrolytic, 20 MFD 450 V.	1.88
C-82	25E71	Electrolytic, 100 MFD 50 V. 10x20 MFD 350 V.	3.20
C-83	25E62	Electrolytic, 5x60—250 V.	2.19
C-84	25E65	Electrolytic, 100 MFD 200 V. 40x40 350 V.	4.72
C-85	23E3608	Molded Tubular, .0047 MFD 600 V.	.29
C-87	23E2039-3	Fixed Ceramic, 500 MMF 30,000 V.	3.89
C-88	23E3415	Molded Tubular, .068 MFD, 400 V.	.39
C-90	23E2025-8	Fixed Ceramic, 82 MMF 2000 V. 10%	.
C-91	23E3415	Molded Tubular, .068 MFD, 400 V.	.39
C-92	23E3418	Molded Tubular, .22 400 V.	.43
C-93	23E3416	Molded Tubular, .1 400 V.	.38
C-94	23E2027-10	Fixed Ceramic, 150 MMF 500 V.	.19
C-95	23E3415	Molded Tubular, .068 400 V.	.32
C-96	23E3416	Molded Tubular, .1 400 V.	.38
C-97	23E20	Fixed Ceramic, 3 MMF, 500 V.	.25
C-98	23E3424	Molded Tubular, .01 Ohm ± 10% 400 V.	.42
C-99	23E2027-12	Fixed Ceramic, 1000 MMF. 500 V.	.22
C-100	23E3406	Molded Tubular, .0022 MFD, 400 V.	.28
C-101	23E2027-12	Fixed Ceramic, 1000 MMF, 500 V.	.22
C-102	23E3406	Molded Tubular, .0022 MFD, 400 V.	.28
C-103	23E3610	Molded Tubular, .01 MFD, 600 V.	.30
C-104		Fixed Ceramic, 15 MMF Part of 2nd Video IF	
C-105		Fixed Ceramic, 15 MMF Part of 3rd Video IF	
C-107	23E2025	Fixed Ceramic, .005 MFD, 500 V.	.31
C-108	23E3410	Molded Tubular, .01 MFD, 400 V.	.28

RESISTORS

Illus. No.	Part No.	Description	List Price
R-11	27E1009-35	Carbon, 10,000 Ohm ½ W. ± 5%	.16
R-13	27E1009-8	Carbon, 5,600 Ohm ½ W. ± 5%	.10
R-14	27E1009-35	Carbon, 10,000 Ohm ½ W. ± 5%	.16
R-15	27E223-2	Carbon, 22,000 Ohm ½ W. ± 10%	.10
R-16	27E470-2	Carbon, 47 Ohm ½ W. ± 10%	.08
R-17	27E183-2	Carbon, 18,000 Ohm ½ W. ± 10%	.07
R-18	27E560-2	Carbon, 56 Ohm ½ W. ± 10%	.08
R-19	27E183-2	Carbon, 18,000 Ohm ½ W. ± 10%	.07
R-20	27E122-2	Carbon, 1,200 Ohm ½ W. ± 10%	.08
R-21	27E333-3	Carbon, 33,000 Ohm 1 W. ± 10%	.12
R-22	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-23	27E10-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-24	27E1009-10	Carbon, 100,000 Ohm ½ W. ± 10%	.08
R-25	27E121-2	Carbon, 120 Ohm ½ W. ± 10%	.08
R-27	27E151-2	Carbon, 150 Ohm ½ W. ± 10%	.08

RESISTORS—(Cont.)

Illus. No.	Part No.	Description	List Price
R-28	28E99	Contrast Control (Dual) 1500 Ohms (See R-31)	2.91
R-29	27E471-2	Carbon, 470 Ohm ½ W. ± 10%	.08
R-30	27E333-2	Carbon, 33,000 Ohm ½ W. ± 10%	.07
R-31	28E99	Volume Control (Dual) 1 Megohm (See R-28)	2.91
R-32	28E100	Tone Control (Dual) 1 Megohm (See SW-2)	3.67
R-33	27E1022	Wirewound 4000 Ohm 5 W.	1.27
R-34	27E683-2	Carbon, 68,000 Ohm ½ W. ± 10%	.08
R-35	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-36	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-37	27E155-2	Carbon, 1.5 Megohm ½ W. ± 20%	.07
R-38	27E1009-8	Carbon, 5,600 Ohm ½ W. ± 5%	.10
R-39	27E474-2	Carbon, 470,000 Ohm ½ W. ± 20%	.07
R-40	27E183-5	Carbon, 18,000 Ohm 2W. ± 10%	.24
R-41	27E103-2	Carbon, 10,000 Ohm ½ W. ± 10%	.08
R-42	27E182-2	Carbon, 1,800 Ohm ½ W. ± 10%	.08
R-43	27E103-3	Carbon, 10,000 Ohm 1 W. ± 10%	.10
R-44	27E222-2	Carbon, 2,200 Ohm ½ W. ± 10%	.08
R-45	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-46	27E103-2	Carbon, 10,000 Ohm ½ W. ± 10%	.08
R-47	27E684-2	Carbon, 680,000 Ohm ½ W. ± 20%	.07
R-48	27E225-2	Carbon, 2.2 Megohm ½ W. ± 20%	.08
R-49	27E105-2	Carbon, 1 Megohm ½ W. ± 20%	.07
R-50	28E87	Brightness Control, 5 Megohm	.91
R-51	27E1016-20	Wirewound, 8,700 Ohm 5 W. ± 10%	.51
R-52	27E682-2	Carbon, 6,800 Ohm ½ W. ± 10%	.07
R-53	27E223-2	Carbon, 22,000 Ohm ½ W. ± 10%	.10
R-54	27E104-2	Carbon, 100,000 Ohm ½ W. ± 20%	.07
R-56	27E1009-10	Carbon, 100,000 Ohm ½ W. ± 10%	.08
R-57	27E820-2	Carbon, 82 Ohm ½ W. ± 10%	.08
R-58	27E332-2	Carbon, 3,300 Ohm ½ W. ± 10%	.07
R-59	27E823-2	Carbon, 82,000 Ohm ½ W. ± 10%	.08
R-60	27E333-2	Carbon, 33,000 Ohm ½ W. ± 10%	.07
R-61	27E471-2	Carbon, 470 Ohm ½ W. ± 10%	.08
R-62	27E1009-8	Carbon, 5,600 Ohm ½ W. ± 5%	.10
R-65	27E475-2	Carbon, 4.7 Megohm ½ W. ± 20%	.07
R-67	27E224-2	Carbon, 220,000 Ohm ½ W. ± 20%	.08
R-68	27E222-2	Carbon, 2,200 Ohm ½ W. ± 10%	.08
R-69	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-70	27E103-2	Carbon, 10,000 Ohm ½ W. ± 10%	.08
R-71	27E823-2	Carbon, 82,000 Ohm ½ W. ± 10%	.08
R-72	27E122-2	Carbon, 1,200 Ohm ½ W. ± 10%	.08
R-75	27E1009-10	Carbon, 100,000 Ohm ½ W. ± 10%	.08
R-76	27E333-2	Carbon, 33,000 Ohm ½ W. ± 10%	.07
R-77	27E222-2	Carbon, 2,200 Ohm ½ W. ± 10%	.08
R-79	28E88	Vertical Size Control, 5 Megohm	.89
R-82	28E90	Vertical Hold Control, 850,000 Ohm	.89
R-85	27E271-2	Carbon, 270 Ohm ½ W. ± 10%	.07
R-86	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07

RESISTORS—(Cont.)

Illus. No.	Part No.	Description	List Price
R-87	27E1009-47	Carbon, 120,000 Ohm ½ W. ± 10%	.14
R-88	27E1009-8	Carbon, 5,600 Ohm ½ W. ± 5%	.10
R-89		Wire Wound, 8.6 Ohm ½ W. ± 5% Part of H.V. Socket Assembly	
R-90	27E1009-50	Carbon, 180,000 Ohm ½ W. ± 10%	.16
R-91	27E105-2	Carbon, 1 Megohm ½ W. ± 20%	.07
R-92	27E681-2	Carbon, 680 Ohm ½ W. ± 10%	.08
R-93	27E681-2	Carbon, 680 Ohm ½ W. ± 10%	.08
R-94	27E224-2	Carbon, 220,000 Ohm ½ W. ± 20%	.08
R-95	27E224-2	Carbon, 220,000 Ohm ½ W. ± 20%	.08
R-96	27E684-2	Carbon, 680,000 Ohm ½ W. ± 20%	.07
R-97	27E104-2	Carbon, 100,000 Ohm ½ W. ± 20%	.07
R-98	27E104-2	Carbon, 100,000 Ohm ½ W. ± 20%	.07
R-99	27E474-2	Carbon, 470,000 Ohm ½ W. ± 20%	.07
R-100	27E1009-5	Carbon, 1.2 Megohm ½ W. ± 10%	.08
R-101	27E332-2	Carbon, 3,300 Ohm ½ W. ± 10%	.07
R-102	27E472-2	Carbon, 4,700 Ohm ½ W. ± 10%	.07
R-104	27E225-2	Carbon, 2.2 Megohm ½ W. ± 20%	.08
R-105	28E97	Vertical Linearity Control, 2000 Ohm	.85
R-106	27E271-3	Carbon, 270 Ohm 1 W. ± 10%	.14
R-107	27E101-2	Carbon, 100 Ohm ½ W. ± 10%	.07
R-108	27E223-2	Carbon, 22,000 Ohm ½ W. ± 10%	.08

CHOKES AND COILS

Illus. No.	Part No	Description	List Price
L-6	20E363-25	Video Series Choke	.78
L-7	20E363-19	Choke, Diode Shunt	.78
L-9	20E363-26	Video Shunt Choke	.78
L-10	20E831	Coil, Horizontal Hold	1.95
L-11	22E83	Choke Filter	4.90
L-12	20E820	Coil, Horizontal Linearity	1.65
L-13	20E883	Tweet Trap	.19
L-14	2E92	RF Choke	.36
T-2	20E857	Transformer, 1st Video IF	.84
T-3	20E858	Transformer, 2nd Video IF	1.94
T-4	20E859	Transformer, 3rd Video IF	1.92
T-5	20E860	Transformer, 4th Video IF	3.92
T-6	20E785	Transformer, 4.5 MC. Trap	1.25
T-7	20E785	Transformer, Sound, I.F.	1.25
T-8	20E783	Transformer, Ratio Detector	3.73
T-9	22E71	Transformer, Audio Output	1.95
T-10	22E86	Transformer Power	29.00
T-11	22E84	Transformer, Horizontal Output	14.80
T-12	20E814	Yoke, Deflection (Direct Interchangeable)	28.75
	or		
T-12	20E814-2	Yoke, Deflection (Direct Interchangeable)	28.75
T-13	22E81	Transformer, Vertical Output	6.50
T-14	22E70	Transformer, Vertical Block Oscillator	2.16

MISCELLANEOUS PARTS LIST FOR ALL MODELS

Illus. No.	Part No.	Description	List Price
SW-1	29E30	Switch, Locality Adjuster	1.05
SW-2	28E100	Tone and Hi-Lite Control (See R-32) (Not used in Models 500, 510, 520)	3.67
F-1	40E8-10	Fuse, 3 Ampere (Slo-Blo) Line Fuse	.29
F-1	40E8-11	Fuse, 4 Ampere (Slo-Blo) Line Fuse (Models 532, 542, 552, 554, 562, 564)	.49
F-2	40E8-2	Fuse (Slo-Blo) H.V. (Models 532, 542, 552, 554, 562, 564)	.47
	95E1	Crystal Diode 1N60	1.00
	55E57	Fuse Holder with Cap	.78
	20E856	Tuner Unit, VHF with Tubes for Models 500, 510, 511, 512, 513, 515, 532, 552, 554	50.00
	20E863	Tuner Unit VHF with Tubes for Models 520, 521, 522, 523, 525, 542, 562, 564	56.00
	20E867	Tuner Unit UHF with Tube for Models 520, 521, 522, 523, 525, 542, 562, 564	55.00
	41E16	Line Cord with Female Plug	1.27
	17E32	Receptacle AC 2 Contact Male	.30
	17E1-17	Socket 9 Pin Miniature	.28
	17E1-18	Socket, Octal	.15
	17E1-27	Socket, Octal, Mica Filled	.24
	17E1-36	Socket, Miniature 7 Pin	.20
	17E1-39	Socket, Miniature 9 Pin Noval Mica	.50

Part No.	Description	List Price
18E25-2	Terminal Antenna VHF	.15
18E25-3	Terminal Antenna UHF	.15
20E419-4	Connector 2nd Anode Picture Tube	.53
20E419-5	Connector 2nd Anode Picture Tube Models 532, 542, 552, 554, 562, 564	.75
20E517-12	Socket Assembly Picture Tube	1.13
20E517-14	Socket Assembly Picture Tube Models 532, 542, 552, 554, 562, 564	1.45
15E174-4	Ion Trap	.93
or		
15E174-6	Ion Trap	.93
15E174-7	Ion Trap, Models 532, 542, 552, 554, 562, 564	.85
20E903-2	Antenna Built-in VHF-UHF (For Models with UHF Tuner)	
20E891-2	Antenna Built-in VHF-UHF	1.66
53E471	UHF Tab Sheet. For Blonde Cabinets used for all VHF Models	.24
53E471-2	UHF Tab Sheet for Mahogany Cabinets used for all VHF Models	.24
5E78	Cabinet Bottom Cover	1.16
20E823	Connector and Lead Assembly Female, For Yoke, Models 532, 542, 553, 505, 562, 564	1.20
62E8	Focus Magnet Assembly Models 532, 542, 552, 562, 564	10.50

MISCELLANEOUS CABINET PARTS LIST

MODEL 500

Part No.	Description	List Price
9E45-3	Safety Glass	8.05
36E84-3	Mask for Picture Tube	3.83
33E85	Gasket Rubber for Mask 45½"	.52
1E49-2	Speaker 6" PM	6.62
20E774	Cabinet Back Assembly with Line Cord	4.60
37E83	Knob, Off-On-Volume	1.03
37E84	Knob, Contrast	.36
37E84-3	Knob, Fine Tuning	.36
37E87	Knob, Channel Selector	1.19

MODELS 510 and 520

Part No.	Description	List Price
9E45	Safety Glass	12.69
36E93	Mask for Picture Tube	5.67
33E85	Gasket Rubber for Mask 58"	.67
1E49-2	Speaker 6" PM	6.62
20E774-9	Cabinet Back Assembly with Line Cord	6.03
20E774-11	Cabinet Back Assembly with Line Cord Model 520	6.03
37E83	Knob, Off-On-Volume	1.03
37E84	Knob, Contrast	.36
37E83-3	Knob, Channel Selector VHF Model 520	1.19
37E84-3	Knob, Fine Tuning	.36
37E87	Knob, Channel Selector VHF For Model 510	1.19
37E88	Knob, Channel Selector UHF For Model 520	.35

MODELS 511, 512, 513, 515, 521, 522, 523, 525

Part No.	Description	List Price
9E45	Safety Glass	12.69
36E83-4	Mask for Picture Tube	5.24
33E85	Gasket Rubber for Mask 58"	.67
1E43-2	Speaker 10" PM	11.03
1E49	Speaker 6" PM for Models 511, 512	7.13
20E774-5	Cabinet Back Assembly with Line Cord	
20E774-12	Cabinet Back Assembly with Line Cord Models 521, 522, 523, 525	
37E83	Knob, Off-On-Volume	1.03
37E83-2	Knob, Off-On-Volume For Blonde Cabinet	1.03
37E83-3	Knob, Channel Selector VHF For Models 521, 522, 523, 525	1.19
37E83-4	Knob, Channel Selector VHF, Blonde Cabinet For Models 521, 522, 523, 525	1.03
37E84	Knob, Contrast, Mahogany and Blonde	.36
37E84-3	Knob, Fine Tuning, Mahogany and Blonde	.36
37E85	Knob, Tone	.36
37E85-2	Knob, Tone for Blonde Cabinets	.35
37E86	Knob, Hi-Lite	.51
37E86-2	Knob, Hi-Lite for Blonde Cabinets	.57
37E87	Knob, Channel Selector VHF For Models 511, 512, 513, 515	1.19
37E87-2	Knob, Channel Selector VHF for Blonde Cabinet Models 511, 512, 513, 515	1.30
37E88	Knob, Channel Selector UHF For Models 521, 522, 523, 525	.35
37E88-2	Knob, Channel Selector UHF for Blonde Cabinet Models 521, 522, 523, 525	.95

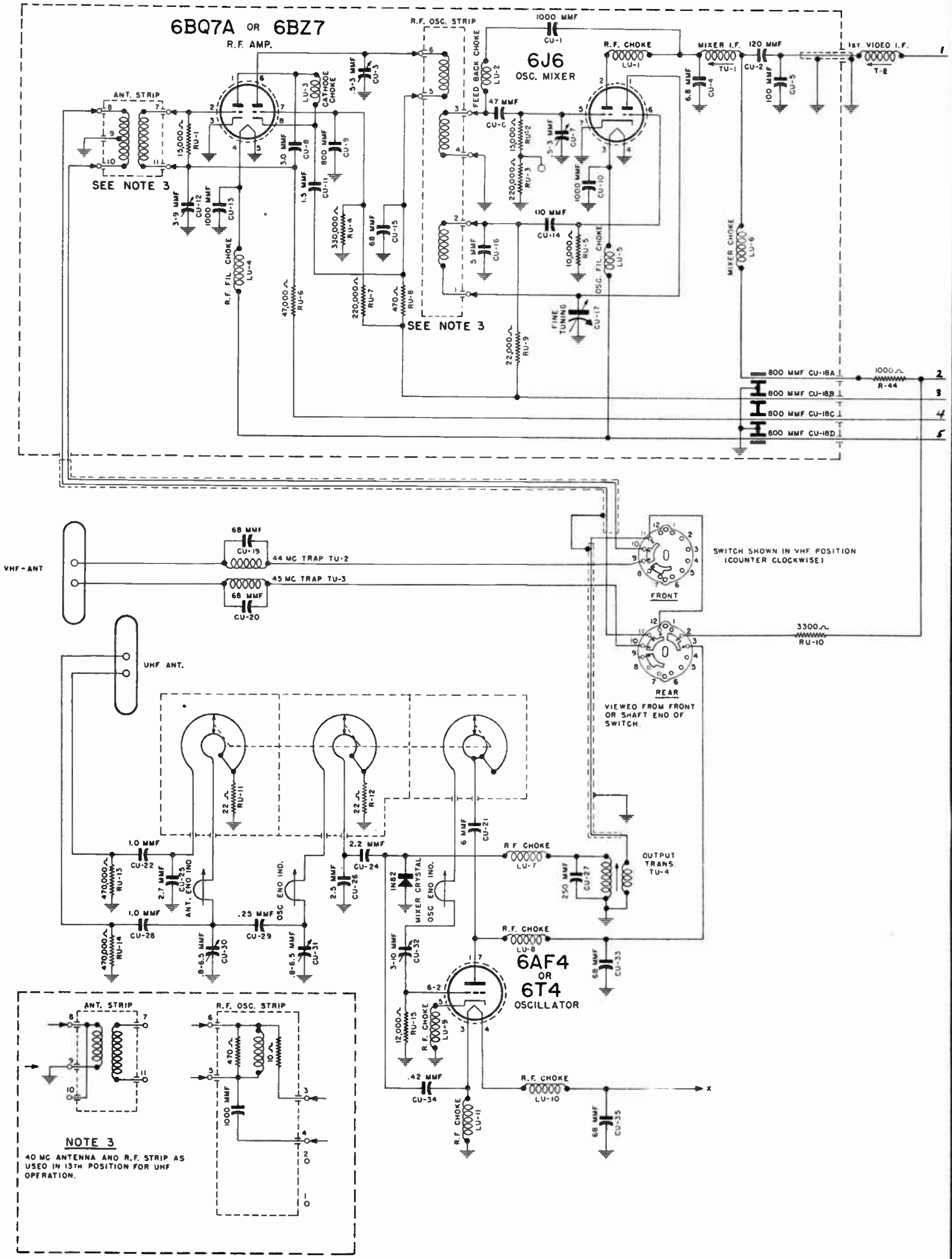
MODELS 532, 542

Part No.	Description	List Price
9E45-8	Safety Glass	
36E96	Mask for Picture Tube	
20E774-10	Cabinet Back Assembly with Line Cord	
1E43	Speaker 10" PM	12.78
37E83	Knob, Off-On-Volume	1.03
37E83-2	Knob, On-Off-Volume Blonde	1.03
37E83-3	Knob, Channel Selector VHF Model 542 Only	.36
37E83-4	Knob, Channel Selector VHF Model 542 Blonde	1.03
37E84	Knob, Contrast, Mahogany and Blonde	1.19
37E84-3	Knob, Fine Tuning, Mahogany and Blonde	.36
37E85	Knob, Tone	.36
37E85-2	Knob, Tone Blonde	.35
37E86-3	Knob, Hi-Lite Mahogany and Blonde	
37E87	Knob, Channel Selector for Model 532	1.19
37E87-2	Knob, Channel Selector Model 532, Blonde	1.30
37E88	Knob, Channel Selector UHF for Model 542	.35
37E88-2	Knob, Channel Selector UHF Model 542 Blonde	.95

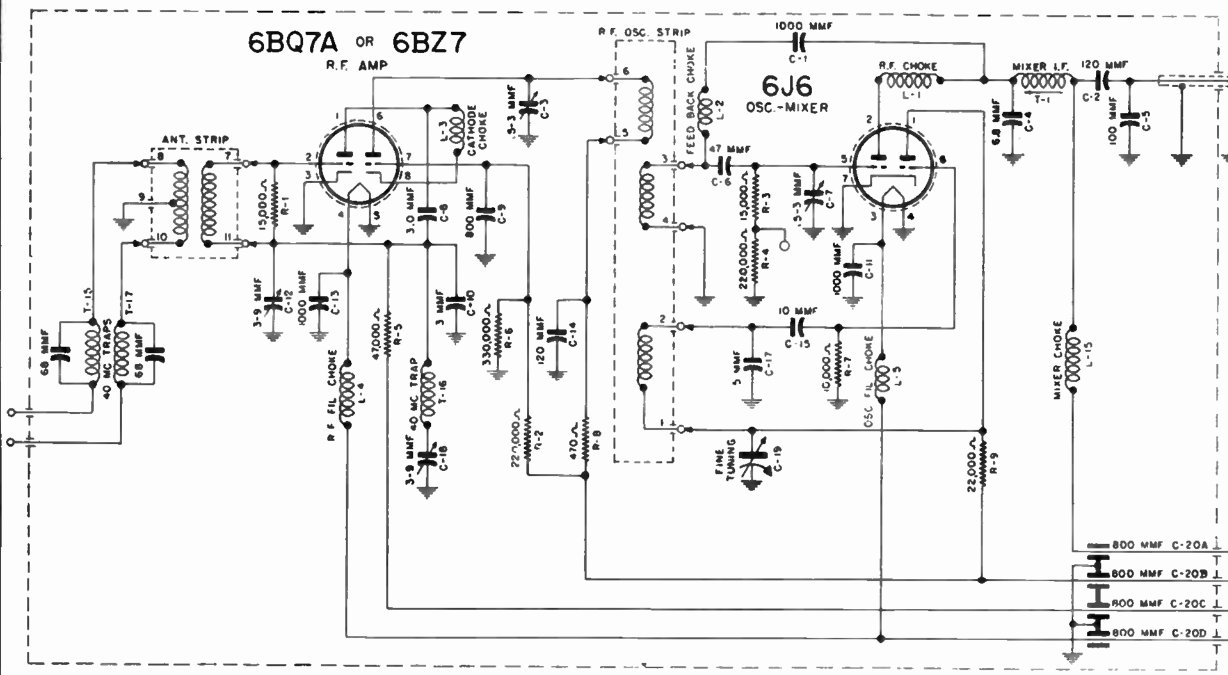
MODELS 552, 554, 562, 564

Part No.	Description	List Price
9E45-5	Safety Glass	25.50
36E88	Mask for Picture Tube	11.60
1E51-2	Speaker 12" PM	18.70
20E774-6	Cabinet Back Assembly with Line Cord	
20E774-13	Cabinet Back Assembly with Line Cord Models 562, 564	
37E83	Knob, Off-On-Volume	1.03
37E83-2	Knob, On-Off-Volume for Blonde Cabinet	1.03
37E83-3	Knob, Channel Selector VHF For Models 562, 564	1.19
37E83-4	Knob, Channel Selector VHF for Blonde Cabinet for Models 562, 564	1.03
37E84	Knob, Contrast, Mahogany and Blonde	.36
37E84-3	Knob, Fine Tuning, Mahogany and Blonde	.36
37E85	Knob, Tone	.36
37E85-2	Knob, Tone for Blonde Cabinets	.35
37E86	Knob, Hi-Lite	.51
37E86-2	Knob, Hi-Lite for Blonde Cabinets	.57
37E87	Knob, Channel Selector VHF For Models 552, 554	1.19
37E87-2	Knob, Channel Selector VHF for Blonde Cabinet Models 552, 554	1.30
37E88	Knob, Channel Selector UHF For Models 562, 564	.35
37E88-2	Knob, Channel Selector UHF for Blonde Cabinet Models 562, 564	.95

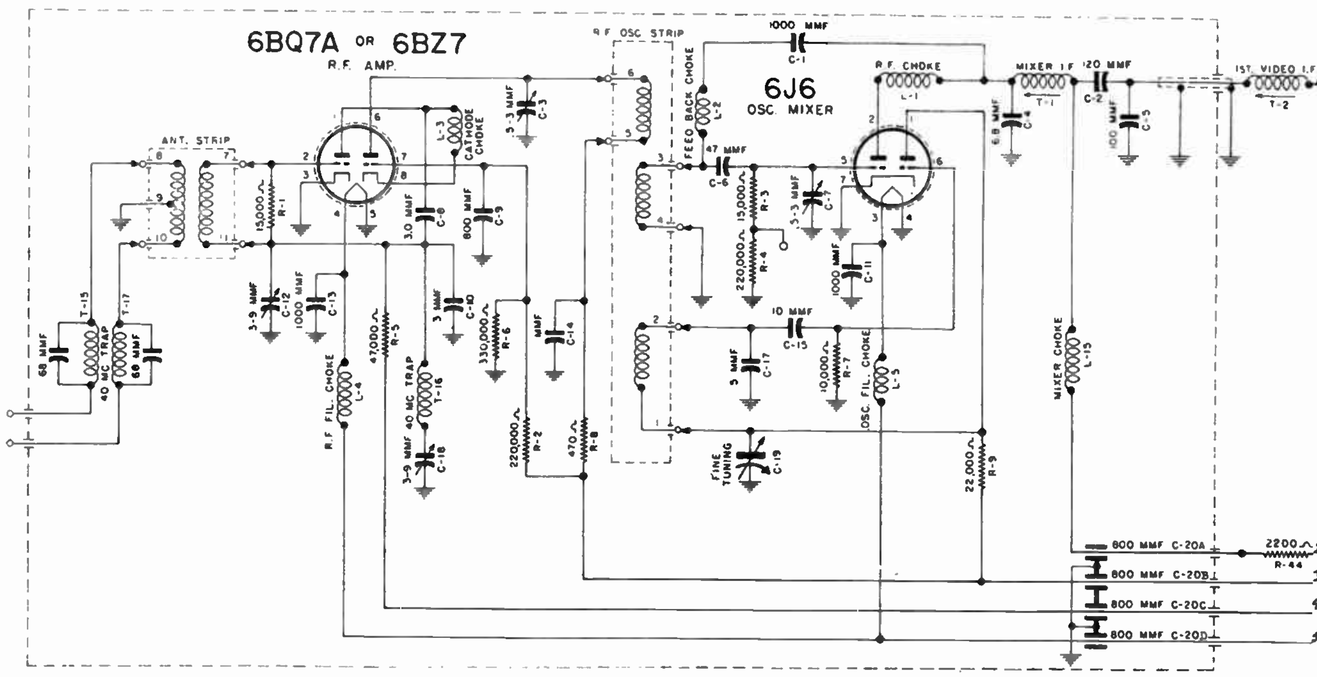
UHF CIRCUIT DIAGRAM FOR MODELS 520, 521, 522, 523, 525, 542, 562, 564

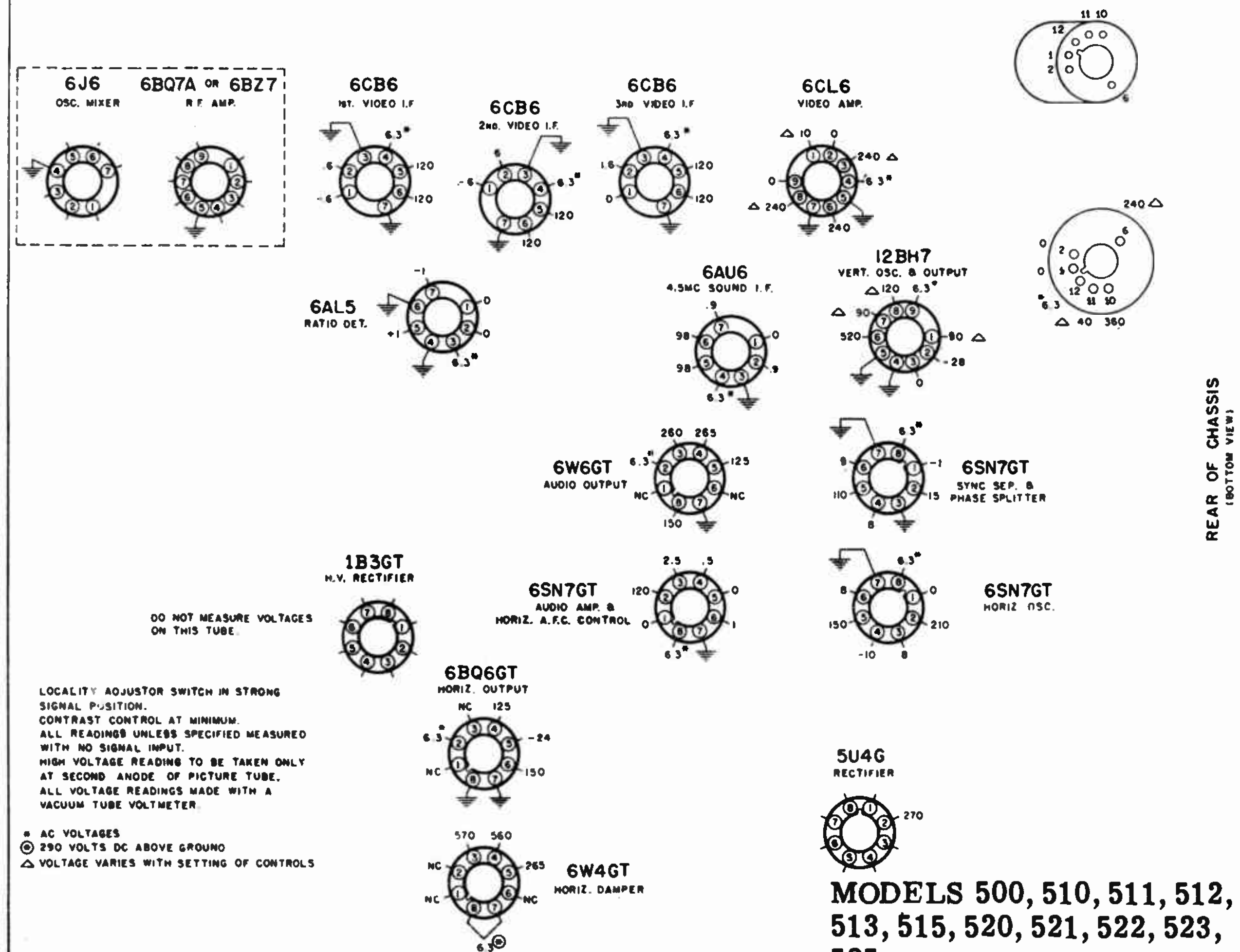


CIRCUIT DIAGRAM FOR MODELS 500, 510, 511, 512, 513, and 515.



CIRCUIT DIAGRAM FOR MODELS 532, 552 AND 554.

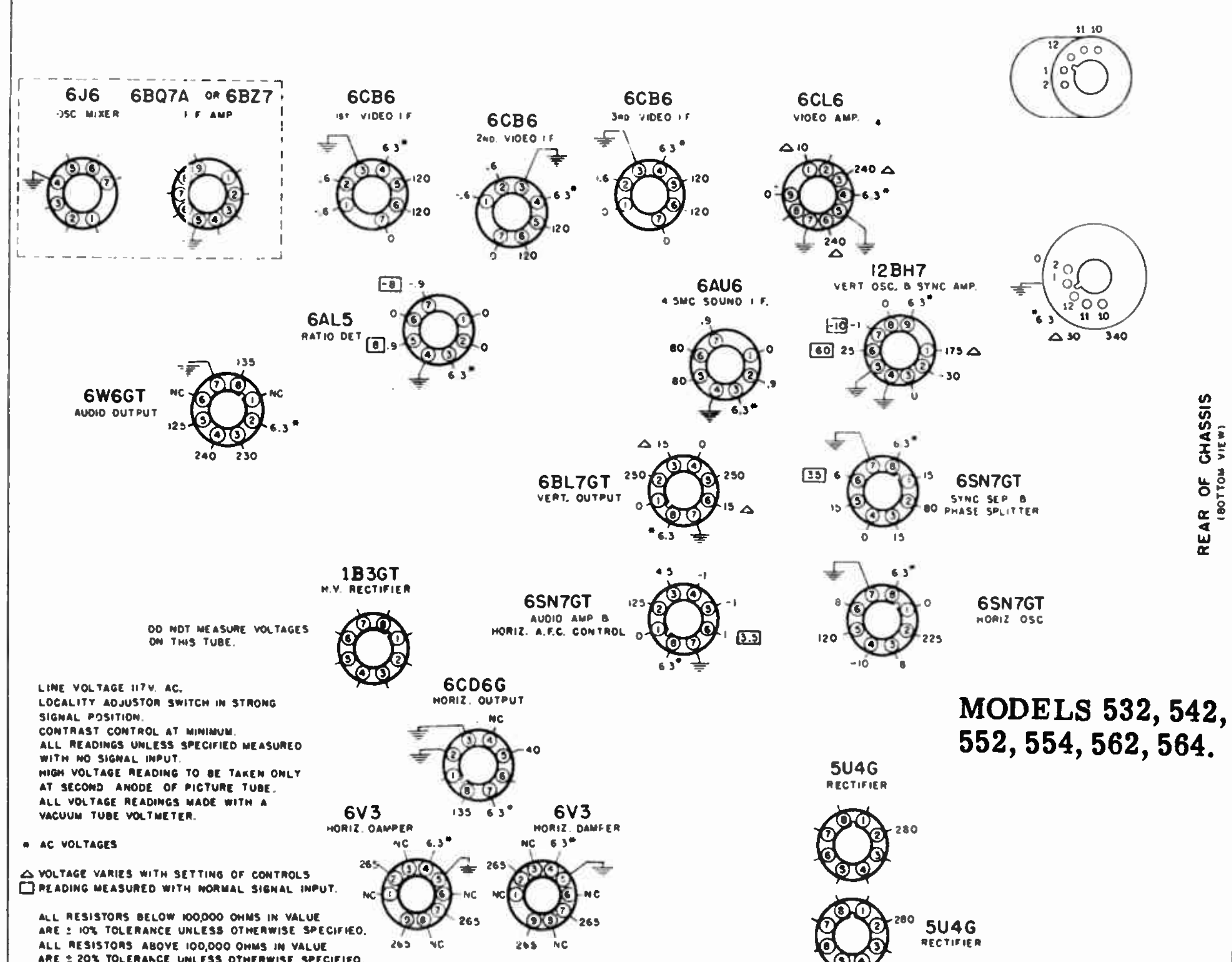




LOCALITY ADJUSTOR SWITCH IN STRONG SIGNAL POSITION.
CONTRAST CONTROL AT MINIMUM.
ALL READINGS UNLESS SPECIFIED MEASURED WITH NO SIGNAL INPUT.
HIGH VOLTAGE READING TO BE TAKEN ONLY AT SECOND ANODE OF PICTURE TUBE.
ALL VOLTAGE READINGS MADE WITH A VACUUM TUBE VOLTMETER.

* AC VOLTAGES
◎ 290 VOLTS DC ABOVE GROUND
△ VOLTAGE VARIES WITH SETTING OF CONTROLS

MODELS 500, 510, 511, 512, 513, 515, 520, 521, 522, 523, 525.

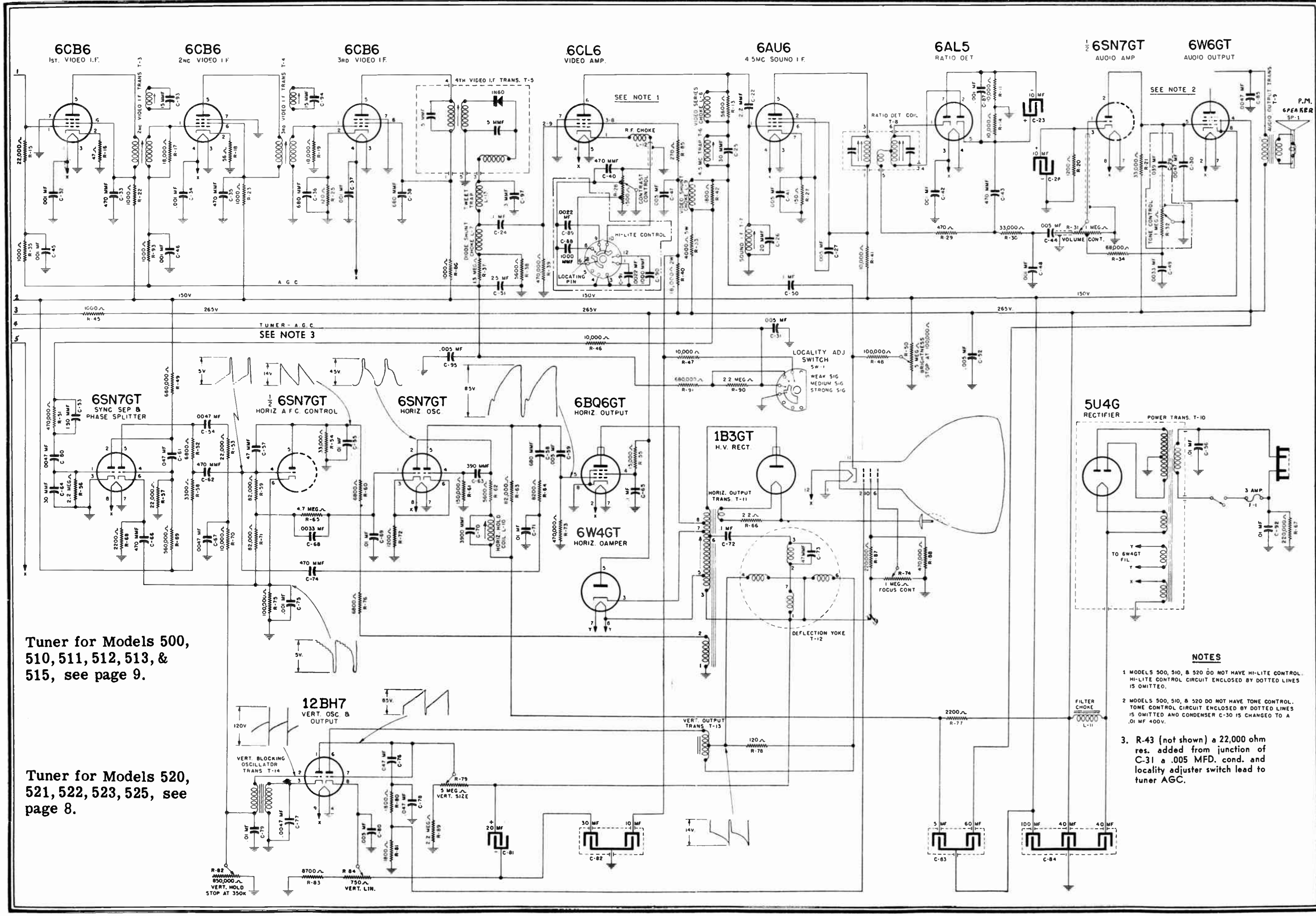


LINE VOLTAGE 117V. AC.
LOCALITY ADJUSTOR SWITCH IN STRONG SIGNAL POSITION.
CONTRAST CONTROL AT MINIMUM.
ALL READINGS UNLESS SPECIFIED MEASURED WITH NO SIGNAL INPUT.
HIGH VOLTAGE READING TO BE TAKEN ONLY AT SECOND ANODE OF PICTURE TUBE.
ALL VOLTAGE READINGS MADE WITH A VACUUM TUBE VOLTMETER.

* AC VOLTAGES
△ VOLTAGE VARIES WITH SETTING OF CONTROLS
□ READING MEASURED WITH NORMAL SIGNAL INPUT.

ALL RESISTORS BELOW 100,000 OHMS IN VALUE ARE ± 10% TOLERANCE UNLESS OTHERWISE SPECIFIED.
ALL RESISTORS ABOVE 100,000 OHMS IN VALUE ARE ± 20% TOLERANCE UNLESS OTHERWISE SPECIFIED.

MODELS 532, 542, 552, 554, 562, 564.

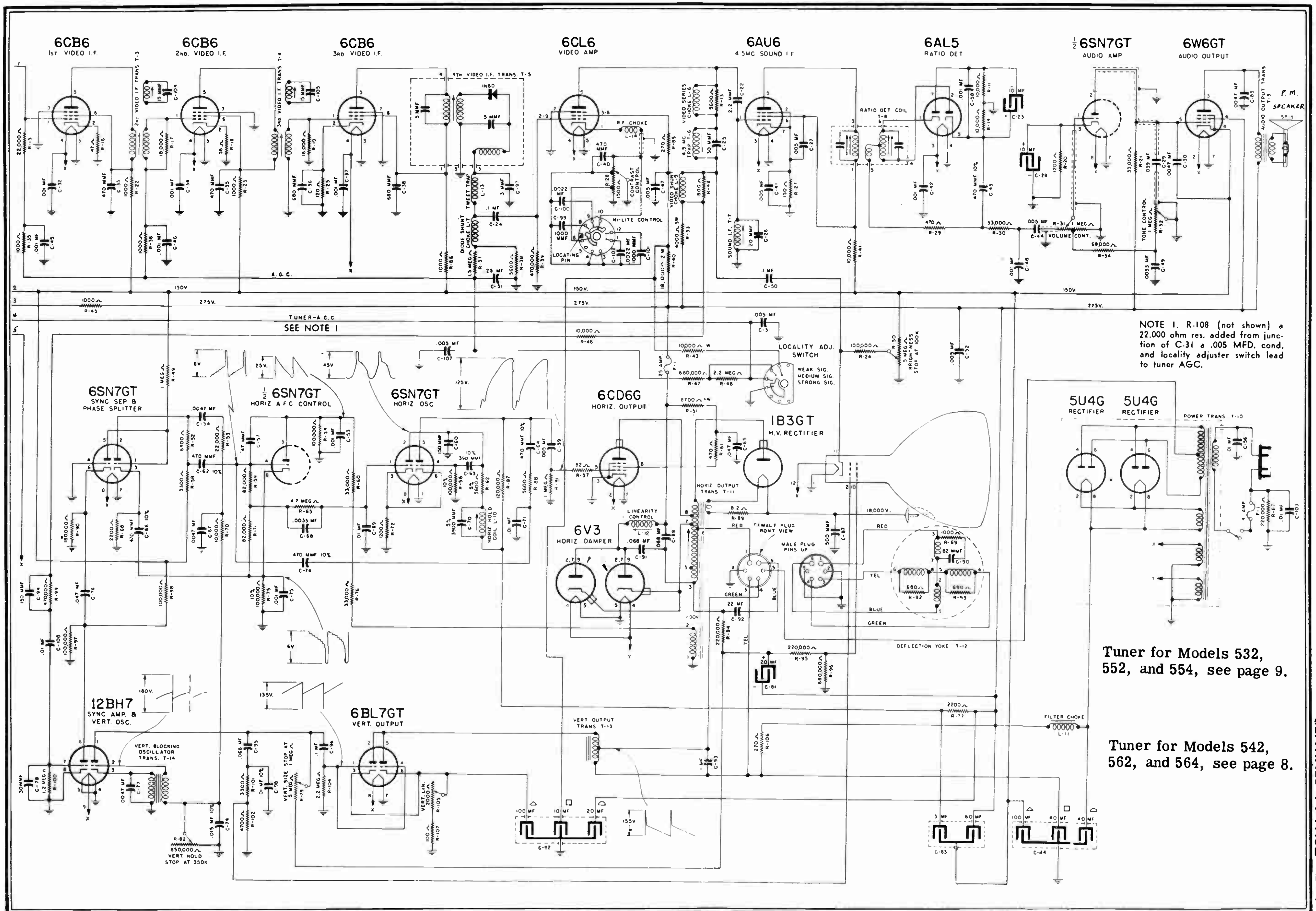


Tuner for Models 500, 510, 511, 512, 513, & 515, see page 9.

Tuner for Models 520, 521, 522, 523, 525, see page 8.

NOTES

1. MODELS 500, 510, & 520 DO NOT HAVE HI-LITE CONTROL. HI-LITE CONTROL CIRCUIT ENCLOSED BY DOTTED LINES IS OMITTED.
2. MODELS 500, 510, & 520 DO NOT HAVE TONE CONTROL. TONE CONTROL CIRCUIT ENCLOSED BY DOTTED LINES IS OMITTED AND CONDENSER C-30 IS CHANGED TO A .01 MF 400V.
3. R-43 (not shown) a 22,000 ohm res. added from junction of C-31 a .005 MFD. cond. and locality adjuster switch lead to tuner AGC.



NOTE 1. R-108 (not shown) a 22,000 ohm res. added from junction of C-31 a .005 MFD. cond. and locality adjuster switch lead to tuner AGC.

Tuner for Models 532, 552, and 554, see page 9.

Tuner for Models 542, 562, and 564, see page 8.

TUBE COMPLEMENT

6BQ7 or 6BZ7	R.F. AMPLIFIER
6J6	OSCILLATOR, MODULATOR
6CB6	VIDEO I.F. AMPLIFIER
6AH6	VIDEO AMPLIFIER
6AU6	SOUND I.F. AMPLIFIER
6AL5	RATIO DETECTOR
6SN7GT	A.F. AMPLIFIER, HORIZONTAL AFC CONTROL
6W6GT	AUDIO OUTPUT
6SN7GT	SYNC SEPARATOR, PHASE SPLITTER
6SN7GT	HORIZONTAL OSCILLATOR
1B3GT	HIGH VOLTAGE RECTIFIER
6CD6G	HORIZONTAL OUTPUT
6V3	HORIZONTAL DAMPERS
12BH7	VERTICAL OSCILLATOR, SYNC AMPLIFIER
6BL7GT	VERTICAL AMPLIFIER
5U4G	POWER RECTIFIERS
27EP4A	27" PICTURE TUBES

ELECTRICAL SPECIFICATIONS

Power Supply	110 to 120 Volts 60 Cycle AC
Power Consumption	250 Watts
Power Output	Undistorted 2.2 Watts Maximum 4.0 Watts
Antenna Input Imp.	300 Ohms Balanced
Tuning Range	12 Channel
Loud Speaker	12" P.M.
Voice Coil Impedance	3.2 Ohm at 400 Cycles
I.F. CIRCUIT	Inter-Carrier Sound
R.F. STAGE	One
I.F. STAGES	Three "Combined Picture and Sound" and one "Sound" 21.9 M.C. Sound Carrier 26.4 M.C. Video Carrier 4.5 M.C. Sound

These Television receivers are equipped with the very latest type of CASCODE TUNER (with duo-matic control) which makes them instantly adjustable to any UHF channel.

Merely remove the small snap out strips from any VHF channel which is not operating in your locality and replace them with the proper small UHF snap-in strips designed for the UHF channel broadcasting in your area.

See parts list for information on ordering the correct UHF channel strips.

PICTURE TUBE HANDLING PRECAUTIONS

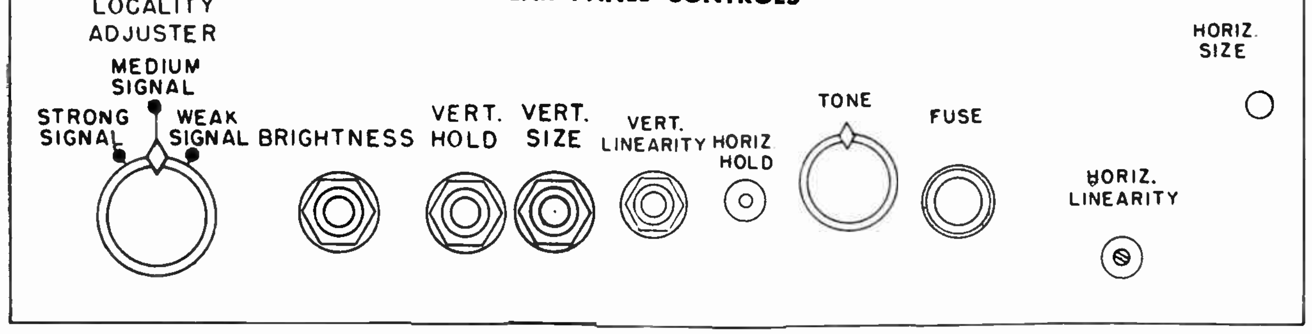
EXTREME CARE MUST BE EXERCISED WHEN HANDLING OR SERVICING THE PICTURE TUBE. ACCIDENTS ARE ONLY CAUSED BY CARELESSNESS.

Listed below are precautions which must be taken when removing the picture tube.

1. To remove the picture tube mounting assembly.
   (a) Disconnect the second anode lead, the picture tube socket assembly, and the deflection yoke plug.
   (b) Remove the main chassis and the two picture tube support braces.
   (c) Remove the wood screws holding the picture tube mounting board assembly to the cabinet.
   (d) Slide picture tube assembly out. Because of its size and weight two persons are required to handle this assembly. The balance or center of weight is at the face of the picture tube.
2. Always wear goggles when handling picture tube.
3. Never hold the picture tube close to the body.
4. Never handle the picture tube by its neck.
5. Never bump or scratch the picture tube.
6. Always clean the neck of the picture tube before adjusting the ion trap.
7. If it becomes necessary to remove the picture tube from its mounting board, always place on a clean soft cloth face down.

SM-1004

REAR PANEL CONTROLS



HIGH VOLTAGE AND CORONA

WARNING: HIGH VOLTAGE DEVELOPED IN THIS RECEIVER IS IN EXCESS OF 18,000 VOLTS.

Increased high voltage not only presents the problem of safety precautions, it also increases the problems of arcing and corona.

When servicing or replacing any part of the high voltage compartment of this receiver the following precautions and suggestions should be followed.

1. All connections to the high voltage transformer, condenser, and socket terminal should be made mechanically tight and all excessive wire clipped off, leaving no sharp points from these terminals.
2. A clean, round and smooth solder connection should be made, covering all sharp points. (Do not use excessive solder.)
3. All lead dresses in the high voltage compartment are critical.
   B+ leads or leads of ground or near ground potential too close to any high voltage leads will cause corona and/or arcing to the extent it may cause the insulation of the wires to burn.
4. All insulating wax when removed around the high voltage socket and condenser must be replaced. Insulating wax may be procured through the Sentinel Service Department.
5. Repairing high voltage transformers is not recommended. Always replace the defective transformer with a new one.
6. Before replacing the high voltage shield cover make a careful inspection of wire dress, soldered connections, and wax insulated parts.

GENERAL INSTALLATION INSTRUCTIONS

While each receiver is correctly aligned at the factory rough handling in transit, ageing, drift, etc., may throw the receiver off, so we suggest that the proper oscillator trimmers, ratio detector, and rear panel controls be checked for correct adjustment with a transmitted television pattern, in the customer's home at the time of installation. Be sure to have the receiver operating for one-half hour before making these adjustments. Listed below is the correct procedure to follow in making these adjustments.

(A) Check all operating channels, using FINE TUNING CONTROL for best picture detail. (See paragraph PEAKING THE INDIVIDUAL OSCILLATOR TRIMMERS.)

(B) Check LOCALITY ADJUSTER CONTROL located on back of chassis for proper setting.
NOTE: The signal strength (too strong or too weak) will be affected by location and distance from the station, type of antenna used, terrain obstructions such as tall buildings, electrical disturbances.

PEAKING THE INDIVIDUAL OSCILLATOR TRIMMERS

(A) Set channel selector knob to the desired channel.

(B) Set the FINE TUNING CONTROL to the center position.

(C) Remove the channel and fine tuning knobs. This will expose the individual channel adjustment screw opening just to right of the channel shaft. See Fig. 1.

(D) Use a non-metallic screwdriver such as polystyrene or nylon.

Adjust the individual oscillator screw for best picture detail. A slight adjustment in either direction is all that is necessary. CAUTION: DO NOT ADJUST INDISCRIMINATELY, this may cause the adjustment screw to fall from its locking position.

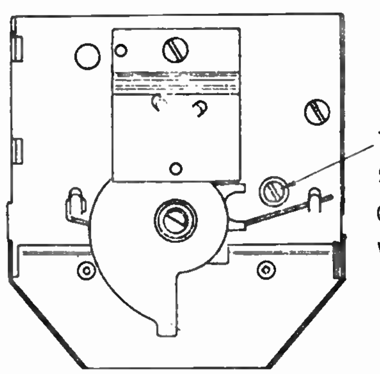
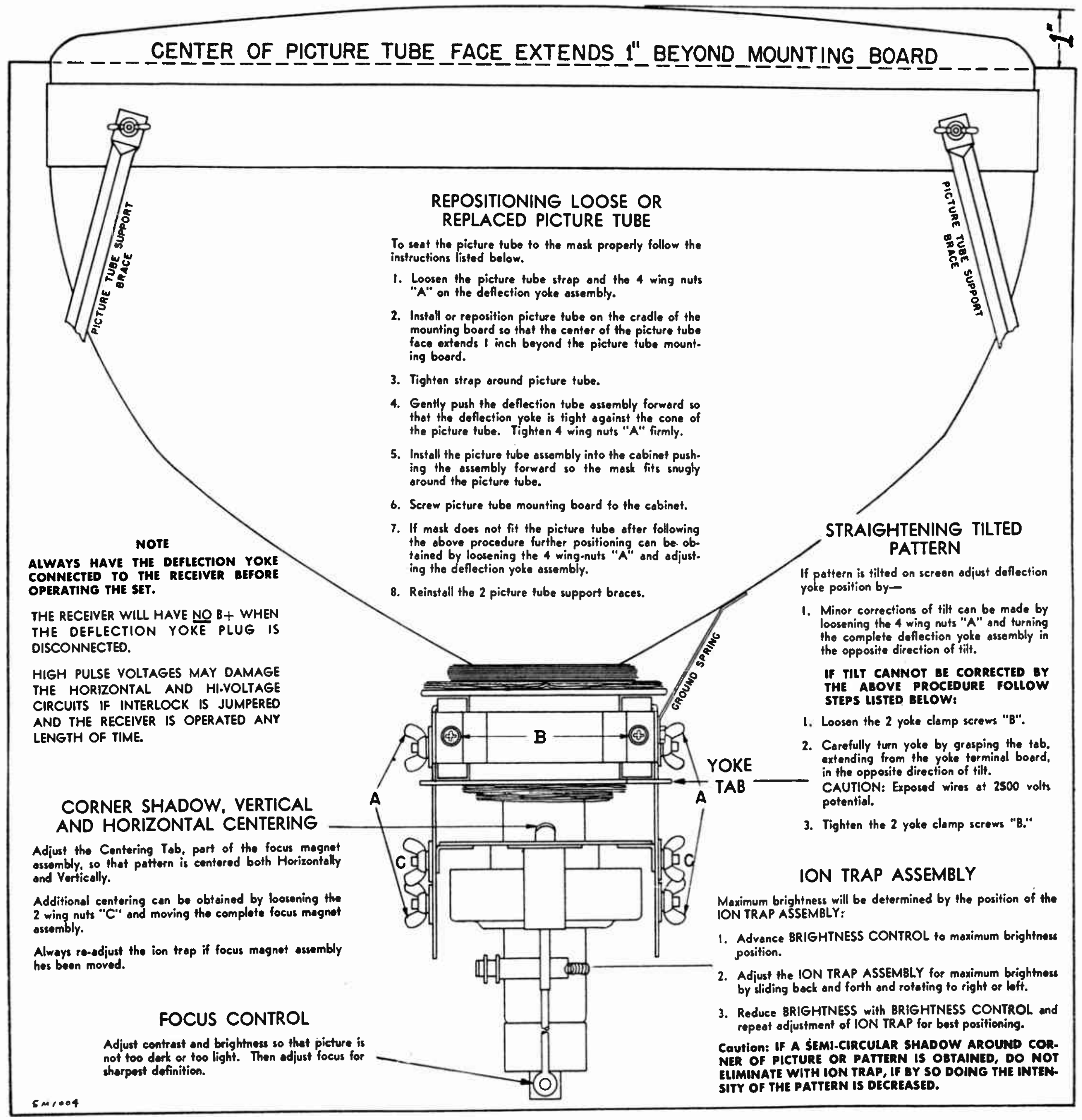


FIG. 1

ADJUSTMENT FOR STATION BUZZ

If station buzz is excessive and is NOT DUE to "contrast control" being advanced too far in a clockwise direction or the locality adjuster control in the incorrect position, adjust the ratio detector secondary adjustment screw located on top of the ratio detector for minimum buzz. MAKE SURE THAT THIS POSITION IS BETWEEN the two MAXIMUM buzz peaks that will be noticed when adjustment screw is turned to the right or left of the minimum buzz position.

ADJUSTMENT PROCEDURE FOR FOCUS, DEFLECTION YOKE, ION TRAP, HORIZONTAL AND VERTICAL CENTERING, CORNER SHADOW, AND PICTURE TUBE ALIGNMENT.



REPOSITIONING LOOSE OR REPLACED PICTURE TUBE

To seat the picture tube to the mask properly follow the instructions listed below.

1. Loosen the picture tube strap and the 4 wing nuts "A" on the deflection yoke assembly.
2. Install or reposition picture tube on the cradle of the mounting board so that the center of the picture tube face extends 1 inch beyond the picture tube mounting board.
3. Tighten strap around picture tube.
4. Gently push the deflection tube assembly forward so that the deflection yoke is tight against the cone of the picture tube. Tighten 4 wing nuts "A" firmly.
5. Install the picture tube assembly into the cabinet pushing the assembly forward so the mask fits snugly around the picture tube.
6. Screw picture tube mounting board to the cabinet.
7. If mask does not fit the picture tube after following the above procedure further positioning can be obtained by loosening the 4 wing-nuts "A" and adjusting the deflection yoke assembly.
8. Reinstall the 2 picture tube support braces.

NOTE

ALWAYS HAVE THE DEFLECTION YOKE CONNECTED TO THE RECEIVER BEFORE OPERATING THE SET.

THE RECEIVER WILL HAVE NO B+ WHEN THE DEFLECTION YOKE PLUG IS DISCONNECTED.

HIGH PULSE VOLTAGES MAY DAMAGE THE HORIZONTAL AND HI-VOLTAGE CIRCUITS IF INTERLOCK IS JUMPERED AND THE RECEIVER IS OPERATED ANY LENGTH OF TIME.

STRAIGHTENING TILTED PATTERN

If pattern is tilted on screen adjust deflection yoke position by—

1. Minor corrections of tilt can be made by loosening the 4 wing nuts "A" and turning the complete deflection yoke assembly in the opposite direction of tilt.

IF TILT CANNOT BE CORRECTED BY THE ABOVE PROCEDURE FOLLOW STEPS LISTED BELOW:

1. Loosen the 2 yoke clamp screws "B".
2. Carefully turn yoke by grasping the tab, extending from the yoke terminal board, in the opposite direction of tilt.
CAUTION: Exposed wires at 2500 volts potential.
3. Tighten the 2 yoke clamp screws "B."

CORNER SHADOW, VERTICAL AND HORIZONTAL CENTERING

Adjust the Centering Tab, part of the focus magnet assembly, so that pattern is centered both Horizontally and Vertically.

Additional centering can be obtained by loosening the 2 wing nuts "C" and moving the complete focus magnet assembly.

Always re-adjust the ion trap if focus magnet assembly has been moved.

ION TRAP ASSEMBLY

Maximum brightness will be determined by the position of the ION TRAP ASSEMBLY:

1. Advance BRIGHTNESS CONTROL to maximum brightness position.
2. Adjust the ION TRAP ASSEMBLY for maximum brightness by sliding back and forth and rotating to right or left.
3. Reduce BRIGHTNESS with BRIGHTNESS CONTROL and repeat adjustment of ION TRAP for best positioning.

Caution: IF A SEMI-CIRCULAR SHADOW AROUND CORNER OF PICTURE OR PATTERN IS OBTAINED, DO NOT ELIMINATE WITH ION TRAP, IF BY SO DOING THE INTENSITY OF THE PATTERN IS DECREASED.

FOCUS CONTROL

Adjust contrast and brightness so that picture is not too dark or too light. Then adjust focus for sharpest definition.

ADJUSTMENTS FOR CORNER SHADOW, VERTICAL AND HORIZONTAL CENTERING CAN BE MADE WITHOUT REMOVING THE CABINET BACK. THE CENTERING TAB CAN BE REACHED BY REMOVING THE 4 SCREWS HOLDING CUP TO THE CABINET BACK.

ALIGNMENT DATA

ALIGNMENT PROCEDURE

All circuits are very stable and will seldom require adjustment. Only when major parts of the tuner or the video I-F strip have been replaced or tampered with will it be necessary to realign the receiver.

Generally under normal conditions only the INDIVIDUAL CHANNEL TRIMMERS in the tuner unit may require adjustment by the service technician.

RATIO DETECTOR AND SOUND I-F ALIGNMENT

In most cases only the secondary of the ratio detector coil will require adjustment. This can be done simply by adjusting the top adjustment screw of the ratio detector for minimum buzz with the sound carrier of a TV station. For complete alignment use steps 1, 2, and 3 in the alignment table.

PICTURE I-F ALIGNMENT

Receiver should be run for at least ½ hour before proceeding with alignment.

EQUIPMENT REQUIRED

VACUUM TUBE VOLTMETER

SIGNAL GENERATOR supplying a 4.5 MC. (within .25%) 20 to 30 MC. and 50 to 216 MC. (within 1%) signal. With output adjustable to at least .1 volt maximum.

CATHODE-RAY OSCILLOSCOPE. Must have good frequency and phase response from 10 cycles to at least 2 MC.

SWEEP GENERATOR. Capable of covering 20 to 30 MC. and 40 to 270 MC. with a 10 MC. sweep with output adjustable to at least .1 volt maximum.

3 VOLT "A" BATTERY to provide fixed bias during video I-F and R-F alignment.

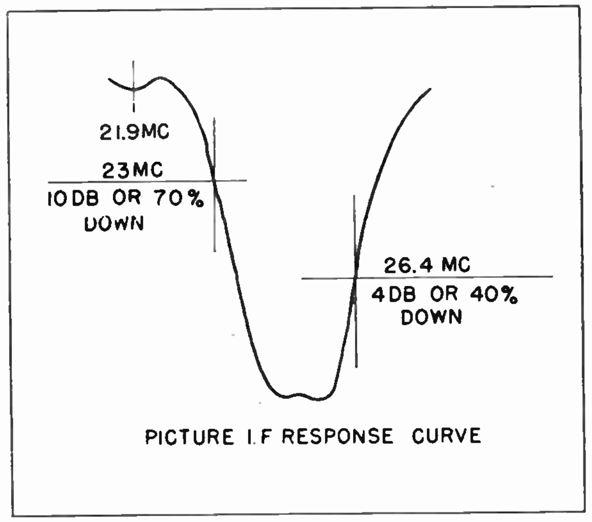


FIG. 2

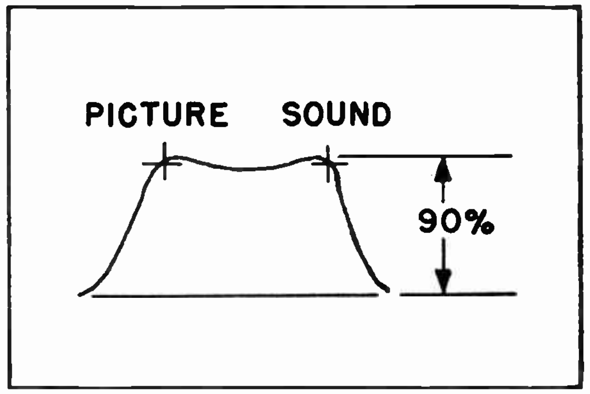


FIG. 3

ALIGNMENT TABLE

RATIO DETECTOR AND SOUND ALIGNMENT

Step No.	Connect Signal Generator to	Sig. Gen. Freq.	Connect Voltmeter to	Miscellaneous Instructions	Adjust
1	In series with .001 Mfd. Cond. to junction of L-7 and L-13 terminal 3 of 4th I.F. See fig. 5	4.5 MC.	In series with 47,000 ohm res. across C-23 a 10 Mfd. cond. See fig. 5	Maintain reading on 10 volt scale contrast at maximum. Remove 3rd video IF tube 6CB6.	T-7 (top) and T-8 (bottom) for max. reading. See fig. 4 & 5
2	In series with .001 Mfd. Cond. to junction of L-7 and L-13 terminal 3 of 4th I.F. See fig. 5	4.5 MC.	In series with 47,000 ohm res. to junction of R-30 and C-44. See fig. 5	Maintain reading on 10 volt scale contrast at maximum. Remove 3rd video IF tube 6CB6.	T-8 (top) for zero reading. See fig. 4
3	In series with .001 Mfd. Cond. to cathode of picture tube yellow lead. See fig. 5	4.5 MC.	In series with 47,000 ohm res. across C-23 a 10 Mfd. cond. See fig. 5	Maintain reading on low volt scale. Remove 3rd video IF tube 6CB6.	T-6 (top) for minimum reading. See fig. 4

NOTE 1: For **minimum buzz** always adjust T-8 (top) with the sound carrier of a TV station.
NOTE 2: Alternate 4.5 MC. trap alignment: Adjust T-6 (top) for minimum 4.5 MC beat on a strong station signal.

ALIGNMENT TABLE—(Cont.)

PICTURE I-F ALIGNMENT

Step No.	Connect Signal Generator to	Sig. Gen. Freq.	Connect Voltmeter to	Miscellaneous Instructions	Adjust
4	In series with .001 Mfd. cond. to lead extending from top of tuner. See fig. 4	24.3 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5.	Tuner on channel 3, 3 volts bias to junction of C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-5 (bottom) for maximum reading. See fig. 4
5	In series with .001 Mfd. cond. to lead extending from top of tuner. See fig. 4	21.9 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5.	Tuner on channel 3, 3 volts bias to junction of C-51 positive side to ground. Locality switch in strong position. See fig. 5 Repeat steps 4 & 5.	T-5 (top) for minimum reading. See fig. 5
6	In series with .001 Mfd. cond. to lead extending from top of tuner. See fig. 4	22.9 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5.	Tuner on channel 3, 3 volts bias to junction of C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-4 (top) for maximum reading. See fig. 4
7	In series with .001 Mfd. cond. to lead extending from top of tuner. See fig. 4	25.9 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5.	Tuner on channel 3, 3 volts bias to junction of C-51 positive side to ground. Locality switch in strong position. See fig. 5	T-3 (top) for maximum reading. See fig. 4
8	In series with .001 Mfd. cond. to lead extending from top of tuner. See fig. 4	24.7 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7. See fig. 5.	Tuner on channel 3, 3 volts bias to junction of C-51 positive side to ground. Locality switch in strong position. See fig. 5 **NOTE:** Detune T-2 by turning slug to center of coil.	T-1 (top) for maximum reading. See fig. 4

SWEEP ALIGNMENT FOR T-2 TO OBTAIN RESPONSE CURVE IN FIG. 2

Step No.	Connect Marker Generator to	Marker Gen. Freq.	Connect Sweep Gen. to	Sweep Freq.	Connect Oscilloscope to	Miscellaneous Connections	Adjust
9	Loosely couple to ungrounded converter tube shield.	26.4 MC.	Ungrounded converter tube shield	20 to 30 MC.	In series with 47,000 ohm res. to junction of R-37 and L-7.	3 volt bias to junction C-51 locality switch in strong position.	T-2 so that 26.4 marker is 4 DB or 40% down with flat response. See fig. 2

NOTE 3: Set the signal generator to provide a 23 MC. marker and observe the response curve. The 23 MC. marker should be at 10 DB or 70% down. Set the signal generator to provide a 21.9 and observe the response curve: The 21.9 marker should be in the hole of the curve. See fig. 2. IF THERE ARE ANY GREAT DEVIATIONS OF THE MARKERS OR THE RESPONSE CURVE STEPS 4 THRU 9 SHOULD BE REPEATED.

TUNER R.F. ALIGNMENT

NOTE 4: NEVER ADJUST C-2, C6 and C-9 UNLESS ABSOLUTELY NECESSARY. THEY ARE FACTORY PRESET BY SPECIAL EQUIPMENT.

Step No.	Connect Marker Generator to	Marker Gen. Freq.	Connect Sweep Gen. to	Sweep Gen. Chan.	Connect Oscilloscope to	Miscellaneous Connections	Adjust
10	Loosely couple to sweep gen. leads.	205.25 MC. and 209.75 MC.	300 ohm antenna terminals.	12	Lead extending from top of tuner. See fig. 4	Tuner on channel 12 3 volt bias to junction of C-51 locality switch in strong position.	C-2, C-6 and C-9 for max. response having linear peaks with picture and sound markers at 90% maximum response. See fig. 3
11	OBSERVE RESPONSE CURVE FOR ALL CHANNELS USING CORRECT FREQUENCIES AND CHANNELS. A SLIGHT COMPROMISE SHOULD BE MADE WITH C-2, C-6 AND C-9 IF MARKERS ARE BELOW 70%.						

NOTE 5: FOR RF OSCILLATOR ALIGNMENT. SET FINE TUNING CONTROL IN CENTER POSITION. ADJUST INDIVIDUAL CHANNEL TRIMMERS FOR BEST PICTURE DETAIL WITH THE PATTERNS OF A TV STATION. NOTE: USE A NON-METALLIC SCREW-DRIVER.

TRIMMER LOCATION AND ALIGNMENT CONNECTION POINTS

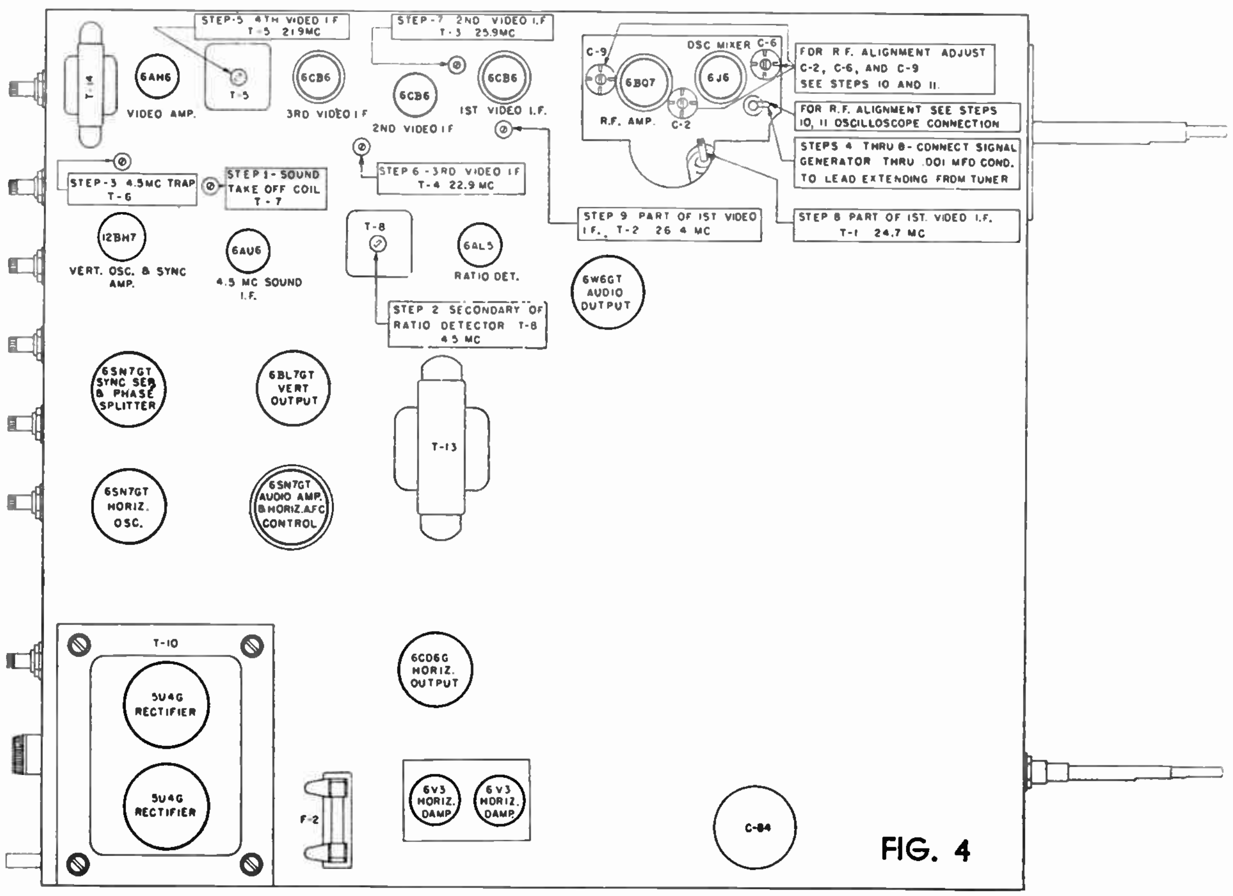


FIG. 4

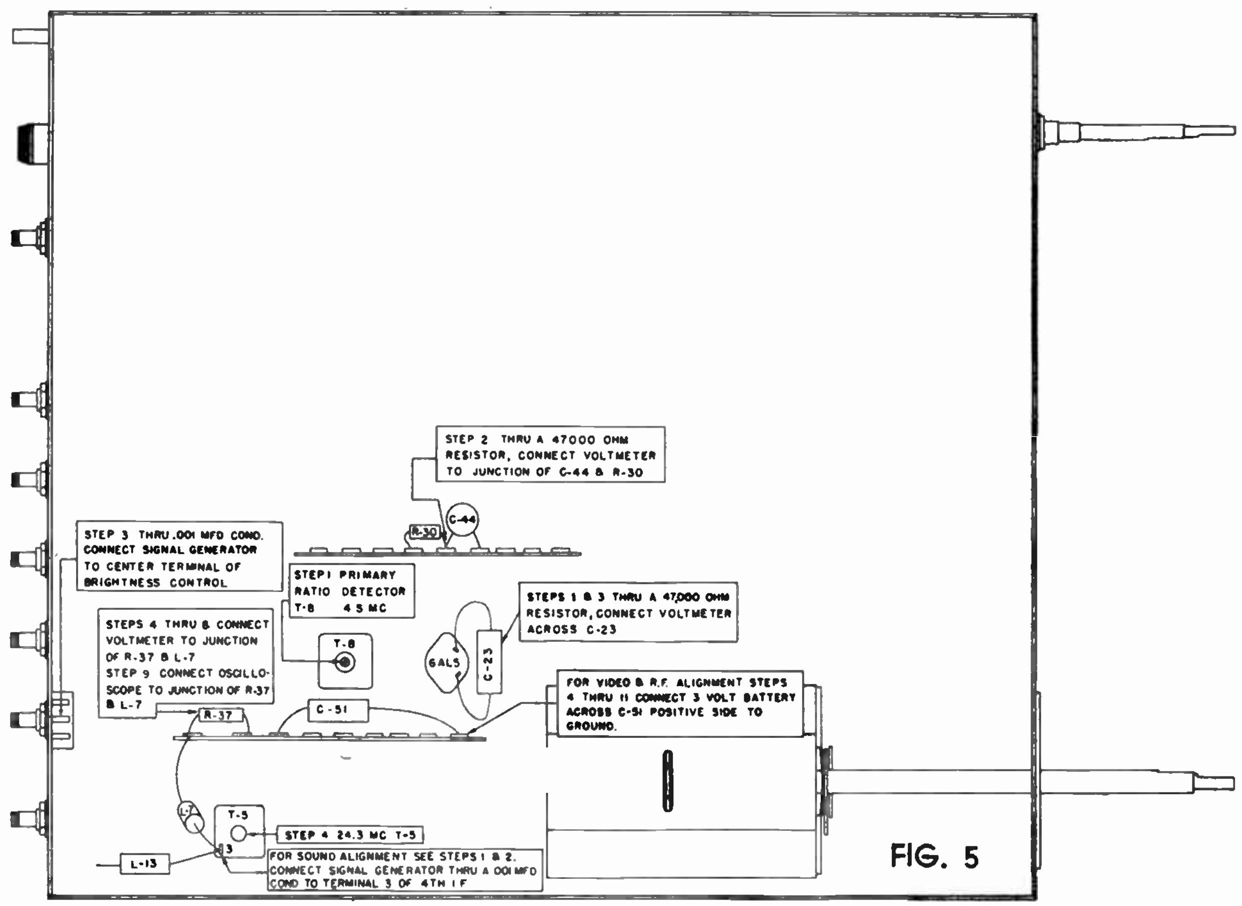


FIG. 5

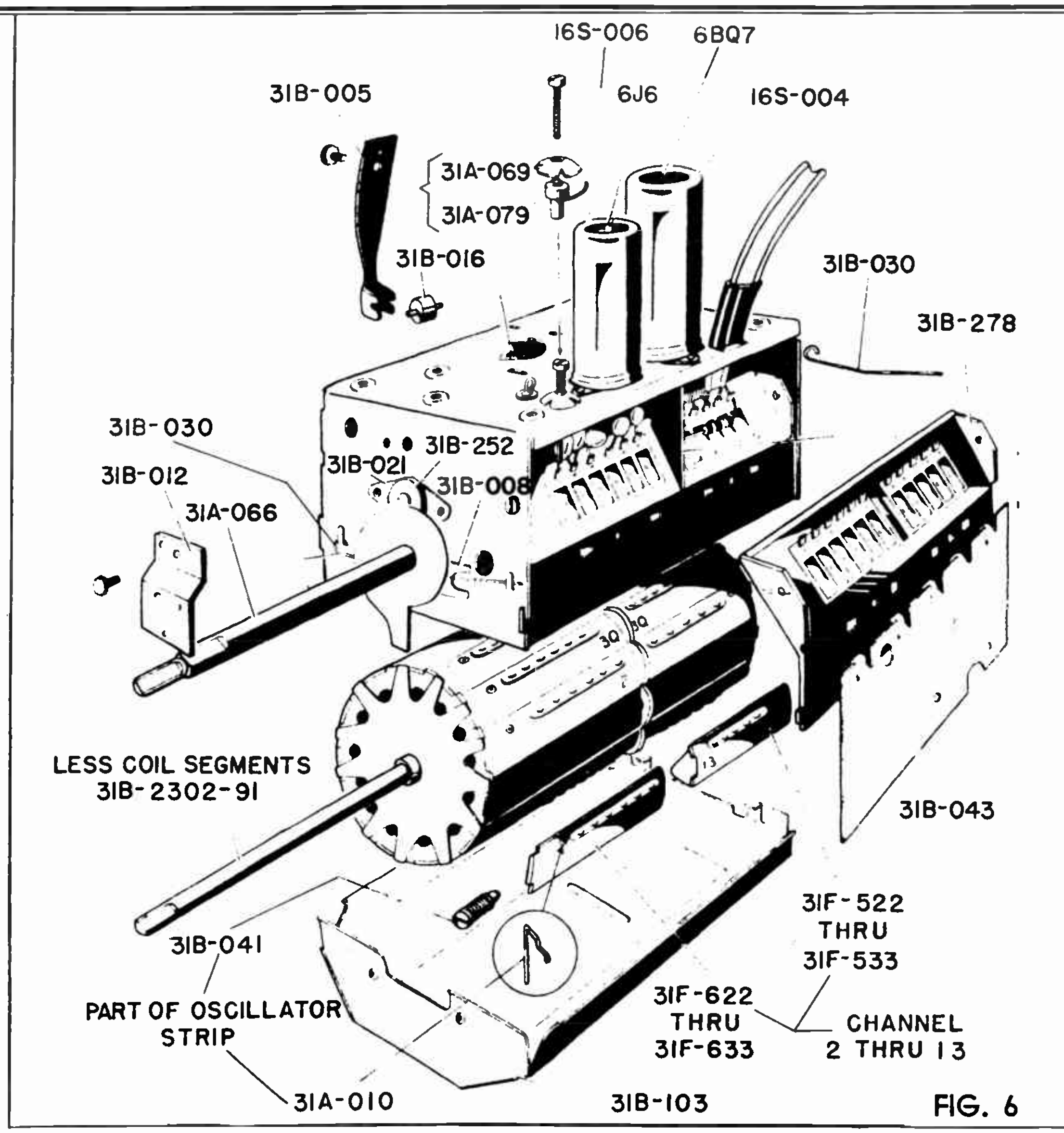


FIG. 6

PARTS LIST

R.F. TUNER UNIT

When Ordering Parts Give The Complete Part Number, Model Number and Description

Part No.	Description	List Price
31A-066-91	Fine Tuning Assembly	$0.59
31B-2302-91	Drum & Shaft Assembly Less Coils	3.83
31B-016	Roller Detent	.18
31B-005	Spring Detent	.18
31B-012	Groundplate, Fine Tuning	.23
31B-008	Ground Spring, Fine Tuning	.18
31B-021	Mounting Strap, Ceramic Bushing	.18
11D-022	Fiber Washer	.09
31B-030	Spring, Shaft Retaining	.18
31B-278	Stator Contact Bracket Assembly	3.38
16S-004	Shield for 6BQ7	.18
16S-006	Shield for 6J6	.18
31B-103	Shield, Bottom Cover	1.35
31B-043	Shield, Side	1.13

CAPACITORS

Illus. No.	Part No.	Description	List Price
C-1	13B-055	Fixed Ceramic, 120 MMF ± 10% 500 V.	.29
C-2	31A-069	Trimmer R.F., .5-3 MMF	.68
C-3	CD8C6R8C	Fixed Ceramic, 6.8 MMF ± .25 MMF	.68
C-4	13B-052	Silver Mica, 68 MMF ± 5%	.34

CAPACITORS—(Cont.)

Illus. No.	Part No.	Description	List Price
C-5	CD8Q470K	Fixed Ceramic, 47 MMF 10%	.27
C-6	31A-069	Trimmer R.F., .5-3 MMF	.68
C-7	CD8C030C	Fixed Ceramic, 3.9 MMF ± .25 MMF	.27
C-8	CD8Y102Z	Fixed Ceramic, 1000 MMF	.22
C-9	31A-079	Trimmer, 3-9 MMF Antenna	.68
C-10	CD8Y102Z	Fixed Ceramic, 1000 MMF	.22
C-11	CD8C1R5M	Fixed Ceramic, 1.5 MMF	.27
C-12	CD8Q470K	Fixed Ceramic, 47 MMF 10%	.27
C-13	CD10C100K	Fixed Ceramic, 10 MMF ± 10%	.22
C-14	CD8U050C	Fixed Ceramic, 5 MMF ± 5%	.27
C-15	CD8Y102Z	Fixed Ceramic, 1000 MMF	.22
C-16	31B-252	Ceramic Bushing & Lead Assembly Fine Tuning	.45
C-17	13D-153	Feed Thru Condenser, 800 MMF Min. (Part of Center Shield Assembly)	.36
C-18	13D-153	Feed Thru Condenser, 800 MMF Min. (Part of Center Shield Assembly)	.36
C-19	13D-153	Feed Thru Condenser, 800 MMF Min. (Part of Center Shield Assembly)	.36
C-20	13D-153	Feed Thru Condenser, 800 MMF Min. (Part of Center Shield Assembly)	.36

R.F. TUNER UNIT—(Cont.)

RESISTORS

Illus. No.	Part No.	Description	List Price
R-1	27E103-2	Carbon, 10,000 Ohm ½ W. ± 5%	$ .14
R-2	27E103-2	Carbon, 10,000 Ohm ½ W.	.08
R-3	27E153-2	Carbon, 15,000 Ohm ½ W.	.08
R-4	27E1009-27	Carbon, 100,000 Ohm ⅓ W. ± 5%	.14
R-5	27E224-2	Carbon, 220,000 Ohm ½ W.	.08
R-6	27E1009-12	Carbon, 160,000 Ohm ½ W. ± 5%	.14
R-7	27E1009-27	Carbon, 100,000 Ohm ½ W. ± 5%	.08
R-8	27E103-2	Carbon, 10,000 Ohm ½ W.	.08
R-9	27E473-2	Carbon, 47,000 Ohm ½ W.	.08
R-10	27E152-2	Carbon, 1500 Ohm ½ W.	.07

CHOKES AND COILS

Illus. No.	Part No.	Description	List Price
L-1	31B-638	Choke, Mixer Plate	.68
L-2	31B-296	Choke, Cathode	.22
L-3	31B-230	Choke, Mixer	.34
L-4	34A-546	Choke, RF Filament	.08
L-5	34A-575	Choke, Oscillator Filament	.08
T-1	31A-095	IF Coil	.56
	31F-522	Antenna Coil Assembly, Channel 2, Code Q	1.13
	31F-523	Antenna Coil Assembly, Channel 3, Code Q	1.13
	31F-524	Antenna Coil Assembly, Channel 4, Code Q	1.13
	31F-525	Antenna Coil Assembly, Channel 5, Code Q	1.13
	31F-526	Antenna Coil Assembly, Channel 6, Code Q	1.13
	31F-527	Antenna Coil Assembly, Channel 7, Code Q	.95
	31F-528	Antenna Coil Assembly, Channel 8, Code Q	.95
	31F-529	Antenna Coil Assembly, Channel 9, Code Q	.95
	31F-530	Antenna Coil Assembly, Channel 10, Code Q	.95

COILS—(Cont.)

Part No.	Description	List Price
31F-531	Antenna Coil Assembly, Channel 11, Code Q	.95
31F-532	Antenna Coil Assembly, Channel 12, Code Q	.95
31F-533	Antenna Coil Assembly, Channel 13, Code Q	.95
31F-622	R.F. and Oscillator Coil Assembly, Channel 2, Code Q	1.49
31F-623	R.F. and Oscillator Coil Assembly, Channel 3, Code Q	1.49
31F-624	R.F. and Oscillator Coil Assembly, Channel 4, Code Q	1.49
31F-625	R.F. and Oscillator Coil Assembly, Channel 5, Code Q	1.49
31F-626	R.F. and Oscillator Coil Assembly, Channel 6, Code Q	1.49
31F-627	R.F. and Oscillator Coil Assembly, Channel 7, Code Q	1.40
31F-628	R.F. and Oscillator Coil Assembly, Channel 8, Code Q	1.40
31F-629	R.F. and Oscillator Coil Assembly, Channel 9, Code Q	1.40
31F-630	R.F. and Oscillator Coil Assembly, Channel 10, Code Q	1.40
31F-631	R.F. and Oscillator Coil Assembly, Channel 11, Code Q	1.40
31F-632	R.F. and Oscillator Coil Assembly, Channel 12, Code Q	1.40
31F-633	R.F. and Oscillator Coil Assembly, Channel 13, Code Q	1.40

Kits containing the necessary strips to convert to any UHF channel are available. When ordering please be sure to: Give required UHF channel number. Give tuner part number, Ink stamped on front of tuner. It is not necessary to remove chassis, just remove the channel and fine tuning knobs. Tuner part number begins with 20E—Series letter on back of chassis may also be used as a reference number.

MAIN CHASSIS

CAPACITORS

Illus. No.	Part No.	Description	List Price
C-21	23E23	Fixed Ceramic, 30 MMF 500 V. (Part of 4th Video IF)	$0.29
C-22	23E21	Fixed Ceramic, 2.2 MMF 500 V.	.84
C-23	25E67	Dry Electrolytic, 10 MFD 50 V.	1.19
C-24	23E3216	Molded Tubular, .1 MFD 200 V.	.34
C-25	23E23	Fixed Ceramic, 30 MMF 500 V.	.29
C-26	23E22	Fixed Ceramic, 20 MMF 500 V.	.29
C-27	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-28	25E66	Dry Electrolytic, 10 MFD. 50 V.	1.14
C-29	23E3423	Molded Tubular, .039 MFD. 400 V.	.34
C-30	23E3408	Molded Tubular, .0047 MFD. 400 V.	.27
C-31	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-32	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-33	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-34	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-35	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-36	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-37	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-38	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-39	23E25	Fixed Ceramic, 10 MMF 500 V.	.31
C-40	23E2027-10	Fixed Ceramic, 150 MMF 500 V.	.19
C-41	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-42	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-43	23E3500-40	Fixed Mica, 470 MMF ± 10% 500 V.	.32
C-44	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-45	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-46	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-47	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-48	23E2027-9	Fixed Ceramic, .001 MFD 500 V.	.22
C-49	23E3407	Molded Tubular, .0033 MFD 400 V.	.28
C-50	23E3416	Molded Tubular, .1 MFD 400 V.	.38
C-51	23E122	Molded Tubular, .25 MFD 100 V.	.42
C-52	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-53	23E3404	Molded Tubular, .001 MFD 400 V.	.27
C-54	23E3408	Molded Tubular, .0047 MFD 400 V.	.27
C-56A, C-56B	23E2037-6	Fixed Ceramic, (Dual) .01 MFD 500 V. (Disc)	.44
C-57	23E2030-15	Fixed Ceramic, 47 MMF 500 V.	.27
C-58	23E2025-3	Fixed Ceramic, .001 MFD 500 V. (Disc)	.22
C-59	23E2025	Fixed Ceramic, .005 MFD 500 V. (Disc)	.31
C-60	23E2027-10	Fixed Ceramic, 150 MMF 500 V.	.19

CAPACITORS—(Cont.)

Illus. No.	Part No.	Description	List Price
C-62	23E3500-40	Fixed Mica, 470 MMF ± 10% 500 V.	.32
C-63	23E3500-39	Fixed Mica, 390 MMF ± 10% 500 V.	.29
C-64	23E3500-40	Fixed Mica, 470 MMF ± 10% 500 V.	.32
C-65	23E3414	Molded Tubular, .047 MFD 400 V.	.33
C-66	23E3500-40	Fixed Mica, 470 MMF ± 10% 500 V.	.32
C-67	23E3408	Molded Tubular, .0047 MFD 400 V.	.27
C-68	23E3407	Molded Tubular, .0033 MFD 400 V.	.28
C-69	23E3410	Molded Tubular, .01 MFD 400 V.	.28
C-70	23E2033-4	Silver Mica, 3900 MMF ± 5% 500 V.	1.35
C-71	23E3410	Molded Tubular, .01 MFD 400 V.	.28
C-74	23E3500-40	Fixed Mica, 470 MMF ± 10% 500 V.	.32
C-75	23E3404	Molded Tubular, .001 MFD 400 V.	.27
C-76	23E3414	Molded Tubular, .047 MFD 400 V.	.33
C-77	23E3408	Molded Tubular, .0047 MFD 400 V.	.27
C-78	23E23	Fixed Ceramic, 30 MMF 500 V.	.29
C-79	23E3425	Molded Tubular, .015 MFD ± 10% 400 V.	.27
C-81	25E64	Electrolytic, 20 MFD 450 V.	1.88
C-82	25E71	Electrolytic, 100 MFD 50 V. 10x20 MFD 350 V.	3.20
C-83	25E62	Electrolytic, 5x60—250 V.	2.19
C-84	25E65	Electrolytic, 100 MFD 200 V. 40x40 350 V.	4.72
C-85	23E3608	Molded Tubular, .0047 MFD 600 V.	.29
C-86	23E2025-3	Molded Tubular, .001 MFD 500 V. (Disc)	.22
C-87	23E2039-3	Fixed Ceramic, 500 MMF 30,000 V.	1.90
C-88	23E3414	Molded Tubular, .047 400 V.	.33
C-89	23E2025-7	Fixed Ceramic, 120 MMF 5000 V. (Disc)	1.20
C-90	23E2025-7	Fixed Ceramic, 120 MMF 5000 V. (Disc)	1.20
C-91	23E3414	Molded Tubular, .047 400 V.	.33
C-92	23E3418	Molded Tubular, .22 400 V.	.43
C-93	23E3416	Molded Tubular, .1 400 V.	.38
C-94	23E2027-10	Fixed Ceramic, 150 MMF 500 V.	.19
C-95	23E3415	Molded Tubular, .068 400 V.	.32
C-96	23E3416	Molded Tubular, .1 400 V.	.38
C-97	23E3410	Molded Tubular, .01 400 V.	.28
C-98	23E3424	Molded Tubular, .01 Ohm ± 10% 400 V.	.42

MAIN CHASSIS—(Cont.)

RESISTORS

Illus. No.	Part No.	Description	List Price
R-11	27E1009-35	Carbon, 10,000 Ohm ½ W. ± 5%	.16
R-12	27E563-2	Carbon, 56,000 Ohm ½ W. ± 10% (Part of 4th Video IF)	.08
R-13	27E1009-8	Carbon, 5,600 Ohm ½ W. ± 5%	.10
R-14	27E1009-35	Carbon, 10,000 Ohm ½ W. ± 5%	.16
R-15	27E1009-26	Carbon, 4,700 Ohm ½ W. ± 5%	.16
R-16	27E470-2	Carbon, 47 Ohm ½ W. ± 10%	.08
R-17	27E1009-22	Carbon, 8,200 Ohm ½ W. ± 5%	.14
R-18	27E470-2	Carbon, 47 Ohm ½ W. ± 10%	.08
R-19	27E1009-8	Carbon, 5,600 Ohm ½ W. ± 5%	.10
R-20	27E122-2	Carbon, 1,200 Ohm ½ W. ± 10%	.08
R-21	27E333-3	Carbon, 33,000 Ohm 1 W. ± 10%	.12
R-22	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-23	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-24	27E822-3	Carbon, 8,200 Ohm 1 W. ± 10%	.13
R-25	27E221-2	Carbon, 220 Ohm ½ W. ± 10%	.08
R-26	27E223-2	Carbon, 22,000 Ohm ½ W. ± 10%	.10
R-27	27E151-2	Carbon, 150 Ohm ½ W. ± 10%	.08
R-28	28E95	Contrast Control, 2500 Ohm (Part of R-31)	2.55
R-29	27E471-2	Carbon, 470 Ohm ½ W. ± 10%	.08
R-30	27E333-2	Carbon, 33,000 Ohm ½ W. ± 10%	.07
R-31	28E95	Volume Control, 1 Megohm (Part of R-28)	2.55
R-32	28E96	Tone Control, 1 Megohm	.80
R-33	27E1009-48	Carbon, 3,900 Ohm 2 W. ± 5%	.50
R-34	27E683-2	Carbon, 68,000 Ohm ½ W. ± 10%	.08
R-35	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-36	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-37	27E155-2	Carbon, 1.5 Megohm ½ W. ± 20%	.07
R-38	27E1009-8	Carbon, 5,600 Ohm ½ W. ± 5%	.10
R-39	27E105-2	Carbon, 1 Megohm ½ W. ± 20%	.07
R-40	27E333-3	Carbon, 33,000 Ohm 1 W. ± 10%	.12
R-41	27E103-2	Carbon, 10,000 Ohm ½ W. ± 10%	.08
R-42	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-43	27E1009-10	Carbon, 100,000 Ohm ½ W. ± 10%	.08
R-44	27E222-2	Carbon, 2,200 Ohm ½ W. ± 10%	.08
R-45	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-46	27E103-2	Carbon, 10,000 Ohm ½ W. ± 10%	.08
R-47	27E474-2	Carbon, 470,000 Ohm ½ W. ± 20%	.07
R-48	27E155-2	Carbon, 1.5 Megohm ½ W. ± 20%	.07
R-49	27E105-2	Carbon, 1 Megohm ½ W. ± 20%	.07
R-50	28E87	Brightness Control, 5 Megohm	.91
R-51	27E1016-20	Wirewound, 8,700 Ohm 5 W. ± 10%	.51
R-52	27E682-2	Carbon, 6,800 Ohm ½ W. ± 10%	.07
R-53	27E223-2	Carbon, 22,000 Ohm ½ W. ± 10%	.10
R-54	27E104-2	Carbon, 100,000 Ohm ½ W. ± 20%	.07
R-55	27E1016-23	Wirewound, 100 Ohm 10 W.	.49
R-56	27E1009-10	Carbon, 100,000 Ohm ½ W. ± 10%	.08
R-57	27E820-2	Carbon, 82 Ohm ½ W. ± 10%	.08
R-58	27E332-2	Carbon, 3,300 Ohm ½ W. ± 10%	.07
R-59	27E823-2	Carbon, 82,000 Ohm ½ W. ± 10%	.08
R-60	27E333-2	Carbon, 33,000 Ohm ½ W ± 10%	.07
R-61	27E820-2	Carbon, 22 Ohm ½ W. ± 10%	.08
R-62	27E1009-8	Carbon, 5,600 Ohm ½ W. ± 5%	.10
R-65	27E475-2	Carbon, 4.7 Megohm ½ W. ± 20%	.07
R-67	27E474-2	Carbon, 470,000 Ohm ½ W. ± 20%	.07
R-68	27E222-2	Carbon, 2,200 Ohm ½ W. ± 10%	.08

RESISTORS—(Cont.)

Illus. No.	Part No.	Description	List Price
R-69	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-70	27E103-2	Carbon, 10,000 Ohm ½ W. ± 10%	.08
R-71	27E823-2	Carbon, 82,000 Ohm ½ W. ± 10%	.08
R-72	27E122-2	Carbon, 1,200 Ohm ½ W. ± 10%	.08
R-75	27E1009-10	Carbon, 100,000 Ohm ½ W. ± 10%	.08
R-76	27E333-2	Carbon, 33,000 Ohm ½ W. ± 10%	.07
R-77	27E222-2	Carbon, 2,200 Ohm ½ W. ± 10%	.08
R-78	27E1016-22	Wirewound, 100 Ohm 5 W. 10%	.38
R-79	28E88	Vertical Size Control, 5 Megohm	.89
R-82	28E90	Vertical Hold Control, 850,000 Ohm	.89
R-85	27E271-2	Carbon, 270 Ohm ½ W. ± 10%	.07
R-86	27E102-2	Carbon, 1,000 Ohm ½ W. ± 10%	.07
R-87	27E1009-10	Carbon, 100,000 Ohm ½ W. ± 10%	.08
R-88	27E822-2	Carbon, 8,200 Ohm ½ W. ± 10%	.08
R-89		Wire Wound, 8.6 Ohm ½ W. ± 5% Part of H.V. Socket Assembly	
R-90	27E274-2	Carbon, 270,000 Ohm ½ W. ± 20%	.08
R-91	27E1009-11	Carbon, 560,000 Ohm ½ W. ± 10%	.08
R-92	27E681-2	Carbon, 680 Ohm ½ W. ± 10%	.08
R-93	27E681-2	Carbon, 680 Ohm ½ W. ± 10%	.08
R-94	27E224-2	Carbon, 220,000 Ohm ½ W. ± 20%	.08
R-95	27E224-2	Carbon, 220,000 Ohm ½ W. ± 20%	.08
R-96	27E684-2	Carbon, 680,000 Ohm ½ W. ± 20%	.07
R-97	27E104-2	Carbon, 100,000 Ohm ½ W. ± 20%	.07
R-98	27E104-2	Carbon, 100,000 Ohm ½ W. ± 20%	.07
R-99	27E474-2	Carbon, 470,000 Ohm ½ W. ± 20%	.07
R-100	27E225-2	Carbon, 2.2 Megohm ½ W. ± 20%	.08
R-101	27E332-2	Carbon, 3,300 Ohm ½ W. ± 10%	.07
R-102	27E472-2	Carbon, 4,700 Ohm ½ W. ± 10%	.07
R-104	27E225-2	Carbon, 2.2 Megohm ½ W. ± 20%	.08
R-105	28E97	Vertical Linearity Control, 2000 Ohm	.85
R-106	27E271-3	Carbon, 270 Ohm 1 W. ± 10%	.14
R-107	27E101-2	Carbon, 100 Ohm ½ W. ± 10%	.07

CHOKES AND COILS

Illus. No.	Part No.	Description	List Price
L-6	20E363-21	Choke, Video Series	.78
L-7	20E363-19	Choke, Diode Shunt	.78
L-8	2E92	Choke, R.F. Filament	.40
L-9	20E363-20	Choke, Video Shunt	.79
L-10	20E831	Coil, Horizontal Hold	1.95
L-11	22E83	Choke Filter	4.90
L-12	20E820	Coil, Horizontal Linearity	1.65
L-13	20E834	Coil, Tweet Trap	1.20
T-2	20E780	Transformer, 1st Video I.F. (Secondary)	1.08
T-3	20E779	Transformer, 2nd Video I.F.	1.19
T-4	20E781	Transformer, 3rd Video I.F.	1.19
T-5	20E782	Transformer, 4th Video I.F.	3.20
T-6	20E785	Transformer, 4.5 MC. Trap	1.25
T-7	20E785	Transformer, Sound I.F.	1.25
T-8	20E783	Transformer, Ratio Detector	3.73
T-9	22E71-2	Transformer, Audio Output	1.95
T-10	22E82	Transformer, Power	25.90
T-11	22E84	Transformer, Horizontal Output	14.80
T-12	20E814	Yoke, Deflection (Direct Interchangeable)	28.75
	or		
T-12	20E814-2	Yoke, Deflection (Direct Interchangeable)	28.75
T-13	22E81	Transformer, Vertical Output	6.50
T-14	22E70	Transformer, Vertical Block Oscillator	2.16

MISCELLANEOUS

Illus. No.	Part No.	Description	List Price
F-1	40E8-10	Fuse, 3 Ampere (Slo-Blo) Line	.29
F-2	40E8-2	Fuse, ¼ Ampere (Slo-Blo) H.V.	.41
SW-1	29E29	Switch, Area Selector	.91
	55E57	Fuse Holder, With Cap	.78
	20E787	Tuner Unit, With Tubes	48.00
	41E8-2	Line Cord, A.C.	.92
	41E19	Line Cord with Male Plug	1.45
	41E20	Line Cord with Female Connector	1.45
	17E32	Receptacle, 2 Contact Male	.30
	17E1-18	Socket, Octal	.15
	17E1-27	Socket, Octal Mica Filled	.24
	17E1-36	Socket, Miniature 7 Pin	.20
	17E1-39	Socket, Miniature 9 Pin	.50
	18E25	Terminal, Antenna	.15
	20E419-5	Connector, 2nd Anode Picture Tube	.75
	20E517-14	Socket Assembly, Picture Tube	1.45
	20E823	Connector and Lead Assembly	1.20

Part No.	Description	List Price
95E1	Crystal Diode, IN60	1.00
15E174-7	Trap, Ion	.85
20E668	Antenna, Built In	1.84
61E18	Clock, Electric Mahogany	19.00
61E18-2	Clock, Electric Blonde	19.00
62E8	Focus Magnet	10.50

CABINET PARTS

Part No.	Description	List Price
1E51-2	Speaker, 12" PM	18.70
5E76	Plate, Clock Mounting	.50
9E45-5	Glass, Safety	25.50
20E774-4	Cabinet Back Assembly, with Line Cord	9.65
36E88	Mask, for Picture Tube	11.60
37E71-5	Knob, Fine Tuning	.59
37E71-6	Knob, Contrast	.59
37E72-11	Knob, Channel Selector	.86
37E72-15	Knob, Volume	.80
37E24-2	Knob, Locality Adjuster, Tone	.11

COVERING MODELS

462 and 463

SUBJECT:

Manufacturers variations of 1B3GT high voltage rectifier tubes.

REASON:

In all makes of 1B3GT tubes except General Electric pin #5 is an open pin.

In General Electric 1B3GT tubes pins #5 and #7 are internally connected.

In the above listed models the 8.7 ohm filament current limiting resistor R 89 is connected between terminals #5 and #7 of the 1B3GT socket.

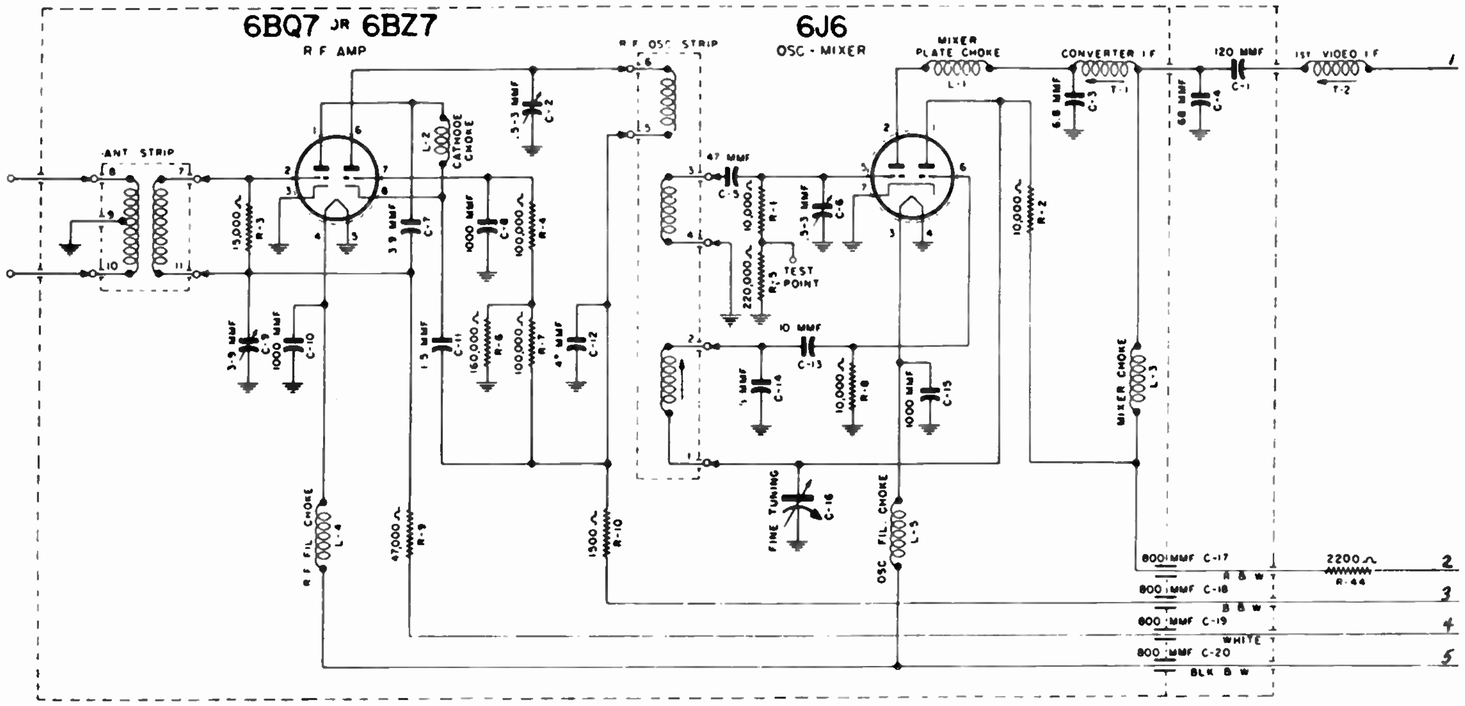
Because of this if a General Electric 1B3GT tube is used (with pins #5 and #7 internally connected) the current limiting resistor would be bypassed resulting in excessive filament voltage, and therefore short tube life.

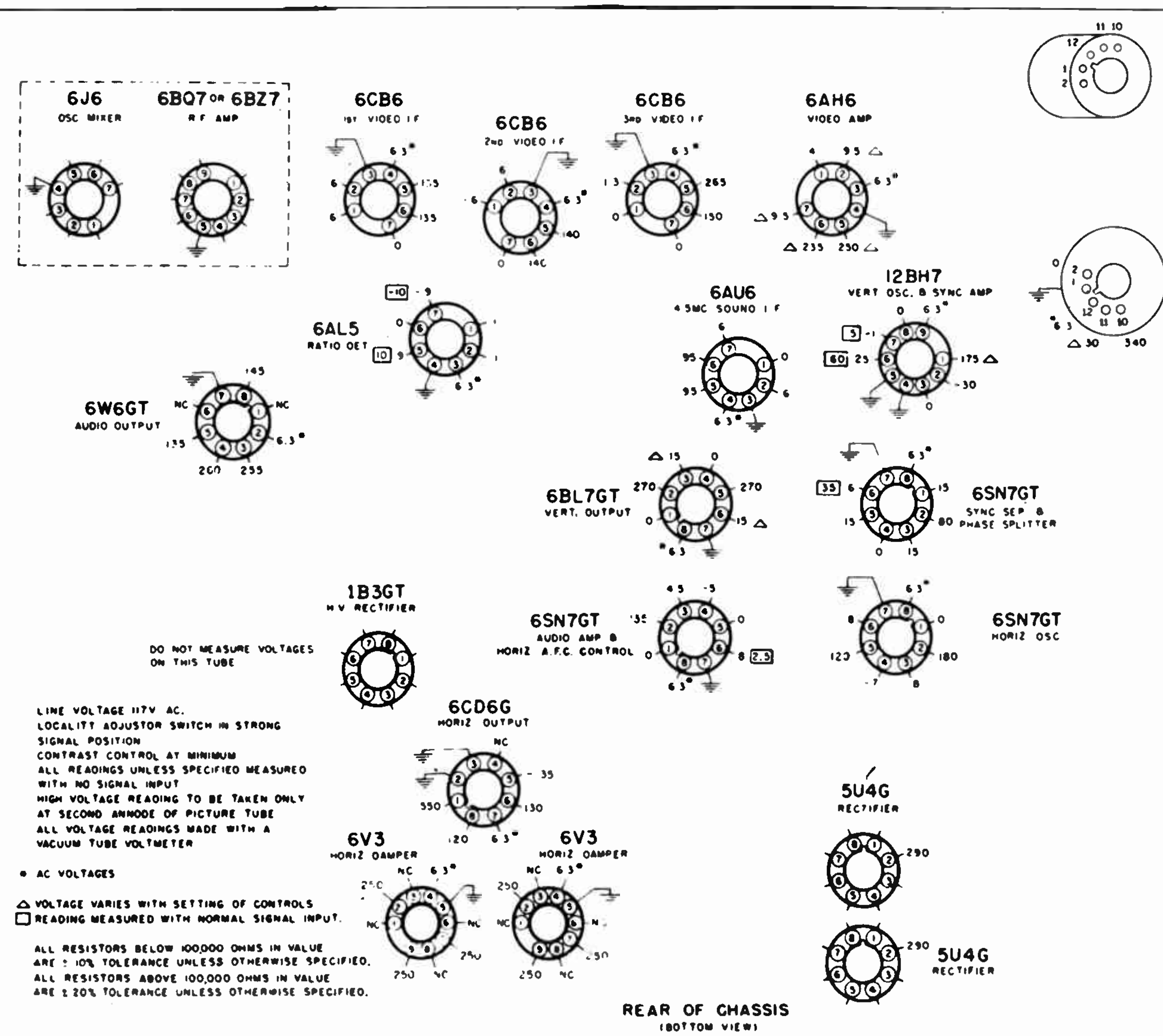
We have been informed that General Electric will soon manufacture and distribute 1B3GT tubes that do not have pins #5 and #7 internally connected. However, until such GE 1B3GT tubes are available DO NOT USE GE 1B3GT TUBES AS REPLACEMENTS IN MODELS 462 and 463, unless pin #5 is clipped off the tube base.

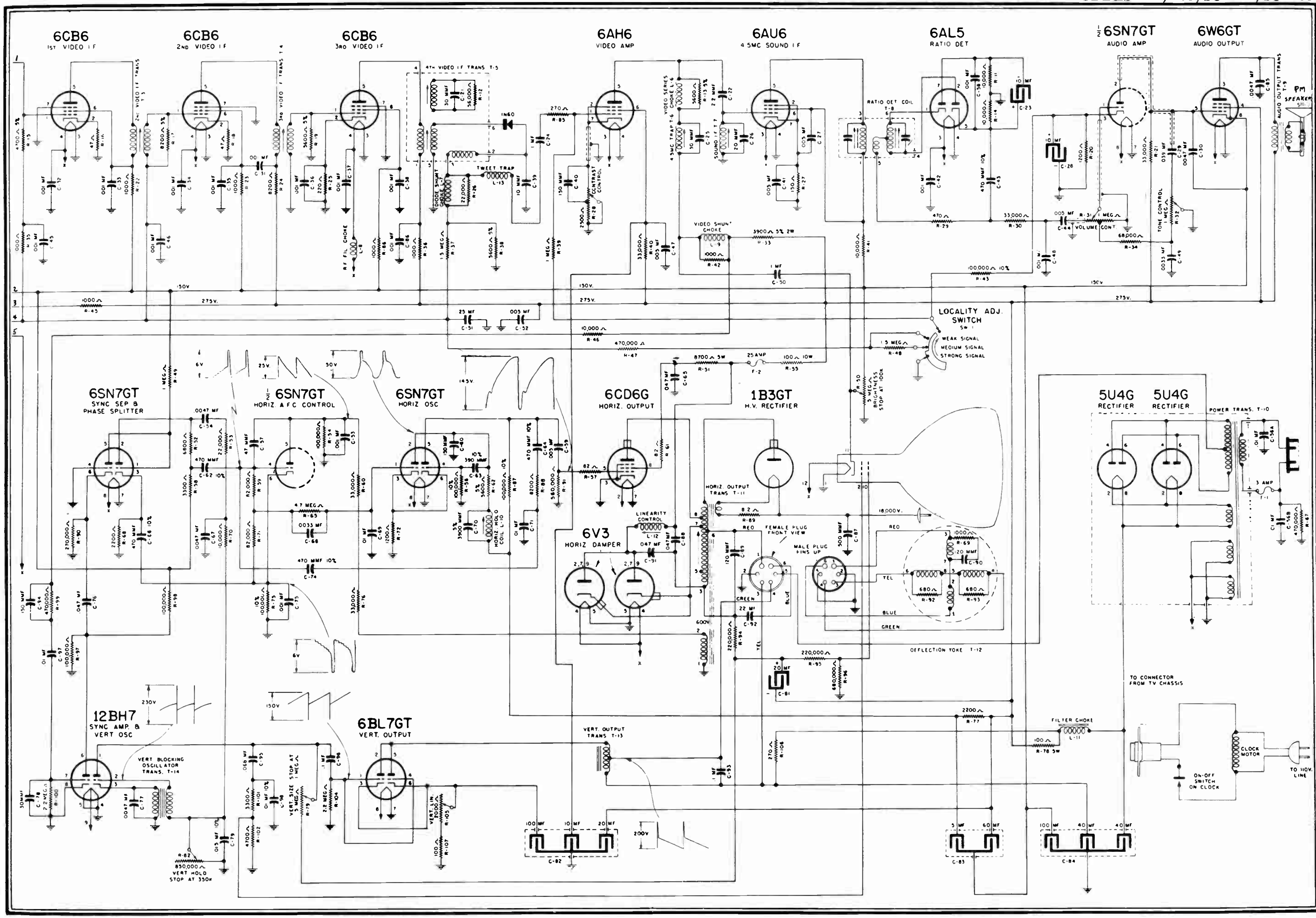
SUBJECT: The 40E8-10 3 ampere slo-blo line fuse used in models 462 and 463 blowing under normal operating conditions.

REASON: Surge current when the receiver is turned ON or OFF may cause the 3 ampere line fuse to blow.

REMEDY: Always replace the 3 ampere fuse with a 4 ampere slo-blo fuse part no. 40E8-11. The 4 ampere fuse is being used in currently produced models 462 and 463.

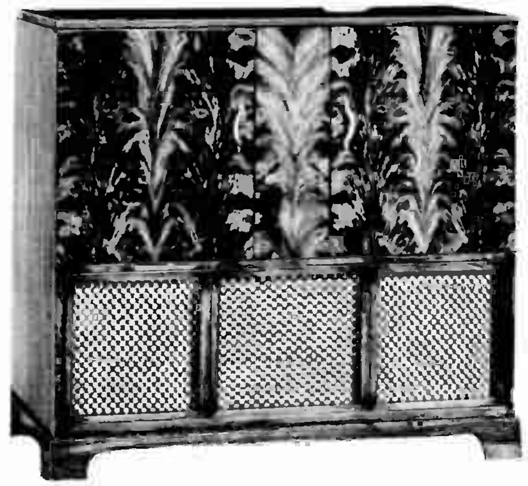





6CB6
1ST VIDEO I.F.
6CB6
2ND VIDEO I.F.
6CB6
3RD VIDEO I.F.
6AH6
VIDEO AMP
6AU6
4.5MC SOUND I.F.
6AL5
RATIO DET
½ 6SN7GT
AUDIO AMP
6W6GT
AUDIO OUTPUT
LOCALITY ADJ. SWITCH
WEAK SIGNAL
MEDIUM SIGNAL
STRONG SIGNAL
6SN7GT
SYNC SEP & PHASE SPLITTER
½ 6SN7GT
HORIZ A.F.C. CONTROL
6SN7GT
HORIZ OSC
6CD6G
HORIZ. OUTPUT
1B3GT
H.V. RECTIFIER
5U4G
RECTIFIER
5U4G
RECTIFIER
6V3
HORIZ DAMPER
12BH7
SYNC AMP. & VERT OSC
6BL7GT
VERT. OUTPUT
DEFLECTION YOKE T-12
TO CONNECTOR FROM TV CHASSIS
FILTER CHOKE
ON-OFF SWITCH ON CLOCK
CLOCK MOTOR
TO 110V. LINE

427
17" Table Model

413
414
Mahogany 21" Combination,
Blonde 21" Combination,
Consolette



415 Mahogany 21" Combination, Console.
416 Blonde 21" Combination, Console.

423 Mahogany 21" Consolette
424 Blonde 21" Consolette

425 Mahogany 21" Consolette
426 Blonde 21" Consolette

445
Blonde 17" Table Model

These models use 19 tubes (Including picture tube and rectifier) plus a crystal diode video detector and employ a intercarrier sound circuit. Picture tube has Electro Static focus which is automatic and permanent.

SAFETY PRECAUTIONS: The kinescope should be handled with extreme care. The person handling this tube should wear gloves and protective goggles as an added precaution.

When power is connected, care must be taken in servicing the HIGH VOLTAGE supply of these receivers. As a safety precaution the AC line is open when the cabinet back is removed. For servicing with chassis out of cabinet a separate line cord must be used.

VOLTAGE READINGS: The voltage readings to be obtained at various locations in the receiver have been indicated on the schematic diagram. These voltages will be very advantageous when "trouble shooting." Check voltages, tubes, fuse and inspect for damaged or burned parts before attempting to re-align receiver. A ¼ amp fuse is located in the low voltage power supply of the receiver.

All voltages were taken with a 117.5 V. 60 Cycle line and with no signal input. The contrast control set at the maximum clockwise position; the brightness control at 50% rotation and all other controls in normal operating position. All voltages are positive with respect to ground unless otherwise indicated.

FREQUENCY CHART

CHANNEL NO.	CHANNEL FREQ. MC.	PICTURE CARRIER M. C.	SOUND CARRIER M. C.	RECEIVER RF. OSC. M. C.
2	54-60	55.25	59.75	81.65
3	60-66	61.25	65.75	87.65
4	66-72	67.25	71.75	93.65
5	76-82	77.25	81.75	103.65
6	82-88	83.25	87.75	109.65
7	174-180	175.25	179.75	201.65
8	180-186	181.25	185.75	207.65
9	186-192	187.25	191.75	213.65
10	192-198	193.25	197.75	219.65
11	198-204	199.25	203.75	225.65
12	204-210	205.25	209.75	231.65
13	210-216	211.25	215.75	237.65

IF. FREQ. M.C.
Picture Carrier 26.4
Sound Carrier 21.9

CENTERING OF PICTURE: The picture may be centered in relation with the opening of the glass panel at the face of the receiver by shifting the centering magnet at the neck of the picture tube. The centering magnet should be rotated and the control adjusted until the picture is properly framed keeping in mind that the effect of the control is governed by the position of rotation. If the control is above or below the neck of the picture tube, the picture will be moved up or down. To the left or right of the neck of the picture tube, the picture will be moved either to the left or right.

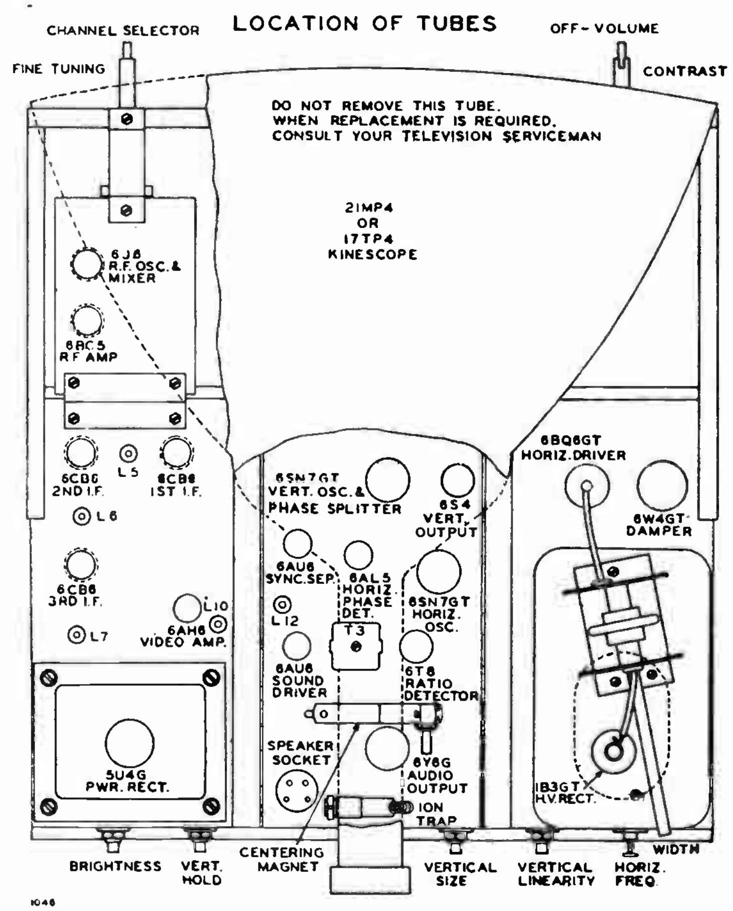
CONTROL ADJUSTMENT

VERTICAL HEIGHT & VERTICAL LINEARITY CONTROLS: The vertical height and linearity controls should both be adjusted at the same time. For best results adjust while a test pattern is being transmitted. The linearity control affects the upper portion of the picture while the height control affects the overall size especially the lower portion of the picture. Adjust both controls simultaneously until the test pattern is symmetrical and fills the entire screen vertically.

WIDTH ADJUSTMENT: Adjust width by turning slug either clockwise or counter-clockwise. A clockwise rotation will decrease width. Proper width is obtained when raster covers entire screen of picture tube.

HORIZONTAL FREQ.: Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync. If in the above check the receiver fails to hold sync, reset horizontal hold slightly.

4.5 MC TRAP ALIGNMENT: 1. Connect the signal generator to the grid (pin 1) of the video amplifier tube v-6, through a 1000 MMF. Capacitor. 2. Connect the germanium crystal detector and voltmeter, between the cathode of the kinescope and chassis, as shown in note 5. 3. Set the signal generator at 4.5 MC and maximum output (setting of 4.5 MC must be accurate). Adjust 4.5 MC trap (L10) for minimum reading on the lowest voltage scale of the meter.



TUNER ASSEMBLY PARTS LIST

CONDENSERS

Ref. No.	Description
C1	Amplifier Grid Trimmer 3-8MMFD
C2, 5, 6, C15	800 MMFD. Minimum (Feed thru Capacitors)
C3	Amplifier Plate Trimmer .5-3 MMFD.
C4	130 MMFD. Ceramic
C7, C14	120 MMFD. Ceramic
C8	5 MMFD. Ceramic
C9	Mixer Grid Trimmer .5-3 MMFD.
C10, C13	10 MMFD. Ceramic
C11	Fine Tuning Rotor
C12, C16	1000 MMFD. Ceramic

COILS & TRANSFORMERS

Ref. No.	Part No.	Description	Channel
T8	N-9152	Antenna Coil Strip	2
	N-9153	Antenna Coil Strip	3
	N-9154	Antenna Coil Strip	4
	N-9155	Antenna Coil Strip	5
	N-9156	Antenna Coil Strip	6
	N-9157	Antenna Coil Strip	7
	N-9158	Antenna Coil Strip	8
	N-9159	Antenna Coil Strip	9
	N-9160	Antenna Coil Strip	10
	N-9161	Antenna Coil Strip	11
	N-9162	Antenna Coil Strip	12
	N-9163	Antenna Coil Strip	13
T9	N-9164	Oscillator & Mixer Coil Strip	2
	N-9165	Oscillator & Mixer Coil Strip	3
	N-9166	Oscillator & Mixer Coil Strip	4
	N-9167	Oscillator & Mixer Coil Strip	5
	N-9168	Oscillator & Mixer Coil Strip	6
	N-9169	Oscillator & Mixer Coil Strip	7
	N-9170	Oscillator & Mixer Coil Strip	8
	N-9171	Oscillator & Mixer Coil Strip	9
	N-9172	Oscillator & Mixer Coil Strip	10
	N-9173	Oscillator & Mixer Coil Strip	11
	N-9174	Oscillator & Mixer Coil Strip	12
	N-9175	Oscillator & Mixer Coil Strip	13
L1		Heater Choke RF Amp	
L2		Heater Choke Oscillator & Mixer	
L3		IF Coil (Mixer Plate Coil)	
L15		Plate Choke (Mixer Plate Choke)	

RESISTORS

Ref. No.	Part No.	Ohms	Watts
R1		15,000	½
R2		47,000	½
R3		2,200	½
R4		1,000	½
R5		4,700	½
R6		220,000	½
R7		10,000	½
R8		15,000	½
R9		6,800	½

MAIN CHASSIS

RESISTORS

Ref. No.	Part No.	Description
R85	N-8125	4.3 Ohms 0.5 W. 10% ....
R11, R15, R27	N-6237	47 Ohms 0.5 W. 10% ....
R61, R62	N-8023	56 Ohms 0.5 W. 10% ....
R81	N-1349	100 Ohms 0.5 W. 20% ....
R18	N-3663	150 Ohms 0.5 W. 10% ....
R42	N-4420	330 Ohms 0.5 W. 10% ....
R39	N-5159	390 Ohms 0.5 W. 10% ....
R19, R84	N-4280	560 Ohms 0.5 W. 10% ....
R75	N-4279	820 Ohms 0.5 W. 10% ....
R10, R12, R38	N-3341	1,000 Ohms 0.5 W. 10% ....
R69	N-6793	1,200 Ohms 0.5 W. 10% ....
R57	N-7398	1,500 Ohms 0.5 W. 10% ....
R66	N-4281	1,800 Ohms 0.5 W. 10% ....
R55	N-8103	2,700 Ohms 0.5 W. 10% ....
R68	N-7399	3,900 Ohms 0.5 W. 10% ....
R67	N-7000	4,700 Ohms 0.5 W. 20% ....
R14	N-7400	5,600 Ohms 0.5 W. 10% ....
R21	N-4630	6,800 Ohms 0.5 W. 10% ....
R79	N-4897	8,200 Ohms 0.5 W. 10% ....
R31, R64	N-4895	10,000 Ohms 0.5 W. 10% ....
R41	N-5690	12,000 Ohms 0.6 W. 10% ....
R17, R23, R40, 47 R91	N-6424	15,000 Ohms 0.5 W. 10% ....
R24	N-7124	47,000 Ohms 0.5 W. 10% ....
R60	N-4823	56,000 Ohms 0.5 W. 10% ....
R78	N-9015	82,000 Ohms 0.5 W. 10% ....
R46, R70, 71, 73	N-2973	100,000 Ohms 0.5 W. 10% ....
R36	N-4468	150,000 Ohms 0.5 W. 10% ....
R48	N-7401	180,000 Ohms 0.5 W. 5% ....
R77	N-7003	180,000 Ohms 0.5 W. 10% ....
R22, 44, 88, 89	N-4899	220,000 Ohms 0.5 W. 10% ....
R45	N-9041	220,000 Ohms 0.5 W. 5% ....
R92	N-7004	270,000 Ohms 0.5 W. 10% ....
R53, R80	N-8026	390,000 Ohms 0.5 W. 10% ....
R74	N-5694	470,000 Ohms 0.6 W. 10% ....
R26, R29, R30	N-7790	560,000 Ohms 0.5 W. 10% ....
R20	N-4469	820,000 Ohms 0.5 W. 10% ....
R90	N-2976	1.0 Megohms 0.5 W. 10% ....
R51	N-4470	1.2 Megohms 0.5 W. 10% ....
R56	N-4420	2.2 Megohms 0.5 W. 10% ....
R25, R72	N-4061	4.7 Megohms 0.5 W. 20% ....
R43	N-4028	6.8 Megohms 0.5 W. 20% ....
R58	N-9016	820 Ohms 1.0 W. 10% ....
R13, R16	N-7793	3,300 Ohms 1.0 W. 10% ....
R76	N-7406	5,600 Ohms 1.0 W. 10% ....
R34, R37	N-7013	39,000 Ohms 1.0 W. 10% ....
R82, R83	N-9017	150,000 Ohms 1.0 W. 10% ....
R86	N-8029	470,000 Ohms 1.0 W. 10% ....
R49	N-9040	220 Ohms 2.0 W. 10% ....
R63	N-7126	2,700 Ohms 2.0 W. 10% ....
R33	N-8491	5,600 Ohms 2.0 W. 10% ....
R28, R50	N-8942	Contrast & On-Off Vol. Variable .....
	N-9117	Contrast & Off Volume (Combination Models Only)
R52	N-8943	1.0 Megohms, Vertical Hold, Variable
R87	N-8944	100,000 Ohms Brightness, Variable
R54	N-8971	2.5 Megohms Vertical Height—Variable
R59	N-8945	5,000 Ohms Vertical Linearity Variable

CAPACITORS

C18, C21, C19	N-7774	.004 MFD. Dual Ceramic 500 V.
C72	N-9045	.01 MFD. Dual Ceramic 500 V.
C20, C29	N-9047	4.7 MMFD. Ceramic 500 V. 5%
C23	N-9048	10 MMFD. Ceramic 500 V. 10%
C27, C74	N-9049	22 MMFD. Ceramic 500 V. 10%
C69	N-9052	43 MMFD. Ceramic 2000 V. 5%
C30	N-9050	47 MMFD. Ceramic 500 V. 10%
C31	N-9051	68 MMFD. Ceramic 500 V. 10%
C43	N-9053	100 MMFD. Ceramic 500 V. 20%
C26	N-9055	220 MMFD. Ceramic 500 V. 10%
C37	N-9059	3,900 MMFD. Ceramic 500 V. 20%
C17, 22, 28, 32 C41, 42, 46, 47 C74	N-6272	.005 MFD. Ceramic 500 V. (GMV)
C33, C38	N-9062	.01 MFD. Ceramic 400 V. (GMV)
C60	N-9054	220 MMFD. Silver Mica 500 V. 5%
C61	N-9056	330 MMFD. Silver Mica 500 V. 5%
C64	N-9057	560 MMFD. Mica 500 V. 5%
C36	N-7780	560 MMFD. Mica 500 V. 10%
C66	N-9058	1,000 MMFD. Mica 1000 V. 10%
C55, C56, C63	N-7783	1,100 MMFD. Mica 500 V. 10%
C49	N-6893	4,700 MMFD. Mica 600 V. 10%
C59	N-1344	.01 MFD. Paper 400 V.
C48	N-9046	.015 MFD. Paper 600 V.
C44	N-1376	.02 MFD. Paper 400 V.
C45, C58	N-1315	.05 MFD. Paper 200 V.
C25, C65, C68	N-1351	.1 MFD. Paper 200 V.
C51, C52; C71	N-1623	.1 MFD. Paper 400 V.
C24	N-1479	.25 MFD. Paper 200 V.
C67	N-2579	.25 MFD. Paper 400 V.
C62	N-9060	3,900 MMFD. Stab. Paper 600 V. 5%
C57	N-9061	4,700 MMFD. Stab. Paper 600 V. 10%
C73	N-8970	100 MFD. Electrolytic 200 V.
C40B, C40A	N-8969	100-40 MFD. Electrolytic 400 V.
C54A, C54B	N-8039	10-10 MFD. Electrolytic 450 V.
C53A, C53B, 53D C53C	N-8967	10 MFD. Electrolytic 400 V. 80-40 MFD. Electrolytic 200 V. 100 MFD. Electrolytic 50 V.
C39	N-6912	16 MFD. Electrolytic 50 V.
C70	N-8041	500 MMFD. High Volt. 20,000 V.

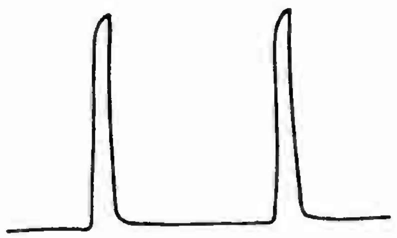
CHOKES, COILS, TRANSFORMERS

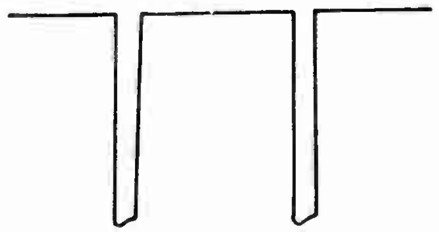
Ref. No.	Part No.	Description
T3	N-8928	Coil, Ratio detector includes C35
L5, L6, L7	N-8929	Coil, I. F.
L10	N-9011	Coil, 4.5 MC Sound Trap
L12	N-7746	Coil, Sound Take-off
T7	N-8930	Coil, Deflection Yoke
L13	N-8931	Coil, Horiz. Freq. Control
L8	N-8932	Coil, Video Peaking-Detector
L9	N-8933	Coil, Video Peaking-Amp. — Series Includes No. R-32
L11	N-8934	Coil, Video Peaking-Amp. — Shunt Includes No. R35
L4	N-7321	Choke, R. F.
L16	N-9250	Choke Coil
T1	N-8935	Transformer, Power
T6	N-8936	Transformer, Horiz. Output
T5	N-8937	Transformer, Vertical Output
T4	N-9002	Transformer, Vertical Osc.
T2	N-8938	Audio Output Transformer
L14		Filter Choke (Part of N-8926 or N-9184 See Miscellaneous)
	N-9092	Filter Choke (Combination Models Only)

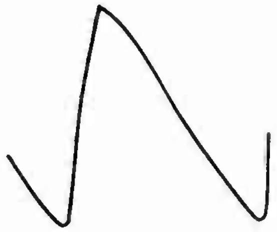
MISCELLANEOUS

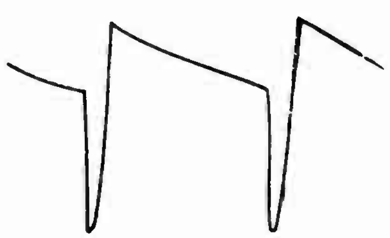
N-8926	Speaker, 8" E. M. (with Cable & Plug)
N-9184	Speaker, 5" E. M. (with Cable & Plug) (Table Models Only)
N-9123	Speaker, 12" P. M. (Model 415, 416)
N-9124	Speaker, 6" P. M. (Model 413, 414)
N-8042	Multiple Resistor Capacitor Assembly (R65 & C50)
N-9012	ION TRAP (17" MODELS ONLY)
N-9268	ION TRAP (21" MODELS ONLY)
N-8939	CENTERING MAGNET

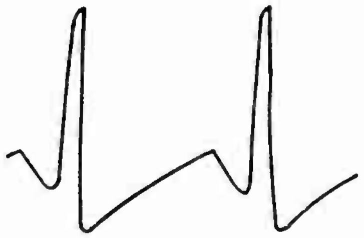
OSCILLOSCOPE PATTERNS

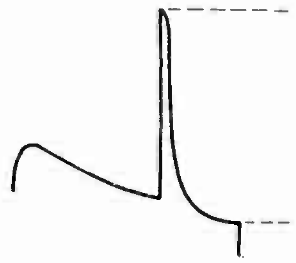

6SN7GT PHASE SPLITTER
PIN 2
15,750 CYCLES
25 VOLTS PP

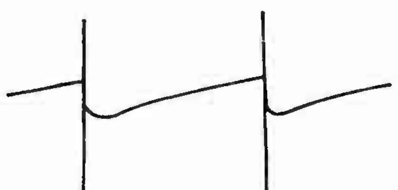

6SN7GT PHASE SPLITTER
PIN 3
15,750 CYCLES
35 VOLTS PP

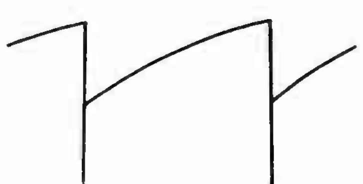

6AL5 HORIZ. PHASE DET.
PIN 1 & 2
15,750 CYCLES
11 VOLTS PP

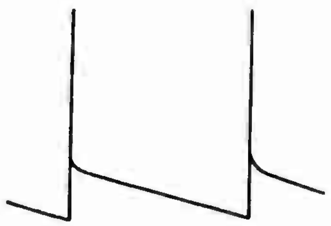

6AL5 HORIZ. PHASE DET.
PIN 5
ON STATION IN SYNC.
11 VOLTS PP

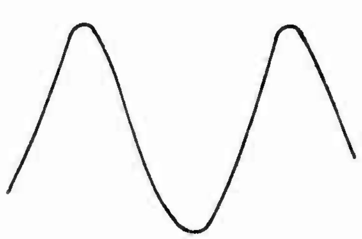

6AL5 HORIZ. PHASE DET.
PIN 7
ON STATION IN SYNC.
8 VOLTS PP

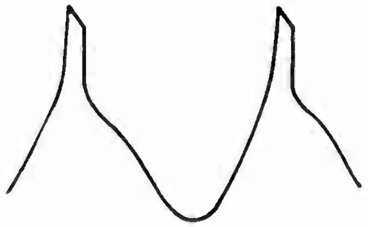

JUNCT. C49 & R65A
ON STATION
OUT OF SYNC.
60 CYCLES
6 VOLTS PP

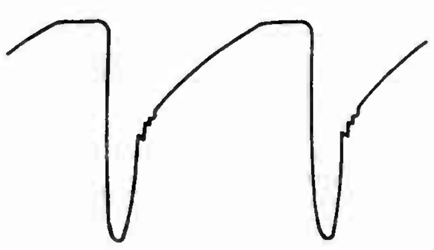

6SN7GT VERT. OSC.
PIN 5
60 CYCLES
220 VOLTS PP


6S4 VERT. OUTPUT
PIN 6
60 CYCLES
130 VOLTS PP

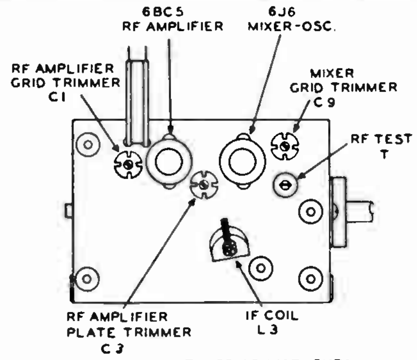

6S4 VERT. OUTPUT
PIN 9
60 CYCLES
1500 VOLTS PP


JUNCT. R76 & C62
15,750 CYCLES
35 VOLTS PP


6SN7GT HORIZ. OSC
PIN 1
15,750 CYCLES
40 VOLTS PP

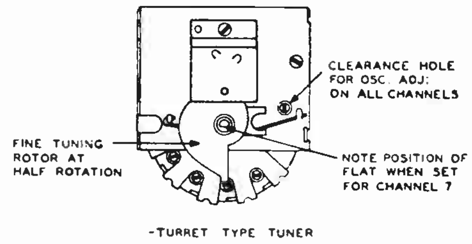

6BQ6GT HORIZ. DRIVER
PIN 5
15,750 CYCLES
130 VOLTS PP

TUNER ALIGNMENT PROCEDURE



1043 TUNER ADJUSTMENTS

NOTE 6



-TURRET TYPE TUNER

1036

NOTE 7

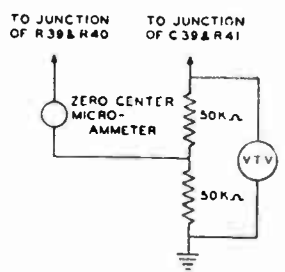
STEP NO.	CONNECT SIGNAL GENERATOR TO	SIGNAL GENERATOR FREQUENCY	CONNECT SWEEP GENERATOR TO	SWEEP GENERATOR FREQUENCY	CONNECT OSCIL-LOSCOPE TO	REMARKS	ADJUSTMENTS
1. RF & MIXER ALIGNMENT	Connect to piece of wire and wrap around 300 Ohm antenna lead.	205.25 MC (Picture Carrier).) 209.75 MC (Sound Carrier.)	Antenna lead of receiver. (Generator must terminate in 300 ohms.)	TO SWEEP TV CHANNEL 12.	Through 10,000 Ohm resistor to test point (T) on tuner.	Connect negative of 1½ volt battery to junction of R10 and R12 and positive of battery to chassis ground.	With tuner set to channel 12, adjust Mixer Grid Trimmer (C9), RF Amplifier Plate Trimmer (C3), and RF Amplifier Grid Trimmer (C1) to obtain response curve shown in Note 4. Response curve should have maximum amplitude with proper band width.
2. RF & MIXER ALIGNMENT	SAME AS ABOVE	Correct sound and picture carrier for each channel. (See listing on first page of booklet.)	SAME AS ABOVE	TO SWEEP PROPER TV CHANNEL.	SAME AS ABOVE	Check response curve of each channel without disturbing trimmers.	If satisfactory response is not obtained for some particular channel try replacing coils for that channel or repeat step 1 of tuner alignment favoring weak channel without seriously offecting other channels.
3. OSCILLATOR ALIGNMENT FOR INDIVIDUAL CHANNEL	SAME AS ABOVE	Correct sound and picture carrier for each channel. (See listing on first page of booklet.)	SAME AS ABOVE	TO SWEEP PROPER TV CHANNEL.	JUNCTION OF C25 and L8.	All adjustments to oscillator coils (T9) must be made with non-metallic alignment tool with ⅛" blade. If slug "falls in" during adjustment, remove strip from tuner and raise slug retention spring. By tapping coil slightly, slug will return to a position retainable by spring.	For fine oscillator adjustment of channel, set tuner to channel and adjust slug of oscillator coil (T9) through hole in face plate of tuner (See Note 7) to position markers in the exact position on the response curve indicated in Note 3 under I. F. alignment. REPEAT OSC. ALIGNMENT FOR EACH CHANNEL AFTER SETTING TUNER TO PROPER CHANNEL.

N-9196

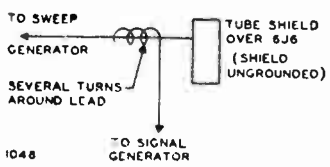
I. F. ALIGNMENT PROCEDURE

STEP NO.	CONNECT SIGNAL GENERATOR TO	SIGNAL GENERATOR FREQUENCY MC	CONNECT SWEEP GENERATOR TO	SWEEP GENERATOR FREQUENCY	CONNECT OSCIL-LOSCOPE TO	REMARKS	ADJUSTMENTS (Use peak obtained when screw is farthest out of can or coil.)
1. AUDIO IF ALIGNMENT	Grid of Video Amp. (6AH6) Pin No. 1. Contrast control at maximum.	4.5 MC. No Modulation. See Adjustments column.	NOT USED		NOT USED	Connect Vacuum Tube Voltmeter and zero center Microammeter as shown in Note 1 (50,000 ohm resistors shown in Note 1 must match within 5%).	Adjust L12 and T3 (Bottom) for maximum on Vacuum Tube Voltmeter. This adjustment should be made with Voltage on Vacuum Tube Voltmeter under 12 Volts. Adjust T3 (Top) for zero on Microammeter. If the receiver is receiving a signal, the above adjustment can be made off a weak station keeping the reading on the Vacuum Tube Voltmeter under 12 Volts.
2. PRELIMINARY VIDEO IF ALIGNMENT	Tube shield over 6J6. Disengage shield from clip to remove ground.	26.1 MC. No Modulation.	NOT USED		NOT USED	Connect —4.5 V. Battery to Junction of R20 and C24. Connect Vaccum Tube Voltmeter to A. G. C. point. Junction of R20 and R21.	Adjust 1st and 4th I. F. coils (L3 in Tuner and L7) for maximum on Vacuum Tube Voltmeter. Adjust at approximately one volt.
3. PRELIMINARY VIDEO IF ALIGNMENT	Tube shield over 6J6. Disengage shield from clip to remove ground.	24.0 MC. No Modulation.	NOT USED		NOT USED	Connect —4.5 V. Battery to Junction of R20 and C24. Connect Vaccum Tube Voltmeter to A. G. C. point. Junction of R20 and R21.	Adjust 3rd I. F. coil (L6) for maximum on Vacuum Tube Voltmeter. Adjust at approximately one volt.
4.	Tube shield over 6J6. Disengage shield from clip to remove ground.	24.4 MC. No Modulation.	NOT USED		NOT USED	SAME AS ABOVE	Adjust 2nd I. F. coil (L5) for maximum on VTVM. Adjust at approximately one volt.
5. FINAL VIDEO IF ALIGNMENT	Signal Generator as shown in Note 2.	26.4 and 23.7 MC. No Modulation. See Note 3.	Tube shield over 6J6. Disengage shield from clip to remove ground.	24.3 Center Frequency and at least 6 MC wide.	Junction of R21 and L8.		With signal generator set at 26.4 MC adjust 1st and 4th I. F. coils to give correct marker position as shown in Note 3. Set signal generator at 23.7 MC and adjust 2nd and 3rd I. F. coils for pattern shown in Note 3. A slight readjustment of 1st and 2nd coils may be necessary.

NOTE 1



NOTE 2



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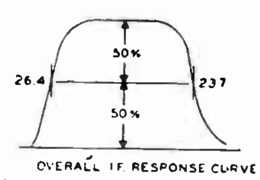
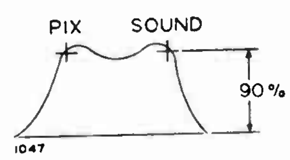
NOTE 3



OVERALL IF RESPONSE CURVE

1035

NOTE 4



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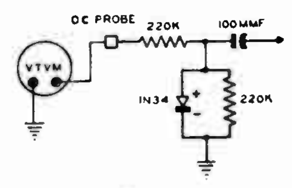
PIX AND AUDIO MARKERS

NOTE 5



VTVM CONNECTIONS

1045

MODELS 413, 414, 415, 416, 421, 422, 423, 424, 425, 426, 427, 428, 429, 445

Service Instructions for Radio and Phonograph of Models

413	Mahogany	21" Combination, Consolette
414	Blonde	21" Combination, Consolette
415	Mahogany	21" Combination, Console
416	Blonde	21" Combination, Console

These combination models have a 5 tube Radio (plus selenium rectifier), and a three speed automatic record changer.

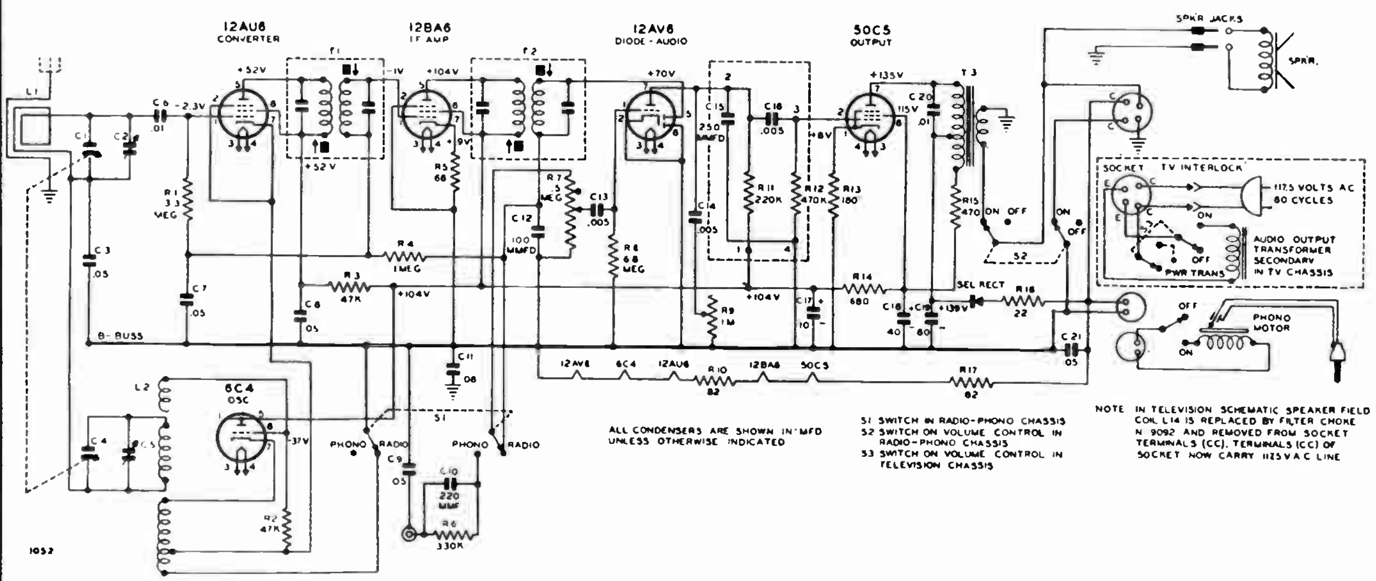
POWER SUPPLY: This receiver is designed to operate on an alternating current supply (AC) ranging from 110 to 120 volts, 60 cycles.

DESCRIPTION OF COMBINATION CONNECTIONS FOR OPERATION

The television and radio receiver both operate off the same speaker. The television Off-Volume control switch (S3) and radio Off-Volume control switch (S2) both incorporate a double pole single throw switch. When television receiver is turned on the secondary of the audio output transformer in the television chassis is connected across the voice coil of the speaker. The radio receiver has a separate output transformer and the secondary connects across voice coil of speaker when turned on. For proper operation the television and radio receiver should not be turned on at the same time. The phono motor operates on power received from the radio chassis and is turned on by turning speed selector to speed indicated on record to be played and depressing start-reject button. Motor is turned off automatically when last record has played. Sound for phono is amplified through the audio section of radio, when Radio-Phono/switch (S1) on radio chassis is turned to phono.

For servicing radio chassis when out of cabinet, (AC) source must be connected to the two prongs (CC) of male socket when removed from television chassis. The two leads with pin jacks can be connected directly across speaker.

For Servicing television chassis when out of cabinet (AC) source is applied to interlock socket. Speaker voice coil may be connected directly to two prongs (EE) of female socket on television chassis.



ALIGNMENT PROCEDURE

The signal source must be an accurately calibrated signal generator capable of supplying 455 Kc and up to 1620 Kc signals modulated 30% with a 400-cycle audio signal.

Volume control at maximum for all adjustments.

Align for maximum output. Reduce input as needed to keep output near 0.4 volts.

Loop antenna should be connected to receiver and in its proper position when making the adjustments.

SIGNAL GENERATOR				TUNER SETTING	ADJUST FOR MAXIMUM OUTPUT
FREQUENCY	COUPLING CAPACIOR	CONNECTION TO RADIO	GROUND CONNECTION		
455 Kc	.05 Mfd.	Rear stator plates of tuning condenser.	B Minus Buss Lead	Any point near center where no interfering signal is received.	Slugs at top and bottom of 2nd I. F. (T2) and then both slugs of 1st I. F. (T1).
1620 Kc	.05 Mfd.	Rear stator plates of tuning condenser.	B Minus Buss Lead	Fully Open	Oscillator trimmer of Gang. (C5).
1400 Kc		Lay Generator lead near back of cabinet.	B Minus Buss Lead	Tune in signal from generator.	Antenna trimmer of Gang. (C2).

PARTS LIST—RADIO CHASSIS

RESISTORS

Ref. No.	Part No.	Description	
R5	N-6485	68 Ohm	.5 W. 10%
R13	N-4068	180 Ohm	.5 W. 10%
R15	N-4066	470 Ohm	.5 W. 20%
R14	N-4228	680 Ohm	.5 W. 10%
R2, R3	N-4063	47K Ohm	.5 W. 20%
R6	N-4230	330K Ohm	.5 W. 20%
R4	N-1262	1 Megohm	.5 W. 20%
R1	N-4062	3.3 Megohm	.5 W. 20%
R8	N-4028	6.8 Megohm	.5 W. 20%
R16	N-5631	22 Ohm	1.0 W. 10%
R10, R17	N-4023	82 Ohm	2.0 W. 10%
•R11	N-4026	220K Ohm	.5 W. 20%
•R12	N-4027	470K Ohm	.5 W. 20%
R7	N-9077	Volume Control Off-On .5 Megohm	
R9	N-9078	Tone Control 1 Megohm	

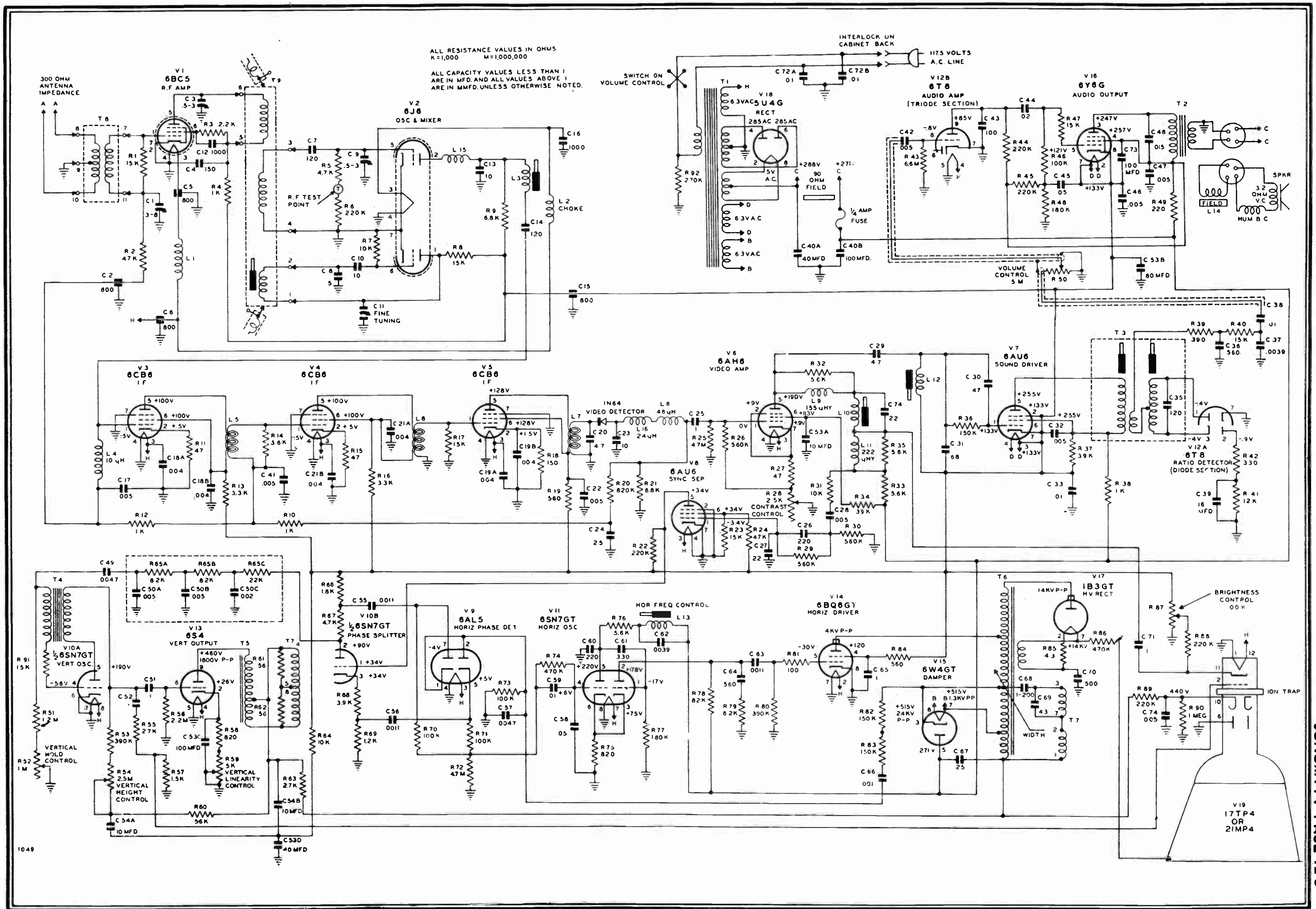
CAPACITORS

Ref. No.	Part No.	Description	
C1, C4	N-8784	Gang Tuning Condenser	
C2, C5		Trimmers on Gang Condenser	
C17	N-9082	Electrolytic	(10 MFD. —150 V.)
C18, C19	N-9080	Electrolytic	(40 MFD. —150 V.) (80 MFD. —150 V.)
C10	N-9055	Ceramic	220 MMFD. 10%
C12	N-6015	Ceramic	100 MMFD. 500 V. 20%
C13, C14	N-4894	Paper	.005 MFD. 600 V. 20%
C6, C20	N-1344	Paper	.01 MFD. 400 V. 20%
C3, C7, C8, C9	N-1345	Paper	.05 MFD. 200 V. 20%
C21	N-1346	Paper	.05 MFD. 400 V. 20%
C11	N-8092	Paper	.08 MFD. 200 V. 20%
•C15	N-6488	Ceramic	250 MMFD. 500 V.
•C16	N-4894	Paper	.005 MFD. 600 V.

• Part of Couplate N-8215

COILS AND TRANSFORMERS

L1	N-8769	Loop Antenna
L2	N-8571	Oscillator Coil
T1, T2	N-7981	I. F. Transformers
T3	N-9085	Output transformer
	N-9112	Record Changer



SONORA TV PAGE 12-5

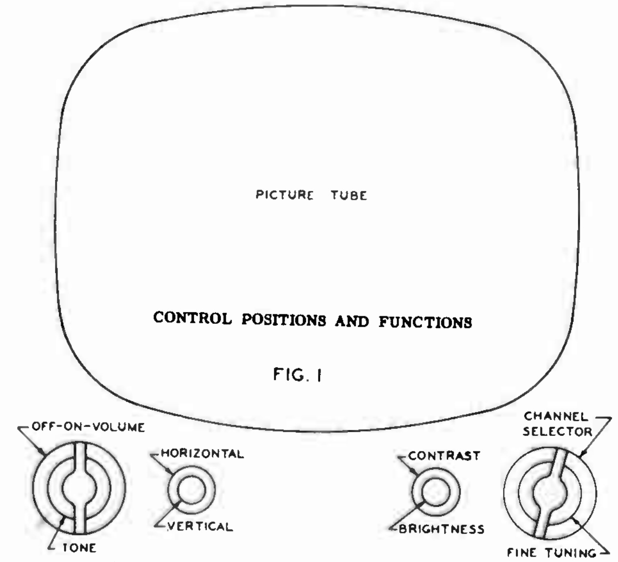
MODELS 413, 414, 415, 416, 421, 422, 423, 424, 425, 426, 427, 428, 429, 445

Sparton COURTNEY
MODEL 5386 LIMED OAK
21 INCH TELEVISION CONSOLE

Sparton CARRINGTON
MODEL 5382 MAHOGANY VENEER
MODEL 5383 GOLDEN WHEAT
21 INCH TELEVISION CONSOLE

Sparton CAMBRIDGE
MODEL 5390 MAHOGANY VENEER
MODEL 5391 GOLDEN WHEAT
21 INCH TELEVISION CONSOLE

Sparton GILMORE
MODEL 5342 MAHOGANY VENEER
MODEL 5343 GOLDEN WHEAT
21 INCH TELEVISION TABLE MODEL



CONTROL POSITIONS AND FUNCTIONS

FIG. 1

Sparton CRESTWOOD
MODEL 5384 MAHOGANY VENEER
21 INCH TELEVISION CONSOLE

CHASSIS DESCRIPTION AND SPECIFICATIONS

CHASSIS DESCRIPTION

Chassis type 25D213 with a self-contained power supply, contains twenty-five tubes and two Selenium Rectifiers, full range tone control and is equipped with the Sparton Ultra-tuner for superior long range reception.
Models 5390 & 5391 are Television-Radio Phonograph combinations using the 6L3 radio chassis and VM950 record player

ELECTRICAL SPECIFICATIONS

Power Supply........................105-125 Volts AC 60 Cycle only

Power Consumption..................230 Watts

Audio Power Output.................Maximum Undistorted 2.5 Watts

Tuning Range........................T.V. Channels 2 thru 13

Antenna Input Impedance............300 Ohms Balanced

Intermediate Frequencies...........Picture 26.25 Mc.

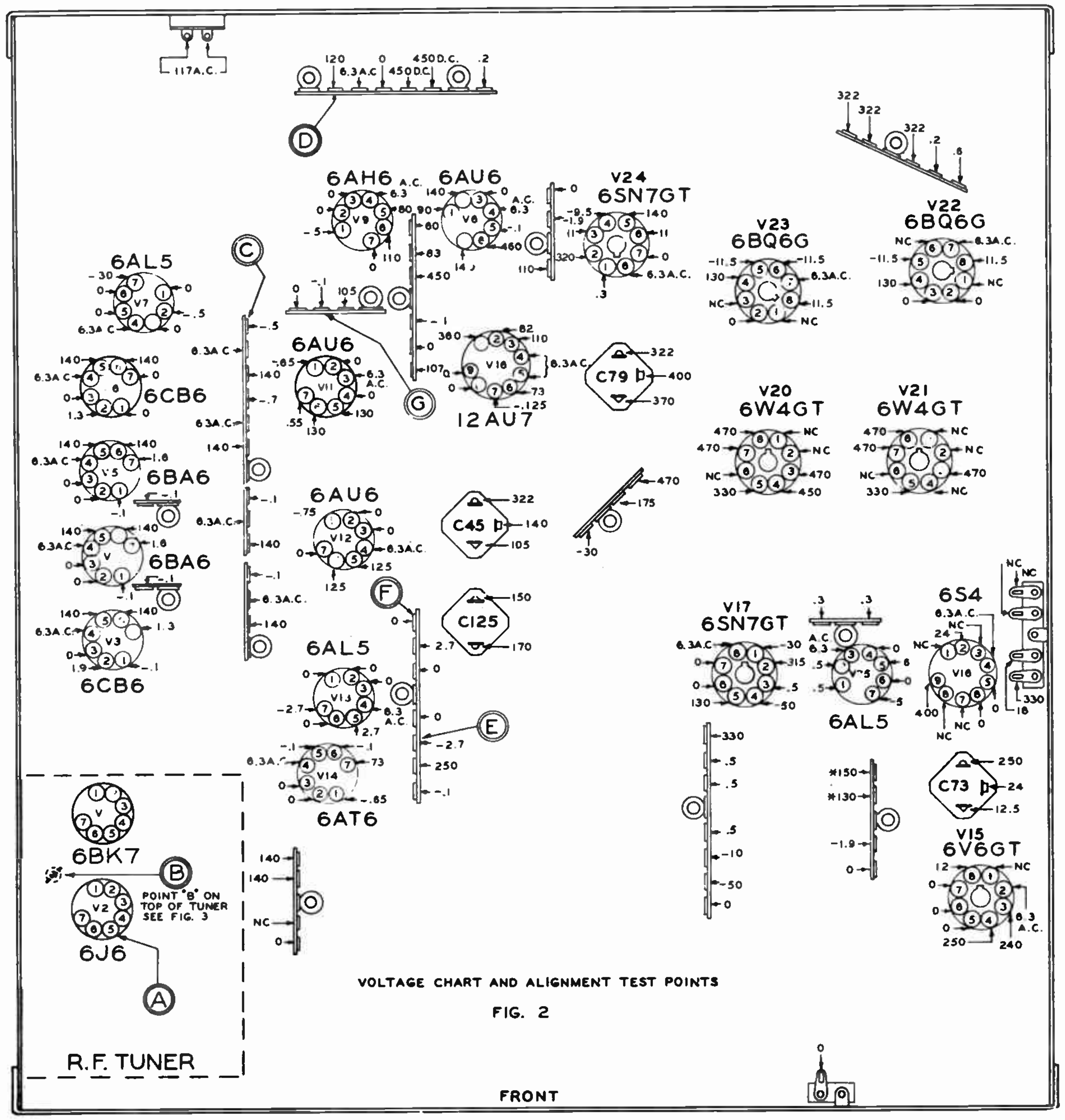
Intercarrier Sound System.........4.5 Mc.

Voice Coil Impedance................3.2 Ohms at 400 Cycles

VOLTAGE TEST SPECIFICATIONS

1. Line Voltage = 117 Volts A.C.
2. Channel Switch Position = Channel #2.
3. Brightness Control Position = Maximum Brilliance on Picture Tube.
4. Contrast Control Position = Maximum (Clockwise).
5. Horizontal and Vertical Hold Control Positions = Set correct position to lock in picture.
6. Horizontal width control position = Set for Maximum
7. Vertical size and Linearity Control Position = Set for normal size & Best linearity.
8. Focus Control Position = Properly focused.
9. Volume Control Position = Maximum Counter-Clockwise.
10. Tone Control Position = Maximum Counter-Clockwise.
11. Instrument (Meter) used = (V.T.V.M.) Vacuum Tube Volt Meter.
12. No signal input applied to set.
13. Unless otherwise designated all voltages measured in respect to Chassis Ground.

NOTE: The points indicated by the letters A,B,C,D,E,F & G are the alignment test points referred to in the following alignment procedure.
These points indicate the terminals for attaching test equipment and are shown in Figure 2.



VOLTAGE CHART AND ALIGNMENT TEST POINTS

FIG. 2

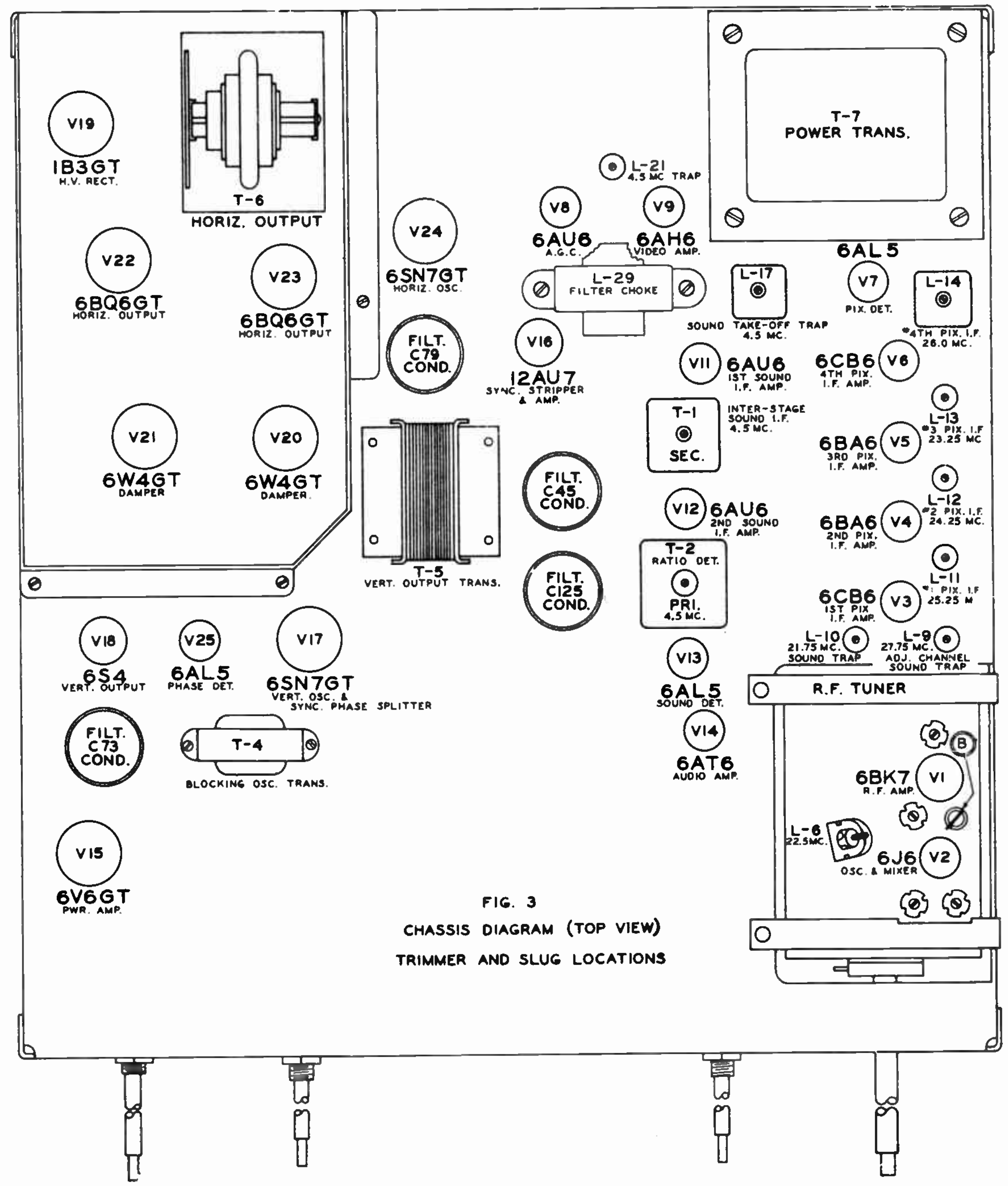


FIG. 3
CHASSIS DIAGRAM (TOP VIEW)
TRIMMER AND SLUG LOCATIONS

(A) Pin #5 of V2 (6J6) Osc. & Mixer Tube.
Apply signals here for spot I.F. Alignment or I.F. Sweep.

(B) Apply minus 3 volts through 220K Ohms to test terminal, located between the tubes on top of R.F. Tuner (See Fig. 3, suggested input adapter Fig. 5)

(C) Diode Load Resistor
Read D.C. output here for spot I.F. Alignment.
Connect scope here for visual I.F. Alignment.
Apply 4.5 Mc. here for sound I.F. Trap Alignment.

(D) Cathode of Picture Tube
Read A.C. output here for overall sensitivity.
Read 4.5 Mc. output here for aligning 4.5 Mc. Trap.

(E) Ratio Detector Output
Read D.C. here for alignment of sound take-off trap, inter-stage sound I.F. trans. and primary of ratio det. trans.

(F) Ratio Detector Balanced Output
Read D.C. here for alignment of secondary of ratio det. trans.

(G) A.G.C. Line
Apply 4.5 volts bias here for visual check of I.F. or overall with oscilloscope.

B. R. F. Frequencies

Channel No.	Picture Carrier	Sound Carrier
2	55.25 Mc.	59.75 Mc.
3	61.25 Mc.	65.75 Mc.
4	67.25 Mc.	71.75 Mc.
5	77.25 Mc.	81.75 Mc.
6	83.25 Mc.	87.75 Mc.
7	175.25 Mc.	179.75 Mc.
8	181.25 Mc.	185.75 Mc.
9	187.25 Mc.	191.75 Mc.
10	193.25 Mc.	197.75 Mc.
11	199.25 Mc.	203.75 Mc.
12	205.25 Mc.	209.75 Mc.
13	211.25 Mc.	215.75 Mc.

ALIGNMENT EQUIPMENT AND TEST SET UP

TEST EQUIPMENT. In order to align and service Sparton television receivers properly the following test equipment should be available:

FIRST: AN R.F. SWEEP GENERATOR or reliable quality that performs the following functions:

A. Provides sweep outputs in the following frequency ranges:

19 to 30 Mc.	10 Mc. sweep width
40 to 90 Mc.	10 Mc. sweep width
170 to 225 Mc.	10 Mc. sweep width

B. Provides an output signal that can be varied by means of an attenuator up to a maximum of at least .1 volt.

SECOND: AN R.F. SIGNAL GENERATOR That will provide an adjustable output signal up to a maximum of at least .1 volt on the following fixed frequencies:

A. I.F. Frequencies

21.75 Mc.	Sound Trap
22.5 Mc.	1st Video I.F. Coil
25 25 Mc.	2nd Video I.F. Coil
24 25 Mc.	3rd Video I.F. Coil
23.25 Mc.	4th Video I.F. Coil
26.0 Mc.	5th Video I.F. Coil
26.25 Mc.	Picture I.F. Carrier
4.5 Mc.	Sound I.F. & Traps
27.75 Mc.	Adjacent Channel Sound Trap

THIRD: A CATHODE-RAY OSCILLOSCOPE of good quality that has a fairly wide band vertical amplifier and a low capacity input probe.

FOURTH: AN ELECTRONIC VOLTMETER with ranges to read 1V. DC, 10V. DC and 7V. AC at 400 cycles and 4.5 Mc.

FIFTH: A CRYSTAL CALIBRATOR that can be used for checks on the accuracy of the output frequencies of the R.F. signal generator.

GENERAL INSTRUCTIONS: Practically all servicing with the exception of some tube replacement will require removal of the receiver chassis from the cabinet.

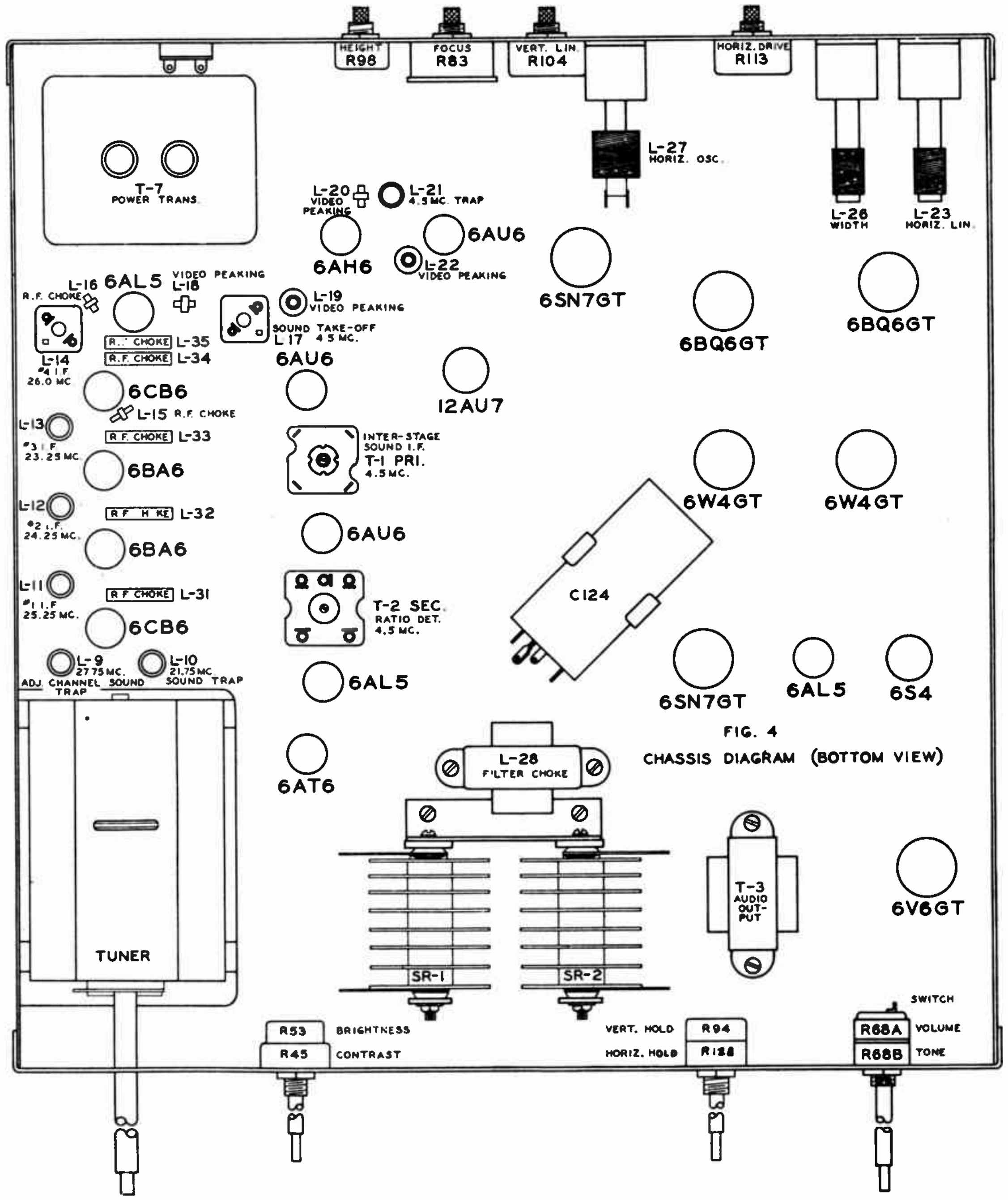


FIG. 4
CHASSIS DIAGRAM (BOTTOM VIEW)

A convenient arrangement that makes both the top and bottom of the chassis accessible for alignment and servicing can be realized by orienting the receiver chassis in such a manner that it rests on its side and on the horizontal output shield can.

ALIGNMENT REQUIREMENTS: Under normal conditions complete receiver realignment will seldom be necessary in the field. However, a detailed description of the overall alignment procedure is included to provide all necessary information if it should be required.

In general it is not recommended that the R.F. and the converter circuits of the R.F. tuner be realigned by the service engineer unless absolutely necessary. In cases where tuner components have been damaged or where complete realignment is indicated, the R.F. tuner assembly should be removed from the chassis and sent back to the factory in exchange for a new unit which will be shipped complete with tubes.

When the new R.F. unit is assembled to the chassis it will be necessary in all cases to realign L6 which is located on the tuner chassis. Normally this is the only adjustment that will be required with tuner change but a check on overall receiver alignment and sensitivity should be made for the sake of certainty and assured customer satisfaction.

EFFECTS OF TUBE REPLACEMENT ON THE ALIGNMENT OF R.F. TUNER CIRCUITS: The alignment of the R.F. and converter circuits of the R.F. tuner is critical and may be affected by a tube change. In cases where these tubes (6BK7 or 6J6) are replaced, it will be necessary for the service engineer to check for satisfactory receiver operation. If realignment is indicated it can usually be avoided by selection of replacement tubes until correct receiver operation is realized.

ORDER OF ALIGNMENT: When complete receiver realignment is indicated it should be performed in the following order:

1. Sound Traps
2. Picture I.F.
3. Sound I F. and 4.5 Mc. Trap
4. Ratio Detector Transformer
5. Retouch Picture I.F.
6. Sound and Picture I.F. Sensitivity Check
7. R.F. and Converter Circuits (not recommended)
8. Overall Sensitivity Check

PRELIMINARY ADJUSTMENTS: Before alignment the receiver controls should be adjusted to the approximated operation positions specified in the table below. The controls should remain in these positions for all checks unless otherwise specified.

Contrast Control - to maximum clockwise
Brightness Control - to position where raster is visible on the kinescope
Focus Control - to position where focus is obtained
Vertical Hold - to center position
Vertical Linearity - to center position
Vertical Size - adjusted to give normal raster height
Horizontal Hold - to center position
Horizontal Size - adjusted to give normal raster width

TEST EQUIPMENT SET UP: A certain amount of experimentation must be employed to secure a stable test set up before alignment or service of the receiver is attempted. It is recommended that the top of the test bench be covered with a sheet of aluminum to insure good grounds between the various pieces of test equipment and the receiver chassis. In general all test signal input leads should be kept away from output leads as much as possible.

SOUND TRAP ALIGNMENT: FIRST, Connect the R.F. Signal generator to the grid of V-2 by means of the I.F. input adapter as shown in Figure 5.

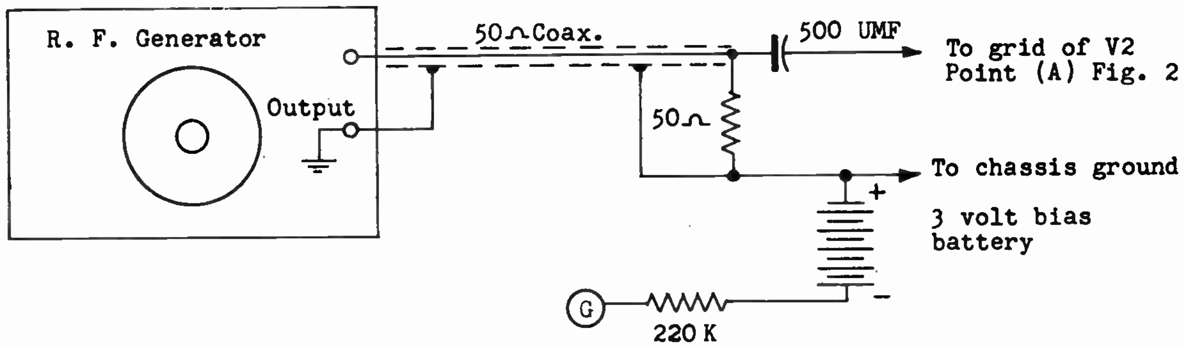


Figure 5 I.F. Input Adapter

SECOND: Set the R.F. tuner to channel #13.

THIRD: Connect a 4.5 volt bias battery between the A.G.C. buss(Point G.Fig.2) and chassis ground so that the voltage on the A.G.C. buss is -4.5 volts in respect to the chassis. Remove AGC tube 6AU6 V8.

FOURTH: Connect the electronic voltmeter across the picture detector load resistor R41, Point C, Fig. 2 and set the voltmeter on the low D.C. volt scale.

FIFTH: Set the R.F. signal generator to the frequency shown below and tune the specified adjustment for minimum indication on the voltmeter. It is advisable to check the output of the generator with the crystal calibrator to make certain that it is exactly on frequency.

27.75 Mc. L9 (Top of chassis Fig. 3)
21.75 Mc. L10(Top of chassis as shown in Figure 3).

PICTURE I.F. ALIGNMENT: FIRST: Connect the R.F. Signal generator, voltmeter and bias battery to the receiver as described in steps 1,2,3 and 4 of the sound trap alignment instructions.

SECOND: Set the signal generator to each of the following frequencies and peak the specified adjustments for maximum indication of the voltmeter.

22.5 Mc.	L6	(Top of tuner as shown in Fig. 3)
25.25 Mc.	L11	(Top of chassis as shown in Fig. 3)
24.25 Mc.	L12	(Top of chassis as shown in Fig. 3)
23.25 Mc.	L13	(Top of chassis as shown in Fig. 3)
26.0 Mc.	L14	(Top of chassis as shown in Fig. 3)

SOUND I.F. ALIGNMENT FIRST: Connect the R.F. signal generator to Point C Fig. 2.

SECOND: Set the signal generator accurately to 4.5 Mc. This is very important because the picture and sound carriers sent out from the television stations are exactly 4.5 Mc. apart.

THIRD: Connect the electronic voltmeter across R69 from Point E to ground as shown in Fig. 2.
Set the voltmeter on the 10 volt scale.

FOURTH: Peak the following coils for maximum reading on the voltmeter.

L17	Top of chassis as shown in Fig. 3.
T1	Top of chassis as shown in Fig. 3 and bottom of chassis as shown in Fig. 4.
T2	(Pri. Ratio Det) Top of chassis as shown in Fig. 3.

RATIO DETECTOR TRANSFORMER ALIGNMENT: FIRST: Connect the R.F. signal generator to the receiver as described in Step 1 of the sound I.F. alignment instructions.

SECOND: Connect the electronic voltmeter from Point F, Fig. 2 to ground. Set the voltmeter on the lowest DC scale.

THIRD: Set the signal generator output to 4.5 Mc. Adjust the secondary of T2 (Bottom view of chassis as shown in Fig. 4) Notice that it is possible to produce a positive or negative voltage indication on the meter by varying this adjustment. As the voltage swings from positive to negative, adjust T2 for zero output as indicated by the voltmeter. This point is called zero ratio detector output and indicates correct alignment of T2 transformer.
If the secondary of T2 is found to be way out of alignment it will be necessary to re-peak the primary as described in the preceeding section on sound I.F. alignment.

4.5 MC. TRAP ALIGNMENT FIRST: Connect the R.F. signal generator as described in Step 1 of the sound I.F. alignment.

SECOND: Connect the electronic voltmeter from the cathode of the picture tube to ground (Point D Fig. 2)
The voltmeter must be capable of giving a reading at 4.5 Mc. at approximately 1 to 2 volts.

THIRD: Peak L21(Top of chassis as shown in Fig. 3) for minimum output on the voltmeter.

PICTURE I.F. TOUCH UP: Connect the R.F. sweep generator output to the grid of V-2 by means of the I.F. input adapter shown in Figure 5.

SECOND: Apply bias to A.G.C. line as described in Step 3 of sound trap alignment. Set R.F. selector to channel #13.

THIRD: Connect the oscilloscope across the picture detector load resistor R41 (Point C Fig. 2) by means of the shielded cable and the filter system shown in Figure 6.

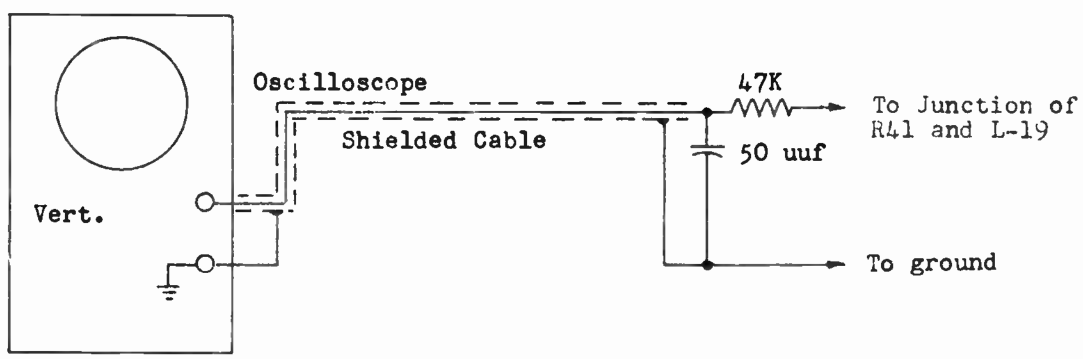


Fig. 6 FILTER SYSTEM FOR SCOPE CONNECTION

FOURTH: Set the R.F. sweep generator so that it sweeps from approximately 20 to 30 Mc.

FIFTH: Adjust the oscilloscope so that the swept I.F. response is visible on the cathode-ray tube screen.

SIXTH: Loosely couple the output of the R.F. signal generator to the grid of V-2 so that marker signals of proper frequency can be mixed in with the R.F. sweep signal.

SEVENTH: Observe the band width, relative position of the picture carrier, and flatness of the overall I.F. response curve. If necessary slightly vary the tuning of the picture I.F. coils L6, L11, L12, L13, L14 until the picture I.F. responseshown in Figure 7 is obtained. The solid curve in Fig. 7 depicts the ideal I.F. response while the dotted curves show permissable variations.

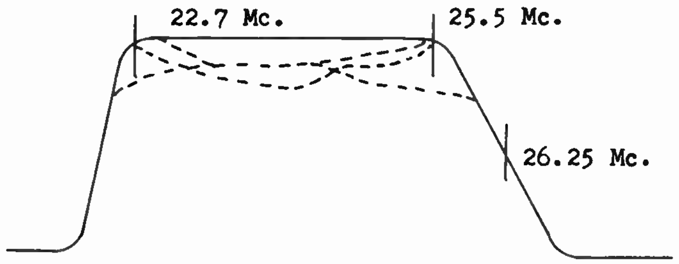


FIGURE 7 IDEAL I.F. RESPONSE WITH PERMISSABLE VARIATIONS

The picture I.F. carrier should appear approximately half way down the I.F. response curve as shown in Figure 7. Variation in the pix carrier position should not exceed $\pm$ 10% from the half way point.

PICTURE I.F. SENSITIVITY CHECK: Connect the R.F. signal generator to the receiver as specified in Steps 1 and 2 of the sound trap alignment instructions. (When making sensitivity checks no bias battery is connected to the A.G.C. buss).

SECOND: Connect the electronic voltmeter across the picture detector load resistor R41 Point C, Fig. 2 and set the meter on the low D.C. volts scale.

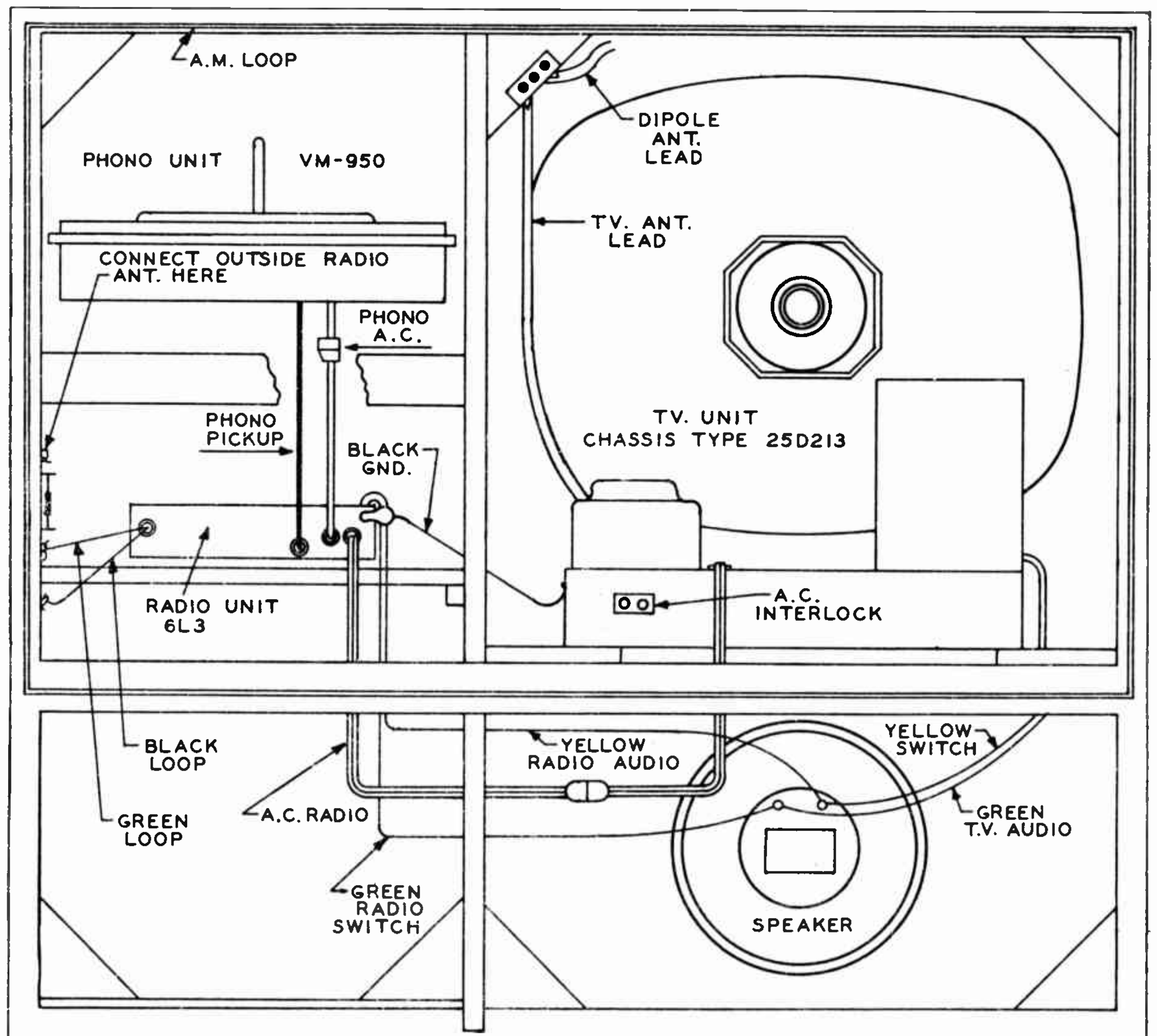
THIRD: Set the generator output frequency at approximately 23 Mc. Adjust the generator output until the voltmeter reads approximately 1.0 volt. Record the R.F. signal input in microvolts. Repeat the procedure with the generator output frequency set at 24.2 and 25.4 Mc. In all cases the I.F. input voltage should be 100 Microvolts or less. The sensitivity at the I.F. Picture carrier 26.25 Mc. should be approximately half of the I.F.sensitivity between 24.2 Mc(Maximum of 100 microvolts.)
If the generator output is not calibrated in microvolts, comparative sensitivity measurements can be made by using another receiver that is known to be in good operating condition as a standard. This applies to all sensitivity measurements and good results can be obtained if sufficient care is used.

R.F. TUNER (S.W. CO. PART NO. PD93158-1)

This Sparton chassis is equipped with a Standard Coil R.F. tuner. With exception to L-6 slug (22.5 Mc.) as shown in Fig. 3, field alignment for this tuner has been purposely omitted from the alignment procedure. Factory experience dictates that this unit can not be properly aligned in the field as special test equipment is required. Therefore any R.F. tuner adjustment in the field should be held to a minimum.

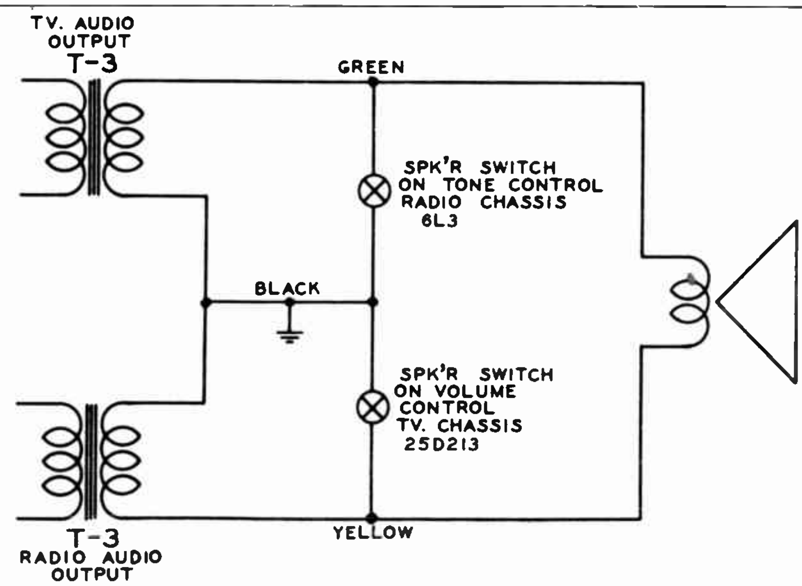
Field Alignment for Standard Coil Tuners has appeared in some set manufacturers service manuals; it is not recommended by our Engineering Department.
After receiver analysis proves the R.F. Tuner to be defective, and in need of realignment, the complete tuner assembly (With tubes) should be returned to Our Factory Service Department for repair or replacement.

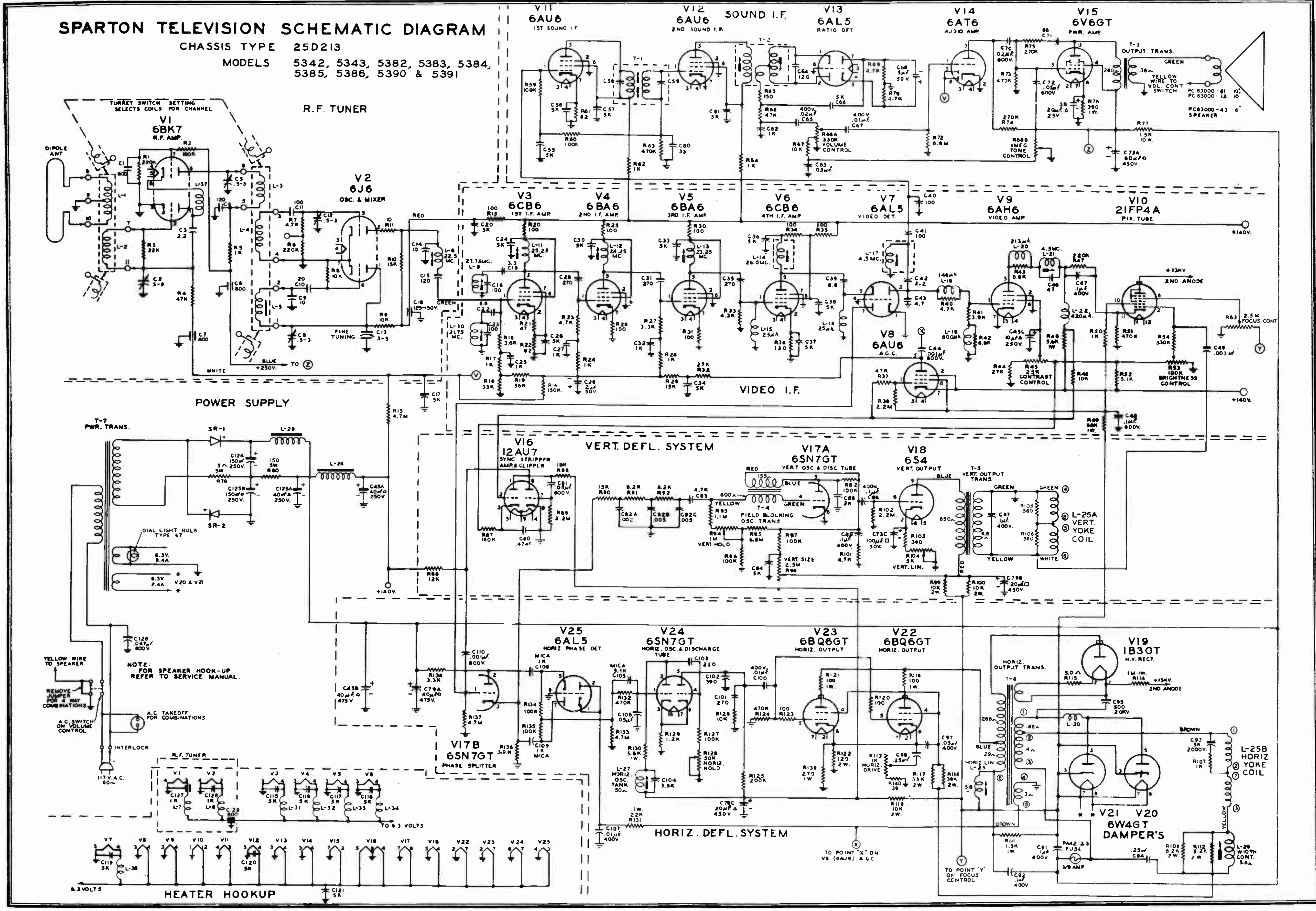
CABINET WIRING DIAGRAM

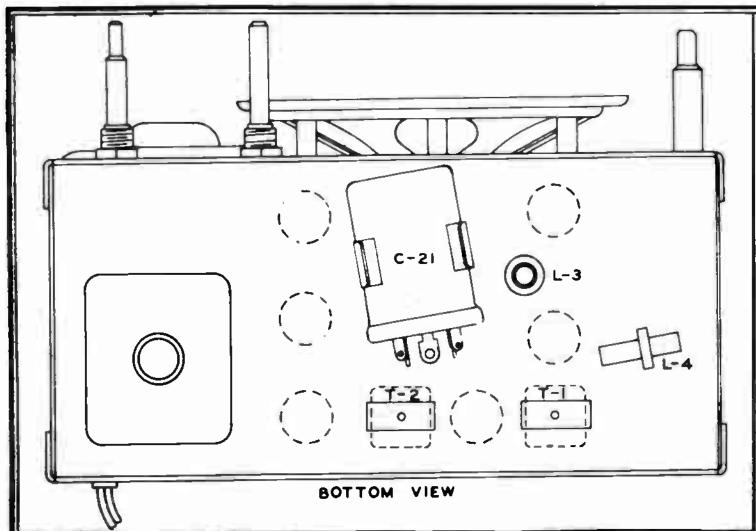


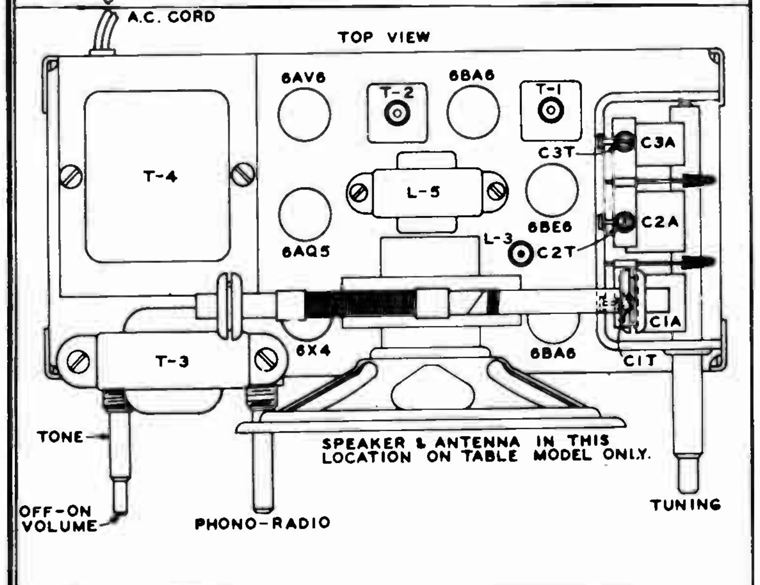
MODELS 5390 & 5391
(CABINET BACK VIEW)

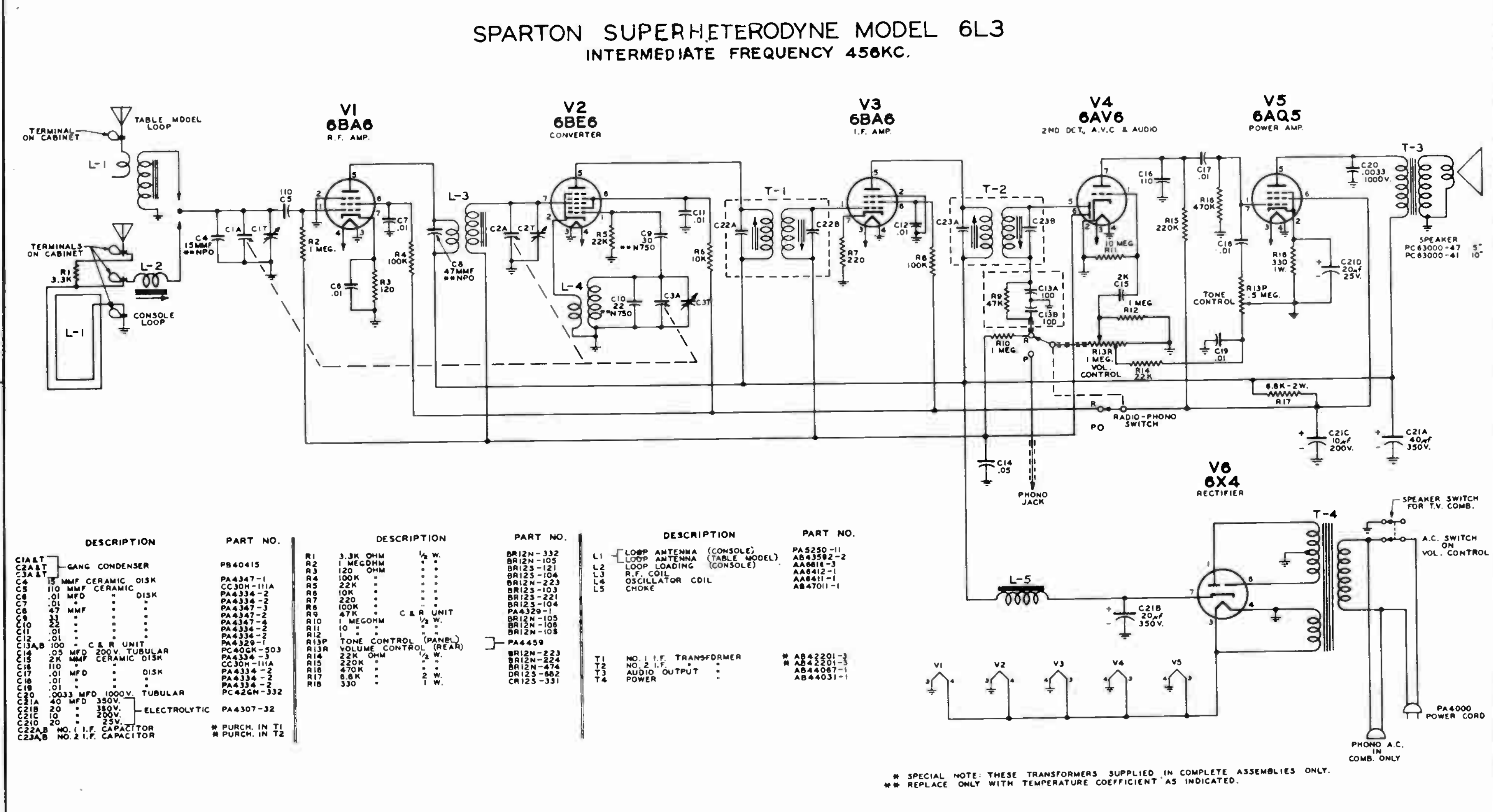
SPEAKER WIRING DIAGRAM
MODELS 5390 & 5391




SPARTON TELEVISION SCHEMATIC DIAGRAM
CHASSIS TYPE 25D213
MODELS 5342, 5343, 5382, 5383, 5384, 5385, 5386, 5390 & 5391
R.F. TUNER
TURRET SWITCH SETTING SELECTS COILS FOR CHANNEL
DIPOLE ANT
V1 6BK7 R.F. AMP.
V2 6J6 OSC. & MIXER
FINE TUNING
SOUND I.F.
V11 6AU6 1ST SOUND I.F.
V12 6AU6 2ND SOUND I.F.
V13 6AL5 RATIO DET.
V14 6AT6 AUDIO AMP.
V15 6V6GT PWR. AMP.
T-3 OUTPUT TRANS.
VOLUME CONTROL
TONE CONTROL
SPEAKER
V3 6CB6 1ST I.F. AMP
V4 6BA6 2ND I.F. AMP
V5 6BA6 3RD I.F. AMP
V6 6CB6 4TH I.F. AMP
V7 6AL5 VIDEO DET.
V8 6AU6 A.G.C.
V9 6AH6 VIDEO AMP.
V10 21FP4A PIX. TUBE
VIDEO I.F.
CONTRAST CONTROL
BRIGHTNESS CONTROL
FOCUS CONT
POWER SUPPLY
T-7 PWR. TRANS.
SR-1
SR-2
DIAL LIGHT BULB TYPE 47
V16 12AU7 SYNC. STRIPPER AMP. & CLIPPER
VERT. DEFL. SYSTEM
V17A 6SN7GT VERT. OSC. & DISC TUBE
T-4 FIELD BLOCKING OSC. TRANS.
VERT. HOLD
VERT. SIZE
VERT. LIN.
V18 6S4 VERT. OUTPUT
T-5 VERT. OUTPUT TRANS.
L-25A VERT. YOKE COIL
V25 6AL5 HORIZ. PHASE DET.
V24 6SN7GT HORIZ. OSC. & DISCHARGE TUBE
V23 6BQ6GT HORIZ. OUTPUT
V22 6BQ6GT HORIZ. OUTPUT
V19 1B3GT H.V. RECT.
V17B 6SN7GT PHASE SPLITTER
HORIZ. OUTPUT TRANS.
HORIZ. HOLD
HORIZ. DRIVE
HORIZ. DEFL. SYSTEM
V21 V20 6W4GT DAMPER'S
L-25B HORIZ YOKE COIL
L-26 WIDTH CONT.
TO POINT "X" ON V8 (6AU6) AGC
TO POINT "Y" OF FOCUS CONTROL
NOTE: FOR SPEAKER HOOK-UP REFER TO SERVICE MANUAL.
YELLOW WIRE TO SPEAKER
REMOVE JUMPER FOR 4 WAY COMBINATIONS
A.C. TAKEOFF FOR COMBINATIONS
A.C. SWITCH ON VOLUME CONTROL
INTERLOCK
117 V. A.C. 60~
HEATER HOOKUP
TO 6.3 VOLTS
6.3 VOLTS







VOLTAGE CHART

Line Voltage: 117 Volts AC

Position of volume control: Full with set tuned to quiet channel.
Position of band switch. Radio

Voltage of Sockets Prongs to Ground. See Prong Nos. on Schematic.

TUBE	FUNCTION	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
6BA6	R.F. Amplifier	**	0	0	*6.3	250	50	0.5
6BE6	Mixer-Osc.	**	0	0	*6.3	250	100	**
6BA6	I.F. Amplifier	**	0	*6.3	0	250	60	1.0
6AV6	2nd Det, AVC, 1st Audio	**	0	*6.3	0	**	-0.3	80
6AQ5	Power Amplifier	**	8	*6.3	0	250	165	**
6X4	Rectifier	*225	NC	*6.3	0	NC	*225	270

NOTES: Voltage readings are for Schematic Diagram in this Bulletin. Allow 15% + or - on all measurements. Always use meter scale which will give greatest deflection within scale limits. All DC measurements made with 20,000 Ohms per volt voltmeter. All AC voltages made with rectifier type voltmeter.
* AC Volts
** Cannot be measured with 20,000 Ohms per volt voltmeter.

ALIGNMENT PROCEDURE

OPER-ATION	ALIGNMENT OF	GENERATOR CONNECTED TO	DUMMY ANTENNA	GENERATOR FREQUENCY	TUNING COND. SETTING	TRIMMER OR SLUG	REMARKS
1	#2 IF	V2 Pin 7	.02 uf.	456 Kc.	Open	T2 Pri. & Sec.	Tune for Max. Output
2	#1 IF	V2 Pin 7	.02 uf.	456 Kc.	Open	T1 Pri. & Sec.	Tune for Max. Output
3	Osc.	Ant.Term.	.02 uf.	1620 Kc.	Open	C3T	Tune for Max. Output
4	Mix.	Ant.Term.	.02 uf.	1500 Kc.	1500 Kc.	C2T	Tune for Max. Output
5	RF.	Driver Loop		1500 Kc.	1500 Kc.	C1T	Tune for Max. Output
6	Osc.	Driver Loop		538 Kc.	Closed	None	Check for Coverage
7	Mix.	Driver Loop		600 Kc.	600 Kc.	None	Check tracking
* 8	RF	Driver Loop		600 Kc.	600 Kc.	L2	Tune for Max. Output
9	RF	Driver Loop		1500 Kc.	1500 Kc.	C1T	Recheck Step 5

* L2 in Consoles only.

SPECIAL INFORMATION: Inductance L3 is mixer grid coil and couples the R.F.Amplifier plate to the mixer grid. The coil contains an iron core and threaded stud for use in factory adjustment only. The slug in this coil should not be varied from the factory setting unless equipment is available to check mutual inductance of the coil after readjustment. Improper adjustment may cause various symptoms of poor performance. All replacements ordered from the Factory Service Dept. will be preset and should not be adjusted after installation.

WHEN ORDERING PARTS ALWAYS SPECIFY PART NUMBER AND MODEL FOR WHICH PART IS INTENDED.

Condenser	-	C17, 20, 24, 26, 30, 33, 34, 36, 37, 38,55,56,57, 61, 66,84,115,116,117,118 119, 120,121 5K Ceramic		PA4334-1
Condenser	-	C18, 23,40,41,100 MMF.Ceramic		PA4332-3
Condenser	-	C19 3.3 MMF. Ceramic		PA4326-4
Condenser-	-	C22,39, 6.8 MMF. Ceramic		PA4328-13
Condenser	-	C25,27,32,62 1K Ceramic		HK36M-102
Condenser	-	C28,31,35, 270 MMF. Ceramic		HK36M-271
Condenser	-	C29,80 .47 MFD 200V. Tubular		PC42DK-474
Condenser	-	C42 2.2 MMF. Ceramic		PA4326-1
Condenser	-	C43 4.7 MMF. Ceramic		PA4328-11
Condenser	-	C44, 110 .001 MFD 600V.Tubular		PC42GM-102
Condenser	-	C45A,B & C 40-40-10 MFD. Elect.		PA4307-25
Condenser	-	C46 47 MMF. Ceramic		CC30A-470F
Condenser	-	C47,85,86,91,92 .1 MFD 400V. Tub.		PC40GL-104
Condenser	-	C48 .1 MFD. 600V. Tubular		PC40GM-104
Condenser	-	C49 .003 MFD. 600V. Tubular		PC40GM-302
Condenser	-	C60 33 MMF. Mica		MC60E-330
Condenser	-	C63 .03 MFD. 200V. Tubular		PC40GK-303
Condenser	-	C64 120 MMF. Ceramic		PA4332-4
Condenser	-	C65 .02 MFD. 400V. Tubular		PC40HL-203
Condenser	-	C67 .01 MFD. 400V. Tubular		PC40HL-103
Condenser	-	C68 5 MFD. 50V.Elect.		PA4308-2
Condenser	-	C70 .02 MFD. 600V. Tubular		PC40HM-203
Condenser	-	C71 68 MMF. Mica		MC60E-680
Condenser	-	C72 .005 MFD. 600V. Tubular		PC40GM-502
Condenser	-	C73A,B & C 80-20-100 MFD. Elect.		PA4307-23
Condenser	-	C79A,B & C 40-20-20 MFD. Elect.		PA4307-22
Condenser	-	C81 .05 MFD. 600V. Tubular		PC40GM-503
Condenser	-	C82A,B & C Herlec Ceramic		PA4339-4
Condenser	-	C83 4.7K MMF. Mica		MC61F-472
Condenser	-	C87 .1 MFD. 400V. Tubular		PC42GL-104
Condenser	-	C88 2K MMF. Mica		MC61E-202
Condenser	-	C93 56 MMF. 2KV. Ceramic Disk		PA4334-5
Condenser	-	C94 .25 MFD. 400V. Tubular		PC40GL-254
Condenser	-	C95 500 MMF. 20KV. Ceramic		PA4342-2
Condenser	-	C97 .05 MFD. 400V. Tubular		PC40HL-503
Condenser	-	C98 .25 MFD. 200V. Tubular		PC40GK-254
Condenser	-	C100 .01 MFD. 400V. Tubular		PC40GL-103
Condenser	-	C101 270 MMF. Mica		MC60E-271
Condenser	-	C102 390 MMF. Mica		MC60E-391
Condenser	-	C103 220 MMF. Mica		MC60E-221
Condenser	-	C104 3.9K Mica		MC63F-392
Condenser	-	C105 5.1K Mica		MC61E-512
Condenser	-	C106 .05 MFD. 200V. Tubular		PC40GK-503
Condenser	-	C107 .01 MFD. 400V. Tubular		PC40FL-103
Condenser	-	C108 & 109 1K Mica		MC61E-102
Condenser	-	C124 150 MFD. 250V. Elect.		PA4309-4
Condenser	-	C125A & B 40-150 MFD. Elect.		PA4307-31
Condenser	-	C126 .047 MFD. 600V. Tubular		PA4346-1
Condenser	-	C29 50V. Elect.		PA4303-14
R45	-	Contrast Control	Dual	PA4457
R53	-	Brightness Control		
R68A	-	Volume Control	Dual	PA4450-2
R68B	-	Tone Control		
R83	-	Focus Control	Dual	PA4454
R98	-	Vert. Size Control		
R94		Vert. Hold Control	Dual	PA4456
R128	-	Hor. Hold Control		
R113	-	Hor. Drive Control		PA4456

L-9	Coil - 27.75 Mc. Trap	AB43523-13
L-10	Coil - 21.75 Mc. Trap	AB43523-12
L-11	Coil - 25.25 Mc. P.I.F. (1)	AA6408-1
L-12	Coil - 24.25 Mc. P.I.F. (2)	AA6408-1
L-13	Coil - 23.25 Mc. P.I.F. (3)	AA6408-1
L-14	Coil - 26.0 Mc. P.I.F.	AA6364-1
L-15 & 16	Choke- 25 uh	AA6650-1
L-17	Coil- 4.5 Mc. Trap	AA6364-2
L-18	Choke-146 uh	AA6402-6
L-19	Choke-600 uh	AA6613-8
L-20	Choke-213 uh	AA6402-7
L-21	Coil - 4.5 Mc. Trap	AA6407-1
L-22	Choke- 420 uh	AA6613-10
L-23	Coil- Horiz. Lin.	AA6400-3
L-24	Coil- Focus	PC70008-1
* L25A & B	Vertical & Horizontal Yoke	PC70018
L30	Choke	AA6650-8
L-26	Coil- Width Control	AA6400-3
L-27	Coil- Horiz. Osc.	AA6403-2
L-28 & 29	Choke-Filter	AB47009-1
L-31,32,33,34 & 35	Choke-Heater	AA6651-1
T-1	Transformer-Sound I.F.	AA6667-5
T-2	Transformer-Ratio Det.	AA6684-4
T-3	Transformer-Audio Output	AB44066-3
T-4	Transformer-Field Block Osc.	AB47006-4
T-5	Transformer-Vert. Output	AB44062-7
T-6	Transformer-Horiz. Output	PC70012
T-7	Transformer-Power	AB44029-1

** R.F. Tuner Assembly (Cascode)		PD93158-1
Kinescope (21FP4A)		PD93172-2
Ion Trap		PA1248-3
Fuse-3/8 Amp.		PA4212-3
Knob-Infrequent Control-Inner	(Models 5342,5382,5384,5390)	PA5659-1
Knob-Infrequent Control-Inner	(Models 5343,5383,5386,5391)	PA5659-2
Knob-Infrequent Control-Outer	(Models 5342,5382,5384,5390)	PA5660-1
Knob-Infrequent Control-Outer	(Models 5343,5383,5386,5391)	PA5660-2
Knob-Off/On-Volume	(Models 5342,5382,5384)	AB43594-1
Knob-Off/On-Volume	(Models 5343,5383,5386)	AB43594-2
Knob-Tone Control	(Models 5342,5382,5384,5390)	PB40364-1
Knob-Tone Control	(Models 5343,5383,5386,5391)	PB40364-2
Knob-Channel Tuner	(Models 5342,5382,5384,5390)	AB43593-1
Knob-Channel Tuner	(Models 5343,5383,5386,5391)	AB43593-2
Knob-Fine Tuning	(Models 5342,5382,5384,5390)	PB40363-1
Knob-Fine Tuning	(Models 5343,5383,5386,5391)	PB40363-2
Sparton Emblem		PB40359
Mask		PD93058
Safety Glass		PB40354-3
Safety Screen (Models 5342,5343)		PB40209-13
** Speaker-6" Round	(Models 5342, 5343)	PC63000-43
** Speaker-10"Round	(Models 5382, 5383,5384,5386)	PC63000-41
** Speaker-10"Round	(Models 5390, 5391)	PC63000-12

* Deflection Yoke Coil PC70018 supplied only as complete assembly.

** Complete speaker & R.F. Tuner Assemblies may be returned to Factory Service Department for repair or replacement.

Sparton HAWTHORNE
MODEL 5240 MAHOGANY FINISH
MODEL 5241 GOLDEN WHEAT
21 INCH TELEVISION TABLE MODEL

Sparton LANCASTER
MODEL 5280 MAHOGANY VENEER
MODEL 5281 LIMED OA.
21 INCH TELEVISION CONSOLE

BRIEF DESCRIPTION

Television chassis type 21S212 is a twenty-one tube "Standard" chassis with a self-contained power supply, an Electro-Static type focusing system and uses a 21FP4A picture tube. This chassis is equipped with the Sparton Ultra-tuner for superior long range reception. The Ultra-tuner will receiver telecasts on all present channels and, with the insertion of simple tuner strips on new U.H.F. channels.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

R.F. FREQUENCY RANGE

Channel Number	Channel Freq.Mc.	Picture Carrier Freq.Mc.	Sound Carrier Freq.Mc.	Receiver R.F.Osc. Freq.Mc.
2	54-60	55.25	59.75	81.5
3	60-66	61.25	65.75	87.5
4	66-72	67.25	71.75	93.5
5	76-82	77.25	81.75	103.5
6	82-88	83.25	87.75	109.5
7	174-180	175.25	179.75	201.5
8	180-186	181.25	185.75	207.5
9	186-192	187.25	191.75	213.5
10	192-198	193.25	197.75	219.5
11	198-204	199.25	203.75	225.5
12	204-210	205.25	209.75	231.5
13	210-216	211.25	215.75	237.5

POWER SUPPLY RATING

117 Volts..............60 Cycles........190 Watts

AUDIO POWER OUTPUT RATING

Maximum Undistorted...................2.5 Watts

LOUD SPEAKER

Models 5240 & 5241....................6" P.M.Round
Models 5280 & 5281...................10" P.M.Round
Voice Coil Impedance..3.2 Ohms @ 400 Cycles

PICTURE I.F. FREQUENCIES

Picture Carrier Frequency.............26.25 Mc.
Accompanying Sound Traps..............21.75 Mc.

SOUND I.F. FREQUENCIES

Sound Carrier Frequency.................4.5 Mc.
Sound Discriminator Band Width
(Between Peaks).........................200 Kc.
Video Response..........................To 4 Mc.
Focus...............................Electrostatic
Sweep Deflection........................Magnetic
Scanning......Interlaced 525 Lines
Horizontal Scanning Frequency...........15,750 Cps.
Vertical Scanning Frequency.................60 Cps.
Frame Frequency (Picture Repetition Rate)...30 Cps.
Receiver Antenna Input Impedance...........300 Ohms Balanced

TUBE COMPLEMENT

TUBE	TYPE	FUNCTION
V1	6BK7/6BQ7	R. F. Amplifier
V2	6J6	Osc. & Mixer
V3	6CB6	1st I.F. Amplifier
V4	6CB6	2nd I.F. Amplifier
V5	6CB6	3rd I.F. Amplifier
V6	6AL5	Video Detector
V7	6AU6	Video Amplifier
V8	21FP4A	Picture Tube
V9	6AU6	Sound I.F.
V10	6AL5	Ratio Detector
V11	6AT6	Audio Amplifier
V12	6V6GT	Power Amplifier
V13	6AU6	Sync.Strip & D.C. Restorer
V14	6SN7GT	Vert. Osc. & Discharge & Phase Splitter
V15	6V6GT	Vertical Output
V16	6AL5	Horiz.Phase Detector
V17	6SN7GT	Horiz. Osc.& Discharge
V18	6BQ6GT	Horiz. Output
V19	1B3GT	Hi-Voltage Rectifier
V20	6W4GT	Damper
V21	5U4G	Rectifier

OPERATING CONTROLS LOCATED ON FRONT PANEL

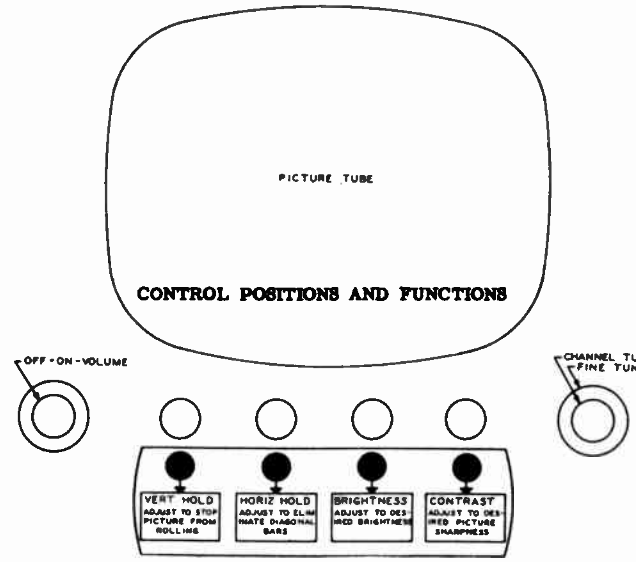
Volume............
Vert. Hold........
Horiz. Hold.......
Brightness........
Contrast..........
Channel Tuning....
Fine Tuning.......

NON-OPERATING CONTROLS

(Not including R.F. & I.F. Adjust)

Focus............
Vert. Size.......
Vert. Lin........
Horiz. Width.....
Horiz. Lin.......
Horiz. Drive.....
Horiz. Osc.......
Defl. Coil........Thumbscrew

FIG. I



ALIGNMENT EQUIPMENT AND TEST SET UP

TEST EQUIPMENT:

FIRST: In order to align and service Sparton television receivers properly the following test equipment should be available:

AN R.F. SWEEP GENERATOR of reliable quality that performs the following functions:

A. Provides sweep outputs in the following frequency ranges:

19 to 30 Mc.	10 Mc. sweep width
40 to 90 Mc.	10 Mc. sweep width
170 to 225 Mc.	10 Mc. sweep width

B. Provides an output signal that can be varied by means of an attenuator up to a miximum of at least .1 volt.

SECOND: AN R.F. SIGNAL GENERATOR That will provide an adjustable output signal up to a maximum of at least .1 volt on the following fixed frequencies:

A. I. F. Frequencies

21.75 Mc.	Sound Trap
23.0 Mc.	1st Video I.F. Coil
25.0 Mc.	2nd Video I.F. Coil
23.8 Mc.	3rd Video I.F. Coil
26.0 Mc.	4th Video I.F. Coil
26.25 Mc.	Picture I.F. Carrier
4.5 Mc.	Sound I.F. & Traps

B. R.F. Frequencies

Channel No.	Picture Carrier	Sound Carrier
2	55.25 Mc.	59.75 Mc.
3	61.25 Mc.	65.75 Mc.
4	67.25 Mc.	71.75 Mc.
5	77.25 Mc.	81.75 Mc.
6	83.25 Mc.	87.75 Mc.
7	175.25 Mc.	179.75 Mc.
8	181.25 Mc.	185.75 Mc.
9	187.25 Mc.	191.75 Mc.
10	193.25 Mc.	197.75 Mc.
11	199.25 Mc.	203.75 Mc.
12	205.25 Mc.	209.75 Mc.
13	211.25 Mc.	215.75 Mc.

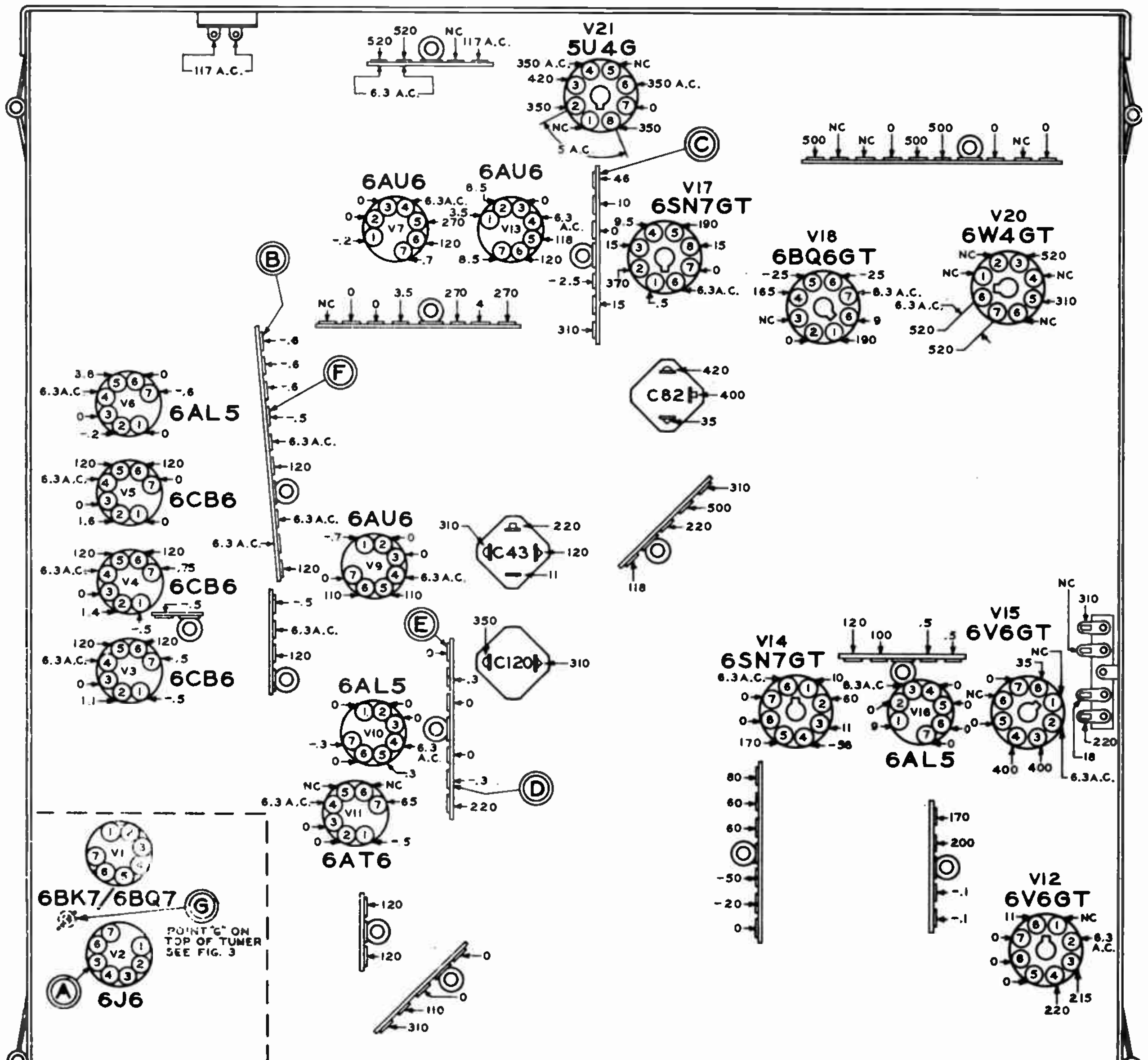
THIRD: A CATHODE-RAY OSCILLOSCOPE of good quality that has a fairly wide band vertical amplifier and a low capacity input probe.

FOURTH: AN ELECTRONIC VOLTMETER with ranges to read IV.DC, 10V. DC and 7V. AC at 400 cycles and 4.5 Mc.

FIFTH: A CRYSTAL CALIBRATOR that can be used for checks on the accuracy of the output frequencies of the R.F. Signal generator.

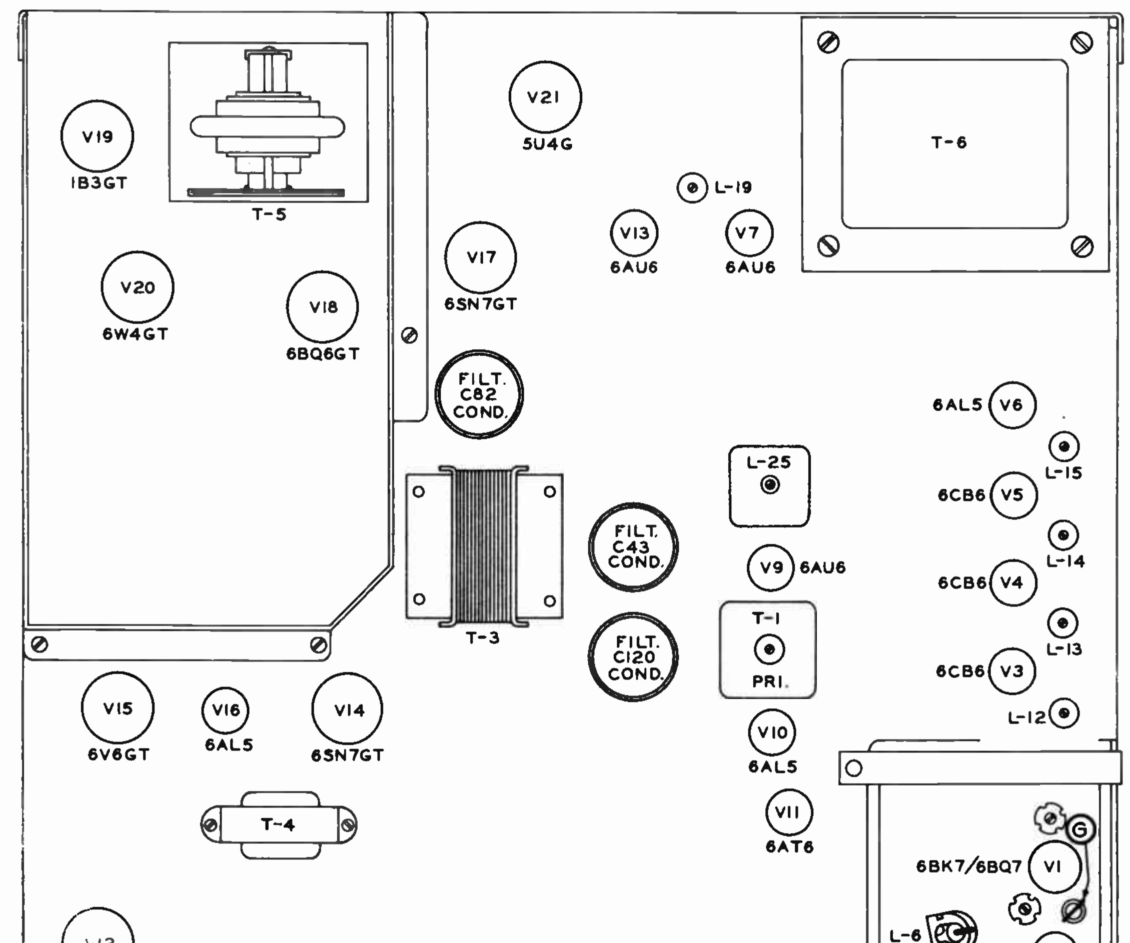
GENERAL INSTRUCTIONS: Practically all servicing with the exception of some tube replacement will require removal of the receiver chassis from the cabinet.

VOLTAGE CHART AND ALIGNMENT TEST POINTS



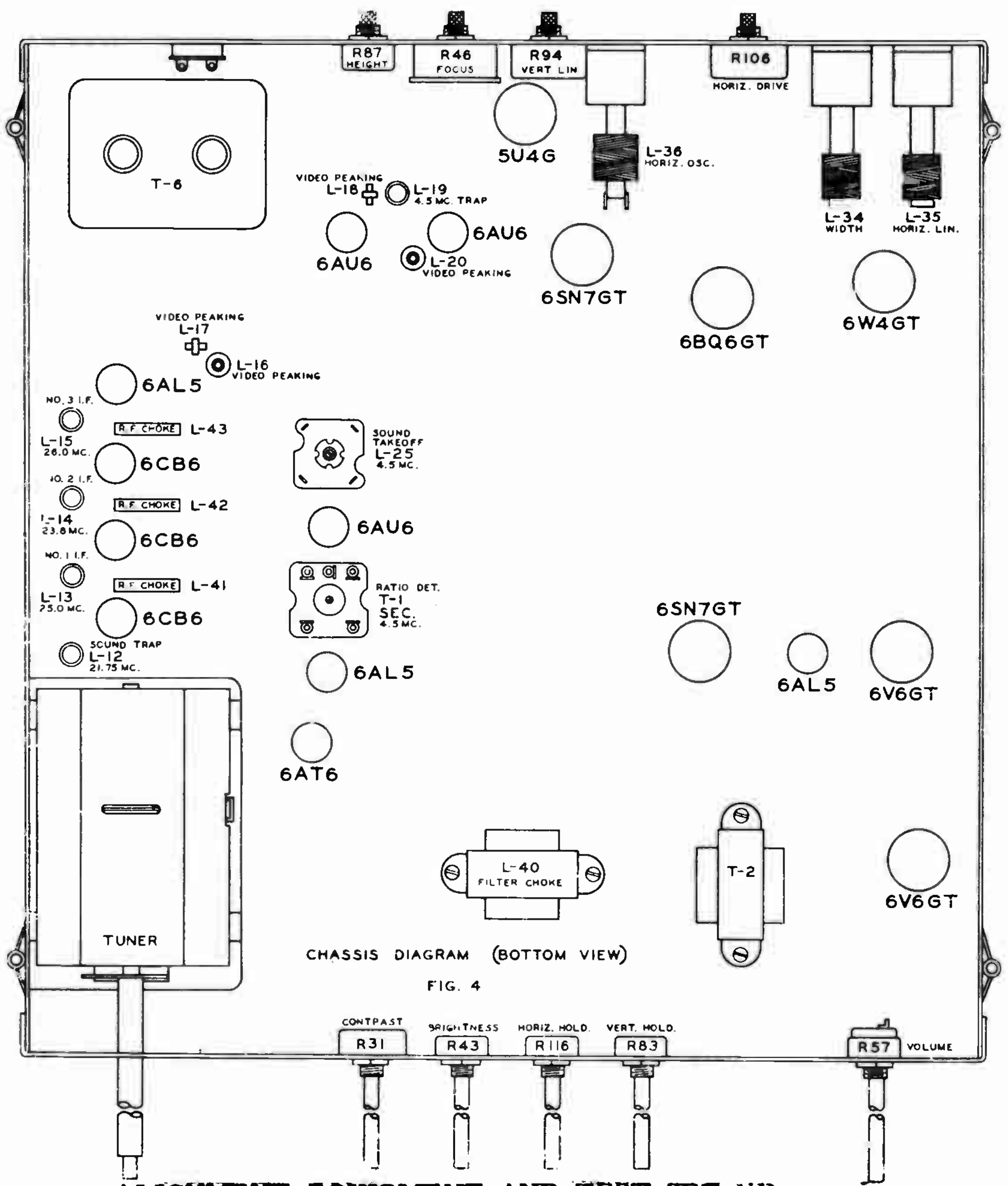
VOLTAGE CHART AND ALIGNMENT TEST POINTS
FIG. 2

TRIMMER AND SLUG LOCATIONS (TOP VIEW)



CHASSIS DIAGRAM (TOP VIEW)
FIG. 3

TRIMMER AND SLUG LOCATIONS (BOTTOM VIEW)



CHASSIS DIAGRAM (BOTTOM VIEW)

FIG. 4

ALIGNMENT EQUIPMENT AND TEST SET UP

A convenient arrangement that makes both the top and bottom of the chassis accessible for alignment and servicing can be realized by orienting the receiver chassis in such a manner that it rests on its side and on the horizontal output shield can.

ALIGNMENT REQUIREMENTS: Under normal conditions complete receiver realignment will seldom be necessary in the field. However, a detailed description of the overall alignment procedure is included to provide all necessary information if it should be required.

In general it is not recommended that the R.F. and the converter circuits of the R.F. tuner be realigned by the service engineer unless absolutely necessary. In cases where tuner components have been damaged or where complete realignment is indicated, the R.F. tuner assembly should be removed from the chassis and sent back to the factory in exchange for a new unit which will be shipped complete with tubes.

When the new R.F. unit is assembled to the chassis it will be necessary in all cases to realign L6 which is located on the tuner chassis. Normally this is the only adjustment that will be required with tuner change but a check on overall receiver alignment and sensitivity should be made for the sake of certainty and assured customer satisfaction.

EFFECTS OF TUBE REPLACEMENT ON THE ALIGNMENT OF R.F. TUNER CIRCUITS: The alignment of the R.F. and converter circuits of the R.F. tuner is critical and may be affected by a tube change. In cases where these tubes (6BK7 & 6BQ7 or 6J6) are replaced, it will be necessary for the service engineer to check for satisfactory receiver operation. If realignment is indicated it can usually be avoided by selection of replacement tubes until correct receiver operation is realized.

ORDER OF ALIGNMENT: When complete receiver realignment is indicated it should be performed in the following order:

1. Sound Traps
2. Picture I.F.
3. Sound I.F. and 4.5 Mc. Trap
4. Ratio Detector Transformer
5. Retouch Picture I.F.
6. Sound and Picture I.F. Sensitivity Check
7. R.F. and Converter Circuits (not recommended)
8. Overall Sensitivity Check

PRELIMINARY ADJUSTMENTS: Before alignment the receiver controls should be adjusted to the approximated operation positions specified in the table below. The controls should remain in these positions for all checks unless otherwise specified.

Contrast Control	-	to maximum clockwise
Brightness Control	-	to position where raster is visible on the kinescope
Focus Control	-	to position where focus is obtained
Vertical Hold	-	to center position
Vertical Linearity	-	to center position
Vertical Size	-	adjusted to give normal raster height
Horizontal Hold	-	to center position
Horizontal Size	-	adjusted to give normal raster width

ALIGNMENT PROCEDURE

TEST EQUIPMENT SET UP: A certain amount of experimentation must be employed to secure a stable test set up before alibnment or service of the receiver is attempted. It is recommended that the top of the test bench be covered with a sheet of aluminum to insure good grounds between the various pieces of test equipment and the receiver chassis. In general all test signal input leads should be kept away from output leads as much as possible.

SOUND TRAP ALIGNMENT: FIRST, Connect the R.F. signal generator to the grid of V-2 by means of the I.F. input adapter as shown in Figure 5.

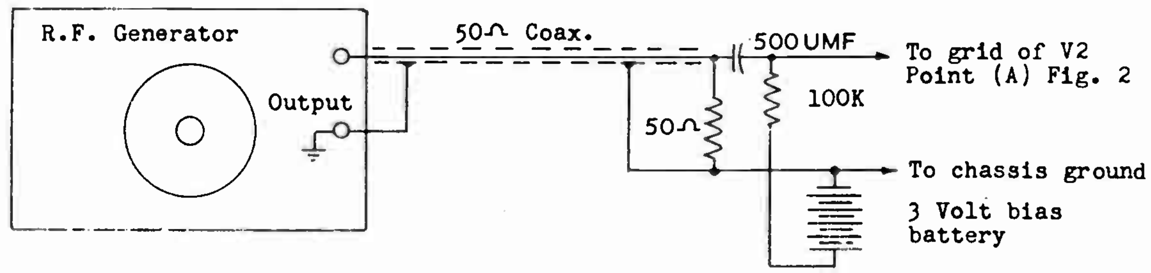


Figure 5 I.F. Input Adapter

SECOND: Set the R.F. tuner to Channel #13.

THIRD: Connect a 3.0 volt bias battery between the A.G. buss (Point F. Fig. 2) and chassis ground so that the voltage on the A.G.C. buss is 3.0 volts in respect to the chassis.

FOURTH: Connect the electronic voltmeter across the picture detector load resistor R-32 Point B, Fig. 2 and set the voltmeter on the low D.C. volt scale.

FIFTH: Set the R.F. signal generator to the frequency shown below and tune the specified adjustment for minimum indication on the voltmeter. It is advisable to check the output of the generator with the crystal calibrator to make certain that it is exactly on frequency.

21.75 Mc. L12 (Top of chassis as shown in Figure 3).

PICTURE I.F. ALIGNMENT: FIRST: Connect the R.F. Signal generator, voltmeter and bias battery to the receiver as described in Steps 1, 2, 3 and 4 of the sound trap alignment instructions.

SECOND: Set the signal generator to each of the following frequencies and peak the specified adjustments for maximum indication of the voltmeter.

23.0 Mc.	L6	(Top of tuner as shown in Fig. 3)
25.0 Mc.	L13	(Top of chassis as shown in Fig. 3)
23.8 Mc.	L14	(Top of chassis as shown in Fig. 3)
26.0 Mc.	L15	(Top of chassis as shown in Fig. 3)

SOUND I.F. ALIGNMENT: FIRST: Connect the R.F. signal generator to Pin #1 of V-6.

SECOND: Set the signal generator accurately to 4.5 Mc. This is very important because the picture and sound carriers sent out from the television stations are exactly 4.5 Mc. apart.

THIRD: Connect the electronic voltmeter across C58 from Point D to ground as shown in Fig. 2.
Set the voltmeter on the 10 volt scale.

FOURTH: Peak the following coils for maximum reading on the voltmeter.

L 25 Top of chassis as shown in Fig. 3.

T-1 (Pri. Ratio Det)Top of chassis as shown in Fig. 3.

RATIO DETECTOR TRANSFORMER ALIGNMENT: FIRST: Connect the R.F. signal generator to the receiver as described in Step 1 of the Sound I.F.Alignment instructions.

SECOND: Connect the electronic voltmeter from Point E, Fig. 2 to ground.
Set the voltmeter on the lowest DC scale.

THIRD: Set the signal generator output to 4.5 Mc. Adjust the secondary of T-1 (Bottom view of chassis as shown in Fig. 4.) Notice that it is possible to produce a positive or negative voltage indication on the meter by varying this adjustment. As the voltage swings from positive to negative, adjust T-1 for zero output as indicated by the voltmeter. This point is called zero ratio detector output and indicates correct alignment of T-1 transformer. If the secondary of T-1 is found to be way out of alignment it will be necessary to re-peak the primary as described in the preceeding section on sound I.F. alignment.

4.5 MC. TRAP ALIGNMENT: FIRST: Connect the R.F. signal generator to Pin #1 of V-7.

SECOND: Connect the electronic voltmeter from the cathode of the picture tube to ground (Point C Fig. 2)
The voltmeter must be capable of giving a reading at 4.5 Mc. at approximately 1 to 2 volts.

THIRD: Peak L-19 (Top of chassis as shown in Fig. 3)for minimum output on the voltmeter.

PICTURE I.F. TOUCH UP: Connect the R.F. Sweep generator output to the grid of V-2 by means of the I.F. input adapter shown in Figure 5.

SECOND: Apply bias to A.G.C. line as described in Step 3 of sound trap alignment. Set R.F. selector to Channel #13.

THIRD: Connect the oscilloscope across the picture detector load resistor R-32 (Point B Fig. 2) by means of the shielded cable and the filter system shown in Figure 6.

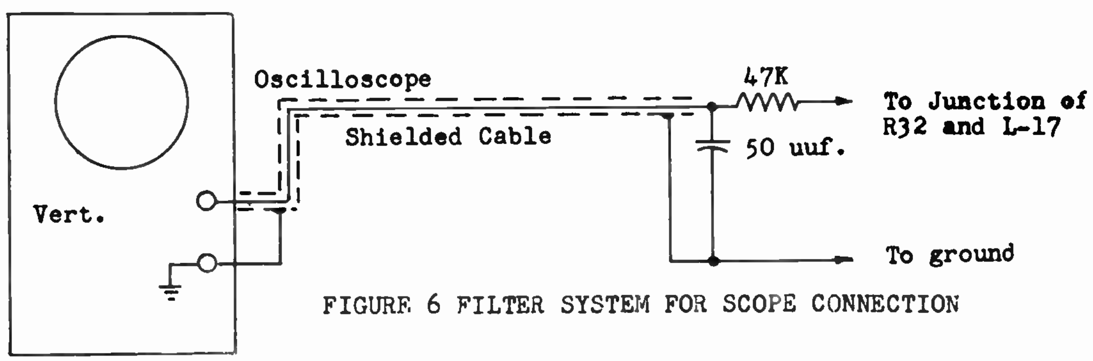


FIGURE 6 FILTER SYSTEM FOR SCOPE CONNECTION

FOURTH: Set the R.F. sweep generator so that it sweeps from approximately 20 to 30 Mc.

FIFTH: Adjust the oscilloscope so that the swept I.F. response is visible on the cathode-ray tube screen.

SIXTH: Loosely couple the output of the R.F. signal generator to the grid of V-2 so that the marker signals of proper frequency can be mixed in with the R.F. sweep signal.

SEVENTH: Observe the band width, relative position of the picture carrier, and flatness of the overall I.F. response curve. If necessary slightly vary the tuning of the picture I.F. coils L6, L13, L14, L15, until the picture I.F. response shown in Figure 7 is obtained. The solid curve in Figure 7 depicts the ideal I.F. response while the dotted curves show permissable variations.

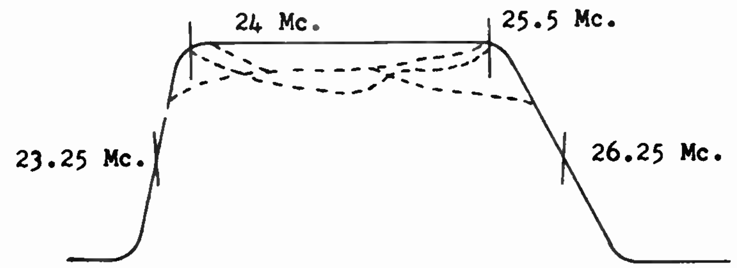


Figure 7 IDEAL I.F. RESPONSE WITH PERMISSABLE VARIATIONS

The picture I.F. Carrier should appear approximately half way down the I.F. response curve as shown in Figure 7. Variation in the pix carrier position should not exceed $\pm$ 10% from the half way point.

PICTURE I.F. SENSITIVITY CHECK: FIRST: Connect the R.F. signal generator to the receiver as specified in Steps 1 and 2 of the sound trap alignment instructions.(When making sensitivity checks no bias battery is connected to the A.G.C. buss.)

SECOND: Connect the electronic voltmeter across the picture detector load resistor R-32 Point B, Fig. 2 and set the meter on the low D.C. volts scale.

THIRD: Set the generator output frequency at approximately 24.5 Mc. Adjust the generator output until the voltmeter reads approximately 1.0 volt. Record the R.F. signal input in Microvolts. Repeat the procedure with the generator output frequency set at 24.2 and 25.4 Mc. In all cases the I.F. input voltage should be 200 MIcrovolts or less. The sensitivity at the I.F. picture carrier 26.25 Mc. should be approximately half of the I.F. Sensitivity between 24.2 Mc. (Maximum of 100 Microvolts.)
If the generabor output is not calibrated in microvolts, comparative sensitivity measurements can be made by using another receiver that is known to be in good operating condition as a standard. This applies to all sensitivity measurements and good results can be obtained if sufficient care is used.

R.F. TUNER (S.W. CO. PART NO. PD93158-1

Sparton chassis type 21S212 is equipped with a standard coil R.F. tuner (Series 2000). With exception to L-6 slug (22.5 Mc.) as shown in Fig. 3, field alignment for this tuner has been purposely omitted from the alignment procedure. Factory experience dictates that this unit can not be properly aligned in the field as special test equipment is required. Therefore any R.F. tuner adjustment in the field should be held to a minimum.

Field Alignment for Standard Coil Tuners has appeared in some set manufacturers service manuals; it is not recommended by our Engineering Department.
After receiver analysis proves the R.F. tuner to be defective, and in need of realignment, the complete tuner assembly (with tubes) should be returned to our Factory Service Department for repair or replacement.

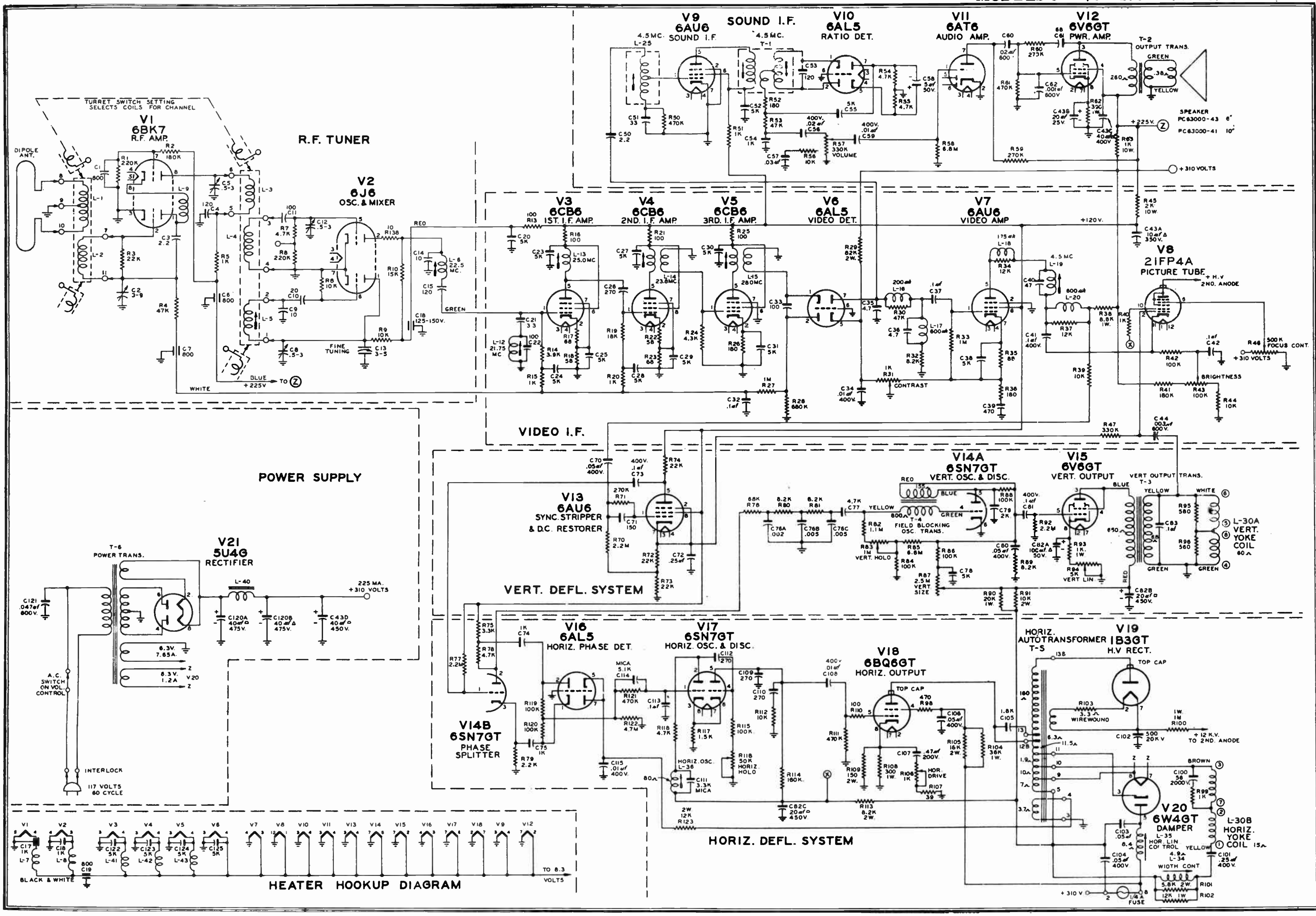
WHEN ORDERING PARTS ALWAYS SPECIFY PART NUMBER AND MODEL FOR WHICH PART IS INTENDED.

DESCRIPTION		PART NO.
Condenser-	C20, 23, 24, 25, 27, 28, 29 30, 31, 38, 52, 55,78, 122 123, 124, 125 5K. Ceramic	PA4334-1
Condenser-	C21 3.3 MMF. Ceramic	PA4326-4
Condenser-	C22 100 MMF. Ceramic	PA4332-3
Condenser-	C26 270 MMF. Ceramic	HK36M-271
Condenser-	C32 .1 MFD. 200V. Tubular	PC40GK-104
Condenser-	C33 100 MMF. Ceramic	HK36M-101
Condenser-	C34, 108 .01 MFD. 400V. Tubular	PC40GL-103
Condenser-	C35, 36 4.7 MMF. Ceramic	PA4328-11
Condenser-	C37, 42 .1 MFD. 200V. Tubular	PC40HK-104
Condenser-	C39 470 MMF. Mica	MC60F-471
Condenser-	C40 47 MMF. Ceramic	CC30A-470F
Condenser-	C41 .1 MFD. 400V. Tubular	PC40HL-104
Condenser-	C43A,B,C,D 10-20-40-40 MFD. Elect.	PA4307-29
Condenser-	C44 .003 MFD. 600V. Tubular	PC40GM-302
Condenser-	C50 2.2 MMF. Ceramic	PA4326-1
Condenser-	C51 33 MMF. Mica	MC60E-330
Condenser-	C53 120 MMF. Ceramic	PA4332-4
Condenser-	C54 1K MMF. Ceramic	HK36M-102
Condenser-	C56 .02 MFD. 400V. Tubular	PC40HL-203
Condenser-	C57 .03 MFD. 200V. Tubular	PC40GK-303
Condenser-	C58 5 MFD. 50V. Elect.	PA4308-2
Condenser-	C59 .01 MFD. 400V. Tubular	PC40HL-103
Condenser-	C60 .02 MFD. 600V. Tubular	PC40HM-203
Condenser-	C61 68 MMF. Mica	MC60E-680
Condenser-	C62 .001 MFD. 600V. Tubular	PC40GM-102
Condenser-	C70, 80, 103, 104 .05 MFD. 400V. Tubular	PC40GL-503
Condenser-	C71 150 MMF. Mica	MC60F-151
Condenser-	C72 .25 MFD. 200V. Tubular	PC40HK-254
Condenser-	C73, 81 .1 MFD. 400V. Tubular	PC40GL-104
Condenser-	C74, 75 1K MMF. Mica	MC61E-102
Condenser-	C76A, B, C .002-.005-.005 Ceramic	PA4339-4
Condenser-	C77 4.7K MMF. Mica	MC61F-472
Condenser-	C79 2K. MMF. Mica	MC61E-202
Condenser-	C82A,B,C 100-20-20 MFD. Elect.	PA4307-30
Condenser-	C83 1 MFD. 200V. Tubular	PC42GK-104
Condenser-	C100 56 MMF. 2000V. Disk	PA4334-5
Condenser-	C101 .25 MFD. 400V. Tubular	PC40GL-254
Condenser-	C102 500 MMF. 20KV. Ceramic	PA4342-2
Condenser-	C105 1800 MMF. Mica	MC61E-182
Condenser-	C106 .05 MFD. 400V. Tubular	PC40HL-503
Condenser-	C107 .47 MFD. 200V. Tubular	PC42GK-474
Condenser-	C109, 110, 112 270 MMF. Mica	MC60E-271
Condenser-	C111 3.3K MMF. Silver Mica	MC63F-332
Condenser-	C113 .1 MFD. 200V. Tubular	PC40FK-104
Condenser-	C114 5.1K MMF. Mica	MC61E-512
Condenser-	C115 .01 MFD. 400V. Tubular	PC40FL-103
Condenser-	C120A, B 40-40 MFD. Elect.	PA4307-13
Condenser-	C121 .047 MMF. 600V. Tubular	PA4346-1
R31 - Control-	Contrast	PA4453-1
R43 - Control-	Brightness	PA4445-3
R46 - Control-	Focus	PA4452
R57 - Control-	Volume	PA4436-1
R83 - Control-	Vertical Hold (1 Meg.)	PA4443-3
R87 - Control-	Vertical Size (2.5 Meg.)	PA4431
R94 - Control-	Vertical Linearity (5K)	PA4411
R106- Control-	Horizontal Drive	PA4446
R116- Control-	Horizontal Hold (50K)	PA4444-3

DESCRIPTION			PART NO.
L-12	Coil -	21.75 Mc. Trap	AB43523-14
L-13	Coil -	25.0 Mc. P.I.F. (1)	AA6408-1
L-14	Coil -	23.8 Mc. P.I.F. (2)	AA6409-1
L-15	Coil -	26.0 Mc. P.I.F. (3)	AA6409-1
L-16	Choke -	200 uh	AA6613-4
L-17	Choke -	600 uh	AA6613-8
L-18	Choke -	175 uh	AA6613-9
L-19	Coil -	4.5 Mc. Trap	AA6407-1
L-20	Choke -	600 uh	AA6613-8
L-25	Coil -	4.5 Mc. Trap	AA6667-6
* L-30 A & B	Coil -	Vertical & Horizontal Yoke	PC70016
L-34	Coil -	Width Control	AA6400-4
L-35	Coil -	Hor. Lin. Control	AA6400-5
L-36	Coil -	Horizontal Osc.	AA6410-1
L-40	Choke -	Choke-Filter	AB47009-1
L-41,42 & 43	Choke-	Heater	AA6651-1
T-1	Transformer- Ratio Det.		AA6684-4
T-2	Transformer- Audio Output		AB44066-3
T-3	Transformer- Vertical Output		AB44062-5
T-4	Transformer- Field Block Oscillator		AB47006-4
T-5	Autotransformer		PC70015
T-6	Transformer- Power		AB44027-1
Ion Trap			PA1248-4
Fuse 1/4 Amp.			PA4212-1
** R. F. Tuner Assembly			PD93158-1 PD93159-1
Kinescope	Hytron 21FP4A		PD93172-2
Knob -	Infrequent Adj.		PA5651
Knob -	Volume/Off/On & Ring Assembly		AA6392-1
Knob -	Channel Tuner		PB40332
Knob -	Fine Tuning		PB40346
Knob -	Control		PB40351
Sparton Script			PA5842
Infrequent Control Cover Assembly			AB43582-1
Safety Screen (Models 5240 & 5241)			PB40209-13
Safety Glass (All models)			PB40354-3
Mask	(All Models)		PD93058
**Speaker -6" Round (Models 5240 & 5241)			PD63000-43
**Speaker -10"Round (Models 5280 & 5281)			PC63000-41

* Deflection Yoke Coil PC70016 supplied only as complete assembly.

** Complete speaker & R.F. Tuner Assemblies may be returned to Factory Service Department for repair or replacement.


R.F. TUNER
V1 6BK7 R.F. AMP.
V2 6J6 OSC. & MIXER
TURRET SWITCH SETTING SELECTS COILS FOR CHANNEL
DIPOLE ANT.
FINE TUNING
SOUND I.F.
V9 6AU6 SOUND I.F.
V10 6AL5 RATIO DET.
V11 6AT6 AUDIO AMP.
V12 6V6GT PWR. AMP.
T-2 OUTPUT TRANS.
SPEAKER
VIDEO I.F.
V3 6CB6 1ST. I.F. AMP.
V4 6CB6 2ND. I.F. AMP.
V5 6CB6 3RD. I.F. AMP.
V6 6AL5 VIDEO DET.
V7 6AU6 VIDEO AMP
V8 21FP4A PICTURE TUBE
CONTRAST
BRIGHTNESS
POWER SUPPLY
V21 5U4G RECTIFIER
T-6 POWER TRANS.
A.C. SWITCH ON VOL. CONTROL
INTERLOCK
117 VOLTS 60 CYCLE
VERT. DEFL. SYSTEM
V13 6AU6 SYNC. STRIPPER & D.C. RESTORER
V14A 6SN7GT VERT. OSC. & DISC.
V15 6V6GT VERT. OUTPUT
VERT OUTPUT TRANS. T-3
L-30A VERT. YOKE COIL
VERT. HOLD
VERT. SIZE
VERT. LIN.
HORIZ. DEFL. SYSTEM
V14B 6SN7GT PHASE SPLITTER
V16 6AL5 HORIZ. PHASE DET.
V17 6SN7GT HORIZ. OSC. & DISC.
V18 6BQ6GT HORIZ. OUTPUT
V19 1B3GT H.V RECT.
V20 6W4GT DAMPER
HORIZ. AUTOTRANSFORMER T-5
L-30B HORIZ. YOKE COIL
HORIZ. HOLD
HOR. DRIVE
WIDTH CONT.
HOR. LIN. CONTROL
TO 2ND. ANODE
HEATER HOOKUP DIAGRAM

Sparton DANBURY
MODEL 5301 DURON MAHOGANY
17 INCH TABLE MODEL

DESCRIPTION

Chassis Type 21S173 is a 17", 21 tube receiver with all electrical characteristics identical to that of chassis type 21S212.
Dual brightness, contrast and syncronization controls are employed on the front panel instead of individual controls as on the 21S212.

PARTS LIST

Tuner		PD93174
Kinescope 17HP4 or 17KP4		PD93167-1, -16 PD93168-11
Ion Trap		PA1248-4
R31 - Contrast Control	Dual	PA4458-1
R43 - Brightness Control		
R83 - Vert. Hold Control	Dual	PA4436-3
R116- Horiz. Hold Control		
R57 - Volume Control		PA4436-3
Knob-Infrequent Control - Inner		PA5659-1
Knob-Infrequent Control - Outer		PA5660-1
Knob-Fine Tuning		PB40363-1
Knob-Dummy		PB40366-1
Knob-Tuner Assembly		AB43593-1
Knob-Off-On-Volume		AB43596-1
Mask		PD93035-2
Safety Glass		PD93036-1
Sparton Emblem Name Plate		PB40359
*Speaker -6" P.M. Round		PC63000-43

*Complete Speaker and R.F. Tuner Assemblies may be returned to Factory Service Department for repair or replacement.

Sparton GLENHURST
MODEL 5340 MAHOGANY FINISH
MODEL 5341 GOLDEN WHEAT
21 INCH TABLE MODEL

Sparton COURTLAND
MODEL 5380 MAHOGANY
MODEL 5381 LIMED OAK
21 INCH OPEN FACE CONSOLE

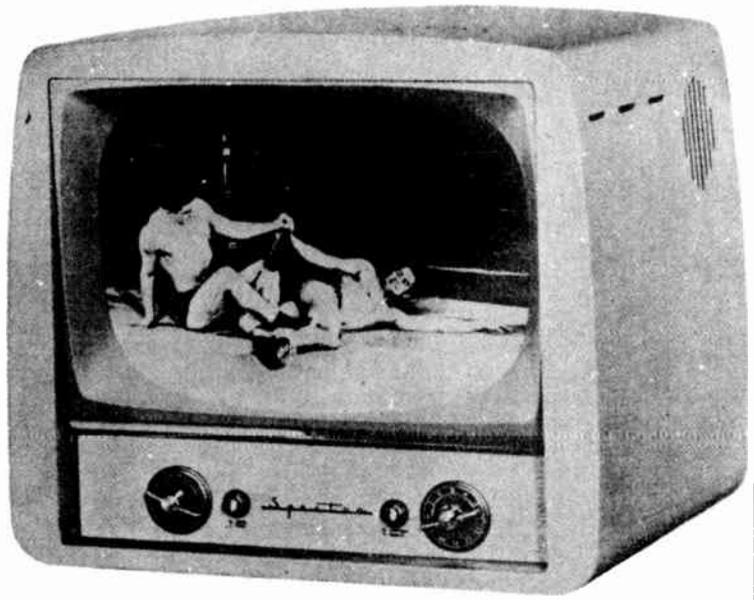
DESCRIPTION

Chassis type 21S213 is a 21",21 tube receiver. All electrical characteristics are identical to that of chassis type 21S212.
Dual brightness, contrast and synchronization controls are employed on the front panel instead of individual controls as on the 21S212.

PART LIST

Kinescope	21FP4A		PD93172-2
R31	- Contrast Control	Dual	PA4458
R43	- Brightness Control		
R83	- Vert. Hold Control	Dual	PA4456
R116	- Horiz. Hold Control		
R57	- Volume Control		PA4436-4
Knob	- Infrequent Control-Inner	(Models 5340 & 5380)	PA5659-1
Knob	- Infrequent Control-Inner	(Models 5341 & 5381)	PA5659-2
Knob	- Infrequent Control-Outer	(Models 5340 & 5380)	PA5660-1
Knob	- Infrequent Control-Outer	(Models 5341 & 5381)	PA5660-2
Knob	- Fine Tuning	(Models 5340 & 5380)	PB40363-1
Knob	- Fine Tuning	(Models 5341 & 5381)	PB40363-2
Knob	- Dummy	(Models 5340 & 5380)	PB40366-1
Knob	- Dummy	(Models 5341 & 5381)	PB40366-2
Knob	- Tuner Assy.	(Models 5340 & 5380)	AB43593-1
Knob	- Tuner Assy.	(Models 5341 & 5381)	AB43593-2
Knob	-Off-On-Volume	(Models 5340 & 5380)	AB43596-1
Knob	-Off-On-Volume	(Models 5341 & 5381)	AB43596-2
Mask			PD93058
Safety Glass			PB40354-3
Sparton Emblem Name Plate			PB40359
*Speaker-6" Round		(Models 5340 & 5341)	PC63000-43
*Speaker-10" Round		(Models 5380 & 5381)	PC63000-41

*Complete speakers may be returned to Factory Service Dept. for repair or replacement.

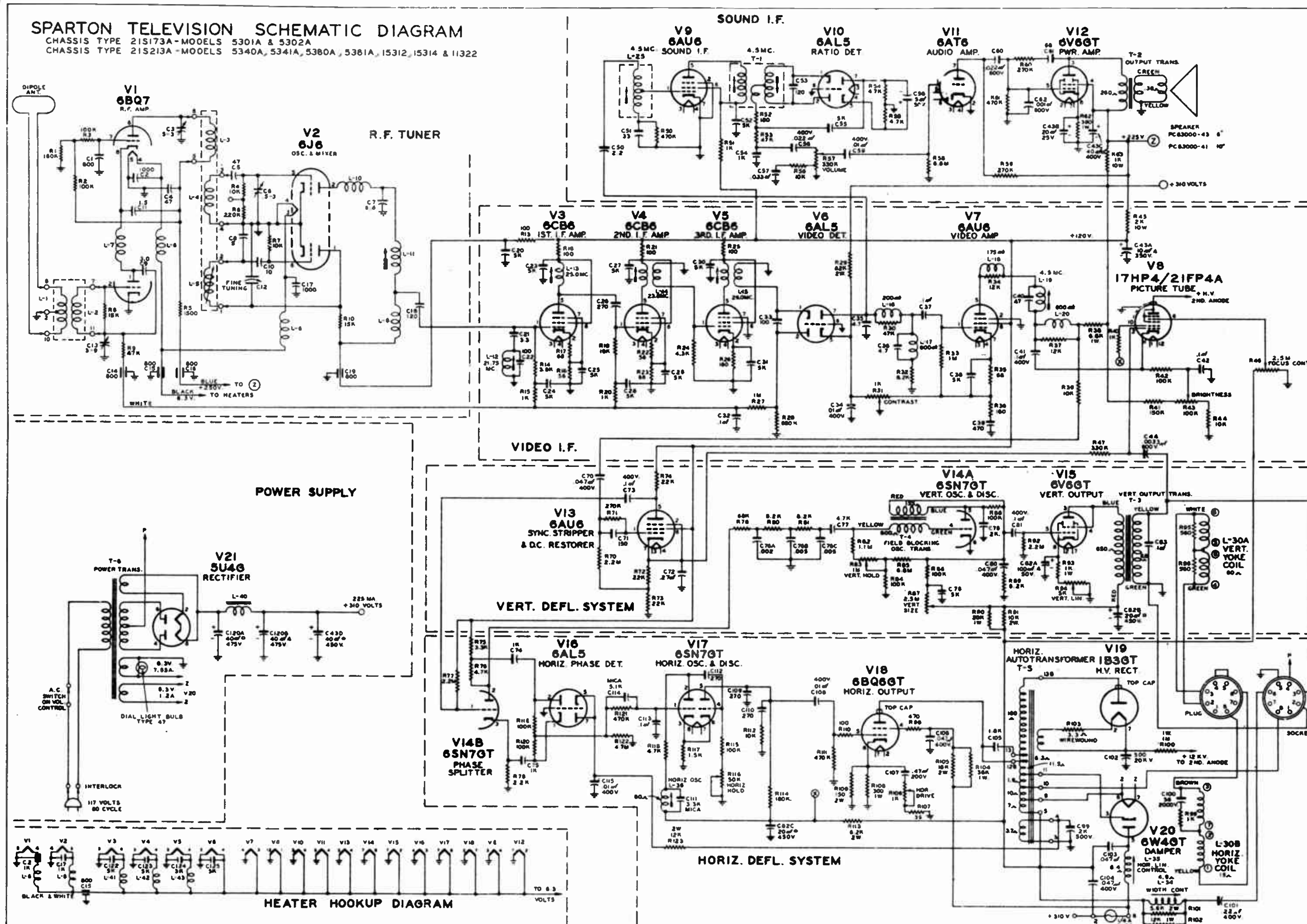


Sparton Derby
Model 15312 Duron Mahogany
Model 15314 Duron Limed Oak
21 Inch Table Model

DESCRIPTION

Chassis type 21S213A is a 21 inch, 21 tube receiver. All electrical characteristics are identical to that of chassis type 21S212.

Sparton Dorset
Model 11322 Duron Mahogany
Model 11324 Duron Limed Oak
21 Inch Console



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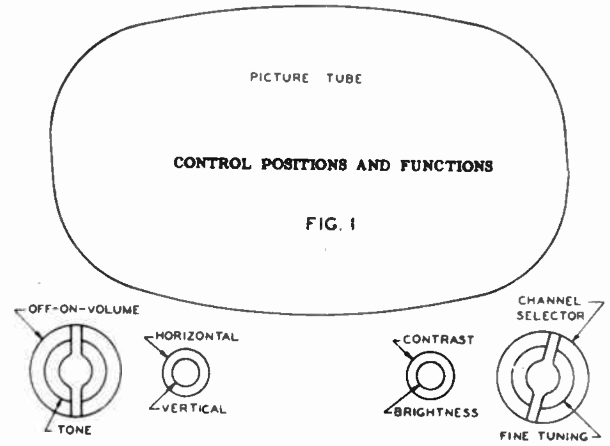
Sparton DEVONSHIRE
MODEL 5325 MAHOGANY VENEER
MODEL 5326 GOLDEN WHEAT
17 INCH TELEVISION TABLE MODEL

Sparton RADFORD
MODEL 5362 MAHOGANY VENEER
MODEL 5363 BLONDE MAHOGANY
17 INCH TELEVISION CONSOLE

BRIEF DESCRIPTION

Television chassis type 25D173A is a twenty-five tube "Deluxe" chassis with a self-contained power supply, an electro-static type focusing system and uses either a 17KP4 or a 17HP4 picture tube. Dual type infrequent controls are readily available on the front panel. This chassis is equipped with the Sparton Ultra-tuner which may be easily converted for the new U.H.F. reception.



ELECTRICAL AND MECHANICAL SPECIFICATIONS

R. F. FREQUENCY RANGE

Channel Number	Channel Freq.Mc.	Picture Carrier Freq.Mc.	Sound Carrier Freq.Mc.	Receiver R.F.Osc. Freq.Mc.
2	54-60	55.25	59.75	81.5
3	60-66	61.25	65.75	87.5
4	66-72	67.25	71.75	93.5
5	76-82	77.25	81.75	103.5
6	82-88	83.25	87.75	109.5
7	174-180	175.25	179.75	201.5
8	180-186	181.25	185.75	207.5
9	186-192	187.25	191.75	213.5
10	192-198	193.25	197.75	219.5
11	198-204	199.25	203.75	225.5
12	204-210	205.25	209.75	231.5
13	210-216	211.25	215.75	237.5

POWER SUPPLY RATING

117 Volts.......60 Cycles...225 Watts

AUDIO POWER OUTPUT RATING

Maximum Undistorted.........2.5 Watts

LOUD SPEAKER

Models 5325 & 5326..........6" P.M. Round
Models 5362 & 5363..........10"P.M. Round
Voice Coil Impedance..3.2 Ohms @ 400 Cycles

PICTURE I.F. FREQUENCIES

Picture Carrier Frequency...26.25 Mc.
Accompanying Sound Traps....21.75 Mc.

SOUND I.F. FREQUENCIES

Sound Carrier Frequency.....4.5 Mc.
Sound Discriminator Band Width
(Between Peaks).............200 Kc.
Video Response..............To 4 Mc.
Focus...............Electrostatic
Sweep Deflection..........Magnetic
Scanning...Interlaced 525 Lines
Horizontal Scanning Freq..15,750 Cps.
Vertical Scanning Freq........60 Cps.
Frame Frequency(picture repetition rate).........30 Cps.
Receiver Ant.Input Impedance..300 Ohms Balanced

TUBE COMPLEMENT

TUBE	TYPE	FUNCTION
V1	6BK7	R.F. Amplifier
V2	6J6	Osc. & Mixer
V3	6CB6	1st I.F.Amplifier
V4	6BA6	2nd I.F.Amplifier
V5	6BA6	3rd I.F.Amplifier
V6	6CB6	4th I.F.Amplifier
V7	6AL5	Video Detector
V8	6AU6	Automatic Gain Control
V9	6AH6	Video Amplifier
V10	17KP4/17HP4	Picture Tube
V11	6AU6	1st Sound I.F.
V12	6AU6	2nd Sound I.F.
V13	6AL5	Ratio Detector
V14	6AT6	Audio Amplifier
V15	6V6GT	Power Amplifier
V16	12AU7	Sync.Strip,Amp.& Clipper
V17	6SN7GT	Vert. Osc. Discharge and Phase Splitter
V18	6V6GT	Vertical Output
V19	6W4GT	Damper Tube
V20	1B3GT	Hi-Voltage Rectifier
V21	6BQ6GT	Horizontal Output
V22	6SN7GT	Horizontal Osc.& Discharge tube
V23	6AL5	Horizontal Phase
V24	5Y3GT	Lo-Voltage Rectifier
V25	5U4G	Med-Voltage Rectifier

OPERATING CONTROLS LOCATED ON FRONT PANEL

Tone..........
Volume........
Vert. Hold....
Horiz. Hold...
Brightness....
Contrast......
Channel Tuning.
Fine Tuning...

NON-OPERATING CONTROLS

(Not including R.F. & I.F.Adjust)
Focus.........
Vert. Size....
Vert. Lin.....
Horiz. Width..
Horiz. Lin....
Horiz. Drive..
Horiz. Osc....
Defl. Coil....

VOLTAGE TEST SPECIFICATIONS

1. Line Voltage = 117 Volts A.C.
2. Channel Switch Position = Channel #2.
3. Brightness Control Position = Maximum Brilliance on Picture Tube.
4. Contrast Control Position = Maximum (Clockwise).
5. Horizontal and Vertical Hold Control Positions = Set correct position to lock in picture.
6. Horizontal width and Vertical Size Controls Positions = Set for Maximum Size.
7. Vertical Linearity Control Position = Set for Best Linearity.
8. Focus Control Position = Properly focused.
9. Volume Control Position = Maximum Counter-Clockwise.
10. Tone Control Position = Maximum Counter-Clockwise.
11. Instrument (Meter) used = (V T.V.M.) Vacuum Tube Volt Meter.
12. No signal input applied to set
13. Unless otherwise Designated All Voltages Measured In Respect To Chassis Ground.

NOTE: The points indicated by the letters A,B,C,D,E F & G are the alignment test points referred to in the following alignment procedure. These points indicate the terminals for attaching generator leads and are shown in Figure 2.

(A) Pin #5 of V2(6J6) osc. & Mixer Tube.
Apply signals here for spot I.F. alignment or I.F. sweep.

(B) Diode Load Resistor
Read D.C. output here for spot I.F. alignment.
Connect scope here for visual I.F. alignment.
Apply 4.5 Mc. here for sound I.F. trap alignment.

(C) Cathode Of Picture Tube
Read A.C. output here for overall sensitivity.
Read 4.5 Mc. output here for aligning 4.5 Mc. trap.

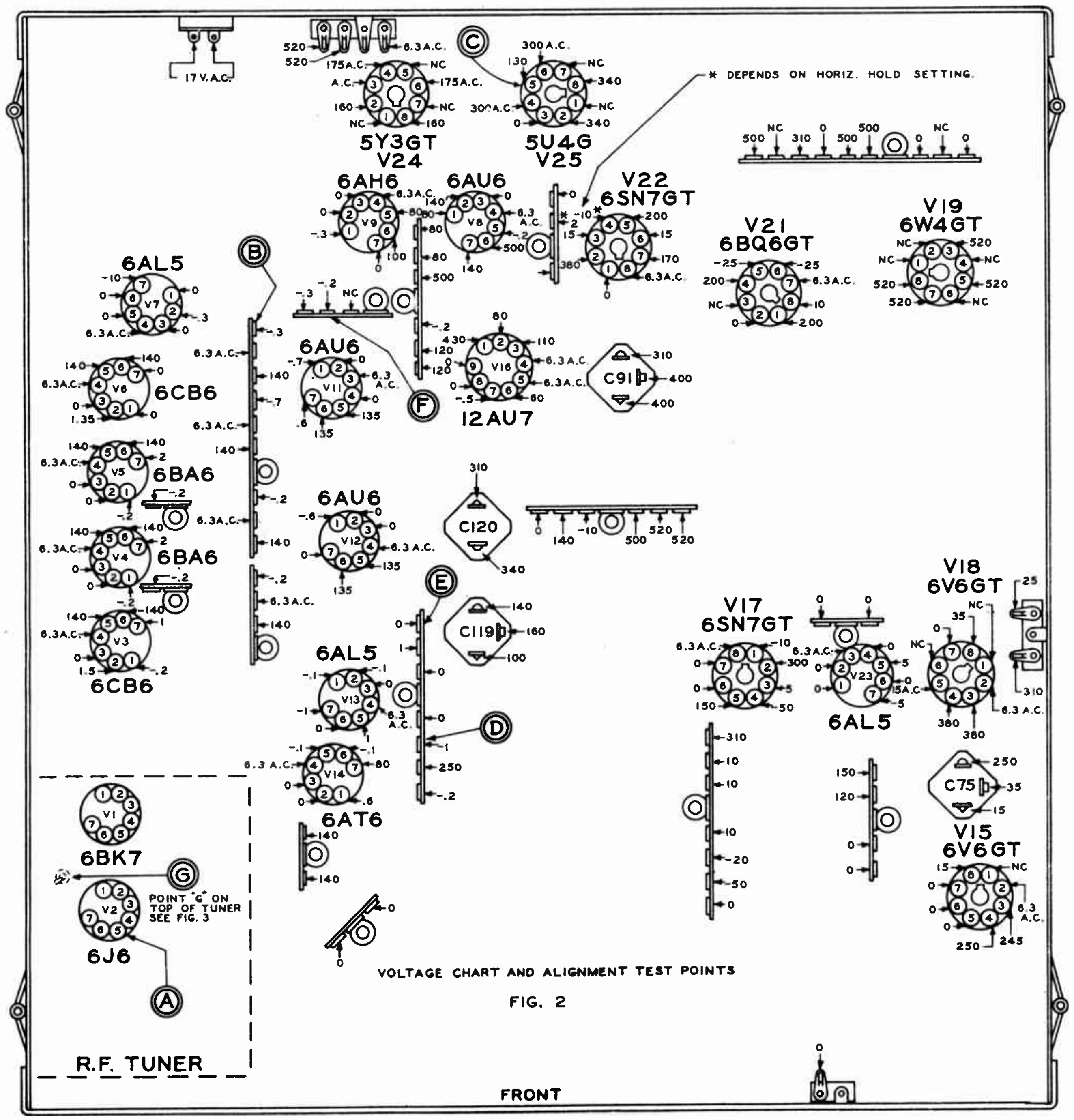
(D) Ratio Det. Output
Read D.C. here for alignment of sound take-off trap, inter-stage sound I.F. transformer and primary of Ratio Det. Trans.

(E) Ratio Det. Balanced Output
Read D.C. here for alignment of secondary of Ratio Det. Trans.

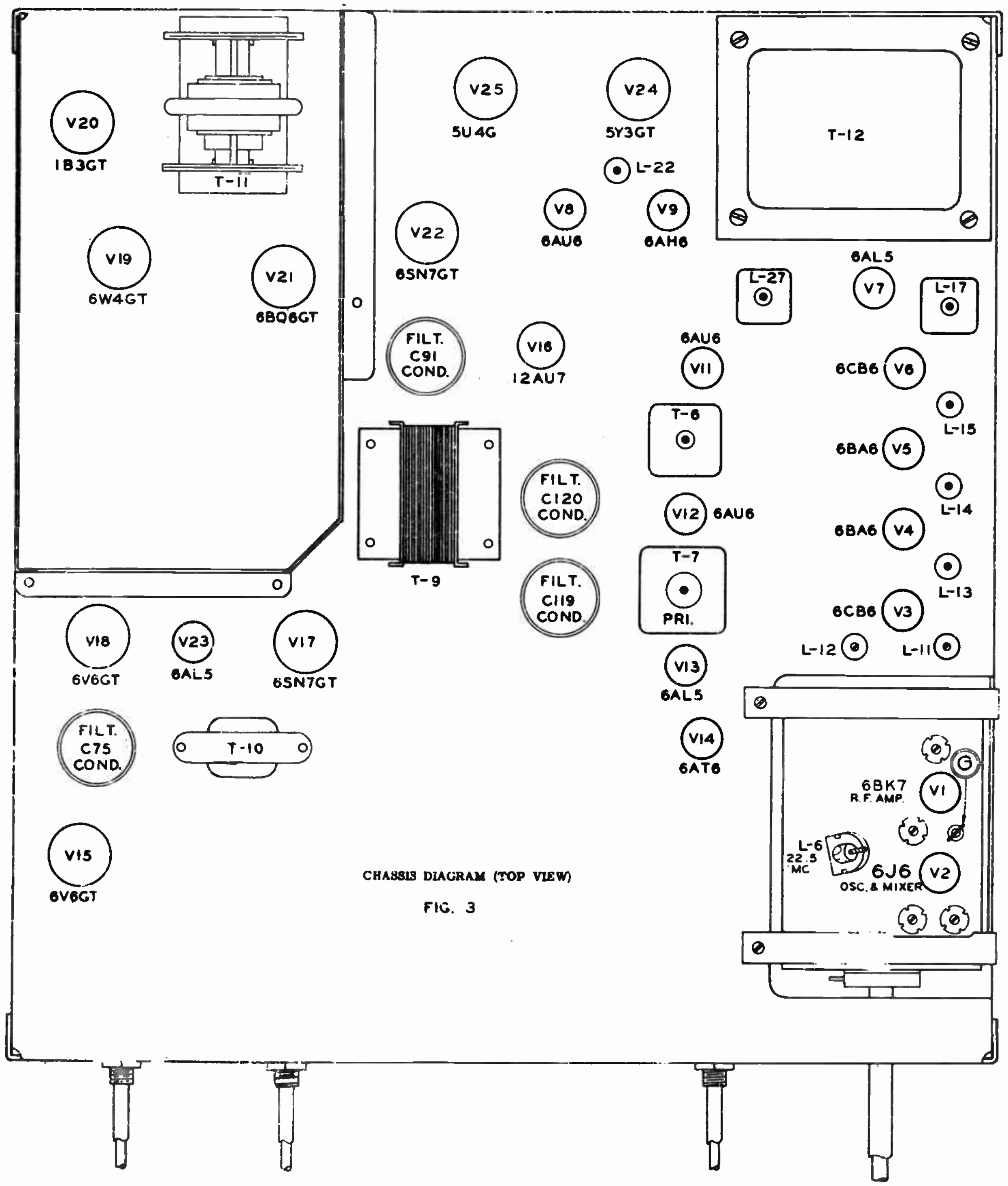
(F) A.G.C. Line
Apply 4.5 volts bias here for visual check of I.F. or overall with oscilloscope.

(G) Apply minus 3 volts through 220K Ohms to test terminal, located between the tubes on top of R.F. Tuner (See Fig. 3).

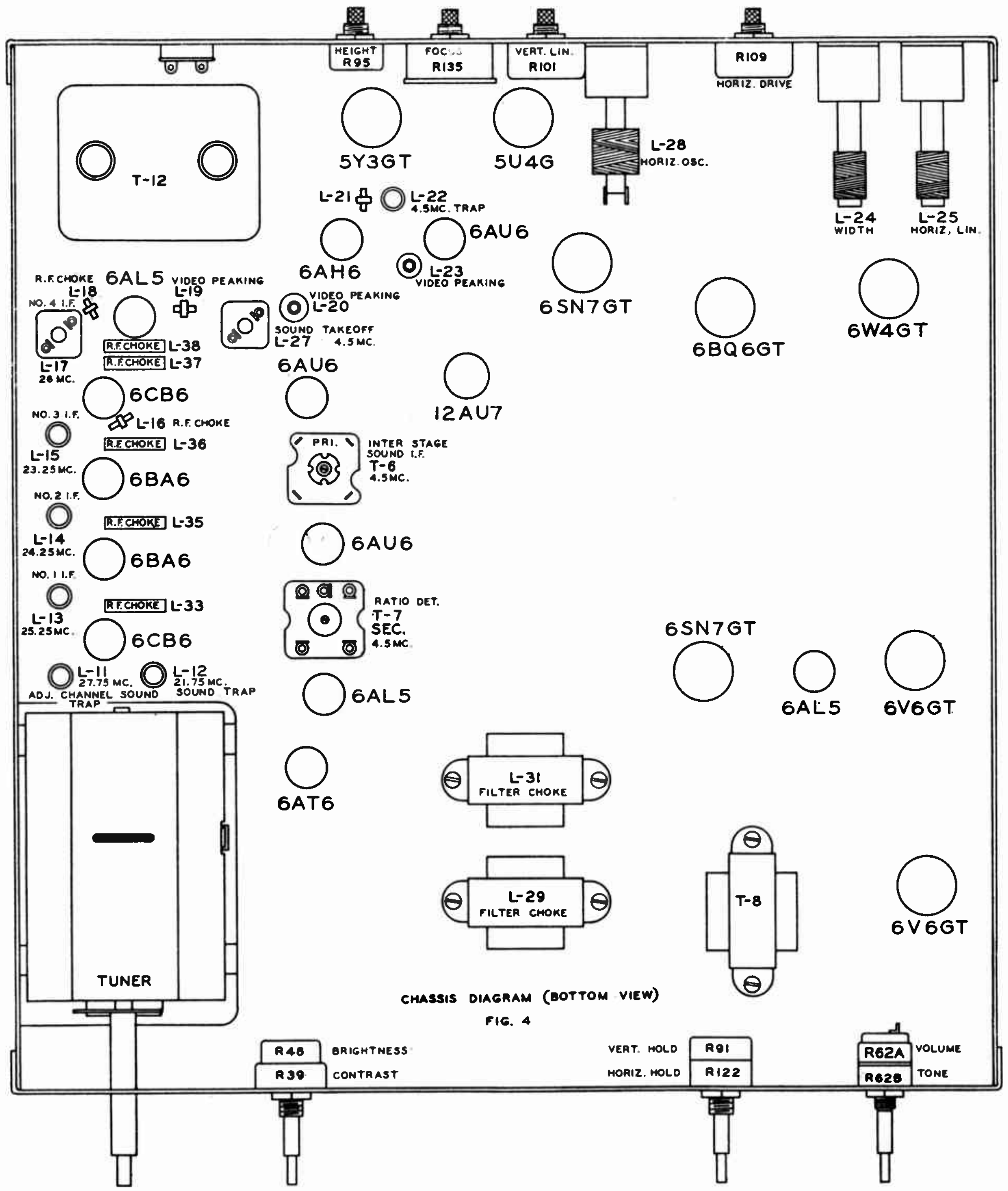
VOLTAGE CHART AND ALIGNMENT TEST POINTS



VOLTAGE CHART AND ALIGNMENT TEST POINTS
FIG. 2



CHASSIS DIAGRAM (TOP VIEW)
FIG. 3



CHASSIS DIAGRAM (BOTTOM VIEW)
FIG. 4

ALIGNMENT EQUIPMENT AND TEST SET UP

TEST EQUIPMENT: In order to align and service Sparton television receivers properly the following test equipment should be available:

FIRST: AN R.F. SWEEP GENERATOR or reliable quality that performs the following functions:

A. Provides sweep outputs in the following frequency ranges:

19 to 30 Mc.	10 Mc. sweep width
40 to 90 Mc.	10 Mc. sweep width
170 to 225 Mc.	10 Mc. sweep width

B. Provides an output signal that can be varied by means of an attenuator up to a maximum of at least .1 volt.

SECOND: AN R.F. SIGNAL GENERATOR That will provide an adjustable output signal up to a maximum of at least .1 volt on the following fixed frequencies:

A. I.F. Frequencies

21.75 Mc.	Sound Trap
22.5 Mc.	1st Video I.F. Coil
25.25 Mc.	2nd Video I.F. Coil
24.25 Mc.	3rd Video I.F. Coil
23.25 Mc.	4th Video I.F. Coil
26.0 Mc.	5th Video I.F. Coil
26.25 Mc.	Picture I.F. Carrier
4.5 Mc.	Sound I.F. & Traps
27.75 Mc.	Adjacent Channel Sound Trap

B. R. F. Frequencies

Channel No.	Picture Carrier	Sound Carrier
2	55.25 Mc.	59.75 Mc.
3	61.25 Mc.	65.75 Mc.
4	67.25 Mc.	71.75 Mc.
5	77.25 Mc.	81.75 Mc.
6	83.25 Mc.	87.75 Mc.
7	175.25 Mc.	179.75 Mc.
8	181.25 Mc.	185.75 Mc.
9	187.25 Mc.	191.75 Mc.
10	193.25 Mc.	197.75 Mc.
11	199.25 Mc.	203.75 Mc.
12	205.25 Mc.	209.75 Mc.
13	211.25 Mc.	215.75 Mc.

THIRD: A CATHODE-RAY OSCILLOSCOPE of good quality that has a fairly wide band vertical amplifier and a low capacity input probe.

FOURTH: AN ELECTRONIC VOLTMETER with ranges to read 1V. DC, 10V. DC and 7V. AC at 400 cycles and 4.5 Mc.

FIFTH: A CRYSTAL CALIBRATOR that can be used for checks on the accuracy of the output frequencies of the R.F. signal generator.

GENERAL INSTRUCTIONS: Practically all servicing with the exception of some tube replacement will require removal of the receiver chassis from the cabinet.
A convenient arrangement that makes both the top and bottom of the chassis accessible for alignment and servicing can be realized by orienting the receiver chassis in such a manner that it rests on its side and on the horizontal output shield can.

ALIGNMENT REQUIREMENTS: Under normal conditions complete receiver realignment will seldom be necessary in the field. However, a detailed description of the overall alignment procedure is included to provide all necessary information if it should be required.

In general it is not recommended that the R.F. and the converter circuits of the R.F. tuner be realigned by the service engineer unless absolutely necessary. In cases where tuner components have been damaged or where complete realignment is indicated, the R.F. tuner assembly should be removed from the chassis and sent back to the factory in exchange for a new unit which will be shipped complete with tubes.

When the new R.F. unit is assembled to the chassis it will be necessary in all cases to realign L6 which is located on the tuner chassis. Normally this is the only adjustment that will be required with tuner change but a check on overall receiver alignment and sensitivity should be made for the sake of certainty and assured customer satisfaction.

EFFECTS OF TUBE REPLACEMENT ON THE ALIGNMENT OF R.F. TUNER CIRCUITS: The alignment of the R.F. and converter circuits of the R.F. tuner is critical and may be affected by a tube change. In cases where these tubes (6BK7 or 6J6) are replaced, it will be necessary for the service engineer to check for satisfactory receiver operation. If realignment is indicated it can usually be avoided by selection of replacement tubes until correct receiver operation is realized.

ORDER OF ALIGNMENT: When complete receiver realignment is indicated it should be performed in the following order:

1. Sound Traps
2. Picture I.F.
3. Sound I.F. and 4.5 Mc. Trap
4. Ratio Detecter Transformer
5. Retouch Picture I.F.
6. Sound and Picture I.F. Sensitivity Check
7. R.F. and Converter Circuits (not recommended)
8. Overall Sensitivity Check

PRELIMINARY ADJUSTMENTS: Before alignment the receiver controls should be adjusted to the approximated operation positions specified in the table below. The controls should remain in these positions for all checks unless otherwise specified.

Contrast Control	to maximum clockwise
Brightness Control	to position where raster is visible on the kinescope
Focus Control	to position where focus is obtained
Vertical Hold	to center position
Vertical Linearity	to center position
Vertical Size	adjusted to give normal raster height
Horizontal Hold	to center position
Horizontal Size	adjusted to give normal raster width

ALIGNMENT PROCEDURE

TEST EQUIPMENT SET UP: A certain amount of experimentation must be employed to secure a stable test set up before alignment or service of the receiver is attempted. It is recommended that the top of the test bench be covered with a sheet of aluminum to insure good grounds between the various pieces of test equipment and the receiver chassis. In general all test signal input leads should be kept away from output leads as much as possible.

SOUND TRAP ALIGNMENT: FIRST, Connect the R.F. signal generator to the grid of V-2 by means of the I.F. input adapter as shown in Figure 5.

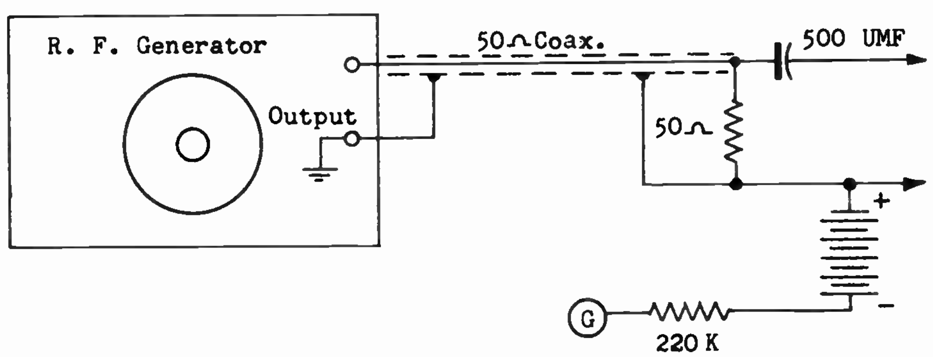


Figure 5 I.F. Input Adapter

ALIGNMENT PROCEDURE (CONT'D)

SECOND: Set the R.F. tuner to Channel #13.

THIRD: Connect a 4.5 volt bias battery between the A.G.C. buss (Point F. Fig. 2) and chassis ground so that the voltage on the A.G.C. buss is -4.5 volts in respect to the chassis. Remove A.G.C. tube (6AU6) V8.

FOURTH: Connect the electronic voltmeter across the picture detector load resistor R37, Point B, Fig. 2 and set the voltmeter on the low D.C. volt scale.

FIFTH: Set the R.F. signal generator to the frequency shown below and tune the specified adjustment for minimum indication on the voltmeter. It is advisable to check the output of the generator with the crystal calibrator to make certain that it is exactly on frequency.

21.75 Mc. L12 (Top of chassis as shown in Figure 3)

PICTURE I.F. ALIGNMENT: FIRST: Connect the R.F. signal generator, voltmeter and bias battery to the receiver as described in Steps 1, 2, 3 and 4 of the sound trap alignment instructions.

SECOND: Set the signal generator to each of the following frequencies and peak the specified adjustments for maximum indication of the voltmeter.

22.5 Mc.	L6	(Top of tuner as shown in Fig. 3)
25.25 Mc.	L13	(Top of chassis as shown in Fig. 3)
24.25 Mc.	L14	(Top of chassis as shown in Fig. 3)
23.25 Mc.	L15	(Top of chassis as shown in Fig. 3)
26.0 Mc.	L17	(Top of chassis as shown in Fig. 3)

SOUND I.F. ALIGNMENT: FIRST: Connect the R.F. signal generator to Point B, Fig. 2.

SECOND: Set the signal generator accurately to 4.5 Mc. This is very important because the picture and sound carriers sent out from the television stations are exactly 4.5 Mc. apart.

THIRD: Connect the electronic voltmeter across R65 from Point D to ground as shown in Fig. 2.
Set the voltmeter on the 10 volt scale.

FOURTH: Peak the following coils for maximum reading on the voltmeter.

L 27 Top of chassis as shown in Fig. 3.
T 6 Top of chassis as shown in Fig. 3.
Bottom of chassis as shown in Fig. 4.
T 7 (pri. Ratio Det) Top of chassis as shown in Fig. 3.

RATIO DETECTOR TRANSFORMER ALIGNMENT: FIRST: Connect the R.F. signal generator to the receiver as described in Step 1 of the Sound I.F. Alignment instructions.

SECOND: Connect the electronic voltmeter from Point E, Fig. 2 to ground.
Set the voltmeter on the lowest DC scale.

THIRD: Set the signal generator output to 4.5 Mc. Adjust the secondary of T7 (Bottom view of chassis as shown in Fig. 4). Notice that it is possible to produce a positive or negative voltage indication on the meter by varying this adjustment. As the voltage swings from positive to negative, adjust T7 for zero output as indicated by the voltmeter. This point is called zero ratio detector output and indicates correct alignment of T7 transformer. If the secondary of T7 is found to be way out of alignment it will be necessary to re-peak the primary as described in the preceeding section on sound I.F. alignment.

4.5 Mc. TRAP ALIGNMENT FIRST: Connect the R.F. signal generator as described in Step 1 of the sound I.F. alignment.

SECOND: Connect the electronic voltmeter from the cathode of the picture tube to ground (Point C Fig. 2)
The voltmeter must be capable of giving a reading at 4.5 Mc. at approximately 1 to 2 volts.

THIRD: Peak L22 (Top of chassis as shown in Fig. 3) for minimum output on the voltmeter.

PICTURE I.F. TOUCH UP: Connect the R.F. sweep generator output to the grid of V-2 by means of the I.F. input adapter shown in Figure 5.

SECOND: Apply bias to A.G.C. line as described in Step 3 of sound trap alignment. Set R.F. selector to Channel #13.

ALIGNMENT PROCEDURE (CONT'D)

THIRD: Connect the oscilloscope across the picture detector load resistor R37 (Point B Fig. 2) by means of the shielded cable and the filter system shown in Figure 6.

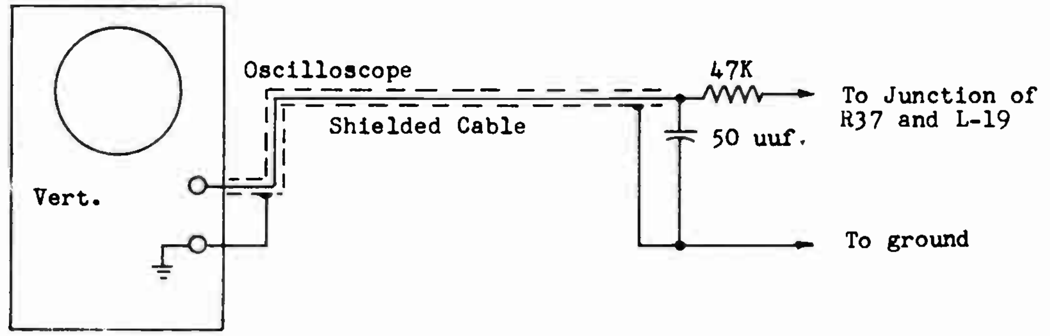


FIGURE 6 FILTER SYSTEM FOR SCOPE CONNECTION

FOURTH: Set the R.F. sweep generator so that it sweeps from approximately 20 to 30 Mc.

FIFTH: Adjust the oscilloscope so that the swept I.F. response is visible on the cathode-ray tube screen.

SIXTH: Loosely couple the output of the R.F. signal generator to the grid of V-2 so that the marker signals of proper frequency can be mixed in with the R.F. sweep signal.

SEVENTH: Observe the band width, relative position of the picture carrier, and flatness of the overall I.F. response curve. If necessary slightly vary the tuning of the picture I.F. coils L6, L13, L14, L15, L17 until the picture I.F. response shown in Figure 7 is obtained. The solid curve in Figure 7 depicts the ideal I.F. response while the dotted curves shown permissable variations.

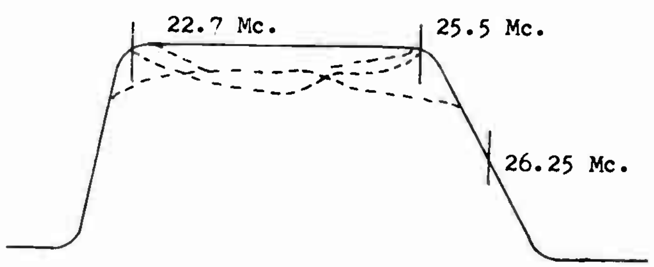


FIGURE 7 IDEAL I.F. RESPONSE WITH PERMISSABLE VARIATIONS

The picture I.F. carrier should appear approximately half way down the I.F. response curve as shown in Figure 7. Variation in the pix carrier position should not exceed ±10% from the half way point.

PICTURE I.F. SENSITIVITY CHECK: FIRST: Connect the R.F. signal generator to the receiver as specified in Steps 1 and 2 of the sound trap alignment instructions. (When making sensitivity checks no bias battery is connected to the A.G.C. buss.)

SECOND: Connect the electronic voltmeter across the picture detector load resistor R37 Point B, Fig. 2 and set the meter on the low D.C. volts scale.

THIRD: Set the generator output frequency at approximately 23 Mc. Adjust the generator output until the voltmeter reads approximately 1.0 volt. Record the R.F. signal input in microvolts. Repeat the procedure with the generator output frequency set at 24.2 and 25.4 Mc. In all cases the I.F. input voltage should be 100 Microvolts or less. The sensitivity at the I.F. picture carrier 26.25 Mc. should be approximately half of the I.F. Sensitivity between 24.- Mc. (Maximum of 100 microvolts.)
If the generator output is not calibrated in microvolts, comparative sensitivity measurements can be made by using another receiver that is known to be in good operating condition as a standard. This applies to all sensitivity measurements and good results can be obtained if sufficient care is used.

R.F. TUNER (S.W. CO. PART NO. PD93158)

Sparton chassis type 25D173A is equipped with a standard coil R.F. tuner (Series 2000). With exception to L-6 slug (22.5 Mc.) as shown in Fig. 3, field alignment for this tuner has been purposely omitted from the alignment procedure. Factory experience dictates that this unit can not be properly aligned in the field as special test equipment is required. Therefore any R.F. tuner adjustment in the field should be held to a minimum.

Field Alignment for Standard Coil Tuners has appeared in some set manufacturers service manuals; it is not recommended by our Engineering Department.
After receiver analysis proves the R.F. tuner to be defective, and in need of realignment, the complete tuner assembly (with tubes) should be returned to our Factory Service Department for repair or replacement.

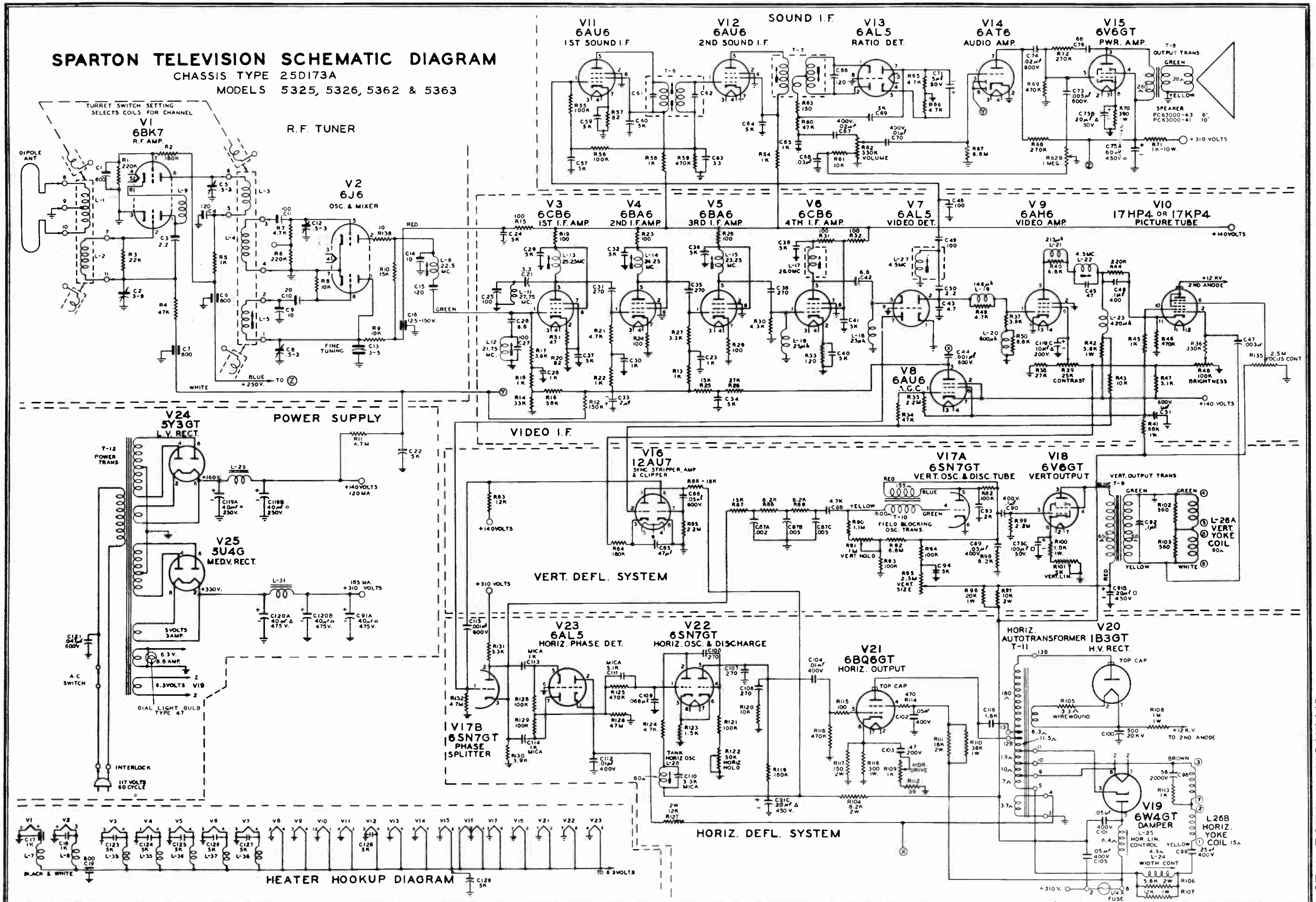
DESCRIPTION			PART NO.
Condenser	-	C21 3.3 MMF. Ceramic	PA4326-4
Condenser	-	C22,24,29,32,34,36 37,39,40,41,57,59 60,64,69,94,123,124 125,126,127,128,129 5K Ceramic	PA4334-1
Condenser	-	C23,28,30,65 1K Ceramic	HK36M-102
Condenser	-	C26,42 6.8 MMF. Ceramic	PA4328-13
Condenser	-	C25,27,48,49 100 MMF.Ceramic	PA4332-3
Condenser	-	C31,35,38 270 MMF. Ceramic	HK36M-271
Condenser	-	C33 2 MFD. Elect.	PA4303-14
Condenser	-	C43 4.7 MMF. Ceramic	PA4328-11
Condenser	-	C44 .001 MFD. 600V. Tubular	PC42GM-102
Condenser	-	C45 47 MMF. Ceramic	CC30A-470F
Condenser	-	C46,90 .1 MFD. 400V. Tubular	PC40GL-104
Condenser	-	C47 .003 MFD. 600V. Tubular	PC40GM-302
Condenser	-	C50 2.2 MMF. Ceramic	PA4326-1
Condenser	-	C51 .1 MFD. 600V. Tubular	PC40GM-104
Condenser	-	C63 33 MMF. Mica	MC60E-330
Condenser	-	C66 120 MMF. Ceramic	PA4332-4
Condenser	-	C67,74 .02 MFD. 400V. Tubular	PC40HL-203
Condenser	-	C68 .03 MFD. 200V. Tubular	PC40GK-303
Condenser	-	C70 .01 MFD. 400V. Tubular	PC40HL-103
Condenser	-	C71 5 MFD. 50V. Elect.	PA4308-2
Condenser	-	C73 .005 MFD. 600V. Tubular	PC40GM-502
Condenser	-	C75A,B & C 80-20-100 MFD. Elect.	PA4307-23
Condenser	-	C76 68 MMF. Mica	MC60E-680
Condenser	-	C85 .47 MFD. 200V. Tubular	PC42DK-474
Condenser	-	C86 .05 MFD. 600V. Tubular	PC40GM-503
Condenser	-	C87A,B & C Herlec Ceramic	PA4339-4
Condenser	-	C88 4.7K Mica	MC61F-472
Condenser	-	C89,101,105 .05 MFD. 400V.Tubular	PC40GL-503
Condenser	-	C91A,B & C 40-20-20 MFD. Elect.	PA4307-22
Condenser	-	C92 .1 MFD. 200V. Tubular	PC42GK-104
Condenser	-	C93 2K Mica	MC61E-202
Condenser	-	C98, 118 56 MMF. 2KV. Ceramic	PA4334-5
Condenser	-	C99 .25 MFD. 400V. Tubular	PC40GL-254
Condenser	-	C100 500 MMF. 20KV. Ceramic	PA4342-2
Condenser	-	C102 .05 MFD. 400V. Tubular	PC40HL-503
Condenser	-	C103 47 MFD. 200V. Tubular	PC42GK-474
Condenser	-	C104 .01 MFD. 400V. Tubular	PC40GL-103
Condenser	-	C106,107,108 270 MMF. Mica	MC60E-271
Condenser	-	C109 .068 MFD. 200V. Tubular	PA4324-2
Condenser	-	C110 3.3K Mica	MC63F-332
Condenser	-	C111 5.1K Mica	MC61E-512
Condenser	-	C112 .01 MFD 400V. Tubular	PC40FL-103
Condenser	-	C113,114 1K, Mica	MC61E-102
Condenser	-	C115 .001 MFD. 600V. Tubular	PC42GM-102
Condenser	-	C119A,B & C 40-40-10 MFD. Elect.	PA4307-21
Condenser	-	C120A & B 40-40 MFD. Elect.	PA4307-13
Condenser	-	C121 .047 MFD. 600V. Tubular	PA4346-1
R39	-	Control-Contrast (25K) } Dual	PA4457-1
R48	-	Control-Brightness (100K) }	
R62A & B	-	Control-Volume & Tone (Dual)	PA4450-1
R91	-	Control-Vert. Hold (1 Meg) } Dual	PA4456-1
R122	-	Control-Hor. Hold (50 K) }	
R95	-	Control-Vert. Size (2.5 Meg)	PA4454
R101	-	Control-Vert. Lin. (5K)	PA4411
R109	-	Control-Hor. Drive	PA4446
R135	-	Control-Focus (2.5 Meg.)	PA4454

WHEN ORDERING PARTS ALWAYS SPECIFY PART NUMBER AND MODEL FOR WHICH PART IS INTENDED

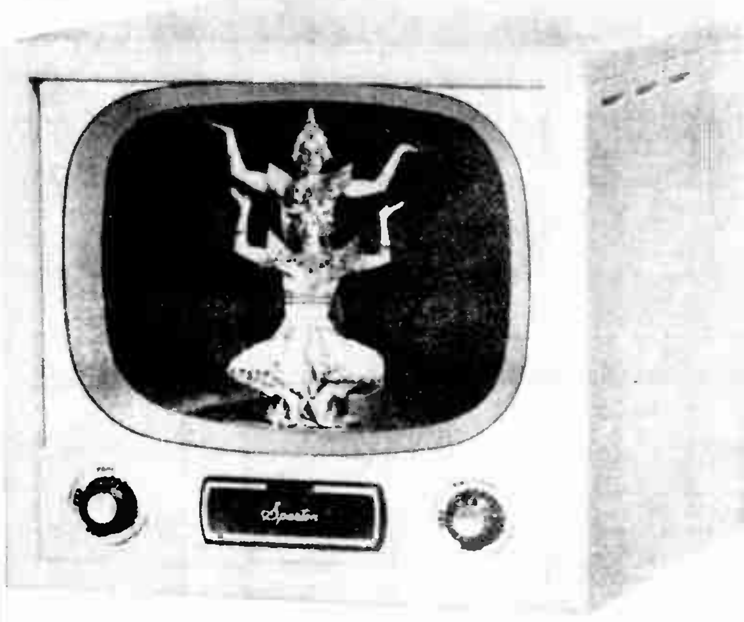
	DESCRIPTION		PART NO.
	L-11	Coil - 27.75 Mc. Trap	AB43523-13
	L-12	Coil - 21.75 Mc. Trap	AB43523-12
	L-13	Coil - 25.25 Mc. P.I.F. (1)	AA6408-1
	L-14	Coil - 24.25 Mc. P.I.F. (2)	AA6408-1
	L-15	Coil - 23.25 Mc. P.I.F. (3)	AA6408-1
	L-16	Choke- 25 uh	AA6650-1
	L-17	Coil - 26.0 Mc. P.I.F.	AA6364-1
	L-18	Choke- 25 uh.	AA6650-1
	L-19	Choke- 150 uh.	AA6402-6
	L-20	Choke- 300 uh.	AA6613-8
	L-21	Choke- 220 uh.	AA6402-7
	L-22	Coil - 4.5 Mc. Trap	AA6407-1
	L-23	Choke- 420 uh.	AA6613-10
	L-24	Width Control	AA6400-4
	L-25	Horiz. Linearity	AA6400-5
*	L-26A & B	Coil- Vert. & Horiz. Yoke	PC70016
	L-27	Coil- 4.5 Mc. Trap	AA6364-2
	L-28	Coil- Horiz. Osc.	AA6410-1
	L-29	Choke-Filter (145V.)	AB47009-1
	L-31	Choke-Filter (Hi-V.)	AB47009-1
	L-33,35,36,37 & 38	Choke-Heater	AA6651-1
	T-6	Transformer- Sound I.F.	AA6667-5
	T-7	Transformer- Ratio Det.	AA6684-4
	T-8	Transformer- Audio Output	AB44066-3
	T-9	Transformer- Vert. Output	AB44062-7
	T-10	Transformer- Vert. Block Osc.	AB47006-4
	T-11	Transformer- Horiz. Auto.	PC70015
	T-12	Transformer- Power	AB44030-1
**	R.F. Tuner Assembly (Cascode)		PD93158
	Kinescope (17HP4)		PD93167-1 & 16
	Kinescope (17KP4)		PD93168-11
	Ion Trap		PA1248-4
	Fuse 1/4 Amp.		PA4212-1
	Knob-Inf. Control - Inner	(Models 5325 & 5362)	PA5659-1
	Knob-Inf. Control - Inner	(Models 5326 & 5363)	PA5659-2
	Knob-Inf. Control - Outer	(Models 5325 & 5362)	PA5660-1
	Knob-Inf. Control - Outer	(Models 5326 & 5363)	PA5660-2
	Knob-Tone Control -	(Models 5325 & 5362)	PB40364-1
	Knob-Tone Control -	(Models 5326 & 5363)	PB40364-2
	Knob-Fine Tuning -	(Models 5325 & 5362)	PB40363-1
	Knob-Fine Tuning -	(Models 5326 & 5363)	PB40363-2
	Knob-Channel Tuning	(Models 5325 & 5362)	AB43593-1
	Knob-Channel Tuning	(Models 5326 & 5363)	AB43593-2
	Knob-Off-On-Volume	(Models 5325 & 5362)	AB43594-1
	Knob-Off-On-Volume	(Models 5326 & 5363)	AB43594-2
	Sparton Emblem		PB40359
	Mask (Models 5362 & 5363)		PD93035-3
	Mask (Models 5325 & 5326)		PD93035-4
	Safety Glass	(Models 5325 & 5326)	PD93046-1
	Safety Glass	(Models 5362 & 5363)	PD93045-1
	Safety Screen	(Models 5325 & 5326)	PB40209-8
**	Speaker-6" Round		PC63000-43
**	Speaker-10" Round		PC63000-41

* Deflection Yoke Coil PC70016 supplied only as complete assembly.

** Complete speaker & R.F. Tuner Assemblies may be returned to Factory Service Department for repair or replacement.



SPARTON TV PAGE 12-23



Sparton HASTINGS
MODEL 5225A MAHOGANY VENEER
MODEL 5226A BLONDE MAHOGANY
17 INCH TABLE TELEVISION

Sparton ROXBURY
MODEL 5270A MAHOGANY VENEER
17 INCH TELEVISION CONSOLE

PARTS LIST

DESCRIPTION	PART NO.
Condenser - C33 .47 MFD. 200V. Tubular	PC42DK-474
Condenser - C118 .25 MFD. 400V. Tubular	PC40GL-254
R39 - Control- contrast (25K)	PA4442-3
R48 - Control- Brightness (100K)	PA4445-2
R91 - Control- Vert. Hold (1 Meg.)	PA4443-2
R122 - Control- Hor. Hold (50K)	PA4444-2
L39 - Choke	AB47010-1
T12 - Transformer- Power	AB44025-1
T13 - Transformer- Filament	AB44020-1
Knob - Infrequent Adj.	PA5651
Knob - Volume Control	PB40329
Knob - Tone Control	PB40347
Knob - Channel Tuner	PB40332
Knob - Fine Tuning	PB40346
Sparton Script	PA5842
Infrequent Control Cover Assy.	AB43582-1
Mask (Models 5225A & 5226A)	PD93035-4
Mask (Model 5270A)	PD93035-3
Safety Glass (Model 5225A)	PD93046-1
Safety Glass (Model 5226A)	PD93046-2
Safety Glass (Model 5270A)	PD93045-1
Safety Screen (Models 5225A & 5226A)	PB40209-11

* Speaker-6" Round	PC63000-43
* Speaker-10" Round	PC63000-41

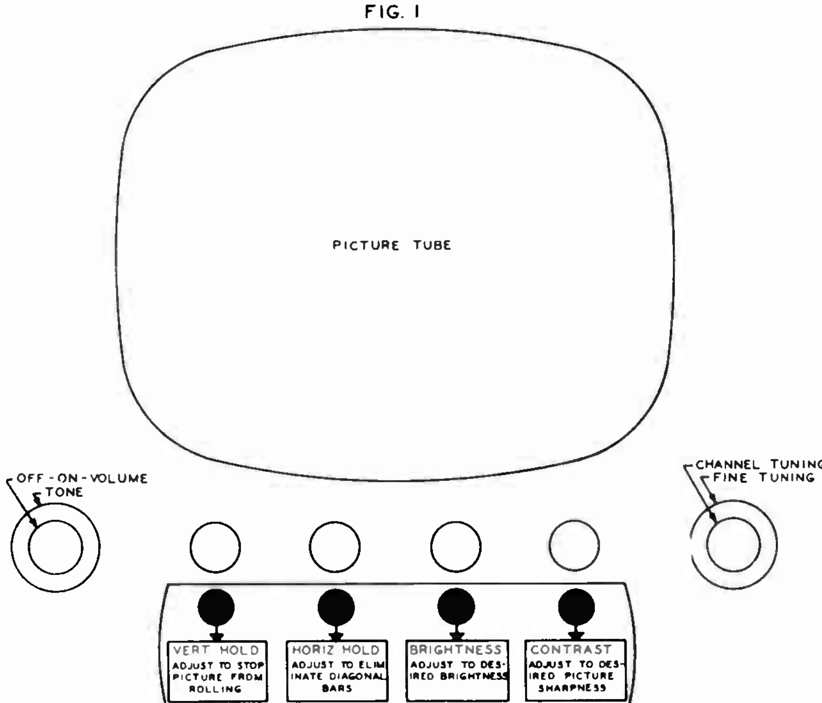
* Complete Speaker Assemblies may be returned to Factory Service Department for repair or replacement.

NOTE: For complete parts lists for electrical components, refer to Ch. 25D173A.

BRIEF DESCRIPTION

Television chassis type 25D173 is a twenty-five tube "Deluxe" chassis with a self-contained power supply, an electro-static type focusing system and uses either a 17KP4 or 17HP4 picture tube. The infrequent controls are concealed by the small trap door on the instrument panel, however, as noted above this chassis is related very closely to chassis type 25D173A.

CONTROL POSITIONS AND FUNCTIONS
FIG. 1



Sparton WHITNEY
MODEL 5207A MAHOGANY
17 INCH TABLE TELEVISION

DESCRIPTION

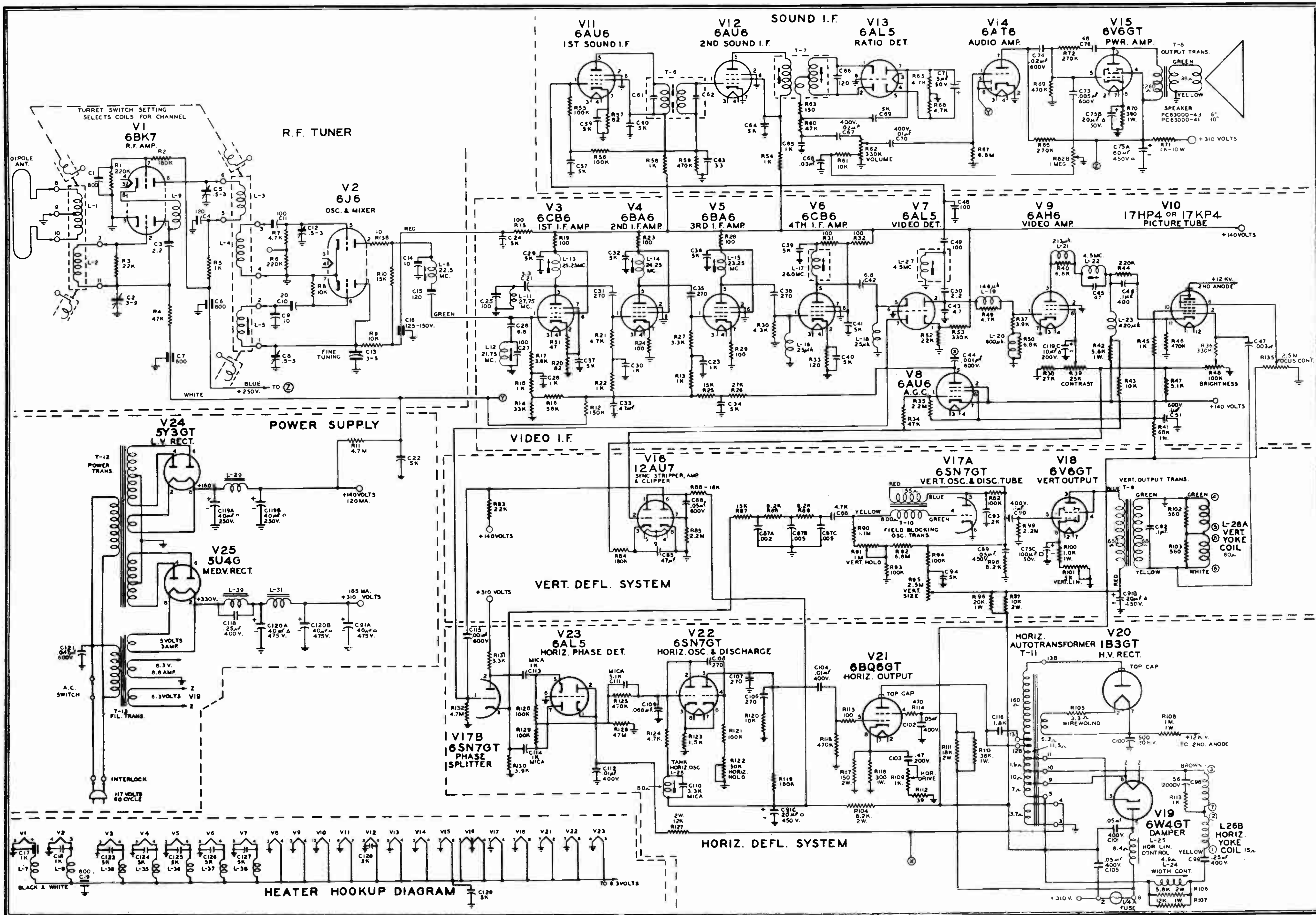
Chassis type 25S172 is a 17", 25 tube receiver with most electrical characteristics identical to that of chassis type 25D173.

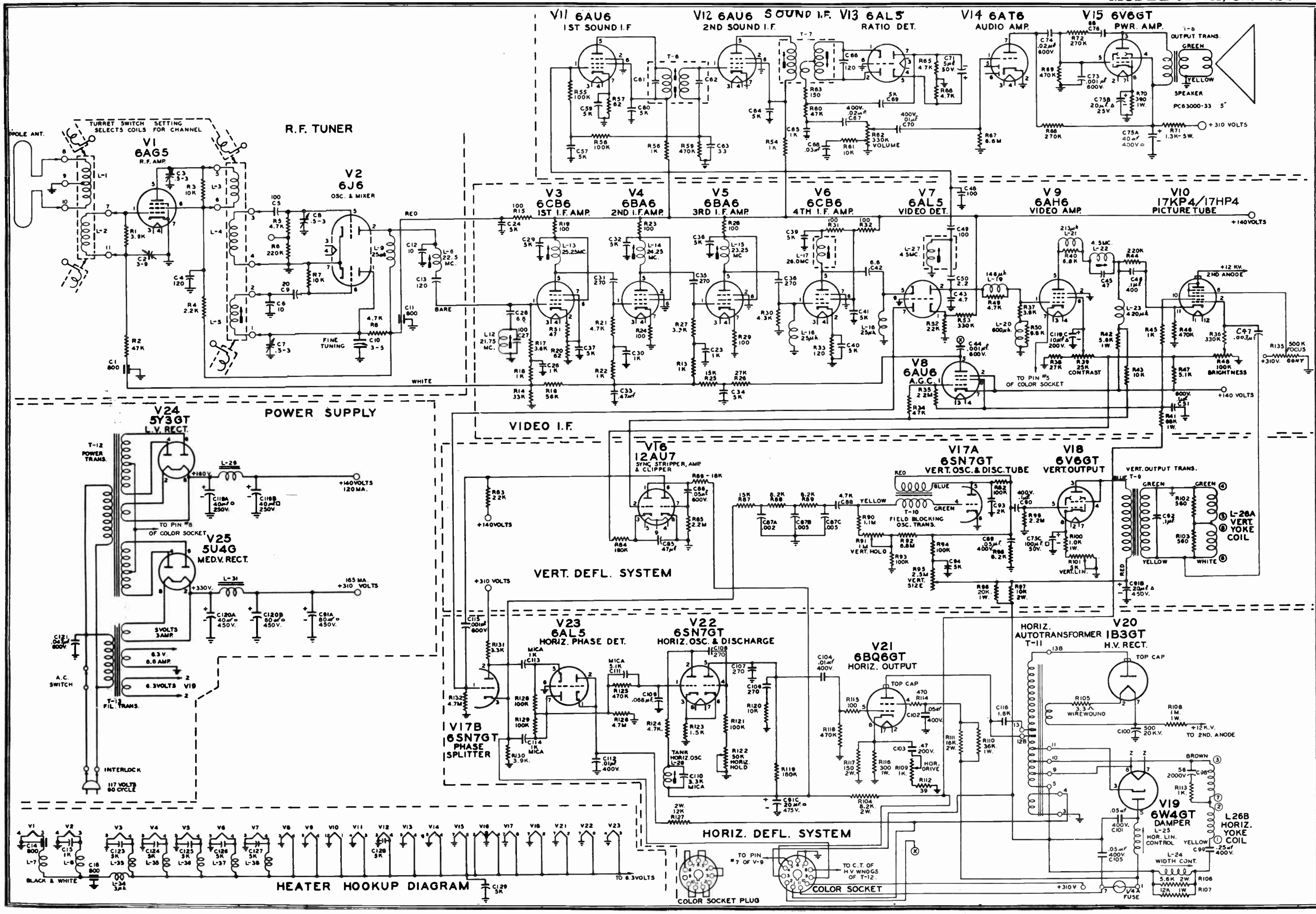
PART LIST

*R.F. Tuner	PD93157
Kinescope 17PP4 & 17HP4	PD93167-1-16
	PD93168-11
Ion Trap	PA1248-4
Condenser - C73 600V. Tubular	PC40GM-102
Condenser - C75A,B & C 40-20-100 MF. Elect.	PA4307-26
Condenser - C91A,B & C 60-20-20 MF. Elect.	PA4307-28
Condenser - C120 A & B 40-60 MF. Elect.	PA4307-27
R62 Volume Control	PA4436-3
L-12 Trap	AB43523-14
L-34 R.F. Choke	AA6651-1
T-12 Power	AB44023-1
Mask	PD93035-2
Safety Glass	PD93036-1
Knob-Infrequent Control Adjustment	PA5651
Knob-Volume Control	PB40339
Knob-Channel Tuner	PB40340
Knob-Fine Tuning	PB40333-1
*Speaker 5" Round	PC63000-33

*Complete speaker & R.F. Tuner Assemblies may be returned to Factory Service Dept. for repair or replacement.

NOTE: For complete parts list, see Chassis 25D173A


SOUND I.F.
V11 6AU6 1ST SOUND I.F.
V12 6AU6 2ND SOUND I.F.
V13 6AL5 RATIO DET.
V14 6AT6 AUDIO AMP.
V15 6V6GT PWR. AMP.
T-8 OUTPUT TRANS.
SPEAKER PC63000-43 6" PC63000-41 10"
TURRET SWITCH SETTING SELECTS COILS FOR CHANNEL
R.F. TUNER
V1 6BK7 R.F. AMP.
DIPOLE ANT.
V2 6J6 OSC. & MIXER
FINE TUNING
V3 6CB6 1ST I.F. AMP
V4 6BA6 2ND I.F. AMP.
V5 6BA6 3RD I.F. AMP.
V6 6CB6 4TH I.F. AMP.
V7 6AL5 VIDEO DET.
V9 6AH6 VIDEO AMP.
V10 17HP4 OR 17KP4 PICTURE TUBE
+12 KV 2ND ANODE
FOCUS CONT.
BRIGHTNESS
CONTRAST
V8 6AU6 A.G.C.
VIDEO I.F.
POWER SUPPLY
V24 5Y3GT L.V. RECT.
T-12 POWER TRANS.
+140 VOLTS 120 MA.
V25 5U4G MED.V. RECT.
185 MA. +310 VOLTS
A.C. SWITCH
T-13 FIL. TRANS.
INTERLOCK
117 VOLTS 60 CYCLE
V16 12AU7 SYNC STRIPPER, AMP & CLIPPER
V17A 6SN7GT VERT. OSC. & DISC. TUBE
V18 6V6GT VERT. OUTPUT
VERT. OUTPUT TRANS. T-9
T-10 FIELD BLOCKING OSC. TRANS.
L-26A VERT. YOKE COIL
VERT. HOLD
VERT. SIZE
VERT. LIN.
VERT. DEFL. SYSTEM
V23 6AL5 HORIZ. PHASE DET.
V22 6SN7GT HORIZ. OSC. & DISCHARGE
V21 6BQ6GT HORIZ. OUTPUT
HORIZ. AUTOTRANSFORMER T-11
V20 1B3GT H.V. RECT.
V17B 6SN7GT PHASE SPLITTER
TANK HORIZ OSC L-26
HORIZ. HOLD
HOR. DRIVE
TO 2ND. ANODE
V19 6W4GT DAMPER
L-25 HOR. LIN. CONTROL
L-24 WIDTH CONT.
L26B HORIZ. YOKE COIL
HORIZ. DEFL. SYSTEM
HEATER HOOKUP DIAGRAM
TO 6.3 VOLTS


R.F. TUNER
V1 6AG5 R.F. AMP.
V2 6J6 OSC. & MIXER
SOUND I.F.
V11 6AU6 1ST SOUND I.F.
V12 6AU6 2ND SOUND I.F.
V13 6AL5 RATIO DET.
V14 6AT6 AUDIO AMP.
V15 6V6GT PWR. AMP.
SPEAKER PC63000-33 5"
V3 6CB6 1ST I.F. AMP.
V4 6BA6 2ND I.F. AMP.
V5 6BA6 3RD I.F. AMP.
V6 6CB6 4TH I.F. AMP.
V7 6AL5 VIDEO DET.
V9 6AH6 VIDEO AMP.
V10 17KP4/17HP4 PICTURE TUBE
V8 6AU6 A.G.C.
VIDEO I.F.
POWER SUPPLY
V24 5Y3GT L.V. RECT.
V25 5U4G MED.V. RECT.
V16 12AU7 SYNC. STRIPPER, AMP & CLIPPER
V17A 6SN7GT VERT. OSC. & DISC. TUBE
V18 6V6GT VERT. OUTPUT
VERT. DEFL. SYSTEM
L-26A VERT. YOKE COIL
V17B 6SN7GT PHASE SPLITTER
V23 6AL5 HORIZ. PHASE DET.
V22 6SN7GT HORIZ. OSC. & DISCHARGE
V21 6BQ6GT HORIZ. OUTPUT
V20 1B3GT H.V. RECT.
HORIZ. AUTOTRANSFORMER T-11
V19 6W4GT DAMPER
L26B HORIZ. YOKE COIL
HORIZ. DEFL. SYSTEM
HEATER HOOKUP DIAGRAM
COLOR SOCKET PLUG
COLOR SOCKET
117 VOLTS 60 CYCLE

Sparton GRAMERCY
MODEL 5262 MAHOGANY
MODEL 5263 BLONDE
17 INCH TELEVISION CONSOLE

Sparton WHITNEY
MODEL 5207 MAHOGANY
MODEL 5208 BLONDE
17 INCH TABLE TELEVISION

BRIEF DESCRIPTION

TELEVISION CHASSIS TYPE 26SS172 is a twenty-six tube standard chassis with a self-contained power supply, an Electro-magnet type focusing system, and uses a 17BP4A picture tube. This chassis is equipped with the Sparton Ultra-Tuner for superior long-range reception. The Ultra-Tuner will receive telecasts on all present channels and, with the insertion of simple tuner strips on new U.H.F. channels.

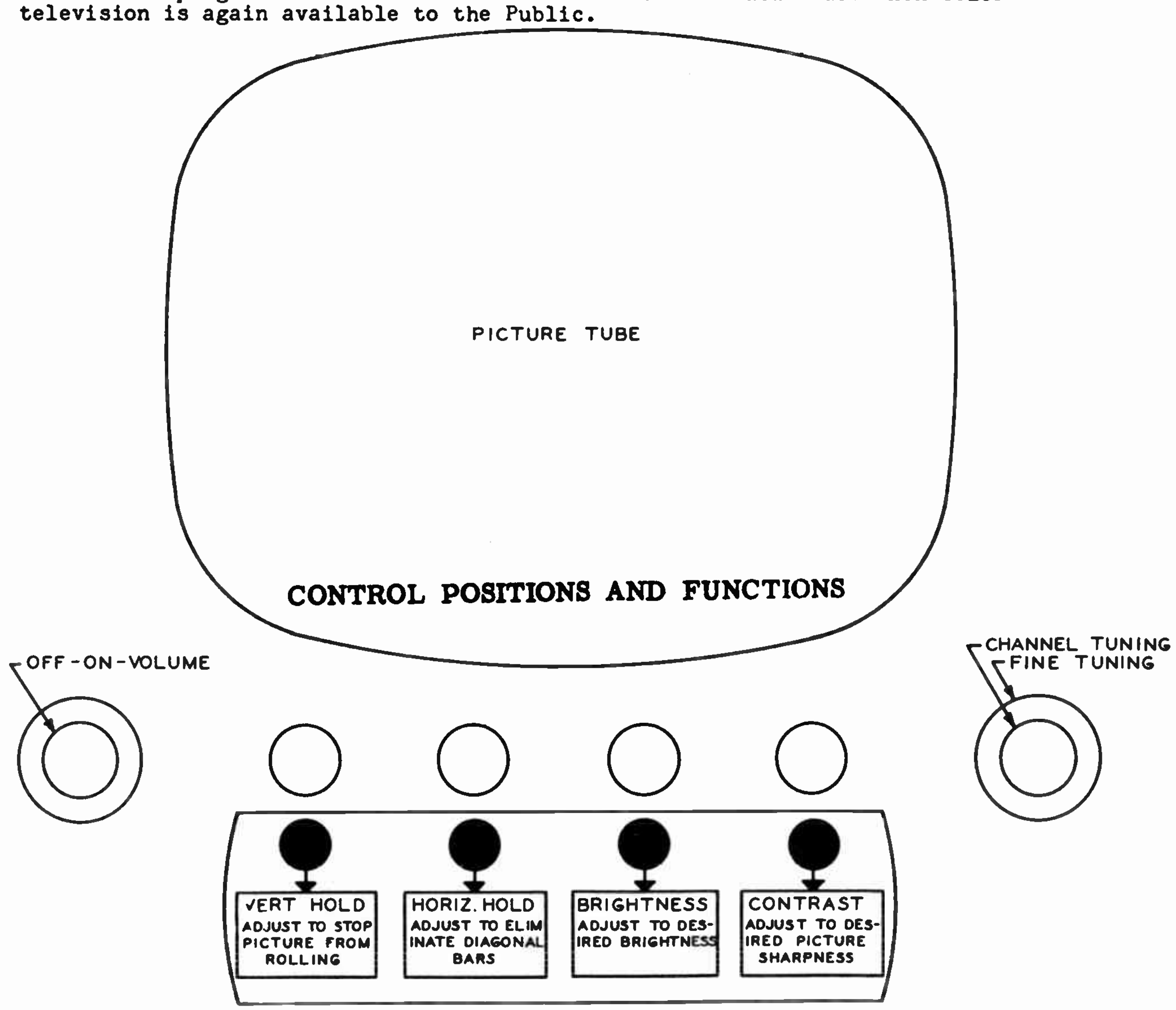
TELEVISION CHASSIS TYPE 26SS172A is equipped as described above, however, relocation of both the operating and non-operating controls accounts for the difference in chassis type designation.

NOTE: For the reason stated above this chassis may not be interchanged with chassis type 26SS172.

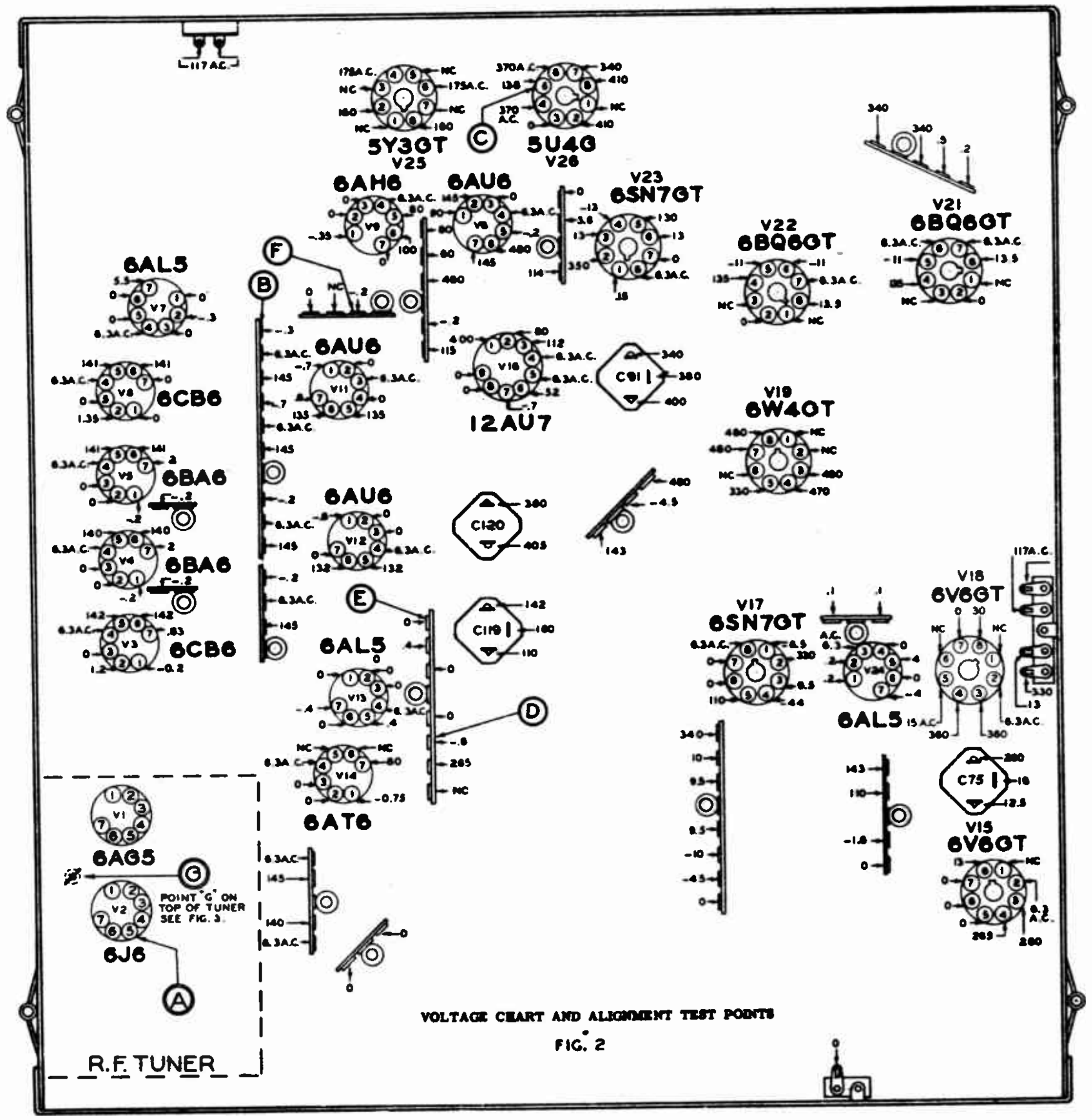
SPECIAL NOTE

Initial production of the above chassis included a color socket, which thru use of a convertor, would have permitted the reception of color television. National Production Authority Order M-90 prohibited the use of such a device, therefore, in order to conform to the terms of Order M-90 the use of the color socket was discontinued. However the accompanying Schematic diagram includes the hook-up of the color socket.

A knock-out plug has been retained in the chassis for future use when color television is again available to the Public.



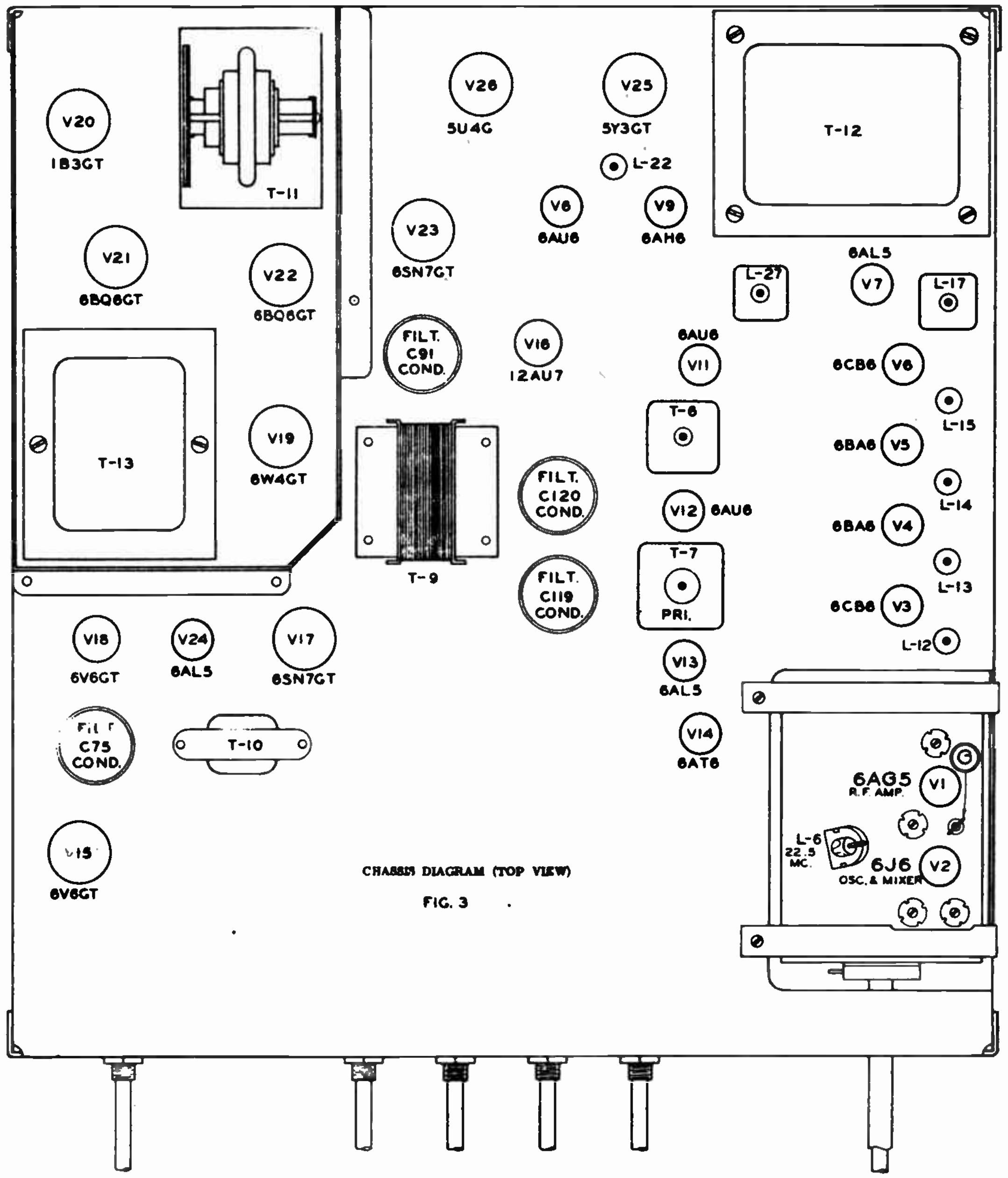
VOLTAGE CHART AND ALIGNMENT TEST POINTS



VOLTAGE CHART AND ALIGNMENT TEST POINTS

FIG. 2

CHASSIS TYPE 26SS172 & 26SS172A



CHASSIS DIAGRAM (TOP VIEW)

FIG. 3

VOLTAGE TEST SPECIFICATIONS

1. Line Voltage = 117 Volts A.C.
2. Channel Switch Position = Channel #2.
3. Brightness Control Position = Maximum Brilliance on Picture Tube.
4. Contrast Control Position = Maximum (Clockwise).
5. Horizontal and Vertical Hold Control Positions = Set correct position to lock in picture.
6. Horizontal width and Vertical Size Controls Positions = Set for Maximum Size.
7. Vertical Linearity Control Position = Set for Best Linearity.
8. Focus Control Position = Properly focused.
9. Volume Control Position = Maximum Counter-Clockwise.
10. Tone Control Position = Maximum Counter-Clockwise.
11. Instrument (Meter) used = (V.T.V.M.) Vacuum Tube Volt Meter.
12. No signal input applied to set.
13. Unless otherwise Designated All Voltages Measured In Respect To Chassis Ground.

NOTE: The points indicated by the letters A, B, C, D, E, F & G are the alignment test points referred to in the following alignment procedure. These points indicate the terminals for attaching Generator Leads and are shown in Figure 2.

(A) Pin #5 of V2 (6J6) osc. & Mixer Tube.
Apply signals here for spot I.F. alignment or I.F. sweep.

(B) Diode Load Resistor
Read D.C. output here for spot I.F. alignment.
Connect scope here for visual I.F. alignment.
Apply 4.5 Mc. here for sound I.F. trap alignment

(C) Cathode Of Picture Tube
Read A.C. output here for overall sensitivity.
Read 4.5 Mc. output here for aligning 4.5 Mc. trap.

(D) Ratio Det. Output
Read D.C. here for alignment of sound take-off trap, inter-stage sound I.F. transformer and primary of Ratio Det. Trans.

(E) Ratio Det. Balanced Output
Read D.C. here for alignment of secondary of Ratio Det. Trans.

(F) A.G.C. Line
Apply 4.5 volts bias here for visual check of I.F. or overall with oscilloscope.

(G) Apply minus 3 volts through 220K Ohms to test terminal, located between the tubes on top of R.F. Tuner (See Fig. 3).

ELECTRICAL AND MECHANICAL SPECIFICATIONS

R. F. FREQUENCY RANGE

Channel Number	Channel Freq.Mc.	Picture Carrier Freq.Mc.	Sound Carrier Freq.Mc.	Receiver R.F. Osc. Freq.Mc.
2	54-60	55.25	59.75	81.5
3	60-66	61.25	65.75	87.5
4	66-72	67.25	71.75	93.5
5	76-82	77.25	81.75	103.5
6	82-88	83.25	87.75	109.5
7	174-180	175.25	179.75	201.5
8	180-186	181.25	185.75	207.5
9	186-192	187.25	191.75	213.5
10	192-198	193.25	197.75	219.5
11	198-204	199.25	203.75	225.5
12	204-210	205.25	209.75	231.5
13	210-216	211.25	215.75	237.5

POWER SUPPLY RATING

117 Volts...............60 Cycles...250 Watts

AUDIO POWER OUTPUT RATING

Maximum Undistorted..................2.5 Watts

LOUD SPEAKERS

Model 5207 & 5208.....................5"P.M.Round
Models 5262 &5263.....................10"P.M.Round
Voice Coil Impedance...3.2 Ohms @ 400 Cycles

PICTURE I.F. FREQUENCIES

Picture Carrier Frequency........26.25 Mc.
Accompanying Sound Traps.........21.75 Mc.

SOUND I.F. FREQUENCIES

Sound Carrier Frequency.......... 4.5 Mc.
Sound Discriminator Band Width
(Between Peaks)..................200 Kc.
Video Response...................to 4 Mc.
Focus............................Magnetic
Sweep Deflection.................Magnetic
Scanning.....Interlaced 525 Lines
Horizontal Scanning Frequency.....15,750 Cps.
Vertical Scanning Frequency...........60 Cps.
Frame Frequency (Picture Repetition Rate)
30 Cps.
Receiver Antenna Input Impedance.....300 Ohms
Balanced

TUBE COMPLEMENT

TUBE	TYPE	FUNCTION
V1	6AG5	R.F. Amplifier
V2	6J6	Osc. & Mixer
V3	6CB6	1st I.F. Amplifier
V4	6BA6	2nd I.F. Amplifier
V5	6BA6	3rd I.F. Amplifier
V6	6CB6	4th I.F. Amplifier
V7	6AL5	Video Detector
V8	6AU6	A.G.C.
V9	6AH6	Video Amplifier
V10	17BP4A	Picture Tube
V11	6AU6	1st Sound I.F.
V12	6AU6	2nd Sound I.F.
V13	6AL5	Ratio Detector
V14	6AT6	Audio Amplifier
V15	6V6GT	Power Amplifier
V16	12AU7	Sync.Strip. Amp. & Clipper
V17	6SN7GT	Vert. Osc. Disc.& Phase Splitter
V18	6V6GT	Vertical Output
V19	6W4GT	Damper Tube
V20	1B3GT	Hi-Voltage Rectifier
V21	6BQ6GT	Horizontal Output
V22	6BQ6GT	Horizontal Output
V23	6SN7GT	Horiz. Osc. & Disc. Tube
V24	6AL5	Horiz. Phase Detector
V25	5Y3GT	Lo-Voltage Rectifier
V26	5U4G	Med. Voltage Rectifier

OPERATING CONTROLS LOCATED ON FRONT PANEL

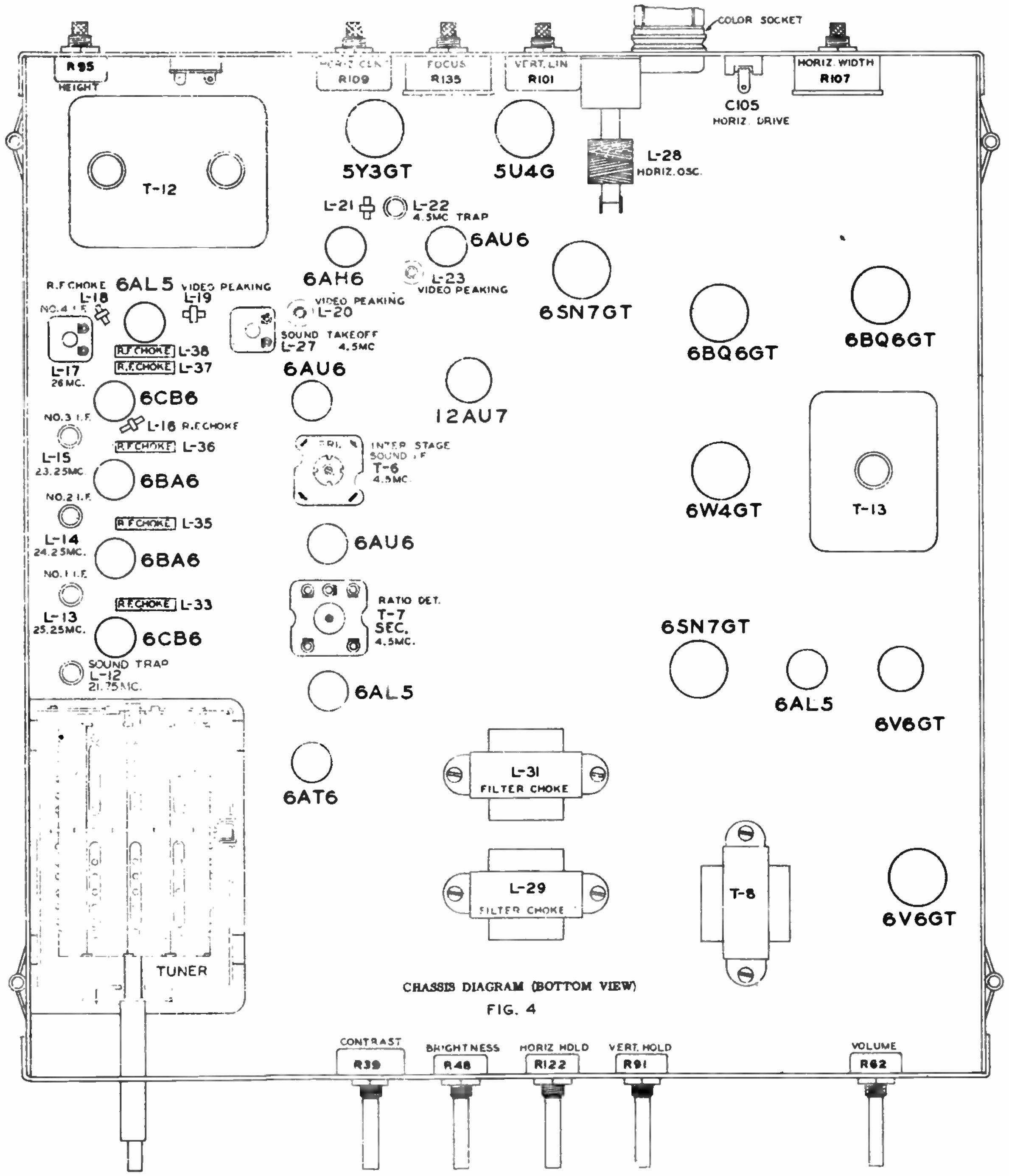
Volume..............
Vertical Hold.......
Horiz. Hold.........
Brightness..........
Contrast............
Channel Tuning......
Fine Tuning.........

NON-OPERATING CONTROLS

(Not Including R.F. & I.F. Adjust)
Chassis 26SS172 Chassis 26SS172A

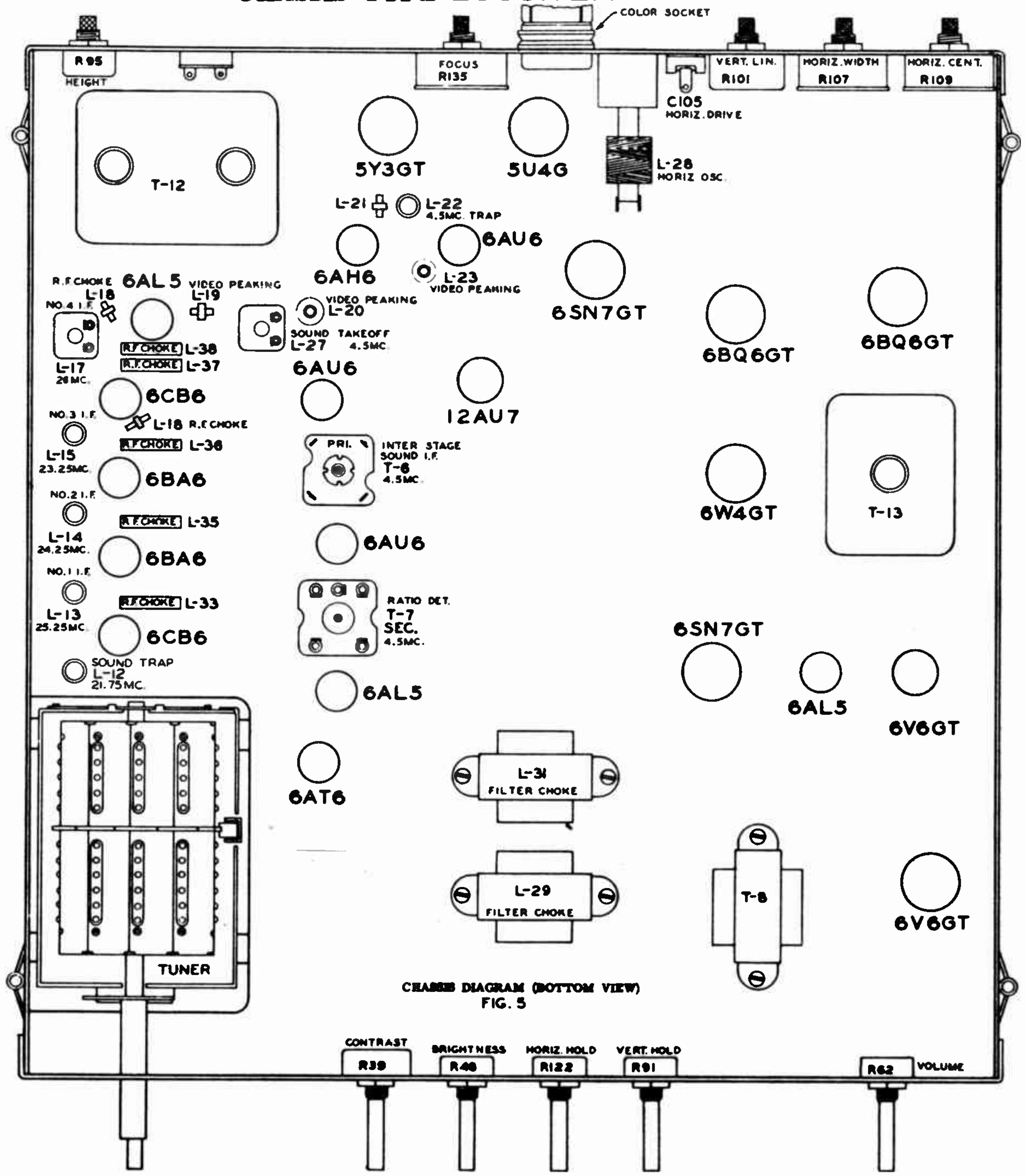
Focus........
Vert. Size...
Vert. Lin....
Horiz.Width..
Horiz.Cent...
Horiz.Drive..
Horiz.Osc....
Defl. Coil...

CHASSIS TYPE 26SS172



CHASSIS DIAGRAM (BOTTOM VIEW)
FIG. 4

CHASSIS TYPE 26SS172A



CHASSIS DIAGRAM (BOTTOM VIEW)
FIG. 5

ALIGNMENT EQUIPMENT AND TEST SET UP

TEST EQUIPMENT: In order to align and service Sparton television receivers properly the following test equipment should be available:

FIRST: AN R.F. SWEEP GENERATOR of reliable quality that performs the following functions:

A. Provides sweep outputs in the following frequency ranges:

19 to 30 Mc.	10 Mc. sweep width
40 to 90 Mc.	10 Mc. sweep width
170 to 225 Mc.	10 Mc. sweep width

B. Provides an output signal that can be varied by means of an attenuator up to a maximum of at least .1 volt.

SECOND: AN R.F. SIGNAL GENERATOR that will provide an adjustable output signal up to a maximum of at least .1 volt on the following fixed frequencies:

A. I.F. Frequencies

21.75 Mc.	Sound Trap
22.5 Mc.	1st Video I.F.Coil
25.25 Mc.	2nd Video I.F.Coil
24.25 Mc.	3rd Video I.F.Coil
23.25 Mc.	4th Video I.F.Coil
26.0 Mc.	5th Video I.F.Coil
26.25 Mc.	Picture I.F. Carrier
4.5 Mc.	Sound I.F. & Traps

B. R.F. Frequencies

Channel No.	Picture Carrier	Sound Carrier
2	55.25 Mc.	59.75 Mc.
3	61.25 Mc.	65.75 Mc.
4	67.25 Mc.	71.75 Mc.
5	77.25 Mc.	81.75 Mc.
6	83.25 Mc.	87.75 Mc.
7	175.25 Mc.	179.75 Mc.
8	181.25 Mc.	185.75 Mc.
9	187.25 Mc.	191.75 Mc.
10	193.25 Mc.	197.75 Mc.
11	199.25 Mc.	203.75 Mc.
12	205.25 Mc.	209.75 Mc.
13	211.25 Mc.	215.75 Mc.

THIRD: A CATHODE-RAY OSCILLOSCOPE of good quality that has a fairly wide band vertical amplifier and a low capacity input probe.

FOURTH: AN ELECTRONIC VOLTMETER with ranges to read 1V. DC, 10V. DC and 7V. AC at 400 cycles and 4.5 Mc.

FIFTH: A CRYSTAL CALIBRATOR that can be used for checks on the accuracy of the output frequencies of the R.F. Signal generator.

GENERAL INSTRUCTIONS: Practically all servicing with the exception of some tube replacement will require removal of the receiver chassis from the cabinet.

A convenient arrangement that makes both the top and bottom of the chassis accessible for alignment and servicing can be realized by orienting the receiver chassis in such a manner that it rests on its side and on the horizontal output shield can.

ALIGNMENT REQUIREMENTS: Under normal conditions complete receiver realignment will seldom be necessary in the field. However, a detailed description of the overall alignment procedure is included to provide all necessary information if it should be required.

In general it is not recommended that the R.F. and the converter circuits of the R.F. tuner be realigned by the service engineer unless absolutely necessary. In cases where tuner components have been damaged or where complete realignment is indicated, the R.F. tuner assembly should be removed from the chassis and sent back to the factory in exchange for a new unit which will be shipped complete with tubes. When the new R.F. unit is assembled to the chassis it will be necessary in all cases to realign L6 which is located on the tuner chassis. Normally this is the only adjustment that will be required with tuner change but a check on overall receiver alignment and sensitivity should be made for the sake of certainty and assured customer satisfaction.

EFFECTS OF TUBE REPLACEMENT ON THE ALIGNMENT OF R.F. TUNER CIRCUITS: The alignment of the R.F. and converter circuits of the R.F. tuner is critical and may be affected by a tube change. In cases where these tubes(6AG5 or 6J6) are replaced it will be necessary for the service engineer to check for satisfactory receiver operation. If realignment is indicated it can usually be avoided by selection of replacement tubes until correct receiver operation is realized.

ORDER OF ALIGNMENT: When complete receiver realignment is indicated it should be performed in the following order:

1. Sound Traps
2. Picture I.F.
3. Sound I.F. and 4.5 Mc. Trap
4. Ratio Detector Transformer
5. Retouch Picture I.F.
6. Sound and Picture I.F. Sensitivity Check
7. R.F. and Converter Circuits(not recommended)
8. Overall Sensitivity Check

PRELIMINARY ADJUSTMENTS: Before alignment the receiver controls should be adjusted to the approximated operation positions specified in the table below. The controls should remain in these positions for all checks unless otherwise specified.

Contrast Control - to center position
Brightness Control - to position where raster is visible on the kinescope
Focus Control - to position where focus is obtained
Vertical Hold - to center position
Vertical Linearity - to center position
Vertical Size - adjusted to give normal raster height
Horizontal Hold - to center position
Horizontal Size - adjusted to give normal raster width
Horizontal Centering- to center raster on tube

ALIGNMENT PROCEDURE

TEST EQUIPMENT SET UP: A certain amount of experimentation must be employed to secure a stable test set up before alignment or service of the receiver is attempted. It is recommended that the top of the test bench be covered with a sheet of aluminum to insure good grounds between the various pieces of test equipment and the receiver chassis. In general all test signal input leads should be kept away from output leads as much as possible.

SOUND TRAP ALIGNMENT: FIRST, Connect the R.F. signal generator to the grid of V-2 by means of the I.F. input adapter as shown in Figure 6.

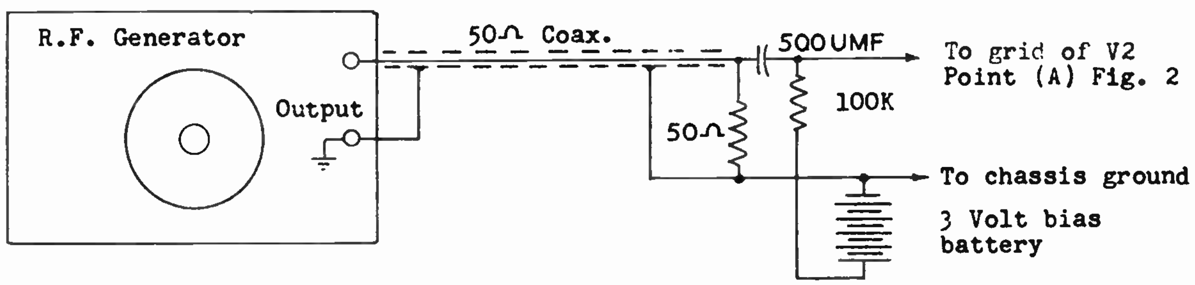


Figure 6 I.F. Input Adapter

SECOND: Set the R.F. tuner to Channel #13.

THIRD: Connect a 4.5 volt bias battery between the A.G.C. buss (Point F. Fig. 2) and chassis ground so that the voltage on the A.G.C. buss is -4.5 volts in respect to the chassis.

FOURTH: Connect the electronic voltmeter across the picture detector load resistor R37, Point B, Fig. 2 and set the voltmeter on the low D.C. volt scale.

FIFTH: Set the R.F. signal generator to the frequency shown below and tune the specified adjustment for minimum indication on the voltmeter. It is advisable to check the output of the generator with the crystal calibrator to make certain that it is exactly on frequency.

21.75 Mc. L12 (Top of chassis as shown in Figure 3)

PICTURE I.F. ALIGNMENT: FIRST: Connect the R.F. Signal generator, voltmeter and bias battery to the receiver as described in steps 1, 2, 3 and 4 of the sound trap alignment instructions.

SECOND: Set the signal generator to each of the following frequencies and peak the specified adjustments for maximum indication of the voltmeter.

22.5 Mc.	L6	(Top of tuner as shown in Fig. 3)
25.25 Mc.	L13	(Top of chassis as shown in Fig. 3)
24.25 Mc.	L14	(Top of chassis as shown in Fig. 3)
23.25 Mc.	L15	(Top of chassis as shown in Fig. 3)
26.0 Mc.	L17	(Top of Chassis as shown in Fig. 3)

SOUND I.F. ALIGNMENT: FIRST: Connect the R.F. signal generator to Point B, Fig. 2

SECOND: Set the signal generator accurately to 4.5 Mc. This is very important because the picture and sound carriers sent out from the television stations are exactly 4.5 Mc. apart.

THIRD: Connect the electronic voltmeter across C71 from Point D to ground as shown in Fig. 2
Set the voltmeter on the 10 volt scale.

FOURTH: Peak the following coils for maximum reading on the voltmeter.

L 27 Top of chassis as shown in Fig. 3.
T 6 Top of chassis as shown in Fig. 3.
Bottom of chassis as shown in Fig. 4
T 7 (Pri Ratio Det)Top of chassis as shown in Fig. 3.

RATIO DETECTOR TRANSFORMER ALIGNMENT: FIRST: Connect the R.F. signal generator to the receiver as described in Step 1 of the Sound I.F. Alignment instructions.

SECOND: Connect the electronic voltmeter from Point E, Fig. 2 to ground.
Set the voltmeter on the lowest DC scale.

THIRD: Set the signal generator output to 4.5 Mc. Adjust the secondary of T7 (Bottom view of chassis as shown in Fig. 4). Notice that it is possible to produce a positive or negative voltage indication on the meter by varying this adjustment. As the voltage swings from positive to negative, adjust T7 for zero output as indicated by the voltmeter. This point is called zero ratio detector output and indicates correct alignment of T7 transformer. If the secondary of T7 is found to be way out of alignment it will be necessary to re-peak the primary as described in the preceeding section on sound I.F. alignment.

4.5 MC. TRAP ALIGNMENT FIRST: Connect the R.F. signal generator as described in Step 1 of the sound I.F. alignment.

SECOND: Connect the electronic voltmeter from the cathode of the picture tube to ground (Point C Fig. 2)
The voltmeter must be capable of giving a reading at 4.5 Mc. at approximately 1 to 2 volts.

THIRD: Peak L22 (Top of chassis as shown in Fig. 3) for minimum output on the voltmeter.

ALIGNMENT PROCEDURE (CONT'D)

PICTURE I.F. TOUCH UP: Connect the R.F. Sweep generator output to the grid of V-2 by means of the I.F. input adapter shown in Figure 6.

SECOND: Apply bias to A.G.C. line as described in Step 3 of sound trap alignment. Set R.F. selector to Channel #13.

THIRD: Connect the oscilloscope across the picture detector load resistor R37 (Point B Fig. 2) by means of the shielded cable and the filter system shown in Figure 7.

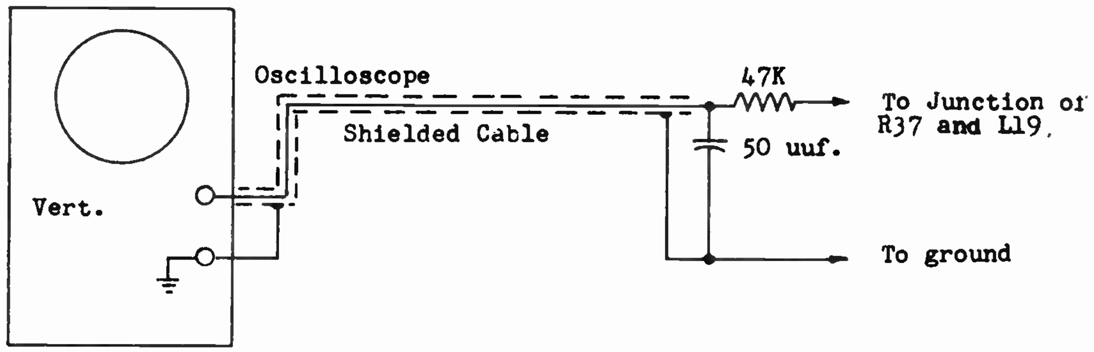


Figure 7 FILTER SYSTEM FOR SCOPE CONNECTION

FOURTH: Set the R.F. sweep generator so that it sweeps from approximately 20 to 30 Mc.

FIFTH: Adjust the oscilloscope so that the swept I.F. response is visible on the cathode-ray tube screen.

SIXTH: Loosely couple the output of the R.F. signal generator to the grid of V-2 so that the marker signals of proper frequency can be mixed in with the R.F. sweep signal.

SEVENTH: Observe the band width, relative position of the picture carrier, and flatness of the overall I.F. response curve. If necessary slightly vary the tuning of the picture I.F. coils L6, L13, L14, L15, L17 until the picture I.F. response shown in Figure 8 is obtained. The solid curve in Figure 8 depicts the ideal I.F. response while the dotted curves shown permissable variations.

ALIGNMENT PROCEDURE (CONT'D)

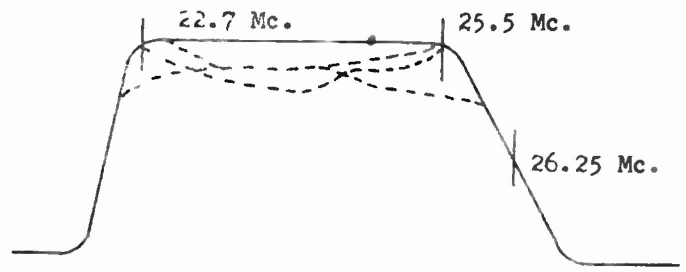


Figure 8 IDEAL I.F. RESPONSE WITH PERMISSABLE VARIATIONS

The picture I.F. carrier should appear approximately half way down the I.F. response curve as shown in Figure 8. Variation in the pix carrier position should not exceed ≠10% from the half way point.

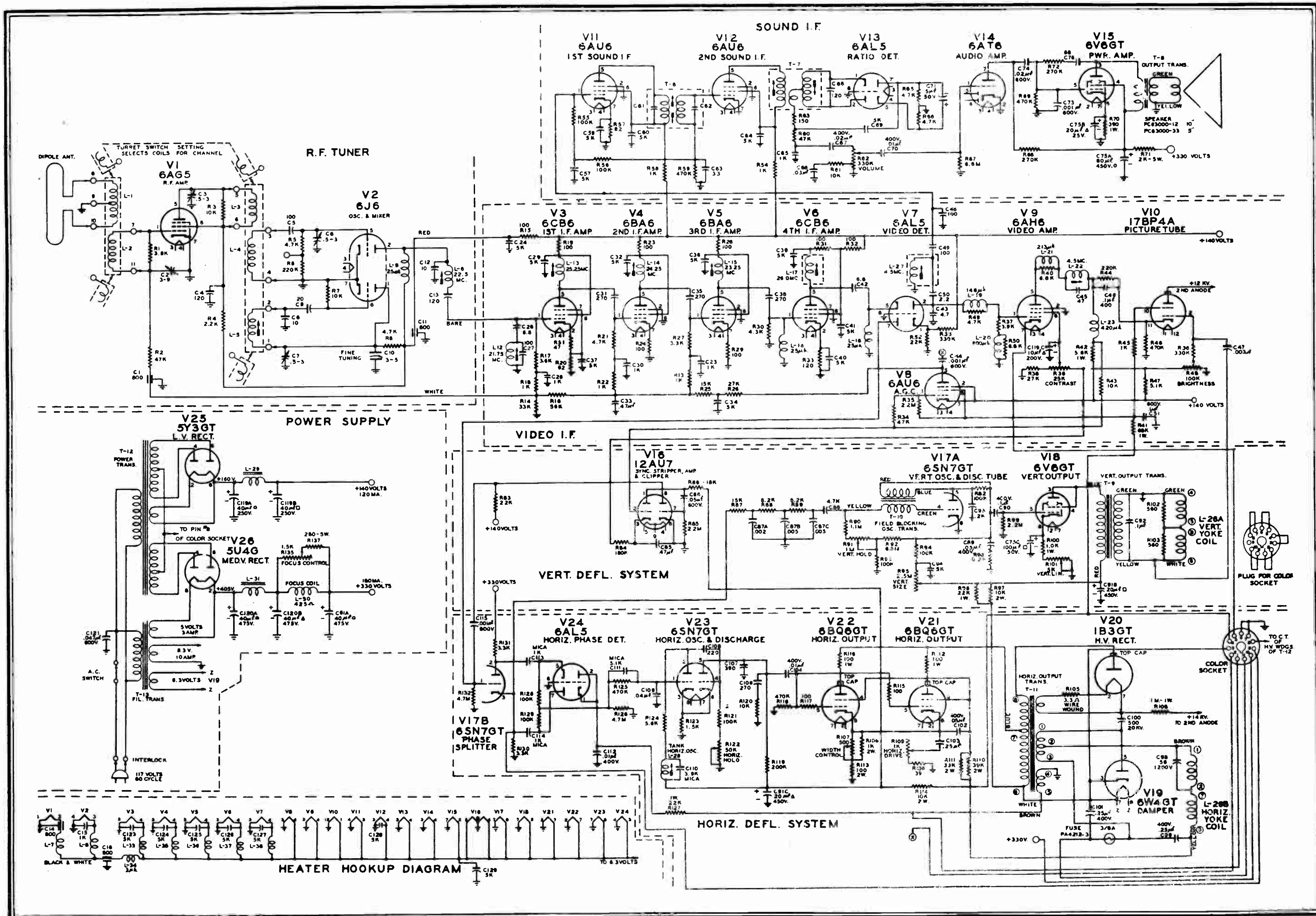
PICTURE I.F. SENSITIVITY CHECK: FIRST: Connect the R.F. signal generator to the receiver as specified in Steps 1 and 2 of the sound trap alignment instructions.(When making sensitivity checks no bias battery is connected to the A.G.C. buss.)

SECOND: Connect the electronic voltmeter across the picture detector load resistor R37 Point A, Fig. 2 and set the meter on the low D.C. volt scale.

THIRD: Set the generator output frequency at approximately 23 Mc. Adjust the generator output until the voltmeter reads approximately 1.0 volt. Record the R.F. signal input in microvolts. Repeat the procedure with the generator output frequency set at 24.2 and 25.4 Mc. In all cases the I.F. input voltage should be 100 microvolts or less The sensitivity at the I F picture carrier 26.25 Mc. should be approximately half of the I.F. Sensitivity between 24.2 Mc. (Maximum of 100 microvolts) If the generator output is not calibrated in microvolts comparative sensitivity measurements can be made by using another receiver that is known to be in good operating condition as a standard. This applies to all sensitivity measurements and good results can be obtained if sufficient care is used.

R.F.TUNER (S.W. Co. Part No. PD93157)
Sparton Chassis types 26SS172 & 26SS172A are equipped with a standard coil R.F. tuner (Type 1311) With exception to L-6 slug (22.5 Mc.) as shown in Fig. 3, page 28, field alignment for this tuner has been purposely omitted from the alignment procedure. Factory experience dictates that this unit can not be properly aligned in the field as special test equipment is required Therefore any R.F. tuner adjustment in the field should be held to a minimum.

Field Alignment for Standard Coil tuners has appeared in some set manufacturers service manuals; it is not recommended by our Eng. Dept. After receiver analysis proves the R F. tuner to be defective, and in need of realignment the complete tuner assembly (with tubes) should be returned to our Factory Service Department for repair or replacement.



MODELS 5207, 5208, 5262, 5263, Ch. 26SS172, A

WHEN ORDERING PARTS ALWAYS SPECIFY PART NUMBER AND MODEL FOR WHICH PART IS INTENDED.

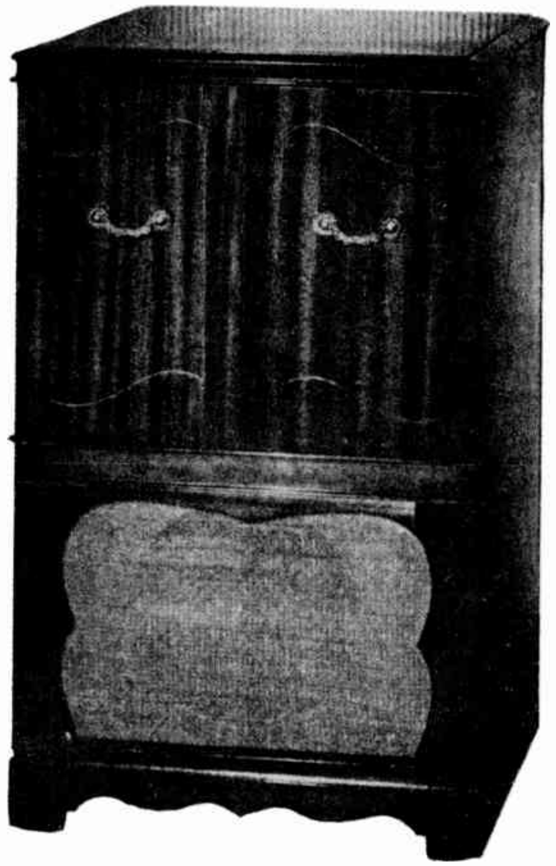
DESCRIPTION	PART NO.
Condenser C23,28,30,65 1K Ceramic	HK36M-102
Condenser - C24,29,32,34,36,37,39,40,41 57,59,60,64,69,94,123,124,125, 126,127,128,129 5K Ceramic	PA4334-1
Condenser - C31,35,38 270 MMF. Ceramic	HK36M-271
Condenser - C26,42 6.8 MMF. Ceramic	PA4328-13
Condenser - C27,48,49 100 MMF.Ceramic	PA4332-3
Condenser - C33,85 .47 MFD. 200V. Tubular	PC42DK-474
Condenser - C43 4.7 MMF. Ceramic	PA4328-11
Condenser - C44,115 .001 MFD. 600V. Tubular	PC42GM-102
Condenser - C45 47 MMF. Ceramic	CC30A-470F
Condenser - C46, 90 .1 MFD. 400V. Tubular	PC40GL-104
Condenser - C47 .003 MFD. 600V. Tubular	PC40GM-302
Condenser - C50 2.2 MMF.Ceramic	PA4326-1
Condenser - C51 .1 MFD. 600V. Tubular	PC40GM-104
Condenser - C63 33 MMF. Mica	MC60E-330
Condenser - C66 120 MMF. Ceramic	PA4332-4
Condenser - C67,74 .02 MFD. 400V. Tubular	PC40HL-203
Condenser - C68 .03 MFD. 200V. Tubular	PC40GK-303
Condenser - C70 .01 MFD. 400V. Tubular	PC40HL-103
Condenser - C71 5 MFD. 50V. Elect.	PA4308-2
Condenser - C73 .001 MFD. 600V. Tubular	PC40GM-102
Condenser - C75A, B & C 80-20-100 MFD.Elect.	PA4307-23
Condenser - C76 68 MMF. Mica	MC60E-680
Condenser - C86 .05 MFD. 600V. Tubular	PC40GM-503
Condenser - C87A,B & C Herlec Ceramic	PA4339-4
Condenser - C88 4.7K Mica	MC61F-472
Condenser - C89 .05 MFD. 400V. Tubular	PC40GL-503
Condenser - C91A, B & C 40-20-20 MFD. Elect.	PA4307-22
Condenser - C92 .1 MFD. 200V. Tubular	PC42GK-104
Condenser - C93 2K Mica	MC61E-202
Condenser - C98 56 MMF. 1200V. Mica	PA4340-6
Condenser - C99, 101 .25 MFD. 400V.Tubular	PC40GL-254
Condenser - C100 500 MMF. 20KV. Ceramic	PA4342-2
Condenser - C102 .05 MFD. 400V. Tubular	PC40HL-503
Condenser - C103 .25 MFD. 200V. Tubular	PC40GK-254
Condenser - C104 .01 MFD. 400V. Tubular	PC40GL-103
Condenser - C105 20-270 MMF. Trimmer	PA4368
Condenser - C106 270 MMF. Mica	MC60E-271
Condenser - C107 390 MMF. Mica	MC60E-391
Condenser - C108 220 MMF. Mica	MC60E-221
Condenser - C109 .04 MFD. 200V. Tubular	PC40GK-403
Condenser - C110 3.9K Mica	MC63F-392
Condenser - C111 5.1K Mica	MC61E-512
Condenser - C112 .01 MFD. 400V. Tubular	PC40FL-103
Condenser - C113, 114 1K Mica	MC61E-102
Condenser - C119A, B & C 40-40-10 MFD.Elect.	PA4307-21
Condenser - C120A & B 40-40 MFD. Elect.	PA4307-13
Condenser - C121 .047 MFD. 600V. Tubular	PA4346-1
R39 - Control-Contrast	PA4442-3
R48 - Control-Brightness	PA4445-2
R62 - Control-Volume	PA4436-3
R91 - Control-Vert. Hold (1 Meg.)	PA4443-2
R95 - Control-Vert. Size (2.5 Meg.)	PA4431
R101 - Control-Vert. Linearity	PA4411
R107 - Control-Hor. Width	PA4448
R109 - Control-Hor. Centering	PA4446
R122 - Control-Hor. Hold	PA4444-2
R135 - Control-Focus	PA4426-1

	DESCRIPTION	PART NO.
L-12	Coil - 21.75 Mc. Trap	AB43523-14
L-13	Coil - 26.0 Mc. P.I.F. (1)	AA6408-1
L-14	Coil - 24.25 Mc. P.I.F. (2)	AA6408-1
L-15	Coil - 23.25 Mc. P.I.F. (3)	AA6408-1
L-16	Choke- 25 uh.	AA6650-1
L-17	Coil - 25.25 Mc. P.I.F.	AA6364-1
L-18	Choke- 25 uh.	AA6650-1
L-19	Choke- 150 uh.	AA6402-6
L-20	Choke- 300 uh.	AA6613-8
L-21	Choke- 220 uh.	AA6402-7
L-22	Coil- 4.5 Mc. Trap	AA6407-1
L-23	Choke- 420 uh.	AA6613-10
*L-26 A & B	Vertical & Horizontal Yoke	PC70009
L-27	Coil - 4.5 Mc. Trap	AA6364-2
L-28	Coil - Hor. Oscillator	AA6403-2
L-29	Choke- Filter	AB47009-1
L-30	Coil - Focus	PC70008
L-31	Choke- Filter	AB47009-1
L-33,34,35,36,37 & 38	Choke-Heater	AA6651-1
T-6	Transformer- Sound I.F.	AA6667-5
T-7	Transformer- Ratio Det.	AA6684-4
T-8	Transformer- Audio Output	AB44066-3
T-9	Transformer- Vertical Output	AB44062-7
T-10	Transformer- Vertical Block Osc.	AB47006-4
T-11	Transformer-Horiz. Output	PC70010
T-12	Transformer- Power	AB44019-2
T-13	Transformer- Filament	AB44020-1
Ion Trap		PA1248-2
Fuse 3/8 Amp.		PA4212-3
** R.F. Tuner Assembly		PD93157
Kinescope		PD93165-1,-8,-9
Mask		PD93035-2
Safety Glass (Models 5207 & 5262)		PD93036-1
Safety Glass (Models 5208 & 5263)		PD93036-2
Safety Screen(Models 5207 & 5208)		PB40209-11
Infrequent Control Cover Assembly		AB43582-1
Sparton Script		PA5842
Knob Escutcheon & Spring Assembly		AA6370-5
Knob Escutcheon & Spring Assembly		AA6370-6
Knob-Volume Control		PB40339
Knob-Channel Tuner		PB40340
Knob-Fine Tuning		PB40333-1
Knob-Infrequent Control		PA5651
** Speaker- 5" Round		PC63000-33
** Speaker-10" Round		PC63000-12

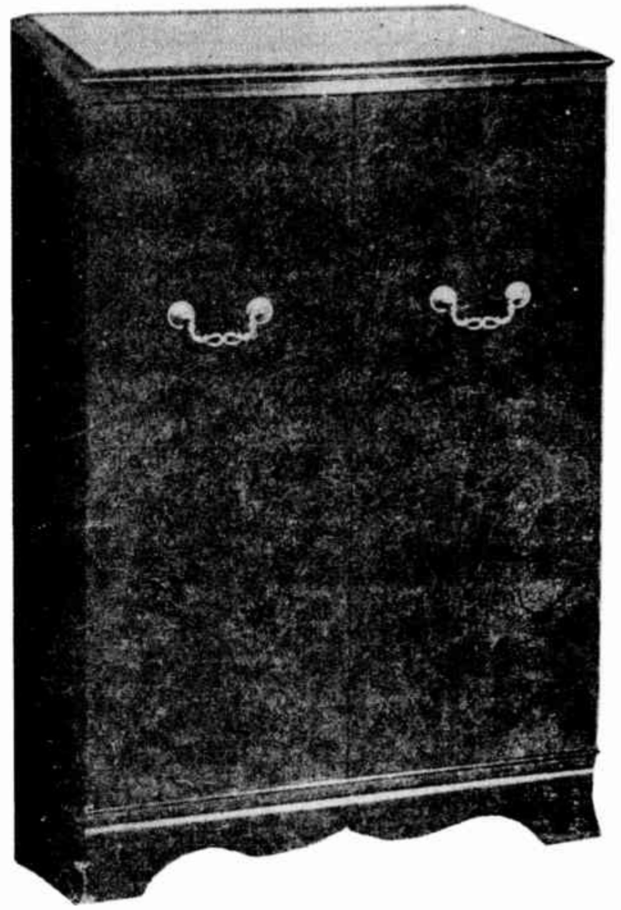
* Deflection Yoke Coil PC70009 supplied only as complete assembly

** Complete speaker & R.F. tuner assemblies may be returned to Factory Service Department for repair or replacement.

Sparton SHEFFIELD
MODEL 5265 MAHOGANY
17 INCH TELEVISION CONSOLE



Sparton MODEL 5267 MAHOGANY
17" Television Console



Sparton RUTLEDGE
MODEL 5268 MAHOGANY
17 INCH TELEVISION CONSOLE

BRIEF DESCRIPTION

TELEVISION CHASSIS TYPE 26SD172 is a twenty-six tube "Deluxe" chassis with a self-contained power supply, an electro-magnet type focusing system, full range tone control, built-in adjustable Dipole antenna and uses a 17BP4A picture tube. This chassis is equipped with the Sparton Ultra-tuner for superior long range reception. The Ultra-tuner will receiver telecasts on all present channels and, with the insertion of simple tuner strips on new U.H.F. channels.

TELEVISION CHASSIS TYPE 26SD172A is equipped as described above, however, relocation of both the operating and non-operating controls accounts for the difference in chassis type designation.

NOTE: For the reason stated above this chassis may not be interchanged with chassis type 26SD172.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

Channel Number	Channel Freq.Mc.	Picture Carrier Freq.Mc.	Sound Carrier Freq.Mc.	Receiver R.F. Osc. Freq.Mc.
2	54-60	55.25	59.75	81.5
3	60-66	61.25	65.75	87.5
4	66-72	67.25	71.75	93.5
5	76-82	77.25	81.75	103.5
6	82-88	83.25	87.75	109.5
7	174-180	175.25	179.75	201.5
8	180-186	181.25	185.75	207.5
9	186-192	187.25	191.75	213.5
10	192-198	193.25	197.75	219.5
11	198-204	199.25	203.75	225.5
12	204-210	205.25	209.75	231.5
13	210-216	211.25	215.75	237.5

TUBE	TYPE	FUNCTION
V1	6AG5	R.F. Amplifier
V2	6J6	Osc. & Mixer
V3	6CB6	1st I.F. Amplifier
V4	6BA6	2nd I.F. Amplifier
V5	6BA6	3rd I.F. Amplifier
V6	6CB6	4th I.F. Amplifier
V7	6AL5	Video Detector
V8	6AU6	A.G.C.
V9	6AH6	Video Amplifier
V10	17BP4A	Picture Tube
V11	6AU6	1st Sound I.F.
V12	6AU6	2nd Sound I.F.
V13	6AL5	Ratio Detector
V14	6AT6	Audio Amplifier
V15	6V6GT	Power Amplifier
V16	12AU7	Sync. Strip. Amp.&Clipper
V17	6SN7GT	Vert. Osc.Disc. & Phase Splitter
V18	6V6GT	Vertical Output
V19	6W4GT	Damper Tube
V20	1B3GT	Hi-Voltage Rectifier
V21	6BQ6GT	Horizontal Output
V22	6BQ6GT	Horizontal Output
V23	6SN7GT	Horiz. Osc. & Disc. Tube
V24	6AL5	Horiz. Phase Detector
V25	5Y3GT	Lo-Voltage Rectifier
V26	5U4G	Med. Voltage Rectifier

POWER SUPPLY RATING

117 Volts..............60 Cycles....250 Watts

AUDIO POWER OUTPUT RATING

Maximum Undistorted................2.5 Watts

LOUD SPEAKER

All Models.........................12" P.M. Round
Voice Coil Impedance..3.2 Ohms @ 400 Cycles

PICTURE I.F. FREQUENCIES

Picture Carrier Frequency.........26.25 Mc.
Accompanying Sound Traps..........21.75 Mc.

SOUND I.F. FREQUENCIES

Sound Carrier Frequency..........4.5 Mc.
Sound Discriminator Band Width
(Between Peaks)..................200 Kc.
Video Response...................To 4 Mc.
Focus............................Magnetic
Sweep Deflection.................Magnetic
Scanning... Interlaced 525 Lines
Horizontal Scanning Frequency....15,750 Cps.
Vertical Scanning Frequency..........60 Cps.
Frame Frequency (Picture Repetition Rate) 30 Cps.
Receiver Antenna Input Impedance....300 Ohms Balanced

OPERATING CONTROLS LOCATED ON FRONT PANEL

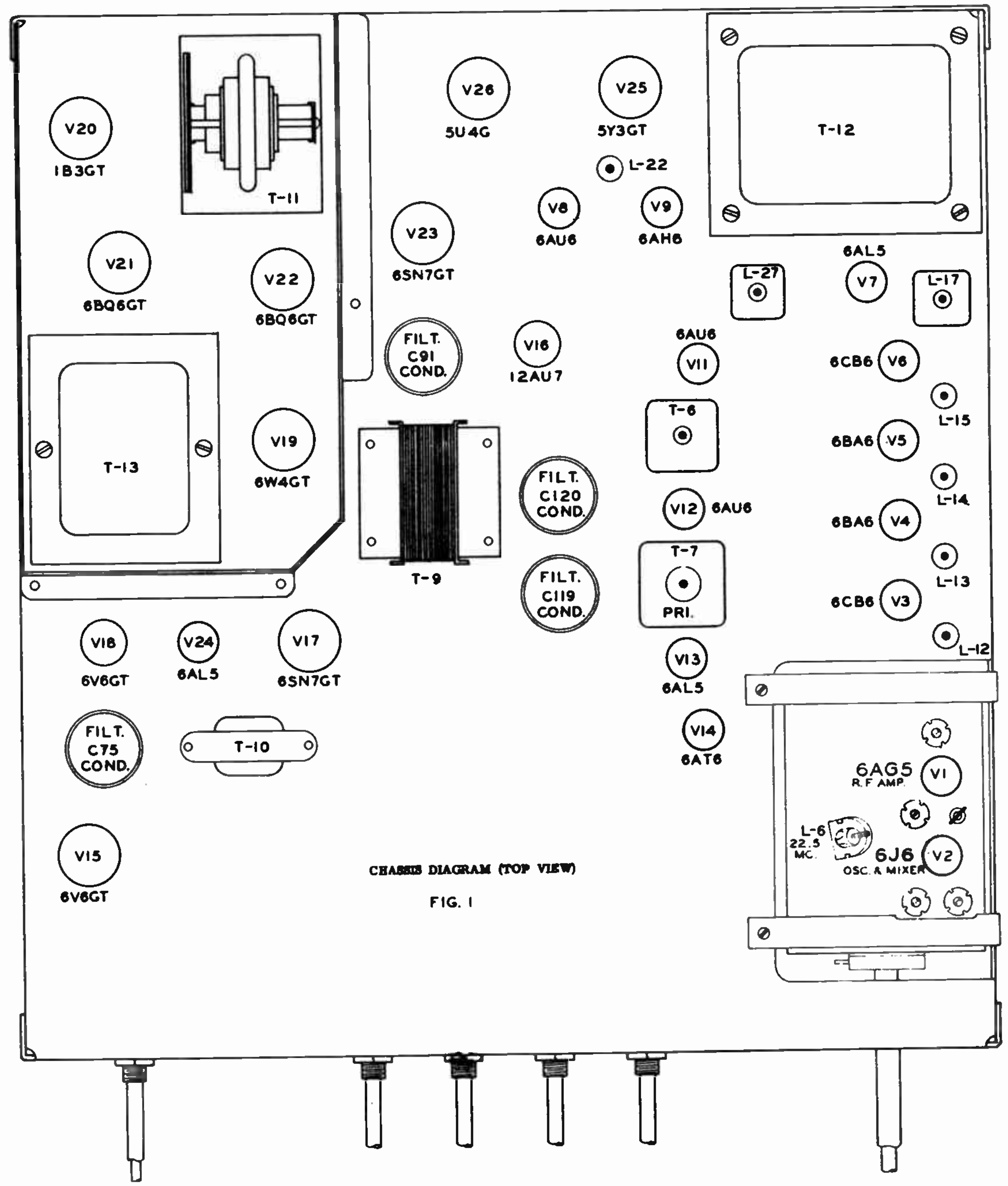
Tone..........
Volume........
Vert. Hold....
Horiz. Hold...
Brightness....
Contrast......
Channel Tuning
Fine Tuning...
Dipole Antenna..On cabinet

NON-OPERATING CONTROLS

(Not including R.F. & I.F. Adjust)

Chassis 26SD172 Chassis 26SD172A

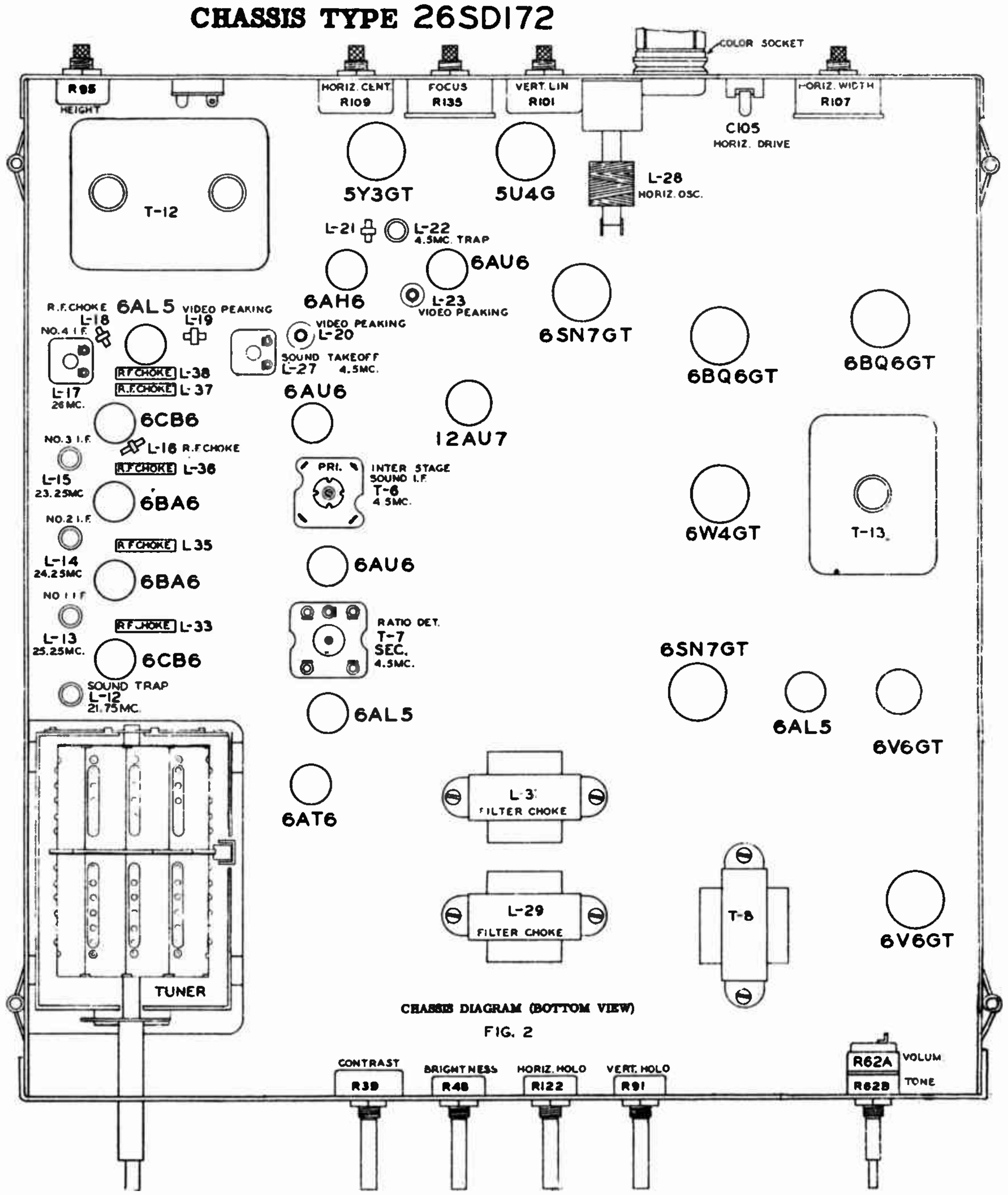
Focus
Vert. Size..
Vert. Lin...
Horiz.Width.
Horiz.Cent..
Horiz.Drive.
Horiz.Osc...
Defl. Coil..



CHASSIS DIAGRAM (TOP VIEW)
FIG. 1

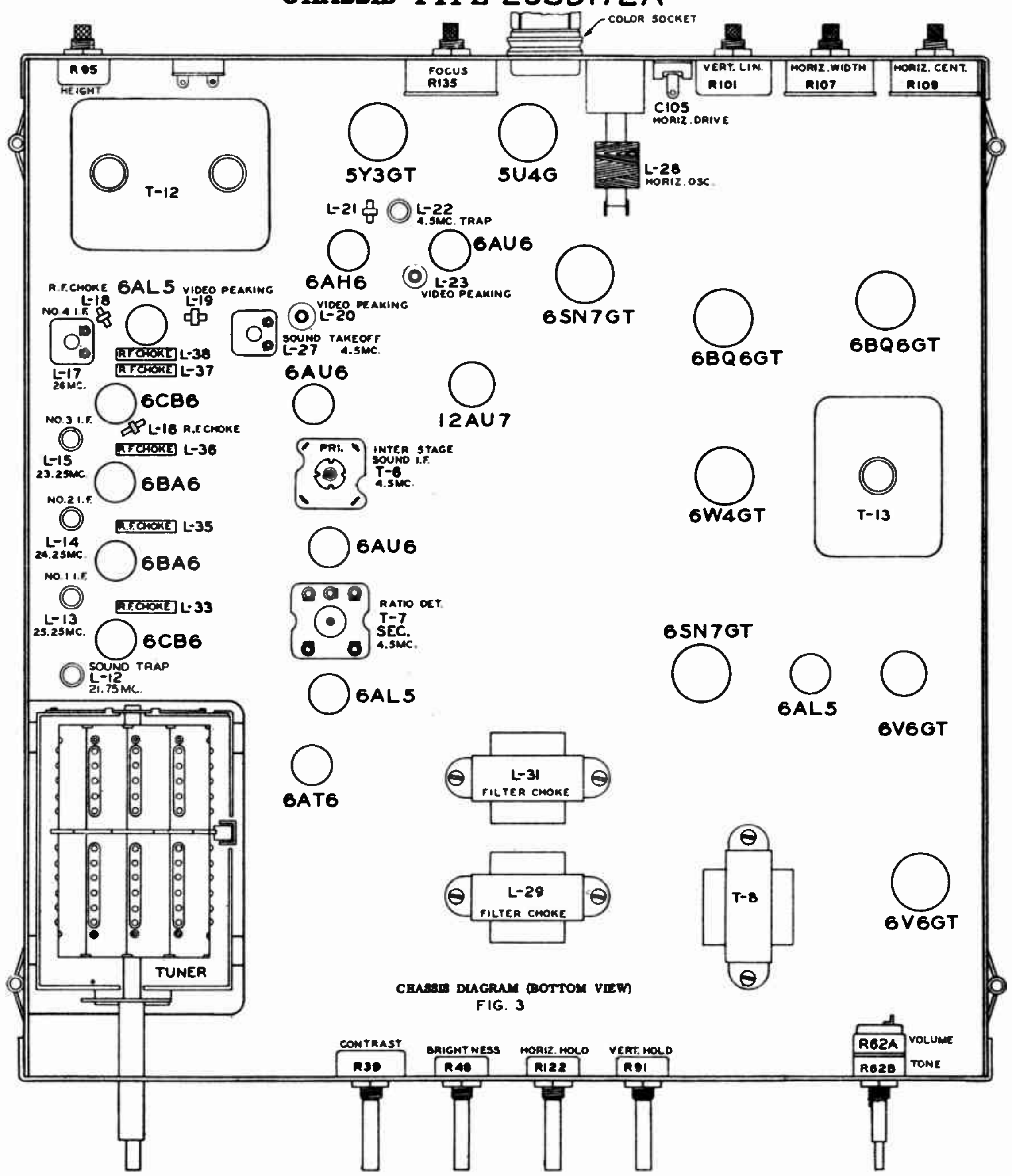
NOTE: For alignment data, see Chassis 26SS172A

CHASSIS TYPE 26SD172



CHASSIS DIAGRAM (BOTTOM VIEW)
FIG. 2

CHASSIS TYPE 26SD172A



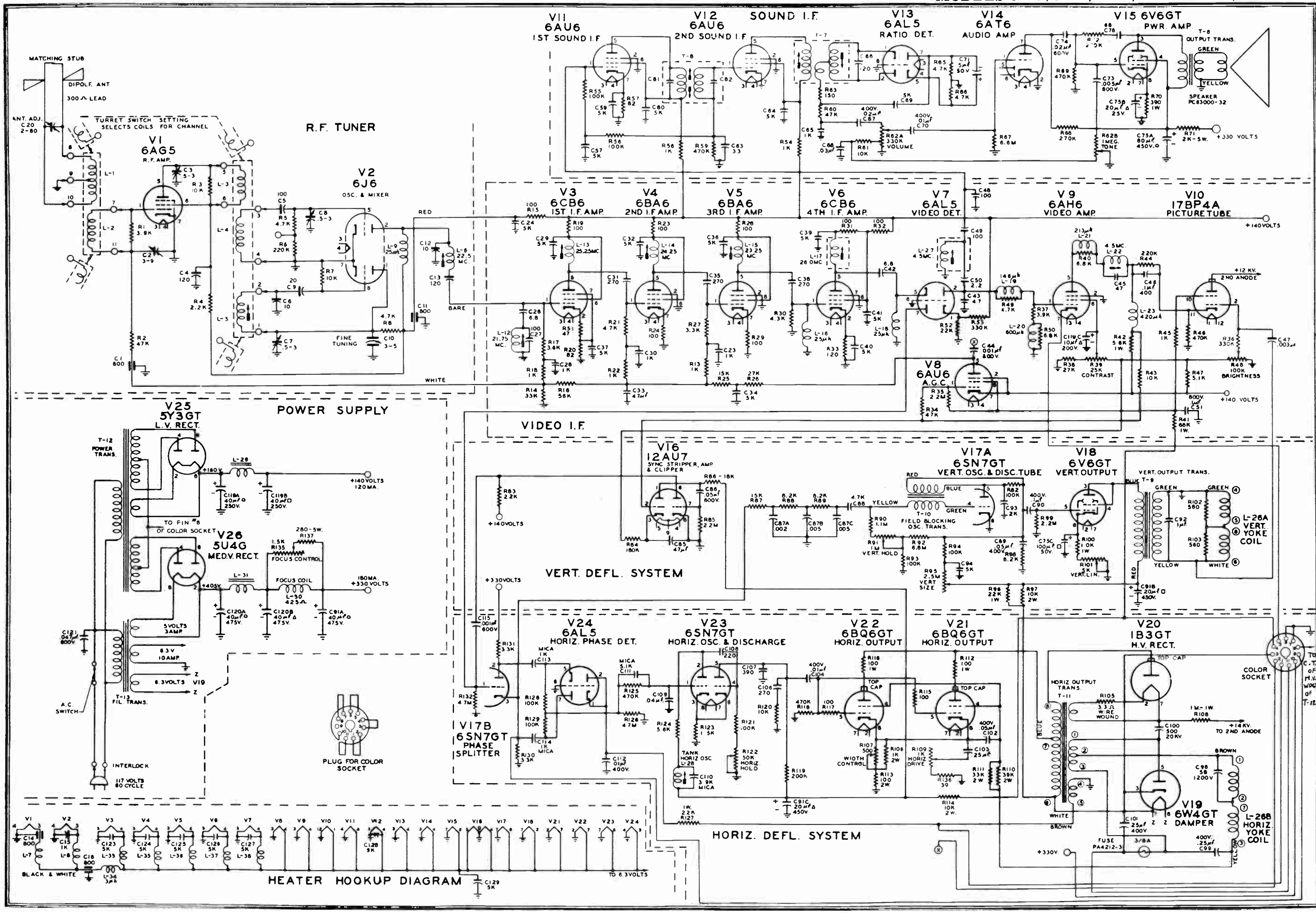
CHASSIS DIAGRAM (BOTTOM VIEW)
FIG. 3

PARTS LIST

DESCRIPTION	PART NO.
Mask	PD93035-2
Safety Glass	PD93036-1
Infrequent Control Cover & Spring Assy.	AB43582-1
Knob Escutcheon & Spring Assy.	AA6370-5
Knob Escutcheon & Spring Assy.	AA6370-6
Knob-Tone Control	PB40328-1
Knob-Fine Tuning	PB40333-1
Knob-Volume Control	PB40337
Knob-Channel Tuner	PB40340
Knob-Infrequent Control (4 Req'd)	PA5651
Knob-Dipole Antenna	PA5650
* Speaker-12" P.M. Round	PC63000-32
Control-Volume & Tone	PA4450-1

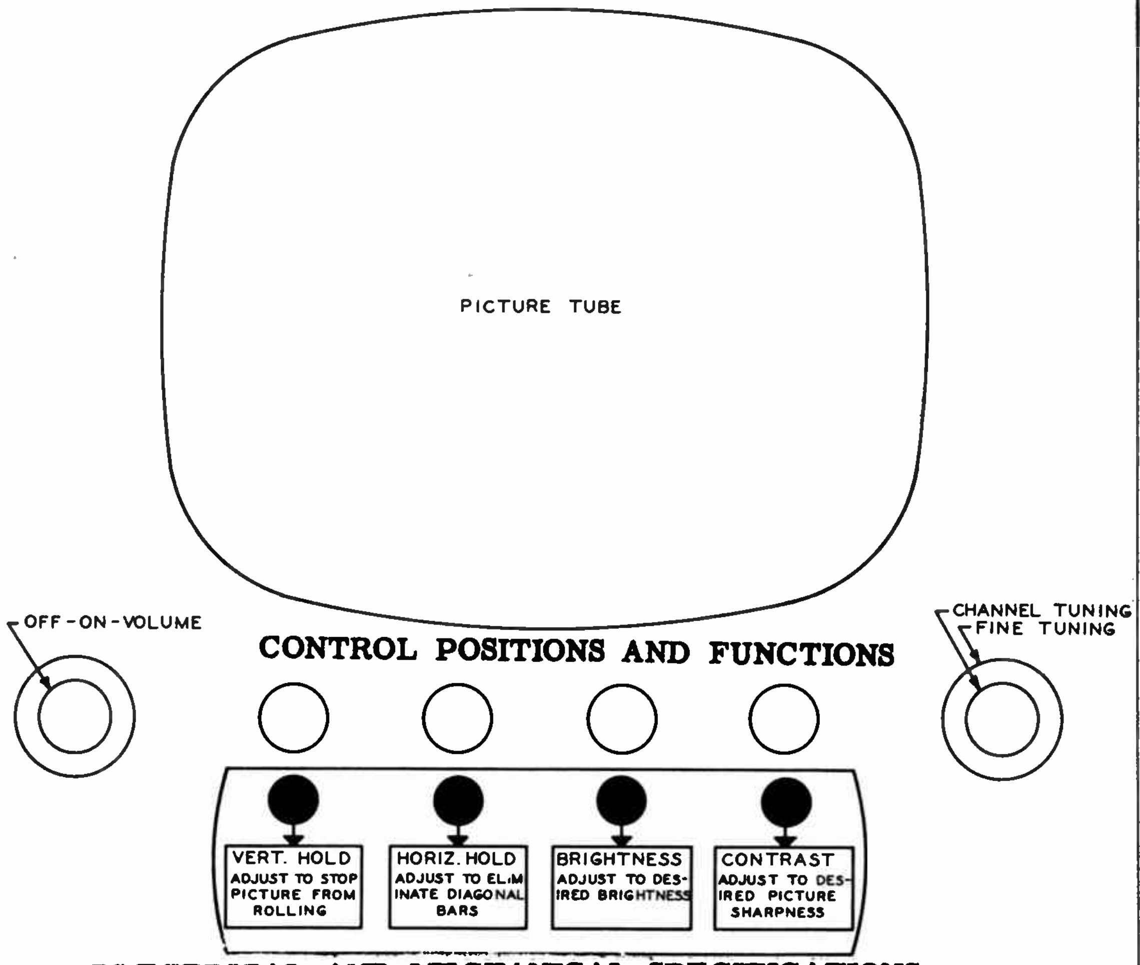
* Complete speaker may be returned to Factory Service Department for repair or replacement.

NOTE: For Complete Parts List for all electrical Components please refer to Ch. 26SS172A.


R.F. TUNER
SOUND I.F.
VIDEO I.F.
POWER SUPPLY
VERT. DEFL. SYSTEM
HORIZ. DEFL. SYSTEM
HEATER HOOKUP DIAGRAM
V1 6AG5 R.F. AMP.
V2 6J6 OSC. & MIXER
V3 6CB6 1ST I.F. AMP.
V4 6BA6 2ND I.F. AMP.
V5 6BA6 3RD I.F. AMP.
V6 6CB6 4TH I.F. AMP.
V7 6AL5 VIDEO DET.
V8 6AU6 A.G.C.
V9 6AH6 VIDEO AMP.
V10 17BP4A PICTURE TUBE
V11 6AU6 1ST SOUND I.F.
V12 6AU6 2ND SOUND I.F.
V13 6AL5 RATIO DET.
V14 6AT6 AUDIO AMP.
V15 6V6GT PWR. AMP.
V16 12AU7 SYNC STRIPPER, AMP & CLIPPER
V17A 6SN7GT VERT. OSC. & DISC. TUBE
V17B 6SN7GT PHASE SPLITTER
V18 6V6GT VERT. OUTPUT
V19 6W4GT DAMPER
V20 1B3GT H.V. RECT.
V21 6BQ6GT HORIZ. OUTPUT
V22 6BQ6GT HORIZ. OUTPUT
V23 6SN7GT HORIZ. OSC. & DISCHARGE
V24 6AL5 HORIZ. PHASE DET.
V25 5Y3GT L.V. RECT.
V26 5U4G MED. V. RECT.
MATCHING STUB
DIPOLE ANT
300 Ω LEAD
TURRET SWITCH SETTING SELECTS COILS FOR CHANNEL
FINE TUNING
CONTRAST
BRIGHTNESS
VOLUME
TONE
SPEAKER PC83000-32
FOCUS CONTROL
FOCUS COIL
T-12 POWER TRANS.
T-13 FIL. TRANS.
A.C. SWITCH
INTERLOCK
117 VOLTS 60 CYCLE
PLUG FOR COLOR SOCKET
COLOR SOCKET
VERT. HOLD
VERT. SIZE
VERT. LIN.
L-26A VERT. YOKE COIL
L-26B HORIZ. YOKE COIL
WIDTH CONTROL
HORIZ. DRIVE
HORIZ. HOLD
TANK HORIZ OSC L-28
TO 2ND ANODE
+330 VOLTS
+140 VOLTS
TO 6.3 VOLTS

Sparton BERKELEY
MODEL 5210 DURON MAHOGANY

FIG. 1



BRIEF DESCRIPTION

TELEVISION CHASSIS TYPE 26SS172B is a twenty-six tube "Standard" chassis with a self-contained power supply and uses a 17BP4A picture tube. This chassis is equipped with a line cord antenna and uses an Electro-magnet type focusing system.

SPECIAL NOTE

Initial production of the above chassis included a color socket, which thru use of a convertor, would have permitted the reception of color television. National Production Authority Order M-90 prohibited the use of such a device, therefore, in order to conform to the terms of Order M-90 the use of the color socket was discontinued. However the accompanying Schematic diagram includes the hook-up of the color socket.

A knock-out plug has been retained in the chassis for future use when color television is again available to the Public.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

R. F. FREQUENCY RANGE

Channel Number	Channel Freq.Mc.	Picture Carrier Freq.Mc.	Sound Carrier Freq.Mc.	Receiver R.F. Osc. Freq.Mc.
2	54-60	55.25	59.75	81.5
3	60-66	61.25	65.75	87.5
4	66-72	67.25	71.75	93.5
5	76-82	77.25	81.75	103.5
6	82-88	83.25	87.75	109.5
7	174-180	175.25	179.75	201.5
8	180-186	181.25	185.75	207.5
9	186-192	187.25	191.75	213.5
10	192-198	193.25	197.75	219.5
11	198-204	199.25	203.75	225.5
12	204-210	205-25	209.75	231.5
13	210-216	211.25	215.75	237.5

POWER SUPPLY RATING

117 Volts........60 Cycles......250 Watts

AUDIO POWER OUTPUT RATING

Maximum Undistorted.............2.5 Watts

LOUD SPEAKERS

Model 5210....................5" P.M. Round

Voice Coil Impedance...3.2 Ohms @ 400 Cycles

TUBE COMPLEMENT

TUBE	TYPE	FUNCTION
V1	6CB6	R.F. Amplifier
V2	12AT7	Osc. & Mixer
V3	6CB6	1st I.F. Amplifier
V4	6BA6	2nd I.F. Amplifier
V5	6BA6	3rd I.F. Amplifier
V6	6CB6	4th I.F. Amplifier
V7	6AL5	Video Detector
V8	6AU6	A.G.C.
V9	6AH6	Video Amplifier
V10	17BP4A	Picture Tube
V11	6AU6	1st Sound I.F.
V12	6AU6	2nd Sound I.F.
V13	6AL5	Ratio Detector
V14	6AT6	Audio Amplifier
V15	6V6GT	Power Amplifier
V16	12AU7	Sync.Stripper,Amp& Clipper
V17	6SN7GT	Vert.Osc.Disc. & Phase Splitter
V18	6V6GT	Vertical Output
V19	6W4GT	Damper Tube
V20	1B3GT	Hi-Voltage Rectifier
V21	6BQ6GT	Horizontal Output
V22	6BQ6GT	Horizontal Output
V23	6SN7GT	Horiz.Osc.& Disc. Tube
V24	6AL5	Horiz. Phase Detector
V25	5Y3GT	Lo-Voltage Rectifier
V26	5U4G	Med. Voltage Rectifier

PICTURE I.F. FREQUENCIES

Picture Carrier Frequency....26.25 Mc.
Accompanying Sound Traps.....21.75 Mc.

SOUND I.F. FREQUENCIES

Sound Carrier Frequency.......4.5 Mc.
Sound Discriminator Band Width
(Between Peaks)..............200 Kc.
Video Response............to 4 Mc.
Focus.....................Magnetic
Sweep Deflection..........Magnetic
Scanning.........Interlaced 525 Lines
Horizontal Scanning Frequency..15,750 Cps.
Vertical Scanning Frequency........60 Cps.
Frame Frequency(Picture Repetition Rate) 30 Cps.
Receiver Antenna Input Impedance..300 Ohms. Balanced

OPERATING CONTROLS LOCATED ON FRONT PANEL

Volume...........
Vert. Hold.......
Horiz. Hold......
Brightness.......
Contrast.........
Channel Tuning...

NON-OPERATING CONTROLS

(Not including R.F. & I.F. Adjust.)

Focus............
Vert. Size.......
Vert. Lin........
Horiz. Width.....
Horiz. Cent......
Horiz. Drive.....
Horiz. Osc.......
Defl. Coil.......

VOLTAGE TEST SPECIFICATIONS

1. Line Voltage = 117 Volts A.C.
2. Channel Switch Position = Channel #2.
3. Brightness Control Position = Maximum Brilliance on Picture Tube.
4. Contrast Control Position = Maximum (Clockwise).
5. Horizontal and Vertical Hold Control Positions = Set correct position to lock in picture.
6. Horizontal width and Vertical Size Controls Positions = Set for Maximum Size.
7. Horizontal and vertical Linearity Control Position = Set for Best Linearity.
8. Focus Control Position = Properly focused.
9. Volume Control Position = Maximum Counter-Clockwise.
10. Tone Control Position = Maximum Counter-Clockwise.
11. Instrument (Meter) used = (V.T.V.M.) Vacuum Tube Volt Meter.
12. No signal input applied to set.
13. Unless Otherwise Designated All Voltages Measured In Respect To Chassis Ground.

NOTE: The Points indicated by the letters A, B, C, E & F are the alignment test points referred to in the following alignment procedure. These points indicate the terminals for attaching Generator Leads and are shown in Figure 4 on the reverse side of this sheet.

(A) Pin #2 of 12AT7
Apply signals here for spot I.F. alignment or I.F. sweep.
Apply -3 volts bias through 100,000 Ohms.

(B) Diode Load Resistor
Read D.C. output here for spot I.F. alignment.
Connect scope here for visual I.F. alignment.
Apply 4.5 Mc. here for sound I.F. trap alignment

(C) Cathode Of Picture Tube
Read A.C. output here for overall sensitivity.
Read 4.5 Mc. output here for aligning 4.5 Mc. trap.

(D) Ratio Det. Output
Read D.C. here for alignment of sound take-off trap, inter-stage sound I.F. transformer and primary of Ratio Det. Trans.

(E) Ratio Det. Balanced Output
Read D.C. here for alignment of secondary of Ratio Det. Trans.

(F) A.G.C. Line
Apply 4.5 volts bias here for visual check of I.F. or overall with oscilloscope.

ALIGNMENT EQUIPMENT AND TEST SET UP

TEST EQUIPMENT: In order to align and service Sparton television receivers properly the following test equipment should be available:

FIRST: AN R.F. SWEEP GENERATOR of reliable quality that performs the following functions:

A. Provides sweep outputs in the following frequency ranges:

19 to 30 Mc.	10 Mc. sweep width
40 to 90 Mc.	10 Mc. sweep width
170 to 225 Mc.	10 Mc. sweep width

B. Provides an output signal that can be varied by means of an attenuator up to a maximum of at least .1 volt.

SECOND: AN R.F. SIGNAL GENERATOR that will provide an adjustable output signal up to a maximum of at least .1 volt on the following fixed frequencies:

A. I.F. Frequencies

21.75 Mc.	Sound Trap
22.5 Mc.	1st Video I.F.Coil
25.25 Mc.	2nd Video I.F.Coil
24.25 Mc.	3rd Video I.F.Coil
23.25 Mc.	4th Video I.F.Coil
26.0 Mc.	5th Video I.F.Coil
26.25 Mc.	Picture I.F. Carrier
4.5 Mc.	Sound I.F. & Traps

B. R.F. Frequencies

Channel No.	Picture Carrier	Sound Carrier
2	55.25 Mc.	59.75 Mc.
3	61.25 Mc.	65.75 Mc.
4	67.25 Mc.	71.75 Mc.
5	77.25 Mc.	81.75 Mc.
6	83.25 Mc.	87.75 Mc.
7	175.25 Mc.	179.75 Mc.
8	181.25 Mc.	185.75 Mc.
9	187.25 Mc.	191.75 Mc.
10	193.25 Mc.	197.75 Mc.
11	199.25 Mc.	203.75 Mc.
12	205.25 Mc.	209.75 Mc.
13	211.25 Mc.	215.75 Mc.

THIRD: A CATHODE-RAY OSCILLOSCOPE of good quality that has a fairly wide band vertical amplifier and a low capacity input probe.

FOURTH: AN ELECTRONIC VOLTMETER with ranges to read 1V. DC, 10V. DC and 7V. AC at 400 cycles and 4.5 Mc.

FIFTH: A CRYSTAL CALIBRATOR that can be used for checks on the accuracy of the output frequencies of the R.F. Signal generator.

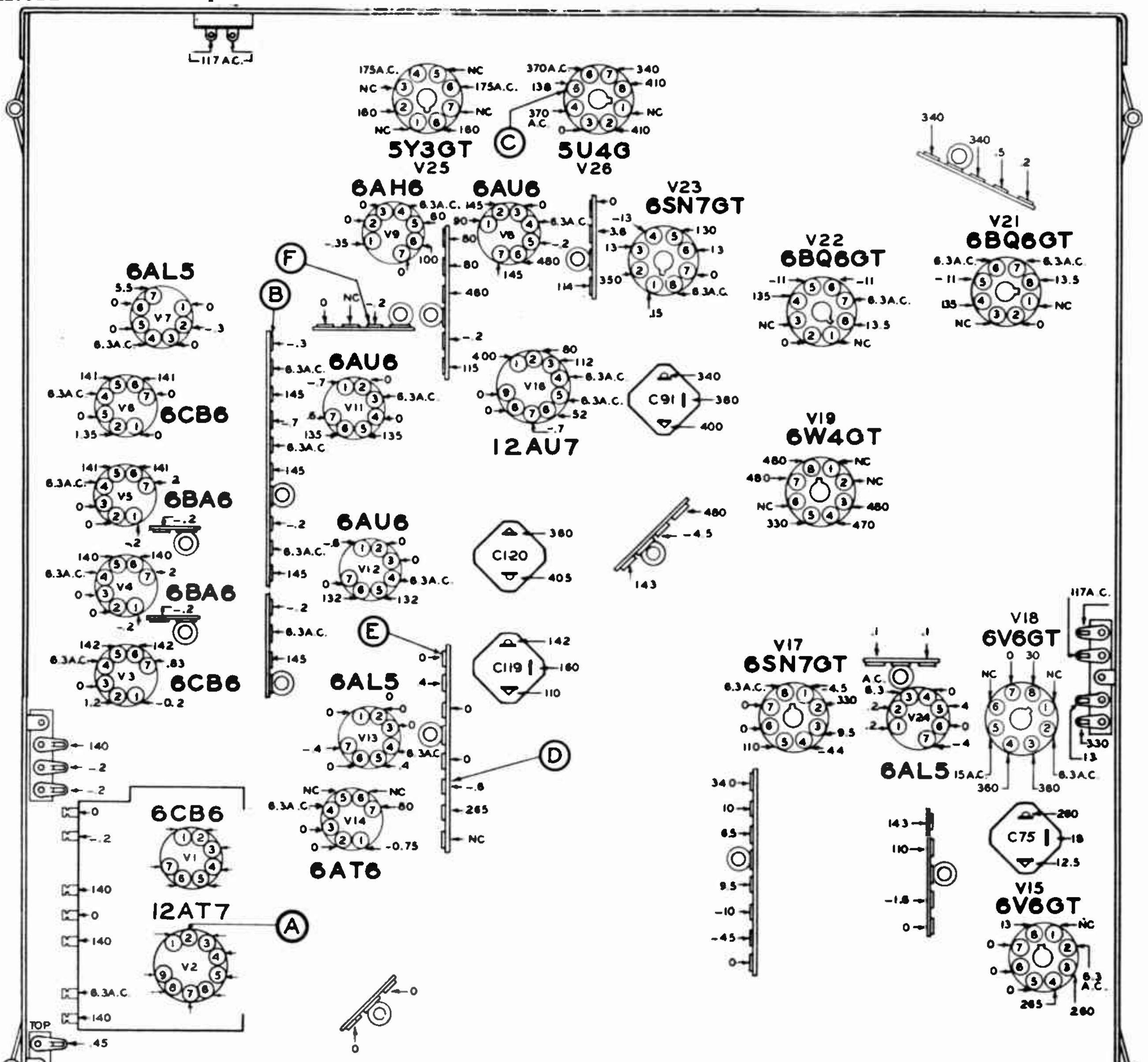
GENERAL INSTRUCTIONS: Practically all servicing with the exception of some tube replacement will require removal of the receiver chassis from the cabinet.

A convenient arrangement that makes both the top and bottom of the chassis accessible for alignment and servicing can be realized by orienting the receiver chassis in such a manner that it rests on its side and on the horizontal output shield can.
ALIGNMENT REQUIREMENTS: Under normal conditions complete receiver realignment will seldom be necessary in the field. However, a detailed description of the overall alignment procedure is included to provide all necessary information if it should be required.

In general it is not recommended that the R.F. and converter circuits of the R.F. tuner be realigned by the service engineer unless absolutely necessary. In cases where tuner components have been damaged, or where complete realignment is indicated, the R.F. tuner assembly should be removed from the chassis and sent back to the factory in exchange for a new unit which will be shipped complete with tubes.

When the new R.F. unit is assembled to the chassis it will be necessary in all cases to realign L6 which is located on the tuner chassis. Normally this is the only adjustment that will be required with tuner change but a check on overall receiver alignment and sensitivity should be made for the sake of certainty and assured customer satisfaction.

EFFECTS OF TUBE REPLACEMENT ON THE ALIGNMENT OF R.F. TUNER CIRCUITS: The alignment of the R.F. and converter circuits of the R.F. tuner is critical and may be affected by a tube change. In ceses where these tubes (6CB6 or 12AT7) are replaced it will be necessary for the service engineer to check for satisfactory receiver operation. If realignment is indicated it can usually be avoided by selection of replacement tubes until receiver operation is realized.



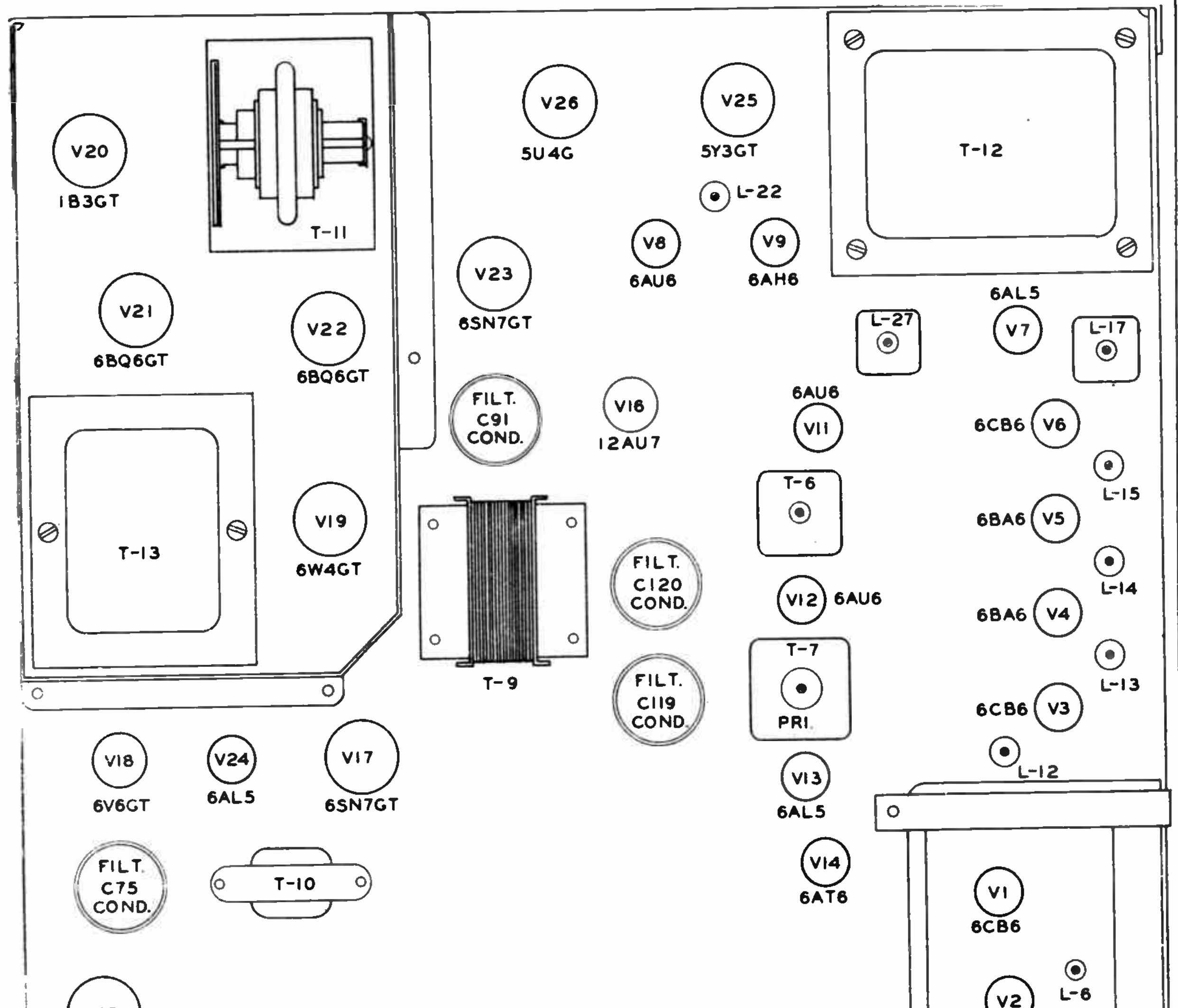
VOLTAGE CHART AND ALIGNMENT TEST POINTS

FIG. 4

ORDER OF ALIGNMENT: When complete receiver realignment is indicated it should be performed in the following order:

1. Sound trap
2. Picture I.F.
3. Sound I.F. and 4.5 Mc. Trap
4. Ratio Detector Transformer
5. Retouch Picture I.F.
6. Sound and Picture I.F. Sensitivity Check
7. R.F. and Converter Circuits(not recommended)
8. Overall Sensitivity Check

PRELIMINARY ADJUSTMENTS: Before alignment the receiver controls should be adjusted to the approximated operation positions specified in the table below. The controls should remain in these positions for all checks unless otherwise specified.



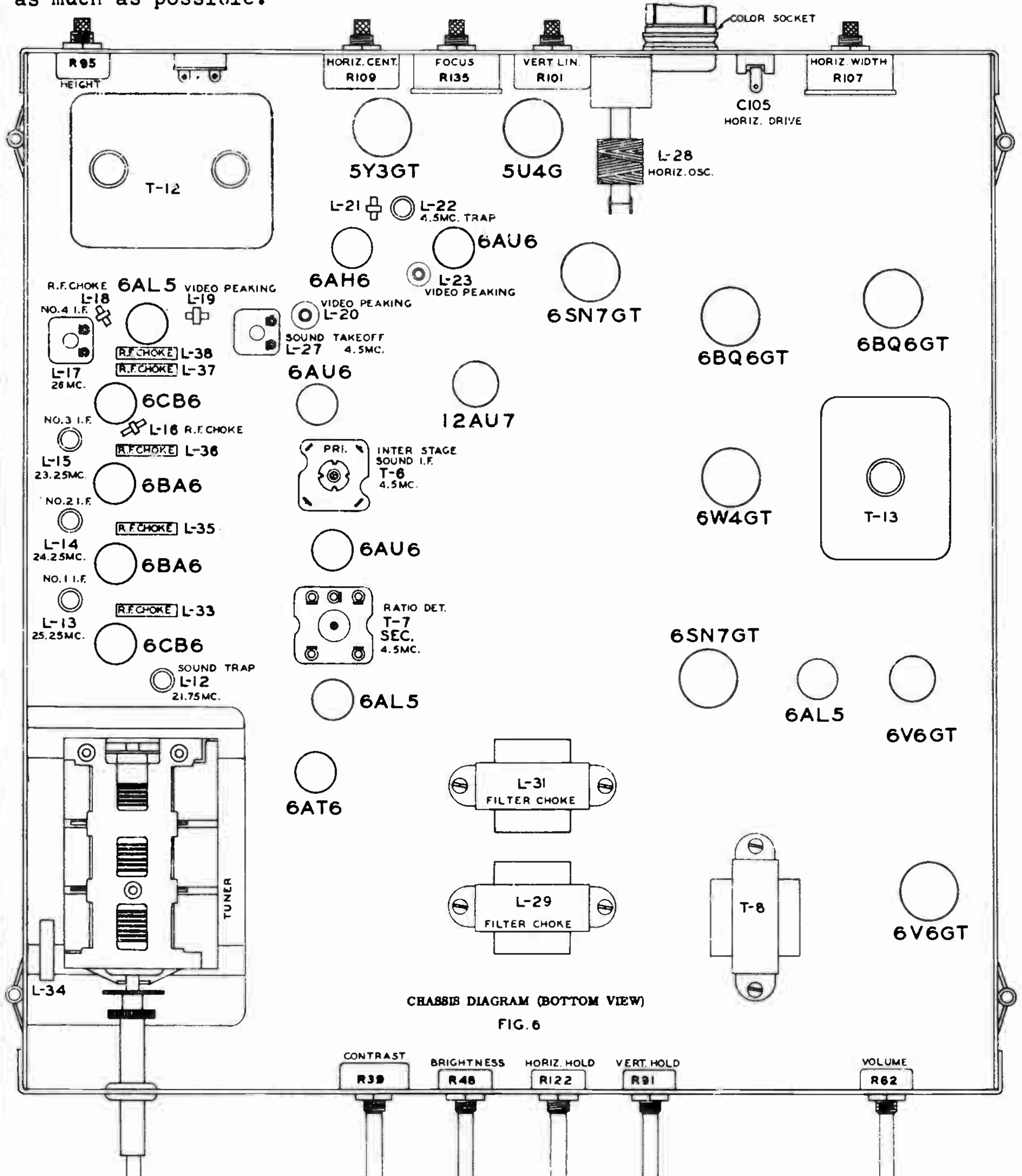
CHASSIS DIAGRAM (TOP VIEW)

FIG. 5

Contrast Control - to center position
Brightness Control- to position where raster is visible on the kinescope
Focus Control - to position where focus is obtained
Vertical Hold - to center position
Vertical Linearity - To center position
Vertical Size - adjusted to give normal raster height
Horizontal Hold - to center position
Horizontal Size - adjusted to give normal raster width
Horizontal Centering - to center raster on tube

ALIGNMENT PROCEDURE

TEST EQUIPMENT SET UP: A certain amount of experimentation must be employed to secure a stable test set up before alignment or service of the receiver is attempted. It is recommended thet the top of the test bench be covered with a sheet of aluminum to insure good grounds between the various pieces of test equipment andthe receiver chassis. In general all test signal input leads should be kept away from output leads as much as possible.



CHASSIS DIAGRAM (BOTTOM VIEW)
FIG. 6

SOUND TRAP ALIGNMENT: FIRST, Connect the R.F. Signal generator to the grid of V-2 by means of the I.F. input adapter as shown in Figure 7.

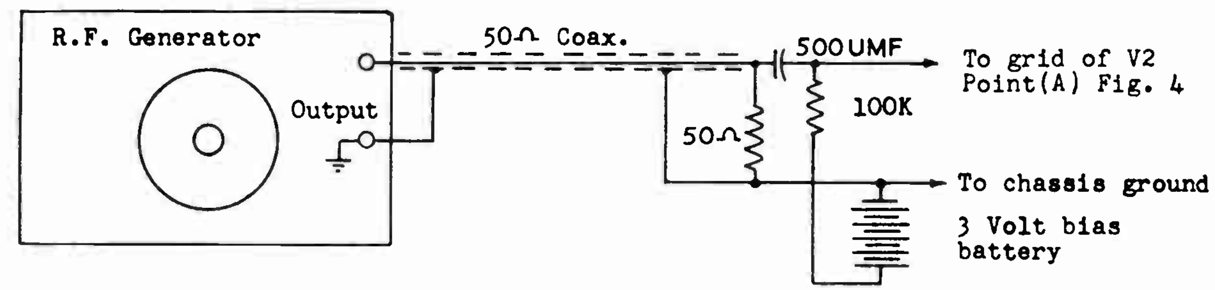


Figure 7 I.F. Input Adapter

SECOND: Set the R.F. tuner to channel #13.

THIRD: Connect a 4.5 volt bias battery between the A.G.C. buss(Point F.Fig.4) and chassis ground so that the voltage on the A.G.C. buss is-4.5 volts in respect to the chassis.

FOURTH: Connect the electronic voltmeter across the picture detector load resistor R37, Point B, Fig. 4 and set the voltmeter on the low D.C. volt scale.

FIFTH: Set the R.F. signal generator to the frequency shown below and tune the specified adjustment for minimum indication on the voltmeter. It is advisable to check the output of the generator with the crystal calibrator to make certain that it is exactly on frequency.

21.75 Mc. L12(Top of chassis as shown in Figure 5)

PICTURE I.F. ALIGNMENT: FIRST: Connect the R.F. Signal generator, voltmeter and bias battery to the receiver as described in steps 1, 2, 3 and 4 of the sound trap alignment instructions.

SECOND: Set the signal generator to each of the following frequencies and peak the specified adjustments for maximum indication of the voltmeter.

22.5 Mc.	L6	(Top of tuner as shown in Fig.5)
25.25 Mc.	L13	(Top of chassis as shown in Fig. 5)
24.25 Mc.	L14	(Top of chassis as shown in Fig. 5)
23.25 Mc.	L15	(Top of chassis as shown in Fig. 5)
26.0 Mc.	L17	(Top of chassis as shown in Fig. 5)

SOUND I.F. ALIGNMENT FIRST: Connect the R.F. signal generator to Point B. Fig. 4.
SECOND: Set the signal generator accurately to 4.5 Mc. This is very important because the picture and sound carriers sent outfrom the television stations are exactly 4.5 Mc. apart.

THIRD: Connect the electronic voltmeter across C71 from Point D to ground as shown in Fig. 4.
Set the voltmeter on the 10 volt scale.

FOURTH: Peak the following coils for maximum reading on the voltmeter.

L 27 Top of chassis as shown in Fig. 5.
T 6 Top of chassis as shown in Fig. 5 and bottom of chassis as shown in Fig. 6.
T 7 (Pri. Ratio Det)Top of chassis as shown in Fig. 5.

RATIO DETECTOR TRANSFORMER ALIGNMENT: FIRST: Connect the R.F. signal generator to the receiver as described in step 1 of the sound I.F. alignment instructions.

SECOND: Connect the electronic voltmeter from Point E, Fig. 4 to ground.
Set the voltmeter on the lowest DC scale.
THIRD: Set the signal generator output to 4.5 Mc. Adjust the secondary of T7 (Bottom view of chassis as shown in Fig. 6). Notice that it is possible to produce a positive or negative voltage indication on the meter by varying this adjustment. As the voltage swings from positive to negative, adjust T7 for

zero output as indicated by the voltmeter. This point iscalled zero ratio detector output and indicates correct alignment of T7 transformer.
If the secondary of T7 is found to be way out of alignment it will be necessary to re-peak the primary as described in the preceeding section on sound I.F. alignment.

4.5 MC. TRAP ALIGNMENT FIRST: Connect the R.F. signal generator as described in Step 1 of the sound I.F. alignment.

SECOND: Connect the electronic voltmeter from the cathode of the picture tube to ground (Point C Fig. 4)
The voltmeter must be capable of giving a reading at 4.5 Mc. at approximately 1 to 2 volts.

THIRD: Peak L22 (Top of chassis as shown in Fig. 5) for minimum output on the voltmeter.

PICTURE I.F. TOUCH UP: Connect the R.F. sweep generator output to the grid of V-2 by means of the I.F. input adapter shown in Figure 7.

SECOND: Apply bias to A.G.C. line as described in Step 3 of sound trap alignment. Set R.F. selector to channel #13.

THIRD: Connect the oscilloscope across the picture detector load resistor R37 (Point B Fig. 4) by means of the shielded cable and the filter system shown in Figure 8.

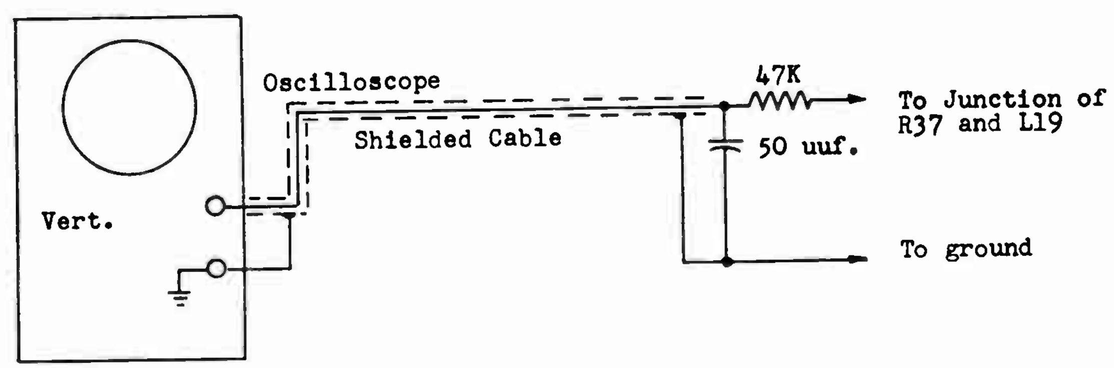


Fig. 8 FILTER SYSTEM FOR SCOPE CONNECTION

FOURTH: Set the R.F. sweep generator so that it sweeps from approximately 20 to 30 Mc.

FIFTH: Adjust the oscilloscope so that the swept I.F. response isvisible on the cathode-ray tube screen.

SIXTH: Loosely couple the output of the R.F. signal generator to the grid of V-2 so that marker signals of proper frequency can be mixed in with the R.F. sweep signal.

SEVENTH: Observe the band width, relative position of the picture carrier, and flatness of the overall I.F. response curve. If necessary slightly vary the tuning of the picture I.F. coils L6, L13, L14, L15, L17 until the picture I.F. response shown in Figure 9 is obtained. The solid curve in Fig. 9 depicts the ideal I.F. response while the dotted curves show permissable variations.

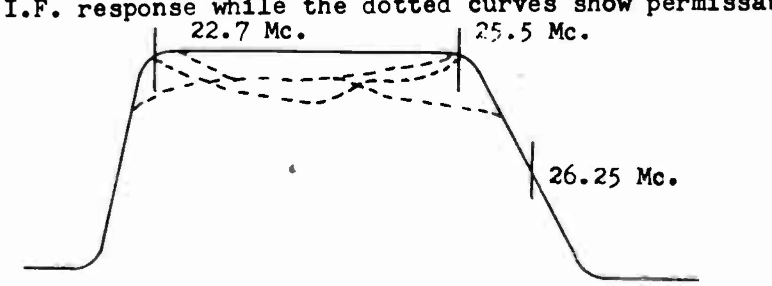


Figure 9 IDEAL I.F. RESPONSE WITH PERMISSABLE VARIATIONS

The picture I.F. carrier should appear approximately half way down the I.F. response curve as shown in Figure 9. Variation in the pix carrier position should not exceed ± 10% from the half way point.

PICTURE I.F. SENSITIVITY CHECK: FIRST: Connect the R.F. signal generator to the receiver as specified in Steps 1 and 2 of the sound trap alignment instructions. (When making sensitivity checks no bias battery is connected to the A.G.C. buss.)

SECOND: Connect the electronic voltmeter across the picture detector load resistor R37 Point A, Fig. 4, and set the meter on the low D.C. volts scale.

THIRD: Set the generator output frequency at approximately 23 Mc. Adjust the generator output until the voltmeter reads approximately 1.0 volt. Record the R.F. signal input in microvolts. Repeat the procedure with the generator output frequency set at 24.2 and 25.4 Mc. In all cases the I.F. input voltage should be 100 Microvolts or less. The sensitivity at the I.F. picture carrier 26.25 Mc. should be approximately half of the I.F. sensitivity between 24.2 Mc. (Maximum of 100 microvolts.)
If the generator output is not calibrated in microvolts, comparative sensitivity measurements can be made by using another receiver that is known to be in good operating condition as a standard. This applies to all sensitivity measurements and good results can be obtained if sufficient care is used.

TUNER ALIGNMENT: The alignment of the R.F. circuits of the tuner is a difficult and tedious task when it must be performed without benefit of special factory test equipment. For this reason it is not recommended that the re-alignment of these circuits be attempted by the service engineer. The information provided in the paragraphs below is intended primarily for descriptive purposes and cases where slight adjustments may be necessary.

An overcoupled tuned circuit is used between the R.F. plate and the converter grid. This overcoupled circuit is tracked with the oscillator. All circuits are gang condenser tuned and shunt trimmer condensers are used. The capacity curves of the gang condenser sections and the high frequency series tracking condensers have been carefully chosen to guarantee a minimum of tuning condenser mistracking. It should never be necessary to adjust the gang condenser capacity by knifing the plates.

In order to correctly track the R.F. and mixer coils to achieve maximum tuner gain and to obtain best response curve symmetry, a system of padding double tuned, overcoupled transformers is used utilizing capacity loading. Capacity loading may be achieved by using a small blade screw driver, and adding additional capacity by touching the screw driver shank with one or more of the fingers. This additional capacity severely detunes one side of the double tuned, overcoupled transformer, so that the single peaked, resonant response of the other side may be observed.

TO ALIGN THE TUNER PROCEED AS FOLLOWS: FIRST: Picture I.F. must be properly aligned.

SECOND: Connect R.F. sweep generator to antenna Terminals through 300 ohm balanced dummy antenna. Dummy antenna may consist of two 150 ohms carbon resistors, one from each terminal of the generator to the antenna terminals marked "A".

THIRD: Connect oscilloscope across the picture detector load resistor R-37 (point B Fig. 4) by means of the shielded cable and the filter system shown in Fig.8.

FOURTH: Perform the operations listed below. In each case adjust for flat wide band overall response with maximum gain as indicated on the oscilloscope screen. The shape of the overall response curve on all channels should be approximately the same as that of the video I.F. response curve shown in Fig.9. Marker pulses of proper frequency should be mixed in with the R.F. sweep input to check overall band width and relative position of the picture carrier on each channel. Always keep the R.F. input signal low so that slight variations in the tuning of the circuits are easily discernable on the oscilloscope screen. The physical location of all the adjustments is shown in Fig. 11,12 & 13.

FIRST: Rotate the tuner to the channel 6 index position.

SECOND: Capacity load the R.F. coil (first stator plate) and adjust the low band mixer trimmer so that the single peaked response curve falls midway between the R.F. carrier markers. (See Figure 10

THIRD: Capacity load the mixer coil (second stator plate) and adjust the low band R.F. trimmer, so that the single peaked response curve falls midway between the R.F. carrier markers.

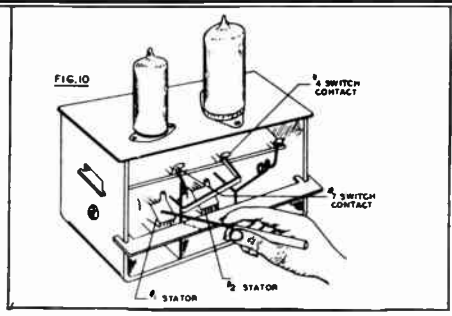


FIG. 10

FOURTH: With no loading on the double tuned circuits adjust the low band oscillator trimmer so that the channel 6 picture carrier marker falls at the 50% voltage reference level. Without loading, the response curve should have symmetrical double humps, the valley between them not being more than 30% down from the peaks.

FIFTH: Check all low band channels. The response curve should remain substantially unchanged through all channels.

HIGH BAND ALIGNMENT: FIRST: Rotate the tuner to the channel 13 index position.

SECOND: Capacity load the R.F. coil (#7 switch lug) and adjust the high band mixer trimmer so that the single peaked response curve falls midway between the R.F. carrier markers.

THIRD: Repeat step 2, loading the mixer coil(#4 switch lug) and adjust the high band R.F. trimmer.

FOURTH: With no loading on the double tuned circuits adjust the high band oscillator trimmer so that the channel 13 picture carrier marker falls at the 50% voltage reference level.

FIFTH: Check all high band channels. The response curve should remain substantially unchanged through all channels.

OVERALL PICTURE SENSITIVITY CHECK:

After alignment of the various sections of the receiver has been completed, the following overall sensitivity checks should be made. (In cases where the signal generator output is not calibrated in microvolts comparative sensitivity measurements can be made by using another receiver which is known to be in good operating condition as a standard.).

FIRST: Connect the R.F. signal generator to the receiver antenna terminals through 300 ohm balanced dummy antenna as described in step #2 of tuner alignment.

SECOND: Connect the D.C. voltmeter across R37 as previously described. Set the voltmeter on the low D.C. volts scale.

THIRD: Set the signal generator at the center frequency of the channel to be measured and tune receiver dial for maximum reading of the D.C. meter. Adjust R.F. level until meter reads 1.0 volts(contrast control in maximum clockwise position). Generator output should be 100 microvolts or less in all bands.

SOUND SENSITIVITY CHECK:

Two R.F. signal generators are required, one of which shall be frequency modulated ± 7.5 Kc. at 400 cycles.

FIRST: Connect both R.F. signal generators to the receiver antenna terminals through separate dummy antenna resistors, doubling the resistance value used for the picture sensitivity test.

SECOND: Open speaker voice coil and connect a 3.ohm audio output meter across output transformer secondary.

THIRD: Connect the D.C. voltmeter across R-37 as previously described.

FOURTH: Set the unmodulated signal generator at the picture carrier frequency of the channel desired. Set the F.M. modulated signal generator at the sound carrier frequency. Keep the two generator outputs equal at all times. Tune receiver for maximum reading of the D.C. meter and then detune toward a lower frequency until the D.C. meter reading is reduced to half. Rock dial of frequency modulated generator for maximum reading on audio meter. Set signal generator outputs for 1.0 watt reading on audio meter. Divide generator microvolts by two since there is a 6DB insertion loss due to the dummy antenna used. This sensitivity reading should be 100 microvolts or less in all channels.

MAXIMUM AUDIO OUTPUT:

With signals applied as in the sound sensitivity check above, and the output of each generator set at 10,000 microvolts, the audio power output should be 3 watts or more.

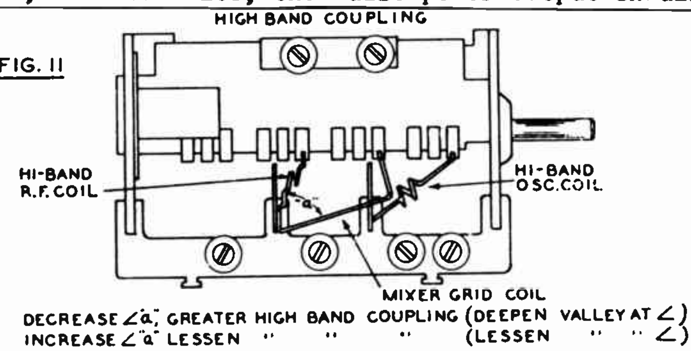


FIG. 11

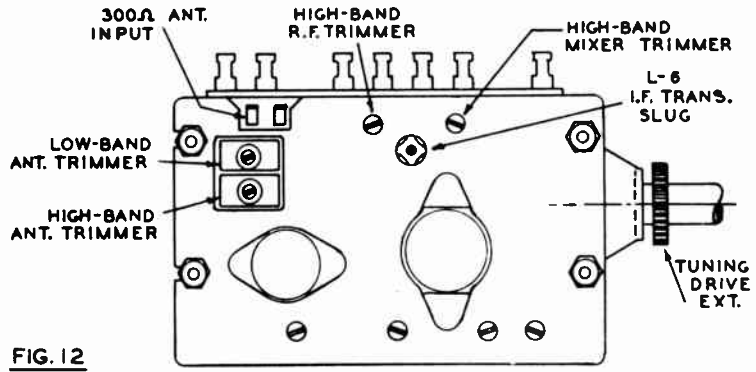


FIG. 12

TOP VIEW

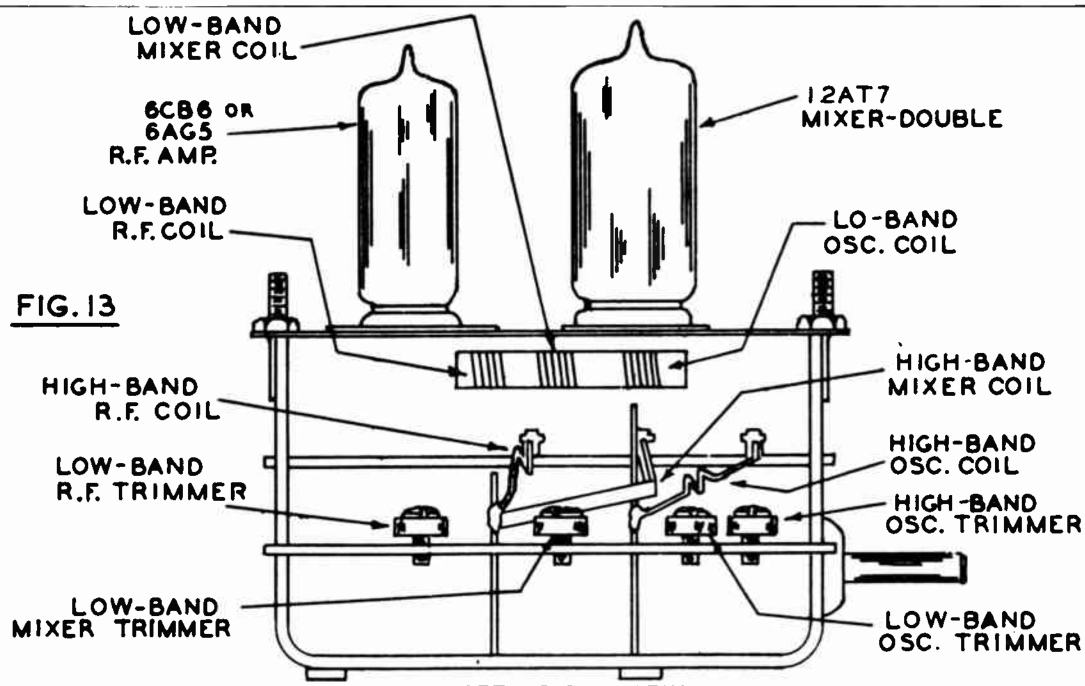


FIG. 13

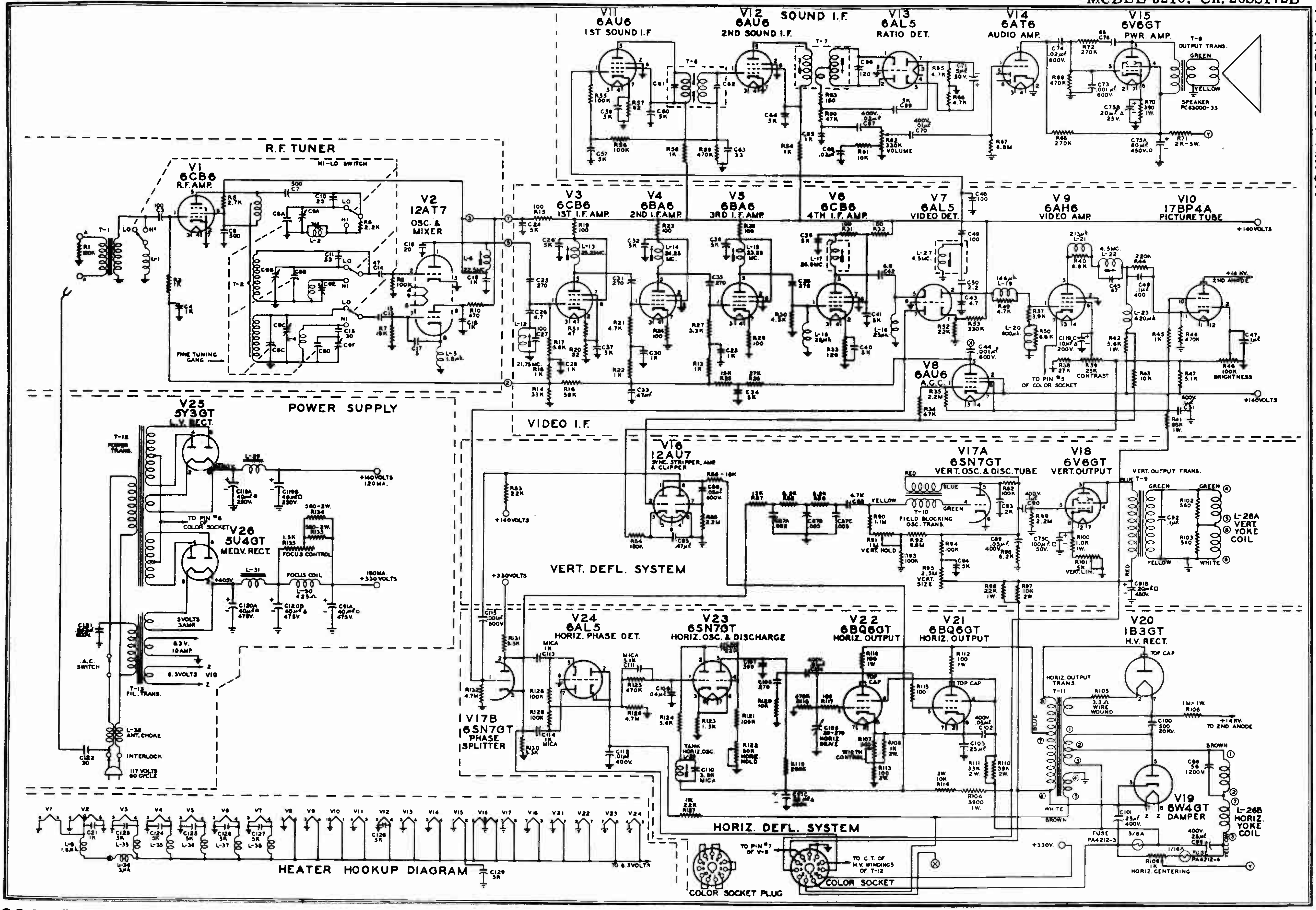
LEFT SIDE VIEW

DESCRIPTION		PART NO.
Condenser	C23,28,30,65 1K Ceramic	HK36M-102
Condenser	- C24,29,32,34,36,37,39,40,41 57,59,60,64,69,94,123,124,125, 126,127,128,129 5K Ceramic	PA4334-1
Condenser	- C25 270 MMF. Ceramic	HK36M-271
Condenser	- C26 4.7 MMF. Ceramic	PA4328-11
Condenser	- C31,35,38 270 MMF. Ceramic	HK36M-271
Condenser	- C42 6.8 MMF. Ceramic	PA4328-13
Condenser	- C27,48,49 100 MMF. Ceramic	PA4332-3
Condenser	- C33,85 .47 MFD. 200V. Tubular	PC42DK-474
Condenser	- C43 4.7 MMF. Ceramic	PA4328-11
Condenser	- C44,115 .001 MFD. 600V. Tubular	PC42GM-102
Condenser	- C45 47 MMF. Ceramic	CC30A-470F
Condenser	- C46, 90 .1 MFD. 400V. Tubular	PC40GL-104
Condenser	- C47 .1 MFD. TUBULAR	PC40HK-104
Condenser	- C50 2.2 MMF. Ceramic	PA4326-1
Condenser	- C51 .1 MFD. 600V. Tubular	PC40GM-104
Condenser	- C63 33 MMF. Mica	MC60E-330
Condenser	- C66 120 MMF. Ceramic	PA4332-4
Condenser	- C67,74 .02 MFD. 400V. Tubular	PC40HL-203
Condenser	- C68 .03 MFD. 200V. Tubular	PC40GK-303
Condenser	- C70 .01 MFD. 400V. Tubular	PC40HL-103
Condenser	- C71 5 MFD. 50V. Elect.	PA4308-2
Condenser	- C73 .001 MFD. 600V. Tubular	PC40GM-102
Condenser	- C75A, B & C 80-20-100 MFD. Elect.	PA4307-23
Condenser	- C76 68 MMF. Mica	MC60E-680
Condenser	- C86 .05 MFD. 600V. Tubular	PC40GM-503
Condenser	- C87A,B & C Herlec Ceramic	PA4339-4
Condenser	- C88 4.7K Mica	MC61F-472
Condenser	- C89 .05 MFD. 400V. Tubular	PC40GL-503
Condenser	- C91A, B & C 40-20-20 MFD. Elect.	PA4307-22
Condenser	- C92 .1 MFD. 200V. Tubular	PC42GK-104
Condenser	- C93 2K Mica	MC61E-202
Condenser	- C98 56 MMF. 1200V. Mica	PA4340-6
Condenser	- C99, 101 .25 MFD. 400V. Tubular	PC40GL-254
Condenser	- C100 500 MMF. 20KV. Ceramic	PA4342-2
Condenser	- C102 .05 MFD. 400V. Tubular	PC40HL-503
Condenser	- C103 .25 MFD. 200V. Tubular	PC40GK-254
Condenser	- C104 .01 MFD. 400V. Tubular	PC40GL-103
Condenser	- C105 20-270 MMF. Trimmer, HOR. DRIVE	PA4368
Condenser	- C106 270 MMF. Mica	MC60E-271
Condenser	- C107 390 MMF. Mica	MC60E-391
Condenser	- C108 220 MMF. Mica	MC60E-221
Condenser	- C109 .04 MFD. 200V. Tubular	PC40GK-403
Condenser	- C110 3.9K Mica	MC63F-392
Condenser	- C111 5.1K Mica	MC61E-512
Condenser	- C112 .01 MFD. 400V. Tubular	PC40FL-103
Condenser	- C113, 114 1K Mica	MC61E-102
Condenser	- C119A, B & C 40-40-10 MFD. Elect.	PA4307-21
Condenser	- C120A & B 40-40 MFD. Elect.	PA4307-13
Condenser	- C121 .047 MFD. 600V. Tubular	PA4346-1
Condenser	- C122 30 MMF. Mica	MC60G-300
R39	- Control-Contrast	PA4442-3
R48	- Control-Brightness	PA4445-2
R62	- Control-Volume	PA4436-3
R91	- Control-Vert. Hold (1 Meg.)	PA4443-2
R95	- Control-Vert. Size (2.5 Meg.)	PA4431
R101	- Control-Vert. Linearity	PA4411
R107	- Control-Hor. Width	PA4448
R109	- Control-Hor. Centering	PA4446
R122	- Control-Hor. Hold	PA4444-2
R135	- Control-Focus	PA4426-1
R17	- 5.6K 1/2W.	BR12S-562
R104	- 3.9K 1W.	CR12S-392
R133	- 560 2W.	DR12S-561
R134	- 560 2W.	DR12S-561

	DESCRIPTION	PART NO.
L-12	Coil - 21.75 Mc. Trap	AB43523-14
L-13	Coil - 26.0 Mc. P.I.F. (1)	AA6408-1
L-14	Coil - 24.25 Mc. P.I.F. (2)	AA6408-1
L-15	Coil - 23.25 Mc. P.I.F. (3)	AA6408-1
L-16	Choke- 25 uh.	AA6650-1
L-17	Coil - 25.25 Mc. P.I.F.	AA6364-1
L-18	Choke- 25 uh.	AA6650-1
L-19	Choke- 150 uh.	AA6402-6
L-20	Choke- 300 uh.	AA6613-8
L-21	Choke- 220 uh.	AA6613-9
L-22	Coil- 4.5 Mc. Trap	AA6407-1
L-23	Choke- 420 uh.	AA6613-10
*L-26 A & B	Vertical & Horizontal Yoke	PC70009
L-27	Coil - 4.5 Mc. Trap	AA6364-2
L-28	Coil - Hor. Oscillator	AA6403-2
L-29	Choke- Filter	AB47009-1
L-30	Coil - Focus	PC70008
L-31	Choke- Filter	AB47009-1
L-33,34,35,36,37 & 38	Choke-Heater	AA6651-1
L-32	Line Cord Antenna Choke	AA6664-1
T-6	Transformer- Sound I.F.	AA6667-5
T-7	Transformer- Ratio Det.	AA6684-4
T-8	Transformer- Audio Output	AB44066-3
T-9	Transformer- Vertical Output	AB44062-7
T-10	Transformer- Vertical Block Osc.	AB47006-4
T-11	Transformer-Horiz. Output	PC70010
T-12	Transformer- Power	AB44019-2
T-13	Transformer- Filament	AB44020-1
Ion Trap		PA1248-2
Fuse 3/8 Amp.		PA4212-3
** R.F. Tuner Assembly		PD93154-1
Kinescope		PD93165-1,-8,-9
Mask		PD93035-2
Safety Glass		PD93036-1
Safety Screen		PB40209-10
Infrequent Control Cover & Spring Assy.		AB43582-1
Sparton Script		PA5842
Knob-Channel Indicator Dial		PA5648-1
Knob Escutcheon & Spring Assembly		AA6370-5
Knob Escutcheon & Spring Assembly		AA6370-6
Knob-Volume Control		PA5652
Knob-Channel Tuner		PA5653
Knob-Fine Tuning		PB40333-1
Knob-Infrequent Control (4 Req'd)		PA5651
Kinescope (17" Rectangular)		PD93165
** Speaker- 5" Round P.M.		PC63000-33

* Deflection Yoke Coil PC70009 supplied only as complete assembly.

** Complete speaker & R.F. tuner assemblies may be returned to Factory Service Department for repair or replacement.


R.F. TUNER
V1 6CB6 R.F. AMP.
V2 12AT7 OSC. & MIXER
V3 6CB6 1ST I.F. AMP.
V4 6BA6 2ND I.F. AMP.
V5 6BA6 3RD I.F. AMP.
V6 6CB6 4TH I.F. AMP.
V7 6AL5 VIDEO DET.
V8 6AU6 A.G.C.
V9 6AH6 VIDEO AMP.
V10 17BP4A PICTURE TUBE
VIDEO I.F.
V11 6AU6 1ST SOUND I.F.
V12 6AU6 2ND SOUND I.F.
SOUND I.F.
V13 6AL5 RATIO DET.
V14 6AT6 AUDIO AMP.
V15 6V6GT PWR. AMP.
SPEAKER PC63000-33
POWER SUPPLY
V25 5Y3GT L.V. RECT.
V26 5U4GT MED.V. RECT.
+140 VOLTS 120MA.
180MA. +330 VOLTS
VERT. DEFL. SYSTEM
V16 12AU7 SYNC. STRIPPER, AMP & CLIPPER
V17A 6SN7GT VERT. OSC. & DISC. TUBE
V18 6V6GT VERT. OUTPUT
L-26A VERT. YOKE COIL
V17B 6SN7GT PHASE SPLITTER
V24 6AL5 HORIZ. PHASE DET.
V23 6SN7GT HORIZ. OSC. & DISCHARGE
V22 6BQ6GT HORIZ. OUTPUT
V21 6BQ6GT HORIZ. OUTPUT
V20 1B3GT H.V. RECT.
V19 6W4GT DAMPER
L-26B HORIZ. YOKE COIL
HORIZ. DEFL. SYSTEM
HEATER HOOKUP DIAGRAM
COLOR SOCKET PLUG
COLOR SOCKET
117 VOLTS 60 CYCLE

SPECIFICATIONS

Direct View Electromagnetic Picture Tube
- 17" Rectangular
- 20" Rectangular
- 21" Rectangular
- 24" Round

Operating Voltage
110-120 60 Cycles

Wattage
175 Watts

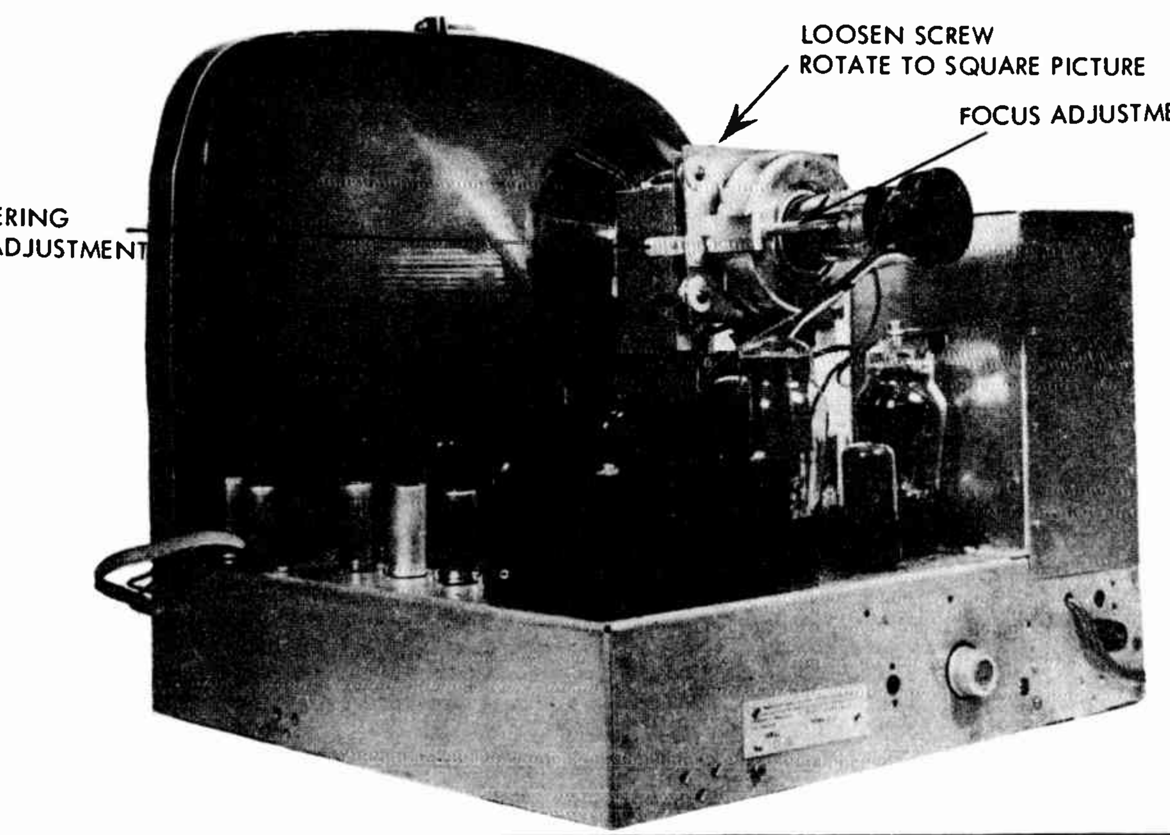
Input Impedance and Transmission Line
300 ohm balanced (between antenna terminals)
75 ohm coaxial cable may be used by connecting shield to chassis and inner conductor to either antenna terminal

Intermediate Frequencies
Video - 25.75 Mc.
Sound - 21.25 Mc.
Intercarrier Sound - 4.5 Mc.

Fuse Location
Horizontal output fuse, F_1, is located inside the high voltage enclosure.
The line fuse, F_2, is located in a fuse holder on the rear apron of the chassis.

Tube Complement

V1	6CB6	R.F. Amp.
V2	6J6	Mixer and Osc.
V3	6CB6	1st I.F. Amp.
V4	6CB6	2nd I.F. Amp.
V5	6CB6	3rd I.F. Amp.
V6	6AL5	Video detector
V7	6AC7	Video Amp.
V8	6AU6	Sound I.F.
V9	6T8	Ratio Det. & Audio Amp.
V10	6V6GT	Audio Output
V11	12AU7	Sync. Separator
V12	6BL7GT	Vert. Osc. and Output
V13	6AU6	AGC Key tube
V14	6AL5	Hor. Phase detector
V15	6SN7GT	Horizontal oscillator
V16	6BG6G	Horizontal output
V17	1B3GT	Pulse rectifier
V18	6W4GT	Damping Diode
V19	5U4G	B plus rectifier
V20	17BP4	- 17" CRT
	20DP4	- 20" CRT
	21EP4	- 21" CRT
	24AP4	- 24" CRT



SPECIFICATIONS

When installing, each set should be checked for picture centering, picture tilt, shaded corners, proper size, linearity, etc., to insure best performance. It is especially important that the Ion Trap be checked, and that the Channel Slugs be adjusted upon installation or servicing of every set to insure ease of tuning. Any adjustments required should be made as described here.

For best results, all checks or adjustments should be made using a transmitted television test pattern. A mirror placed in front of the picture tube screen will be of help in observing the picture while adjusting rear chassis controls.

HIGH VOLTAGE WARNING

Operation of this receiver outside of its cabinet involves a shock hazard from the power supplies. No work should be attempted on this receiver by anyone who is not thoroughly familiar with the precautions necessary when working on the high voltage equipment.

EXTERNAL ANTENNA

When an external indoor or an outdoor antenna is required, be sure to disconnect the built-in antenna leads from the antenna terminal board, tape them and place them away from the chassis.

OPERATING THE TELEVISION RECEIVER

The controls of this receiver are operated conventionally. When tuning, carefully adjust the TUNING control for the best picture.

INDIVIDUAL CHANNEL SLUG ADJUSTMENT "A3" USING TELEVISION SIGNAL

Individual channel oscillator adjustment of every receiver should be checked upon installation or servicing. If this adjustment is properly made, it is possible to tune from one station to another by merely turning the CHANNEL control. With correct oscillotor channel adjustment, best picture will be located at the approximate center of the range of the Tuning control.

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.
b. Set the CHANNEL knob for a station in operation. Set all other controls for a normal picture.
c. Set TUNING control at center of its range by rotating it approximately half-way.
d. Remove the CHANNEL and TUNING knobs.
e. Insert a 1/8" blade, NON-METALLIC screwdriver in the 1/4" hole adjacent to the channel tuning shaft. For each channel in operation, carefully adjust the channel slug for the best picture with clear detail. Be sure that the Tuning control is set at the center of its range before adjusting each channel slug. Only slight rotation of the slug will be required; turning the slug in too far will cause it to fall into the coil. (If the slug falls into the coil, remove the coil, move the retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace slug and re-set retaining spring;)

If a number of slugs are found to tune all the way in or all the way out, or if the 6J6 oscillator-mixer tube has been replaced, it may be necessary to make the "Overall Oscillator Adjustment" as discussed below.

OVER-ALL OSCILLATOR ADJUSTMENT "A1" USING TELEVISION SIGNAL

Over-all oscillator adjustment should only be necessary when replacing the oscillator-mixer tube (6J6), or when all channel slugs are off in the same direction. When replacing the oscillator-mixer tube (6J6), it is recommended that several tubes be tried to select one which will cause least oscillator frequency shift.

A1 is generally adjusted so that approximately 3/16" of screw thread is exposed.

Adjust as follows:

a. Follow steps "a", "b", and "c" above.
b. Carefully adjust trimmer C6 (figure 8) for best picture with clear detail.
c. Check and, if necessary, make individual channel adjustments as indicated above.

ION TRAP ADJUSTMENT

To properly adjust the Ion Trap, Focusing Device and the Deflection Yoke the following procedure should be followed.

The Deflection Yoke should be placed in position closest to the "bell" of the Cathode Ray Tube as far forward on the neck of the tube as is possible. The Focus Device is next in line and Ion Trap last. See Figure 1.

The antenna should be connected to the receiver, the set should be turned on, the brilliance control turned to MAXIMUM and the contrast control at MAXIMUM.

The Ion Trap should be moved forward and backward and at the same time rotated to achieve the brightest raster on the face of the CRT.

Reduce the brilliance control to a point slightly over normal brightness and adjust the Focus Control on the rear of the Focus Device with a non-magnetic screwdriver for clearest and sharpest horizontal sweep lines. The Ion Trap should then be readjusted slightly for the brightest response on the face of the tube.

The Focus Device aperture should be moved to secure a complete raster centered and with no corners cut off.

Finally the Deflection Yoke should be rotated to "square" the raster with the chassis as a reference. The screws on the yoke brackets should then be set.

HEIGHT, WIDTH AND LINEARITY

To adjust the overall size and linearity of the picture it is almost mandatory that a pattern transmitted from a local station be used. Linearity adjustments, particularly, cannot be accurately made on moving transmissions. It should also be remembered that in areas where more than one station is being received, that pictures transmitted from different stations will vary slightly in size. The smallest transmitted picture should be made to fill the area delineated by the mask.

The first step in linearity and size adjustment is to turn the Width Control (rear of chassis) all the way in. (clockwise)

The Horizontal Drive trimmer should then be adjusted for the best compromise between maximum brightness and good horizontal linearity. Misadjustment of the Horizontal drive condenser will show as bright vertical bars on the left hand side of the picture. The Width Control should then be backed out until the picture is the correct width.

Vertical Linearity and height adjustment are made in the conventional manner. It will be noted that there is some interaction between these controls.

HORIZONTAL OSCILLATOR ADJUSTMENT

The set should hold horizontal sync over approximately one turn of the horizontal hold control. This will vary with signal strength of the received station. The control will bind at the extreme ends of its rotation. Do not attempt to force it to turn after binding is encountered or serious damage will result. If the set does not hold at a point in the center of the control range it indicates trouble in the horizontal oscillator or sync phase detector.

PICTURE TUBE REPLACEMENT

Important: After replacing any picture tube, be sure to make all deflection adjustments -- Picture Centering, Deflection Yoke, and Ion Trap -- Especially note comments on picture centering.

WARNING: Because of the high 2nd anode voltage used (approximately 12KV) and the possibility of danger of implosion due to high vacuum, the following precautions should be noted when removing or replacing picture tubes:

a. Before handling a picture tube, remove the 2nd anode static charge from both the picture tube and the 2nd anode connector by shorting them to chassis.
b. Shatterproof goggles and heavy gloves should be worn while handling or installing a picture tube.
c. Always handle the picture tube very carefully. DO NOT pick the tube up by the neck.

VOLTAGE CHART

TUBE		1	2	3	4	5	6	7	8	9
V1	6CB6	0♦	0♦	0♦	6.3AC♦	105♦	105♦	0♦	-	-
V2	6J6	105♦	105♦	0♦	6.3AC♦	0♦	0♦	0♦	-	-
V3	6CB6	-0.4	0.5	6.3AC	0	90	90	0	-	-
V4	6CB6	-0.4	0.5	6.3AC	0	95	95	0	-	-
V5	6CB6	0	1.4	6.3AC	0	100	100	0	-	-
V6	6AL5	0	0	6.3AC	0	0	0	-0.5	-	-
V7	6AC7	0	6.3AC	0	-0.5	1.4	100	0	225	-
V8	6AU6	-0.3	0	6.3AC	0	100	100	0.6	-	-
V9	6T8	-0.4	-0.8	-0.4	0	6.3AC	0	0	-0.8	75
V10	6V6	NC	0	225	250	0	NC	6.3AC	10	-
V11	12AU7	60	10	10	6.3AC	6.3AC	10	-0.7	0	0
V12	6BL7	-0.9	320	19	-30	75	0	0	6.3AC	-
V13	6AU6	235	250	250	6.3AC*	†	350	250	-	-
V14	6AL5	0	0	6.3AC	0	6	0	-4	-	-
V15	6SN7	-7	120	13	1.3	320	13	6.3AC	0	-
V16	6BG6	-25	0	0	NC	-25	NC	6.3AC	270	-
V17	1B3	†	†	†	†	†	†	†	†	-
V18	6W4	NC	NC	550	NC	†	†	250	6.3AC‡	-
V19	5U4	NC	5AC △	NC	355AC	NC	355AC	NC	360	-

TEST CONDITIONS:

LINE 117V. - 60 CYCLE A.C.
ANTENNA SHORTED-TUNE TO CHANNEL 13
CONTRAST, BRIGHTNESS, & VOLUME AT MINIMUM.
OTHER CONTROLS IN NORMAL OPERATING POSITION.
VOLTAGES TAKEN WITH VTVM FROM POINT INDICATED TO CHASSIS EXCEPT WHERE NOTED.

NOTES:

♦ TUBE REMOVED FROM SOCKET
† DO NOT MEASURE
* MEASURED BETWEEN PINS NO.3 & NO.4
‡ MEASURED BETWEEN PINS NO.7 & NO.8
△ MEASURED BETWEEN PINS NO.2 & NO.8

TELEVISION ALIGNMENT PROCEDURE

GENERAL

Complete alignment consists of the following individual procedures. Complete alignment should be performed in this sequence.

a. IF Amplifier Alignment.
b. 4.5 MC Sound IF Alignment.
c. RF and Mixer Alignment.
d. Overall RF and IF Response Curve Check and High Frequency Oscillator Alignment.

TEST EQUIPMENT

To properly service this receiver, it is recommended that the following test equipment be available. Note: Equipment below may be available as a single unit, except for the vacuum tube voltmeter.

SWEEP GENERATOR

Sweep generator must provide sweep frequencies from
18 to 30 MC range: 10 MC sweep width.
50 to 90 MC range: 10 MC sweep width.
170 to 225 MC range: 10 MC sweep width.
Output: adjustable; at least one-tenth volt maximum.
Output impedance: 300 ohms balanced to ground.
Sweep generator should preferably have a built-in marker generator with calibration crystal for checking dial accuracy.

SIGNAL GENERATOR with crystal calibrator which can also be used as a marker generator.
4.5 MC frequency.
18 to 30 MC frequency range.
50 to 90 MC frequency range.
170 to 225 MC frequency range.
Must have a built-in calibration crystal for checking dial accuracy.

OSCILLOSCOPE

Standard oscilloscope, preferably one with a wide band vertical deflection, vertical sensitivity at least .5 volt peak-to-peak per inch.

VACUUM-TUBE VOLTMETER

Standard Vacuum-tube Voltmeter with high resistance input and low voltage DC Range (3 volts or less). In addition, a zero center low voltage range will be found useful.

ALIGNMENT TOOLS

An alignment tool kit consisting of one metallic and one non-metallic screwdriver is necessary.

SWEEP GENERATOR NOTE

A sweep generator which does not have constant output voltage and reasonably linear sweep frequency distribution, will produce curves which are widely different from the "IF" Response Curve" or Overall RF and IF Response Curve" Shown in the following pages. If repeated difficulty is encountered in obtaining these curves, the sweep generator should be checked. A simple check is to observe the response curve for a set that is known to be in alignment.

Before suspecting the generator, be sure the alignment instructions in this manual have been followed carefully.

IF AMPLIFIER ALIGNMENT

a. Disconnect antenna; connect jumper wire across terminals.
b. Set receiver to channel 13 or other unassigned high channel to prevent interference during IF alignment. Set Picture control fully to right.
c. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Signal Gen. Frequency (MC)	VTVM and Signal Generator Connections	Instructions	Adjust
1	25.2	VTVM high side to test point "T", low to chassis. R.F. gen. high side to floating tube shield on 6J6. Low to chassis.	Use VTVM 3 volt DC scale. Adjust signal generator to maintain approximately 1 volt output.	L4 & L2 for Max.
2	23.0			L1 & L3 for Max.
3	To insure correct I.F. alignment, make the "I.F. Response Curve Check" given below.			

IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope with sweep input to RF Mixer V2).

Differences in tube gain and component values affect IF response. These differences are not apparent in alignment of IFs when using a signal generator and VTVM (single frequency alignment); hence it is preferable that an IF response curve check be made after completion of the IF amplifier alignment.

The IF response curve check can be made as indicated directly below. However, also note that a better check can be made by feeding the sweep signal through the entire RF and IF system as given under "Overall RF and IF Response Curve Check (Step 1)". The overall check should be made after making all other alignments.

a. Make all control settings and connections as given in "a" through "c" the IF amplifier alignment chart above.
b. Connect oscilloscope* between point "T" and chassis ground, see fig. 4. Keep leads away from receiver.
c. Connect sweep generator high side to tube shield of 6J6 (V2) osc-mixer tube. Be sure to insulate tube shield from chassis. Connect sweet generator low side to chassis close to 6J6 tube base. Set sweep generator to sweep the IF band pass (19 to 29 MC).
d. If sweep generator does not have a built-in marker generator, loosely couple marker generator high side to the sweep generator lead connected to tube shield on tuner; low side to chassis ground.

To avoid distortion of the response curve, keep the sweep generator and marker generator outputs at a very minimum.

Marker pips should be just kept barely visible. To minimize distortion, set sweep generator output for VTVM reading of approximately .6 volt DC, measured between test point "T" and chassis. Connecting a 1-1/2 volt battery (negative to AGC Line, positive to chassis) will allow greater signal input without distorting the response curve.

e. Check curve obtained against the ideal IF response curve shown in figure 3. Since it is not always possible to get ideal curves, it should be noted that the height of opposite peaks should be within 30% of each other. The dip or valley in the center of the curve should not be greater than 30% down from the highest peak of the curve. Check video and sound IF carrier points by means of marker generator. It is important that marker pips be in the proper location on the response curve. The 25.75 MC marker, should be 50% below the highest peak on the high frequency side of the curve. The 22 MC marker should be at the opposite side of the response curve, located approximately 85% below the highest peak. The 21.25 MC marker should be located at least 95% below the highest peak, and may or may not be visible.

Consistent with proper band width and correct location of markers, the response curve should preferably have maximum amplitude, symmetry, and flat top appearance.

If the procedure given has been carefully followed and the response curve obtained differs greatly from the curve shown, repeat the IF Amplifier Alignment, making sure generator frequencies are precise and adjustments are accurately made.

***OSCILLOSCOPE NOTE**

• In dealing with RF and IF response curves, it is well to remember that an inverted or mirror image may result, depending on the sweep generator and oscilloscope used. The general waveform should still be identical.
When using a wide band oscilloscope for alignment, marker pips will be more distinct if condenser from 100 to 1,000 mmfd. is connected across the oscilloscope input. Caution: Use the smallest condenser possible, since too high a capacity will affect the shape of the response curve.

ALIGNMENT HINT

After becoming familiar with alignment procedure, some servicemen simplify subsequent alignment of sets by merely using the essential alignment data given in figures below.

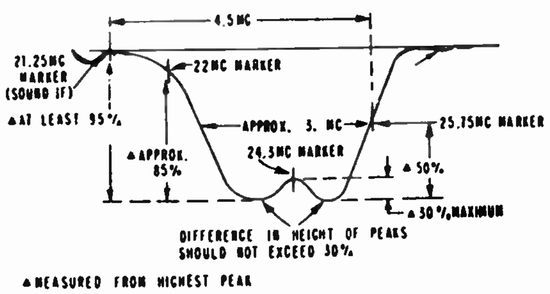


Figure 3 IF Response Curve.

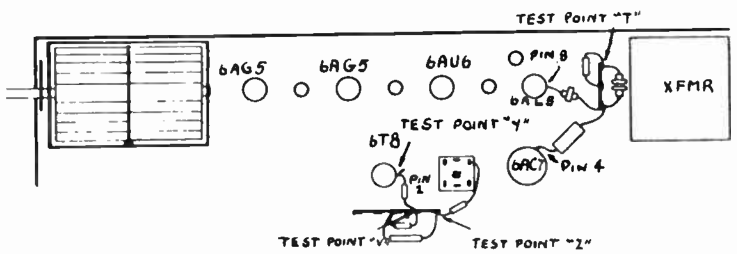


Figure 4 Bottom View Showing Test Point Connections.

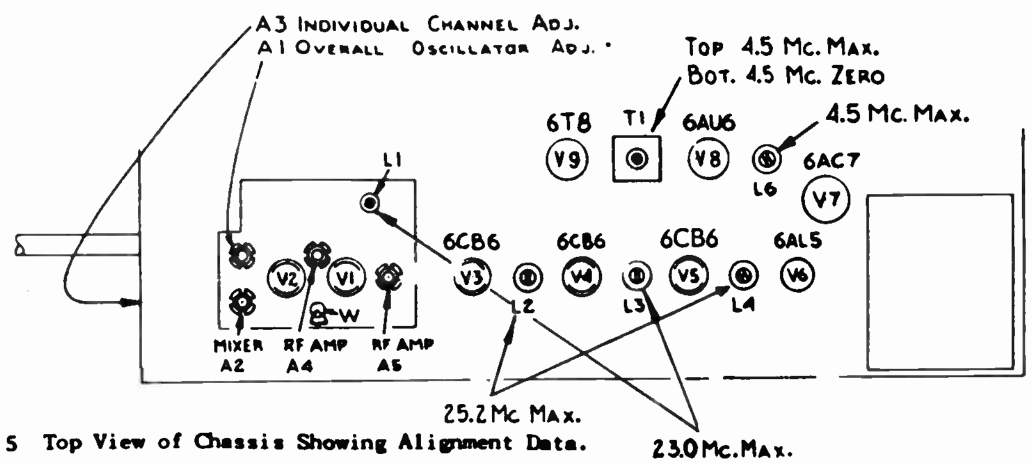


Figure 5 Top View of Chassis Showing Alignment Data.

4.5 MC SOUND IF ALIGNMENT

a. Disconnect antenna. Connect jumper wire across terminals.
b. Connect signal generator high side to Pin 4 V7, connect low side to chassis.
c. Allow about 15 minutes for receiver and test equipment to warm up.
d. Set Picture control fully to the right (clockwise).

Step	Signal Gen. Freq. (MC)	VTVM Connections	Instructions	Adjust
1	Since the transmitted video and sound carriers have an accurate 4.5 MC frequency difference, it is adviseable to use a TV station signal instead of a signal generator for accurate alignment of steps below. When using a television signal, it may be necessary to use a higher scale on the VTVM. (30V) IMPORTANT: When using a signal generator, be sure to check it against a crystal calibrator or other frequency standard for accurate frequency calibration at 4.5 MC. Accuracy required is within one kilocycle.			
2	4.5 unmodulated or AM modulated. See step 1 for use of station signal.	High side to test point "Y"; common to chassis.	Use 3 volt DC scale on VTVM. Keep VTVM leads well separated from signal generator (if used) and chassis wiring.	L6 and top of T1 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt).
3		High side to test point "Z" common to test point "V"	Use 3 volt zero center scale on VTVM, if available. Keep VTVM leads well separated from signal generator (if used) and chassis wiring.	Bottom of T1 for zero on VTVM (the correct zero point is located between a positive and a negative maximum).

(See MC Chart, Fig. 6. RF Response Curve, Fig. 7. Front view of T V Tuner and Fig. 8. Top of TV Tuner, Showing Adjustment Location) Fig. 4 For Test Point Location.

RF AND MIXER ALIGNMENT

a. If used earlier, disconnect 1-1/2 volt battery.
b. Disconnect antenna from receiver.
c. Connect sweep generator to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.
d. Connect oscilloscope through a 10,000 ohm resistor to test point "W" on tuner (Fig. 8). Keep scope leads away from chassis.
e. Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	205.25 (Video Carrier) 209.75 (Sound Carrier)	Sweeping Channel 12	Check for curve resembling RF Response Curve shown below. If necessary, adjust A8, A9 and A10 (figure 9) as required. Note that adjusting A9 will shift the center of the response curve in relation to the video and sound carrier markers. A8 and A10 should be alternately adjusted for best gain with flat top appearance. Consistent with proper band width and correct marker location, response curve should have maximum amplitude and flat top appearance.
2	See frequency table below. Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve resembling RF Response Curve shown below. In general, the adjustment performed in step 1 is sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for the weak channel as a compromise adjustment to favor this particular channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.

OVERALL RF and IF RESPONSE CURVE CHECK (Step 1) and HF OSCILLATOR ALIGNMENT (Step 2)

(Using sweep generator and oscilloscope.)

IMPORTANT

Since HF Oscillator alignment requires absolute frequency accuracy, a station signal is generally best suited for alignment of the individual channel oscillator slugs A3. The procedure for using a station signal (and without removal of chassis) is given in "Individual Channel Slug Adjustment Using Television Signal" on page 1.

The procedure for HF Oscillator alignment with an oscilloscope and a sweep generator is given below.

a. Disconnect antenna.
b. Disconnect signal generator and VTVM (if used earlier).
c. Set the Tuning control at half rotation by rotating it approximately 150° as shown in Figure 7.
d. Connect sweep generator to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible. Connecting a 1-1/2 volt battery (negative to AGC Line; positive to chassis) will allow greater signal input without distorting response curve.
e. Connect oscilloscope between point "T" and chassis ground (see Figure 4). Keep oscilloscope leads away from chassis.
f. Allow about 15 minutes for receiver and test equipment to warm up.
g. When adjusting A3, use a NON-METALLIC alignment screwdriver with a 1/8 inch blade.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	Sweep the RF band pass (channel 13 or other unassigned high channel) and check the shape of the overall response curve obtained against the ideal curve shown below. If shape of curve is not within limits shown, it will be necessary to repeat the IF Amplifier Alignment. The IFs must be accurately aligned before correct oscillator adjustment can be made.		
2	See frequency table on page 11. Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency. Marker generator must have, or be used with, a calibrating source providing an accuracy of at least .05%.		Set the Tuning control at half rotation (see figure 7). Check to see whether oscillator alignment is required by comparing the location of the video and sound carrier markers (sound carrier marker may or may not be visible) on the response curve obtained for each channel with the "Overall RF and IF Response Curve" shown below. Note whether mis-alignment is evident on a major number of channels or on only a few channels. *If the markers for a major number of channels* are far off in the same direction, adjust the overall oscillator adjustment A1 (on channel 13 or other unassigned high channel) so that the video carrier marker is located as shown in the response curve given below. (If the video carrier marker is at the proper point on the curve, the sound carrier marker should locate at the proper point on the curve.) Be sure the Tuning control is at half rotation while making this adjustment. Recheck all channels individually for proper marker location. *If only individual channel adjustment is required,* adjust the particular individual channel slug A3, (using a NON-METALLIC alignment tool with a 1/8" blade) so that the video carrier marker is located as shown in the response curve given below. Only slight rotation of the slug will be required; turning the slug in too far will cause the slug to fall into the coil.[1] (If the video carrier marker is at the proper point on the curve, the sound carrier marker should locate at the proper point on the curve.) Be sure the Tuning control is at half rotation while making this adjustment.
3	To insure best reception and ease of tuning, a "touchup" adjustment of the individual channel slugs A3, using the station signal from each of the stations in the service area, must be made, preferably in the customer's home. See "Individual Channel Slug Adjustment Using Television Signal"		

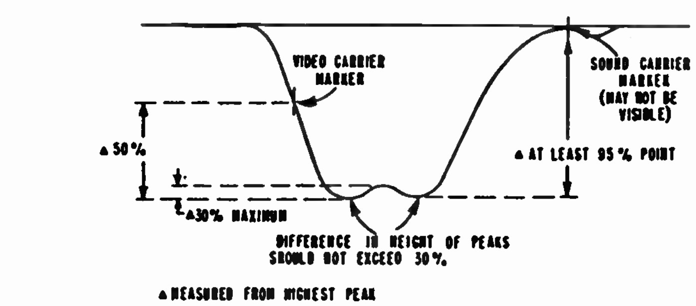
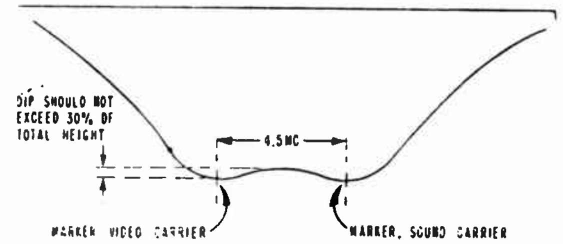


Fig. 9 Overall RF and IF Response Curve.

[1] If an oscillator slug should fall into a coil, remove the coil, move the slug retaining spring aside, lightly tap the open end of the coil against a solid object until the slug slips out. Replace slug and set the retaining spring into its cut-out slot.

Channel Number	Channel Freq. MC	Video Carrier, MC	Sound Carrier, MC
2	54- 60	55.25	59.75
3	60- 66	61.25	65.75
4	66- 72	67.25	71.75
5	76- 82	77.25	81.75
6	82- 88	83.25	87.75
7	174-180	175.25	179.75
8	180-186	181.25	185.75
9	186-192	187.25	191.75
10	192-198	193.25	197.75
11	198-204	199.25	203.75
12	204-210	205.25	209.75
13	210-216	211.25	215.75



Full skirt of curve will not be visible unless generator sweep width extends beyond 10 MC.
Figure 6. RF Response Curve.

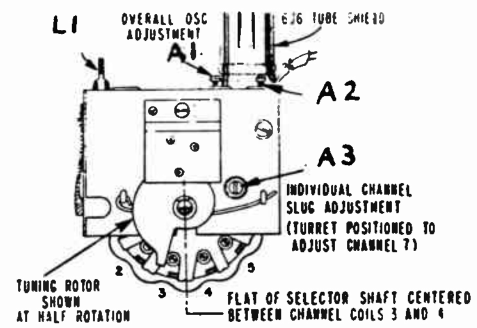


Fig. 7. Front View of TV Tuner.

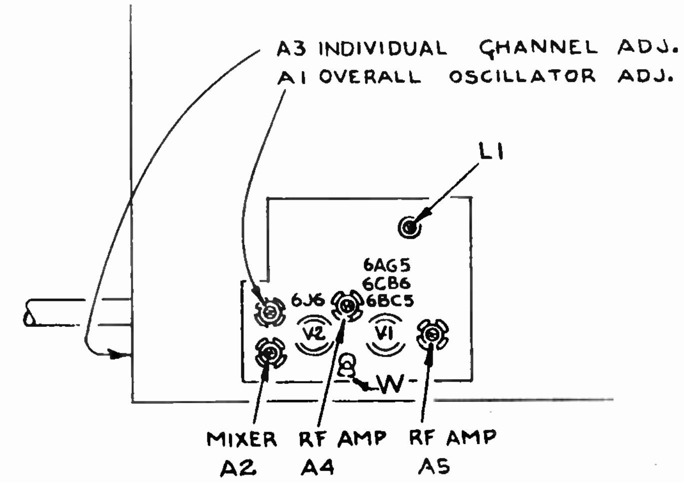


Figure 8. Top of TV Tuner, Showing Adjustment Location.

TELEVISION TUNER SERVICE

GENERAL

The TV tuner is a sub-chassis consisting of an RF amplifier stage and a mixer-oscillator stage.

Three different RF amplifier tubes, either 6AG5, 6BC5, or 6CB6, are used in this tuner. Although these tubes have similar characteristics and are generally interchangeable, it is advisable to check the RF amplifier curve with a sweep generator and oscilloscope after replacement. A dual triode 6J6 tube is used in the mixer-oscillator stage.

Channel selection is accomplished by rotation of the tuner turret assembly, which has a separate set of two coils for each of the 12 television channels. Each set consists of an antenna coil in one assembly, and a mixer-oscillator coil in another. Coils are the snap-in type. Coils can be identified as to channel by the number stamped on the outside of the coil assembly. A Tuning control permits fine adjustment of oscillator frequency.

The high frequencies used in television make it necessary that extreme care be exercised in servicing tuners.

Location and lead dress of components and wiring are usually very critical. Wiring leads, acting as small inductances or capacities, may appreciably alter electrical characteristics of critical circuits at high frequencies.

Parts location and ground connections should be as originally made. When replacing components, *it is important that they be replaced with parts of identical electrical characteristics and physical size.* Refer to parts list for temperature coefficients, tolerances, and other essential description.

Note resemblance between some ceramic condensers and resistors. If in doubt, check Schematic.

Also note that replacement of tubes (especially 6J6 oscillator-mixer tube) may cause some slight detuning of tuner circuits. This is due to the inherent differences of inter-electrode capacitances. When replacing 6J6 tube, it is recommended that several tubes be tried in order to select a tube which will cause least oscillator frequency shift. This is easily checked by noting the amount of rotation of the Tuning control required to tune in the television signal. It is recommended that this check be made on the high channels. Make individual channel slug adjustments as instructed on page

Channel snap-in coils must be handled with care. Do not disturb coil windings. Also be sure the coils are properly paired for the indicated channel number, and that coils follow proper sequence when reassembled in the turret drum. For proper reference of tuner shaft in relation to coil position refer to figure 7.

TUNER REPLACEMENT

Replacement of the complete tuner should generally never become necessary since electrical and mechanical parts are easily replaceable.

TUNING CONTROL

The Tuning control is a variable dielectric type condenser. The normal tuning range of the Tuning control for high channels is plus or minus 3 MC, for low channels plus or minus 1.5 MC.

Slight rubbing of the dielectric rotor of M104 against the grounded stator plate M107 is intentional, in order to avoid vibration with resulting microphonics. However the dielectric rotor should not be allowed to contact the circular disc riveted to the body of the tuner.

The Tuning control is permanently set at the factory and cannot be readjusted for frequency tuning range.

REMOVING CHANNEL COILS

Insert a screwdriver blade between the coil retainer spring and the turret end plate. Twist the blade away from the turret and lift the end of the coil upward.

CLEANING CONTACTS

Remove several sets of coils from turret and rotate turret to position making contact points of contact plate accessible for cleaning.

Using a small, stiff brush and carbon tetrachloride, clean contact surfaces of stationary contacts.

Remove accumulated dust or grease from stationary contacts and contact plate with a soft canvas cloth dampened with carbon tetrachloride. Accumulated rosin may be removed with a soft cloth dampened with alcohol.

Clean contact surfaces of rotating coils in same manner.

TUNER LUBRICATION

In general the lubrication applied to points of wear or friction at time of manufacture should make lubrication seldom, if ever necessary. However, should tuner lubrication become necessary, it is important that the correct amount and type of lubricant be used.

Using a clean brush, apply a film of switch contact oil, Viscosity Oil Co. #7069) to the surfaces of the coil contacts and stationary contact points.

Lubricate bearing surfaces of all other moving parts with light vaseline or preferably Viscosity Oil Co. #8857 lubricant.

CAUTION: Do not use lubriplate or any similar lubricant containing zinc or cadmium.

ADJUSTING CONTACT SPRINGS

Should the stationary contact springs make poor contact due to insufficient tension, remove several sets of coils from the turret. Rotate the turret to position making the bottom of the contact strip accessible for observation. With a narrow blade screwdriver, adjust the contact spring tension by carefully bending the spring inward until highest point on the spring extends about 9/64 of an inch above the plastic surface of the contact plate. With correct tension of the contact spring, the spring should clear the flat surface of the turret coil by about 1/64 of an inch.

OSCILLATOR SLUGS IN TOO FAR

If HF oscillator slugs "fall into" coil form, remove the channel coil, move the slug retaining spring M112 aside, and tap the coil assembly until the slug slips forward. Set the slug retaining spring into position; it should rest firmly against the slug.

REMOVING TUNER TURRET ASSEMBLY

a. Remove retaining bracket M107 in front of the tuner.
b. Remove rotor shaft assembly M104, rotor contact spring M124 and fibre washer M113. For reassembly, note order of parts removal.
c. Remove front and rear turret retaining springs M125 by pressing straight end away from tab on chassis.
d. Using a screwdriver blade at the side of the tuner, press the detent spring M122 and roller M121 away from the turret detent plate.
e. Grasp tuner shaft and slip out of end plate bearings.

REPLACEMENT OF THE UNGROUNDED STATOR PLATE OF TUNING CONTROL

Stator plate M118 is replaced with wiring lead and trimmer condenser C5 attached, because it is difficult to solder the wire lead to the silver plated surface on the ceramic stator plate disc.

To replace the stator plate, remove the turret assembly. Remove mounting rivets from stator plate by drilling out or clipping them out with diagonal wire cutters. Remove trimmer screw M115 and locking nut M114 from trimmer condenser C5. Unsolder wiring lead connecting trimmer to terminal on contact plate.

Assemble the replacement stator plate (M118) by placing the ceramic button over the 5/8" hole in the chassis with the wiring lead extending into the chassis. Place the mounting bracket over the ceramic button and mount securely using #4x3/16 round head machine screws with #4-40x3/16 hex nuts and #4 shake proof lock washers. Mount trimmer condenser C5 in chassis and solder wire lead to its original terminal on the contact plate making this lead as short as possible. Dress wiring lead from ceramic stator plate to trimmer condenser C5 so it does not come in contact with the turret drum. After replacement of the stator plate, adjust trimmer condenser C5 (overall oscillator adjustment).

REMOVING CONTACT PLATE ASSEMBLY M123

a. Remove turret.
b. Remove the mounting screws at the front and rear of Contact Plate and Bracket Assembly M123.
c. Unsolder both ends of contact plate assembly. Press outward the front and rear tuner chassis end plates.
d. To free contact plate assembly, release the contact plate tabs by pushing them away from the slots in the end plates.
e. Unsolder all connections to contact plate. Unsolder the solder joint holding contact plate to the center partition of the tuner chassis.
f. Reassemble in the same manner.

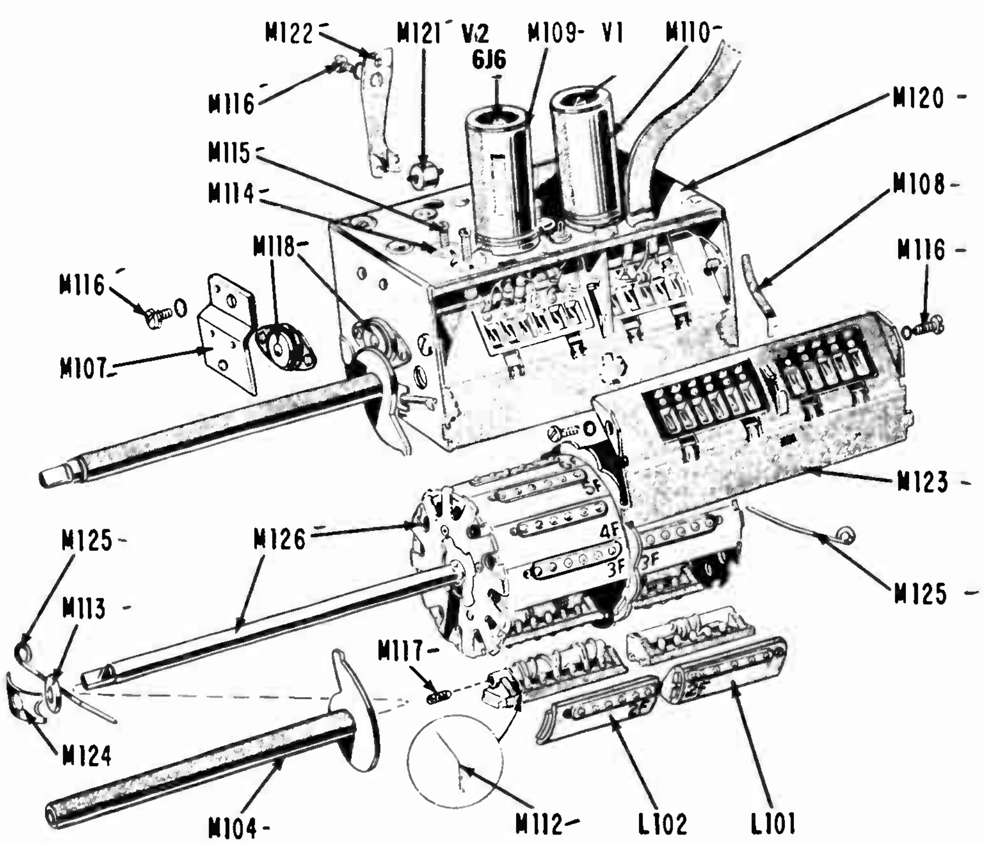


Figure 10. Exploded View, TV Tuner.

INTERMITTENT PICTURE AND SOUND

This trouble is most commonly due to an intermittent tube, loose tube socket contacts, dirty or loose coil contacts, loose or cold (rosin) soldered joints, or loose or vibrating parts in the underside of the tuner chassis.

When replacing tubes, see tube note under "General"

Loose tube socket contacts may sometimes be tightened by compressing contacts with an ice pick or a large needle. Defective tube socket contacts can sometimes be replaced individually.

For cleaning and adjusting coil contacts, see "Cleaning Contacts" and "Adjusting Contact Springs"

Loose or intermittent connections can be found by tapping components or rotating the channel selector and watching the pattern on an oscilloscope. A visual inspection or a continuity check will also be helpful.

Apply a hot soldering iron to soldered joints which appear doubtful. Caution: Do not change lead lengths or move components other than to slightly separate parts or leads which have caused trouble by contact with the chassis or other parts. See discussion under "General".

SOUND BARS IN PICTURE (DUE TO MICROPHONICS)

Microphonics in the TV Tuner will generally produce sound bars in the picture or a ringing sound as the volume is turned up or as the cabinet is tapped lightly.

Check for microphonic oscillator mixer tube, V2 (6J6). It is recommended that several tubes be tried, in order to select a tube which will be least microphonic and at the same time, causes a minimum of oscillator frequency shift, as noted with rotation of Tuning control. In some cases, replacement of the oscillator mixer tube, may necessitate readjustment of trimmer condenser A1 (C5) (overall oscillator adjustment).

Microphonics can also be due to vibration of loose wires or loose components. In some instances, the ceramic stator plate M118 (tuning stator) has been a source of microphonics since the rivets which fasten this part to the tuner chassis may be loose. This can be remedied by soldering the plate mounting bracket to the tuner chassis. To solder the plate mounting bracket to the tuner chassis, remove the grounded Tuning stator plate M107, and move the tuner shaft M104 forward.

Also, check for any mechanical "rub" such as loose screws which hold the tuner sub-chassis to the main chassis, loose solder connection from tube shield base to chassis, or extremely dry tuner shaft.

CHANGES AND NOTES

CHASSIS 317B, 317D, 321B, 321D

These chassis use a keyed AGC system and unless certain precautions are observed some difficulties may be encountered when IF or RF alignment adjustments are made. First be sure to read carefully the "Television Alignment Procedure"

A 1 1/2 volt bias battery should be connected across the AGC line (negative to junction of C24 and R52, positive to chassis), when making all alignment adjustments. This will prevent the amplifiers from overloading in the event that it is not possible to attenuate the signal generator sufficiently. Also, when the RF or IF amplifiers are sweep aligned the response curves will be distorted if a fixed bias is not applied to the AGC line due to the fact that the time constant of the keyed AGC circuit is short compared to the sweep frequency of the sweep generator. Therefore, the gain of the IF and RF amplifiers will not remain constant while the signal is sweeping through the response curve. When a sweep generator which does not have blanking is used, it will be impossible to make the forward and reverse response curves coincide unless a fixed bias is used.

In order to check the keyed AGC circuit for proper operation, the following simple test will be useful. When the grid of the AGC key tube (pin 1 V13) is shorted to the cathode (pin 7) the voltage on the AGC bus (across C24) should be approximately 40 to 70 volts negative as measured with a VTVM. In the event that this voltage is not obtained the trouble will probably be in the key tube V13, the horizontal output transformer T5, in one of the coupling or bypass condensers in the AGC line, or R52.

It may be found that in some cases there are minor deviations in the receivers in part values from those specified in the schematic. For example, a .047 mfd condenser may be used in place of a .05 mfd condenser or a .22 mfd condenser in place of a .25 mfd condenser. In decoupling circuits in the AGC and B+ lines 100 ohm or 200 ohm resistors may be used in place of the 150 ohm resistors specified with negligible effect on the performance. When such substitutions are made they are always made in locations where the value of the part is not critical for it to effectively perform its function. There are many locations where tolerances of 100% or more are permissible. However, when replacements are made, if there is any doubt as to the suitability of the replacement part, the value as specified in the manual should be used.

Occasionally 6AG5 tubes are used in place of the 6CB6 tubes specified for the IF amplifiers V3, V4, and V5. It should be noted that these tubes are not directly interchangeable due to the different internal wiring of the tubes. Therefore, when replacing these tubes, be sure to use the same type that was originally supplied in the receiver. If 6AG5 tubes were originally used this type number will appear on the chassis near the tubes.

On chassis serial numbered approximately 79,600 or greater the following changes were made referring to the schematic diagram and the parts list.

1. Capacitor C24 was 1.0 mfd 200 volts in early production and has been changed to .5 mfd 200 volts as indicated.

2. Capacitor C50 has been changed from a 10,000 mmf ceramic disc to a .01 mfd 400 volt paper part #CPZ04103M.

3. Capacitor C34 has been changed from a .001 mfd paper condenser to a 220 mmf ±20% mica condenser part#CMA03221M.

4. Video load resistor R29 has been changed from 6800 ohms 1 watt to 5600 ohms 1 watt ±10% part #RCF562K.

5. Peaking coil L12 has been changed from a 36 microhenry coil to a 120 microhenry coil part #A-1482-10.

6. Peaking coil L13 has been changed from a 120 microhenry peaking coil to a 600 microhenry peaking coil part #A-1485-10.

7. The hot end of R31 is now connected to the junction of C32, C33, and R30.

8. A decoupling filter consisting of an 8 mfd 450 volt condenser and a 1000 ohm 2 watt resistor has been added in series with the B+ 240 volt lead to the audio output tube V10 on all chassis.

The following changes are incorporated on chassis marked 317D and 321D:

1. High Voltage filter condenser returns to damper plate (pin #5) instead of to chassis ground.

2. AGC keying coil removed from horizontal output transformer and wound on width coil. Both the pulse to AGC keyer and feed back to horizontal multivibrator are taken off AGC winding on width coil. (Part No. B-1467-10)

3. Horizontal output transformer part no. B-1675-13A or B-1676-13A is used.

4. A type 6BZ7 RF amplifier tube is used in tuner rather than 6BQ7. These tubes are directly interchangeable.

CAPACITORS

Ref. No.	Part No.	Description
C1	CCC05050D	Ceramic tubular 5uuf ± .5uuf NPO
C2	CVC030ST	Ceramic trimmer 0.5-3uuf CRL
C3	CVC030ST	Ceramic trimmer 0.5-3uuf CRL
C4	CVC030ST	Ceramic trimmer 0.5-3uuf CRL
C5	CVC030ST	Ceramic trimmer 0.5-3uuf CRL
C6	CCU05121K	Ceramic tubular 120 uuf ± 100% N750
C7	CCU05101K	Ceramic tubular 100uuf ± 10% N750
C8	CCC05200K	Ceramic tubular 20uuf ± 10% NPO
C9	CCU05100K	Ceramic tubular 10uuf ± 10% N750
C10	CCC05100K	Ceramic tubular 10uuf ± 10% NPO
C11	CDZ05102Y	Ceramic disc 1000uuf GMV †
C12		Fine tuning consists of tuner parts
C13	CCU05121K	Ceramic tubular 120uuf ± 10% N750
C14	CDZ05502Y	Ceramic disc, 5000uuf GMV
C15	CDZ05502Y	Ceramic disc, 5000uuf GMV
C16	CCC05200K	Ceramic tubular 20 MMF ± 10% NPO
C17	CDZ05103Y	Ceramic disc 10,000 MMF GMV
C18	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C19	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C20	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C21	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C22	CCZ05102Y	Ceramic tubular 1000 MMF GMV
C23	CDZ05102Y	Ceramic disc 1000 MMF GMV †
C24	CPZ02504M	Molded paper .5 MFD - 200V
C25	CDZ05502Y	Ceramic disc 5000 MMF GMV
C26	CDZ05502Y	Ceramic disc 5000 MMF GMV
C27	CDZ05502Y	Ceramic disc 5000 MMF GMV
C28	CCC05068K	Ceramic tubular 6.8 MMF ± 10% NPO
C29	CDZ05103Y	Ceramic disc, 10,000 uuf GMV
C30	CPZ04104M	Molded paper .1 MFD 400 V
C31	CPZ04104M	Molded paper, .1 MFD 400 V
C32	CPZ04503M	Molded paper .05 MFD 400 V
C33	CMA03221M	Molded mica 220 MMF ± 20% 300 V
C34	CPZ06103M	Molded paper .001 MFD 600V
C35	CDZ05103Y	Ceramic disc, 10,000 uuf GMV
C36	CSC05100K	Silver mica, 10 uuf ± 10% 500V
C37	CSC05101K	Silver mica, 100 uuf ± 10% 500V
C38	CMA05331M	Molded mica, 330 uuf ± 20% 500V
C39	CMA05152M	Molded mica, 1500 uuf ± 20% 500V
C40	CES0405	Tubular electrolytic 4 MFD 50V
C41	CDZ05502Y	Ceramic disc 5000 MMF GMV
C42	CWZ06502M	Molded paper, .005 MFD 600V
C43	CMA05102K	Molded mica, 1000 uuf ± 10%
C44	CMA05102K	Molded mica, 1000 uuf ± 10%
C45	CPZ06502M	Molded paper .005 MFD 600V
C46	CPZ06503M	Molded paper, .05 MFD 600V
C47	CPZ06104M	Molded paper, .1 MFD 600V
C48	CET21C45	Tubular electrolytic, 150 MFD 50V ‡
C49	CES2003	Tubular electrolytic 20 MFD 25V
C50	CDZ05103Y	Ceramic disc 10,000 MMF GMV
C51	CDZ05502Y	Ceramic disc, 5000 uuf GMV
C52	CDZ05103Y	Ceramic disc 10,000 MMF GMP
C53	CMB05392K	Molded mica, 3900 uuf ± 10% 500V
C54	CMA05331K	Molded mica, 330 uuf ± 10% 500V

CAPACITORS

Ref. No.	Part No.	Description
C55	CMA05391K	Molded mica, 390 uuf ± 10% 500V
C56	CPZ06103M	Molded paper, .01 MFD 600V
C57	CVM501ST	Compression trimmer, 50 uuf ± 500 uuf
C58	CPZ06503M	Molded paper, .05 MFD 600V
C59	CPZ06254M	Molded paper, .25 MFD 600V
C60	CPZ02254M	Molded paper, .25 MFD 200V
C61	CDZ20K501	Ceramic, 500 uuf GMV 20KV CRL
C62	CMA10560K	Molded mica, 56 uuf ± 10% 1000V
C63	CET21C45	Tubular electrolytic 20 MFD 450V †
C64	CET21C45	Tubular electrolytic 10 MFD 450V †
C65	CED4445	Tubular electrolytic 40 MFD 450V *
C66	CED4445	Tubular electrolytic 40 MFD 450V *
C67	CES8045	Tubular electrolytic 80 MFD 450V

NOTES:
*C65 and C66 in same unit. ± C48, C63, & C64 in same unit.
†C11 & C23 may be a dual disc capacitor.

RESISTORS

Ref. No.	Part No.	Description
R1	RCC392K	Carbon, 3900 ohms ± 10% 1/2 watt
R2	RCC103K	Carbon, 10K ± 10% 1/2 watt
R3	RCC472M	Carbon, 4700 ohms ± 20% 1/2 watt
R4	RCC224M	Carbon, 220K ± 20% 1/2 watt
R5	RCC153M	Carbon, 15K ± 20% 1/2 watt
R6	RCC473M	Carbon, 47K ± 20% 1/2 watt
R7	RCC222M	Carbon, 2200 ohms ± 20% 1/2 watt
R8	RCC103K	Carbon, 10K ± 10% 1/2 watt
R9	RCC472M	Carbon, 4700 ohms ± 20% 1/2 watt
R10	RCC682K	Carbon, 6800 ohms ± 10% 1/2 watt
R11	RCC470K	Carbon, 47 ohms ± 10% 1/2 watt
R12	RCC103M	Carbon, 10K ± 20% 1/2 watt
R13	RCC104M	Carbon, 100K ± 20% 1/2 watt
R14	RCC223K	Carbon, 22K ± 10% 1/2 watt
R15	RCC470K	Carbon, 47 ohms ± 10% 1/2 watt
R16	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R17	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R18	RCC562K	Carbon, 5600 ohms ± 10% 1/2 watt
R19	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R20	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R21	RCC471M	Carbon, 470 ohms ± 20% 1/2 watt
R22	RCC183M	Carbon, 18K ± 20% 1/2 watt
R23	RCC562K	Carbon, 5600 ohms ± 10% 1/2 watt
R24	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R25	RCC270M	Carbon, 27 ohms ± 20% 1/2 watt
R26	RVM100S	Carbon composition variable 1000 ohms reverse audio taper*
R27	RCC564M	Carbon, 560K ± 20% 1/2 watt
R28		Carbon, 18K ± 20% 1 watt †
R29	RCF682K	Carbon, 6800 ohms ± 10% 1 watt
R30	RCC474M	Carbon, 470K ± 20% 1/2 watt
R31	RCC225M	Carbon, 2.2M ± 20% 1/2 watt
R32	RCC824M	Carbon, 820K ± 20% 1/2 watt

RESISTORS

Ref. No.	Part No.	Description
R33	RCC394M	Carbon, 390K ± 20% 1/2 watt
R34	RVC100N	Carbon composition variable, 250K linear taper 1/2 watt
R35	RCC684M	Carbon, 680K ± 20% 1/2 watt
R36	RCC474M	Carbon, 470K ± 20% 1/2 watt
R37	RCC820M	Carbon, 82 ohms ± 20% 1/2 watt
R38	RWT332K	Wire wound 1000 ohms ± 10% 12 watts
R39	RCC151M	Carbon, 150 ohms ± 20% 1/2 watt
R40	RCC473M	Carbon, 47K ± 20% 1/2 watt
R41	RCC682K	Carbon, 6800 ohms ± 10% 1/2 watt
R42	RCC682K	Carbon, 6800 ohms ± 10% 1/2 watt
R43	RVM100S	Carbon composition variable. 1.0M audio taper*
R44	RCC475M	Carbon, 4.7M ± 20% 1/2 watt
R45	RCF271M	Carbon, 270 ohms 1 watt
R46	RWT332K	Wire wound 2300 ohms ± 10% 9 watts
R47	RCC472K	Carbon, 4700 ohms ± 10% 1/2 watt
R48	RCC682K	Carbon, 6800 ohms ± 10% 1/2 watt
R49	RCC272K	Carbon, 2700 ohms ± 10% 1/2 watt
R50	RCC474M	Carbon, 470K ± 20% 1/2 watt
R51	RCF102M	Carbon, 1000 ohms ± 20% 1 watt
R52	RCC104M	Carbon, 100K ± 20% 1/2 watt
R53	RCC155M	Carbon, 1.5M ± 200% 1/2 watt
R54	RVC101N	Carbon composition variable, 1.0M linear taper 1/2 watt
R55	RCC155M	Carbon, 1.5M ± 20% 1/2 watt
R56	RVC102N	Carbon composition variable, 3.0M linear taper 1/2 watt
R57	RCC822K	Carbon, 8200 ohms ± 10% 1/2 watt
R58	RCC225M	Carbon, 2.2M ± 20% 1/2 watt
R59	RCC471M	Carbon, 470 ohms ± 20% 1/2 watt
R60	RVC103N	Carbon composition variable, 5000 ohms linear taper 2 watts
R61	RCC561K	Carbon, 560 ohms ± 10% 1/2 watt
R62	RCC561K	Carbon, 560 ohms ± 10% 1/2 watt
R63	RCF472K	Carbon, 4700 ohms ± 10% 1 watt
R64	RCC224M	Carbon, 220K ± 20% 1/2 watt
R65	RCC104K	Carbon, 100K ± 10% 1/2 watt
R66	RCC104K	Carbon, 100K ± 10% 1/2 watt
R67	RCC475M	Carbon, 4.7M ± 20% 1/2 watt
R68	RCC474M	Carbon, 470K ± 20% 1/2 watt
R69	RCC152K	Carbon, 1500 ohms ± 10% 1/2 watt
R70	RCC392K	Carbon, 3900 ohms ± 10% 1/2 watt
R71	RCC104K	Carbon, 100K ± 10% 1/2 watt
R72	RCC274K	Carbon, 270K ± 10% 1/2 watt
R73	RCC472M	Carbon, 4700 ohms ± 20% 1/2 watt
R74	RCC474M	Carbon, 470K ± 20% 1/2 watt
R75	RCG103M	Carbon, 47 ohms ± 20% 1/2 watt
R76	RCG103M	Carbon, 10K ± 20% 2 watts
R77	RCC033K	Carbon, 3.3 ohms ± 10% 1/2 watt
R78	RCF684M	Carbon, 680K ± 20% 1 watt
R79	RCC104M	Carbon, 100K ± 20% 1/2 watt

NOTES: *R26 and R43 are part of same unit which also includes switch S1. † used as winding form for L14.
K = 1000 ohms M = 1,000,000 ohms

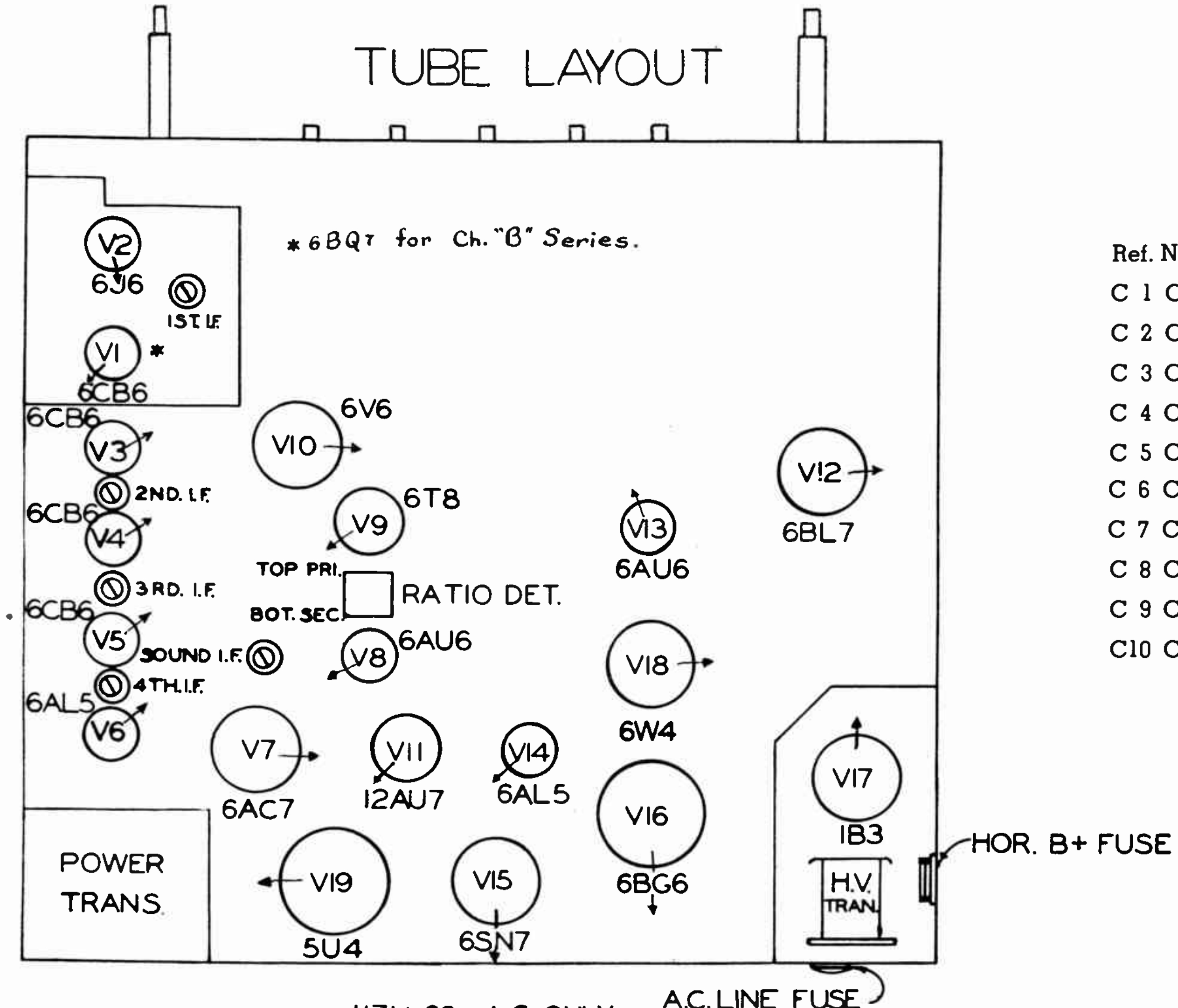
Ref. No.	Part No.	Description	Price
		PRINTED CIRCUITS	
PC80	A-1376-6F	Audio Couplate CRL FC-80	
PC100	A-1375-6F	Vertical Integrator Network - CRL PC-100	
		COILS	
L1		Mixer Plate Coil	
L2	B-1471-10	1st I.F. Coil	
L3	B-1471-10	2nd I.F. Coil	
L4	B-1471-10	3rd I.F. Coil	
L6	A-1470-10	4.5 M.C. Sound take-off Coil	
		Channel #2 Antenna Coil Ass.	
		Channel #3 Antenna Coil Ass.	
		Channel #4 Antenna Coil Ass.	
		Channel #5 Antenna Coil Ass.	
		Channel #6 Antenna Coil Ass.	
L7		Channel #7 Antenna Coil Ass.	
L8		Channel #8 Antenna Coil Ass.	
		Channel #9 Antenna Coil Ass.	
		Channel #10 Antenna Coil Ass.	
		Channel #11 Antenna Coil Ass.	
		Channel #12 Antenna Coil Ass.	
		Channel #13 Antenna Coil Ass.	
		Chan. #2 Mixer-Osc. Coil Ass.	
		Chan. #3 Mixer-Osc. Coil Ass.	
		Chan. #4 Mixer-Osc. Coil Ass.	
		Chan. #5 Mixer-Osc. Coil Ass.	
L9		Chan. #6 Mixer-Osc. Coil Ass.	
L10		Chan. #7 Mixer-Osc. Coil Ass.	
L11		Chan. #8 Mixer-Osc. Coil Ass.	
		Chan. #9 Mixer-Osc. Coil Ass.	
		Chan. #10 Mixer-Osc. Coil Ass.	
		Chan. #11 Mixer-Osc. Coil Ass.	
		Chan. #12 Mixer-Osc. Coil Ass.	
		Chan. #13 Mixer-Osc. Coil Ass.	
L12	A-1469-10	36UH Peaking Coil	
L13	A-1482-10	120UH Peaking Coil	
L14	A-1483-10	240UH Video Amp. Peaking Coil (includes R28)	
L15	A-1484-10	380UH Video Amp. Peaking Coil	
L16	A-1479-10	Horizontal Hold - A.F.C. Coil	
L17	A-1486-10	Width Control	
L18	A-1651-10	Filter Choke, 2HY-220 MA.	
L19	A-1481-10	Filament Choke (Video I.F.)	
L20	A-1481-10	Filament Choke (Video I.F.)	
L21		Filament Choke, Tuner	
L22		Filament Choke, Tuner	
		TRANSFORMERS	
T1	B-1472-10	4.5 MC Ratio Detector Transformer (includes C36 and C37)	
T2	B-1653-13	Audio Output Transformer (6V6 to 3.2 V.C.)	

Ref. No.	Part No.	Description
T3	A-1661-13	Vertical blocking Osc. Transformer
T4	B-1662-13	Vertical Output Transformer
T5	C-1677-13A	Horizontal Output Transformer
T6	B-1650-13	Power Transformer 350-0-350 @ 220 MA. DC., 5V @ 3A, 6.3V @ 1.2A, 6.3V @ 1.2A, 6.3V @ 8A
		FUSES
F1	A-3750-30	1/4 Amp 250 Volt Cartridge Fuse
F2	A-3751-30	5 Amp 250 Volt 3AG Fuse.

MISCELLANEOUS		
Y1	B-1452-9	Deflection Yoke for 70 CRT (8.3 MH Hor. 48MH Vert.)
S1		Power Switch (included as part of Contrast volume control Part #RVM 100S)
	B-4100-33	Tuner, Standard Coil
	A-4102-33	Ion Trap
	B-4101-33	Focalizer
	A-1553-2	CRT Socket (with leads)
	A-1008-1	Yoke Mounting Hood
	A-1500-11	Line Cord
	A-1501-11	Hi-Voltage CRT Lead with Connector

B-4600-15	Speaker, 6" PM (for 17" Console Receivers)
B-4604-15	Speaker, 8" PM (for 21" Console Receivers)
B-4602-15	Speaker, 5" PM (for Table Model Receivers)

TUBE LAYOUT



117V-60~A.C. ONLY
180 WATTS
R.M.A. CODE 217

NOTE: Parts not listed may be obtained by giving complete description of Part, Model Number, Serial Number, and Chassis Number of Receiver.

RESISTORS

½ watt carbon composition insulated

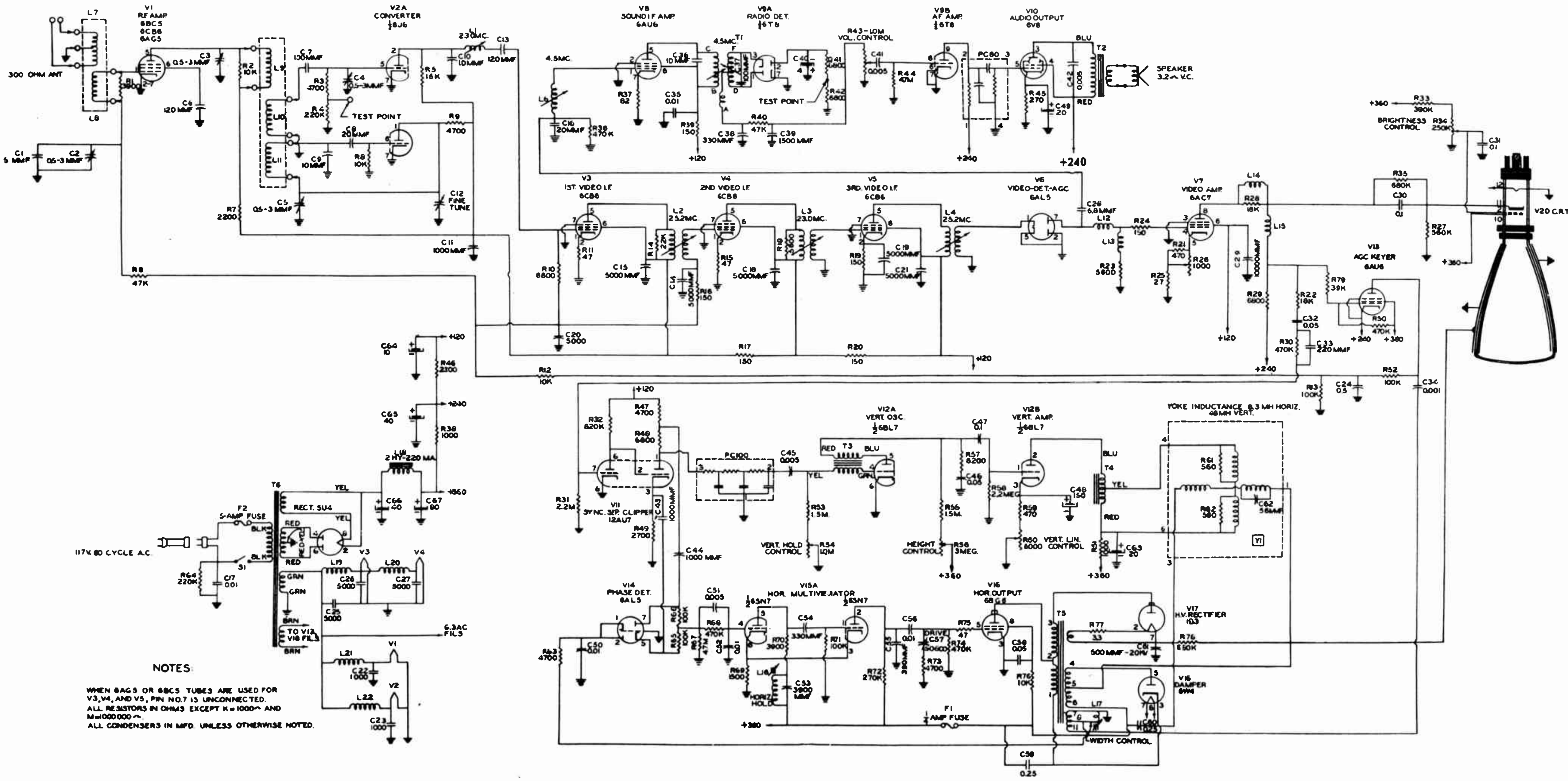
R 1	RCC164J	160K ± 5%
R 2	RCC104J	100K ± 5%
R 3	RCC104K	100K ± 10%
R 4	RCC103M	10K ± 20%
R 5	RCC152M	1500 ohms ± 20%
R 6	RCC224M	220K ± 20%
R 7	RCC103K	10K ± 10%
R 8	RCC153K	15K ± 10%
R 9	RCC473M	47K ± 20%
R10	RCC103K	10K ± 10%

Ref. No.	Part No.	Description
C 1	CBZ05802Y	800 MMF GMV feed through
C 2	CDZ05102Y	1000 MMF GMV Ceramic disc
C 3	CVC030ST	.5-3 MMF Trimmer
C 4	CDP05470K	47 MMF ±10% Ceramic disc N140
C 5	CDP05470K	47 MMF ±10% Ceramic disc N140
C 6	CVC030ST	.5-3 MMF Trimmer
C 7	CDC05068C	6.8 MMF ±.25 MMF ceramic disc NPO
C 8	CDU05050D	5 MMF ±.5 MMF ceramic disc N750
C 9	CDC05039C	3.9 MMF ±.25 MMF ceramic disc NPO
C10	CDC05100K	10 MMF ±10% ceramic disc NPO
C11	CDG05015C	1.5 MMF ±.25 MMF ceramic disc GP
C12		Fine tuning condenser
C13	CVC05090ST	3-9 MMF ceramic trimmer
C14	CBZ05802Y	800 MMF GMV feed through
C15	CBZ05802Y	800 MMF GMV feed through
C16	CBZ05802Y	800 MMF GMV feed through
C17	CBZ05802Y	800 MMF GMV feed through
C18	CCU05121K	120 MMF ±10% ceramic tubular N750
C19	CDZ05102Y	1000 MMF GMV ceramic disc

COILS

L 1, L 2	Antenna coil assembly (Specify channel)
L 3, L 4, L 5	Mixer / oscillator coil assembly (Specify channel)
L 6	6BQ7 filament choke
L 7	RF plate choke
L 8	6J6 filament choke
L 9	Mixer plate shunt choke
L10	Mixer plate series choke
L11	Mixer plate tuning coil

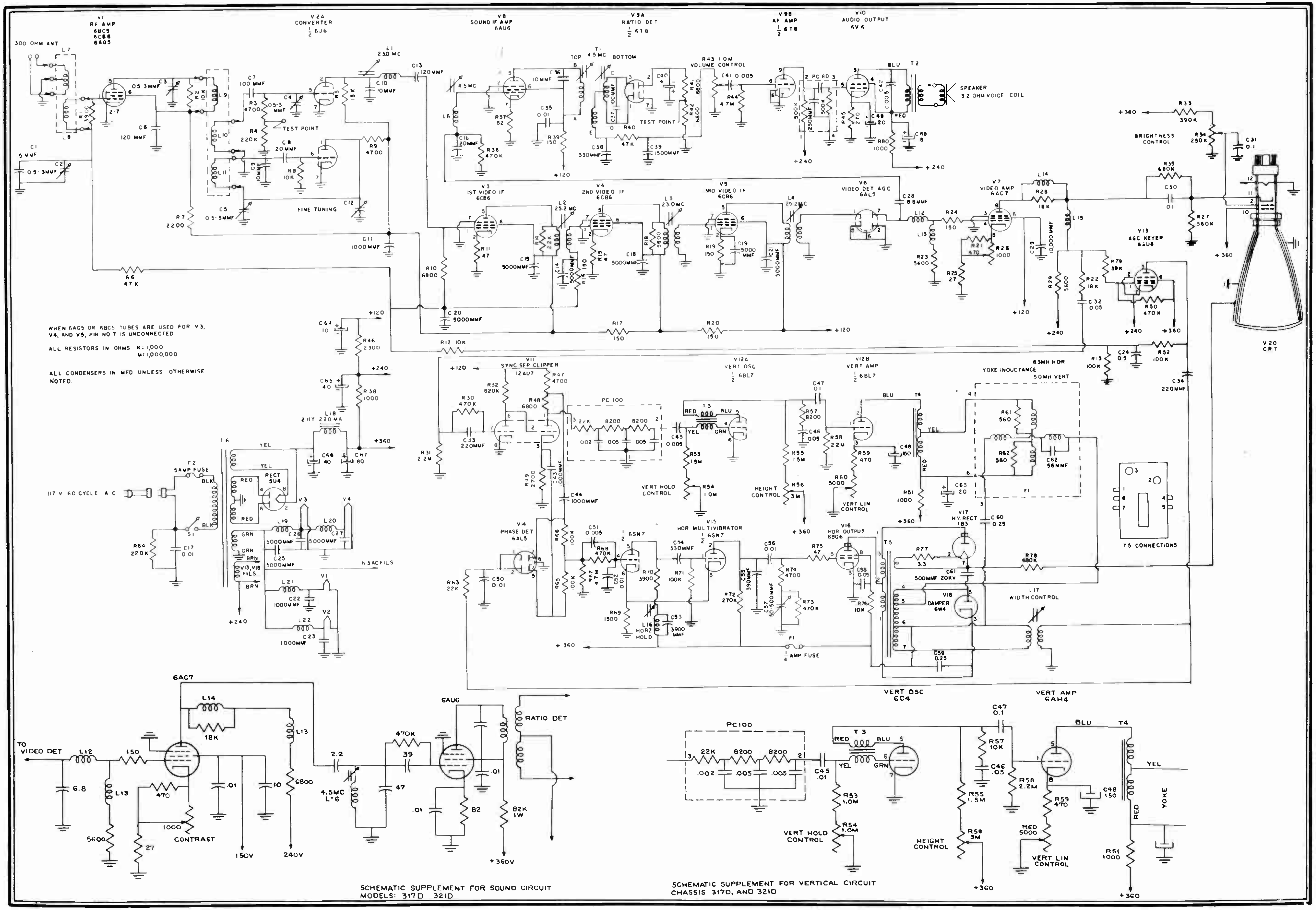
When ordering parts please give model number, chassis number and serial number of receiver. Give description and part number of items (if available) and specify that parts are for use in Cascode tuner.



NOTES:

WHEN 6AG5 OR 6BC5 TUBES ARE USED FOR V3, V4, AND V5, PIN NO. 7 IS UNCONNECTED.
ALL RESISTORS IN OHMS EXCEPT K=1000~ AND M=1000000~.
ALL CONDENSERS IN MFD. UNLESS OTHERWISE NOTED.

SPIEGEL TV PAGE 12-9


V1 RF AMP 6BC5 6CB6 6AG5
V2A CONVERTER 1/2 6J6
V8 SOUND IF AMP 6AU6
V9A RATIO DET 1/2 6T8
V9B AF AMP 1/2 6T8
V10 AUDIO OUTPUT 6V6
300 OHM ANT
SPEAKER 3.2 OHM VOICE COIL
R43 1.0M VOLUME CONTROL
TEST POINT
FINE TUNING
BRIGHTNESS CONTROL
V3 1ST VIDEO IF 6CB6
V4 2ND VIDEO IF 6CB6
V5 3RD VIDEO IF 6CB6
V6 VIDEO DET AGC 6AL5
V7 VIDEO AMP 6AC7
V13 AGC KEYER 6AU6
V20 CRT
WHEN 6AG5 OR 6BC5 TUBES ARE USED FOR V3, V4, AND V5, PIN NO 7 IS UNCONNECTED
ALL RESISTORS IN OHMS K=1,000 M=1,000,000
ALL CONDENSERS IN MFD UNLESS OTHERWISE NOTED.
V11 SYNC SEP CLIPPER 12AU7
PC 100
V12A VERT OSC 1/2 6BL7
V12B VERT AMP 1/2 6BL7
YOKE INDUCTANCE 83MH HOR 50MH VERT
VERT HOLD CONTROL
HEIGHT CONTROL
VERT LIN CONTROL
117 V 60 CYCLE A C
5AMP FUSE
RECT 5U4
6.3AC FILS
V14 PHASE DET 6AL5
V15 HOR MULTIVIBRATOR 6SN7
V16 HOR OUTPUT 6BG6
V17 HV RECT 1B3
V18 DAMPER 6W4
L16 HORZ HOLD
L17 WIDTH CONTROL
1/4 AMP FUSE
T5 CONNECTIONS
VERT OSC 6C4
VERT AMP 6AH4
TO VIDEO DET
CONTRAST
RATIO DET
YOKE
SCHEMATIC SUPPLEMENT FOR SOUND CIRCUIT MODELS: 317D 321D
SCHEMATIC SUPPLEMENT FOR VERTICAL CIRCUIT CHASSIS 317D, AND 321D

GENERAL SPECIFICATIONS

DIMENSIONS

Model	Height	Width	Depth
9132-A	22-3/16"	22-1/4"	21-5/8"

WEIGHTS (packed)

9132-A—108 lbs.

POWER REQUIREMENTS

117 volts 60 cycles 245 watts

PICTURE SIZE

21" Rectangular

SPEAKER

Type	Size	V. C. Imped.
P.M. Dynamic	6" x 9"	3.2 ohms

ANTENNA INPUT IMPEDANCE

300 ohms—balanced to ground.

BUILT-IN ANTENNA

Broad band dipole.

R. F. TUNER

Turret type construction; individually removable coil assemblies for all channels. All components are easily accessible for servicing.

"KEYED" AUTOMATIC GAIN CONTROL

Outstanding new development; minimizes "airplane flutter"; reduces contrast variation when changing from one channel to another; increases immunity of sync system to external interference.

INTERMEDIATE FREQUENCIES

Sound Carrier 22.25 Mc.
Picture Carrier 26.75 Mc.

I.F. SYSTEM

Four Stage—stagger tuned—for composite signal.
Two additional stages for sound channel.

VIDEO AMPLIFIER

Two Stage—broad band.

RETRACE LINE SUPPRESSOR

Eliminates retrace lines thruout the normal range of picture brightness and contrast.

DEFLECTION & FOCUS

Magnetic

HORIZONTAL SYNCHRONIZATION

Automatic frequency control and "keyed" A.G.C. provide excellent picture stability and noise immunity.

HIGH VOLTAGE POWER SUPPLY

"Fly-back" type. Completely enclosed in a shielded compartment.

CONTROL ADJUSTMENT PROCEDURE

The various controls on the receiver may be divided into two classes, Operating and Pre-set. Operating controls are those which control program selection as well as sound and picture quality and their functions are indicated in Fig. 1.

The Pre-set controls are those which require adjustment at the time the receiver is installed and they rarely need attention thereafter. Although they have been factory adjusted for optimum performance, it is usually necessary to make some fine adjustment of these controls at the time of installation.

There are eleven Pre-set controls, four of which are located at the back of the chassis (see Figure 19). Six controls are located under the Name Plate on the front panel. This plate is hinged at the bottom; to obtain access to controls, merely tilt plate forward. The Auxiliary Fine Tuning Screw can be reached by removing the "Channel Selector" and "Television Fine Tuning" knobs.

To gain access to the centering adjustments and ion trap, it will be necessary to remove the back of the cabinet by taking out the screws around edges.

Operate the receiver according to the instructions given in the section of this manual entitled "How To Tune The Television Receiver" and make the following adjustments as required.

1. **ADJUST ION TRAP**—If screen remains dark or is only dimly illuminated when "Brightness" control is turned clockwise, the ion trap may require adjustment.

The ion trap is located on the neck of the picture tube as shown in Figure 19 and consists of a magnet held in position by metal bands.

With "Brightness" control (located at rear of receiver) set approximately ½ turn clockwise, rotate the entire ion trap assembly while sliding it back and forth until picture tube screen is illuminated to maximum brilliance. Reduce "Brightness" control setting and repeat this operation to assure accurate positioning of ion trap.

Do not turn "Brightness" control to its maximum clockwise position until ion trap is correctly adjusted—failure to observe this precaution may result in damage to the picture tube.

CAUTION: There is only ONE correct setting of the ion trap. This position is attained when maximum brilliancy occurs on the picture tube screen. If defocusing of picture or neck shadow results, DO NOT adjust position of ion trap—see instructions located elsewhere in this manual for removing these aforementioned faults. Failure to observe this precaution will result in an ion burn (brown spot) on the face of the picture tube. Since this condition is brought about by lack of proper ion trap adjustment at time of receiver installation, the picture tube will not be eligible for warranty adjustment.

2. **AUXILIARY FINE TUNING ADJUSTMENT**—If it is found that the tuning range of the "Fine Tuning" control is inadequate to permit correct tuning of a station in its assigned channel, then adjustment of the "Auxiliary Fine Tuning" screw will be necessary. This special screw is accessible after removal of the "Channel Selector" and "Fine Tuning" knobs. They may be removed by merely pulling them forward.

Adjustment of the "Auxiliary Fine Tuning" screw may be undertaken in accordance with the following procedure.

a. Set "Channel Selector" to desired channel; then remove this knob.

b. Set "Fine Tuning" knob to the center of its range; then remove this knob. The flat portion of the main tuning shaft (outer shaft) should now be in the uppermost position. Note the location of the "Auxiliary Fine Tuning" adjustment screw on receiver chassis—see Fig. 14.

c. Using a thin screwdriver (preferably non-metallic), adjust the setting of "Auxiliary Fine Tuning" screw for correct tuning of the desired television station—**CAUTION: Do not attempt to rotate this screw more than two full turns in either direction, as further rotation may release it from the thread clip within the tuning mechanism and the coil for that channel (located in R.F. Tuner Unit) would then have to be removed in order to restore the screw to the correct position.** If a metal screwdriver is used, detuning occurs when the screwdriver is removed but it will be noted that this degree of detuning can now be compensated by resetting the "Television Fine Tuning" control (outer shaft). Thus the range of the "Television Fine Tuning" control (after knob is replaced on the shaft) will be adequate to tune in the station.

d. This completes the adjustment of the "Auxiliary Fine Tuning" screw for one channel. Identical screws are provided on each channel and they are all accessible thru the same opening in the tuning mechanism as each successively moves into position when the "Channel Selector" knob is rotated.

3. **HORIZONTAL HOLD**—Should the picture appear to move horizontally across the screen or break up into a series of light and dark streaks as shown in Figure 10 adjust the "Horizontal Hold" control (located behind Name Plate) until the picture remains stationary and does not slip horizontally when operating "Channel Selector" knob.

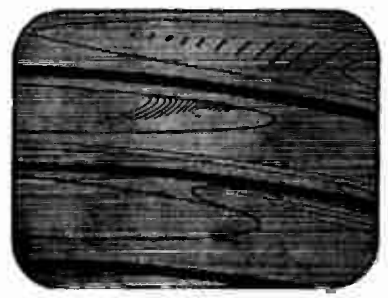


Fig. 10—HORIZONTAL MOVEMENT; ADJUST HORIZ. HOLD CONTROL

4. **VERTICAL HOLD**—Should the picture appear to roll by in a vertical direction or cause multiple vertical images as shown in Figure 11, it will be necessary to adjust the "Vertical Hold" control located behind the Name Plate (see Figure 14). After this adjustment is made, reduce contrast until picture is barely visible and check setting of "Vertical Hold" control for proper picture synchronization.

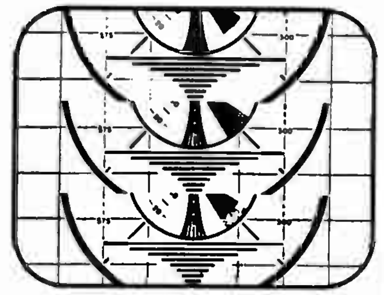


Fig. 11—VERTICAL MOVEMENT; ADJUST VERTICAL HOLD CONTROL

5. **INITIAL FOCUS**—Adjust the "Focus" control, located behind name plate, until picture is clearly defined.

Fuzzy picture may also be due to reproduction of poor quality film when station is televising a motion picture.

Incorrect tuning of receiver produces a similar effect. Check for proper tuning point as described in step 5 of section entitled "How To Tune the Receiver."

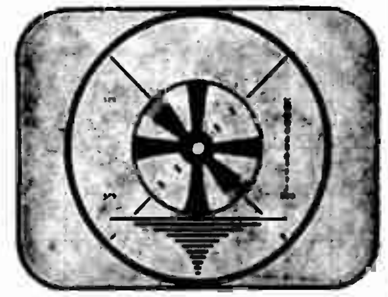


Fig. 12—BLURRED APPEARANCE; ADJUST FOCUS CONTROL

6. **TONE**—This television receiver is equipped with a tone control located under the name plate—see Fig. 14. This control should be adjusted for most pleasing tone. To increase bass emphasis, turn control counter-clockwise.

The following adjustments should be made while the station is transmitting its circular test pattern.

7. **STRAIGHTENING TILTED RASTER** — If the pattern should appear on the screen in a tilted position as shown in Figure 13, loosen the deflection yoke locking screw labeled A in Fig. 19 and rotate the yoke sufficiently to correct this condition. Be sure to re-tighten the screw securely.

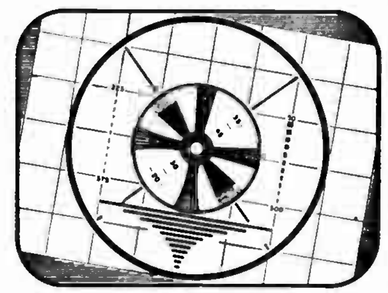


Fig. 13—TILTED PICTURE; ADJUST YOKE POSITION

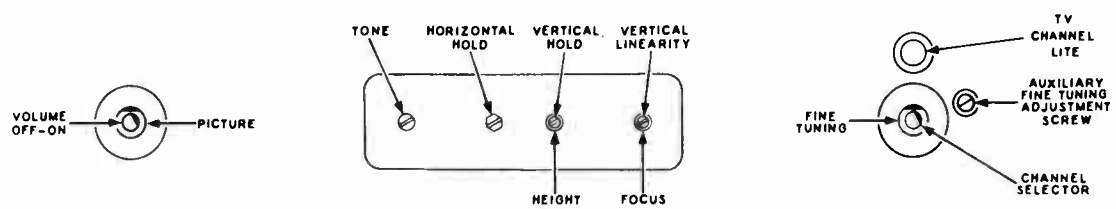


Fig. 14—LOCATIONS OF PRE-SET CONTROLS

8. **CENTERING**—To center the test pattern on the screen, position focus coil by adjusting the three nuts labeled B in Fig. 19.

NOTE: If a decrease in picture tube brilliance is noted when making the centering adjustment readjust ion trap as explained in step #1.

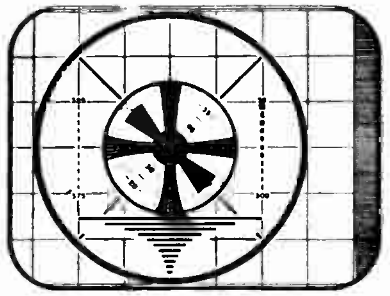


Fig. 15—OFF CENTER; ADJUST FOCUS COIL POSITION

9. **HEIGHT** — Control of picture size in the vertical direction is accomplished by means of the "Height" control located behind the Name Plate. Height and width adjustments should be checked for all transmitting stations to be sure that picture properly fills the viewing area. It may be necessary to change the setting of the "Height" control after the "Vertical Linearity" control is adjusted.

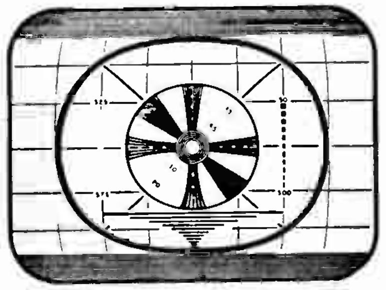


Fig. 16—TOO SHORT; ADJUST HEIGHT CONTROL

10. **VERTICAL LINEARITY** — Improper vertical linearity causes the circular test pattern to appear condensed on the upper edge of the screen and extended on the lower edge or vice versa. This effect is illustrated in Figure 17. Adjust for proper linearity by using "Vertical Linearity" control located behind Name Plate. It may be necessary to readjust the "Height" control if an appreciable change is made in the linearity control setting.

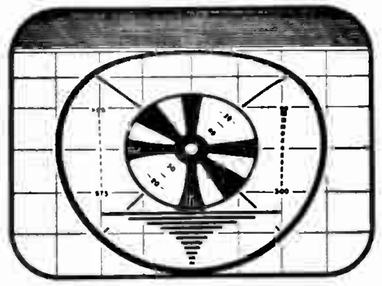


Fig. 17—VERTICAL DISTORTION; ADJUST VERTICAL LINEARITY CONTROL

11. **WIDTH** — Control of picture size in the horizontal direction is accomplished by means of the "Width" control located on the rear of H. V. power supply (see Fig. 19).

If abnormally low line voltage makes it difficult to obtain sufficient picture width when using the "Width" control, then the setting of the "Horizontal Drive" control may be incorrect. The method of adjusting this control is explained in paragraph #13.

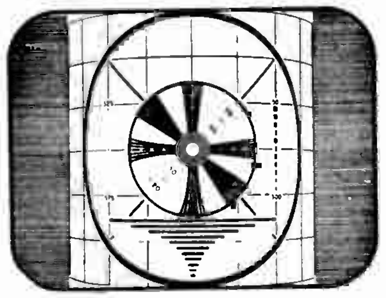


Fig. 18—TOO NARROW; ADJUST WIDTH CONTROL

12. **HORIZONTAL LINEARITY** — Improper horizontal linearity causes the circular test pattern to appear condensed on the right edge of the screen and extended on the left edge or vice versa. This effect is illustrated in Figure 20. Adjust for proper linearity by using "Horizontal Linearity" control located at rear of chassis (see Figure 19). In event that proper horizontal linearity cannot be obtained by adjusting this control, then check the setting of the "Horizontal Drive" control to be sure it has been correctly adjusted.

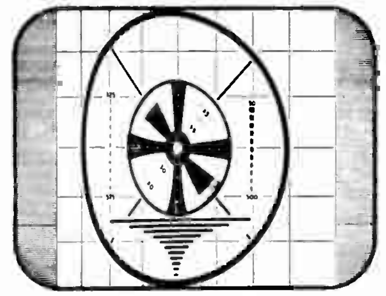


Fig. 20—HORIZONTAL DISTORTION; ADJUST HORIZONTAL LINEARITY CONTROL

13. **HORIZONTAL DRIVE**—The "Horizontal Drive" control located at rear of chassis (see Fig. 19) should be rotated clockwise to a point just prior to where the picture tube brilliancy and size decrease. Then adjust this control ½ turn **counter-clockwise.**

14. **ELIMINATING SEMI-CIRCULAR SHADOW**—This shadow is caused by the electron stream striking the neck of the tube and it can generally be corrected by applying one or a combination of the following procedures:

a. Make sure deflection yoke is symmetrically positioned with respect to the neck of the picture tube by loosening the three wing nuts labeled C in Fig. 19 and adjusting yoke position.

Should a change in height of the deflection yoke be required to obtain symmetry of yoke around neck of picture tube, it will be necessary to loosen the four wing nuts labeled D in Fig. 19 (two nuts located on each leg of mounting frame) and raise or lower yoke as required. After adjustment has been completed be sure to retighten nuts securely.

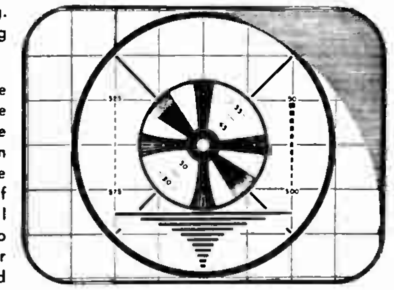


Fig. 21 SEMI-CIRCULAR SHADOW

b. Shift deflection yoke as far forward as possible after loosening the yoke locking screw labeled A in Fig. 19. If raster becomes tilted during this adjustment refer to step #7.

15. **BRIGHTNESS**—The "Brightness" control (located at rear of receiver Chassis—see Fig. 19) should be initially adjusted in conjunction with the "Contrast" control for the brightness level desired by set owner—check all active station channels. Too much brightness will have the same effect as too little contrast, and vice versa, therefore, it is necessary to strike a proper balance between contrast and brilliance.

16. **FINAL ADJUSTMENTS**—With all controls set for normal reception of a television station, recheck setting of "Focus" control for best picture focus.

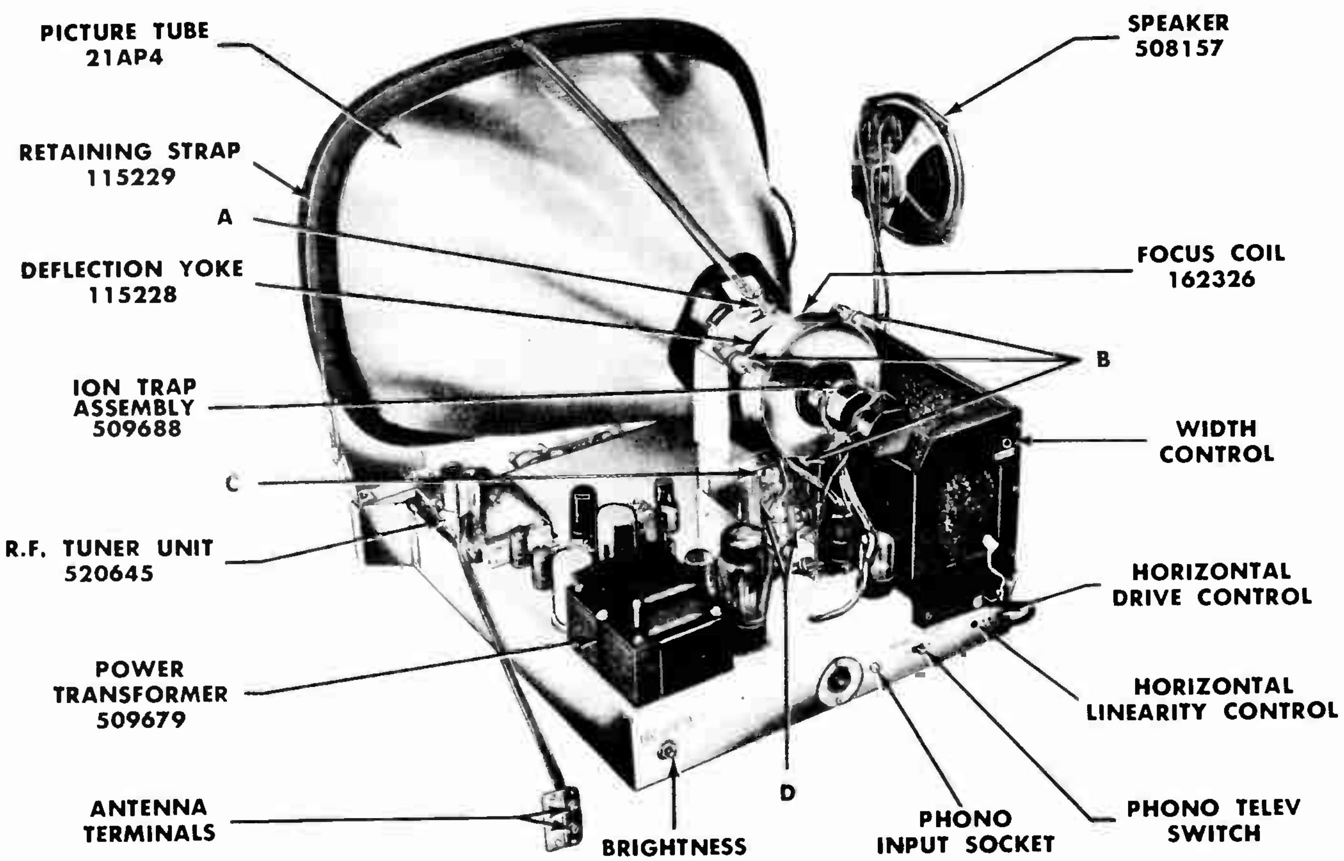


Fig. 19—CHASSIS AND PICTURE TUBE ASSEMBLY

REDUCTION OF INTERCARRIER BUZZ

If a prominent humming or buzzing sound is noted in the sound reception of a television broadcast, it may be due to a fault in transmission from the station, or incorrect adjustment of the discriminator transformer (tuning of secondary circuit) in the receiver.

This type of disturbance, which is only present when receiving a station signal, is known as "Intercarrier Buzz" and it should not be confused with power supply hum that would occur upon failure of a filter condenser.

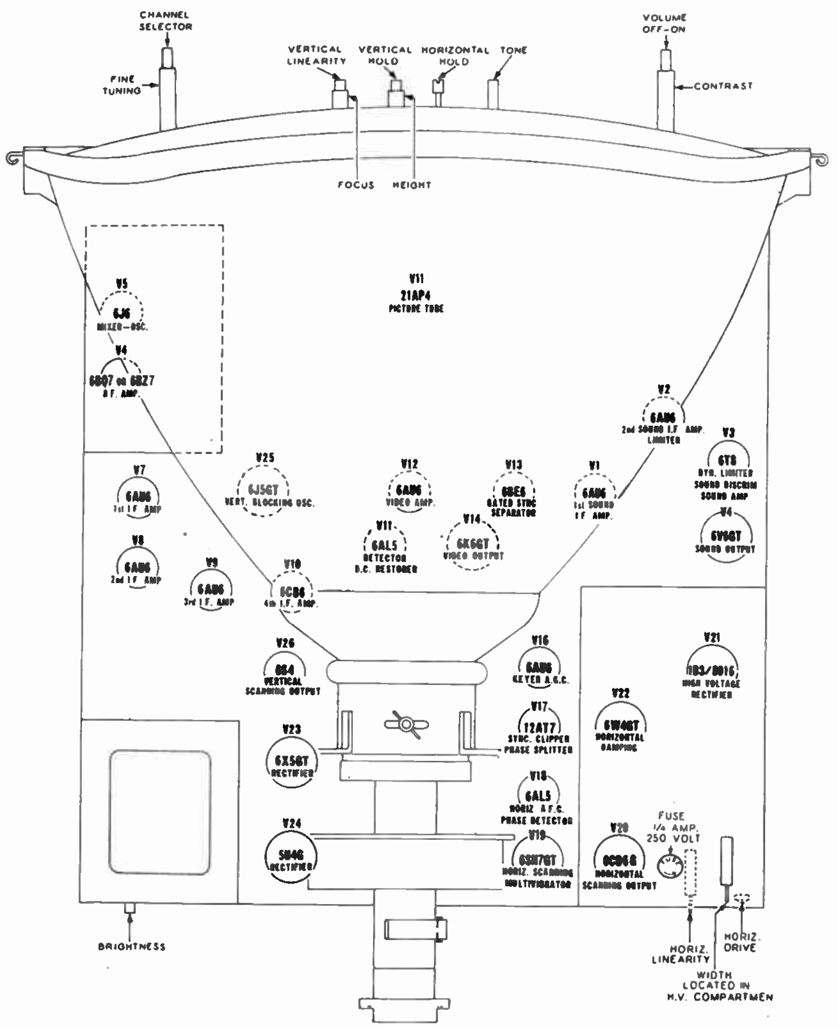
Where "Intercarrier Buzz" is objectionable, first be sure that the receiver has been properly tuned to the station—see section of this manual entitled "How To Tune The Receiver." If Intercarrier Buzz is still too prominent, then it is advisable to check the adjustment of the sound discriminator secondary slug. This slug is accessible from the top of the discriminator transformer which is located on top of the chassis at the right front side. As the slug is rotated approximately ½ turn in either direction, a "dip" point in the buzzing sound will be noted. At this position program sound will be clear and free from distortion and buzz should be at an acceptable minimum if station transmission is not at fault.

PICTURE TUBE REPLACEMENT

REPLACEMENT PROCEDURE—When replacement of a picture tube is necessary, proceed as follows:

1. Disconnect power cord from wall outlet.
2. Remove chassis from cabinet.
3. Remove high voltage lead from side of picture tube Insulating Sleeve and **momentarily short this lead to chassis to discharge high voltage filter condenser.**
4. Remove the tube socket at base of picture tube.
5. Disengage ion trap from neck of tube.
6. Remove retaining screw that holds anchor strap to yoke mounting assembly.
7. Loosen the two bolts on the ends of the Strap Assembly that encircles the front Insulating Ring of the tube.
8. Carefully remove picture tube by pulling it forward.
9. Remove Insulating Ring from front edge of tube and slip Insulating Sleeve off rear of tube.
10. When replacing tube, be sure it has the same type number and observe the following precautions. Be sure that Insulating Sleeve fits under Insulating Ring all around edge of tube. Also that copper high voltage strap on Insulating Sleeve fits around rim of tube. This rim is the high voltage contact of the tube, therefore, a good contact must be made with copper strap and rim.

TUBE LOCATIONS



REAR OF CHASSIS

CIRCUIT DESCRIPTION FOR 520645 RF TUNER

The turret type tuner incorporated in this chassis is of the latest design and utilizes a 6BQ7 or 6BZ7 tube as the R.F. amplifier (V5) and a 6J6 tube (V6) as the Mixer-Oscillator.

Channel selection is accomplished by rotation of the turret containing two sets of easily removable coil assemblies for each channel. The individual antenna coil sections consist of a balanced primary to minimize noise pick-up on the transmission line and an R.F. grid coil which couples the incoming signal to the grid of the first section of the R.F. Amplifier tube (V5). The inductance and amount of coupling of the tuned antenna input circuit are changed for each channel so that a constant input impedance of 300 ohms is maintained. This provides maximum transfer of energy to the R.F. Amplifier stage, particularly when interconnection between an outdoor antenna and the receiver is made with 300 ohm transmission line.

The R.F. Amplifier tube is a dual-triode tube and is connected in the circuit as a direct coupled grounded-grid type amplifier. This circuit was developed to meet the demand for an R.F. Amplifier that would provide more nearly equal gain on both the low and high Television Channels, while keeping inherent tube noise to a minimum. The circuit can be thought of very simply as two triode tubes in series, the first or driver unit acting not as an amplifier, but rather as an antenna impedance matching device and also as a variable cathode impedance, or bias source, for the second, or grounded-grid unit. In addition the first unit of the R.F. Amp. acts as a power amplifier due to its extremely low plate impedance, which is in reality the cathode circuit of unit two, and converts the weak signal voltage from the antenna to a low voltage-high current signal which is then applied to the cathode of unit number two. The signal coupling unit between the first and second units is a series peaking coil, symbol 406, similar to that found in a video amplifier circuit. Its purpose is to form a series resonant circuit with the input capacity of the second unit. The coil is so made as to resonate at a frequency slightly higher than channel 13. In a standard pentode type amplifier, the gain falls off rapidly as progressively higher channels are selected. With the use of the plate to cathode peaking coil an almost equal gain can be realized for all channels.

The R.F. Amp. tube has inherently low interelectrode capacity due to physical design and this factor in conjunction with the low output impedance of the first section is responsible for the low noise factor at this stage. While neutrolization of the first unit is not necessarily due to its low plate to grid capacity, additional noise reduction has been realized, with only a slight decrease in gain, by the addition of a neutralizing condenser, item 405. Due to the low output impedance of the stage, it is not necessary that the neutralizing condenser be turnable.

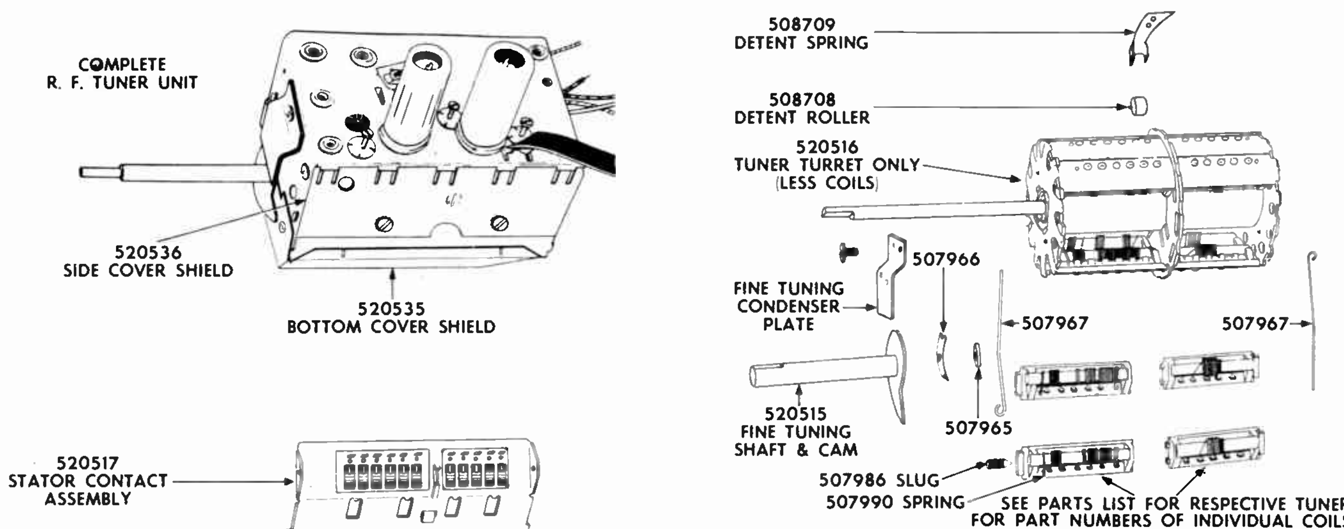
Because of the circuits' excellent internal shielding, low input impedance and radiation rejection, the second section of the R.F. Amp. is connected as a driven grounded-grid amplifier. While this might not be apparent at first glance due to the fact that grid has no direct D.C. return, it will be found upon further examination that any high frequency A.C. potentials are by-passed to ground through condenser 407.

The second section of turret coils includes the tuned R.F. amplifier plate coil, tuned mixer grid coil, and oscillator coil. The output of the R.F. amplifier stage is coupled to the grid of the mixer stage, which utilizes one triode section of a 6J6 tube (V6). The other half of the 6J6 is connected as a modified Colpitts oscillator which injects oscillator voltage into the mixer stage through coupling between the oscillator coil and the mixer grid coil. Course oscillator tuning is accomplished by adjusting the positions of the slugs in the individual oscillator coils, while Fine Tuning is obtained when using condenser #417 in the oscillator plate circuit. This Fine Tuning condenser is composed of two fixed plates, and its capacitance is changed by the insertion of a bakelite cam between these plates.

Signal output from the mixer stage is coupled to the IF amplifiers through the converter plate I.F. coil, diagram #427, located on the tuner unit.

REPAIR DATA FOR 520645 RF TUNER

All replacement parts for the RF Tuner Unit are included in the complete receiver parts list

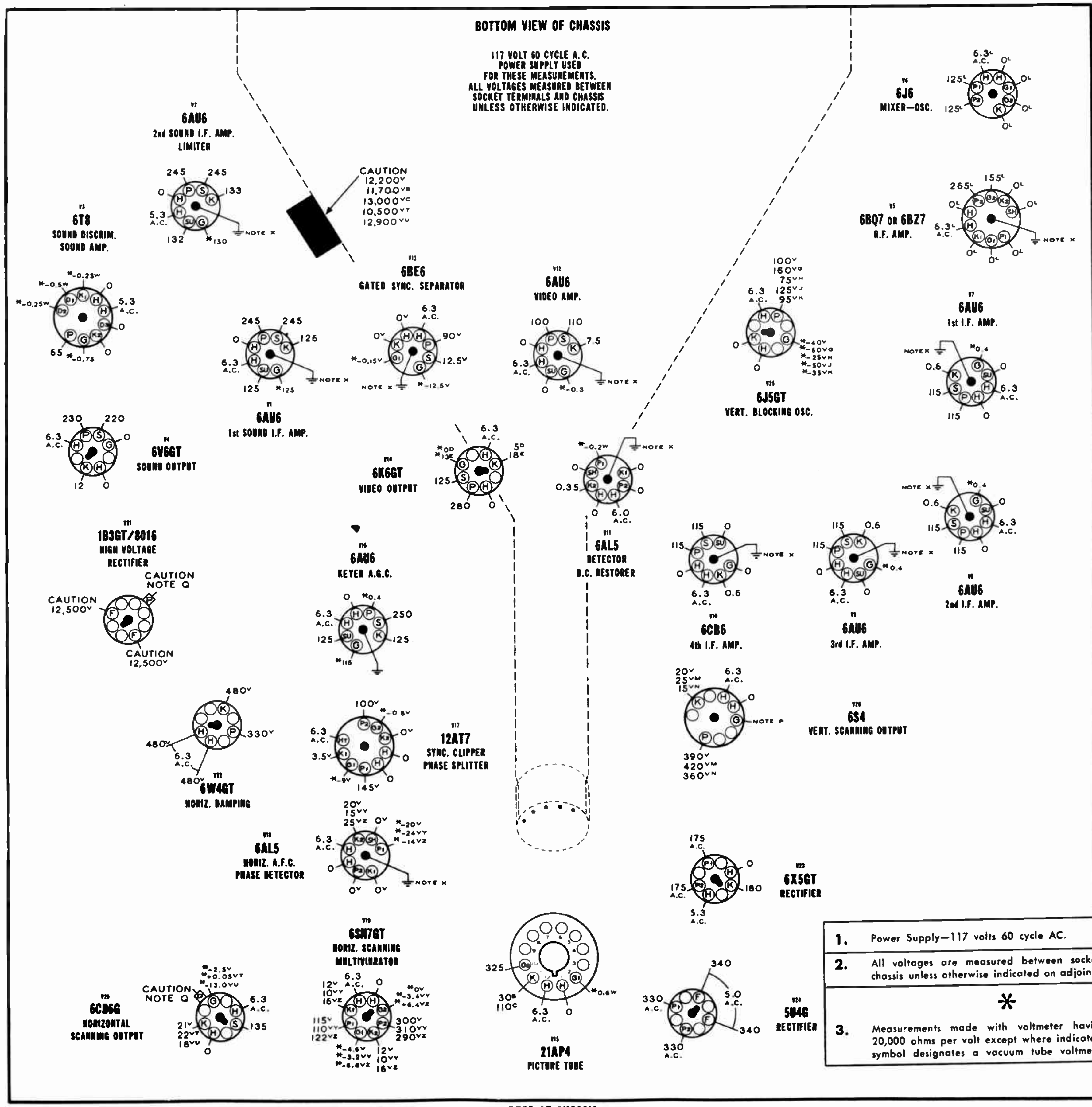


SERVICE PRECAUTIONS

SUBJECT	PRECAUTIONS
ELECTRICAL COMPONENTS	The high frequencies used in the RF section of a television receiver make it necessary that considerable care be exercised in servicing the tuner. Lead dress and location of components are very critical at these frequencies. When replacing parts, it is important to use components of identical electrical characteristics and physical size. Always reconnect the replacement item in the same location and position in the tuner as the original component.
TUBES	Replacement of tubes in the Tuner Unit may cause slight detuning of RF circuits due to inherent differences in inter-electrode capacitances. When replacing tubes (especially 6J6 mixer-oscillator tube) make sure that Fine Tuning control will tune in television stations at approximately the middle of its range. It may be necessary to change the setting of the individual oscillator coil slugs for some channels to accomplish this.

EXPLANATION OF NOTES

B.	Brightness Control max. clockwise
C.	Brightness Control max. counter-clockwise
D.	Contrast Control max. clockwise
E.	Contrast Control max. counter-clockwise
G.	Height Control max. clockwise
H.	Height Control max. counter-clockwise
J.	Vertical Hold Control max. clockwise
K.	Vert. Hold Control max. counter-clockwise
L.	This voltage measurement was taken from the top of the tuner chassis with the tube removed from its socket.
M.	Vertical Linearity Control max. clockwise.
N.	Vertical Linearity Control max. counter-clockwise.
P.	The measurement should be made with a vacuum tube voltmeter. The voltage reading will fluctuate in the vicinity of 0.05 volts.
Q.	Do not attempt to measure the voltage at this position. There is a high R. F. potential at this point.
T.	Horiz. Drive Control max. clockwise.
U.	Horiz. Drive Control max. counter-clockwise.
V.	Before measuring this voltage, connect external antenna and adjust controls for normal reception of station signal.
W.	Before making this measurement, remove 6CB6 (V10 4th I.F. Amp.). This will prevent noise in the R.F. and I.F. stages from affecting voltage measured at this point.
X.	Grounding of center stud on tube socket is necessary to reduce capacity coupling between other pins. Oscillation may result if this ground is omitted.
Y.	Horiz. Hold Control turned in a clockwise direction until picture approaches loss of sync.
Z.	Horiz. Hold Control turned in a counter-clockwise direction until picture approaches loss of sync.



1.	Power Supply—117 volts 60 cycle AC.
2.	All voltages are measured between socket terminals and chassis unless otherwise indicated on adjoining chart.
	*
3.	Measurements made with voltmeter having sensitivity of 20,000 ohms per volt except where indicated by (*). The (*) symbol designates a vacuum tube voltmeter measurement.

SUBJECT	PRECAUTIONS
CHANNEL COILS AND SLUGS	Channel Coils must be handled with care. **Do not disturb coil windings.** If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.
FINE TUNING CONTROL	Rubbing of the bakelite Fine Tuning Cam against the Fine Tuning Condenser Plate is intentional in order to avoid vibration with resulting microphonics. However, the Fine Tuning Cam should not rub or contact the small circular plate located on the body of the tuner.

REMOVAL AND REPLACEMENT OF PARTS

ITEM	PROCEDURE
RF TUNER UNIT	To remove the Tuner Unit from receiver chassis, proceed as follows: 1. Remove channel selector dial lamp socket. 2. Remove screws which hold tuner to front and rear support brackets. 3. Disconnect the leads from the tuner to the main chassis. See illustration on circuit diagram page showing tuner connections. 4. Tuner unit may now be withdrawn from underside of chassis.
CHANNELS COILS	It is not necessary to remove entire tuner unit to replace a snap-in channel coil but removal of bottom shield will be required. This may be accomplished by grasping the front end of the shield and pulling downward and unhooking it from rear of tuner frame. Insert a screwdriver blade between Coil Retainer Spring and the end of the Tuner Turret. Twist the blade to pull spring away from the molded body of Channel Coil. Lift this end of coil body upward and remove individual coil assembly from tuner. When replacing Channel Coils, be sure they are reinstalled in their correct positions. Coil numbers should increase consecutively in a counter-clockwise direction when tuner is viewed from the front. If all the Channel Coils have been removed from the Tuner Turret, rotate turret until flat surface on end of tuner shaft points down. Install #3 Channel Coils into bottom position on turret. Then follow the correct sequence indicated above to replace other coils.
TUNER TURRET ASSEMBLY	To remove turret from RF Tuner Unit, remove complete tuner and bottom shield as described in previous sections and proceed as follows: 1. Remove rear Turret Shaft Retaining Spring by disengaging straight end of spring from projection on tuner frame. 2. Remove Fine Tuning Condenser Plate from front of Tuner Unit. This plate forms one side of Fine Tuning control condenser and is held in place by one screw. 3. Slide Fine Tuning Cam and Shaft off of main Channel Selector Shaft. 4. Remove Spring Contactor Washer and Fiber Spacer Washer from Channel Selector Shaft. 5. Remove Shaft Retaining Spring at front of tuner by disengaging straight end of spring from projection on frame. 6. Remove turret assembly from frame. To replace turret, reverse the above procedure. Tooth on bakelite Fine Tuning Cam should point downward during assembly so that it does not become locked between the stops on the Fine Tuning Condenser Plate. Also be sure to replace bottom shield.
STATOR CONTACT ASSEMBLY	To remove this assembly, remove complete tuner as described in previous sections and proceed as follo : 1. Remove side shield by taking out the two retaining screws and unsolder shield at one point. Now, disengage shield from upper edge of tuner frame. 2. Remove the two screws at the front and rear of the Stator Contact Assembly. 3. Unsolder all electrical connections to contact plate. 4. Unsolder five soldered joints between Stator Contact Assembly and Tuner Unit. 5. Contact Assembly may now be withdrawn from frame. To reinstall this assembly: 1. Place Stator Contact Assembly in position and replace, but do not tighten, the two screws at the front and rear of the assembly. 2. Remove 3 consecutive pairs of Channel Coils from the turret (for example, the antenna and rf-osc. coils for channels #5, 6 and 7). 3. Position Tuner Turret so that the edges of the next highest Channel Coils (in this case, the coils for channel #8) just pass the row of 11 contacts on the Stator Contact Assembly. 4. Adjust position of the Stator Contact Assembly so that there are a few thousandths of an inch spacing between the contacts on the contact plate and the molded body of the Channel Coils. 5. The Contact Assembly is now correctly positioned and screws at front and rear may be tightened. 6. Solder Stator Contact Assembly to tuner frame at same points that were used previously. 7. Make all electrical connections to contact plate. 8. Replace Channel Coils. 9. Replace side shield.

ALIGNMENT PROCEDURE
MODEL 9132-A

Alignment of all RF and IF tuned circuits in this receiver may be accomplished by utilizing the procedures described in the following charts.

SEQUENCE OF ALIGNMENT: These procedures should preferably be applied in the order in which they are presented, however, alignment of the Sound Channel or IF Channel may be accomplished individually if desired.

The RF Amplifier and Mixer alignment may also be accomplished independent of Sound or IF Channel alignment, but oscillator calibration can only be done after IF Channel has been correctly aligned. Proper IF band pass characteristic is necessary for Oscillator alignment as results of RF circuit tuning are observed by means of an oscilloscope connected to the output of the detector stage.

REMOVAL OF CHASSIS: The receiver chassis must be removed from the cabinet in order to accomplish alignment of all tuned circuits as there are adjustment points located on the underside of the unit.

This can be accomplished by first removing all knobs and disconnecting the receiver "built-in" antenna and speaker. The chassis may then be removed by releasing the hold-down screws located on the underside of the cabinet.

CAUTION

The picture tube is highly evacuated and if broken, glass fragments will be violently expelled. Handle with care, using safety goggles and gloves.

INSTRUMENTS: The following instruments will be required as signal sources and output indicators during the alignment process. Since accurate alignment of a television receiver is heavily dependent upon the performance of your instruments, it is imperative that they meet the essential specifications described here.

1. **STANDARD SIGNAL GENERATOR** to provide unmodulated (pure RF) signals at the following frequencies. Maximum output on all ranges should be at least .1 volt with provision for attenuation as desired. This instrument must have good frequency stability and be accurately calibrated. Generators which incorporate a separate crystal controlled oscillator and heterodyne circuit are self calibrating and therefore capable of providing the accuracy of frequency calibration required for television circuit alignment.

   a. IF Frequencies:
      - 4.5 Mc. Sound Channel
      - 22.25 Mc. Sound IF marker
      - 22.4 Mc. 1st IF Trap Coil
      - 23.5 Mc. 1st and 3rd IF stages
      - 24.9 Mc. 4th IF stage
      - 26.1 Mc. Converter and 2nd IF stages
      - 26.75 Mc. Picture IF marker

   b. RF Frequencies:
      - 54 to 88 Mc.
      - 174 to 216 Mc.

2. **RF SWEEP GENERATOR** to provide frequency modulated signals at the following frequencies:
   - 20 to 30 Mc. with 10 Mc. sweep width.
   - 54 to 88 Mc. with 10 Mc. sweep width.
   - 174 to 216 Mc. with 10 Mc. sweep width.

   Output adjustable with at least .1 volt maximum.

   Output should be "flat" (no amplitude variation) for all settings of the sweep width control.

   Provision for connection of generator sweep modulating voltage to horizontal deflection system of an oscilloscope.

   Provision for blanking the output signal on each return sweep so that oscillogram will not show retrace.

3. **CATHODE RAY OSCILLOSCOPE,** preferably a unit with vertical amplifier having wide range frequency response and low capacity pick-up probe.

4. **VACUUM TUBE VOLTMETER.** The lowest voltage range of this instrument should preferably permit a 1.0 volt reading to be indicated at not less than one third of full scale deflection.

INSTRUMENT CONNECTIONS: The method of connection, including details of matching and coupling networks, for instruments used in this alignment procedure is given in several illustrations on subsequent pages. Specific instructions for each instrument application will be found in various sections of the alignment charts.

GENERAL INSTRUCTIONS: When aligning IF and RF circuits it is necessary to apply a fixed bias voltage to the AGC system of the receiver. This fixed bias is obtained by using a 3 volt battery and connecting it as described in Fig. 14.

IMPORTANT

When observing the receiver band pass characteristic on an oscilloscope, it is exceedingly important to avoid distortion of that characteristic which would occur when using a large input signal from the sweep generator or standard generator (marker signal). Always set attenuator on sweep generator so that the reading on the vacuum tube voltmeter does not exceed one volt (when meter is connected from high side of video detector load, resistor symbol 196, to receiver chassis). Standard generator output should also be attenuated so that marker signal does not pull or tear the band pass characteristic as shown on the 'scope.

SOUND CHANNEL ALIGNMENT PROCEDURE

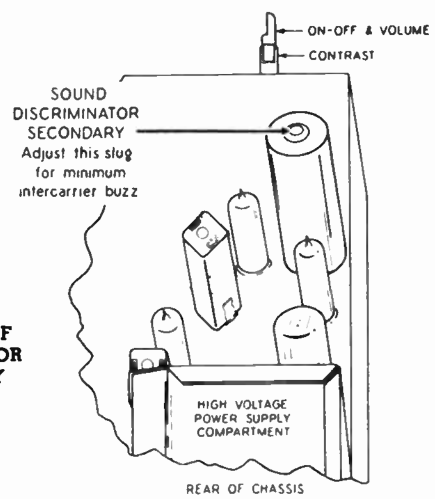
1. Short antenna terminals together with a jumper wire.
2. Set receiver Channel Selector to any inactive television channel; other controls may be left at any desired setting.
3. No special aligning tool is required to adjust the cores in the Sound IF and discriminator transformers. The blade of a small screwdriver will fit the slot in these cores, however, the screwdriver should be of a non-metallic or insulated type to prevent detuning when inserted in the transformer can.

STANDARD SIGNAL GENERATOR: CONNECTIONS	STANDARD SIGNAL GENERATOR: FREQUENCY	VTVM CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect as shown in Fig 1.	**4.5 MC.** unmodulated **IMPORTANT** This signal must be accurate within 1/4 of 1% of 4.5 Mc. Check generator calibration against a crystal controlled signal source by "zero beating" (heterodyning) with harmonics of the crystal frequency.	Connect as shown in Fig. 2.	A "swishing" sound may be heard in the speaker during Sound Channel Alignment. This spurious oscillation is caused by horizontal sweep voltage being picked up in the audio system thru stray coupling of instrument leads; it should be disregarded as it will have no effect on alignment of the sound channel.	**#1** Discriminator Secondary	Adjust for maximum reading on VTVM.
				#2 Discriminator Primary	Adjust for maximum reading on VTVM.
				#3 2nd Sound IF Secondary	Adjust for maximum reading on VTVM.
				#4 2nd Sound IF Primary	Adjust for maximum reading on VTVM.
				#5 1st Sound IF Secondary	Adjust for maximum reading on VTVM.
				#6 1st Sound IF Primary	Adjust for maximum reading on VTVM.
Same as above.	Same as above.	Connect as shown in Fig 3.	To obtain zero balance of the discriminator circuit, two 68,000 ohm resistors will be required. These resistors must be matched so that their respective resistances do not differ by more than 1%—the accuracy of the total resistance is not critical. Connect the two resistors in series from pin 2 to the 6T8 tube to chassis ground as shown in Fig. 3.	**#1** Discriminator Secondary	Note that as slug #1 is rotated, a point will be found where the voltmeter will swing rather sharply from a positive to a negative reading or vice versa. The correct setting of slug #1 is obtained when the meter reads zero as the slug is moved thru this point.

REDUCTION OF INTERCARRIER BUZZ

Slight "dynamic" unbalance of the discriminator secondary can emphasize intercarrier buzz due to incomplete amplitude modulation rejection. Therefore it is vitally important to obtain an accurate setting of the discriminator secondary slug under actual reception conditions.

Disconnect all instruments and then connect an antenna to the receiver to obtain program reception from a local station. If intercarrier buzz is prominent, a slight readjustment of the discriminator secondary slug (#1) should be made to obtain the "dip" point for the buzzing sound. Note that program sound will be clear and free from distortion at this point. Buzz should now be at an acceptable minimum if station transmission is not at fault.



LOCATION OF DISCRIMINATOR SECONDARY SLUG

INSTRUMENT CONNECTIONS FOR SOUND CHANNEL ALIGNMENT

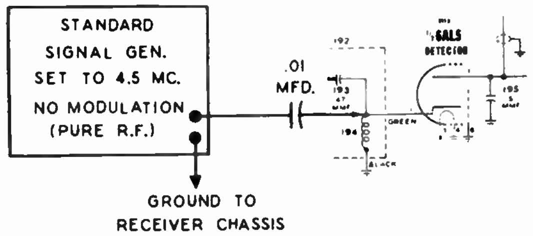


FIG. 1
Generator Connections for Sound Channel Alignment

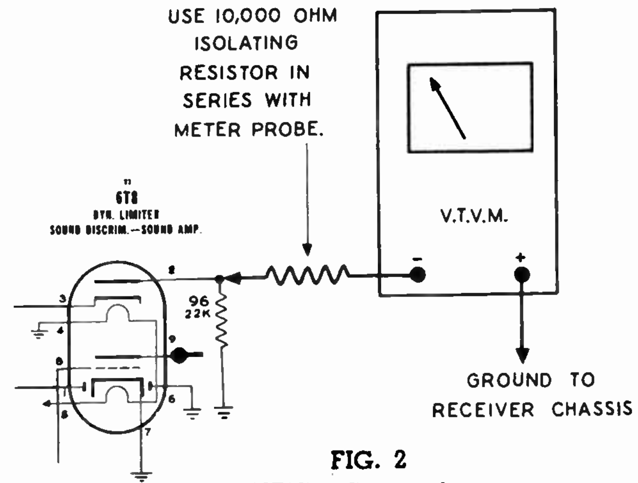


FIG. 2
VTVM Connections for Sound IF Alignment

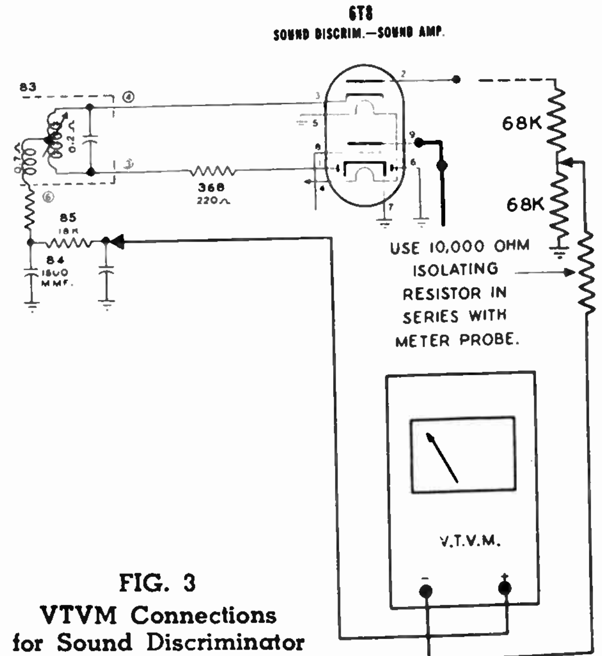


FIG. 3
VTVM Connections for Sound Discriminator Alignment

INSTRUMENT CONNECTIONS FOR IF CHANNEL ALIGNMENT

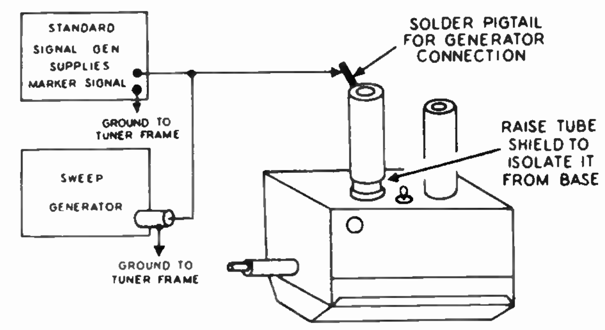


FIG. 9
Generator Connections for IF Channel Alignment

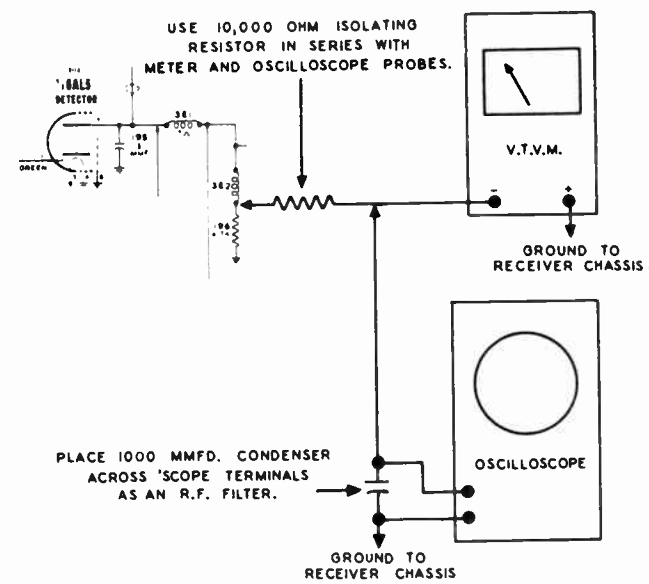


FIG. 10
VTVM and Oscilloscope Connections for IF Channel Alignment

IF CHANNEL ALIGNMENT PROCEDURE

1. A special aligning tool designed to fit the stems on adjustable cores of the IF and Trap coils (see points 8, 9, 10, 11 and 12 in Fig. 13) is available and may be obtained from Stewart-Warner by requesting IF Alignment Tool #507479.
2. Turn receiver Channel Selector to television channel #12 and short antenna terminals together with a jumper wire.
3. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to the AGC line and positive terminal of battery connects to receiver chassis. See Fig. 14 for convenient point of connection.
4. If the IF channel is badly misaligned and two or more immediately adjoining IF stages are tuned to the same frequency, oscillation may occur. Such oscillation shows up as a voltage across the video detector load resistor, symbol 196, and is indicated by the VTVM that is connected to this point during alignment. It should be noted that voltage due to IF oscillation is unaffected by strength of signal from the generator.

Where IF oscillation is encountered, it is generally possible to correct the condition by detuning the IF coils in different directions. If that does not have the desired effect, increase fixed bias on AGC line by using a 4½ volt battery instead of the 3 volt battery referred to in instruction #3. After stopping the oscillation in this manner it will then be possible to align all IF stages using the following procedure, however, the AGC bias battery must be changed back to 3 volts when using the oscilloscope to observe band pass characteristics. Once all stages have been aligned using the 4½ volt bias, the IF channel should be stable with reduced bias.

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
Connect as shown in Fig. 4.	26.1 MC.	Use a 330 Mmf. isolating condenser and connect as shown in Fig. 4 but keep power switch turned off during this step.	——	Connect as shown in Fig. 5.	Not used.	——	#7 Converter plate coil	Adjust for maximum reading on VTVM.
							#8 2nd I.F.	Adjust for maximum reading on VTVM.
Same as above.	24.9 MC.	Same as above.	——	Same as above.	Not used.	——	#9 4th I.F.	Adjust for maximum reading on VTVM.
Same as above.	23.5 MC.	Same as above.	——	Same as above.	Not used.	——	#10 1st I.F.	Adjust for maximum reading on VTVM.
							#11 3rd I.F.	Adjust for maximum reading on VTVM.
Same as above.	22.4 MC.	Same as above.	——	Same as above.	Not used.	——	#12 1st IF Trap Coil	Adjust for minimum reading on VTVM.
Same as above.	26.75 MC.	With connections made as shown in Fig. 4, turn on this generator and set controls for operation as specified in next column.	25 MC. Sweeping ± 5 Mc.	Same as above.	Connect as shown in Fig. 5.	IMPORTANT: 1. Adjust output attenuator on sweep generator so that reading on VTVM is approximately one volt. 2. Set attenuator on standard signal generator so that marker signal does not distort the pattern on the oscilloscope. 3. Be sure that a 3 volt battery is connected to AGC line as specified in instruction #3 at the head of this chart. Do not use a battery of any other voltage.	The IF band pass characteristic now displayed on the 'scope should be compared with the curve shown in Fig. 6. If top of curve is not properly shaped, make a slight readjustment of slug #9. Should that adjustment fail to yield the desired result, then note whether the curve has a peak on the high or low frequency side. Slugs #7 and #8 control high frequency response (26.1 Mc.) and slugs #10 and #11 affect the low frequency response (23.5 Mc.); by making a small change in the settings of the high or low frequency slugs, it will be possible to obtain correct band pass curve. (Fig. 6 below) The 26.75 Mc. picture IF carrier marker should now appear at the 40% amplitude position on side of the band pass characteristic (see Fig. 6). If position of the marker appears too high or too low, slight readjustment of slugs #7, 8 and 9 is required.	
Same as above.	22.25 MC.	Same as above.	Same as above.	Same as above.	Same as above.	Same as above.	Adjust the vertical gain control on the 'scope in order to magnify the sound portion of the response curve. The 22.25 Mc. sound IF carrier marker should appear at the position indicated in Fig. 6. If the position of the sound marker is incorrect, readjust Trap Coil #12.	

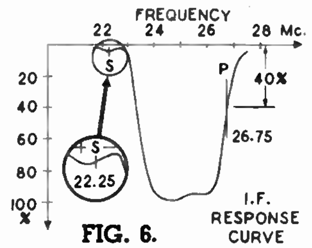


FIG. 6.

RF CHANNEL ALIGNMENT PROCEDURE

Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to AGC line and positive terminal of battery connects to receiver chassis. (See Fig. 14 for convenient point of connection.)

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
RF AMPLIFIER AND MIXER ALIGNMENT								
Connect as shown in Fig. 10.	*209.75 MC. ‡205.25 MC.	Connect as shown in Fig. 10 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #12	Not used.	Connect as shown in Fig. 11.	Set Channel Selector to #12 —— IMPORTANT: Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	#13 Mixer Grid.	Adjust these trimmers to obtain properly shaped RF band pass characteristic as shown in Fig. 7. Use Mixer Grid trimmer #13; and RF Amplifier Plate trimmer #14 to obtain correct amplitude of characteristic in vicinity of picture and sound carrier markers. Then adjust RF Amp. Grid trimmer #15 to equalize overall amplitude. Repeat adjustment of trimmers to be sure correct response has been obtained.
							#14 RF Amp. Plate.	
							#15 RF Amp. Grid.	IMPORTANT: When adjusting trimmers #13, 14 and 15 it will be noted that the band pass characteristic can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as that would result in a loss of sensitivity.
Same as above.	*215.75 MC. ‡211.25 MC.	Same as above.	CHANNEL #13	Not used.	Same as above.	Set Channel Selector to #13	The RF band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers #13, 14 and 15. Adjust the RF sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers. (Fig. 7 below) Band pass characteristic of these channels should conform to the RF response curve in Fig. 7. If necessary, a compromise may be obtained to compensate for small variations in channel response by returning to channel #12 and making slight changes in the settings of trimmers #13, 14 and 15.	
	*203.75 MC. ‡199.25 MC.		CHANNEL #11			Set Channel Selector to #11		
	*197.75 MC. ‡193.25 MC.		CHANNEL #10			Set Channel Selector to #10		
	*191.75 MC. ‡187.25 MC.		CHANNEL #9			Set Channel Selector to #9		
	*185.75 MC. ‡181.25 MC.		CHANNEL #8			Set Channel Selector to #8		
	*179.75 MC. ‡175.25 MC.		CHANNEL #7			Set Channel Selector to #7		
	* 87.75 MC. ‡ 83.25 MC.		CHANNEL #6			Set Channel Selector to #6		
	* 81.75 MC. ‡ 77.25 MC.		CHANNEL #5			Set Channel Selector to #5		
	* 71.75 MC. ‡ 67.25 MC.		CHANNEL #4			Set Channel Selector to #4		
	* 65.75 MC. ‡ 61.25 MC.		CHANNEL #3			Set Channel Selector to #3		
	* 59.75 MC. ‡ 55.25 MC.		CHANNEL #2			Set Channel Selector to #2		

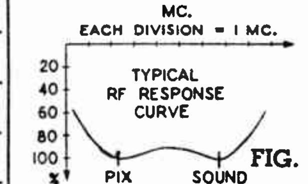


FIG. 7.

*Sound Carrier Marker
‡Picture Carrier Marker

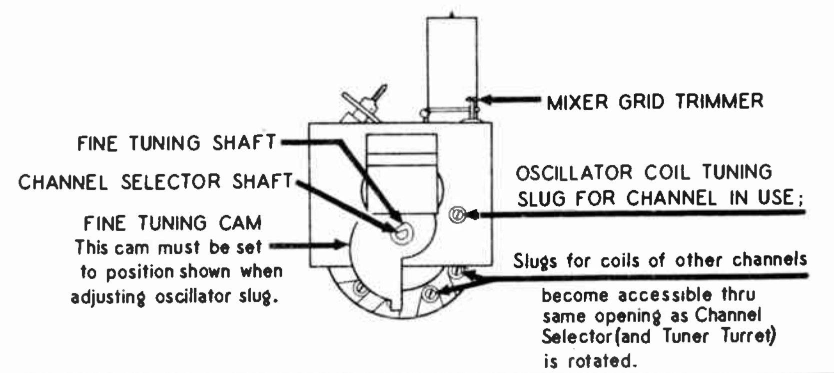


FIG. 8
Front view of
RF Tuner Unit

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.				

OSCILLATOR ALIGNMENT

1. **IMPORTANT:** Before undertaking oscillator alignment be sure IF circuits are correctly aligned for band pass characteristic illustrated in Fig. 6.
2. During oscillator alignment, it is necessary to set the Fine Tuning control so that the tooth on the bakelite fine tuning cam points downward (correct position for this control is shown in Fig. 8).

Connect as shown in Fig. 10.	*209.75 MC. ‡205.25 MC.	Connect as shown in Fig. 10 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #12	Connect as shown in Fig. 12	Connect as shown in Fig. 12	Set Channel Selector to #12 — Be sure that Fine Tuning control has been properly positioned (tooth on the cam pointing down—see Fig. 8). — During this step and thru-out all succeeding steps it is necessary to: 1. Keep output of sweep generator at a level that does not allow reading on VTVM to exceed one volt. 2. Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the 'scope.	NOTE: Before making the following adjustment, advance the vertical gain control on the 'scope in order to magnify the sound portion of the response curve. Then, use a non-metallic screwdriver to adjust channel #12 oscillator slug (accessible thru hole on front of RF Tuner Unit—see Fig. 8) and shift response curve so that sound carrier marker is located at the position indicated in Fig. 9. Now, reduce gain control setting of 'scope to restore pattern to normal amplitude and observe position of picture carrier marker. This marker should appear at the 50% amplitude position on the low frequency side of the characteristic curve (see Fig. 9).
Same as above.	*215.75 MC. ‡211.25 MC.	Same as above.	CHANNEL #13	Same as above.	Same as above.	Set Channel Selector to #13	Adjust the RF sweep generator and marker generator for operation on the other television channels; set marker generator to sound carrier frequency. After setting Channel Selector to corresponding channel, adjust oscillator slug thru hole on front of RF Tuner Unit (see Fig. 8). This permits response curve to be shifted so that sound carrier marker will appear at the position indicated in Fig. 9. The picture carrier marker for the corresponding channel should then appear at the 50% amplitude position on the opposite side of the band pass characteristic curve. NOTE: Make sure that cam on fine tuning control shaft remains properly positioned during this step (tooth on the cam pointing downward—see Fig. 8).
	*203.75 MC. ‡199.25 MC.		CHANNEL #11			Set Channel Selector to #11	
	*197.75 MC. ‡193.25 MC.		CHANNEL #10			Set Channel Selector to #10	
	*191.75 MC. ‡187.25 MC.		CHANNEL #9			Set Channel Selector to #9	
	*185.75 MC. ‡181.25 MC.		CHANNEL #8			Set Channel Selector to #8	
	*179.75 MC. ‡175.25 MC.		CHANNEL #7			Set Channel Selector to #7	
	* 87.75 MC. ‡ 83.25 MC.		CHANNEL #6			Set Channel Selector to #6	
	* 81.75 MC. ‡ 77.25 MC.		CHANNEL #5			Set Channel Selector to #5	
	* 71.75 MC. ‡ 67.25 MC.		CHANNEL #4			Set Channel Selector to #4	
	* 65.75 MC. ‡ 61.25 MC.		CHANNEL #3			Set Channel Selector to #3	
	* 59.75 MC. ‡ 55.25 MC.		CHANNEL #2			Set Channel Selector to #2	

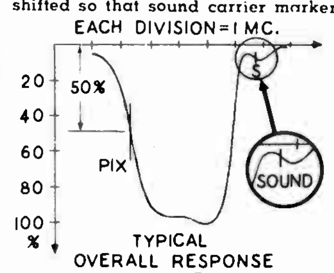


FIG. 9

If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.

If an unsatisfactory overall response is obtained for a particular channel, observe RF Amp. and Mixer response curve for that channel (as described on page 1950-60D). If characteristic does not conform reasonably well within the typical curve shown in Fig. 7, then, (1) attempt to obtain a better compromise for RF response on all channels by realigning RF Amp. and Mixer circuits, or (2) try replacing Antenna, RF and Oscillator coils for the particular channels.

*Sound Carrier Marker
‡Picture Carrier Marker

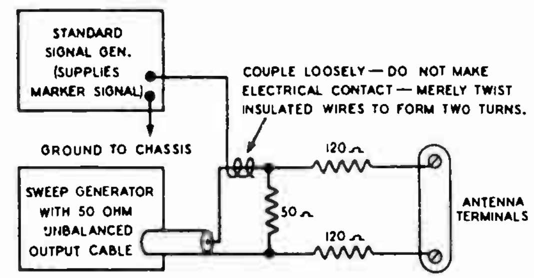


FIG. 10
Generator Connections for RF Channel Alignment

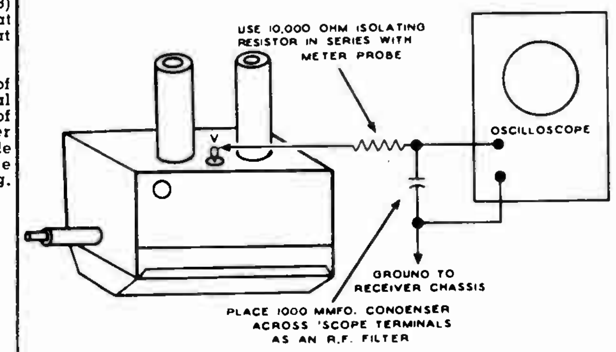


FIG. 11
Oscilloscope Connections for RF Amp. and Mixer Alignment

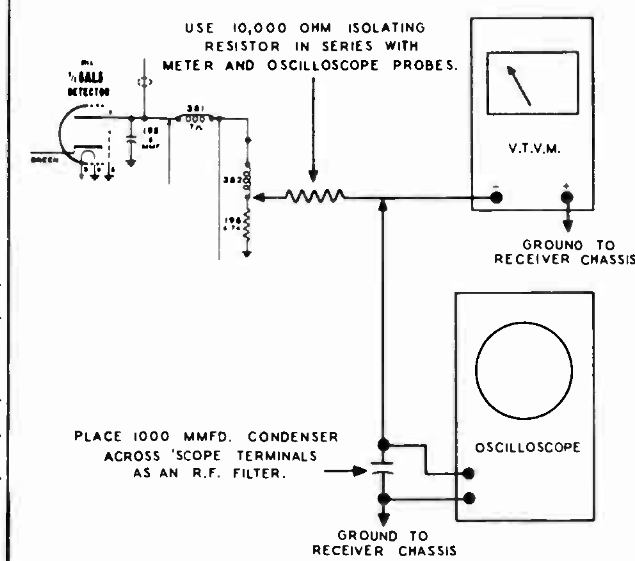
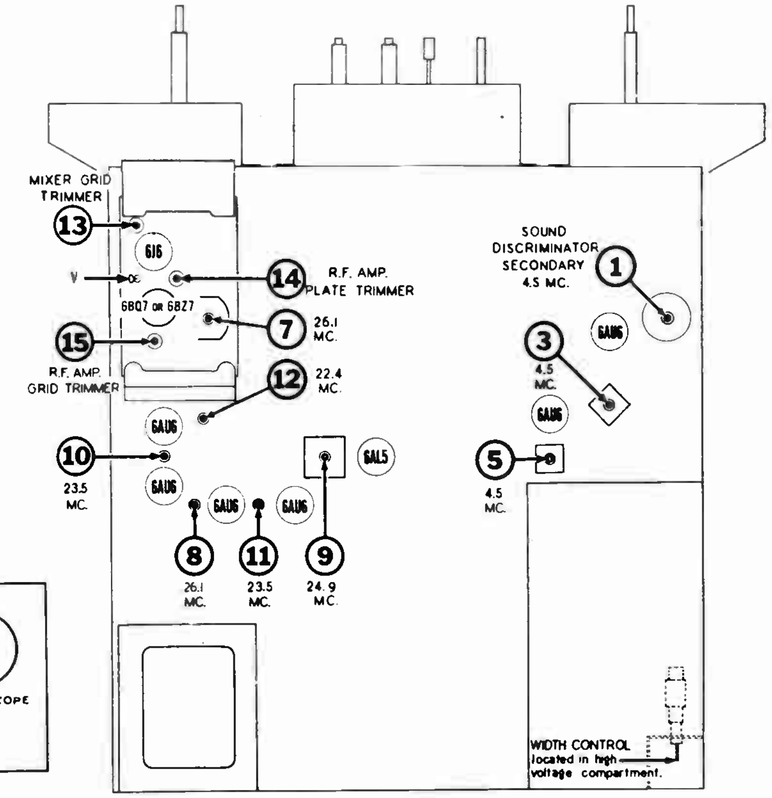
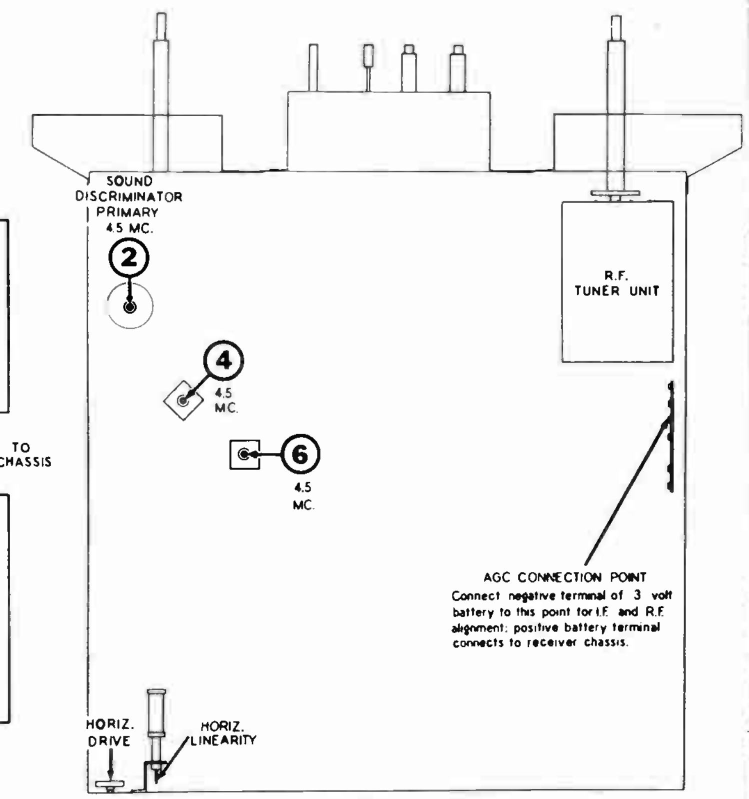


FIG. 12
VTVM and Oscilloscope Connections for Oscillator Alignment



TOP VIEW OF CHASSIS

FIG. 13



BOTTOM VIEW OF CHASSIS

FIG. 14

Notice: Same parts listed below have special characteristics. Do not use substitutes for replacement purposes.

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
		CONDENSERS	
67	513001	Condenser—ceramic 2.2 Mmfd. 500 volt	$ .16
68-A, B	508061	Condenser—ceramic 51 Mmfd. (part of 1st TV sound I.F. transformer)	1.85
69	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
72	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
74-A, B	508061	Condenser—ceramic 51 Mmfd. (part of 2nd TV sound I.F. transformer)	1.85
75	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
77	513433	Condenser—ceramic 47 Mmfd. ± 10% 500 volt (Temperature compensating)	.28
78	513018	Condenser—ceramic 220 Mmfd. 500 volt	.24
80	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
83-A	509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
83-B	509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
84	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
86	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
87	512027	Condenser—.05 Mfd. 200 volt	.40
89	512007	Condenser—.005 Mfd. 600 volt	.25
91	512007	Condenser—.005 Mfd. 600 volt	.25
98	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
99	505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
100	513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
102	502527	Condenser—electrolytic 50 Mfd. 25 volt	1.10
104	504719	Condenser—electrolytic 4 Mfd. 450 volt	1.00
106	512003	Condenser—.002 Mfd. 600 volt	.25
157	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
162	513445	Condenser—ceramic 22 Mmfd. ± 10% 500 volt (Temperature compensating)	.30
164	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
167	513016	Condenser—ceramic 82 Mmfd. ± 10% 500 volt	.25
170	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
172	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
175	513016	Condenser—ceramic 82 Mmfd. ± 10% 500 volt	.25
178	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
182	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
186	513016	Condenser—ceramic 82 Mmfd. ± 10% 500 volt	.25
190	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
193	513433	Condenser—ceramic 47 Mmfd. ± 10% 500 volt (Temperature compensating)	.28
195	513432	Condenser—ceramic 5 Mmfd. ± 10% 500 volt (Temperature compensating)	.30
198	512045	Condenser—.25 Mfd. ± 10% 200 volt	.36
202	512027	Condenser—.05 Mfd. 200 volt	.40
205	512045	Condenser—.25 Mfd. ± 10% 200 volt	.36
211	512027	Condenser—.05 Mfd. 200 volt	.40
223	512031	Condenser—.05 Mfd. 600 volt	.35
225	512031	Condenser—.05 Mfd. 600 volt	.35
231	512019	Condenser—.02 Mfd. 600 volt	.30
232	512031	Condenser—.05 Mfd. 600 volt	.35
238	513027	Condenser—ceramic 56 Mmfd. ± 10% 1500 volt	.45
242	512027	Condenser—.05 Mfd. 200 volt	.40
247	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
248	513009	Condenser—1000 Mmfd. 500 volt	.30
251	512013	Condenser—.01 Mfd. 600 volt	.30
254	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
256	512027	Condenser—.05 Mfd. 200 volt	.40
259	512540	Condenser—mica 3900 Mfd. ± 10% 500 volt	.60
260	512541	Condenser—mica 330 Mmfd. 500 volt	.30
264	512535	Condenser—mica 390 Mmfd. ± 10% 500 volt	.35
265	512536	Condenser—mica 270 Mmfd. ± 10% 500 volt	.30
266	508071	Condenser—trimmer 10-160 Mmfd. (Horizontal Drive Control)	.40
269	508684	Condenser—electrolytic 5 Mfd. 50 volt	1.00
271	513025	Condenser—ceramic 3.3 Mmfd. ± 15% 1500 volt	.40
272	512031	Condenser—.05 Mfd. 600 volt	.35
278	512031	Condenser—.05 Mfd. 600 volt	.35
280	512045	Condenser—.25 Mfd. ± 10% 200 volt	.36
281	508888	Condenser—ceramic 500 Mmfd. 20,000 volt	2.00
283	512031	Condenser—.05 Mfd. 600 volt	.35
285	512031	Condenser—.05 Mfd. 600 volt	.35
287	508680	Condenser—electrolytic 10 Mfd. 600 volt	2.55
288	512255	Condenser—.01 Mfd. 400 volt	.25
289	512255	Condenser—.01 Mfd. 400 volt	.25
292	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
294	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
295	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
297	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
298	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
301-A, B	508073	Condenser—electrolytic A—20 Mfd. 300 volt B—60 Mfd. 300 volt	3.35
302-A, B, C	508072	Condenser—electrolytic A—40 Mfd. 450 volt B—40 Mfd. 450 volt C—40 Mfd. 450 volt	4.50
305	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
307	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
309	513016	Condenser—ceramic 82 Mmfd. ± 10% 500 volt	.25
317-A	508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
317-C	508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
317-E	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
317-G	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
319	512533	Condenser—mica 4700 Mmfd. ± 5% 1000 volt	1.40
325	512037	Condenser—.1 Mfd. 600 volt	.45
327	512308	Condenser—.05 Mfd. ± 10% 600 volt	.30
331	508682	Condenser—electrolytic 100 Mfd. 50 volt	1.50
344	513009	Condenser—ceramic 1000 Mmfd. 500 volt	.28
355	512005	Condenser—.003 Mfd. 600 volt	.25
369	513001	Condenser—ceramic 2.2 Mmfd. 500 volt	.16
373	508888	Condenser—ceramic 500 Mmfd. 20,000 volt	2.00
377	512007	Condenser—.005 Mfd. 600 volt	.25
378	512009	Condenser—.01 Mfd. 200 volt	.25
388	512027	Condenser—.05 Mfd. 200 volt	.40
390	512027	Condenser—.05 Mfd. 200 volt	.40
394	512029	Condenser—.05 Mfd. 400 volt	.35
399	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
402	509064	Condenser—trimmer 3-9 Mmfd.	.50
405	520721	Condenser—ceramic 3.6 Mmfd. ± 10% 500 volt	.35
407	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (Part of center shield)	—
410	507968	Condenser—trimmer 0.5-3 Mmfd.	.40
412	520719	Condenser—ceramic 47 Mmfd. ± 10% 500 volt (Temperature compensating)	.40
414	520717	Condenser—ceramic 5 Mmfd. ± 5% 500 volt (Temperature compensating)	.35
416	520719	Condenser—ceramic 47 Mmfd. ± 10% 500 volt (Temperature compensating)	.40
417	*	Condenser—ceramic 3-5 Mmfd. (Fine Tuning)	—
420	520718	Condenser—ceramic 10 Mmfd. ± 10% 500 volt (Temperature compensating)	.30
421	507968	Condenser—trimmer 0.5-3 Mmfd.	.40
425	520716	Condenser—ceramic 6.8 Mmfd. ± 5% 500 volt (Temperature compensating)	.35
428	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
		CONDENSERS—Continued	
429	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (port of center shield)	—
430	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
431	513029	Condenser—ceramic 120 Mmfd. ± 10% 500 volt	.35
432	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
433	520735	Condenser—ceramic 1000 Mmfd. 500 volt	.30
435	520735	Condenser—ceramic 1000 Mmfd. 500 volt	.30
437	520720	Condenser—ceramic 1.5 Mmfd. 500 volt	.35
		RESISTORS	
70	510117	Resistor—carbon 82 Ohms ± 10% ½ watt	.12
73	510137	Resistor—carbon 1000 Ohms ½ watt	.12
76	510185	Resistor—carbon 470,000 Ohms ½ watt	.12
79	510117	Resistor—carbon 82 Ohms ± 10% ½ watt	.12
81	510137	Resistor—carbon 1000 Ohms ½ watt	.12
85	510159	Resistor—carbon 18,000 Ohms ± 10% ½ watt	.12
88	510170	Resistor—carbon 68,000 Ohms ½ watt	.12
92	510197	Resistor—carbon 10 Meg. ½ watt	.12
96	510160	Resistor—carbon 22,000 Ohms ± 10% ½ watt	.12
103	510227	Resistor—carbon 330 Ohms ± 10% 1 watt	.16
105	510153	Resistor—carbon 8200 Ohms ± 10% ½ watt	.12
158	510151	Resistor—carbon 6800 Ohms ± 10% ½ watt	.12
159	510137	Resistor—carbon 1000 Ohms ½ watt	.12
161	510117	Resistor—carbon 82 Ohms ± 10% ½ watt	.12
164	510137	Resistor—carbon 1000 Ohms ½ watt	.12
168	510153	Resistor—carbon 8200 Ohms ± 10% ½ watt	.12
169	510137	Resistor—carbon 1000 Ohms ½ watt	.12
171	510117	Resistor—carbon 82 Ohms ± 10% ½ watt	.12
174	510137	Resistor—carbon 1000 Ohms ½ watt	.12
176	510153	Resistor—carbon 8200 Ohms ± 10% ½ watt	.12
177	510137	Resistor—carbon 1000 Ohms ½ watt	.12
180	510117	Resistor—carbon 82 Ohms ± 10% ½ watt	.12
183	510151	Resistor—carbon 6800 Ohms ± 10% ½ watt	.12
184	510137	Resistor—carbon 1000 Ohms ½ watt	.12
188	510117	Resistor—carbon 82 Ohms ± 10% ½ watt	.12
189	510153	Resistor—carbon 8200 Ohms ± 10% ½ watt	.12
191	510137	Resistor—carbon 1000 Ohms ½ watt	.12
196	510148	Resistor—carbon 4700 Ohms ± 10% ½ watt	.12
199	510253	Resistor—carbon 8200 Ohms ± 10% 1 watt	.16
201	510163	Resistor—carbon 33,000 Ohms ± 10% ½ watt	.12
203	510164	Resistor—carbon 33,000 Ohms ½ watt	.12
204	510155	Resistor—carbon 10,000 Ohms ½ watt	.12
206	510180	Resistor—carbon 270,000 Ohms ± 10% ½ watt	.12
210	510147	Resistor—carbon 3900 Ohms ± 10% ½ watt	.12
215	510191	Resistor—carbon 1 Meg. ½ watt	.12
216	510126	Resistor—carbon 270 Ohms ± 10% ½ watt	.12
219	510723	Resistor—carbon 12,000 Ohms ± 5% ½ watt	.16
221	510339	Resistor—carbon 1500 Ohms ± 10% 2 watt	.24
222	510339	Resistor—carbon 1500 Ohms ± 10% 2 watt	.24
224	510156	Resistor—carbon 12,000 Ohms ± 10% ½ watt	.12
226	510173	Resistor—carbon 100,000 Ohms ½ watt	.12
227	510191	Resistor—carbon 1 Meg. ½ watt	.12
228	510171	Resistor—carbon 82,000 Ohms ± 10% ½ watt	.12
230	510161	Resistor—carbon 22,000 Ohms ½ watt	.12
233	510159	Resistor—carbon 18,000 Ohms ± 10% ½ watt	.12
234	510143	Resistor—carbon 2200 Ohms ½ watt	.12
240	510132	Resistor—carbon 560 Ohms ± 10% ½ watt	.12
241	510132	Resistor—carbon 560 Ohms ± 10% ½ watt	.12
243	510172	Resistor—carbon 100,000 Ohms ± 10% ½ watt	.12
244	510151	Resistor—carbon 6800 Ohms ± 10% ½ watt	.12
245	510147	Resistor—carbon 3900 Ohms ± 10% ½ watt	.12
246	510148	Resistor—carbon 4700 Ohms ± 10% ½ watt	.12
249	510172	Resistor—carbon 100,000 Ohms ± 10% ½ watt	.12
250	510172	Resistor—carbon 100,000 Ohms ± 10% ½ watt	.12
252	510162	Resistor—carbon 27,000 Ohms ± 10% ½ watt	.12
253	510195	Resistor—carbon 4.7 Meg. ½ watt	.12
255	510185	Resistor—carbon 470,000 Ohms ½ watt	.12
258	510147	Resistor—carbon 3900 Ohms ± 10% ½ watt	.12
261	510139	Resistor—carbon 1500 Ohms ± 10% ½ watt	.12
262	510172	Resistor—carbon 100,000 Ohms ± 10% ½ watt	.12
263	510180	Resistor—carbon 270,000 Ohms ± 10% ½ watt	.12
267	510184	Resistor—carbon 470,000 Ohms ± 10% ½ watt	.12
268	510116	Resistor—carbon 68 Ohms ½ watt	.12
270	510716	Resistor—wire wound 220 Ohms ± 10% 5 watt	.90
273	510356	Resistor—carbon 12,000 Ohms ± 10% 2 watt	.24
277	510254	Resistor—carbon 10,000 Ohms ± 10% 1 watt	.16
279	510725	Resistor—carban 3.3 Ohms ± 10% ½ watt	.16
282	510390	Resistor—carbon 1 Meg. ± 10% 2 watt	.30
286	510713	Resistor—carbon 3000 Ohms ± 5% 2 watt	.40
290	510179	Resistor—carbon 220,000 Ohms ½ watt	.12
299	510319	Resistor—carbon 100 Ohms 2 watt	.24
303	510726	Resistor—wire wound 850 Ohms 5 watt	.80
306	510754	Resistor—wire wound 1000 Ohms ± 10% 10 w.	.85
315	510704	Resistor—wire wound 4.3 Ohms ± 10% 1 watt	.25
317-B	508062	Resistor—carbon 22,000 Ohms ⅕ watt (part of Integrator Unit)	1.40
317-D	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
317-F	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
320	510767	Resistor—carbon 1.5 Meg. ± 5% ½ watt	.20
322	510766	Resistor—carbon 100,000 Ohms ± 10% ½ watt	.12
323	510771	Resistor—carbon 6.8 Meg. ½ watt	.12
324	510770	Resistor—carbon 1.2 Meg. ± 10% ½ watt	.12
326	510151	Resistor—carbon 6800 Ohms ± 10% ½ watt	.12
328	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
329	510133	Resistor—carbon 680 Ohms ± 10% ½ watt	.12
356	510133	Resistor—carbon 680 Ohms ± 10% ½ watt	.12
363	510356	Resistor—carbon 12,000 Ohms ± 10% 2 watt	.24
367	510124	Resistor—carbon 220 Ohms ± 10% ½ watt	.12
368	510124	Resistor—carbon 220 Ohms ± 10% ½ watt	.12
370	510157	Resistor—carbon 15,000 Ohms ± 10% ½ watt	.12
371	510194	Resistor—carbon 3.3 Meg. ½ watt	.12
375	510137	Resistor—carbon 1000 Ohms ½ watt	.12
376	510185	Resistor—carbon 470,000 Ohms ½ watt	.12
380	510185	Resistor—carbon 470,000 Ohms ½ watt	.12
383	510119	Resistor—carbon 100 Ohms ½ watt	.12
384	510139	Resistor—carbon 1500 Ohms ± 10% ½ watt	.12
385	510155	Resistor—carbon 10,000 Ohms ½ watt	.12
386	510166	Resistor—carbon 47,000 Ohms ± 10% ½ watt	.12
387	510772	Resistor—carbon 2.7 Meg. ± 5% ½ watt	.12
389	510743	Resistor—carbon 1.8 Meg. ± 5% ½ watt	.16
391	510171	Resistor—carbon 82,000 Ohms ± 10% ½ watt	.12
392	510172	Resistor—carbon 100,000 Ohms ± 10% ½ watt	.12
393	510169	Resistor—carbon 68,000 Ohms ± 10% ½ watt	.12
395	510149	Resistor—carbon 4700 Ohms ½ watt	.12
396	510191	Resistor—carbon 1 Meg. ½ watt	.12
397	510162	Resistor—carbon 27,000 Ohms ± 10% ½ watt	.12
398	510236	Resistor—carbon 1000 Ohms ± 10% 1 watt	.16
403	510157	Resistor—carbon 15,000 Ohms ± 10% ½ watt	.12
404	510167	Resistor—carbon 47,000 Ohms ½ watt	.12
408	510774	Resistor—carbon 160,000 Ohms ± 5% ½ watt	.16
409	510751	Resistor—carbon 100,000 Ohms ± 5% ½ watt	.20

*—This part is not supplied as a Service replacement item.

ALL PRICES ON THIS PARTS LIST ARE SUBJECT TO CHANGE WITHOUT NOTICE.

PARTS LIST (Cont.)

RESISTORS—Continued

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
411	510139	Resistor—carbon 1500 Ohms ± 10% ½ watt	.12
418	510154	Resistor—carbon 10,000 Ohms ± 10% ½ watt	.12
419	510179	Resistor—carbon 220,000 Ohms ½ watt	.12
422, 423	510154	Resistor—carbon 10,000 Ohms ± 10% ½ watt	.12
438	510172	Resistor—carbon 100,000 Ohms ± 10% ½ watt	.12

CONTROLS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
90-A,B,C	520663	Contrast and Volume control (includes ON-OFF switch) A—Volume control; 1 Meg. ¼ watt B—Contrast control; 3000 Ohms ± 10% 4 watt C—On-Off switch	3.50
229	520642	Brightness potentiometer (50,000 Ohms)	1.00
257	508967	Horizontal Hold coil (includes slug and clip)	1.10
	508963	Slug core for Horizontal Hold coil	.15
266	508071	Horizontal Drive trimmer condenser (10-160 Mmfd.)	.40
276	508667	Width coil (includes slug and clip)	1.75
	508784	Slug core for Width coil	.65
284	162190	Coil—Horizontal Linearity (includes slug & clip)	1.60
	507429	Slug core for Horizontal Linearity coil	.60
321-A,B	508893	Height and Vertical Hold potentiometers A—Vertical Hold control; 1 Meg. ¼ watt B—Height control; 2.5 Meg. ¼ watt	1.75
330-A, B	509302	Vertical Linearity and Focus potentiometers A—Vertical Linearity control; 5,000 Ohms ½ watt B—Focus control; 10,000 Ohms ± 10% 4 watt	3.75
375-A,B	520563	Switch, "PHONO-TELEV."	.55
379	520651	Tone potentiometer (500,000 Ohms)	1.00
417	*	Fine Tuning condenser (3-5 Mmfd.)	—

COILS AND TRANSFORMERS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
68	508061	Transformer—1st sound I.F. (includes condensers 68-A and 68-B)	1.85
71	507373	Coil—choke	.80
74	508061	2nd Sound I.F. transformer (includes condensers 74-A and 74-B)	1.85
83	509706	Transformer—TV sound discriminator (includes condenser 83-A and 83-B)	3.00
108	505912	Transformer—sound output	2.05
160	520341	Coil—I.F. trap (includes slug and clip)	1.00
	507357	Slug core for I.F. trap coil	.20
165	507343	Coil—1st video I.F. (less slug)	.70
	507357	Slug core for 1st video I.F. coil	.20
173	507343	Coil—2nd video I.F. (less slug)	.70
	507357	Slug core for 2nd video I.F. coil	.20
185	507343	Coil—3rd video I.F. (less slug)	.70
	507357	Slug core for 3rd video I.F. coil	.20
187	507367	Coil—choke	.70
194	507367	Coil—choke	.70
192	507591	Coil—4th video I.F. assembly (includes condenser 193 and choke coil 194)	2.45
	507357	Slug core for 4th video I.F. coil	.20
200	520643	Coil—peaking	.65
209	520622	Coil—peaking	.70
218	508069	Coil—peaking	.55
220	508070	Coil—peaking	.65
236	162326	Coil—focus (includes cable and plug)	14.00
239	115185	Yoke—picture tube deflection (includes cable and plug)	12.50
257	508967	Coil—Horizontal Hold (includes slug and clip)	1.10
	508963	Slug core for Horizontal Hold coil	.15
275	508679	Transformer—horizontal sweep	12.50
276	508667	Coil—Width (includes slug & clip)	1.75
	508784	Slug core for Width coil (includes mtg. clip)	.65
284	162190	Horizontal Linearity coil (includes slug and clip)	1.60
	507429	Slug core for Horizontal Linearity coil	.60
291	509679	Transformer—power	19.00
293	507586	Coil—choke	.28
296	507587	Coil—choke	.30
300	507584	Coil—choke	.28
304	508341	Choke—filter	3.60

COILS AND TRANSFORMERS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
308	507586	Coil—choke	.28
310	507584	Coil—choke	.28
318	508076	Transformer—vertical blocking oscillator	1.90
332	508956	Transformer—vertical output	3.65
354	509615	Coil—trap	.45
381	520620	Coil—peaking	.65
382	520621	Coil—peaking	.65
401	520702	Coil-antenna; channel #2 (coded "2Q")	1.40
	520703	Coil-antenna; channel #3 (coded "3Q")	1.40
	520704	Coil-antenna; channel #4 (coded "4Q")	1.40
	520705	Coil-antenna; channel #5 (coded "5Q")	1.40
	520706	Coil-antenna; channel #6 (coded "6Q")	1.40
	520707	Coil-antenna; channel #7 (coded "7Q")	1.15
	520708	Coil-antenna; channel #8 (coded "8Q")	1.15
	520709	Coil-antenna; channel #9 (coded "9Q")	1.15
	520710	Coil-antenna; channel #10 (coded "10Q")	1.15
	520711	Coil-antenna; channel #11 (coded "11Q")	1.15
	520712	Coil-antenna; channel #12 (coded "12Q")	1.15
	520713	Coil-antenna; channel #13 (coded "13Q")	1.15
406	520701	Coil-cathode coupling	.15
413	520722	Coil-R.F. and osc; channel #2 (coded "2Q")	1.85
	520723	Coil-R.F. and osc; channel #3 (coded "3Q")	1.85
	520724	Coil-R.F. and osc; channel #4 (coded "4Q")	1.85
	520725	Coil-R.F. and osc; channel #5 (coded "5Q")	1.85
	520726	Coil-R.F. and osc; channel #6 (coded "6Q")	1.85
	520727	Coil-R.F. and osc; channel #7 (coded "7Q")	1.70
	520728	Coil-R.F. and osc; channel #8 (coded "8Q")	1.70
	520729	Coil-R.F. and osc; channel #9 (coded "9Q")	1.70
	520730	Coil-R.F. and osc; channel #10 (coded "10Q")	1.70
	520731	Coil-R.F. and osc; channel #11 (coded "11Q")	1.70
	520732	Coil-R.F. and osc; channel #12 (coded "12Q")	1.70
	520733	Coil-R.F. and osc; channel #13 (coded "13Q")	1.70
	507986	Slug for osc coil; auxiliary fine tuning adj.	.05
424	520714	Coil-choke	.15
426	520715	Coil-choke	.45
427	520734	Coil-converter plate I.F. (includes slug and clip)	.75
	509062	Slug core for converter plate coil	.12
434	520518	Coil-choke	.10
436	520520	Coil-choke	.10

OTHER ELECTRICAL PARTS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
109	508157	Speaker—P.M. Dynamic (6")	7.40
235	509688	Ion Trap	.85
274	508713	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt	.20
316	118921	Channel Lite (Mazda #47) 6-8V. 150 Ma.	.15
317-A to G	508062	Integrator coupling unit A—Condenser-ceramic .01 Mfd. 450 volt B—Resistor-carbon 22,000 Ohms 1/5 watt C—Condenser-ceramic 2000 Mmfd. 450 volt D—Resistor-carbon 8200 Ohms 1/5 watt E—Condenser-ceramic 5000 Mmfd. 450 volt F—Resistor-carbon 8200 Ohms 1/5 watt G—Condenser-ceramic 5000 Mmfd. 450 volt	1.40
343	509517	Fuse; 1 Amp. 250 volt	.25
400	509695	Built-in antenna	1.00

MECHANICAL PARTS FOR 520645 R.F. TUNER

(for electrical parts see preceding classified listings of condensers, resistors and coils)

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
	520645	R.F. Tuner complete with coils and tubes	37.50
	508081	Bracket for mounting R.F. tuner (front)	.16
	520233	Bracket for mounting R.F. tuner (rear)	.25
	507339	Clip for mounting video converter plate coil	.10
	520515	Fine Tuning cam and shaft	.70
	508708	Roller-detent.	.10
	520535	Shield, bottom cover	.50
	520536	Shiled, side cover	.35
	520354	Shield—tube; miniature for 6J6 tube	.15
	520519	Shield—tube; miniature for 6BQ7 or 6BZ7 tube	.20
	509062	Slug core for converter plate coil	.12
	507986	Slug for osc. coil; auxiliary fine tuning adj.	.05
	507987	Socket—miniature (7 pin) for 6J6 tube (includes base for mounting shield)	.45
	520521	Socket—miniature (9 pin) for 6BQ7 or 6BZ7 tube (includes base for mounting shield)	.50
	507966	Spring—contactor washer (on front turret shaft)	.08
	508709	Spring—detent.	.08
	507990	Spring—retains osc. fine tuning slug	.10
	507967	Spring—turret shaft retaining	.03
	520517	Stator contact assembly (includes 11 contacts and metal frame)	3.75
	520516	Turner turret and shaft assembly (less coils)	3.00
	507965	Washer, fiber spacer (on turret shaft)	.01

CABINET PARTS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
	115238	Back for cabinet	2.25
	520650-A	Cabinet for Model 9132-A	50.00
	509132	Call letter tabs	.40
	520476	Glass window for Model 9132-A	10.00
	509016	Knob—Channel Selector	.80
	509017	Knob—"F" (Fine Tuning)	.45
	509018	Knob—"OFF-VOLUME-ON"	.75
	509019	Knob—"C" (Contrast Control)	.45
	520475-A	Mask for picture tube; Model 9132-A	6.50
	509698	Name plate	2.25
	509702	Hinge for name plate	.30
	18796	Screw—#10 x 1"; mounts TV chassis	.02
	162163	Terminal strip for TV antenna connection	.22

MISCELLANEOUS PARTS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
	301270	Base for mounting electrolytic condenser	.06
	508153	Bracket base for support of yoke and focus coil (left or right hand)	.25
	520669	Bracket mounts yoke and focus coil	2.75
	508081	Bracket for mounting R.F. tuner (front)	.16
	520233	Bracket for mounting R.F. tuner (rear)	.25
	508154	Bracket ("U" shaped) for support of yoke and focus coil	.55
	520425	Bracket, chassis extension (left hand)	1.50
	520426	Bracket, chassis extension (right hand)	1.50
	520312	Bracket for mounting picture tube (left hand)	1.00
	520311	Bracket for mounting picture tube (right hand)	1.00
	520424	Bracket for mounting pre-set controls	.75
	509132	Call letter tabs	.40
	508681	Clip for mounting electrolytic condenser #197	.10
	508715	Clip for mounting fuse holder	.03
	505101	Clip for mounting 1st and 2nd Sound I.F. transformers	.05
	507339	Clip for mounting video converter plate, 1st video I.F., 2nd video I.F., 3rd video I.F., Horiz. Linearity or trap coil	.10
	507592	Clip for mounting 4th video I.F. coil	.04
	508964	Clip for mounting Horizontal Hold	.04
	504691	Clip for mounting Width coil	.03
	508714	Fuse holder	.35
	509688	Ion trap	.85
	*	Jumper for color socket 1¼" of #11 wire	—
	508617	Nut—for retaining focus coil	.12
	508962	Nut on end of Horizontal Hold control slug	.10
	520428	Connector for H.V. terminal (includes cap and lead)	1.00

MISCELLANEOUS PARTS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
	508515	Plug (8 pin) for yoke cable	.70
	508878	Plug (3 pin) for focus coil leads	.25
	507699	Power cord assembly (includes plugs at both ends)	1.00
	509290	Ring—corona shield for 1B3GT/8016 tube socket	.10
	520313	Ring, insulating for mounting picture tube	3.50
	507422	Rubber sleeve between neck of picture tube and focus coil	.30
	507793	Rubber spacer support between flared neck of picture tube and yoke bracket	.15
	18796	Screw—#10 x 1"; mounts TV chassis	.02
	162324	Shield for TV Channel Lite	.20
	162138	Shield—H.V. supply (front section)	2.70
	508088	Shield—H.V. supply (rear section)	2.10
	520519	Shield—tube; miniature for 6BQ7 or 6BZ7 tube	.20
	520534	Shield—tube; miniature for 6J6 tube	.15
	520429	Sleeve, insulating for picture tube (includes H.V. contact)	3.00
	509062	Slug core for converter plate coil	.12
	507357	Slug core for 1st, 2nd, 3rd or 4th video I.F. coil, or trap coil	.20
	508963	Slug core for Horizontal Hold coil	.15
	507429	Slug core for Horizontal Linearity coil	.60
	508784	Slug core for Horizontal Width coil (includes mounting clip)	.65
	508049	Socket and cable assembly for picture tube	1.05
	520244	Socket and mounting bracket for TV Channel Lite	.25
	162259	Socket assembly for 1B3GT/8016 tube (includes mounting frame)	1.20
	508419	Socket (8 pin) for deflection yoke cable	.70
	508879	Socket (3 pin) for focus coil leads	.35
	507932	Socket—male, power cord interlock	.25
	507364	Socket—miniature (7 pin)	.24
	507987	Socket—miniature (7 pin) for 6J6 (includes base for mounting shield)	.45
	508044	Socket—miniature (9 pin)	.35
	509507	Socket—miniature (9 pin) (for 6S4 tube)	.25
	520521	Socket—miniature (9 pin) for 6BQ7 or 6BZ7 (includes base for mounting shield)	.50
	508703	Socket—octal	.15
	508703	Socket—octal; for color TV adapter	.15
	506469	Socket—octal (for 6W4 tube)	.18
	160039	Socket—(1 pin) for phono. pick-up cable	.12
	509320	Spring—tension for focus coil mounting	.10
	520672	Strap, anchor for picture tube	.45
	520623	Strap, tube retaining	.50
	520443	Support for tuner shaft (plastic)	.04
	162163	Terminal strip for TV antenna connections	.22
	170195	Wing nut—#8-32; for mounting yoke and focus coil	.10
	170817	Wing screw—#10-24; for height adj. of yoke and focus coil	.05

*—This part is not supplied as a Service replacement item.

ALL PRICES ON THIS PARTS LIST ARE SUBJECT TO CHANGE WITHOUT NOTICE.

In those cases where the mask of a particular model was changed during production and it is not inter changeable with the original mask, the series letter stamped on the rear of the chassis, which identifies this change, will also be shown.

MODEL NO.	ORIGINAL MASK NO.	SUBSTITUTE FOR ORIGINAL MASK NO.	LATEST TYPE MASK NO.	CHASSIS LETTER IDENTIFYING LATEST MASK
9132-A	520475-A†	520475-B	520834-A*	"A"

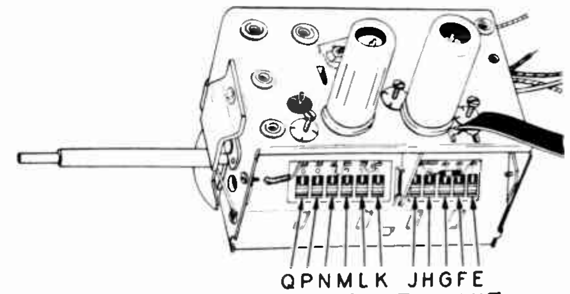
PRODUCTION CHANGES

The following tabulation furnishes complete details on changes which occurred during receiver production. The receivers incorporating these changes are identified by coding stamped on rear surface of chassis. This coding consists of one or more letters following the word SERIES, as SERIES B, SERIES AC, etc., and corresponds to similarly lettered changes shown below. Chassis incorporate only that change indicated by letter designation; i.e., chassis stamped "SERIES BE" does not include changes "A" or "C" or "D".

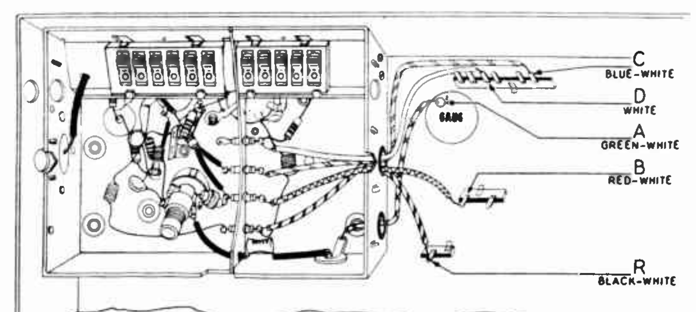
The circuit shown on this page applies to "UNCODED" chassis.

A letter following the component circuit diagram number thus —201[A], indicates that this particular item was affected by a circuit change. The letter corresponds to the series code letter listed in the production change column, from which complete change information can be obtained.

LETTER INCLUDED IN DESIGNATION FOLLOWING THE WORD "SERIES"	CHANGE INCORPORATED IN CHASSIS
UNCODED	INITIAL PRODUCTION
‡	On some chassis the Color Adaptor Socket was not incorporated. There is no series letter identification on rear of chassis to identify this change.

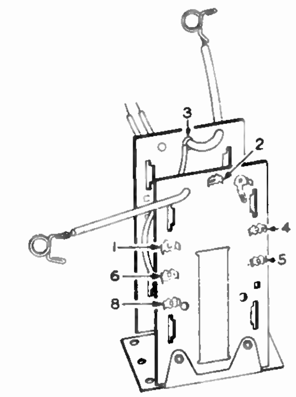


520645 R.F. TUNER UNIT
(SHOWN WITH SIDE SHIELD REMOVED)

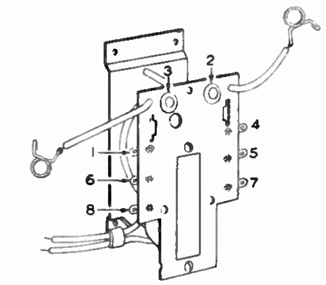


BOTTOM VIEW OF CHASSIS SHOWING CONNECTIONS TO RF TUNER UNIT

ALTERNATE HORIZONTAL SWEEP TRANSFORMERS

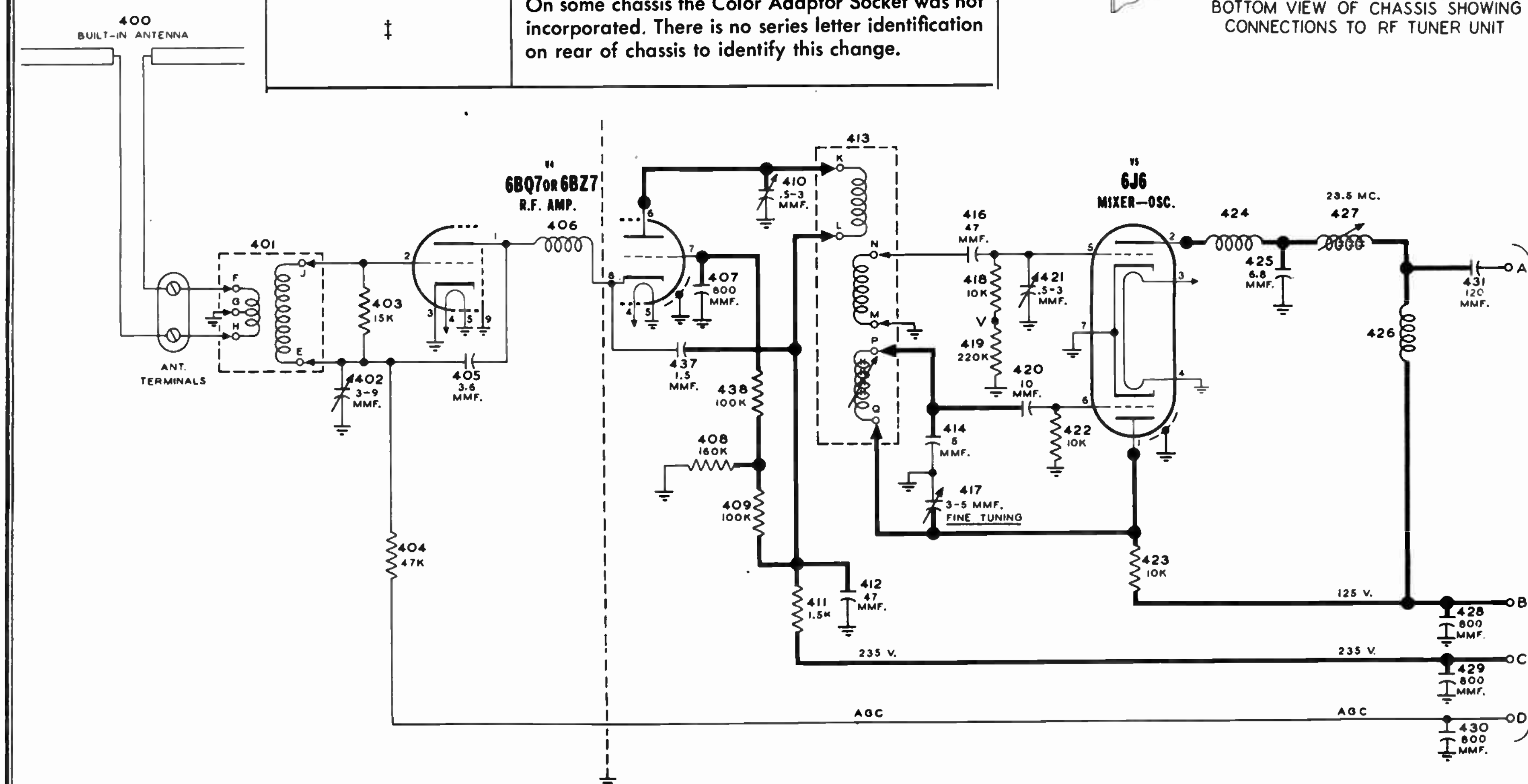


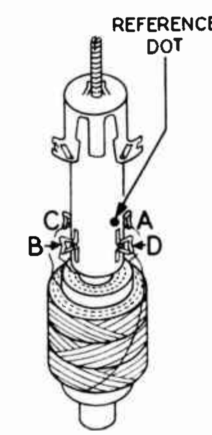
RESISTANCE MEASUREMENT
Between terminal 1 & 2— 40 Ohms
Between terminal 2 & 3—375 Ohms
Between terminal 5 & 8— 5.5 Ohms
Between terminal 6 & 8— 13 Ohms



RESISTANCE MEASUREMENT
Between terminal 1 & 2— 40 Ohms
Between terminal 2 & 3—375 Ohms
Between terminal 5 & 8— 2.2 Ohms
Between terminal 6 & 8— 4.5 Ohms

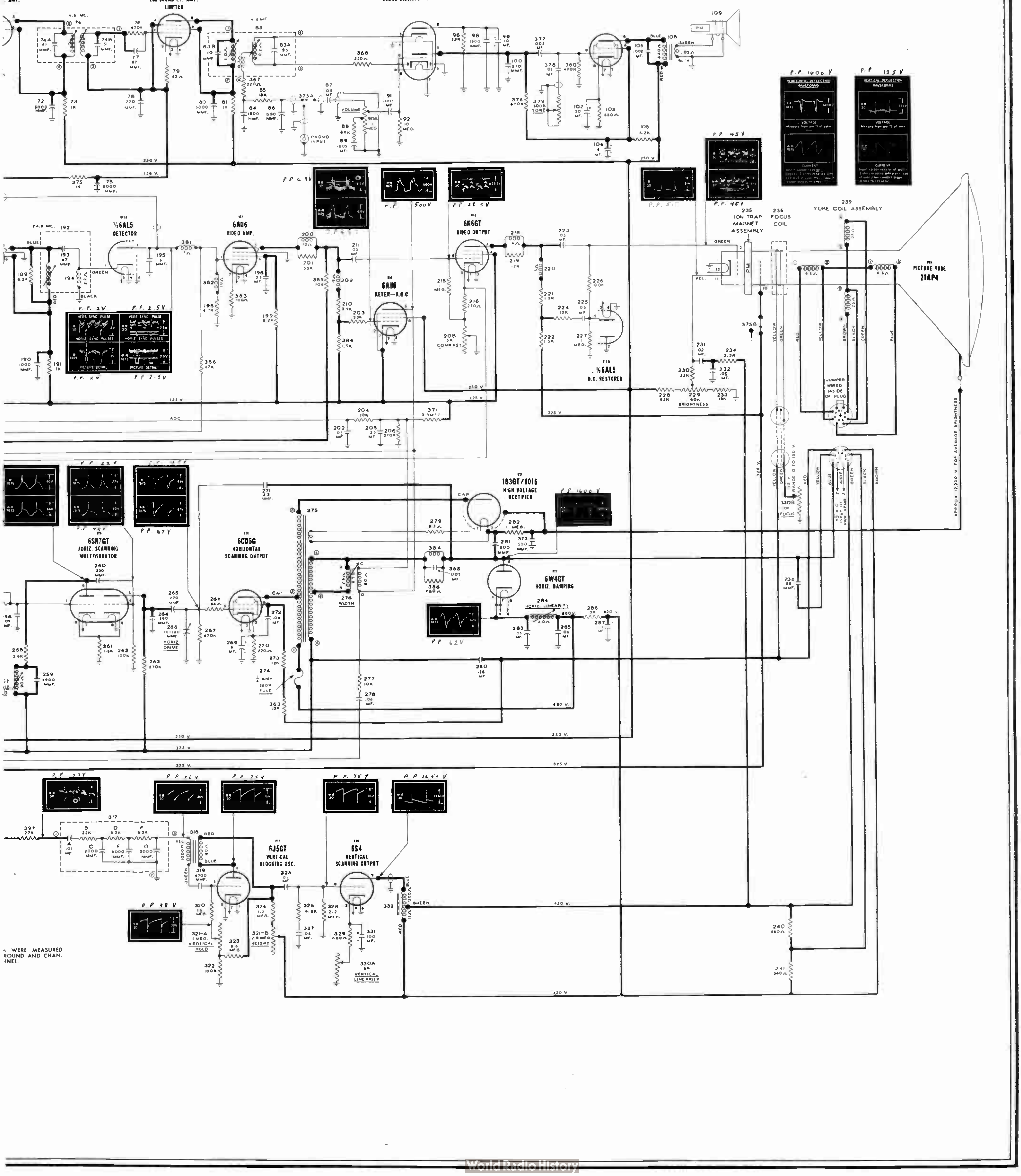
These three types of transformers all carry the same Part No. 508679 and are directly interchangeable. Connection terminals are numbered to correspond to similarly numbered terminals shown in the complete circuit diagram

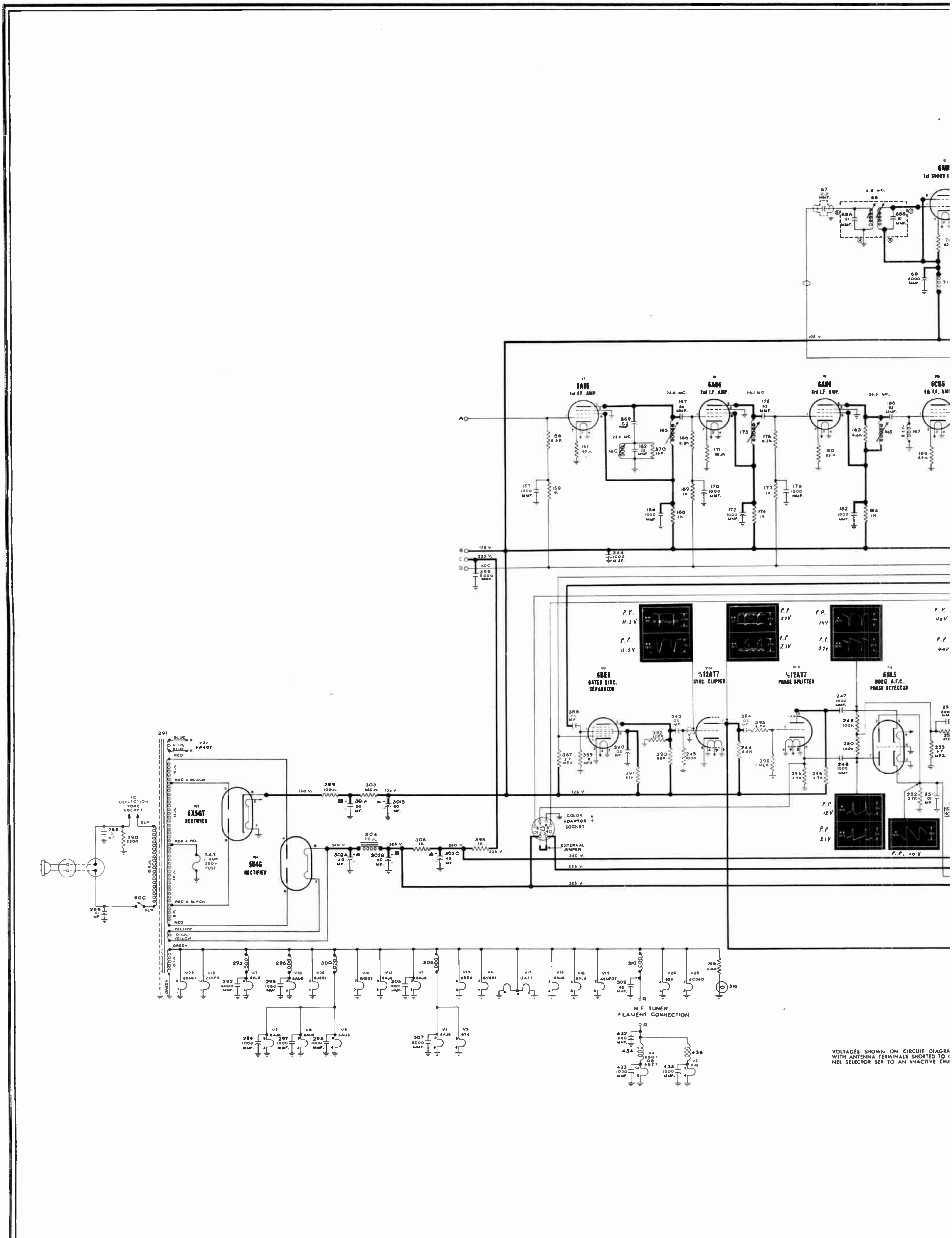




508667 WIDTH COIL

Lettered terminals in illustrations correspond to similarly lettered terminals on the circuit diagram.


6AU6
2nd SOUND I.F. AMP. LIMITER
6T8
SOUND DISCRIM.—SOUND AMP.
6V6GT
SOUND OUTPUT
½ 6AL5
DETECTOR
6AU6
VIDEO AMP.
6K6GT
VIDEO OUTPUT
6AU6
KEYER—A.G.C.
½ 6AL5
D.C. RESTORER
ION TRAP MAGNET ASSEMBLY
FOCUS COIL
YOKE COIL ASSEMBLY
PICTURE TUBE
21AP4
1B3GT/8016
HIGH VOLTAGE RECTIFIER
6SN7GT
HORIZ. SCANNING MULTIVIBRATOR
6CD6G
HORIZONTAL SCANNING OUTPUT
6W4GT
HORIZ. DAMPING
6J5GT
VERTICAL BLOCKING OSC.
6S4
VERTICAL SCANNING OUTPUT
VOLUME
TONE
CONTRAST
BRIGHTNESS
WIDTH
HORIZ. DRIVE
HORIZ. LINEARITY
VERTICAL HOLD
HEIGHT
VERTICAL LINEARITY
FOCUS
PHONO INPUT
JUMPER WIRED INSIDE OF PLUG
APPROX. 12,200 V FOR AVERAGE BRIGHTNESS
WERE MEASURED
ROUND AND CHAN-
NEL.


6AU6 1st I.F. AMP.
6AU6 2nd I.F. AMP.
6AU6 3rd I.F. AMP.
6CB6 4th I.F. AMP.
6BE6 GATED SYNC. SEPARATOR
½12AT7 SYNC. CLIPPER
½12AT7 PHASE SPLITTER
6AL5 HORIZ. A.F.C. PHASE DETECTOR
6X5GT RECTIFIER
5U4G RECTIFIER
TO DEFLECTION YOKE SOCKET
COLOR ADAPTOR SOCKET
EXTERNAL JUMPER
R.F. TUNER FILAMENT CONNECTION
VOLTAGES SHOWN ON CIRCUIT DIAGRA
WITH ANTENNA TERMINALS SHORTED TO
NEL SELECTOR SET TO AN INACTIVE CHA

GENERAL SPECIFICATIONS

DIMENSIONS

Model	Height	Width	Depth
27C-9212A	43¾"	29¼"	24"

WEIGHT (packed)

Model 27C-9212A 194 lbs.

POWER REQUIREMENTS

117 volts 60 cycles 275 watts

PICTURE SIZE

27" Rectangular

SPEAKER

Type	Size	V.C. Imped.
P.M. Dynamic	6"x9"	3.2 ohms

ANTENNA INPUT IMPEDANCE

300 ohms—balanced to ground.

BUILT-IN ANTENNA

Broad band dipole.

R. F. TUNER

Turret type construction; individually removable coil assemblies for all channels. All components are easily accessible for servicing.

INTERMEDIATE FREQUENCIES

Sound Carrier—22.25 Mc.
Picture Carrier—26.75 Mc.

I.F. SYSTEM

Three Stages—stagger tuned—for composite signal.
One additional stage for sound channel.

DETECTOR

Sound—Ratio Type
Picture—Germanium Crystal Type

RETRACE LINE SUPPRESSOR

Eliminates retrace lines thruout the normal range of picture brightness and contrast.

DEFLECTION & FOCUS

Magnetic

HORIZONTAL SYNCHRONIZATION

Automatic frequency control provides excellent picture stability.

HIGH VOLTAGE POWER SUPPLY

"Fly-back" type. Completely enclosed in a shielded compartment.

Due to the operating characteristic of the 27" picture tube, additional modifications have been incorporated. A different power transformer as well as an additional low voltage rectifier tube, V19, a type 5U4G, were utilized. The horizontal sweep transformer, deflection yoke and its associated circuits and components were modified. The Horizontal Scanning Output tube, V15, was changed to a type 6CD6G, the Horizontal Damping tube, V17, was changed to a type 6AX4GT, and the Vertical Scanning Output tube, V21, was changed to a type 6BQ6GT.

SOCKET VOLTAGES
MODEL 27C-9212A

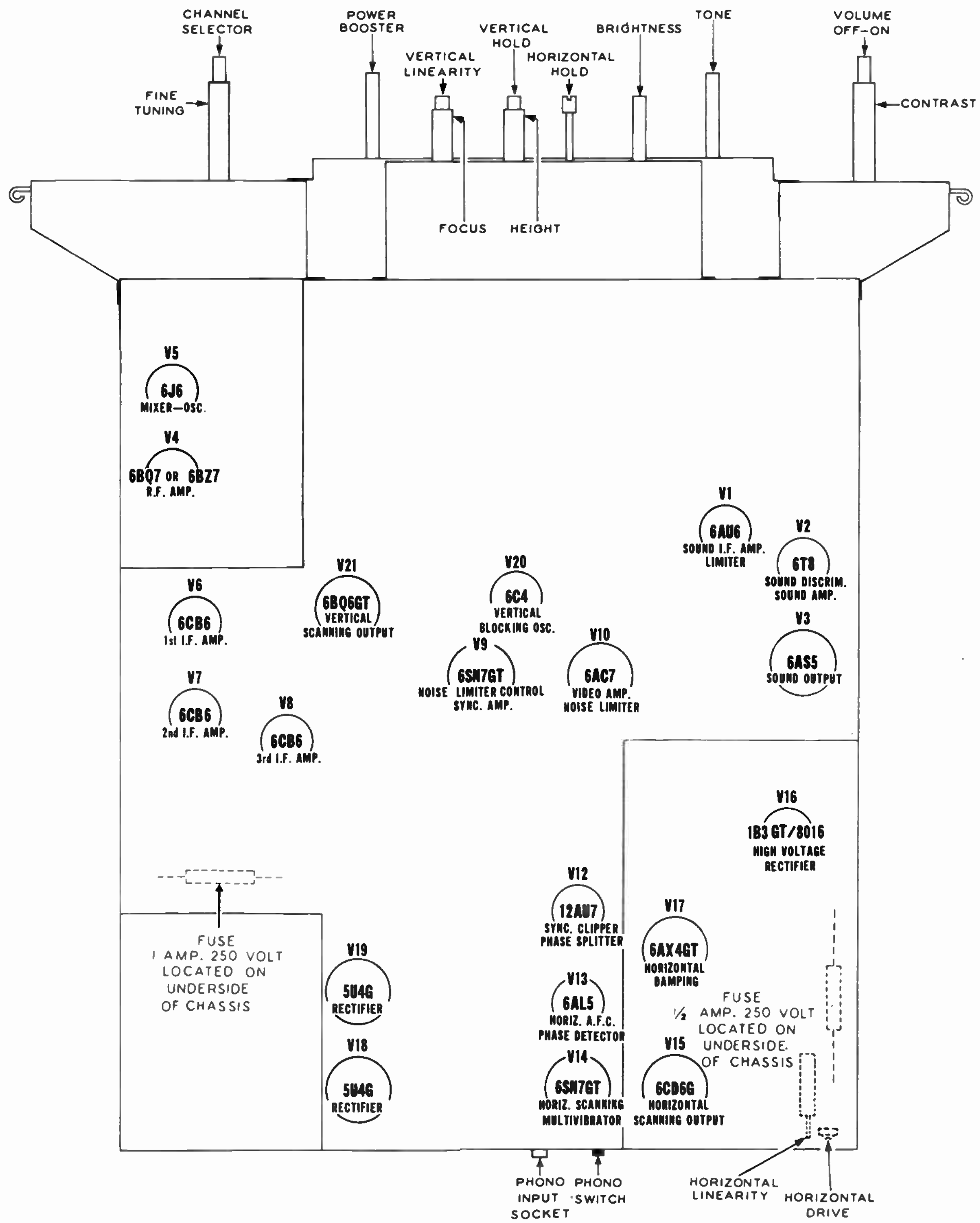
CAUTION

THE PICTURE TUBE is highly evacuated and if broken, glass fragments will be violently expelled. Scratching, chipping, undue pressure, or careless handling such as lifting the tube by its neck is dangerous and should be avoided. If it is necessary to handle the picture tube, use safety goggles and heavy gloves.

HIGH VOLTAGE (10 to 18 kilovolts) is produced in a supply circuit of this receiver. Exercise care to avoid contact with elements of this circuit and particularly the tube terminals which are labeled "CAUTION" in the adjoining voltage chart.

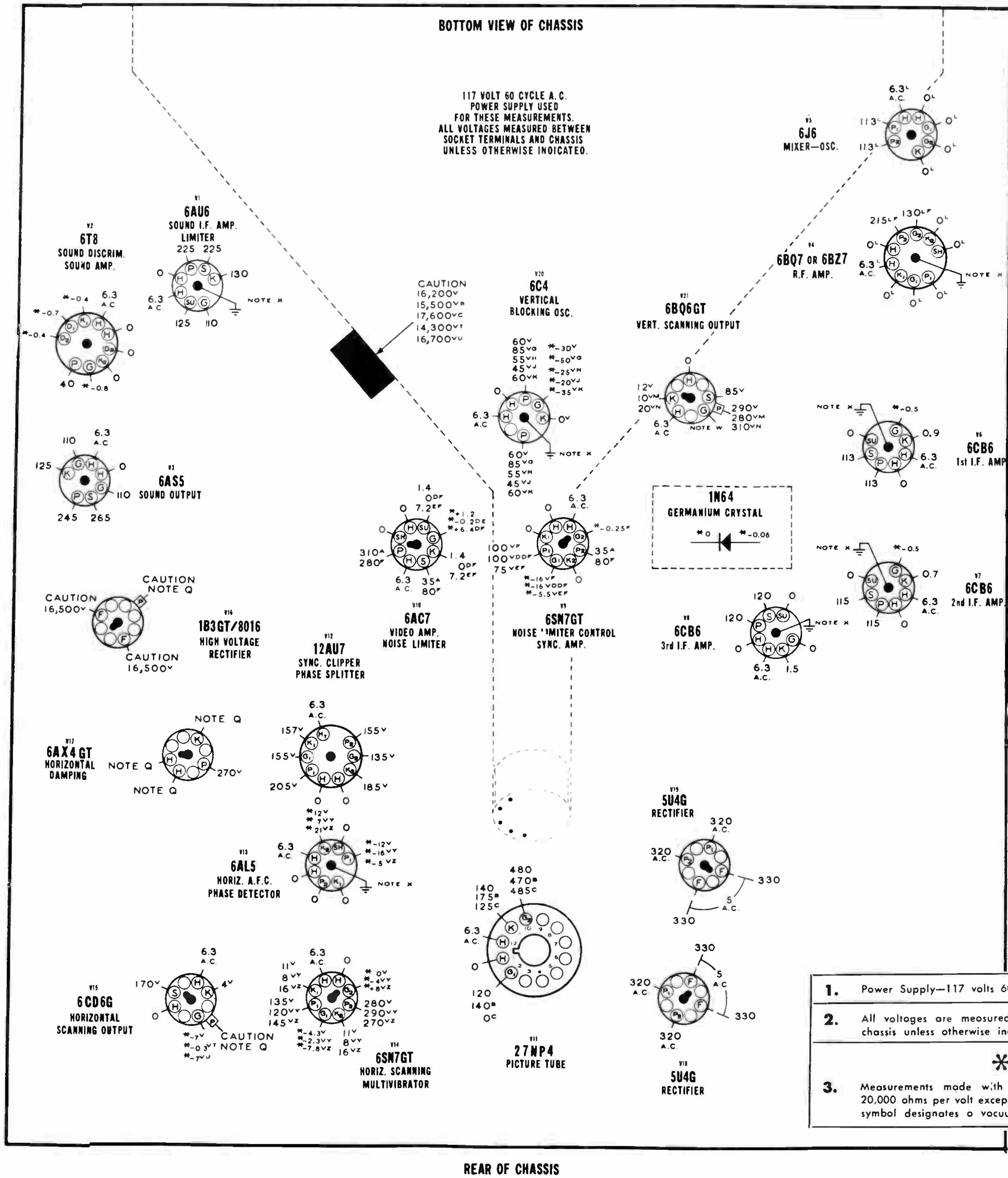
THE HIGH VOLTAGE LEAD, which supplies approximately 10 to 18 kilovolts to the picture tube, should be momentarily shorted to the chassis whenever it is disconnected for service purposes. This discharges the high voltage filter condenser and prevents a shock hazard when working on the receiver after it has been turned off.

INTERMEDIATE B+ VOLTAGES, are dangerous and caution should be observed when the receiver chassis components are exposed for service purposes.



EXPLANATION OF NOTES

A.	Power Booster control max. clockwise
B.	Brightness Control max. clockwise
C.	Brightness Control max. counter-clockwise
D.	Contrast Control max. clockwise
DD.	Contrast control set to max. voltage reading but not necessarily max. clockwise setting of control
E.	Contrast Control max. counter-clockwise
F.	Power Booster control max. counter-clockwise.
G.	Height Control max. clockwise
H.	Height Control max. counter-clockwise
J.	Vertical Hold Control max. clockwise
K.	Vert. Hold Control max. counter-clockwise
L.	This voltage measurement was taken from the top of the tuner chassis with the tube removed from its socket.
M.	Vertical Linearity Control max. clockwise.
N.	Vertical Linearity Control max. counter-clockwise.
Q.	Do not attempt to measure the voltage at this position. There is a high R. F. potential at this point.
T.	Horiz. Drive Control max. clockwise
U.	Horiz. Drive Control max. counter-clockwise.
V.	Before measuring this voltage, connect external antenna and adjust controls for normal reception of station signal.
W.	This measurement should be made with a vacuum tube voltmeter. This voltage reading will fluctuate in the vicinity of 0.15 volts.
X.	Grounding of center stud on tube socket is necessary to reduce capacity coupling between other pins. Oscillation may result if this ground is omitted.
Y.	Horiz. Hold Control turned in a clockwise direction until picture approaches loss of sync.
Z.	Horiz. Hold Control turned in a counter-clockwise direction until picture approaches loss of sync.



1.	Power Supply—117 volts 60 cycle AC.
2.	All voltages are measured between socket terminals and chassis unless otherwise indicated on adjoining chart.
3.	* Measurements made with voltmeter having sensitivity of 20,000 ohms per volt except where indicated by (*). The (*) symbol designates a vacuum tube voltmeter measurement.

520645 RF TUNER

Channel selection is accomplished by rotation of the turret containing two sets of easily removable coil assemblies for each channel. The individual antenna coil sections consist of a balanced primary to minimize noise pick-up on the transmission line and an R.F. grid coil which couples the incoming signal to the grid of the first section of the R.F. Amplifier tube (V4). The inductance and amount of coupling of the tuned antenna input circuit are changed for each channel so that a constant input impedance of 300 ohms is maintained. This provides maximum transfer of energy to the R.F. Amplifier stage, particularly when interconnection between an outdoor antenna and the receiver is made with 300 ohm transmission line.

The R.F. Amplifier tube is a dual-triode tube and is connected in the circuit as a direct coupled grounded-grid type amplifier. This circuit was developed to meet the demand for an R.F. Amplifier that would provide more nearly equal gain on both the low and high Television Channels, while keeping inherent tube noise to a minimum. The circuit can be thought of very simply as two triode tubes in series, the first or driver unit acting not as an amplifier, but rather as an antenna impedance matching device and also as a variable cathode impedance, or bias source, for the second, or grounded-grid unit. In addition the first unit of the R.F. Amp. acts as a power amplifier due to its extremely low plate impedance, which is in reality the cathode circuit of unit two, and converts the weak signal voltage from the antenna to a low voltage-high current signal which is then applied to the cathode of unit number two. The signal coupling unit between the first and second units is a series peaking coil, symbol 406, similar to that found in a video amplifier circuit. Its purpose is to form a series resonant circuit with the input capacity of the second unit. The coil is so made as to resonate at a frequency slightly higher than channel 13. In a standard pentode type amplifier, the gain falls off rapidly as progressively higher channels are selected. With the use of the plate to cathode peaking coil an almost equal gain can be realized for all channels.

The R.F. Amp. tube has inherently low interelectrode capacity due to physical design and this factor in conjunction with the low output impedance of the first section is responsible for the low noise factor at this stage. While neutralization of the first unit is not necessarily due to its low plate to grid capacity, additional noise reduction has been realized, with only a slight decrease in gain, by the addition of a neutralizing condenser, item 405. Due to the low output impedance of the stage, it is not necessary that the neutralizing condenser be turnable.

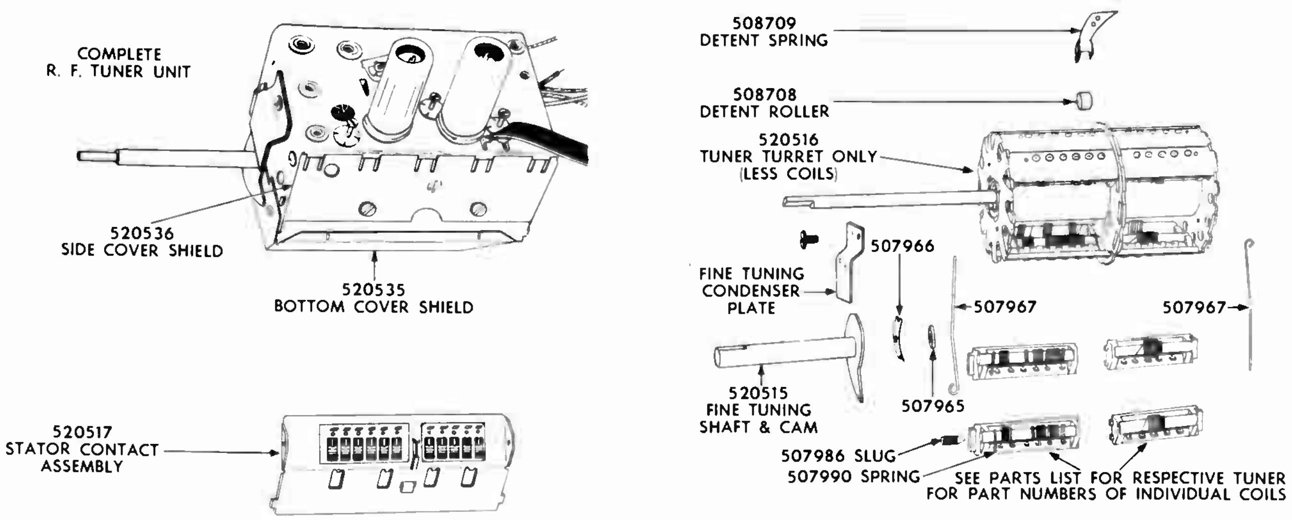
Because of the circuits' excellent internal shielding, low input impedance and radiation rejection, the second section of the R.F. Amp. is connected as a driven grounded-grid amplifier. While this might not be apparent at first glance due to the fact that grid has no direct D.C. return, it will be found upon further examination that any high frequency A.C. potentials are by-passed to ground through condenser 407.

The second section of turret coils includes the tuned R.F. amplifier plate coil, tuned mixer grid coil, and oscillator coil. The output of the R.F. amplifier stage is coupled to the grid of the mixer stage, which utilizes one triode section of a 6J6 tube (V5). The other half of the 6J6 is connected as a modified Colpitts oscillator which injects oscillator voltage into the mixer stage through coupling between the oscillator coil and the mixer grid coil. Course oscillator tuning is accomplished by adjusting the positions of the slugs in the individual oscillator coils, while Fine Tuning is obtained when using condenser #417 in the oscillator plate circuit. This Fine Tuning condenser is composed of two fixed plates, and its capacitance is changed by the insertion of a bakelite cam between these plates.

Signal output from the mixer stage is coupled to the IF amplifiers through the converter plate I.F. coil, diagram #427, located on the tuner unit.

REPAIR DATA FOR 520645 RF TUNER

All replacement parts for the RF Tuner Unit are included in the complete receiver parts list



SERVICE PRECAUTIONS

SUBJECT	PRECAUTIONS
ELECTRICAL COMPONENTS	The high frequencies used in the RF section of a television receiver make it necessary that considerable care be exercised in servicing the tuner. Lead dress and location of components are very critical at these frequencies. When replacing parts, it is important to use components of identical electrical characteristics and physical size. Always reconnect the replacement item in the same location and position in the tuner as the original component.
TUBES	Replacement of tubes in the Tuner Unit may cause slight detuning of RF circuits due to inherent differences in inter-electrode capacitances. When replacing tubes (especially 6J6 mixer-oscillator tube) make sure that Fine Tuning control will tune in television stations at approximately the middle of its range. It may be necessary to change the setting of the individual oscillator coil slugs for some channels to accomplish this.

SUBJECT	PRECAUTIONS
CHANNEL COILS AND SLUGS	Channel Coils must be handled with care. **Do not disturb coil windings.** If an oscillator slug "falls into" its coil form during adjustment, remove the Channel Coil from the turret assembly and lift the Slug Retaining Spring aside. By tapping the coil form it should be possible to make the slug move toward the end so that its threads will be engaged by the Slug Retaining Spring when that spring is returned to its normal position.
FINE TUNING CONTROL	Rubbing of the bakelite Fine Tuning Cam against the Fine Tuning Condenser Plate is intentional in order to avoid vibration with resulting microphonics. However, the Fine Tuning Cam should **not** rub or contact the small circular plate located on the body of the tuner.

REMOVAL AND REPLACEMENT OF PARTS

ITEM	PROCEDURE
RF TUNER UNIT	To remove the Tuner Unit from receiver chassis, proceed as follows: 1. Remove channel selector dial lamp socket. 2. Remove screws which hold tuner to front and rear support brackets. 3. Disconnect the leads from the tuner to the main chassis. See illustration on circuit diagram page showing tuner connections. 4. Tuner unit may now be withdrawn from underside of chassis.
CHANNELS COILS	It is not necessary to remove entire tuner unit to replace a snap-in channel coil but removal of bottom shield will be required. This may be accomplished by grasping the front end of the shield and pulling downward and unhooking it from rear of tuner frame. Insert a screwdriver blade between Coil Retainer Spring and the end of the Tuner Turret. Twist the blade to pull spring away from the molded body of Channel Coil. Lift this end of coil body upward and remove individual coil assembly from tuner. When replacing Channel Coils, be sure they are reinstalled in their correct positions. Coil numbers should increase consecutively in a counter-clockwise direction when tuner is viewed from the front. If all the Channel Coils have been removed from the Tuner Turret, rotate turret until flat surface on end of tuner shaft points down. Install #3 Channel Coils into bottom position on turret. Then follow the correct sequence indicated above to replace other coils.
TUNER TURRET ASSEMBLY	To remove turret from RF Tuner Unit, remove complete tuner and bottom shield as described in previous sections and proceed as follows: 1. Remove rear Turret Shaft Retaining Spring by disengaging straight end of spring from projection on tuner frame. 2. Remove Fine Tuning Condenser Plate from front of Tuner Unit. This plate forms one side of Fine Tuning control condenser and is held in place by one screw. 3. Slide Fine Tuning Cam and Shaft off of main Channel Selector Shaft. 4. Remove Spring Contactor Washer and Fiber Spacer Washer from Channel Selector Shaft. 5. Remove Shaft Retaining Spring at front of tuner by disengaging straight end of spring from projection on frame. 6. Remove turret assembly from frame. To replace turret, reverse the above procedure. Tooth on bakelite Fine Tuning Cam should point downward during assembly so that it does not become locked between the stops on the Fine Tuning Condenser Plate. Also be sure to replace bottom shield.
STATOR CONTACT ASSEMBLY	To remove this assembly, remove complete tuner as described in previous sections and proceed as follows: 1. Remove side shield by taking out the two retaining screws and unsolder shield at one point. Now, disengage shield from upper edge of tuner frame. 2. Remove the two screws at the front and rear of the Stator Contact Assembly. 3. Unsolder all electrical connections to contact plate. 4. Unsolder five soldered joints between Stator Contact Assembly and Tuner Unit. 5. Contact Assembly may now be withdrawn from frame. To reinstall this assembly: 1. Place Stator Contact Assembly in position and replace, but do not tighten, the two screws at the front and rear of the assembly. 2. Remove 3 consecutive pairs of Channel Coils from the turret (for example, the antenna and rf-osc. coils for channels #5, 6 and 7). 3. Position Tuner Turret so that the edges of the next highest Channel Coils (in this case, the coils for channel #8) just pass the row of 11 contacts on the Stator Contact Assembly. 4. Adjust position of the Stator Contact Assembly so that there are a few thousandths of an inch spacing between the contacts on the contact plate and the molded body of the Channel Coils. 5. The Contact Assembly is now correctly positioned and screws at front and rear may be tightened. 6. Solder Stator Contact Assembly to tuner frame at same points that were used previously. 7. Make all electrical connections to contact plate. 8. Replace Channel Coils. 9. Replace side shield.

ALIGNMENT PROCEDURE

Alignment of all RF and IF tuned circuits in this receiver may be accomplished by utilizing the procedures described in the following charts.

SEQUENCE OF ALIGNMENT: These procedures should preferably be applied in the order in which they are presented, however, alignment of the Sound Channel or IF Channel may be accomplished individually if desired.

The RF Amplifier and Mixer alignment may also be accomplished independent of Sound or IF Channel alignment, but oscillator calibration can only be done after IF Channel has been correctly aligned. Proper IF bond pass characteristic is necessary for Oscillator alignment as results of RF circuit tuning are observed by means of an oscilloscope connected to the output of the crystal detector.

REMOVAL OF CHASSIS: The receiver chassis must be removed from the cabinet in order to accomplish alignment of all tuned circuits as there are adjustment points located on the underside of the unit.

This can be accomplished by first removing all knobs and disconnecting the receiver "built-in" antenna and speaker. The chassis may then be removed by releasing the hold-down screws located on the underside of the cabinet chassis mounting board.

CAUTION

The picture tube is highly evacuated and if broken, glass fragments will be violently expelled. Handle with care, using safety goggles and gloves.

INSTRUMENTS: The following instruments will be required as signal sources and output indicators during the alignment process. Since accurate alignment of a television receiver is heavily dependent upon the performance of your instruments, it is imperative that they meet the essential specifications described here.

1. **STANDARD SIGNAL GENERATOR** to provide unmodulated (pure RF) signals at the following frequencies. Maximum output on all ranges should be at least .1 volt with provision for attenuation as desired. This instrument must have good frequency stability and be accurately calibrated. Generators which incorporate a separate crystal controlled oscillator and heterodyne circuit are self calibrating and therefore capable of providing the accuracy of frequency calibration required for television circuit alignment.

   a. IF Frequencies:
      - 4.5 Mc. Sound Channel
      - 21.6 Mc. Sound IF marker
      - 23.5 Mc. Converter and 1st IF stages
      - 25.9 Mc. 2nd and 3rd IF stages
      - 26.1 Mc. Picture IF marker

   b. RF Frequencies:
      - 54 to 88 Mc.
      - 174 to 216 Mc.

2. **RF SWEEP GENERATOR** to provide frequency modulated signals at the following frequencies:

   20 to 30 Mc. with 10 Mc. sweep width.
   54 to 88 Mc. with 10 Mc. sweep width.
   174 to 216 Mc. with 10 Mc. sweep width.

   Output adjustable with at least .1 volt maximum.

   Output should be "flat" (no amplitude variation) for all settings of the sweep width control.

   Provision for connection of generator sweep modulating voltage to horizontal deflection system of an oscilloscope.

   Provision for blanking the output signal on each return sweep so that oscillogram will not show retrace.

3. **CATHODE RAY OSCILLOSCOPE,** preferably a unit with vertical amplifier having wide range frequency response and low capacity pick-up probe.

4. **VACUUM TUBE VOLTMETER.** The lowest voltage range of this instrument should preferably permit a 1.0 volt reading to be indicated at not less than one third of full scale deflection.

INSTRUMENT CONNECTIONS: The method of connection, including details of matching and coupling networks, for instruments used in this alignment procedure is given in several illustrations on subsequent pages. Specific instructions for each instrument application will be found in various sections of the alignment charts.

GENERAL INSTRUCTIONS: When aligning IF and RF circuits it is necessary to apply a fixed bias voltage to the AGC system of the receiver. This fixed bias is obtained by using a 3 volt battery and connecting it as described in Fig. 15.

IMPORTANT

When observing the receiver band pass characteristic on an oscilloscope, it is exceedingly important to avoid distortion of that characteristic which would occur when using a large input signal from the sweep generator or standard generator (marker signal). Always set attenuator on sweep generator so that the reading on the vacuum tube voltmeter does not exceed one-half volt (when meter is connected from high side of video detector load, symbol 122, to receiver chassis). The sweep width should never be set greater than that needed to fully display the receiver band pass characteristics on the oscilloscope. Standard generator output should also be attenuated so that marker signal does not pull or tear the band pass characteristic as shown on the 'scope.

SOUND CHANNEL ALIGNMENT PROCEDURE

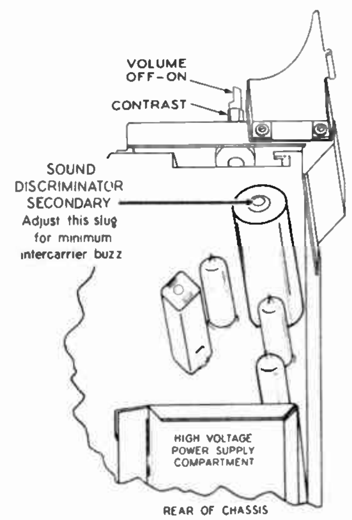
1. Short antenna terminals together with a jumper wire.
2. Set receiver Channel Selector to any inactive television channel and contrast control to its maximum counter-clockwise position; other controls may be left at any desired setting.
3. No special aligning tool is required to adjust the cores in the Sound IF and discriminator transformers. The blade of a small screwdriver will fit the slot in these cores, however, the screwdriver should be of a non-metallic or insulated type to prevent detuning when inserted in the transformer can.

STANDARD SIGNAL GENERATOR		VTVM CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY				
Connect as shown in Fig. 1.	**4.5 MC.** unmodulated IMPORTANT This signal must be accurate within ¼ of 1% of 4.5 Mc. Check generator calibration against a crystal controlled signal source by "zero beating" (heterodyning) with harmonics of the crystal frequency.	Connect as shown in Fig. 2.	1. Set Contrast control to its maximum clockwise position. 2. A special detector must be utilized when aligning the 4.5 Mc. Sound Trap Coil. This unit can be constructed in accordance with the information contained in the circuit shown below. If a VTVM containing a high frequency A.C. probe is available, this probe can be utilized in place of the crystal detector shown in Fig. 2. 3. During this adjustment only, remove one of the three 6CB6 IF amplifier tubes (V6, V7 or V8). This will prevent noise in the RF stages from effecting the voltage reading while adjusting the sound trap.	#1 4.5 MC Sound Trap	Adjust for minimum reading on VTVM.
		Connect as shown in Fig. 3.	A "swishing" sound may be heard in the speaker during Sound Channel Alignment. This spurious oscillation is caused by horizontal sweep voltage being picked up in the audio system thru stray coupling of instrument leads; it should be disregarded as it will have no effect on alignment of the sound channel.	#2 Discriminator Secondary	Adjust for maximum reading on VTVM.
				#3 Discriminator Primary	Adjust for maximum reading on VTVM.
				#4 Sound IF Transformer	Adjust for maximum reading on VTVM.
Same as above.	Same as above.	Connect as shown in Fig. 4.	To obtain zero balance of the discriminator circuit, two 68,000 ohm resistors will be required. These resistors must be matched so that their respective resistances do not differ by more than 1%—the accuracy of the total resistance is not critical. Connect the two resistors in series from pin 2 of the 6T8 tube to chassis ground as shown in Fig. 4.	#2 Discriminator Secondary	Note that as slug #2 is rotated, a point will be found where the voltmeter will swing rather sharply from a positive to a negative reading or vice versa. The correct setting of slug #2 is obtained when the meter reads zero as the slug is moved thru this point.

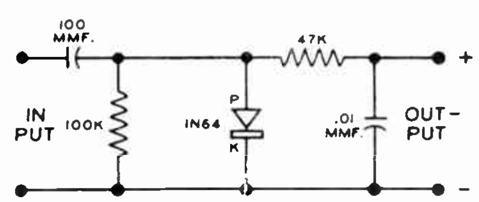
REDUCTION OF INTERCARRIER BUZZ

Slight "dynamic" unbalance of the discriminator secondary can emphasize intercarrier buzz due to incomplete amplitude modulation rejection. Therefore it is vitally important to obtain an accurate setting of the discriminator secondary slug under actual reception conditions.

Disconnect all instruments (be sure that I.F. tube removed for the adjustment of Sound Trap has been replaced) and then connect an antenna to the receiver to obtain program reception from a local station. If intercarrier buzz is prominent, a slight readjustment of the discriminator secondary slug (#2) should be made to obtain the "dip" point for the buzzing sound. Note that program sound will be clear and free from distortion at this point. Buzz should now be at an acceptable minimum if station transmission is not at fault.



CIRCUIT DIAGRAM FOR CRYSTAL DETECTOR



INSTRUMENT CONNECTIONS FOR SOUND CHANNEL ALIGNMENT

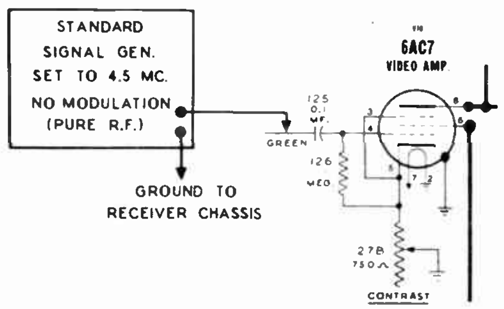


FIG. 1
Generator Connections for Sound Channel and 4.5 Mc. Sound Trap Alignment

INSTRUMENT CONNECTIONS FOR SOUND CHANNEL ALIGNMENT

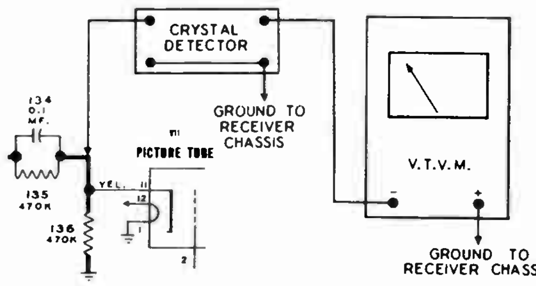


FIG. 2
Crystal Detector and VTVM Connections for 4.5 Mc. Sound Trap Alignment

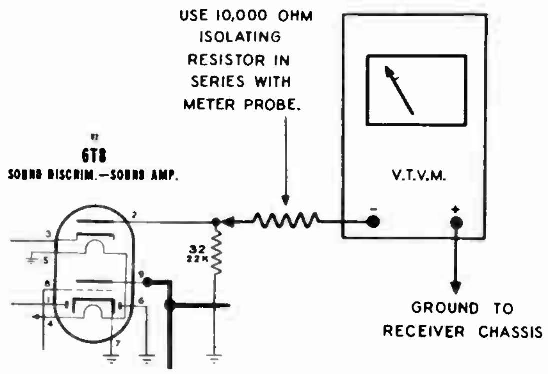


FIG. 3
VTVM Connections for Sound IF Alignment

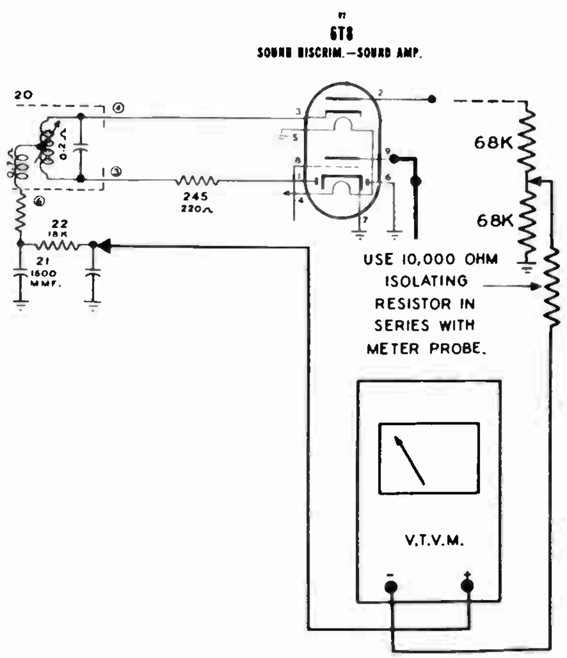


FIG. 4
VTVM Connections for Sound Discriminator Alignment

INSTRUMENT CONNECTIONS FOR IF CHANNEL ALIGNMENT

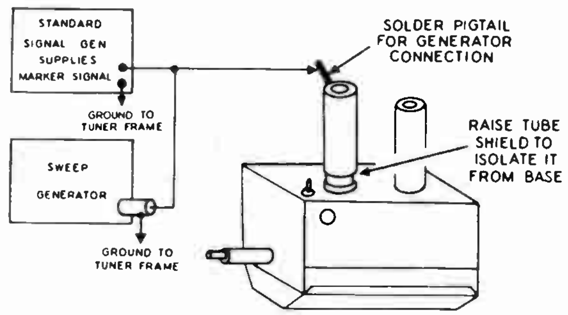


FIG. 5
Generator Connections for IF Channel Alignment

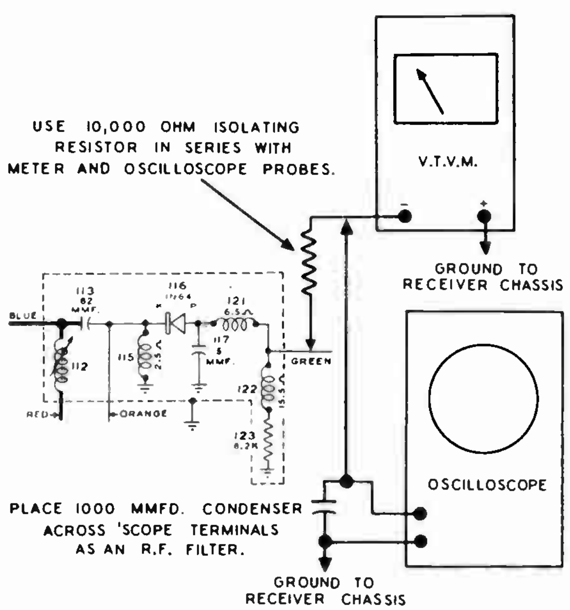
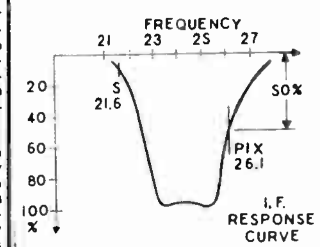


FIG. 6
VTVM and Oscilloscope Connections for IF Channel Alignment

IF CHANNEL ALIGNMENT PROCEDURE

1. A special aligning tool designed to fit the stems on adjustable cores of the IF and Trap coils (see points 5, 6, 7 and 8 in Fig. 14) is available and may be obtained from Sears and Roebuck by requesting IF Alignment Tool #507479.
2. Turn receiver Channel Selector to television channel #12 and short antenna terminals together with a jumper wire.
3. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to the AGC line and positive terminal of battery connects to receiver chassis. See Fig. 15 for convenient point of connection.
4. If the IF channel is badly misaligned, oscillation may occur. Such oscillation shows up as an excessive voltage across the video detector load, symbol 122, and is indicated by the VTVM that is connected to this point during alignment. It should be noted that voltage due to IF oscillation is unaffected by strength of signal from the generator.

Where IF oscillation is encountered, it is generally possible to correct the condition by detuning the IF coils in different directions. If that does not have the desired effect, increase fixed bias on AGC line by using a 4½ volt battery instead of the 3 volt battery referred to in instruction #3. After stopping the oscillation in this manner it will then be possible to align all IF stages using the following procedure, however, the AGC bias battery must be changed back to 3 volts when using the oscilloscope to observe band pass characteristics. Once all stages have been aligned using the 4½ volt bias, the IF channel should be stable with reduced bias.

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
Connect as shown in Fig. 5.	23.5 MC.	Connect as shown in Fig. 5 but keep generator power switch turned off during this step.	—	Connect as shown in Fig. 6.	Not used.	—	#5 Converter plate coil	Adjust for maximum reading on VTVM.
							#6 1st I.F.	Adjust for maximum reading on VTVM.
Same as above.	25.9 MC.	Same as above.	—	Same as above.	Not used.	—	#7 2nd I.F.	Adjust for maximum reading on VTVM.
							#8 3rd I.F.	Adjust for maximum reading on VTVM.
Same as above.	26.1 MC.	With connections made as shown in Fig. 5, turn on this generator and set controls for operation as specified in next column.	25 MC. Sweeping ± 5 Mc.	Same as above.	Connect as shown in Fig. 6	IMPORTANT: 1. Adjust output attenuator on sweep generator so that reading on VTVM is approximately one-half volt. 2. Set attenuator on standard signal generator so that marker signal does not distort the pattern on the oscilloscope. 3. Be sure that a 3 volt battery is connected to AGC line as specified in instruction #3 at the head of this chart. Do not use a battery of any other voltage.	The IF band pass characteristic now displayed on the 'scope should be compared with the curve shown in Fig. 7. If top of curve is not properly shaped, make a slight readjustment of slug #7. Should that adjustment fail to yield the desired result, then note whether the curve has a peak on the high or low frequency side. Slugs #7 and #8 control high frequency response and slugs #5 and #6 affect the low frequency response; by making a small change in the settings of the high or low frequency slugs, it will be possible to obtain correct band pass curve.  **FIG. 7** The 26.1 Mc. picture IF carrier marker should now appear at the 50% amplitude position on side of the band pass characteristic (see Fig. 7). If position of the marker appears too high or too low, slight readjustment of slugs #7 and/or 8 is required.	
Same as above.	21.6 MC.	Same as above.	Same as above.	Same as above.	Same as above.	Same as above.	Adjust the vertical gain control on the 'scope in order to magnify the sound portion of the response curve. The 21.6 Mc. sound IF carrier marker should appear at the position indicated in Fig. 7. If the position of the sound marker is incorrect, readjustment of slugs #5 and/or 6 is required.	

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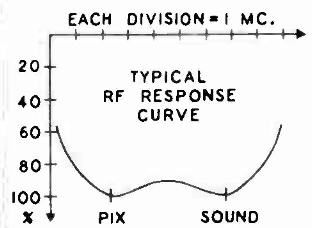
RF AMPLIFIER AND MIXER ALIGNMENT

Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to AGC line and positive terminal of battery connects to receiver chassis. (See Fig. 15 for convenient point of connection.)

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
Connect as shown in Fig. 11.	*209.75 MC. ‡205.25 MC.	Connect as shown in Fig. 10 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #12	Not used.	Connect as shown in Fig. 12	Set Channel Selector to #12 — IMPORTANT: Keep output of standard signal generator at a level that provides a readable marker but does not distort the curve that is being observed on the scope.	#9 Mixer Grid. #10 RF Amp. Plate. #11 RF Amp. Grid.	Adjust these trimmers to obtain properly shaped RF band pass characteristic as shown in Fig. 8. Use Mixer Grid trimmer #9; and RF Amplifier Plate trimmer #10 to obtain correct amplitude of characteristic in vicinity of picture and sound carrier markers. Then adjust RF Amp. Grid trimmer #11 to equalize overall amplitude. Repeat adjustment of trimmers to be sure correct response has been obtained. IMPORTANT: When adjusting trimmers #9, 10 and 11 it will be noted that the band pass characteristic can be broadened by sacrificing amplitude. It is undesirable to overly broaden the curve as that would result in a loss of sensitivity.
Same as above.	*215.75 MC. ‡211.25 MC.	Same as above.	CHANNEL #13	Not used.	Same as above.	Set Channel Selector to #13		The RF band pass characteristic of the other television channels should now be checked without disturbing the settings of trimmers #9, 10 and 11. Adjust the RF sweep generator and marker generator for operation on the other television channels, observing position of both the sound carrier and picture carrier markers.  FIG. 8 Band pass characteristic of these channels should conform to the RF response curve in Fig. 8. If necessary, a compromise may be obtained to compensate for small variations in channel response by returning to channel #12 and making slight changes in the settings of trimmers #9, 10 and 11.
	*203.75 MC. ‡199.25 MC.		CHANNEL #11			Set Channel Selector to #11		
	*197.75 MC. ‡193.25 MC.		CHANNEL #10			Set Channel Selector to #10		
	*191.75 MC. ‡187.25 MC.		CHANNEL #9			Set Channel Selector to #9		
	*185.75 MC. ‡181.25 MC.		CHANNEL #8			Set Channel Selector to #8		
	*179.75 MC. ‡175.25 MC.		CHANNEL #7			Set Channel Selector to #7		
	* 87.75 MC. ‡ 83.25 MC.		CHANNEL #6			Set Channel Selector to #6		
	* 81.75 MC. ‡ 77.25 MC.		CHANNEL #5			Set Channel Selector to #5		
	* 71.75 MC. ‡ 67.25 MC.		CHANNEL #4			Set Channel Selector to #4		
	* 65.75 MC. ‡ 61.25 MC.		CHANNEL #3			Set Channel Selector to #3		
	* 59.75 MC. ‡ 55.25 MC.		CHANNEL #2			Set Channel Selector to #2		

*Sound Carrier Marker
‡Picture Carrier Marker

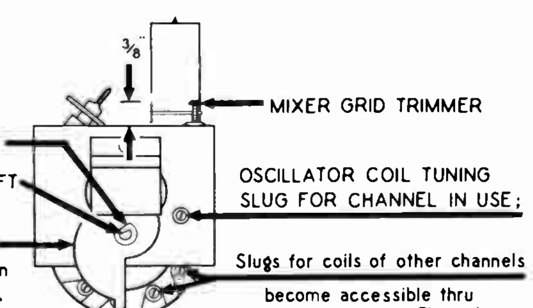
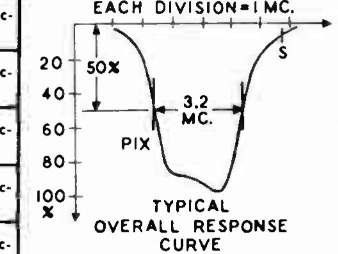


FIG. 9
Front view of RF Tuner Unit

R.F. OSCILLATOR ALIGNMENT

1. **IMPORTANT:** Before undertaking oscillator alignment be sure IF circuits are correctly aligned for band pass characteristic illustrated in Fig. 7.
2. During oscillator alignment, it is necessary to set the Fine Tuning control so that the tooth on the bakelite fine tuning cam points downward (correct position for this control is shown in Fig. 9).
3. Connect a 3 volt battery to the receiver AGC system so that negative terminal of battery connects to A.G.C. line and positive terminal of battery connects to receiver chassis. (See Fig. 15 for convenient point of connection).

STANDARD SIGNAL GENERATOR		SWEEP GENERATOR		VTVM CONNECTIONS	OSCILLOSCOPE CONNECTIONS	MISCELLANEOUS INSTRUCTIONS	TRIMMER OR SLUG	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
CONNECTIONS	FREQUENCY	CONNECTIONS	FREQ.					
Connect as shown in Fig. 11.	*215.75 MC. ‡211.25 MC.	Connect as shown in Fig. 11 and set controls for sweep width of 10 Mc. on television channel specified in the next column.	CHANNEL #13	Connect as shown in Fig. 13	Connect as shown in Fig. 13.	Set Channel Selector to #13		Adjust the RF sweep generator and marker generator for operation on the other television channels; set marker generator to sound carrier frequency. After setting Channel Selector to corresponding channel, adjust oscillator slug thru hole on front of RF Tuner Unit (see Fig. 9). This permits response curve to be shifted so that sound carrier marker  FIG. 10 will appear at the position indicated in Fig. 10. The picture carrier marker for the corresponding channel should then appear at the 50% amplitude position on the opposite side of the band pass characteristic curve. If overall response curve for all channels is not reasonably similar to that shown in Fig. 10, undertake slight readjustment of I.F. slugs.
	*203.75 MC. ‡199.25 MC.		CHANNEL #11			Set Channel Selector to #11		
	*197.75 MC. ‡193.25 MC.		CHANNEL #10			Set Channel Selector to #10		
	*191.75 MC. ‡187.25 MC.		CHANNEL #9			Set Channel Selector to #9		
	*185.75 MC. ‡181.25 MC.		CHANNEL #8			Set Channel Selector to #8		
	*179.75 MC. ‡175.25 MC.		CHANNEL #7			Set Channel Selector to #7		
	* 87.75 MC. ‡ 83.25 MC.		CHANNEL #6			Set Channel Selector to #6		
	* 81.75 MC. ‡ 77.25 MC.		CHANNEL #5			Set Channel Selector to #5		
	* 71.75 MC. ‡ 67.25 MC.		CHANNEL #4			Set Channel Selector to #4		
	* 65.75 MC. ‡ 61.25 MC.		CHANNEL #3			Set Channel Selector to #3		
	* 59.75 MC. ‡ 55.25 MC.		CHANNEL #2			Set Channel Selector to #2		

If an unsatisfactory overall response is obtained for a particular channel, observe RF Amp. and Mixer response curve for that channel (as described on preceding page). If characteristic does not conform reasonably well within the typical curve shown in Fig. 8, then, (1) attempt to obtain a better compromise for RF response on all channels by realigning RF Amp. and Mixer circuits, or (2) try replacing Antenna, RF and Oscillator coils for the particular channel.

*Sound Carrier Marker
‡Picture Carrier Marker

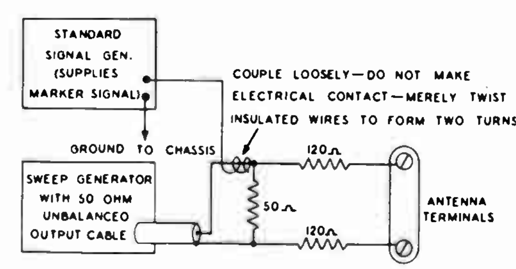


FIG. 11
Generator Connections for RF Channel Alignment

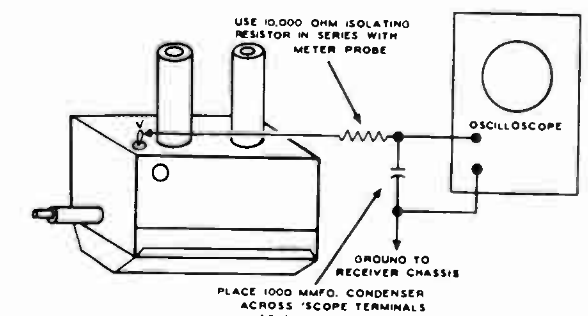


FIG. 12
Oscilloscope Connections for RF Amp. and Mixer Alignment

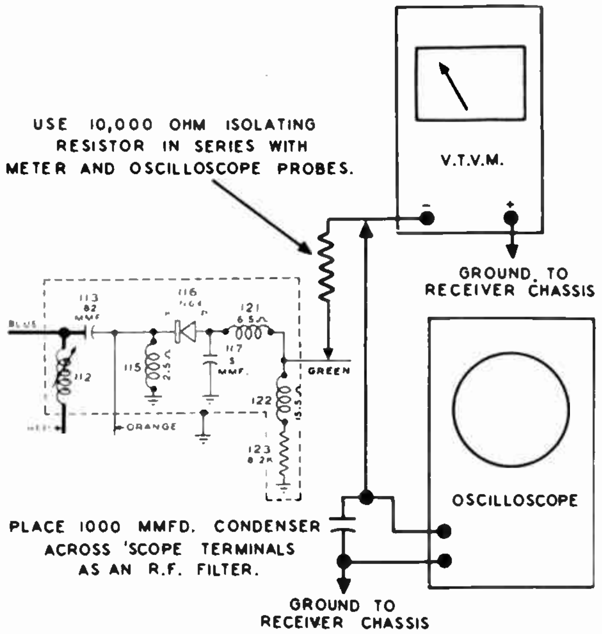
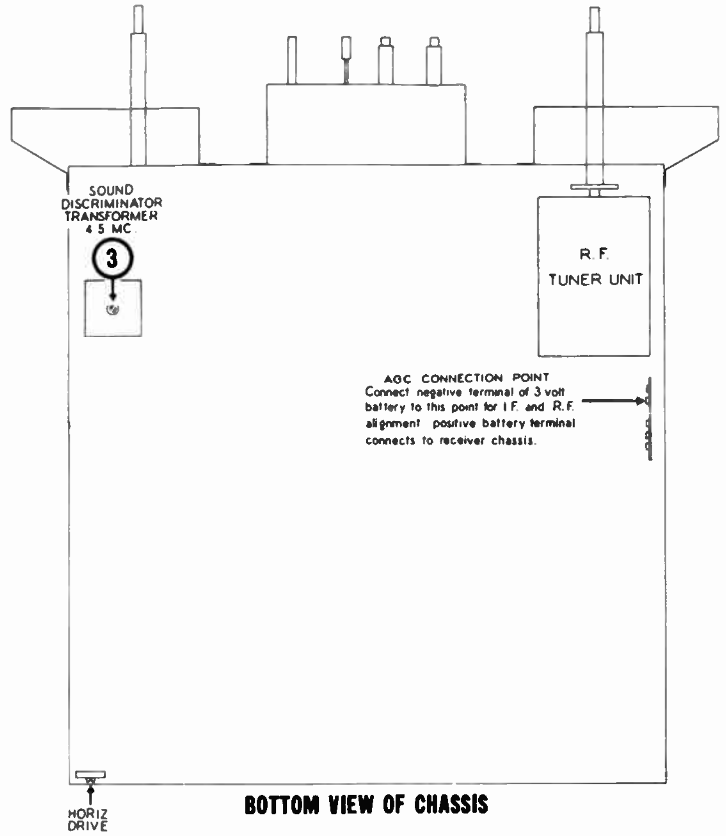
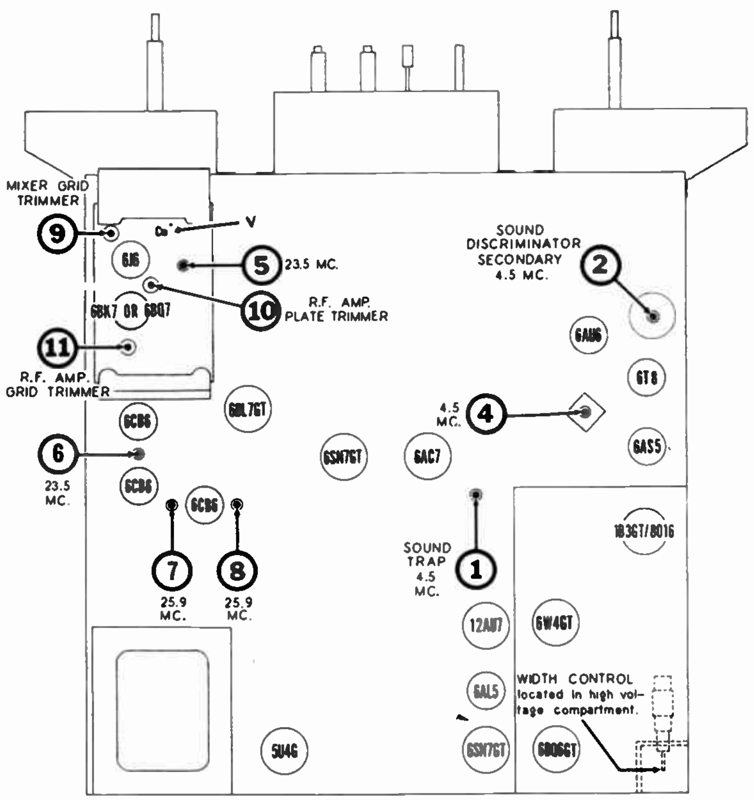


FIG. 13
VTVM and Oscilloscope Connections for Oscillator Alignment



BOTTOM VIEW OF CHASSIS

FIG. 15



TOP VIEW OF CHASSIS

FIG. 14

HIGH VOLTAGE ARCING ON MODEL 27C-9212A

Several cases of high voltage failure, reduced brightness and intermittant arcing have been traced to a faulty H. F. condenser, circuit diagram #195, part 508888 (500 Mmfd. -20,000 volts). If this occurs, replace with part 521479 (500 Mmfd. - 20,000 volts). This new condenser should be mounted in the hole above and to the right of the previous position. Model 9212 receivers which contain the Letter "D" in the "SERIES" coding, already incorporate this modification.

PRODUCTION CHANGES

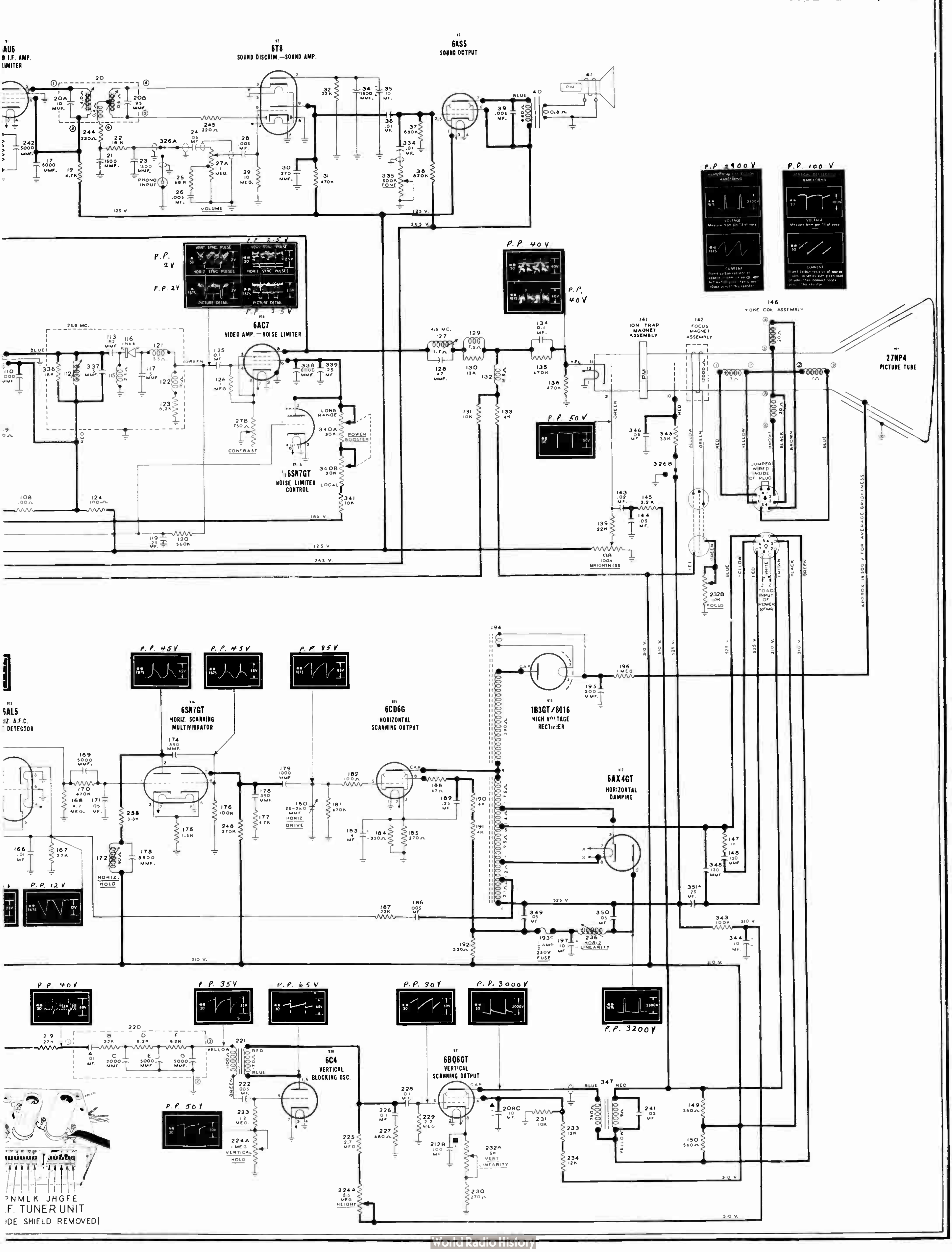
The following tabulation furnishes complete details on changes which occurred during receiver production. The receivers incorporating these changes are identified by coding stamped on rear surface of chassis. This coding consists of one or more letters following the word SERIES, as SERIES B, SERIES AC, etc., and corresponds to similarly lettered changes shown below. Chassis incorporate only that change indicated by letter designation; i.e., chassis stamped "SERIES BE" does not include changes "A" or "C" or "D".

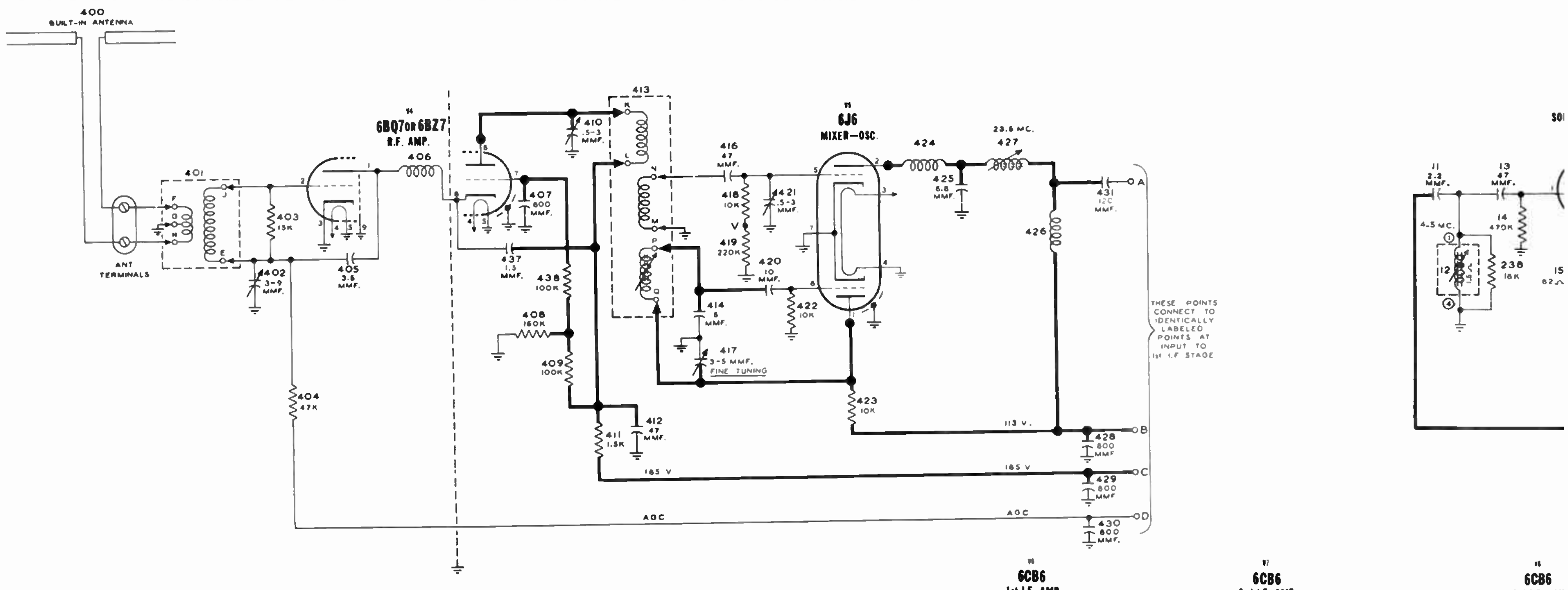
The circuit shown on this page applies to "SERIES ABC" chassis.

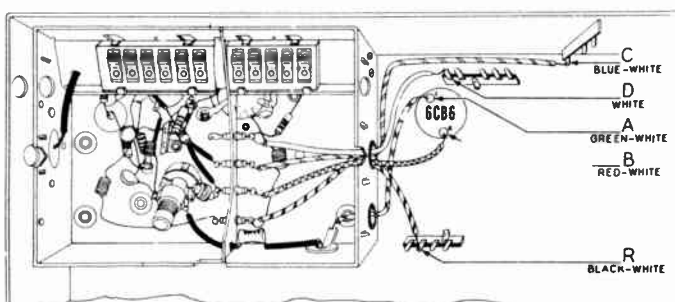
A letter following the component circuit diagram number thus —201A, indicates that this particular item was affected by a circuit change. The letter corresponds to the series code letter listed in the production change column, from which complete change information can be obtained.

LETTER INCLUDED IN DESIGNATION FOLLOWING THE WORD "SERIES"	CHANGE INCORPORATED IN CHASSIS
UNCODED	INITIAL PRODUCTION
"A"	The following change was incorporated to minimize the ringing effect of the horizontal sweep transformer. 1. Disconnect condenser 351 (.25 Mfd.) in horizontal sweep circuit from terminal #3 of horizontal sweep transformer and reconnect it to terminal #1 of this transformer.
"B"	The following change was incorporated to facilitate production I.F. alignment. 1. Change resistor 106 in grid circuit of V8 (3rd I.F. Amp.) from 4700 Ohms to 5600 Ohms.
"C"	The following change was incorporated to eliminate fuse blow-out during surge voltages. 1. Change fuse 193 in horizontal sweep circuit from ¼ Amp. 250 volt to ½ Amp. 250 volt.

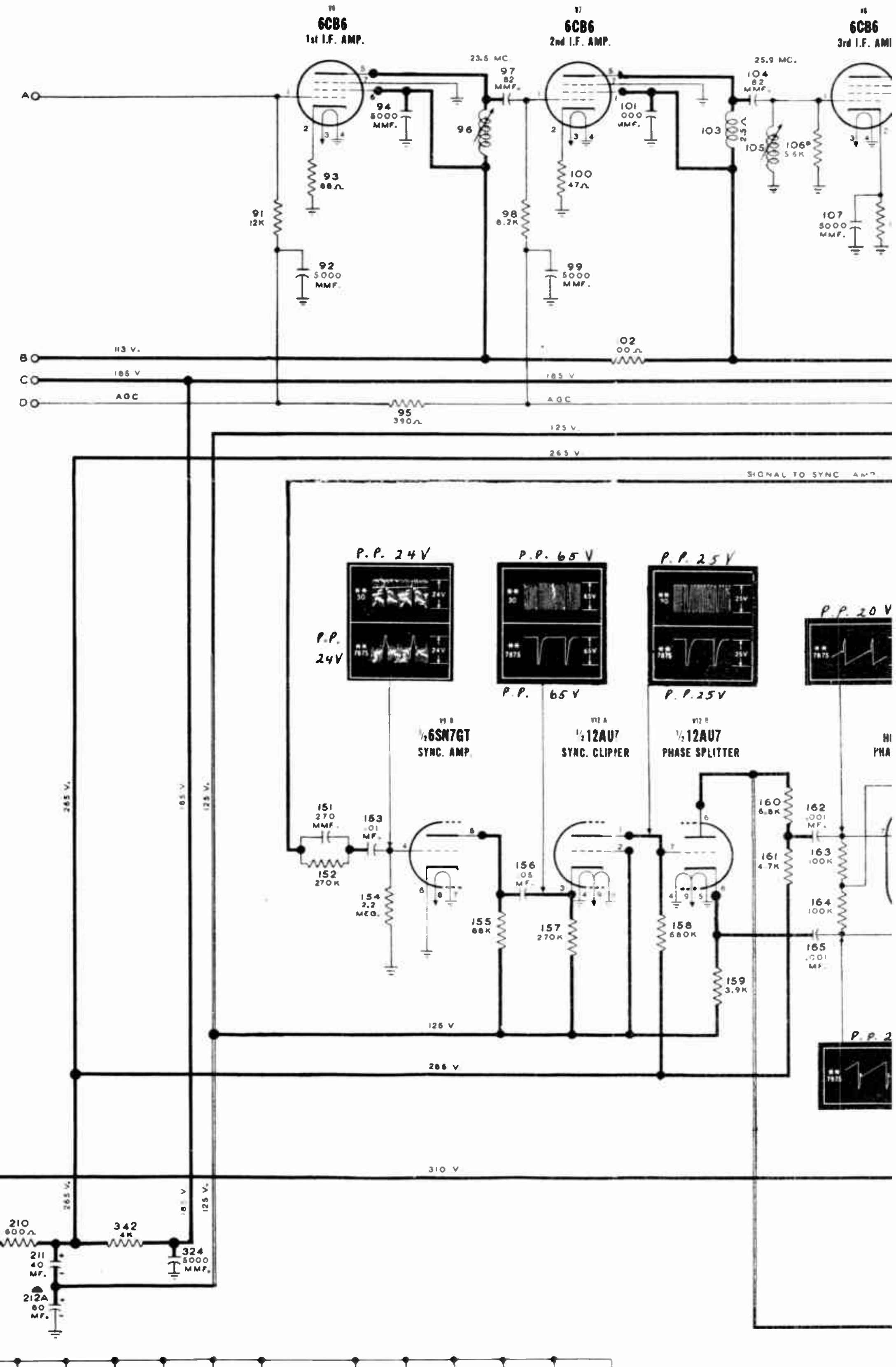
MODEL 27C-9212A







BOTTOM VIEW OF CHASSIS SHOWING CONNECTIONS TO RF TUNER UNIT



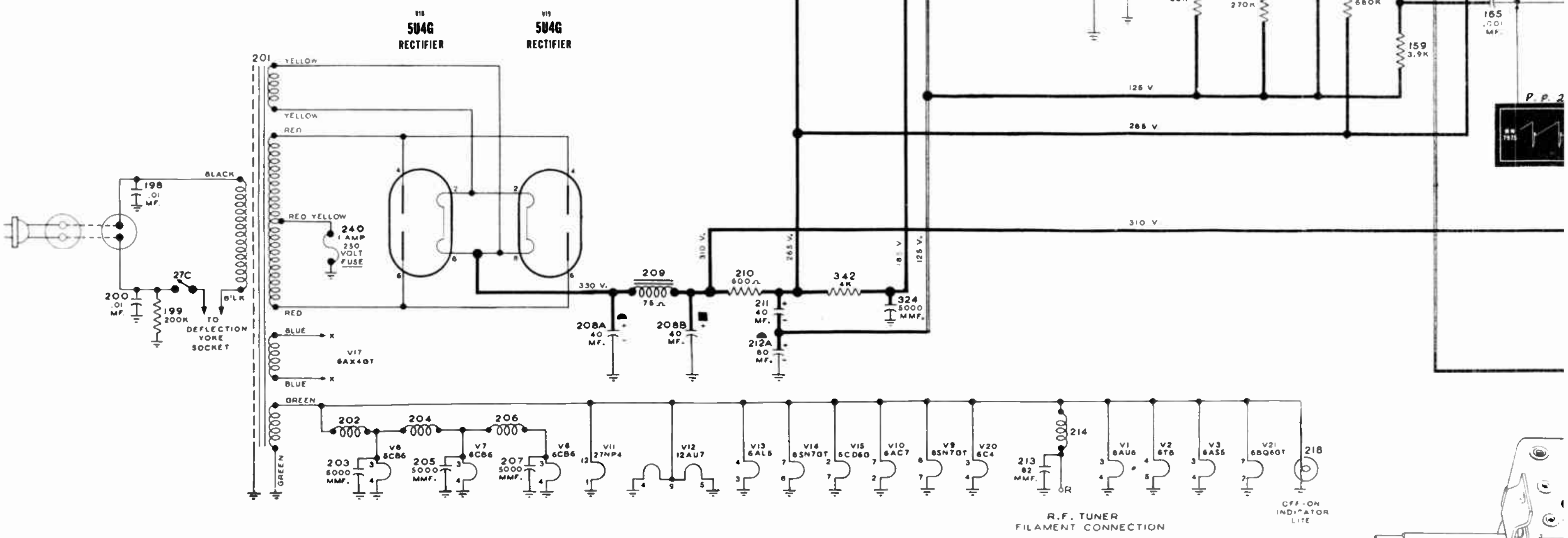
OSCILLOGRAMS

All oscillograms taken with ground lead of 'scope connected to receiver chassis (unless otherwise indicated) and with receiver controls set for normal reception of a station transmitting its standard test pattern.

Number appearing below asterisk specifies setting of horizontal sweep frequency control on 'scope.

*—This symbol on illustration indicates that wave form was observed on a 'scope whose vertical amplifier had very limited high frequency response (50 to 100 Kc).

**—This symbol indicates that wave form was observed on a 'scope whose vertical amplifier frequency response was flat to within 20% up to 2 Mc.



VOLTAGES SHOWN ON CIRCUIT DIAGRAM WERE MEASURED WITH ANTENNA TERMINALS SHORTED TO GROUND AND CHANNEL SELECTOR SET TO AN INACTIVE CHANNEL. ALL CONTROLS ARE SET FOR NORMAL OPERATION EXCEPT FOR POWER BOOSTER CONTROL WHICH WAS SET TO MAXIMUM COUNTER-CLOCKWISE POSITION.

520645 F
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Notice: Some parts listed below have special characteristics. Do not use substitutes for replacement purposes.

CONDENSERS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
11	513001	Condenser—ceramic 2.2 Mmfd. 500 volt	$ .16
13	513002	Condenser—ceramic 47 Mmfd. 500 volt	.24
17	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
20-A	509706	Condenser—ceramic 10 Mmfd. (part of sound discriminator)	3.00
20-B	509706	Condenser—ceramic 95 Mmfd. (part of sound discriminator)	3.00
21	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
23	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
24	512027	Condenser—.05 Mfd. 200 volt	.40
26	512007	Condenser—.005 Mfd. 600 volt	.25
28	512007	Condenser—.005 Mfd. 600 volt	.25
30	513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
34	513010	Condenser—ceramic 1500 Mmfd. 350 volt	.30
35	505174	Condenser—electrolytic 10 Mfd. 150 volt	.90
36	512011	Condenser—.01 Mfd. 400 volt	.25
39	512007	Condenser—.005 Mfd. 600 volt	.25
92	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
94	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
97	513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
99	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
101	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
104	513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
107	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
110	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
113	513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
117	513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature compensating)	.30
119	512045	Condenser—.25 Mfd. ±10% 200 volt	.36
125	512033	Condenser—.1 Mfd. 200 volt	.30
128	513438	Condenser—ceramic 47 Mmfd. ±5% 500 volt (Temperature compensating)	.45
134	512035	Condenser—.1 Mfd. 400 volt	.30
143	512019	Condenser—.02 Mfd. 600 volt	.30
144	512031	Condenser—.05 Mfd. 600 volt	.35
148	512546	Condenser—mica 130 Mmfd. ±5% 2000 volt	.55
151	513006	Condenser—ceramic 270 Mmfd. 500 volt	.25
153	512013	Condenser—.01 Mfd. 600 volt	.30
156	512029	Condenser—.05 Mfd. 400 volt	.35
162	512001	Condenser—.001 Mfd. 600 volt	.22
165	512001	Condenser—.001 Mfd. 600 volt	.22
166	512009	Condenser—.01 Mfd. 200 volt	.25
169	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
171	512027	Condenser—.05 Mfd. 200 volt	.40
173	512540	Condenser—mica 3900 Mmfd. ±10% 500 volt	.60
174	512535	Condenser—mica 390 Mmfd. ±10% 500 volt	.35
178	512535	Condenser—mica 390 Mmfd. ±10% 500 volt	.35
179	512515	Condenser—mica 1000 Mmfd. ±10% 500 volt	.40
180	520127	Condenser—trimmer 25-280 Mmfd. (Horizontal Drive Control)	.50
183	520921	Condenser—electrolytic 4 Mfd. 150 volt	1.20
186	512007	Condenser—.005 Mfd. 600 volt	.25
189	512049	Condenser—.25 Mfd. ±10% 600 volt	.60
195	508888	Condenser—ceramic 500 Mmfd. 20,000 volt	2.00
197	161024	Condenser—electrolytic 10 Mfd. 450 volt	1.50
198	512255	Condenser—.01 Mfd. 400 volt	.25
200	512255	Condenser—.01 Mfd. 400 volt	.25
203	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
205	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
207	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
208-A, B, C	509001	Condenser—electrolytic A—40 Mfd. 450 volt B—40 Mfd. 450 volt C—10 Mfd. 450 volt	4.00
211	160095	Condenser—electrolytic 40 Mfd. 300 volt	2.00
212-A, B	509002	Condenser—electrolytic A— 80 Mfd. 250 volt B—100 Mfd. 50 volt	3.00
213	513016	Condenser—ceramic 82 Mmfd. ±10% 500 volt	.25
220-A	508062	Condenser—ceramic .01 Mfd. 450 volt (part of Integrator Unit)	1.40
220-C	508062	Condenser—ceramic 2000 Mmfd. 450 volt (part of Integrator Unit)	1.40
220-E	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
220-G	508062	Condenser—ceramic 5000 Mmfd. 450 volt (part of Integrator Unit)	1.40
222	512007	Condenser—.005 Mfd. 600 volt	.25
226	512037	Condenser—.1 Mfd. 600 volt	.45
228	512037	Condenser—.1 Mfd. 600 volt	.45
241	512031	Condenser—.05 Mfd. 600 volt	.25
242	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
324	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
334	512009	Condenser—.01 Mfd. 200 volt	.25
337	513432	Condenser—ceramic 5 Mmfd. ±10% 500 volt (Temperature Compensating)	.30
338	513013	Condenser—ceramic 5000 Mmfd. 450 volt	.36
339	512223	Condenser—.25 Mfd. 400 volt	.60
344	508680	Condenser—electrolytic 10 Mfd. 600 volt	2.55
346	512031	Condenser—.05 Mfd. 600 volt	.35
348	512546	Condenser—mica 130 Mmfd. ±5% 2000 volt	.55
349	512031	Condenser—.05 Mfd. 600 volt	.35
350	512031	Condenser—.05 Mfd. 600 volt	.35
351	512223	Condenser—.25 Mfd. 400 volt	.60
402	509064	Condenser—trimmer 3-9 Mmfd	.50
405	520721	Condenser—ceramic 3.6 Mmfd. ±10% 500 volt	.35
407	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
410	507968	Condenser—trimmer 0.5-3 Mmfd.	.40
412	520719	Condenser—ceramic 47 Mmfd. ±10% 500 volt (Temperature compensating)	.40
414	520717	Condenser—ceramic 5 Mmfd. ±5% 500 volt (Temperature compensating)	.35
416	520719	Condenser—ceramic 47 Mmfd. ±10% 500 volt (Temperature compensating)	.40
417	*	Condenser—ceramic 3-5 Mmfd. (Fine Tuning)	—
420	520718	Condenser—ceramic 10 Mmfd. ±10% 500 volt (Temperature compensating)	.30
421	507968	Condenser—trimmer 0.5-3 Mmfd.	.40
425	520716	Condenser—ceramic 6.8 Mmfd. ±5% (Temperature compensating)	.35
428	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
429	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
430	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
431	513029	Condenser—ceramic 120 Mmfd. ±10% 500 volt	.35
432	*	Condenser—ceramic 800 Mmfd. (Feed thru type) (part of center shield)	—
433	520735	Condenser—ceramic 1000 Mmfd. 500 volt	.30
435	520735	Condenser—ceramic 1000 Mmfd. 500 volt	.30
437	520720	Condenser—ceramic 1.5 Mmfd. 500 volt	.35

RESISTORS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
14	510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	$ .12
15	510117	Resistor—carbon 82 Ohms ±10% ½ watt	.12
19	510249	Resistor—carbon 4700 Ohms 1 watt	.16
22	510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
25	510170	Resistor—carbon 68,000 Ohms ½ watt	.12
29	510197	Resistor—carbon 10 Meg. ½ watt	.12
31	510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
32	510160	Resistor—carbon 22,000 Ohms ±10% ½ watt	.12
37	510746	Resistor—carbon 680,000 Ohms ±5% ½ watt	.20
38	510747	Resistor—carbon 820,000 Ohms ±5% ½ watt	.20
91	510723	Resistor—carbon 12,000 Ohms ±5% ½ watt	.16
93	510116	Resistor—carbon 68 Ohms ½ watt	.12
95	510129	Resistor—carbon 390 Ohms ±10% ½ watt	.12
98	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
100	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
102	510119	Resistor—carbon 100 Ohms ±10% ½ watt	.12
106	510150	Resistor—carbon 5600 Ohms ±10% ½ watt (used when letter "B" is included in series designation at rear of chassis)	.12
106	510148	Resistor—carbon 4700 Ohms ±10% ½ watt (used when letter "B" is not included in series designation at rear of chassis)	.12
108	510119	Resistor—carbon 100 Ohms ½ watt	.12
109	510118	Resistor—carbon 100 Ohms ±10% ½ watt	.12
120	510186	Resistor—carbon 560,000 Ohms ±10% ½ watt	.12
123	510153	Resistor—carbon 8200 Ohms ±10% ½ watt	.12
124	510119	Resistor—carbon 100 Ohms ±10% ½ watt	.12
126	510191	Resistor—carbon 1 Meg. ½ watt	.12
130	510723	Resistor—carbon 12,000 Ohms ±5% ½ watt	.16
131	510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
133	510753	Resistor—wire wound 4000 Ohms ±10% 5 watt	1.00
135, 136	510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
139	510160	Resistor—carbon 22,000 Ohms ±10% ½ watt	.12
145	510142	Resistor—carbon 2200 Ohms ±10% ½ watt	.12
147	510236	Resistor—carbon 1000 Ohms ±10% ½ watt	.16
149, 150	510132	Resistor—carbon 560 Ohms ±10% ½ watt	.12
152	510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
154	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
155	510169	Resistor—carbon 68,000 Ohms ±10% ½ watt	.12
157	510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
158	510187	Resistor—carbon 680,000 Ohms ±10% ½ watt	.12
159	510748	Resistor—carbon 3900 Ohms ±5% ½ watt	.20
160	510151	Resistor—carbon 6800 Ohms ±10% ½ watt	.12
161	510750	Resistor—carbon 4700 Ohms ±5% ½ watt	.20
163, 164	510751	Resistor—carbon 100,000 Ohms ±5% ½ watt	.20
167	510162	Resistor—carbon 27,000 Ohms ±10% ½ watt	.12
168	510195	Resistor—carbon 4.7 Meg. ½ watt	.12
170	510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
171	510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
176	510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
177	510148	Resistor—carbon 4700 Ohms ±10% ½ watt	.12
181	510184	Resistor—carbon 470,000 Ohms ±10% ½ watt	.12
182	510119	Resistor—carbon 100 Ohms ½ watt	.12
184	510327	Resistor—carbon 330 Ohms ±10% 2 watt	.25
185	510326	Resistor—carbon 270 Ohms ±10% 2 watt	.25
187	510360	Resistor—carbon 22,000 Ohms ±10% 2 watt	.30
188	510112	Resistor—carbon 47 Ohms ±10% ½ watt	.12
190, 191	510773	Resistor—wire wound 4000 Ohms ±10% 3 watt	1.80
192	510757	Resistor—wire wound 330 Ohms ±10% 10 watt	.90
196	510390	Resistor—carbon 1 Meg. ±10% 2 watt	.30
199	510179	Resistor—carbon 220,000 Ohms ½ watt	.12
210	510741	Resistor—wire wound 600 Ohms ±10% 10 watt	.90
219	510162	Resistor—carbon 27,000 Ohms ± 10% ½ watt	.12
220-B	508062	Resistor—carbon 22,000 Ohms ⅕ watt (part of Integrator Unit)	1.40
220-D	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
220-F	508062	Resistor—carbon 8200 Ohms ⅕ watt (part of Integrator Unit)	1.40
223	510777	Resistor—carbon 1.2 Meg. ±5% ½ watt	.12
225	510772	Resistor—carbon 2.7 Meg. ±5% ½ watt	.12
227	510134	Resistor—carbon 680 Ohms ½ watt	.12
229	510193	Resistor—carbon 2.2 Meg. ½ watt	.12
230	510126	Resistor—carbon 270 Ohms ±10% ½ watt	.12
231	510254	Resistor—carbon 10,000 Ohms ±10% 1 watt	.16
233, 234	510356	Resistor—carbon 12,000 Ohms ±10% 2 watt	.24
235	510145	Resistor—carbon 3300 Ohms ±10% ½ watt	.12
238	510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
244, 245	510124	Resistor—carbon 220 Ohms ±10% ½ watt	.12
248	510180	Resistor—carbon 270,000 Ohms ±10% ½ watt	.12
336	510159	Resistor—carbon 18,000 Ohms ±10% ½ watt	.12
341	510354	Resistor—carbon 10,000 Ohms ±10% 2 watt	.25
342	510773	Resistor—wire wound 4000 Ohms ±10% 3 watt	1.80
343	510766	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12
345	510164	Resistor—carbon 33,000 Ohms ½ watt	.12
403	510157	Resistor—carbon 15,000 Ohms ±10% ½ watt	.12
404	510167	Resistor—carbon 47,000 Ohms ½ watt	.12
408	510774	Resistor—carbon 160,000 Ohms ±5% ½ watt	.16
409	510751	Resistor—carbon 100,000 Ohms ±5% ½ watt	.20
411	510139	Resistor—carbon 1500 Ohms ±10% ½ watt	.12
418	510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
419	510179	Resistor—carbon 220,000 Ohms ½ watt	.12
422, 423	510154	Resistor—carbon 10,000 Ohms ±10% ½ watt	.12
438	510172	Resistor—carbon 100,000 Ohms ±10% ½ watt	.12

COILS AND TRANSFORMERS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
12	509378	Transformer—audio take-off	1.50
20	509706	Transformer—TV sound discriminator (includes condensers 20-A and 20-B)	3.00
40	509376	Transformer—audio output	1.85
96	507343	Coil—1st video I.F. (less slug)	.70
	507357	Slug core for 1st video I.F. coil	.20
103	507367	Coil—choke	.70
105	507343	Coil—2nd video I.F. (less slug)	.70
	507357	Slug core for 2nd video I.F. coil	.20
112	507343	Coil—3rd video I.F. (less slug)	.70
	507357	Slug core for 3rd video I.F. coil	.20
115	507367	Coil—choke	.70
121	520620	Coil—peaking	.60
122	520985	Coil—peaking	.65
127	509603	Coil—4.5 Mc. trap (includes slug and condenser #128)	1.20
	507357	Slug core for 4.5 Mc. trap	.20
129	520689	Coil—peaking	.65
132	509342	Coil—peaking	.60
142	162326	Coil—focus (includes cable and plug)	14.00
146	115311	Yoke—picture tube deflection (includes leads and plug)	24.00
172	508967	Coil—Horizontal Hold (includes slug and clip)	1.10
	508963	Slug core for Horizontal Hold coil	.15
194	521343	Transformer—horizontal sweep	12.50
201	521156	Transformer—power	16.00
202	507584	Coil—choke	.28
204	507584	Coil—choke	.28
206	507584	Coil—choke	.28
209	508341	Choke—filter	3.60
214	507584	Coil—choke	.28
221	508076	Transformer—vertical blocking oscillator	1.90
236	520911	Coil—Horizontal Linearity (includes slug and clip)	1.50
	521336	Slug core for Horizontal Linearity coil	—
347	509375	Transformer—vertical output	4.00
401	520702	Coil-antenna; channel #2 (coded "2Q")	1.40
	520703	Coil-antenna; channel #3 (coded "3Q")	1.40
	520704	Coil-antenna; channel #4 (coded "4Q")	1.40
	520705	Coil-antenna; channel #5 (coded "5Q")	1.40
	520706	Coil-antenna; channel #6 (coded "6Q")	1.40
	520707	Coil-antenna; channel #7 (coded "7Q")	1.15
	520708	Coil-antenna; channel #8 (coded "8Q")	1.15
	520709	Coil-antenna; channel #9 (coded "9Q")	1.15
	520710	Coil-antenna; channel #10 (coded "10Q")	1.15
	520711	Coil-antenna; channel #11 (coded "11Q")	1.15
	520712	Coil-antenna; channel #12 (coded "12Q")	1.15
	520713	Coil-antenna; channel #13 (coded "13Q")	1.15
406	520701	Coil-cathode coupling	.15
413	520722	Coil-R.F. and osc; channel #2 (coded "2Q")	1.85
	520723	Coil-R.F. and osc; channel #3 (coded "3Q")	1.85
	520724	Coil-R.F. and osc; channel #4 (coded "4Q")	1.85
	520725	Coil-R.F. and osc; channel #5 (coded "5Q")	1.85
	520726	Coil-R.F. and osc; channel #6 (coded "6Q")	1.85
	520727	Coil-R.F. and osc; channel #7 (coded "7Q")	1.70
	520728	Coil-R.F. and osc; channel #8 (coded "8Q")	1.70
	520729	Coil-R.F. and osc; channel #9 (coded "9Q")	1.70
	520730	Coil-R.F. and osc; channel #10 (coded "10Q")	1.70
	520731	Coil-R.F. and osc; channel #11 (coded "11Q")	1.70
	520732	Coil-R.F. and osc; channel #12 (coded "12Q")	1.70
	520733	Coil-R.F. and osc; channel #13 (coded "13Q")	1.70
	507986	Slug for osc coil; auxiliary fine tuning adj.	.05
424	520714	Coil-choke	.15
426	520715	Coil-choke	.45
427	520734	Coil—converter plate I.F. (includes slug and clip)	.75
	509062	Slug core for converter plate coil	.12
434	520518	Coil-choke	.10
436	520520	Coil-choke	.10

CONTROLS

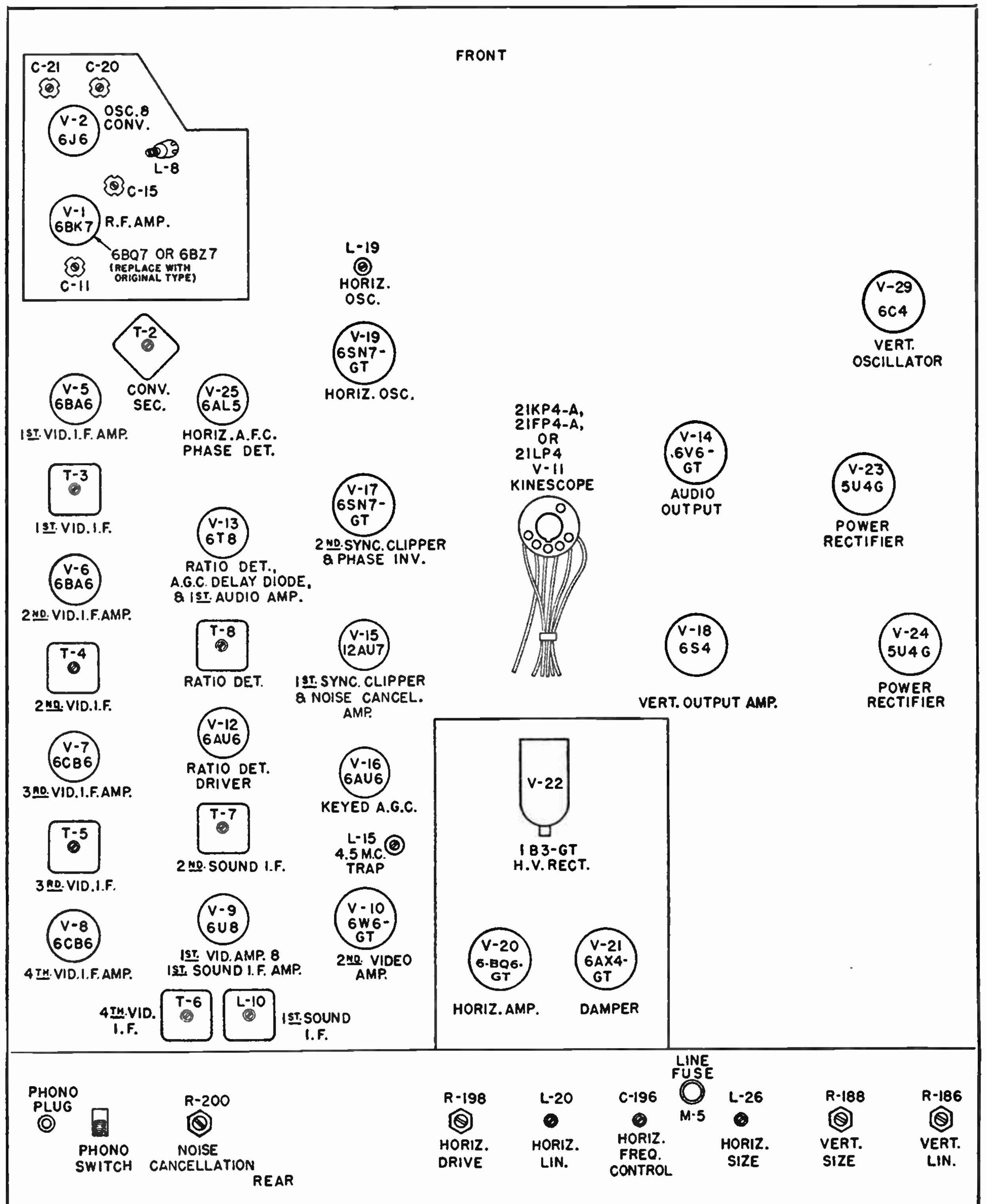
DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
27-A,B,C	520292	Volume and Contrast control (includes OFF-ON switch) A—Volume control; 1 Meg. ¼ watt B—Contrast control; 750 Ohms 2 watt C—Off-On switch	3.50
138	509893	Brightness potentiometer (100,000 Ohms)	1.00
172	508967	Horizontal Hold coil (includes slug and clip)	1.10
	508963	Slug core for Horizontal Hold coil	.15
180	520127	Horizontal Drive trimmer condenser (25-280 Mmfd.)	.50
224-A,B	508893	Height and Vertical Hold potentiometers A—Vertical Hold control; 1 Meg. ¼ watt B—Height control; 2.5 Meg. ¼ watt	1.75
232-A,B	509302	Vertical Linearity and Focus potentiometers A—Vertical Linearity control; 5,000 Ohms ½ watt B—Focus control; 10,000 Ohms ±10% 4 watt	3.75
236	520911	Horizontal Linearity coil (includes slug and clip)	1.50
	521336	Slug core for Horizontal Linearity coil	—
335	520746	Tone potentiometer (500,000 Ohms)	1.00
340-A,B	520745	Power Booster potentiometer A—30,000 Ohms ½ watt B—30,000 Ohms ½ watt	2.30
417	*	Fine Tuning condenser (3-5 Mmfd)	—

OTHER ELECTRICAL PARTS

DIAGRAM NO.	PART NO.	DESCRIPTION	LIST PRICE
41	508174	Speaker—P.M. Dynamic (6" x 9")	8.40
116	509386	Crystal detector	2.00
141	508603	Ion trap	1.00
193	521381	Fuse for horizontal sweep circuit; ½ Amp. 250 volt (used when letter "C" is included in series designation at rear of chassis)	.25
	508063	Fuse for horizontal sweep circuit; ¼ Amp. 250 volt (used when letter "C" is not included in series designation at rear of chassis)	.30
218	118921	TV Channel Lite (Mazda 47 6-8 V. 150 Ma.)	.15
220-A to G	508062	Integrator Coupling Unit A—Condenser—ceramic .01 Mfd. 450 volt B—Resistor—carbon 22,000 Ohms ⅕ watt C—Condenser—ceramic 2000 Mmfd. 450 volt D—Resistor—carbon 8200 Ohms ⅕ watt E—Condenser—ceramic 5000 Mmfd. 450 volt F—Resistor—carbon 8200 Ohms ⅕ watt G—Condenser—ceramic 5000 Mmfd. 450 volt	1.40
240	509517	Fuse; 1 Amp.; 250 volt	.25
326-A,B	520563	Switch, "PHONO-TELEV."	.55
400	520939	Antenna—built in	1.10

*—This part is not supplied as a Service replacement item.

ALL PRICES ON THIS PARTS LIST ARE SUBJECT TO CHANGE WITHOUT NOTICE



TUBE VOLTAGE CHART

1. Measurements are made at 117 V. line using vacuum tube voltmeter. All voltages are D.C. and are positive with respect to chassis ground except where noted.
2. Contrast control set at minimum, brightness control set at minimum, antenna disconnected.

			PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V-5	6BA6	1st VID. I.F.	—2.4	0	0	AC 6.3	140	110	.9		
V-6	6BA6	2nd VID. I.F.	—.4	0	0	AC 6.3	140	110	.8		
V-7	6CB6	3rd VID. I.F.	0	1.4	0	AC 6.3	120	115	0		
V-8	6CB6	4th VID. I.F.	0	1.2	0	AC 6.3	110	110	0		
V-9	6U8	1st VID. AMP. & 1st AUDIO I.F. AMP.	100	0	110	AC 6.3	0	110	1.4	0	—1
V-10	6W6	VIDEO AMP.	0	0	300	120	0	TP 510	AC 6.3	14	
V-15	12AU7	NOISE AMP. SYNC. CLIP.	100	—23	—.5	AC 6.3	AC 6.3	31	—5.6	0	0
V-16	6AU6	KEYED AGC	105	120	120	120	—.5	320	120		
V-17	6SN7	PHASE INVERTER	0	110	10	10	100	13	AC 6.3	0	
V-25	6AL5	PHASE DETECTOR	0	0	0	AC 6.3	9	0	—10		
V-29	6C4	VERT. OSC.	NC 105	0	0	AC 6.3	105	—24	0		
V-18	6S4	VERT. AMP.	0	24	—.6	AC 6.3	0	—.6	450		
V-19	6SN7	HORIZ. OSC.	—13.5	210	11.5	1.	270	11.5	AC 6.3	0	
V-20	6BQ6	HORIZ. AMP.	460	6.3	NC	465	—27.5	TP	AC 6.3	8.5	
V-22	1B3GT	H.V. RECTIFIER	0	0	0	0	0	0	0	0	
V-21	6AX4	DAMPER	NC	NC	540	NC	320	0	AC 6.3	AC 6.3	
V-12	6AU6	AUDIO DRIVER	—1	0	0	AC 6.3	100	100	0		
V-13	6T8	RATIO DETECTOR	—13	—22	—14	AC 6.3	0	0	0	—.9	65
V-14	6V6	AUDIO OUTPUT	0	0	240	270	0	NC	AC 6.3	1.3	
V-23 & V-24	5U4	L.V. RECTIFIER	NC	5 VAC	TP	AC 300	NC	AC 300	NC	5 VAC 340	
			PIN 1	PIN 2	PIN 10	PIN 11	PIN 12				
V-11	21FP4	KINESCOPE	AC 6.3	0	510	115	AC 6.3				
		DEFL. SOCKET	0	320	440	—	—	TP	450	450	

TUNER Blue Lead—Plate RF 240 Volts
TUNER Red Lead—B+ to Conv. 120 Volts

NOTE — NC = No connection.
TP = Tie Point.

Typical AGC voltage developed across C-160 vs. second detector voltage at Pin 9 of V-9, 6U8.

Strong local signal	18 V AGC	1.5 Second detector voltage.
Medium signal (slight snow)	6 V AGC	1.3 Second detector voltage.
Weak signal	3 V AGC	1. Second detector voltage.

Apply ADC bias of approximately —3 V to AGC line (across C-160). Maintain the output level of the sweep generator such that the detector output is 2 volts peak to peak.

NOTE: USE A NON METALLIC ALIGNING TOOL AND LIGHT PRESSURE ON ALL SLUGS.

	Signal Generator Connection	Oscilloscope or VTVM Connection	Adjustments and Notes
1 Quadruple Alignment	Output of sweep generator to grid of 1st IF tube, pin 1 of V-5, 6BA6 thru 100 MMF isolating capacitor.	Input of scope to grid of video amplifier, pin 9 of V-9, 6U8 thru 47K ohm isolating resistor.	1. Adjust the bottom slug of T-3, 1st IF Transformer for low intermediate frequency. (23.7 mc. approx). 2. Adjust the bottom slug of T-4, 2nd IF Transformer for low frequency. (23.0 mc. approx). 3. Adjust the bottom slug of T-5, 3rd IF transformer for high frequency. (26.0 mc. approx). 4. Adjust the bottom slug of T-6, 4th IF transformer for high intermediate frequency. (25.3 mc. approx). 5. Maintaining the above relative frequency positions of the individual stages, adjust the slugs to produce a curve as shown with the 22.7 mc. and 26.4 mc. markers at 70% response. See Fig. 1.
2 Sound Traps	Same as Step #1 Using 21.9 mc. marker.	Same as Step #1.	1. Adjust the top slug of T-4 for minimum response at 21.9 mc. 2. Adjust the top slug of T-3 for curve shown in Fig. 2.
3 Adjacent Sound Trap	Same as Step #1 using 27.9 mc. marker.	Same as Step #1.	1. Adjust the top slug of T-5 for minimum response at 27.9 mc. 2. Repeat Step #1 (Quadruple alignment) to reproduce the curve as shown in Fig. 1.
4 Double-Tuned Stage Alignment	Couple the output of the sweep generator into the converter plate by means of the split tube shield.	Same as Step #1.	1. Adjust L-8 on tuner assembly and T-2 for curve as shown in Fig. 4 for maximum gain, maintaining the 22.7 mc. and 26.4 mc. markers at 50% response.
5 Sound IF Alignment	Connect an unmodulated 4.5 mc. signal to the grid of the 1st sound IF amp. pin 2 of V-9, 6U8.	Connect 2-100K resistors in series from plate of ratio detector pin 2 of V-13, 6T8 to ground. Connect VTVM from junction of the 2-100K resistors to ground.	1. Adjust L-10, T-7, and bottom slug of T-8 for maximum response.
6 Ratio Detector Balance	Same as Step #5.	Reconnect the VTVM from the junction of the 2-100K resistors (see 5 above) to the junction of C-134 and R-131.	1. Adjust the secondary (top slug) of T-8 for zero volts between the positive and negative excursions.

FIG. 1

FIG. 2

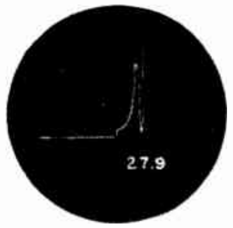


FIG. 3

FIG. 4

GENERAL ASSEMBLY

DESCRIPTION	521 TM S-C Part No.	521 TO S-C Part No.	521 CM S-C Part No.	521 CO S-C Part No.	521 CDM S-C Part No.	521 C5D S-C Part No.
BACK PANEL ASSEMBLY	101211	101211	101211	101211	101211	101211
BRACKET — SPEAKER MTG.	105372	105372				
BRACKET — SPEAKER STIFFENER	105377	105377				
CABINET	108278	108291	108279		108280	See Table I
CHASSIS ASSEMBLY	112153	112153	112153	112153	112153	112153
CLAMP — SPEAKER	113071	113071				
CLAMP — LENS	113090	113100	113090	113100		
DECAL	121075	121075	121075	121075	121075	121075
Door Set					81837	See Table I
ESCUTCHEON — TV CHANNEL	142197	142199	142197	142199	142197	See Table II
GLIDER — FEET	81849	81849	81849	81849	81849	81849
HINGE — R.H. DOOR					132186	132083—Upper 132091—Lower
HINGE — L.H. DOOR					132187	132084—Upper 132092—Lower
KNOB — INNER	134183	134194	134183	134194	134183	See Table II
KNOB — OUTER	134184	134192	134184	134192	134184	See Table II
KNOB — TV CHANNEL INDICATOR	134181	134188	134181	134188	134181	See Table II
KNOB — TV FINE TUNING	134182	134190	134182	134190	134182	See Table II
LENS	138037	138037	138037	138037	138037	138037
MASK	121072	121074	121072	121074	121072	See Table I
LOCKWASHER — CHASSIS MTG.	163147	163147	163147	163147	163147	163147
NUT — SPEAKER MTG.			163182	163182	163182	163182
NUT — T — LENS CLAMP	163113	163113	163113	163113		
SCREW — CHASSIS MTG. (SMALL)	163151	163151	163151	163151	163151	163151
SCREW — CHASSIS MTG. (LARGE)	203549	203549	203549	203549	203549	203549
SCREW — TV ESCUTCHEON MTG.	520146	520146	520146	520146	520146	520146
SCREW — LENS CLAMP	163202	163205	163202	163205		
SCREW — SAFETY BACK	521076	521076	521076	521076	521076	521076
SCREW — # 8 x 32 — ALLEN HEAD	530220	530220	530220	530220	530220	530220
SCREEN — CHASSIS SHELF	130194	130194	130194	130194	130194	130194
SPEAKER ASSEMBLY	155207	155207	155283	155283	155283	155283
SPEAKER ONLY	155187	155187	155284	155284	155284	155284
SPEAKER GRILLE — METAL					130198	

Table I

	CABINET	DOORS	MASK
C5M	108281	81835	121072
C5O	108282	81836	121074
C5D	108283		121073
C5G	108284		121073
C5I	108285		121073
C5R	108286		121073

Table II

KNOBS	BROWN	YELLOW	BLACK
INNER	134183	134194	134193
OUTER	134184	134192	134191
TV CHANNEL INDICATOR	134181	134188	134187
TV FINE TUNING	134182	134190	134189
ESCUTCHEON — TV CHANNEL	142197	142199	142198

CAPACITORS

Circuit Symbol	S-C Part No.	Capacity	Type	Voltage
C-10	171225	3 MMF	Ceramic	
C-11	171213	3-9 MMF		Trimmer
C-12	171226	800 MMF	Ceramic	
C-13	171227	.001 MF	Ceramic	
C-14	171228	47 MMF	Ceramic	
C-15	171212	.5-3 MMF		Trimmer
C-16	171218	800 MMF	Ceramic	
C-17	171218	800 MMF	Ceramic	
C-21	171212	.5-3 MMF		Trimmer
C-22	171230	47 MMF	Ceramic	
C-23	171231	5 MMF	Ceramic	
C-24	171232	10 MMF	Ceramic	
C-25	171233	.001 MMF	Ceramic	
C-26	171234	6.8 MMF	Ceramic	
C-27	171235	.005 MF	Ceramic	
C-28	171218	800 MMF	Ceramic	
C-29	171218	800 MMF	Ceramic	
C-50	110439	2.2 MMF	Ceramic	500
C-51	110685	2 x .004 MF	Ceramic	450
C-53	110586	.005 MF	Ceramic	450
C-54	110586	.005 MF	Ceramic	450
C-60	110439	2.2 MMF	Ceramic	500
C-61	110685	2 x .004 MF	Ceramic	450
C-62	110586	.005 MF	Ceramic	450
C-63	110586	.005 MF	Ceramic	450
C-71	110685	2 x .004 MF	Ceramic	450
C-72	110586	.005 MF	Ceramic	450
C-81	110685	2 x .004 MF	Ceramic	450
C-82	110586	.005 MF	Ceramic	450
C-91	110598	5 MMF	Ceramic	350
C-92	110586	.005 MF	Ceramic	450
C-93	110598	5 MMF	Ceramic	350
C-94	110586	.005 MF	Ceramic	450
C-95	110598	5 MMF	Ceramic	350
C-100	110724	.1 MF	Semi	400
C-101	111082	500 MF	Tub. Elec.	12
C-103	110459	68 MMF	Ceramic	500
C-105	110672	.01 MF	Ceramic	450
C-110	110724	.1 MF	Semi	400
C-112	110724	.1 MF	Semi	400
C-113	110743	.1 MF	Semi	600
C-120	110486	33 MMF	Ceramic	400
C-121	110672	.01 MF	Ceramic	450
C-131	110213	750 MMF	Mica	300
C-132	111047	5 MF	Tub. Elec.	50
C-133	110672	.01 MF	Ceramic	450
C-134	110715	.0033 MF	Semi	400
C-135	110586	.005 MF	Ceramic	450
C-136	110586	.005 MF	Ceramic	450
C-137	110716	.0047 MF	Semi	400
C-140	110737	.01 MF	Semi	600
C-141	110737	.01 MF	Semi	600
C-150	110596	82 MMF	Ceramic	500
C-151	110722	.047 MF	Semi	400
C-152	110724	.1 MF	Semi	400
C-153	110722	.047 MF	Semi	400
C-160	110675	2 MF	Paper	50
C-162	110586	.005 MF	Ceramic	450
C-170	110737	.01 MF	Semi	600
C-171	110712	.001 MF	Semi	400
C-172	110712	.001 MF	Semi	400
C-173	110716	.0047 MF	Semi	400
C-180	110740	.033 MF	Semi	600
C-181	110745	.22 MF	Semi	600
C-182	110743	.1 MF	Semi	600
C-183	111012	50 MF	Tub. Elec.	50
C-184	110743	.1 MF	Semi	600
C-190	110309	3900 MMF	Mica	500
C-192	110722	.047 MF	Semi	400
C-193	110262	390 MMF	Mica	500
C-194	110737	.01 MF	Semi	600
C-195	110262	390 MMF	Mica	500
C-196	110043	70-470 MMF	Mica	Trimmer
C-198	110263	470 MMF	Mica	500
C-199	110250	33 MMF	Mica	500
C-201	111093	5 MF	Tub. Elec.	50
C-203	110741	.047 MF	Semi	600
C-210	110723	.068 MF	Semi	400
C-211	110722	.047 MF	Semi	400
C-212	110721	.033 MF	Semi	400
C-213	110562	.001 MF	Molded	1000
C-214	110819	56 MMF	Ceramic	7 kv
C-216	110724	.1 MF	Semi	400
C-217	110286	56 MMF	Mica	1500
C-218	110454	330 MMF	Ceramic	350
C-219	110572	.047 MF	Molded	1000
C-220	110680	500 MMF	Ceramic	20 kv
C-221	110207	220 MMF	Mica	500
C-235	110718	.01 MF	Semi	400
C-236	111095	40-40 MF	Can Elec.	450
C-237	111094	40-20-10-10 MF	Can. Elec.	450
C-238	111089	20 MF	Tub. Elec.	300
C-239	111089	20 MF	Tub. Elec.	300
C-240	110568	.01 MF	Molded	1000
C-241	110568	.01 MF	Molded	1000

RESISTORS

Circuit Symbol	S-C Part No.	Resistance	Watt	Tol.
R-1	149080	4700 ohms	2 W	20%
R-6	149331	8000 ohms	10 W	10%
R-10	28172	15K ohms	½ W	10%
R-11	149111	47K ohms	½ W	20%
R-12	171236	160K ohms	½ W	10%
R-13	149385	100K ohms	½ W	10%
R-14	28160	1500 ohms	½ W	10%
R-15	149385	100K ohms	½ W	10%
R-20	28170	10K ohms	½ W	10%
R-21	149115	220K ohms	½ W	20%
R-22	28170	10K ohms	½ W	10%
R-23	28172	15K ohms	½ W	10%
R-24	149107	10K ohms	½ W	20%
R-50	28165	3900 ohms	½ W	10%
R-51	28144	68 ohms	½ W	10%
R-52	149101	1000 ohms	½ W	20%
R-53	149097	220 ohms	½ W	20%
R-54	149097	220 ohms	½ W	20%
R-60	28165	3900 ohms	½ W	10%
R-61	28144	68 ohms	½ W	10%
R-62	149097	220 ohms	½ W	20%
R-70	28171	12K ohms	½ W	10%
R-71	149096	150 ohms	½ W	20%
R-80	28173	18K ohms	½ W	10%
R-81	28149	180 ohms	½ W	10%
R-82	149097	220 ohms	½ W	20%
R-90	149096	150 ohms	½ W	20%
R-92	28159	1200 ohms	½ W	10%
R-93	149095	100 ohms	½ W	20%
R-94	28160	1500 ohms	½ W	10%
R-100	28162	2200 ohms	½ W	10%
R-101	149097	220 ohms	½ W	20%
R-104	149097	220 ohms	½ W	20%
R-105	149117	470K ohms	½ W	20%
R-106	28144	68 ohms	½ W	10%
R-107	149411	2000 ohms	7 W	10%
R-110	28184	270K ohms	½ W	10%
R-112	149119	1 Megohm	½ W	20%
R-113	145140	100K-1000 ohms Pot. Contrast Brightness Control		
R-115	149107	10K ohms	½ W	20%
R-121	149142	4700 ohms	1 W	20%
R-122	149108	15K ohms	½ W	20%
R-130	149097	220 ohms	½ W	20%
R-131	28173	18K ohms	½ W	10%
R-132	149111	47K ohms	½ W	20%
R-134-A	145148	500K ohms	Pot.	
R-134-B		On-Off-Volume-Tone		
R-135	149125	10 Megohms	½ W	20%
R-140	149117	470K ohms	½ W	20%
R-141	149117	470K ohms	½ W	20%
R-142	149170	270 ohms	1 W	10%
R-150	149119	1 Megohm	½ W	20%
R-151	149121	2.2 Megohms	½ W	20%
R-152	28173	18K ohms	½ W	10%
R-153	28180	82K ohms	½ W	10%
R-155	149110	33K ohms	½ W	20%
R-158	149121	2.2 Megohms	½ W	20%
R-159	28173	18K ohms	½ W	10%
R-160	149109	22K ohms	½ W	20%
R-161	28176	39K ohms	½ W	10%
R-162	149111	47K ohms	½ W	20%
R-163	149119	1 Megohm	½ W	20%
R-165	149109	22K ohms	½ W	20%
R-166	149122	3.3 Megohms	½ W	20%
R-170	28162	2200 ohms	½ W	10%
R-171	28158	1000 ohms	½ W	10%
R-172	149121	2.2 Megohms	½ W	20%
R-173	28162	2200 ohms	½ W	10%
R-174	149385	100K ohms	½ W	10%
R-175	149385	100K ohms	½ W	10%
R-176	149117	470K ohms	½ W	20%
R-177	149111	47K ohms	½ W	20%
R-179	149114	150K ohms	½ W	20%
R-180	28166	4700 ohms	½ W	10%
R-181	28194	1.8 Megohms	½ W	10%
R-182	149121	2.2 Megohms	½ W	20%
R-183	149136	470 ohms	1 W	20%
R-184	28190	820K ohms	½ W	10%
R-185	149107	10K ohms	½ W	20%
R-186	145079	5K ohms Vertical-Linearity	Pot.	
R-187	145146	1 Megohm-50K ohms Horizontal and Vertical Hold	Pot.	
R-188	145100	6 Megohms Vertical Size	Pot.	
R-189	149078	2200 ohms	2 W	20%
R-190	149078	2200 ohms	2 W	20%
R-191	149118	680K ohms	½ W	20%
R-192	149184	5600 ohms	1 W	10%
R-193	28180	82K ohms	½ W	10%
R-194	149387	1500 ohms	½ W	5%
R-195	28182	180K ohms	½ W	10%
R-196	28162	2200 ohms	½ W	10%
R-197	28167	5600 ohms	½ W	10%
R-198	145132	10K ohms Horizontal Drive	Pot.	
R-199	149123	4.7 Megohms	½ W	20%
R-200	145147	500K ohms Noise Cancel.	Pot.	
R-201	28144	68 ohms	½ W	10%
R-202	149070	100 ohms	2 W	20%
R-203	33912	15K ohms	5 W	10%
R-205	149095	100 ohms	½ W	20%
R-206	28182	180K ohms	½ W	10%
R-210	28161	1800 ohms	½ W	10%
R-211	28155	560 ohms	½ W	10%
R-212	28155	560 ohms	½ W	10%
R-213	149101	1000 ohms	½ W	20%
R-215	149160	27 ohms	1 W	10%
R-220	149419	3.3 ohms	½ W	20%
R-231	149420	1250 ohms	5 W	10%
R-236	149425	3000 ohms	20 W	10%
R-237	149428	75 ohms	10 W	10%
R-238	28184	270K ohms	½ W	10%
R-239	28184	270K ohms	½ W	10%
R-240	149113	100K ohms	½ W	20%

CHASSIS ASSEMBLY

Description	S-C Part No.
Base — Chassis	104068
Bracket — Chassis Mounting Foot	105391
Bracket — TV Tuner Shaft	105335
Bracket — Horizontal Size Coil Mounting	105352
Bracket — High Voltage Shield Support	105356
Bracket — Deflection Yoke Housing	105395
Clamp — Tube — 5U4G	113045
Clamp — Electrolytic Capacitor	113046
Clamp — H. V. Cage Cover	113050
Connector — Anode	165036
Cover — H. V. Cage	119046
Fuse Holder — Line Fuse	128008
Grommet — ⅜" x 17/64"	131012
Insulation — Polyethelene — 7" x 3"	133103
Insulation — 1B3 Socket Assy. Mounting	133109
Nut — # 8-32 Steel	525152
Nut — Palnut # 6-32	163156
Nut — Palnut # ⅜-32	163160
Nut — Wing Nut	163175
Phonojack	34421
Receptacle — AC	165008
Rivet — .088" x ⅛"	530003
Rivet — .125" x 9/64"	530034
Rivet — .125" x 7/32"	530044
Rivet — .125" x 5/32"	530036
Screw — # 6 x ¼" Self Tapping	530103
Screw — # 8 x ¼" Self Tapping	530105
Sems Unit — # 6-32 x ¼"	35744
Sems Unit — # 8-32 x ¼"	35746
Shield — Tube — V-5, V-6, V-7, V-8, V-12	151126
Shield — Tube — V-9	151139
Shield Assembly — H.V. Cage, R. H.	151144
Shield Assembly — H.V. Cage — Lower Chassis	151145

Description	S-C Part No.
Socket — Tube — V-10, V-17, V-19, V-18, V-14, V-23, V-24, V-21	152014
Socket — Speaker	152033
Socket — Tube — V-13, V-15	152056
Socket — Tube — V-5, V-6, V-7, V-8, V-12	152095
Socket — Tube — V-12, V-25	152098
Socket — Tube — V-9	152103
Socket Assembly — Tube — V-22	152111
Socket Assembly — Kinescope	152120
Spring — Kinescope-Ground	156043
Spring Assembly — 2nd Anode Lead	156060
Switch — Phono	158037
Terminal — Ground Lug	22436
Terminal Board — 1 lug	160033
Terminal Board—2 lug—mounting—2 lug	160044
Terminal Board—2 lug—ground	160084
Terminal Board—1 lug—ground—1 lug	160087
Terminal Board—2 lug—ground—5 lug	160059
Terminal Board—1 lug—ground—3 lug	160097
Terminal Board—ground—2 lug—ground—4 lug	160081
Terminal Board—3 lug—ground—3 lug	160094
Terminal Board Assembly—Component mounting	160082
Terminal Plate—V-5, V-6, V-7, V-8, V-12 Socket Mounting	142157
Tuning Unit	164020
Socket Terminal Plate—V-9, V-15, V-13—Socket Mounting	142158
Washer — 1/7" x 15/64"	22938
Washer — #8 Screw	525542
Washer — Lock — # 8 Screw	526045
Centering Device	114117
Beam Bender	114645
Support	133119
Insulation	133120
Fastening Unit	163197

TUBES

Circuit Symbol	S-C Part No.	Description
V-1	162160	6BQ7 RF Amplifier
V-2	162118	6J6 VHF Converter
V-5	162012	6BA6 1st Video I.F. Amp.
V-6	162012	6BA6 2nd Video I.F. Amp.
V-7	162092	6CB6 3rd Video I.F. Amp.
V-8	162092	6CB6 4th Video I.F. Amp.
V-9	162171	6U8 1st Video Amp. & 1st Audio I.F. Amp.
V-10	162101	6W6-GT Video Amplifier
V-11	162169	21FP4A Kinescope
V-12	162032	6AU6 Ratio Detector Driver
V-13	162077	6T8 Ratio Detector
V-14	162136	6V6-GT Audio Output
V-15	162042	12AU7 1st Sync Clipper and Noise Amp.
V-16	162032	6AU6 Keyed AGC
V-17	162018	6SN7 Phase Inverter & 2nd Sync Clipper
V-18	162173	6S4 Vert. Output Amp.
V-19	162018	6SN7 Horiz. Osc.
V-20	162174	6BQ6 Horiz. Amplifier
V-21	162161	6AX4 Damper
V-22	162029	1B3 H.V. Rectifier
V-23	162107	5U4-G Rectifier (L.V.)
V-24	162107	5U4-G Rectifier (L.V.)
V-25	162022	6AL5 Phase Detector
V-29	162030	6C4 Vertical Osc.

COILS

Circuit Symbol	S-C Part No.	Description
L-4	171223	Mixer Plate Choke
L-5	171224	Cathode Choke
L-6	171220	Filament Choke
L-7	171237	Filament Choke
L-8	171221	I.F. Coil Assembly
L-9	114741	Deflection Yoke
L-10	114400	1st Sound I.F.
L-14	114657	Peaking Coil
L-15	114415	4.5 Mc. Trap Coil
L-16	161030	Filter Choke
L-19	114069	Horiz. Osc. Coil
L-20	114084	Horiz. Linearity Coil
L-21	114693	Choke 2.2 UH
L-22	114640	Peaking Coil
L-25	114745	Peaking Coil
L-26	114083	Horizontal Size Coil
L-27	114637	Peaking Coil

TRANSFORMERS

Circuit Symbol	S-C Part No.	Description
T-2	114119	Conv. Sec. I.F. Transformer
T-3	114397	1st Video I.F.
T-4	114397	2nd Video I.F.
T-5	114406	3rd Video I.F.
T-6	114407	4th Video I.F.
T-7	114401	2nd Audio I.F. Transformer
T-8	114375	Ratio Detector
T-9	161042	Horiz. Output
T-10	161255	Vertical Output
T-11	161254	Vertical Blocking
T-12	161256	Audio Output Transformer CM & CDM
T-12	161259	Audio Output Transformer TX
T-13	161443	Power Transformer
T-15	171402-483	VHF & UHF Ant. & Osc. Transformers

Note: Last two digits of part number indicate the channel number of strip.

MISCELLANEOUS

Circuit Symbol	S-C Part No.	Description
M-1	128200	Circuit Network
M-2	128000	Fuse ¼ Amp.
M-3	158037	Slide Switch
M-5	128007	Fuse 5 Amps.
M-6	162157	1N64 Crystal Diode

MODELS 521 SERIES RECEIVERS — Service Notes Corrections.

1. The Tube Voltage Chart in the 521 Series Service Notes incorrectly lists the screen voltage at pin 4 of the 6BQ6 Horizontal Amplifier tube as 465 volts. This should be corrected to read 165 volts.

2. Resistor R-50, 5600 ohm, 1/2 watt, is listed in the parts list as S.C. No. 28165. The parts list should be corrected to read R-50, S.C. No. 28167, 5600 ohms, 1/2 watt, 10%.

MODELS 521 SERIES RECEIVERS — Vertical Output Transformer.

A few vertical output transformers (S.C. # 161255) used in the production of the 521 series receivers hod the center tap and B + Lead colors reversed. Normally the B + Lead is red and the center tap lead is green.

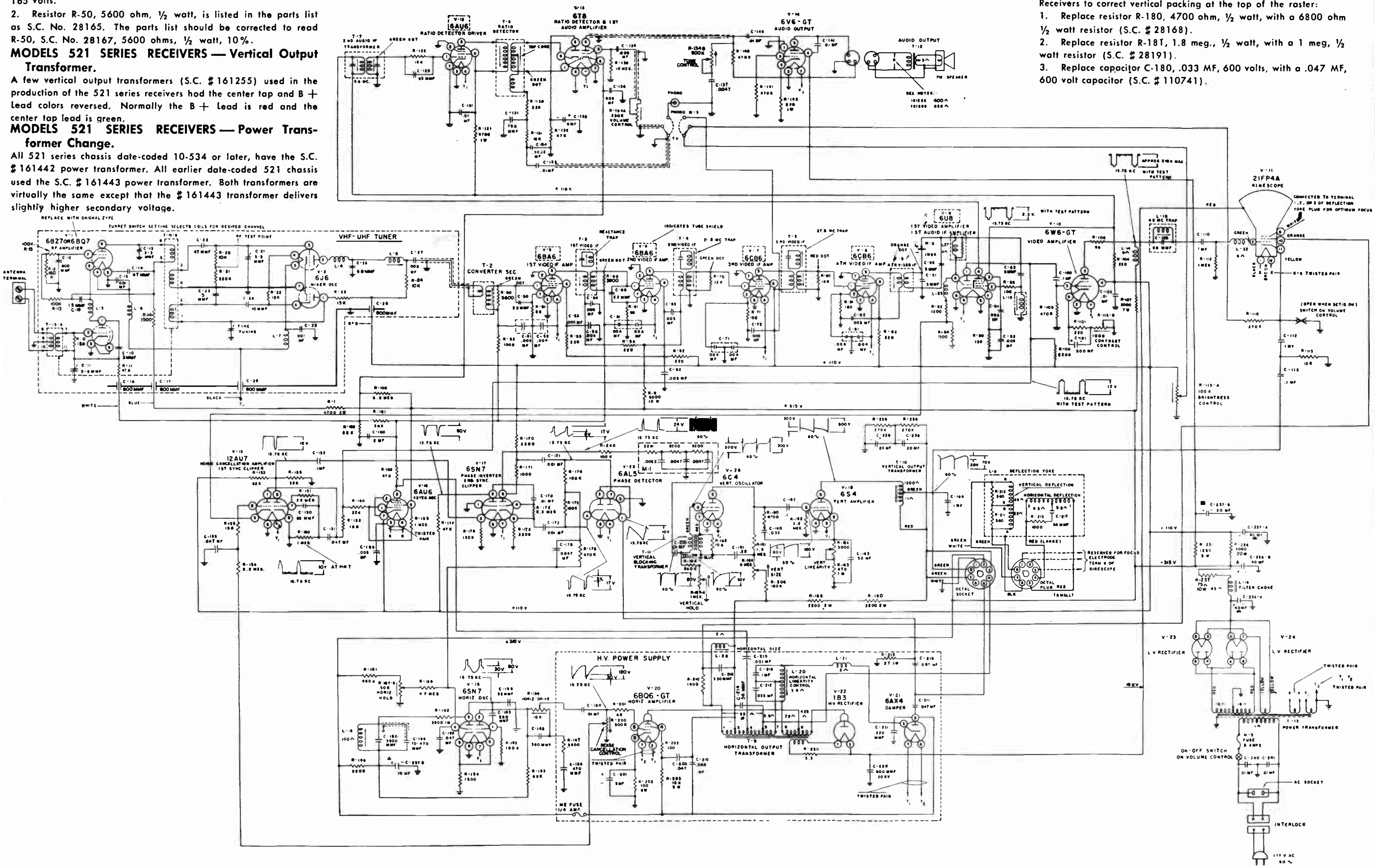
MODELS 521 SERIES RECEIVERS — Power Transformer Change.

All 521 series chassis date-coded 10-534 or later, have the S.C. # 161442 power transformer. All earlier date-coded 521 chassis used the S.C. # 161443 power transformer. Both transformers are virtually the same except that the # 161443 transformer delivers slightly higher secondary voltage.

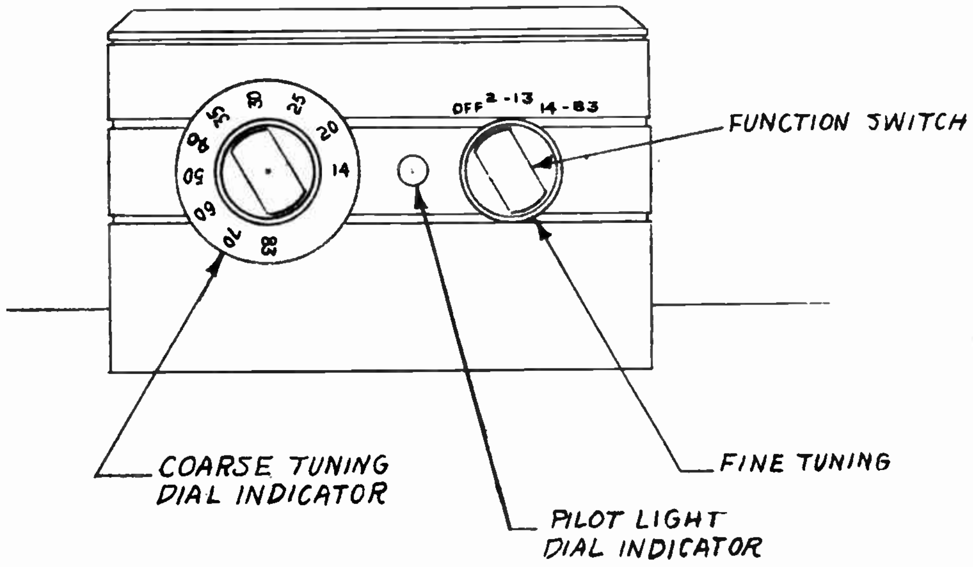
MODELS 521 SERIES RECEIVERS — Vertical Packing.

The following circuit revisions may be made in the 521 Series Receivers to correct vertical packing at the top of the raster:

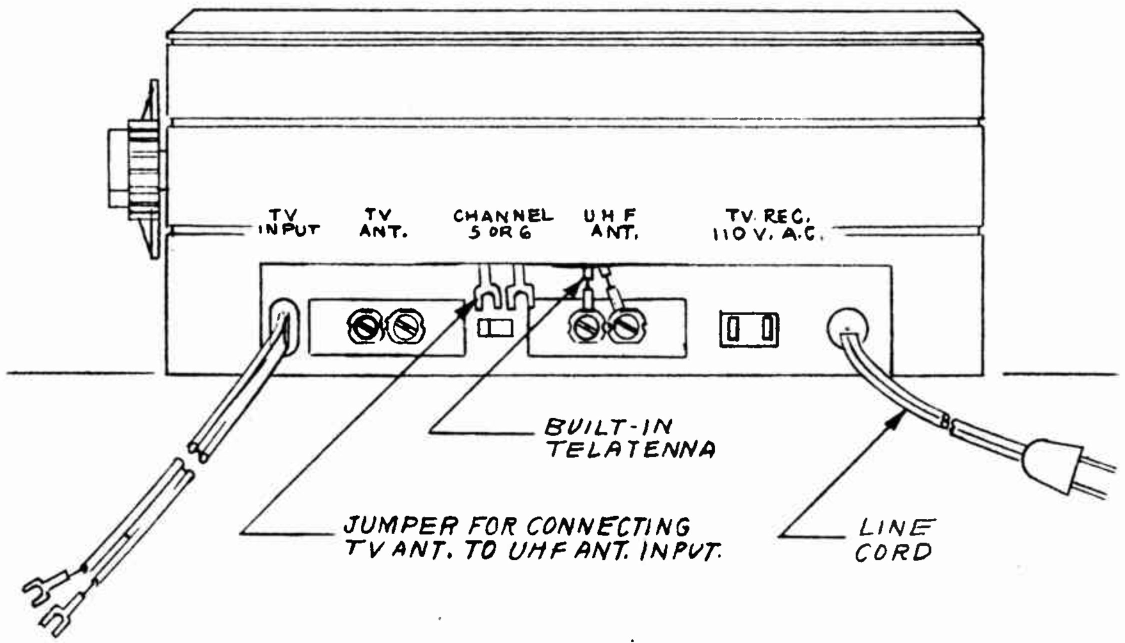
1. Replace resistor R-180, 4700 ohm, 1/2 watt, with a 6800 ohm 1/2 watt resistor (S.C. # 28168).
2. Replace resistor R-18T, 1.8 meg., 1/2 watt, with a 1 meg, 1/2 watt resistor (S.C. # 28191).
3. Replace capacitor C-180, .033 MF, 600 volts, with a .047 MF, 600 volt capacitor (S.C. # 110741).



Number of Operating Controls (Located on right side of cabinet):



Service Controls: At Rear of Chassis



Dial Type: Calibrated Coarse Tuning Knob.

Antenna: Built-in Stromberg Carlson Telatenna.
Provision also available to employ present Channel 2-13 antenna for UHF reception or, if necessary, a separate UHF antenna.

Voltage Rating: 117 Volts, 60 Cycles, 20 Watts.

Tuning Range: Continuous tuning covering all proposed UHF Channels 14-83 (470 mc. to 890 mc.)

Number of Tubes: 2 tubes plus 1 selenium power rectifier and 1 germanium crystal mixer.

Tubes and Functions:

Tube	Function
1 - 6AF4	UHF Local Oscillator
1 - 6BQ7	Lo-Noise Cascode Pre-Amplifier
1 - 1N72 Crystal	UHF Mixer
1 - Selenium Rectifier	Power Rectifier

The UHF tuner is housed in a sturdy wood cabinet. This cabinet is covered with a rich gold embossed simulated leather.

Padded mounting feet are used to prevent the UHF tuner from marring any polished cabinet top.

CIRCUITS:

A. The converter uses a double-superheterodyne circuit employing Channel 5 or
C Channel 6 of an existing television receiver as the first IF. Instant selection of either 5 or 6 is provided by a simple slide switch in the rear of the converter.

B. All proposed UHF channels can be received. (Channel 14-83, 470 mc. -890mc.)

C. Low-noise 1N72 crystal is used as a UHF mixer.

D. Very low-noise cascode IF pre-amplifier used in converter to provide excellent fringe area reception.

E. Three possible UHF antenna combinations are provided for varying reception conditions:
(1) Built-in Telatenna for strong signal areas.
(2) Built-in facilities for using present Channel 2-13 antenna for medium signal areas.
(3) Facilities for using separate high-gain UHF antenna for fringe area reception.

F. AC power supply using power transformer eliminates the possibilities of short circuits, hum, and shock hazard between converter and television receiver.

G. Easy customer installation.

H. Jewel-box cabinet styling harmonizes with all receivers.

I. Function switch on converter turns on television receiver and selects Channel 2-13 or Channel 14-83.

J. Pilot light which also acts as channel marker.

K. After the initial warm-up period has passed, the user can switch from VHF to UHF at will and at no time encounter any delay in operation.

The cabinet is styled in green leatherette and proportioned to harmonize with the television receiver. The outside cabinet dimensions are approximately 8" wide, 4" high and 6" deep. The unit weighs 5 1/2 pounds and has a power consumption of about 10 watts. Channel indicator, vernier tuning knob and function switch are all located on the right side of the unit.

GENERAL

The converter is designed for connection between the antenna lead-in and the television receiver. Receiver power is obtained from a socket in the rear of the converter chassis which in turn is plugged directly into the AC line. A single three-position function switch provides the following combinations:

1. Off - Both converter and television receiver.
2. VHF - AC power to television receiver on, VHF antenna directily connected to television input. Converter heaters on.
3. UHF - AC power to both units and choice of separate UHF antenna, VHF antenna or built-in cabinet antenna depending upon signal conditions.

The converter can be operated by tuning the receiver to either of two channels (#5 or 6) which is not occupied by a local station. This choice is made during installation by a switch in the rear of the converter chassis, which shifts the first IF tuning 6 mc. The bandwidth of the UHF pre-selector circuits is 12 mc., allowing this shift without loss of tracking. Selection of this IF is a compromise providing a mean between the extremes of the high noise factor in the high channels and the undesirable spurious responses of the very low frequency channels. The rapid attenuation with increasing distance of UHF signals which might cause spurious interference appears to make it practical to use a lower IF than would otherwise be possible.

RF PRE-SELECTION AND MIXER CIRCUITS

In both the antenna and mixer circuits, the tuning elements are inductively padded in order to secure the proper tuning range. This is accomplished by extending both conductors of the antenna section and one of the conductors of the mixer section about 7/8" external to thetuning unit. The balanced 300 ohm antenna is coupled into the extended section of the tuning unit with the aid of an ungrounded loop.

A combination of high-side capacitive and inductive coupling is used between the antenna and mixer tuned circuits in order to provide a bandwidth of 12 mc. throughout the UHF band.

The 1N72 crystal mixer is coupled capacitively to the mixer tuned circuit, and an RF choke provides a D. C. return path for this circuit.

Grounding of the low frequency ends of the antenna and mixer lines and the grounding of the rotor of the antenna section eliminate spurious suckouts within the band.

LOCAL OSCILLATOR

The oscillator design utilized a miniaturized version of the 6F4. A series trimmer condenser effectively sets the low frequency end of the tuning range, and a series trimmer inductance consisting of the grid and plate leads control the total range and the high frequency limit. This adjustment consists of varying the separation between these leads. "Holes" in the frequency range are avoided by using resistors rather than chokes in the plate and grid return circuits and by using dissimilar chokes in the cathode and ungrounded heater leads. A special UHF low-capacity tube socket is used to prevent bypassing the tuned circuit by the grid-plate socket capacity.

Tube "warm-up" drift, although somewhat a function of individual tubes, is nearly complete within one minute after application of plate voltage, with heaters previously warmed up. This initialadrift is minimized by using the lowest plate power which will give reliable performance.

Complete shielding of the oscillator tube, circuit, and tuner section together with low oscillator plate voltage reduces oscillator radiation.

CASCODE PRE-AMPLIFIER

The conversion loss of the crystal mixer is overcome by the addition of allow noise amplifier. A "cascode" circuit using a 6BQ7 tube was selected because of its inherently good noise factor. This circuit consists of a neutralized grounded cathode input section followed by a grounded grid stage.

Both the input grid and the interstage circuit of the cascode are adjusted to have bandwidths of about 12 mc., i.e., to include both Channels #5 and 6. The plate of the output triode, however, is adjusted for a 6 mc. bandwidth and a switch is provided on the rear of the chassis to select the desired channel.

Economy is achieved by the use of a simple slide switch as a channel selector which varies the value of capacity in series with the plus B end of the plate tuning coil.

Balanced output is used in order to eliminate interference pickup on the lead coupling the converter to the VHF receiver.

POWER SUPPLY

Since most television receivers have no provision for supplying power to an external converter, this converter is self-powered. Both chassis height limitations and power economy dictated the use of a selenium rectifier in preference to a vacuum tube, but a power transformer is used to eliminate hum interference between converter and television receiver.

AC power for the television receiver can be secured from the rear of the chassis, and a switch on the converter energizes both units and selects either VHF or UHF reception.

The heaters of the converter tubes remain on for both types of reception with a plus B switch being provided in the ground return of the power transformer secondary. Switching in this manner allows instantaneous change from VHF to UHF and also removes the voltage from the converter filter condensers during VHF operation.

ANTENNA SELECTION

Input terminals for both VHF and UHF antennas are provided on the rear of the chassis. When receiving signals on Channels #2 to 13, the VHF antenna is directly connected to the television receiver input. For reception on Channels #14 to 84, a separate UHF antenna may be used, or if signal conditions allow, either the VHF antenna or a built-in cabinet antenna may be selected.

CAPACITORS

Symbol No.	Part No.	Description
C1	110052	.5-3mmf, trimmer
C2	110686	1.0mmf 500V, ceramic
C3	110439	2.2mmf 500V, ceramic
C4	110440	3.3mmf 550V
C5	110052	.5-3mmf, trimmer
C6	110812	1000mmf, feed-thru
C7	110812	1000mmf, feed-thru
C8	111100	100-100mf, electrolytic
C9	171158	1000mmf 500V, ceramic
C10	110486	33mmf 400V, ceramic
C11	110813	5.6mmf, special
C12	110599	1000mmf, 350V, ceramic
C13	171158	1000mmf, 500V, ceramic
C14	110455	470mmf 350V
C15	171158	1000mmf 500V, ceramic
C16		See detail on 112141
C17		Detail No. 6 on 112141
C18		Detail No. 7 on 112141
C19	110440	3.3mmf 500V, ceramic
C20	110686	1.0mmf 500V, ceramic
C21	110686	1.0mmf 500V, ceramic
C22	110686	1.0mmf 500V, ceramic
C23	110686	1.0mmf 500V, ceramic
C24	110437	.68mmf 500V, ceramic

RESISTORS

R1	149102	1500Ω 1/2w
R2	149101	1000Ω 1/2w
R3	28178	56KΩ 10% 1/2w
R4		Part of L-7 220Ω 1/2w
R5	149027	22Ω 10% 2w
R6	149173	560Ω 1w 10%
R8	28155	560Ω 10% 1/2w
R9	28146	100Ω 10% 1/2w

NOTES:

Chassis assembly 112141
Tube voltage chart S-98039
General assembly 100326
Mfg. J spec. 2067

1. C-18 to be altered in length when adjusting capacity in circuit.
2. L-1 formed from detail 10 shown on 112141. Adjust loop for circuit inductance.
3. L-2 formed from detail 9 shown on 112141. Adjust loop for circuit inductance.
4. L-13 formed from long ribbon lead of C-11. Adjust loop for circuit inductance.

COILS

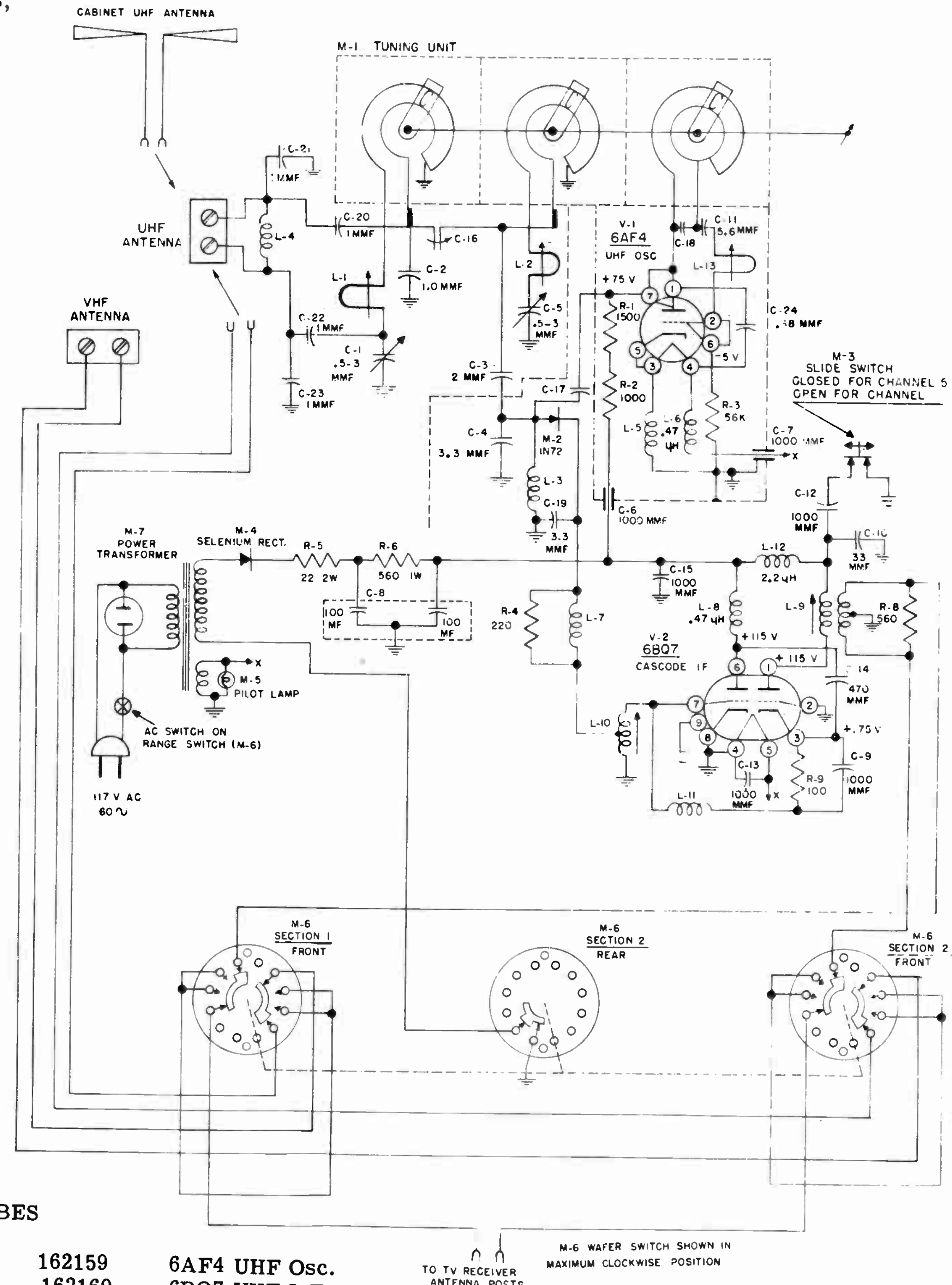
L1		See detail 10 on 112141
L2		See detail 9 on 112141
L3	114733	Coil assem. (R.F.)
L4	114736	Ant. coupling coil
L5	114731	R.F. filament choke
L6	114729	R.F. filament choke
L7	114734	R.F. coil assem.
L8	114729	R.F. choke
L9	114115	Cascode output
L10	114114	Cascode input
L11	114735	Neutralizing coil
L12	114693	Choke 2.2 µh
L13		Ribbon lead of C11

MISCELLANEOUS

M1	164018	Tuning unit
M2	162164	1N72 crystal diode
M3	158040	Slide switch
M4	162158	Selenium rect.
M5	29956	Pilot lamp
M6	158047	Range switch
M7	161432	Power transformer

TUBES

V1	162159	6AF4 UHF Osc.
V2	162160	6BQ7 VHF I. F.



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Models 175B, BU, L, LU, M & MU

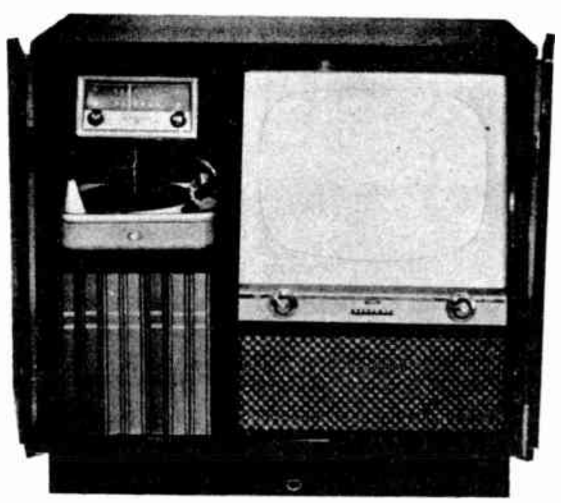
Models 120B, BU, M & MU

Models 126B, BU, L, LU, M & MU

Models 172K, KU, M & MU

Models 177B, BU, M & MU

Models 176B, BU, L, LU, M & MU



Models 178B, BU, M & MU

GENERAL DESCRIPTION

All models described in this bulletin are direct viewing television receivers reproducing the picture on a 21 inch black faced, electromagnetically deflected, cylindrical picture tube.

Chassis 1-508-1 and 1-510-1 provide reception of the twelve commercial VHF television channels, 2 through 13 inclusive. In these chassis provisions are made for the simple addition of a UHF tuner, thus permitting reception of channels 14 through 83 of the UHF band. Cabinet versions, including these chassis, show a single alphabetical suffix after the body number. (For example: 176M.)

Chassis 1-508-2 and 1-510-2 include the UHF tuner and thus provide reception of VHF channels 2 through 13 and UHF channels 14 through 83 inclusive. Cabinet versions including these chassis, show a double alphabetical suffix after the body number. (For example: 176MU.)

Combination models incorporating these chassis also include a 1-603-1 radio chassis which provides reception of standard and frequency modulation broadcast bands and a 1-312-3 three speed automatic record changer.

Representative cabinet styling of the receivers is illustrated in the photographs. Models not shown in the illustrations differ from those shown only in cabinet finish. HaloLight is featured exclusively on models incorporating the 1-508-1 and 1-508-2 chassis.

NOTE: For convenience in servicing, separate schematics are furnished with their respective Repair Parts List and Wave Forms appearing on the reverse side.

SPECIFICATIONS

Frequency Range

Television

Channels 2 to 6 (all chassis)	54 to 88 Mc.
Channels 7 to 13 (all chassis)	174 to 216 Mc.
Channels 14 to 83 (chassis 1-508-2, 1-510-2)	470 to 890 Mc.
Picture IF Carrier	45.75 Mc.
Sound IF Carrier	4.5 Mc. and 41.25 Mc.

Standard Broadcast (AM 540 to 1600 Kc.
IF Carrier 455 Kc.
(Models 178B, 178BU, 178M, 178MU)

Frequency Modulation (FM) 88 to 108 Mc.
IF Carrier 10.7 Mc.
(Models 178B, 178BU, 178M, 178MU)

Power Supply 105 to 128 Volts, 60 Cycle AC

Power Consumption in Watts

120B, 120M, 126B, 126L, 126M	235 Watts
120BU, 126LU, 120MU, 126BU, 126MU	240 Watts
172K, 172M, 175B, 175L, 175M, 176B, 176L, 176M, 177B, 177M	255 Watts

Power Consumption (Cont.)

172KU, 172MU, 175BU, 175LU, 175MU, 176BU, 176LU, 176MU, 177BU, 177MU	260 Watts
178B, 178BU, 178M, 178MU	350 Watts

Loudspeaker

120B, 120BU, 120M, 120MU, 175B, 175BU, 175L, 175LU, 175M, 175MU	6-1/2" P.M.
126B, 126BU, 126L, 126LU, 126M, 126MU	8" P.M.
172K, 172KU, 172M, 172MU, 176B, 176BU, 176L, 176LU, 176M, 176MU, 177B, 177BU, 177M, 177MU	10" P.M.
178B, 178BU, 178M, 178MU	12" P.M.

Antenna Input Impedance

These receivers have an antenna input impedance of 300 ohms and are shipped to the customer with the built-in antenna connected. This must be disconnected if it is desired to attach an external antenna.

SYLVANIA TUBE COMPLEMENT
(includes rectifiers and picture tube)

Chassis 1-508-1 & 1-508-2

Symbol	Function	Type
V1	R. F. Amplifier	6BK7
V2	Oscillator-Mixer	6J6
V3	1st Video IF Amplifier	6CB6
V4	2nd Video IF Amplifier	6CB6
V5	3rd Video IF Amplifier	6CB6
V6	4th Video IF Amplifier	6CB6
	Video Detector	D440 Crystal
V7	Video Amplifier	12BY7

(Tube Complement Cont.)

V8	Sound IF Amplifier	6AU6
V9	Sound IF Limiter	6AU6
V10	Ratio Detector	6AL5
V11	1st Audio Amplifier & Tuner AGC Clamp	6AV6
V12	Audio Output	6V6GT
V13	AGC Amplifier	6AU6
V14	Sync Separator & AGC Rect.	12AX7
V15	Sync Amplifier & Clipper	12AU7
V16	Vertical Oscillator	6C4
V17	Vertical Output	6AH4GT
V18	Horizontal Discriminator	6AL5
V19	Horizontal Control	6CB6
V20	Horizontal Oscillator & Discharge	12AU7
V21	Horizontal Regulator	40A1
V22	Horizontal Output	6BQ6GT
V23	Damper	6V3
V24	H. V. Rectifier	1B3GT
V25	H. V. Rectifier	1B3GT
V26	L. V. Rectifier	5U4G
V27	L. V. Rectifier	5U4G
V28	Picture Tube	21EP4A
	UHF Oscillator (1-508-2 only)	6J6
	UHF Oscillator Doubler (1-508-2 only)	1N82 Crystal
	UHF Mixer (1-508-2 only)	N82 Crystal

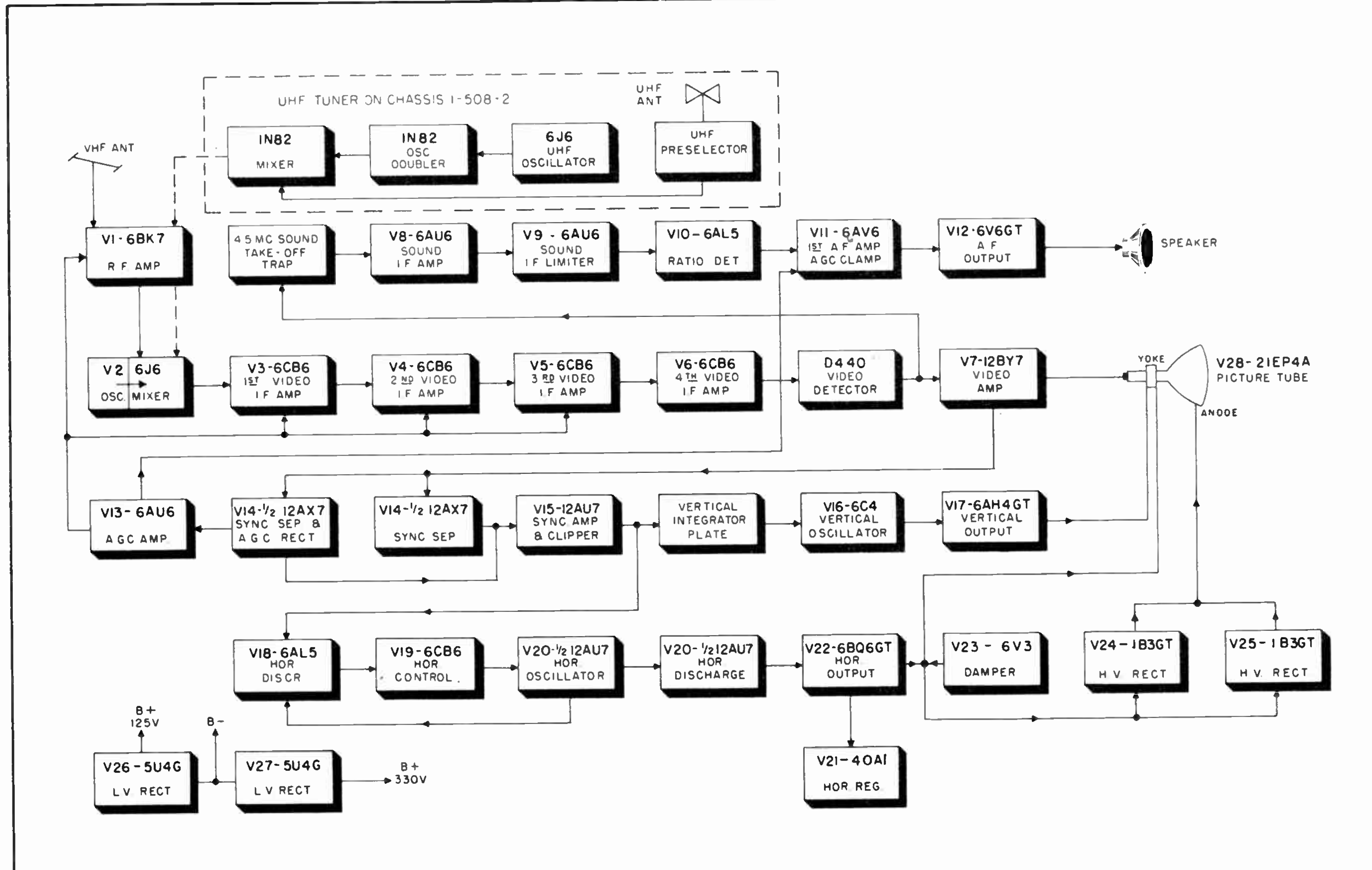


FIGURE 1 - BLOCK DIAGRAM FOR 1-508-1 AND 1-508-2 TV CHASSIS

Chassis 510-1 & 510-2

Symbol	Function	Type	Symbol	Function	Type
			V12	Sync Separator & Amplifier	12AU7
			V13	Vertical Oscillator	6C4
V1	R. F. Amplifier	6BC5	V14	Vertical Output	6AH4GT
V2	Oscillator-Mixer	6X8	V15	Horizontal Phase Detector	6AL5
V3	1st Video IF Amplifier	6CB6	V16	Horizontal Oscillator	6SN7GT
V4	2nd Video IF Amplifier	6CB6	V17	Horizontal Output	6BQ6GT
V5	3rd Video IF Amplifier	6CB6	V18	Horizontal Regulator	40A1
V6	4th Video IF Amplifier	6CB6	V19	Damper	6V3
	Video Detector	D440 Crystal	V20	High Voltage Rectifier	1B3GT
V7	Video Amplifier	12BY7	V21	High Voltage Rectifier	1B3GT
V8	Sound IF Amplifier	6AU6	V22	Low Voltage Rectifier	5U4G
V9	Sound Ratio Detector	6AL5	V23	Picture Tube	21EP4A
V10	1st Audio Amplifier	6AV6		UHF Oscillator (1-510-2 only)	6AF4
V11	Audio Output	6Y6G		UHF Mixer (1-510-2 only)	6AN4

Chassis 1-603-1

V35	RF Amplifier - FM	6AU6	V39	FM Discriminator	6AL5
V36	Oscillator-Mixer	6BE6	V40	AM Detector, AVC & AF	6AT6
V37	1st IF Amplifier - AM, FM	6BA6	V41	Audio Output	6W6GT
V38	2nd IF Amplifier - FM	6AU6	V42	Rectifier	7Z4

CAUTION NOTICE

THE HIGH VOLTAGE LEAD TO THE PICTURE TUBE HAS A POTENTIAL OF 17,000 VOLTS. PRECAUTIONS SHOULD BE OBSERVED WHEN THE CHASSIS IS REMOVED FROM THE CABINET FOR SERVICE PURPOSES.

DO NOT OPERATE THE RECEIVER WITH THE H V COVER REMOVED.

ALWAYS USE SAFETY GOGGLES AND GLOVES IF IT IS NECESSARY TO REMOVE THE PICTURE TUBE.

CIRCUIT DESCRIPTION

The Sylvania television receiver chassis 1-508-1 and 1-508-2 operate with twenty-three and twenty-four tubes, respectively. In addition, there are two high voltage rectifiers, two low voltage rectifiers, one germanium diode and one picture tube on each chassis. Television chassis 1-510-1 and 1-510-2 operate with nineteen and twenty-one tubes, respectively. On these chassis, two high voltage rectifiers, one low voltage rectifier, one germanium diode and one picture tube are included. The operating controls on the front panel of the television receiver on all models are the Volume and Tone controls, with the 1-508-1 and 1-508-2 chassis featuring a Brightness control and the 1-510-1 and 1-510-2 a Contrast control on the front panel also. On models with HaloLight*, the control for this is also incorporated on the front panel. The remaining controls which are seldom adjusted are located on the rear of the chassis.

Combination models include an AM-FM radio which operates with seven tubes plus one rectifier. The AM-FM radio controls are ON-OFF-Volume, Tone, AM-FM radio tuning and function switch, all located on the front panel.

All models include a broad-band VHF built-in antenna. In addition, a di-fan type UHF antenna is built-in for all 1-508-2 and 1-510-2 models. Combination models also include built-in AM and FM antennas. These antennas will provide satisfactory reception in most strong signal locations.

For convenience in tracing circuits, Figure 1 shows a block diagram of chassis 1-508-1 and 1-508-2, and Figure 2 shows a block diagram of chassis 1-510-1 and 1-510-2. The antennas are connected to the inputs of the UHF and the VHF tuners. The VHF tuner selects the desired television channel by switch tuning and a fine tuning control. The output of the VHF tuner is at intermediate frequency and of sufficient bandwidth to pass both picture and sound carriers of the desired channel. When the UHF tuner is in operation, the oscillator in the VHF tuner becomes inoperative and the output of the UHF tuner, which is also at intermediate frequency, is fed through the R. F. and bandpass stages of the VHF tuner.

On the 1-508-2 and 1-510-2 chassis, the UHF tuners, while differing physically, function essentially the same. The desired UHF channel is preselected by continuous tuning. The incoming signal is combined with a local oscillator signal. A crystal in the 1-508-2 and a triode in the 1-510-2 function as mixers.

*Sylvania Trade-Mark

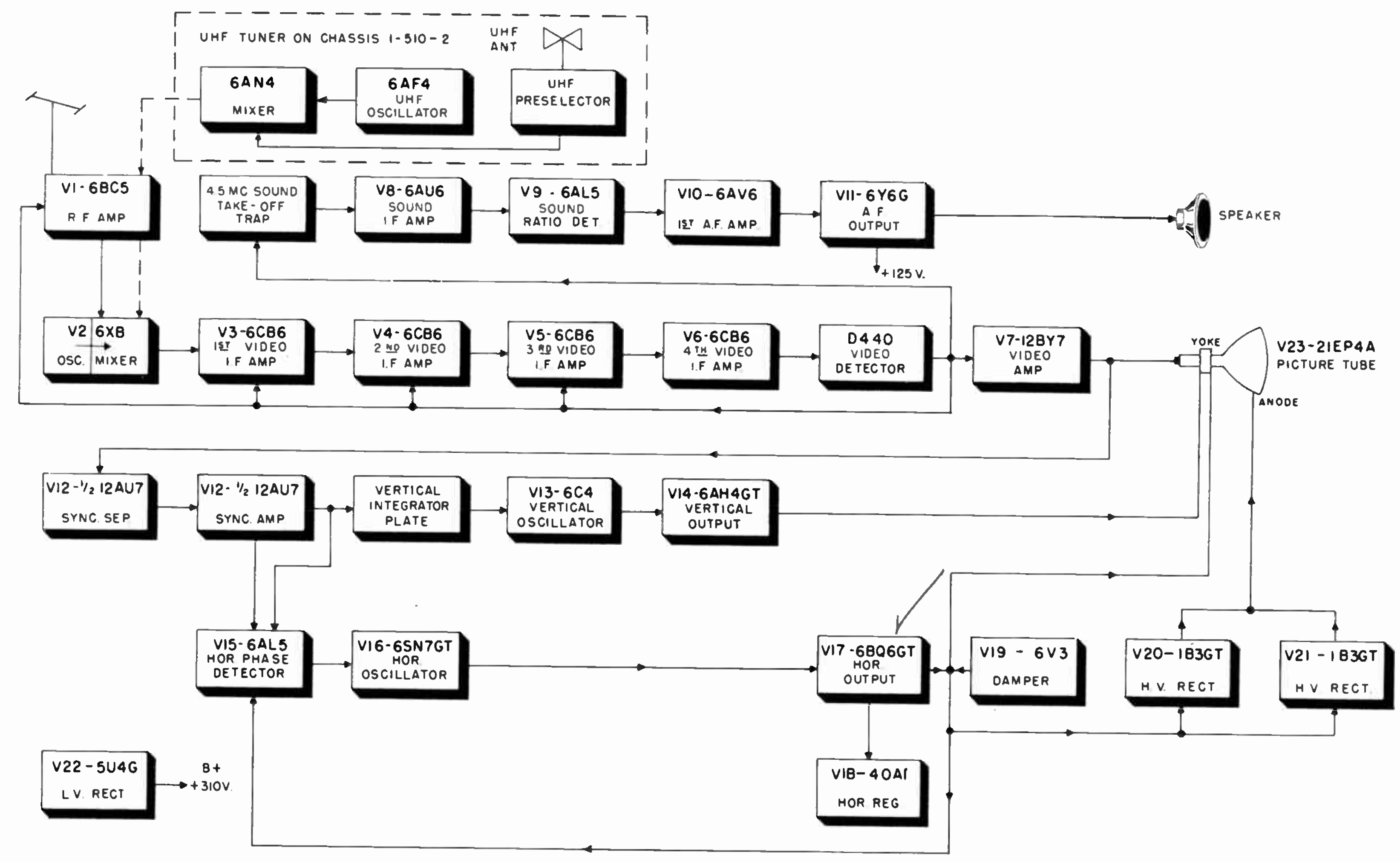


FIGURE 2 - BLOCK DIAGRAM FOR 1-510-1 AND 1-510-2 TV CHASSIS

The output of each tuner is fed to the VHF tuner on the respective chassis.

The output of the VHF tuner is applied to the Video IF Amplifier consisting of 4 stagger-tuned stages. The adjacent channel carriers and co-sound carrier are attenuated by this IF Amplifier.

The amplified signal at the output of the Video IF Amplifier is fed to a crystal diode functioning as the Video Detector.

The video signal out of the Video Detector is amplified by a single stage and applied to the Picture Tube.

On the 1-510-1 and 1-510-2, an automatic gain control voltage is obtained from the Video Detector load resistor and applied to the RF and IF Amplifiers.

On the 1-508-1 and 1-508-2, automatic gain control is obtained from the AGC Rectifier, amplified by the AGC Amplifier and applied to the R. F. and IF Amplifiers. The Tuner AGC Clamp prevents the tuner AGC line from going positive under weak signal conditions.

The sync pulses are separated from the video signal, amplified, and clipped and then fed to the Horizontal Discriminator and Vertical Integrator Plate on the 1-508-1 and 1-508-2. On the 1-510-1 and 1-510-2 chassis, the sync pulses are separated from the video signal, amplified and fed to the Horizontal Phase Detector and Vertical Integrator Plate. The vertical sync information from the Vertical Integrator Plate is applied to the Vertical Oscillator to keep this oscillator in step with the vertical sync pulses from the station. The Vertical Oscillator produces a peaked saw-tooth wave which is applied to the Vertical Output stage energizing the vertical deflection coils.

On chassis 1-508-1 and 1-508-2, horizontal sync information from the Sync Clipper is supplied to the Horizontal Discriminator. A voltage from the Horizontal Oscillator is also supplied to the Horizontal Discriminator. The output of the Horizontal Discriminator is then applied to the Horizontal Control tube which functions to hold the Horizontal Oscillator in synchronism with the incoming horizontal sync pulses.

On the 1-510-1 and 1-510-2 chassis, a pair of horizontal sync pulses of opposite polarity from the Sync Amplifier are supplied to the

Horizontal Phase Detector. Also supplied to the Horizontal Phase Detector is a saw-tooth voltage coupled back from the horizontal output circuit. The Horizontal Phase Detector compares the phase of the two pulses with the phase of the saw-tooth voltage and produces a resultant correction voltage. This correction voltage is applied to the Horizontal Oscillator and functions to hold its multivibrator circuit in synchronism with the incoming transmitted signal.

On the 1-510-2 and 1-510-2, the Horizontal Oscillator produces a peaked saw-tooth wave which is applied to the Horizontal Output tube. Part of the saw-tooth component of this wave causes current to flow in the plate circuit of the Horizontal Output tube. For the 1-508-1 and 1-508-2, the Horizontal Oscillator actuates the Horizontal Discharge tube through the Horizontal Ringing Coil producing a peaked saw-tooth wave. Approximately one-half of the saw-tooth component of this wave causes current to flow in the plate circuit of the Horizontal Output tube. On all chassis, this current energizes the horizontal deflection coils through the horizontal scanning transformer to provide the right half of the horizontal scan. During the right half of the scan a small current is also flowing through the Damper tube. At the end of the saw-tooth, the negative pulse component acts on the grid of the Horizontal Output tube to cut off plate current flow. When this occurs, the energy in the horizontal deflection circuit transfers rapidly from the inductive branch of the circuit to the capacitive branch.

The transfer of energy in the horizontal deflection circuit results in a voltage peak of approximately 3,000 volts across the horizontal deflection coils. This voltage is stepped up to approximately 9,000 volts by the turns ratio of the horizontal scanning transformer and is fed to the voltage doubling rectifier circuit to provide approximately 17,000 volts for the Picture Tube H.V. anode.

The Damper tube does not conduct during the high voltage pulse period because of the polarity of the pulse. During this pulse period, when the energy transfers from the inductive branch of the horizontal deflection circuit to the capacitive branch and back again to the inductive branch, the electron beam in the Picture Tube is moved rapidly from the right to the left edge of the raster to accomplish retrace.

At the completion of retrace, energy again flows out of the inductive branch of the circuit. The Horizontal Output tube is still cut off during this time and a high current flows through the Damper tube. This current decreases to zero in a linear manner, to provide the left half of the scan. As the current approaches zero, the Horizontal Output tube again begins to conduct and the entire cycle is repeated.

The Horizontal Regulator tube protects the Horizontal Output tube from excessive plate current due to line voltage fluctuations.

SPECIAL INSTALLATION AND SERVICE INSTRUCTIONS

Chassis Handling Precaution

Whenever handling a 1-508-1, 1-508-2, 1-510-1 or 1-510-2 chassis exercise extreme caution at all times. The chassis should be carried by means of the handle provided on the rear tube mounting bracket and the front center lower lip of the picture tube. When carrying a chassis in this manner care should be observed that the hands are free of dirt and grease to prevent slipping on the smooth surface of the glass.

Alignment of Picture Tube To Mask

(All Models)

Replacement of the chassis after normal servicing should not necessitate alignment of the mask and picture tube. However, if the tube support members have been disturbed as in the case of tube replacement it will be necessary to observe the following procedure. See Figure 3

1. Locate the tube and its associated mounting brackets in their approximate normal position, with the front face of the tube tilted forward about 3 degrees, then tighten the following just enough to permit further adjustment in the cabinet.
   a. Mounting stud nuts on tube holddown strap.
   b. Nuts on holddown strap rods.
   c. Nut on rear mounting bracket rod.
   d. Wing nuts on yoke.
   e. Screws at base of rear mounting bracket, if previously loosened.
2. Carefully slide chassis in cabinet, replace and tighten chassis holddown screws.
3. Replace all knobs and electrical connections. If tuner shaft does not center, loosen tuner rear bracket wing nuts and shift tuner until knobs function freely.
4. By carefully moving the tube in its mountings align the mask and face of the tube so that no space remains between them. Complete the tightening of the mounting assemblies listed in step one, exercising caution when drawing down the holddown strap so that equal tension is applied to each rod. CAUTION: DURING THE ABOVE OPERATIONS CARE SHOULD BE TAKEN AT ALL TIMES TO AVOID PUTTING ANY STRAIN ON NECK OF THE TUBE.
5. Correctly position deflection yoke and adjust ion trap, pin cushion corrector, centering and focus magnets as described.

UHF Tuner

The use of the Ultra-High Frequency band for television broadcasting necessitates a high degree of precision in the manufacture of suitable tuners. This precision manufacture applies expecially to component placement, lead lengths, lead dress, and component size. Thus, the servicing of a UHF tuner results in problems not usually encountered in conventional radio and television receivers. Also, because of the high cost and scarcity of suitable UHF test equipment, the alignment of the UHF tuner presents unusual problems. Therefore, it is recommended that no servicing or alignment of a UHF tuner be attempted in the field. Sylvania stocks a number of UHF tuners which are available to Sylvania set distributors on an exchange basis.

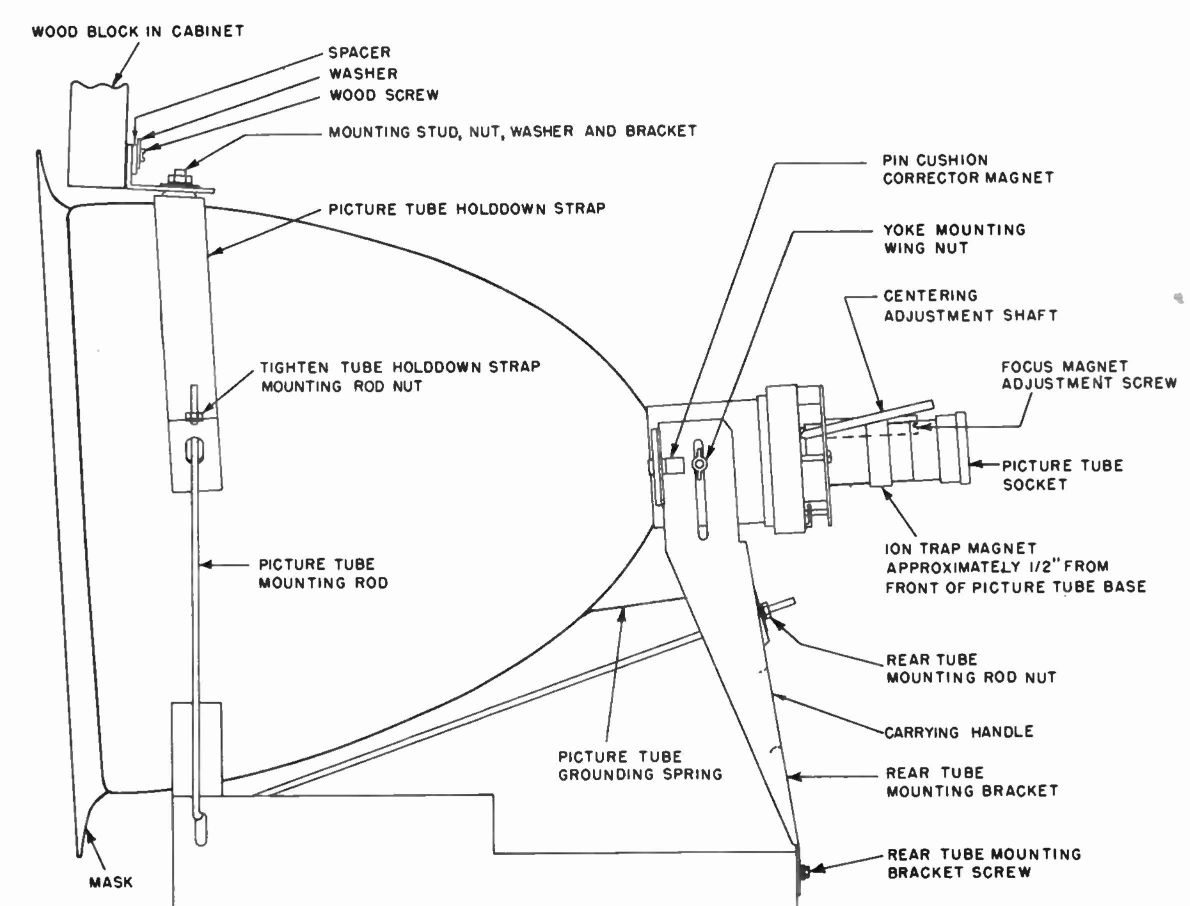


FIGURE 3 - PICTURE TUBE INSTALLATION (ALL CHASSIS)

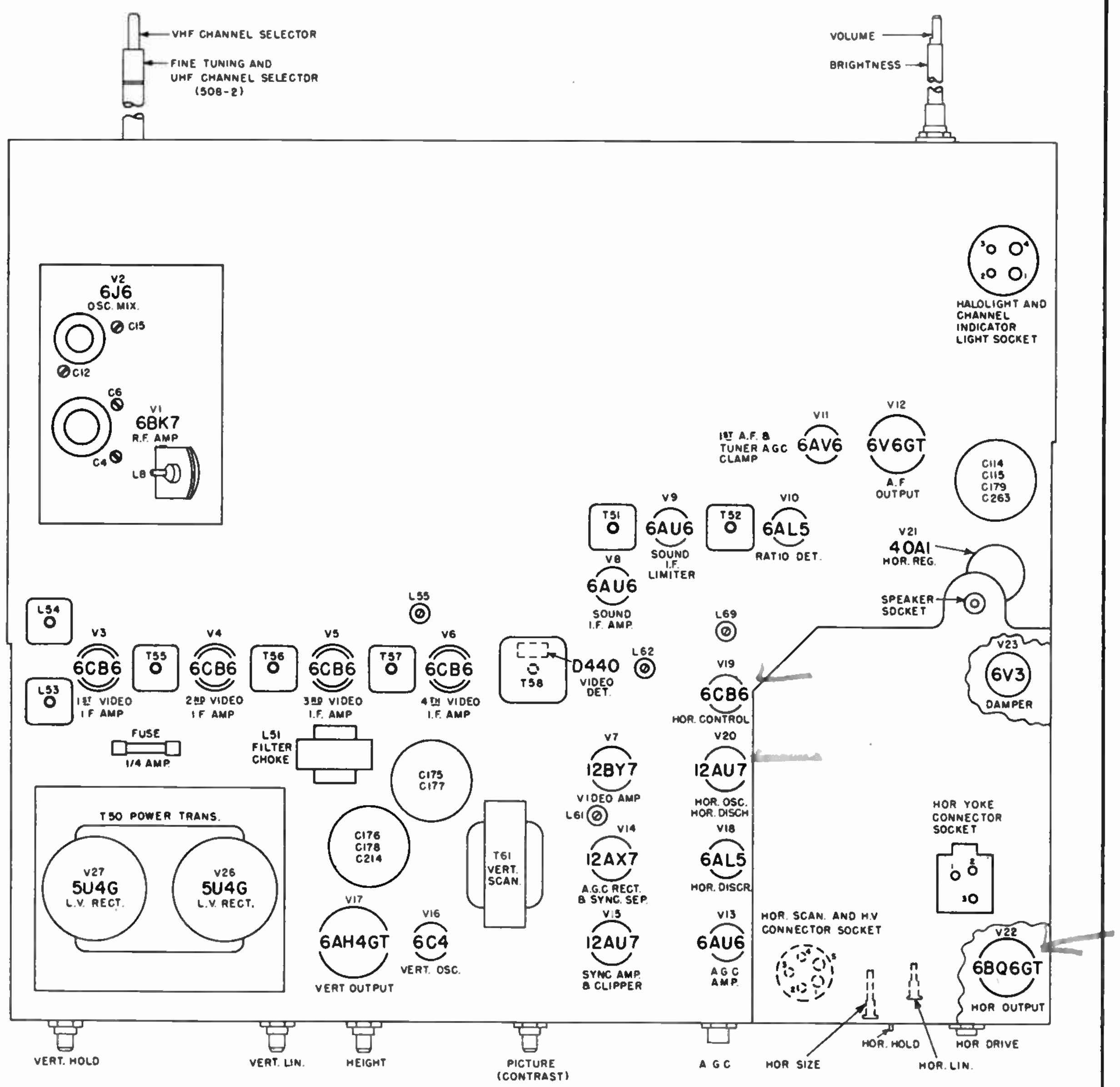


FIGURE 4 - TOP LAYOUT FOR 1-508-1, 1-508-2 TV CHASSIS

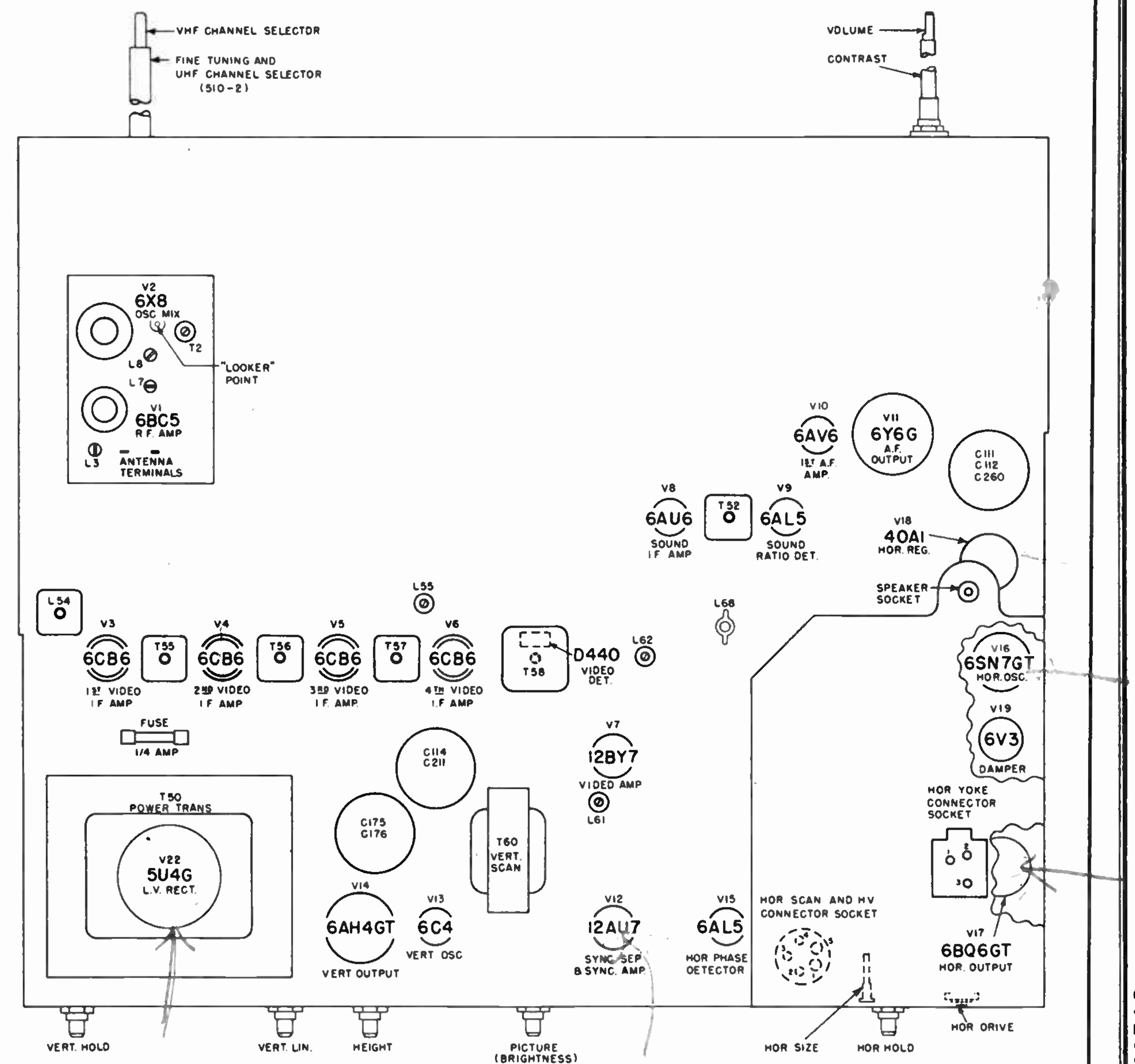


FIGURE 5 - TOP LAYOUT FOR 1-510-1, 1-510-2 TV CHASSIS

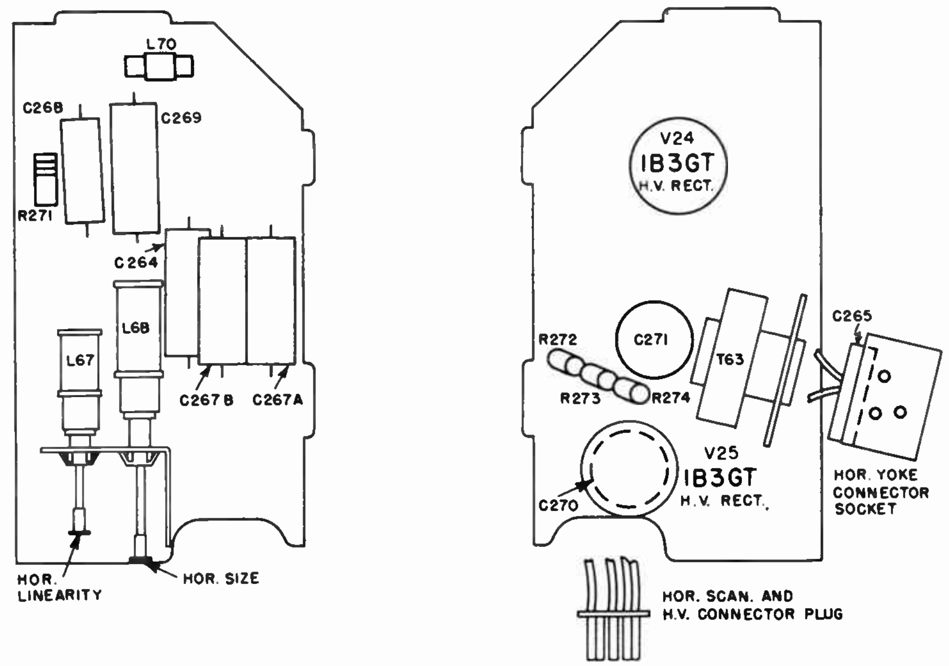


FIGURE 6 - HIGH VOLTAGE ASSEMBLY 1-508-1, 1-508-2

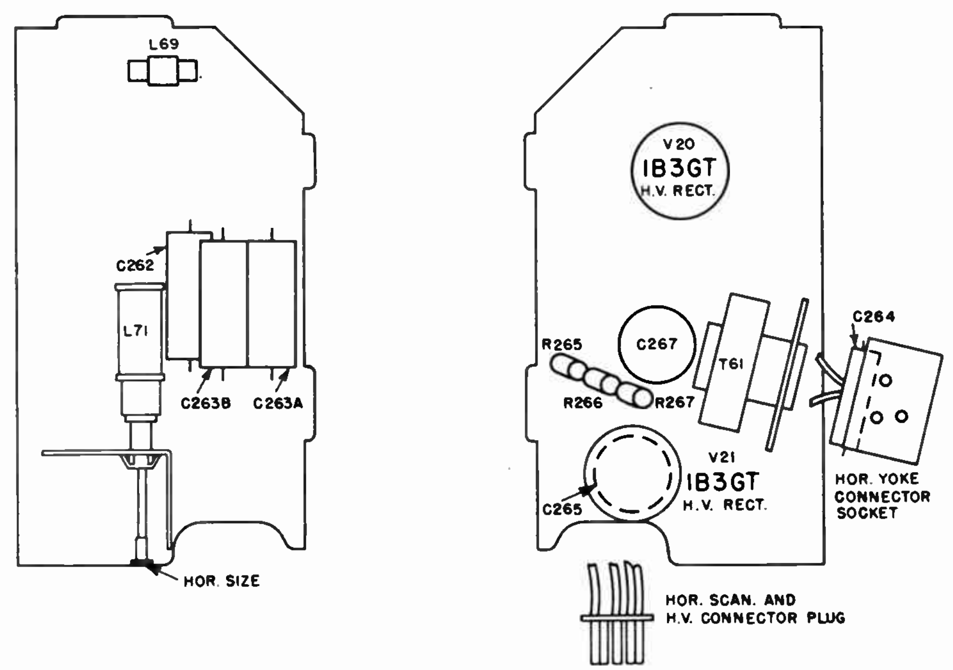


FIGURE 7 - HIGH VOLTAGE ASSEMBLY 1-510-1, 1-510-2

Preset Controls Adjustments

All preset controls except the Horizontal Frequency adjustment 1-510-1, 1-510-2, are located at the rear of the receiver and are readily available without removing the interlock cover. However, the Horizontal Frequency adjustment (L68) necessitates the removal of this cover for adjustment. See top layout for 1-510-1, 1-510-2 TV chassis on page 5 for physical location.

AGC (1-508-1, 1-508-2 only) - See "AGC control Adjustment". (Page 9.)

Horizontal Hold (1-508-1, 1-508-2 only) - See "Check of Horizontal AFC Operation".(Page 16)

Horizontal Hold and Horizontal Frequency (1-510-1, 1-510-2 only) - With a normal air signal rotate the Horizontal Hold control to mid-position. Adjust the Horizontal Frequency lug (L68 on top of chassis) until the picture locks in.

Horizontal Drive (1-508-1, 1-508-2 only) - Turn the Horizontal Drive control clockwise as far as possible without crowding the center of the picture or causing a vertical white line to appear.

Horizontal Drive (1-510-1, 1-510-2 only) - Turn the Horizontal Drive trimmer counterclockwise as far as possible without crowding the center of the picture or causing a vertical white line to appear.

Picture (Contrast: 1-508-1, 1-508-2) - Adjust to obtain best contrast with a good picture or test pattern.

Picture (Brightness: 1-510-1, 1-510-2) - Adjust to obtain most pleasing picture.

Vertical Linearity and Height (All models) - Adjust the Height control until the picture fills the screen vertically. Adjust the Vertical Linearity control until the pattern is symmetrical from top to bottom. The Vertical Linearity and Height controls are interdependent and adjustment of one will necessitate readjustment of the other.

Vertical Hold (All models) - Rotate the Vertical Hold control until the pattern is slowly moving downward. Back off on the control to a point just beyond where the picture moves upward and locks in.

Horizontal Size (All models) - Adjust the Horizontal Size slug until the picture fills the mask horizontally. This adjustment must be made with the mask and bezel in place and chassis in position in cabinet.

Horizontal Linearity (1-508-1, 1-508-2 only) - Adjust the Horizontal Linearity control until the picture is symmetrical left to right.

The Horizontal Drive Adjustment of all models should be rechecked after adjusting Horizontal Size or Linearity controls or both.

Note: On the 1-508-1 and 1-508-2 models, the Horizontal Linearity control and the Pincushion Corrector Magnets are interdependent. If the Pincushion Corrector Magnets have been moved, it is recommended that they be repositioned according to instructions under "Adjustment of Ion Trap Magnet, Focus Magnet, Centering Shutter and Pincushion Corrector Magnets" (page 8) before proceeding with adjustment of Horizontal Linearity control.

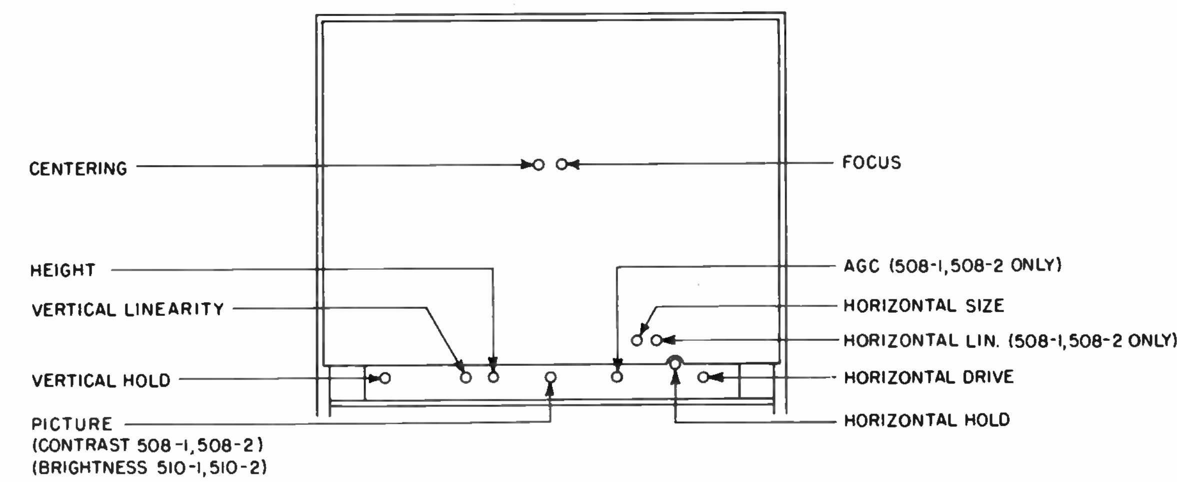


FIGURE 8 - REAR PANEL CONTROLS

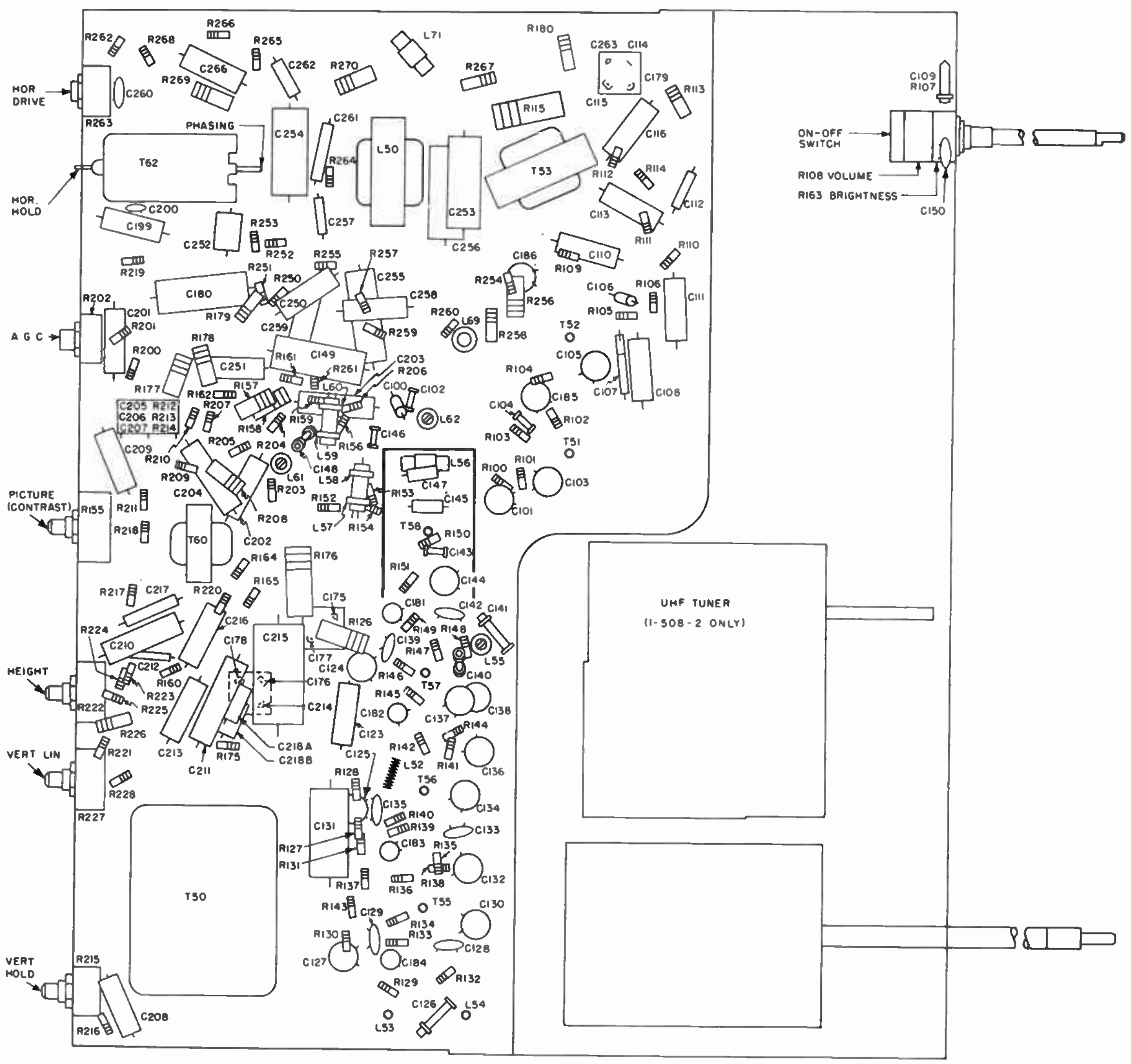


FIGURE 9 - BOTTOM LAYOUT FOR 1-508-1, 1-508-2 CHASSIS

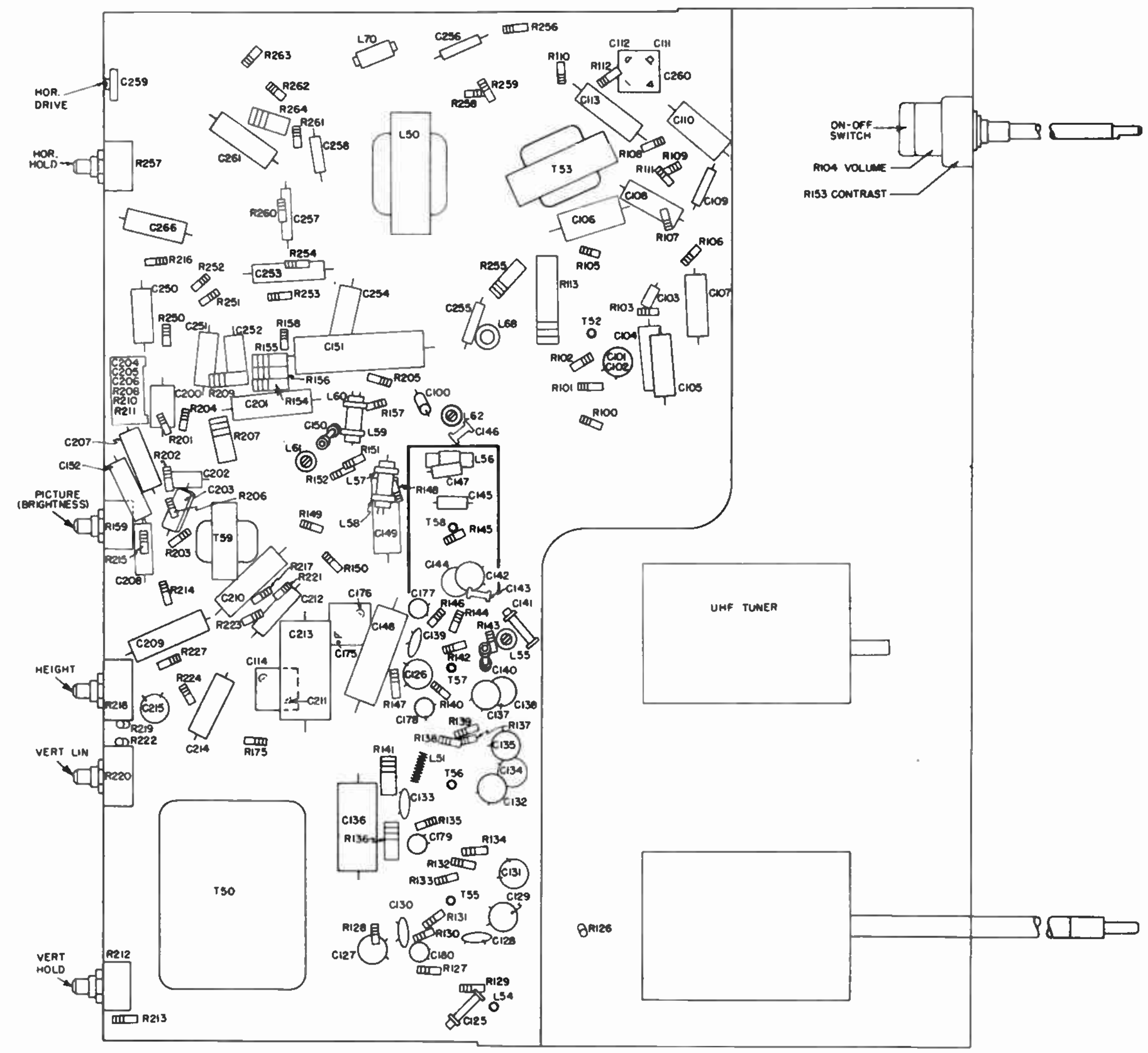


FIGURE 10 - BOTTOM LAYOUT FOR 1-510-1, 1-510-2 CHASSIS

Adjustment of Ion Trap Magnet, Focus Magnet, Centering Shutter, and Pincushion Corrector Magnets

The Ion Trap Magnet, Focus Magnet, and Centering Shutter adjustments are interdependent so all three must be checked at the same time.

Before making any adjustments, the function of each magnet should be noted.

The Ion Trap Magnet is used to obtain maximum brilliance of the raster or picture and should be adjusted to obtain maximum brilliance as described below.

The Focus Magnet is used to obtain correct focus of the picture.

The Centering Shutter is an integral part of the focus magnet assembly. Its function is to position the picture, both horizontally and vertically.

Before making any adjustments, check that the deflection yoke is positioned so that it is pressing against the flare of the picture tube. To ensure this, loosen the wing-fasteners located at each side of the yoke and push the yoke as far forward as it will go. If the picture is not square with the screen mask, rotate the yoke and then tighten the wing-fasteners.

Next, check that the Focus Magnet is firmly held in position.

When adjusting the focus of the receiver it is to be noted that optimum focus of the picture is not necessarily attained when either the vertical or horizontal definition is adjusted to maximum. Optimum focus is frequently a compromise between these two settings. It is highly desirable, therefore, that a transmitted picture, containing both vertical and horizontal lines, be available for correct focusing of the receiver.

Make sure the Ion Trap Magnet is correctly adjusted before proceeding with the receiver focus adjustment.

Adjust the Picture control (Contrast) on the 1-508-1 and 1-508-2 chassis and the Contrast control on the 1-510-1 and 1-510-2 chassis to approximately 3/4 maximum position. Position the Ion Trap Magnet on the picture tube neck approximately 1/2" forward of the tube base. Set the Brightness control on the 1-508-1 and 1-508-2 chassis and the Picture control (Brightness) on the 1-510-1 and 1-510-2 chassis to maximum.

Do not operate receiver longer than necessary with brightness at maximum. Rotate and move the Ion Trap Magnet backwards and forwards on picture tube neck until picture or raster is visible on screen. Continue adjustment of trap until greatest possible brilliance is obtained. Adjust brightness to less than normal and readjust Ion Trap Magnet for maximum brilliance.

The adjustment screw on the Focus Magnet should now be turned to obtain a picture which is focused - this preliminary adjustment will not be necessary if the picture is already in focus.

If the picture is not centered on the screen, properly position it by adjustment of the Centering Shutter, and with brightness at a low level, check to see that no corner cutting exists.

Adjust contrast and brightness controls to obtain a normal picture and then adjust Ion Trap Magnet to obtain the highest possible brilliance level. The focus should now be adjusted to obtain the best horizontal and vertical focus, as previously mentioned.

Note:

(a) In some cases optimum adjustment of the Ion Trap Magnet may be obtained with the magnet located on either side of the diagonal slot in the picture tube electrode assembly; it is permissible for the magnet to be located either between the slot and the tube base or over the slot. Do not locate magnet between slot and Focus Magnet.

(b) Optimum adjustment of the Ion Trap Magnet may be obtained irrespective of which way around it is placed on the picture tube neck. It should be noted, however, that in some cases one way around will result in a better focus characteristic than the other.

(c) Some receivers may have the facility to allow the Focus Magnet to be rotated. On such receivers a better focus characteristic may be obtained by rotating the Focus Magnet to a different angular position and again adjusting the Focus screw. This will require a check of the centering shutter to make sure that there is no corner cutting with the picture properly centered on the screen. Recheck the Ion Trap Magnet as previously mentioned with brightness and contrast adjustments set for a normal picture. Carefully adjust the focus for the best possible compromise between horizontal and vertical focus. Since these adjustments are interdependent, recheck all three until the best possible picture is obtained.

The Pincushion Corrector Magnets eliminate curvature of the edges of the raster. Move the Centering Shaft on the Focus Magnet so that one edge of the raster is approximately 1/2" from the edge of the picture tube screen. Adjust the Pincushion Corrector Magnet on the corresponding side of the picture tube until the edge of the raster is a straight vertical line. Repeat this procedure for the other edge, using the magnet on the opposite side of the picture tube. Move the picture up and then down the screen to check the top and bottom edges. The Pincushion Corrector Magnets should be adjusted for the best overall compromise.

ADJUSTMENT OF HORIZONTAL AFC CIRCUIT

(1-508-1, 1-508-2)

Check of Operation

The operation of the AFC circuit should be checked as follows:

A. Tune the receiver to a channel on which no signal is received and return to the original channel. The picture should immediately fall into synchronization.

B. Switch off the power to the receiver for about five minutes and then switch back on. Picture should immediately fall into synchronization.

C. Check for correct phasing of Horizontal AFC Circuit by noting that there is approximately 1/4" of blanking visible on the right hand edge of the picture. It will be necessary to turn the Picture (Contrast) control towards minimum and readjust the Brightness Control to see the blanking.

NOTE: Before making check "C" above, be sure the Horizontal Drive control is correctly adjusted. Refer to "Preset Controls Adjustments," page 6. If the receiver passes the above checks, no adjustments to the Horizontal AFC Circuit need be made.

If the receiver cannot pass checks "A," "B," or "C" the adjustment of the Horizontal Hold control as noted under "Horizontal Hold Adjustment" should be made.

Horizontal Hold Adjustment

A. Tune in a station and adjust the Channel Selector for best picture quality. Adjust the Picture Contrast and Brightness controls for normal picture.

B. Remove V18 - 6AL5 - Horizontal Discriminator tube.

C. Turn the Horizontal Hold control until the picture moves back and forth across the screen with blanking bar vertical.

D. Replace the Horizontal Discriminator tube and repeat A, B, and C under "Check of Operation" above.

E. If receiver still will not pass these checks, it will be necessary to proceed with "Phase Adjustment".

Phase Adjustment

A. Turn the core in Ringing Coil - L69 - all the way out (counterclockwise). Short out the 4,700 ohm horizontal charge circuit peaking resistor - R264.

With the horizontal size coil set for approximately the correct picture width, and with the horizontal linearity coil adjusted for best linearity, rotate the Horizontal Drive control fully counterclockwise. Slowly turn the drive control clockwise until crowding is visible in the center of the picture. Now carefully turn the control back (counterclockwise) just enough to remove the crowding or vertical lines in the picture or pattern.

NOTE: Do not operate the receiver with the Horizontal Drive control maladjusted.

B. Remove the Horizontal Discriminator tube V18 - 6AL5 from its socket.

C. Carefully turn the horizontal hold (frequency adjustment) screw top of Horizontal Discriminator Transformer - T62 until the picture moves back and forth across the screen with the blanking bar vertical.

D. Replace the 6AL5 in its socket.

E. Adjust the phase adjustment screw bottom of Horizontal Discriminator Transformer - T62 until approximately 1/4" of "blanking" is visible on the right-hand edge of the picture. In order to see the "blanking" it will be necessary to readjust the Brightness Control and turn the Picture (Contrast) control towards minimum.

F. Check the "free-running" of the horizontal oscillator as described under paragraphs "B," "C," and "D," and, if necessary, readjust the frequency adjustment screw on top of Horizontal Discriminator Transformer - T62.

G. Make a final check of the phasing as described in paragraph "E" above. It is important that both the "free-running" and the phasing are correct.

H. Remove the short from across the 4,700 ohm resistor R264 and readjust the Horizontal Drive control as described in "A". Turn the core in the Horizontal Ringing Coil - L69 - clockwise until approximately 1/4" of "blanking" is again visible on the right-hand edge of the picture.

I. Before the horizontal synchronization circuit is adjusted to the final position, it will be necessary to check the operation as follows:

Slowly turn the oscillator frequency adjustment screw (top of transformer T62) in either direction until the picture suddenly falls out of synchronization as indicated by the presence of a number of diagonal bars. Slowly turn the adjustment screw so as to decrease the number of bars and note the total number of bars visible just before the picture again falls into synchronization. The last number of bars visible must not be less than three, or more than six. The two half-bars at the top and bottom of the screen are counted as only one bar. In order to get an accurate indication of the minimum number of bars obtainable, the adjustment screw must be turned very slowly and carefully once the number of bars has been reduced to six or seven. Turn the adjustment screw in the opposite direction until the picture suddenly falls out of synchronization in the opposite direction and repeat the foregoing procedure. Again, not less than three or more than six bars must be visible just before the picture falls into synchronization.

J. After checking the operation as in "I," it is necessary to repeat the procedure described in paragraphs "B," "C," and "D."

K. Remove the signal by tuning to a "free" channel, then retuning to the original channel. The picture should immediately fall into synchronization.

L. Switch off the power to the receiver for about five minutes and then switch receiver on and check that the picture pulls into synchronization.

AGC CONTROL ADJUSTMENT

The AGC control should be readjusted according to the following procedure each time the receiver is connected to a different antenna installation.

1. Connect a good antenna installation to the receiver.

2. Set Picture (Contrast) control to approximately 7/8 of maximum position.

3. Tune receiver to the strongest station available in area.

4. Turn AGC control fully clockwise so that picture is "blacked" out.

5. Retard control to a point where the picture reappears and does not tear or fall out of synchronization as the fine tuning control is rocked through the picture.

6. If, when the AGC control is finally adjusted, the picture has too much contrast, reduce the contrast with the Picture (contrast) control. DO NOT use the AGC control as a contrast control.

7. Turn Volume control to normal level. Intercarrier buzz should be negligible as the Fine Tuning control is rocked near the correct tuning point. (Note: Intercarrier buzz is merely a reference for correct adjustment of the AGC control and only a slight touch up should be necessary. If much adjustment is required to remove intercarrier buzz, the sound section is maladjusted and requires realignment.)

Note: The intent of the AGC control adjustment is to ensure proper AGC voltage consistent with correct synchronizing action and negligible intercarrier buzz. This condition ensures the best possible synchronization under interference conditions, and also the greatest amount of picture contrast.

TEST EQUIPMENT REQUIREMENTS

1. RF Sweep Generator or Generators with frequency range from 4-220 Mc. having sweep width adjustable from 50 Kc. to 10 Mc. with an output of at least 0.1 volt, a marker system, either built-in or external type and flat within $\pm$ 1 Db.

2. Signal Generator or Generators with a frequency range from 4-222 Mc. and an adjustable output of at least 0.1 volt.

3. Sylvania Cathode Ray Oscilloscope type 400 or equivalent capable of passing a 60 cycle square wave.

4. Sylvania Polymeter type 221 or equivalent Vacuum Tube Voltmeter.

5. Sylvania High Voltage Probe Adapter type 225 or equivalent with 0-30 KV DC range.

6. Sylvania Tube Tester type 220 or equivalent capable of testing shorts with proper voltages and performance under dynamic conditions.

ALIGNMENT PROCEDURE

Should any chassis under service require realignment, carry out the alignment procedure in the following listed order.

PREALIGNMENT INSTRUCTIONS - READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT.

1. Lay chassis on side for under chassis adjustments.

2. Ground all test equipment unless otherwise stated.

3. When constructing detector circuit, keep leads short.

4. Use proper insulated alignment tools for powdered iron cores with hex holes or slots and metallic screw drivers for those cores adjusted by brass screws. The sound interstage transformer T51 (chassis 1-508-1 and 1-508-2) may have either hex holes in the cores and thus be adjustable from either top or bottom, or slots which necessitate adjustment of the primary from the bottom of the chassis and the secondary from the top of the chassis.

5. Before attempting alignment, allow the receiver approximately fifteen minutes warm up time.

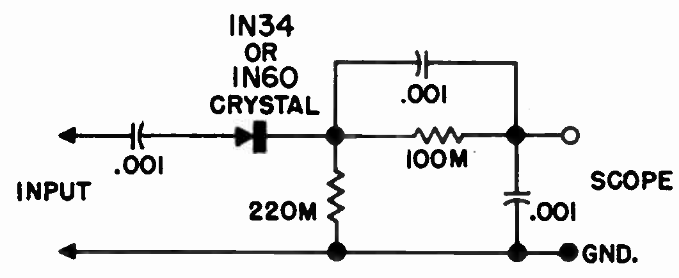


FIGURE 11 - DETECTOR CIRCUIT - IF ALIGNMENT

VIDEO IF ALIGNMENT

STEP	SIGNAL GENERATOR Connection	SIGNAL GENERATOR Freq.	SWEEP GENERATOR Connection	SWEEP GENERATOR Freq.	VTVM CONNECTION	OSCILLOSCOPE CONNECTION	ADJUST	OUTPUT READING	COMMENTS
1	Loosely Coupled through Hole in Cover to Control Grid (Pin 5) of V2-6J6 (1-508-1, -2) or Pin 7 of V2-6X8 (1-510-1, -2)	39.75 Mc. 45.75 Mc. 42.1 Mc.	Pin 5 of 6J6 (1-508-1, -2) Pin 7 of 6X8 (1-510-1, -2)	44.25 Mc. 10 Mc. Sweep	——	Through Detector Circuit (Fig. 11) to Cathode, Pin 2 of V3-6CB6	1-508-1, -2: L53 (Both Cores) L8 (Tuner) L54 (Both Cores) 1-510-1, -2: L54 (Both Cores) T2 (Tuner)	Response Curve shown in Fig. A	L54 controls width of Curve. Set Channel Selector between any two channels. Pin 5 shorted to Pin 6 on V3-6CB6.
2	Repeat Step 1 adjustments until Curve is flat with 42.1 Mc.and 45.75 Mc. Markers on Corners,then remove Short from V3.								
3	To jig Shield on Osc.-Mixer (all Chassis)	41.25 Mc.	——	——	Across Diode Load Res. R152 3.3M (1-508-1, -2) R149 4.7M (1-510-1, -2)	——	L55 4th Video IF Trap	Min.	Set Tuner to free channel. Apply −12V. between junction of R137 and C131 and Chassis on 1.508-1 and -2; −3V. between C136 and Chassis on 1-510-1, -2. Use sufficient output for satisfactory readings.
4	Same as 3	47.25 Mc.	——	——	Same as 3	——	Top Core of T56	Min.	Same as 3
5	Same as 3	41.25 Mc.	——	——	Same as 3	——	Top Core of T55	Min.	Same as 3
6	Same as 3	39.75 Mc.	——	——	Same as 3	——	1-508-1, -2: Top Core L53 1-510-1, -2: Top Core L54	Min.	Same as 3
7	Same as 3	44.0 Mc.	——	——	Same as 3	——	T58	Max.	Same as 3. Reduce Sig. Gen. output to keep VTVM reading between 1 and 2 Volts.
8	Same as 3	42.0 Mc.	——	——	Same as 3	——	T57	Max.	Same as 7
9	Same as 3	45.2 Mc.	——	——	Same as 3	——	T56 (Bot. Core)	Max.	Same as 7
10	Same as 3	43.2 Mc.	——	——	Same as 3	——	T55 (Bot. Core)	Max.	Same as 7
11	Repeat steps 3 to 6 inclusive.								
12	Same as 1	41.25 Mc. 42.1 Mc. 45.75 Mc. 47.25 Mc.	Same as 1	Same as 1	——	Across Diode Load Res. with 33M Resistor in series with hot scope lead	T58, T57 T56 (Bot. Core) and T55 (Bot. Core)	Response Curve shown in Fig. B	Same as 3 Use low signal input and high scope gain.

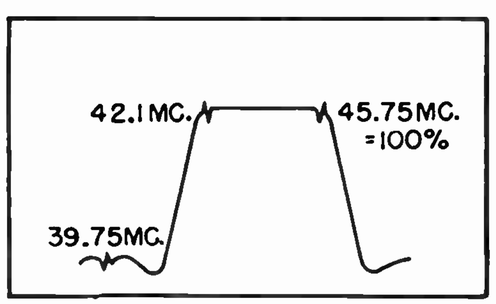


FIG. A

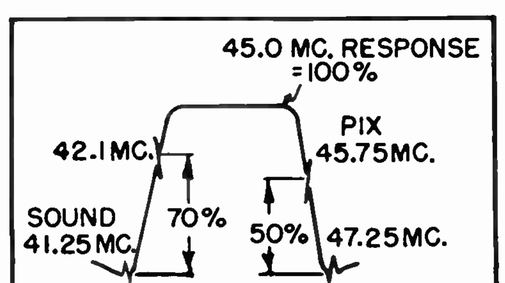


FIG. B

4.5 MC. TRAP ALIGNMENT

STEP	SIGNAL GENERATOR Connection	SIGNAL GENERATOR Freq.	VTVM CONNECTIONS Probe	VTVM CONNECTIONS Ground Lead	ADJUST	OUTPUT READING	COMMENTS
1	To Pin 2 of 12BY7 Video Amplifier (all chassis)	4.5 Mc.	RF Probe connected to Cathode (Pin 11) of Picture Tube	To chassis	L61	Min.	Short Pin 1 of V6-6CB6 4th Video IF Amplifier to Chassis

SOUND ALIGNMENT

STEP	SIGNAL GENERATOR Connection	SIGNAL GENERATOR Freq.	VTVM CONNECTIONS D C Probe	VTVM CONNECTIONS Ground Lead	ADJUST	OUTPUT READING	COMMENTS
1	Through 47M Resistor to junction of C146 and L58 (all chassis)	4.5 Mc.	D C Probe connected to junction of two matched 100M Resistors in series across R109 (1-508-1, -2) R105 (1-510-1, -2)	To junction of C107 and R106 (1-508-1, -2) or C104 and R103 (1-510-1, -2)	T52 Sec.-Pri. T51 Sec.-Pri. (1-508-1, -2 only) and L62	Max.	Pin 1 of V6 shorted to Chassis for steps 1 and 2. Use ungrounded VTVM. Repeat adjustments until maximum is reached. Keep sig. gen. output low to prevent limiter from limiting.
2	Same as 1	4.5 Mc.	Same as 1	Same as 1	T52 Sec. (Top Core)	Zero	Use lowest meter scale set to zero center. At correct setting, a slight turn of core will give either a positive or a negative reading.
3	Remove Test Equipment, Resistors and Short noted in step 1.						

ALTERNATE SOUND ALIGNMENT

This method, using signal from a television station, prevents inaccuracies of test equipment from affecting sound alignment

STEP	SIGNAL SOURCE	VTVM CONNECTIONS D C Probe	VTVM CONNECTIONS Ground Lead	ADJUST	OUTPUT READING	COMMENTS
1	Strong Station Tone modulated as broadcast with test pattern	Same as step 1 above	Same as step 1 above	Same as step 1 above	Max.	Same as step 1 above, except that Pin 1 of V6 is not shorted to chassis.
2	Same as 1	Same as step 2 above	Same as step 2 above	Same as step 2 above	Same as step 2 above	Same as step 2 above.
3	Remove Test Equipment and Resistors.					

RF TUNER ALIGNMENT

(1-508-1, -2)

NOTES ON VHF TUNER ALIGNMENT

Observe the following procedure in making the equipment setup shown in Figure 12.

1. Construct the detector circuit so as to maintain leads as short as possible. Connection of the detector circuit to the 1st IF plate terminal (see Figure 12 for location) should also be made with short leads.

2. Use shielded leads in making the following connections to reduce hum and synchronous voltage pick-up.

   (a) The lead for observation of the RF response from the scope isolating resistor (10,000 ohms located at the tuner "looker" point) to the RF output switch position of the scope switch.

   (b) The connection from the IF detector circuit output to the IF switch position of the scope switch.

   (c) The connection from the sweep generator to the horizontal input of the scope. (Use externally generated sweep instead of internal oscilloscope sweep in order to obtain synchronization).

3. Locate the single pole double throw "scope switch" at the vertical input terminals of the scope. This switching arrangement will permit observation of either the IF response or the overall RF response. The aforementioned positions will be re-

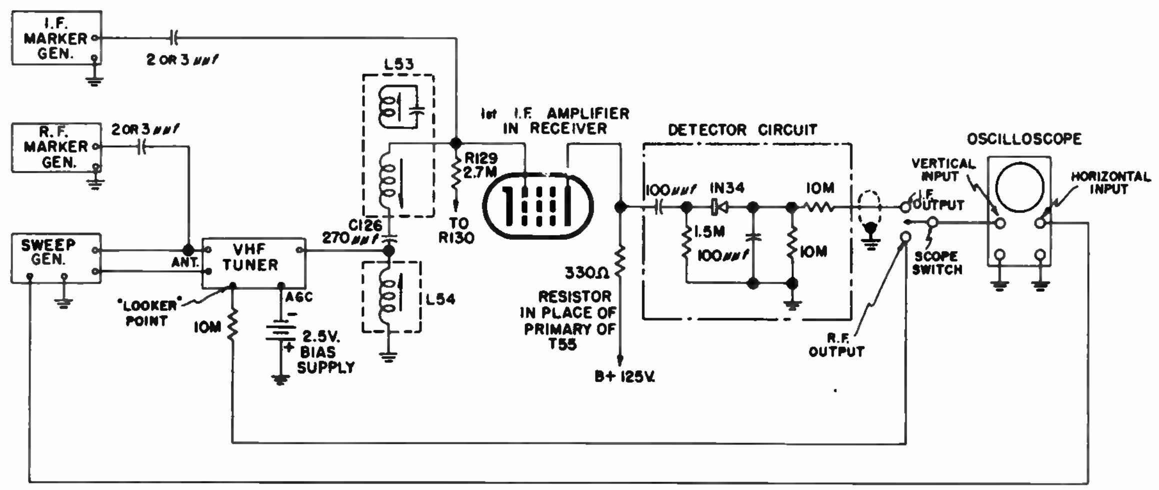


FIGURE 12 - RF TUNER ALIGNMENT SETUP 1-508-1, -2

ferred to in subsequent text as the "IF" and "RF" positions respectively.

4. The marker generator coupling capacitors should be as small a value as possible to prevent any effect on tuner response, but must be large enough to permit easy observation of markers on either the IF response or overall RF response. (Approximately 2 or 3 Mmfd. should be satisfactory in most cases).

5. During tuner alignment, remove the second IF amplifier tube to prevent coupling back from the receiver IF system.

6. In all of the following tests the oscilloscope vertical gain should be as close to maximum gain as possible, consistent with hum and synchronous voltage interference limitations. This precaution will allow the use of low levels from RF sweep Generator and increase the visibility of IF and RF markers.

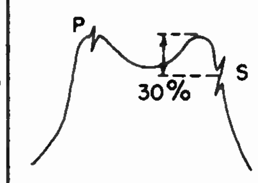
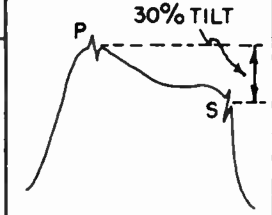
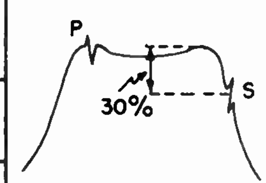
7. Disconnect the primary winding of T55 by unsoldering lead from plate (pin 5) of 6CB6 1st video IF Amp. Connect 330 ohm resistor in place of primary winding.

8. Refer to the VHF Tuner Layout, Figure 15 for location of adjustment points.

VHF TUNER ALIGNMENT — CHASSIS 1-508-1, 1-508-2

STEP	TUNER SET TO CHANNEL	GENERATORS SWEEP (10 Mc.)	IF MARKER	RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
1	4	Channel 4 69 Mc.	—	67.25 Mc. (P) 71.75 Mc. (S)	RF Output	C15, C12, C6, C4, then C9 (wire loop near C12)	see page	Connect 330 Ohm Resistor across Antenna Leads. Passband should be somewhat broader than that with antenna circuit operating, with picture marker inside.

VHF TUNER ALIGNMENT — CHASSIS 1-508-1, 1-508-2

STEP	TUNER SET TO CHANNEL	GENERATORS SWEEP (10 Mc.)	IF MARKER	RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
2	13	Channel 13 213 Mc.	—	211.15 Mc. (P) 215.75 Mc. (S)	Same as 1	C9 and L9 (See "Comments")	 P 30% S	C9 determines passband. If band width is too narrow, move C8 and C10 apart. A valley that is too deep can be flattened by adjusting turns spacing on L9. Overall band width also depends on antenna selectivity. Adjust interstage band width so proper overall band width occurs with antenna circuit aligned.
3	4	Same as 1	—	Same as 1	Same as 1	C4—Antenna Trimmer	 30% TILT P S	Obtain symmetrical response curve.
4	4	Same as 1	Alternate 42 Mc. and 45.75 Mc. or two Markers	—	IF Output	L8, then L54 and L53 (both on TV Chassis)		Adjust for symmetrical overcoupled, double peaked response curve with markers on peaks. L8 and L53 determine position of 45.75 Mc. marker. L54 determines band width or position of 42.1 Mc. marker.
5	2	Channel 2 57 Mc.	Same as 4 for steps 5 through 16	55.75 Mc. (P) 59.75 Mc. (S)	Same as 4 for steps 5 through 16	L7		Check Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels.
6	3	Channel 3 63 Mc.		61.25 Mc. (P) 65.75 Mc. (S)		L7	 P 30% S	See note below.
7	4	Channel 4 69 Mc.		67.25 Mc. (P) 71.75 Mc. (S)		L7		
8	5	Channel 5 79 Mc.		77.25 Mc. (P) 81.75 Mc. (S)		L7		Same as 5 and 6.
9	6	Channel 6 85 Mc.		83.25 Mc. (P) 87.75 Mc. (S)		L7		
10	7	Channel 7 177 Mc.		175.25 Mc. (P) 179.75 Mc. (S)		L7	P=PICTURE MARKER S=SOUND MARKER COINCIDE 45.75 MC. MARKER WITH PICTURE MARKER	
11	8	Channel 8 183 Mc.		181.25 Mc. (P) 185.75 Mc. (S)		L7		
12	9	Channel 9 189 Mc.		187.25 Mc. (P) 191.75 Mc. (S)		L7		
13	10	Channel 10 195 Mc.		193.25 Mc. (P) 197.75 Mc. (S)		L7		
14	11	Channel 11 201 Mc.		199.25 Mc. (P) 203.75 Mc. (S)		L7		
15	12	Channel 12 207 Mc.		205.25 Mc. (P) 209.75 Mc. (S)		L7		
16	13	Channel 13 213 Mc.		211.25 Mc. (P) 215.75 Mc. (S)		L7		

NOTE: If one or more coil strips cannot be made to track properly, replace strips. Do not peak coils to correct passbands. If Channels 7 and 8 show deep valley, adjust L9 as in step 2. If this does not correct condition, change V2, the 6J6 Oscillator-Mixer Tube. This will necessitate repetition of steps 1 through 5.

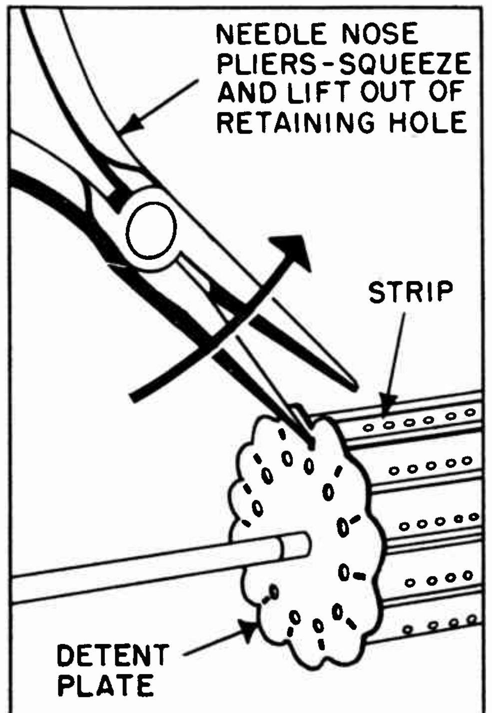
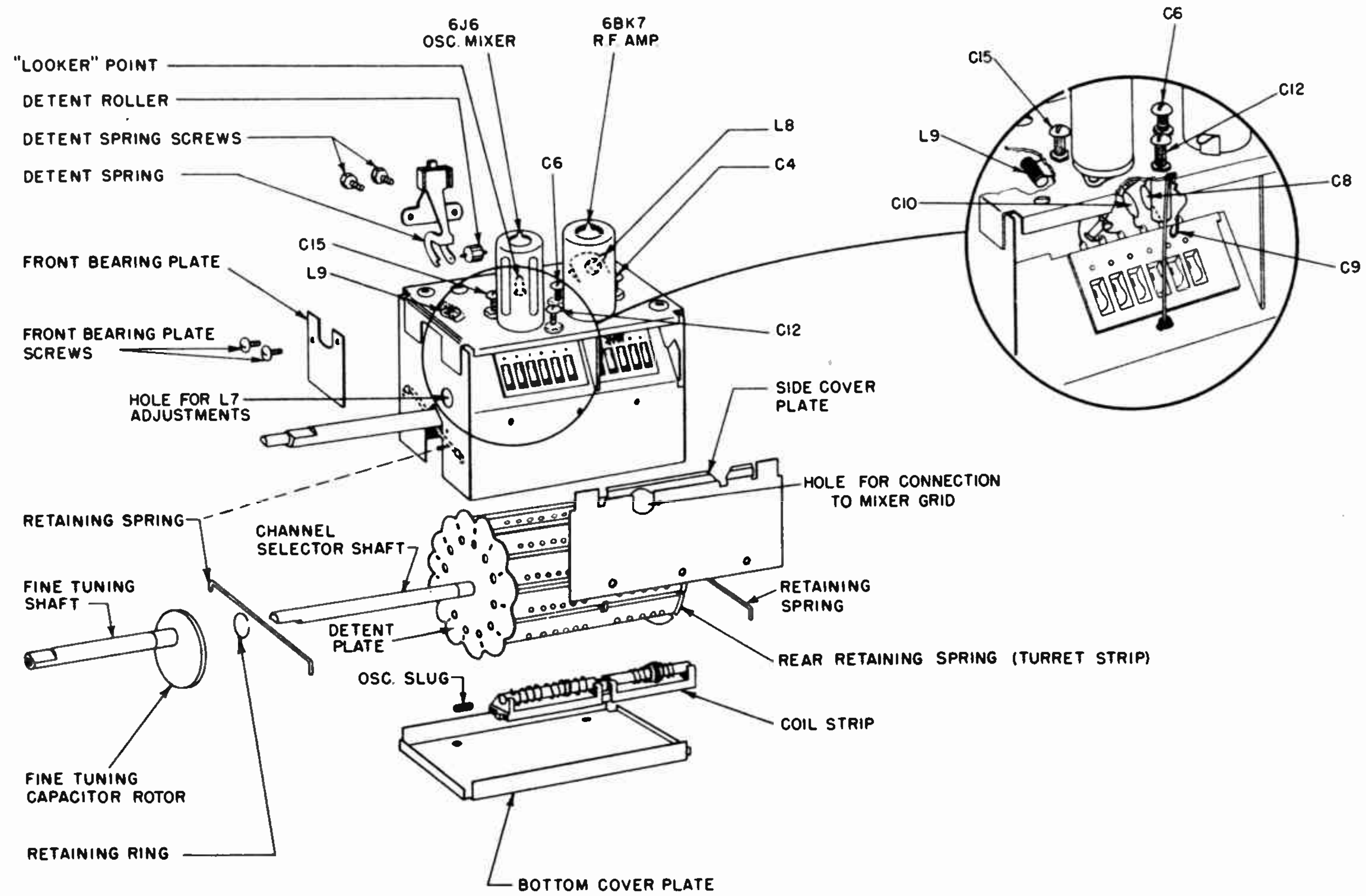


FIGURE 13 - TUNER STRIP REMOVAL 1-508-1



Note: This R.F. tuner has been thoroughly tested at the factory and should provide trouble-free reception. However, if service other than alignment is required, return the complete tuner to your Sylvania Distributor for replacement.

FIGURE 15 - VHF TUNER LAYOUT 1-508-1, 1-508-2

NOTES ON VHF TUNER DISASSEMBLY

To remove turret drum from VHF tuner it is not necessary to remove the tuner from the chassis. With the chassis lying on its side, remove the following items in the order given. See Figure 15.

1. Bottom cover plate.
2. Shaft retaining springs (front and rear).
3. Front bearing plate.

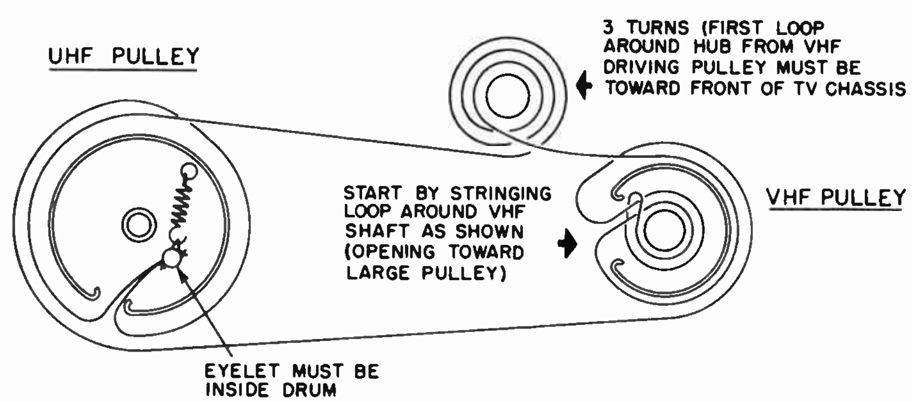


FIGURE 14 - VHF-UHF DIAL CORD HOOKUP 1-508-1, 1-508-2

The drum should now be free of its mounting and readily removed from the tuner housing through the slots provided.

To replace the turret, reverse the above steps, exercising caution when inserting in housing to make sure that the rotor of the fine tuning capacitor meshes with the stator plates.

Replacement of Coil Strips in Tuner

When received from the front the coil strips are numbered consecutively from 2 to 13 in clockwise rotation with one blank strip between numbers 13 and 2. The flat on the channel selector shaft (as viewed from the front) is in line with coil strip for channel 3.

To remove and replace coil strips proceed as follows: (Note: It is not necessary to remove tuner from chassis)

1. Remove bottom cover plate.
2. Rotate channel selector shaft so that coil to be removed is in line with slots in end of tuner case.
3. Using needle nose pliers release base on strip from detent plate as shown in Figure 13.
4. Carefully lift strip up and then free from rear retaining spring.

To replace strip, insert boss on rear of strip into retaining spring and apply only enough pressure against spring so that from boss clears detent plate. Push strip into position so that front boss engages slot in detent plate. Replace bottom cover.

RF TUNER ALIGNMENT

(1-510-1, -2)

NOTES ON VHF TUNER ALIGNMENT

Observe the following procedure in making the equipment setup shown in Figure 16 for the 1-510-1 and 1-510-2 chassis.

1. The detector circuits should be constructed and connected so as to maintain leads as short as possible.

2. Use shielded leads for the following connections in order to minimize hum and synchronous voltage pickup.

   a. Lead from "looker" point to detector #1.
   b. Lead from detector #1 to scope switch.
   c. Lead from detector #2 to scope switch.
   d. Lead from sweep generator to the horizontal input of the scope. (To obtain synchronization use externally generated sweep instead of internal oscilloscope sweep).

3. The single pole double throw "Scope Switch" should be located at the vertical input terminals of the scope. This switching arrangement will permit observation of either the IF response or the overall RF response. These switch positions will be referred to in the tuner alignment charts as the "IF" and "RF" positions respectively.

4. The marker generator coupling capacitors should be as small in value as possible, to prevent any effect on tuner response, but must be large enough to permit easy observation of markers in either the "IF" or "RF" switch positions. (2 or 3 Mmfd. should be satisfactory in most cases.

Observe the following general instructions for alignment of the 1-510-1 and 1-510-2 VHF tuner.

1. Connect a sweep generator with a 300 Ohm balanced output impedance to the antenna terminals of the tuner. Use a 10 Mc. sweep setting.

2. Connect the negative terminal of a 1.5 volt battery to the AGC terminal (terminal "C" on schematic and tuner layout drawings) and positive terminal to ground.

3. Set the fine tuning control, C19, to half capacity by noting that the variable capacitor plates are approximately half meshed.

4. Use a non-metallic pick to spread or compress the necessary coils.

5. During tuner alignment, remove the 2nd Video IF Amplifier tube - V4 - 6CB6, to prevent coupling back from the receiver IF system.

6. In all of the following tests the oscilloscope vertical gain should be as close to maximum setting as possible, consistent with hum and synchronous voltage interference limitations. This precaution will permit the use of low levels from RF sweep generator thereby increasing visibility of IF and RF markers.

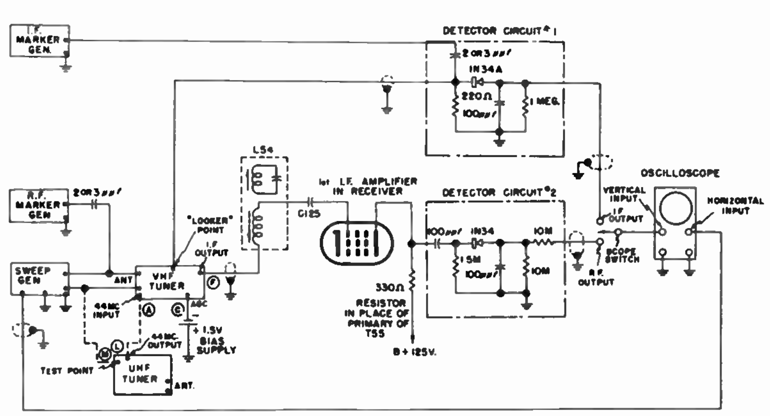


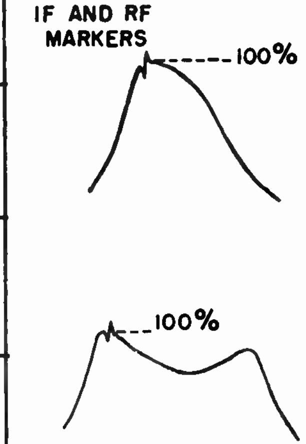
FIGURE 16 - RF TUNER ALIGNMENT SETUP 1-510-1, 1-510-2

VHF TUNER ALIGNMENT — CHASSIS 1-510-1, 1-510-2

HIGH BAND OSCILLATOR ALIGNMENT

STEP	TUNER SET TO CHANNEL	GENERATORS: SWEEP (10 Mc.)	IF MARKER	RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
1	13	Channel 13 213 Mc.	45.75 Mc.	211.25 Mc.	RF Output	L9 Screw	See Curves below	Coincide Markers as shown.

NOTE: Refer to VHF Tuner Layout (Fig. 18) and VHF Tuner Schematic for location of specified Wafers, Coil Increments, and Screw Adjustments mentioned in the following steps. As Channels 12 to 7 and 5 to 2 are aligned by means of consecutive coil increments, the aligned increments that precede must not be disturbed.

STEP	TUNER SET TO CHANNEL	SWEEP (10 Mc.)	IF MARKER	RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
2	12	Channel 12 207 Mc.	45.75 Mc.	205.25 Mc.	Same as 1	Chan. 12 loop on Wafer 5		Squeeze or spread loop for Channel 12 on Wafer 5 to coincide Markers as shown.
3	11	Channel 11 201 Mc.	45.75 Mc.	199.25 Mc.	Same as 1	Chan. 11 loop on Wafer 5		Adjust each succeeding Hi-Channel Loop on Wafer 5 (steps 3 to 7) to coincide appropriate Markers for that Channel.
4	10	Channel 10 195 Mc.	45.25 Mc.	193.25 Mc.	Same as 1	Chan. 10 loop on Wafer 5		
5	9	Channel 9 189 Mc.	45.25 Mc.	187.25 Mc.	Same as 1	Chan. 9 loop on Wafer 5		
6	8	Channel 8 183 Mc.	45.25 Mc.	181.25 Mc.	Same as 1	Chan. 8 loop on Wafer 5		
7	7	Channel 7 177 Mc.	45.25 Mc.	175.25 Mc.	Same as 1	Chan. 7 loop on Wafer 5		

TYPICAL CURVES
NOTE: CURVES MAY NOT BE SYMMETRICAL UNTIL R. F. ALIGNMENT IS COMPLETE.

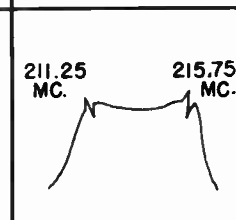
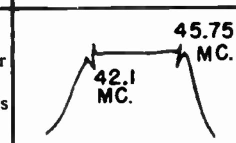
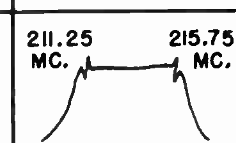
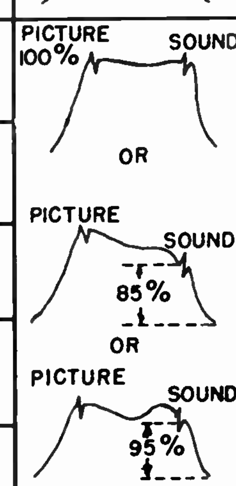
LOW BAND OSCILLATOR ALIGNMENT

STEP	TUNER SET TO CHANNEL	SWEEP (10 Mc.)	IF MARKER	RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
8	6	Channel 6 85 Mc.	45.25 Mc.	83.25 Mc.	Same as 1	L11 Screw	See Curves above	Coincide Markers as shown.
9	5	Channel 5 79 Mc.	45.25 Mc.	77.25 Mc.	Same as 1	Chan. 6 Coil on Wafer 5		Squeeze or spread turns of Channel 5 Coil on Wafer 5 to coincide Markers as shown.
10	4	Channel 4 69 Mc.	45.75 Mc.	67.25 Mc.	Same as 1	Chan. 4 Coil on Wafer 5		Adjust each succeeding Lo-Channel Coil on Wafer 5 (steps 10 to 12) to coincide appropriate Markers for that Channel.

LOW BAND OSCILLATOR ALIGNMENT

STEP	TUNER SET TO CHANNEL	GENERATORS SWEEP (10 Mc.)	GENERATORS I F MARKER	GENERATORS R F MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
11	3	Channel 3 63 Mc.	45.75 Mc.	61.25 Mc.	Same as 1	Chan. 3 Coil on Wafer 5	See page 13.	Adjust each succeeding Lo-Channel Coil on Wafer 5 (steps 10 to 12) to coincide appropriate Markers for that Channel.
12	2	Channel 2 57 Mc.	45.75 Mc.	55.25 Mc.	Same as 1	Chan. 2 Coil on Wafer 5	See page 13.	

HIGH AND LOW BAND RF ALIGNMENT

STEP	TUNER SET TO CHANNEL	GENERATORS SWEEP (10 Mc.)	GENERATORS I F MARKER	GENERATORS R F MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
1	13	Channel 13 213 Mc.	—	211.25 Mc. (P) 215.75 Mc. (S)	R F Output	L3, L7, L8 Screws		Adjust L3 for maximum mid-band height regardless of skirts. Adjust L7 for proper skirt figuring. Adjust L8 for flat top. Pix carrier must be at 100%; sound carrier may ride down to 85%.
2	13	Same as 1	45.75 Mc. and 42.1 Mc.	——	I F Output	T2 on Tuner and L54 on Main Chassis		Adjust for response curve shown.
3	13	Same as 1	——	211.25 Mc. (P) 215.75 Mc. (S)	R F Output	L8		Touch up for flat top if necessary. There must not be more than 5% dip.
4	12	Channel 12 207 Mc.	—	205.25 Mc. (P) 209.75 Mc. (S)	Same as 3	Chan. 12 loop on Wafers 1, 3 and 4		Squeeze or spread loops for Channel 12 to acquire response curve shown. Loop on Wafer 1 adjusts mid-band amplitude; Loop on Wafer 3 adjusts skirt frequency; Loop on Wafer 4 adjusts for flat top. Align each succeeding channel (steps 5 to 15) adjusting appropriate inductances on Wafers 1, 3, and 4. Refer to Figure and for locations of specified coil increments.
5	11	Channel 11 201 Mc.	—	199.25 Mc. (P) 203.75 Mc. (S)	Same as 3	Chan. 11 loops on Wafers 1, 3 and 4		
6	10	Channel 10 195 Mc.	—	193.25 Mc. (P) 197.75 Mc. (S)	Same as 3	Chan. 10 loops on Wafers 1, 3 and 4		
7	9	Channel 9 189 Mc.	—	187.25 Mc. (P) 191.75 Mc. (S)	Same as 3	Chan. 9 loops on Wafers 1, 3 and 4		
8	8	Channel 8 183 Mc.	—	181.25 Mc. (P) 185.75 Mc. (S)	Same as 3	Chan. 8 loops on Wafers 1, 3 and 4		
9	7	Channel 7 177 Mc.	—	175.25 Mc. (P) 179.75 Mc. (S)	Same as 3	Chan. 7 loops on Wafers 1, 3 and 4		

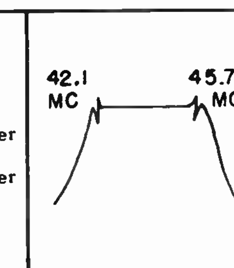
HIGH AND LOW BAND RF ALIGNMENT

STEP	TUNER CHANNEL SWITCH	GENERATORS SWEEP (10 Mc.)	GENERATORS I F MARKER	GENERATORS R F MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
10	6	Channel 6 85 Mc.	—	83.25 Mc. (P) 87.75 Mc. (S)	Same as 3	Chan. 6 coils on Wafers 1, 3 and 4	See Curves on page 27. Dip or Tilt not to be more than 30% on low channels.	Squeeze or spread loops for Channel 12 to acquire response curve shown. Loop on Wafer 1 adjusts mid-band amplitude; Loop on Wafer 3 adjusts skirt frequency; Loop on Wafer 4 adjusts for flat top. Align each succeeding channel (steps 5 to 15) adjusting appropriate inductances on Wafers 1, 3, and 4. Refer to Figure and for locations of specified coil increments.
11	5	Channel 5 79 Mc.	—	77.25 Mc. (P) 81.75 Mc. (S)	Same as 3	Chan. 5 coils on Wafers 1, 3 and 4		
12	4	Channel 4 69 Mc.	—	67.25 Mc. (P) 71.75 Mc. (S)	Same as 3	Chan. 4 coils on Wafers 1, 3 and 4		
13	3	Channel 3 63 Mc.	—	61.25 Mc. (P) 65.75 Mc. (S)	Same as 3	Chan. 3 coils on Wafers 1, 3 and 4		
14	2	Channel 2 57 Mc.	—	55.25 Mc. (P) 59.75 Mc. (S)	Same as 3	Chan. 2 coils on Wafers 1, 3 and 4		

NOTE: As each Channel is aligned by adjustment of its inductance increments in the order listed in steps 4 to 14, care must be exercised not to disturb the aligned increments preceding the one being adjusted.

15	Recheck all Channels for flat top response curve touching up L8 for Channel 13 and appropriate coil increment on Wafer 4 for each of the other Channels. Dip must be under 5%.

NOTE: Step 16 needs to be carried out only on 1-510-2 models, or any 1-510-1 models that have been converted for UHF reception.

16	UHF	44 Mc.	45.75 Mc. and 41.25 Mc.	—	R F Output	L29 on UHF Tuner L2 on VHF Tuner		Couple 44 Mc. sweep gen. sig. to test point of UHF tuner (terminal M). Adjust for indicated response curve and maximum amplitude. Switch sweep generator to 75 Ohm output impedance or insert proper matching network.

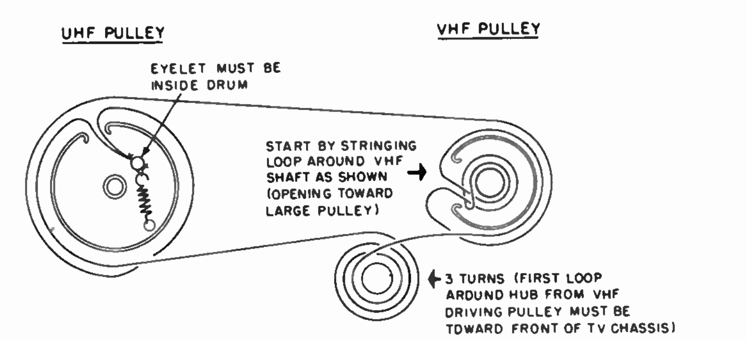
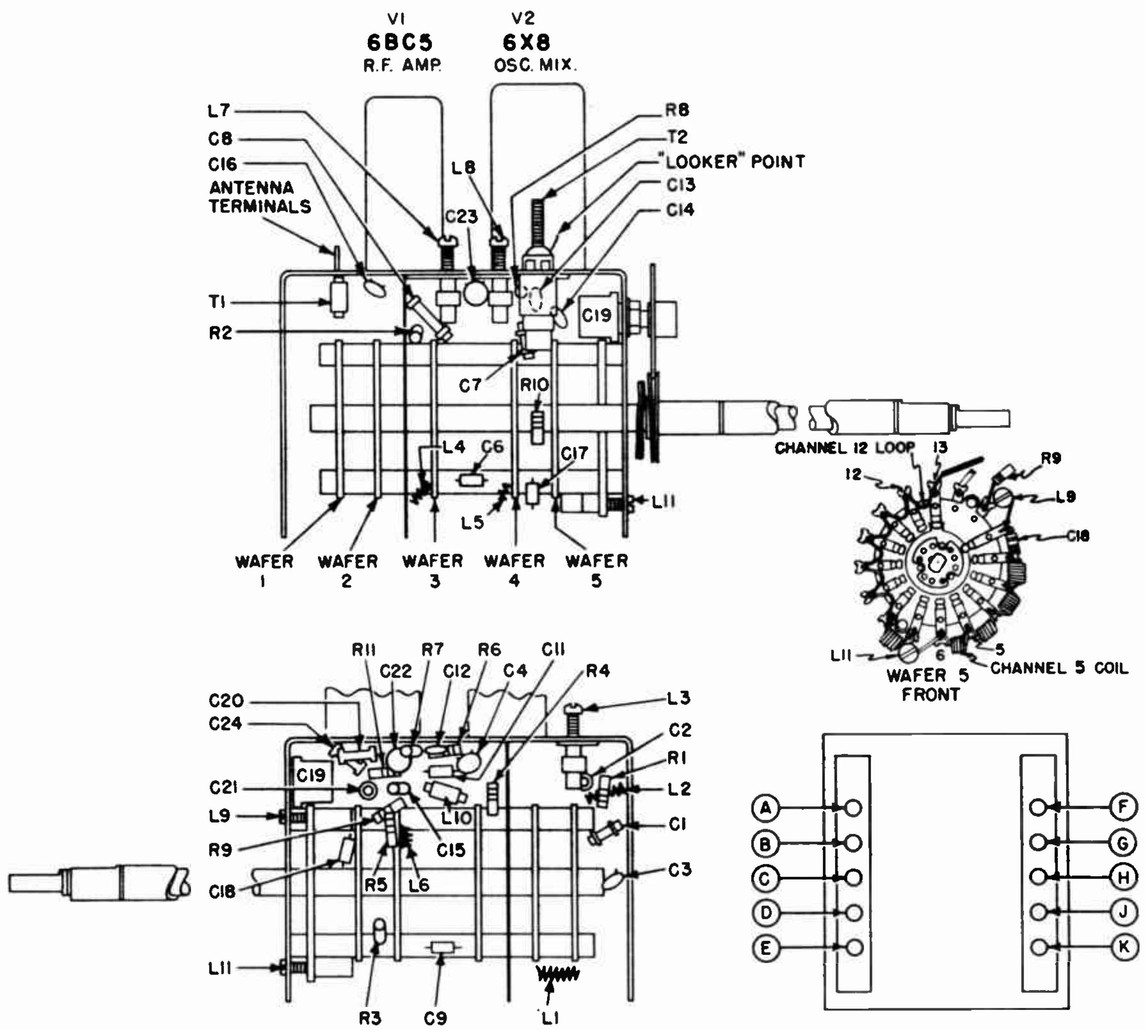


FIGURE 17 - VHF-UHF DIAL CORD HOOKUP 1-510-1, 1-510-2



Note: This R. F. tuner has been thoroughly tested at the factory and should provide trouble-free reception. However, if service other than alignment is required, return the complete tuner to your Sylvania Distributor for replacement.

FIGURE 18 - VHF TUNER LAYOUT 1-510-1, 1-510-2

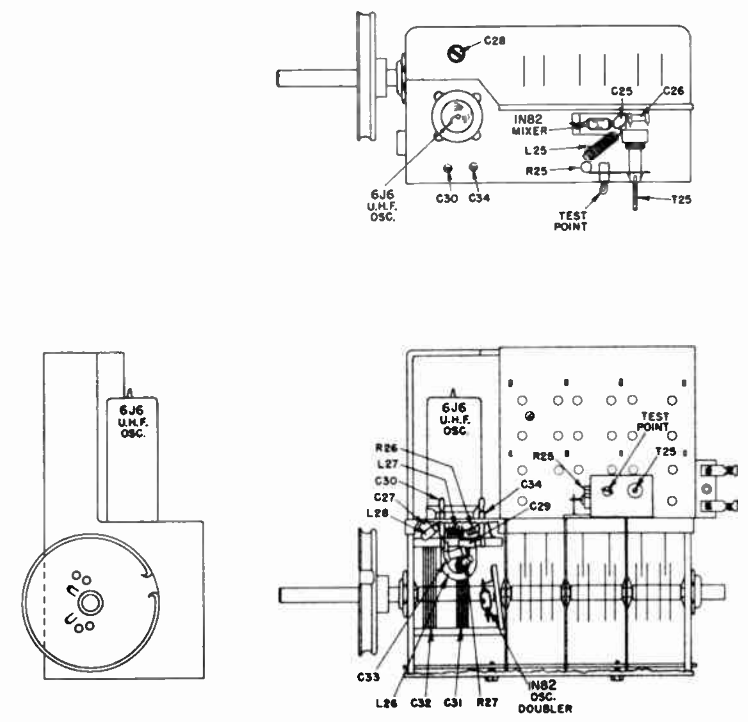


FIGURE 19 - UHF TUNER PARTS LAYOUT 1-508-2

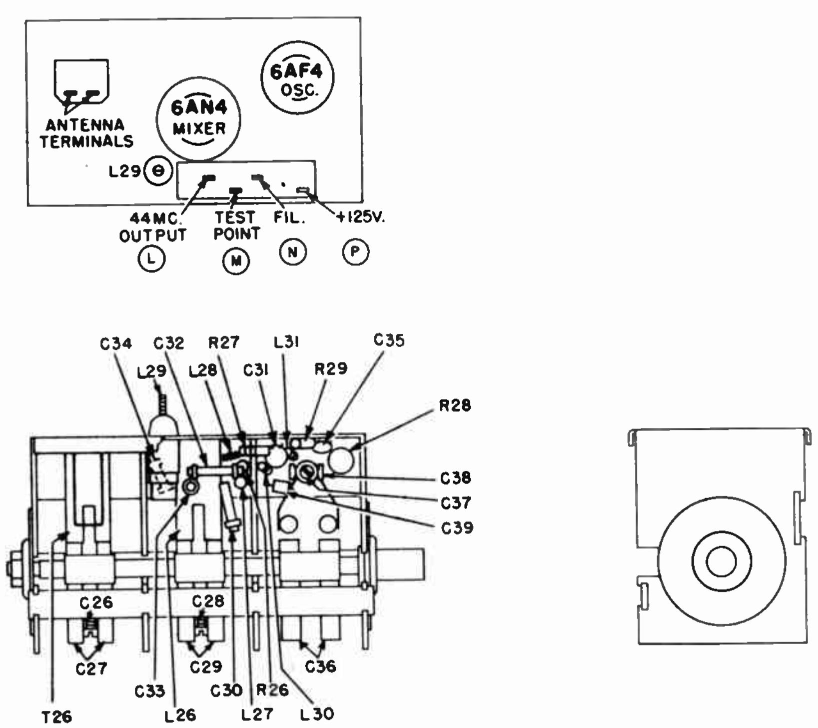


FIGURE 20 - UHF TUNER PARTS LAYOUT 1-510-2

AM-FM Radio

(1-603-1)

ALIGNMENT PROCEDURE

WARNING: No attempt should be made to adjust the alignment of this receiver without using the following equipment: Signal Generator, FM Sweep Generator, Output Meter, Insulated Screw Driver.

AM ALIGNMENT

Output meter connection	Across speaker voice coil
Generator ground lead connection	Receiver chassis
Generator modulation	30% 400 cycles
Position of volume control	Extreme Clockwise
Position of tone control	Extreme Counterclockwise
Position of FM-AM-PHO Switch	AM

A Hazeltine Loop may be used to radiate a signal into the receiver loop instead of dummy antenna connections listed below.

Keep generator output at lowest usable value and obtain maximum output meter indication.

TUNER POSITION	GENERATOR FREQUENCY	DUMMY ANTENNA	GENERATOR CONNECTION	CORE & TRIMMER ADJUSTMENTS (IN ORDER SHOWN)	CORE OR TRIMMER FUNCTION
Open	455 KC.	0.1 Mfd.	Signal Grid (Pin 7) 6BE6	T28-A Bot., T28-B Top T26-A Top, T26-B Bot.	I. F.
1650 KC.	1650 KC.	50 Mmfd.	Ext. Ant.	C60	Osc.
1400 KC.	1400 KC.	50 Mmfd.	Ext. Ant.	C52	Ant.

FM IF ALIGNMENT

Sweep generator frequency	10.7 MC.
Sweep generator deviation	300 KC.
Dummy antenna	0.1 Mfd.
Sweep generator ground lead connection	Receiver chassis
Position of tuner	Open
Position of volume control	Extreme Clockwise
Position of tone control	Extreme Counterclockwise
Position of FM-AM-PHO switch	FM

Make shielded probe shown in Figure for use with Oscilloscope where indicated below.

Keep generator output at lowest usable value and obtain maximum vertical amplitude for curves in Figures A and B.

GENERATOR CONNECTION	OSCILLOSCOPE CONNECTION	CORE ADJUSTMENTS	ADJUST FOR CURVE IN	CORE FUNCTION
FM - First IF grid (Pin 1) 6BA6	Probe - across T29 - Primary	T27-A, T27-B	Figure A	IF
Signal Grid (Pin 7) 6BE6	Probe - across T29 - Primary	T25-A, T25-B	Figure A	IF
FM - Second IF Grid (Pin 1) 6AU6	Across C85	T29-A, T29-B	Figure B	Disc.

FM RF ALIGNMENT

Output meter connection	Across speaker voice coil
Sweep generator deviation	22.5 KC.
Sweep generator modulation	400 cycle
Dummy antenna	Two 120 ohm resistors
Sweep generator connection	FM antenna board
Position of volume control	Extreme Clockwise
Position of tone control	Extreme Counterclockwise
Position of FM-AM-PHO switch	FM

Keep generator output at lowest usable value and obtain maximum output meter indication.

POSITION OF TUNER	GENERATOR FREQUENCY	TRIMMER & COIL ADJUSTMENT	TRIMMER OR COIL FUNCTION
Open	108.5 MC.	C58	Osc.
108 MC.	108.0 MC.	C56	Mixer
Closed	88.5 MC.	L29	Osc.
88 MC.	88.0 MC.	L28	Mixer

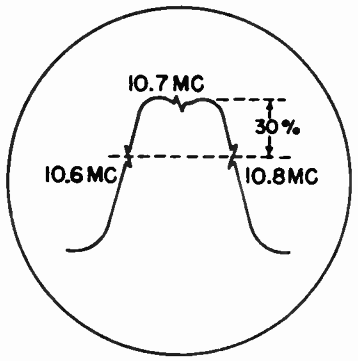


FIGURE A

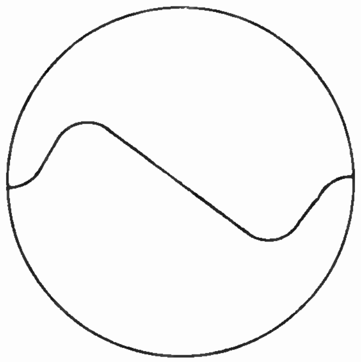


FIGURE B

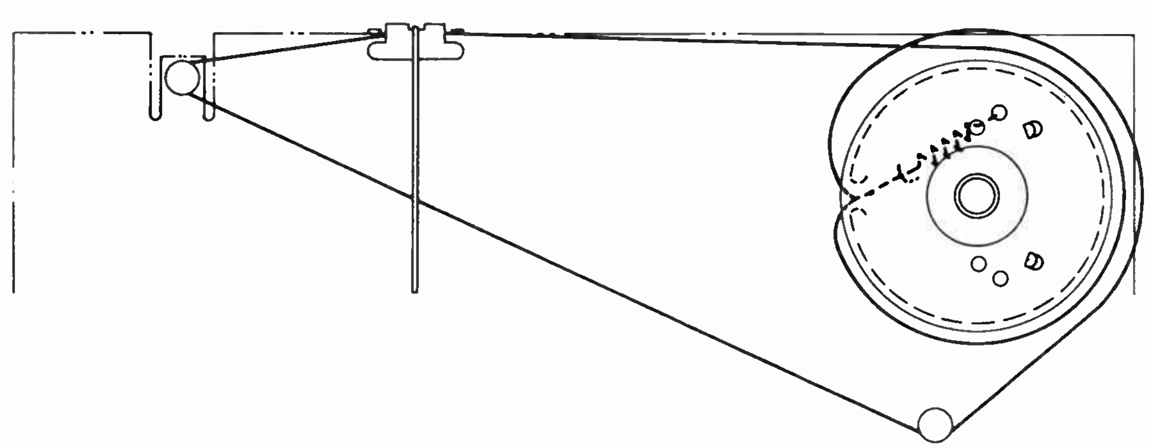


FIGURE 21 - AM-FM RADIO DIAL CORD HOOKUP

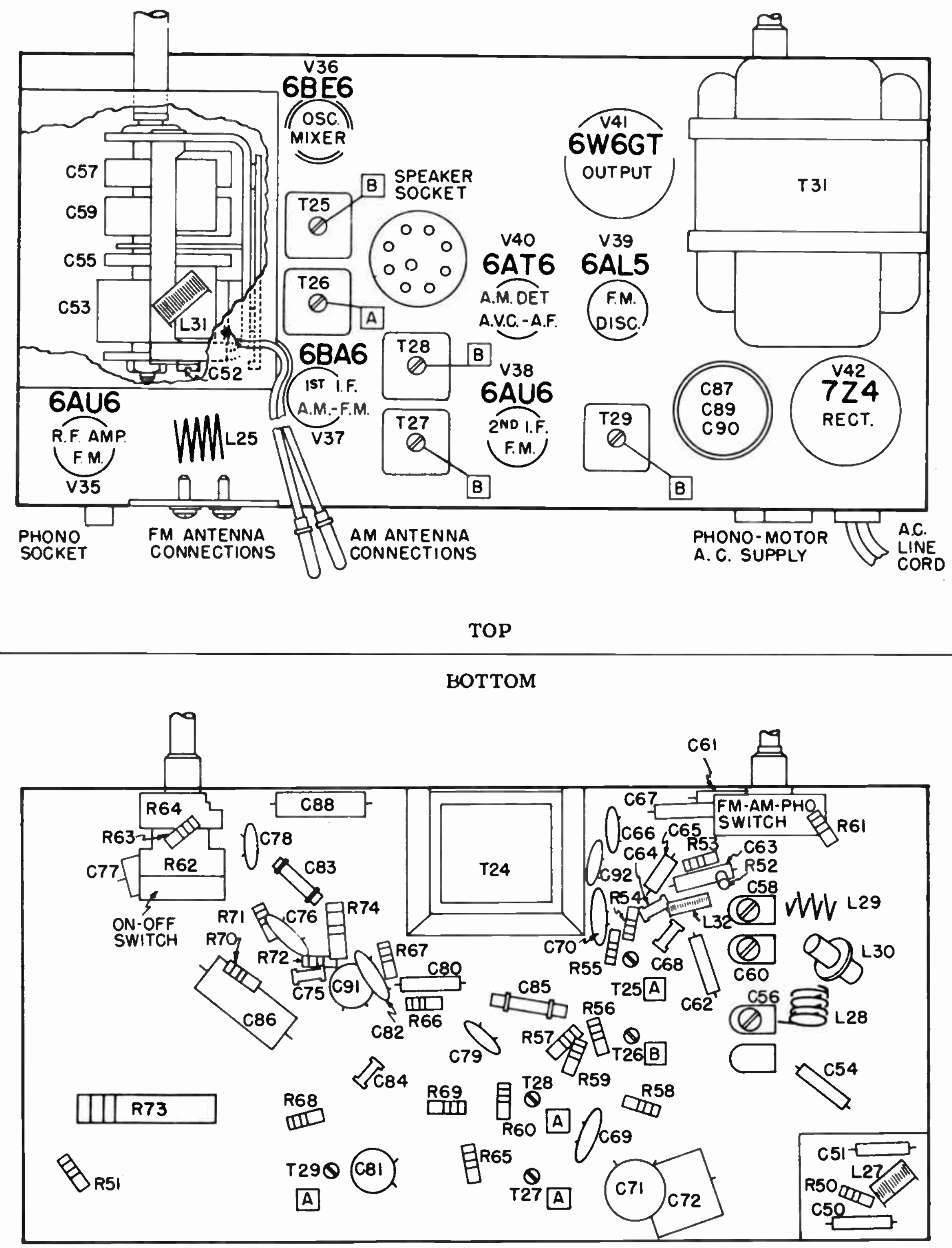


FIGURE 22 - LAYOUT FOR 1-603-1 AM-FM RADIO CHASSIS

REPAIR PARTS LIST AM-FM RADIO

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	949-0001	Adaptor - Record
	726-0003	Background - Dial
	416-0011	Board - Antenna - FM
	497-0005	Bushing - Line Cord
	487-0013	Button - Snap
C64, C65	165-0006A	Capacitor - Ceramic - .000006 Mfd. - 500 V.
C61	166-0010P	Capacitor - Ceramic - .00001 Mfd. - 500 V.
C75	166-0270N	Capacitor - Ceramic - .00027 Mfd. - 500 V.
C68, C84	166-0470N	Capacitor - Ceramic - .00047 Mfd. - 500 V.
C83	166-2000P	Capacitor - Ceramic - .002 Mfd. - 500 V.
C85	166-3300P	Capacitor - Ceramic - .0033 Mfd. - 500 V.
C66, C78, C79, C81, C91, C92	166-4700D	Capacitor - Ceramic - .0047 Mfd. - 500 V.
C69, C70, C71, C76, C82	168-0002D	Capacitor - Ceramic - .01 Mfd. - 500 V.
C86	161-1008	Capacitor - Electrolytic - 4 Mfd. - 50 V.
C89	161-3011	Capacitor - Electrolytic - 60 Mfd. - 250 V.
C90		60 Mfd. - 250 V.
C87		25 Mfd. - 25 V.
C54	163-0022	Capacitor - Mica - .000022 Mfd. - 500 V.
C63, C77	163-0047	Capacitor - Mica - .000047 Mfd. - 500 V.
C73, C74, C80	163-0100	Capacitor - Mica - .0001 Mfd. - 500 V.
C50, C51, C62, C67	163-0470	Capacitor - Mica - .00047 Mfd. - 500 V.
C72	163-3900	Capacitor - Mica - .0039 Mfd. - 500 V.
C88	160-0411	Capacitor - Paper - Molded - .01 Mfd. - 400 V.
C52	172-0031	Capacitor - Trimmer - Loop
	170-0008	Capacitor - Variable - 4 Gang
	487-0004	Clip - IF Transformer Can Mounting
	554-0019	Clip - Tuning Shaft Retaining
L31	146-0014	Coil - AM Antenna
L30	113-0011	Coil - AM - Oscillator
L25	111-0012	Coil - FM - Antenna
L29	113-0021	Coil - FM - Oscillator
L32	146-0013	Coil - FM - Oscillator - Cathode Choke
L27	146-0014	Coil - FM RF - Plate Choke
L28	112-0009	Coil - Assembly - FM RF Grid
	417-0006	Connector - Pin - Antenna Lead
R62, R64	157-0017	Control - Dual - Tone, Volume and On-Off
	195-0002	Cord - Line
	760-0022	Cover - Record Changer Compartment
	722-0020	Dial - Station
	714-0007	Escutcheon
	497-0012	Grommet - Rubber
	740-0028	Knob - Center
	743-0002	Knob - Function
	744-0017	Knob - Outer - Radio
	611-0047	Lamp - #47
L26	582-0012	Loop - Antenna - AM
	792-0007	Pointer - Dial
	494-0007	Pulley
R74	189-0007	Resistor - 4.3 Ohm - 1/2 W. - W.W.
R58	181-0680	Resistor - 68 Ohm - 1/2 W.
R53, R65	181-0101	Resistor - 100 Ohm - 1/2 W.
R50	181-0121	Resistor - 120 Ohm - 1/2 W.
R51, R56, R68	181-0181	Resistor - 180 Ohm - 1/2 W.
R55, R59	181-0272	Resistor - 2,700 Ohm - 1/2 W.
R52, R69, R70	181-0223	Resistor - 22,000 Ohm - 1/2 W.

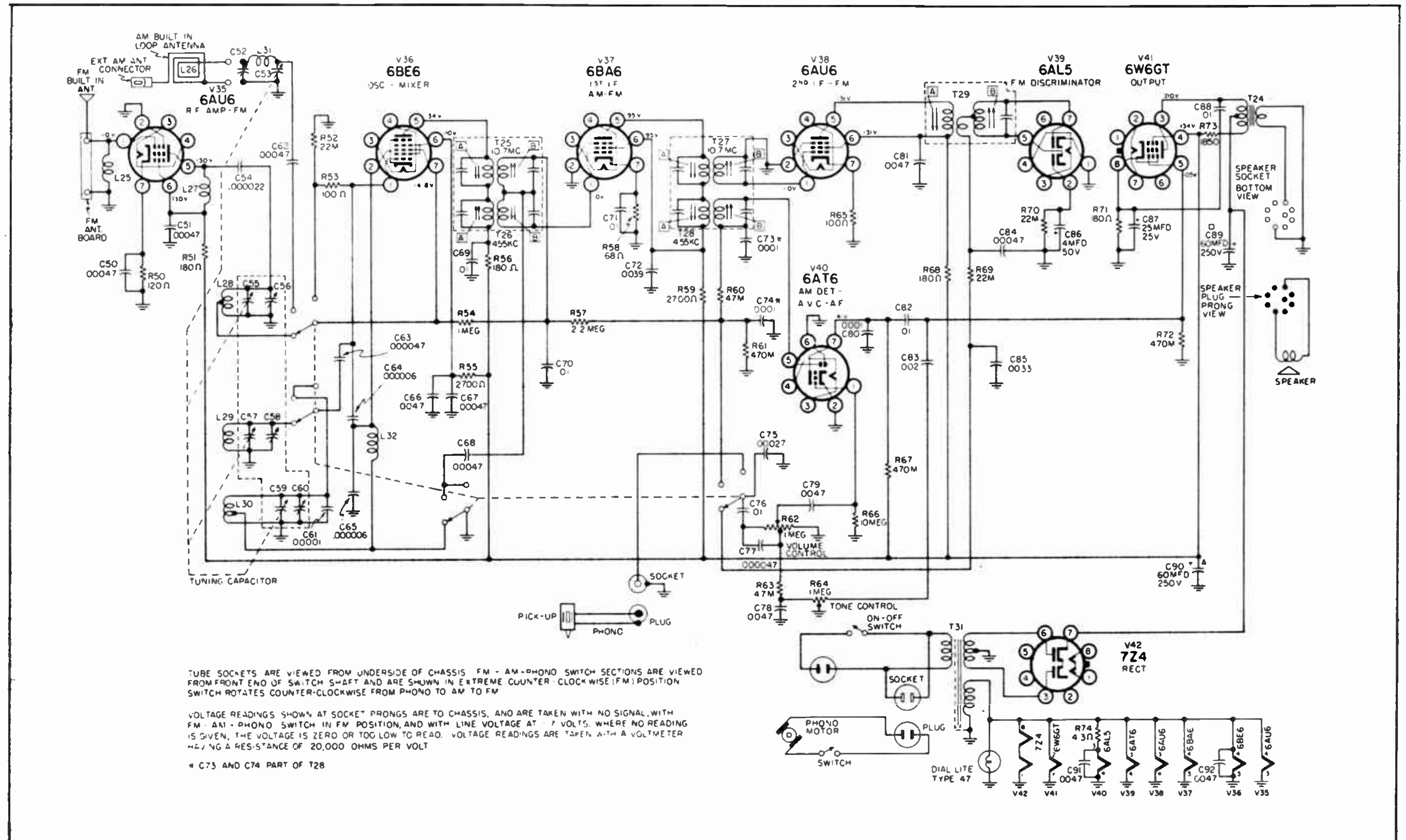


FIGURE 23 - SCHEMATIC DIAGRAM 1-603-1 AM-FM RADIO

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION			
R60, R63	181-0473	Resistor - 47,000 Ohm - 1/2 W.		419-0003	Socket - 8 Prong - Speaker
R61, R67, R72	181-0474	Resistor - 470,000 Ohm - 1/2 W.		496-0023	Spring - Drive String Tension
R54	181-0105	Resistor - 1.0 Megohm - 1/2 W.		495-0005	String - Drive (35")
R57	181-0225	Resistor - 2.2 Megohm - 1/2 W.		573-0004	Switch - Function - FM, AM, PHO
R66	181-0106	Resistor - 10 Megohm - 1/2 W.	T30	143-0018	Transformer - Audio Output
R71	182-0181	Resistor - 180 Ohm - 1 W.	T29	128-0007	Transformer - Discriminator - FM
R73	187-0009	Resistor - 1,850 Ohm - 5 W. - W. W.	T26	121-0018	Transformer - IF - AM - #1
	497-0005	Retainer - Line Cord	T28	122-0019	Transformer - IF - AM - #2
	493-0016	Shaft - Tuning	T25	121-0017	Transformer - IF - FM - #1
	482-0004	Shield - Tube - Miniature	T27	122-0017	Transformer - IF - FM - #2
	811-0001	Slide - Record Changer	T31	141-0017	Transformer - Power - 117 V. - 60 Cycle
	411-0007	Socket - Dial Light	V39		Tube - 6AL5
	417-0002	Socket - 1 Prong	V35, V38		Tube - 6AU6
	417-0009	Socket - 2 Prong - Phono	V40		Tube - 6AT6
	412-0015	Socket - 7 Prong - Miniature	V37		Tube - 6BA6
	412-0019	Socket - 7 Prong - Miniature - Mica filled	V36		Tube - 6BE6
	412-0003	Socket - 8 Prong - Octal	V41		Tube - 6W6GT
	412-0001	Socket - 8 Prong - Lock-in	V42		Tube - 7Z4

Note 1: The terms "Horizontal," "Vertical," or "60 cps sine wave" refer to the oscilloscope sweep employed.

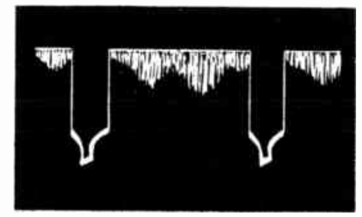
Note 2: All waveforms are taken with the oscilloscope horizontal sweep direction from left to right and with upward deflection corresponding to positive polarity.

Note 3: In some instances the waveforms obtained will not be identical with those shown, due to the electrical characteristics of the oscilloscope used.

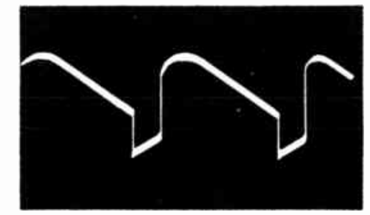
Note 4: All waveforms are measured with respect to chassis unless otherwise indicated.

Note 5: Have Picture Contrast control at maximum.

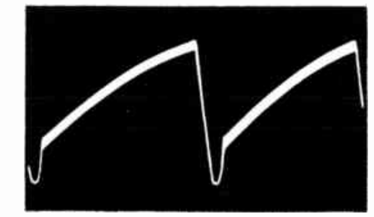
*The peak to peak (PP) voltages of these waveforms are dependent on the depth of modulation of the transmitted signal; voltages shown are obtained when modulation is approximately 90 percent.



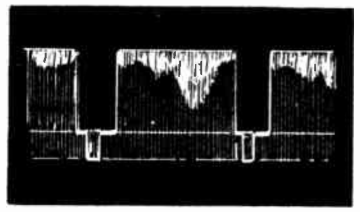
*12BY7 (V7) Video Amplifier Control Grid (Pin 2) 7.5 Volts (PP) Horizontal



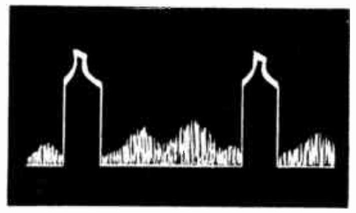
6AL5 (V15) Horizontal Phase Detector (Pin 7) 28 Volts (PP) Horizontal



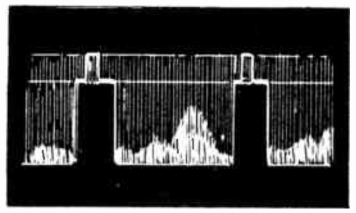
6SN7GT (V16) Horizontal Oscillator Plate (Pin 2) 150 Volts (PP) Horizontal



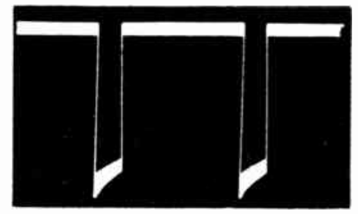
*12BY7 (V7) Video Amplifier Control Grid (Pin 2) 7.5 Volts (PP) Vertical



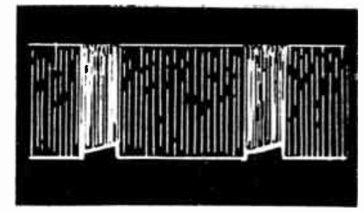
*12BY7 (V7) Video Amplifier Plate (Pin 7) 60 Volts (PP) Horizontal



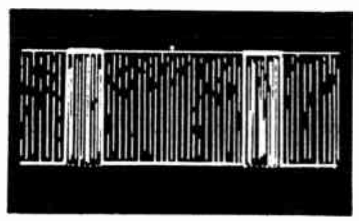
*12BY7 (V7) Video Amplifier Plate (Pin 7) 60 Volts (PP) Vertical



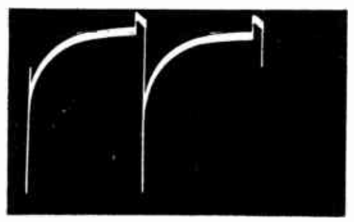
12AU7 (V12) Sync Separator Plate (Pin 6) 60 Volts (PP) Horizontal



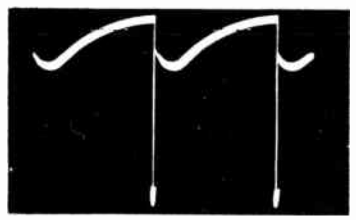
12AU7 (V12) Sync Separator Plate (Pin 6) 60 Volts (PP) Vertical



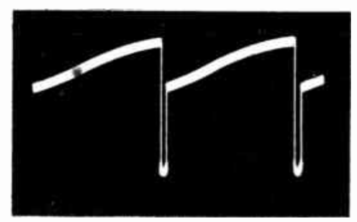
12AU7 (V12) Sync Amplifier Plate (Pin 1) 90 Volts (PP) Vertical



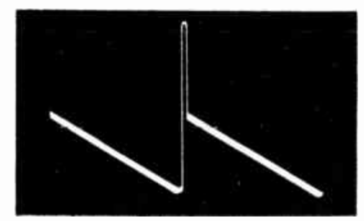
6C4 (V13) Vertical Oscillator Grid (Pin 6) 180 Volts (PP) Vertical



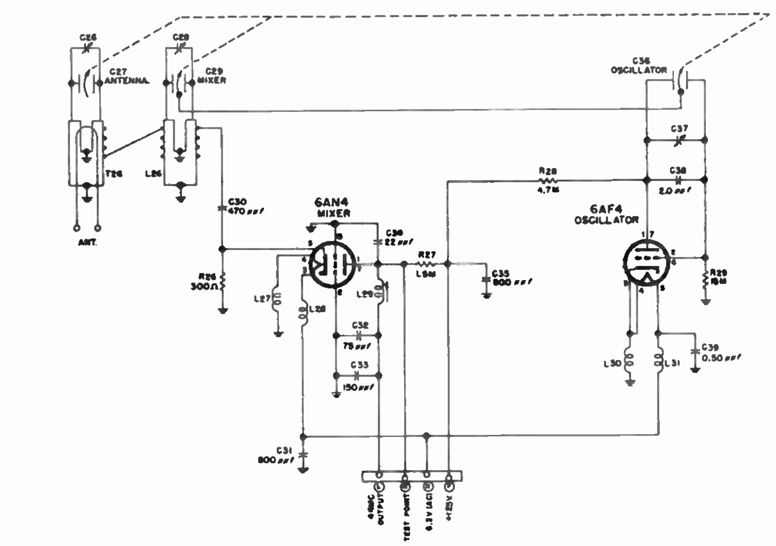
6C4 (V13) Vertical Oscillator Plate (Pin 5) 250 Volts (PP) Vertical



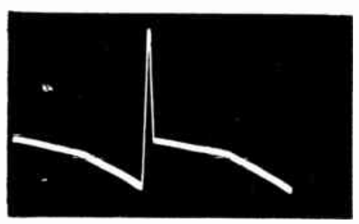
6AH4GT (V14) Vertical Output Grid (Pin 1) 80 Volts (PP) Vertical



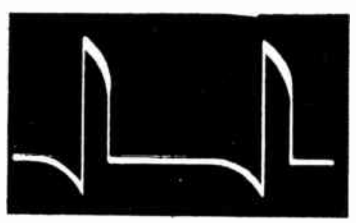
6AH4GT (V14) Vertical Output Plate (Pin 5) 810 V. (PP) Vertical



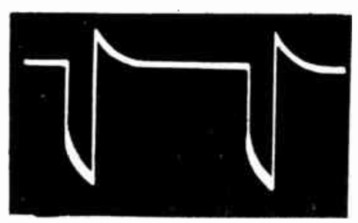
UHF TUNER SCHEMATIC



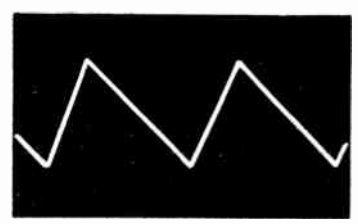
Vertical Deflection Coils (White lead - Vertical Output Transformer) 70 Volts (PP) Vertical



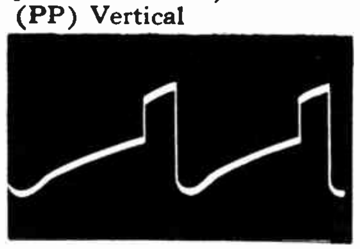
Junction of R207 and R209 27 Volts (PP) Horizontal



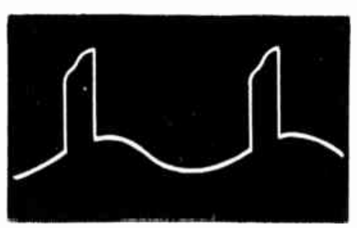
12AU7 (V12) Sync Amplifier Cathode (Pin 3) 27 Volts (PP) Horizontal



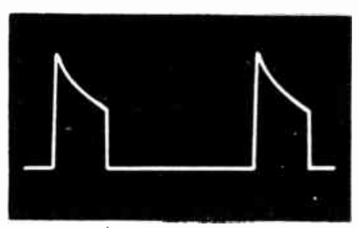
6AL5 (V15) Horizontal Phase Detector (Pin 1 or 2) 9 Volts (PP) Horizontal



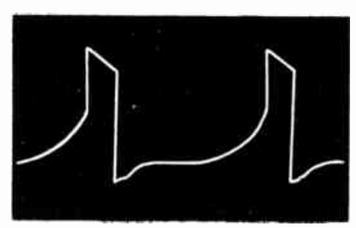
6AL5 (V15) Horizontal Phase Detector (Pin 5) 28 Volts (PP) Horizontal



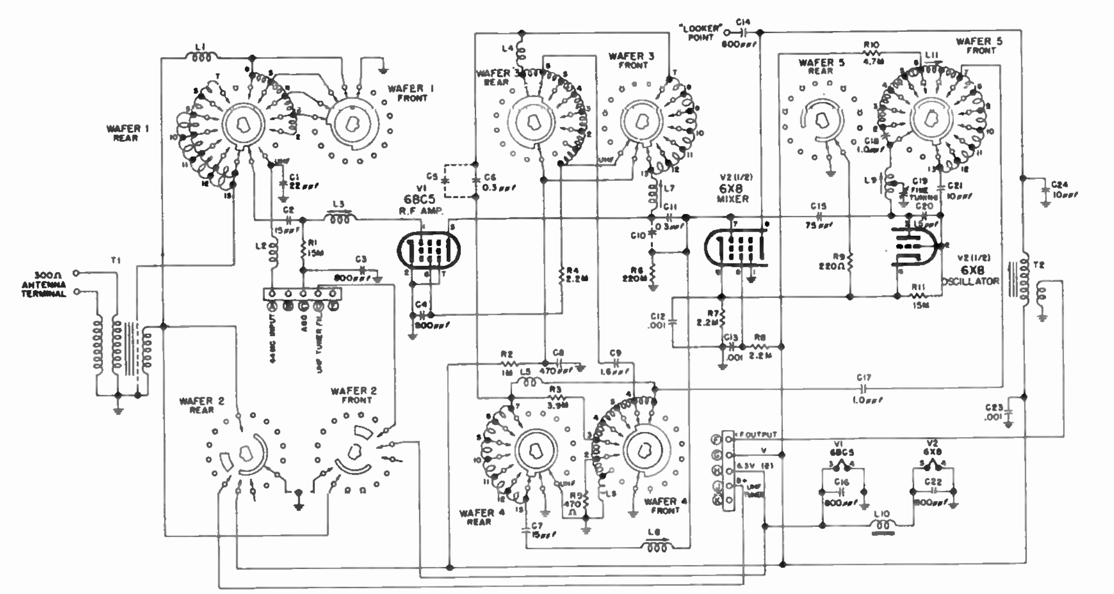
6SN7GT (V16) Horizontal Oscillator Plate (Pin 5) 65 Volts (PP) Horizontal



6SN7GT (V16) Horizontal Oscillator Cathodes (Pin 3 or 6) 25 Volts (PP) Horizontal



6SN7GT (V16) Horizontal Oscillator Grid (Pin 1) 65 Volts (PP) Horizontal



NUMBERS AT WAFER TERMINALS INDICATE CHANNEL POSITIONS. WAFER SWITCH SHOWN IN CHANNEL 13 POSITION.

VHF TUNER SCHEMATIC

SCHEMATIC DIAGRAM FOR 1-510-1 AND 1-510-2 TV CHASSIS

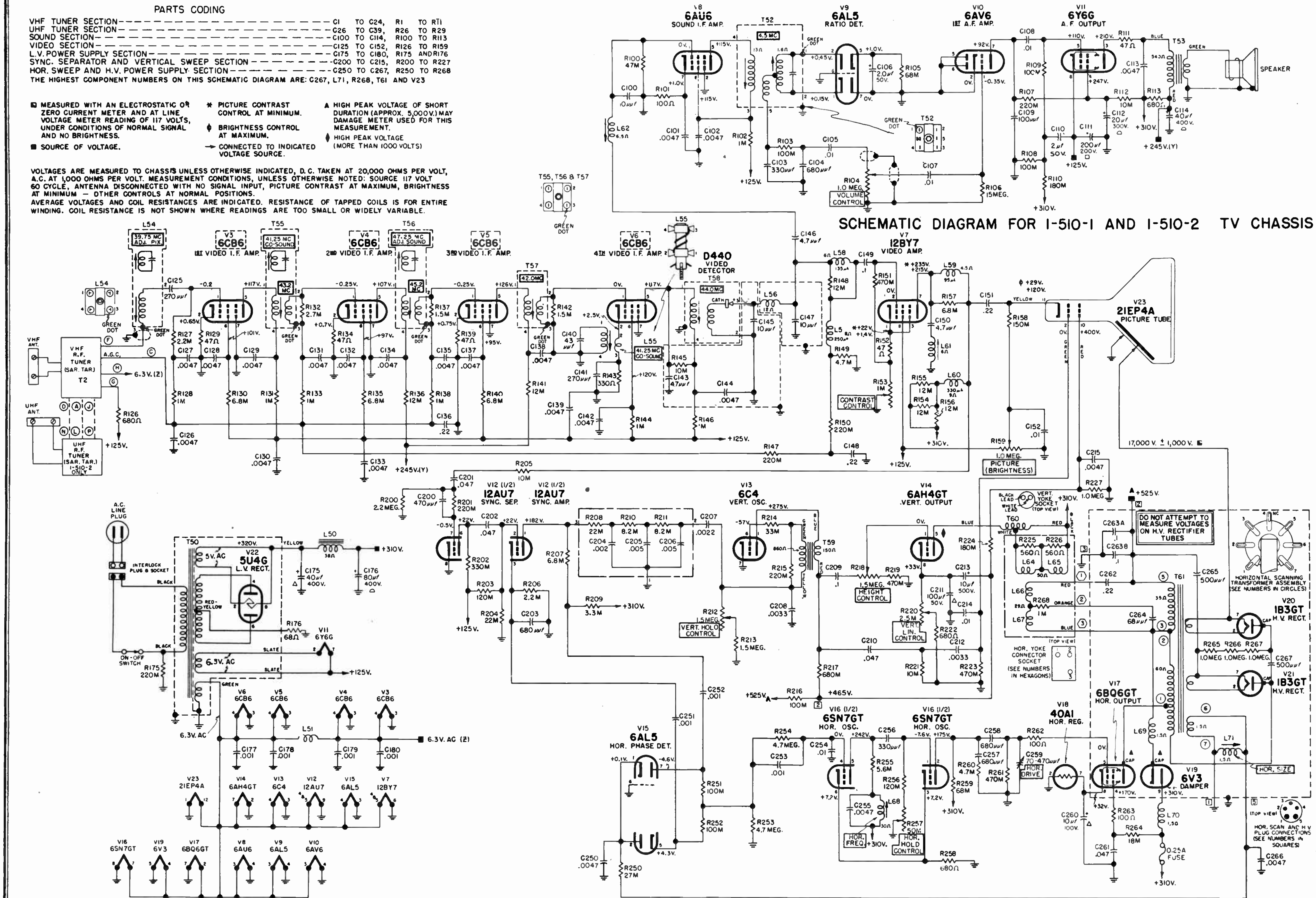
PARTS CODING

VHF TUNER SECTION	C1 TO C24,	R1 TO RT1
UHF TUNER SECTION	C26 TO C39,	R26 TO R29
SOUND SECTION	C100 TO C114,	R100 TO R113
VIDEO SECTION	C125 TO C152,	R126 TO R159
L.V. POWER SUPPLY SECTION	C175 TO C180,	R175 AND R176
SYNC. SEPARATOR AND VERTICAL SWEEP SECTION	C200 TO C215,	R200 TO R227
HOR. SWEEP AND H.V. POWER SUPPLY SECTION	C250 TO C267,	R250 TO R268

THE HIGHEST COMPONENT NUMBERS ON THIS SCHEMATIC DIAGRAM ARE: C267, L71, R268, T61 AND V23

- MEASURED WITH AN ELECTROSTATIC OR ZERO CURRENT METER AND AT LINE VOLTAGE METER READING OF 117 VOLTS, UNDER CONDITIONS OF NORMAL SIGNAL AND NO BRIGHTNESS.
- SOURCE OF VOLTAGE.
- * PICTURE CONTRAST CONTROL AT MINIMUM.
- BRIGHTNESS CONTROL AT MAXIMUM.
- → CONNECTED TO INDICATED VOLTAGE SOURCE.
- ▲ HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 5,000V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT.
- HIGH PEAK VOLTAGE (MORE THAN 1000 VOLTS)

VOLTAGES ARE MEASURED TO CHASSIS UNLESS OTHERWISE INDICATED, D.C. TAKEN AT 20,000 OHMS PER VOLT, A.C. AT 1,000 OHMS PER VOLT. MEASUREMENT CONDITIONS, UNLESS OTHERWISE NOTED: SOURCE 117 VOLT 60 CYCLE, ANTENNA DISCONNECTED WITH NO SIGNAL INPUT, PICTURE CONTRAST AT MAXIMUM, BRIGHTNESS AT MINIMUM — OTHER CONTROLS AT NORMAL POSITIONS.
AVERAGE VOLTAGES AND COIL RESISTANCES ARE INDICATED. RESISTANCE OF TAPPED COILS IS FOR ENTIRE WINDING. COIL RESISTANCE IS NOT SHOWN WHERE READINGS ARE TOO SMALL OR WIDELY VARIABLE.



REPAIR PARTS LIST

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	486-0005	Button - Corona - H.V. Assembly
	417-0008	Cable and Socket Assembly - Picture Tube
C143, C146, C150	168-0008N	Capacitor - Ceramic .0000047 Mfd. - 500 V.
C100, C145, C147	166-0010P	Capacitor - Ceramic .00001 Mfd. - 500 V.
C140	166-0043P	Capacitor - Ceramic .000043 Mfd. - 500 V.
C264	174-0068	Capacitor - Ceramic .000068 Mfd. - 2,000 V.
C125, C141	166-0270N	Capacitor - Ceramic .00027 Mfd. - 500 V.
C103	166-0330	Capacitor - Ceramic .00033 Mfd. - 500 V.
C265, C267	169-0015	Capacitor - Ceramic .0005 Mfd. - 20,000 V.
C177, C178, C179	166-1000D	Capacitor - Ceramic .001 Mfd. - 500 V.
C180		
C126, C127, C128	166-4700D	Capacitor -Ceramic .0047 Mfd. - 500 V.
C129, C130, C131		
C132, C133, C134		
C135, C137, C138		
C139, C142, C144		
C125, C255		
C101, C102	168-0011D	Capacitor-Ceramic-Dual .0047 Mfd. - 500 V.
C106, C110	161-1001	Capacitor - Electrolytic 2 Mfd. - 50 V.
C213	161-1010	Capacitor - Electrolytic 10 Mfd. - 500 V.
C175	161-2004	Capacitor - Electrolytic 40 Mfd. - 400 V.
C176		80 Mfd. - 400 V.
C114	161-2005	Capacitor - Electrolytic 40 Mfd. - 400 V.
C211		100 Mfd. - 50 V.
C260	161-3014	Capacitor - Electrolytic 10 Mfd. - 100 V.
C112		20 Mfd. - 300 V.
C111		200 Mfd. - 200 V.
C109	163-0100	Capacitor - Mica .0001 Mfd. - 500 V.
C265	163-0330	Capacitor - Mica .00033 Mfd. - 500 V.
C200	163-0470	Capacitor - Mica .00047 Mfd. - 500 V.
C104, C203, C257	163-0680	Capacitor - Mica .00068 Mfd. - 500 V.
C258		
C208, C212	162-06233	Capacitor - Paper .0033 Mfd. - 600 V.
C113, C250, C266	162-06247	Capacitor - Paper .0047 Mfd. - 600 V.
C105, C107, C152	162-0411	Capacitor - Paper .01 Mfd. - 200 V.
C214, C254		
C108	162-0611	Capacitor - Paper .01 Mfd. - 600 V.
C210	162-06147	Capacitor - Paper .047 Mfd. - 600 V.
C155	162-0402	Capacitor - Paper .22 Mfd. - 400 V.
C251, C252, C253	160-06215	Capacitor - Paper - Molded .001 Mfd. - 400 V.
C207	160-06222	Capacitor - Paper - " .0022 Mfd. - 400 V.
C202	160-02147	Capacitor - Paper - " .047 Mfd. - 200 V.
C261	160-04147	Capacitor - Paper - " .047 Mfd. - 400 V.
C149	160-0201	Capacitor - Paper - " .1 Mfd. - 200 V.
C209, C263A, C263B	160-0601	Capacitor - Paper - " .1 Mfd. - 600 V.
C136, C148, C262	160-0402	Capacitor - Paper - " .22 Mfd. 400 V.
	190-0007	Capacitor - Resistor Comb'n. - Integrator Plate
C204		.002 Mfd. - 500 V.
C205		.005 Mfd. - 500 V.
C206		.005 Mfd. - 500 V.
R210		8,200 Ohm
R211		8,200 Ohm
R208		22,000 Ohm
C259	172-0032	Capacitor - Trimmer - Horizontal Drive Control
	196-0007	Cap and Lead - Damper Tube
	196-0010	Cap and Lead - H.V. Rectifier Tube
	196-0007	Cap and Lead - Horizontal Output Tube
L50	145-0004	Choke - Filter - B+
L51	147-0014	Choke - Heater
	487-0008	Clip - Fuse
	487-0004	Clip - Transformer and Coil Mounting
L55	118-0011	Coil - Cathode Trg.
L56, L59, L70	118-0010	Coil - Filter
L68	132-0001	Coil - Horizontal Frequency
L71	132-0002	Coil - Horizontal Size
L57, L58	131-2003	Coil - Peaking - Dual
L59, L60	131-2008	Coil - Peaking - Dual
L62	130-0001	Coil - Sound Take-off Trap
L54	119-0002	Coil - Tuner Coupling

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
L61	130-0001	Coil - Video 4.5 Mc. Trap
	196-0014	Conector - H.V. Anode and Lead Assembly
R159	153-0016	Control - Brightness
R104, R154	157-0020	Control - Dual - Contrast, Volume and On-Off
R218	153-0014	Control - Height
R257	153-0017	Control - Horizontal Hold
R212	153-0014	Control - Vertical Hold
R220	153-3011	Control - Vertical Linearity
	195-0001	Cord - Line
	483-0018	Cover - H.V. Rectifier Tube Socket
	760-0032	Cover - Interlock Assembly
	191-0005	Fuse - ¼ Amp. - 250 V.
	710-0009	Glass - Picture Window
	486-0006	Insulator - Ceramic - H.V. Assembly
	486-0009	Insulator - Paper - H.V. Assembly
	744-0023	Knob - Inner
	744-0022	Knob - Outer
	740-0029	Knob - Fine Tuning
	743-0022	Knob - Outer Knob and Dial Assembly
	715-0009	Lens - Bezel
	400-0014	Magnet - Focus and Centering
	400-0013	Magnet - Ion Trap
	100-0010	Magnet - Pin Cushion Corrector
	716-0003	Mask - 21
	822-0002	Mounting Board Assembly - Horizontal Scan and H.V. Section
	818-0004	Name Plate - Sylvania
	552-0001	Nut - #8 - 32 - Yoke Mounting
	552-0003	Nut - #8 - 32 - Glass & Mark Mounting Clamps
	552-0024	Nut - #8 - 32 - Speaker Mounting
	488-0002	Pad - Rubber - Horizontal Scan Transformer
	415-0004	Plug - 1 Prong - Speaker
	415-0002	Plug - 2 Prong - Interlock
	415-0011	Plug - 5 Prong - Horizontal Scan and H.V. Connector
R111, R129, R134	181-0470	Resistor - 47 Ohm - ½ W.
R139, R153		
R101, R262, R263	181-0101	Resistor - 100 Ohm - ½ W.
R143	181-0331	Resistor - 330 Ohm - ½ W.
R225, R226	181-0561	Resistor - 560 Ohm - ½ W.
R126, R222, R258	181-0681	Resistor - 680 Ohm - ½ W.
R102, R128, R131	181-0102	Resistor - 1,000 Ohm - ½ W.
R133, R138, R144		
R146, R268		
R137, R142	181-0152	Resistor - 1,500 Ohm - ½ W.
R127, R206	181-0222	Resistor - 2,200 Ohm - ½ W.
R132	181-0272	Resistor - 2,700 Ohm - ½ W.
R149, R260	181-0472	Resistor - 4,700 Ohm - ½ W.
R130, R135, R140	181-0682	Resistor - 6,800 Ohm - ½ W.
R157		
R221	181-01035	Resistor - 10,000 Ohm - ½ W.
R145, R205	181-0103	Resistor - 10,000 Ohm - ½ W.
R148	181-0123	Resistor - 12,000 Ohm - ½ W.
R204	181-0223	Resistor - 22,000 Ohm - ½ W.
R250	181-0273	Resistor - 27,000 Ohm - ½ W.
R214	181-0333	Resistor - 33,000 Ohm - ½ W.
R100	181-0473	Resistor - 47,000 Ohm - ½ W.
R105, R259	181-0683	Resistor - 68,000 Ohm - ½ W.
R109, R145, R205	181-0104	Resistor - 100,000 Ohm - ½ W.
R251, R252		
R108	181-0104	Resistor --100,000 Ohm - ½ W.
R203, R256	181-0124	Resistor - 120,000 Ohm - ½ W.
R158	181-0154	Resistor - 150,000 Ohm - ½ W.
R110	181-01845	Resistor - 180,000 Ohm - ½ W.
R107, R147, R150	181-0224	Resistor - 220,000 Ohm - ½ W.
R175, R201, R215		
R202	181-0334	Resistor - 330,000 Ohm - ½ W.
R152, R219, R223	181-0474	Resistor - 470,000 Ohm - ½ W.
R261		
R217	181-0684	Resistor - 680,000 Ohm - ½ W.

R213	181-0155	Resistor - 1.5 Megohm - ½ W.
R200	181-0225	Resistor - 2.2 Megohm - ½ W.
R253, R254	181-0475	Resistor - 4.7 Megohm - ½ W.
R106		Resistor - 15 Megohm - ½ W.
R209	182-0332	Resistor - 3,300 Megohm - 1 W.
R225	182-0562	Resistor - 5,600 Ohm - 1 W.
R112	182-0103	Resistor - 10,000 Ohm - 1 W.
R207	183-0682	Resistor - 6,800 Ohm - 2 W.
R136, R141, R154	183-0123	Resistor - 12,000 Ohm - 2 W.
R155, R156		
R264	183-0183	Resistor - 18,000 Ohm - 2 W.
R176		Resistor - 68 Ohm - 10 W.
R113	189-0028	Resistor - 680 Ohm - 10 W.
	189-0024	Resistor Assembly - H.V. Supply
R267		1 Megohm - 2 W.
R266		1 Megohm - 2 W.
R265		1 Megohm - 2 W.
	551-1007	Screw - #4 - 40 - Horizontal Scan Transformer
	486-0008	Shield - Corona - H.V. Resistor
	482-0007	Shield - Tube
	417-0002	Socket - 1 Prong - Speaker
	414-0006	Socket - 3 Prong - Horizontal Deflection Coils
	417-0014	Socket - 5 Prong - Horizontal Scan and High Voltage
	412-0015	Socket - 7 Prong - Miniature
	412-0020	Socket - 7 Prong - Miniature
	412-0006	Socket - 8 Prong - Octal
	412-0022	Socket - 8 Prong - Octal - H.V. Assembly
	412-0018	Socket - 8 Prong - Octal - Shock Mounted
	412-0012	Socket - 9 Prong - Miniature
	412-0021	Socket - 9 Prong - Miniature (Damper Tube)
	558-0003	Spacer - Shock Mounted
	558-0005	Spacer - H.V. Mounting
	539-0602	Speaker - 6½" PM (120B, 120M)
	539-0802	Speaker - 8" PM (126B, 126M)
	496-0079	Spring - Grounding - Picture Tube
T53	143-0023	Transformer - Audio Output
T61	241-0007	Transformer - Horizontal Scan
T55	119-0003	Transformer - IF - Video Interstage
T56	119-0004	Transformer - IF - Video Interstage
T57	119-0005	Transformer - IF - Video Interstage
T58	126-0001	Transformer - IF - Video Output
T50	141-0024	Transformer - Power - 117 V. - 60 Cycle
T52	128-0008	Transformer - Sound Discriminator
T59	242-0002	Transformer - Vertical Oscillator
T60	241-0008	Transformer - Vertical Scan
V20, V21		Tube - 1B3GT
V22		Tube - 5U4G
		Tube - 6AF4 (1-510-2 only)
V14		Tube - 6AH4GT
		Tube - 6AN4 (1-510-2 only)
V9, V15		Tube - 6AL5
V8		Tube - 6AU6
V10		Tube - 6AV6
V1		Tube - 6BC5
V17		Tube - 6BQ6GT
V13		Tube - 6C4
V3, V4, V5, V6		Tube - 6CB6
V16		Tube - 6SN7GT
V19		Tube - 6V3
V2		Tube - 6X8
V11		Tube - 6Y6G
V12		Tube - 12AU7
V7		Tube - 12BY7
V23		Tube - 21EP4A
V18		Tube - 40A1
	323-0021	Tuner Unit - UHF (with Tubes) (1-510-2 only)
	323-0018	Tuner Unit - VHF (with Tubes)
	553-4010	Washer - Rubber - H.V. Ceramic Insulator
L66, L67	100-0009	Yoke - Deflector Coils - Horizontal
L64, L65		Vertical

Note 1: The terms "Horizontal," "Vertical," or "60 cps sine wave" refer to the oscilloscope sweep employed.

Note 2: All waveforms are taken with the oscilloscope horizontal sweep direction from left to right and with upward deflection corresponding to positive polarity.

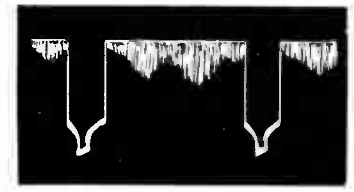
Note 3: In some instances the waveforms obtained will not be identical with those shown, due to the electrical characteristics of the oscilloscope used.

Note 4: All waveforms are measured with respect to chassis unless otherwise indicated.

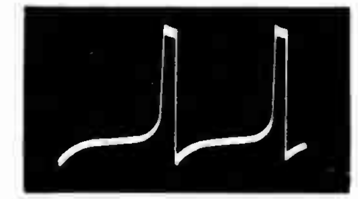
Note 5: Have Picture (Contrast) control at maximum.

*The peak to peak (PP) voltages of these waveforms are dependent on the depth of modulation of the transmitted signal; voltages shown are obtained when modulation is approximately 90 percent.

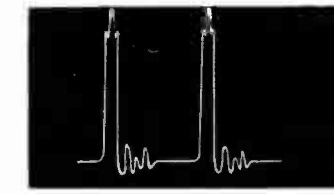
*12BY7 (V7) Video Amplifier Control Grid (Pin 2) 3.5 Volts (PP) Vertical



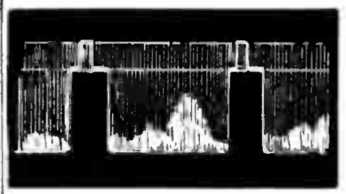
*12BY7 (V7) Video Amplifier Control Grid (Pin 2) 3.5 Volts (PP) Horizontal



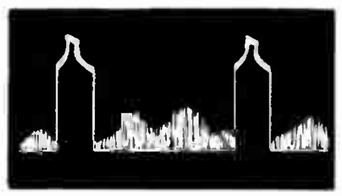
6AL5 (V18) Horizontal Discriminator Plate (Pin 2) 55 Volts (PP) Horizontal



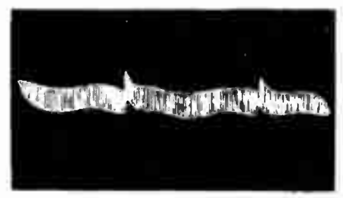
AGC Winding of Horizontal Output Transformer (Point X to Ground) 300 Volts (PP) Horizontal



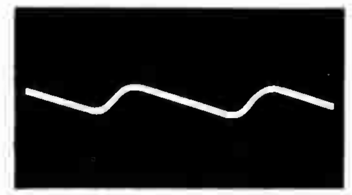
*12BY7 (V7) Video Amplifier Plate (Pin 7) 75 Volts (PP) Vertical



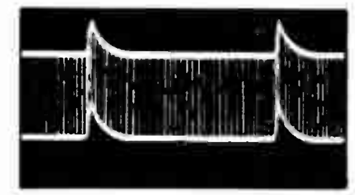
*12BY7 (V7) Video Amplifier Plate (Pin 7) 75 Volts (PP) Horizontal



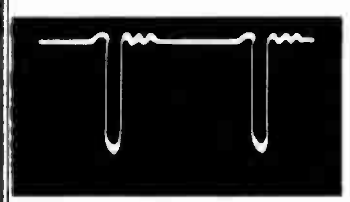
12AX7 (V14) Hor. Sync Separator and AGC Rectifier Cathode (Pin 3) 6 Volts (PP) Vertical



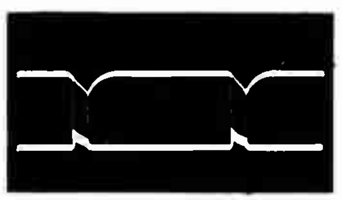
12AX7 (V14) Hor. Sync Separator and AGC Rectifier Cathode (Pin 3) 4.0 Volts (PP) Horizontal



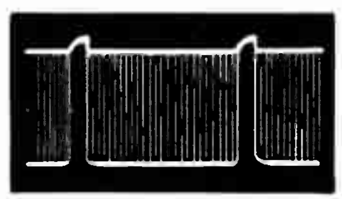
12AX7 (V14) Hor. Sync Separator and AGC Rectifier Plate (Pin 1) 45 Volts (PP) Vertical



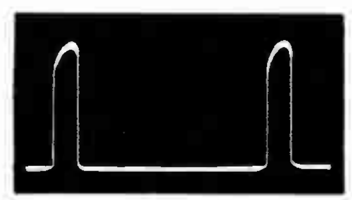
12AX7 (V14) Hor. Sync Separator and AGC Rectifier Plate (Pin 1) 45 Volts (PP) Horizontal



12AX7 (V14) Sync Separator Plate (Pin 6) 40 Volts (PP) Vertical

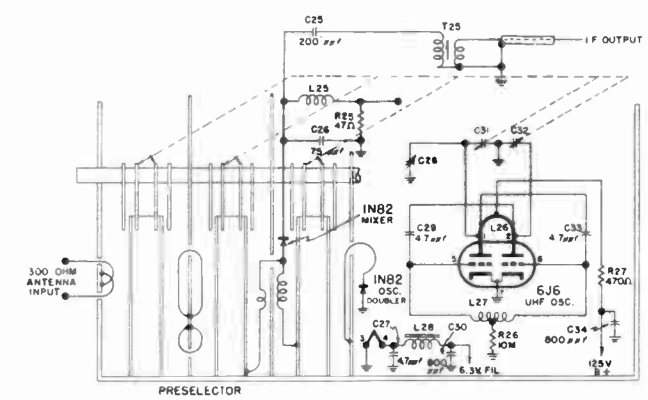


12AU7 (V15) Sync Amplifier and Clipper Plate (Pin 1) 90 Volts (PP) Vertical

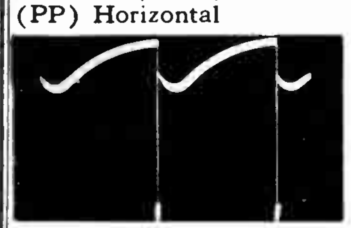


12AU7 (V15) Sync Amplifier and Clipper Plate (Pin 1) 80 Volts (PP) Horizontal

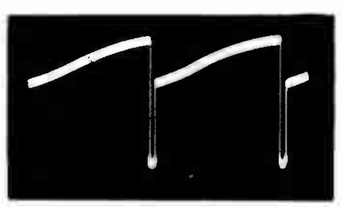
6C4 (V16) Vertical Oscillator Grid (Pin 6) 180 Volts (PP) Vertical



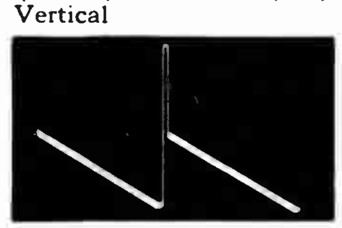
UHF TUNER SCHEMATIC



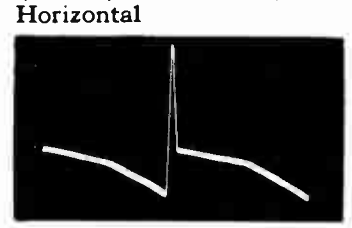
6C4 (V16) Vertical Oscillator Plate (Pin 1) 180 Volts (PP) Vertical



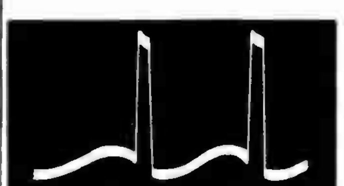
6AH4GT (V17) Vertical Output Grid (Pin 1) 85 Volts (PP) Vertical



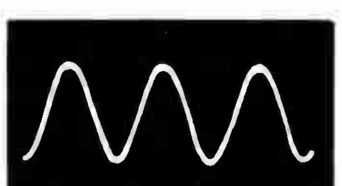
6AH4GT (V17) Vertical Output Plate (Pin 5) 700 Volts (PP) Vertical



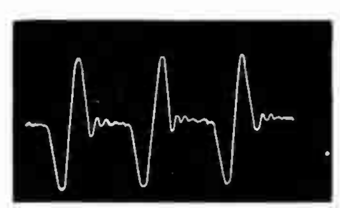
Vertical Deflection Coils (Test Point 1) 70 Volts (PP) Vertical



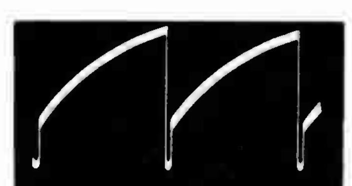
6AL5 (V18) Horizontal Discriminator Plate (Pin 7) 55 Volts (PP) Horizontal



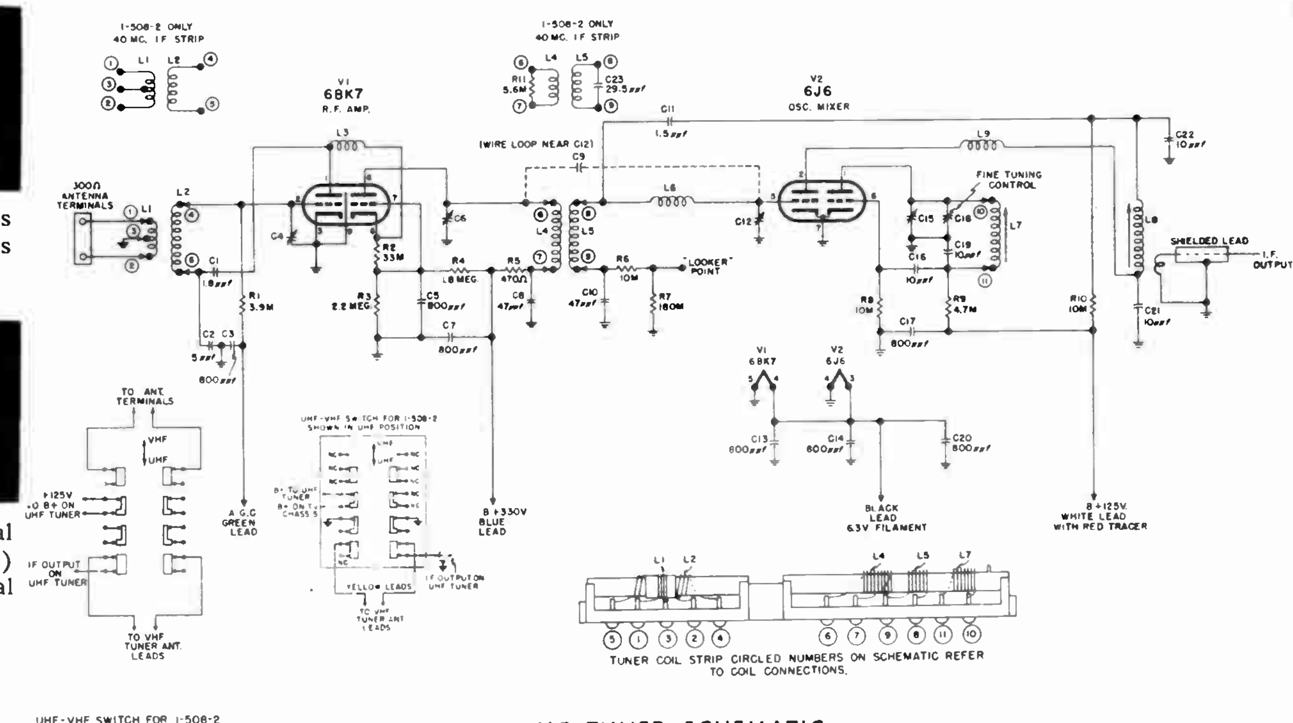
6CB6 (V19) Horizontal Control Plate (Pin 5) 70 Volts (PP) Horizontal



12AU7 (V20) Horizontal Oscillator Plate (Pin 1) 80 Volts (PP) Horizontal



12AU7 (V20) Horizontal Discharge Plate (Pin 6) 85 Volts (PP) Horizontal



VHF TUNER SCHEMATIC

SCHEMATIC DIAGRAM FOR 1-508-1 AND 1-508-2 TV CHASSIS

PARTS CODING

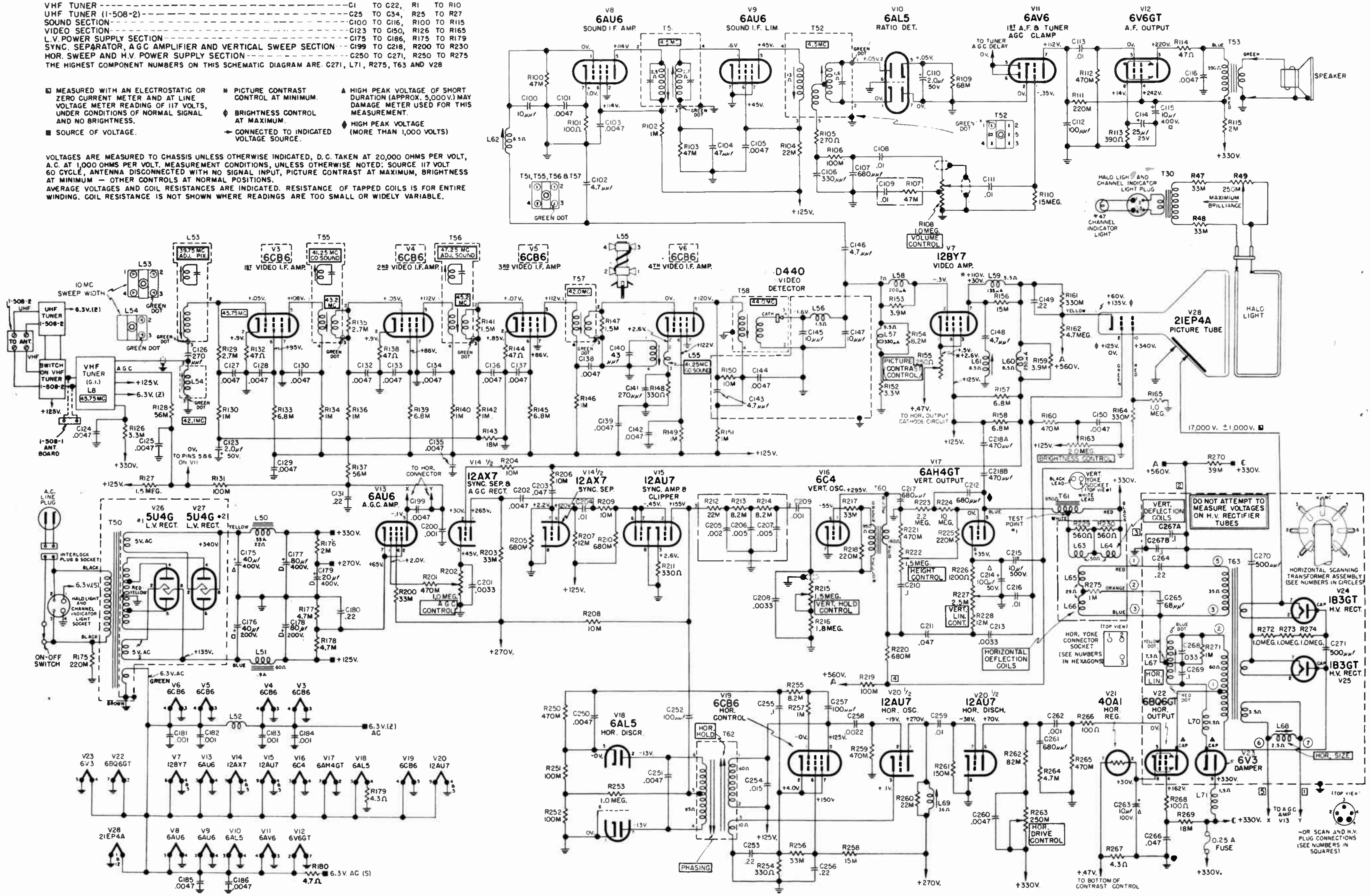
VHF TUNER	C1 TO C22,	R1 TO R10
UHF TUNER (1-508-2)	C25 TO C34,	R25 TO R27
SOUND SECTION	C100 TO C116,	R100 TO R115
VIDEO SECTION	C123 TO C150,	R126 TO R165
L.V. POWER SUPPLY SECTION	C175 TO C186,	R175 TO R179
SYNC. SEPARATOR, AGC AMPLIFIER AND VERTICAL SWEEP SECTION	C199 TO C218,	R200 TO R230
HOR. SWEEP AND H.V. POWER SUPPLY SECTION	C250 TO C271,	R250 TO R275

THE HIGHEST COMPONENT NUMBERS ON THIS SCHEMATIC DIAGRAM ARE C271, L71, R275, T63 AND V28

- ◘ MEASURED WITH AN ELECTROSTATIC OR ZERO CURRENT METER AND AT LINE VOLTAGE METER READING OF 117 VOLTS, UNDER CONDITIONS OF NORMAL SIGNAL AND NO BRIGHTNESS.
- ■ SOURCE OF VOLTAGE.
- * PICTURE CONTRAST CONTROL AT MINIMUM.
- ⌽ BRIGHTNESS CONTROL AT MAXIMUM.
- ← CONNECTED TO INDICATED VOLTAGE SOURCE.
- ▲ HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 5,000V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT.
- ♦ HIGH PEAK VOLTAGE (MORE THAN 1,000 VOLTS)

VOLTAGES ARE MEASURED TO CHASSIS UNLESS OTHERWISE INDICATED, D.C. TAKEN AT 20,000 OHMS PER VOLT, A.C. AT 1,000 OHMS PER VOLT. MEASUREMENT CONDITIONS, UNLESS OTHERWISE NOTED: SOURCE 117 VOLT 60 CYCLE, ANTENNA DISCONNECTED WITH NO SIGNAL INPUT, PICTURE CONTRAST AT MAXIMUM, BRIGHTNESS AT MINIMUM — OTHER CONTROLS AT NORMAL POSITIONS.

AVERAGE VOLTAGES AND COIL RESISTANCES ARE INDICATED. RESISTANCE OF TAPPED COILS IS FOR ENTIRE WINDING. COIL RESISTANCE IS NOT SHOWN WHERE READINGS ARE TOO SMALL OR WIDELY VARIABLE.



REPAIR PARTS LIST

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	582-0015	Antenna - UHF (1-508-2 chassis models)
	714-0011	Bezel - 21" Rectangular (172, 178 models)
	714-0010	Bezel - 21" Rectangular (175 models)
	714-0012	Bezel - 21" Rectangular (176, 177 models)
	822-0002	Board - Mounting (H. V. Assembly)
	480-0001	Board - Terminal - HaloLighting Transformer
	486-0005	Button - Corona - H. V. Power Supply
	417-0019	Cable and Socket - Picture Tube
	483-0018	Cap - Tube Socket (H. V. Rectifiers)
C102, C143, C146, C148	168-0008N	Capacitor - Ceramic 4.7 Mmfd. - 500 V.
C100, C145, C147	166-0010P	Capacitor - Ceramic 10 Mmfd. - 500 V.
C140	166-0043P	Capacitor - Ceramic 43 Mmfd. - 500 V.
C104	166-0047N	Capacitor - Ceramic 47 Mmfd. - 500 V.
C265	174-0068	Capacitor - Ceramic 68 Mmfd. - 2,000 V.
C126, C141	166-0270N	Capacitor - Ceramic 270 Mmfd. - 500 V.
C106	166-0330	Capacitor - Ceramic 330 Mmfd. - 500 V.
C270, C271	169-0015	Capacitor - Ceramic 500 Mmfd. - 20,000 V.
C181, C182, C183, C184, C200	166-1000D	Capacitor - Ceramic .001 Mfd. - 500 V.
C262	166-1000P	Capacitor - Ceramic .001 Mfd. - 500 V.
C101, C103, C105, C124, C125, C127, C128, C129, C130, C132, C133, C134, C135, C136, C137, C138, C139, C142, C144, C150, C185, C186, C260	166-4700D	Capacitor - Ceramic .0047 Mfd. - 500 V.
C110, C123	161-1001	Capacitor - Electrolytic 2 Mfd. - 50 V.
C215	161-1010	Capacitor - Electrolytic 10 Mfd. - 500 V.
C263	161-4006	Capacitor - Electrolytic 10 Mfd. - 100 V.
C115		10 Mfd. - 400 V.
C179		20 Mfd. - 400 V.
C114		25 Mfd. - 25 V.
C175	161-2004	Capacitor - Electrolytic 40 Mfd. - 400 V.
C177		80 Mfd. - 400 V.
C176	161-3012	Capacitor - Electrolytic 40 Mfd. - 200 V.
C178		80 Mfd. - 200 V.
C214		100 Mfd. - 50 V.
C112, C252, C257	163-0100	Capacitor - Mica 100 Mmfd. - 500 V.
C218A, C218B	163-0470	Capacitor - Mica 470 Mmfd. - 500 V.
C107, C212, C217, C261	163-0680	Capacitor - Mica 680 Mmfd. - 500 V.
C209	162-0621	Capacitor - Paper .001 Mfd. - 600 V.
C258	160-06222	Capacitor - Paper .0022 Mfd. - 600 V.
C201, C208, C213	162-06233	Capacitor - Paper .0033 Mfd. - 600 V.
C116, C199, C202, C250, C251	162-06247	Capacitor - Paper .0047 Mfd. - 600 V.
C108, C111, C113, C204, C216, C259	162-0611	Capacitor - Paper .01 Mfd. - 600 V.
C268	160-06133	Capacitor - Paper .033 Mfd. - 600 V.
C203, C211, C266	160-04147	Capacitor - Paper .047 Mfd. - 400 V.
C210, C255, C267A, C267B, C269	160-0601	Capacitor - Paper - Molded .1 Mfd. - 600 V.
C131, C149, C180, C253, C256	162-0202	Capacitor - Paper .22 Mfd. - 200 V.
C264	160-02022	Capacitor - Paper - Molded .22 Mfd. - 200 V.
C254	169-0010	Capacitor - Polystyrene .015 Mfd. - 400 V.
C109	190-0006	Capacitor - Resistor Combination - Tone Compensating .01 Mfd. -
R107		47 000 Ohm - ½ W.
C205	190-0007	Capacitor - Resistor Combination - Integrator Plate .002 Mfd. -
C206		.005 Mfd. -
C207		.005 Mfd. -
R213		8,200 Ohm - ½ W.
R214		8,200 Ohm - ½ W.
R212		22,000 Ohm - ½ W.
L50	145-0006	Choke - Filter - B+ (+330 V.)
L51	145-0002	Choke - Filter - B+ (+125 V.)
L52	147-0014	Choke - Heater
	196-0010	Clip and Lead Assembly - Damper Cathode
	196-0007	Clip and Lead Assembly - Horizontal Output Plate
	487-0008	Clip - Fuse
	487-0020	Clip - Glass Mounting - Top
	487-0004	Clip - IF Transformer Mounting
L56, L70, L71	118-0010	Coil - Filter
L67	133-0002	Coil - Horizontal Linearity
L68	132-0002	Coil - Horizontal Size
L54	115-0001	Coil - Link Shunt
L57, L58	131-2010	Coil - Peaking - Dual
L59, L60	131-2007	Coil - Peaking - Dual
L69	146-0005	Coil - Ringing
L61, L62	130-0001	Coil - Trap - 4.5 Mc.
L55	118-0011	Coil - Trap - IF Cathode
L53	119-0002	Coil - Tuner Coupling
	196-0014	Connector - Anode and Lead Assembly
R202	153-0009	Control - AGC
R108, R163	157-0019	Control - Brightness, Volume and On-Off

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
R49	153-0015	Control - HaloLight
R222	153-0014	Control - Height
R263	153-0007	Control - Horizontal Drive
R155	153-3007	Control - Picture (Contrast)
R215	153-0014	Control - Vertical Hold
R227	153-3011	Control - Vertical Linearity
	195-0001	Cord - Line
	760-0036	Cover - Interlock Assembly (includes line cord) 172 models
	760-0032	Cover - Interlock Assembly (includes line cord) 175 models
	760-0033	Cover - Interlock Assembly (includes line cord) 176 models
	760-0034	Cover - Interlock Assembly (includes line cord) 177 models
	760-0035	Cover - Interlock Assembly (includes line cord) 178 models
		Detector - Crystal Diode - D440
	339-0035	Drum and Shaft Assembly - VHF Tuner
	191-0005	Fuse - ¼ Amp - 250 V.
	710-0009	Glass - Picture Window
	497-0015	Grommet - Rubber (Hor. Scan and H. V. Shield)
	486-0006	Insulator - Ceramic (Hor. Scan and H. V. Assembly)
	486-0009	Insulator - Tube Socket Cap
	818-0007	Jewel - Radio (178 models)
	818-0008	Jewel - TV (172, 177, 178 models)
	744-0022	Knob - Channel Selector
	740-0029	Knob - Fine Tuning
	744-0021	Knob - Halo Selector
	744-0023	Knob - Outer - Brightness
	400-0014	Magnet - Focus and Centering Unit
	400-0013	Magnet - Ion Trap
	100-0010	Magnet - Pin Cushion Corrector
	716-0003	Mask - 21"
	818-0004	Nameplate - Sylvania
	552-0001	Nut - #8-32 Wing - Yoke Mounting
	488-0002	Pad - Rubber (Hor. Scan Transformer Assembly)
	415-0004	Plug - 1 Prong - Speaker
	415-0010	Plug - 2 Prong - HaloLight Connector
	415-0002	Plug - 2 Prong - Interlock
	415-0011	Plug - 5 Prong - Hor. Scan and H. V. Connector
R179, R267	189-0007	Resistor - 4.3 Ohm - ½ W. - W. W.
R114, R132, R138, R144	181-0470	Resistor - 47 Ohm - ½ W.
R101, R266, R268	181-0101	Resistor - 100 Ohm - ½ W.
R105	181-0271	Resistor - 270 Ohm - ½ W.
R148, R211, R254	181-0331	Resistor - 330 Ohm - ½ W.
R229, R230	181-0561	Resistor - 560 Ohm - ½ W.
R102, R130, R134, R136, R140, R142, R146, R149, R151, R257, R275	181-0102	Resistor - 1,000 Ohm - ½ W.
R141, R147	181-0152	Resistor - 1,500 Ohm - ½ W.
R129, R135	181-0272	Resistor - 2,700 Ohm - ½ W.
R152	181-0332	Resistor - 3,300 Ohm - ½ W.
R153, R159	181-0392	Resistor - 3,900 Ohm - ½ W.
R264	181-0472	Resistor - 4,700 Ohm - ½ W.
R133, R139, R145	181-0682	Resistor - 6,800 Ohm - ½ W.
R154, R255	181-0822	Resistor - 8,200 Ohm - ½ W.
R150, R204, R206, R209	181-0103	Resistor - 10,000 Ohm - ½ W.
R228	181-01235	Resistor - 12,000 Ohm - ½ W.
R207	181-0123	Resistor - 12 000 Ohm - ½ W.
R156	181-0153	Resistor - 15,000 Ohm - ½ W.
R143	181-0183	Resistor - 18,000 Ohm - ½ W.
R104, R260	181-0223	Resistor - 22,000 Ohm - ½ W.
R200, R203, R217	181-0333	Resistor - 33,000 Ohm - ½ W.
R100, R103	181-0473	Resistor - 47,000 Ohm - ½ W.
R128, R137	181-0563	Resistor - 56,000 Ohm - ½ W.
R109	181-0683	Resistor - 68,000 Ohm - ½ W.
R262	181-0823	Resistor - 82,000 Ohm - ½ W.
R106, R131, R219, R251, R252	181-0104	Resistor - 100,000 Ohm - ½ W.
R261	181-0154	Resistor - 150,000 Ohm - ½ W.
R111, R175, R218, R225	181-0224	Resistor - 220,000 Ohm - ½ W.
R161, R164	181-0334	Resistor - 330,000 Ohm - ½ W.
R112, R160, R201, R221, R250, R259, R265	181-0474	Resistor - 470,000 Ohm - ½ W.
R205, R210, R220	181-0684	Resistor - 680,000 Ohm - ½ W.
R165, R253	181-0105	Resistor - 1.0 Megohm - ½ W.
R127	181-0155	Resistor - 1.5 Megohm - ½ W.
R216	181-0185	Resistor - 1.8 Megohm - ½ W.
R223	181-0225	Resistor - 2.2 Megohm - ½ W.
R162	181-0475	Resistor - 4.7 Megohm - ½ W.
R224	181-0105	Resistor - 10 Megohm - ½ W.
R110	181-0156	Resistor - 15 Megohm - ½ W.
R180	189-0029	Resistor - 4.7 Ohm - 1 W.
R113	182-0391	Resistor - 390 Ohm - 1 W.

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
R226	182-0122	Resistor - 1,200 Ohm - 1 W.
R258	182-0153	Resistor - 15,000 Ohm - 1 W.
R271	183-0102	Resistor - 1,000 Ohm - 2 W.
R177, R178	183-0472	Resistor - 4,700 Ohm - 2 W.
R157, R158	183-0682	Resistor - 6,800 Ohm - 2 W.
R208	183-0103	Resistor - 10,000 Ohm - 2 W.
R269	183-0183	Resistor - 18,000 Ohm - 2 W.
R47, R48	189-0026	Resistor - 33,000 Ohm - 2 W.
R256	183-0333	Resistor - 33,000 Ohm - 2 W.
R270	183-0393	Resistor - 39,000 Ohm - 2 W.
	189-0024	Resistor Assembly - H. V. Power Supply
R272		1.0 Megohm - 2 W.
R273		1.0 Megohm - 2 W.
R274		1.0 Megohm - 2 W.
R115, R176	187-0005	Resistor - 2,000 Ohm - 5 W. - W. W.
R126	187-0008	Resistor - 3,300 Ohm - 5 W. - W. W.
	486-0007	Retainer - Filament Leads (H. V. Rectifier)
	554-0021	Ring - Tube Socket Cap (H. V. Rectifiers)
	551-1007	Screw - #4-40 x 2½" (Hor. Scan and H. V. Supply)
	486-0008	Shield - Corona - Resistor
	483-0019	Shield - Light
	482-0007	Shield - Tube (7 Prong Miniature)
	417-0002	Socket - 1 Prong (Speaker)
	414-0006	Socket - 3 Prong - Yoke Connecting
	413-0006	Socket - 4 Prong - Channel Indicator Light and HaloLighting
	417-0004	Socket - 5 Prong - Hor. Scan and H. V. Connector
	412-0015	Socket - 7 Prong Miniature
	412-0020	Socket - 7 Prong Miniature with Base
	412-0006	Socket - 8 Prong Octal
	412-0018	Socket - 8 Prong Octal - Shock Mounted
	412-0012	Socket - 9 Prong Miniature
	412-0021	Socket - 9 Prong Miniature
	558-0005	Spacer - H. V. Assembly Mounting
	558-0003	Spacer - Shock Mounted Socket
	539-0602	Speaker - 6½" P. M. (175 models)
	539-1004	Speaker - 10" P. M. (176 models)
	539-1005	Speaker - 10" P. M. (172, 177 models)
	539-1205	Speaker - 12" P. M. (178 models)
	496-0079	Spring - Picture Tube Grounding
	339-0036	Spring - Retaining - VHF Tuner Drum
L1, L2, L4, L5, L7	110-0002	Strip - Coil - VHF Tuner - Channel 2
"	110-0003	Channel 3
"	110-0004	Channel 4
"	110-0005	Channel 5
"	110-0006	Channel 6
"	110-0007	Channel 7
"	110-0008	Channel 8
"	110-0009	Channel 9
"	110-0010	Channel 10
"	110-0011	Channel 11
"	110-0012	Channel 12
"	110-0013	Channel 13
"	110-0001	40 Mc. IF Strip (1-508-2 only)
	577-0004	Switch Assembly - UHF - VHF (1-508-2)
	143-0022	Transformer - Audio Output
T30	143-0023	Transformer - HaloLighting
T62	128-0009	Transformer - Horizontal Discriminator
T63	241-0007	Transformer - Horizontal Scanning Assembly
T51	120-0003	Transformer - IF - Sound
T55	119-0003	Transformer - IF - Video
T56	119-0004	Transformer - IF - Video
T57	119-0005	Transformer - IF - Video
T58	126-0001	Transformer - IF - Video (Output)
T50	141-0021	Transformer - Power
T52	128-0008	Transformer - Sound Discriminator
T60	242-0002	Transformer - Vertical Oscillator
T61	241-0008	Transformer - Vertical Scanning
	611-2100	Tube - Cold Cathode - HaloLight
V24, V25		Tube - 1B3GT
V26, V27		Tube - 5U4G
V17		Tube - 6AH4GT
V10, V18		Tube - 6AL5
V8, V9, V13		Tube - 6AU6
V11		Tube - 6AV6
V1		Tube - 6BK7
V22		Tube - 6BQ6GT
V16		Tube - 6C4
V3, V4, V5, V6, V19		Tube - 6CB6
V2		Tube - 6J6
V23		Tube - 6V3
V12		Tube - 6V6GT
V15, V20		Tube - 12AU7
V14		Tube - 12AX7
V7		Tube - 12BY7
V28		Tube - 21EP4A
V21		Tube - 40A1
	323-0019	Tuner Unit - UHF (with tubes) - 1-508-2 only
	323-0017	Tuner Unit - VHF (with tubes)
	553-4010	Washer - Neoprene (H. V. Shield)
L65, L66	100-0009	Yoke - Deflection - Horizontal
L63, L64		Vertical

REVISIONS AND CODE CHANGES TO CHASSIS 1-508-1, -2, 1-510-1, -2 AS NOTED

CHASSIS 1-508-1, 1-508-2, 1-510-1, 1-510-2

All chassis covered are now using a 1/4 Amp slow blow fuse, Service Part 191-0014 instead of the original type.

C267A and C267B (chassis 1-508-1 and 1-508-2), and 263A and C263B (chassis 1-510-1 and 1-510-2), .1 Mfd. 600 V. capacitors are combined into C267 and C263 respectively, .22 Mfd. 600 V. capacitors, Service Part 160-06022.

These revisions bear no code change numbers.

CHASSIS 1-508-1 C01, C02, C03 AND 1-508-2

Reduction of sound interference in the picture is accomplished under code change C01 on chassis 1-508-1 and in original production of chassis 1-508-2 by connecting pin 6 of V11, the 6AV6 1st A. F. Amplifier and Tuner AGC Clamp as indicated in Figure 27. Correct the note on AGC delay (at junction of resistors R127, 1.5 megohm and R131, 100M ohms) to read "To pin 5 on V11".

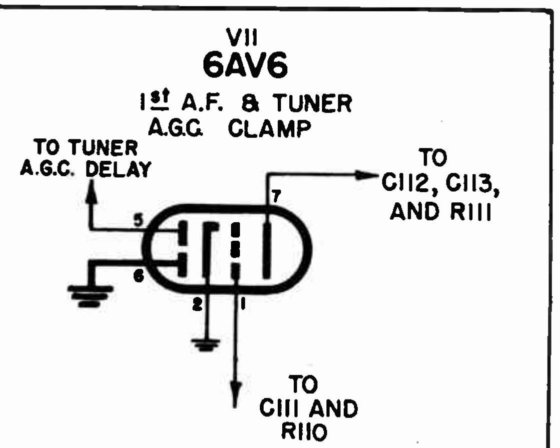


FIGURE 27 - PARTIAL SCHEMATIC DIAGRAM CHASSIS 1-508-1 C01

R215, the Vertical Hold control on chassis 1-508-1 and 1-508-2 is changed from 1.5 megohms to 2.0 megohms, Service Part 153-0018, to increase its range. This revision is coded C02 in chassis 1-508-1 and incorporated in initial production of chassis 1-508-2.

Under code change C03, a high pass filter, Service Part 114-0001 is now used on chassis 1-508-1 between the VHF antenna and the VHF tuner to improve IF rejection of the tuner.

C218A and C218B, 470 Mmfd., 500V. capacitors are combined into C218, a 220 Mmfd., 1000 V. capacitor, Service Part 160-1032 on chassis 1-508-1 and 1-508-2. This revision bears no code change number in either chassis.

CHASSIS 1-510-1 C01, C02, C03, C04 AND 1-510-2

C215, .0047 Mfd., 500 V. ceramic capacitor is changed to a .0047 Mfd., 600 V. paper unit, Service Part 162-06247 in chassis 1-510-1 as C01 and in original production of chassis 1-510-2. The revision provides greater voltage tolerance for this capacitor.

The following revisions constitute code change C02 in chassis 1-510-1. These revisions will be included in initial production of chassis 1-510-2.

1. C106, 2 Mfd. capacitor and R105, 68M ohm resistor are now connected as in Figure 28 to prevent possible sound interference in the picture at high volume levels.

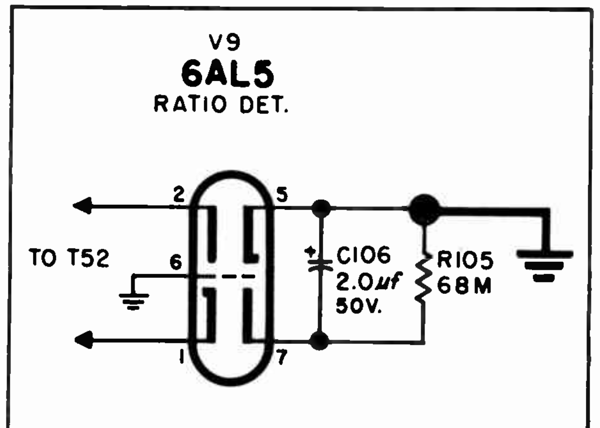


FIGURE 28 - RATIO DETECTOR CIRCUIT CHANGE CHASSIS 1-510-1 C02.

2. The ventilation of R176, 68 ohm resistor (75 ohms in certain initially produced chassis) is improved by physically relocating both this resistor and C136, .22 Mfd. capacitor.

3. R255, 5,600 ohm resistor has been physically relocated as a factory change.

Sensitivity in chassis 1-510-1 and 1-510-2 is increased by the following component changes. These changes constitute code C03 in chassis 1-510-1 and are incorporated in initial production of chassis 1-510-2.

1. R126 - 680 ohm resistor is removed.

2. R130, R135 and R140 are changed from 6,800 ohms to 4,700 ohms Service Part 181-0472.

3. R136 and R141 are changed from 12,000 ohms to 6,800 ohms, Service Part 183-0682.

A factory revision under code change C03 also eliminates C215 - .0047, 600 V. capacitor, previously added by code change C01.

Code change C04 in Chassis 1-510-1 and initial production of chassis 1-510-2 includes the following changes.

1. R222 has been changed from 680 ohms to 1000 ohms, Service Part 182-0102 to improve the range of R220, the Vertical Linearity control.

2. The stability of the horizontal oscillator has been improved by changing R258 from 680 ohms to 820 ohms, Service Part 181-0821.

3. A high pass filter, Service Part 114-0001 is now incorporated between the VHF antenna terminals and the VHF tuner to improve rejection of IF by the tuner.

Revise the Repair Parts Lists appearing on pages 21 and 24 to include these changes as noted below.

REPAIR PARTS LIST CHASSIS 1-508-1, 1-508-2

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
		DELETE
C218A, C218B	163-0470	Capacitor - Mica - 470 Mmfd. - 500 V.
C267A, C267B	160-0601	Capacitor - Paper - Molded - .1 Mfd. - 600 V.
R215	153-0014	Control - Vertical Hold
	191-0005	Fuse - 1/4 Amp - 250 V.
		ADD
C218	160-10322	Capacitor - Paper - Molded - 220 Mmfd. - 1000 V.
C267	160-06022	Capacitor - Paper - Molded - .22 Mfd. - 600 V.
R215	153-0018	Control - Vertical Hold
	114-0001	Filter - High Pass
	191-0014	Fuse - 1/4 Amp - 250 V. - Slow Blow

REPAIR PARTS LIST CHASSIS 1-510-1, 1-510-2

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
		DELETE
C215	166-4700D	Capacitor - Ceramic - .0047 Mfd. - 500 V.
C263A, C263B	160-0601	Capacitor - Paper - Molded - .1 Mfd. - 600 V.
	191-0005	Fuse - 1/4 Amp - 250 V.
R126, R222, R258	181-0681	Resistor - 680 Ohm - 1/2 W.
R130, R135, R140	181-0682	Resistor - 6,800 Ohm - 1/2 W.
R136, R141	183-0123	Resistor - 12,000 Ohm - 2 W.
		ADD
C215	162-06247	Capacitor - Paper - .0047 Mfd. - 600 V.
C263	160-06022	Capacitor - Paper - Molded - .22 Mfd. - 600 V.
	114-0001	Filter - High Pass
	191-0014	Fuse - 1/4 Amp - 250 V. - Slow Blow
R258	181-0821	Resistor - 820 Ohm - 1/2 W.
R130, R135, R140	181-0472	Resistor - 4,700 Ohm - 1/2 W.
R222	182-0102	Resistor - 1,000 Ohm - 1 W.
R136, R141	183-0682	Resistor - 6,800 Ohm - 2 W.

PARTS CODING

VHF TUNER SECTION — C1 TO C24, R1 TO R11
UHF TUNER SECTION — C26 TO C39, R26 TO R29
SOUND SECTION — C100 TO C114, R100 TO R114
VIDEO SECTION — C124 TO C152, R127 TO R159
L.V. POWER SUPPLY SECTION — C175 TO C180, R175 AND R176
SYNC. SEPARATOR AND VERTICAL SWEEP SECTION — C200 TO C214, R200 TO R227
HOR. SWEEP AND H.V. POWER SUPPLY SECTION — C250 TO C267, R250 TO R268
THE HIGHEST COMPONENT NUMBERS ON THIS SCHEMATIC DIAGRAM ARE: C267, L71, R268, T61 AND V23

▣ MEASURED WITH AN ELECTROSTATIC OR ZERO CURRENT METER AND AT LINE VOLTAGE METER READING OF 117 VOLTS, UNDER CONDITIONS OF NORMAL SIGNAL AND NO BRIGHTNESS.

■ SOURCE OF VOLTAGE.

* PICTURE CONTRAST CONTROL AT MINIMUM.

♦ BRIGHTNESS CONTROL AT MAXIMUM.

→ CONNECTED TO INDICATED VOLTAGE SOURCE.

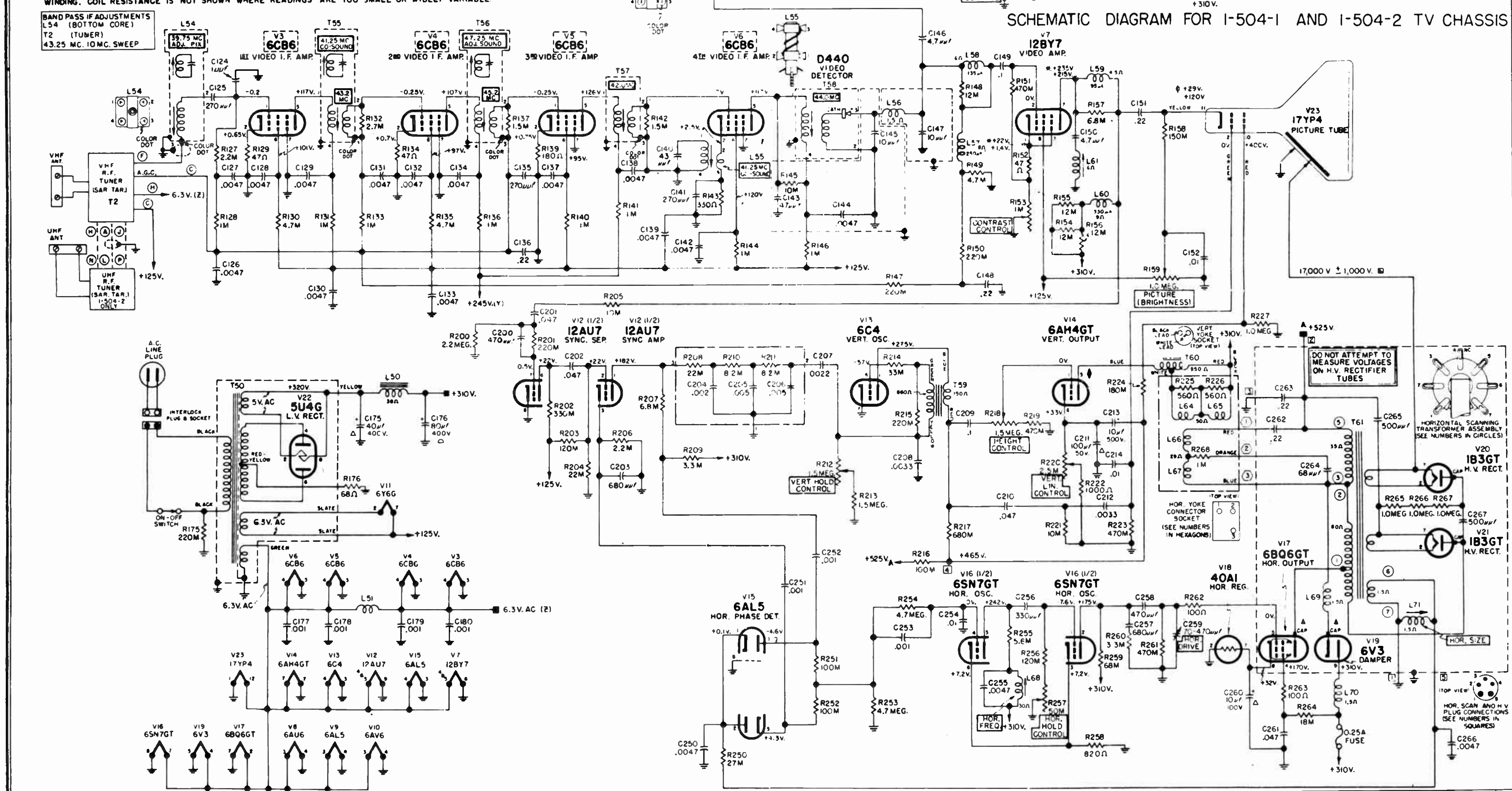
▲ HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 5,000V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT.

♦ HIGH PEAK VOLTAGE (MORE THAN 1000 VOLTS)

VOLTAGES ARE MEASURED TO CHASSIS UNLESS OTHERWISE INDICATED, D.C. TAKEN AT 20,000 OHMS PER VOLT, A.C. AT 1,000 OHMS PER VOLT. MEASUREMENT CONDITIONS, UNLESS OTHERWISE NOTED: SOURCE 117 VOLT 60 CYCLE, ANTENNA DISCONNECTED WITH NO SIGNAL INPUT, PICTURE CONTRAST AT MAXIMUM, BRIGHTNESS AT MINIMUM — OTHER CONTROLS AT NORMAL POSITIONS.
AVERAGE VOLTAGES AND COIL RESISTANCES ARE INDICATED. RESISTANCE OF TAPPED COILS IS FOR ENTIRE WINDING. COIL RESISTANCE IS NOT SHOWN WHERE READINGS ARE TOO SMALL OR WIDELY VARIABLE.

BAND PASS IF ADJUSTMENTS	
L54	(BOTTOM CORE)
T2	(TUNER)
43.25 MC. 10MC. SWEEP	

SCHEMATIC DIAGRAM FOR 1-504-1 AND 1-504-2 TV CHASSIS



CHASSIS 1-508-2, 1-510-2

The two Bearing Rings, Service Part 554-0022, employed on the VHF-UHF drive assembly of TV chassis 1-508-2 and 1-510-2, have been replaced by two new parts as listed below:

1. A new Bearing Ring, Service Part 554-0024, is used in place of the old front bearing ring.
2. A new Bushing Ring, Service Part 554-0025, is used in place of the old rear bearing ring.

These new parts provide for easier assembly and disassembly of the VHF-UHF drive assembly.

CHASSIS 1-504-1, 1-504-2

To bring the 1-504-1 and 1-504-2 Repair Parts List up to date, add the following service part numbers for the appropriate part:

1. Service Part Number 163-4700, Capacitor - Polystyrene - .0047 Mfd. - 500 V. - C255
2. Service Part Number 554-0024, Ring - Bearing (1-504-2 only).
3. Service Part Number 554-0025, Ring - Bushing (1-504-2 only).

To include the changes contained in this supplement, revise the Repair Parts Lists appearing on pages 21 and 24 as noted below.

REPAIR PARTS LIST CHASSIS 1-508-1, 1-508-2

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
		DELETE
R208	183-0103	Resistor - 10,000 Ohm - 2 W.
	554-0022	Ring - Bearing (1-508-2 only)
		ADD
R199	182-0333	Resistor - 33,000 Ohm - 1 W.
R198	182-03645	Resistor - 360,000 Ohm - 1 W.
R208	183-0153	Resistor - 15,000 Ohm - 2 W.
	554-0024	Ring - Bearing (1-508-2 only)
	554-0025	Ring - Bushing (1-508-2 only)

REPAIR PARTS LIST CHASSIS 1-510-1, 1-510-2

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
		DELETE
C200	163-0470	Capacitor - Mica - 470 Mmfd. - 500 V.
C201	160-04147	Capacitor - Paper - Molded - .047 Mfd. - 400 V.
R201	181-0224	Resistor - 220,000 Ohm - 1/2 W.
R200	181-0225	Resistor - 2.2 Megohm - 1/2 W.
	554-0022	Ring - Bearing (1-510-2 only)
		ADD
C200	163-0220	Capacitor - Mica - 220 Mmfd. - 500 V.
C201	160-0411	Capacitor - Paper - Molded - .01 Mfd. - 400 V.
R200, R201	181-0474	Resistor - 470,000 Ohm - 1/2 W.
	554-0024	Ring - Bearing (1-510-2 only)
	554-0025	Ring - Bushing (1-510-2 only)

ADDITION OF MODELS 200M, 200MU 225M, 225MU

The 200M and 200MU are direct viewing table model TV receivers varying only in frequency range. Model 200M contains the 1-504-1 chassis, and provides reception of the 12 commercial VHF channels; Model 200MU contains the 1-504-2 chassis, and provides reception of all commercial channels - VHF channels 2 through 13 and UHF channels 14 through 83. The 225M and 225MU are direct viewing table model television receivers that vary only in frequency range. Model 225M contains the 1-510-1 chassis, and provides reception of VHF channels 2 through 13. Chassis 1-510-2 is used in Model 225MU, providing reception of all commercial television channels - VHF channels 2 through 13 and UHF channels 14 through 83.

MODEL 200M

MODEL 225M

To include the models listed in this supplement, the following parts should be added

REPAIR PARTS LIST CHASSIS 1-504-1, 1-504-2

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	714-0018	Bezel Assembly - 17"
	487-0023	Clip - Bezel Mounting
	491-0016	Gasket - Dust - Tube Mask
	818-0010	Insert - UHF
	743-0024	Knob Assembly - Outer (Channel Selector)
	744-0022	Knob Assembly - Outer (Volume & On-Off)
	539-0503	Speaker - 5" P. M.

REPAIR PARTS LIST CHASSIS 1-510-1, 1-510-2

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	714-0020	Bezel Assembly - 21"
	487-0023	Clip - Bezel Mounting
	491-0015	Gasket - Dust - Tube Mask
	818-0010	Insert - UHF
	743-0024	Knob Assembly - Outer (Channel Selector)
	744-0022	Knob Assembly - Outer (Volume & On-Off)
	539-0503	Speaker - 5" P. M.

CHASSIS 1-504-1 C01, C02 — CHASSIS 1-508-1 C07, C08, C09 — 1-508-2 C02, C03
CHASSIS 1-510-1 C07, C08

CHASSIS 1-504-1 C01

Code change C01 for TV chassis 1-504-1 includes the following changes to improve sensitivity:

1. C139 - .0047 Mfd. capacitor is removed.
2. R146 - 1000 ohm resistor is changed to a 6800 ohm resistor.

Refer to the revised 1-504-1, -2 schematic diagram included in this supplement for revisions in B+ connections to the plate circuits of V4, V5, and V6 accompanying these component changes.

CHASSIS 1-510-1 C07

The following component changes constitute code change C07 for the 1-510-1 TV chassis and result in improved sensitivity:

1. R113 - 680 ohm, 10 watt resistor is changed to a 680 ohm, 2 watt resistor.
2. R114 - 680 ohm, 2 watt resistor is added and connected in parallel to R113.
3. R136 - 6,800 ohm resistor is changed to a 1,000 ohm resistor.
4. R140 - 4,700 ohm resistor is changed to a 1,000 ohm resistor.

5. R141 - 6,800 ohm resistor is changed to a 1,000 ohm resistor.

6. R138 - 1,000 ohm resistor is removed.

7. R139 - 47 ohm resistor is changed to a 180 ohm resistor.

8. R146 - 1,000 ohm resistor is changed to a 6,800 ohm resistor.

9. C135 - .0047 Mfd. capacitor is changed to a 270 Mmfd. capacitor.

10. C139 - .0047 Mfd. capacitor is removed.

Refer to the revised 1-510-1, -2 schematic diagram included in this supplement for revisions in B+ connections to the plate circuits of V4, V5, and V6 accompanying these component changes.

A factory change also identified as code change C07 for the 1-510-1 TV chassis removes the high pass filter, Service Part 114-0001.

CHASSIS 1-508-1 C07, C08, C09
CHASSIS 1-508-2 C02, C03

Code change C07 for the 1-508-1 TV chassis removes the high pass filter, Service Part 114-0001, as a factory change. This filter was formerly added by code change C03.

Code change C08 for 1-508-1 chassis changes the voltage rating for C256 - .22 Mfd. capacitor from 200 V. to 400 V.

Code change C09 for the 1-508-1 chassis consists of the following revisions:

1. C121 - .047 Mfd. capacitor is added and connected across R131 - 100,000 ohm resistor as a factory change.

2. C122 - .22 Mfd. capacitor is added and connected from the VHF tuner AGC line to ground. This change serves to eliminate a white flash type of interference in the picture.

Under code change C02 for TV chassis 1-508-2, the VHF tuner, Service Part 323-0017, is changed to Service Part 323-0031. This version of the 1-508-2 VHF tuner includes the 40 Mc. IF strip.

Code changes C08 and C09 for the 1-508-1 have been incorporated in the 1-508-2 chassis; however, they are identified on the 1-508-2 as code change C03.

On both chassis 1-508-1 and 1-508-2, the shield has been removed from the lead connecting Vertical Hold control R215 to the yellow lead of the Vertical Oscillator transformer T60.

This factory revision bears no code change number for either chassis.

See schematic on page 35.

CHASSIS 1-504-1 C02; CHASSIS 1-510-1 C08

Code changes C02 for TV chassis 1-504-1 and C08 for chassis 1-510-1 add a Noise Inverter stage, plus an improved filtering circuit for the +125 V. source, on the respective chassis. The Noise Inverter stage improves sync stability under noise conditions, and improved filtering of +125 V. removes possible vertical scan instability caused by sound interference.

Component revisions under these code changes on both chassis series are as follows:

1. C253 - .001 Mfd. capacitor is changed to .0047 Mfd.

2. C254 - .01 Mfd. capacitor is changed to .047 Mfd.

3. R205 - 10,000 ohm resistor is changed to 33,000 ohms.

4. R115 - 68 ohm resistor is inserted in series with pin 8 of V11 - A.F. Output 6Y6G and +125 V. source.

5. C115 - 20 Mfd. capacitor is connected to pin 8 of V11 - A.F. Output 6Y6G. (This capacitor consists of the ⌓ section of electrolytic C111 - C112 - C260, formerly wired as C112 to pin 4 of V11.)

6. C112 - 20 Mfd. capacitor, ⌓ section of C111 - C112 - C260, is replaced by a wire-in type electrolytic rated at 10 Mfd. 350 V.

7. C111 - 200 Mfd. capacitor is rewired to +125 V. source side of R115 - 68 ohm resistor.

8. R200 - 470,000 ohm resistor on chassis 1-510-1 and 2.2 megohm on chassis 1-504-1, is replaced by a 1.2 megohm resistor.

9. C203 - 680 Mmfd. is changed to a 70 to 470 Mmfd. variable capacitor and becomes the Sync Balancing adjustment. Adjust C203 as described in the procedure on this page.

See schematic on page 36.

Component revisions peculiar to the C02 change on chassis 1-504-1 are as follows:

1. C200 - 470 Mmfd. capacitor is changed to a 220 Mmfd. capacitor.

2. C201 - .047 Mfd. is replaced by a .01 Mfd. capacitor.

3. R201 - 220,000 ohm resistor is changed to a 470,000 ohm resistor.

See schematic on page 37.

In addition to the above listed component revisions, an entire new stage consisting of a 12AU7 tube functioning as a Noise Inverter has been added to both chassis series. Parts coding assigned to components in this stage are: capacitors - C230 to C232, resistors - R230 to R237, and the 12AU7 tube - V24.

Refer to the complete revised schematic diagrams of TV chassis 1-504-1, -2 and 1-510-2, -2 for both new and revised circuits accompanying the 1-504-1 C02 and 1-510-1 C08 changes.

ADJUSTMENT OF C203
SYNC BALANCING TRIMMER

1. Tune in air signal.

2. Short pin 2 of V15 Horizontal Phase Detector 6AL5 to chassis.

3. Connect VTVM from pin 4 of V16 Horizontal Oscillator 6SN7GT to chassis.

4. Adjust C203 for minimum voltage.

5. Remove VTVM from circuit.

6. With Horizontal Hold control in mechanical center position, adjust L68 Horizontal Frequency control until picture moves back and forth across screen with blanking bar vertical.

7. Remove short from pin 2 of V15 Horizontal Phase Detector 6AL5.

8. With Contrast control in extreme counterclockwise position, rotate Horizontal Hold control until picture locks in and appears normal.

9. Advance Contrast control to normal position and check Horizontal Hold control on all available channels. A slight readjustment of Horizontal Hold control may be necessary.

CHASSIS 1-504-1, 1-504-2

A factory change on the 1-504-1 and 1-504-2 television chassis adds two pincushion corrector magnets to eliminate curvature of the edges of the raster. Adjust these magnets as described on page 8.

CHASSIS 1-504-1, -2; 1-508-1, -2; 1-510-1, -2

The type designation for the D440 germanium diode functioning as the Video Detector on all chassis covered has been changed to the RTMA assigned number 1N105. All references to the D440 number should be changed to 1N105

CHASSIS 1-504-1, -2; 1-510-1, -2

As mentioned previously, a coding of V24 has been assigned to the new 12AU7 Noise Inverter stage on chassis 1-504-1, -2 and 1-510-1, -2. To eliminate confusion, the coding assigned to the UHF tuner tubes, i.e. - V24 for the 6AN4 UHF Mixer, and V25 for the 6AF4 UHF Oscillator - has been changed to V30 and V31, respectively. All references to these tubes should be changed to the new coding numbers.

Production of 1-504-1, -2 and 1-510-1, -2 chassis now include VHF tuners with the terminal board lugs identified by numbers stamped on the tuner. The revised schematic diagrams for these chassis use the new numbers for terminal locations. Figure 31 provides a means of cross-checking the former schematic letter designations against later production tuners with numbers.

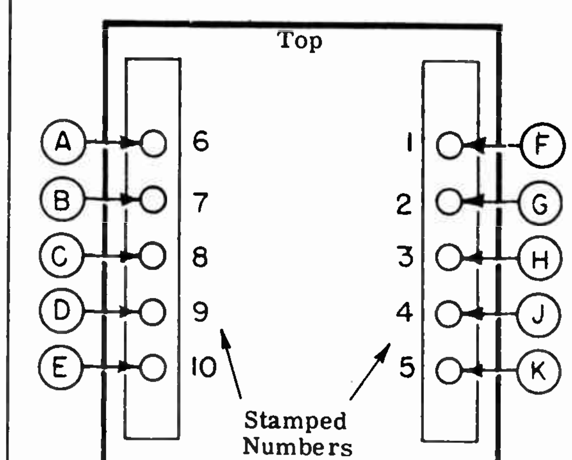


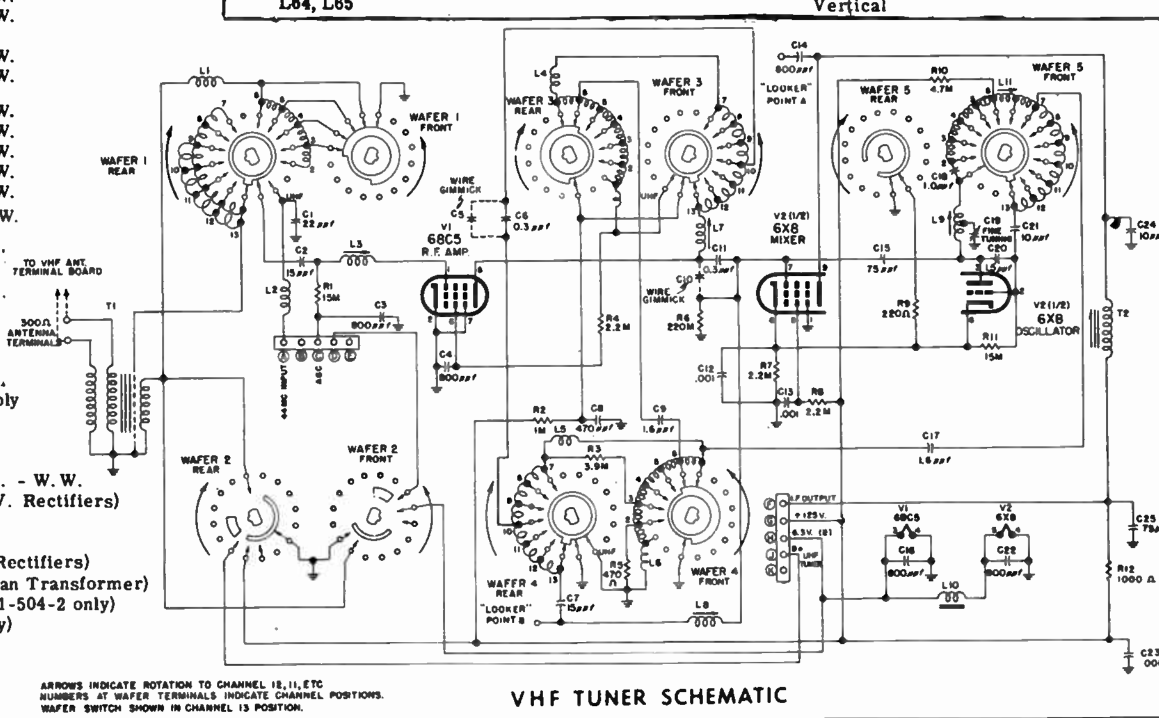
FIGURE 31 - VHF TUNER TERMINALS
1-504-1, -2 & 1-510-1, -2

Note: For convenience in servicing, complete schematic diagrams of the 1-504-1 and -2, 1-508-1 and -2, and 1-510-1 and -2 TV chassis are included in this supplement. All revisions described in this supplement are incorporated on the respective schematic diagrams and Revised Repair Parts Lists.

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	582-0015	Antenna - UHF (1-504-2 chassis models)
	714-0016	Bezel - 17" Rectangular
	822-0002	Board - Mounting (H.V. Assembly)
	486-0005	Button - Corona - H.V. Power Supply
	417-0008	Cable and Socket - Picture Tube
	483-0018	Cap - Tube Socket (H.V. Rectifiers)
C143, C146, C150	168-0008N	Capacitor - Ceramic - 4.7 Mmfd. - 500 V.
C100, C145, C147	166-0010P	Capacitor - Ceramic - 10 Mmfd. - 500 V.
C140	166-0043P	Capacitor - Ceramic - 43 Mmfd. - 500 V.
C264	174-0068	Capacitor - Ceramic - 68 Mmfd. - 2,000 V.
C125, C135, C141	166-0270N	Capacitor - Ceramic - 270 Mmfd. - 500 V.
C103	166-0330	Capacitor - Ceramic - 330 Mmfd. - 500 V.
C265, C267	169-0015	Capacitor - Ceramic - 500 Mmfd. - 20,000 V.
C177, C178, C179, C180	166-1000D	Capacitor - Ceramic - .001 Mfd. - 500 V.
C126, C127, C128, C129, C130, C131, C132, C133, C134, C137, C138, C139, C142, C144	166-4700D	Capacitor - Ceramic - .0047 Mfd. - 500 V.
C101, C102	168-0011D	Capacitor - Ceramic - Dual - .0047 Mfd. - 500 V.
C106, C110	161-1001	Capacitor - Electrolytic - 2 Mfd. - 50 V.
C213	161-1010	Capacitor - Electrolytic - 10 Mfd. - 500 V.
C175	161-2004	Capacitor - Electrolytic - 40 Mfd. - 400 V.
C176		80 Mfd. - 400 V.
C114	161-2005	Capacitor - Electrolytic - 40 Mfd. - 400 V.
C211		100 Mfd. - 50 V.
C260	161-3014	Capacitor - Electrolytic - 10 Mfd. - 100 V.
C112		20 Mfd. - 300 V.
C111		200 Mfd. - 200 V.
C109	163-0100	Capacitor - Mica - 100 Mmfd. - 500 V.
C256	163-0330	Capacitor - Mica - 330 Mmfd. - 500 V.
C200, C258	163-0470	Capacitor - Mica - 470 Mmfd. - 500 V.
C104, C203, C257	163-0680	Capacitor - Mica - 680 Mmfd. - 500 V.
C207	162-0622	Capacitor - Paper - .0022 Mfd. - 600 V.
C208, C212	162-0623	Capacitor - Paper - .0033 Mfd. - 600 V.
C113, C250, C266	162-06247	Capacitor - Paper - .0047 Mfd. - 600 V.
C105, C107, C108, C152, C214, C254	162-0611	Capacitor - Paper - .01 Mfd. - 600 V.
C202	162-0215	Capacitor - Paper - .047 Mfd. - 200 V.
C210	162-06147	Capacitor - Paper - .047 Mfd. - 600 V.
C149	162-0201	Capacitor - Paper - .1 Mfd. - 200 V.
C136, C148	162-0202	Capacitor - Paper - .22 Mfd. - 200 V.
C151	162-0402	Capacitor - Paper - .22 Mfd. - 400 V.
C251, C252, C253	160-0421	Capacitor - Paper - Molded - .001 Mfd. - 400 V.
C201, C261	160-04147	Capacitor - Paper - Molded - .047 Mfd. - 400 V.
C209	160-0401	Capacitor - Paper - Molded - .1 Mfd. - 400 V.
C262, C263	160-06022	Capacitor - Paper - Molded - .22 Mfd. - 600 V.
C255		Capacitor - Polystyrene - .0047 Mfd. - 500 V.
	190-0007	Capacitor - Resistor Combination - Integrator Plate
C204		.002 Mfd. - 500 V.
C205		.005 Mfd. - 500 V.
C206		.005 Mfd. - 500 V.
R210		8,200 Ohm - 1/2 W.
R211		8,200 Ohm - 1/2 W.
R208		22,000 Ohm - 1/2 W.
C259	172-0032	Capacitor - Trimmer - Horizontal Drive Control
L50	145-0004	Choke - Filter - B+
L51	147-0014	Choke - Heater
	487-0022	Clamp - Bearing (1-504-2 only)
	196-0007	Clip and Lead Assembly - Damper Cathode, Horizontal Output Plate
	196-0010	Clip and Lead Assembly - H.V. Rectifier Plate
	487-0008	Clip - Fuse
	487-0004	Clip - IF Transformer Mounting
L56, L69, L70	118-0010	Coil - Filter
L68	132-0001	Coil - Horizontal Frequency
L71	132-0002	Coil - Horizontal Size
L57, L58	131-2003	Coil - Peaking - Dual
L59, L60	131-2008	Coil - Peaking - Dual
L61, L62	130-0001	Coil - Trap - 4.5 Mc.
L55	118-0011	Coil - Trap - IF Cathode
L54	119-0002	Coil - Tuner Coupling
	196-0014	Connector - H.V. Anode and Lead Assembly
R104, R153	157-0021	Control - Dual - Contrast, Volume and On-Off
R218	153-0014	Control - Height
R257	153-0017	Control - Horizontal Hold
R159	153-0016	Control - Picture (Brightness)
R212	153-0014	Control - Vertical Hold
R220	153-3011	Control - Vertical Linearity
	195-0001	Cord - Line
	760-0037	Cover - Interlock Assembly (includes line cord)

		Detector - Crystal Diode - D440
	722-0030	Dial - UHF (1-504-2 only)
	722-0028	Dial - UHF Dummy
	191-0014	Fuse - 1/4 Amp. - 125 V. - Slow Blow
	484-0013	Gear and Hub Assembly (1-504-2 only)
	710-0011	Glass - Picture Window
	486-0006	Insulator - Ceramic (Hor. Scan and H.V. Assembly)
	486-0009	Insulator - Tube Socket Cap (H.V. Rectifiers)
	744-0023	Knob - Inner - Contrast
	740-0029	Knob - Inner - Fine Tuning
	744-0022	Knob - Outer - Volume and On-Off
	743-0022	Knob - Outer and Dial Assembly
	715-0009	Lens - Bezel
	400-0014	Magnet - Focus and Centering Unit
	400-0013	Magnet - Ion Trap
	716-0005	Mask - 17"
	552-0001	Nut - 8-32 Wing - Yoke Mounting
	552-0024	Nut - 8-32 - Speaker Mounting
	488-0002	Pad - Rubber (Hor. Scan Transformer Assembly)
	484-0014	Pinion and Screws Assembly (1-504-2 only)
	415-0004	Plug - 1 Prong - Speaker
	415-0002	Plug - 2 Prong - Interlock
	415-0011	Plug - 5 Prong - Hor. Scan and H.V. Connector
	494-0009	Pulley and Sleeve Assembly (1-504-2 only)
R111, R129, R134, R152	181-0470	Resistor - 47 Ohm - 1/2 W.
R101, R262, R263	181-0101	Resistor - 100 Ohm - 1/2 W.
R139	181-0181	Resistor - 180 Ohm - 1/2 W.
R143	181-0331	Resistor - 330 Ohm - 1/2 W.
R225, R226	181-0561	Resistor - 560 Ohm - 1/2 W.
R258	181-0821	Resistor - 820 Ohm - 1/2 W.
R102, R128, R131, R133, R136, R140, R141, R144, R146, R268	181-0102	Resistor - 1,000 Ohm - 1/2 W.
R137, R142	181-0152	Resistor - 1,500 Ohm - 1/2 W.
R127, R206	181-0222	Resistor - 2,200 Ohm - 1/2 W.
R132	181-0272	Resistor - 2,700 Ohm - 1/2 W.
R260	181-0332	Resistor - 3,300 Ohm - 1/2 W.
R130, R135, R140, R149	181-0472	Resistor - 4,700 Ohm - 1/2 W.
R157	181-0682	Resistor - 6,800 Ohm - 1/2 W.
R145, R205	181-0103	Resistor - 10,000 Ohm - 1/2 W.
R221	181-01035	Resistor - 10,000 Ohm - 1/2 W.
R148	181-0123	Resistor - 12,000 Ohm - 1/2 W.
R204	181-0223	Resistor - 22,000 Ohm - 1/2 W.
R250	181-0273	Resistor - 27,000 Ohm - 1/2 W.
R214	181-0333	Resistor - 33,000 Ohm - 1/2 W.
R100	181-0473	Resistor - 47,000 Ohm - 1/2 W.
R105, R259	181-0683	Resistor - 68,000 Ohm - 1/2 W.
R103, R109, R216, R251, R252	181-0104	Resistor - 100,000 Ohm - 1/2 W.
R108	181-01045	Resistor - 100,000 Ohm - 1/2 W.
R203, R256	181-0124	Resistor - 120,000 Ohm - 1/2 W.
R158	181-0154	Resistor - 150,000 Ohm - 1/2 W.
R224	181-0184	Resistor - 180,000 Ohm - 1/2 W.
R110	181-01845	Resistor - 180,000 Ohm - 1/2 W.
R107, R147, R150, R175, R201, R215	181-0224	Resistor - 220,000 Ohm - 1/2 W.
R202	181-0334	Resistor - 330,000 Ohm - 1/2 W.
R151, R219, R223, R261	181-0474	Resistor - 470,000 Ohm - 1/2 W.
R217	181-0684	Resistor - 680,000 Ohm - 1/2 W.
R227	181-0105	Resistor - 1.0 Megohm - 1/2 W.
R213	181-0155	Resistor - 1.5 Megohm - 1/2 W.
R200	181-0225	Resistor - 2.2 Megohm - 1/2 W.
R253, R254	181-0475	Resistor - 4.7 Megohm - 1/2 W.
R106	181-0156	Resistor - 15 Megohm - 1/2 W.
R222	182-0102	Resistor - 1,000 Ohm - 1 W.
R209	182-0332	Resistor - 3,300 Ohm - 1 W.
R255	182-0562	Resistor - 5,600 Ohm - 1 W.
R112	182-0103	Resistor - 10,000 Ohm - 1 W.
R113, R114	183-0681	Resistor - 680 Ohm - 2 W.
R207	183-0682	Resistor - 6,800 Ohm - 2 W.
R154, R155, R156	183-0123	Resistor - 12,000 Ohm - 2 W.
R264	183-0183	Resistor - 18,000 Ohm - 2 W.
	189-0024	Resistor Assembly - H.V. Supply
R265		1 Megohm - 2 W.
R266		1 Megohm - 2 W.
R267		1 Megohm - 2 W.
R176	187-0013	Resistor - 68 Ohm - 10 W. - W.W.
	486-0007	Retainer - Filament Leads (H.V. Rectifiers)
		Ring - Bearing (1-504-2 only)
		Ring - Bushing (1-504-2 only)
	554-0021	Ring - Tube Socket Cap (H.V. Rectifiers)
	551-1007	Screw - 4-40 x 2-1/2" (Hor. Scan Transformer)
	551-0018	Screw - 6-32 x 5/32" Special (1-504-2 only)
	493-0031	Shaft - UHF Drive (1-504-2 only)
	486-0008	Shield - Corona - Resistor

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	482-0007	Shield - Tube (7 Prong Miniature)
	417-0002	Socket - 1 Prong (Speaker)
	414-0006	Socket - 3 Prong - Yoke Connecting
	417-0014	Socket - 5 Prong - Hor. Scan and H.V. Connector
	412-0015	Socket - 7 Prong - Miniature
	412-0020	Socket - 7 Prong - Miniature with Base
	412-0006	Socket - 8 Prong - Octal
	412-0022	Socket - 8 Prong - Octal - H.V. Assembly
	412-0018	Socket - 8 Prong - Octal - Shock Mounted
	412-0012	Socket - 8 Prong - Miniature
	412-0021	Socket - 9 Prong - Miniature (Damper Tube)
	558-0006	Spacer (1-504-2 only)
	558-0005	Spacer - H.V. Assembly Mounting
	558-0003	Spacer - Shock Mounted Socket
	539-0602	Speaker - 6-1/2" P.M.
	496-0080	Spring - Picture Tube Grounding
T53	143-0023	Transformer - Audio Output
T61	241-0007	Transformer - Horizontal Scanning Assembly
T55	119-0003	Transformer - IF - Video
T56	119-0004	Transformer - IF - Video
T57	119-0005	Transformer - IF - Video
T58	126-0001	Transformer - IF - Video (Output)
T50	141-0024	Transformer - Power - 117 V. - 60 Cycle
T52	128-0008	Transformer - Sound Discriminator
T59	242-0002	Transformer - Vertical Oscillator
T60	241-0008	Transformer - Vertical Scanning
V20, V21		Tube - 1B3GT
V22		Tube - 5U4G
V25		Tube - 6AF4 (1-504-2)
V14		Tube - 6AH4GT
V24		Tube - 6AN4 (1-504-2)
V9, V15		Tube - 6AL5
V8		Tube - 6AU6
V10		Tube - 6AV6
V1		Tube - 6BC5
V17		Tube - 6BQ6GT
V13		Tube - 6C4
V3, V4, V5, V6		Tube - 6CB6
V16		Tube - 6SN7GT
V19		Tube - 6V3
V2		Tube - 6X8
V11		Tube - 6Y6G
V12		Tube - 12AU7
V7		Tube - 12BY7
V23		Tube - 17YP4
V18		Tube - 40A1
	323-0030	Tuner Unit Assembly - VHF (with tubes and UHF drive components)
	323-0021	Tuner Unit - UHF (with tubes) (1-504-2 only)
	323-0027	Tuner Unit - VHF (with tubes) (less UHF drive components)
	553-4010	Washer - H.V. Ceramic Insulator Mounting
L66, L67	100-0009	Yoke - Deflection - Horizontal
L64, L65		Vertical



VHF TUNER SCHEMATIC

REVISED REPAIR PARTS LIST

CHASSIS 1-504-1, 1-504-2

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	582-0015	Antenna - UHF (1-504-2 Chassis Models)
	714-0016	Bezel Assembly (105 Models)
	714-0018	Bezel Assembly (200 Models)
	822-0002	Board - Mounting (H.V. Assembly)
	486-0005	Button - Corona - H.V. Power Supply
	417-0008	Cable and Socket - Picture Tube
	483-0018	Cap - Tube Socket (H.V. Rectifiers)
C143, C146, C150	168-0008N	Capacitor - Ceramic - 4.7 Mmfd. - 500 V.
C100, C145, C147	166-0010P	Capacitor - Ceramic - 10 Mmfd. - 500 V.
C140	166-0043P	Capacitor - Ceramic - 43 Mmfd. - 500 V.
C264	174-0068	Capacitor - Ceramic - 68 Mmfd. - 2,000 V.
C125, C135, C141	166-0270N	Capacitor - Ceramic - 270 Mmfd. - 500 V.
C103	166-0330	Capacitor - Ceramic - 330 Mmfd. - 500 V.
C265, C267	169-0015	Capacitor - Ceramic - 500 Mmfd. - 20,000 V.
C177, C178, C179, C180	166-1000D	Capacitor - Ceramic - .001 Mfd. - 500 V.
C126, C127, C128, C129, C130, C131, C132, C133, C134, C137, C138, C142, C144	166-4700D	Capacitor - Ceramic - .0047 Mfd. - 500 V.
C101, C102	168-0011D	Capacitor - Ceramic - Dual - .0047 Mfd. - 500 V.
C106, C110	161-1001	Capacitor - Electrolytic - 2 Mfd. - 50 V.
C112	161-1007	Capacitor - Electrolytic - 10 Mfd. - 350 V.
C213	161-1010	Capacitor - Electrolytic - 10 Mfd. - 500 V.
C175	161-2004	Capacitor - Electrolytic - 40 Mfd. - 400 V. △
C176		80 Mfd. - 400 V. ⌓
C114	161-2005	Capacitor - Electrolytic - 40 Mfd. - 400 V. ⌓
C211		100 Mfd. - 50 V. △
C260	161-3014	Capacitor - Electrolytic - 10 Mfd. - 100 V. △
C115		20 Mfd. - 300 V. ⌓
C111		200 Mfd. - 200 V. □
C109	163-0100	Capacitor - Mica - 100 Mmfd. - 500 V.
C200	163-0220	Capacitor - Mica - 220 Mmfd. - 500 V.
C256	163-0330	Capacitor - Mica - 330 Mmfd. - 500 V.
C258	163-0470	Capacitor - Mica - 470 Mmfd. - 500 V.
C104, C257	163-0680	Capacitor - Mica - 680 Mmfd. - 500 V.
C207	162-0622	Capacitor - Paper - .0022 Mfd. - 600 V.
C208, C212	162-0623	Capacitor - Paper - .0033 Mfd. - 600 V.
C113, C250, C253, C266	162-06247	Capacitor - Paper - .0047 Mfd. - 600 V.
C105, C107, C108, C152, C214, C231, C232	162-0611	Capacitor - Paper - .01 Mfd. - 600 V.
C202, C254	162-0215	Capacitor - Paper - .047 Mfd. - 200 V.
C210	162-06147	Capacitor - Paper - .047 Mfd. - 600 V.
C149	162-0201	Capacitor - Paper - .1 Mfd. - 200 V.
C136, C148	162-0202	Capacitor - Paper - .22 Mfd. - 200 V.
C151	162-0402	Capacitor - Paper - .22 Mfd. - 400 V.
C251, C252	162-0421	Capacitor - Paper - Molded - .001 Mfd. - 400 V.
C201	160-0411	Capacitor - Paper - Molded - .01 Mfd. - 400 V.
C261	160-04147	Capacitor - Paper - Molded - .047 Mfd. - 400 V.
C209, C230	160-0401	Capacitor - Paper - Molded - .1 Mfd. - 600 V.
C262, C263	162-06022	Capacitor - Paper - Molded - .22 Mfd. - 600 V.
C255	163-4700	Capacitor - Polystyrene - .0047 Mfd. - 500 V.
	190-0007	Capacitor - Resistor Combination - Integrator Plate
C204		.002 Mfd. - 500 V.
C205		.005 Mfd. - 500 V.
C206		.005 Mfd. - 500 V.
R210		8,200 Ohm - 1/2 W.
R211		8,200 Ohm - 1/2 W.
R208		22,000 Ohm - 1/2 W.
C259	172-0032	Capacitor - 70 to 470 Mmfd. Trimmer (Horizontal Drive Control)
C203	172-0032	Capacitor - 70 to 470 Mmfd. Trimmer (Sync Balancing Adjustment)
L50	145-0004	Choke - Filter - B+
L51	147-0014	Choke - Heater
	487-0022	Clamp - Bearing (1-504-2 only)
	196-0007	Clip and Lead Assembly - Damper Cathode, Horizontal Output Plate
	196-0010	Clip and Lead Assembly - H.V. Rectifier Plate
	487-0023	Clip - Bezel Mounting
	487-0008	Clip - Fuse
	487-0004	Clip - IF Transformer Mounting
L56, L69, L70	118-0010	Coil - Filter
L68	132-0001	Coil - Horizontal Frequency
L71	132-0002	Coil - Horizontal Size
L57, L58	131-2003	Coil - Peaking - Dual
L59, L60	131-2008	Coil - Peaking - Dual

L61, L62	130-0001	Coil - Trap - 4.5 Mc.
L55	118-0011	Coil - Trap - IF Cathode
L54	119-0002	Coil - Tuner Coupling
	196-0014	Connector - H.V. Anode and Lead Assembly
R104, R153	157-0021	Control - Dual - Contrast, Volume and On-Off
R218	153-0014	Control - Height
R257	153-0017	Control - Horizontal Hold
R159	153-0016	Control - Picture (Brightness)
R212	153-0014	Control - Vertical Hold
R220	153-3011	Control - Vertical Linearity
	195-0001	Cord - Line
	760-0037	Cover - Interlock Assembly (Includes Line Cord)
		Detector - Crystal Diode 1N105
	722-0030	Dial - UHF (1-504-2 only)
	722-0028	Dial - UHF Dummy
	191-0014	Fuse - 1/4 Amp. - 250 V. - Slow Blow
	491-0016	Gasket - Dust (Tube Mask)
	484-0013	Gear and Hub Assembly (1-504-2 only)
	710-0011	Glass - Picture Window
	818-0010	Insert - UHF (200 Models)
	486-0006	Insulator - Ceramic (Hor. Scan and H.V. Assembly)
	486-0009	Insulator - Tube Socket Cap (H.V. Rectifiers)
	744-0023	Knob - Inner - Contrast
	740-0029	Knob - Inner - Fine Tuning
	743-0022	Knob - Outer and Dial Assembly (105 Models)
	743-0024	Knob - Outer and Dial Assembly (200 Models)
	744-0022	Knob - Outer - Volume and On-Off
	715-0009	Lens - Bezel
	400-0014	Magnet - Focus and Centering Unit
	400-0013	Magnet - Ion Trap
	400-0016	Magnet - Pin Cushion Corrector
	716-0005	Mask - 17"
	552-0001	Nut - 8-32 Wing - Yoke Mounting
	552-0024	Nut - 8-32 - Speaker Mounting
	488-0002	Pad - Rubber (Hor. Scan Transformer Assembly)
	484-0014	Pinion and Screws Assembly (1-504-2 only)
	415-0004	Plug - 1 Prong - Speaker
	415-0002	Plug - 2 Prong - Interlock
	415-0011	Plug - 5 Prong - Hor. Scan and H.V. Connector
	494-0009	Pulley and Sleeve Assembly (1-504-2 only)
R111, R129, R134, R152	181-0470	Resistor - 47 Ohm - 1/2 W.
R101, R262, R263	181-0101	Resistor - 100 Ohm - 1/2 W.
R139	181-0181	Resistor - 180 Ohm - 1/2 W.
R143	181-0331	Resistor - 330 Ohm - 1/2 W.
R225, R226	181-0561	Resistor - 560 Ohm - 1/2 W.
R258	181-0821	Resistor - 820 Ohm - 1/2 W.
R102, R128, R131, R133, R136, R140, R141, R144, R268	181-0102	Resistor - 1,000 Ohm - 1/2 W.
R137, R142	181-0152	Resistor - 1,500 Ohm - 1/2 W.
R127, R206	181-0222	Resistor - 2,200 Ohm - 1/2 W.
R132	181-0272	Resistor - 2,700 Ohm - 1/2 W.
R234, R260	181-0332	Resistor - 3,300 Ohm - 1/2 W.
R130, R135, R149	181-0472	Resistor - 4,700 Ohm - 1/2 W.
R146, R157	181-0682	Resistor - 6,800 Ohm - 1/2 W.
R145	181-0103	Resistor - 10,000 Ohm - 1/2 W.
R221	181-01035	Resistor - 10,000 Ohm - 1/2 W. - 5%
R148, R236	181-0123	Resistor - 12,000 Ohm - 1/2 W.
R204	181-0223	Resistor - 22,000 Ohm - 1/2 W.
R250	181-0273	Resistor - 27,000 Ohm - 1/2 W.
R205, R214	181-0333	Resistor - 33,000 Ohm - 1/2 W.
R100	181-0473	Resistor - 47,000 Ohm - 1/2 W.
R232	181-0563	Resistor - 56,000 Ohm - 1/2 W.
R105, R259	181-0683	Resistor - 68,000 Ohm - 1/2 W.
R237	181-0823	Resistor - 82,000 Ohm - 1/2 W.
R103, R109, R216, R251, R252	181-0104	Resistor - 100,000 Ohm - 1/2 W.
R108	181-01045	Resistor - 100,000 Ohm - 1/2 W. - 5%
R203, R256	181-0124	Resistor - 120,000 Ohm - 1/2 W.
R158	181-0154	Resistor - 150,000 Ohm - 1/2 W.
R224	181-0184	Resistor - 180,000 Ohm - 1/2 W.
R110	181-01845	Resistor - 180,000 Ohm - 1/2 W. - 5%
R107, R147, R150, R175, R201, R215	181-0224	Resistor - 220,000 Ohm - 1/2 W.
R202	181-0334	Resistor - 330,000 Ohm - 1/2 W.
R151, R201, R219, R223, R230, R231, R261	181-0474	Resistor - 470,000 Ohm - 1/2 W.
R217	181-0684	Resistor - 680,000 Ohm - 1/2 W.
R227	181-0105	Resistor - 1.0 Megohm - 1/2 W.
R200	181-0125	Resistor - 1.2 Megohm - 1/2 W.
R213	181-0155	Resistor - 1.5 Megohm - 1/2 W.
R253, R254	181-0475	Resistor - 4.7 Megohm - 1/2 W.

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
R106	181-0156	Resistor - 15 Megohm - 1/2 W.
R235	181-0226	Resistor - 22 Megohm - 1/2 W.
R115	182-0680	Resistor - 68 Ohm - 1 W.
R222	182-0102	Resistor - 1,000 Ohm - 1 W.
R209	182-0332	Resistor - 3,300 Ohm - 1 W.
R255	182-0562	Resistor - 5,600 Ohm - 1 W.
R112	182-0103	Resistor - 10,000 Ohm - 1 W.
R113, R114	183-0681	Resistor - 680 Ohm - 2 W.
R207	183-0682	Resistor - 6,800 Ohm - 2 W.
R154, R155, R156	183-0123	Resistor - 12,000 Ohm - 2 W.
R264	183-0183	Resistor - 18,000 Ohm - 2 W.
	189-0024	Resistor Assembly - H.V. Supply
R265		1 Megohm - 2 W.
R266		1 Megohm - 2 W.
R267		1 Megohm - 2 W.
R176	187-0013	Resistor - 68 Ohm - 10 W. - W.W.
	486-0007	Retainer - Filament Leads (H.V. Rectifiers)
	554-0024	Ring - Bearing (1-504-2 only)
	554-0025	Ring - Bushing (1-504-2 only)
	554-0021	Ring - Tube Socket Cap (H.V. Rectifiers)
	551-1007	Screw - 4-40 x 2-1/2" (Hor. Scan Transformer)
	551-0018	Screw - 6-32 x 5/32" Special (1-504-2 only)
	493-0031	Shaft - UHF Drive (1-504-2 only)
	486-0008	Shield - Corona - Resistor
	482-0007	Shield - Tube (7 Prong Miniature)
	417-0002	Socket - 1 Prong (Speaker)
	414-0006	Socket - 3 Prong - Yoke Connecting
	417-0014	Socket - 5 Prong - Hor. Scan and H.V. Connector
	412-0015	Socket - 7 Prong - Miniature
	412-0020	Socket - 7 Prong - Miniature With Base
	412-0006	Socket - 8 Prong - Octal
	412-0022	Socket - 8 Prong - Octal - H.V. Assembly
	412-0018	Socket - 8 Prong - Octal - Shock Mounted
	412-0021	Socket - 9 Prong - Miniature
	412-0021	Socket - 9 Prong - Miniature (Damper Tube)
	558-0006	Spacer (1-504-2 only)
	558-0005	Spacer - H.V. Assembly Mounting
	558-0003	Spacer - Shock Mounted Socket
	539-0503	Speaker - 5" P.M. (200 Models)
	539-0602	Speaker - 6-1/2" P.M. (105 Models)
	496-0080	Spring - Picture Tube Grounding
T53	143-0023	Transformer - Audio Output
T61	241-0007	Transformer - Horizontal Scanning Assembly
T55	119-0003	Transformer - IF - Video
T56	119-0004	Transformer - IF - Video
T57	119-0005	Transformer - IF - Video
T58	126-0001	Transformer - IF - Video (Output)
T50	141-0024	Transformer - Power - 117 V. - 60 Cycle
T52	128-0008	Transformer - Sound Discriminator
T59	242-0002	Transformer - Vertical Oscillator
T60	241-0068	Transformer - Vertical Scanning
V20, V21		Tube - 1B3GT
V31		Tube - 6AF4 (1-504-2)
V14		Tube - 6AH4GT
V30		Tube - 6AN4 (1-504-2)
V9, V15		Tube - 6AL5
V8		Tube - 6AU6
V10		Tube - 6AV6
V1		Tube - 6BC5
V17		Tube - 6BQ6GT
V13		Tube - 6C4
V3, V4, V5, V6		Tube - 6CB6
V16		Tube - 6SN7GT
V19		Tube - 6V3
V2		Tube - 6X8
V11		Tube - 6Y6G
V12, V24		Tube - 12AU7
V7		Tube - 12BY7
V23		Tube - 17YP4
V18		Tube - 40A1
	323-0030	Tuner Unit Assembly - VHF (With Tubes and UHF Drive Components)
	323-0021	Tuner Unit - UHF (With Tubes) (1-504-2 only)
	323-0027	Tuner Unit - VHF (With Tubes) (Less UHF Drive Components)
	553-4010	Washer - H.V. Ceramic Insulator Mounting
L66, L67	100-0009	Yoke - Deflection - Horizontal
L64, L65		Vertical

REVISED REPAIR PARTS LIST

CHASSIS 1-508-1, 1-508-2

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	582-0015	Antenna - UHF [illegible]-508-[illegible] Models)
	714-0011	Bezel - 21" Rectangular (172, 178 Models)
	714-0010	Bezel - 21" Rectangular (175 Models)
	714-0012	Bezel - 21" Rectangular (176, 177 Models)
	822-0002	Board - Mounting (H. V. Assembly)
	480-0001	Board - Terminal - HaloLighting Transformer
	486-0005	Button - Corona - H. V. Power Supply
	417-0019	Cable and Socket - Picture Tube
	926-0009	Cam and Screw Assembly (1-508-2)
	483-0018	Cap - Tube Socket (H. V. Rectifiers)
C102, C143, C146, C148	168-0008N	Capacitor - Ceramic - 4.7 Mmfd. - 500 V.
C100, C145, C147	166-0010P	Capacitor - Ceramic - 10 Mmfd. - 500 V.
C140	166-0043P	Capacitor - Ceramic - 43 Mmfd. - 500 V.
C104	166-0047N	Capacitor - Ceramic - 47 Mmfd. - 500 V.
C265	174-0068	Capacitor - Ceramic - 68 Mmfd. - 2,000 V.
C126, C141	166-0270N	Capacitor - Ceramic - 270 Mmfd. - 500 V.
C106	166-0330	Capacitor - Ceramic - 330 Mmfd. - 500 V.
C270, C271	169-0015	Capacitor - Ceramic - 500 Mmfd. - 20,000 V.
C181, C182, C183, C184, C200	166-1000D	Capacitor - Ceramic - .001 Mfd. - 500 V.
C262	166-1000P	Capacitor - Ceramic - .001 Mfd. - 500 V.
C101, C103, C105, C124, C125, C127, C128, C129, C130, C132, C133, C134, C135, C136, C137, C138, C139, C142, C144, C150, C185, C186, C260	166-4700D	Capacitor - Ceramic - .0047 Mfd. - 500 V.
C110, C123	161-1001	Capacitor - Electrolytic - 2 Mfd. - 50 V.
C215	161-1010	Capacitor - Electrolytic - 10 Mfd. - 500 V.
C263	161-4006	Capacitor - Electrolytic - 10 Mfd. - 100 V.
C115		10 Mfd. - 400 V.
C179		20 Mfd. - 400 V.
C114		25 Mfd. - 25 V.
C175	161-2004	Capacitor - Electrolytic - 40 Mfd. - 400 V.
C177		- 80 Mfd. - 400 V.
C176	161-3012	Capacitor - Electrolytic - 40 Mfd. - 200 V.
C178		- 80 Mfd. - 200 V.
C214		100 Mfd. - 50 V.
C112, C252, C257	163-0100	Capacitor - Mica - 100 Mmfd. - 500 V.
C107, C212, C217, C261	163-0680	Capacitor - Mica - 680 Mmfd. - 500 V.
C209	162-0621	Capacitor - Paper - .001 Mfd. - 600 V.
C201, C208, C213	162-06233	Capacitor - Paper - .0033 Mfd. - 600 V.
C116, C199, C202, C250, C251	162-06247	Capacitor - Paper - .0047 Mfd. - 600 V.
C108, C111, C113, C204, C216, C259	162-0611	Capacitor - Paper - .01 Mfd. - 600 V.
C121	162-02147	Capacitor - Paper - .047 Mfd. - 200 V.
C122, C131, C149, C180, C253	162-0202	Capacitor - Paper - .22 Mfd. - 200 V.
C256	162-0402	Capacitor - Paper - .22 Mfd. - 400 V.
C218	160-[illegible]322	Capacitor - Paper - Molded - 220 Mmfd. - 1,000 V.
C258	160-06222	Capacitor - Paper - Molded - .0022 Mfd. - 600 V.
C268	160-06133	Capacitor - Paper - Molded - .033 Mfd. - 600 V.
C203, C211, C266	160-04147	Capacitor - Paper - Molded - .047 Mfd. - 400 V.
C210, C255, C269	160-0601	Capacitor - Paper - Molded - .1 Mfd. - 600 V.
C264	160-02022	Capacitor - Paper - Molded - .22 Mfd. - 200 V.
C267	160-06022	Capacitor - Paper - Molded - .22 Mfd. - 600 V.
C254	169-0010	Capacitor - Polystyrene - .015 Mfd. - 400 V.
C109	190-0006	Capacitor - Resistor Combination - Tone Compensating .01 Mfd.
R107		47,000 Ohm - 1/2 W.
C205	190-0007	Capacitor - Resistor Combination - Integrator Plate .002 Mfd.
C206		.005 Mfd.
C207		.005 Mfd.
R213		8,200 Ohm - 1/2 W.
R214		8,200 Ohm - 1/2 W.
R212		22,000 Ohm - 1/2 W.
L50	145-0006	Choke - Filter - B+ (+330 V.)
L51	145-0002	Choke - Filter - B+ (+125 V.)
L52	147-0014	Choke - Heater
	487-0022	Clamp - Bearing (1-508-2)
	196-0007	Clip and Lead Assembly - Damper Cathode and Horizontal Output Plate
	196-0010	Clip and Lead Assembly - H. V. Rectifier Plate
	487-0019	Clip - Cold Cathode Tube Mounting
	487-0008	Clip - Fuse
	487-0020	Clip - Glass Mounting - Top
	487-0004	Clip - IF Transformer Mounting
L56, L70, L71	118-0010	Coil - Filter
L67	133-0002	Coil - Horizontal Linearity
L68	132-0002	Coil - Horizontal Size
L54	115-0001	Coil - Link Shunt
L57, L58	131-2010	Coil - Peaking - Dual
L59, L60	131-2007	Coil - Peaking - Dual
L69	146-0005	Coil - Ringing
L61, L62	130-0001	Coil - Trap - 4.5 Mc.
L55	118-0011	Coil - Trap - IF Cathode
L53	119-0002	Coil - Tuner Coupling
	196-0014	Connector - Anode and Lead Assembly
R202	153-0009	Control - AGC
R106, R163	157-0019	Control - Brightness, Volume and On-Off
R49	153-0015	Control - HaloLight
R222	153-0014	Control - Height
R263	153-0007	Control - Horizontal Drive
R155	153-3007	Control - Picture (Contrast)
R215	153-0018	Control - Vertical Hold
R227	153-3011	Control - Vertical Linearity
	195-0008	Cord and Receptacle Assembly (178 Models)
	195-0001	Cord - Line
	760-0036	Cover - Interlock Assembly (Includes Line Cord) 172 Models

	760-0032	Cover - Interlock Assembly (Includes Line Cord) 175 Models
	760-0033	Cover - Interlock Assembly (Includes Line Cord) 176 Models
	760-0034	Cover - Interlock Assembly (Includes Line Cord) 177 Models
	760-0035	Cover - Interlock Assembly (Includes Line Cord) 178 Models
	722-0027	Dial - UHF (1-508-2 Models)
	722-0028	Dial - UHF - Dummy (1-508-1 Models)
		Detector - Crystal Diode 1N105
	339-0035	Drum and Shaft Assembly - VHF Tuner
	191-0014	Fuse - 1/2 Amp. - 250 V. - Slow Blow
	484-0013	Gear and Hub Assembly (1-508-2)
	710-0009	Glass - Picture Window
	486-0006	Insulator - Ceramic - Horizontal Scan and H. V. Assembly
	486-0009	Insulator - Tube Socket Cap
	818-0008	Jewel - TV (172, 177, 178 Models)
	740-0029	Knob - Fine Tuning
	744-0021	Knob - Halo Control
	744-0023	Knob - Inner - Brightness
	743-0023	Knob - Outer and Dial Assembly
	744-0022	Knob - Outer - Volume and On-Off
	611-0047	Lamp - #47
	715-0009	Lens - Bezel
	400-00[illegible]	Magnet - Focus and Centering Unit
	400-0013	Magnet - Ion Trap
	400-0016	Magnet - Pin Cushion Corrector
	716-0003	Mask - 21"
	818-0004	Nameplate - Sylvania
	552-0001	Nut - #8-32 Wing - Yoke Mounting
	488-0002	Pad - Rubber (Horizontal Scan Transformer Assembly)
	484-0014	Pinion and Screws Assembly (1-508-2)
	415-0004	Plug - 1 Prong - Speaker
	415-0010	Plug - 2 Prong - HaloLight Connector
	415-0002	Plug - 2 Prong - Interlock
	415-0015	Plug - 4 Prong - HaloLight and Channel Indicator Light
	415-0011	Plug - 5 Prong - Horizontal Scan and H. V. Connector
	494-0008	Pulley and Sleeve Assembly (1-508-2)
R179, R267	189-0007	Resistor - 4.3 Ohm - 1/2 W. - W. W.
R114, R132, R138, R144	181-0470	Resistor - 47 Ohm - 1/2 W.
R101, R266, R268	181-0101	Resistor - 100 Ohm - 1/2 W.
R105	181-0271	Resistor - 270 Ohm - 1/2 W.
R148, R211, R254	181-0331	Resistor - 330 Ohm - 1/2 W.
R229, R230	181-0561	Resistor - 560 Ohm - 1/2 W.
R102, R130, R134, R136, R140, R142, R146, R149, R151, R257, R275	181-0102	Resistor - 1,000 Ohm - 1/2 W.
R141, R147	181-0152	Resistor - 1,500 Ohm - 1/2 W.
R129, R135	181-0272	Resistor - 2,700 Ohm - 1/2 W.
R152	181-0332	Resistor - 3,300 Ohm - 1/2 W.
R153, R159	181-0392	Resistor - 3,900 Ohm - 1/2 W.
R264	181-0472	Resistor - 4,700 Ohm - 1/2 W.
R133, R139, R145	181-0682	Resistor - 6,800 Ohm - 1/2 W.
R154, R255	181-0822	Resistor - 8,200 Ohm - 1/2 W.
R150, R204, R206, R209	181-0103	Resistor - 10,000 Ohm - 1/2 W.
R228	181-01235	Resistor - 12,000 Ohm - 1/2 W. - 5%
R207	181-0123	Resistor - 12,000 Ohm - 1/2 W.
R156	181-0153	Resistor - 15,000 Ohm - 1/2 W.
R143	181-0183	Resistor - 18,000 Ohm - 1/2 W.
R104, R260	181-0223	Resistor - 22,000 Ohm - 1/2 W.
R200, R203, R217	181-0333	Resistor - 33,000 Ohm - 1/2 W.
R100, R103	181-0473	Resistor - 47,000 Ohm - 1/2 W.
R128, R137	181-0563	Resistor - 56,000 Ohm - 1/2 W.
R109	181-0683	Resistor - 68,000 Ohm - 1/2 W.
R262	181-0823	Resistor - 82,000 Ohm - 1/2 W.
R106, R131, R219, R251, R252	181-0104	Resistor - 100,000 Ohm - 1/2 W.
R261	181-0154	Resistor - 150,000 Ohm - 1/2 W.
R111, R175, R218, R225	181-0224	Resistor - 220,000 Ohm - 1/2 W.
R161, R164	181-0334	Resistor - 330,000 Ohm - 1/2 W.
R112, R160, R201, R221, R250, R259, R265	181-0474	Resistor - 470,000 Ohm - 1/2 W.
R205, R210, R220	181-0684	Resistor - 680,000 Ohm - 1/2 W.
R165, R253	181-0105	Resistor - 1.0 Megohm - 1/2 W.
R127	181-0155	Resistor - 1.5 Megohm - 1/2 W.
R216	181-0185	Resistor - 1.8 Megohm - 1/2 W.
R223	181-0225	Resistor - 2.2 Megohm - 1/2 W.
R162	181-0475	Resistor - 4.7 Megohm - 1/2 W.
R224	181-0106	Resistor - 10 Megohm - 1/2 W.
R110	181-0156	Resistor - 15 Megohm - 1/2 W.
R180	189-0029	Resistor - 4.7 Ohm - 1 W.
R113	182-0391	Resistor - 390 Ohm - 1 W.

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
R226	182-0122	Resistor - 1,200 Ohm - 1 W.
R258	182-0153	Resistor - 15,000 Ohm - 1 W.
R199	182-0333	Resistor - 33,000 Ohm - 1 W.
R198	182-0364	Resistor - 360,000 Ohm - 1 W.
R271	183-0102	Resistor - 1,000 Ohm - 2 W.
R177, R178	183-0472	Resistor - 4,700 Ohm - 2 W.
R157, R158	183-0682	Resistor - 6,800 Ohm - 2 W.
R208	183-0153	Resistor - 15,000 Ohm - 2 W.
R269	183-0183	Resistor - 18,000 Ohm - 2 W.
R47, R48	189-0026	Resistor - 33,000 Ohm - 2 W.
R256	183-0333	Resistor - 33,000 Ohm - 2 W.
R270	183-0393	Resistor - 39,000 Ohm - 2 W.
	189-0024	Resistor Assembly - H. V. Power Supply
R272		1.0 Megohm - 2 W.
R273		1.0 Megohm - 2 W.
R274		1.0 Megohm - 2 W.
R115, R176	187-0005	Resistor - 2,000 Ohm - 5 W. - W. W.
R126	187-0012	Resistor - 3,300 Ohm - 5 W. - W. W.
	486-0007	Retainer - Filament Leads (H. V. Rectifier)
	554-0024	Ring - Bearing (1-508-2)
	554-0025	Ring - Bushing (1-508-2)
	554-0021	Ring - Tube Socket Cap (H. V. Rectifiers)
	551-1007	Screw - #4-40 x 2-1/2" (Horizontal Scan and H. V. Supply)
	551-0018	Screw - Special - VHF Tuner Unit Assembly (1-508-2)
	493-0031	Shaft - UHF Drive (1-508-2)
	486-0008	Shield - Corona - Resistor
	483-0019	Shield - Light
	482-0007	Shield - Tube (7 Prong Miniature)
	417-0002	Socket - 1 Prong (Speaker)
	414-0006	Socket - 3 Prong - Yoke Connecting
	413-0006	Socket - 4 Prong - Channel Indicator Light and HaloLighting
	417-0014	Socket - 5 Prong - Horizontal Scan and H. V. Connector
	412-0015	Socket - 7 Prong Miniature
	412-0020	Socket - 7 Prong Miniature with Base
	412-0006	Socket - 8 Prong Octal
	412-0022	Socket - 8 Prong Octal - H. V. Rectifiers
	412-0018	Socket - 8 Prong Octal - Shock Mounted
	412-0012	Socket - 9 Prong Miniature
	412-0021	Socket - 9 Prong Miniature - Damper Tube
	558-0005	Spacer - H. V. Assembly Mounting
	558-0003	Spacer - Shock Mounted Socket
	558-0006	Spacer - VHF Tuner Unit Assembly (1-508-2)
	539-0602	Speaker - 6-1/2" P. M. (175 Models)
	539-1004	Speaker - 10" P. M. (176 Models)
	539-1005	Speaker - 10" P. M. (172, 177 Models)
	539-1205	Speaker - 12" P. M. (178 Models)
	496-0079	Spring - Picture Tube Grounding
	339-0036	Spring - Retaining - VHF Tuner Drum
	495-0009	String - Drive Assembly (1-508-2)
L1, L2, L4, L5, L7	110-0002	Strip - Coil - VHF Tuner - Channel 2
"	110-0003	Channel 3
"	110-0004	Channel 4
"	110-0005	Channel 5
"	110-0006	Channel 6
"	110-0007	Channel 7
"	110-0008	Channel 8
"	110-0009	Channel 9
"	110-0010	Channel 10
"	110-0011	Channel 11
"	110-0012	Channel 12
"	110-0013	Channel 13
L1, L2, L4, L5	110-0001	40 Mc. IF Strip (1-508-2 only)
	577-0004	Switch Assembly - UHF - VHF (1-508-2)
T53	143-0022	Transformer - Audio Output
T30	141-0023	Transformer - HaloLighting
T62	128-0009	Transformer - Horizontal Discriminator
T63	241-0007	Transformer - Horizontal Scan
T51	120-0003	Transformer - IF Sound
T55	119-0003	Transformer - IF - Video
T56	119-0004	Transformer - IF - Video
T57	119-0005	Transformer - IF - Video
T58	126-0001	Transformer - IF - Video (Output)
T50	141-0021	Transformer - Power - 117 V. - 60 Cycle
T52	128-0008	Transformer - Sound Discriminator
T60	242-0002	Transformer - Vertical Oscillator
T61	241-0008	Transformer - Vertical Scanning
	611-2100	Tube - Cold Cathode - HaloLight
V24, V25		Tube - 1B3GT
V26, V27		Tube - 5U4G
V17		Tube - 6AH4GT
V10, V18		Tube - 6AL5
V8, V9, V13		Tube - 6AU6
V11		Tube - 6AV6
V1		Tube - 6BK7
V22		Tube - 6BQ6GT
V16		Tube - 6C4
V3, V4, V5, V6, V19		Tube - 6CB6
V2, V29, (1-508-2)		Tube - 6J6
V23		Tube - 6V3
V12		Tube - 6V6GT
V15, V20		Tube - 12AU7
V14		Tube - 12AX7
V7		Tube - 12BY7
V28		Tube - 21EP4A
V21		Tube - 40A1
	323-0019	Tuner Unit - UHF (with tubes) - 1-508-2
	323-0017	Tuner Unit - VHF (with tubes, less UHF drive components)
	323-0031	Tuner Unit - VHF (with tubes and 40 Mc. IF strip) - 1-508-2
	323-0026	Tuner Unit Assembly - VHF (with tubes and UHF drive components)
	553-4010	Washer - Neoprene - H. V. Ceramic Insulator Mounting
	554-0023	Washer - VHF Tuner Unit (1-508-2)
L65, L66	100-0009	Yoke - Deflection - Horizontal
L63, L64		Vertical

REVISED REPAIR PARTS LIST

CHASSIS 1-510-1, 1-510-2

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
R225, R226	181-0561	Resistor - 560 Ohm - 1/2 W.
R258	181-0821	Resistor - 820 Ohm - 1/2 W.
R102, R128, R131, R133, R136, R140, R141, R144, R268	181-0102	Resistor - 1,000 Ohm - 1/2 W.
R137, R142	181-0152	Resistor - 1,500 Ohm - 1/2 W.
R127, R206	181-0222	Resistor - 2,200 Ohm - 1/2 W.
R132	181-0272	Resistor - 2,700 Ohm - 1/2 W.
R234, R260	181-0332	Resistor - 3,300 Ohm - 1/2 W.
R130, R135, R149	181-0472	Resistor - 4,700 Ohm - 1/2 W.
R146, R157	181-0682	Resistor - 6,800 Ohm - 1/2 W.
R145	181-0103	Resistor - 10,000 Ohm - 1/2 W.
R221	181-01035	Resistor - 10,000 Ohm - 1/2 W. - 5%
R148, R236	181-0123	Resistor - 12,000 Ohm - 1/2 W.
R204	181-0223	Resistor - 22,000 Ohm - 1/2 W.
R250	181-0273	Resistor - 27,000 Ohm - 1/2 W.
R205, R214	181-0333	Resistor - 33,000 Ohm - 1/2 W.
R100	181-0473	Resistor - 47,000 Ohm - 1/2 W.
R232	181-0563	Resistor - 56,000 Ohm - 1/2 W.
R105, R259	181-0683	Resistor - 68,000 Ohm - 1/2 W.
R237	181-0823	Resistor - 82,000 Ohm - 1/2 W.
R103, R109, R216, R233, R251, R252	181-0104	Resistor - 100,000 Ohm - 1/2 W.
R108	181-01045	Resistor - 100,000 Ohm - 1/2 W. - 5%
R203, R256	181-0124	Resistor - 120,000 Ohm - 1/2 W.
R158	181-0154	Resistor - 150,000 Ohm - 1/2 W.
R224	181-0184	Resistor - 180,000 Ohm - 1/2 W.
R110	181-01845	Resistor - 180,000 Ohm - 1/2 W. - 5%
R107, R147, R150, R175, R201, R215	181-0224	Resistor - 220,000 Ohm - 1/2 W.
R202	181-0334	Resistor - 330,000 Ohm - 1/2 W.
R151, R201, R219, R223, R230, R231, R261	181-0474	Resistor - 470,000 Ohm - 1/2 W.
R217	181-0684	Resistor - 680,000 Ohm - 1/2 W.
R227	181-0105	Resistor - 1.0 Megohm - 1/2 W.
R200	181-0125	Resistor - 1.2 Megohm - 1/2 W.
R213	181-0155	Resistor - 1.5 Megohm - 1/2 W.
R253, R254	181-0475	Resistor - 4.7 Megohm - 1/2 W.
R106	181-0156	Resistor - 15 Megohm - 1/2 W.
R235	181-0226	Resistor - 22 Megohm - 1/2 W.
R106	181-0156	Resistor - 15 Megohm - 1/2 W.
R235	181-0226	Resistor - 22 Megohm - 1/2 W.
R115	182-0680	Resistor - 68 Ohm - 1 W.
R222	182-0102	Resistor - 1,000 Ohm - 1 W.
R209	182-0332	Resistor - 3,300 Ohm - 1 W.
R255	182-0562	Resistor - 5,600 Ohm - 1 W.
R112	182-0103	Resistor - 10,000 Ohm - 1 W.
R113, R114	183-0681	Resistor - 680 Ohm - 2 W.
R207	183-0682	Resistor - 6,800 Ohm - 2 W.
R154, R155, R156	183-0123	Resistor - 12,000 Ohm - 2 W.
R264	183-0183	Resistor - 18,000 Ohm - 2 W.
	189-0024	Resistor Assembly - H.V. Power Supply
R265		1 Megohm - 2 W.
R266		1 Megohm - 2 W.
R267		1 Megohm - 2 W.
R176	187-0013	Resistor - 68 Ohm - 10 W. - W.W.
	486-0007	Retainer - Filament Leads (H.V. Rectifiers)
	554-0024	Ring - Bearing (1-510-2 only)
	554-0025	Ring - Bushing (1-510-2 only)
	554-0021	Ring - Tube Socket Cap (H.V. Rectifiers)
	551-1007	Screw - #4 - 40 x 2-1/2" (Hor. Scan Transformer)
	551-0018	Screw - #6 - 32 x 5/32, Special (1-510-2 only)
	493-0031	Shaft - UHF Drive (1-510-2 only)
	486-0008	Shield - Corona - Resistor
	482-0007	Shield - Tube (7 Prong Miniature)
	417-0002	Socket - 1 Prong (Speaker)
	414-0006	Socket - 3 Prong - Yoke Connecting
	417-0014	Socket - 5 Prong - Hor. Scan and H.V. Connector
	412-0015	Socket - 7 Prong - Miniature
	412-0020	Socket - 7 Prong - Miniature (with base)
	412-0006	Socket - 8 Prong - Octal
	412-0022	Socket - 8 Prong - Octal - H.V. Rectifier
	412-0018	Socket - 8 Prong - Octal - Shock Mounted
	412-0012	Socket - 9 Prong - Miniature
	412-0021	Socket - 9 Prong - Miniature (Damper Tube)
	558-0006	Spacer (1-510-2 only)
	558-0005	Spacer - H.V. Assembly Mounting
	558-0003	Spacer - Shock Mounted Tube Socket
	539-0503	Speaker - 5" P.M. (225 models)
	539-0602	Speaker - 6-1/2" P.M. (120 models)
	539-0802	Speaker - 8" P.M. (126 models)
	496-0079	Spring - Picture Tube Grounding
T53	143-0023	Transformer - Audio Output
T61	241-0007	Transformer - Horizontal Scan
T55	119-0003	Transformer - IF - Video

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
T56	119-0004	Transformer - IF - Video
T57	119-0005	Transformer - IF - Video
T58	126-0001	Transformer - IF - Video (Output)
T50	141-0024	Transformer - Power - 117 V. - 60 Cycle
T52	128-0008	Transformer - Sound Discriminator
T59	242-0002	Transformer - Vertical Oscillator
T60	241-0008	Transformer - Vertical Scanning
V20, V21		Tube - 1B3GT
V22		Tube - 5U4G
V31		Tube - 6AF4 (1-510-2 only)
V14		Tube - 6AH4GT
V30		Tube - 6AN4 (1-510-2 only)
V9, V15		Tube - 6AL5
V8		Tube - 6AU6
V10		Tube - 6AV6
V1		Tube - 6BC5
V17		Tube - 6BQ6GT
V13		Tube - 6C4
V3, V4, V5, V6		Tube - 6CB6
V16		Tube - 6SN7GT
V19		Tube - 6V3
V2		Tube - 6X8
V11		Tube - 6Y6G
V12, V24		Tube - 12AU7
V7		Tube - 12BY7
V23		Tube - 21EP4A
V18		Tube - 40A1
	323-0025	Tuner Unit Assembly - VHF (with tubes and UHF drive components)
	323-0021	Tuner Unit - UHF (with tubes) (1-510-2 only)
	323-0018	Tuner Unit - VHF (with tubes) (less UHF drive components)
	553-4010	Washer - Neoprene - H.V. Ceramic Insulator Mounting
L66, L67	100-0009	Yoke - Deflection - Horizontal
L64, L65		Vertical
	582-0015	Antenna - UHF (1-510-2 chassis models)
	714-0014	Bezel Assembly (120 models)
	714-0015	Bezel Assembly (126 models)
	714-0020	Bezel Assembly (225 models)
	822-0002	Board - Mounting (H.V. Assembly)
	486-0005	Button - Corona - H.V. Power Supply
	417-0008	Cable and Socket - Picture Tube
	483-0018	Cap - Tube Socket (H.V. Rectifiers)
C143, C146, C150	168-0008N	Capacitor - Ceramic - 4.7 Mmfd. - 500 V.
C100, C145, C147	166-0010P	Capacitor - Ceramic - 10 Mmfd. - 500 V.
C140	166-0043P	Capacitor - Ceramic - 43 Mmfd. - 500 V.
C264	174-0068	Capacitor - Ceramic - 68 Mmfd. - 500 V.
C125, C135, C141	166-0270N	Capacitor - Ceramic - 270 Mmfd. - 500 V.
C103	166-0330	Capacitor - Ceramic - 330 Mmfd. - 500 V.
C265, C267	169-0015	Capacitor - Ceramic - 500 Mmfd. - 20,000 V.
C177, C178, C179, C180	166-1000D	Capacitor - Ceramic - .001 Mfd. - 500 V.
C126, C127, C128, C129, C130, C131, C132, C133, C134, C137, C138, C142, C144	166-4700D	Capacitor - Ceramic - .0047 Mfd. - 500 V.
C101, C102	168-0011D	Capacitor - Ceramic - Dual - .0047 Mfd. - 500 V.
C106, C110	161-1001	Capacitor - Electrolytic - 2 Mfd. - 50 V.
C112	161-1007	Capacitor - Electrolytic - 10 Mfd. - 350 V.
C213	161-1010	Capacitor - Electrolytic - 10 Mfd. - 500 V.
C175	161-2004	Capacitor - Electrolytic - 40 Mfd. - 400 V. △
C176		80 Mfd. - 400 V.
C114	161-2005	Capacitor - Electrolytic - 40 Mfd. - 400 V.
C211		100 Mfd. - 50 V. △
C260	161-3014	Capacitor - Electrolytic - 10 Mfd. - 100 V. △
C115		20 Mfd. - 300 V.
C111		200 Mfd. - 200 V. □
C109	163-0100	Capacitor - Mica - 100 Mmfd. - 500 V.
C200	163-0220	Capacitor - Mica - 220 Mmfd. - 500 V.
C256	163-0330	Capacitor - Mica - 330 Mmfd. - 500 V.

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
C258	163-0470	Capacitor - Mica - 470 Mmfd. - 500 V.
C104, C257	163-0680	Capacitor - Mica - 680 Mmfd. - 500 V.
C208, C212	162-06233	Capacitor - Paper - .0033 Mfd. - 600 V.
C113, C250, C253, C266	162-06247	Capacitor - Paper - .0047 Mfd. - 600 V.
C105, C107, C108, C152, C214, C231, C232	162-0611	Capacitor - Paper - .01 Mfd. - 200 V.
C210, C254	162-06147	Capacitor - Paper - .047 Mfd. - 600 V.
C151	162-0402	Capacitor - Paper - .22 Mfd. - 400 V.
C251, C252	160-06215	Capacitor - Paper - Molded - .001 Mfd. - 400 V.
C207	160-06222	Capacitor - Paper - Molded - .0022 Mfd. - 400 V.
C201	160-0411	Capacitor - Paper - Molded - .01 Mfd. - 400 V.
C202, C261	160-04147	Capacitor - Paper - Molded - .047 Mfd. - 400 V.
C149, C209, C230	160-0601	Capacitor - Paper - Molded - .1 Mfd. - 600 V.
C136, C148, C262, C263	160-0602	Capacitor - Paper - Molded - .22 Mfd. - 600 V.
C255	163-4700	Capacitor - Polystyrene - .0047 Mfd. - 500 V.
	190-0007	Capacitor - Resistor Combination - Integrator Plate
C204		.002 Mfd. - 500 V.
C205		.005 Mfd. - 500 V.
C206		.005 Mfd. - 500 V.
R210		8,200 Ohm
R211		8,200 Ohm
R208		22,000 Ohm
C203	172-0032	Capacitor - 70 to 470 Mmfd. Trimmer - Sync Balancing Adjustment
C259	172-0032	Capacitor - 70 to 470 Mmfd. Trimmer - Horizontal Drive Control
L50	145-0004	Choke - Filter - B+
L51	147-0014	Choke - Heater
	487-0022	Clamp - Bearing (1-510-2 only)
	196-0007	Clip and Lead Assembly - Damper Cathode, Horizontal Output Plate
	196-0010	Clip and Lead Assembly - H.V. Rectifier Plate
	487-0023	Clip - Bezel Mounting
	487-0008	Clip - Fuse
	487-0004	Clip - IF Transformer Mounting
L56, L69, L70	118-0010	Coil - Filter
L68	132-0001	Coil - Horizontal Frequency
L71	132-0002	Coil - Horizontal Size
L57, L58	131-2003	Coil - Peaking - Dual
L59, L60	131-2008	Coil - Peaking - Dual
L61, L62	130-0001	Coil - Trap - 4.5 Mc.
L55	118-0011	Coil - Trap - IF Cathode
L54	119-0002	Coil - Tuner Coupling
	196-0014	Connector - H.V. Anode and Lead Assembly
R104, R153	157-0020	Control - Dual - Contrast, Volume and On-Off
R218	153-0014	Control - Height
R257	153-0017	Control - Horizontal Hold
R159	153-0016	Control - Picture (Brightness)
R212	153-0014	Control - Vertical Hold
R220	153-3011	Control - Vertical Linearity
	195-0001	Cord - Line
	760-0032	Cover - Interlock Assembly (includes line cord)
		Detector - Crystal Diode - 1N105
	722-0030	Dial - UHF (1-510-2 chassis models)
	722-0028	Dial - UHF - Dummy (1-510-1 chassis models)
	191-0014	Fuse - 1/4 Amp - 250 V. - Slow Blow
	491-0015	Gasket - Dust - Tube Mask
	484-0013	Gear and Hub Assembly (1-510-2 only)
	710-0009	Glass - Picture Window
	818-0010	Insert - UHF (225 models)
	486-0006	Insulator - Ceramic (Hor. Scan and H.V. Assembly)
	486-0009	Insulator - H.V. Rectifier Tube Socket Cap
	740-0029	Knob - Fine Tuning
	744-0023	Knob - Inner - Contrast
	743-0022	Knob - Outer and Dial Assembly (120 and 126 models)
	743-0024	Knob - Outer and Dial Assembly (225 models)
	744-0022	Knob - Outer - Volume and On-Off
	715-0009	Lens - Bezel
	400-0014	Magnet - Focus and Centering Unit
	400-0013	Magnet - Ion Trap
	400-0016	Magnet - Pin Cushion Corrector
	716-0003	Mask - 21"
	818-0004	Nameplate - Sylvania
	552-0001	Nut - #8-32 Wing - Yoke Mounting
	552-0024	Nut - #8-32 - Speaker Mounting
	488-0002	Pad - Rubber (Hor. Scan Transformer Assembly)
	484-0014	Pinion and Screws Assembly (1-510-2 only)
	415-0004	Plug - 1 Prong - Speaker
	415-0002	Plug - 2 Prong - Interlock
	415-0011	Plug - 5 Prong - Hor. Scan and H.V. Connector
	494-0008	Pulley and Sleeve Assembly (1-510-2 only)
R111, R129, R134, R152	181-0470	Resistor - 47 Ohm - 1/2 W.
R101, R262, R263	181-0101	Resistor - 100 Ohm - 1/2 W.
R139	181-0181	Resistor - 180 Ohm - 1/2 W.
R143	181-0331	Resistor - 330 Ohm - 1/2 W.

CHASSIS 1-508-1 C04, C05, & 1-508-2 C00 CHASSIS 1-510-1 C05, & 1-510-2 C00

CHASSIS 1-508-1 C04, C05 & 1-508-2 C00

C110, 2 Mfd. capacitor and R109, 68M ohm resistor are now connected as shown in Figure 29 to eliminate a 4.5 Mc. harmonic interference in the picture. This revision is coded C04 in the 1-508-1 chassis, and is included in initial production of chassis 1-508-2.

Code change C05 for chassis 1-508-1 adds a shield that extends over the 3rd and 4th Video IF Amplifier tube sockets on the underside of the chassis in addition to the existing Video Detector circuit shield. Original production of chassis 1-508-2 incorporates this change.

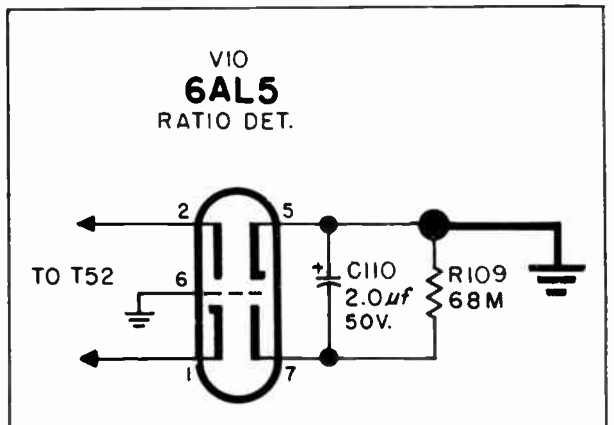


FIGURE 29 - PARTIAL SCHEMATIC CHASSIS 1-508-1 C04

CHASSIS 1-510-1 C05 & 1-510-2 C00

A shield over the 3rd and 4th Video IF Amplifier tube sockets on the underside of the chassis has been added to the 1-510-1 chassis. Used in addition to an existing shield over the Video Detector circuits, this change is coded C05. Initial production of chassis 1-510-2 will include this change.

To bring the 1-508-1, 1-508-2, 1-510-1 and 1-510-2 Parts Lists up to date, add the following item:

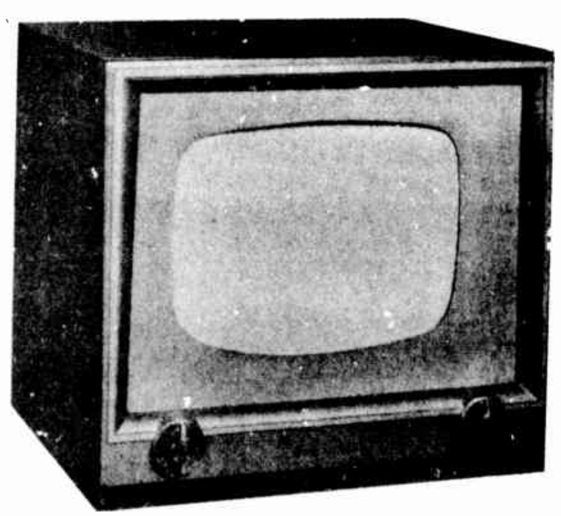
SERVICE PART NUMBER	DESCRIPTION
483-0024	Shield - Video IF

ADDITION OF CHASSIS 1-504-1, 1-504-2 & MODELS 105 B, 105 BU, 105 M, 105 MU

GENERAL DESCRIPTION

Sylvania television chassis 1-504-1 and 1-504-2 are the 17 inch versions of the 1-510-1 and 1-510-2 TV chassis, respectively. Electrically, the two chassis series are very similar; and all specifications, service, and adjustment information for the 1-510-1 and 1-510-2 apply to the 1-504-1 and 1-504-2 chassis, except as noted in this supplement.

Chassis 1-504-1 provides reception of the twelve commercial VHF television channels, 2 through 13 inclusive. In this chassis, provisions are made for the simple addition of a UHF tuner, thus permitting reception of channels 14 to 83 of the UHF band.



MODEL 105 M

Chassis 1-504-2 includes the UHF tuner and thus provides reception of all commercial television channels - VHF channels 2 through 13 and UHF channels 14 through 83.

The 105 series of models are direct viewing table model TV receivers varying only in cabinet finish and frequency range. Models 105B and 105M contain the 1-504-1 chassis and models 105BU and 105MU contain the 1-504-2 chassis. All 105 models feature a 6-1/2" P.M. speaker.

CHASSIS 1-508-1 C06 & 1-508-2 C01 — CHASSIS 1-510-1 C06

CHASSIS 1-508-1 C06 & 1-508-2 C01

Code change C06 for TV chassis 1-508-1 and code change C01 for chassis 1-508-2 revise the circuits of V14 12AX7 - the Sync Separator & AGC Rectifier, and V15 12AU7 - the Sync Amplifier & Clipper. The change, in effect, adds a "noise gate" action between the sync take-off circuit and the sync separator circuit, and functions to stabilize vertical and horizontal sync and AGC operation under interference conditions.

Component changes are as follows:

1. C203 - .047 Mfd. capacitor is changed from a 200 volt to a 400 volt capacitor. (A 400 volt replacement part is already called for in the Repair Parts List.)
2. R208 - 10M ohm resistor is changed to a 15M ohm resistor.
3. R199 - 33M ohm resistor is added and connected in parallel with R208.
4. R198 - 360M ohm resistor is added and connected between +560 volts and V14 and V15 as shown in the partial schematic.

Wiring revisions for these 1-508-1 and 1-508-2 code changes are illustrated in the partial schematic in Figure 30.

CHASSIS 1-510-1 C06

Code change C06 for TV chassis 1-510-1 changes the values of the following components in the sync separator circuit to improve sync stability.

1. C200 - 470 Mmfd. capacitor is changed to a 220 Mmfd. capacitor.
2. C201 - .047 Mfd. capacitor is replaced by a .01 Mfd. capacitor.
3. R200 - 2.2 Megohm resistor is replaced by a 470M resistor.
4. R201 - 220M resistor is changed to a 470M resistor.

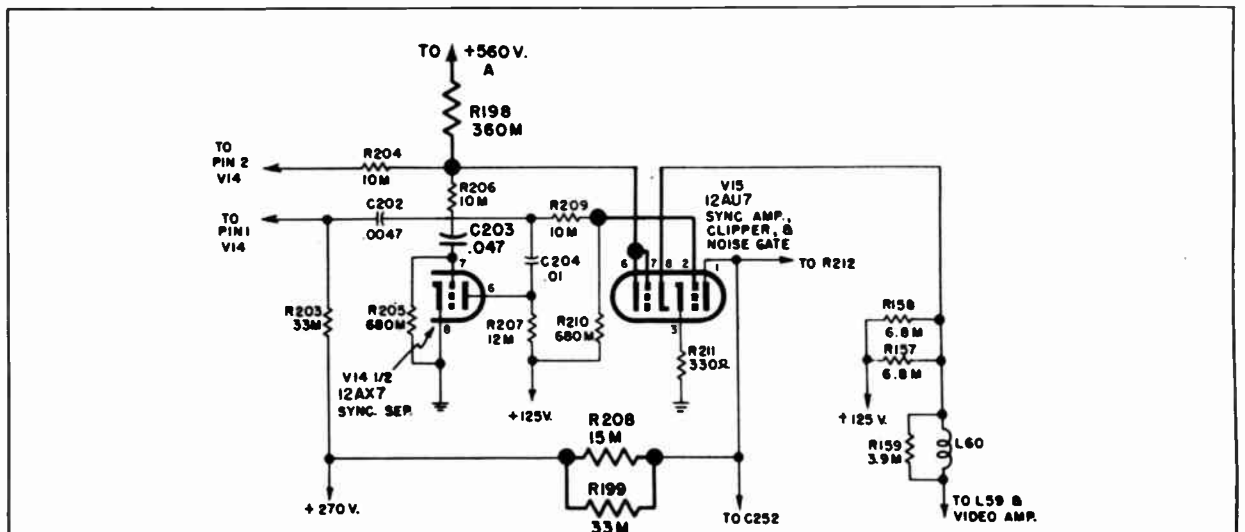


FIGURE 30 - PARTIAL SCHEMATIC OF CHASSIS 1-508-1 C06, 1-508-2 C01

SUPPLEMENTARY SERVICE INFORMATION

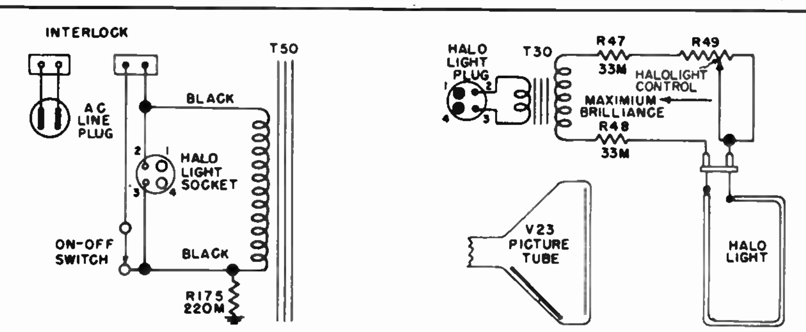
covering

CHASSIS	MODELS
1-504-1, -2, -4	ALL
1-508-1, -2, -3	ALL
1-510-1, -2, -4	ALL

ITEM 1 SUBJECT: Code Changes 1-504-1 C05 and 1-504-4 C01.
REASON: Reduction of Possible Microphonism.
DESCRIPTION: Horizontal Oscillator tube socket is changed from a rigid to a shock-mounted type and this stage, plus the Audio Output transformer T53 are physically relocated on the chassis.

ITEM 2 SUBJECT: Horizontal Hold and Picture Controls of Later Production Chassis.
REASON: To Facilitate Adjustment.
DESCRIPTION: New Horizontal Hold and Picture (Brightness) controls are incorporated in initial production of chassis 1-504-4, 1-510-4 and later production of chassis 1-504-1, 1-510-1 and 1-510-2. The new controls are provided with a knob to permit finger adjustment and are electrically equivalent to the old controls.

ITEM 3
SUBJECT: Models 270 and 271 Added to Line.
DESCRIPTION: Sylvania models in the 270 and 271 series are HaloLight versions of the 120 and 126 series, respectively - differing only by the addition of HaloLight.

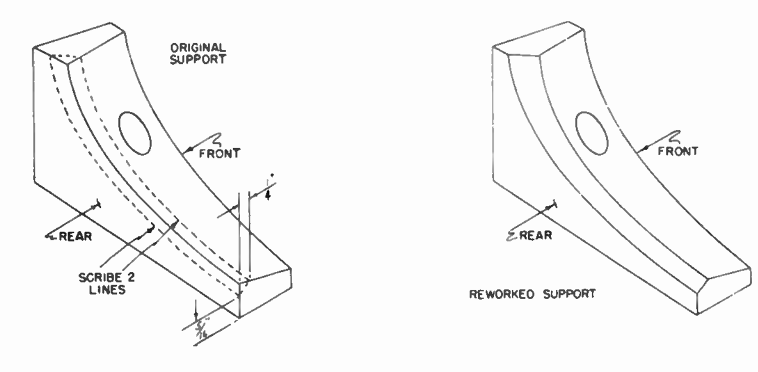


WIRING OF HALOLIGHT COMPONENTS IN 1-510 TV CHASSIS

ITEM 4 SUBJECT: The following components should be added to the parts list
REASON: To pickup parts changes noted in items 2 and 3.

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	480-0001	Board - Terminal - HaloLight Transformer
	487-0019	Clip - HaloLight Tube mounting
R49	153-0015	Control - HaloLight
R257	153-0021	Control - Horizontal Hold (knob-adjusted)
R159	153-0020	Control - Picture (Brightness) (knob-adjusted)
	744-0025	Knob - HaloLight Control
	740-0038	Knob - Horizontal Hold Control
	740-0039	Knob - Picture (Brightness) Control
	552-0031	Nut - HaloLight Control knob mounting
	415-0010	Plug - 2 Prong - HaloLight Tube connector
	415-0015	Plug - 4 Prong - HaloLight Transformer connector
R47, R48	189-0026	Resistor - 33,000 Ohm - 2 W.
	483-0019	Shield - Mask
	413-0006	Socket - 4 Prong - HaloLight Transformer connector
T30	141-0039	Transformer - HaloLight Power
	611-2100	Tube - Cold Cathode - HaloLight

ITEM 5 SUBJECT: Picture Tube Replacement on 1-508 and 1-510 Chassis.
REASON: Glass Weld on Later 21EP4A Tubes.
DESCRIPTION: A raised glass weld around the front face of later 21EP4A picture tubes will necessitate reworking both lower front picture tube supports on all 1-508 and 1-510 TV chassis not initially incorporating the beveled type support. When replacement with this type tube becomes necessary, grind or file off the rear edge of each support to clear this glass weld; thus, any irregular strain on the tube will be avoided when tightening the picture tube hold down strap.
First, remove the rubber pad on each support and then scribe two lines as shown. Grind or file down the support to these lines. Before the supports are reinstalled, cement the rubber pads to the reworked supports.



PICTURE TUBE SUPPORT - 1-508 AND 1-510 TV CHASSIS

SCHEMATIC DIAGRAM FOR 1-508-1 C09 AND 1-508-2 C03 TV CHASSIS

PARTS CODING

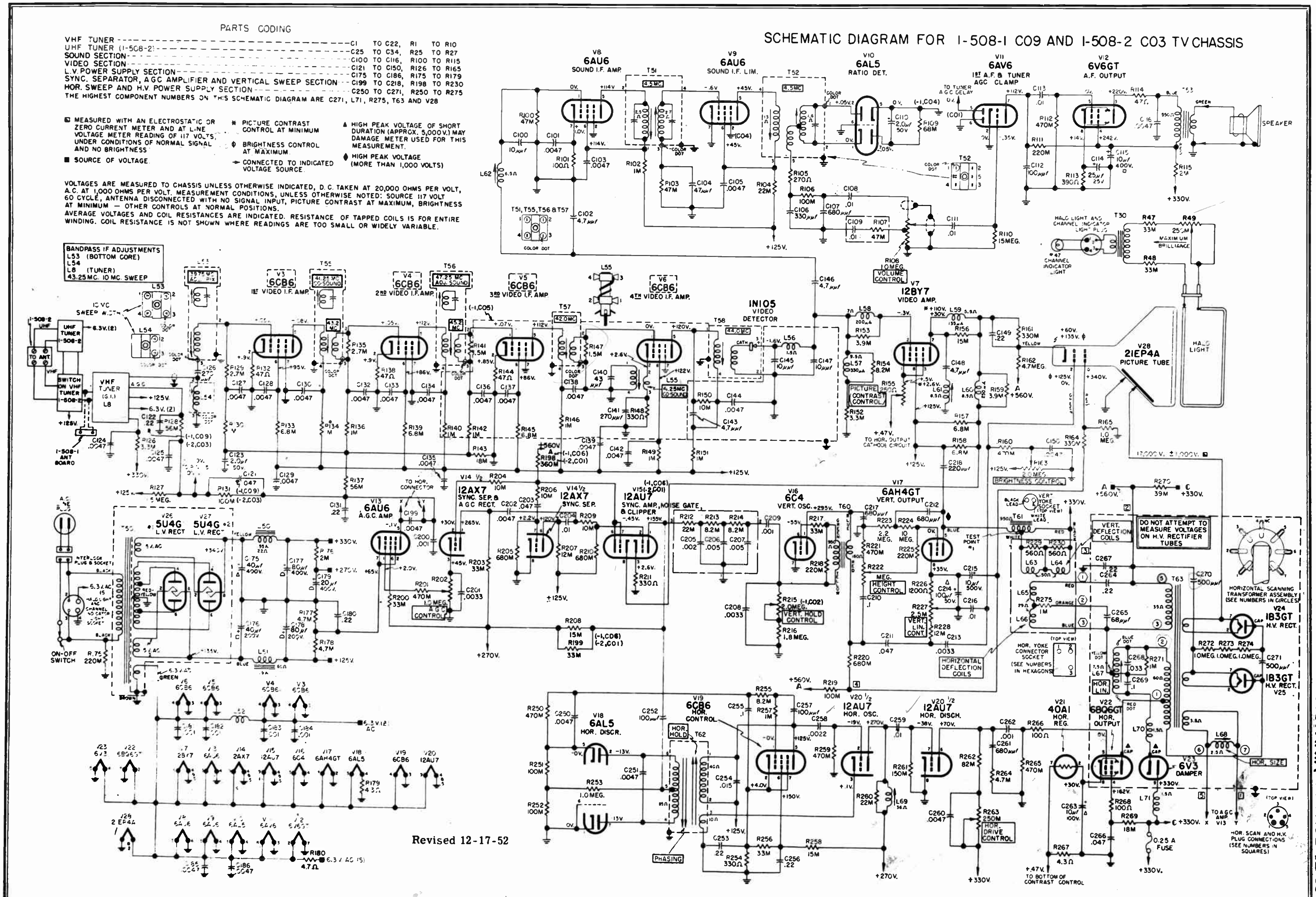
VHF TUNER	C1 TO C22,	R1 TO R10
UHF TUNER (1-508-2)	C25 TO C34,	R25 TO R27
SOUND SECTION	C100 TO C116,	R100 TO R115
VIDEO SECTION	C121 TO C150,	R126 TO R165
L.V. POWER SUPPLY SECTION	C175 TO C186,	R175 TO R179
SYNC. SEPARATOR, AGC AMPLIFIER AND VERTICAL SWEEP SECTION	C199 TO C218,	R198 TO R230
HOR. SWEEP AND H.V. POWER SUPPLY SECTION	C250 TO C271,	R250 TO R275

THE HIGHEST COMPONENT NUMBERS ON THIS SCHEMATIC DIAGRAM ARE C271, L71, R275, T63 AND V28

- ◘ MEASURED WITH AN ELECTROSTATIC OR ZERO CURRENT METER AND AT LINE VOLTAGE METER READING OF 117 VOLTS, UNDER CONDITIONS OF NORMAL SIGNAL AND NO BRIGHTNESS
- ■ SOURCE OF VOLTAGE.
- * PICTURE CONTRAST CONTROL AT MINIMUM
- ◊ BRIGHTNESS CONTROL AT MAXIMUM.
- → CONNECTED TO INDICATED VOLTAGE SOURCE.
- ▲ HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 5,000 V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT.
- ♦ HIGH PEAK VOLTAGE (MORE THAN 1,000 VOLTS)

VOLTAGES ARE MEASURED TO CHASSIS UNLESS OTHERWISE INDICATED, D.C. TAKEN AT 20,000 OHMS PER VOLT, A.C. AT 1,000 OHMS PER VOLT. MEASUREMENT CONDITIONS, UNLESS OTHERWISE NOTED: SOURCE 117 VOLT 60 CYCLE, ANTENNA DISCONNECTED WITH NO SIGNAL INPUT, PICTURE CONTRAST AT MAXIMUM, BRIGHTNESS AT MINIMUM — OTHER CONTROLS AT NORMAL POSITIONS.

AVERAGE VOLTAGES AND COIL RESISTANCES ARE INDICATED. RESISTANCE OF TAPPED COILS IS FOR ENTIRE WINDING. COIL RESISTANCE IS NOT SHOWN WHERE READINGS ARE TOO SMALL OR WIDELY VARIABLE.



SCHEMATIC DIAGRAM FOR 1-510-1 C08 AND 1-510-2 TV CHASSIS

PARTS CODING

VHF TUNER SECTION	C1 TO C24,	R1 TO R11
UHF TUNER SECTION	C26 TO C39,	R26 TO R29
SOUND SECTION	C100 TO C115,	R100 TO R115
VIDEO SECTION	C125 TO C152,	R126 TO R159
L.V. POWER SUPPLY SECTION	C175 TO C180,	R175 AND R176
SYNC. SEPARATOR AND VERTICAL SWEEP SECTION	C200 TO C215,	R200 TO R227
HOR. SWEEP AND H.V. POWER SUPPLY SECTION	C250 TO C267,	R250 TO R268

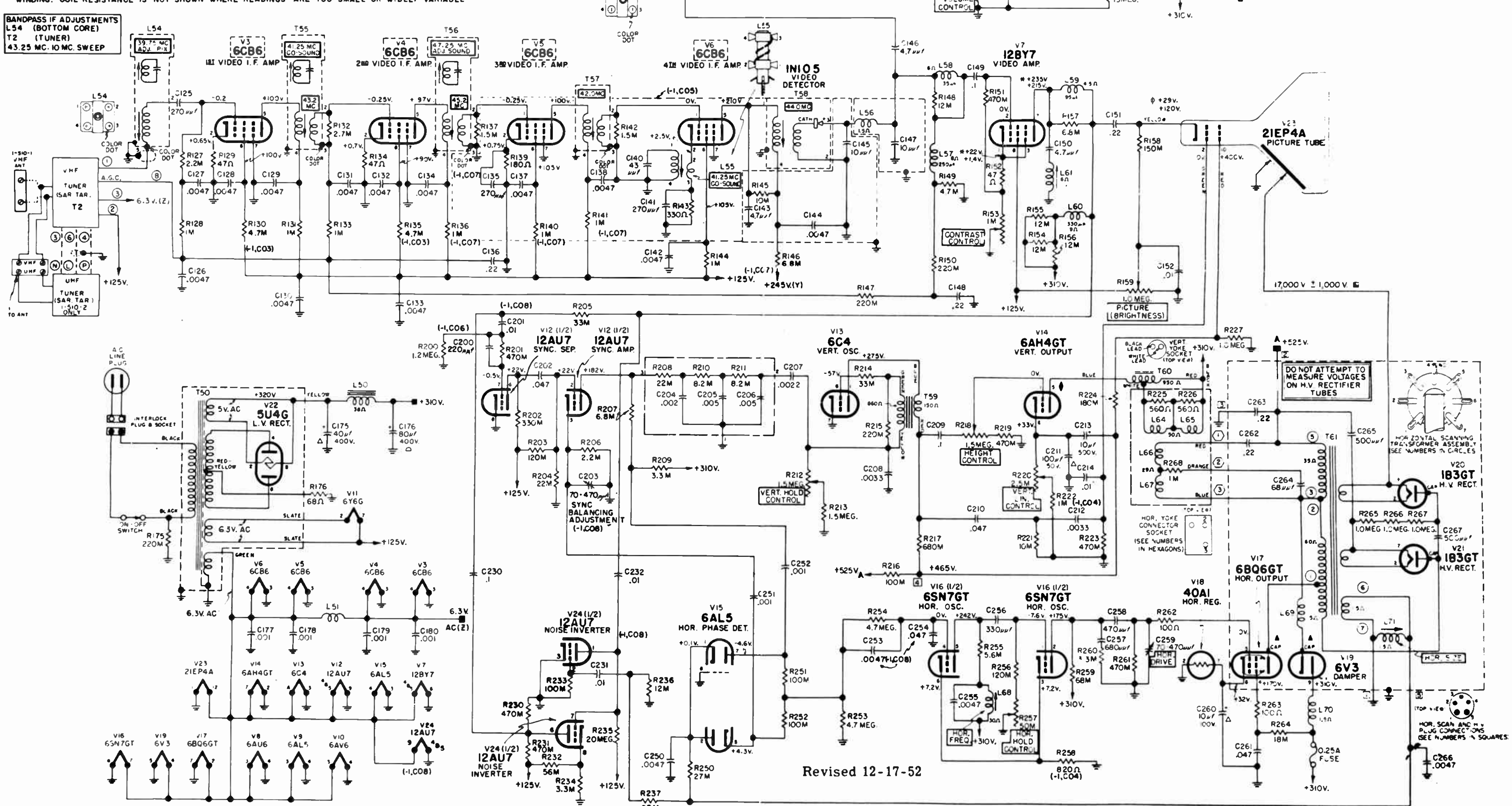
THE HIGHEST COMPONENT NUMBERS ON THIS SCHEMATIC DIAGRAM ARE: C267, L71, R268, T61 AND V24

NOISE INVERTER STAGE	C230 TO C232,	R230 TO R237

- ◘ MEASURED WITH AN ELECTROSTATIC OR ZERO CURRENT METER AND AT LINE VOLTAGE METER READING OF 117 VOLTS, UNDER CONDITIONS OF NORMAL SIGNAL AND NO BRIGHTNESS.
- ■ SOURCE OF VOLTAGE.
- * PICTURE CONTRAST CONTROL AT MINIMUM.
- ♦ BRIGHTNESS CONTROL AT MAXIMUM.
- → CONNECTED TO INDICATED VOLTAGE SOURCE.
- ▲ HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 5,000 V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT.
- ♦ HIGH PEAK VOLTAGE (MORE THAN 1000 VOLTS)

VOLTAGES ARE MEASURED TO CHASSIS UNLESS OTHERWISE INDICATED, D.C. TAKEN AT 20,000 OHMS PER VOLT, A.C. AT 1,000 OHMS PER VOLT. MEASUREMENT CONDITIONS, UNLESS OTHERWISE NOTED: SOURCE 117 VOLT 60 CYCLE, ANTENNA DISCONNECTED WITH NO SIGNAL INPUT, PICTURE CONTRAST AT MAXIMUM, BRIGHTNESS AT MINIMUM — OTHER CONTROLS AT NORMAL POSITIONS.
AVERAGE VOLTAGES AND COIL RESISTANCES ARE INDICATED. RESISTANCE OF TAPPED COILS IS FOR ENTIRE WINDING. COIL RESISTANCE IS NOT SHOWN WHERE READINGS ARE TOO SMALL OR WIDELY VARIABLE

BANDPASS IF ADJUSTMENTS
L54 (BOTTOM CORE)
T2 (TUNER)
43.25 MC. 10 MC. SWEEP



SCHEMATIC DIAGRAM FOR 1-504-1 C02 AND 1-504-2 TV CHASSIS

PARTS CODING

VHF TUNER SECTION	C1 TO C24, R1 TO R11
UHF TUNER SECTION	C26 TO C39, R26 TO R29
SOUND SECTION	C100 TO C114, R100 TO R115
VIDEO SECTION	C124 TO C152, R127 TO R159
L.V. POWER SUPPLY SECTION	C175 TO C180, R175 AND R176
SYNC. SEPARATOR AND VERTICAL SWEEP SECTION	C200 TO C215, R200 TO R227
HOR. SWEEP AND H.V. POWER SUPPLY SECTION	C250 TO C267, R250 TO R268

THE HIGHEST COMPONENT NUMBERS ON THIS SCHEMATIC DIAGRAM ARE: C267, L72, R268, T61 AND V24

NOISE INVERTER STAGE	C230 TO C232, R230 TO R237

■ MEASURED WITH AN ELECTROSTATIC OR ZERO CURRENT METER AND AT LINE VOLTAGE METER READING OF 117 VOLTS, UNDER CONDITIONS OF NORMAL SIGNAL AND NO BRIGHTNESS.

■ SOURCE OF VOLTAGE.

* PICTURE CONTRAST CONTROL AT MINIMUM.

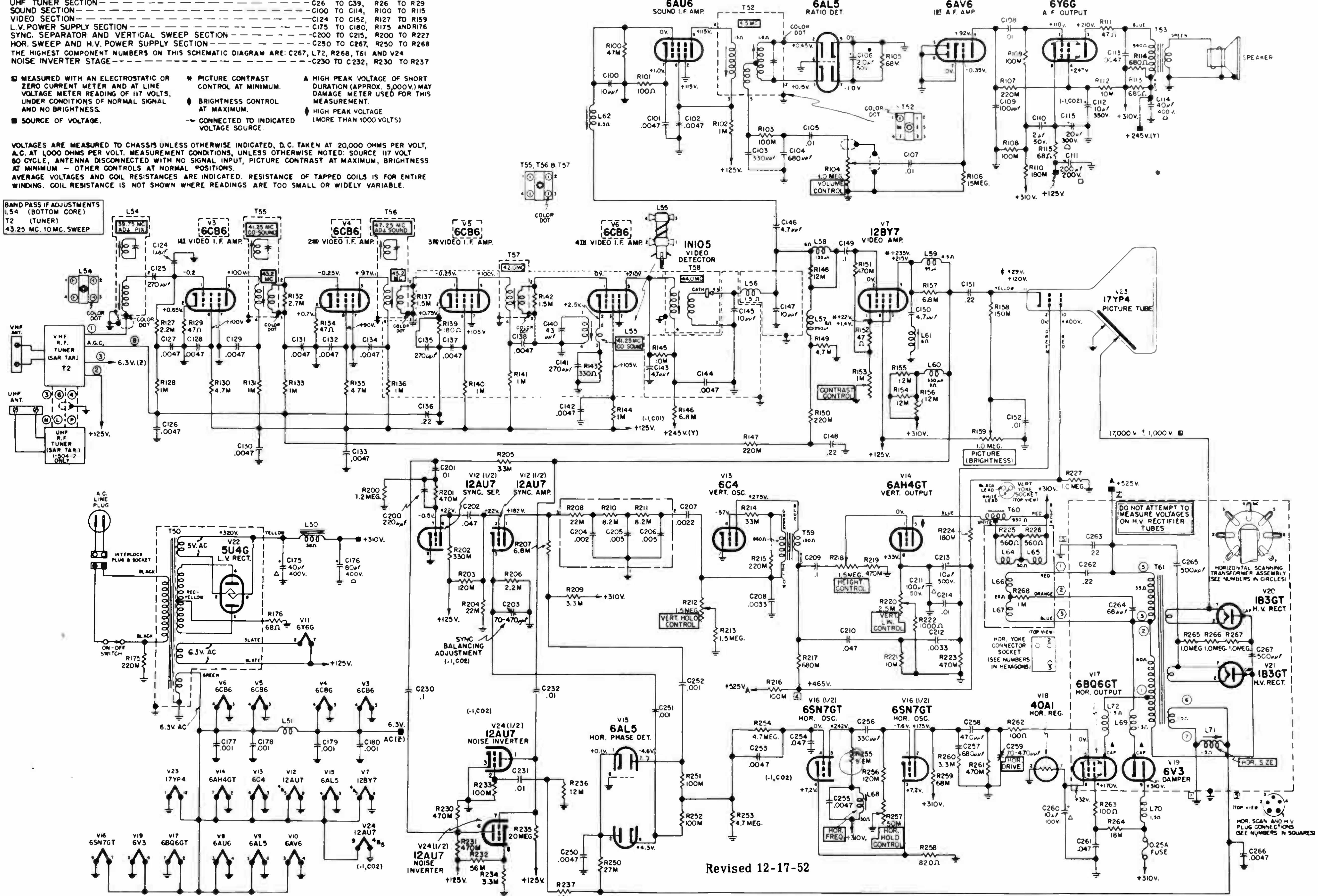
♦ BRIGHTNESS CONTROL AT MAXIMUM.

→ CONNECTED TO INDICATED VOLTAGE SOURCE.

▲ HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 5,000V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT.

♦ HIGH PEAK VOLTAGE (MORE THAN 1000 VOLTS)

VOLTAGES ARE MEASURED TO CHASSIS UNLESS OTHERWISE INDICATED, D.C. TAKEN AT 20,000 OHMS PER VOLT, A.C. AT 1,000 OHMS PER VOLT. MEASUREMENT CONDITIONS, UNLESS OTHERWISE NOTED: SOURCE 117 VOLT 60 CYCLE, ANTENNA DISCONNECTED WITH NO SIGNAL INPUT, PICTURE CONTRAST AT MAXIMUM, BRIGHTNESS AT MINIMUM — OTHER CONTROLS AT NORMAL POSITIONS.
AVERAGE VOLTAGES AND COIL RESISTANCES ARE INDICATED. RESISTANCE OF TAPPED COILS IS FOR ENTIRE WINDING. COIL RESISTANCE IS NOT SHOWN WHERE READINGS ARE TOO SMALL OR WIDELY VARIABLE.



Revised 12-17-52

SPECIAL INSTALLATION AND SERVICE INSTRUCTIONS

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Picture Tube Replacement

Use extreme caution at all times when handling these chassis. Carry 21" chassis by handle on rear tube mounting bracket and center of lower front lip of picture tube. Make sure hands are free of dirt and grease to prevent slipping on smooth surface of glass. Carry 17" chassis by the two side picture tube braces.

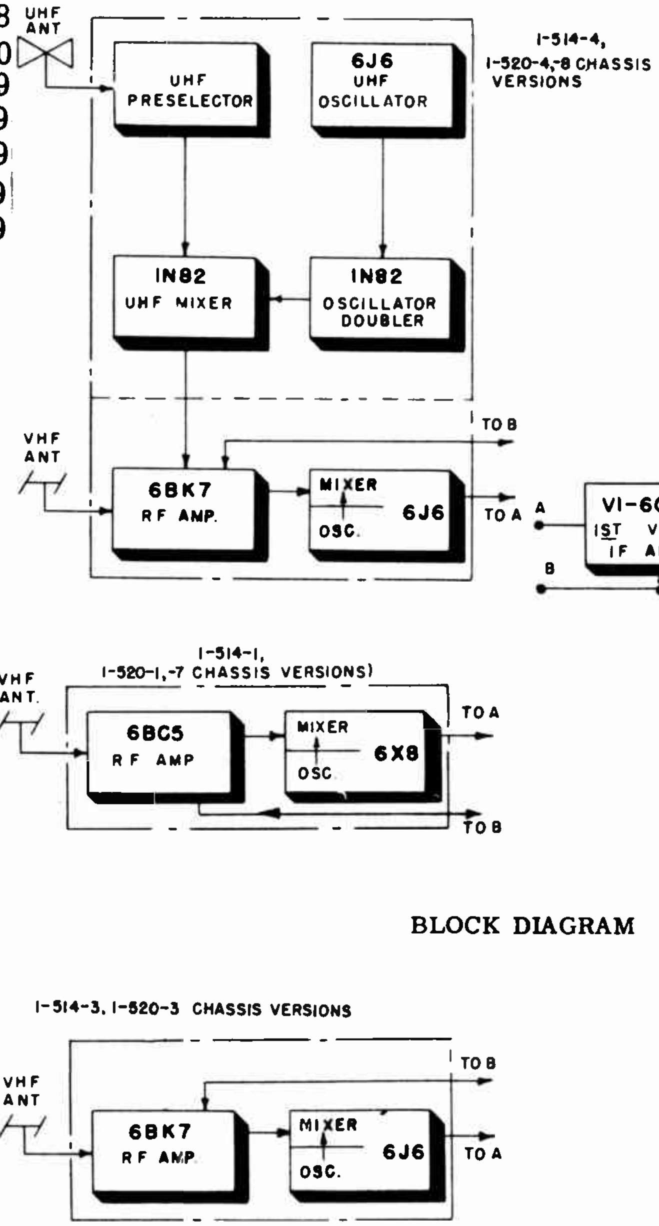
Alignment of the mask and picture tube should not be necessary after normal servicing of the chassis. However, if tube support members have been disturbed during picture tube replacement, observe the following procedure. See Picture Tube Installation illustrations.

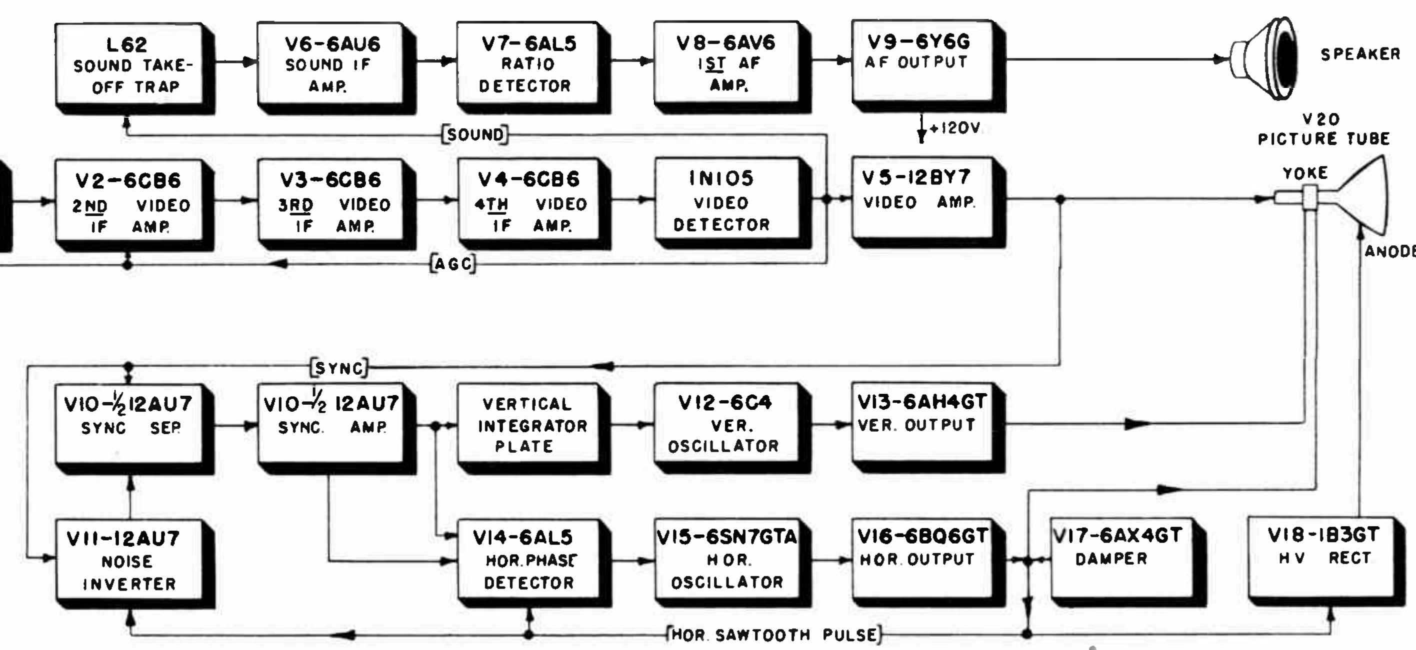
1. Position tube with face tilted forward about 3 degrees with brackets in approximately normal position. Tighten the following just enough to permit further adjustment in cabinet.
   - (a) Tube holddown strap mounting nuts (21" chassis only).
   - (b) Holddown strap rod or rod nuts.
   - (c) Rear tube mounting rod nut.
   - (d) Yoke mounting wing nuts.
   - (e) Rear tube mounting bracket screws if previously loosened.
2. Carefully slide chassis into cabinet, replace and tighten chassis holddown screws.
3. Replace all knobs and electrical connections. If tuner does not center, loosen tuner rear bracket wing screws and shift tuner until knobs function freely. Retighten wing screws.
4. Carefully move tube in mountings to align face of tube with mask so that no space remains between them. Tighten mounting assemblies listed in step one completely. Make sure that equal tension is applied to tube holddown strap rod nuts.
5. Correctly position deflection yoke. Adjust ion trap, focus, centering and pincushion corrector magnets.

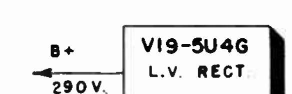
CAUTION: DURING ALL ABOVE OPERATIONS AVOID PUTTING ANY STRAIN ON NECK OF TUBE.

HaloLight Tube Replacement

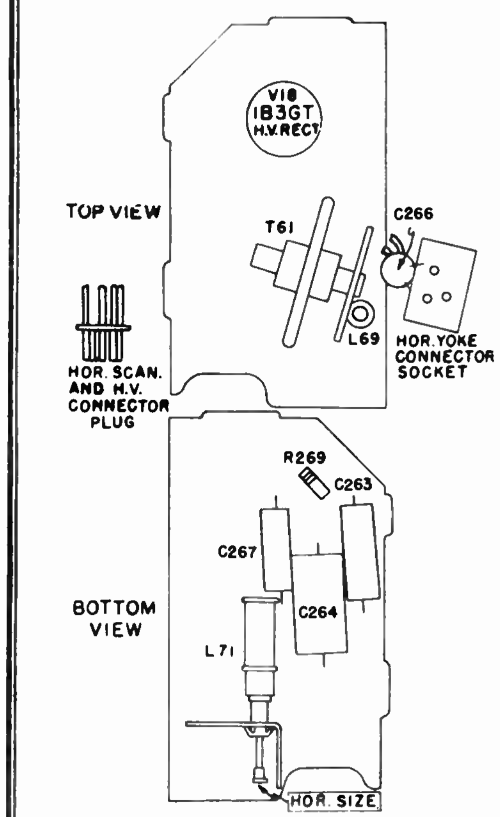
1. Remove chassis from cabinet.
2. Unfasten the nuts that hold the bezel assembly to the cabinet and remove assembly.
3. Lay bezel assembly face down on a surface that will not scratch bezel.
4. Remove clamps holding light shield and mask to bezel.
5. Remove HaloLight plug, and transformer and control assembly.
6. Remove retaining channels and lift HaloLight shield from assembly.
7. Remove tape holding HaloLight tube mounting clips and leads to shield.
8. Remove vinyl tubing from ends of tube and carefully lift tube from shield.
9. Unsolder leads from tube.
10. To replace tube, follow the foregoing steps in reverse order. It is important that all tape removed from assembly be replaced to minimize dust collection on picture tube face.







BLOCK DIAGRAM

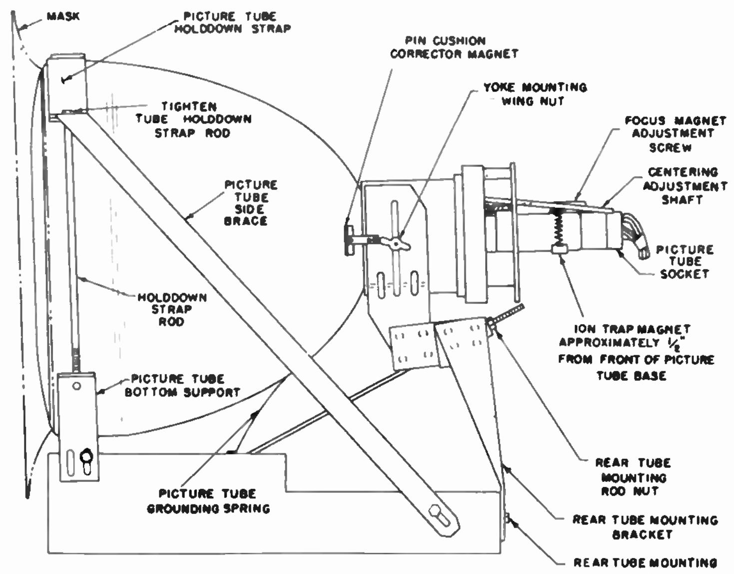


HIGH VOLTAGE ASSEMBLY

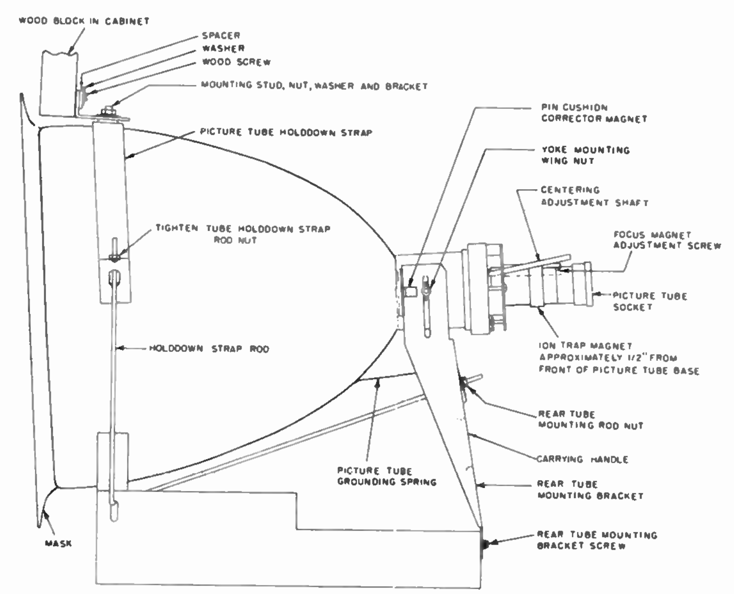
CHASSIS VARIATIONS

CHASSIS	PICTURE TUBE	TUNERS VHF	TUNERS UHF	HALOLIGHT	MODELS
1-514-1	17YP4(Cyl.)	S.T.	—	No	105-14; 300
1-514-3	17YP4(Cyl.)	G.I.	—	No	Same as 1-514-1.
1-514-4	17YP4(Cyl.)	G.I.	G.I.	No	105-14; 300 ("U" Models)
1-520-1	21ZP4A(Spher.)	S.T.	—	No	120-20; 320; 325
1-520-3	21ZP4A(Spher.)	G.I.	—	No	Same as 1-520-1.
1-520-4	21ZP4A(Spher.)	G.I.	G.I.	No	120-20; 325 ("U" Models)
1-520-7	21EP4A (Cyl.)	S.T.	—	Yes	326
1-520-8	21EP4A (Cyl.)	G.I.	G.I.	Yes	326 ("U" Models)

S.T. - Sarkes - Tarzian tuner.
G.I. - General Instrument tuner.
"U" Models - All-channel models designated BU, MU, etc.
Cyl. - Cylindrical faced; Spher. - Spherical faced.
I.P. - Change incorporated in initial production.

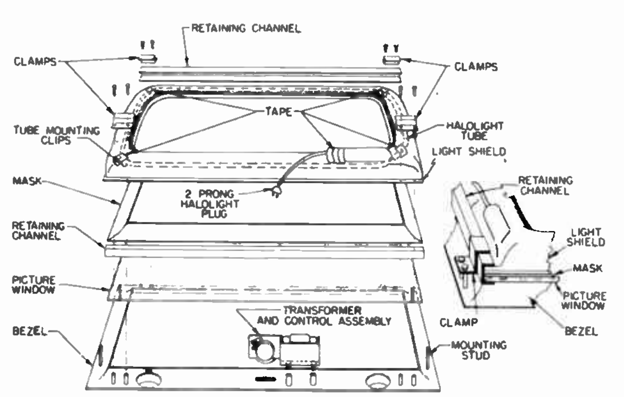


1-514 CHASSIS

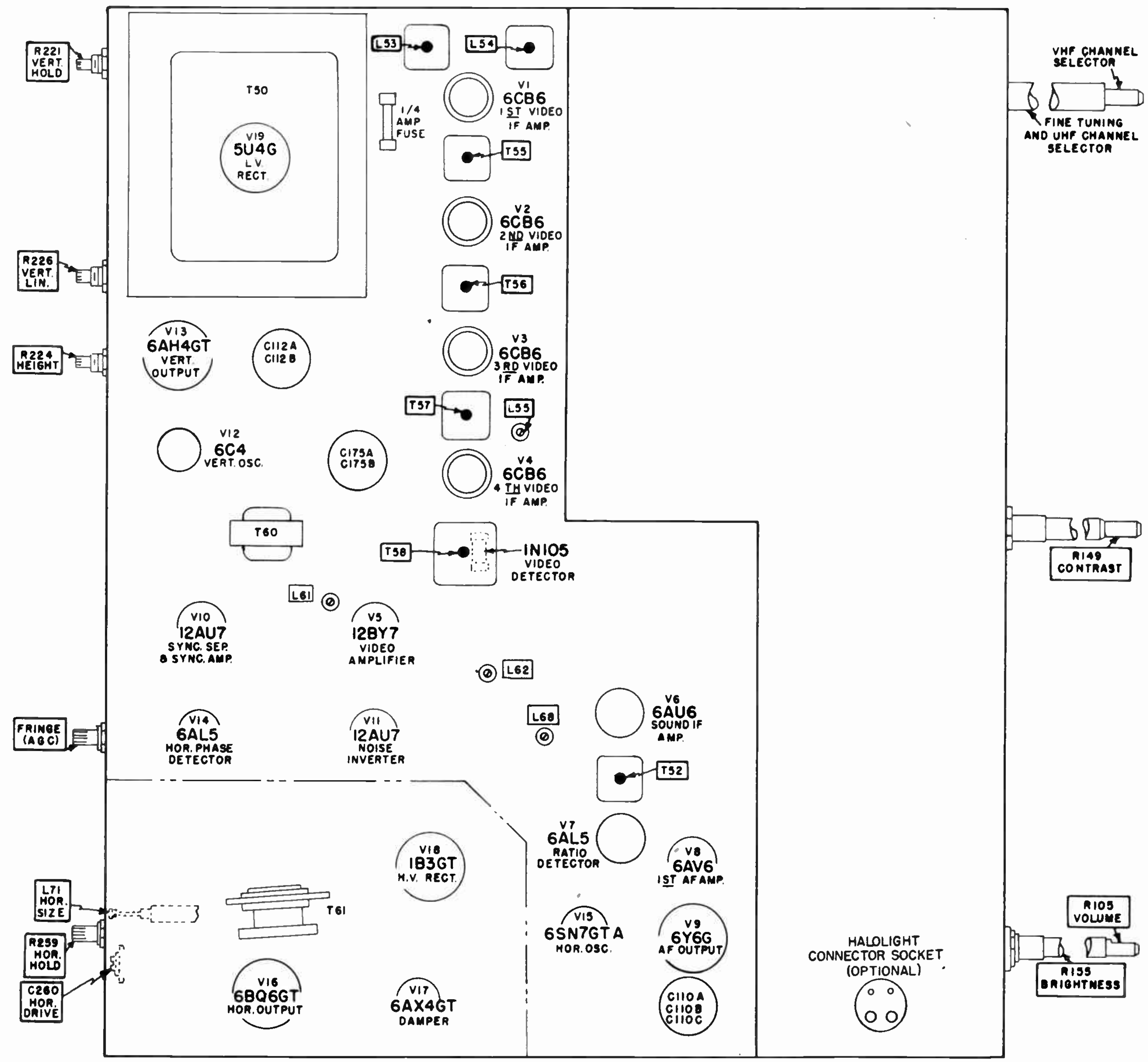


1-520 CHASSIS

PICTURE TUBE INSTALLATION

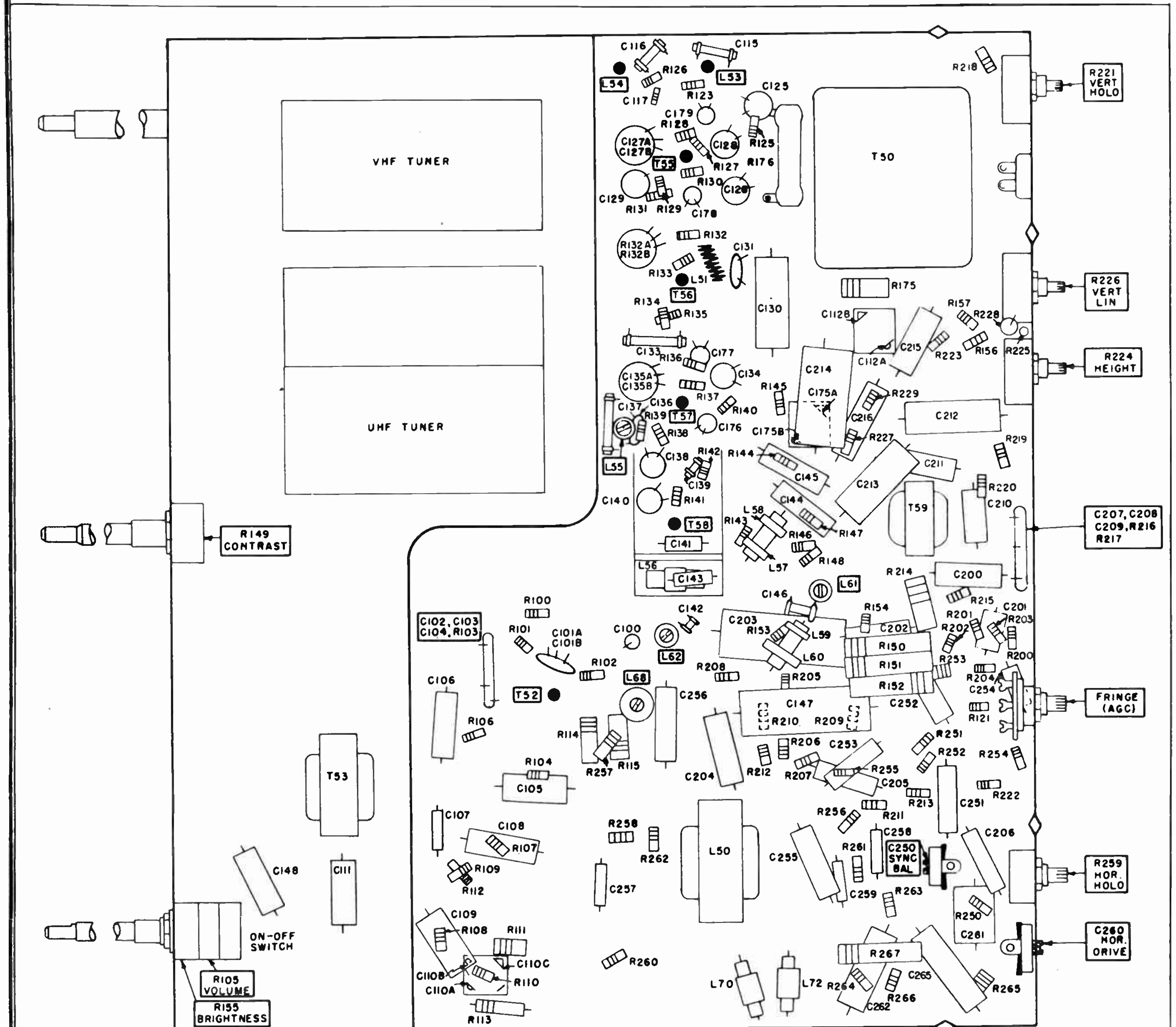


HALOLIGHT TUBE REMOVAL



TOP LAYOUT

NOTES ON VHF AND UHF TUNER DISASSEMBLY



BOTTOM LAYOUT

ALL G.I. VHF AND UHF CHASSIS
REMOVAL OF DRIVE ASSEMBLY

1. Code and unsolder leads to VHF tuner.
2. Remove dial cord.
3. Remove tuner from chassis by unscrewing one front and two rear (wing) mounting screws.
4. Remove drive components as shown in UHF Drive Assembly drawing.

NOTE: To remove bushing ring and bearing ring, first loosen set screws in pinion and then slide both pinion, and pulley and sleeve assembly toward tuner case; thus exposing front bearing ring. Remove bearing ring. Slide pulley and sleeve assembly off fine tuning sleeve to expose rear bushing ring. Remove bushing ring. Caution: Do not spread front bearing ring any more than is necessary to slide it off the front of the fine tuning sleeve.

When replacing the drive assembly, reverse the above procedure, making sure that the front bearing ring is fully seated in the end of the pulley and sleeve assembly. Proper action of the anti-backlash gears is obtained by holding one gear stationary and advancing the other one tooth, so that tension is applied to the springs. This must be done during assembly when engaging pinion and gear.

REMOVAL OF SWITCH ASSEMBLY

1. Code and unsolder leads to switch.
2. Remove switch and cam as shown in UHF Switch Assembly drawing.

After replacing the switch assembly, rotate the cam through its complete travel to insure that it clears all projections and that the switch operates freely. Note that when the cam is fully engaged (flat on shaft parallel to and facing bottom of tuner case) the switch is in the down (UHF) position.

TURRET DRUM REMOVAL - VHF TUNER

To remove turret drum from VHF tuner, it is not necessary to remove the tuner from the chassis. With the chassis lying on its side, remove the following items in the order given. See the VHF Tuner Layout illustration

1. Bottom cover plate.
2. Shaft retaining springs (front and rear).
3. Front bearing plate.

The drum should now be free of its mounting and readily removed from the tuner housing through the slots provided.

To replace the turret, reverse the above steps, exercising caution when inserting in housing to make sure that the rotor of the fine tuning capacitor meshes with the stator plates.

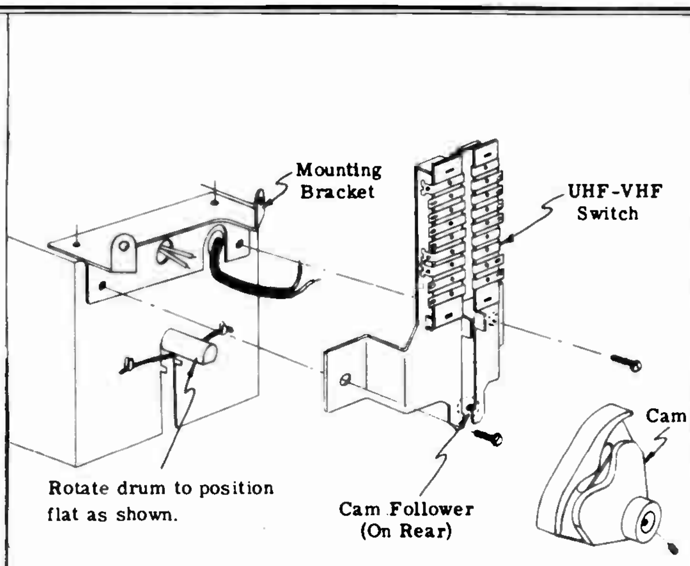
COIL STRIP REPLACEMENT - VHF TUNER

When viewed from the front, the coil strips are numbered consecutively from 2 to 13 in clockwise rotation with the 40 MC IF strip between numbers 13 and 2. The flat on the channel selector shaft (as viewed from the front) is in line with coil strip for channel 3.

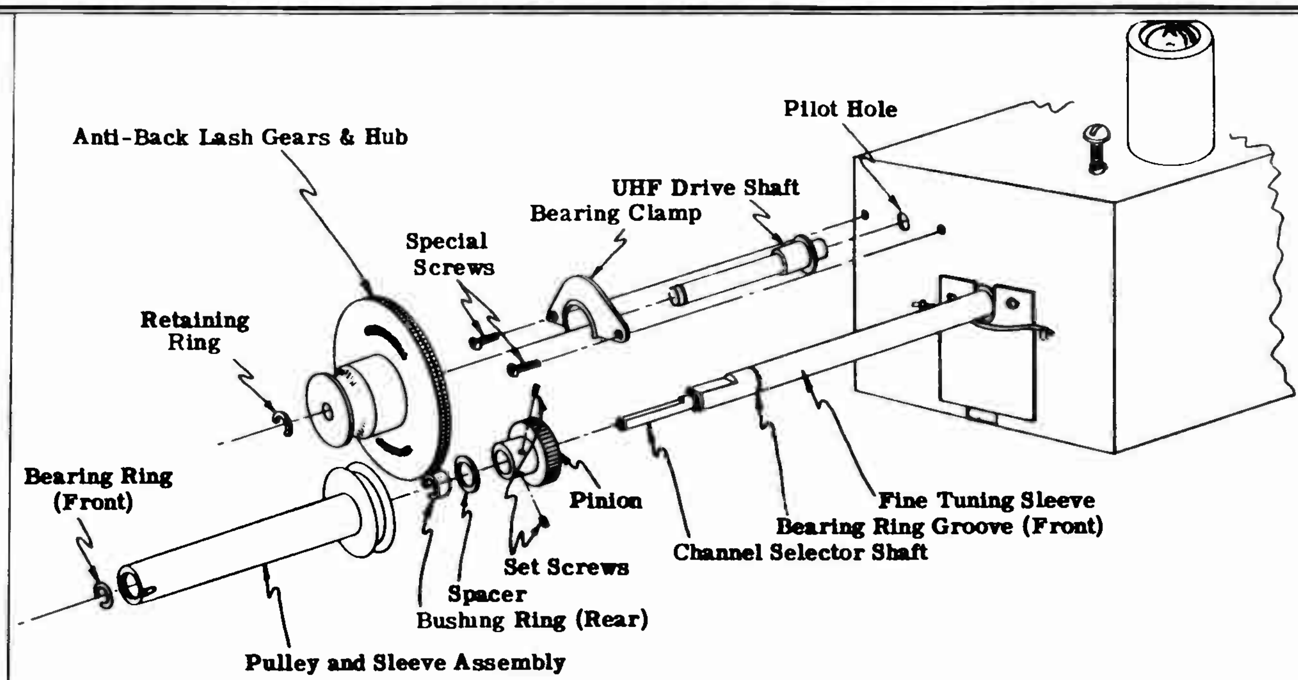
To remove and replace coil strips proceed as follows: (Note: It is not necessary to remove tuner from chassis).

1. Remove bottom cover plate.
2. Rotate channel selector shaft so that coil to be removed is in line with slots in end of tuner case.
3. Using needle nose pliers release boss on strip from detent plate as shown in the VHF Tuner Strip Removal illustration.
4. Carefully lift strip up and then free from rear retaining spring.

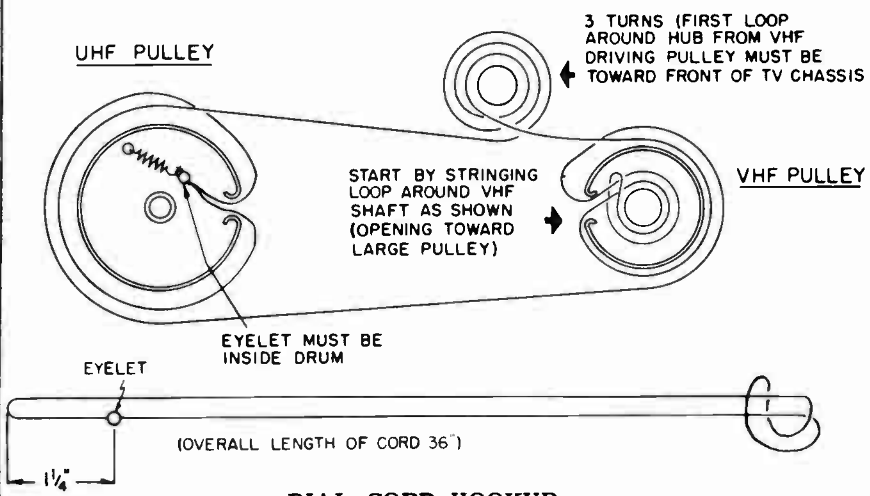
To replace strip, insert boss on rear of strip into retaining spring and apply only enough pressure against spring so that front boss clears detent plate. Push strip into position so that front boss engages slot in detent plate. Replace bottom cover.



UHF/VHF SWITCH ASSEMBLY



UHF DRIVE ASSEMBLY

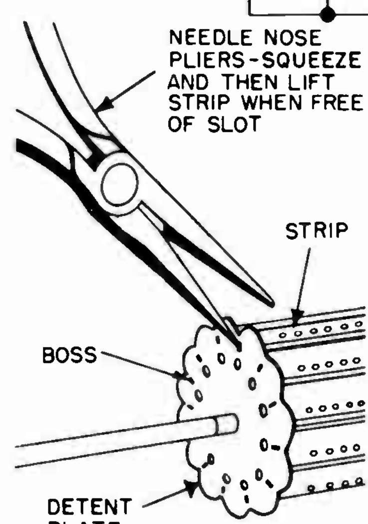


DIAL CORD HOOKUP

DIAL CORD STRINGING

In replacing the dial drive cord, position the eyelet in the cord as shown and proceed in the following order. See VHF/UHF Dial Cord Hookup drawing.

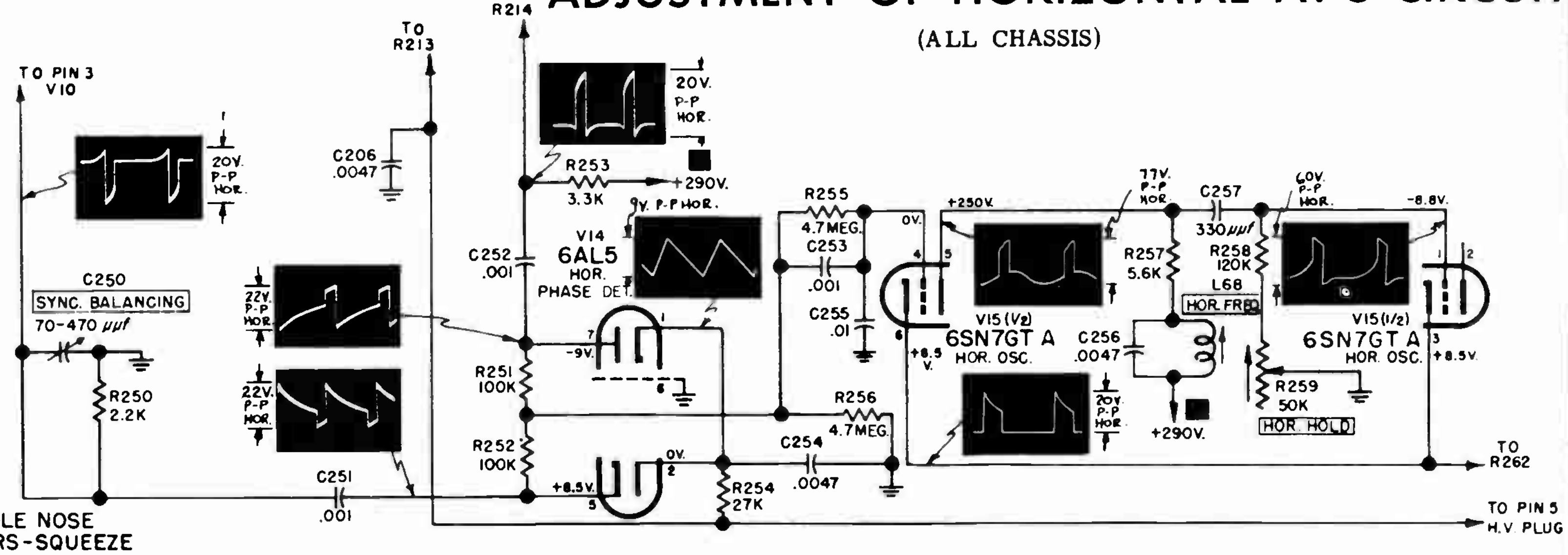
1. Loop around shaft of VHF pulley.
2. Loops around VHF pulley in each direction.
3. Three turns around hub on anti-backlash gear.
4. Loops around UHF pulley in each direction.
5. Feed eyelet through opening in UHF pulley and hook to spring.



VHF TUNER STRIP REMOVAL

ADJUSTMENT OF HORIZONTAL AFC CIRCUIT

(ALL CHASSIS)



1. Tune in air signal.
2. Short pin 2 of V14 Horizontal Phase Detector 6AL5 to chassis.
3. Connect VTVM from pin 4 of V15 Horizontal Oscillator 6SN7GT/A to chassis.
4. Adjust C250 for minimum voltage.
5. Remove VTVM from circuit.
6. With Horizontal Hold control in mechanical center position, adjust L68 Horizontal Frequency adjustment screw until picture moves back and forth across screen with blanking bar vertical.
7. Remove short from pin 2 of V14 Horizontal Phase Detector 6AL5.
8. With Contrast control in extreme counterclockwise position, rotate Horizontal Hold control until picture locks in and appears normal.
9. Advance Contrast control to normal position and check Horizontal Hold control on all available channels. A slight readjustment of Horizontal hold control may be necessary.

UHF TUNER ALIGNMENT

CHASSIS 1-514-4; CHASSIS 1-520-4; CHASSIS 1-520-8

Notes on VHF Tuner Alignment

Observe the following general procedure for connecting equipment for VHF tuner alignment setups.

1. The detector circuits should be constructed to maintain leads as short as possible.

2. Use shielded leads where indicated to minimize hum and synchronous voltage pickup.

3. The single pole double throw "scope switch" should be located at the vertical input terminal of the scope. This switching arrangement will permit observation of either the IF response or the overall RF response.

4. Use very loose coupling for the marker generators to prevent any affect on tuner response. A turn or two of wire around the points indicated in the tuner alignment setup should be sufficient.

5. Disconnect the primary winding of T55 by unsoldering lead from plate (pin 5) of 6CB6 1st Video IF Amplifier. Connect 330 ohm resistor in place of primary winding.

6. During tuner alignment, remove the 2nd Video IF Amplifier tube - V2 - 6CB6, to prevent coupling back from the receiver IF system.

7. In all of the following tests the oscilloscope vertical gain should be as close to maximum setting as possible, consistent with hum and synchronous voltage interference limitations. This precaution will permit the use of low levels from RF Sweep Generator thereby increasing visibility of IF and RF markers.

The Fine Tuning control on all chassis should be set to mid-capacity as follows:

1. On 1-514-3, 1-514-4, 1-520-3, 1-520-4 and 1-520-8 chassis, orient Fine Tuning Shaft as shown in VHF Tuner Layout illustration.

2. On 1-514-1, 1-520-1 and 1-520-7 chassis, set the Fine Tuning variable capacitor plates to halfmeshed position.

PRELIMINARY INSTRUCTIONS

1. Allow receiver to warm up before performing UHF alignment.
2. Check Video IF bandpass response as outlined in step 2 of "Video IF Alignment". Leave detector circuit connected for use in UHF tuner alignment.
3. When the bandpass adjustments have been checked, switch VHF tuner to "UHF" position and proceed with UHF alignment as indicated in the following paragraphs.

OUTPUT CIRCUIT ALIGNMENT

1. Apply 43.25 MC sweep (10 MC sweep width) into Test Point on UHF tuner.
2. Apply 42.1 MC and 45.75 MC markers as shown in "VHF Tuner Alignment Setup".
3. Adjust T25 on UHF tuner for response curve shown in Figure A.

PRESELECTOR ALIGNMENT

1. Inject 42.1 MC and 45.75 MC markers as shown in "VHF Tuner Alignment Setup".
2. Apply UHF sweep signal to UHF antenna terminals through a properly terminated output cable (matched to 300 Ohms) or through the matching pad shown in Figure B.
3. Tune UHF sweep generator and UHF tuner simultaneously across entire tuning range from 464 MC to 896 MC and observe response curve.
4. Adjust trimmers C37, C38 and C39 for best compromise on dip and tilt; if necessary, additional adjustment may be accomplished by bending the rotor plates slightly. Overall response curves should appear as in Figure C.

CAUTION - Do not attempt to correct for excessive tilt in overall UHF response curves by adjusting band pass circuit (L8, L53, L54). Readjustment of these circuits will adversely affect VHF reception of receiver.

5. Disconnect test equipment, remove 330 Ohm resistor and reconnect T55 into circuit.

OSCILLATOR ALIGNMENT

1. Apply UHF RF signal to UHF antenna terminals through a properly terminated output cable (matched to 300 Ohms) or through the matching pad in Figure B.
2. Connect DC VTVM across video detector load resistor R147 - 4.7K.
3. Turn UHF tuning shaft to extreme high frequency end of dial. At this point, UHF tuning capacitor plates are fully unmeshed.
4. Adjust C28 on UHF tuner for maximum reading on VTVM.

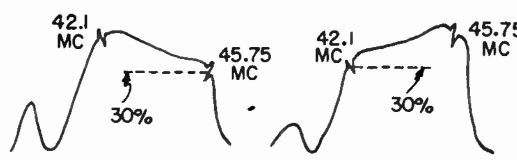


FIGURE C

FIGURE A

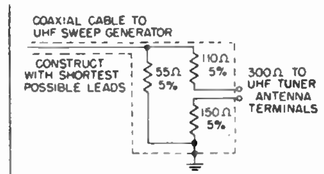
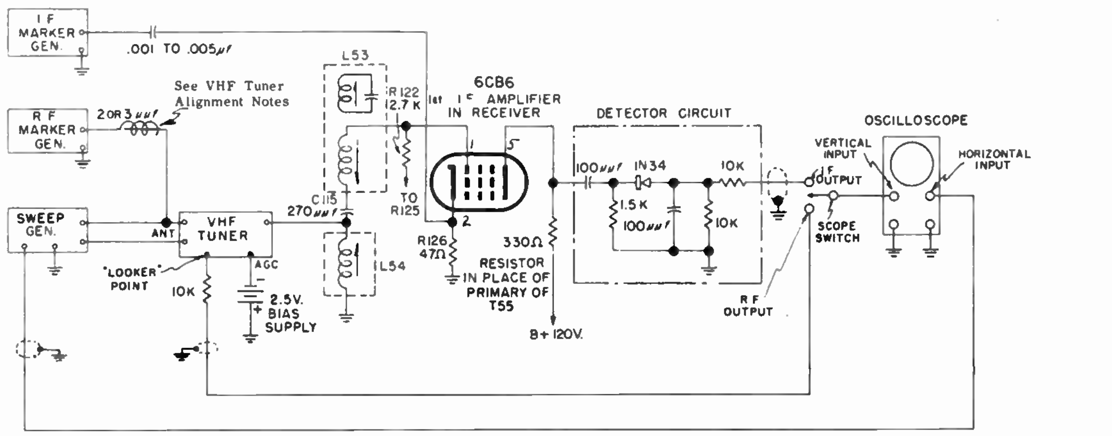
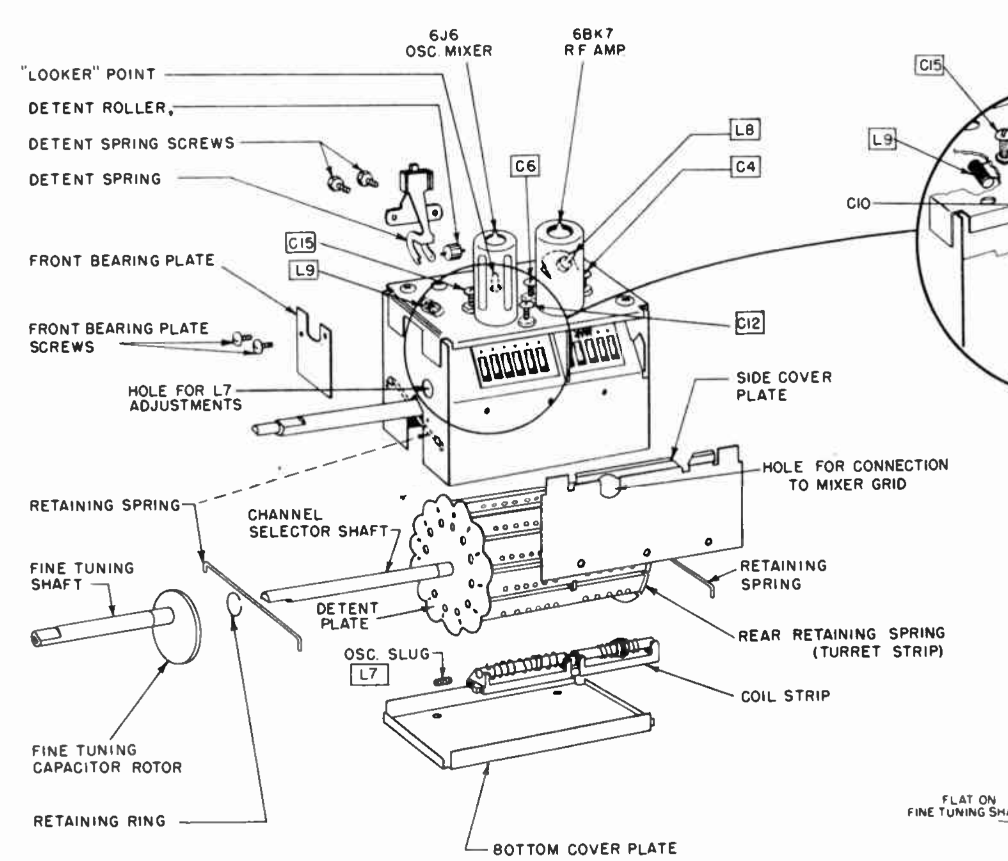


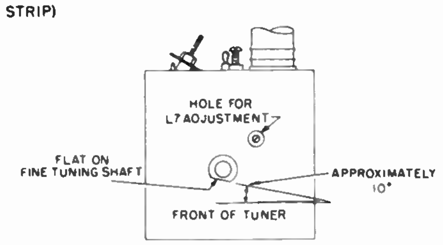
FIGURE B



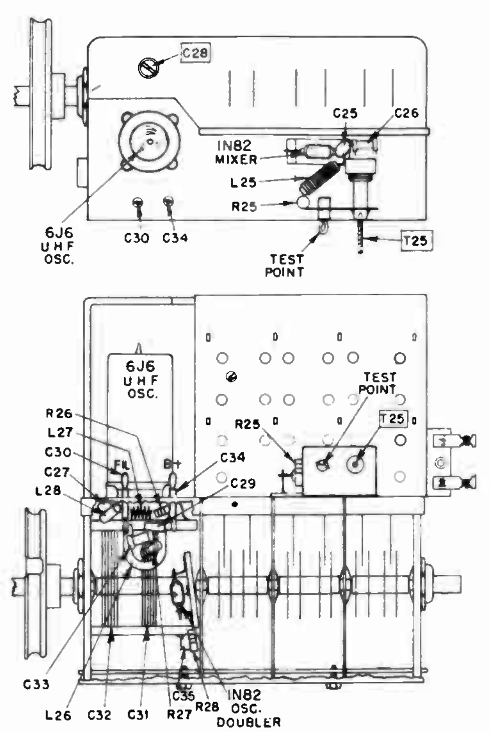
VHF TUNER ALIGNMENT SETUP - CHASSIS 1-514-3, 1-514-4, 1-520-3, 1-520-4, 1-520-8



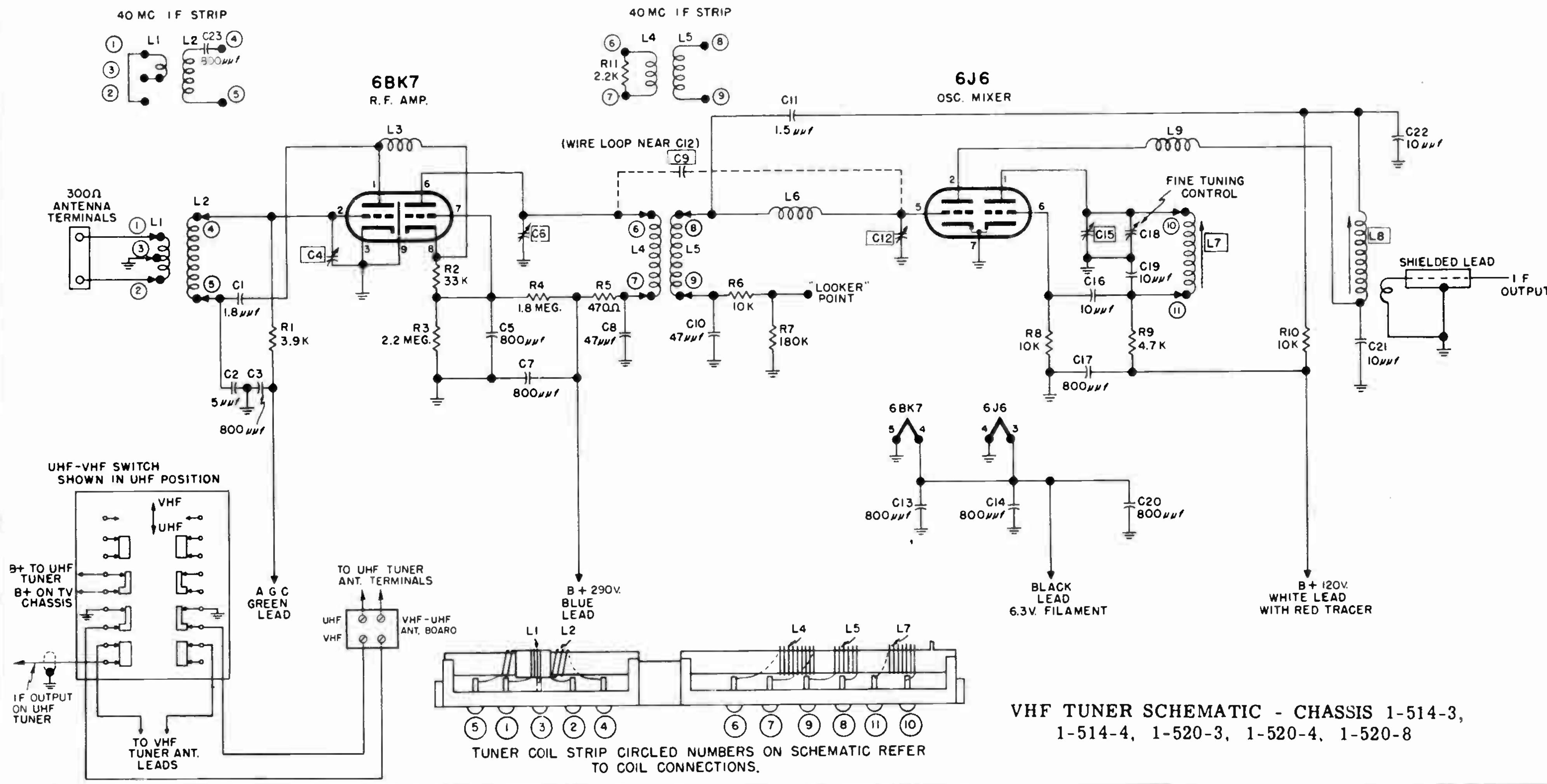
VHF TUNER LAYOUT - CHASSIS 1-514-3, 1-514-4, 1-520-3, 1-520-4, 1-520-8



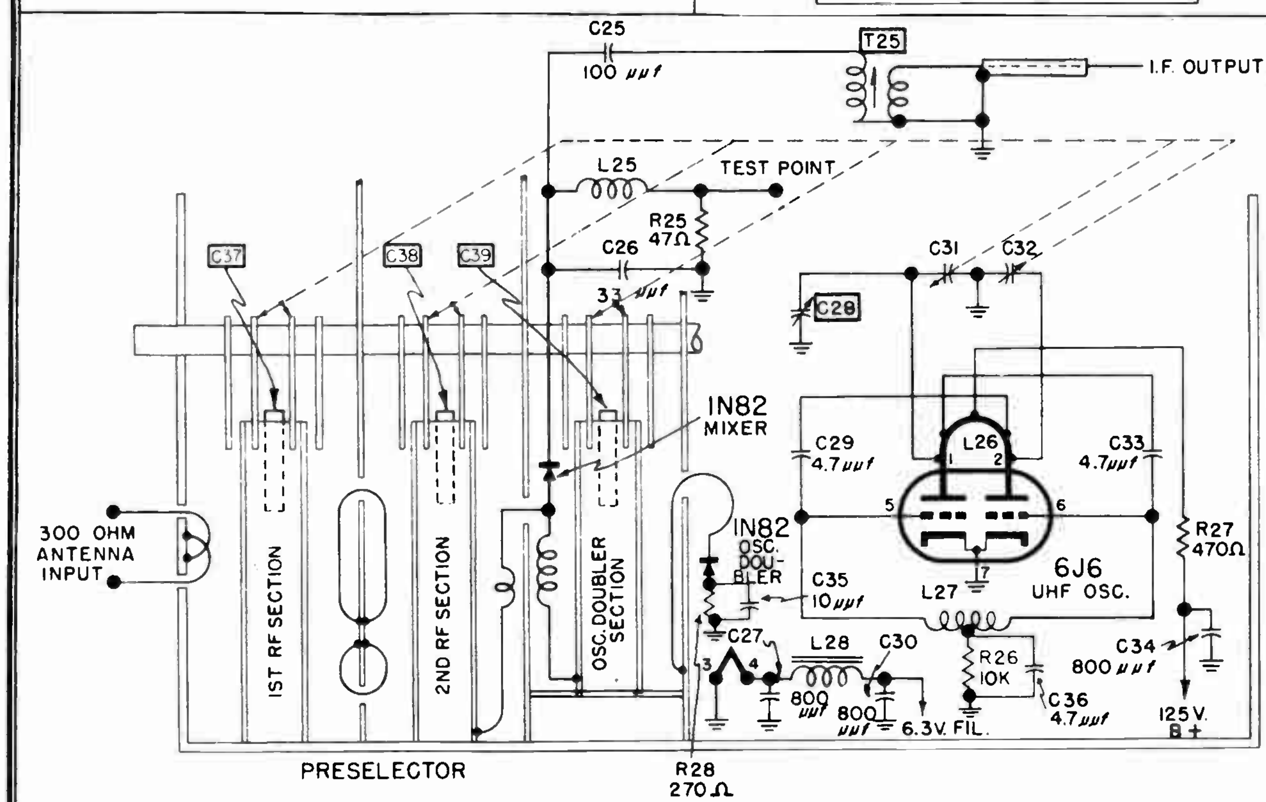
Fine Tuning Shaft Positioning



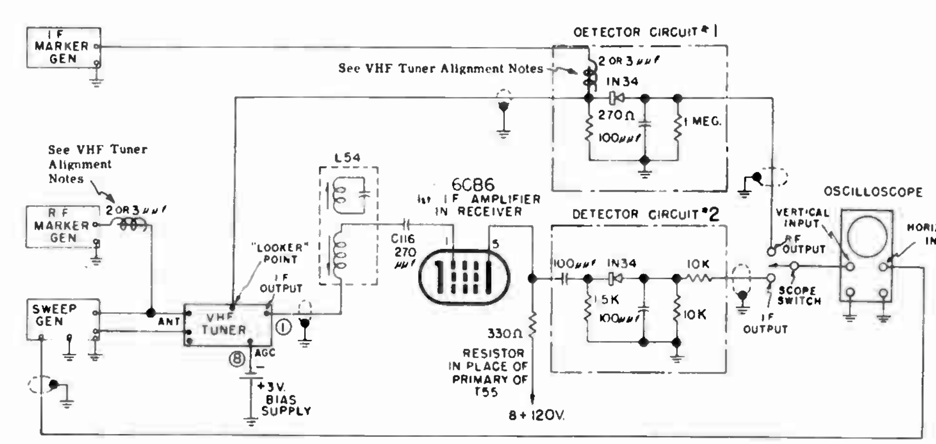
UHF TUNER LAYOUT



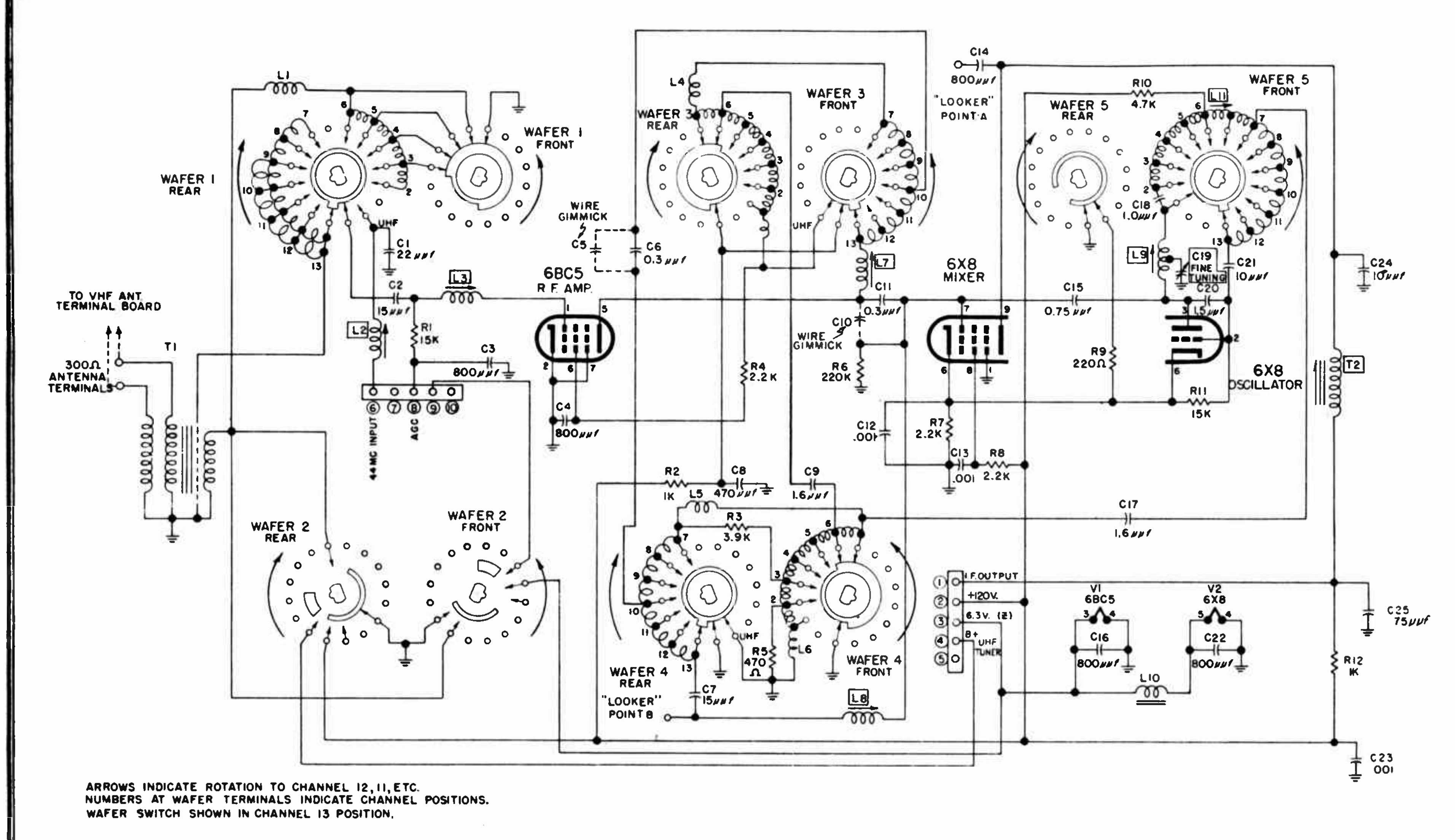
VHF TUNER SCHEMATIC - CHASSIS 1-514-3, 1-514-4, 1-520-3, 1-520-4, 1-520-8



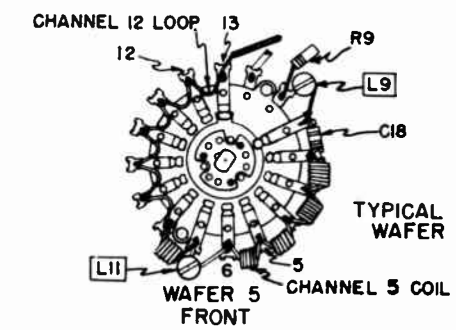
UHF TUNER SCHEMATIC

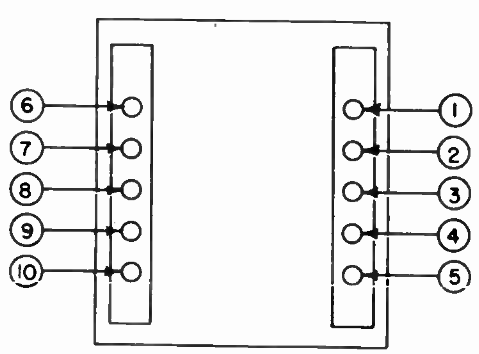


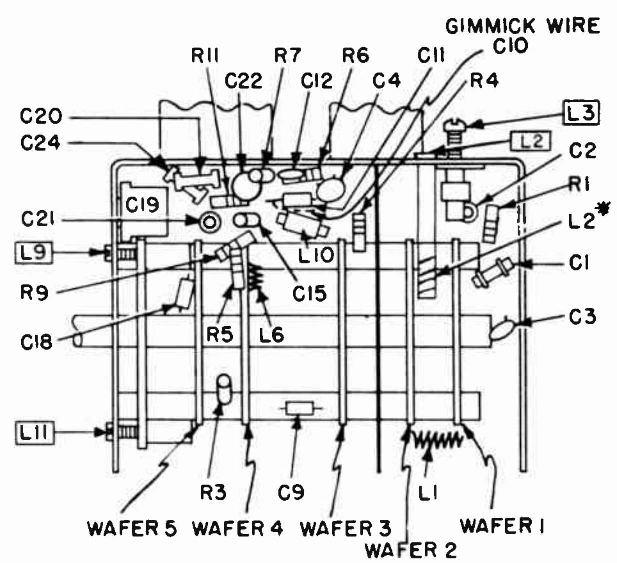
VHF TUNER ALIGNMENT SETUP - 1-514-1, 1-520-1, 1-520-7 CHASSIS



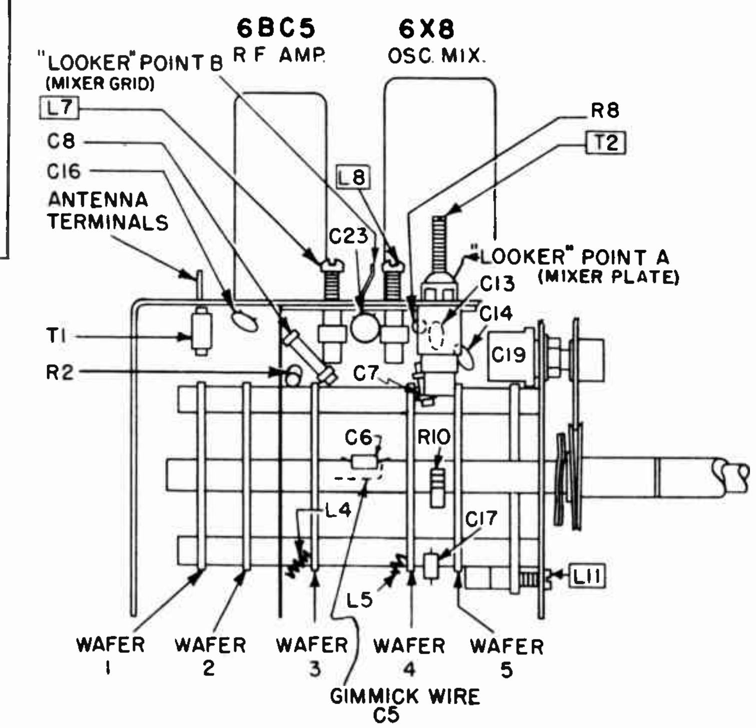
VHF TUNER SCHEMATIC - 1-514-1, 1-520-1, 1-520-7 CHASSIS







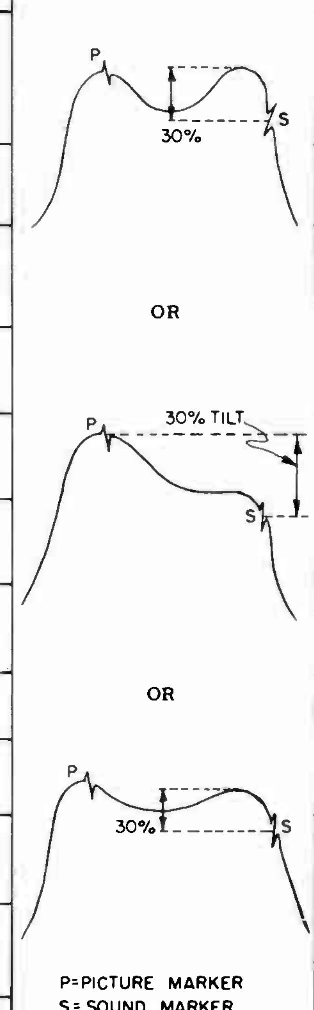
*Some tuners use small wire coil for L2.



VHF TUNER LAYOUT - 1-514-1, 1-520-1, 1-520-7 CHASSIS

VHF TUNER ALIGNMENT

CHASSIS 1-514-3, 1-514-4, 1-520-3, 1-520-4, 1-520-8

STEP	TUNER SET TO CHANNEL	SWEEP (10 MC)	GENERATORS IF MARKER	RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
1.	4	Channel 4 69 MC	———	67.25 MC (P) 71.75 MC (S)	RF Output	C12, C6, C4, then C9*(wire loop near C12)	30% deviation permissible as shown below: 	Connect 300 ohm resistor across Antenna Leads. Pass-band should be somewhat broader than that with antenna circuit operating and with picture marker inside.
2.	13	Channel 13 213 MC	———	211.25 MC (P) 215.75 MC (S)	RF Output	See "Comments" and note at bottom of chart.		Interstage band width is adjusted by C9*. When proper band width cannot be obtained by adjustment of C9, it may be necessary to move C8* and C10* slightly farther apart. Overall band width also depends on antenna selectivity. Interstage band width should be adjusted so that proper overall band width occurs with antenna circuit aligned.
3.	4	Channel 4 69 MC	———	67.25 MC (P) 71.75 MC (S)	RF Output	C4 Antenna Trimmer		Obtain symmetrical response curve.
4.	Set VHF Tuner between any two channels. Connect 43.25 MC Sweep Generator sweeping 10 MC through hole in VHF tuner cover to pin 5 of 6J6 Osc. - Mixer. Inject 42.1 MC and 45.75 MC Markers.					L8, then L54 and L53 (both on TV Chassis)		Adjust for symmetrical overcoupled, double peaked response curve with markers on peaks. L8 and L54 determine position of 45.75 MC marker. L53 determines band width or position of 42.1 MC marker.
5.	4	Channel 4 69 MC	45.75 MC	71.75 MC	IF Output	C15		If C15 cannot be made to track properly, L7 is out of adjustment and must be tuned as in step 8.
6.	2	Channel 2 57 MC	Alternate 42.1 MC and 45.75 MC or two Markers	55.25 MC (P) 59.75 MC (S)	IF Output	L7		Check RF Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels.
7.	3	Channel 3 63 MC		61.25 MC (P) 65.75 MC (S)		L7		
8.	4	Channel 4 69 MC		67.25 MC (P) 71.75 MC (S)		L7		
9.	5	Channel 5 79 MC		77.25 MC (P) 81.75 MC (S)		L7		
10.	6	Channel 6 85 MC		83.25 MC (P) 87.75 MC (S)		L7		
11.	7	Channel 7 177 MC		175.25 MC (P) 179.75 MC (S)		L7		See note below.
12.	8	Channel 8 183 MC		181.25 MC (P) 185.75 MC (S)		L7		
13.	9	Channel 9 189 MC		187.25 MC (P) 191.75 MC (S)		L7		Same as for steps 6 through 18.

NOTE: If one or more coil strips cannot be made to track properly, replace strips. Do not peak coils to correct passbands. If Channels 7 and 8 show deep valley, adjust L9 as in step 18. If this does not correct conditions change the 6J6 Oscillator/Mixer tube. This will necessitate repetition of steps 1 through 5.

STEP	TUNER SET TO CHANNEL	SWEEP (10 MC)	IF MARKER	RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
14.	10	Channel 10 195 MC	Alternate 42.1 MC and 45.75 MC or two Markers	193.25 MC (P) 197.75 MC (S)	IF Output	L7	See curves above	Check Passbands on each channel. If necessary slightly readjust C15, C12, C6 and C4 for satisfactory compromise on all channels.
15.	11	Channel 11 201 MC		199.25 MC (P) 203.75 MC (S)		L7		
16.	12	Channel 12 207 MC		205.25 MC (P) 209.75 MC (S)		L7		
17.	13	Channel 13 213 MC		211.25 MC (P) 215.75 MC (S)		L7		
18.	13	Channel 13 213 MC		211.25 MC (P) 215.75 MC (S)		See "Comments" and note at bottom of chart.		A valley that is too deep can be flattened by adjusting turns spacing on L9*.

*In order to adjust C8, C9, C10 and L9, it is necessary to remove side cover of tuner. Remove side cover screw by means of a small wrench and slide cover out between chassis and tuner. The above mentioned adjustments may then be made through hole in chassis opposite tuner. Replace cover when adjustments are complete.

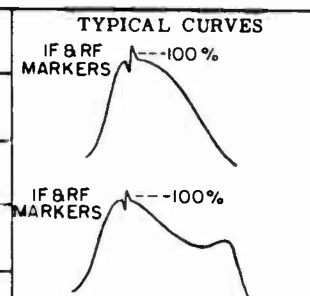
VHF TUNER ALIGNMENT

CHASSIS 1-514-1; 1-520-1; 1-520-7

HIGH BAND OSCILLATOR ALIGNMENT

STEP	TUNER SET TO CHANNEL	GENERATORS SWEEP (10 MC)	GENERATORS IF MARKER	GENERATORS RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
1.	13	Channel 13 213 MC	45.75 MC	211.25 MC	RF Output	L9 Screw	See Curves below	Coincide Markers as shown.

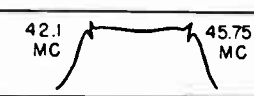
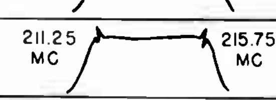
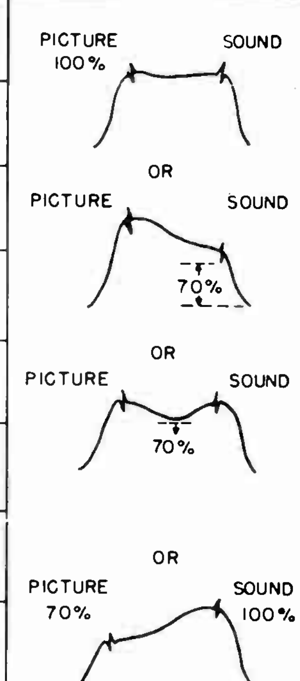
NOTE: Refer to VHF Tuner Layout and VHF Tuner Schematic for location of specified Wafers, Coil Increments, and Screw Adjustments mentioned in the following step. As Channels 12 to 7 and 5 to 2 are aligned by means of consecutive coil increments, the aligned increments that precede must not be disturbed.

STEP	TUNER SET TO CHANNEL	SWEEP (10 MC)	IF MARKER	RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
2.	12	Channel 12 207 MC	45.75 MC	205.25 MC	RF Output	Channel 12 Loop on Wafer 5	TYPICAL CURVES  Note: Curves may not be symmetrical until RF alignment is complete.	Squeeze or spread loop for Channel 12 on Wafer 5 to coincide Markers as shown.
3.	11	Channel 11 201 MC	45.75 MC	199.25 MC	RF Output	Channel 11 Loop on Wafer 5		Adjust each succeeding Hi-Channel Loop on Wafer 5 (steps 3 to 7) to coincide appropriate Markers for that Channel.
4.	10	Channel 10 195 MC	45.75 MC	193.25 MC	RF Output	Channel 10 Loop on Wafer 5		
5.	9	Channel 9 189 MC	45.75 MC	187.25 MC	RF Output	Channel 9 Loop on Wafer 5		
6.	8	Channel 8 183 MC	45.75 MC	181.25 MC	RF Output	Channel 8 Loop on Wafer 5		
7.	7	Channel 7 177 MC	45.75 MC	175.25 MC	RF Output	Channel 7 Loop on Wafer 5		

LOW BAND OSCILLATOR ALIGNMENT

STEP	TUNER SET TO CHANNEL	SWEEP (10 MC)	IF MARKER	RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
8.	6	Channel 6 85 MC	45.75 MC	83.25 MC	RF Output	L11 Screw	See Curves above	Coincide Markers as shown.
9.	5	Channel 5 79 MC	45.75 MC	77.25 MC	RF Output	Channel 5 Coil on Wafer 5		Squeeze or spread turns of Channel 5 Coil on Wafer 5 to coincide Markers as shown.
10.	4	Channel 4 69 MC	45.75 MC	67.25 MC	RF Output	Channel 4 Coil on Wafer 5		Adjust each succeeding Lo-Channel Coil on Wafer 5 (steps 10 to 12) to coincide appropriate Markers for that Channel.
11.	3	Channel 3 63 MC	45.75 MC	61.25 MC	RF Output	Channel 3 Coil on Wafer 5		
12.	2	Channel 2 57 MC	45.75 MC	55.25 MC	RF Output	Channel 2 Coil on Wafer 5		

HIGH AND LOW BAND RF ALIGNMENT

STEP	TUNER SET TO CHANNEL	SWEEP (10 MC)	IF MARKER	RF MARKER	SCOPE SWITCH POSITION	ADJUST	ACCEPTABLE RESPONSE CURVES	COMMENTS
1.	13	Channel 13 213 MC	—	211.25 MC (P) 215.75 MC (S)	RF Output	L3, L7, L8 Screws		Adjust L3 for maximum mid-band height regardless of skirts. Adjust L7 for proper skirt figuring. Adjust L8 for flat top. Pix carrier must be at 100%; sound carrier may ride down 30%.
2.	13	Same as 1	45.75 MC and 42.1 MC		IF Output	T2 on Tuner and L54 on Main Chassis		Adjust for response curve shown.
3.	13	Same as 1	—	211.25 MC (P) 215.75 MC (S)	RF Output	L8 Screw		Touch up for flat top if necessary. There must not be more than 5% dip.
4.	12	Channel 12 207 MC	—	205.25 MC (P) 209.75 MC (S)	RF Output	Channel 12 Loops on Wafers 1, 3 and 4		Squeeze or spread loops for Channel 12 to acquire acceptable response curve. Loop on Wafer 1 adjusts mid-band amplitude; Loop on Wafer 3 adjusts skirt frequency; Loop on Wafer 4 adjusts for flat top. Align each succeeding channel (steps 5 to 14) adjusting inductances of appropriate loops or coils on Wafers 1, 3, and 4. Refer to VHF Tuner Schematic and Parts Layout for locations of specified loop increments. Picture and Sound carriers must remain on top of curve.
5.	11	Channel 11 201 MC	—	199.25 MC (P) 203.75 MC (S)	RF Output	Channel 11 Loops on Wafers 1, 3 and 4		
6.	10	Channel 10 195 MC	—	193.25 MC (P) 197.75 MC (S)	RF Output	Channel 10 Loops on Wafers 1, 3 and 4		
7.	9	Channel 9 189 MC	—	187.25 MC (P) 191.75 MC (S)	RF Output	Channel 9 Loops on Wafers 1, 3 and 4		
8.	8	Channel 8 183 MC	—	181.25 MC (P) 185.75 MC (S)	RF Output	Channel 8 Loops on Wafers 1, 3 and 4		
9.	7	Channel 7 177 MC	—	175.25 MC (P) 179.75 MC (S)	RF Output	Channel 7 Loops on Wafers 1, 3 and 4		
10.	6	Channel 6 85 MC	—	83.25 MC (P) 87.75 MC (S)	RF Output	Channel 6 Coils on Wafers 1, 3 and 4		
11.	5	Channel 5 79 MC	—	77.25 MC (P) 81.75 MC (S)	RF Output	Channel 5 Coils on Wafers 1, 3 and 4		
12.	4	Channel 4 69 MC	—	67.25 MC (P) 71.75 MC (S)	RF Output	Channel 4 Coils on Wafers 1, 3 and 4		
13.	3	Channel 3 63 MC	—	61.25 MC (P) 65.75 MC (S)	RF Output	Channel 3 Coils on Wafers 1, 3 and 4		
14.	2	Channel 2 57 MC	—	55.25 MC (P) 59.75 MC (S)	RF Output	Channel 2 Coils on Wafers 1, 3 and 4		

NOTE: As each Channel is aligned by adjustment of its inductance increments in the order listed in steps 4 to 14, care must be exercised not to disturb the aligned increments preceding the one being adjusted.

15.	Recheck all channels for flat top response curve, touching up L8 for Channel 13 and appropriate coil increments. Dip up to 30% is permissible for all channels. If bandwidth on any channel is insufficient after these adjustments, touch up by means of gimmick capacitors C5 and C10 near C6 and C11, respectively. Adjust these gimmicks by bending wires toward or away from C6 and C11.

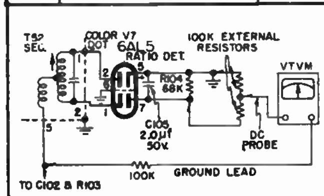
VIDEO IF, 4.5MC TRAP AND SOUND ALIGNMENT PROCEDURES

PREALIGNMENT INSTRUCTIONS - READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT.

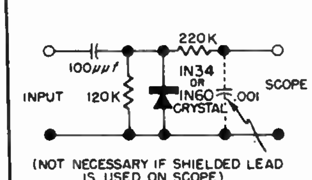
1. Lay chassis on side with H. V. supply down for under-chassis adjustments.
2. Ground all test equipment unless otherwise stated.
3. Keep detector leads short.
4. Use proper non-metallic alignment tools for powdered iron cores with hex holes or slots. Metallic screw drivers may be used for cores adjusted by brass screws.
5. Receiver should warm up for approximately 15 minutes before alignment.
6. During Video IF Alignment, when indicated, raise shield on Oscillator/Mixer tube so ground contact is broken.
7. Set Fringe (AGC) switch to maximum counterclockwise position on 1-514-3, 1-514-4, 1-520-3, 1-520-4 and 1-520-8 chassis.

VIDEO IF ALIGNMENT

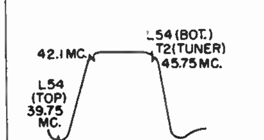
STEP	SIGNAL GENERATOR Connection	SIGNAL GENERATOR Freq.	SWEEP GENERATOR Connection	SWEEP GENERATOR Freq.	VTVM CONNECTION	OSCILLOSCOPE CONNECTION	ADJUST	OUTPUT READING	COMMENTS
1.	To raised tube shield on Osc. /Mix. tube.	39.75 MC			Across diode load resistor R147-4.7K.		L54 (Top Core)	Min.	Set VHF tuner to free channel. Apply -3V. between C130 - .22 Mfd. and chassis. Use sufficient output for satisfactory reading.
2.	CHASSIS 1-514-1, 1-520-1 AND 1-520-7 ONLY:								Remove AGC voltage. Disconnect T55 primary lead from pin 5 of V1 - 6CB6; connect 330 Ohm resistor in its place (from R128 - 1K to pin 5 of V1). Lower Osc./Mix. tube shield to normal position. On chassis 1-514-1 and 1-520-1 and -7, set VHF tuner to any free high channel; on chassis 1-514-3, 1-514-4, 1-520-3, 1-520-4 and 1-520-8, set VHF tuner between any two channels. L53 controls width of curve on 1-514-3, 1-514-4, 1-520-3, 1-520-4 and 1-520-8 chassis.
	Loosely couple marker to Looker Point "B" on VHF tuner.	42.1 & 45.75 MC	Looker Point "B" on VHF tuner.	43.25 MC 10 MC Sweep		Pin 5 of 1st Video IF Amp. thru detector circuit.	L54 (Bot. Core); T2 (VHF tuner)	Response curve shown in Fig. A.	
	CHASSIS 1-514-3, 1-514-4, 1-520-3, 1-520-4, 1-520-8 ONLY:								
	Loosely couple marker to pin 5, 6J6 thru hole in VHF tuner.	42.1 & 45.75 MC	Pin 5, 6J6 thru hole in VHF tuner.	43.25 MC 10 MC Sweep		Pin 5 of 1st Video IF Amp. thru detector circuit.	L54 (Bot. Core); L8 (VHF tuner); L53	Response curve shown in Fig. C.	
3.	Repeat step 2 adjustments until curve is flat with 42.1 MC and 45.75 MC markers on corners. REMOVE 330 OHM RESISTOR AND RECONNECT T55 before proceeding with step 4.								
4.	To raised tube shield on Osc. /Mix. tube.	41.25 MC			Across diode load resistor R147-4.7K.		L55 4th Video IF trap.	Min.	Set VHF tuner to free channel. Apply -3V. between C130 - .22 Mfd. and chassis. Use sufficient output for satisfactory reading.
5.	Same as 4	47.25 MC	———	——	Same as 4	———	T56 (Top Core)	Min.	Same as 4
6.	Same as 4	41.25 MC	———	——	Same as 4	———	T55 (Top Core)	Min.	Same as 4
7.	Same as 4	44.0 MC	———	——	Same as 4	———	T58	Max.	Same as 4. Reduce signal generator output to keep VTVM reading between 1 and 2 volts.
8.	Same as 4	42.0 MC	———	——	Same as 4	———	T57	Max.	Same as 7
9.	Same as 4	45.2 MC	———	——	Same as 4	———	T56 (Bot. Core)	Max.	Same as 7
10.	Same as 4	43.2 MC	———	——	Same as 4	———	T55 (Bot. Core)	Max.	Same as 7
11.	Repeat steps 4 to 6 inclusive.								
12.	Loosely couple marker to raised tube shield on Osc. /Mixer.	41.25 MC 42.1 MC 45.75 MC 47.25 MC	To raised tube shield on Osc. /Mixer tube.	43.25 MC 10 MC Sweep	———	Across diode load resistor R147 - 4.7K with 33K resistor in series with hot scope lead.	T58 T57 T56 (Bot. Core) T55 (Bot. Core)	Response Curve shown in Fig. B	Same as 4. Use low signal input and high scope gain. Retouch T58, T57, T56 and T55 adjustments slightly to obtain response curve shown.



SOUND DISCRIMINATOR ALIGNMENT SETUP



VIDEO IF DETECTOR CIRCUIT



1-514-1, 1-520-1, 1-520-7
FIGURE A

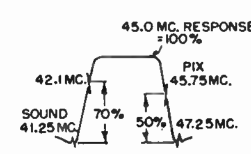
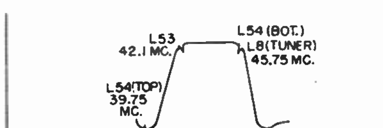


FIGURE B



1-514-3, 1-514-4, 1-520-3, 1-520-4, 1-520-8
FIGURE C

VIDEO IF RESPONSE CURVES

4.5MC TRAP ALIGNMENT

STEP	SIGNAL GENERATOR Connection	SIGNAL GENERATOR Freq.	VTVM CONNECTIONS RF Probe	VTVM CONNECTIONS Ground Lead	ADJUST	OUTPUT READING	COMMENTS
1.	To Pin 2 of 12BY7 Video Amplifier.	4.5 MC	RF Probe connected to Cathode (Pin 11) of Picture Tube.	To chassis.	L61	Min.	Short Pin 1 of V4-6CB6 4th Video IF Amplifier to Chassis.

SOUND ALIGNMENT

STEP	SIGNAL GENERATOR CONNECTION	VTVM CONNECTIONS DC Probe	VTVM CONNECTIONS Ground Lead	ADJUST	OUTPUT READING	COMMENTS
1.	45 MC and 4.5 MC generators each connected through a 1000 ohm resistor to pin 1 of V1-6CB6 1st video IF Amplifier or 45 MC generator with 4.5 MC marker (preferably crystal controlled) through 1000 ohm resistor to pin 1 of V1.	To pin 5 of V7-6AL5.	To pin 7 of V7.	T52 Sec. (Top Core) T52 Pri. (Bot. Core) L62	Max.	Set tuner to free channel with minimum interference.
2.	Same as 1	To junction of two matched 100K resistors connected in series across R104.	Thru 100K resistor to terminal 5 of T52.	T52 Sec. (Top Core)	Zero	Use lowest meter scale set to zero center. At correct setting, a slight turn of core will give either a positive or negative reading.
3.	Remove test equipment and resistors.					

ALTERNATE SOUND ALIGNMENT

STEP	SIGNAL SOURCE	VTVM CONNECTIONS DC Probe	VTVM CONNECTIONS Ground Lead	ADJUST	OUTPUT READING	COMMENTS
1.	Connect a good antenna installation to the receiver.					
2.	Strong station	To pin 5 of V7-6AL5.	To pin 7 of V7-6AL5.	T52 Pri. (Bot. Core) L62	Max.	Repeat all adjustments until maximum is reached.
3.	Strong station	Thru 100K resistor to terminal 5 of T52.	To junction of two matched 100K resistors connected in series across R104.	T52 Sec. (Top Core)	Zero	Use lowest meter scale set to zero center. At correct setting, a slight turn of core will give either a positive or negative reading.
4.	Remove test equipment and resistors.					

REPAIR PARTS LIST

CAPACITORS

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
C100	166-0010P	10 Mmfd. - 500 V. - Ceramic
C101	168-0011D	.0047 Mfd. - 500 V. - Dual Ceramic
C102, C103, C104		Listed under "Miscellaneous Electrical Parts"
C105	161-1001	2 Mfd. - 50 V. - Electrolytic
C106	160-0411	.01 Mfd. - 400 V. -Molded Paper
C107	163-0100	100 Mmfd. - 500 V. - Mica
C108	160-0611	.01 Mfd. - 600 V. -Molded Paper
C109	161-1001	2 Mfd. - 50 V. - Electrolytic
	161-3017	Three Section Electrolytic
C110 A		20 Mfd. - 300 V. ⌓
C110 B		100 Mfd. - 200 V. □
C110 C		100 Mfd. - 200 V. △
C111	160-06247	.0047 Mfd. - 600 V. -Molded Paper
	161-2005	Two Section Electrolytic
C112 A		40 Mfd. - 400 V. ⌓
C112 B		100 Mfd. - 50 V. △
C115	166-0270N	270 Mmfd. - 500 V. - Ceramic
C116	166-0270N	270 Mmfd. - 500 V. - Ceramic
C117	166-0001P	1 Mmfd. - 500 V. - Ceramic
C125	166-4700D	.0047 Mfd. - 500 V. - Ceramic
C126	166-4700D	.0047 Mfd. - 500 V. - Ceramic
C127	168-0011D	.0047 Mfd. - 500 V. - Dual Ceramic
C128	166-4700D	.0047 Mfd. - 500 V. - Ceramic
C129	166-4700D	.0047 Mfd. - 500 V. - Ceramic
C130	162-0202	.22 Mfd. - 200 V. - Paper
C131	166-4700D	.0047 Mfd. - 500 V. - Ceramic
C132	168-0011D	.0047 Mfd. - 500 V. - Dual Ceramic
C133	166-0270N	270 Mmfd. - 500 V. - Ceramic
C134	166-4700D	.0047 Mfd. - 500 V. - Ceramic
C135	168-0011D	.0047 Mfd. - 500 V. - Dual Ceramic
C136	166-0043P	43 Mmfd. - 500 V. - Ceramic
C137	166-0270N	270 Mmfd. - 500 V. - Ceramic
C138	166-4700D	.0047 Mfd. - 500 V. - Ceramic
C139	168-0008N	4.7 Mmfd. - 500 V. - Ceramic
C140	166-4700D	.0047 Mfd. - 500 V. - Ceramic
C141	166-0010P	10 Mmfd. - 500 V. - Ceramic
C142	168-0008N	4.7 Mmfd. - 500 V. - Ceramic
C143	166-0010P	10 Mmfd. - 500 V. - Ceramic
C144	160-0201	.1 Mfd. - 200 V. -Molded Paper
C145	162-0202	.22 Mfd. - 200 V. - Paper
C146	168-0008N	4.7 Mmfd. - 500 V. - Ceramic
C147	160-06022	.22 Mfd. - 600 V. -Molded Paper
C148	160-0411	.01 Mfd. - 400 V. -Molded Paper
	161-2004	Two Section Electrolytic
C175 A		40 Mfd. - 400 V. △
C175 B		80 Mfd. - 400 V. ⌓
C176	166-1000D	.001 Mfd. - 500 V. - Ceramic
C177	166-1000D	.001 Mfd. - 500 V. - Ceramic
C178	166-1000D	.001 Mfd. - 500 V. - Ceramic
C179	166-1000D	.001 Mfd. - 500 V. - Ceramic
C200	160-04147	.047 Mfd. - 400 V. -Molded Paper
C201	163-0220	220 Mmfd. - 500 V. - Mica
C202	160-0411	.01 Mfd. - 400 V. -Molded Paper
C203	160-0601	.1 Mfd. - 600 V. -Molded Paper
C204	160-0611	.01 Mfd. - 600 V. -Molded Paper
C205	160-0411	.01 Mfd. - 400 V. -Molded Paper
C206	162-06247	.0047 Mfd. - 600 V. - Paper
C207,C208,C209		Listed under "Miscellaneous Electrical Parts"
C210	162-0622	.0022 Mfd. - 600 V. - Paper
C211	162-0623	.0033 Mfd. - 600 V. - Paper
C212	160-0401	.1 Mfd. - 400 V. -Molded Paper
C213	162-06147	.047 Mfd. - 600 V. - Paper
C214	161-1010	10 Mfd. - 500 V. - Electrolytic
C215	160-0411	.01 Mfd. - 400 V. - Molded Paper
C216	160-06247	.0047 Mfd. - 600 V. - Molded Paper
C250	172-0032	Trimmer: 70-470 Mmfd. (Sync Balancing Adjustment)
C251	160-0421	.001 Mfd. - 400 V. - Molded Paper
C252	160-0421	.001 Mfd. - 400 V. - Molded Paper
C253	160-0421	.001 Mfd. - 200 V. - Molded Paper
C254	162-04247	.0047 Mfd. - 400 V. - Paper
C255	160-0411	.01 Mfd. - 400 V.-Molded Paper
C256	160-06247	.0047 Mfd. - 600 V. - Molded Paper
C257	163-0330	330 Mmfd. - 500 V. - Mica
C258	163-0680	680 Mmfd. - 500 V. - Mica
C259	163-1000	.001 Mfd. - 500 V. - Mica
C260	172-0032	Trimmer: 70 - 470 Mmfd. (Horizontal Drive Adjustment)
C261	161-1012	10 Mfd. - 350 V. - Electrolytic
C262	162-02047	.47 Mfd. - 200 V. - Paper
C263	162-0202	.22 Mfd. - 200 V. - Paper
C264	161-1012	10 Mfd. - 350 V. - Electrolytic
C265	160-0401	.1 Mfd. - 400 V. - Molded Paper
C266	174-0056	56 Mmfd. - 2000 V. - Ceramic

COILS, CHOKES AND TRANSFORMERS

L50	145-0004	Choke - B+ Filter
L51	147-0014	Choke - Heater
L53	115-0001	Coil - Link Shunt (1-514-3, -4; 1-520-3, -4, -8 Chassis)
L54	119-0002	Coil - Tuner Coupling
L55	118-0011	Coil - Cathode Trap
L56	118-0010	Coil - Filter
L57, L58	131-2003	Coil - Dual Peaking
L59, L60	131-2008	Coil - Dual Peaking
L61	130-0001	Coil - 4.5 MC
L62	130-0001	Coil - Sound Take-Off
L64, L65	100-0009	Yoke - Deflection - Vertical
L66, L67		- Horizontal
L68	132-0001	Coil - Horizontal Frequency
L69	118-0010	Coil - Filter
L70	118-0010	Coil - Filter
L71	132-0002	Coil - Horizontal Size Adjustment
L72	118-0010	Coil - Filter
T30	141-0030	Transformer - HaloLight Power
T50	141-0024	Transformer - Power - 117 V. 60 Cycle
T52	128-0008	Transformer - Sound Discriminator
T53	143-0023	Transformer - Audio Output
T55	119-0003	Transformer - 1st Video IF
T56	119-0004	Transformer - 2nd Video IF
T57	119-0005	Transformer - 3rd Video IF
T58	126-0001	Transformer - Video IF Output
T59	242-0002	Transformer - Vertical Oscillator
T60	241-0008	Transformer - Vertical Scan
T61	241-0011	Transformer - Horizontal Scan

CONTROLS

R49	153-0015	Control - HaloLight (326 Models)
	157-0025	Control - Dual & On/Off Switch (1-514-1, -3, -4 Chassis)
R105		Volume
R155		Brightness
	157-0024	Control - Dual & On/Off Switch (1-520-1, -3, -4 Chassis)
R105		Volume
R155		Brightness
	157-0026	Control - Dual & On/Off Switch (1-520-7, -8 Chassis)
R105		Volume
R155		Brightness
R149	153-3014	Control - Contrast (1-514-1, -3, -4 Chassis)
R149	153-3013	Control - Contrast (1-520-1, -3, -4 Chassis)
R149	153-3015	Control - Contrast (1-520-7, -8 Chassis)
R221	153-0014	Control - Vertical Hold
R224	153-0014	Control - Height
R226	153-3011	Control - Vertical Linearity
R259	153-0021	Control - Horizontal Hold

RESISTORS

All resistors are 10% carbon unless otherwise specified.

R47	189-0026	33,000 Ohm - 2 W.
R48	189-0026	33,000 Ohm - 2 W.
R49		Listed under "Controls"
R100	181-0473	47,000 Ohm - 1/2 W.
R101	181-0101	100 Ohm - 1/2 W.
R102	181-0102	1,000 Ohm - 1/2 W.
R103		Listed under "Miscellaneous Electrical Parts"
R104	181-0683	68,000 Ohm - 1/2 W.
R105		Listed under "Controls"
R106	181-0156	15 Megohm - 1/2 W.
R107	181-0224	220,000 Ohm - 1/2 W.
R108	181-01045	100,000 Ohm - 1/2 W. - 5%
R109	181-0104	100,000 Ohm - 1/2 W.
R110	181-01845	180,000 Ohm - 1/2 W. - 5%
R111	182-0680	68 Ohm - 1 W.
R112	181-0470	47 Ohm - 1/2 W.
R113	182-0103	10,000 Ohm - 1 W.
R114	183-0681	680 Ohm - 2 W.
R115	183-0681	680 Ohm - 2 W.
R120	183-0272	2,700 Ohm - 2 W.
R121	181-0683	68,000 Ohm - 1/2 W.
R122	181-0272	2,700 Ohm - 1/2 W.
R123	181-0222	2,200 Ohm - 1/2 W.
R125	181-0102	1,000 Ohm - 1/2 W.
R126	181-04705	47 Ohm - 1/2 W. -5%
R127	181-0472	4,700 Ohm - 1/2 W.
R128	181-0102	1,000 Ohm - 1/2 W.
R129	181-0272	2,700 Ohm - 1/2 W.
R130	181-0102	1,000 Ohm - 1/2 W.
R131	181-04705	47 Ohm - 1/2 W. -5%
R132	181-0472	4,700 Ohm - 1/2 W.
R133	181-0102	1,000 Ohm - 1/2 W.
R134	181-0152	1,500 Ohm - 1/2 W.
R135	181-0181	180 Ohm - 1/2 W.
R136	181-0102	1,000 Ohm - 1/2 W.
R137	181-0102	1,000 Ohm - 1/2 W.
R138	181-0152	1,500 Ohm - 1/2 W.
R139	181-0331	330 Ohm - 1/2 W.
R140	181-0102	1,000 Ohm - 1/2 W.
R141	181-0103	10,000 Ohm - 1/2 W.
R142	181-0682	6,800 Ohm - 1/2 W.
R143	181-0123	12,000 Ohm - 1/2 W.
R144	181-0224	220,000 Ohm - 1/2 W.
R145	181-0224	220,000 Ohm - 1/2 W.
R146	181-0474	470,000 Ohm - 1/2 W.
R147	181-0472	4,700 Ohm - 1/2 W.
R148	181-0470	47 Ohm - 1/2 W.
R149		Listed under "Controls"
R150	183-0123	12,000 Ohm - 2 W.
R151	183-0123	12,000 Ohm - 2 W.
R152	183-0123	12,000 Ohm - 2 W.
R153	181-0682	6,800 Ohm - 1/2 W.
R154	181-0334	330,000 Ohm - 1/2 W.
R155		Listed under "Controls"
R156	181-0105	1 Megohm - 1/2 W.
R157	181-0184	180,000 Ohm - 1/2 W.
R175	183-0104	100,000 Ohm - 2 W.
R176	187-0013	68 Ohm - 10 W. - W.W.
R200	181-0334	330,000 Ohm - 1/2 W.
R201	181-0124	120,000 Ohm - 1/2 W.
R202	181-0223	22,000 Ohm - 1/2 W.
R203	181-0474	470,000 Ohm - 1/2 W.
R204	181-0125	1.2 Megohm - 1/2 W.
R205	181-0474	470,000 Ohm - 1/2 W.
R206	181-0474	470,000 Ohm - 1/2 W.
R207	181-0563	56,000 Ohm - 1/2 W.
R208	181-0333	33,000 Ohm - 1/2 W.
R209	181-0332	3,300 Ohm - 1/2 W.
R210	181-0104	100,000 Ohm - 1/2 W.
R211	181-0123	12,000 Ohm - 1/2 W.
R212	181-0226	22 Megohm - 1/2 W.
R213	181-0823	82,000 Ohm - 1/2 W.
R214	183-0682	6,800 Ohm - 2 W.
R215	131-0223	22,000 Ohm - 1/2 W.
R216, R217		Listed under "Miscellaneous Electrical Parts"
R218	181-0155	1.5 Megohm - 1/2 W.
R219	181-0333	33,000 Ohm - 1/2 W.
R220	181-0224	220,000 Ohm - 1/2 W.
R221		Listed Under "Controls"
R222	181-0104	100,000 Ohm - 1/2 W.
R223	181-0684	680,000 Ohm - 1/2 W.
R224		Listed under "Controls"
R225	181-0474	470,000 Ohm - 1/2 W.
R226		Listed under 'Controls"
R227	181-01035	10,000 Ohm - 1/2 W. - 5%
R228	182-0102	1,000 Ohm - 1 W.
R229	181-0474	470,000 Ohm - 1/2 W.
R230	181-0561	560 Ohm - 1/2 W.
R231	181-0561	560 Ohm - 1/2 W.
R232	181-0102	1,000 Ohm - 1/2 W.
R250	181-0222	2,200 Ohm - 1/2 W.
R251	181-0104	100,000 Ohm - 1/2 W.
R252	181-0104	100,000 Ohm - 1/2 W.
R253	182-0332	3,300 Ohm - 1 W.
R254	181-0273	27,000 Ohm - 1/2 W.
R255	181-0475	4.7 Megohm - 1/2 W.
R256	181-0475	4.7 Megohm - 1/2 W.
R257	182-0562	5,600 Ohm - 1 W.
R258	181-0124	120,000 Ohm - 1/2 W.
R259		Listed under "Controls"
R260	181-0683	68,000 Ohm - 1/2 W.
R261	181-0332	3,300 Ohm - 1/2 W.
R262	181-0821	820 Ohm - 1/2 W.
R263	181-0474	470,000 Ohm - 1/2 W.
R264	181-0101	100 Ohm - 1/2 W.
R265	183-0181	180 Ohm - 2 W.
R266	181-0101	100 Ohm - 1/2 W.
R267	183-0183	18,000 Ohm - 2 W.
R268	189-0035	2.7 Ohm - 1/2 W.

MISCELLANEOUS ELECTRICAL PARTS

	195-0001	Cord - Line
	191-0014	Fuse - .25 Amp. - 250V.
	191-0013	Plate - De-emphasis
C102		330 Mmfd. - 400V.
C103		680 Mmfd. - 400V.
C104		.01 Mfd. - 400V.
R103		100,000 Ohm - 1/5 W.
	190-0012	Plate - Integrator
C207		.002 Mfd. - 500V.
C208		.005 Mfd. - 500V.
C209		.005 Mfd. - 500V.
R216		8,200 Ohm - 1/2 W.
R217		8,200 Ohm - 1/2 W.
	539-0503	Speaker - 5" PM (300, 320 Models)
	539-0602	Speaker - 6 1/2" PM (105-14, 120-20, 325 Models)
	539-0802	Speaker - 8" PM (326 Models)
L1, L2, L4, L5	110-0001	Strip - VHF Tuner Coil - 40 MC (1-514-4, 1-520-4, - 8 Only)
L1,L2,L4,L5,L7	110-0002 to 110-0013	Strip - VHF Tuner Coil - Channel 2 to 13 (110-0002, Chan. 2; 110-0003, Chan. 3, etc.)
	572-0004	Switch - Fringe (AGC) (1-514-3, - 4, 1-520-3, - 4, - 8 Chassis)
	577-0004	Switch - UHF/VHF (1-514-4, 1-520-4, - 8 Chassis)
	611-2100	Tube - Cold Cathode - HaloLight
	323-0034	Tuner Unit - VHF (1-514-1 Chassis)
	323-0044	Tuner Unit - VHF (1-514-3 Chassis)
	323-0037	Tuner Unit - VHF (1-514-4 Chassis)
	323-0033	Tuner Unit - VHF (1-520-1 Chassis)
	323-0045	Tuner Unit - VHF (1-520-3 Chassis)
	323-0038	Tuner Unit - VHF (1-520-4 Chassis)
	323-0041	Tuner Unit - VHF (1-520-7 Chassis)
	323-0035	Tuner Unit - VHF (1-520-8 Chassis)
	323-0019	Tuner Unit - UHF (1-514-4, 1-520-4, - 8 Chassis)

MISCELLANEOUS CHASSIS PARTS

480-0002	Board - Antenna Terminal (1-520-4, - 8 Models)
480-0001	Board - Terminal - HaloLight Control Assembly (326 Models)
417-0008	Cable and Socket - Picture Tube
483-0018	Cap - Tube Socket (H. V. Rectifier)
487-0022	Clamp - Bearing (1-514-4, 1-520-4, - 8 Chassis)
487-0008	Clip - Fuse
487-0004	Clip - IF Transformer Mounting
196-0003	Connector - H. V. Anode and Lead Assembly
493-0031	Drive Shaft - UHF (1-514-4, 1-520-4, - 8 Chassis)
484-0013	Gear and Hub Assembly (1-514-4, 1-520-4, - 8 Chassis)
486-0006	Insulator - Ceramic (H. V. Assembly)
400-0014	Magnet - Focus and Centering Unit
400-0013	Magnet - Ion Trap
400-0016	Magnet - Pin Cushion Corrector
822-0003	Mounting Board Assembly (H. V.)
484-0014	Pinion and Screws Assembly (1-514-4, 1-520-4, -8 Chassis)
415-0004	Plug - 1 Prong - Speaker
415-0010	Plug - 2 Prong - External Antenna Connector (1-520 Models)
415-0002	Plug - 2 Prong - Interlock
415-0012	Plug - 2 Prong - Vert. Yoke Connector
415-0013	Plug - 3 Prong - Hor. Yoke Connector
415-0015	Plug - 4 Prong - HaloLight Connector
415-0011	Plug - 5 Prong - Hor. Scan Connector
494-0009	Pulley and Sleeve Assembly (1-514-4 Chassis)
494-0013	Pulley and Sleeve Assembly (1-520-4, -8 Chassis)
486-0007	Retainer - H.V. Rectifier Filament Leads
554-0024	Ring - Bearing (1-514-4, 1-520-4, -8 Chassis)
554-0025	Ring - Bushing (1-514-4, 1-520-4, -8 Chassis)
554-0028	Ring - Retaining ((1-514-4, 1-520-4, -8 Chassis)
554-0021	Ring - Tube Socket Cap (H.V. Rectifier)
551-5000	Screw - #8/32 Wing - VHF Tuner Unit Mounting
551-0018	Screw - Special (1-514-4, 1-520-4, -8 Chassis)
482-0007	Shield - 7 Prong Miniature Tube
417-0002	Socket - 1 Prong - Speaker
419-0007	Socket - 2 Prong - Vertical Yoke Connector
414-0006	Socket - 3 Prong - Hor. Yoke Connector
413-0006	Socket - 4 Prong - HaloLight Connector
417-0014	Socket - 5 Prong - Hor. Scan Connector
412-0015	Socket - 7 Prong - Miniature Tube
412-0026	Socket - 7 Prong - Miniature Tube (Vert. Osc.)
412-0020	Socket - 7 Prong - Miniature Tube (with base)
412-0006	Socket - 8 Prong - Octal Tube
412-0022	Socket - 3 Prong - Octal Tube (H.V. Rectifier)
412-0018	Socket - 8 Prong - Octal Tube - Shock Mounted
412-0012	Socket - 9 Prong - Miniature Tube
558-0005	Spacer - H.V. Assembly Mounting
558-0003	Spacer - Shock Mounted Tube Socket
558-0006	Spacer - Drive Assembly (1-514-4, 1-520-4, -8 Chassis)
496-0023	Spring - String Drive (1-514-4, 1-520-4, -8 Chassis)
496-0079	Spring - Picture Tube Grounding (1-520 Chassis)
496-0080	Spring - Picture Tube Grounding (1-514 Chassis)
495-0009	String Assembly - UHF Drive (1-514-4, 1-520-4, -8 Chassis)
553-4010	Washer - Neoprene - H.V. Insulator Mounting

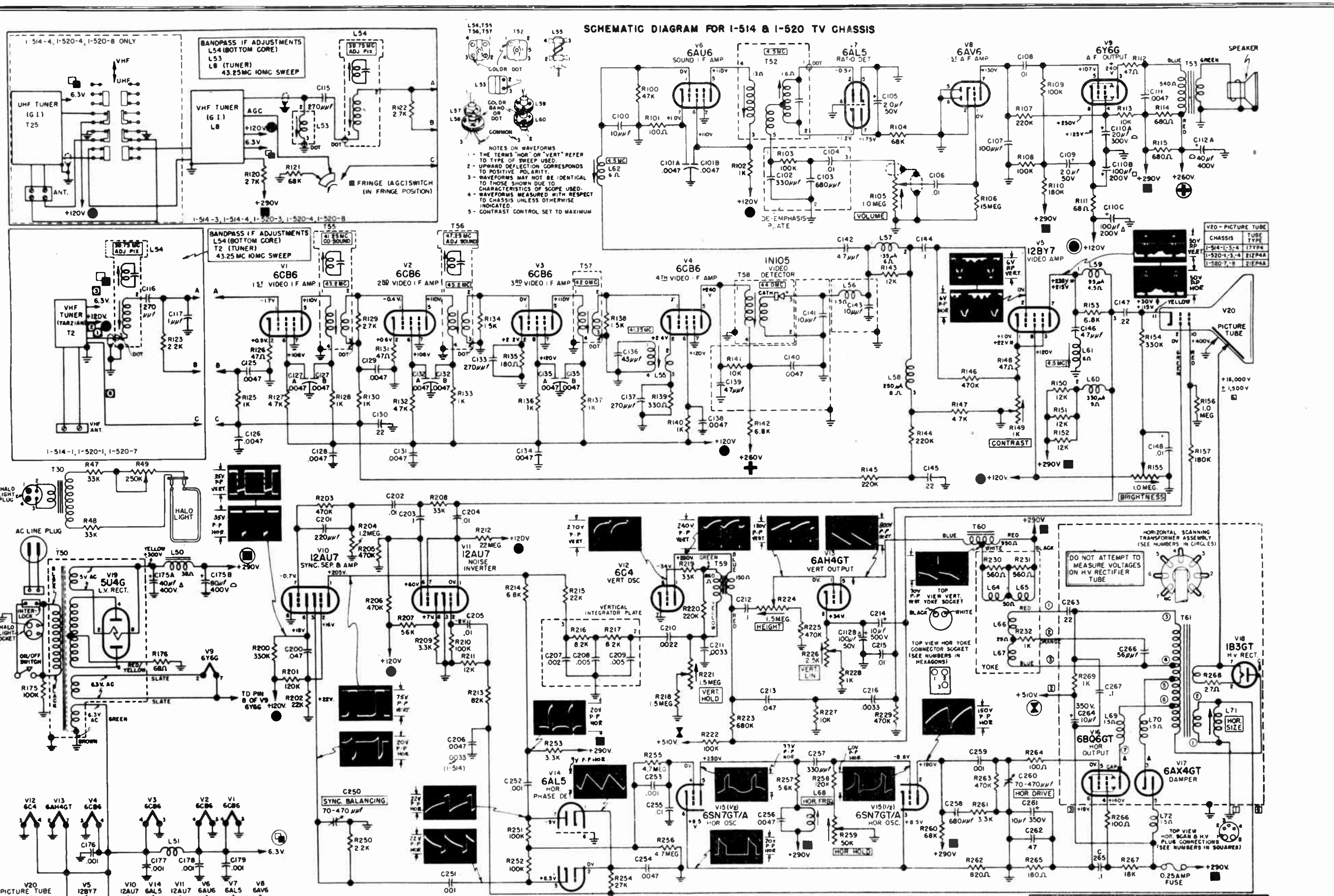
MISCELLANEOUS CABINET PARTS

714-0024	Bezel Assembly (105-14 Models)
714-0023	Bezel Assembly (120-20 Models)
714-0025	Bezel Assembly (300 Models)
714-0022	Bezel Assembly (320 Models)
714-0021	Bezel Assembly (325, 326 Models)
715-0009	Bezel Lens (105-14, 120-20, 300 Models)
715-0010	Bezel Lens (320, 325, 326 Models)
487-0023	Clip - Bezel Mounting
487-0019	Clip - HaloLight Tube Mounting (326 Models)
760-0037	Cover - Interlock Assembly (Includes Line Cord) (105-14, 300 Models)
760-0051	Cover - Interlock Assembly (Includes Line Cord) (120-20 Models)
760-0047	Cover - Interlock Assembly (Includes Line Cord) (320 Models)
760-0050	Cover - Interlock Assembly (Includes Line Cord) (325 Models)
760-0052	Cover - Interlock Assembly (Includes Line Cord) (326 Models)
722-0027	Dial - UHF (1-514-4, 1-520-4, - 8 Models)
722-0028	Dial - UHF Dummy (1-514-1, - 3, 1-520-1, - 3, - 7 Models)
491-0016	Gasket - Tube Mask (17")
491-0017	Gasket - Tube Mask (21")
710-0011	Glass - Picture Window (17" Models)
710-0009	Glass - Picture Window (21" Models)
740-0045	Knob - Contrast
744-0025	Knob - HaloLight Control (326 Models)
740-0038	Knob - Horizontal Hold, Fringe (AGC) Switch
744-0023	Knob - Inner - Brightness
740-0029	Knob - Inner - Fine Tuning
743-0023	Knob - Outer and Dial Assembly (VHF Models, Except 300's)
743-0022	Knob - Outer and Dial Assembly (UHF/VHF Models)
743-0024	Knob - Outer and Dial Assembly (300B, M Models)
744-0022	Knob - Outer - Volume and On/Off
716-0005	Mask - 17" (1-514-1, -3, -4 Chassis)
716-0007	Mask - 21" (1-520-1, -3, -4 Chassis)
716-0003	Mask - 21" (1-520-7, -8 Models)
818-0004	Nameplate - Sylvania
552-0021	Nut - #6/32 - Speaker Mounting (300, 320 Models Only)
552-0024	Nut - #8/32 - Speaker Mounting
558-0007	Spacer - Dial
553-4011	Washer - Outer Knob

TUBE COMPLEMENT

V1, V2, V3, V4	6CB6
V5	12BY7
V6	6AU6
V7	6AL5
V8	6AV6
V9	6Y6G
V10, V11	12AU7
V12	6C4
V13	6AH4GT
V14	6AL5
V15	6SN7GT/A
V16	6BQ6GT
V17	6AX4GT
V18	1B3GT
V19	5U4G
V20	17YP4 (1-514-1, -3, -4 Chassis)
V20	21ZP4A (1-520-1, -3, -4 Chassis)
V20	21EP4A (1-520-7, -8 Chassis)

SCHEMATIC DIAGRAM FOR 1-514 & 1-520 TV CHASSIS



■ MEASURED WITH AN ELECTROSTATIC OR ZERO CURRENT METER AND AT LINE VOLTAGE METER READING OF 117 VOLTS, UNDER CONDITIONS OF NORMAL SIGNAL AND NO BRIGHTNESS.

♦ HIGH PEAK VOLTAGE (MORE THAN 1,000 VOLTS)

◊ BRIGHTNESS CONTROL AT MAXIMUM.

■ FRINGE (AGC) SWITCH AT MAXIMUM COUNTERCLOCKWISE POSITION.

* PICTURE CONTRAST CONTROL AT MINIMUM.

▲ HIGH PEAK VOLTAGE OF SHORT DURATION (APPROX. 5,000 V.) MAY DAMAGE METER USED FOR THIS MEASUREMENT.

VOLTAGE SOURCES ARE INDICATED BY ENCIRCLED SYMBOLS; CORRESPONDING SYMBOLS WITHOUT CIRCLES INDICATE VOLTAGE TIE POINTS.

VOLTAGES ARE MEASURED TO CHASSIS UNLESS OTHERWISE INDICATED, D.C. TAKEN AT 20,000 OHMS PER VOLT. MEASUREMENT CONDITIONS, UNLESS OTHERWISE NOTED: SOURCE 117 VOLT 60 CYCLE, ANTENNA DISCONNECTED WITH NO SIGNAL INPUT, PICTURE CONTRAST AT MAXIMUM, BRIGHTNESS AT MINIMUM — OTHER CONTROLS AT NORMAL POSITIONS.

AVERAGE VOLTAGES AND COIL RESISTANCES ARE INDICATED. RESISTANCE OF TAPPED COILS IS FOR ENTIRE WINDING. COIL RESISTANCE IS NOT SHOWN WHERE READINGS ARE TOO SMALL OR WIDELY VARIABLE.

ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION OF CONTROLS.

CAUTION NOTICE

THE HIGH VOLTAGE LEAD TO THE PICTURE TUBE HAS A POTENTIAL OF 16,000 VOLTS. PRECAUTIONS SHOULD BE OBSERVED WHEN THE CHASSIS IS REMOVED FROM THE CABINET FOR SERVICE PURPOSES.

DO NOT OPERATE THE RECEIVER WITH THE H.V. COVER REMOVED.

ALWAYS USE SAFETY GOGGLES AND GLOVES IF IT IS NECESSARY TO REMOVE THE PICTURE TUBE.

SUPPLEMENTARY SERVICE INFORMATION

EARLY PRODUCTION PARTS REVISIONS

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	DELETIONS	
C261	161-1012	10 Mfd. - 350V. - Electrolytic
	ADDITIONS	
C267	160-0601	.1 Mfd. - 600V. - Molded Paper
R269	181-0102	1,000 Ohm - 1/2 W.
	CHANGES	
C206	160-06247	.0047 Mfd. - 600V. - Molded Paper (1-514 Chassis Only)
R138	181-0122	1,200 - 1/2 W.
T50	141-0039	Transformer - Power - 117V. 60 Cycle
	492-0059	Bracket and Socket Assembly (L. V. Rectifier) (Used with 141-0039 transformer)

CODE CHANGES

CHASSIS → / DESCRIPTION OF CHANGE	1-514-1	1-514-3	1-514-4	1-520-1	1-520-3	1-520-4	1-520-7	1-520-8	
Hor. Osc. socket and Audio Output transformer relocated.	C01	I. P.	C01	I. P.	I. P.	I. P.	I. P.	I. P.	
R269 - 1 K and C267 - .1 Mfd. added to H. V. assembly (Initial change).	C02	I. P.	C02	C01	I. P.	C01	I. P.	I. P.	
R269 - 1 K and C267 - .1 Mfd. added to H. V. assembly (Revised production).	C03	I. P.	C03	C02	I. P.	C02	C01	C01	
C206 - .0033 Mfd. changed to 0047 Mfd. (1-514 only)	C04	—	C04	—	—	—	—	—	
C261 - 10 Mfd. removed.	C04	I. P.	C04	C03	I. P.	C03	C02	C02	

Items 1, 2, 3 and 4 are incorporated in the chassis and identified by code change numbers as indicated in the following chart.

DESCRIPTION OF CHANGE	1-514-1	1-514-3	1-514-4	1-520-0	1-520-1	1-520-3	1-520-4	1-520-7	1-520-8
See Item 1.	C05	C01	C05	C01	C04	I.P.	C04	C03	C03
See Item 2.	C05	C01	C05	C01	C04	I.P.	C04	C03	C03
See Item 3.	C05	C01	C05	C01	C04	I.P.	C04	C03	C03
See Item 4.		C01	C05	C01		I.P.	C04		C03
I. P. - Change incorporated in initial production.									

ITEM 1 SUBJECT: Code Changes as Noted in Above Chart.
REASON: Prevention of Possible Audio Interference in Horizontal Oscillator Circuit.
DESCRIPTION: C111 - .0047 Mfd., formerly across primary of T53, is reconnected from blue lead of T53 to +290V. (This change is incorporated on the initial 514/520 schematic)

ITEM 2 SUBJECT: Code Changes, as Noted in Above Chart.
REASON: Improved Video IF Response.
DESCRIPTION: R138 - 1,500 Ohm resistor is changed to 1,200 Ohms. (This component is included under "Early Production Parts Revisions")

ITEM 3 SUBJECT: Code Changes as Noted in Above Chart.
REASON: To Increase Wattage Tolerance.
DESCRIPTION: R269 - 1,000 Ohm 1/2W. resistor is changed to 1,000 Ohm 1W. resistor.

ITEM 4 SUBJECT: Code Changes as Noted in Above Chart.
REASON: Additional RF Filtering for Tuner B+ Lead.
DESCRIPTION: C114 - .0047 Mfd. capacitor is added and connected from junction of tuner B+ lead and R120-2.7K, to ground.

ITEM 5 SUBJECT: Addition of New Chassis.
DESCRIPTION: The following chassis should be added to the "Chassis Variations" chart on sheet 1.

CHASSIS	PICTURE TUBE	TUNERS VHF	TUNERS UHF	HALOLIGHT	MODELS
1-520-0	21EP4A(Cyl.)	G.I.	——	Yes	Same as 1-520-7. (326 Models)

All parts peculiar to 1-520-7 chassis are used in the 1-520-0 with the exception of the VHF tuner. This component is the same as that used in the 1-520-8 chassis.

ITEM 6 SUBJECT: Omission of Specific UHF RF Generator Setting.
DESCRIPTION: In Oscillator Alignment section of "UHF Tuner Alignment", change step 4 to read, "Set UHF RF signal generator to 896 MC and adjust C28 on UHF tuner for maximum reading on VTVM."

ITEM 7 SUBJECT: Light Shield on 326 HaloLight Models.
DESCRIPTION: Order light shield, service part number 483-0019 when replacement of this item on 326 models becomes necessary.

ITEM 8 SUBJECT: Outer Knob and Dial Assemblies.
DESCRIPTION: The outer knob and dial assemblies for the various 514/520 models are outlined below by service part number.

743-0022: 1-514-3, -4 (105-14; 300 models)
1-520-0, -3, -4, -8 (120-20; 320; 325; 326 models)
743-0023: 1-514-1 (105-14 models only)
1-520-1, -7 (120-20; 320; 325; 326 models)
743-0024: 1-514-1 (300 models only)

(Note that the same models may contain different chassis. This condition necessitates a close check on chassis type when ordering this particular knob.

ITEM 9 SUBJECT: The parts list should be revised as shown below.
REASON: To include parts changes noted in items 3, 4, 5 and 7 of this supplement.

SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
	ADDITIONS	
C114	166-4700D	.0047 Mfd. - 500V. - Ceramic
	483-0019	Shield - Light (326 Models)
	CHANGES	
R269	182-0102	1,000 Ohm - 1W.

SUPPLEMENTARY SERVICE INFORMATION

NO. 2

covering

CHASSIS
1-514-1, -3, -4
1-520-0, -1, -3, -4, -7, -8,

MODELS
ALL TO DATE
ALL TO DATE

DESCRIPTION OF CHANGE	1-514-1	1-514-3	1-514-4	1-520-0	1-520-1	1-520-3	1-520-4	1-520-7	1-520-8
See Item 1.	—	CO2	CO6	—	CO5	—	CO5	—	CO4
See Item 2.	—	CO2	CO6	—	CO5	—	CO5	—	CO4
See Item 3.	—	CO2	CO6	—	CO5	—	CO5	—	CO4
See Item 4.	—	CO3	CO6	—	CO6	—	CO6	—	CO4
(—) Designates no change from previous issue.									

ITEM 1 SUBJECT: Code Changes as Noted in Above Chart.
REASON: To Reduce Excessive Horizontal Drive.
DESCRIPTION: C259-.001 Mfd. mica capacitor is changed to 820 Mmfd. mica capacitor.

ITEM 2 SUBJECT: Code Changes as Noted in Above Chart.
REASON: To Improve Video Response.
DESCRIPTION: R150, R151 and R152-12,000 Ohm 2 Watt resistors are changed to new type units smaller physically than original type. This substitution effectively reduces the combined inductance of this resistor group; however, resistance and wattage ratings remain the same.

ITEM 3 SUBJECT: Code Changes as Noted in Above Chart.
REASON: To Standardize Vertical Hold Control Types.
DESCRIPTION: R221-1.5 Megohm Vertical Hold control is changed to 2.0 Megohm control.

ITEM 4 SUBJECT: Code Changes as Noted in Above Chart.
REASON: To Improve Audio Performance.
DESCRIPTION: C111-.0047 Mfd. capacitor is changed to .015 Mfd. capacitor.

ITEM 5 SUBJECT: Change in Power Transformer Type.
REASON: To Provide a More Satisfactory L.V. Rectifier Tube Mounting.
DESCRIPTION: Early production of 1-514 and 1-520 chassis substitute a new type power transformer, service part 141-0039 for the original transformer. This new transformer is electrically similar to the original but features an external bracket and socket assembly for the L.V. Rectifier Tube. (These components are included under "Early Production Parts Revisions".)

ITEM 6 SUBJECT: Addition of 306 Model Series.
REASON: Revise the "Chassis Variations" chart as follows:

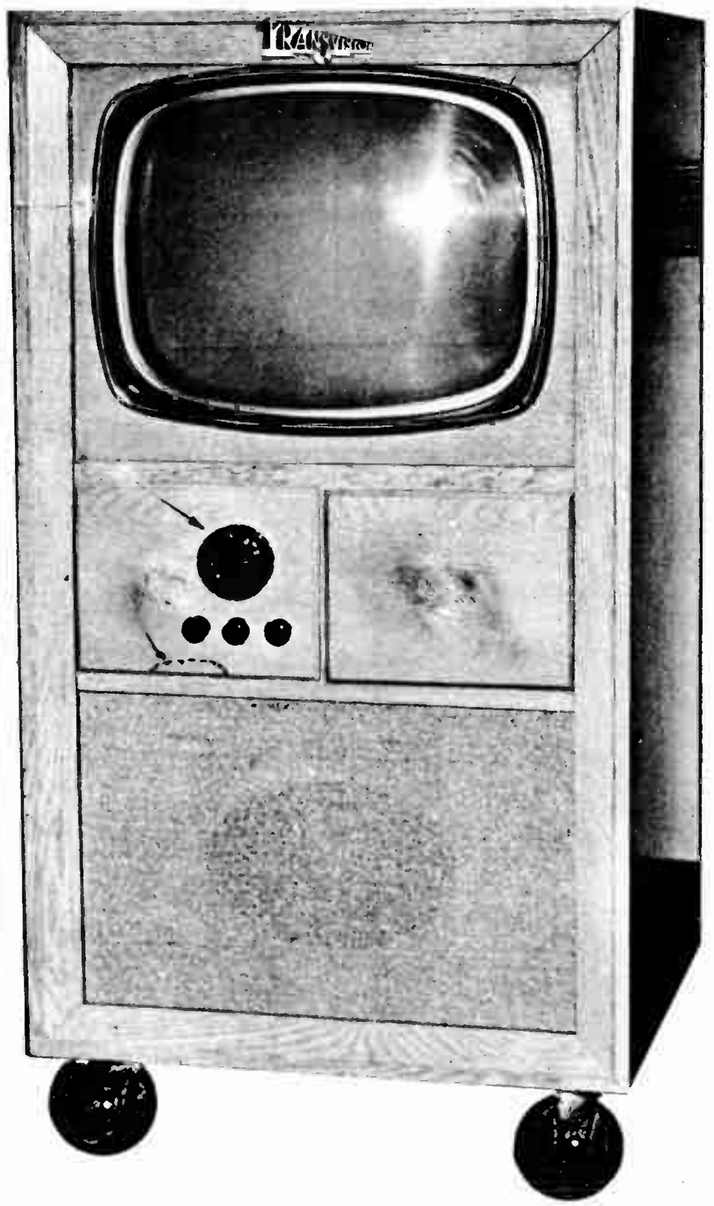
CHASSIS	PICTURE TUBE	TUNERS VHF	TUNERS UHF	HALOLIGHT	MODELS
1-514-3	17YP4 (Cyl.)	G.I.	—	No	105-14; 300; 306
1-514-4	17YP4 (Cyl.)	G.I.	G.I.	No	105-14; 300; 306 ("U" Models)

All parts peculiar to 306 models are listed in item 7 of this supplement.

ITEM 7 SUBJECT: Parts List Revisions.
REASON: To include parts changes noted in items 1, 2, 3, 4 and 6 of this supplement.

EFF. CHASSIS SERIAL NO.	SCHEMATIC LOCATION	SERVICE PART NUMBER	DESCRIPTION
		ADDITIONS (306 Models)	
		714-0025	Bezel Assembly
		715-0010	Bezel Lens
		760-0037	Cover-Interlock Assembly (Includes Line Cord)
		743-0022	Knob-Outlet and Dial Assembly
		415-0010	Plug-2 Prong-External Antenna Connector
		539-0802	Speaker-8" P.M.
		CHANGES	
514303-, 514406-, 520106-, 520406-, 520804-	C111	160-06115	.015 Mfd. -600V. -Molded Paper
514302-, 514406-, 520105-, 520405-, 520804-	C259	163-0820	820 Mmfd. -500V. -Mica
514302-, 514406-, 520105-, 520405-, 520804-	R150, R151, R152	189-0038	12,000 Ohm-2W.
514302-, 514406-, 520105-, 520405-, 520804-	R221	153-0018	Control-Vertical Hold (2 Megohm)

Transvision C-1 chassis used on table model set as shown and on consoles too.



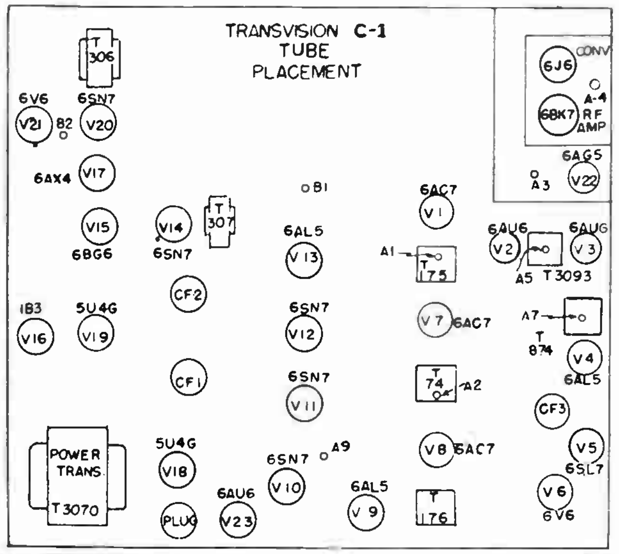
Minimum Brightness Level on rear skirt of chassis is set by serviceman for at least minimum picture brightness when front brightness level control is at *minimum*. Thus customer will not miss the action of Free-Viewer.

Master Volume Control on rear skirt of chassis, set by serviceman for maximum permissible volume when front volume control is at *maximum*. Have the operator advise proper volume maximum desired.

To service chassis make certain shorting plug, or similar shorting device is inserted in UHF-COLOR socket on rear skirt of chassis, otherwise there will be open circuit in primary power.

The Yoke-Focus-Coil plug contains provision for interlock. In use this is properly inserted in socket next to the power transformer. In no case can chassis operate with this plug removed. If absolutely necessary to work with CRT in jig then octal extension cord should be used.

Picture Touch-Up. Set your tuning on a Test Pattern. Use fine tuning for best response. A non-metallic screwdriver should then be used for all adjustments: Adjust A-4 slug (tilted) on the tuner, watching especially for clear-cut lines on vertical wedges of pattern. Adjust A-3 slug next to 6AG5 tube. The first hole in top of can 175 (A1) is peaked for best pix. The second hole in top of can 174 is similarly peaked for best pix. A-9 slug under focus coil removes sound bars in picture. *Use with caution, since this affects sound takeoff. CAUTION in touching up Sound IF slugs. Make certain this is indeed your sound problem. Then adjust Sound I.F. as in steps 1 and 2 in Alignment Instructions shown.*



V1	2ND VIDEO I-F	V9	VIDEO DET D-C-REST	V17	DAMPER
V2	1ST SOUND I-F	V10	VIDEO OUTPUT	V18	L.V. RECT.
V3	2ND SOUND I-F	V11	SYNC CLIP.-HOR AFC	V19	L.V. RECT.
V4	RATIO DET	V12	SYNC-AMP.+PHASE INV.	V20	VERT. OSC.
V5	AF AMP	V13	PHASE DET.	V21	VERT OUTPUT
V6	AUDIO OUTPUT	V14	HOR. OSCILLATOR	V22	1ST VIDEO I-F
V7	3D VIDEO I-F	V15	HOR. OUTPUT	V23	AGC
V8	4TH VIDEO I-F	V16	HV RECT.		

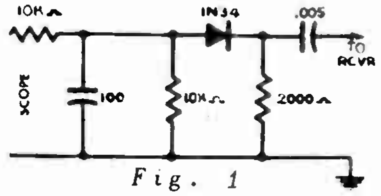


Fig. 1

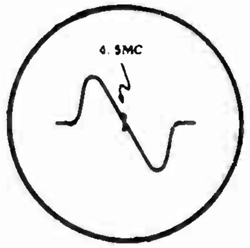


Fig. 2

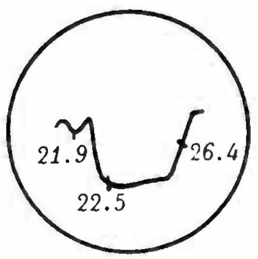
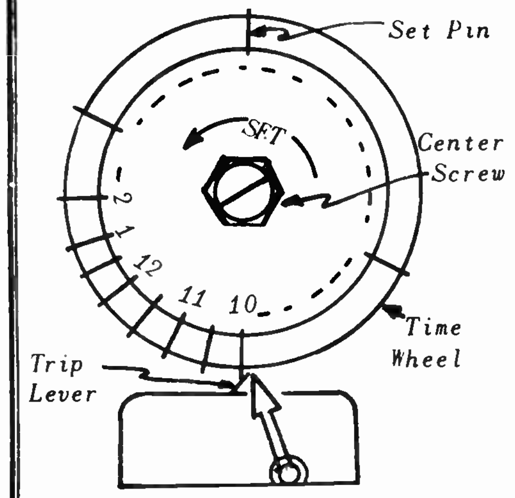


Fig. 3

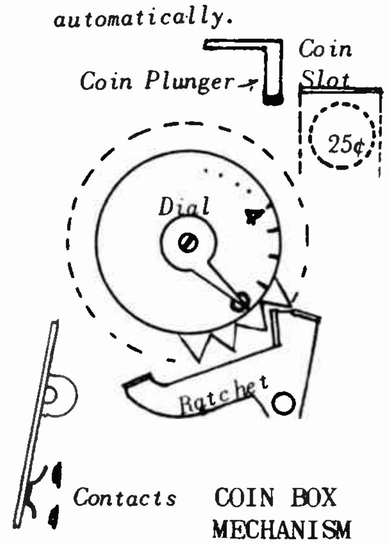
TRANSVISION C-1 ALIGNMENT INSTRUCTIONS

Step	Signal	Frequency	Measuring Instrument	Adjust	Procedure
SOUND I.F. Alignment, using A.M. Generator, Sweep Generator, V.T.V.M. and Scope.					
1	*A.M. Generator through .01 ufd. capacitor to pin 4 of Video Amplifier V-10.*	*4.5 MC*	*Connect VTVM through 10 K external resistor to V-3 grid return, junction of R98 and C81.*	*Sound Takeoff top & bottom 3092, A9. Audio I.F. top & bottom 3093.*	*Adjust for maximum voltage. Reduce A.M. Generator output so that VTVM does not read over 20 volts.*
2	*Sweep Generator.* *A.M. Generator In Parallel as Marker.*	*4.5 MC* *1 MC wide* *4.5 MC*	*Replace VTVM with scope connected through 10 K external resistor to Audio Detector output, junction of R4 and C5.*	*Ratio detector transformer 874 top & bottom.*	*Position 4.5 MC marker at center of S-curve by adjusting secondary. Peak primary for maximum amplitude and linearity. Disconnect one end of C8 for test to avoid incorrect curve. Fig. 2.*
TRAP ADJUSTMENT, using A.M. Generator and V.T.V.M.					
3	*Sweep Generator* *A.M. Generator in Parallel as Marker.*	*4.5 MC* *1 MC wide* *4.5 MC*	*Use VTVM DC Probe at AGC Bus, point 'G'.*	*Top of 175 can A1.* *Top of 174 can A2.*	*Adjust for MINIMUM deflection.*
4.5 MC TRAP ADJUSTMENT, using Scope.					
4	*A.M. Generator to pin 4 (grid) of 6SN7 Video Amplifier V10A.*	*4.5 MC* *unmodulated*	*Apply Scope through Detector probe to pin 2 of CRT. (See Probe, Fig. 1.)*	*Sound Takeoff 3092, bottom.*	*Adjust for MINIMUM deflection.*
I.F. Alignment, using Sweep Generator and Scope.					
5	*Sweep Generator to ungrounded tube shield floating over mixer tube 6BK7. A.M. Generator in Parallel as Marker.*	*23 MC* *10 MC sweep* *21.9 MC* *22.5 MC* *26.4 MC*	*Apply Scope to point D, Video Detector output at junction of R38 and the 125 uH Peaking Coil.*	*A3, top of 603 coil, next to 6AG5 tube. A4, tilted slug on tuner.*	*Adjust for response curve similar to Fig. 3.*



Transvision FREE-VIEWER

1. Gently unscrew Center Screw. Lift off time wheel. See set pins on every ¼ hour slot on 24 hour face.
2. To remove Set Pin lift it up while pulling it away outward from center. REMOVE ALL SET PINS FROM 10 EVENING THROUGH 10 MORNING. THEN REMOVE THE ALTERNATE PINS REMAINING FOR Free-Viewer ACTION OPERATING FROM 10AM TO 10PM, REMAINING INOPERATIVE ALL NIGHT.
3. If the set operator requests different Free-Viewer timing from STANDARD METHOD shown above, pins may be re-set.
4. Replace Time Wheel remembering that it must rotate only in direction of arrow. Screw Center Screw back on gently.
5. To SET Time Wheel turn it in counter-clockwise direction, FIRMLY. Hear internal click of wheel ratchet. Now listening VERY INTENTLY hear the Trip Lever click even BEFORE trips past Set Pin. A click here means INTERNAL CONTACT. Identify this click positively by gently rocking without tripping Set Pin. THIS SETTING IS 1- MINUTE BEFORE THE TIME OF THAT SET PIN. Insert line plug in A.C. receptacle in the wall, watching an external correct clock setting for co-ordination. Reset if correction needed by pulling out plug for a few seconds.
6. Power interruption will make it necessary to re-set Free-Viewer as in (5) above.
7. At these settings Television Set will turn on every ½hour remaining on for 4 minutes.
8. The line plug of Free-Viewer goes to A.C. receptacle. The 6-pin female socket receives the Coin Box plug. A female unit remains for the T.V set line-cord plug. Thus, set's current must be fed via this unit.
9. When a QUARTER in fed in the COIN BOX a circuit is closed by-passing FREE-VIEWER, permitting COIN BOX to exercise control of current to set. When the COIN BOX control is ended FREE-VIEWER takes over automatically.



COIN BOX MECHANISM

By jiggling the ratchet from one extreme position to the other you can make the dial step and provide a quick test of Coin Box.

YOU CANNOT PASS ZERO IN EITHER DIRECTION. Do not force it. Manipulate the ratchet with the left and return the dial with right hand and you can return the dial to the first marking representing 25¢ worth of operation-- ½ hour.

Make your tests and leave the Coin Box to run out its time. Now it is ready for use. The large numerals on the dial indicate COINS, not time. TIME is always in ½ hour intervals. The coin is always 25¢.

To TEST: Leave Dial at ZERO. Now, insert coin. PUSH COIN PLUNGER. Note that Dial now is at 1. Box may be primed up to 20 quarters in advance, following instructions above.

When a quarter has been inserted and the plunger pushed down, the CONTACTS close, remaining closed until ½ hour has passed and the ratchet has stepped up one notch on the dial.

The Coin Box key is different from the TV Set back key. Thus only the operator can open the Coin Box. The serviceman may use the Coin Box key only upon specific individual consent of operator, and must be returned to the operator after use.

The Coin- Box plug terminates in a 6-prong male plug. This is inserted in 6-pin female socket in Free-Viewer (IF FREE-VIEWER IS USED). In that case the UHF COLOR socket on the back skirt of the chassis has a dummy plug inserted, shorting out pins 3 and 6 of 6-pin chassis socket.

IF FREE-VIEWER IS NOT USED, remove the dummy plug from rear chassis socket and insert Coin-Box Plug instead. Now, coin-operation controls the chassis direct.

HOSPITAL SET with BEDSIDE CONTROL (may be operated as shown extreme right without removing control from cubicle). Above schematic are shown the cable plugs.

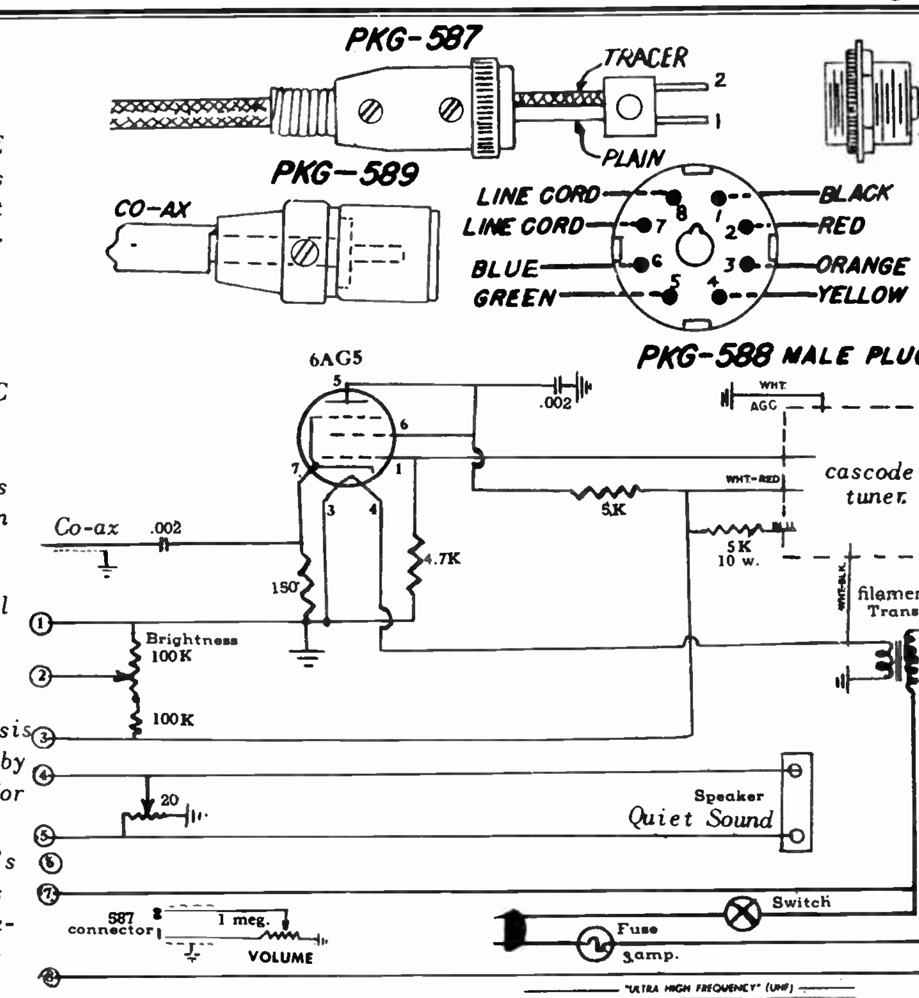
Essentially the control is a self-powered complete front end (plugged into A.C like portable radio). The antenna is connected here.

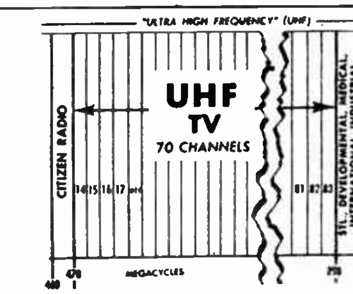
Cathode Follower supplies output to chassis proper in console through 25 to 50' of control cable.

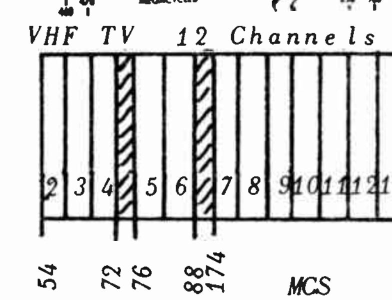
QUIET SOUND is individual small speaker in Control, with own volume control.

Automatic Contrast wired as CONTRAST CONTROL in chassis schematic may be adjusted by serviceman on rear skirt for optimum setting.

This set is Transvision's only one where the chassis is installed sideways, making room for Hospital Control.







Dual Revenuer

This exclusive Transvision device consists of switching arrangement in parallel with CONTACTS on Coin Box Mechanism (see drawing). A key kept by the TV Set Operator may be inserted in the slot in the Coin box. Turning the key closes these contacts, by-passing both Coin Box and Free-Viewer, putting the TV Set on straight operation.

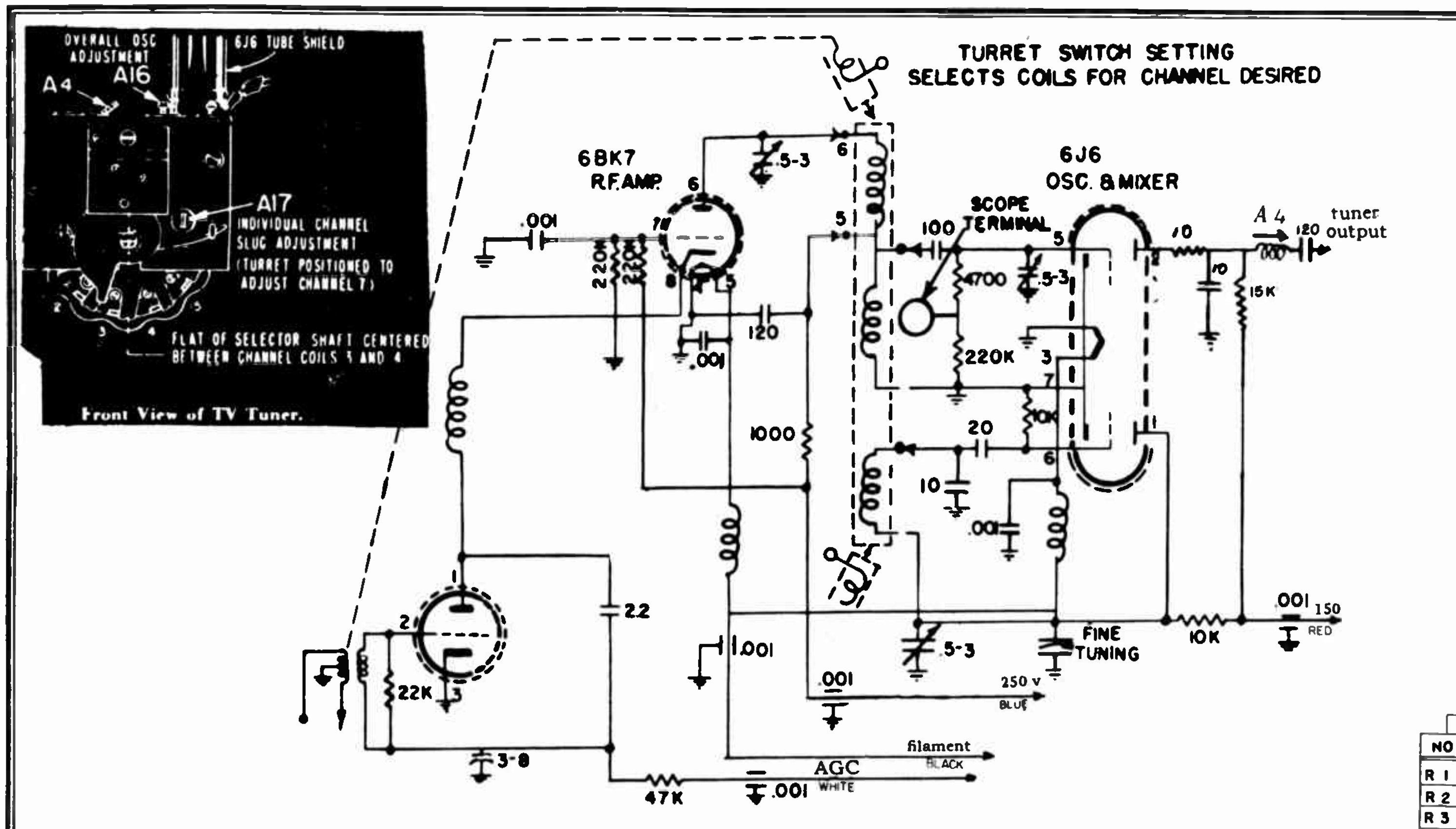
You can tell if set has Dual Revenuer by simple inspection. Look on outside door. If there is provision there for TWO KEYS then they are Coin Box and Dual Revenuer.

Horizontal and Vertical Hold Controls are set in back in mid range. No front controls are required for either. The hold stays put. Blocking oscillators--most stable sort are used with blocking transformers.

Width Coil is between 5U4 and Yoke Plug socket. Adjust slug for picture width. There is also auxiliary width slug between Vertical Size and Horizontal Drive controls on back skirt. Normally this is half-way in.

RESISTOR-CONDENSER COLOR CODE

Color	Significant Figure	Decimal Multiplier	Tolerance (%)	Voltage Rating**
Black	0	1	-	—
Brown	1	10	1*	100
Red	2	100	2*	200
Orange	3	1000	3*	300
Yellow	4	10,000	4*	400
Green	5	100,000	5*	500
Blue	6	1,000,000	6*	600
Violet	7	10,000,000	7*	700
Gray	8	100,000,000	8*	800
White	9	1,000,000,000	9*	900
Gold	-	0.1	5	1000
Silver	-	0.01	10	2000



STANDARD CASCODE TUNER

R.F. AND MIXER ALIGNMENT

1. Set station selector to Channel 12.
2. Connect oscilloscope through 10,000 ohms to test point T (Wire loop on top of tuner).
3. For negative bias connect -3 volts DC to A.G.C. lead (white covered wire) from tuner.
4. Feed sweep generator into antenna terminals, sweeping Channel 12.
5. Adjust 3 upright screws on top of tuner (not A4 or A16) for flat top response curve and maximum gain. Check markers on all channels. They should fall in automatically on all channels.

INDIVIDUAL CHANNEL SLUG ADJUSTMENT USING A TELEVISION SIGNAL

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

a. Turn the set on and allow 15 minutes to warm up.
b. Set the CHANNEL knob for a station in operation. Set all other controls for a normal picture.
c. Set TUNING control at center of its range by rotating it approximately half-way.
d. Remove the CHANNEL and TUNING knobs.
e. Insert a ⅛" blade, NON-METALLIC screwdriver in the ¼" hole adjacent to the channel tuning shaft. For each channel in operation, carefully adjust the channel slug for best picture with clear detail. Be sure that the Tuning control is set at the center of its range before adjusting each channel slug. Only slight rotation of the slug will be required; turning the slug in too far will cause it to fall into the coil. (If the slug falls into the coil, remove the coil, move the retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace slug and re-set retaining spring.)

If a number of slugs are found to tune all the way in or all the way out, or if the 6J6 oscillator-mixer tube has been replaced, it may be necessary to make the "Over-all Oscillator Adjustment" as instructed below.

OVER-ALL OSCILLATOR ADJUSTMENT (A16) USING TELEVISION SIGNAL

Over-all oscillator adjustment should only be necessary when replacing the oscillator-mixer tube (6J6), or when all channel slugs are off in the same direction. When replacing the oscillator-mixer tube (6J6), it is recommended that several tubes be tried to select one which will cause least oscillator frequency shift.

A16 is generally adjusted so that approximately 3/16" of screw thread is exposed.

Adjust as follows:

a. Follow steps "a", "b" and "c" under "Individual Channel Slug Adjustment Using A Television Signal."
b. Carefully adjust trimmer "A16" for best picture with clear detail.
c. Check and, if necessary, make individual channel adjustments as indicated above.

Resistance Chart

All resistance values taken with reference to chassis as GROUND.

Socket Pins		1	2	3	4	5	6	7	8	
V-1	6AC7	0	.1	0	210K	100	100K	.1	30K	2nd Vid. IF
V-2	6AU6	1	0	.1	0	48K	48K	82		1st Aud. IF
V-3	6AU6	47K	0	.1	0	26K	80K	47		2nd Aud. IF
V-4	6AL5	---	---	0	.1	7800	---	7800		Aud. Detec.
V-5	6SL7	3 meg	250K	0	0-1 meg	250K	3300	.1	0	Aud. Amp.
V-6	6V6	0	0	25K	25K	470K	---	.1	390	Aud. Output
V-7	6AC7	0	0	0	2 meg	100	80K	.1	30K	3rd Vid. IF
V-8	6AC7	0	0	0	0	150	80K	.1	30K	4th Vid. IF
V-9	6AL5	0	0	0	.1	1 meg	0	5K	--	Vid. Detec.
V-10	6SN7	1 meg	24K	0-10K	5K	13K	330	.1	0	Vid. Amp.
V-11	6SN7	1 meg	15K	0	--	60K	10K	.1	0	Sync. Amp.
V-12	6SN7	470K	80K	1K	470K	60K	5K	.1	0	Sync. Amp.
V-13	6AL5	---	---	0	.1	100K	0	100K	--	Phase Conv.
V-14	6SN7	80K	400K	0	80K	150K	0	0	.1	Hor. Osc.
V-15	6BG6	---	0	68	60K	1 meg	125K	.1	--	Hor. Output
V-16	1B3	---	---	--	--	--	--	--	--	H.V. Rect.
V-17	6AX4	---	---	--	--	60K	--	--	--	Hor. Damper
V-18	5U4	---	60K	--	17	--	17	--	60K	L. V. Rect.
V-19	5U4	---	60K	--	17	--	17	--	60K	L. V. Rect.
V-20	6SN7	680-1.6meg	1 meg-1.1meg	0	680K-1.6meg	180K	0	.1	0	Vert. Osc.
V-21	6V6	---	.1	60K	60K	1 meg	--	0	0-5K	Vert. Out.
V-22	6AG5	310K	47	0	.1	70K	80K	--	--	1st Vid. IF
V-23	6AU6	23K	10K	.1	0	100K	24K	10K		Keyed AGC

C.R.T. 1 black 0, 2 green 1 meg, 10 red 200K, 11 yellow 0-50K, 12 brown .1

RESISTOR CHART

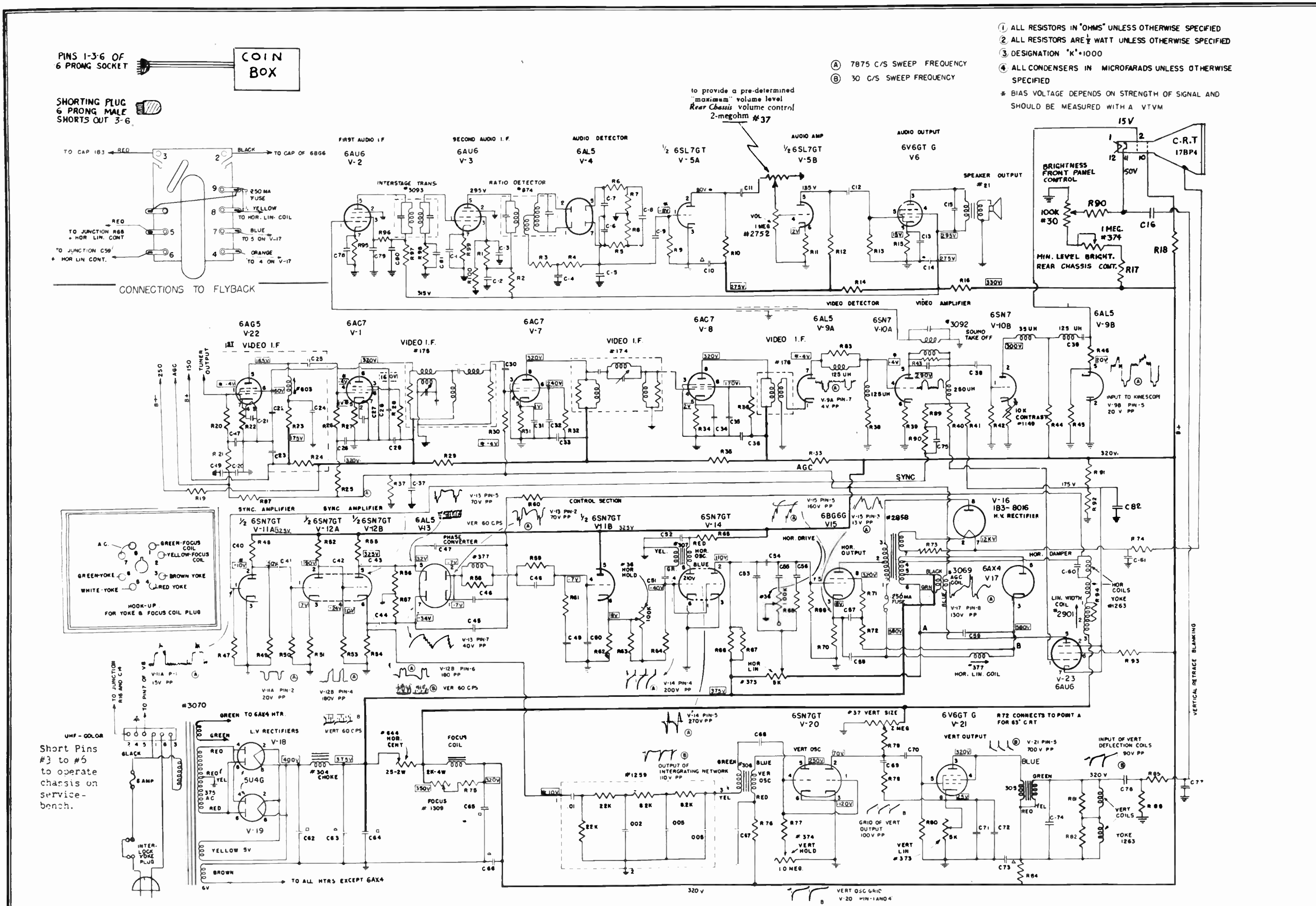
NO	VALUE	PART#
R 1	56K	54
R 2	1K	457
R 3	47	337
R 4	47K	53
R 5	1K.	45
R 6	1K	45
R 7	6800	49
R 8	6800	49
R 9	3.3 MEG	62
R10	220K	57
R11	3.3 K	47
R12	220K	57
R13	470 K	59
R14	22K 1-W	1007
R15	390	43
R16	1K-10W	343
R17	100K	56
R18	56 K	54
R19	4.7K	48
R20	6.8 K	49
R21	100K	56
R22	47	337
R23	1 K	45
R24	10K-10W	344
R25	100K	56
R26	10 K	50
R27	100	41
R28	56K	54
R29	150	42
R30	22K	51
R31	100	41
R32	56 K	54
R33	150	42
R34	150	42
R35	150	42
R36	56K	54
R37	100 K	56
R38	4.7 K	48
R39	330	1260
R40	10K	50
R41	3.3K	47
R42	1.0MEG	60
R43	10 K	50
R44	3300-2W	643
R45	1.0 MEG	60
R46	22K	51
R47	1.0 MEG	60
R48	100K - 1W	66
R49	15 K	638
R50	470 K	59
R51	1 K	45
R52	22K-1W	1007
R53	470 K	59
R54	4.7 K	48
R55	4.7 K	48
R56	100 K	56
R57	100 K	56
R58	4.7 K	48
R59	470K	59
R60	47 K-2W	1004
R61	4.7K	48
R62	10 K	50
R63	56 K	54
R64	47 K	53
R65	100K	56
R66	680K-1 W	1005
R67	680K-1 W	1005
R68	56 K	54
R69	1.0 MEG	60
R70	68 - 2W	1395
R71	100	41
R72	10K- 10W	344
R73	3.3	338
R74	100 K-1W	66
R75	510-10W	516
R76	100 K	56
R77	680K	339
R78	10K	50
R79	1.0MEG	60
R80	1.0 MEG	60
R81	470	44
R82	470	44
R83	22K	51
R84	470-1W	641
R85	1K	45
R86	15K	638
R87	100K	56
R88	100K	56
R89	15K	638
R90	220K	57
R91	10K 10W	95
R92	10K 10W	96
R93	22K	51
R94	500 10W	2638
R95	82	2415
R96	22K	51
R97	1K	45
R98	47K	48
R99	47	337
R100	15K	2473

CONDENSER CHART

NO	VALUE	PART#
C1	.01	79
C2	.01	79
C3	.01	79
C4	470 MMF	73
C5	.002	76
C6	470 MMF	73
C7	470 MMF	73
C8	4-50V ELECT	230
C9	.01	79
C10	10 CF-3 ELECT	90
C11	.01	79
C12	.01	79
C13	20 CF-3 ELECT.	90
C14	30 CF-3 ELECT.	90
C15	.01	79
C16	0.1	80
C17	.002	76
C19	.01	79
C20	.002	76
C21	.002	76
C22	.002	76
C23	.01	79
C24	.002	76
C25	150 MM	72
C26	.002	76
C27	.002	76
C28	.002	76
C29	.002	76
C30	150MMF	72
C31	.002	76
C32	.002	76
C33	.002	76
C34	.002	76
C35	.002	76
C36	.002	76
C37	0.5	2929
C38	.05	74
C39	.05	74
C40	.05	74
C41	.05	74
C42	.005	77
C43	500MMF	73
C44	500 MMF	73
C45	500MMF	73
C46	.001	82
C47	500MMF	73
C48	.005	77
C49	0.1	80
C50	.01	79
C51	500 MMF	73
C52	0.1	80
C53	150 MMF	72
C54	.01	79
C55	.001	85
C56	150 MMF	72
C57	.05	74
C58	.03 / 1600V	1482
C59	.05	74
C60	50 MMF	71
C61	500MMF 20KV	330
C62	30 CF-1 ELECT.	90
C63	30 CF-1 ELECT.	90
C64	30 CF-2 ELECT.	90
C65	30 CF-3 ELECT.	90
C66	30 CF-2 ELECT.	90
C67	0.1	80
C68	.005	1160
C69	.05	74
C70	0.1	80
C71	20 CF-1 ELECT.	90
C72	20 CF-2 ELECT.	90
C73	10 CF-2 ELECT.	90
C74	.05	74
C75	150 MMF	72
C76	.05	74
C77	.01	79
C78	.01	79
C79	.01	79
C80	.01	79
C81	50MMF	71
C82	10 MFD	90

NOTE:

1. R78 MAY BE 4700 OHMS IN SOME SETS
2. R74 MAY BE 470K OHMS IN SOME SETS
3. R63 MAY BE OMITTED IN SOME SETS
4. VOLTAGES MAY VARY 10 %


PINS 1-3-6 OF 6 PRONG SOCKET
COIN BOX
SHORTING PLUG 6 PRONG MALE SHORTS OUT 3-6
CONNECTIONS TO FLYBACK
Ⓐ 7875 C/S SWEEP FREQUENCY
Ⓑ 30 C/S SWEEP FREQUENCY
① ALL RESISTORS IN "OHMS" UNLESS OTHERWISE SPECIFIED
② ALL RESISTORS ARE ½ WATT UNLESS OTHERWISE SPECIFIED
③ DESIGNATION "K"=1000
④ ALL CONDENSERS IN MICROFARADS UNLESS OTHERWISE SPECIFIED
* BIAS VOLTAGE DEPENDS ON STRENGTH OF SIGNAL AND SHOULD BE MEASURED WITH A VTVM
to provide a pre-determined "maximum" volume level Rear Chassis volume control 2-megohm #37
FIRST AUDIO I.F 6AU6 V-2
SECOND AUDIO I.F. 6AU6 V-3
AUDIO DETECTOR 6AL5 V-4
½ 6SL7GT V-5A
AUDIO AMP ½ 6SL7GT V-5B
AUDIO OUTPUT 6V6GT G V6
C.R.T 17BP4
BRIGHTNESS FRONT PANEL CONTROL
MIN. LEVEL BRIGHT. REAR CHASSIS CONT.
VIDEO DETECTOR
VIDEO AMPLIFIER
6AG5 V22 1ST VIDEO I.F
6AC7 V-1
6AC7 V-7
6AC7 V-8
6AL5 V-9A
6SN7 V-10A
6SN7 V-10B
6AL5 V-9B
SOUND TAKE OFF
INPUT TO KINESCOPE
AGC
SYNC
CONTROL SECTION
SYNC. AMPLIFIER
½ 6SN7GT V-11A
½ 6SN7GT V-12A
½ 6SN7GT V-12B
6AL5 V13
PHASE CONVERTER
½ 6SN7GT V11B
6SN7GT V-14
6BG6G V15
V-16 1B3-8016 H.V. RECTIFIER
HOR. DRIVE
HOR. OUTPUT
6AX4 V17
HOR. DAMPER
HOR COILS YOKE #1263
LIN. WIDTH COIL #2901
V-23 6AU6
HOR. LIN. COIL
HOOK-UP FOR YOKE & FOCUS COIL PLUG
GREEN-FOCUS COIL
YELLOW-FOCUS COIL
BROWN YOKE
RED YOKE
GREEN-YOKE
WHITE-YOKE
Short Pins #3 to #6 to operate chassis on service-bench.
UHF-COLOR
L.V. RECTIFIERS
5U4G V-18
V-19
#304 CHOKE
FOCUS COIL
FOCUS #1309
#644 HOR. CENT
OUTPUT OF INTERGRATING NETWORK 110V PP
6SN7GT V-20
VERT OSC
6V6GT G V-21
VERT OUTPUT
#37 VERT SIZE
R72 CONNECTS TO POINT A FOR 63° CRT
INPUT OF VERT DEFLECTION COILS 90V PP
VERT COILS
YOKE 1263
VERT HOLD
VERT LIN #373
GRID OF VERT OUTPUT 100V PP
VERT OSC GRID V-20 PIN-1 AND 4
TO ALL HTRS EXCEPT 6AX4
VERTICAL RETRACE BLANKING

TELEVISION RECEIVERS: MODEL 160A

SERVICE DATA

I. GENERAL DESCRIPTION

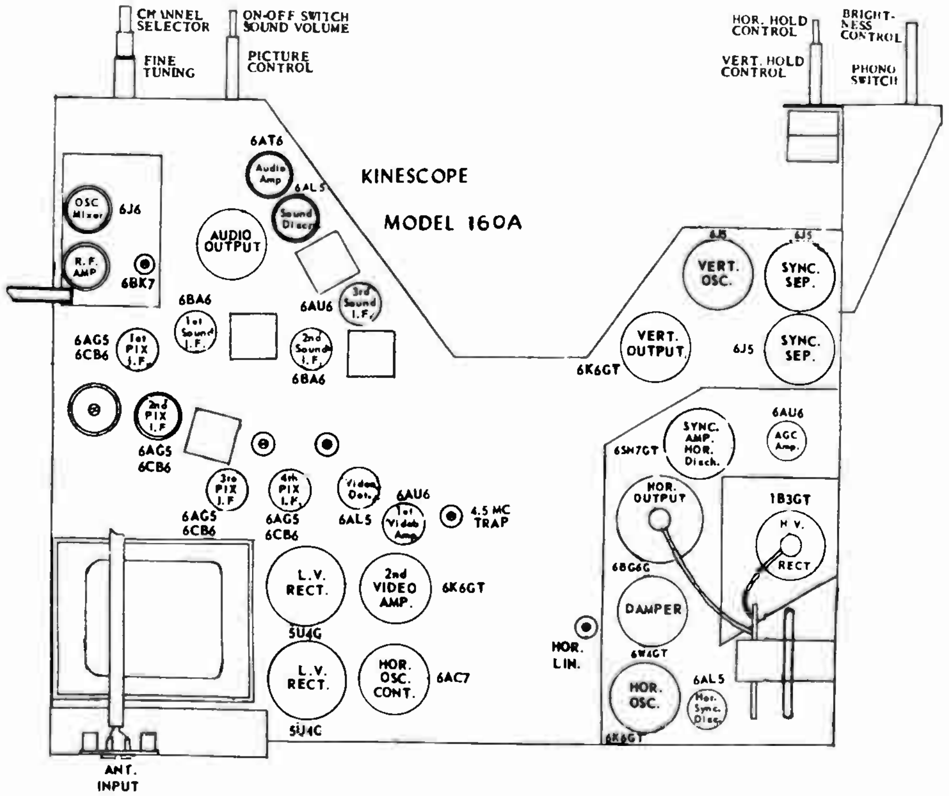
The following Series of Television Receivers are distinguished by related chassis types:

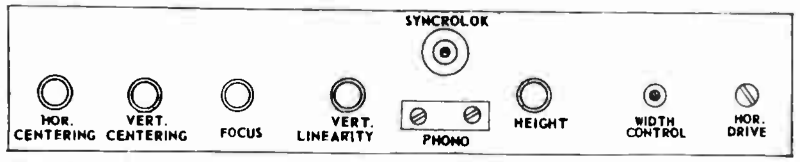
(a) Model 160A: A 32 tube receiver (including picture tube and three rectifiers). Features include: full 12 channel coverage; latest Standard Coil Cascode Circuit RF tuner, with high signal to noise ratio, UHF adaptable; limiter-discriminator FM sound system; high second anode potential for full picture brilliance and definition; automatic frequency control of the horizontal oscillator (Syncrolok); full 4 mc. band-width of the picture channel; noise saturation circuits; keyed A.G.C.; and a phono-graph input connector by means of which the sound section may be used as an audio amplifier. Reference is made to the overall Circuit Diagram of the 160A.

(b) Model 160A Loran: Includes all features of Model 160A except that the Video IF alignment, and other factors are designed for greater overall reception sensitivity for long range (Loran), as is described in Section VIII.

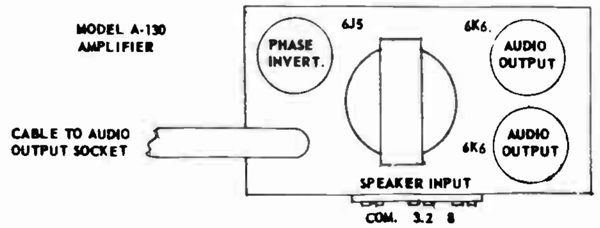
II. ELECTRICAL SPECIFICATIONS

RF Frequency Range: Channels 2 to 13 in 12 steps
Power Supply Rating: 117 volts, 60 cycles, 275 watts
Audio Power Rating: Undistorted - 5 watts
Maximum - 8 watts
Antenna Input Impedance: 300 ohms





IMPORTANT DRESS KINESCOPE SOCKET LEADS AWAY FROM DEFLECTION YOKE LEADS



III. TUBE COMPLIMENT

Circuit Symbol	Tube Type	Function
V101	6BA6	1st Sound IF Amplifier
V102	6BA6	2nd Sound IF Amplifier
V103	6AU6	3rd Sound IF Amplifier
V104	6AL5	Sound Discriminator
V105	6AT6	1st Sound Amplifier & Syncrolok Damper
V107	6CB6	1st Pix IF Amplifier
V108	6CB6	2nd Pix IF Amplifier
V109	6CB6	3rd Pix IF Amplifier
V110	6CB6	4th Pix IF Amplifier
V111	6AL5	Pix 2nd Det. and D.C. Restorer
V112	6AU6	1st Video Amplifier
V113	6K6	2nd Video Amplifier
V114	6AU6	AGC Keying Tube
V115	6J5-GT	High Frequency Sync. Clipper
V116	6J5-GT	Low Frequency Sync. Clipper
V117	6SN7-GT	2nd Sync. Amplifier & Horizontal Discharge
V118	6J5-GT	Vertical Oscillator & Discharge Tube
V119	6K6	Vertical Output Tube
V120	6AL5	Horizontal Sync. Discriminator
V121	6K6-GT	Horizontal Oscillator
V122	6BG6-G	Horizontal Output
V123	6AC7	Horizontal Oscillator Control
V124	1B3-GT/8016	High Voltage Rectifier
V125	6W4-GT	Damper
V126	5U4-G	Rectifier
V127	5U4-G	Rectifier
V128	6J5	Phase Inverter) Located
V129	6K6	Audio Output } in A-130
V130	6K6	Audio Output) Amplifier

RF amplifier and RF oscillator - Mixer tubes are also supplied. These are the 6J6, oscillator and mixer, and 6BK7 or 6BQ7, RF amplifier in the tuner.

IV. CIRCUIT DESCRIPTION

1. Video I. F.

The video I. F. section of the 160A Model is composed of the 4 amplifier stages V-107, V-108, V-109, and V-110. This video I. F. section provides ample gain and gives very satisfactory pictures in all TV signal reception areas. The I. F. sound is taken off at the plate of the 1st I. F. video amplifier (V-108) affording the advantage of extra gain by the 1st video I. F. stage. The video I. F. section is equipped with adjacent traps to eliminate interference from channels on either side of the station being received. The video I. F. picture carrier frequency is 26. 25 megacycles. Also, a 4. 5 mc trap (L205 and C152) is incorporated to eliminate sound "pebble" from the picture.

2. Video Detector and Amplifiers

All 160A Models employ a 6AL5 half-wave detector (V-111A); and a 6AU6 first video amplifier (V-112). A 6K6 (V-113) is employed as the second video amplifier. The gain of the video is controlled in the cathode of this stage by degeneration with high frequency compensation.

3. Sound Section

The sound section of the 160A Models consists of two 6BA6, (V101) (V102) sound I. F. amplifiers and one 6AU6 limiter (V103) tuned to 21. 75 megacycles; a phase discriminator using a 6AL5 duodiode (V104); a 6AT6 (V105) first audio amplifier and a 6K6 (V106) audio output tube.

Provision has been made to allow the audio section to be used as a phonograph amplifier. Phono input is located on the rear of the chassis, the picture tube and video amplifier are inactivated by turning the brightness control to the extreme counterclockwise position until phono-switch snaps into position.

4. Syncronizing Circuits

The vertical and horizontal syncronizing pusles are taken off in the plate circuit of the 1st video amplifier. They are then fed through two 6J5 (V115, V116) triode stages and one 6SN7 triode stage (V117A) for shaping and amplification. The vertical sync pulse is removed after the second stage of amplification and is applied to the grid of a 6J5 (V118) triode functioning as the vertical blocking oscillator. The resulting saw-tooth waveform is fed through a 6K6 (V119) vertical amplifier which drives the vertical deflection coils.

The horizontal sync pulse is clipped and amplified by the V-115, V-116, and V-117A and then fed to the horizontal discriminator described below. The horizontal sweep voltage is applied to the grid of a 6BG6-G (V122) horizontal amplifier which drives the horizontal deflection coils.

5. Horizontal Oscillator and Frequency Control Circuit

The horizontal oscillator and frequency control system of 160A Model receivers is the extremely dependable Syncrolok circuit. This system possesses all the characteristics required of a good horizontal frequency control circuit including excellent noise immunity and phase control.

This circuit uses three tubes, a horizontal oscillator 6K6 (V121), a horizontal control tube 6AC7 (V123), and a horizontal sync discriminator 6AL5 (V120). The discriminator compares the frequency and phase of the sync wave output of the oscillator with that of the incoming horizontal sync pulses. If there is a difference between the two, the discriminator circuit acts through the oscillator control circuit to correct the oscillator frequency.

Since the control tube circuit is designed to react only to changes in the average level of discriminator output, noise pulses have little effect on the circuit, their duration usually being too short to affect the average output level.

6. High Voltage Circuit

The high voltage supply consists of a "flyback" high voltage system, a 6W4 (V125) damper tube, and a single 1B3 (V124) high voltage rectifier. By employing a very efficient high voltage transformer, 15 KV anode voltage is consistantly obtained on the picture tube.

7. Low Voltage Supply

The low voltage supply is of the conventional type and consists of a 117V, 60-cycle power transformers, two 5U4G (V126, V127) full wave rectifiers, plus its associated filter components.

8. Vertical Blanking Circuit

The 160A series television receivers are equipped with a vertical blanking circuit which prevents the appearance of annoying "retrace lines" that result from improper adjustment of the contrast and brightness controls by the viewer. This blanking is achieved by properly "shaping" some of the voltage pulse which is available at the output of the vertical output transformer, and applying it to the cathode of the picture tube.

V. INSTALLATION NOTES

When the set is ready for installation, subject it to a thorough visual inspection to be sure that no damage has occurred in shipment.

1. Antenna

An efficient antenna installation is essential to good picture reception. In most locations, a good outdoor antenna will produce the best pictures; however, if an outdoor antenna is not feasible, an indoor or window mounted antenna can be used as a substitute. The indoor type selected should be easily adjustable in any direction; the window antenna usually proves more satisfactory for operation in steel-framed buildings. The 160A chassis uses a 300 ohm impedance line input.

When the antenna has been installed and connected to the chassis, connect the set to a 117V 60-cycle AC outlet.

2. Adjust the front panel controls, and obtain a picture.

3. In some cases, it may not be possible, as a result of transit, to immediately obtain a satisfactory picture by means of the front panel controls. If this happens, it may be necessary to re-adjust the rear panel controls. The names and locations of these controls are shown on the accompanying diagram, Fig. III.

4. Adjust the Ion Trap

In order to prolong the life of the picture tube, it is important that the following adjustment be made on every receiver upon installation and every time the receiver is serviced:

Very carefully move the ion trap forward or backward, and at the same time, rotate it in either direction; adjust for the brightest picture possible with the brightness control set for average brightness.

Note that there may be two locations where the brightest picture can be produced. The ion trap location that is further forward on the picture tube neck should not be used; use the location nearer the rear.

IMPORTANT: If the corners of the picture are shaded, be sure the ion trap has been properly adjusted. Do not sacrifice picture brightness when adjusting the ion trap to remove shaded corners. To eliminate shaded corners, see discussion under "Check Picture Centering". Be sure to readjust the ion trap each time after adjusting the focus coil.

5. If the picture or raster is off-center with respect to the mask, to the right or left, or too high or too low, it may readily be repositioned by adjustment of the Horizontal and Vertical centering controls located on the rear apron of the chassis. (See Fig. III.)

6. If the picture has a slightly blurred or fuzzy appearance, this may be cleared up by adjustment of the FOCUS control on the rear panel. The focus control should be adjusted for sharpest and clearest picture while viewing the face of the picture tube at close range, using a mirror if necessary. A good indication can be gotton by closely observing the scanning lines of the picture and adjusting for the sharpest and thinnest lines across the entire face of the picture tube.

7. When the height of the picture is not sufficient to fill the mask, or if vertical non-linearity is present (evidenced by unequal heights of the vertical wedges in the test pattern, or heads and bodies being out of proportion in a picture), the VERTICAL LINEARITY AND HEIGHT controls must be adjusted. These two controls affect each other and when one is adjusted, it is usually necessary to readjust the other to obtain a satisfactory picture. The HEIGHT CONTROL has its greatest effect on the bottom half of the picture, while the LINEARITY CONTROL mostly affects the top half. If the picture width is not right, or if horizontal non-linearity is present, (ie. one side of the picture expanded and the other side squeezed in), adjustment of the HORIZONTAL WIDTH, HORIZONTAL LINEARITY and/or HORIZONTAL DRIVE controls will be necessary (See Fig. III).

8. Check Picture Tilt

If the picture is tilted, loosen the wing screw on the deflection yoke coil and slightly rotate the yoke until the picture is straight. Before tightening the wing screw, be sure that the yoke is moved as far forward as possible,otherwise corners of the picture may become shaded.

9. If the picture does not hold in sync throughout the range of the HORIZONTAL HOLD control, it may be possible to make it do so by adjusting the SYNCROLOK control on the rear panel. If this cannot be done, a detailed adjustment of the sync system, as described in Section VI must be made.

10. Using a Record Player with the 160A Series Chassis

Provision is made on the chassis for playing a record player through the receiver. The record player may be placed at a remote point, or near the set. The means of connecting the record player to the receiver is as follows:

> A terminal-link board at the central rear chassis apron is the external means for connecting the record player through the audio amplifier of the television receiver. This is so labeled on the rear chassis apron. Also, see Fig. III. Use a shielded phono lead between the player and the television chassis. This is to minimize extraneous pickup into the sensitive audio system of the chassis. Connect the shield end of the phono lead to the link board Terminal #1, which is at ground. Connect the phono output lead to Terminal #3.

Operation: The procedure for using the record player through the television receiver after the preceding connections are installed is as follows:

> A phono switch is provided on the Brightness Control. When the Brightness Control is turned to its extreme counterclockwise positon, a click will be heard at this point, as the phono switch is thus turned on. With this simple motion all reception and light are entirely extinguished from the picture tube, and the phono circuit is put into operation. Reference may be made to the Schematic Circuit Diagram for the simple circuit involved.

The record player is now ready to be used. To adjust the phono volume, use the regular volume control on the television receiver.

When resumption of television is desired, simply turn and reset the Brightness Control clockwise in the normal manner.

VI. SERVICE INFORMATION

This television set is pre-aligned and pre-adjusted before being shipped from the factory, and should give satisfactory performance upon installation. However, should it at any time become necessary to realign either the Sound or Video I. F. stages, or readjust the horizontal syncronizing circuits, it is suggested that the following procedures be used as guides.

HIGH VOLTAGE WARNING! OPERATION OF THE TELEVISION RECEIVER OUTSIDE THE CABINET, OR WITH COVERS REMOVED INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WHEN WORKING ON THE CHASSIS, ALL PRECAUTIONS SHOULD BE TAKEN TO PREVENT CONTACT WITH HIGH VOLTAGE POINTS. DO NOT OPERATE THE CHASSIS WITH THE HIGH VOLTAGE COMPARTMENT SHIELD REMOVED.

1. Adjustment of Horizontal Oscillator

Connect a suitable antenna to the receiver and tune to an operating television station. A picture or test pattern should appear on the screen. The picture should remain in horizontal sync with the HORIZONTAL HOLD control in both the extreme clockwise and extreme counterclockwise positions. The picture should also pull into sync with the hold control in either of these positions when the signal is momentarily removed.

If the above check reveals a lack of sync in the set, make the following adjustments:

(a) Tune in a television station and adjust the fine tuning control for best sound quality.

(b) Turn the syncrolok frequency control (on the rear of the chassis) until the picture is syncronized.

(c) If the blanking bar appears in the picture, turn the "phase adjustment" (rear slug of syncrolok transformer under the chassis) until the blanking bar moves to the right and off the raster.

(d) Turn horizontal hold to extreme counterclockwise position and turn "syncrolok frequency adjustment" (located on rear apron of the chassis) clockwise until the picture falls out of sync. Then turn the adjustment slowly counterclockwise to the point where the picture falls into sync again.

(e) Readjust the phase adjustment so that the left side of the picture is close to the left side of the raster, but does not begin to fold over.

(f) Turn HORIZONTAL HOLD to its extreme clockwise position. The right side of the picture should be close to the right side of the raster, but should not begin to fold over. If it does, readjust the phase.

(g) Momentarily remove the signal by tuning the station selector off channel and then returning. When the signal is restored, the picture should fall into sync. If it doesn't, then turn the sync frequency adjustment counterclockwise until it does.

(h) Turn horizontal hold to extreme counterclockwise position. Remove the signal momentarily. When the signal is restored, the picture should fall into sync.

2A. Video I. F. Alignment: Model 160A

The following procedures should be followed when aligning the Video I. F. sections of Model 160A. Refer to Figure 1. The next paragraph 2B describes procedure for Model 160A Loran.

Connect the FOCUS COIL and DEFLECTION YOKE to the set. Speaker and picture tube connections need not be made for I. F. alignment.

(a) Plug set into 117V, 60 cycle line; turn set on.

(b) Disable AGC by shorting Pin #1 of 6AU6 (V114) Keying Tube, to ground.

(c) Connect -1.5 volt bias between chassis and AGC strip. (Junction of R122 and C127)

(d) Connect a calibrated signal generator to the tuner by connecting the "hot" lead to the tuner mixer tube shield, and the ground lead to the chassis. Shield must be disconnected from ground so that signals can be coupled into the mixer through the shield to tube capacity.

(e) Connect one lead of a vacuum tube voltmeter to the plate side of the 3900 ohm video detector lead resistor (R139), the other lead to ground, using lowest voltage range on meter.

(f) Adjust traps first. Inject trap frequencies of 20.25 mc; 21.75 mc; and 27.75 mc, into tuner and adjust the respective traps for minimum deflection on meter.

(g) Inject video I. F. amplifier frequencies of 25.8 mc; 22.8 mc; 22.3 mc; 25.7 mc, and 23.9 mc into the tuner, adjust each stagger tuned stage at its respective frequency for maximum deflection on vacuum tube voltmeter.

(h) Repeat step (f).

(i) Connect 4.5mc generator to grid of first video amplifier (Pin #2 of V112).

(j) Connect VTVM with crystal probe across R141 and ground.

(k) Tune 4.5 mc trap (L205) for minimum deflection of the VTVM.

NOTE: In all alignment procedures, use as low a signal input as possible to prevent overload.

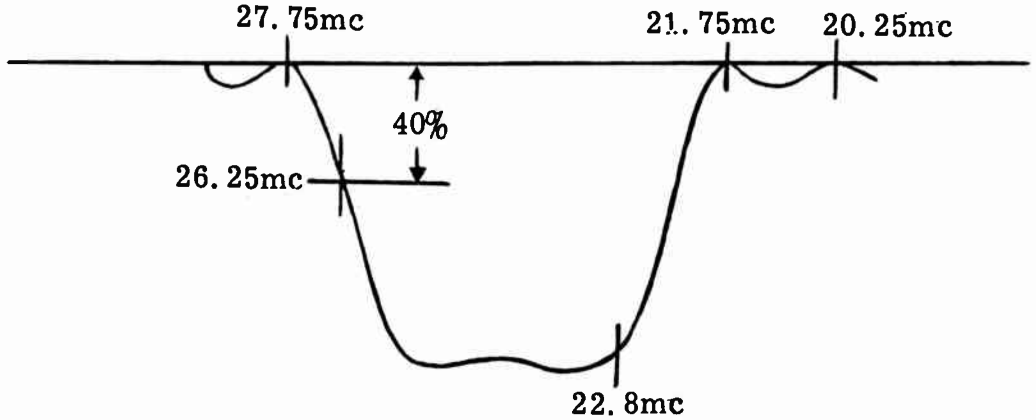


Fig. I I. F. Alignment Curve Model 160-A.

2B. Video I. F. Alignment: Model 160A Loran

The alignment of Model 160A Loran is identical to the alignment of the 160A described above, except that in tuning the Video I. F. amplifiers (step (g)), the frequencies of the tuned stages are 26.4, 23.9, 24.5, 25.9, and 22.75 mc respectively, instead of the frequencies given for the 160A.

3. Sound I. F. Alignment

The following procedures should be followed when aligning the Sound I. F. sections of all the 160A Models.

The Sound I. F. carrier frequency is 21.75 mc. Inject a 21.75 mc signal on the grid of the first sound I. F. amplifier. Connect a d. c. voltmeter in series with a 1 meg. resistor between ground and the high side of the second I. F. amplifier grid loud resistor (R106). Adjust I. F. transformers (T111 and T112) to obtain a maximum reading on the voltmeter (the voltage should be between -1 and -3 volts.)

Now connect the voltmeter and the 1. meg. resistor between ground and the junction of the discriminator load resistors. Adjust the discriminator transformer primary for minimum deflection on the meter.

Connect the voltmeter across the total discriminator load and adjust the discriminator secondary for zero reading on the meter. Make sure that the meter goes positive as the secondary is adjusted to one side of the balance point and negative as it is moved to the other side.

4. Use of Oscilloscope to Check Alignment

In all cases it is desirable to check the alignment of both the Sound and Video I. F. sections as outlined above by using an oscilloscope in conjunction with suitable sweep equipment. This procedure is outlined herewith:

To check both Video and Sound I. F. alignment, attach a sweep generator to the antenna terminal and inject I. F. markers from the crystal controlled source between the chassis and the ground side of the cathode resistor of the first Video I. F. amplifier.

(a) Switch channel selector on set to Channel Six (6) and adjust the sweep generator to sweep Channel Six.

(b) Connect horizontal input of oscilloscope to "Scope" terminal of sweep generator.

(c) Connect vertical input of oscilloscope across the video detector load resistor (R139).

(d) Slight adjustment of the Video I. F. coils should bring the I. F. curve into proper shape. Check trap frequencies and half voltage point frequencies with crystal markers only.

The curves that should be obtained from a properly aligned I. F. are shown in Figs. I and II, depending on the Model.

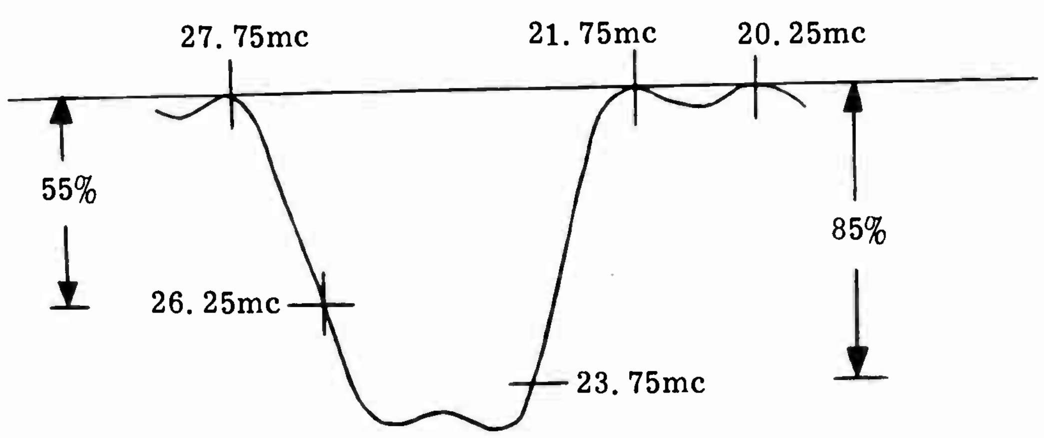


Fig. II I. F. Alignment Curve Model 160-A Loran.

The sound I. F. curves can be observed by connecting the vertical input of the oscilloscope in series with a 50K resistor between the grid side of the 6AU6 limiter tube, grid resistor (R106) and ground. The discriminator curve can be observed by connecting the vertical input of the oscilloscope across the discriminator diode load resistors (Junction R111 and R109).

5. Tuner Channel Slug Adjustment

Individual channel tuner oscillator adjustments of the television receiver should be checked, upon its installation or servicing, If such adjustments are properly made, it is possible to tune from one station to another by merely turning the CHANNEL Selector and, if necessary, slightly readjusting the fine TUNING control. With correct oscillator channel adjustment, best picture and satisfactory sound will be located at the approximate center (half rotation) of the range of the FINE TUNING control.

Channel slug adjustment can be made without removing the chassis from the cabinet. Adjust as follows:

(a) Turn the set on and allow 15 minutes to warm up.

(b) Set the CHANNEL SELECTOR knob for a station; set other controls for normal picture and sound.

(c) Set FINE TUNING control at center of its range by rotating it approximately half way.

(d) Remove the CHANNEL SELECTOR and FINE TUNING knobs.

(e) Insert a 1/8" blade, non-metallic screwdriver in the 1/4" hole (to the right of the channel tuning shaft). For each channel in operation, carefully adjust the channel slug for best picture with clear detail and best sound. Be sure that the FINE TUNING control is set at the center of its range before adjusting each channel slug. Generally, only a slight rotation of the slug will be required, turning the slug in too far will cause it to fall into its coil. (If the slug falls into the coil, remove the coil strip from the tuner, move the retaining spring aside, lightly tap the open end of the coil until the slug slips out. Replace slug and reset retaining spring.)

6. Troubleshooting Data

Reference is made to Section IX "Resistance Measurement Chart", and Section X, "Voltage Measurement Chart" for the 160A series. These charts are useful in locating the section of the chassis which may be inoperative. Any resistance or voltage measurements which do not correspond to these charts will help indicate where the source of trouble is located.

VII. TUNER DESCRIPTION

The latest type cascode circuit Standard Coil tuner is used in all models of the 160A Series. It is a rugged, sensitive 12-position turret tuner. Each channel has its individual set of coils, connected into the television circuit, when selected. The cascode circuit of this tuner provides higher gain and greater signal-to-noise reception ratios than ever before practicable. The fine tuning control permits crisp, sharp pictures to be brought in individually for each channel, at the point of best and truest sound reception. Correct UHF sets may be inserted in place of any unused VHF channel, for direct reception through this receiver of any ultra high frequency (UHF) channels that will be authorized by the F. C. C.

VIII. MODEL 160A LORAN LONG RANGE CONSIDERATIONS

These long range television receivers are an evolution of Model 160A. They embody basically the construction and components of the Model 160A. Reference is made to the Schematic Circuit Diagram for the 160A Loran. The tuner is the 12-channel cascode turret tuner described in Section VII (c) above, specifically designed for high gain, low noise, full bandwidth television reception. The Video I. F. section is a 4-stage stagger-tuned circuit designed and aligned for maximum Video I. F. gain. Reference is made to Sections IV-1 and VI-2 (b) as to this part of the chassis, and Fig. II. The overall gain of both the video and sound television signals as amplified by the 160A Loran chassis, provides a gain of ten times that of the average standard receiver on the market. The resultant video sensitivity is of the order of 4 microvolts, as measured by RTMA standards. Excellent reception is provided in remote fringe areas, in "dead" spots in city areas, or with indoor antennas in metropolitan areas. The keyed AGC materially aids in providing uniform reception against fading or interference. The strong horizontal "Syncrolok" hold keeps "weak" signals in rocksteady condition, with excellent noise immunity. All these features in the 160A Loran Models combine to produce outstanding DX television reception. Where only one distant channel is available in an installation, a Yagi type antenna tuned to that channel is recommended.

RESISTANCE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V101	0	0	0	0	18K	18K	100		
V102	600K	0	0	0	18K	20K	100		
V103	22K	0	0	0	8.2K	8.2K	0		
V104	190K	94K	0	0	0	0	94K		
V105	12.5meg	0	0	0	20K	20K	430K		
V107	230K	39	0	0	16K	16K	39		
V108	96K	40	0.15	0	16K	16K	40		
V109	92K	37	0.15	0	18K	15.5K	37		
V110	0.4	130	0	0	21K	15.5K	130		
V111	0.4	13.5	0	0	930K	0	3.9K		
V112	3.9	0	0	0	18K	14K	0.3		
V113	NC	0	18.5K	14.5K	1.1meg	3.9K	0	4.2K	
V114	44K	14K	0	0	87K	28K	14K		
V115	0	0	62K	NC	27K	14.5K	0	2. meg	
V116	0	0	62K	NC	27K	15K	0	2.2meg	
V117	310K	24K	0	230K	275K	580	0	0	
V118	0	0	0.48meg	86K	1.6meg	56K	0	580	
V119	55K	0	16K	16K	2.2meg	0.75K	0	2.6K	
V120	1.4meg	700K	0	0	12	0	700K		
V121	NC	0	20K	24K	30K	28K	0	9	
V122	NC	0	10K	Inf.	450K	NC	0	15K	
V123	0	0	0	1.8meg	9	19K	0	40K	
V124	NC	Inf.	NC	NC	NC	NC	Inf.		
V125	TP	NC	28K	14.5K	14.5K	15K	28K	28K	
V126	NC	15K	NC	570	NC	570	NC	15K	
V127	NC	15K	NC	570	NC	570	NC	15K	

All measurements were made with a Senior Voltohmyst VTVM. Measurements were made with focus coil and deflection yoke connected, but without a kinescope. The resistance measurements were made with no power applied to the chassis.

All readings were taken under the following conditions unless other wise noted:
Focus control in center position.
Brightness control in maximum counterclockwise position (minimum brightness position) just before Phone switch clicks.
All readings are in ohms and measured to ground.
Measured with RCA voltohmyst.
All controls in maximum clockwise position.

NC - No Connection TP - No tube connection - used as tie point

VOLTAGE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V101	0	0	0	6.2AC	100	100	0.8		
V102	0	0	6.3AC	0	100	98	0.9		
V103	-0.25	0	0	6AC	39	39	0		
V104	.02	-0.46	6AC	0	0	0	-0.5		
V105	-0.84	0	6AC	0	-0.3	-0.3	66		
V107	-2.7	0.38	0	6AC	80	80	0.38		
V108	-0.27	0.47	6AC	0	84	84	0.47		
V109	-0.27	0.4	6AC	0	62	84	0.4		
V110	0	1.1	6AC	0	56	94	1.1		
V111	0	0	6AC	0	17	0	-1.2		
V112	-1.2	0	0	6AC	88	102	0		
V113	NC	0	75	102	2.1	0	6AC	5.4	
V114	90	98	6AC	0	450*	245	98		
V115	0	6AC	235	NC	82	250(TP)	0	92	
V116	0	6AC	235	NC	80	250(TP)	0	90	
V117	1.35	34	0	-170	-35	-140	6AC	0	
V118	0	0	270	-125	-250	-142(TP)	6AC	-140	
V119	-140(TP)	6AC	220	220	-155	-142(TP)	0	-110	
V120	-2	-15	0	6AC	-1.9	0	-15		
V121	NC	0	165	180	-21	500(TP)	6AC	.25	
V122	NC	6AC	-135	TP	-150	NC	0	-140	
V123	0(TP)	0	0	-2.9**	0.04	98**	6AC	210**	
V124	DANGEROUS HIGH VOLTAGE - DO NOT MEASURE!								
V125	255(TP)	NC	510	250(TP)	250	255(TP)	510	510	
V126	NC	270	NC	-140	NC	-140	NC	270	
V127	NC	270	NC	-140	NC	-140	NC	270	

*Peak to Peak, measured with oscilloscope.
**These readings may be erratic due to action of V-123 with no signal input,

All readings were taken under the following conditions unless otherwise noted:
With Focus control in center position.
Without Signal Input.
With Yoke and focus coil attached but without kinescope.
All controls in maximum clockwise position.

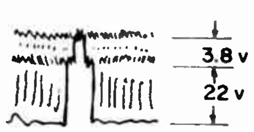
All voltages measured to ground at 115 volts line voltage, with RCA Voltohmyst and are positive D. C. unless preceded by a minus sign (-) or designated A. C.

NC - No Connection TP - No tube connection - used as tie point

XI WAVE-FORMS

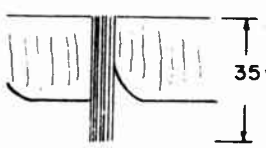
THESE WAVE-FORMS ARE SKETCHED FROM AN R.C.A. CATHODE RAY OSCILLOSCOPE WITH VERTICAL AMPLIFIERS OF EXTENDED HIGH FREQUENCY RESPONSE.

VIDEO SIGNAL OUTPUT OF PIX 2nd DETECTOR AT JUNCTION OF L188 AND R139 (60~)

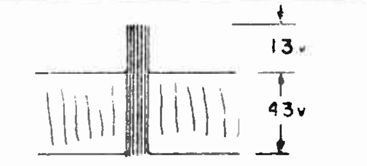


VIDEO SIGNAL OUTPUT OF 1st VIDEO AMPLIFIER AT JUNCTION OF L190 AND C149 (60~)

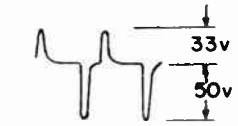
VIDEO SIGNAL OUTPUT TO GRID OF KINESCOPE AT JUNCTION OF L192 AND C151 (60~)



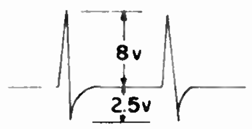
OUTPUT OF SYNC CLIPPERS V115 AND V116 AT PIN 3 OF EITHER TUBE (60~)



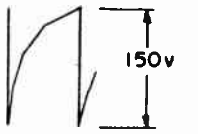
OUTPUT OF 2nd SYNC AMPLIFIER AT PIN 2 OF V117 (6SN7) (60~)



DIFFERENTIATED OUTPUT OF HORIZONTAL OSCILLATOR AT JUNCTION OF C176 AND C177 (15,750~)

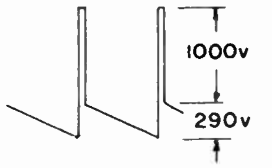


VERTICAL SYNC PULSE AT JUNCTION OF TERMINAL 3 OF THE VERTICAL INTEGRATING NETWORK AND THE YELLOW WIRE OF VERTICAL OSCILLATOR TRANSFORMER (6J5 VERT OSC (V118) REMOVED FROM SOCKET) (60~)

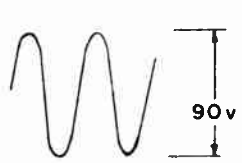


HORIZONTAL SAW TOOTH AT PIN 5 OF V122 6BG6 HORIZONTAL OUTPUT (15,750~)

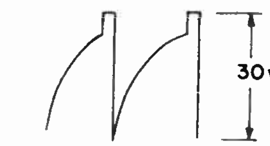
VERTICAL OSCILLATOR GRID PULSE (60 cycles) AT PIN 5 OF V118 6J5 (60~)



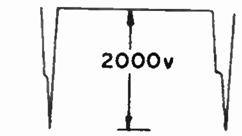
AMPLIFIED VERTICAL SAW-TOOTH AT PIN 3 OR 4 OF V119 6K6 VERTICAL OUTPUT (60~)



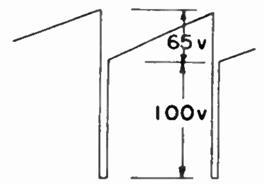
SINE WAVE AT TERMINAL A OF T108, SYNC DISCRIMINATOR TRANSFORMER (15,750~)



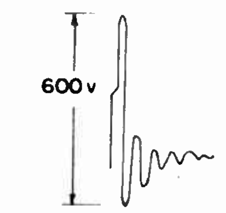
SINE WAVE PLUS HORIZONTAL SYNC PULSE AT TERMINAL F OF T108 SYNC DISCRIMINATOR TRANSFORMER (15,750~)



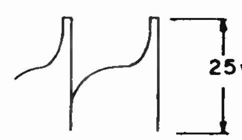
HORIZONTAL PULSE VOLTAGE TO YOKE AT TERMINAL 7 OF HORIZONTAL OUTPUT TRANSFORMER (15,750~)



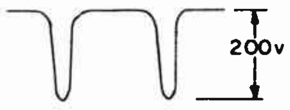
VERTICAL SAW-TOOTH AT PIN5 OF V119 6K6 VERTICAL OUTPUT (60~)



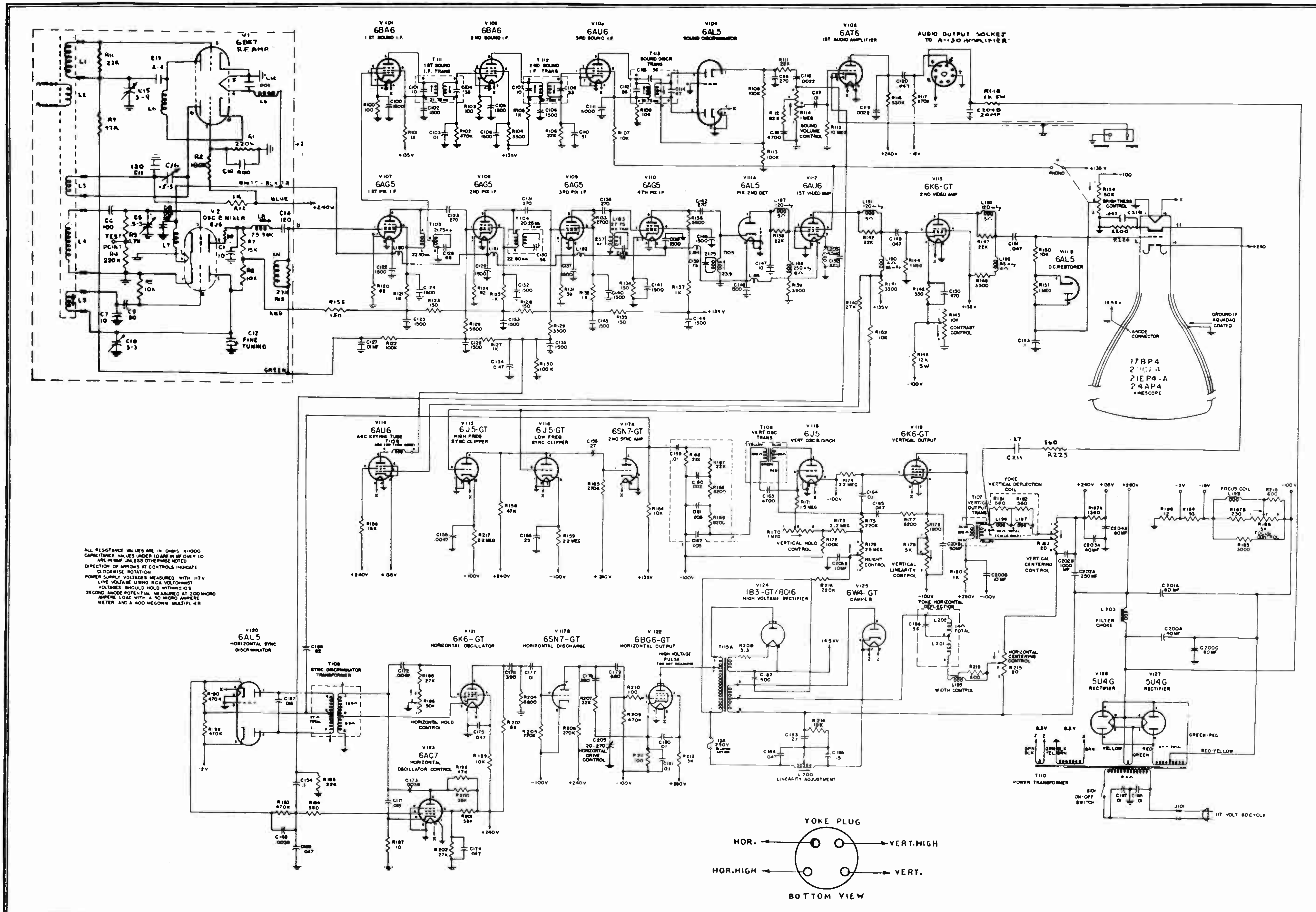
AGC KEYING PULSE AT PIN 5 OF V114 6AU6 AGC KEYING TUBE (15,750~)



SINE WAVE PLUS HORIZONAL SYNC PULSE AT TERMINAL D OF T108, SYNC DISCRIMINTOR TRANSFORMER (15,750~)



OUTPUT OF PLATE CIRCUIT OF HORIZONTAL OSCILLATOR AT PIN 3 OF V121 6K6 (15,750~)



VIDAIRE TV PAGE 12-7

MODEL 160A

RESISTORS - Fixed - Carbon - 1/2 watt

Symbol No.	Part No.	Description
R208	ERA-33G1	3.3Ω 10%
R197	ERA-1001	10Ω 10%
R131	ERA-3901	39Ω 10%
R120, R124	ERA-8201	82Ω 10%
R100, R103, R210	ERA-1011	100Ω 10%
R123, R128, R134, R135, R155	ERA-1511	150Ω 10%
R145	ERA-3311	330Ω 10%
R181, R182, R189, R194	ERA-5611	560Ω 10%
R101, R105, R121, R125, R127, R132, R137	ERA-1021	1000Ω 10%
R178	ERA-1821	1.8KΩ 10%
R191	ERA-2221	2.2KΩ 10%
R133	ERA-2725	2.7KΩ 5%
R129	ERA-3325	3.3KΩ 5%
R104, R141	ERA-3321	3.3KΩ 10%
R139	ERA-3925	3.9KΩ 5%
R126, R136	ERA-5625	5.6KΩ 5%
R204	ERA-6821	6.8KΩ 10%
R177	ERA-8221	8.2KΩ 10%
R108, R150, R152	ERA-1031	10KΩ 10%
R156	ERA-1531	15KΩ 10%
R106, R111, R165, R207	ERA-2231	22KΩ 10%
R140, R195	ERA-2731	27KΩ 10%
R158	ERA-4731	47KΩ 10%
R112	ERA-8231	82KΩ 10%
R109, R113, R122, R130, R172	ERA-1041	100KΩ 10%
R175, R205, R216	ERA-2241	220KΩ 10%
R117, R163, R206	ERA-2741	270KΩ 10%
R116	ERA-3341	330KΩ 10%
R102, R190, R192, R193, R209	ERA-4741	470KΩ 10%
R144, R151	ERA-1051	1 meg 10%
R171	ERA-1555	1.5 meg 5%
R159, R173, R174, R217	ERA-2251	2.2 meg 10%
R115	ERA-1061	10 meg 10%

RESISTORS - Fixed - Carbon - 1 watt

Symbol No.	Part No.	Description
R188	ERB-1201	12Ω 10%
R180	ERB-1021	1000Ω 10%
R148	ERB-3321	3.3KΩ 10%
R107, R164, R199	ERB-1031	10KΩ 10%
R202	ERB-2731	27KΩ 10%
R200, R201	ERB-3931	39KΩ 10%
R198	ERB-4731	47KΩ 10%

RESISTORS - Fixed - Carbon - 2 watt

Symbol No.	Part No.	Description
R211	ERC-1011	100Ω 10%
R146	ERC-1231	12KΩ 10%

RESISTORS - Fixed - Wirewound - High Wattage

Symbol No.	Part No.	Description
R184	ERD-115	100Ω 10% 5w
R218, R219	ERD-104	600Ω 10% 10w
R185	ERD-110	3KΩ 10% 10w
R203, R212	ERD-122	5KΩ 10% 10w
R214	ERD-107	15KΩ 10% 10w
R214	ERD-109	25KΩ 10% 10w
R187A, R187B	ERD-102	1360Ω, 230Ω 27w Bleeder assy.

CONTROLS

Symbol No.	Part No.	Description
R176	EP-101	Height control, 2.5 meg
R170, R196	EP-105	Vertical and horizontal hold, dual control, 50KΩ-1meg
R154	EP-106	Brightness control 50KΩ
R114, R143	EP-107	Power on-off - sound - contrast, dual control, 1meg 10K
R186	EP-108	Focus control, w.w. 5KΩ 5w
R179	EP-111	Vertical linearity control, w.w. 5KΩ 2w
R183, R215	EP-104	Vertical and Horizontal centering controls, 20Ω 2w

CAPACITORS - Fixed - Ceramic

Symbol No.	Part No.	Description
C147	ECC-100	10mmf 10% 500V
C110	ECC-101	51mmf 10% 500V
C186	ECC-114	56mmf 10% 1000V
C100, C102, C105, C106, C108, C122, C125, C128, C129, C132, C133, C135, C137, C138, C140, C143, C144, C145,	ECC-111	1500mmf 500V, dual GMV
C124, C141, C146	ECC-108	1500mmf 500V, single GMV
C111	ECC-110	5000mmf 500V, single GMV

CAPACITORS High Voltage - Ceramic

Symbol No.	Part No.	Description
C182	ECC-105-B	500mmf 20KV

CAPACITORS - Fixed - Mica

Symbol No.	Part No.	Description
C166	ECM-100-A	82mmf 10% 600V
C115, C123, C136, C142, C131	ECM-101	270mmf 10% 600V
C178, C176	ECM-113	390mmf 10% 600V
C150, C152	ECM-114	470mmf 10% 600V
C179	ECM-115	680mmf 10% 600V
C163	ECM-102	4700mmf 10% 600V
C205	ECM-112	20-270mmf, mica padder

CAPACITORS - Fixed - Moulded Paper

Symbol No.	Part No.	Description
C116	ECP-102	.0022mf 600V
C119	ECP-116	.0022mf 400V
C168, C173	ECP-103	.0039mf 400V
C118, C120, C121, C155, C172	ECP-105	.0047mf 400V
C103, C117, C127, C187, C188, C177, C191	ECP-107	.01mf 400V
C167, C171	ECP-123	.015mf 10% 400V
C165, C184	ECP-111	.047mf 600V
C149, C151, C174, C169, C194, C175	ECP-113	.1mf 400V
C164, C180	ECP-114	.1mf 600V
C185	ECP-117	.15mf 600V
C156, C158, C193, C192	ECP-115	.27mf 400V
C183	ECP-124	.27mf 600V
C134	ECP-121	.47mf 200V

CAPACITORS - High Electrolytic

Symbol No.	Part No.	Description
C204B, C204C	ECE-100	20mf/450V, 80mf/350V
C200A, C200B, C200C	ECE-102	40mf/450V, 80mf/150V, 10mf/450V
C201A, C201B	ECE-104	80mf/450V, 50mf/50V
C203A, C203B, C203C	ECE-101	40mf/450V, 10mf/450V
C202B, C202A	ECE-109	1000mf/6V, 250mf/12V, dual

COILS AND TRANSFORMERS

Symbol No.	Part No.	Description
L180, L181, L182, L184, L186	EL-111	Filament choke
L203	EL-113	Filter choke
T103	EL-120	1st Video I. F. coil (21.75mc sound take off)
T104	EL-101	2nd Video I. F. coil (20.25mc trap)
L183	EL-121	3rd Video I. F. coil (27.75mc trap)
T105	EL-122	4th Video I. F. coil (2175mc trap)
L-187, L191, L193	EL-107	Peaking coil, blue (120µh, 22K)
L190, L192	EL-108	Peaking coil, red (93 µh)
L188	EL-106	Peaking coil, green (250 µh)
L198	EL-114C	Focus coil
L200	EL-126	Linearity coil
L205	EL-102	4.5mc trap
L195	EL-127	Width coil
T111, T112	EL-104	Sound IF transformer
T113	EL-105	Sound discriminator transformer
	EL-112D	Deflection yoke
	EL-138	Deflection yoke, cosine corrected
T110	ET-101B	Power transformer
T114	ET-105	Audio output transformer
T106	ET-102	Vertical blocking osc. trans.
T107	ET-103	Vertical output transformer
T108	ET-100	Syncrolok transformer
T115A	ET-106	Horizontal output, high voltage transformer with AGC winding

TUBES

Symbol No.	Part No.	Description
V103, V112, V114	EVT-111	6AU6
V104, V120	EVT-101	6AL5
V105	EVT-112	6AT6
V113, V119, V121	EVT-103	6K6
V107, V108, V109, V110	EVT-100	6AG5
V117	EVT-104	6SN7
V123	EVT-114	6AC7
V124	EVT-106	1B3
V125	EVT-120	6W4
V115, V116, V118	EVT-102	6J5
V126, V127	EVT-108	5U4G
V122	EVT-105	6BG6

ELECTRICAL COMPONENTS

Part No.	Description
EF-101	Fuse, pig tail, delayed action, .15 amp
ENW-100	Network, Integrating
EFE-105	Tuner, Cascode, with tubes and shields

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ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles only
Power Consumption	220 Watts
Power Output	2.4 Watts (Max.) 1.8 Watts (10% Distortion)
Tuning Range	12 Channel
Antenna Input Imp.	300 Ohms balanced
Intermediate Frequencies	Picture 26.20MC Sound 21.70MC
Intercarrier Sound System	4.5 MC
Loud Speaker	8" PM Dynamic
Voice Coil Imp.	3.2 Ohms 400 Cycles

TUBE COMPLEMENT

Symbol	Type	Function
Tuner	6J6	R-F Osc. and Mixer
Tuner	6BK7	R-F Amplifier
V1	6CB6	1st Pix I-F Amplifier
V2	6CB6	2nd Pix I-F Amplifier
V3	6CB6	3rd Pix I-F Amplifier
V4 A & B	6AL5	Pix Det. and DC Restorer
V5 A & B	12AT7	1st Video Amp. and 1st Sync Amp.
V6 A & B	12AU7	Sync. Separator & Video Output
V7	21MP4	Picture Tube 21" Rectangular
V8	6AU6	Automatic Gain Control
V9 A & B	6SN7-GT	Vert. Osc. & Phase Splitter
V10	6S4	Vertical Output
V11	6AU6	1st Sound I-F
V12	6AU6	2nd Sound I-F
V13	6AL5	Ratio Detector
V14	6AQ5	Audio Output
V15	6AV6	Audio Amplifier
V16	6SN7-GT	Horizontal Oscillator
V17	6AL5	Horizontal Phase Det.
V18	6BG6-G	Horizontal Output
V19	1B3-GT/8016	High Voltage Rectifier
V20	6W4-GT	Damper
V21	5U4-G	Low Voltage Rectifier

RADIO FREQUENCY RANGES

Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc	Receiver R-F Osc. Frequency Mc
2	54-60	55.25	59.75	81.45
3	60-66	61.25	65.75	87.45
4	66-72	67.25	71.75	93.45
5	76-82	77.25	81.75	103.45
6	82-88	83.25	87.75	109.45
7	174-180	175.25	179.75	201.45
8	180-186	181.25	185.75	207.45
9	186-192	187.25	191.75	213.45
10	192-198	193.25	197.75	219.45
11	198-204	199.25	203.75	225.45
12	204-210	205.25	209.75	231.45
13	210-216	211.25	215.75	237.45

RECEIVER LOCATION—Advise the owner as to the proper location for the television receiver. The following may be used as a guide:

1. Choose an area in the home where sunlight or light from lamps does not strike the face of the picture tube and cause glare.
2. Remember the necessity of an electrical outlet and the location of the point at which the antenna leads enter the room.
3. The receiver should be placed a short distance from the wall to allow adequate ventilation.
4. The receiver should be placed to permit easy access for operation and comfortable viewing from all angles.

ANTENNA—This receiver has been designed to use an antenna with a 300 ohm balanced transmission line. This line must be as short as possible because the longer the line the greater the chances are for picking up electrical disturbances. Stand-off insulation should be used to keep the line away from the mast, metal or walls. Twist this line about one turn per foot throughout the line to cancel out direct signal and/or noise pickup by the transmission line. It should also be securely anchored in place so that a change in weather will not affect its position.

HIGH VOLTAGE WARNING

This television receiver contains high voltages which are dangerous to life. Never operate or service the receiver outside of the cabinet or with the covers removed until all the safety precautions necessary for working with high voltage equipment have been observed.

PICTURE TUBE HANDLING PRECAUTION

Shatterproof goggles and heavy gloves must be worn by individuals while handling the picture tube or installing the picture tube into the receiver.

The picture tube encloses a high vacuum and due to the large surface area, is subjected to excessive air pressure. Therefore, care should be taken not to bump or scratch the picture tube accidentally as it may cause the tube to implode resulting in damage to property or injury to an individual.

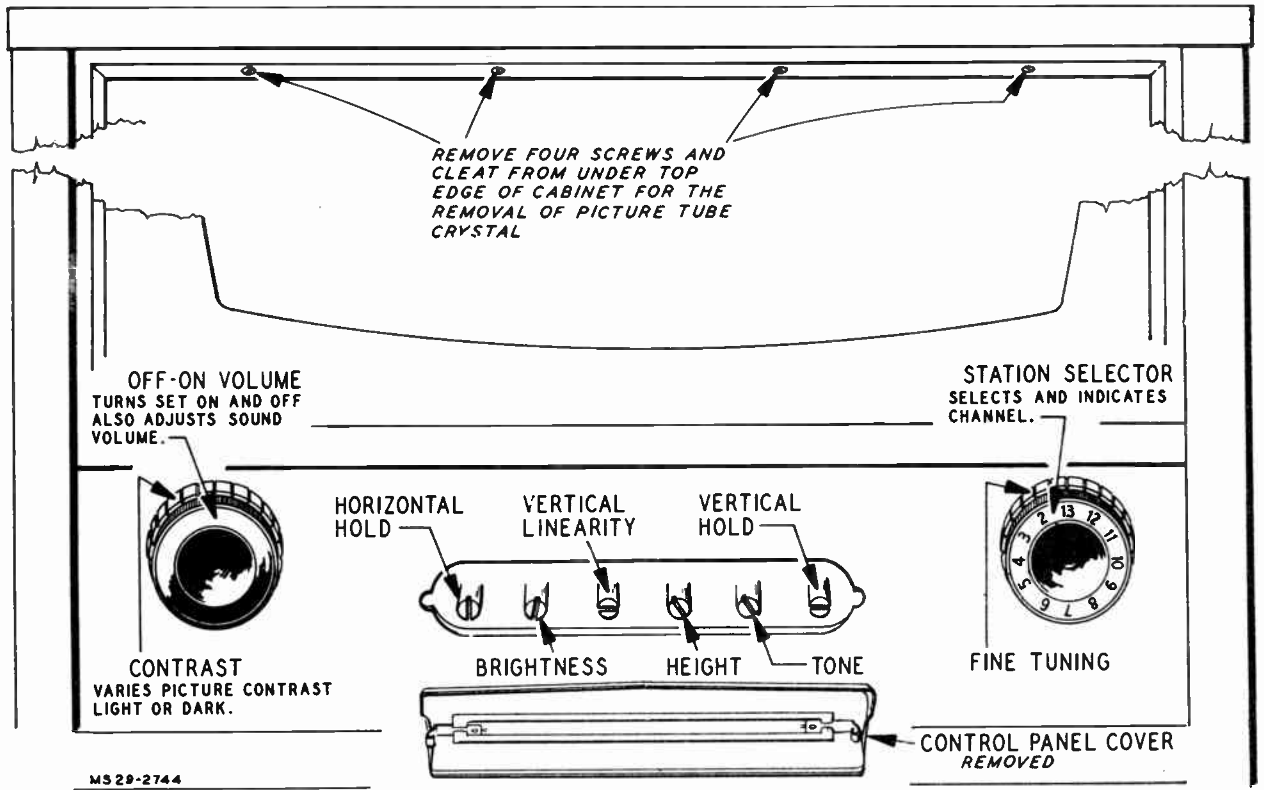


Fig. 2—Front Panel Controls.

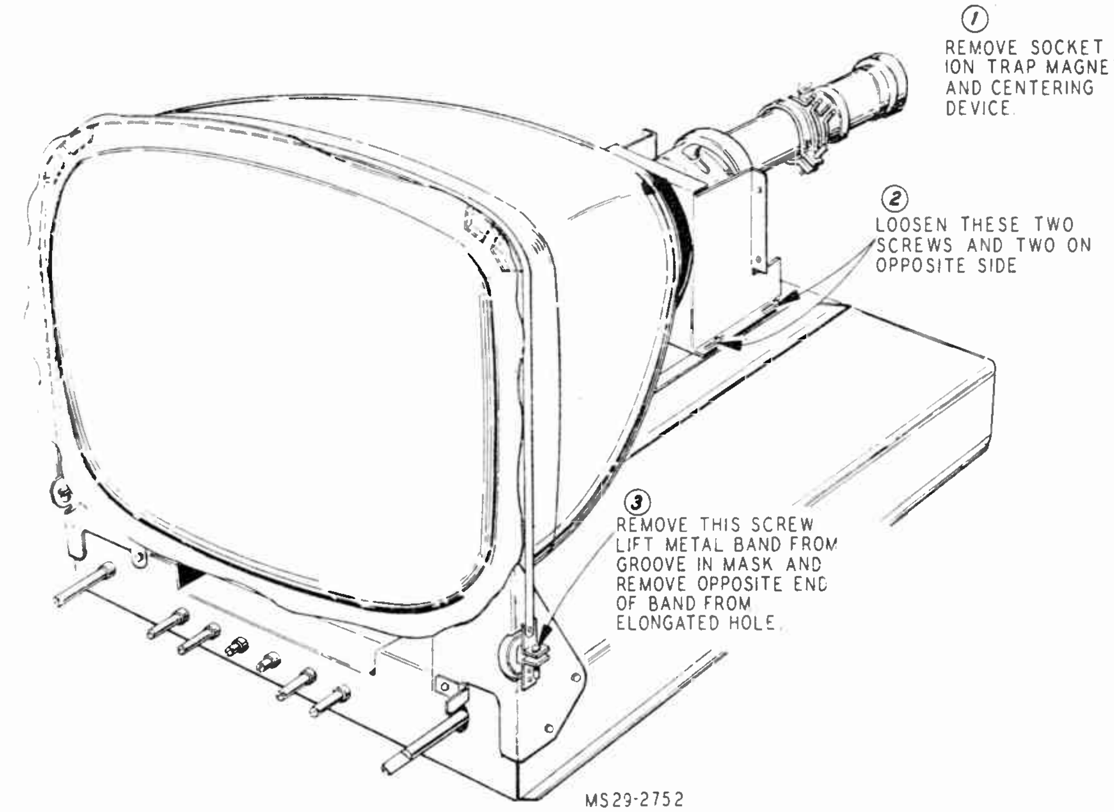


Fig. 3 — Removal Of Picture Tube

TUNING PROCEDURE

1. To turn the television receiver on, turn the OFF-ON VOLUME control clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.
2. Turn the STATION SELECTOR control to the desired channel. This control may be turned in either direction.
3. Turn the CONTRAST control clockwise until activity or definite form is noted on the screen.
4. Adjust the FINE TUNING control for clearest picture and the VOLUME control for desired volume.
5. To turn off the receiver, turn the OFF-ON VOLUME control counterclockwise until a click is heard.

OCCASIONAL ADJUSTMENTS TO IMPROVE PICTURE RECEPTION

There are six controls at the front of the chassis. These controls are accessible after the removal of the control panel cover at the front of the cabinet. Control panel may be removed with fingers. Pull both ends at once. (See illustration on Page . The controls are pre-set at the factory and may occasionally need adjustment due to aging of the components in the receiver and the fluctuating line voltages in different areas. If any adjustments are necessary, follow the instructions under "Controls and Functions."

IMPORTANT—Be sure that the FINE TUNING control has been set for the clearest picture before adjusting any controls.

CONTROLS AND FUNCTIONS

HORIZONTAL HOLD—Stops horizontal movement (diagonal bars.)

BRIGHTNESS—Adjusts for desired picture brilliance.

VERTICAL LINEARITY—Adjusts picture symmetry, top to bottom.

HEIGHT—Adjusts picture to fit mosk vertically.

VERTICAL HOLD—Stops upward or downward picture movement.

TONE—Adjusts for tonal quality bass or treble.

RECORD PLAYER CONNECTION AND TV-PHONO SWITCH

This receiver has a PHONO socket located at the rear of the chassis. When it is desired to play records through the receiver, insert the connector on the cable of any standard record player or changer into this socket. Push the TV-PHONO switch (at rear of receiver) to PHONO and use the volume control to adjust the sound level.

NOTE — Be sure to push the TV-PHONO switch back to the TV position when through playing records, otherwise receiver will not operate.

PICTURE TUBE SAFETY GLASS — It will be necessary to clean this glass and the face of the picture tube occasionally. Remove the safety glass carefully as outlined in the illustration on page .

CAUTION—UPON REMOVAL OF THE LAST SCREW AND THE CLEAT THE GLASS WILL FALL FORWARD. SUPPORT THE GLASS WITH ONE HAND AS YOU LIFT IT GENTLY FROM THE CABINET. Clean the safety glass and the face of the picture tube with a soft lint-free cloth dampened with water or mild soapsuds.

PICTURE TUBE REPLACEMENT — To replace the picture tube it is necessary to remove the chassis from the cabinet. This may be accomplished in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove the cabinet back. You will note that the interlocked line cord disconnects the power when the cabinet back is removed.
3. Disconnect the leads from the speaker, remove the antenna terminal board at the rear of the cabinet and then the five chassis mounting bolts. Pull chassis CAREFULLY out of the cabinet.
4. Remove the picture tube as shown and outlined in the illustration. To install a new picture tube, reverse the procedure making sure that the picture tube fits close against the picture tube cushion. If the picture tube sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube. It is important that all the clips and shims used in mounting the tube be replaced, otherwise difficulty may be encountered when horizontal or vertical centering is required.

WARNING — Before handling the picture tube, it will be necessary to remove the static charge. In receivers with glass picture tubes, ground the anode lead to chassis, and insert an insulated wire from the well in the tube to chassis. In receivers with metal picture tubes, remove the static charge by grounding an insulated wire from the chassis to the metal portion of the tube.

FRONT OF CHASSIS

(Accessible After The Removal of Front Panel Control Cover)

Horizontal Hold	R-80
Brightness	R-32
Vertical Linearity	R-54
Height	R-47
Tone	R-115
Vertical Hold	R-43

NON-OPERATING CONTROLS
REAR OF CHASSIS

Horizontal Centering, Vertical Centering	Centering Device
Ion Trap Magnet	Wing Nut Adjustment
Deflection Yoke	Wing Screw
Width	L-19
Horizontal Linearity	L-18
Horizontal Drive	R-77
Horizontal Frequency	L-17

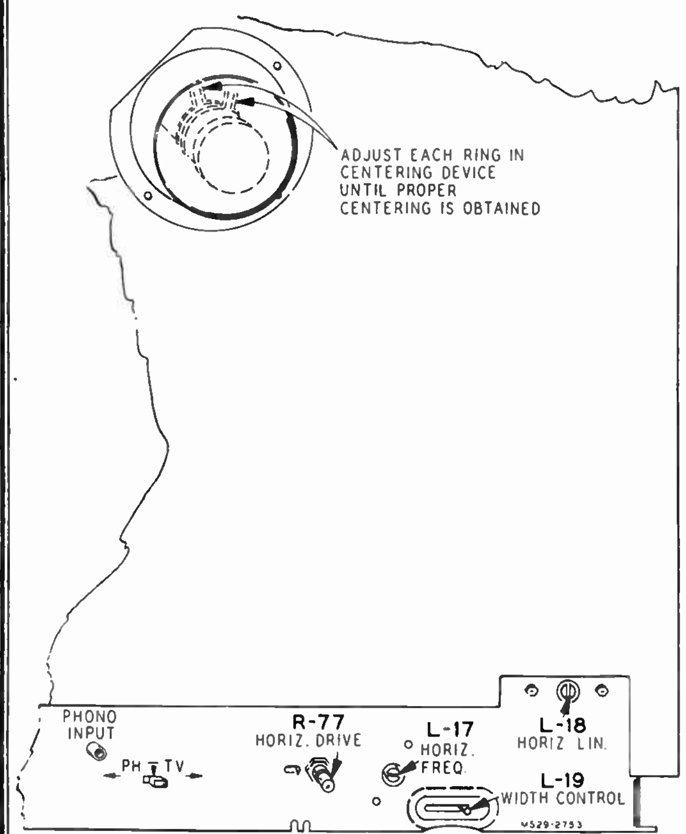


Fig. 4—Adjustments Rear of Chassis

ION TRAP MAGNET ADJUSTMENT — The ion trap magnet should be positioned close to the base of tube. From this position adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the picture tube until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Re-adjust the ion trap magnet for maximum raster brilliance.

DEFLECTION YOKE ADJUSTMENT— If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

CENTERING ADJUSTMENT — If horizontal or vertical centering is required, adjust each ring in the centering device until proper centering is obtained.

PICTURE ADJUSTMENT — For further adjustments, obtain a test pattern on the receiver. Turn on receiver and follow tuning procedure on page 2. When a test pattern is obtained it may be necessary to slightly re-adjust the fine tuning control for clearest picture.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT —Tune in a station and adjust the horizontal hold control until the picture falls into sync. Momentarily remove the signal by switching off channel and then back. The picture should pull into sync over a range of 90° rotation of the horizontal hold control. If in the above check the receiver fails to hold sync or the pull-in range is at the extreme end of the control, and is less than 60°, it will be necessary to make the following adjustment.

HORIZONTAL FREQUENCY ADJUSTMENT —With the horizontal hold control set to the center of its range of rotation, adjust the horizontal frequency control (L-17) until the picture pulls into sync. Recheck the "Horizontal Oscillator Alignment."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS — Adjust the height control (R-47) until the picture fills the mask vertically. Adjust the vertical linearity control (R-54) until the picture is symmetrical from top to bottom. Adjust the picture centering device to align picture with the mask. Adjustment of any control will require a re-adjustment of the other controls.

WIDTH, DRIVE AND LINEARITY ADJUSTMENTS — Turn the horizontal drive control clockwise (R-77) until white bars appear at the left center portion of the raster. Then turn counterclockwise until the white bars just disappear. This adjustment will allow the horizontal system to operate at maximum efficiency. Adjust width control (L-19) until the picture fills the mask. Adjust the horizontal linearity control (L-18) for best linearity. Adjust picture centering device to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

The oscillator is preset at the factory and normally needs no adjustment. However, if adjustments are required, they can be made without removing the chassis from the cabinet. Remove the channel selector and fine tuning knobs from the tuning shaft.

TEST PROCEDURE:

1. Set channel selector to receive desired station.
2. Set fine tuning control in center of its range.
3. Adjust oscillator slug, with bakelite type screwdriver, for best picture resolution.
4. Repeat steps 1, 2 and 3 on all channels used.

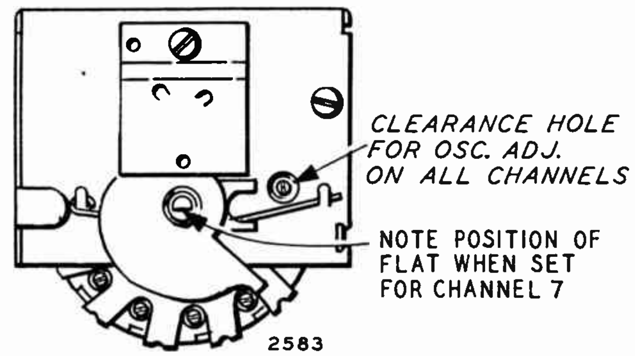


Fig. 5 — Turret Type Tuner

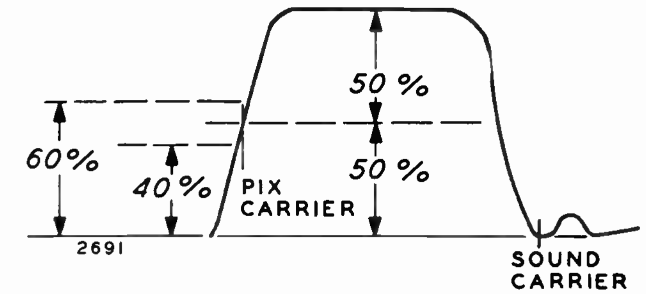


Fig. 6 — Sweep Patterns

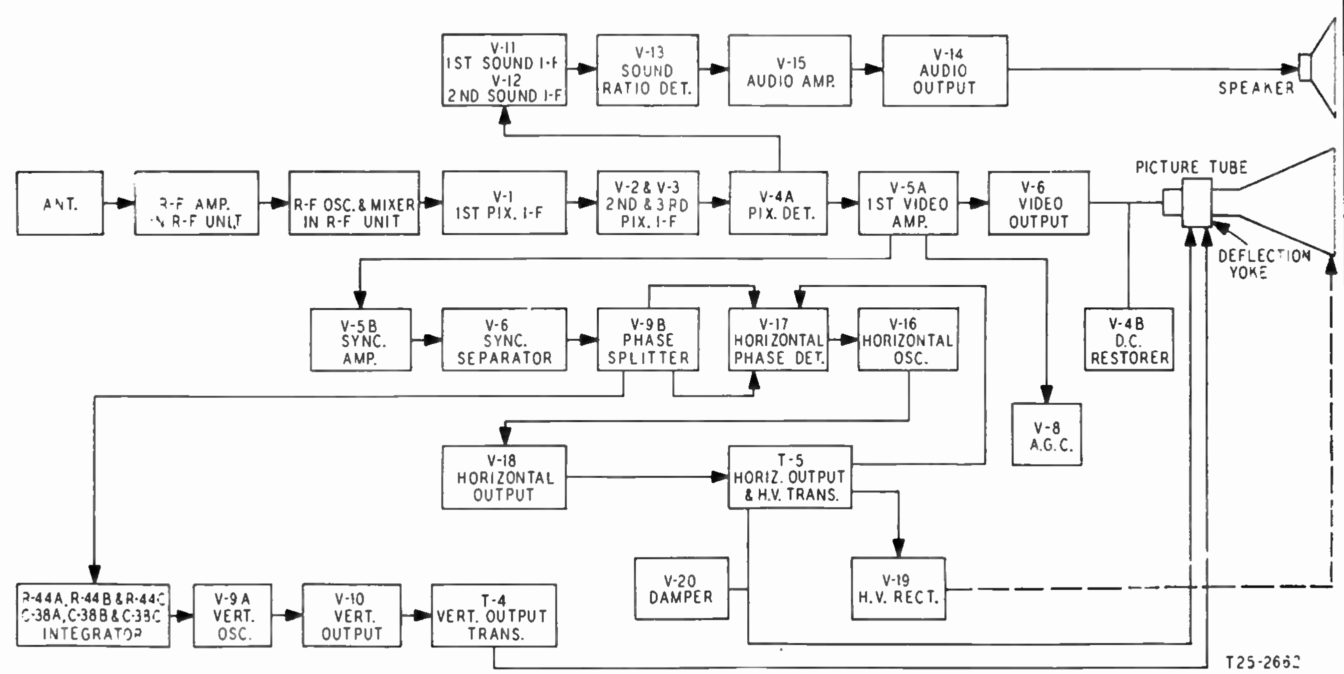


Fig. 7 — Block Diagram.

SERVICE SUGGESTIONS

NO RASTER ON PICTURE TUBE —If raster cannot be obtained check below for the possible causes.

1. Ion trap magnet adjustment is incorrect.
2. No +B voltage. Check ¼ ampere fuse. Replace if defective. If fuse continually burns out, check (A) Horizontal output tube V-18 (6BG6-G). (B) Check damper tube V-20 (6W4-GT). (C) Check horizontal oscillator V-16 (6SN7-GT) for proper operation. (D) With an ohm-meter, check for a short between terminal 4 of the horizontal output transformer (T-5) and the chassis. (E) Check DC resistance of T-9.
3. No high voltage. Check V-18, 19 and V-20 tubes and circuits. If the horizontal deflection circuits are operating as evidenced by the correct voltage measured on pin 3 of the damper tube (V-20), the trouble can be isolated to the high voltage rectifier V-19 circuit. Either the high voltage winding to the 6BG6-G plate and 1B3 plate is open, tube V-19 is defective, its filament circuit is open, or the high voltage filter capacitor C-83 is shorted.
4. Defective picture tube. Heater open or cathode return circuit open.

HORIZONTAL DEFLECTION ONLY —If only horizontal deflection is obtained as evidenced by a straight line across the face of the picture tube, it can be caused by the following:

1. Vertical oscillator V-9A (6SN7-GT) or vertical output tube V-10 (6S4) inoperative. Check voltages on grid and plate.
2. Vertical oscillator transformer (T-7) defective.
3. Vertical output transformer (T-4) open or shorted.
4. Yoke vertical coils open.
5. Vertical hold, height or linearity controls may be defective.

POOR VERTICAL LINEARITY — If adjustment of the height and linearity controls will not correct this condition, any of the following may be the cause.

1. Check variable resistors R-47 and R-54.
2. Vertical output transformer (T-4) defective.
3. Capacitors C-40, C-77 or C-88A defective.
4. V-9A (6SN7-GT) or V-10(6S4) defective, check voltages.
5. Excess leakage or incorrect value of capacitor C-41, or open or incorrect value of resistors R-50 & R-51.
6. Low plate voltages. Check rectifier tubes and capacitors in+B supply circuits.
7. Capacitor C-42 defective.
8. Vertical deflection coils defective (part of L-16 yoke).

POOR HORIZONTAL LINEARITY — If adjustment of the Horizontal drive and linearity controls does not correct this condition, check the following:

1. Check or replace horizontal output tube V18.
2. Check or replace damper tube V-20 (6W4-GT).
3. Check capacitors C-81, C-82, C-84 and horizontal linearity control (L-18) for defects.
4. Horizontal deflection coils defective (part of L-20 yoke).

TRAPEZOIDAL OR NONSYMMETRICAL RASTER

1. Improper adjustment of focus coil or ion trap magnet.
2. Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER —This condition can be caused by:

1. Defective yoke due to C-85 or R-92 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.
2. V-20 (6W4) defective.

SMALL RASTER — This condition can be caused by:

1. Low +B or line voltage. Check V-21 (5U4G).
2. Insufficient output from horizontal output tube V18. Replace tube.
3. Insufficient output from vertical oscillator tube V-9A or vertical output tube V-10. Replace tubes.
4. Incorrect setting of horizontal drive control R-77.
5. V-20 (6W4) defective.

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND —This condition can be caused by:

1. No signal on picture tube grid. Check V-5A (12AT7) & V6A (12AU7) tubes and associated circuits.
2. Bad contact to picture tube grid (lead to socket broken).

SIGNAL APPEARS ON PICTURE TUBE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY —A condition of this nature can be caused by:

1. Defective sync amplifier V-5B or separator V-6A or phase splitter V-9B.
2. If tubes are O.K. check voltages, and associated circuits.
3. AGC system inoperative. Check V-8 (6AU6) AGC tube and associated circuits.

SIGNAL ON PICTURE TUBE GRID AND HORIZONTAL SYNC ONLY —If this condition is encountered, check:

1. Vertical integrating network capacitors C-38A, B & C, and resistors R-44 A, B & C.
2. Vertical hold control R-48 defective.

PICTURE STABLE BUT WITH POOR RESOLUTION —If the picture resolution is not up to standard, it may be caused by any of the following:

1. Defective pix I-F tubes V-1, 2 & 3, (6CB6's).
2. Defective picture detector V-4A (6AL5) or video amplifier V-5A or video output V-6B (12AU7).
3. Defective picture tube.
4. Open video peaking coil. Check all peaking coils L-5, L-6, L-7, L-8, L-10 and L-11 for continuity. Note that L-7, L-8 and L-10 have shunting resistors.
5. Leakage in V-6A (12AU7) grid capacitor C-24. If the above component is not found to be defective, check the following:

1. Check all potentials in video circuits.
2. Check picture tube grid circuit for poor or dirty contact.
3. Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE SMEAR:

1. Normally, smear can be attributed to phase shift at the low frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video output tube V-6B (12AU7).
2. This trouble can also originate at the transmitter. Check reception from another station.
3. Check and realign, if necessary, the picture I-F and R-F circuits.

PICTURE JITTER:

1. If regular sections at left of the picture are displaced, replace the horizontal oscillator tube V-16.
2. Vertical instability may be due to loose connections or noise received with the signal.
3. Horizontal instability may be due to unstable transmitted sync or to noise.
4. Check receiver AGC system for proper operation.
5. Check phase splitter V-9B (6SN7-GT).

ALIGNMENT PROCEDURE

TEST EQUIPMENT —To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:

(a) Frequency ranges:
  18 to 30 mc, 10 mc sweep width
  40 to 90 mc, 10 mc sweep width
  170 to 225 mc, 10 mc sweep width
(b) Output adjustable with at least .1 volt maximum.
(c) Output constant on all ranges.
(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)

(a) Intermediate alignment frequencies.

23.1 mc first picture I-F coil.
24.1 mc third picture I-F coil.
25.9 mc second picture I-F coil.
21.7 mc sound trap.
4.5 mc video trap & sound I-F.
25.1 mc converter plate coil (Tuner).

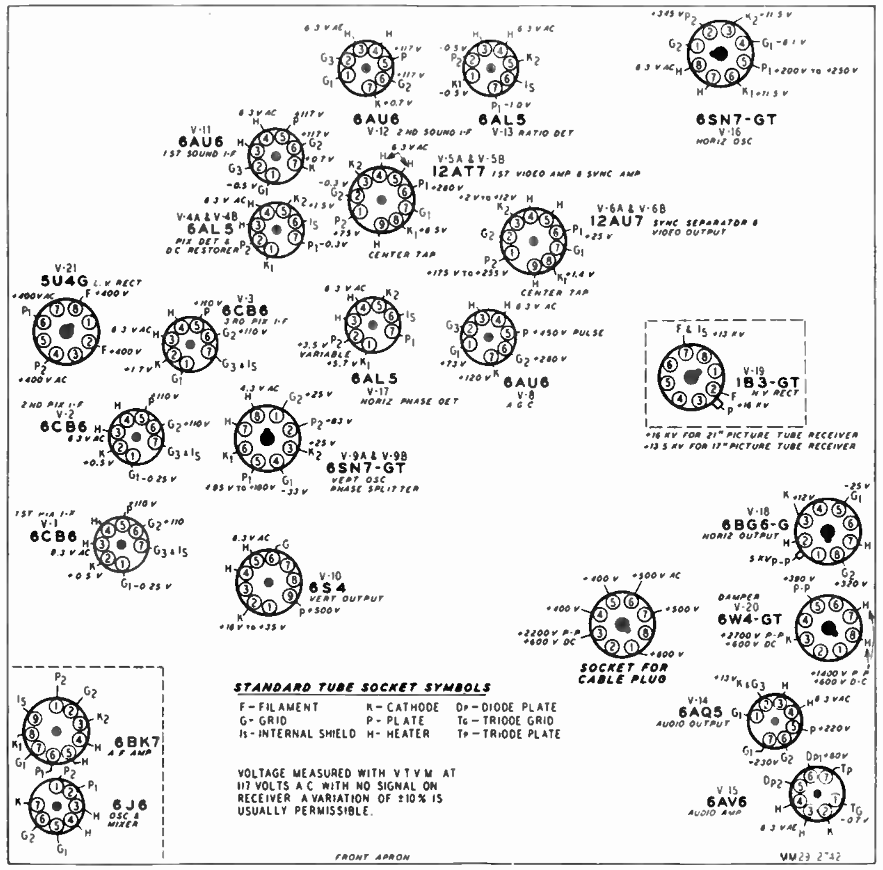


Fig. 8 — Bottom Socket Voltages

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 20 kilovolts.

SERVICE PRECAUTIONS — To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the cabinet back, disconnect the leads from the speaker, remove the antenna terminal board at rear of cabinet, and then the 5 chassis mounting bolts. The chassis may be serviced with the picture tube in place provided the chassis is turned on its side with the power transformer on the bottom. The weight of the chassis will be supported against the high voltage housing.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high voltage filter resistor R-99.

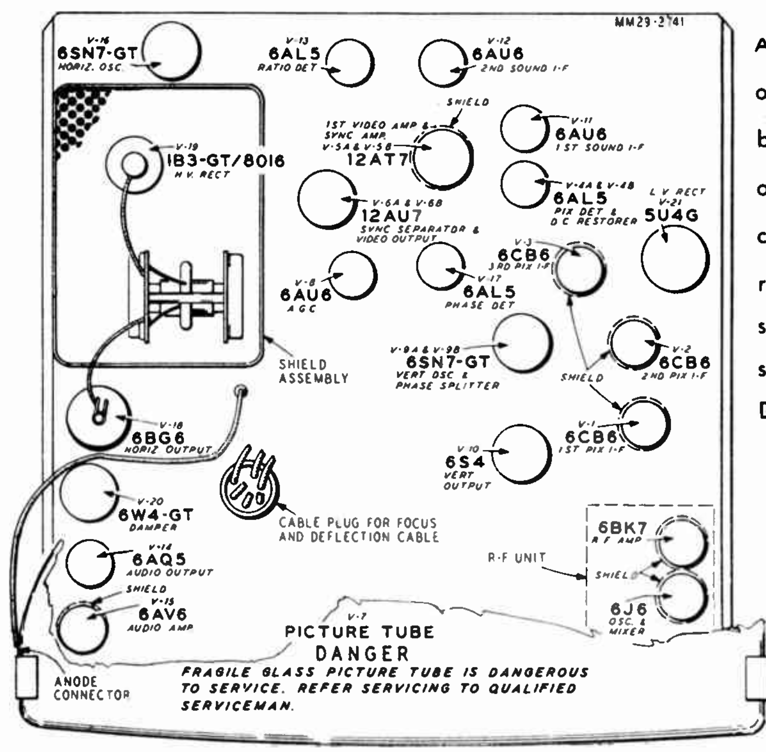


Fig. 9 — Tube Layout

ALIGNMENT PROCEDURE

PIX I-F

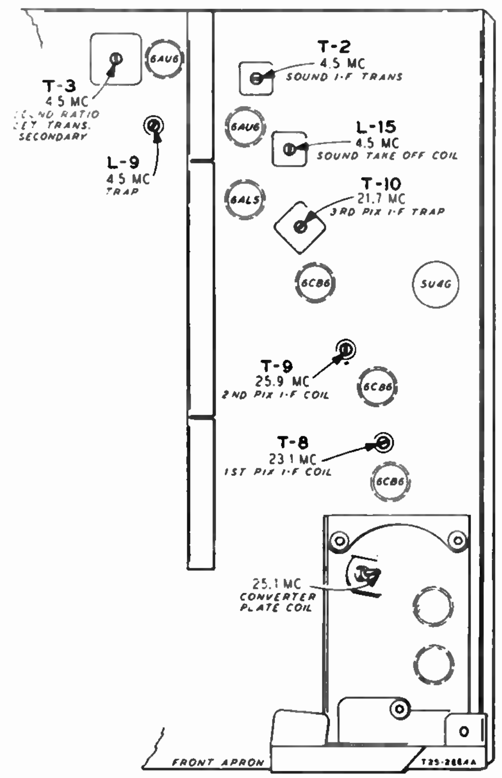


Fig. 10 — Top Chassis Video and Audio I-F Adjustments

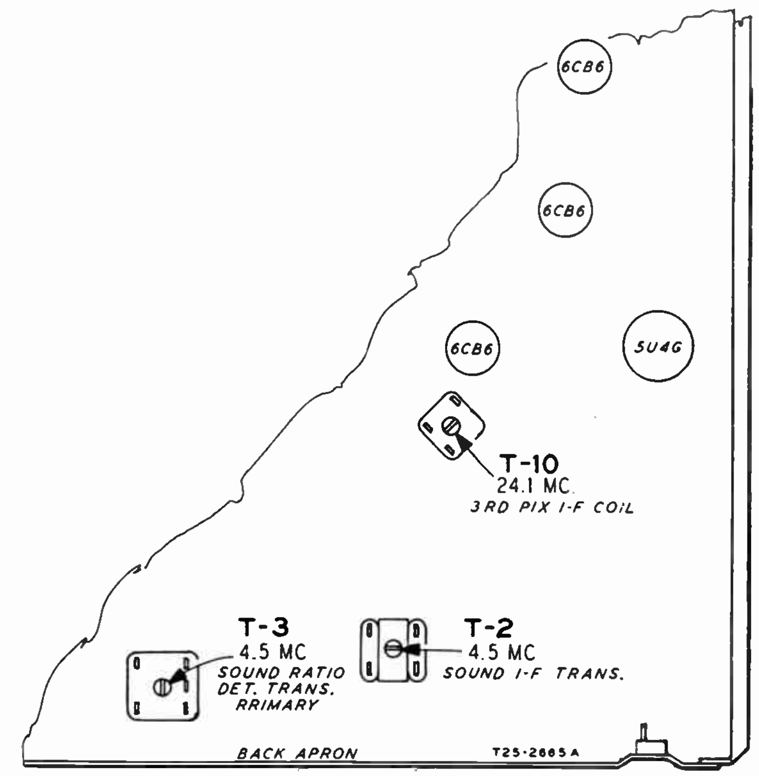


Fig. 11 — Bottom Chassis Video and Audio I-F Adjustments

A. Unmodulated R-F signal into Converter Grid by means of tube shield insulated from base. VTVM with filter in lead of 10 K ohms and 5000 mmf connected to pic. det. load resistor, (R-18) 5600 ohms, in series with peaking coil (L-6) from Pin 7 of 6AL5. Input signal level should be such that output is less than 2 volts DC. Apply -3.0V battery Bias on AGC line.

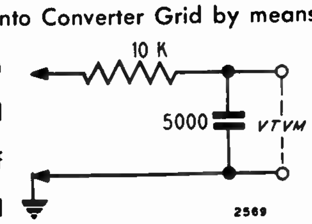


Fig. 12 — VTVM Connections

	FREQUENCY	ADJUST
1.	25.1 MC	Converter plate coil (on top of tuner) for maximum dc at picture detector.
2.	23.1 MC	1st picture I-F coil (T-8 above chassis) for maximum dc at picture detector.
3.	25.9 MC	2nd picture I-F coil (T-9 above chassis) for maximum dc at picture detector.
4.	24.1 MC	3rd picture I-F coil (T-10 below chassis) for maximum dc at picture detector.
5.	21.7 MC	3rd picture I-F trap (T-10 in can above chassis) for minimum dc at picture detector.

B. I-F Sweep Generator into converter grid by means of tube shield insulated from base. Connect oscilloscope across R-18 (in place of VTVM). Apply -3.0V bias (DC) to AGC line (battery). Tuner should be switched to dead channel so as not to cause interference.

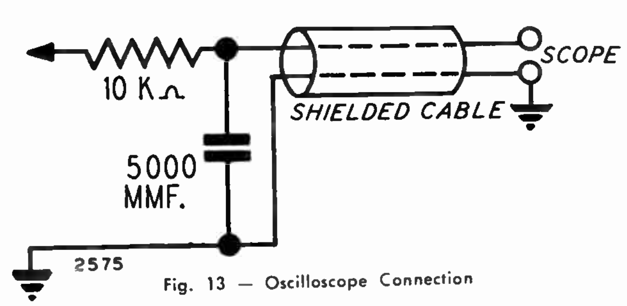


Fig. 13 — Oscilloscope Connection

ALIGNMENT PROCEDURE (continued)

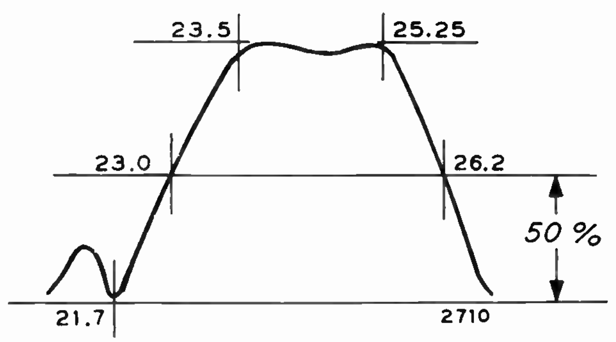


Fig. 14 — Overall Response Curve

Observe overall I-F response, which should be as shown above: A slight touch-up may be required. At no time should the trap coil be re-adjusted, nor should it be necessary to turn any of the picture I-F coils more than 1/2 turn of the slug. The following comments are suggestions only:

1. The height of the 26.2 MC marker is controlled by the 25.1 MC (Converter Plate Coil on tuner) and the 25.9 MC (2nd P.I.F.) coils.
2. The uniformity of response (flatness across top and position of 23.5 MC) marker is controlled for the most part by the 24.1 MC third picture I-F coil.
3. The 23.0 MC marker position is controlled by the first picture I-F (23.1 MC coil). However, it is NOT advisable to change the setting of the coil, due to its effect on sound rejection. Its adjustment should be avoided unless believed to be absolutely necessary.

VIDEO

With 4.5 MC unmodulated signal from a high impedance source, (10,000 ohms in series with generator), into plate of pix det. tube (Pin 7 of 6AL5 second detector) and VTVM on picture tube grid, tune 4.5 MC trap L-9 (top of chassis) for minimum response. VTVM on 0-10V AC scale.

AUDIO I-F

Ground sound AGC (bottom of sound take-off coil) With signal generator set to 4.5 MC and dc V.T.V.M. connected to ratio detector (6AL5 Pin No. 7) adjust sound take-off coil (L-15), sound I-F primary and secondary (T-2), and ratio detector primary (T-3 bottom) for max. voltage. Select output levels on signal generator which will maintain d-c voltage about 10 volts.

With same setup as above except dc V.T.V.M. is connected as follows: Ground side of V.T.V.M. is connected to junction of 5600 ohm resistors (R-63 & R-64) across pins 5 and 7 of 6AL5 ratio detector and high side of V.T.V.M. is connected to ratio detector audio output at junction of 68,000 ohm resistor (R-62) and 470 mmf condenser (C-55).

Align ratio detector secondary (T-7 Top) for crossover (0 voltage) as read on V.T.V.M. lowest scale (3 V.).

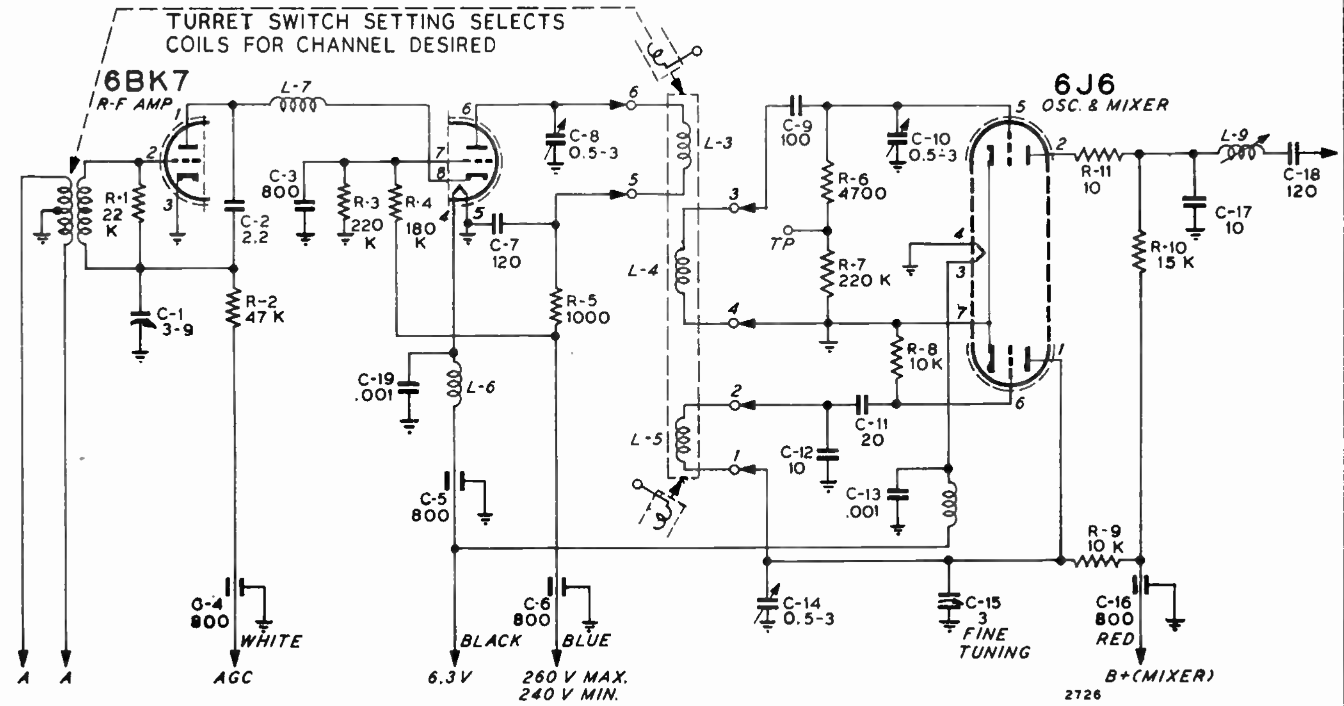


Fig. 18 — Cascode Tuner Schematic Diagram

TUNER ALIGNMENT

A. Sweep generator with balanced 300 ohm output to antenna terminals. Marker generator output to antenna terminals. Oscilloscope to "tie point" (Figure 15) on tuner. Connect 1½ V bias to AGC line at junction of R-1 and C-1 on the receiver.

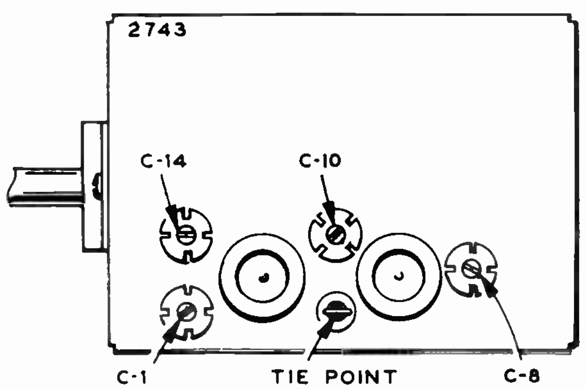


Fig. 15 — Top Tuner Adjustments

B. RF AND CONVERTER ADJUSTMENT.
1. With channel selector on Channel 12, adjust C-1 slightly favoring the Pix carrier, then adjust C-10 and C-8 for response as in Figure 16. Picture and sound markers at 90% maximum response.
2. Check response on all channels. If markers are below 70% on any channel, readjust C-1, C-10 and C-8. Recheck all channels.

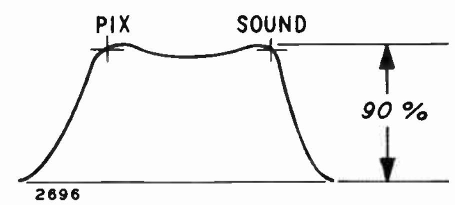


Fig. 16 — Pix and Audio Markers

C. OSCILLATOR ADJUSTMENT.

1. Apply -3 volts on IF AGC line.
2. Connect oscilloscope to output of video detector. Place fine tuning in center of range. Check response on all channels. Sound marker should be in notch and picture marker at 50%. (See Figure 14). If markers are all off in some directions set channel selector on Channel 13 and adjust C-14.
3. If some channels are off, individual oscillator coil slugs will require adjustment. Adjust each channel slug, accessible through hole in front of chassis with a non-metallic screwdriver to bring sound marker to correct position.

TUNER ASSEMBLY PARTS LIST

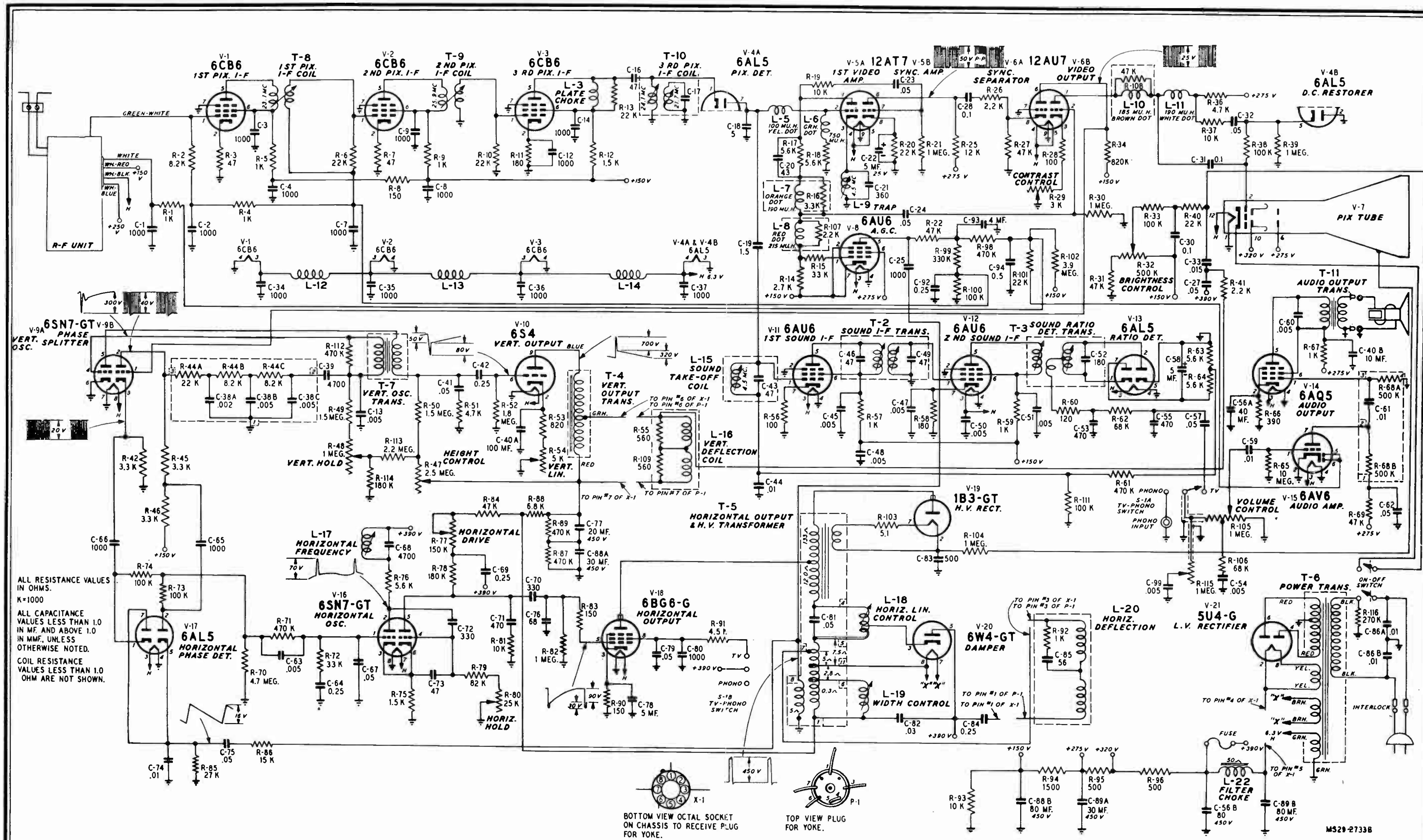
RESISTORS

Ref. No.	Part No.	Ohms	Tolerance	Watts
R-1	12A-118	22 K	±20%	0.5
R-2	12A-039	47 K	±20%	0.5
R-3, R-7	12A-041	220 K	±20%	0.5
R-4	12A-153	180 K	±10%	0.5
R-5	12A-027	1000 Ohms	±20%	0.5
R-6	12A-042	4700 Ohms	±10%	0.5
R-8, R-9	12A-040	10 K	±10%	0.5
R-10	12A-021	15 K	±20%	0.5
R-11	12A-150	10 Ohms	±20%	0.5

CAPACITORS

Ref. No.	Part No.	Capacity	Tolerance
C-1	31A-079	3-9 mmf	Trimmer
C-2	13D-167	2.2 mmf	10%
*C-3	13D-163	800 mmf	Min.
C-4, C-5, C-6, C-16	13D-153	800 mmf	Min.
C-7, C-18	13D-045	120 mmf	5%
C-8, C-10, C-14	31A-069	.5-3 mmf	Trimmers
C-9	13D-046	100 mmf	10%
C-11	13D-042	20 mmf	10%
C-12	13D-064	10 mmf	5%
C-13, C-19	13D-041	1000 mmf	10%
C-15	(Part of Fine Tuning Assembly)		
C-17	13D-053	10 mmf	5%

*Not recommended as a Field Replacement.

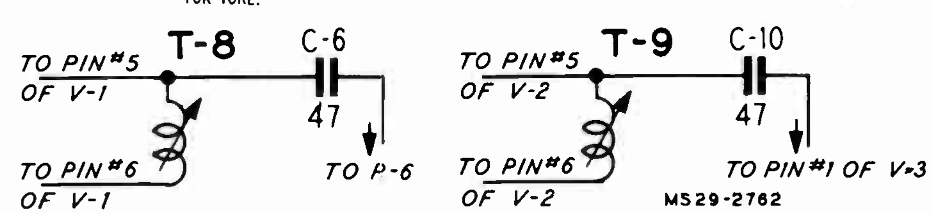


ALL RESISTANCE VALUES IN OHMS.
K=1000

ALL CAPACITANCE VALUES LESS THAN 1.0 IN MF. AND ABOVE 1.0 IN MMF., UNLESS OTHERWISE NOTED.

COIL RESISTANCE VALUES LESS THAN 1.0 OHM ARE NOT SHOWN.

NOTE — In some receivers the 1st and 2nd Pix I-F Coils T-8 & T-9 are capacity coupled single wound coils part number 9A2225.



Use only GENUINE factory tested parts to insure service jobs you can depend on and to obtain original set performance.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CAPACITORS

					List Price
C-1, C-2, C-3, C-4, C-7, C-8, C-9, C-12, C-14, C-34, C-35, C-36, C-37, C-65, C-66, C-80	47X519	1000 mmf		Ceramic	.20
C-6, C-10, C-16, C-73	47X565	47 mmf	500 V	Molded Mica	.20
C-13, C-54, C-63	B65502	.005 mf	200 V	Tubular	.20
C-17	Part of T-10				
C-18	47X562	5mmf	500 V	Ceramic	.80
C-19	47X584	1.5 mmf		Composition	.10
C-20	47X563	43 mmf	500 V	Ceramic	.30
C-21	47X568	360 mmf	500 V	Molded Mica	.20
C-22, C-58, C-78	45X378	5 mf	25 V	Dry Electrolytic	.95
C-23, C-62, C-81	D65503	.05 mf	400 V	Tubular	.25
C-24, C-32	46X397	.05 mf	400 V	Molded Tubular	.30
C-25	47X569	1000 mmf	1000 V	Molded Mica	.40
C-27, C-41, C-79	F65503	.05 mf	600 V	Tubular	.25
C-28	D65104	0.1 mf	400 V	Tubular	.25
C-30	B65104	0.1 mf	200 V	Tubular	.20
C-31	46X403	0.1 mf	600 V	Molded Tubular	.50
C-33	F65153	.015 mf	600 V	Tubular	.25
C-38A, C-38B, C-38C	Part of 76X7 (See Miscellaneous)				
C-39, C-68	47X543	4700 mmf	500 V	Molded Mica	.85
C-40A, C-40B	45X385	100 mf 10 mf	50 V 450 V	Dry Electrolytic	2.05
C-42, C-69, C-84	D65254	0.25 mf	400 V	Tubular	.35
C-43	Part of L-15				
C-44	47X595	.01 mf		Ceramic	.25
C-45, C-47, C-48, C-50, C-51	47X507	.005 mf		Ceramic	.30
C-46, C-49	Part of T-2				
C-52	Part of T-3				
C-53, C-55, C-71	47X525	470 mmf	500 V	Molded Mica	.25
C-56A, C 56B	45X384	40 mf 80 mf	50 V 450 V	Dry Electrolytic	3.55

CAPACITORS—Cont.

					List Price
C-57, C-67, C-75	B65503	.05 mf	200 V	Tubular	.20
C-59, C-74	B65103	.01 mf	200 V	Tubular	.20
C-60	F65502	.005 mf	600 V	Tubular	.20
C-61	Part of 76X5 (See Miscellaneous)				
C-64, C-92	B65254	.25 mf	200 V	Tubular	.35
C-70, C-72	47X570	330 mmf	500 V	Molded Mica	.25
C-76	47X599	68 mmf	500 V	Ceramic	.30
C-77	45X382	20 mf	450 V	Dry Electrolytic	1.50
C-82	D65303	.03 mf	400 V	Tubular	.20
C-83	47X560	500 mmf	20KV	Ceramic	2.00
C-85	47X598	56 mmf	1500 V	Ceramic	.35
C-86A, C-86B	76X8	.01 mf		Dual Ceramic	.45
C-88A, C-88B	45X376	30 mf 80 mf	450 V 450 V	Dry Electrolytic	4.10
C-89A, C-89B	45X376	30 mf 80 mf	450 V 450 V	Dry Electrolytic	4.10
C-93	45X361	4 mf	100 V	Dry Electrolytic	1.00
C-94	B65504	0.5 mf	200 V	Tubular	.50
C-99	D65502	.005 mf	400 V	Tubular	.20

RESISTORS

		Ohms	Watts		
R-1, R-4, R-5, R-9, R-57, R-59, R-92	B85102	1 K	0.5	Carbon	.10
R-2	B83822	8.2 K	0.5	Carbon	.20
R-3, R-7	B83470	47	0.5	Carbon	.20
R-6, R-10	B83223	22 K	0.5	Carbon	.20
R-8, R-83	B84151	150	0.5	Carbon	.15
R-11	B84181	180	0.5	Carbon	.15
R-12	B85152	1.5 K	0.5	Carbon	.10
R-13, R-20, R-101	B84223	22 K	0.5	Carbon	.15
R 14	C83272	2.7 K	1.0	Carbon	.25
R-15, R-72	B84333	33 K	0.5	Carbon	.15
R-16	Part of L-7				
R-17	B83562	5.6 K	0.5	Carbon	.20
R-18	C84562	5.6 K	1.0	Carbon	.20
R-19, R-37, R-81	B84103	10 K	0.5	Carbon	.15
R-21, R-30, R-39	B85105	1 meg.	0.5	Carbon	.10
R-22, R-27, R-84	B84473	47 K	0.5	Carbon	.15
R-25	B84123	12 K	0.5	Carbon	.15
R-26	B84222	2.2 K	0.5	Carbon	.15
R-28, R-56	B84101	100	0.5	Carbon	.15
R-29, R-105	78X9	3 K 1 meg.	Contrast and Volume Control		2.70

RESISTORS—Cont.

		Ohms	Watts		List Price
R-31, R-69	B85473	47 K	0.5	Carbon	.10
R-32	40X333	500 K	Brightness Control		.90
R-33, R-38	B85104	100 K	0.5	Carbon	.10
R-34	B84824	820 K	0.5	Carbon	.15
R-36	C83472	4.7 K	1.0	Carbon	.25
R-40	B85223	22 K	0.5	Carbon	.10
R-41	B85222	2.2 K	0.5	Carbon	.10
R-42, R-46	B83332	3.3 K	0.5	Carbon	.20
R-44A, R-44B, R-44C	Part of 76X7 (See Miscellaneous)				
R-45	B84332	3.3 K	0.5	Carbon	.15
R-47	40X293	2.5 meg	Height Control		.70
R-48	40X334	1 meg.	Vertical Hold Control		.90
R-49, R-50	B84155	1.5 meg	0.5	Carbon	.15
R-51	B84472	4.7 K	0.5	Carbon	.15
R-52	B84185	1.8 meg	0.5	Carbon	.15
R-53	B84821	820	0.5	Carbon	.15
R-54	40X294	5 K	Vertical Linearity Control		.95
R-55, R-109	B84561	560	0.5	Carbon	.15
R-58	B85181	180	0.5	Carbon	.10
R-60	B84121	120	0.5	Carbon	.15
R-61, R-87, R-89	B84474	470 K	0.5	Carbon	.15
R-62, R-106	B84683	68 K	0.5	Carbon	.15
R-63, R-64, R-76	B84562	5.6 K	0.5	Carbon	.15
R-65	B85106	10 meg.	0.5	Carbon	.10
R-66	C84391	390	1.0	Carbon	.20
R-67	D84102	1 K	2.0	Carbon	.30
R-68A, R-68B	Part of 76X5 (See Miscellaneous)				
R-70	B85475	4.7 meg	0.5	Carbon	.10
R-71, R-98, R-112	B85474	470 K	0.5	Carbon	.10
R-73, R-74, R-100, R-111	B84104	100 K	0.5	Carbon	.15
R-75	B84152	1.5 K	0.5	Carbon	.15
R-77	40X331	150 K	Horizontal Drive Control		.75
R-78, R-114	B84184	180 K	0.5	Carbon	.15
R-79	B84823	82 K	0.5	Carbon	.15
R-80	40X336	25 K	Horizontal Hold Control		.85
R-82	B84105	1 meg.	0.5	Carbon	.15
R-85	B84273	27 K	0.5	Carbon	.15
R-86	C84153	15 K	1.0	Carbon	.20
R-88	43X266	6.8 K	5.0	Wirewound	.50
R-90	43X263	150	5.0	Wirewound	.30
R-91	43X268	4.5 K	15.0	Wirewound	.45
R-93	43X247	10 K	5.0	Wirewound	.65
R-94	43X261	1500	15.0	Wirewound	.55
R-95, R-96	43X245	500	10.0	Wirewound	.50
R-99	B84334	330 K	0.5	Carbon	.15
R-102	B84395	3.9 meg.	0.5	Carbon	.15
R-103	43X239	5.1	0.5	Wirewound	.40
R-104	C85105	1 meg.	1.0	Carbon	.15
R-107	Part of L-8				
R-108	Part of L-10				
R-113	B84225	2.2 meg.	0.5	Carbon	.15
R-115	40X334	1 meg.	Tone Control		.90
R-116	B85274	270 K	0.5	Carbon	.10

TRANSFORMERS AND COILS

L-3	9A1979	Plate Choke	.50
L-5	36A1	Peaking Coil	.45

TRANSFORMERS AND COILS—Cont.

			List Price
L-6	36A5	Peaking Coil	.55
L-7	36A9	Peaking Coil	.50
L-8	36A4	Peaking Coil	.50
L-9	9A2074	4.5 MC Trap	.60
L-10	36A8	Peaking Coil	.55
L-11	36A2	Peaking Coil	.50
L-12, L-13, L-14	9A2033	R-F Heater Choke	.20
L-15	9A2168	Sound Take-Off Coil	1.10
L-16, L-20	Part of Deflection Coil (See Miscellaneous)		
L-17	9A2096	Horizontal Frequency Control	1.10
L-18	9A2172	Horizontal Linearity Control	1.95
L-19	9A2183	Width Control	1.60
L-22	52X88	Filter Choke	4.45
T-2	9A2170	Sound I-F Transformer	1.60
T-3	9A2171	Sound Ratio Det. Transformer	2.90
T-4	51X151	Vertical Output Transformer	3.40
T-5	53X319	Horizontal Output Transformer	11.30
T-6	53X318	Power Transformer	27.70
T-7	54X7	Vertical Osc. Transformer	2.25
T-8, T-9	9A2225	1st & 2nd Pix I-F Coils (Single Wound)	.60
OR			
T-8, T-9	9A2230	1st & 2nd Pix I-F Coils (Dual Wound)	.75
T-10	9A2226	3rd Pix I-F Coil	1.80
T-11	51X150	Audio Output Transformer	2.70

MISCELLANEOUS

12A477	8" P.M. Speaker	7.40
76X5	Multiple Resistor Capacitor Assembly	.65
3A305	Phono Jack	.10
3A402	Switch (Phono-TV)	.45
25A1088	R. F. Tuner Assembly	
76X7	Multiple Resistor-Capacitor Assembly	.90
9A2257	Deflection Yoke Assembly	9.65
2A407	Ion Trap Magnet	.80
13X812	Tube Socket (Pix Tube)	1.00
3A303	Tube Socket (5U4)	.20
3A427	Tube Socket (6AU6-6AL5-6AQ5)	.25
3A455	Tube Socket (6S4)	.30
3A458	Tube Socket (Miniature)	.20
3A462	Tube Socket (12AU7)	.30
3A463	Tube Socket (12AT7)	.40
3A466	Tube Socket (1B3)	.60
3A464	Tube Socket (6BG6-6SN7—Yoke Plug)	.15
3A445	Tube Socket (6W4)	.25
3A408	Antenna Terminal Strip	.40
3A470	Socket (Octal)	.15
6A301	Yoke Plug	.25
6A305	Power Cord Receptacle	.25
6A315	Anode Connector	.05
7A32	No. 51 Pilot Bulb	.15
7A236	Pilot Light Socket Assembly	.20
16X147	Fuse	.40
16X146	Fuse Holder	.25
32X403	Tube Shield (3A458 Socket)	.10
32X405	Tube Shield (3A463 Socket)	.20
S-14X56	Cabinet Back and Power Cord Assembly	
S-25X81	Tube Mtg. Strap Assembly	.80
25X1705	Bracket Tube Front Support (R.H.)	.30
25X1706	Bracket Tube Front Support (L.H.)	.40
25X1738	Bracket Pix Tube Rear Mtg.	2.35
8X227	Collar, Pix Tube Rear Mtg.	.55
6X71	Rubber Grommet (Mtg. Tuner)	.03
20X1514	Eyelet (Mtg. Tuner)	.01
20X1652	Wing Screw	.05
17X166	Pix Crystal	10.55
4X1180	Pix Mask	6.70
S-4X17	Escutcheon Control Panel Assembly	2.50
10A778	Knob (Channel Selector)	1.55
10A785	Knob (Fine Tuning)	1.50
10A786	Knob (Contrast)	1.15
10A779	Knob (Off-Volume)	1.45
14X485	Ventilator Grille	.30
4X1157	Pix Tube Mtg. Ring	4.75
28X598	Spring	.05
2A419	Centering Device	1.25

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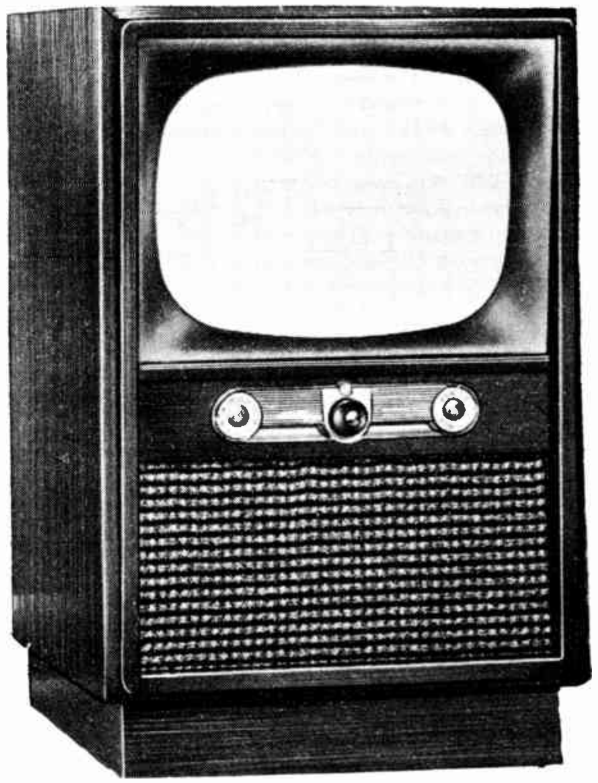
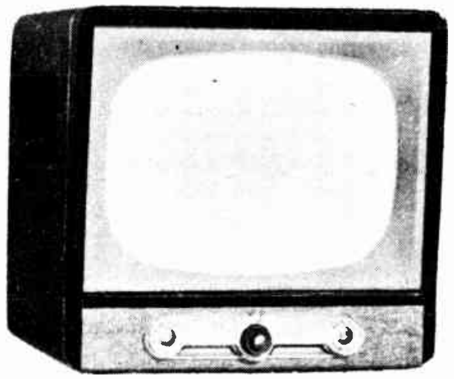
GENERAL DESCRIPTION

The models covered in this manual are an 18 tube, including the picture tube, 20 tubes with the UHF Tuner incorporated, AC operated, direct view, 17 and 21-inch rectangular television receivers. The receivers are complete in one unit and feature full coverage of all 12 V.H.F. channels and complete coverage of the entire UHF band with the UHF Tuner, automatic gain control, automatic horizontal frequency control, inter-carrier sound system, electrostatic focusing, magnetically deflected picture tube and a sync stabilizer switch and control to adjust the operational characteristics of the receiver for various signal areas.

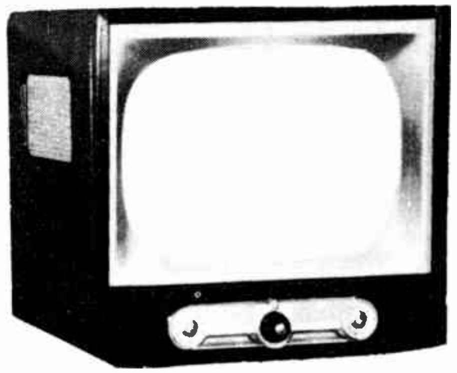
At the rear of the receivers is a safety interlock to prevent dangerous electrical shock and as an added safety measure, a fusible resistor is located in the low voltage power supply to protect the receiver in case of overloading.



2D1315A, 21" TV Mahogany.
2D1325A, 21" TV Blond.



2D2312A, 17" TV Brown Leatherette
2D2314A, 21" TV Green Leatherette



2D2321A, 21" TV Mahogany Finish
2D2322A, 21" TV Mahogany Finish with UHF Tuner installed.

WARNING

At all times during operation the top chassis plate is at 125 volts DC potential above ground and it also may be at the line-voltage potential depending on how the line cord plug is inserted in the power receptacle.

Extreme caution must be observed when working with the chassis outside the cabinet and when power is applied to the receiver with the cabinet back removed. SEVERE SHOCK may result from contact with chassis.

Use an isolation transformer between the line cord plug and power receptacle when service is required. This removes all shock hazards and is the ONLY safeguard. Damage to the receiver and test equipment may result without the use of an isolation transformer.

MODEL IDENTIFICATION CHART

MODEL	CHASSIS	CABINET	TYPE
2D-1315A	21T1A	Console	Mahogany
2D-1325A	21T1A	Console	Blond
2D-2312A **	17T1B	Mantel	Leatherette
2D-2314A	21T1A	Mantel	Leatherette
2D-2321A	21T1A	Mantel	Mahogany
2D-2322A*	21T2A	Mantel	Mahogany

* UHF Tuner Incorporated ** 17-Inch Receiver

CONTROLS

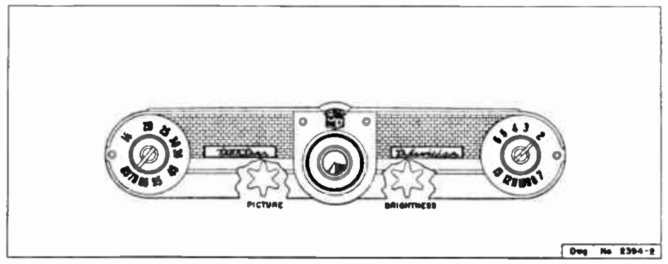


Figure 1. Front Controls.

OPERATOR'S CONTROLS

On-Off Volume – Turns the receiver on or off and adjusts the sound volume level.
Contrast or Picture – Varies the contrast between the light and dark portions of the picture.
Tuning – Tunes the receiver to the desired station or channel. May be turned in either direction.

Brightness – Controls the brilliance of the picture.

V. Hold – Controls synchronization of the picture vertically.

H. Hold – Controls synchronization of the picture horizontally.

SERVICEMAN'S CONTROLS

V. Size – Controls the size of the picture vertically.

V. Linearity – Controls vertical distribution of picture.

Fringe-Suburban-Local Switch – Three position switch for selection of the proper operational characteristics of the receiver for various signal level areas.

Sync Stabilizer Adjust – Changes the operational characteristics of the receiver for the area in which the receiver is located. Control has no effect in "local" switch position.

H. Size – Controls the size of the picture horizontally. To some extent, affects the vertical size control setting.
H. Linearity Magnet – (17" only) – Controls horizontal distribution of right side of picture.
Anti-Pin Cushion Magnet – (21" only) – Eliminates pin-cushioning and keystoning.
Centering Magnet – Controls positioning of the picture for proper framing.
Ion Trap Magnet – Controls focus and picture tube illumination.

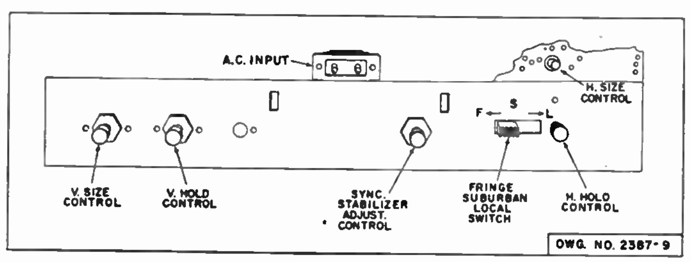


Figure 2. Rear Controls.

The front and rear controls are located as shown in figures 1, 2 and 3. Refer to figure 6 for the location of the vertical linearity control. Note that the vertical hold control in figure 2 has a red rubber knob for easy identification.

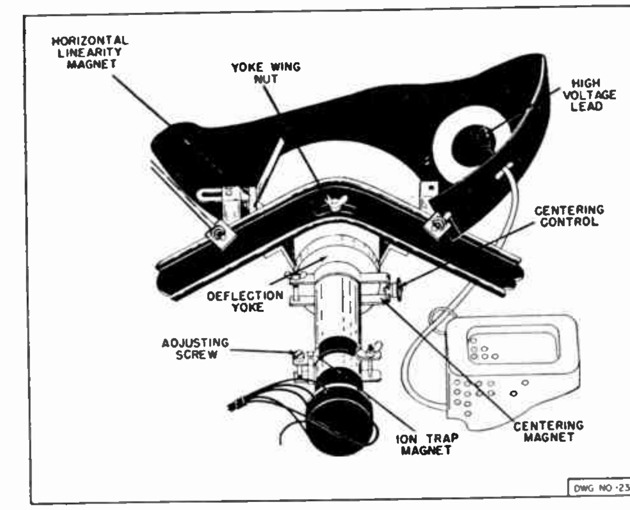


Figure 3A. 17-inch Tube Assembly.

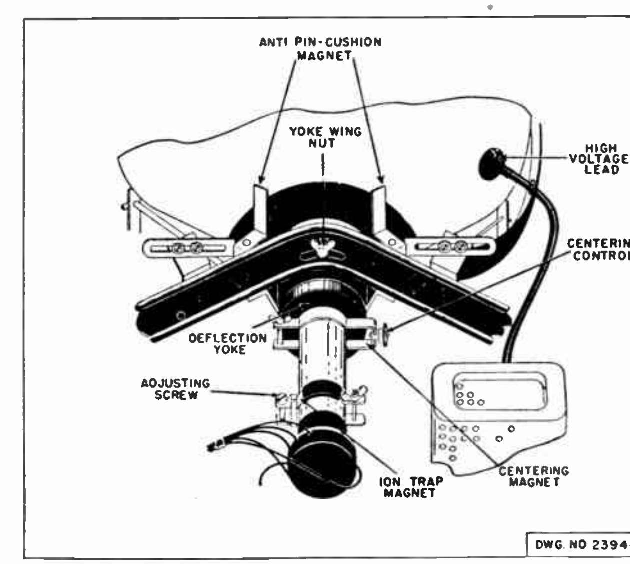


Figure 3B. 21-inch Tube Assembly.

SERVICE DATA

SPECIFICATIONS

Sensitivity at the Antenna
Video - 150 microvolts
Audio - 150 microvolts
(one volt above noise at detector)

Antenna Impedance Requirements
Balanced 300-ohm

Audio Power Output Rating
2 watts undistorted

Speaker
Permanent magnet type
3.2 ohm voice coil impedance

Power Supply Rating
115 volts 60 Cycles, AC
Power Consumption, 220 watts

Intermediate Frequencies
Video - 26.75 mc.
Audio - 22.25 mc.
Intercarrier Sound- 4.5 mc.

Dimensions
17" Chassis - 16" x 16½" x 2½"
21" Chassis - 19" x 17½" x 2½"

TUBE COMPLEMENT

Schematic Ref. No.	RTMA Type	Tube Function
1	6BK7	VHF, RF Amplifier
2	12AT7	VHF Oscillator-Converter
3-4-5	6CB6	IF Amplifiers
6	6AH6V	Video Amplifier
7	17HP4	Cathode-Ray Tube
7	21FP4A	Cathode-Ray Tube
8	6AU6	Audio IF Amplifier
9	6AL5	Audio Detector
10	6AV6	Audio Amplifier
11	25L6GT	Audio Output
12	6BE6	Sync Clipper
13	12SN7GT	Vert. Blocking Osc. and Output.
14	6AL5	A.F.C. Discriminator
15	6SN7GT	Horizontal Multivibrator
16	25BQ6GT	Horizontal Pulse Amplifier
17	6AX4GT	Damper
18	1X2A	High Voltage Rectifier
19	6AF4	UHF Oscillator
20	6BK7	UHF Pre-IF Amplifier

WARNING:

High voltage on the plate caps of the 1X2A high voltage rectifier and the 25BQ6 horizontal pulse amplifier. DO NOT MEASURE this voltage.

Schematic Diagram:

The schematic diagram located at the rear of this manual shows all the values of resistance and capacitance and gives all the proper voltages at the pins of the tube sockets. The voltage readings were taken with a 20,000 ohm/volt voltmeter with normal operation, no signal input, and line voltage at 115 volts A.C.

Replacing Tubes

Before replacing the tubes the cabinet back must first be removed. Removing the cabinet back disengages the safety interlock and removes the power to the receiver. Do not tamper with or attempt to defeat the purpose of the safety interlock as severe shock may result.

Before replacing the High Voltage tubes first be sure the power is turned off and then short the corona ring of the 1X2A to the chassis.

WARNING:

Do not remove any tubes while the receiver is in operation as over-loading and component failures may result. Also contact with the top chassis plate during operation may produce a severe shock.

If the receiver has been in operation for some time, the tubes become hot and gloves should be used when replacing tubes to prevent finger burns.

Picture Tube Handling:

Due to the large surface and extreme high vacuum of the picture tube, care should be used when handling the chassis outside the cabinet. Do not subject the tube to excessive pressure of rough handling as an implosion may result causing serious personal injury.

High Voltage Power Supply:

In the process of inspection, repairs, changing of tubes or transformers, or for any other reason where it is necessary to work within the high voltage power supply, the following should be closely observed.

1. Terminals on the 1X2A socket must be dressed toward the inside of the corona ring and be free of sharp protrusions.
2. The corona ring must be dressed in such a way as to make its presence useful; that is, properly centered and about 1/8-inch below the socket terminals.
3. All leads must be dressed as far away as possible from the transformer winding. Excess lead length should be transferred to the top side of the chassis.

When replacement of the H.V. deflection transformer is necessary, be sure to closely follow the precautions listed above. The transformer can easily be replaced with the chassis in the cabinet by the following procedure.

1. Remove two (2) hex head screws on either side of the H. Size control.
2. Disengage the H.V. lead holder ring. (back side of shield can)
3. Remove 25BQ6 plate cap.
4. Remove shield can by pushing back side of shield can toward front and lifting up.

SERVICE ADJUSTMENTS

Vertical Size and Vertical Linearity Controls (R-73 and R-75):

The vertical size and linearity controls should both be adjusted at the same time while a test pattern is being transmitted. The linearity control affects the upper portion of the picture while the size control affects the overall size especially the lower portion of the picture. Adjust both controls simultaneously until the test pattern is symmetrical and fills the entire screen vertically. Readjust the vertical hold control if necessary.

CAUTION:

The vertical linearity control is on the top chassis plate, therefore, severe shock may result from contact. If an isolation transformer is unavailable, use an insulated screwdriver for the adjustment to reduce shock hazards. The adjustment can be made from either the top or bottom of the chassis.

Fringe-Suburban-Local Switch (Figure 2):

The three position switch selects the proper operational characteristics of the receiver for the signal strength area in which located. The position of the switch is governed by the signal strength available.

In the Fringe position the A.G.C. voltage is reduced to a bare minimum and the sync stabilizer adjust control affects the sync clipping level to reduce noise affects.

In the Suburban position full A.G.C. is applied and the sync stabilizer adjust control functions as in the fringe position.

In the Local position full A.G.C. is applied and the sync stabilizer adjust control is disabled.

Sync Stabilizer Adjust Control (R-61):

The control varies the operational characteristics of the sync clipper stage to obtain the optimum operation point for the least effect of noise interrupting synchronization. The control should be adjusted for a steady picture.

Ion Trap Magnet (Figure 3):

The position of the ion trap magnet MUST be over the grid of the picture tube (second cylinder from the base identified by a flared forward lip). If the adjustment is necessary, loosen the wing nut and rotate until the position which gives maximum illumination is found. Adjust the screw for maximum illumination. Repeat the above two steps. Rotate and slide magnet until the best focus position is found. Tighten wing nut. Adjustment should be made with brightness and picture controls set for normal viewing.

Horizontal Size Control (Figure 2):

The horizontal size control should be adjusted until the picture fills the entire screen horizontally. A clockwise rotation will decrease size. To some extent the vertical size control setting may be affected by a major horizontal size adjustment.

Horizontal Hold Control (L-30):

The horizontal hold control is located on the rear flange of the chassis and should be adjusted in the following manner.

Set the picture control to its normal operating position. Turn the thumb screw clockwise until it reaches its stop. Turn two complete turns counter-clockwise. The thumb screw is a vernier adjustment and will then be in the center of its range.

Turn the iron core with a small screwdriver or adjusting tool until the picture is steady (no horizontal movement). Set the core to the middle of its range.

After the iron core has been properly adjusted the thumb screw should then be used as a vernier adjustment to control synchronization when necessary.

Centering Magnet (Figure 3):

The centering magnet should be rotated and the control adjusted until the picture is properly framed keeping in mind that the effect of the control is governed by the position of rotation. If the control is above or below the neck of the picture tube, the picture will be moved up or down. To the left or right of the neck of the picture tube, the picture will be moved either to the left or right.

Deflection Yoke (Figure 3):

The correct position for the deflection yoke is as far forward on the neck of the picture tube as the shape of the tube will allow. Tube shadow or a tilted raster may result from an incorrectly positioned yoke. If a positioning adjustment is necessary, loosen the yoke wing nut located at the top of the picture tube assembly (fig 2).

Horizontal Linearity Magnet - 17" only (Fig. 3A):

The horizontal linearity magnet affects the linearity of the right side of the picture only. The magnet pulls or stretches the right side and has a greater effect closer to the picture tube.

Anti-Pin Cushion Magnet - 21" only (Figure 3B):

Adjust centering until an edge of the raster is visible. Loosen the positioning screws and slide the magnet backward or forward until the edge of the raster is vertically straight. If keystoning is noticed adjust magnets in vertical plane.

SERVICE DATA

TELEVISION FREQUENCY RANGES

(All figures represent megacycles)

Channel	Channel Frequencies	Picture Carrier Frequency	Sound Carrier Frequency	Receiver RF Oscillator Frequency
Low Band				
2	54-60	55.25	59.75	82
3	60-66	61.25	65.75	88
4	66-72	67.25	71.75	94
5	76-82	77.25	81.75	104
6	82-88	83.25	87.75	110
High Band				
7	174-180	175.25	179.75	202
8	180-186	181.25	185.75	208
9	186-192	187.25	191.75	214
10	192 198	193.25	197.75	220
11	198-204	199.25	203.75	226
12	204-210	205.25	209.75	232
13	210-216	211.25	215.75	238

COIL DC RESISTANCE CHART

The DC resistance readings shown in the chart below have been taken with a ohmmeter directly across the coil being measured. The coils not listed in the chart have a DC resistance reading of less than one ohm. A tolerance of ± 5% is permissible.

COILS	RESISTANCE IN OHMS	COILS	RESISTANCE IN OHMS
L9	2	T4 pri.	170
L17	1.5	T5 pri.	960
L20	1.5	sec.	160
L22	2.2	T6 pri.	1100
L23	2	sec.	6.6
L24	2	T7A	68
L25	2	B	12.5
L27	8	T8 25BQ6 plate to 1X2A plate	180
L28	8	25BQ6 plate to term 4	9.5
L29	1.5	25BQ6 plate to term 3	17.5
L30	80	25BQ6 plate to term 1	25.5
L31	2.3	term 7 to term 8	2.6
L32	72	term 7 to term 10	5.4
L33	8.5	T9 pri.	7
T3 pri.	4.7		

R.M.A. WIRE COLOR CODE

Listed below is a R.M.A. wire color code chart to aid in circuit tracing.

Wire Color	Where used
Black	B- or Ground leads
Brown	Filament leads
Red	B+ leads
Orange	Screen leads
Yellow	Cathode leads
Green	Grid or Control leads
Blue	Plate leads
Violet	Not used
Gray	A.C. leads
White	Bias leads

REMOVABLE SAFETY GLASS

To clean the inside of the safety glass or the face of the picture tube, simply follow the procedure below.

1. Remove the three (3) phillips head screws in the safety glass holder directly above the escutcheon.
2. Remove the safety glass holder.
3. Carefully remove the safety glass by pulling out and down from the bottom.

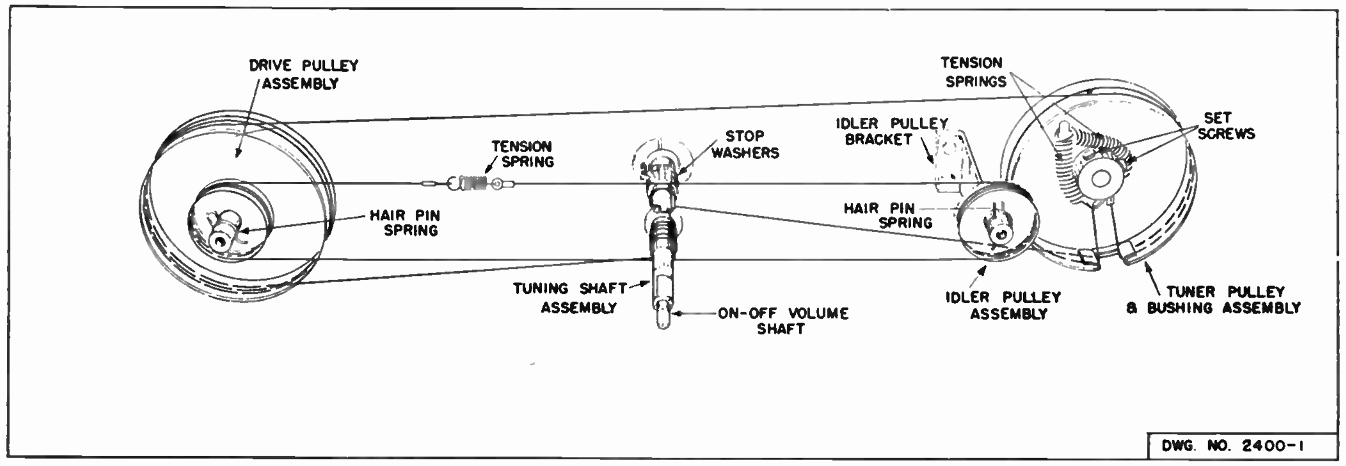


Figure 4. Dial Stringing.

DIAL CORD REPLACEMENT

DIAL CORD STRINGING: If dial cord replacement is necessary turn the tuning shaft counter-clockwise. Two separate dial cords are used and can be restrung separately.

Idler Pulley Stringing: Follow the diagram and start by attaching the dial cord to the tension spring, route to idler pulley and make 2½ clockwise turns around pulley. Route under tuning shaft to small drive pulley, make 2½ clockwise turns around pulley and connect to tension spring.

Tuner Pulley Stringing: Follow the diagram and start by attaching the dial cord to the tension spring shown at the extreme right on the tuner pulley. Route the cord through the opening in the pulley and make a ½ counter-clockwise turn around the pulley and route to the large drive pulley. Make 2½ counter-clockwise turns around the pulley and route under the tuning shaft. Make 5½ counter-clockwise turns around the tuning shaft in front of the washer. Make one counter-clockwise turn around lug on washer and continue in the counter-clockwise direction and make 1½ turns around the tuning shaft behind the washer. Route to the tuner pulley and make one complete turn before routing through the opening and then attach to the tension spring. Add second tension spring as shown.

MECHANICAL TRACKING: If for any reason the stop washers do not correspond to the stop position of the tuner, loosen the set screws on the tuner pulley and bushing assembly and reposition. Turn the tuning shaft to the extreme counter-clockwise position (stop washers in position shown in diagram) and tuner shaft also to the extreme counter-clockwise position. Retighten set screws.

GENERAL DESCRIPTION

VHF Tuner:

The Tuner is composed of a separate sub-chassis consisting of a 6BK7 (twin triode) cascode RF Amplifier and a 12AT7 tube (twin triode) for the oscillator and converter. Separate high and low band coils and trimmers are used with an automatic switching device to change bands. The tuner selects and amplifies the stations signal and converts it to the carrier IF frequency of 26.75 MC for video and 22.25 MC for sound which in turn is then fed to the IF amplifiers for further amplification.

Video IF Amplifier:

The Video IF Amplifiers are mounted on a separate sub-chassis along with a crystal video detector and the A.G.C. network. The IF amplifier section consists of three (3) staggered tuned stages with an over coupled output IF transformer using 6CB6 (pentode) tubes with self resonant core tuned coils. Since the receiver is of the intercarrier type both the video and sound IF frequencies are amplified simultaneously and then detected by a Raytheon CK-706 crystal. The signal is then coupled to the video amplifier and the first grid of the sync clipper. The A.G.C. network of R-59 and C-78 develops a negative bias voltage proportional to the average composite video signal.

Video Amplifier:

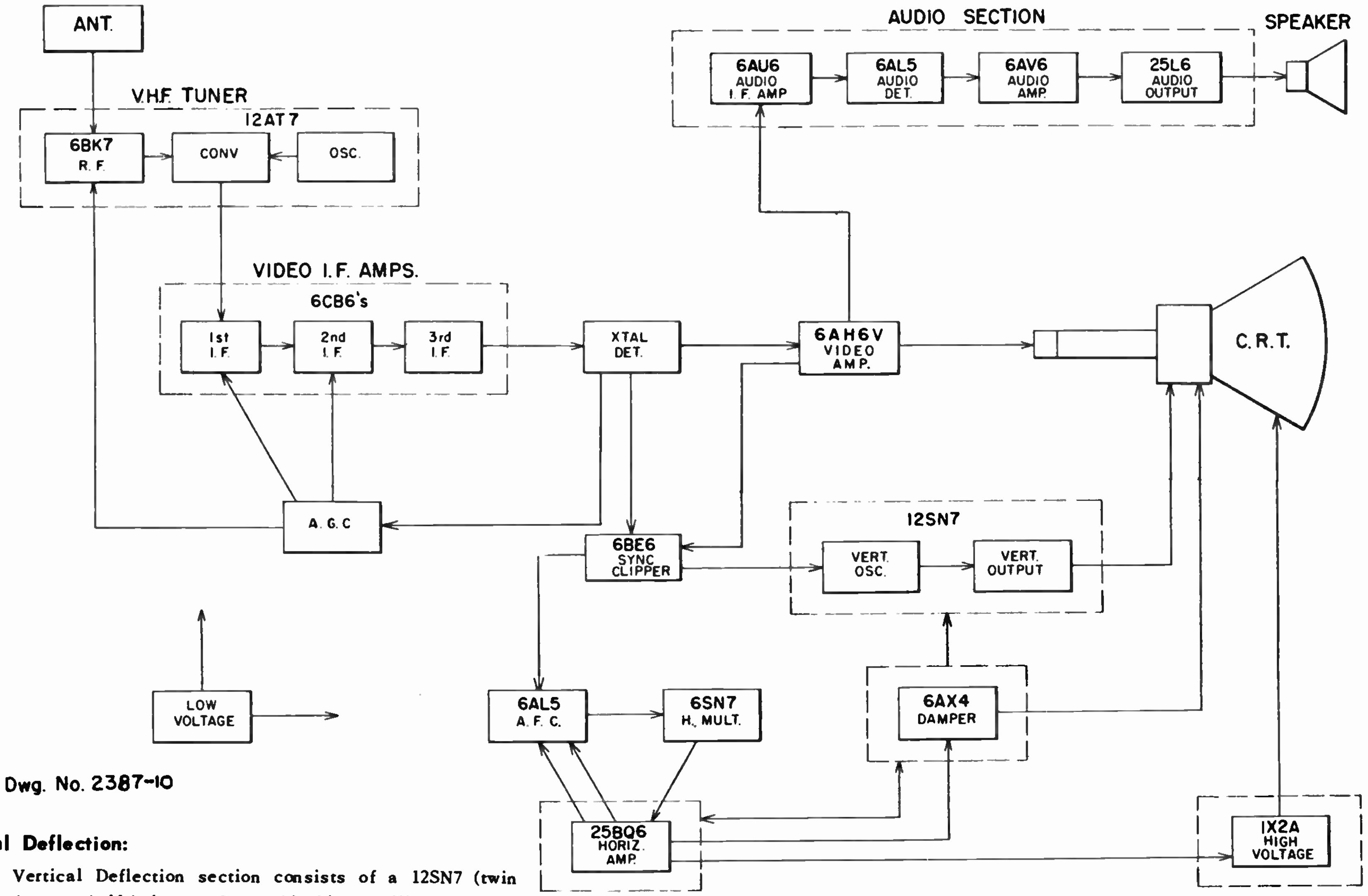
The Video Amplifier section consists of a 6AH6V (pentode) tube with a degenerative picture (or contrast) control (R-33) to vary the signal to the cathode of the picture tube. The audio signal is also amplified in this stage and then separated by a 4.5 MC trap (L-29). This trap also serves to separate or keep the audio from appearing in the picture.

Sound Section:

The Sound Section consists of a 6AU6 (pentode) 4.5 MC audio IF amplifier, 6AL5 (twin diode) ratio detector, 6AV6 (triode) audio amplifier and a 25L6 (beam power amplifier) output tube. Due to the hetrodyne action between the video and sound IF frequencies at the video detector a 4.5 MC signal is obtained containing the audio information. After the video detector the audio information is amplified by the video amplifier, separated from the video by the trap (L-29), amplified, detected and further amplified before being coupled to the speaker.

Sync Clipper:

The Sync Clipper stage utilizes a 6BE6 (heptode) tube which functions as a sync separator and noise clipper. The signal from the output of the video amplifier is coupled to pin 7 through R-34 and C-77. With the positive going signal at pin 7 and the low plate voltage sync separation is accomplished. When noise bursts are present the negative going signal from the video detector, coupled through R-58 to pin 1, cuts the tube off and eliminates false sync information in the output. A sync stabilizer adjust control (R-61) is provided to adjust the cut-off or clipping level by varying the bias voltage to pin number 1. A three position F-S-L switch is also provided to change the operational characteristics of the receiver for various signal level areas. The switch disconnects the control (R-61) from the circuit and applies a fixed bias voltage only in the "local" position. In the "fringe" position the A.G.C. source is connected to 240 volt B plus through 10 megohms of resistance (R-56, R-60). No bias voltage to the RF and IF tubes is utilized in this position allowing maximum amplification. In the "suburban" and "local" positions, full A.G.C. is applied. sync pulses are separated from the video signal without the noise effects and then coupled to the vertical blocking oscillator cathode and horizontal A.F.C.



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Vertical Deflection:

The Vertical Deflection section consists of a 12SN7 (twin triode) tube, one-half being used as a blocking oscillator and the other half as an output amplifier. The signal from the plate of the sync clipper is coupled through R-67 and C-81 to the cathode of the blocking oscillator. The vertical hold control (R-69) in the grid circuit varies the oscillator operating frequency, thus providing adjustment for synchronization. The vertical size control (R-73) varies the amplitude of the pulse to the grid of the amplifier and controls the amount of vertical deflection. The vertical linearity control (R-75) varies the cathode resistance, thus adjusting the operating characteristics of the amplifier to provide the proper wave shape to obtain a linear picture vertically. The network of C-84, C-85 and R-70, R-71 is designed to eliminate vertical retrace lines at high brightness levels.

AFC Discriminator:

The Automatic Frequency Control section utilizes a 6AL5 (twin diode) tube which functions as a discriminator. The horizontal sync pulses from the output of the sync clipper are coupled to the AFC tube through capacitor C-79. At the same time two feed back voltages of opposite polarity are intergrated and applied to the plates of the AFC tube. The two feed back voltages are obtained from a separate winding (terminals 7 and 10) of the HV deflection transformer and are of the same frequency as the horizontal multivibrator. Any phase shift between the horizontal sync pulses and the horizontal multivibrator signal will cause one diode section to conduct more than that of the other. This will result in a DC bias voltage applied to the grid of the multivibrator and change the operating frequency. The output of the AFC discriminator thus synchronizes the horizontal multivibrator to the incoming horizontal sync pulse.

Horizontal Multivibrator:

The Horizontal Multivibrator uses a 6SN7 (twin triode) tube and is of the conventional cathode coupled type. The core tuned parallel resonant circuit (L-30 and C-97) is used as a hold adjustment to stabilize the frequency of oscillation. Because of the wide pull-in range of the automatic frequency control tube a fine hold control is not necessary. The output signal of the multivibrator is coupled to the horizontal pulse amplifier through capacitor C-106. Capacitor C-107 is a negative peaking device to aid in cutting off the pulse amplifier tube at the proper time.

Horizontal Pulse Amplifier:

The Horizontal Pulse Amplifier utilizes a 25BQ6 (beam pentode) tube to develop the necessary power for the fly back pulse and the horizontal winding of the deflection yoke.

CIRCUIT DESCRIPTION

Damper:

The Damper tube (6AX4-diode) performs three functions: aids in horizontal scanning, suppresses oscillations which occur over part of the horizontal scanning cycle and gives an increase in plate supply voltage for the vertical blocking oscillator, vertical output amplifier and first anode of the picture tube.

Hi-Voltage Supply:

The High Voltage (second anode) is obtained from the auto-transformer type primary winding of the HV deflection transformer (T-8). When the plate current of the H pulse amplifier tube is cut off, the field built up in the primary winding collapses and induces a high voltage surge which is rectified by the 1X2A tube, filtered by the capacity of the aquadag coating of the picture tube and applied to the second anode. The 1X2A is a conventional half-wave high voltage rectifier and obtains its filament power from a separate secondary winding of the HV deflection transformer.

Low Voltage Supply:

The B plus voltage for the receiver is obtained from the voltage doubler arrangement of two selenium rectifiers and filter capacitors C-90 and C-91. The majority of the receivers tubes obtain its filament power from the filament transformer (T-9), however, three tubes are connected in series with resistor R-101 and placed across the 115 volt AC line. A safety interlock is provided to reduce shock hazards and a resistor type fuse is connected in series to protect the receiver in case of overloading.

SERVICE HINT

V.H.F. Tuner:

Before looking into the tuner for a particular trouble, first make the following observations. Since the receiver is of the inter-carrier type both the sound and video information are amplified simultaneously by the tuner, IF and video amplifiers. Therefore, if the sound section is functioning normally it can be assumed that there are no defects in the tuner, IF or video amplifiers. If the receiver is "dead" (no sound or picture - raster normal) first determine whether a signal is being transmitted and then check the antenna, lead-in and connections to the receiver. Next, rotate the contrast or picture control completely to the left (counter-clockwise) and observe the face of the picture tube. Advance the control to the extreme clockwise position and again observe the face of the picture tube. If no "snow" appears check the video amplifier, detector and second and third IF amplifiers. If, however, an increase of "snow" appears check the first IF amplifier before looking into the tuner.

The tuner can easily be serviced by removing the three hex-head nuts on top and the one on the bottom which holds bottom cover in place. Removing the bottom cover makes all the tuner components within easy reach and all parts can be serviced. When working inside the tuner do not move any component a great distance as a change in the distributed capacity may result and offset the alignment. When replacing components be sure to obtain the same lead length and replace them in the same position.

A majority of tuner troubles are often open and high resistance ground or coil solder connections, defective trimmers or coils and defective switch contacts.

Open or high resistance connections can easily be repaired by placing a hot soldering iron at the solder connection.

Defective switch contacts may cause an intermittent condition or the loss of one or both bands. Contact replacement is easily accomplished by removing the two switch plate tension springs, the hex-head bolt and the switch plate bracket. Lift up the switch plate assembly and remove the switch contact holder and replace contacts.

A. G. C.

The A.G.C. is a negative bias voltage proportional to the average composite video signal, developed by the network of R-59 and C-78 and applied to the RF and first and second IF amplifiers. The magnitude of the A.G.C. voltage will vary according to the strength of the signal being received. However, it will closely correspond to the detector output voltage (across R-27). As a fast and simple check to determine whether the A.G.C. voltage is normal, measure both the A.G.C. and detector output voltage. Under normal operating conditions these two voltages will be approximately the same.

Sync Stability:

For optimum sync stability the following points should be considered. A three position F-S-L switch and a sync stabilizer adjust control are provided along with the two hold controls. The position of the switch is governed by the strength of the signal being received and the control should be adjusted for a steady picture. The position of the switch and the adjustment of the control are important for good sync stability (control will not function in "local" switch position).

For good horizontal sync stability both the horizontal hold thumb screw and coil core should be set to the center of their respective ranges. (Center position before going out of sync in either direction).

For good vertical sync stability the vertical hold control can be adjusted to reduce the effect of noise that may interrupt synchronization in reception areas where noise conditions exist. Rotate the vertical hold control until the picture is moving upward and just locks into place. At this control setting, the noise will have the least tendency to interrupt vertical synchronization.

Vertical Distribution:

A fast and simple method to check the vertical distribution of a TV picture, without a test pattern, rotate the vertical hold control until the picture is moving slowly downward. Observe the black horizontal bar. If the vertical size and linearity controls are properly adjusted, the bar will not change in thickness as it moves from top to bottom.

TROUBLE-SHOOTING

Trouble	Probable Location
No Raster No Sound	1. Defective tubes 11-13-16. 2. Defective selenium rectifier. 3. Defective resistors R52-82-101. 4. Defective capacitors C70-72-74-90-91. 5. Defective transformer T9 or choke L32. 6. Defective safety interlock or on-off switch.
No Raster Sound Normal	1. Insufficient or no high voltage, (refer to "No High Voltage" section). 2. Defective picture tube. 3. Second anode lead disconnected. 4. Ion trap magnet misadjusted. 5. Defective C.R.T. socket.
No High Voltage	1. Defective tubes 15-16-17-18. 2. Defective transformer T8, yoke T7 or coil L30-31. 3. Defective capacitor C105-106-107-108-110-111-112. 4. Defective resistor R92-96-97-98-99-100.
No Picture No Sound Raster Normal	1. Defective antenna or lead-in. 2. Defective tuner tube 1-2. 3. Defective tuner (refer to page 12). 4. Defective tubes 3-4-5-6. 5. Improper voltages or resistances at sockets of tubes 3-4-5-6. 6. Improper alignment. 7. Defective crystal detector. 8. UHF power plug not in place.
No Sound Picture Normal	1. Defective tubes 8-9-10-11. 2. Improper voltages or resistances at socket of tube 8-9-10-11. 3. Defective speaker or leads broken or not in place. 4. Defective transformer T3-4 or coil L29. 5. Improper sound alignment.

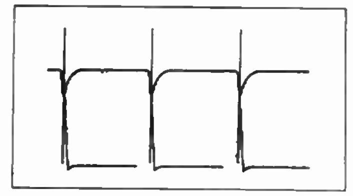
Trouble	Probable Location
No Sync	1. Defective tube 12. 2. Improper voltages or resistances at socket of tube 12. 3. Defective F-S-L switch or in wrong position. 4. Sync stabilizer adjust control misadjusted.
Insufficient or no Vertical Sweep	1. Defective tube 13. 2. Defective transformer T5-6 or yoke T7. 3. Defective capacitor C70-85-86-87. 4. Defective resistor R68-73-74-75-76-77.
Picture Cannot be Centered	1. Defective picture tube. 2. Defective centering magnet. 3. Defective ion trap magnet.
Poor Focus	1. Improper adjustment of Ion trap. 2. Defective picture tube.
Poor Horizontal Linearity	1. Improper adjustment of linearity magnet (17") or anti-pin cushion magnets (21"). 2. Defective tube 16-17. 3. Defective capacitor C105-106-111. 4. Defective transformer T8 or coil L31.
Snow or Poor Picture	1. Insufficient signal input. 2. Defective antenna or lead-in. 3. Improper alignment of C1-A-B. 4. Weak tubes 1-2-3-4-5. 5. Improper video IF alignment.
Lack of Contrast	1. Defective tube 6. 2. Defective crystal detector. 3. Improper video IF alignment.
Washed Out or Picture Smear	1. F-S-L switch in wrong position. 2. Defective crystal detector. 3. Gassy tube 1-3-4. 4. Improper video IF alignment.

WAVE FORM ANALYSIS

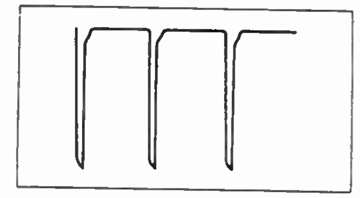
The drawings on this page illustrate the wave forms at various positions within the receiver. The wave forms are not theoretical but exact copies of that shown by an oscilloscope and were taken under normal operating conditions, with a transmitted signal and the picture in sync at all times.

When checking the wave forms, connect the ground lead from the oscilloscope to the top chassis plate and the hot lead to the position indicated. The wave shapes may vary somewhat depending on the strength of the signal, the picture information being transmitted and the adjustments of the various controls.

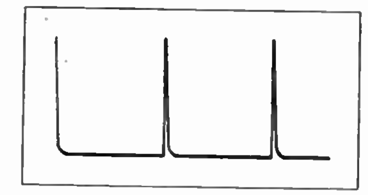
Under each wave form is the schematic reference, position taken at, peak-to-peak voltage and the type of wave form indicated (Vertical -60 cycles and Horizontal -15,750 cycles).



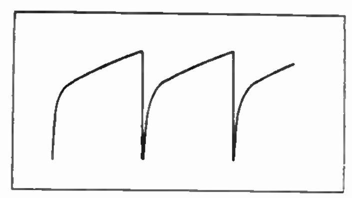
VERTICAL PULSE
Pin 5 of Tube 12.
Plate of Sync Clipper
25 volts Peak-to-Peak



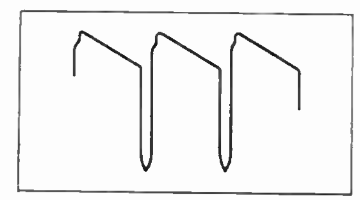
HORIZONTAL PULSE
Pin 5 of Tube 12.
Plate of Sync Clipper
25 volts Peak-to-Peak



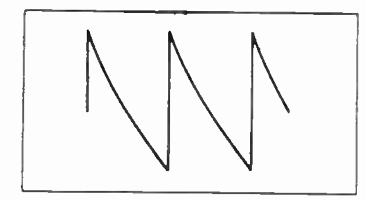
VERTICAL PULSE
Pin 3 of Tube 13
Cathode of V. Blocking Osc.
125 volts Peak-to-Peak



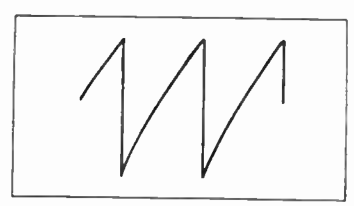
VERTICAL PULSE
Pin 4 of Tube 13
Grid of V. Output
95 volts Peak-to-Peak



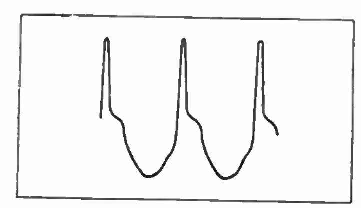
HORIZONTAL PULSE
Pin 1 or 5 of Tube 14
Cathode of A.F.C. Discr.
15 volts Peak-to-Peak



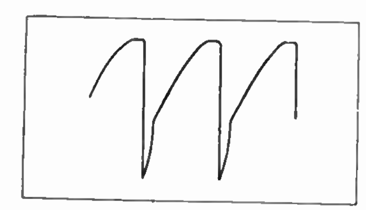
HORIZONTAL PULSE
Pin 2 of Tube 14
Plate of A.F.C. Discr.
4 volts Peak-to-Peak



HORIZONTAL PULSE
Pin 7 of Tube 14
Plate of A.F.C. Discr.
6 volts Peak-to-Peak



HORIZONTAL PULSE
Pin 5 of Tube 15
Plate of H. Mult.
35 volts Peak-to-Peak



HORIZONTAL PULSE
Pin 5 of Tube 16
Grid of H. Pulse Amp.
100 volts Peak-to-Peak

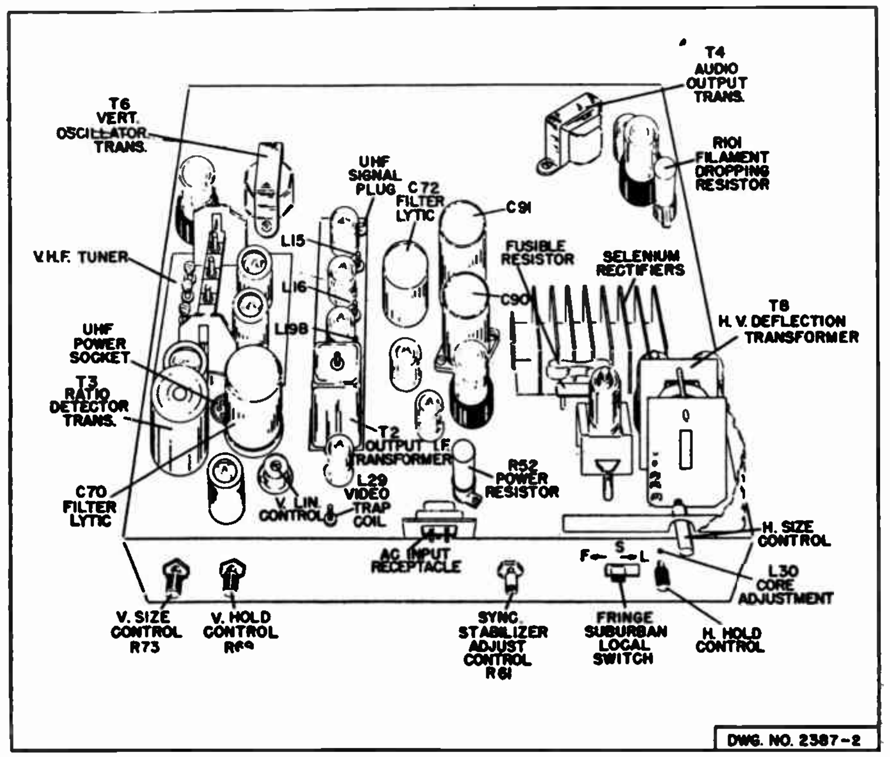


Figure 6. Top Chassis View.

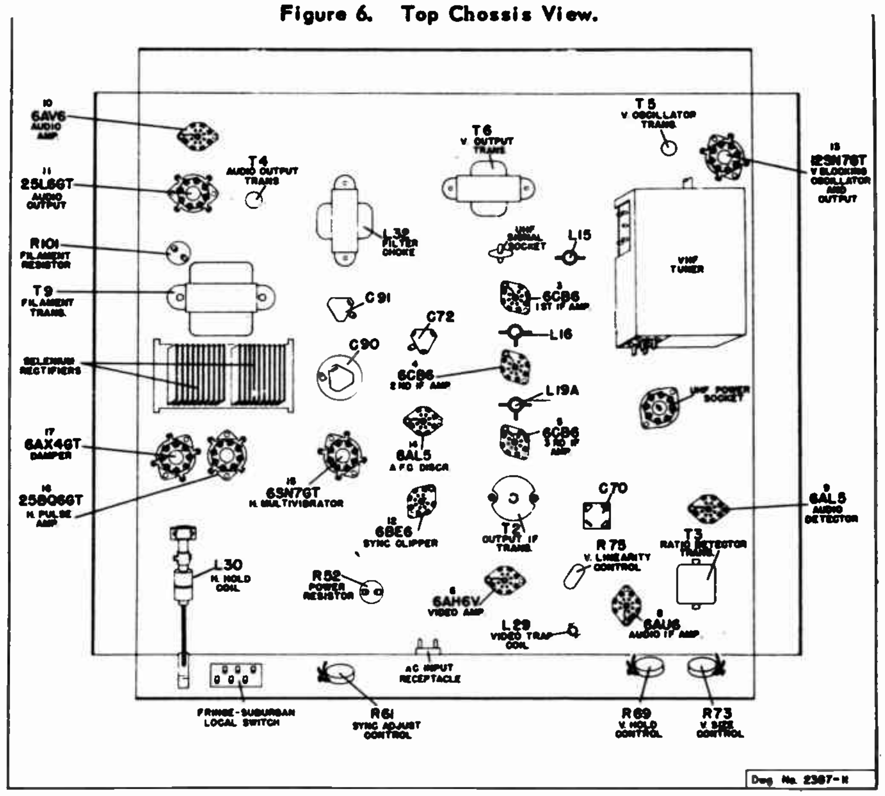


Figure 7. Bottom Chassis View.

PRE-ALIGNMENT PRECAUTIONS

1. If sweep generator does not have a balanced output, connect a 150 ohm resistor in series with the ground lead and 150 ohms minus the internal resistance of the generator in series with the hot lead.
2. Connect a 1000 mmf capacitor across scope terminals and a 10K ohm resistor in series with hot scope lead as close to test point as possible.
3. Connect signal generator through a 1000 mmf capacitor.
4. Set F-S-L switch to "Fringe" position.
5. When aligning the IF Amplifier be sure tuner is turned to high band channel 13.

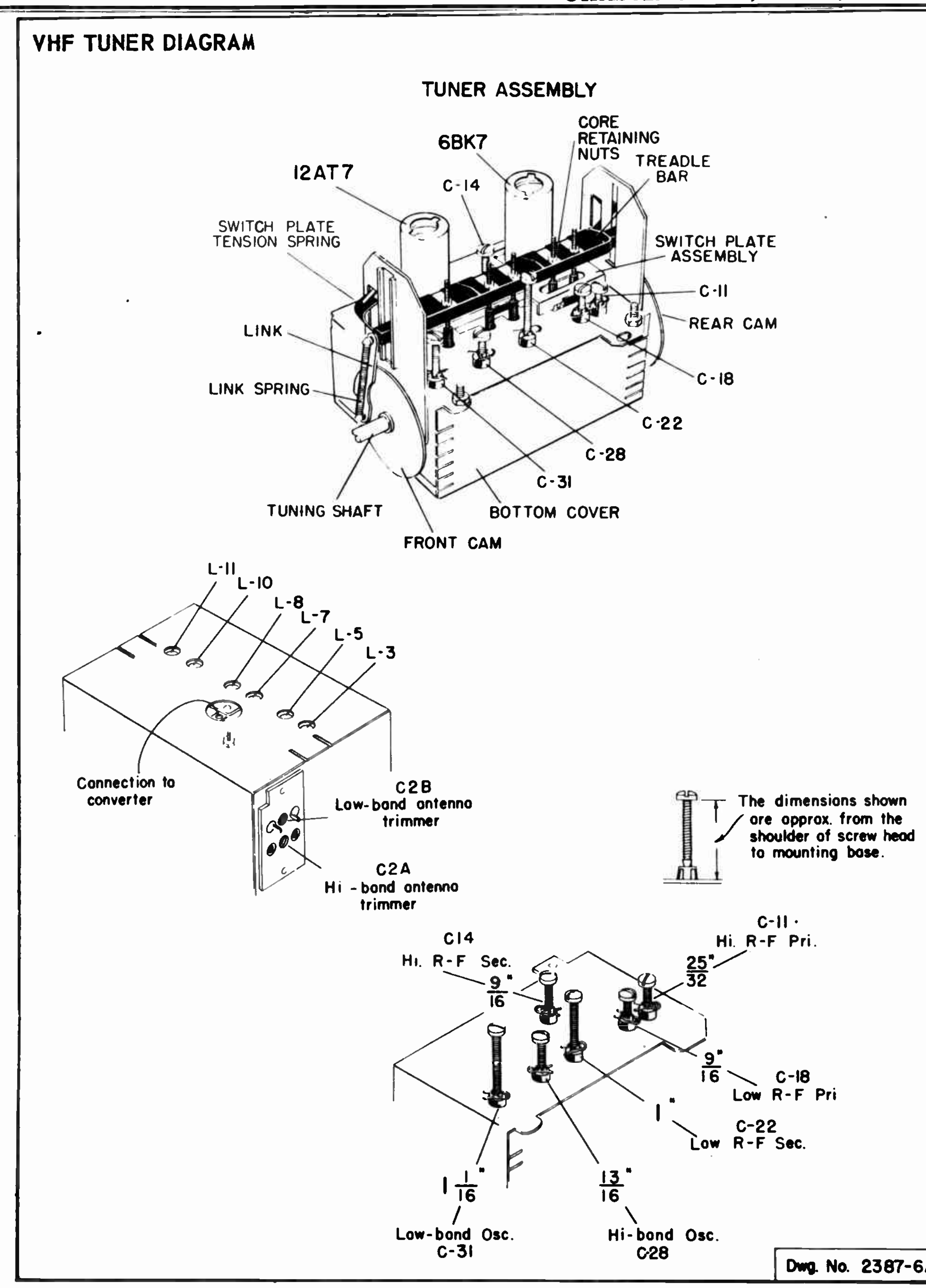


Figure 8. VHF Tuner Diagram.

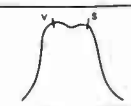
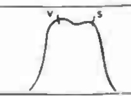
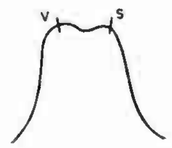
TUNER ALIGNMENT

1. Preset trimmer screws C11-14-18-22-28-31- to dimensions shown on page 16.
2. Preset coil cores L3-5-7-8-10-11 in the following manner:
   - (a) In low band position, turn tuner to top of stroke (cores furthest out of coil).
   - (b) Switch will be in low band position.
   - (c) Adjust coil cores 1.6 inch from core to end of coil form (use core aligning tool if available).

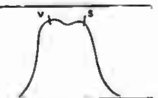
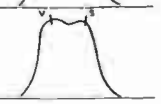
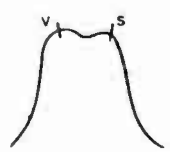
V-video
S-sound

LOW BAND RF TRACKING Turn Tuner to channel 6.

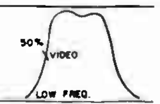
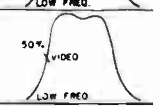
NOTE: Low Band must be aligned before high band.

No. Step	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	V–83.25 S–87.75	Channel 6	Antenna Terminals	Test Point (terminal 6) *	Adjust for maximum response	C-2B	
2	V–83.25 S–87.75	Channel 6	Antenna Terminals	Test Point (terminal 6) *	Adjust for maximum response	C-18 C-22	
3	V–77.25 S–81.75 V–67.25 S–71.75 V–61.25 S–65.75 V–55.25 S–59.75	Channel 5 Channel 4 Channel 3 Channel 2	Antenna Terminals	Test Point (terminal 6) * See sketch on schematic	Adjust tuner until response curve appears on scope. Adjust trimmers for compromise which will give the best overall response across band.	C-18 C-22	

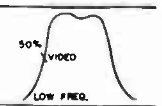
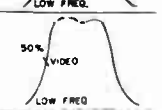
HIGH BAND RF TRACKING Turn Tuner to channel 13.

No. Step	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	V–211.25 S–215.75	Channel 13	Antenna Terminals	Test Point (terminal 6) *	Adjust for maximum response	C-2A	
2	V–211.25 S–215.75	Channel 13	Antenna Terminals	Test Point (terminal 6) *	Adjust for maximum response	C-11 C-14	
3	V–205.25 S–209.75 V–199.25 S–203.75 V–193.25 S–197.75 V–187.25 S–191.75 V–181.25 S–185.75 V–175.25 S–179.75	Channel 12 Channel 11 Channel 10 Channel 9 Channel 8 Channel 7	Antenna Terminals	Test Point (terminal 6) * See sketch on schematic	Adjust tuner until response curve appears on scope. Adjust trimmers for compromise which will give the best overall response across band.	C-11 C-14	

LOW BAND OSCILLATOR TRACKING Turn Tuner to channel 6.

No. Step	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	83.25	Channel 6	Antenna Terminals	Scope at junction of L25, R27, C58	Adjust until marker is 50% down on low frequency slope	C-31	
2	67.25 55.25	Channel 4 Channel 2	Antenna Terminals	Scope at junction of L25, R27, C58	Marker should be 50% down on low frequency slope	———	

HIGH BAND OSCILLATOR TRACKING Turn Tuner to channel 13.

No. Step	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	211.25	Channel 13	Antenna Terminals	Scope at junction of L25, R27, C58	Adjust until marker is 50% down on low frequency slope	C-28	
2	193.25 175.25	Channel 10 Channel 7	Antenna Terminals	Scope at junction of L25, R27, C58	Marker should be 50% down on low frequency slope	———	

V.H.F. TUNER

Ref. No.	Part No.	Description
		Capacitors
C1	8G-11892	22 mmf, 500 volt, ceramic, (included with T1)
C2A-B	8E-17142	5-20 mmf. dual trimmer
C3	8G-13962	5000 mfd, 500 volt, ceramic
C4	8G-20880	6 mmf. feed thru
C5	8G-20878	1000 mmf. feed thru
C6	8G-12495-8	1.5 mmf. 500 volt, ceramic
C7	8G-16045	220 mmf, 500 volt, ceramic
C8	8G-20878	1000 mmf. feed thru
C9	8G-13201	1000 mmf. 500 volt, ceramic
C10	8G-20850	1000 mmf. feed thru
C11	201-15142	.5-10 mmf, trimmer
C12	8G-13017	15 mmf, 500 volt, ceramic
C13	8G-13201	1000 mmf, 500 volt, ceramic
C14	201-15142	.5-10 mmf, trimmer
C15	8G-19314	4 mmf, 500 volt ceramic
C16	8G-20878	1000 mmf, feed thru
C17	8G-13201	1000 mmf, 500 volt, ceramic
C18	201-15142	.5-10 mmf, trimmer
C19	8G-12495-1	.68 mmf, 500 volt, ceramic
C20	8G-13201	1000 mmf, 500 volt, ceramic
C21	8G-12495-8	1.5 mmf, 500 volt, ceramic
C22	201-15142	.5-10 mmf, trimmer
C23	8G-13201	1000 mmf, 500 volt, ceramic
C24	8G-12495-2	1.0 mmf, 500 volt, ceramic
C25	8G-13201	1000 mmf, 500 volt, ceramic
C26	8G-19568	2.5 mmf, 500 volt, ceramic
C27	8G-11891	51 mmf, 500 volt, ceramic
C28	201-15142	.5-10 mmf, trimmer
C29	8G-15224	7 mmf, 500 volt, ceramic
C30	8G-20879	6 mmf, feed thru
C31	201-15142	.5-10 mmf, trimmer
C32	8G-20878	1000 mmf, feed thru
C35	8G-12495-8	1.5 mmf, 500 volt, ceramic
		Resistors
R1	9B1-29	470K ohm, ½ watt, 20% (incl with T1)
R2	9B1-62	1000 ohm, ½ watt, 10%
R3	9B1-74	10K ohm, ½ watt, 10%
R4	9B1-38	10 ohm, ½ watt, 10%
R5	9B1-13	1000 ohm, ½ watt, 20%
R6	9B1-78	22K ohm, ½ watt, 10%
R7	9B1-27	220K ohm, ½ watt, 20%
R8	9B1-74	10K ohm, ½ watt, 10%
R9	9B1-66	2200 ohm, ½ watt, 10%

Ref. No.	Part No.	Description
		Chokes, Transformers and Coils
T1 (Incl. T1A, T1B, C1, C2A, C2B, C3 and R1)	201-21192	Antenna transformer assembly
T1A	13E-20767	H.B. Antenna transformer (incl. with T1)
T1B	13E-21189	L.B. Antenna transformer (incl. with T1)
L1	13M-20781	Cascode plate-to-cathode coil
L2	13M-20780	Cascode cathode-to-grid coil
L3	13E-17140	H.B. R.F. primary coil
L4	16A-20777	Filament choke
L5	13E-12046	L.B. R.F. primary coil
L6	16A-17128	R.F. choke
L7	13E-17140	H.B. R.F. secondary coil
L8	13E-12046	L.B. R.F. secondary coil
L9	201-15608	R.F. choke
L10	13E-17140	H.B. oscillator coil
L11	13D-12155	L.B. oscillator coil
		Miscellaneous
	200-20772	T1 shield assembly
	201-20766	Coil alignment strip
	200-20779	Switch lever assembly
	2D-20893	Switch lever bracket
	200-18824	Rear cam
	200-21193	Shaft and front cam
	200-20881	Bottom cover
	201-20769	Capacitor plate assembly (included C5-8-16-30-32)
	49A-20763	Hair-pin spring (for trimmer)
	5M-18807	Treadle bar
	2M-16276	Core mounting clip
	43A2-5444	Hex nut, 2-56x3/16"
	51A-15713	Iron core (white) for L-10
	51A-17162	Iron core (brown) for L3-7
	51A-21200	Iron core (pink) for L-11
	51A-15715	Iron core (blue) for L-5
	51A-17161	Iron core (orange) for L-8
	2C-21099-1	Front end plate
	2C-18805-1	Rear end plate
	49A-18799	Link spring
	2M-18800	Front link
	2M-21278	Rear link
	2M-19150	Flat spring
	2B-19323	Tube shield (12AT7)
	2B-20864	Tube shield (6BK7)
	2J-16310	Sliding switch contact
	5F-16311	Switch contact holder

MAIN CHASSIS

Ref. No.	Part No.	Description
		Capacitors
C34	8G-15224	7 mmf, 500 volt, ceramic
C36	8G-13962	5000 mmf, 500 volt, ceramic
C37	8G-11789	10 mmf, 500 volt, ceramic
C38	8F3-8	100 mmf, 500 volt, mica
C39-40	8G-13201	1000 mmf, 500 volt, ceramic
C41	8G-19731	47 mmf, 500 volt, ceramic (included with L-16)
C42	8G-19522	2000 mmf, 500 volt, ceramic
C43-44	8G-13201	1000 mmf, 500 volt ceramic
C45	8G-21105	680 mmf, 500 volt, ceramic
C46	8G-11732	470 mmf, 500 volt, ceramic (included with L-19)
C47	8G-19731	47 mmf, 500 volt, ceramic (included with L-19)
C48	8G-13962	5000 mmf, 500 volt, ceramic
C49	8G-13201	1000 mmf, 500 volt, ceramic
C50	8G-13962	5000 mmf, 500 volt, ceramic
C51	8G-12166	5 mmf, 500 volt, ceramic (included with T-2)
C52	8G-12166	5 mmf, 500 volt, ceramic
C56-57	8G-13962	5000 mmf, 500 volt, ceramic
C58	8J-16085	.1 mfd, 200 volt, molded
C59	8J-16083	.1 mfd, 400 volt, molded
C60	8G-12166	5 mmf, 500 volt, ceramic
C61	8G-13909	22 mmf, 500 volt, ceramic
C62	8G-13962	5000 mmf, 500 volt, ceramic
C63	8G-12198	47 mmf, 500 volt, ceramic
C64	8J-20634	.0022 mfd, 400 volt, molded
C65	8J-20582	.01 mfd, 200 volt, molded
C66	8F3-122	560 mmf, 500 volt, mica
C67	8G-21207	5000 mmf, 500 volt, ceramic
C68	8J-20582	.01 mfd, 200 volt, molded
C69	8G-13962	5000 mmf, 500 volt, ceramic
C70A-B-C-D	8C-20808	10 mfd, 75 volt–100 mfd, 300 volt–100 mfd, 25 volt–10 mfd, 300 volt filter lytic
C71	8J-16084	.01 mfd, 400 volt, molded
C72A-B-C	8C-20954	10 mfd, 15 volt–10 mfd, 300 volt–10 mfd, 300 volt filter lytic
C73	8J-20594	.015 mfd, 400 volt, molded
C74	8J-21505	.47 mfd, 400 volt, molded
C77	8J-20590	.0022 mfd, 400 volt, molded
C78	8J-16082	.22 mfd, 200 volt, molded
C79	8F3-113	100 mmf, 500 volt, mica

Ref. No.	Part No.	Description
C80	8J-16083	.1 mfg, 400 volt molded
C81	8J-20592	.0047 mfd, 400 volt, molded
C-82	8J-16086	.022 mfd, 200 volt, molded
C83-84	8J-16096	.047 mfd, 200 volt, molded
C85	8J-16081	.047 mfd, 400 volt, molded
C86	8J-16084	.01 mfd, 400 volt, molded
C87	8J-21505	.47 mfd, 400 volt, molded
C88	8J-16097	.01 mfd, 600 volt, molded
C89	8J-16083	.1 mfd, 400 volt, molded
C90	8C-20709	100 mfd, 150 volt, lytic
C91	8C-20684	100 mfd, 150 volt, lytic
C95	8F3-123	680 mmf, 300 volt, mica
C96	8F3-117	220 mmf, 500 volt, mica
C97	8J-20613	3900 mmf, 600 volt, ceramic
C98	8G-13962	5000 mmf, 500 volt, ceramic
C99	8J-16096	.047 mfd, 200 volt, molded
C100	8J-16082	.22 mfd, 200 volt, molded
C101	8F3-123	680 mmf, 300 volt, mica
C102-103	8F3-117	220 mmf, 500 volt, mica
C104	8F3-119	330 mmf, 500 volt, mica
C105	8F3-122	560 mmf, 500 volt, mica
C106	8J-16084	.01 mfd, 400 volt, molded
C107	8G-12198	47 mmf, 500 volt, ceramic
C108	8J-16081	.047 mfd, 400 volt, molded
C109	8G-12198	47 mmf, 500 volt, ceramic (included with T-7)
C110	8J-16082	.22 mfd, 200 volt, molded
C111	8C-21274	50 mfd, 300 volts, lytic
C112	8G-21440	470 mmf, 1000 volt, ceramic

Resistors

Ref. No.	Part No.	Description
R13	9B1-13	1000 ohm, ½ watt, 20%
R14	9B1-73	8200 ohm, ½ watt, 10%
R15	9B2-79	27K ohm, 1 watt, 10%
R16-17	9B1-82	47K ohm, ½ watt, 10%
R18	9B1-46	47 ohm, ½ watt, 10%
R19	9B1-13	1000 ohm, ½ watt, 20%
R20	9B1-82	47K ohm, ½ watt, 10%
R21	9B1-46	47 ohm, ½ watt, 10%
R22	9B1-13	1000 ohm, ½ watt, 20%
R23	9B1-74	10K ohm, ½ watt, 10% (included with L-19)
R24	9B1-49	82 ohm, ½ watt, 10%
R25	9B1-13	1000 ohm, ½ watt, 20%
R26	9B1-78	22K ohm, ½ watt, 10%
R27	9B1-71	5600 ohm, ½ watt, 10%
R31	9B1-94	470K ohm, ½ watt, 10%
R32	9B2-79	27K ohm, 1 watt, 10%
R33	10B-21476	Picture control—2500 ohm
R34	9B1-71	5600 ohm, ½ watt, 10%
R35	9B4-71	5600 ohm, 2 watt, 10%
R36	9B1-76	15K ohm, ½ watt, 10%
R37	10B-17275	Brightness control—100K
R38	9B1-90	220K ohm, ½ watt, 10%
R39	9B1-62	1000 ohm, ½ watt, 10%
R40	9B1-86	100K ohm, ½ watt, 10%
R41	9B1-51	120 ohm, ½ watt, 10%
R42	9B4-73	8200 ohm, 2 watt, 10%
R43	9B1-46	47 ohm, ½ watt, 10%
R44	9B1-78	22K ohm, ½ watt, 10%
R45	9B1-110	10 megohm, ½ watt, 10%
R46	9B1-78	22K ohm, ½ watt, 10%
R47	9B1-90	220K ohm, ½ watt, 10%
R48	9B1-94	470K ohm, ½ watt, 10%
R49	9B2-51	120 ohm, 1 watt, 10%
R50	9C12-1103	2200 ohm, 5 watt, 10%
R51	9B1-62	1000 ohm, ½ watt, 10%
R52	9M-20736	1500 ohm, 10 watt, 10% - Power
R53	10A-21484	On-off volume control - 1 meg.
R56	9B-110	10 megohms, ½ watt, 10%
R57	9B1-98	1 megohm, ½ watt, 10%
R58	9B1-82	47K ohm, ½ watt, 10%
R59	9B1-98	1 megohm, ½ watt, 10%
R60	9B1-110	10 megohms, ½ watt, 10%
R61	10B-20558	Sync adjust control - 500K

Ref. No.	Part No.	Description
R62	9B1-80	33K ohm, ½ watt, 10%
R63	9B1-94	470K ohm, ½ watt, 10%
R64	9B2-79	27K ohm, 1 watt, 10%
R65	9B1-75	12K ohm, ½ watt, 10%
R66	9B1-90	220K ohm, ½ watt, 10%
R67	9B1-82	47K ohm, ½ watt, 10%
R68	9B1-73	8200 ohm, ½ watt, 10%
R69	10B-20558	V. Hold control - 500K
R70	9B1-68	3300 ohm, ½ watt, 10%
R71	9B1-65	1800 ohm, ½ watt, 10%
R72	9B1-75	12K ohm, ½ watt, 10%
R73	10B-19220	V. Size control - 750K
R74	9B1-90	220K ohm, ½ watt, 10%
R75	10B-21052	V. Linearity control - 4000
R76	9B1-98	1 megohm, ½ watt, 10%
R77	9B1-90	220K ohm, ½ watt, 10%
R78	9B1-88	150K ohm, ½ watt, 10%
R79-80	9B1-62	1000 ohm, ½ watt, 10% (included with T-7)
R81	9B1-94	470K ohms, ½ watt, 10%
R82	46M-20681	Fusible resistor, 5.6 ohm, 1 amp.
R83	9B1-92	330K ohm, ½ watt, 10%
R85	9B1-88	150K ohm, ½ watt, 10%
R86	9B1-102	2.2 megohm, ½ watt, 10%
R87	9B1-96	680K ohm, ½ watt, 10%
R88	9B1-102	2.2 megohm, ½ watt, 10%
R89	9B1-88	150K ohm, ½ watt, 10%
R90	9B1-83	56K ohm, ½ watt, 10%
R91	9B1-96	680K ohm, ½ watt, 10%
R92	9B2-71	5600 ohm, 1 watt, 10%
R93	9B1-61	820 ohm, ½ watt, 10%
R94	9B1-97	820K ohm, ½ watt, 10%
R95	9B1-88	150K ohm, ½ watt, 10%
R96	9B1-86	100K ohm, ½ watt, 10%
R97	9B1-50	100 ohm, ½ watt, 10%
R98	9B1-94	470K ohm, ½ watt, 10%
R99	9B4-73	8200 ohm, 2 watt, 10%
R100	9C1-1067	2.2 ohm, ½ watt, 10%
R101	9M-21715	175 ohm, 20 watt, 10%-Filament
R105	9C1-1072	5.6 ohm, ½ watt, 10%

Chokes, Transformers and Coils

Ref. No.	Part No.	Description
T2 (incl. C51, L24 & CK-706)	13B-21167	Output I.F. transformer
T3 (alternate)	13M-19643	Ratio detector transformer
T3	13M-21644	Ratio detector transformer
T4	12C-21215	Audio output transformer
T5	12M-18241-3	Vertical oscillator transformer
T6	12C-20761-1	Vertical output transformer
**T7A-B(incl. R79-80 & C109)	201-21130	Deflection yoke assembly
*T7A-B(incl. R79-80 & C109)	201-21514	Deflection yoke assembly
T8	201-21025	H.V. Deflection transformer
T9	12D-21160	Filament transformer
L13	16A-21656	R.F. choke
L14	201-15608	R.F. choke
L15	201-20782	1st I.F. coil assembly
L16(incl. C41)	201-21111	2nd I.F. coil assembly
L17	16A-18676	B+ choke
L18	16A-17937	Filament choke
L19 (incl. R23, C-46-47)	201-21494	3rd I.F. coil assembly
L20	16A-18676	B+ choke
L21	16A-17937	Filament choke
L22-23	201-15608	Choke coil
L24	201-15608	Choke coil (incl. with T-2)
L25	201-20265	Choke Coil
L26	16A-17937	Filament choke
L27-28	16A-20970	Peaking coil (270 uhy)
L29	201-21398	Video trap coil
L30	201-20291	H. Hold coil
L31	201-15608	Choke coil
L32	16A-21214	Filter choke (2.6 H)
L33	16A-21391	Peaking coil (305 uhy)

Miscellaneous

Part No.	Description
2M-19378	Flat screw spring (L-30)
32T8-19377	Thumb screw (L-30)
25A-13005	Mounting grommet (L-30)
7B-13050	Antenna terminal board
49A-15857	14½" wire shield
43D-17860	Coil fastener (L-19)
51A-17966	Iron core (L-19)
2D-21118	Tuner shaft support bracket
200-21362	Tuner pulley and bushing assem.
52C-14443	Set screw (6-32x¼")
49A-11324	Tension spring
2D-21421	Idler pulley bracket
200-21409	Idler pulley assembly
49A-18851	Hair pin spring (2 used)
200-21242	Tuning shaft assembly
2D-21231	Tuning shaft support bracket
29M-21234	Front stop washer
29M-21235	Center stop washer (3 used)
29M-21236	Rear stop washer
29E-21513	Spring washer
29A-15939	Flat washer
200-21410	Drive pulley assembly
2D-21420	Drive pulley bracket
5M-21418	Pointer indicator
43D-21392	Ring for above
47A-21419	Pilot light assembly
46A-10793	Pilot light bulb (T-47)
25M-18177	Red rubber knob
15C-16007	7-pin tube socket
15B-10440	8-pin tube socket
15B-20860	6AX4 tube socket
19B-11920	UHF tuner socket
19A-21244	UHF tuner plug
2H-17588	Tube shield
2M-17589	Tube shield base
15B-21186	Lytic mounting plate (C-90)
46M-20681	Fusible resistor
7M-20751	Fuse mounting board
7M-20752	Fuse terminal board
19A-19446	A.C. receptacle
2D-11490	Condenser mounting clip (C-111)
21J-20097	Selenium rectifier
20B-21506	F-S-L switch
201-20248	1X2A socket assembly (including the five (5) items below)
15C-18735	1X2A tube socket
5M-18733	Standoff insulator
62D-18734	H.V. ring
41M-20092	Tube positioner
9C1-1067	2.2 ohm resistor (R-100)
2B-20646	H.V. shield can
2B-20549	H.V. shield can cover
49A-19389	Ring (3 used)
23M-16744	Yoke wing nut
50A-20783	Felt pad tube protector
16M-19906	Ion Trap magnet
16M-20697	Centering magnet

**** 17-INCH MISCELLANEOUS**

Part No.	Description
2M-20695	C.R.T. outer coat contact
14C-19133	H. V. Cable assembly
38A-21096	Anode retainer
2C-20876	R.H. tube holding plate
2C-20877	L.H. tube holding plate
25M-20703	Rubber pad (4 used)
213-21464	Deflection yoke mounting brace
2M-20705	Tube strap
2D-18542	Tube strap bracket
3M-20689	Support rod
15B-17278-7	C.R.T. socket and cable
16M-21526	Linearity magnet
51A-19322	Iron core (L-30)
49A-21691	Spring (large)
49A-19707	Spring (small)

*** 21-INCH MISCELLANEOUS**

Part No.	Description
2M-21559	C.R.T. Outer coat contact
41M-21584	H. Size extension shaft
14C-20824	H. V. Cable assembly
38A-21515	Anode retainer
2C-21490	R.H. tube holding plate
2C-21491	L.H. tube holding plate
213-21466	Deflection yoke mounting brace
200-20109	Tube strap
200-20976	Tube strap
25M-19382	Rubber pad (4 used)
3M-21497	Support rod
15B-17278-8	C.R.T. socket and cable
51A-21426	Iron core (L-30)
16M-21499	Anti-pin-cushiong magnet

(Model 2D-2322A Only)

Part No.	Description
211-21279-3	UHF Tuner
32F10-16304	Mounting screws (4 used)
43A-21280	Tinnerman twin clip (2 used)
4C-21281	Drive gear
42A4-1827	Drive gear screw
200-22543	Switch arm and link assembly
20A-21414	Band switch

CABINET PARTS

Part No.	Description
24D-21564	Cabinet (2D-2312A)
24D-21566	Cabinet (2D-2321A, 2D-2322A)
24D-21565	Cabinet (2D-2314A)
24D-21567	Cabinet (2D-2315A)
24D-21653	Cabinet (2D-1325A)
25M-21482A-101	Mask (2D-2312A)
25M-21579A-101	Mask (2D-2321A, 2D-2322A)
25M-21579A-106	Mask (2D-2314A, 2D-1325A)
25M-21579A-103	Mask (2D-1315A)
30M-20725	17-inch Safety glass
30M-21485	21-inch Safety glass
2D-21569A-103	Safety glass holder (2D-2312A)
2D-21257A-76	Safety glass holder (2D-2321A 2D-1315A, 2D-2322A)
2D-21257A-107	Safety glass holder (2D-2314A)
2D-21257A-56	Safety glass holder (2D-1325A)
32D6-21460	Safety glass holder screws
5C-21255	Escutcheon
32D6-21585	Escutcheon screws
18A-21216	5" PM Speaker (2D-2312A)
18A-21433	6" PM Speaker (2D-2321A, 2D-2314A, 2D-2322A)
18A-21442	10" PM Speaker (2D-1315A, 2D-1325A)
5B-21423A-103	Volume knob (2D-2312A)
5B-21423A-76	Volume knob (2D-2321A, 2D-1315A, 2D-2322A)
5B-21423-92	Volume knob (2D-2314A)
5B-21423A-56	Volume knob (2D-1325A)
5B-21422A-103	Tuning knob (2D-2312A)
5B-21422A-76	Tuning knob (2D-2321A, 2D-1315A, 2D-2322A)
5B-21422-92	Tuning knob (2D-2314A)
5B-21422A-56	Tuning knob (2D-1315A)
5B-21393-29	Star knob
200-21438	17-Inch Cabinet back assembly
200-21578	21-Inch Cabinet back assembly
201-20237-2	T.V. Built-in antenna
5B-18382-36	Antenna knob

** NOTE: 17-inch Receivers Only.
* NOTE: 21-inch Receivers Only.

UHF Information: refer to the Model 3DX-6000 UHF service information

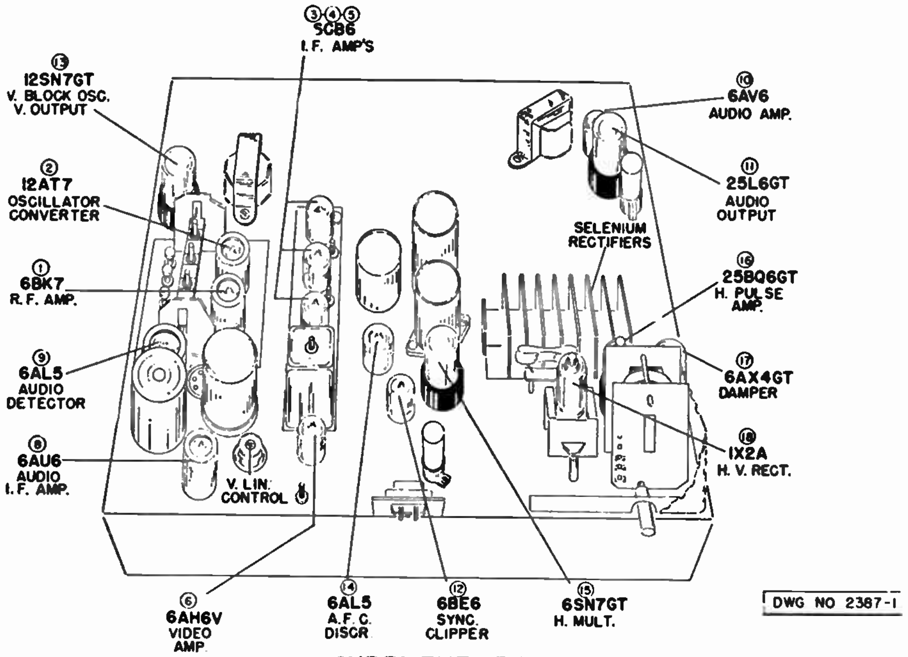


Figure 9. Tube Layout.

SUPPLEMENT "B"

(Changes from "A" Listing)

TUBES

12BH7 (13) Replaces 12SN7GT Vert. Blocking Osc. and Output Tube

VHF TUNER

Ref. No. R9, 9B1-66 Changed to 9B1-50, 100 ohm, 1/2 watt, 10%

Ref. No. R10, added is 9B1-66, 2200 ohm, 1/2 watt, 10%

Omit Ref. No. 9, Part 201-15608 R.F. Choke

MAIN CHASSIS PARTS LIST

Ref. No. C98 Changed from 8G-13962 to 8J-20582, .01 mfd., 200 volt, molded

Ref. No. C113 added: 8G-19505 1000 mmf, 500 volts, ceramic

Ref. No. R64 Changed from 9B2 to 9C12-1115, 22K ohm, 5 watt, 10%

Ref. No. R77 Changed from 9B1-90 to 9B1-86, 100K ohm, ½ watt, 10%

Ref. No. R100 Changed from 9C1-1067 to 9C1-1070, 3.9 ohm, ½ watt, 10%

MISCELLANEOUS PARTS

Parts No.	Description	Part No.	Description
15C-16007	7-pin tube socket	2B-20549	H.V. shield can cover
15B-10440	8-pin tube socket	49A-19389	Ring (3 used)
15B-21968	9-pin tube socket	23M-16744	Yoke wing nut
15B-20860	6AX4 tube socket	50A-20783	Felt pad tube protector
19B-11920	UHF tuner socket	16M-19906	Ion Trap magnet
19A-21244	UHF tuner plug	16M-20697	Centering magnet
2H-17588	Tube shield	2M-19378	Flat screw spring (L-30)
2M-17580	Tube shield base	32T8-19377	Thumb screw (L-30)
15B-21186	Lytic mounting plate (C-90)	25A-13005	Mounting grommet (L-30)
46M-20681	Fusible resistor	7B-13050	Antenna terminal board
7M-20751	Fuse mounting board	49A-15857	14½" wire shield
7M-20752	Fuse terminal board	43D-17860	Coil fastener (L-19)
19A-19446	A.C. receptacle	51A-17966	Iron core (L-19)
2D-11490	Condenser mounting clip (C-111)	200-21242	Tuning shaft assembly
21J-20097	Selenium rectifier	200-21880	Drive assembly
20B-21506	F-S-L switch	200-21893	Support bracket assembly
201-21910	1X2A socket assembly (including the five (5) items below)	3C-21896	Spacer
		32F8-3919	Spacer Screw
15C-18735	1X2A tube socket	25E-21948	Rubber channel
5M-18733	Standoff insulator	5M-21418	Pointer indicator
62D-18734	H.V. ring	43D-21392	Ring for above
41M-20092	Tube positioner	47A-21419	Pilot light assembly
9C1-1070	3.9 ohm resistor (R-100)	46A-10793	Pilot light bulb (T-47)
2B-20646	H.V. shield can	25M-18177	Red rubber knob

COIL DC RESISTANCE CHART

The DC resistance readings shown in the chart below have been taken with a ohmmeter directly across the coil being measured. The coils not listed in the chart have a DC resistance reading of less than one ohm. A tolerance of ±5% is permissible.

COILS	RESISTANCE IN OHMS	COILS	RESISTANCE IN OHMS
L17	1.5	T3 pri.	4.7
L20	1.5	T4 pri.	170
L22	2.2	T5 pri.	960
L23	2	sec.	160
L24	2	T6 pri.	1100
L25	2	sec.	6.6
L27	8	T7A	68
L28	8	B	12.5
L29	1.5	T8 25BQ6 plate to 1X2A plate	180
L30	80	25BQ6 plate to term 4	9.5
L31	2.3	25BQ6 plate to term 3	17.5
L32	72	25 BQ6 plate to term 1	25.5
L33	8.5	term 7 to term 8	2.6
L34	2.3	term 7 to term 10	5.4
T3 pri.	4.7	T9 pri.	7

REMOVABLE SAFETY GLASS

To clean the inside of the safety glass or the face of the picture tube, simply follow the procedure below.

1. Remove the three (3) phillips head screws in the safety glass holder directly above the escutcheon.
2. Remove the safety glass holder.
3. Carefully remove the safety glass by pulling out and down from the bottom.

CAUTION

Before the chassis can be removed from the cabinet, the escutcheon, on-off-volume and tuning knobs must be removed. Pull knobs straight out and remove the two outside escutcheon screws and escutcheon.

DIAL CORD REPLACEMENT

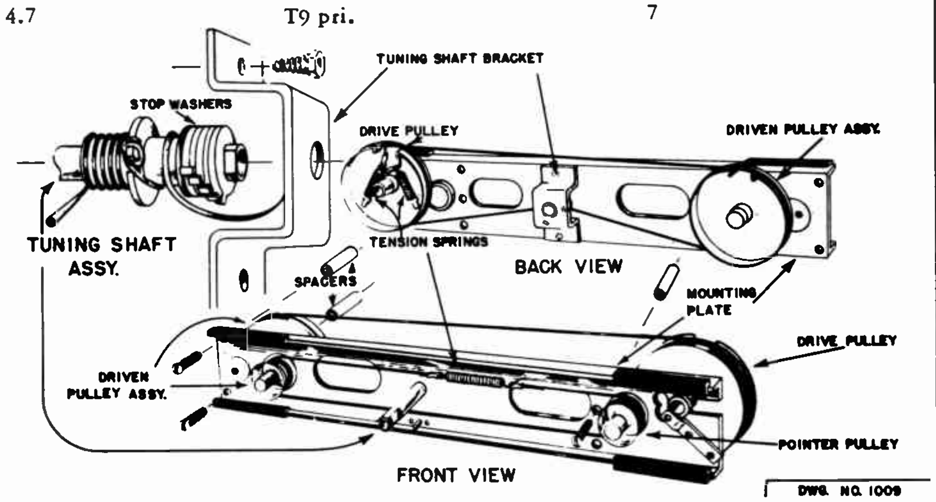
DIAL CORD STRINGING: Two separate dial cords are used and can be restrung separately if replacement is necessary.

POINTER PULLEY STRINGING: Follow the above diagram (front view) and start by attaching the dial cord to the tension spring, route to pointer pulley and make 2½ clockwise turns around pulley. Route under tuning shaft to small pulley of driven pulley assembly, make 2½ clockwise turns around pulley and connect to other end of tension spring. Tension spring must be in location shown when tuning shaft is rotated to extreme clockwise position.

MECHANICAL TRACKING: If for any reason the stop washers do not correspond to the stop position of the tuner, loosen the two(2) drive pulley allen head set screws and reposition. Turn both the tuning shaft and tuner shaft to the extreme counter-clockwise position. Turn tuning shaft only 1/6 turn clockwise. Tighten allen head set screws.

POINTER POSITIONING: If when a station is properly tuned in and the pointer is off calibration, reposition the pointers as follows.

1. Remove the on-off volume and tuning knobs. (pull straight out)
2. Remove two outside escutcheon screws and escutcheon
3. Remove pointer indicator and reposition.

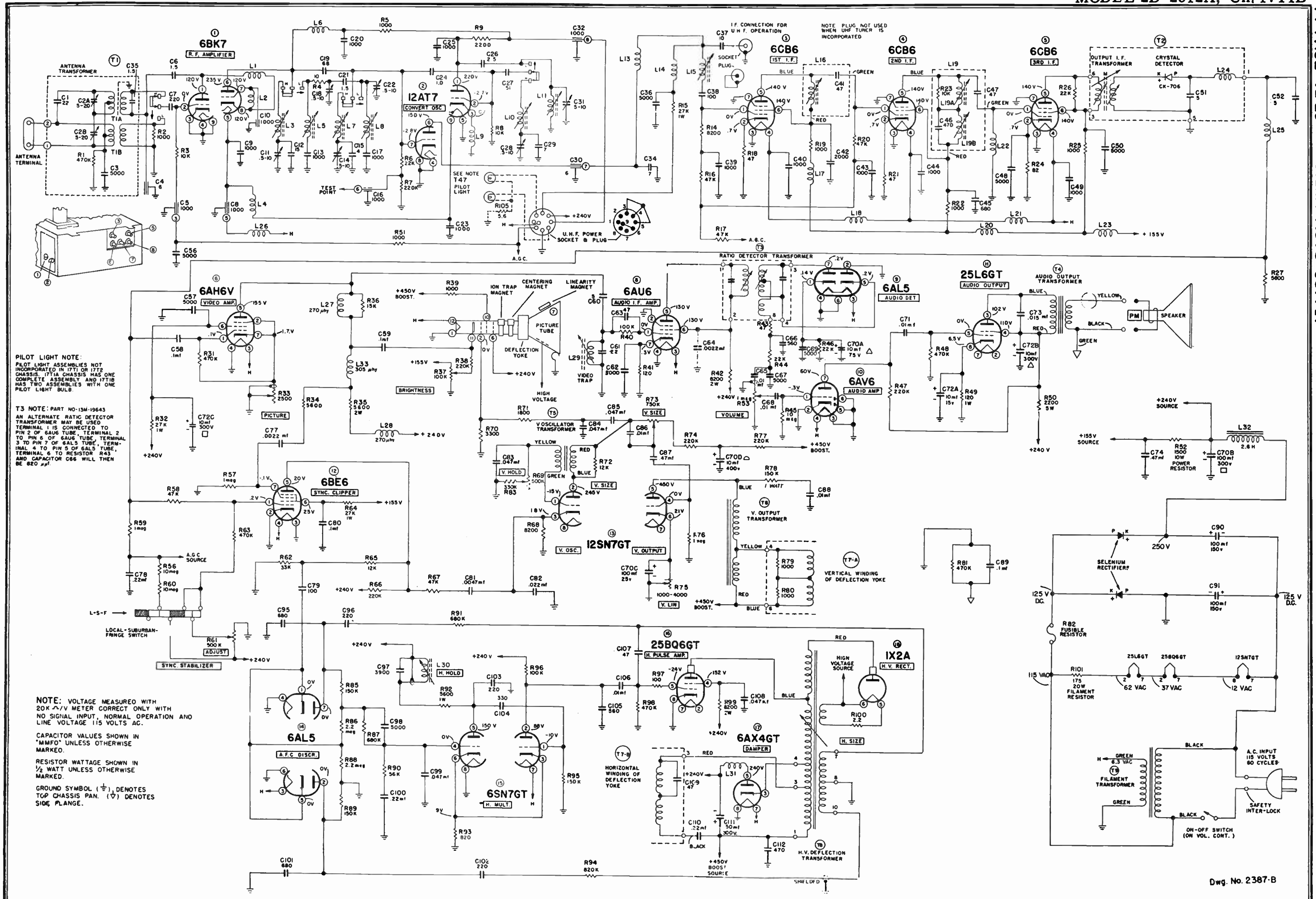


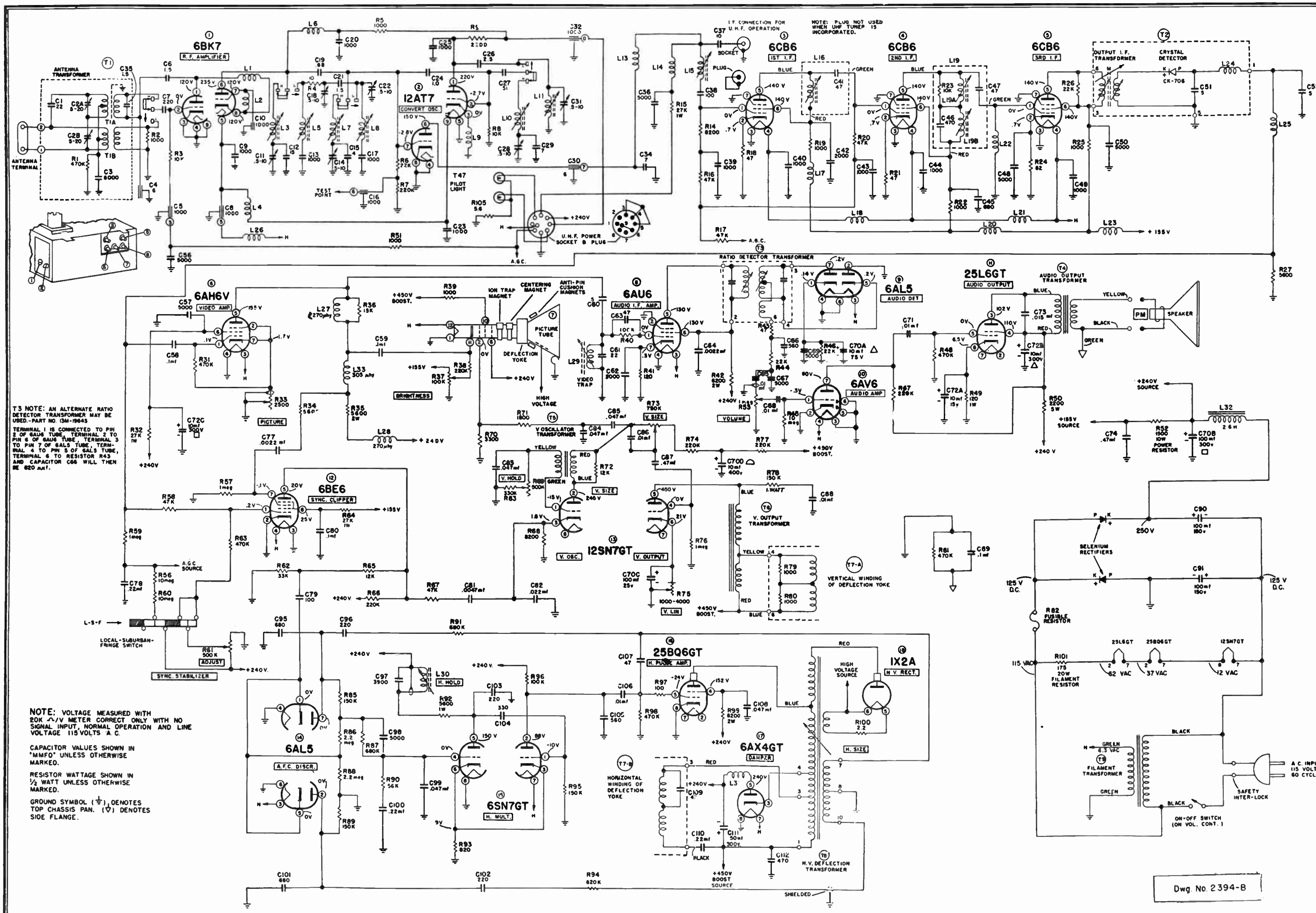
DRIVE PULLEY STRINGING: Drive pulley restringing requires removal of the mounting plate assembly. To remove the mounting plate assembly follow the simple instructions below.

1. Remove two (2) star knobs
2. Remove two (2) pilot light shields and pilot light bulbs.
3. Loosen two (2) drive pulley allen head set screws.
4. Remove three (3) spaces screws
5. Pulley assembly straight out.

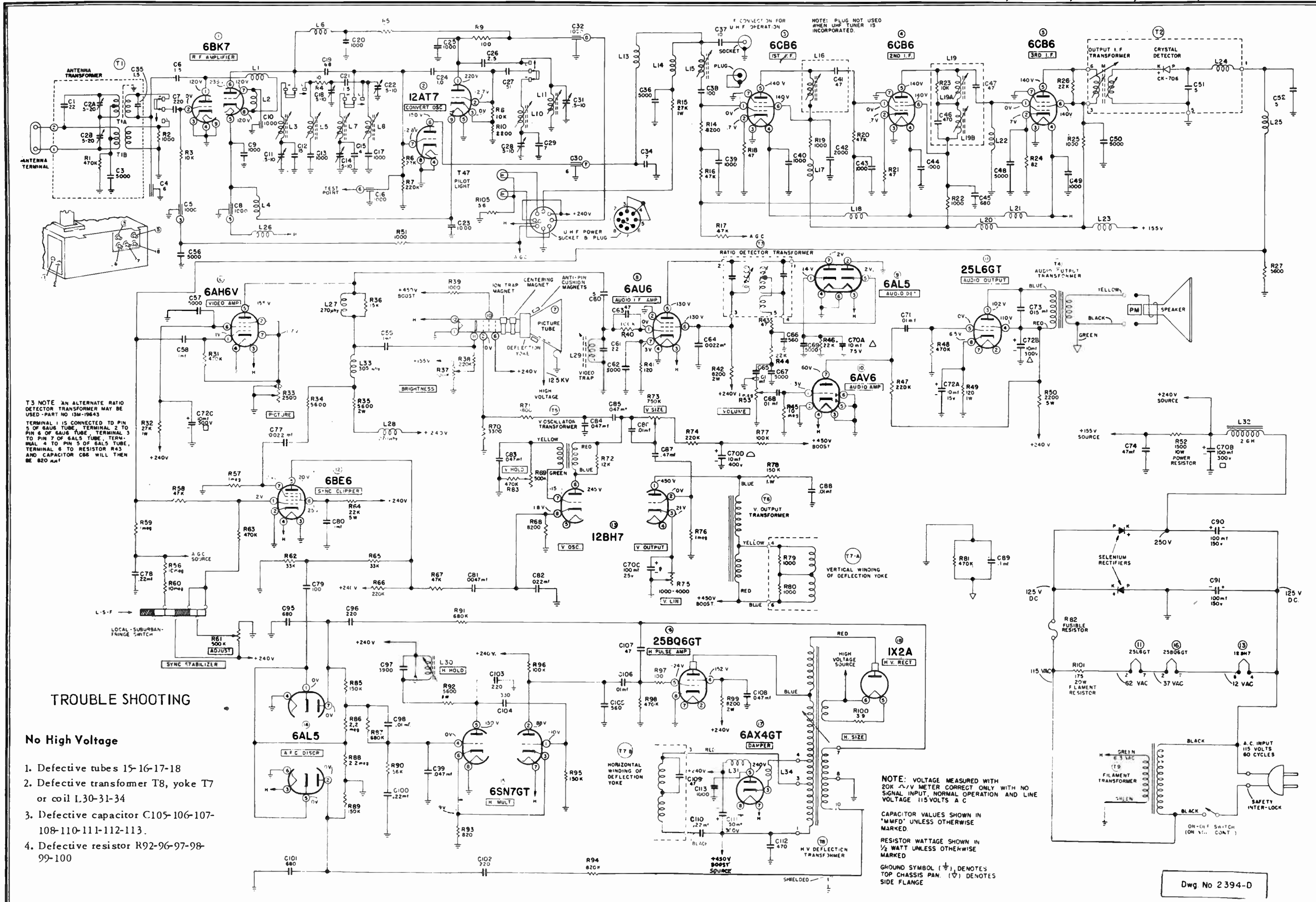
To restring the drive pulley turn the tuning shaft completely counter-clockwise. Follow the above diagram (back view) and start by attaching the dial cord to the tension spring shown at the extreme left on the drive pulley. Route the cord through the opening in the pulley and make a 1/2 counter-clockwise turn around the pulley and route under the tuning shaft. Make 5 1/2 counter-clockwise turn around tuning shaft between mounting plate and lugged washer. Then make one counter-clockwise turn around lug on washer and continue in the counter-clockwise direction and make 1 1/2 turn around the tuning shaft between the lugged washer. Route to the large driven pulley and make 1 1/2 turn around the pulley and route to the drive pulley. Make 2 complete counter-clockwise turns around the pulley and route through the opening and attach to the tension spring. Add second tension spring as shown.

Replace mounting plate assembly and follow directions for mechanical tracking.


6BK7
R.F. AMPLIFIER
12AT7
CONVERT OSC
6CB6
1ST I.F.
6CB6
2ND I.F.
6CB6
3RD I.F.
ANTENNA TRANSFORMER
ANTENNA TERMINAL
I.F. CONNECTION FOR U.H.F. OPERATION
NOTE PLUG NOT USED WHEN UHF TUNER IS INCORPORATED
OUTPUT I.F. TRANSFORMER
CRYSTAL DETECTOR
CK-706
TEST POINT
U.H.F. POWER SOCKET & PLUG
6AH6V
VIDEO AMP.
6AU6
AUDIO I.F. AMP.
6AL5
AUDIO DET
25L6GT
AUDIO OUTPUT
AUDIO OUTPUT TRANSFORMER
SPEAKER
RATIO DETECTOR TRANSFORMER
6AV6
AUDIO AMP
ION TRAP MAGNET
CENTERING MAGNET
LINEARITY MAGNET
PICTURE TUBE
DEFLECTION YOKE
HIGH VOLTAGE
VIDEO TRAP
BRIGHTNESS
PICTURE
VOLUME
PILOT LIGHT NOTE:
PILOT LIGHT ASSEMBLIES NOT INCORPORATED IN 17T1 OR 17T2 CHASSIS. 17T1A CHASSIS HAS ONE COMPLETE ASSEMBLY AND 17T1B HAS TWO ASSEMBLIES WITH ONE PILOT LIGHT BULB.
T3 NOTE: PART NO-13M-19643
AN ALTERNATE RATIC DETECTOR TRANSFORMER MAY BE USED TERMINAL 1 IS CONNECTED TO PIN 2 OF 6AU6 TUBE, TERMINAL 2 TO PIN 6 OF 6AU6 TUBE, TERMINAL 3 TO PIN 7 OF 6AL5 TUBE, TERMINAL 4 TO PIN 5 OF 6AL5 TUBE, TERMINAL 6 TO RESISTOR R43 AND CAPACITOR C66 WILL THEN BE 820 μμf.
6BE6
SYNC. CLIPPER
V OSCILLATOR TRANSFORMER
V. HOLD
V. SIZE
V. OSC.
12SN7GT
V. OUTPUT
V. LIN
V. OUTPUT TRANSFORMER
VERTICAL WINDING OF DEFLECTION YOKE
SELENIUM RECTIFIERS
POWER RESISTOR
FUSIBLE RESISTOR
FILAMENT RESISTOR
L-S-F
LOCAL-SUBURBAN-FRINGE SWITCH
ADJUST
SYNC. STABILIZER
6AL5
A.F.C. DISCR.
H. HOLD
6SN7GT
H. MULT
25BQ6GT
H. PULSE AMP.
1X2A
H.V. RECT.
HIGH VOLTAGE SOURCE
H. SIZE
6AX4GT
DAMPER
HORIZONTAL WINDING OF DEFLECTION YOKE
H.V. DEFLECTION TRANSFORMER
FILAMENT TRANSFORMER
A.C. INPUT 115 VOLTS 60 CYCLES
SAFETY INTER-LOCK
ON-OFF SWITCH (ON VOL. CONT.)
NOTE: VOLTAGE MEASUREO WITH 20K Ω/V METER CORRECT ONLY WITH NO SIGNAL INPUT, NORMAL OPERATION ANO LINE VOLTAGE 115 VOLTS AC.
CAPACITOR VALUES SHOWN IN "MMFO" UNLESS OTHERWISE MARKEO.
RESISTOR WATTAGE SHOWN IN 1/2 WATT UNLESS OTHERWISE MARKED.
GROUND SYMBOL (⏚) DENOTES TOP CHASSIS PAN. (▽) DENOTES SIDE FLANGE.
Dwg. No. 2387-B



MODELS 2D-1315A, -1325A, -2314A, -2321A, Ch. 21T1A; 2D-2322A, Ch. 21T2A



T3 NOTE AN ALTERNATE RATIO DETECTOR TRANSFORMER MAY BE USED - PART NO 13M-19643

TERMINAL 1 IS CONNECTED TO PIN 5 OF 6AU6 TUBE, TERMINAL 2 TO PIN 6 OF 6AU6 TUBE, TERMINAL 3 TO PIN 7 OF 6AL5 TUBE, TERMINAL 4 TO PIN 5 OF 6AL5 TUBE, TERMINAL 6 TO RESISTOR R43 AND CAPACITOR C66 WILL THEN BE 820 MMF

TROUBLE SHOOTING

No High Voltage

1. Defective tubes 15-16-17-18
2. Defective transformer T8, yoke T7 or coil L30-31-34
3. Defective capacitor C105-106-107-108-110-111-112-113.
4. Defective resistor R92-96-97-98-99-100

NOTE: VOLTAGE MEASURED WITH 20K Ω/V METER CORRECT ONLY WITH NO SIGNAL INPUT, NORMAL OPERATION AND LINE VOLTAGE 115 VOLTS A C

CAPACITOR VALUES SHOWN IN "MMFD" UNLESS OTHERWISE MARKED.

RESISTOR WATTAGE SHOWN IN ½ WATT UNLESS OTHERWISE MARKED

GROUND SYMBOL (⏚) DENOTES TOP CHASSIS PAN. (▽) DENOTES SIDE FLANGE

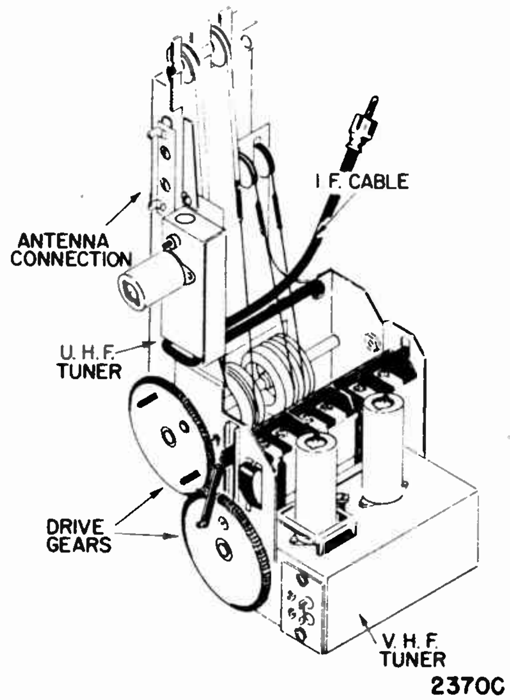
Dwg. No 2394-D

UHF TUNER SERVICE MANUAL

MODEL NO. 3D6000

CAN BE USED WITH MODELS

2D-1091A, 2D-1095A, 2D-1191A, 2D-1195A, 2D-1224A, 2D-1225A, 2D-1228A, 2D-1315A, 2D-1325A, 2D-2043A, 2D-2047B, 2D-2049A, 2D-2052A, 2D-2052B, 2D-2052C, 2D-2052D, 2D-2052E, 2D-2149A, 2D-2152A, 2D-2215A, 2D-2219A, 2D-2223A, 2D-2312A, 2D-2312A, 2D-2314A, 2D-2321A, 2D-2322A, 2D-2322B.



GENERAL DESCRIPTION

The UHF Tuner is a single conversion, continuous tuning device which mechanically mounts directly over the VHF tuner in the receiver. The tuner is coupled to the VHF tuner by drive gears which thus provides tuning of both UHF and VHF by the same tuning knob. The tuner obtains its filament and plate supply voltages from the TV chassis and a switch is provided to select the desired tuner for operation. Signal points and filament leads are not switched.

Two variations of UHF tuners may be encountered. Only minor differences exist as can be seen by referring to figures 3 (early version) and 4 (later version). The later version tuner can easily be identified by the terminal strip below resistor R-2. (see figure 5).

The UHF Tuner selects the UHF stations video and sound carrier and converts them to the carrier IF frequency of 26.75 MC for video and 22.25 MC for sound which is coupled to the IF amplifiers in the receiver by 10 inches of RG-62U cable.

CIRCUIT DESCRIPTION

The UHF Tuner employs a double coaxial line RF cavity pre-selector. The coaxial line arrangement has the advantages of high selectivity, low insertion losses, uniform band-width and good shielding against oscillator radiation. The coaxial cavity is basically a one-quarter wave shorted tuned stub. The electrical length of the cavities is varied by a ribbon which is attached to the dial cord and pulley arrangement. In this manner tuning is accomplished similar to varying the length of a tuned stub which would change the resonant length for various frequencies. The dial cord is of a special material which is not affected by temperature or moisture and is locked to the pulleys which eliminates the possibility of slippage. Tracking screws are provided in the cavities to obtain uniform band width and sensitivity. The tracking screws vary the capacity between the ribbon and the cavity wall and thus vary the electrical length of the ribbon.

The oscillator tube used is a 6AF4 which is similar to the 6F4. Oscillator tuning is accomplished by a one-quarter wave shorted parallel wire transmission line arrangement. It differs from the RF cavities, in that a shorting bar is used to vary the electrical length of the lines. This method provides very stable operation.

Inductive or link coupling is employed to transfer the signal between stages. The arrangement of link coupling gives maximum selectivity and constant band-width over the entire UHF band. The signal from the output coupling link is mixed and detected by a CK-710 crystal detector and then applied to the tuned input of the cascode Pre-IF amplifier which is tuned to a center frequency of 25 MC and has the features of low noise and broad band-width. The signal is amplified by the cascode amplifier and then coupled to the IF amplifier section in the receiver through 10 inches of RG-62U coaxial cable.

The UHF Tuner maintains a fairly constant antenna input impedance of 300 ohms, has an overall band-width of 6 to 8 megacycles and has an oscillator injection current ratio of approximately 2 to 1. The only amplification of the signal takes place in the cascode amplifier. The signal is not amplified in the RF cavities, therefore, the sensitivity of the receiver on UHF will not quite equal that of VHF. A receiver equipped with a UHF tuner will have an overall UHF sensitivity of approximately 150 microvolts.

Service features of this tuner provides a convenient check point for measuring the oscillator grid current to determine whether the oscillator is functioning. Also provisions have been made for measuring the oscillator injection current to check both the crystal detector and the oscillator. An opening is also provided for coupling to the input grid coil when alignment of the cascode amplifier is necessary.

SERVICE HINTS

If the receiver is "dead" when attempting to view a UHF program, first check the position of the selector switch, then determine whether a signal is being transmitted and then check the antenna and lead-in connections before suspecting the tuner for trouble.

Also as a fast check, view the face of the picture tube at minimum contrast or picture control setting and advance the control to maximum. Compare the difference. If there is little or no difference (no "snow") check the video detector and IF amplifiers. If an increase of "snow" appears at maximum control setting, check the first IF stage before looking to the tuner for a defect.

If the UHF tuner is not functioning properly, first substitute the oscillator (6AF4) and cascode amplifier (6BK7) tubes. Next check the voltages at the UHF power socket or cable connections in the receiver.

If soldering iron servicing, crystal detector or component parts replacement is necessary, the picture tube must be removed. Removing the picture tube makes the majority of the UHF Tuner components within easy reach and most of the parts can be serviced. The tuner should not be removed from the chassis when service is required, also caution must be observed not to lay the chassis on the tuner side. Damage to the UHF Tuner may result.

CAUTION: When attempting to service the Tuner, do not move or rearrange components or mechanical parts as a change in distributed capacity may result and offset the alignment. When replacing a component, be sure to obtain the same lead lengths and replace in the same physical position.

SCHEMATIC DIAGRAM

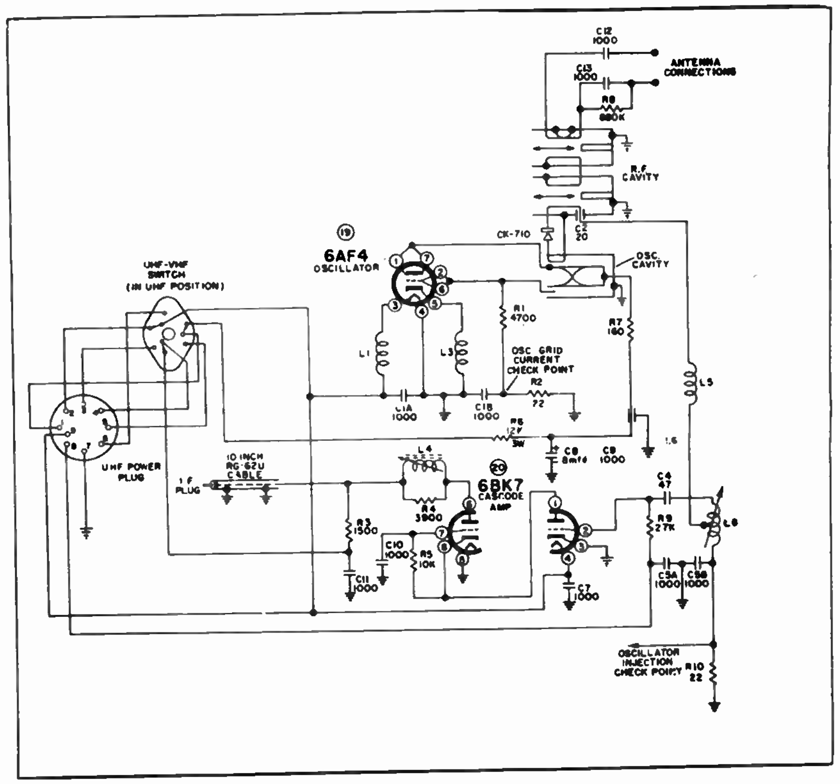


Figure 2 -- Early Version

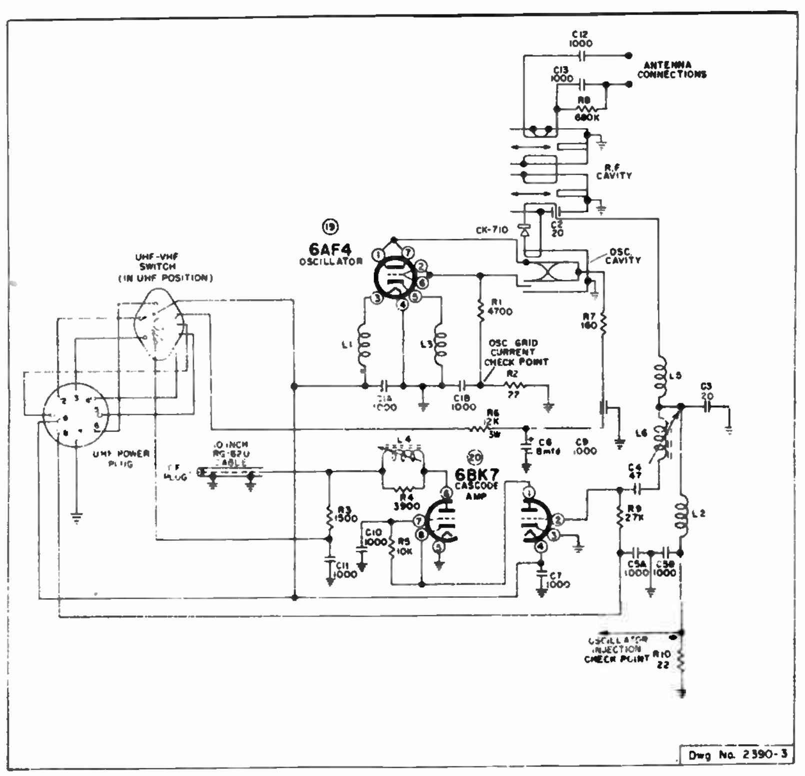


Figure 3 -- Later Version

SERVICE DATA

To determine whether the oscillator section is functioning, a convenient check point has been provided where the oscillator grid current can be measured. To measure the oscillator grid current, place a Simpson Model 260 Multimeter (or equivalent) on the 100 microamp scale across the 22 ohm resistor (R2). See figure 4. A reading of 10 to 30 microamperes should be obtained if the oscillator is functioning normally.

Both the oscillator and crystal detector can easily be checked by measuring the oscillator injection current. Place a Simpson Model 260 Multimeter (or equivalent) on the 100 microamp scale across the 22 ohm resistor (R 10) at the terminal indicated in Figure 5A or 5B depending on the version of the tuner. A reading of 5 to 40 microamperes should be obtained if both the oscillator and crystal are functioning normally.

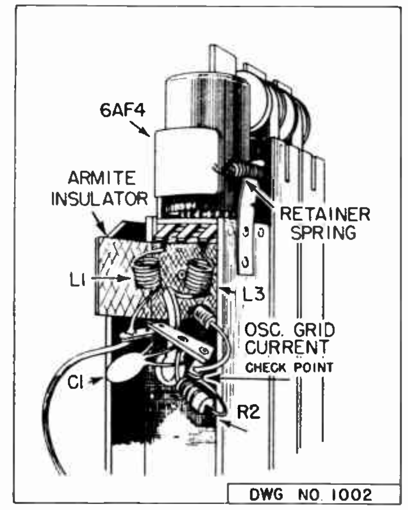


Figure 4

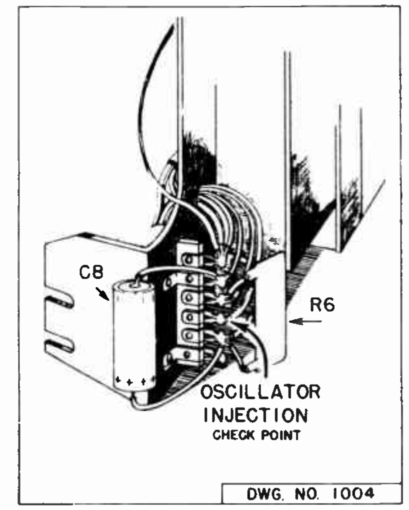


Figure 5A
Early Version

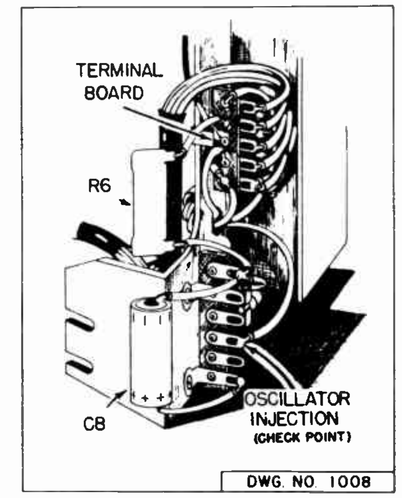


Figure 5B
Later Version

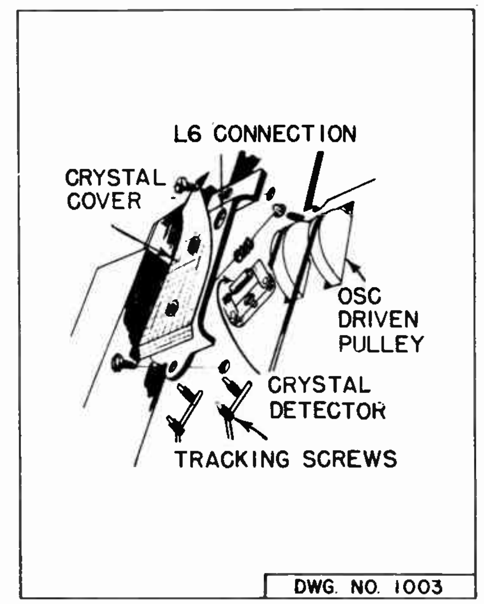


Figure 6

CRYSTAL DETECTOR: If replacement of the CK-710 Crystal Detector is necessary, the picture tube must be removed along with the crystal cover (refer to figure 6). The crystal is soldered into place and should be carefully resoldered after replacement. Overheating may damage the crystal. To dissipate the heat, grasp each crystal lead with a pliers when soldering into place.

ALIGNMENT

Since UHF is a relatively new field, test equipment necessary for RF and Oscillator Alignment is highly expensive and not readily available on the market at the present time. Therefore, a complete alignment procedure is not presented in this manual.

The cascode Pre-IF Amplifier can easily be realigned if necessary by connecting a 25 MC unmodulated signal to the center tap of L6 (see figure 7) or to the junction of Coil L-5 and Capacitor C-2 (see figure 6), depending on the version of the tuner and a VTVM at the video IF Detector output of the receiver. Connect generator through a 1 mmf capacitor. Adjust both L4 and L6 for maximum VTVM reading.

If for any reason such as dial cord replacement, component replacement, etc., the RF cavities may be adjusted for peak performance. Before attempting adjustment, note position of ribbons and mark the UHF drive gear so that original positions can be relocated if necessary. Loosen the pulley positioning screw (refer to figure 8) and rotate the pulleys for the sharpest and clearest picture.

CAUTION: Do not under any circumstances attempt adjustment of the tracking screws, oscillator trimmer screw or oscillator cavity. Precision test equipment is necessary for the adjustment.

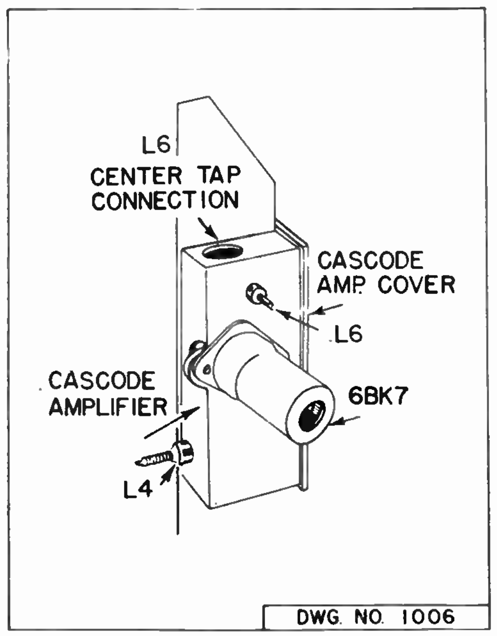


Figure 7

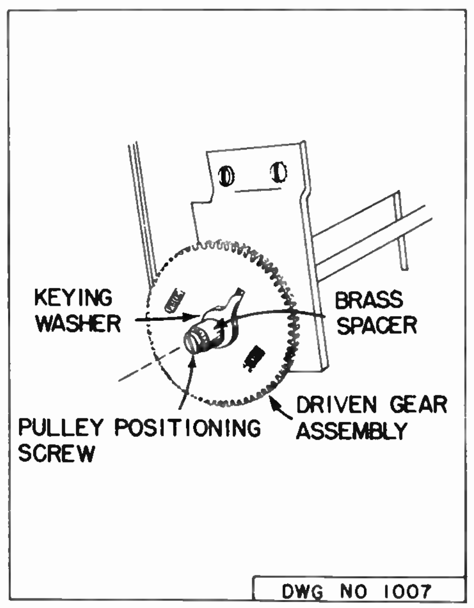


Figure 8

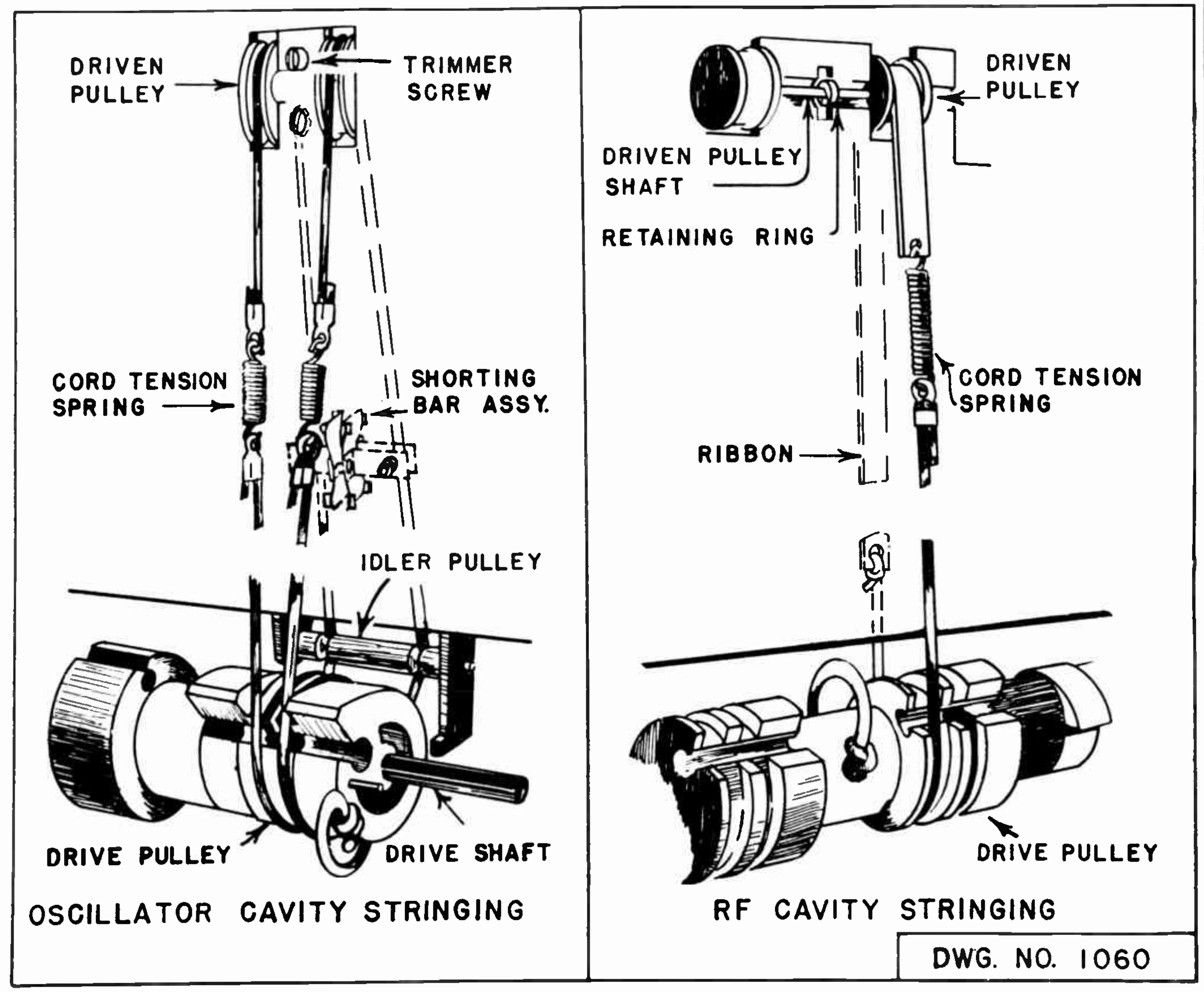


Figure 9

U. H. F. TELEVISION FREQUENCY RANGES

(All Figures Represent Megacycles)

CHANNEL	CHANNEL FREQUENCIES	PICTURE CARRIER FREQUENCY	SOUND CARRIER FREQUENCY	UHF TUNER OSCILLATOR FREQUENCY
14	470-476	471.25	475.75	498
15	476-482	477.25	481.75	504
16	482-488	483.25	487.75	510
17	488-494	489.25	493.75	516
18	494-500	495.25	499.75	522
19	500-506	501.25	505.75	528
20	506-512	507.25	511.75	534
21	512-518	513.25	517.75	540
22	518-524	519.25	523.75	546
23	524-530	525.25	529.75	552
24	530-536	531.25	535.75	558
25	536-542	537.25	541.75	564
26	542-548	543.25	547.75	570
27	548-554	549.25	553.75	576
28	554-560	555.25	559.75	582
29	560-566	561.25	565.75	588
30	566-572	567.25	571.75	594
31	572-578	573.25	577.75	600
32	578-584	579.25	583.75	606
33	584-590	585.25	589.75	612
34	590-596	591.25	595.75	618
35	596-602	597.25	601.75	624
36	602-608	603.25	607.75	630
37	608-614	609.25	613.75	636
38	614-620	615.25	619.75	642
39	620-626	621.25	625.75	648
40	626-632	627.25	631.75	654
41	632-638	633.25	637.75	660
42	638-644	639.25	643.75	666
43	644-650	645.25	649.75	672
44	650-656	651.25	655.75	678
45	656-662	657.25	661.75	684
46	662-668	663.25	667.75	690
47	668-674	669.25	673.75	696
48	674-680	675.25	679.75	702
49	680-686	681.25	685.75	708
50	686-692	685.25	691.75	714
51	692-698	693.25	697.75	720
52	698-704	699.25	703.75	726
53	704-710	705.25	709.75	732
54	710-716	711.25	715.75	738
55	716-722	717.25	721.75	744
56	722-728	723.25	727.75	750
57	728-734	729.25	733.75	756
58	734-740	735.25	739.75	762
59	740-746	741.25	745.75	768
60	746-758	747.25	751.75	774
61	752-758	753.25	757.75	780
62	758-764	759.25	763.75	786
63	764-770	765.35	769.75	792
64	770-776	771.25	775.75	798
65	776-782	777.25	781.75	804
66	782-788	783.25	787.75	810
67	788-794	789.25	793.75	816
68	794-800	795.25	799.75	822
69	800-806	801.25	805.75	828
70	806-812	807.25	811.75	834
71	812-818	813.25	817.75	840
72	818-824	819.25	823.75	846
73	824-830	825.25	829.75	852
74	829-836	831.25	835.75	858
75	836-842	837.25	841.75	864
76	842-848	843.25	847.75	870
77	848-854	849.25	853.75	876
78	854-860	855.25	859.75	882
79	860-866	861.25	865.75	888
80	866-872	867.25	871.75	894
81	872-878	873.25	877.75	900
82	878-884	879.25	883.75	906
83	884-890	885.25	889.75	912

NOTE: The UHF oscillator frequency listed is only for those UHF tuners which employ single conversion and a low frequency video IF strip. (25MC) Below is a simple formula for determining the particular frequencies for any UHF channel.

Fl -- (N-14) 6 + 470 MC	N -- UHF Channel number
Fh -- Fl + 6 MC	Fl -- UHF Channel low frequency end
Pc -- Fl + 1.25 MC	Fh -- UHF Channel high frequency end
Sc -- Fl + 4.5 MC	Pc -- UHF Picture Carrier frequency
O -- Fl + 28 MC	Sc -- UHF Sound carrier frequency
	O -- UHF Oscillator frequency

PARTS LIST

Ref. No.	Part No.	Description
		CAPACITORS
C1A, B	8G-19506	1000 mmf, dual ceramic
C2	8G-21315	20 mmf, feed thru
* C3	8G21951	20 mmf, ceramic
C4	8G20740	47 mmf, ceramic
C5A, B	8G-19506	1000 mmf, dual ceramic
C7	8G-13201	1000 mmf, ceramic
C8	8G-13453	8 mfd x 450 volt, lytic
C9	8G-20878	1000 mmf, feed thru
C10, 11	8G-13201	1000 mmf, ceramic
C12, 13	8G-19862	100 mmf, ceramic
		RESISTORS
R1	9B1-70	4700 ohm, ½ watt, 10%
R2	9B1-42	22 ohm, ½ watt, 10%
R3	9B1-64	1500 ohm, ½ watt, 10%
R4	9B1-69	3900 ohm, ½ watt, 10%
R5	9B1-74	10K ohm, ½ watt, 10%
R6	9C11-1112	12K ohm, 3 watt, 10%
R7	9B1-140	160 ohm, ½ watt, 5%
R8	9B1-96	680K ohm, ½ watt, 10%
R9	9B1-79	27K ohm, ½ watt, 10%
R10	9B1-42	22 ohm, ½ watt, 10%
		COILS
L1	16A-20469	Filament Choke Coil
* L2	201-20265	Choke Coil
L3	16A-20470	Cathode Choke Coil
L4	201-20483	Output IF Coil
** L5	16A-20537	Crystal Coupling Coil
* L5	16A-21934	Crystal Coupling Coil
** L6	201-20482	Input IF Coil
* L6	201-21933	Input IF Coil

Ref No.	Part No.	Description
		MISCELLANEOUS
	201-21283	Ribbon Contact Arm Assembly (bottom)
	**201-21284	Ribbon Contact Arm Assy. (top)
	* 201-21954	Ribbon Contact Arm Assy. (top)
	5M-21286	RF Driven Pulley
	3A-21287	Shaft for R.F. Pulley
	5M-21289	Oscillator Driven Pulley
	29C-21288	Retaining Ring (RF Pulley Shaft)
	3A-21290	Oscillator Pulley Shaft
	3A-21292	Oscillator Idler Pulley
	213-21583	Oscillator Cover Assembly
	8M-21655	Crystal (CK-710)
	200-21295	Crystal Cover
	200-21298	Driven Gear Assembly
	3A-21300	Drive Shaft
	29M-21512	Keying Washer
	3C-10073	Brass Spacers
	3C-21374	Sleeve Spacer
	32F8SE-5882	Pulley Positioning Screw
	5M-21373	R.F. Cavity Drive Pulley
	200-21299	Oscillator Drive Pulley & Pin
	2C-21301	R.F. Cavity Cover
	2B-21304	Cascode Amplifier Cover
	3M-21305	Tracking Screw
	62M-21306	Locking Wire (for above)

* Note: Later version Tuner only

** Note: Early version Tuner only

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H-740T21

H-742K21 (MAH.)
H-743K21 (BLOND)

CHASSIS ASSEMBLY V-2233-1

SERVICE NOTES

SPECIFICATIONS

FREQUENCY RANGES:

CHANNEL NUMBER	CHANNEL FREQUENCY (MC.)	VIDEO CARRIER FREQUENCY (MC.)	SOUND CARRIER FREQUENCY (MC.)	RECEIVER H-F OSCILLATOR FREQUENCY (MC.)
2	54 - 60	55.25	59.75	101
3	60 - 66	61.25	65.75	107
4	66 - 72	67.25	71.75	113
5	76 - 82	77.25	81.75	123
6	82 - 88	83.25	87.75	129
7	174 - 180	175.25	179.75	221
8	180 - 186	181.25	185.75	227
9	186 - 192	187.25	191.75	233
10	192 - 198	193.25	197.75	239
11	198 - 204	199.25	203.75	245
12	204 - 210	205.25	209.75	251
13	210 - 216	211.25	215.75	257

NOTE: Provisions for UHF reception are included. To activate the UHF positions of the channel selector, small single-channel UHF units can be inserted into the UHF sockets at the rear of the RF tuner or an all-channel UHF tuner can be installed. Installation instructions are furnished with the units.

FINE TUNING RANGES:
1 mc. minimum; 2 mc. maximum

POWER CONSUMPTION: .... 240 watts

AUDIO POWER OUTPUT:
Undistorted .... 1.8 watts
Maximum .... 2.8 watts

LOUDSPEAKER:
Type .... P.M.
Voice Coil Impedance .. 3.2 ohms at 400 cycles

RECEIVER ANTENNA INPUT IMPEDANCE:
...... 300 ohms balanced or 72 ohms unbalanced

TUBE COMPLEMENT:

1	1B3GT	High voltage rectifier
2	5U4G	Low voltage rectifiers
1	6AL5	Horizontal AFC
1	6AU6	Sound I-F amplifier
1	6AU6	Sync separator
1	6AU6	Keyed AGC
1	6AX4GT	Horizontal damper
1	6BK5	Audio output
1	6BN6	FM detector
1	6BQ6GT	Horizontal output
1	6BZ7	RF amplifier
3	6CB6	I-F amplifiers
1	6SN7GT	Vertical multivibrator
1	6X8	HF oscillator and mixer
1	12AT7	Sync amplifier and sync control
1	12AU7	Horizontal multivibrator
1	12BH7	Vert. output and noise clipper
1	12BY7	Video output
1	21FP4A	Cathode ray tube

OPERATING VOLTAGE:
105 to 120 volts, 60 cycles A-C

VIDEO CARRIER INTERMEDIATE FREQUENCY:
.... 45.75 mc.

VIDEO RESPONSE: .... 3.5 mc.

SOUND CARRIER INTERMEDIATE FREQUENCY:
.... 4.5 mc.

FOCUS: .... Electrostatic

SWEEP DEFLECTION: .... Magnetic

SCANNING: .... Interlaced 525 line

HORIZONTAL SCANNING FREQUENCY:
.... 15,750 CPS

VERTICAL SCANNING FREQUENCY: .... 60 CPS

FRAME FREQUENCY:
(picture repetition rate): .... 30 CPS

HIGH VOLTAGE WARNING

The danger accompanying shock is always present when the receiver is operated outside the cabinet or when the rear cover is removed from the cabinet. Only a person familiar with the precautions to be observed when working with high-voltage equipment should service this receiver.

CATHODE RAY TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves should be worn at all times when handling a cathode ray tube. The tube should not be handled in the vicinity of any person not so equipped. When handling the tube, always keep it away from the body.

Due to the large surface area of the tube and the high vacuum contained within, more than ordinary care is required to prevent shattering the tube. The large end of the bulb, particularly the rim of the viewing surface, must not be struck, scratched, or subjected to more than moderate pressure. If the tube binds during removal or replacement, determine the cause of the trouble -- **DO NOT FORCE THE TUBE.**

An additional precaution is required when handling a cathode ray tube that has an aquadag coating on the outside of the tube. The outside aquadag coating forms one plate of a capacitor, and the inside coating to which the high voltage is applied serves as the other plate. The high voltage charge may be retained in this capacitor for a long time after the high voltage lead is disconnected. Since the charge could produce a shock that would startle the handler into dropping the tube, the charge should be dissipated before any handling of the tube is attempted. To dissipate the charge, place a jumper from the outside aquadag coating to the high voltage button on the tube. Due to the relatively high resistance of the aquadag, the jumper should be held in place for some time to insure complete discharge.

INSTALLATION INSTRUCTIONS

TO PREPARE THE RECEIVER FOR OPERATION:

These models are shipped in operating condition. There is no shipping material to be removed. Simply remove the receiver from its carton, and connect the AC plug to a 105 to 120 volt 60 cycle AC outlet.

The receiver contains a built-in antenna for use in areas of normal reception. In such areas when the built-in antenna provides good reception, external antenna is not required. However, in weak signal areas or under adverse conditions, it may be necessary to use an outside antenna.

Two sets of antenna terminals are located on the back of the receiver, one labeled UHF and the other labeled STD. If an external antenna is to be connected to the receiver, the built-in antenna wires must be disconnected from the STD terminals. This can be accomplished by loosening the terminal screws and removing the wires. The built-in antenna wires should be dressed in such a position that they do not touch the chassis or metal components. The lead-in wires from the external antenna should then be connected to the STD terminals. The UHF antenna terminals are not used unless UHF units are installed (see note under FREQUENCY RANGES on front cover).

TO CHECK THE OPERATION OF THE RECEIVER:

1. Turn on the receiver by rotating the off-on-volume control clockwise.

2. Rotate the channel selector to the desired channel number. The two channel selector positions marked UHF are not operative unless UHF units have been installed (see note on front cover of this booklet). It should be noted that the channel selector position between 6 and 7 and the position between 13 and UHF are blank positions although the channel selector will come to rest in these positions.

3. Adjust the brightness control to a position where the picture screen is moderately lighted.

4. Check the ion trap magnet adjustment as outlined under ADJUSTMENTS.

5. Rotate the picture control to the position that provides best picture contrast.

6. If the picture moves up or down on the screen, the vertical hold control should be adjusted as explained under ADJUSTMENTS.

7. If the picture is pulled into diagonal bars or if the edge of the picture quivers or tends to fold over, adjust the horizontal control for correct synchronization. This control can be adjusted so that it will seldom be necessary to re-adjust it thereafter. To obtain this adjustment, tune in a TV station, and rotate the control to the middle of the range over which the picture is synchronized. If the middle of the sync range does not correspond approximately to the middle of the mechanical range, make the adjustments described under Horizontal Ringing Coil in the ADJUSTMENTS section. Check the adjustment of the horizontal control by switching to another channel and then back again. The picture should be stable when switching from channel to channel.

8. Rotate the fine tuning control to the position that provides best picture detail.

9. Re-adjustment of the brightness and picture controls may improve the picture shading. The correct balance between these controls produces the best picture. Once the brightness control has been adjusted to suit the preference of the user, it will seldom be necessary to re-adjust it.

10. Adjust the off-on-volume control for the desired sound volume.

11. Check the operation on all available TV stations.

12. If necessary, adjust the vertical linearity, height, horizontal linearity, width, focus, or centering as explained under ADJUSTMENTS.

ADJUSTMENTS

CATHODE RAY TUBE CUSHION

The CRT cushion must fit snugly against the flare of the CRT in order that the rear of the tube will be supported firmly. If this condition is not obtained, loosen the CRT cushion adjustment screws and the deflection yoke adjustment screw, slide the CRT cushion forward as far as possible, and re-tighten the screws.

DEFLECTION YOKE

The deflection yoke must be positioned as close as possible to the flare in the CRT. If adjustment is required, loosen the deflection yoke adjustment screw, slide the deflection yoke forward as far as possible, and re-tighten the screw. Note that the CRT cushion must fit snugly against the CRT flare as described previously.

The deflection yoke adjustment screw also permits the picture to be rotated to make it square with respect to the mask. To rotate the picture, loosen the deflection yoke adjustment screw and move it to the left or right. The picture will tilt to the left or right with the movement. Tighten the screw when the picture is squared in the mask.

FOCUS

The focus control is located on the back of the chassis as shown in Fig. 4. With the brightness and picture controls set at their normal operating positions, the focus control should be adjusted for best focus.

QUIETING CONTROL

The quieting control is located at the lower left on the back of the receiver and is adjusted by means of a screwdriver inserted through the hole in the back cover. This control, which determines the AM rejection characteristics of the sound system, is normally adjusted during alignment of the sound system as described under SOUND ALIGNMENT PROCEDURE and will not ordinarily require further adjustment. In very weak signal areas, however, a reduction in noise or hiss on the sound may be obtained by slightly re-adjusting the control.

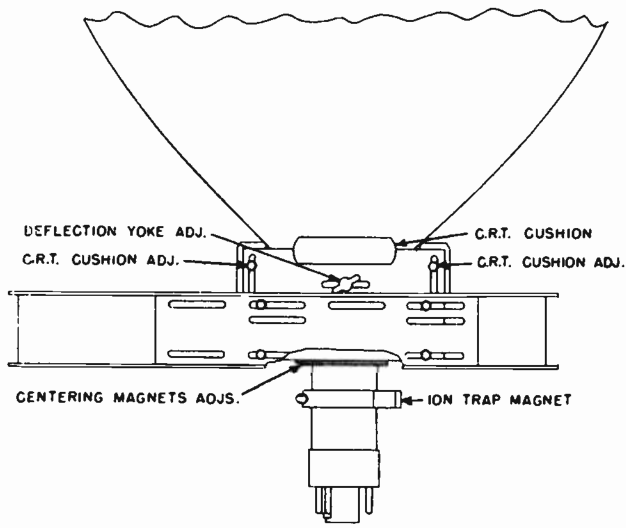


FIG. 1 — CRT ADJUSTMENTS

CENTERING

Centering is accomplished by rotating the centering magnet adjusting rings clockwise or counterclockwise as required. The two adjusting rings are located on the back of the deflection yoke as shown in Fig. 1. A tab projection on each of the rings serves to facilitate adjustment.

If difficulty is experienced in centering the picture or eliminating "neck shadows", make certain the CRT cushion is tight against the flare in the CRT. Also make certain that the deflection yoke is as far forward as possible.

ION TRAP MAGNET

It is extremely important that the ion trap magnet be correctly adjusted immediately after the set is first turned on during installation. This is true even though the set appears to be operating satisfactorily. When the magnet is not correctly oriented, the electron beam strikes the edge of the aperture in the anode top disc instead of moving cleanly through the hole. The resultant heat vaporizes the metal of the disc, thus releasing gas which has a harmful effect on the tube. Some of the vaporized material may be deposited on the screen of the tube and be apparent as darkened area. An excessively high setting of the brightness control will aggravate this condition. From this it is apparent that the brightness control should never be turned up to compensate for an incorrectly adjusted ion trap magnet. The tube can be ruined in a very short time under this condition.

To adjust the ion trap magnet, position the magnet approximately as shown in Fig. 1 with the color code mark facing upward, then rotate the magnet and move it forward and backward until the position is found where the picture is brightest. If the brightness peaks at two positions of the magnet, the position nearer the base of the tube is the correct one. Never move the ion trap magnet to remove a shadow from the raster if the brightness is decreased by so doing. Shadows should be removed by adjusting the position of the deflection yoke. *The ion trap magnet must always be adjusted for maximum picture brightness.*

HEIGHT AND VERTICAL LINEARITY

The height adjustment on the back of the chassis controls the overall height of the picture, and the vertical linearity adjustment controls the relationship between the vertical dimensions of the upper and the lower sections of the picture. A balance between the two controls is necessary to make the picture symmetrical and fill the mask vertically.

WIDTH AND HORIZONTAL LINEARITY

The width adjustment on the back of the chassis controls the overall width of the picture, and the horizontal linearity adjustment controls the relationship between the horizontal dimensions of the left and the right sections of the picture. A balance between the two controls is necessary to make the picture symmetrical with correct horizontal dimensions. These controls can be adjusted with a ¼" Spintite-type wrench.

VERTICAL HOLD

The vertical synchronization is controlled by the vertical hold adjustment. To adjust, rotate the control clockwise or counterclockwise until the picture is stabilized vertically. The adjustment should preferably be made on the weakest signal that is available, and a check should be made to see that the receiver pulls into sync on all channels.

HORIZONTAL RINGING COIL

The horizontal ringing coil (L401) should be adjusted as follows:

1. Short out the ringing coil with a short jumper wire.

2. Set the horizontal hold control to the middle of its range, and leave it in this position during the steps that follow.

3. Connect a VTVM to the junction of R477 and C456, located in the pin #2 grid circuit of the horizontal multivibrator, so as to measure the DC voltage between this point and ground.

4. With the receiver tuned to a TV station, adjust C457 (located near the horizontal multivibrator tube as shown in Fig. 4) for *zero* voltage on the meter. If zero voltage can be approached but not quite reached at one extreme of the C457 adjustment, it may be necessary to set the horizontal hold control slightly to one side of mid-position to obtain zero voltage.

5. Remove the jumper from across the ringing coil.

6. Adjust the ringing coil for *zero* voltage on the meter, and check the adjustment by switching to another channel and then back again. The receiver should pull into horizontal synchronization on all channels.

CRITICAL LEAD DRESS

Leads that are susceptible to R-F pickup with resulting interaction between stages must be dressed close to the chassis mounting plate. Leads in this category include heater, AGC, B plus, and the 125 volt bus leads. These leads must be long enough to permit dressing most of the path length close to the mounting plate. The heater wiring arrangement should not be altered.

Leads associated with the 41.25 mc. trap must be as short as possible and dressed away from the chassis.

Video peaking coils should be dressed away from the chassis and clear of adjacent parts.

The lead-in from the antenna terminals to the tuner must be dressed away from the I-F chassis to prevent an R-F "tweet" from interfering with the picture.

ALIGNMENT

TEST EQUIPMENT

To service these chassis, the following test equipment should be available:

1. R-F sweep generator that is capable of producing a 10 mc. sweep at a center frequency of 44 mc. The output must be adjustable from at least 100,000 microvolts down to a very low minimum, and the output must be flat at all positions of the attenuator.

2. Cathode ray oscilloscope, preferably one with a wide-band vertical deflection amplifier and a low-capacitance input probe. The oscilloscope should have good low-frequency response characteristics.

3. Signal generator or generators capable of producing an accurate unmodulated signal at 4.5 mc., 41.25 mc., 42.25 mc., 43.0 mc., 44.0 mc., 45.0 mc., and 45.75 mc. The accuracy of these frequencies is very important. If the signal generator does not include a crystal calibrator, a heterodyne frequency meter equipped with a crystal calibrator should be used to insure accuracy. The output level must be adjustable from at least 100,000 microvolts down to a very low minimum.

4. Vacuum tube voltmeter equipped with a high voltage multiplier probe for measurements up to 15,000 volts and an R-F probe for measuring R-F voltages.

GENERAL INFORMATION

The chassis and the test equipment should be bonded together by short lengths of heavy braided copper ribbon, and all interconnecting leads should be shielded and should be as short as possible consistent with ease in making connections. The effectiveness of the bonding can be checked during alignment by placing the hand on the chassis or test equipment case. If the response curve or meter reading changes, the bonding must be improved before the circuits are aligned.

It is important that the coaxial cable used to couple the sweep generator output to the receiver be terminated at its output end in the characteristic impedance of the sweep generator output circuit. To accomplish this, connect the appropriate value of resistance across the output leads at the open end of the cable. The oscilloscope vertical input cable and the generator output cables must be well separated from each other.

ALIGNMENT TOOL

To adjust the slugs in the common I-F transformers a special tool is required. This tool must fit into the .035" x .093" slot in slug. *An incorrectly designed tool will cause chipping of the slug.* A suitable tool is stocked under Westinghouse part number V-8345.

COMMON I-F ALIGNMENT PROCEDURE

The common I-F system uses over-coupled I-F transformers to obtain the required band width. In the alignment of this type system, the visual method of stage-by-stage alignment is used. A sweep generator is used to develop the I-F response curve on the oscilloscope, and an unmodulated signal generator (marker) is used to provide spot frequency indications on the curve.

With some of the I-F transformers, peaks may be obtained at two positions of the adjustment slugs. If a transformer is badly out of adjustment, it is advisable to turn the slug out (counterclockwise) as far as possible before beginning alignment. Then turn the slug clockwise until the first peak is reached. This procedure is recommended to obtain the correct peak rather than an undesired second peak which is sometimes obtained when the slug is turned farther clockwise.

The alignment procedure to be used is given in the following steps:

1. To avoid undesirable beat response during alignment, remove the 6BZ7 R-F amplifier tube from its socket and rotate the channel selector to channel 13. The channel selector is on channel 13 when the flat of the shaft is facing straight up.

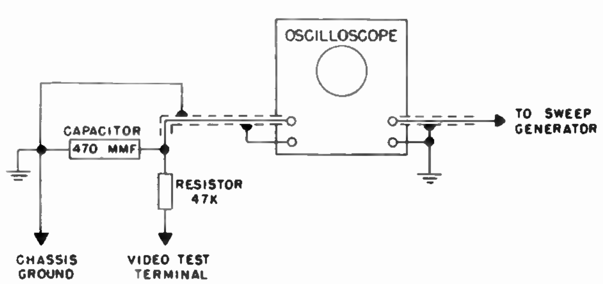


FIG. 2 — OSCILLOSCOPE CONNECTIONS

2. Connect the vertical input of the oscilloscope to the video test terminal (point "D" on Fig. 4) through the decoupling network shown in Fig. 2. The oscilloscope horizontal input should be connected to the sweep (synchronizing) output from the sweep generator *through well shielded leads.* Turn the sweep control on the oscilloscope to the "x" or "off" position.

3. Connect the negative terminal of a 9 volt bias battery to the AGC line, and connect the positive terminal to chassis ground.

4. Couple the marker generator output to the sweep generator output so that the two signals are applied together to the points specified in the steps that follow. Some sweep generators have facilities for connecting the marker output directly into the sweep generator. With other sweep generators, the marker can be coupled to the sweep by wrapping a few turns of insulated wire around the center conductor of the sweep generator output cable and connecting the marker generator to this wire. The loose coupling obtained in this manner is desirable because *excessive marker signal injection will distort the response curve.*

5. Adjust the sweep generator for a center frequency of 44 mc. with a sweep deviation of 10 mc.

6. Connect the high side of the sweep generator output cable directly to the control grid of the 3rd I-F amplifier, and connect the ground side of the cable to the chassis partition as close as possible to the ground point for the 3rd I-F amplifier tube. Keep the leads from the cable as short as possible.

7. Detune the plate circuit of the 2nd I-F amplifier by attaching an "alligator" or similar type clip to pin 5 of the 6CB6 2nd I-F amplifier tube. *Use care to avoid shock.* This step is necessary to avoid absorption of the signal that is applied at the 3rd I-F grid.

8. Adjust the oscilloscope vertical gain and the sweep generator output level to obtain a curve on the oscilloscope. To avoid a distorted curve, the recommended practice is to use maximum oscilloscope vertical gain and only enough sweep signal amplitude to obtain a good curve.

9. Set the marker generator to 44 mc. with the output attenuated until the marker pip is barely visible on the curve, and adjust the primary of the 3rd common I-F transformer, T304, until the 44 mc. marker pip is at the highest point on the response curve.

10. Adjust the secondary of T304 to make the top of the response curve symmetrical.

11. Make certain that the response curve coincides with Fig. 5A, using the marker to check at the appropriate frequencies. The 44 mc. pip must strike the center of the flat response region, the 42.25 mc. and 45.75 mc. points must be at equal heights, and the 43 mc. and 45 mc. points must be at equal heights. Re-adjust the primary and secondary of T304 if necessary to obtain these conditions.

12. Remove the detuning clip from the plate of the 2nd I-F amplifier tube, and attach it to the plate of the 1st I-F amplifier tube.

13. Move the sweep output connection from grid of the 3rd I-F amplifier to the grid of the 2nd I-F amplifier. Connect the ground side of the cable to the chassis partition as close as possible to the ground point for the 2nd I-F amplifier tube.

14. Adjust the primary of the 2nd common I-F transformer, T303, for maximum height of the response curve at 44 mc., and adjust the secondary of T303 to make the top of the curve symmetrical.

15. Make certain that the curve corresponds to Fig. 5B. The 44 mc. pip must strike the center of the flat response region, the 42.25 mc. and 45.75 mc. points must have equal heights, and the 43 mc. and 45 mc. points must have equal heights. Re-adjust the primary and secondary of T303 if necessary.

16. Remove the detuning clip from the plate of the 1st I-F amplifier.

17. Move the sweep output connection from the grid of the 2nd I-F amplifier to the grid of the 1st I-F amplifier, and connect the ground side of the cable as close as possible to the ground point for the 1st I-F amplifier tube.

18. Adjust the primary of the 1st common I-F transformer, T302, for maximum height of the response curve at 44 mc., and adjust the secondary of T302 to make the top of the curve symmetrical. If difficulty is experienced in aligning T302, adjust the adjacent channel interference trap, L308, to a higher frequency by rotating the slug completely counterclockwise. Complete information on the adjustment of L308 is given in step 26.

19. Make certain that the curve corresponds to Fig. 5C. The 44 mc. pip must strike the center of the flat response region, the 42.25 mc. and 45.75 mc. points must have equal height, and the 43 mc. and 45 mc. points must have equal heights. Re-adjust the primary and secondary of T302 if necessary.

20. Remove the sweep output connection from the 1st I-F amplifier grid, and couple it to the 6X8 mixer-oscillator tube through the coupling system illustrated in Fig. 3. This system provides adequate signal injection and at the same time provides shielding which prevents radiation of the signal. The device is constructed by flaring a piece of tubular copper braid over the top of the 6X8 tube and wrapping gummed tape over the braid to serve as insulation. The tube shield is then replaced over the tube with the braid protruding through the hole in the top of the shield. *The braid must not contact the chassis or the tube shield at any point.* The tube shield should be locked securely to its mounting base. Connect the high side of the sweep generator output cable to the copper braid, and connect the ground side to the nearest point on the chassis.

21. Rotate the slug of the 41.25 mc. trap (L301) completely clockwise.

22. It is possible to obtain two peaks when adjusting the primary of the I-F input coupling network, T101, located on the R-F tuner. These peaks

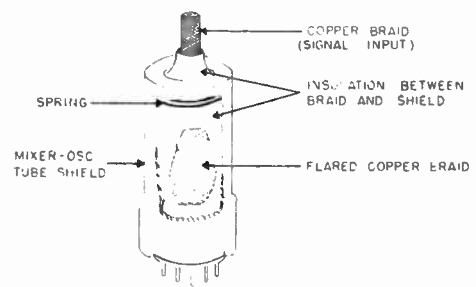


FIG. 3 — COUPLING SIGNAL GENERATOR TO MIXER TUBE

produce different overall bandwidths. The correct peak to use is normally the peak that occurs with the adjustment screw turned further counterclockwise.

Turn the adjustment screw of T101 completely counterclockwise. Then adjust T101 for maximum height of the response curve at 44 mc., and adjust the secondary of the I-F input coupling network, T301, to make the top of the curve symmetrical. If necessary, re-adjust T101 and T301 to make 44 mc. strike the center of the flat response region.

23. Set the marker generator to 41.25 mc., and increase the output until the pip is readily visible on the curve.

24. Adjust L301 to minimize the amplitude of the 41.25 mc. marker pip. L301 functions as a 41.25 mc. trap.

25. Make certain that the final response curve corresponds to Fig. 5D. Use the marker to check at the frequencies shown on the drawing. If necessary, re-adjust T101 and T301 to obtain the correct curve.

If the bandpass of the response curve is too narrow so that the 45.75 mc. marker occurs at less than 40 percent of maximum response, turn T101 clockwise until a second peak at 44 mc. is obtained. Adjust T301 for flat response at the top of the curve, and re-adjust T101 to center 44 mc. on the flat response.

26. L308 is the adjustment for the adjacent channel interference trap. If adjacent channel interference does not constitute a problem in the areas where the receiver is to be operated, L308 will not ordinarily require adjustment; however, the trap must not be mis-adjusted into the I-F response region. In areas where adjacent channel interference is not troublesome, L308 can be set to its highest tuneable frequency by rotating the slug completely counterclockwise, and it can be left in this position.

In areas where adjacent channel interference is evident, however, L308 should be adjusted to 47.25 mc. This can be accomplished in either of two ways. One is to connect an amplitude modulated signal generator that has an output of .02 volt or higher to the grid of the 1st I-F amplifier, and adjust the output frequency accurately to 47.25 mc. This will produce an indication on an oscilloscope connected to the video test terminal. Adjust L308 for minimum response on the oscilloscope. If a signal generator capable of this high output is not available, connect a good antenna to the receiver, and tune the receiver to the TV station on which the adjacent channel interference occurs, carefully adjusting the fine tuning control to its correct setting. Then, beginning with L308 in its completely counterclockwise position, rotate L308 clockwise until the position is found where the adjacent channel interference is eliminated. In some cases, the trap adjustment may affect the adjustment of T302. If this occurs, it will be necessary to repeat steps 17, 18 and 19.

4.5 MC. TRAP ALIGNMENT PROCEDURE

1. Connect the high side of the signal generator to the video test terminal (point "D" on Fig. 4) through a .001 mfd mica capacitor, and ground the low side to the chassis.

2. Adjust the signal generator to 4.5 mc. (unmodulated). The accuracy of this frequency is very important. If a crystal controlled signal generator is not available, the frequency should be checked with an accurate frequency meter.

3. Connect the common lead from the VTVM to the chassis, and connect the *R-F probe* from the VTVM to the cathode of the CRT. This point is shown as point "E" on Fig. 6. Note that this point is above ground potential and, therefore the R-F probe must contain a blocking capacitor.

4. Using a strong 4.5 mc. signal, adjust the 4.5 mc. trap, L309, for minimum indication on the meter.

SOUND ALIGNMENT PROCEDURE

The sound system can be aligned using either locally generated signals or a received TV signal. Since the latter method does not require signal generating equipment, it will be described first and will be followed by the procedure using locally generated signals.

To use an "air" TV signal for alignment:

1. Tune the receiver to a TV station and connect an attenuator between the receiver and the antenna so that the strength of the signal can be varied from weak to strong.

2. Set the quieting control (R201) located on the back of the chassis approximately to its mid-position.

3. Adjust the 4.5 mc. IF slugs (L201 and L202) for maximum program sound. If peaks occur at two different positions of the slug, use the peak that occurs when the slug is farthest counterclockwise. Reduce the signal to its lowest useable level and recheck the adjustments.

4. Apply a *strong* signal to the receiver, and adjust the quadrature coil (L204) for maximum program sound. If peaks occur at two different positions that are widely separated, use the one that occurs with the slug farthest counterclockwise. If two peaks occur within a *narrow* range of adjustment, sufficient signal is not being applied to the receiver or the quieting control is not set at the desired position.

5. Apply a very weak signal that allows noise to be heard and adjust the quieting control (R201) for minimum noise. The position at which the noise is minimized depends on the strength of the signal; therefore, the weakest useable station in the area should be used for this adjustment. This control determines the AM rejection characteristics of the sound system, and its correct setting is normally about mid-position. ***Do not leave the quieting control set at its maximum counterclockwise position.***

To use locally generated signals for alignment:

1. Connect an oscilloscope or an AC voltmeter across the volume control for use as an indicator.

2. Apply a 4.5 mc. FM signal (deviation approximately 7.5 kc.) to the video test point (D on Fig. 4).

3. Using the lowest signal level that will produce an indication, adjust L201 and L202 for maximum output.

4. Using a *strong* signal, adjust L204 for maximum output.

5. Apply a 4.5 mc. AM signal (modulated apx. 30 percent) to the video test point.

6. Beginning with a very low signal level, increase the generator output, while rotating the quieting control back and forth, until the signal level is such that the AM output across the volume control dips to *zero* with a rise on each side as the quieting control is rotated. Set the quieting control for zero output at this signal level.

H. F. OSCILLATOR ALIGNMENT PROCEDURE

If the 6X8 oscillator tube is replaced, the different inter-electrode capacitance of the new tube may change the oscillator frequency enough to necessitate re-alignment of the oscillator.

Alignment of the oscillator on the high band is accomplished by adjusting the brass slug located adjacent to the vernier drive wheel on the front of the tuner. Alignment of the oscillator on the low band is accomplished by adjusting the brass slug on the lower front of the tuner. The adjustment procedure is as follows:

1. Set the fine tuning control to the middle of its range, and keep it in this position during the following adjustments. The control is set to the middle of its range when the set-screw in the fine tuning drive wheel is straight up.

2. Set the selector switch to the highest of the low-band (channels 2 through 6) stations operating in your vicinity.

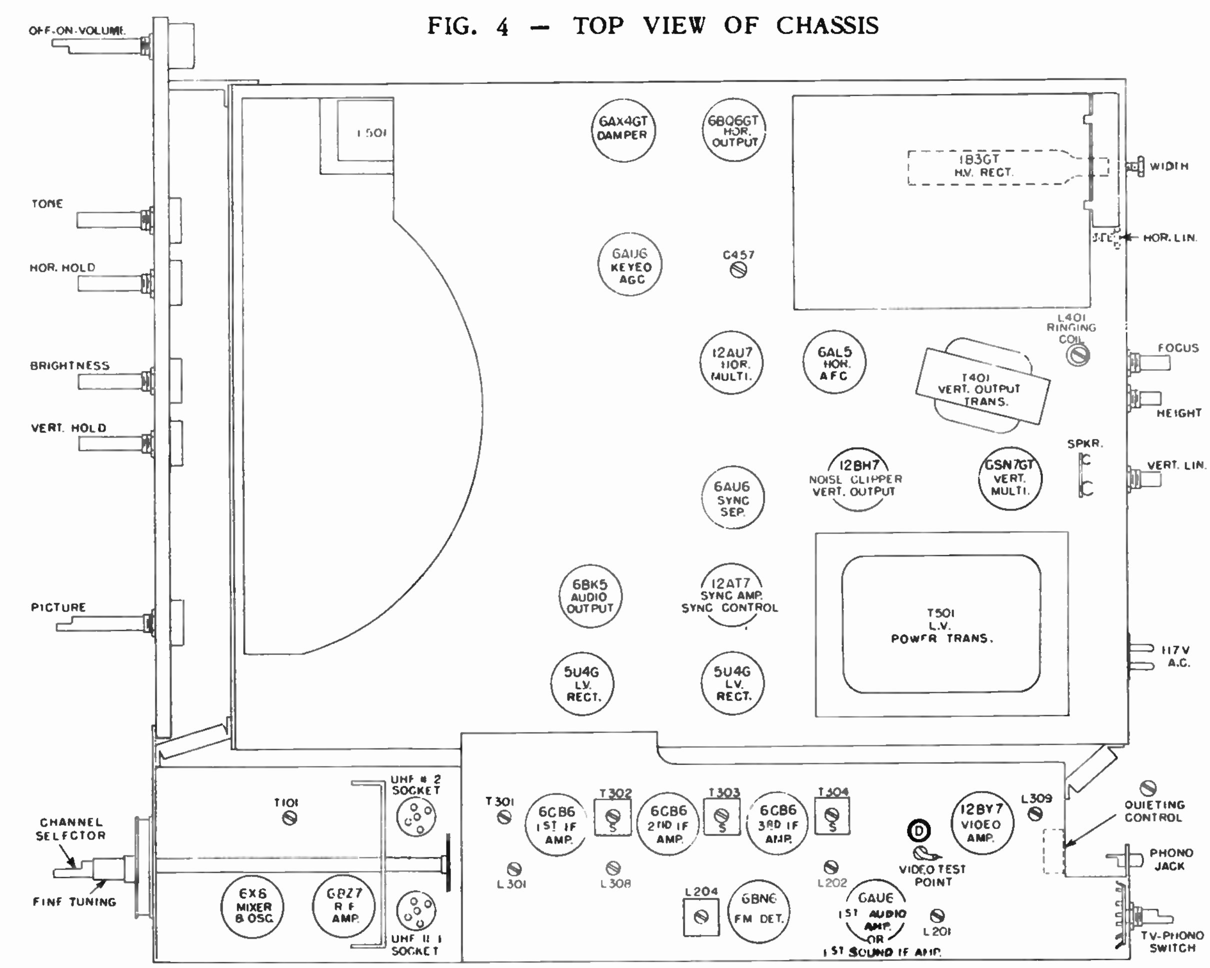
3. Peak the low band adjustment slug (L109) for the best picture detail.

4. Set the selector switch to the highest of the high-band (channels 7 through 13) stations operating in your vicinity.

5. Peak the high band adjustment slug (L110) for the best picture detail.

6. Check the previously made low band adjustment, and if the tuning has changed repeat steps 2 and 3.

FIG. 4 — TOP VIEW OF CHASSIS



ALIGNMENT CHARTS

The information in these charts is condensed from the foregoing detailed information as a convenience to the service technician. It is recommended that the detailed information be studied before using the charts.

COMMON I-F SECTION

Remove the 6BZ7 RF amplifier tube from its socket, and turn the channel selector to channel 13.

Connect the oscilloscope to the video test terminal through the decoupling network shown in Fig. 2.

Connect a 9 volt bias battery to the AGC line.

Adjust the sweep generator for a center frequency of 44 mc. with a 10 mc. sweep deviation, and couple the marker generator to the sweep generator.

Step	*Connect Sweep and Marker Generators to —*	*Marker Use*	*Connect Detuning Clip to —*	*Adjust —*
1.	3rd I-F amp. grid	Check for equal response at 42.25 mc and 45.75 mc using weak signal. Also 43 mc and 45 mc.	2nd I-F amp. plate	Pri. of T304 for max. response and sec. of T304 for symmetrical curve shown in Fig. 5A.
2.	2nd I-F amp. grid	Same as step 1	1st I-F amp. plate	Pri. of T303 for max. response and sec. of T303 for symmetrical curve shown in Fig. 5B.
3.	1st I-F amp. grid	Same as step 1	Not used	Pri. of T302 for max. response and sec. of T302 for symmetrical curve shown in Fig. 5C.
4.	6X8 mixer through coupling device shown in Fig. 3.	Check at 44 mc. Markerpip must be at center of flat region on curve	Not used	Turn L301 adj. completely clockwise and adjust T101 for max. response. Adjust T301 for symmetrical.
5.	Same as preceding step	Adjust to 41.25 mc. and increase output until pip is readily visible.	Not used	L301 to minimize amplitude of 41.25 mc. marker pip.
6.	Same as preceding step	Check curve at frequencies shown on Fig. 5.	Not used	Re-adjust T101 and T301 to obtain curve shown in Fig. 5D.
7.	Tune L308 to 47.25 mc. as described in step 26 of detailed information.			

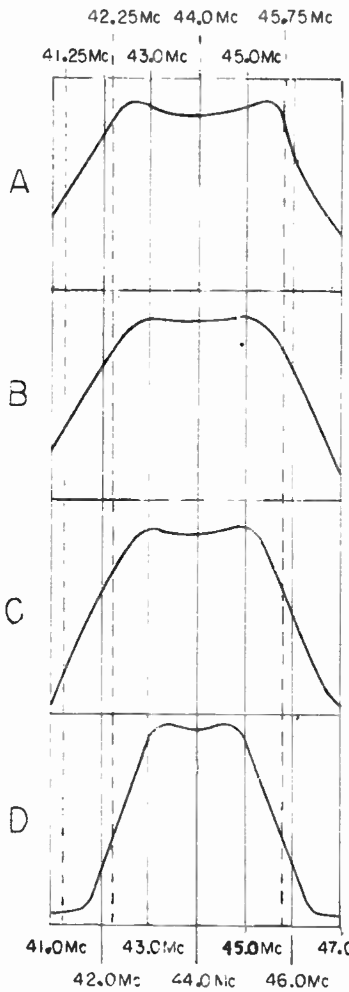


FIG. 5 — RESPONSE CURVES AT VARIOUS STAGES OF ALIGNMENT

4.5 MC. TRAP

Connect the signal generator to the video test terminal (point "D" on Fig. 4) through a .001 mfd capacitor.

Step	*Signal Gen. Frequency*	*VTVM Connections*	*Remarks*	*Adjust —*
1.	4.5 mc. unmodulated	RF probe to point "E" (see Fig. 6) and common lead to chassis.	Use strong signal from generator	L309 for minimum voltage

SOUND SECTION

Refer to SOUND ALIGNMENT PROCEDURE Using a weak signal, adjust L201 and L202 for maximum response to a 4.5 mc. FM signal. Using a strong signal, adjust L204 for maximum response to a 4.5 mc. FM signal. Using a weak signal, adjust the quieting control for minimum AM noise.

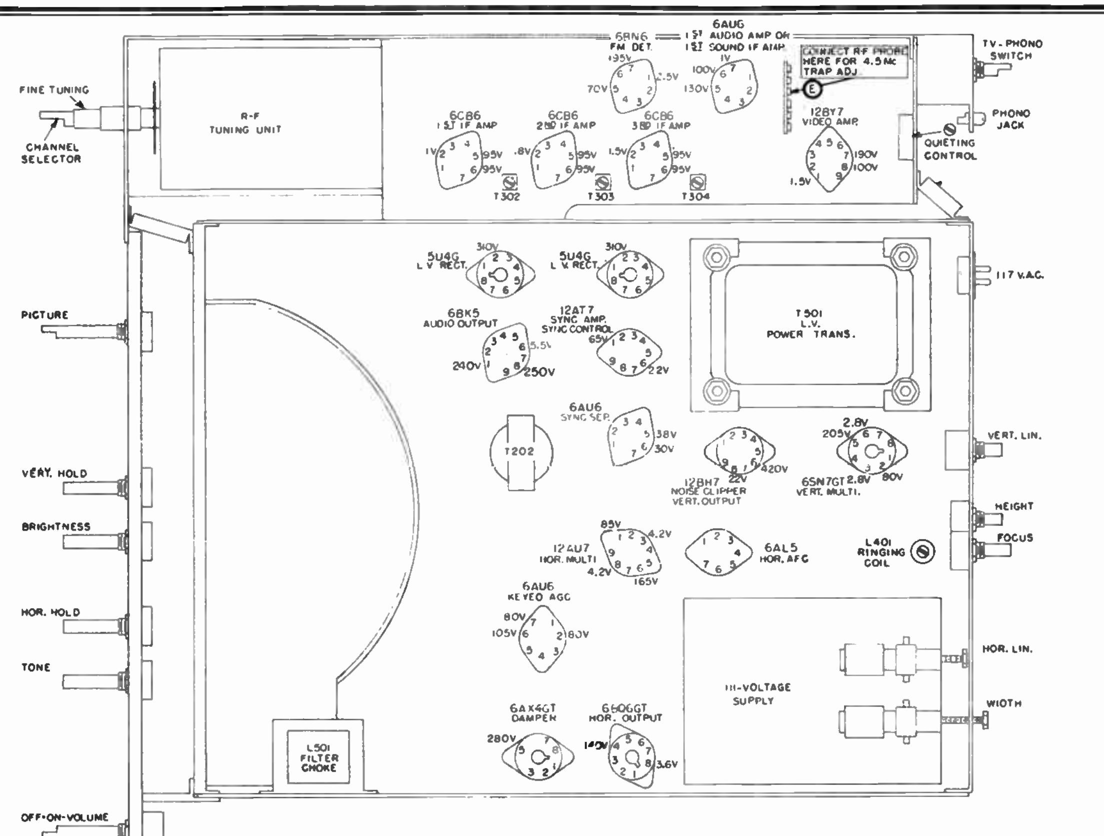


FIG. 6 — BOTTOM VIEW OF CHASSIS

PEAK-TO-PEAK VOLTAGE MEASUREMENTS USING AN OSCILLOSCOPE

To determine whether or not a television circuit is functioning correctly, it is sometimes necessary to compare the waveforms observed on an oscilloscope with those shown on the schematic diagram. In some cases, the complete story is not revealed unless peak-to-peak voltages are compared also. Peak-to-peak voltages can be measured on an oscilloscope by proceeding as follows:

1. Place a graph screen over the face of the cathode ray tube. A graph screen is a transparent sheet with lines drawn on it to form equal-sized squares, and it is normally furnished as part of the oscilloscope.

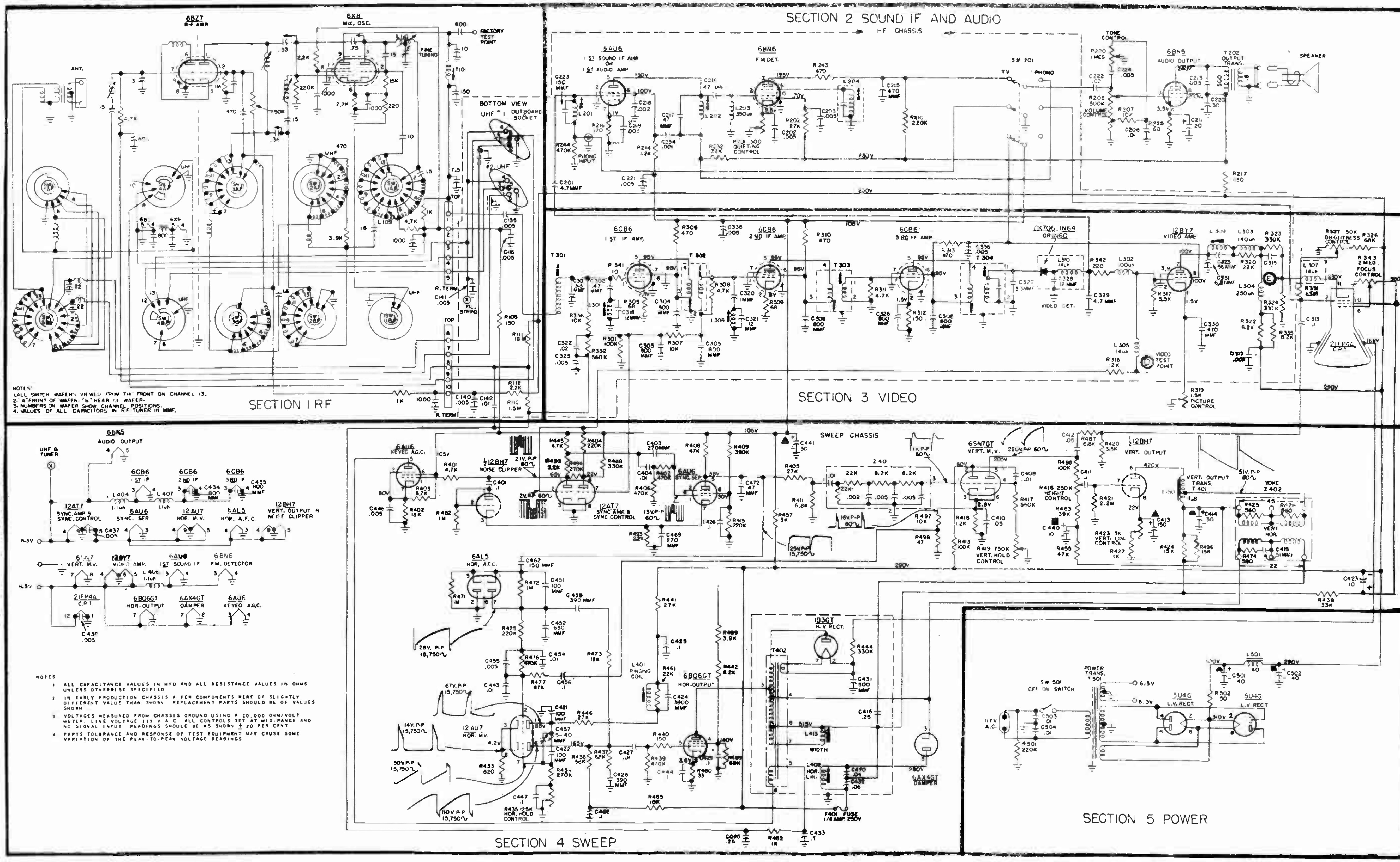
2. Connect the vertical input terminals of the oscilloscope to a source of calibrating voltage. The heater supply line in the television receiver is a convenient source. If the peak-to-peak voltage of the waveform to be measured is expected to be 20 volts or less connect the vertical input terminals across one branch of the heater line and ground so as to obtain 6.3 volts AC. If the expected peak-to-peak voltage is greater than 20 volts, connect the vertical input terminals across the two branches of the heater line so as to obtain 12.6 volts AC.

3. Compute the peak-to-peak voltage of the calibrating source. The calibrating voltage as measured on an AC voltmeter must be multiplied by 2.828 (2.83 is sufficiently accurate) to determine its peak-to-peak voltage. Thus, the peak-to-peak voltage corresponding to 6.3 volts r.m.s. is 17.8 volts, and the peak-to-peak voltage corresponding to 12.6 volts r.m.s. is 35.6 volts.

4. Adjust the vertical attenuator and vertical gain controls on the oscilloscope until the sine wave calibrating voltage is the desired size on the oscilloscope. Assuming there are 20 squares vertically and 20 squares horizontally on the usable area of the graph screen (this is common), the oscilloscope will have a response of one volt per square if the calibrating voltage is 17.8 volts peak-to-peak (6.3 volts r.m.s.) and the vertical gain of the oscilloscope is adjusted so that the calibrating sine wave occupies 17.8 squares vertically. If the calibrating voltage is 35.6 volts peak-to-peak (12.6 volts r.m.s.) and the oscilloscope gain is adjusted so the sine wave occupies 17.8 squares vertically (one-half of 35.6), the oscilloscope response is 2 volts per square. If the calibrating voltage is 35.6 volts peak-to-peak and occupies 8.9 squares vertically (one-fourth of 35.6), the oscilloscope response is 4 volts per square. This illustrates the manner in which the voltage per square response is determined. Once the voltage per square response has been established, *do not move the vertical gain or vertical attenuator controls.*

5. Disconnect the vertical input leads from the calibrating source, and connect them across the voltage to be measured. If necessary, center the waveform by adjusting the vertical centering control.

6. Multiply the number of vertical squares that the waveform occupies by the voltage per square response which was established in step 4.



CHASSIS NO. V-2233-1

FIG. 7 — SCHEMATIC DIAGRAM

IMPORTANT — Since many of the components are very critical, exact duplicates must be used for replacement purposes. However, any substiture supplied by Westinghouse will assure performance equal to or better than the list part.

PARTS LIST FOR MODELS H-740T21, H-742K21 AND H-743K21

When ordering parts, specify model number of set in addition to part number and description of part.

MODEL PARTS

	Part No.	Description	List Price Each
	V-10841-1	Baffle and Grille Cloth (H-740T21)	$ .50
†	V-1292-1	Cabinet (H-740T21)	36.67**
†	V-1293-1	Cabinet (H-742K21)	64.69**
†	V-1293-2	Cabinet (H-743K21)	66.73**
	V-5860-3	Cable Assembly, speaker (H-740T21)	.27
	V-5860-14	Cable Assembly, speaker (H-742K21, H-743K21)	.40
	V-5684-2	Clip, plate to mask	.03
	V-5522	Cord, AC power	1.25
†	V-10962-13	Cover Assembly, back	4.75
	V-11501-1	Gasket, dust seal	.65
†	V-9158-17	Grille Cloth (H-742K21)	***
†	V-10361-13	Grille Cloth (H-743K21)	***
†	V-11577-1	Knob, on-off-volume, picture (H-740T21, H-742K21)	.35
†	V-11577-2	Knob, on-off-volume, picture (H-743K21)	.35
†	V-11512-2	Knob, channel selector	1.20
†	V-11513-1	Knob, fine tuning (H-740T21, H-742K21)	.45
†	V-11513-2	Knob, fine tuning (H-743K21)	.35
	V-9547-1	Knob, phono switch	.10
†	V-11584-1	Mask, picture (H-740T21, H-742K21)	.45
†	V-11584-2	Mask, picture (H-743K21)	.45
†	V-11151-3	Nut, speed (control panel assy. mtg.)	.03
†	V-11505-2	Plate, front glass	15.50
	V-10932-1	Plate, mask (H-740T21, H-742K21)	.20
	V-10932-2	Plate, mask (H-743K21)	.25
†	V-11503-1	Panel, control assembly (H-740T21, H-742K21)	3.00
†	V-11503-2	Panel, control assembly (H-743K21)	3.20
	V-10030-1	Speaker, 5¼" PM (H-740T21)	3.90**
	V-9770-1	Speaker, 10" PM (H-742K21, H-743K21)	8.00**

V-2233-1 CHASSIS PARTS

MISCELLANEOUS

	Part No.	Description	List Price Each
†	V-11338-2	Belt, dial drive	$ .35
	V-5426	Clip, IF mounting	.03
	V-10110-1	Clip, tube cap (6BQ6GT)	.10
	V-5906-7	Connector Assembly, HV	.50
	V-9867-2	Cushion, yoke hood	.06
†	V-9784-5	Magnet, ion trap	.55
	V-5549	Plug, AC power (male)	.30
	V-5926	Screw, wing, #8-32 (yoke)	.04
	V-10038-1	Shield, miniature tube (crystal det., 6CB6)	.06
†	V-10038-3	Shield, miniature tube (6BN6)	.10
	V-10907-2	Socket Assembly, CRT	.80
	V-10918-1	Socket Assembly, 12BH7	.50
	V-10918-1	Socket Assembly, HMV	.50
	V-9888-1	Socket, miniature wafer (all 7-pin tubes)	.13
	V-9889-1	Socket, miniature wafer (all 9-pin tubes)	.15
	V-8605	Socket and Capacitor Assembly, HV (includes R444, C431)	3.25
	V-4514-1	Socket, molded octal (5U4G, 6SN7GT, 6BQ6GT)	.17
	V-4514-2	Socket, molded octal (6AX4GT)	.15
	V-10958-1	Socket, miniature wafer (12BY7, 6BK5)	.20
†	V-11657-1	Socket, phono input	.10
	V-10970-1	Socket, UHF connector	.35
	V-11468-2	Strap Assembly, CRT	.30
†	V-11543-1	Superstructure, yoke	.30
†	V-11656-1	Switch, TV-phono	1.10

† New part number listed for the first time in Westinghouse radio or television service information.
* Sold only as complete assembly. Price shown covers complete assembly.
** Price includes Federal Excise Tax.
*** Price furnished on request.
NOTE: All prices are subject to change without notice.

SECTION 1 — R-F

	Ref. No.	Part No.	Description	Function	List Price Each
	C116	V-5596	Capacitor, .005 mfd	Tuner decoupling	$ .25
	C135	V-5596	Capacitor, .005 mfd	Tuner coupling	.25
	C140	V-5596	Capacitor, .005 mfd	Tuner decoupling	.25
	C141	V-5596	Capacitor, .005 mfd	Heater bypass	.25
	C142	RCP10W4103M	Capacitor, .01 mfd 400 v.	AGC filter	.20
	R108	RC20AE151K	Resistor, 150 ohms ½ w.	Tuner decoupling	.05
†	R110	RC20AE155J	Resistor, 1.5 megohms ½ w.	AGC decoupling	.15
†	R111	RC20AE186J	Resistor, 18 megohms ½ w.	AGC divider	.15
†	R112	RC40AE222K	Resistor, 2200 ohms 2 w.	B plus dropping	.25
		V-11333-1	RF tuner assembly	Tuner decoupling	47.50

SECTION 2 — SOUND I-F AND AUDIO

	Ref. No.	Part No.	Description	Function	List Price Each
	C201	V-9926-3	Capacitor, 4.7 mmf	Sound take-off	.07
	C202	V-5596	Capacitor, .005 mfd	Cathode bypass	.25
	C203	V-5596	Capacitor, .005 mfd	Screen bypass	.25
	C208	RCP10W4103M	Capacitor, .01 mfd 400 v.	Tone compensation	.20
†	*C211	V-11535-1	Capacitor, 20 mfd 50 v. (assy. consists of C211, C440, C413, C414)	Filter	3.75*
	C213	RCP10W6502M	Capacitor, .005 mfd 600 v.	Tone compensation	.15
	C215	RCM20B471K	Capacitor, 470 mmf	Bypass	.31
	C216	RCM20B470K	Capacitor, 47 mmf	IF coupling	.22
	C217	RCM20B470K	Capacitor, 47 mmf	IF tank	.22
	C218	RCP10W6202M	Capacitor, .002 mfd 600 v.	Screen bypass	.19
	C219	V-5596	Capacitor, .005 mfd	Cathode bypass	.25
	*C220	V-9891	Capacitor, 30 mfd 450 v. elec. (assy. consists of C220, C441, C501, C502)	Filter	4.35*
	C221	V-5596	Capacitor, .005 mfd	Line bypass	.25
	C222	RCP10W4203M	Capacitor, .02 mfd 400 v.	Audio coupling	.18
	C223	RCM20B151K	Capacitor, 150 mmf	IF tank	.20
	C224	RCP10W4502M	Capacitor, .005 mfd 400 v.	Tone control coupling	.17
	C234	RCP10W4102M	Capacitor, .001 mfd 400 v.	Decoupling	.17
	L201	V-9882-5	Reactor	Sound IF grid	.60
	L202	V-9882-2	Reactor	Sound IF grid	.70
	L203	V-9915-2	Reactor, 350 microhenries	RF choke	.30
	L204	V-11396-1	Coil, quadrature	FM det.	1.60
	R201	V-11345-2	Resistor, variable (0-500 ohms)	Quieting control	1.40
	R202	RC40AE273K	Resistor, 27,000 ohms 2 w.	Screen dropping	.22
	R207	RC20AE103M	Resistor, 10,000 ohms ½ w.	Tone compensation	.05
†	*R208	V-11540-1	Control, 500,000 ohms (assy. consists of R208, SW501)	Volume	1.20*
	R210	RC20AE224K	Resistor, 220,000 ohms ½ w.	Plate load	.05
	R214	RC20AE122K	Resistor, 1200 ohms ½ w.	Screen decoupling	.05
	R216	RC20AE121K	Resistor, 120 ohms ½ w.	Cathode bias	.06
†	R217	RC40AE681K	Resistor, 680 ohms 2 w.	Audio coupling	.22
†	R220	V-11636-1	Control, 1 megohm	Tone	.80
	R225	RC20AE181K	Resistor, 180 ohms ½ w.	Cathode bias	.10
	R232	RC40AE223K	Resistor, 22,000 ohms 2 w.	Plate load	.18
	R243	RC20AE471M	Resistor, 470 ohms ½ w.	Plate linearity	.05
	R244	RC20AE474K	Resistor, 470,000 ohms ½ w.	Isolation	.05
†	SW201	V-11656-1	Switch	TV-phono	1.10
	T202	V-9238	Transformer	Audio output	1.90

SECTION 3 — VIDEO

	Ref. No.	Part No.	Description	Function	List Price Each
	C301	V-9926-2	Capacitor, 3.3 mmf	1st IF tank	.10
	C302	V-5658-11	Capacitor, 0.47 mmf	IF trap coupling	.08
	C303	V-9863-1	Capacitor, 800 mmf	AGC decoupling	.20
	C304	V-9863-1	Capacitor, 800 mmf	IF screen bypass	.20
	C305	V-9863-1	Capacitor, 800 mmf	AGC decoupling	.20
	C306	V-9863-1	Capacitor, 800 mmf	IF screen bypass	.20
	C308	V-9863-1	Capacitor, 800 mmf	IF screen bypass	.20
	C313	RCP10W4104M	Capacitor, .1 mfd 400 v.	CRT grid bypass	.24

† New part number listed for the first time in Westinghouse radio or television service information.
* Sold only as complete assembly. Price shown covers complete assembly.
** Price includes Federal Excise Tax.
*** Price furnished on request.
NOTE: All prices are subject to change without notice.

PARTS LIST FOR MODELS H-740T21, H-742K21 AND H-743K21 (continued)

	Ref. No.	Part No.	Description	Function	List Price Each
	C315	RCP10W4104M	Capacitor, .1 mfd 400 v.	Video bypass	$ .24
	C317	V-5596	Capacitor, .005 mfd	B plus bypass	.25
	C318	R3CC20SL120K	Capacitor, 12 mmf	41.25 mc. trap	.19
	C320	V-5658-1	Capacitor, 1.0 mmf	Adjacent channel trap	.08
	C321	R3CC20SL120K	Capacitor, 12 mmf	Adjacent channel trap	.19
	C322	RCP10W4203M	Capacitor, .02 mfd 400 v.	AGC anti-hunt	.18
	C323	RCM20B560K	Capacitor, 56 mmf	4.5 mc. trap	.20
	C325	V-5596	Capacitor, .005 mfd	AGC bypass	.25
	C326	V-9863-1	Capacitor, 800 mmf	Cathode bypass	.20
	C327	V-9926-2	Capacitor, 3.3 mmf	IF tank	.10
	C328	R3CC20SL120K	Capacitor, 12 mmf	Plate bypass	.19
	C329	V-9926-3	Capacitor, 4.7 mmf	Det. plate filter	.07
		V-10916-1	Crystal	Video detector	1.20
	C330	RCM20B471K	Capacitor, 470 mmf	Cathode bypass	.31
	C331	V-5658-12	Capacitor, 6.8 mmf	Vid. amp. plate	.10
	C335	V-5596	Capacitor, .005 mfd	Switch bypass	.25
	C336	V-5596	Capacitor, .005 mfd	Bypass	.25
	L301	V-10771-1	Reactor, slug tuned	41.25 mc. trap	.70
	L302	V-9915-1	Reactor, 100 microhenries	Video peaking	.30
	L303	V-5902-1	Reactor, 140 microhenries	Video peaking	.45
	L304	V-5902-5	Reactor, 250 microhenries	Video peaking	.39
	L305	V-4886-1	Reactor, 14 microhenries	Sync decoupling	.55
	L307	V-4886-1	Reactor, 14 microhenries	Video amp. decoupling	.55
	L308	V-10771-1	Reactor, slug tuned	Adjacent channel trap	.70
	L309	V-9882-3	Reactor, tuned	4.5 mc. trap	.70
	L310	V-4886-1	Reactor, 14 microhenries	Decoupling	.55
	R301	RC20AE104J	Resistor, 100,000 ohms ½ w.	AGC divider	.09
	R305	RC20AE680K	Resistor, 68 ohms ½ w.	Cathode bias	.04
	R306	RC20AE471M	Resistor, 470 ohms ½ w.	Decoupling	.05
	R307	RC20AE103M	Resistor, 10,000 ohms ½ w.	Grid decoupling	.05
	R308	V-9927-2	Resistor, 4700 ohms ½ w.	IF damping	.11
	R309	RC20AE680K	Resistor, 68 ohms ½ w.	Cathode bias	.04
	R310	RC20AE471M	Resistor, 470 ohms ½ w.	Screen decoupling	.05
	R311	V-9927-2	Resistor, 4700 ohms ½ w.	IF damping	.11
	R312	RC20AE151K	Resistor, 150 ohms ½ w.	Cathode bias	.05
	R313	RC20AE471M	Resistor, 470 ohms ½ w.	Screen decoupling	.05
	R316	RC20AE123K	Resistor, 12,000 ohms ½ w.	Sync take-off	.05
	R317	RC20AE332K	Resistor, 3300 ohms ½ w.	Det. load	.05
†	R319	V-11537-1	Control, 1500 ohms	Picture control	.85
	R320	RC20AE223K	Resistor, 22,000 ohms ½ w.	Damping	.06
	R322	RC40AE822K	Resistor, 3200 ohms 2 w.	Plate load	.20
	R323	RC20AE334K	Resistor, 330,000 ohms ½ w.	Divider	.05
	R324	RC20AE334K	Resistor, 330,000 ohms ½ w.	Divider	.05
	R326	RC30AE683K	Resistor, 68,000 ohms 1 w.	Divider	.09
†	R327	V-11536-1	Control, 50,000 ohms	Brightness	.80
	R331	RC20AE155K	Resistor, 1.5 megohms ½ w.	Retrace suppression	.05
	R332	RC20AE564J	Resistor, 560,000 ohms ½ w.	AGC divider	.10
	R335	RC40AE822K	Resistor, 8200 ohms 2 w.	Video plate load	.20
	R336	V-9927-10	Resistor, 10,000 ohms ½ w.	IF damper	.10
	R341	RC20AE100K	Resistor, 10 ohms ½ w.	1st IF grid	.06
	R342	RC20AE221K	Resistor, 220 ohms ½ w.	Video amp. grid	.05
	R343	V-9894-2	Control, 2 megohms	Focus	.75
	T301	V-9882-7	Reactor	IF input	.60
	T302	V-9879	Transformer	1st IF	1.30
	T303	V-9879	Transformer	2nd IF	1.30
	T304	V-9880	Transformer	3rd IF	1.30

SECTION 4 — SWEEP

	Ref. No.	Part No.	Description	Function	List Price Each
	C401	RCP10W4104M	Capacitor, .1 mfd 400 v.	Noise clipper coupling	.25
	C403	RCM20B271K	Capacitor, 270 mmf	Sync sep. grid	.20
	C404	RCP10W4103M	Capacitor, .01 mfd 400 v.	Vert. sync coupling	.24
	C408	RCP10W4103K	Capacitor, .01 mfd 400 v.	Vert. MV coupling	.19
	C410	RCP10W4503M	Capacitor, .05 mfd 400 v.	Cathode bypass	.24
	C411	RCP10M6104M	Capacitor, .1 mfd 600 v.	Vert. coupling	.35
	C412	RCP10W4503K	Capacitor, .05 mfd 400 v.	Pulse shaping net	.25
†	•C413	V-11535-1	Capacitor, 150 mfd 50 v. (assy. consists of C413, C414, C440, C211)	Filter	$ 3.75•
†	•C414	V-11535-1	Capacitor, 30 mfd 450 v. (assy. consists of C413, C414, C440, C211)	Filter	3.75•
†	C415	V-9792-10510J	Capacitor, 51 mmf (used only with the V-11571-1 defl. yoke)	Transient damping	.25
	C416	RCP10W4254M	Capacitor, .25 mfd 400 v.	Hor. yoke return	.35
	C421	RCM20B101K	Capacitor, 100 mmf	MV plate bypass	.22
	C422	RCM20B101K	Capacitor, 100 mmf	MV coupling	.22
	C423	V-10293-1	Capacitor, 10 mfd 450 v.	MV decoupling	1.25
	C424	RCM30C392K	Capacitor, 3900 mmf	MV plate tank	1.17
	C425	RCP10W4104M	Capacitor, .1 mfd 400 v.	MV plate decoupling	.25
	C426	RCM20B391K	Capacitor, 390 mmf	AFC coupling	.23
	C427	RCP10M6103M	Capacitor, .01 mfd 600 v.	Coupling	.21
	C428	RCP10W4104M	Capacitor, .1 mfd 400 v.	Screen bypass	.25
	C429	RCP10M6104M	Capacitor, .1 mfd 600 v.	Screen bypass	.35
	C431	V-9901-3	Capacitor, 500 mmf	HV filter	1.70
	C432	RCP10W4603M	Capacitor, .06 mfd 400 v.	Phasing network	.22
	C433	RCP10W4104M	Capacitor, .1 mfd 400 v.	AGC filter	.24
	C434	V-9863-1	Capacitor, 800 mmf	Heater bypass	.20
	C435	V-9863-1	Capacitor, 800 mmf	Heater bypass	.20
	C437	V-5596	Capacitor, .005 mfd	Heater bypass	.25
	C438	V-5596	Capacitor, .005 mfd	Heater bypass	.25
†	•C440	V-11535-1	Capacitor, 10 mfd 450 v. (assy. consists of C413, C414, C440, C211)	Decoupling	3.75•
	•C441	V-9891	Capacitor, 30 mfd 350 v. (assy. consists of C220, C441, C501, C502)	Filter	4.35•
	C443	RCP10W4103M	Capacitor, .01 mfd 400 v.	AGC delay	.20
	C444	RCP10W4104M	Capacitor, .1 mfd 400 v.	Cathode bypass	.24
	C445	RCP10W4254M	Capacitor, .25 mfd 400 v.	AGC bypass	.35
	C446	V-5596	Capacitor, .005 mfd	Cathode bypass	.25
	C447	RCP10W4104M	Capacitor, .1 mfd 400 v.	Control bypass	.24
	C451	RCM20B101K	Capacitor, 100 mmf	AFC cathode	.22
	C452	RCM20B681K	Capacitor, 680 mmf	AFC plate bypass	.25
	C453	RCM20B391K	Capacitor, 390 mmf	AFC coupling	.23
	C454	RCP10W4103M	Capacitor, .01 mfd 400 v.	MV grid	.20
	C455	RCP10W4502M	Capacitor, .005 mfd 400 v.	Coupling	.17
	C456	RCP10W4104M	Capacitor, .1 mfd 400 v.	MV grid	.24
	C457	V-11228-1	Capacitor, 5-40 mmf	MV trimmer	.35
	C462	RCM20B151K	Capacitor, 150 mmf	AFC coupling	.20
	C466	RCP10W4104M	Capacitor, .1 mfd 400 v.	HMV decoupling	.24
	C469	RCM20B271K	Capacitor, 270 mmf	Cathode bypass	.20
	C470	RCP10W4403M	Capacitor, .04 mfd 400 v.	Phasing network	.20
	C472	RCM20B470K	Capacitor, 47 mmf	Bypass	.22
	F401	V-6171-3	Fuse, ¼ amp. 250 v.	Protection	.30
	L401	V-6764	Coil	Ringing	1.45
†	L402	V-11545-1	Reactor	H. linearity	1.30
	L404	V-4886-2	Reactor, 1.1 microhenries	Heater isolation	.38
	L406	V-4886-2	Reactor, 1.1 microhenries	Heater decoupling	.38
	L407	V-4886-2	Reactor, 1.1 microhenries	Heater isolation	.38
†	L413	V-11546-2	Reactor	Width	1.35
	R401	RC20AE472K	Resistor, 4700 ohms ½ w.	Keyed AGC grid	.05
	R402	RC40AE183K	Resistor, 18,000 ohms 2 w.	AGC cathode	.18
	R403	RC30AE472K	Resistor, 4700 ohms 1 w.	AGC screen	.09
	R404	RC20AE224K	Resistor, 220,000 ohms ½ w.	Sync amp. deg	.05
	R405	RC20AE273K	Resistor, 27,000 ohms ½ w.	DC divider	.06
	R406	RC20AE474K	Resistor, 470,000 ohms ½ w.	Sync sep. grid	.05
	R407	RC20AE474K	Resistor, 470,000 ohms ½ w.	Coupling limite	.05
	R408	RC20AE473K	Resistor, 47,000 ohms ½ w.	Decoupling	.05
	R409	RC20AE394K	Resistor, 390,000 ohms ½ w.	Bleeder	.05
	R411	RC20AE682K	Resistor, 6800 ohms ½ w.	Sig. divider	.05
	R413	RC30AE104K	Resistor, 100,000 ohms 1 w.	Decoupling	.10
	R415	RC20AE224K	Resistor, 220,000 ohms ½ w.	Bypass	.05
	R416	V-9813-4	Control, 250,000 ohms	Height	.75
	R417	RC20AE564K	Resistor, 560,000 ohms ½ w.	Grid return	.05
	R418	RC20AE122K	Resistor, 1200 ohms ½ w.	Cathode bias	.05

† *New part number listed for the first time in Westinghouse radio or television service information.*
* *Sold only as complete assembly. Price shown covers complete assembly.*
** *Price includes Federal Excise Tax.*
*** *Price furnished on request.*
NOTE: *All prices are subject to change without notice.*

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PARTS LIST FOR MODELS H-740T21, H-742K21 AND H-743K21 (continued)

	Ref. No.	Part No.	Description	Function	List Price Each
†	R419	V-11539-1	Control, 750,000 ohms	Vert. hold	$ .75
	R420	RC20AE332K	Resistor, 3300 ohms ½ w.	Pulse shape net	.05
	R421	RC20AE225K	Resistor, 2.2 megohms ½ w.	Grid return	.05
	R422	RC20AE102K	Resistor, 1000 ohms ½ w.	Cath. bias	.05
	R423	V-6463	Control, 5000 ohms	Vert. linearity	.76
	R424	RC40AE153K	Resistor, 15,000 ohms 2 w.	Decoupling	.20
	R425	RC20AE561K	Resistor, 560 ohms ½ w.	Transient damping	.05
	R426	RC20AE561K	Resistor, 560 ohms ½ w.	Transient damping	.05
	R433	RC20AE821K	Resistor, 820 ohms ½ w.	Cathode bias	.05
	R434	RC20AE274J	Resistor, 270,000 ohms ½ w.	HMV grid	.15
	R435	V-11538-1	Control, 125,000 ohms	H. hold	.75
	R436	RC20AE563K	Resistor, 56,000 ohms ½ w.	Plate load	.10
	R437	RC20AE682K	Resistor, 6800 ohms ½ w.	Horiz. discharge	.05
	R438	RC20AE333K	Resistor, 33,000 ohms ½ w.	Boost decoupling	.05
	R439	RC20AE474K	Resistor, 470,000 ohms ½ w.	Grid return	.05
	R440	RC20AE151M	Resistor, 150 ohms ½ w.	Suppressor	.06
	R441	RC20AE273K	Resistor, 18,000 ohms ½ w.	HMV decoupling	.06
†	R442	V-11328-9	Resistor, 8200 ohms 5 w.	Bleeder	.75
	R444	V-9927-7	Resistor, 330,000 ohms 1 w.	HV filter	.10
	R445	RC20AE472K	Resistor, 4700 ohms ½ w.	Decoupling	.05
	R446	RC20AE273K	Resistor, 27,000 ohms ½ w.	Plate load	.06
	R452	RC20AE102K	Resistor, 1000 ohms ½ w.	AGC filter	.05
	R455	RC20AE473K	Resistor, 47,000 ohms ½ w.	Decoupling	.05
†	R457	V-9375-4	Resistor, 3000 ohms 20 w.	Bleeder	1.35
	R460	RC30AE330K	Resistor, 33 ohms 1 w.	Cathode bias	.11
	R461	RC20AE223K	Resistor, 22,000 ohms ½ w.	Coil shunt	.06
	R471	RC20AE105K	Resistor, 1 megohm ½ w.	AFC bleeder	.05
	R472	RC20AE105K	Resistor, 1 megohm ½ w.	AFC cathode	.05
	R473	RC20AE183K	Resistor, 18,000 ohms ½ w.	Error take-off	.05
	R474	RC20AE391K	Resistor, 390 ohms ½ w. (used only with V-1157-1 defl. yoke)	Transient damping	.08
	R475	RC20AE224K	Resistor, 220,000 ohms ½ w.	Plate decoupling	.05
	R476	RC20AE474K	Resistor, 470,000 ohms ½ w.	AFC delay	.05
	R477	RC20AE473K	Resistor, 47,000 ohms ½ w.	Plate load	.05
	R482	RC20AE105K	Resistor, 1 megohm ½ w.	Load	.05
	R483	RC20AE393K	Resistor, 39,000 ohms ½ w.	Decoupling	.05
	R485	RC20AE103K	Resistor, 10,000 ohms ½ w.	Decoupling	.05
	R486	RC20AE104K	Resistor, 100,000 ohms ½ w.	Plate load	.05
	R487	RC20AE682K	Resistor, 6800 ohms ½ w.	Pulse shape net	.05
	R488	RC20AE334K	Resistor, 330,000 ohms ½ w.	Sync control plate	.05
	R489	RC30AE683K	Resistor, 68,000 ohms 1 w.	Bleeder	.09
	R492	RC20AE222K	Resistor, 2200 ohms ½ w.	Signal divider	.05
	R493	RC20AE222K	Resistor, 2200 ohms ½ w.	Cathode bias	.05
	R494	RC20AE274K	Resistor, 270,000 ohms ½ w.	Divider	.06
	R496	RC40AE153K	Resistor, 15,000 ohms 2 w.	Vert. decoupling	.20
	R497	RC20AE103K	Resistor, 10,000 ohms ½ w.	Divider	.05
	R498	RC20AE470K	Resistor, 47 ohms ½ w.	Divider	.05
	R499	RC40AE392K	Resistor, 3900 ohms 2 w.	Dropping	.22
	T401	V-10909-1	Transformer	Vertical output	3.90
†	T402	V-11548-2	Transformer	Hor. output & HV	13.75
	T403	V-9902	Control	Width	1.55
	Z401	V-11192-1	Filter	Integrating	1.30
†	Z402	V-11570-1	Yoke assembly (contains V-11571-1 defl. yoke)	Deflection	13.50
			SECTION 5 — POWER		
	*C501	V-9891	Capacitor, 40 mfd 450 v. (assy. consists of C220, C441, C501, C502)	Filter output	4.35*
	*C502	V-9891	Capacitor, 40 mfd 450 v. (assy. consists of C220, C441, C501, C502)	Filter input	4.35*
	C503	V-5040-15	Capacitor, .01 mfd 600 v.	Line filter	.35
	C504	V-5040-15	Capacitor, .01 mfd 600 v.	Line filter	.35
	L501	V-6471-2	Reactor	LV filter	2.35
	R401	RC30AE224M	Resistor, 22,000 ohms 1 w.	Protection	.10
†	R502	V-11328-8	Resistor, 50 ohms 10 w.	Current limiter	.75
†	*SW501	V-11540-1	Switch (assy. consists of SW501, R208)	On-off	1.20*
†	T501	V-11544-1	Transformer	Power	19.06

† *New part number listed for the first time in Westinghouse radio or television service information.*
* *Sold only as complete assembly. Price shown covers complete assembly.*
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NEW FEATURES IN V-2233-1 CHASSIS

FUSE

A ¼ ampere fuse is used to protect the horizontal output tube and associated circuits. The fuse is located on top, near the center of the sweep chassis.

PHONO PROVISIONS

A record player can be connected to the phono jack located on the back of the IF chassis. When the TV-PHONO switch is in the PHONO position, plate voltage is removed from the 3rd IF amplifier, screen voltage is removed from the video amplifier, the grid of the CRT is grounded, and the 6AU6 sound IF amplifier serves as an audio amplifier for the phono signal. Thus, during phono operation, the face of the CRT is completely darkened.

16 KV HIGH VOLTAGE

A high-efficiency auto-transformer provides approximately 16,000 volts for the second anode of the CRT. This high voltage is desirable for good picture definition. A new tube (6AX4GT) which features a higher cathode to heater voltage rating is used in the horizontal damper circuit. Along with these circuit variations from previous Westinghouse chassis, the 15,750 CPS pulse applied to the horizontal AFC circuit is taken from the horizontal multivibrator rather than the horizontal output stage.

NEW CIRCUIT

If 60 cycle vertical sync pulses reach the horizontal sweep circuits, they may cause improper operation which appears as a bend in the top portion of the picture. This effect is eliminated by taking some 60 cycle pulse voltage from the cathode of the vertical multivibrator, dividing it to the correct amplitude (R497 and R498), and applying it to the grid of the horizontal multivibrator so as to cancel any 60 cycle sync pulses feeding through to this point.

SUPPLEMENTARY INFORMATION

CHASSIS ASSEMBLY V-2233-1

PRODUCTION CHANGES

The changes that follow are incorporated in later production of the V-2233-1 chassis and are included on the schematic diagram in this supplement.

TUNER VOLTAGE — To prevent excessive power dissipation in the RF amplifier tube under conditions of high line voltage, a 1000 ohm 1 watt resistor (R113) is inserted in series with R112 which connects to terminal #10 of the tuner.

AUDIO TONE — To improve the tone control action and eliminate excessive high tones, C215 in the plate circuit of the 6BN6 FM detector is changed to 270 mmf and a .001 mfd capacitor (C235) is added in parallel with C215.

RESISTOR CHANGE — The audio load resistor (R232) located in the plate circuit of the 6AU6 sound IF or audio amplifier tube is changed to 18,000 ohms to decrease power dissipation in the resistor.

PARASITIC SUPPRESSION — To suppress parasitic oscillations in the audio output stage at high volume levels, a 150 ohm resistor (R219) is inserted in series with the control grid of the 6BK5 tube and a 1000 ohm resistor (R234) is inserted in series with the screen grid.

FM DETECTOR — To improve the limiting action in the 6BN6 FM detector, the plate load resistor (R210) is changed to 330,000 ohms.

PHONO INPUT — To insure against overload on phonograph operation, the phono input voltage is divided by adding a 470,000 ohm resistor (R245) in series with the phono input jack.

TWEET ELIMINATION — To eliminate tweet interference which appears on the picture in some instances, an 800 mmf capacitor (C238) is added between ground and the 250 volt line that supplies accelerator voltage to the 6BN6 FM detector.

RESISTOR CHANGE — To lower power dissipation in the video amplifier plate load resistance when the picture control is set at minimum resistance, a 10 ohm resistor (R334) is added in series with the picture control.

RESISTOR CHANGE — A single 3900 ohm 5 watt resistor (R322) is used as a video amplifier plate load resistor in place of the two 8200 ohm resistors (R322 and R335) that had been used in parallel.

INCREASED BRIGHTNESS RANGE — To improve the range of the brightness control, a 10,000 ohms resistor (R325) is inserted between the control and ground.

HORIZONTAL OVERDRIVE ELIMINATION — To eliminate a white vertical line which appears approximately one third of the way from the left side of the raster under certain conditions, R485 in the horizontal multivibrator plate circuit (pin #6) is changed to 27,000 ohms, decreasing the drive to the horizontal output stage.

VERTICAL BAND ELIMINATION — To eliminate a vertical band that appears on the right side of the raster under some conditions, a 100,000 ohm resistor (R410) is added between the boosted voltage line and the 290 volt line.

RIPPLE ELIMINATION — To reduce hum at the plate of the horizontal multivibrator which may cause vertical lines in the picture to wave slightly when the receiver is operated on a non-synchronous AC line, C466 located in the pin #6 plate circuit of the horizontal multivibrator is changed to 0.25 mfd.

WIDTH REACTOR — To reduce temperature rise in the horizontal output transformer, the width reactor, L413, is changed to part number V-11546-3.

In the original parts list for the V-2233-1 chassis, reference number T403 is erroneously listed as a width control. Since T403 is not used in the V-2233-1 chassis (the width reactor is L413), T403 should be deleted from the parts list to avoid confusion.

DAMPER TUBE SUBSTITUTE — A 6AS4GT tube can be substituted in place of the 6AX4GT horizontal damper tube.

PARTS LIST CORRECTIONS AND ADDITIONS

Ref. No.	*Part No.*	*Description*	*Function*	*List Price Each*
	V-6171-6	Fuse, ¼ amp. 250 v.		$ .27
	V-11966-1	Holder, fuse		.20
C142	RCP10M6103M	Capacitor, .01 mfd 600 v.	AGC filter	.21
R113	RC30AE102M	Resistor, 1000 ohms 1 w.	B plus dropping	.09
C208	RCP10M6103M	Capacitor, .01 mfd 600 v.	Tone compensation	.21
C213	RCP10M6502M	Capacitor, .005 mfd 600 v.	Tone compensation	.20
C215	RCM20B271K	Capacitor, 270 mmf	RF bypass	.20
C222	RCP10M6203M	Capacitor, .02 mfd 600 v.	Audio coupling	.25
C224	RCP10M6502M	Capacitor, .005 mfd 600 v.	Tone control coupling	.20
C234	RCP10M6102M	Capacitor, .001 mfd 600 v.	Decoupling	.18
C235	RCP10M6102M	Capacitor, .001 mfd 600 v.	Audio bypass	.18
C238	V-9863-1	Capacitor, 800 mmf	Audio bypass	.20
R210	RC20AE334K	Resistor, 330,000 ohms ½ w.	Plate load	.05
R219	RC20AE151K	Resistor, 150 ohms ½ w.	Suppressor	.05
R232	RC40AE183K	Resistor, 18,000 ohms 2 w.	Dropping	.18
R234	RC20AE102K	Resistor, 1000 ohms ½ w.	Decoupling	.05
R245	RC20AE474K	Resistor, 470,000 ohms ½ w.	Divider	.05
C315	RCP10M4104M	Capacitor, .1 mfd 400 v.	Video bypass	.25
C322	RCP10M6203M	Capacitor, .02 mfd 600 v.	AGC anti-hunt	.25
R322	V-5924-3	Resistor, 3900 ohms 5 w.	Plate load	1.15
R325	RC20AE103K	Resistor, 10,000 ohms ½ w.	Brightness bleeder	.05
R344	RC20AE100K	Resistor, 10 ohms ½ w.	Cathode bias	.06
C404	RCP10M6103M	Capacitor, .01 mfd 600 v.	Sync coupling	.21
C408	RCP10M6103K	Capacitor, .01 mfd 600 v.	VMV coupling	.25
C415	V-9792-10430J	Capacitor, 43 mmf (used only with V-11571-2 defl. yoke)	Transient damping	*
C416	RCP10M4254M	Capacitor, .25 mfd 400 v.	Hor. yoke return	.40
C432	RCP10M4603M	Capacitor, .06 mfd 600 v.	Linearity network	.25
C443	RCP10M6103M	Capacitor, .01 mfd 600 v.	AGC delay	21
C454	RCP10M6103M	Capacitor, .01 mfd 600 v.	MV grid	.21
C455	RCP10M6502M	Capacitor, .005 mfd 600 v.	Coupling	.20
C466	RCP10W4254M	Capacitor, .25 mfd 400 v.	HMV decoupling	.40
C470	RCP10M4403M	Capacitor, .04 mfd 400 v.	Linearity network	.25
L413	V-11546-3	Reactor	Width	1.40
R410	RC30AE104K	Resistor, 100,000 ohms 1 w.	Bleeder	.10
R485	RC20AE273K	Resistor, 27,000 ohms ½ w.	Plate decoupling	.06

• Price furnished on request.
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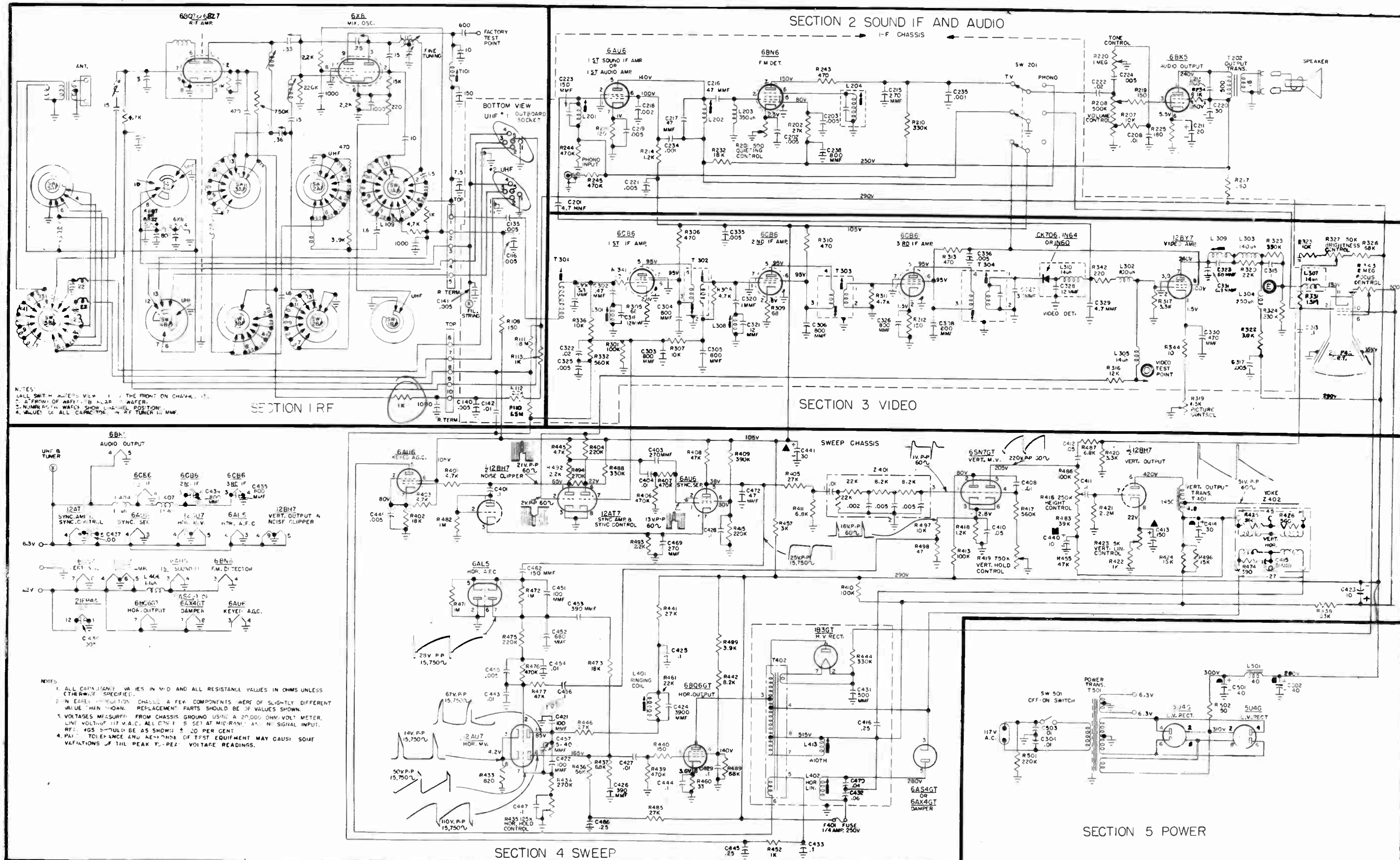

CHASSIS NO. V-2233-1

SCHEMATIC DIAGRAM

SUPPLEMENTARY INFORMATION
CHASSIS ASSEMBLY V-2232-2

A V-2232-2 chassis is used in later production of Model H-737T17. Included in this supplement are a schematic diagram, top view, bottom view and chassis parts list covering the V-2232-2 chassis.

For alignment, adjustment and other service information on the V-2232-2 chassis, refer to the H-740T21, H-742K21 and H-743K21 service notes.

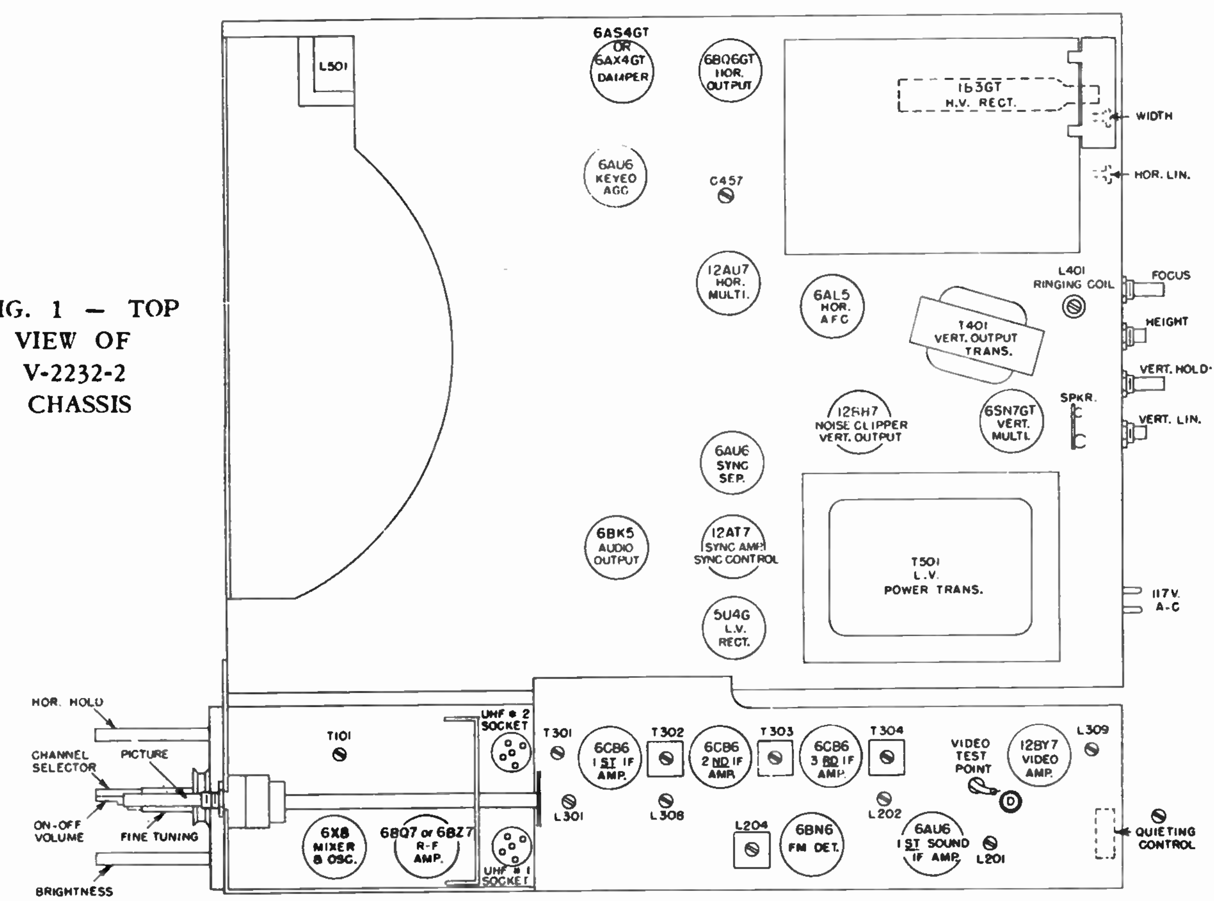

FIG. 1 — TOP VIEW OF V-2232-2 CHASSIS

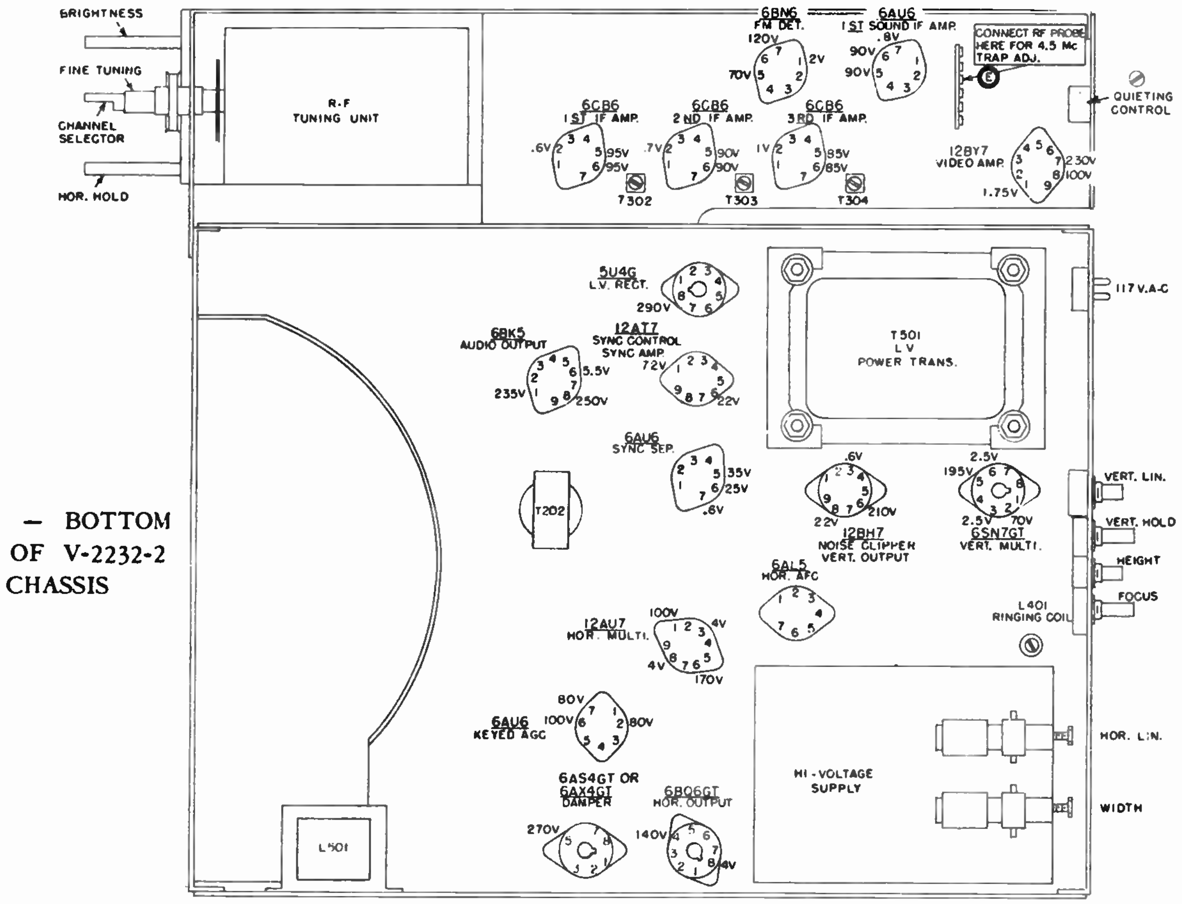

FIG. 2 — BOTTOM VIEW OF V-2232-2 CHASSIS

V-2232-2 CHASSIS PARTS

MISCELLANEOUS

	Part No.	Description	List Price Each
	V-11338-1	Belt, dial drive	$ .30
	V-5426	Clip, IF mounting	.03
	V-10110-1	Clip, tube cap (6BQ6GT)	.10
	V-5906-5	Connector Assembly, HV	.45
	V-9867-2	Cushion, yoke hood	.06
	V-6171-6	Fuse	.27
	V-11966-1	Holder, fuse	.20
	V-9784-4	Magnet, ion trap	.55
	V-5549	Plug, AC power (male)	.30
	V-5926	Screw, wing, #8-32 (yoke)	.04
	V-10038-1	Shield, miniature tube (crystal det., 6CB6)	.06
	V-10038-3	Shield, miniature tube (6BN6)	.10
	V-10907-1	Socket Assembly, CRT	.80
	V-10918-1	Socket Assembly, 12BH7	.50
	V-10918-1	Socket Assembly, HMV	.50
	V-9888-1	Socket, miniature wafer (all 7-pin tubes and crystal)	.13
	V-9889-1	Socket, miniature wafer (12AT7)	.15
	V-8605	Socket and Capacitor Assembly, HV (includes R444, C431)	3.25
	V-4514-1	Socket, molded octal (5U4G, 6SN7GT, 6BQ6GT)	.17
	V-4514-2	Socket, molded octal (6AX4GT)	.15
	V-10958-1	Socket, miniature wafer (12BY7, 6BK5, 12AU7)	.20
	V-10970-1	Socket, UHF connector	.35
✓	V-11468-4	Strap Assembly, CRT	.40
✓	V-11569-2	Superstructure, yoke	1.05

✓ *New part number listed for the first time in Westinghouse radio or television service information.*
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** *Price includes Federal Excise Tax.*
*** *Price furnished on request.*
NOTE: *All prices are subject to change without notice.*

PARTS LIST FOR V-2232-2 CHASSIS (continued)

SECTION 1 — R-F

Ref. No.	Part No.	Description	Function	List Price Each
C116	V-5596	Capacitor, .005 mfd	Tuner decoupling	$ .25
C135	V-5596	Capacitor, .005 mfd	Tuner coupling	.25
C140	V-5596	Capacitor, .005 mfd	Tuner decoupling	.25
C141	V-5596	Capacitor, .005 mfd	Heater bypass	.25
C142	RCP10W4103M	Capacitor, .01 mfd 400 v.	AGC filter	.20
R108	RC20AE151K	Resistor, 150 ohms ½ w.	Tuner decoupling	.05
R110	RC20AE155J	Resistor, 1.5 megohms ½ w.	Divider	.15
R111	RC20AE186J	Resistor, 18 megohms ½ w.	AGC divider	.15
R112	RC40AE222K	Resistor, 2200 ohms 2 w.	B plus dropping	.25
	V-11333-1	RF tuner assembly		47.50

SECTION 2 — SOUND I-F AND AUDIO

Ref. No.	Part No.	Description	Function	List Price Each
C201	V-9926-3	Capacitor, 4.7 mmf	Sound take-off	.07
C202	V-5596	Capacitor, .005 mfd	Cathode bypass	.25
C203	V-5596	Capacitor, .005 mfd	Screen bypass	.25
C208	RCP10W4203M	Capacitor, .02 mfd 400 v.	Tone compensation	.18
•C211	V-11535-1	Capacitor, 20 mfd 50 v. (assy. consists of C211, C440, C413, C414	Cathode bypass	3.75•
C213	RCP10W4502M	Capacitor, .005 mfd 400 v.	Audio plate	.17
C215	RCM20B471K	Capacitor, 470 mmf	Bypass	.31
C216	RCM20B470K	Capacitor, 47 mmf	IF coupling	.22
C217	RCM20B470K	Capacitor, 47 mmf	IF tank	.22
C218	RCP10W6202M	Capacitor, .002 mfd 600 v.	Screen bypass	.19
C219	V-5596	Capacitor, .005 mfd	Cathode bypass	.25
•C220	V-9891	Capacitor, 30 mfd 450 v. elec. (assy. consists of C220, C441, C501, C502)	Filter	4.35•
C221	V-5596	Capacitor, .005 mfd	Line bypass	.25
C222	RCP10W4203M	Capacitor, .02 mfd 400 v.	Audio coupling	.18
C223	RCM20B151K	Capacitor, 150 mmf	IF tank	.20
C235	RCP10W4102M	Capacitor, .001 mfd 400 v.	Filter	.17
L201	V-9882-5	Reactor	Sound IF grid	.60
L202	V-9882-2	Reactor	Sound IF grid	.70
L203	V-9915-2	Reactor, 350 microhenries	RF choke	.30
L204	V-11396-1	Coil, quadrature	FM det.	1.60
R201	V-11345-2	Resistor, variable (0-500 ohms)	Quieting control	1.40
R202	RC40AE273K	Resistor, 27,000 ohms 2 w.	Screen dropping	.22
R207	RC20AE273K	Resistor, 27,000 ohms ½ w.	Tone compensation	.06
•R208	V-9877-4	Control, 500,000 ohms (assy. consists of R208, R319, SW501)	Volume	2.15•
R210	RC20AE224K	Resistor, 220,000 ohms ½ w.	Plate load	.05
R214	RC20AE122K	Resistor, 1200 ohms ½ w.	Screen decoupling	.05
R216	RC20AE121K	Resistor, 120 ohms ½ w.	Cathode bias	.06
R217	RC40AE681K	Resistor, 680 ohms 2 w.	Dropping	.22
R225	RC20AE181K	Resistor, 180 ohms ½ w.	Cathode bias	.10
R243	RC20AE471M	Resistor, 470 ohms ½ w.	Plate linearity	.05
T202	V-9238	Transformer	Audio output	1.90

SECTION 3 — VIDEO

Ref. No.	Part No.	Description	Function	List Price Each
C301	V-9926-2	Capacitor, 3.3 mmf	1st IF tank	.10
C302	V-5658-11	Capacitor, 0.47 mmf	IF trap coupling	.08
C303	V-9863-1	Capacitor, 800 mmf	AGC decoupling	.20
C304	V-9863-1	Capacitor, 800 mmf	IF screen bypass	.20
C305	V-9863-1	Capacitor, 800 mmf	AGC decoupling	.20
C306	V-9863-1	Capacitor, 800 mmf	IF screen bypass	.20
C308	V-9863-1	Capacitor, 800 mmf	IF screen bypass	.20
C313	RCP10W4104M	Capacitor, .1 mfd 400 v.	CRT grid bypass	.24
C315	RCP10W4104M	Capacitor, .1 mfd 400 v.	Video bypass	.24
C317	V-5596	Capacitor, .005 mfd	Decoupling	.25

+ *New part number listed for the first time in Westinghouse radio or television service information.*
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Ref. No.	Part No.	Description	Function	List Price Each
C318	R3CC20SL120K	Capacitor, 12 mmf	41.25 mc. trap	$ .19
C320	V-5658-1	Capacitor, 1.0 mmf	Adjacent channel trap	.08
C321	R3CC20SL120K	Capacitor, 12 mmf	Adjacent channel trap	.19
C322	RCP10W4104M	Capacitor, .02 mfd 400 v.	AGC filter	.24
C323	RCM20B560K	Capacitor, 56 mmf	4.5 mc. trap	.20
C325	V-5596	Capacitor, .005 mfd	AGC bypass	.25
C326	V-9863-1	Capacitor, 800 mmf	Cathode bypass	.20
C327	V-9926-2	Capacitor, 3.3 mmf	IF tank	.10
C328	R3CC20SL120K	Capacitor, 12 mmf	Plate bypass	.19
C329	V-9926-3	Capacitor, 4.7 mmf	Det. plate filter	.07
	V-10916-1	Crystal	Video detector	1.20
C330	RCM20B471K	Capacitor, 470 mmf	Cathode bypass	.31
C331	V-5658-12	Capacitor, 6.8 mmf	Vid. amp. plate	.10
C335	V-5596	Capacitor, .005 mfd	Bypass	.25
L301	V-10771-1	Reactor, slug tuned	41.25 mc. trap	.70
L302	V-9915-1	Reactor, 100 microhenries	Video peaking	.30
L303	V-5902-1	Reactor, 140 microhenries	Video peaking	.45
L304	V-5902-5	Reactor, 250 microhenries	Video peaking	.39
L305	V-4886-1	Reactor, 14 microhenries	Sync decoupling	.55
L307	V-4886-1	Reactor, 14 microhenries	Video amp. decoupling	.55
L308	V-10771-1	Reactor, slug tuned	Adjacent channel trap	.70
L309	V-9882-3	Reactor, tuned	4.5 mc. trap	.70
L310	V-4886-1	Reactor, 14 microhenries	Decoupling	.55
R301	RC20AE104J	Resistor, 100,000 ohms ½ w.	AGC divider	.09
R305	RC20AE680K	Resistor, 68 ohms ½ w.	Cathode bias	.04
R306	RC20AE471M	Resistor, 470 ohms ½ w.	Decoupling	.05
R307	RC20AE103M	Resistor, 10,000 ohms ½ w.	Grid decoupling	.05
R308	V-9927-2	Resistor, 4700 ohms ½ w.	IF damping	.11
R309	RC20AE680K	Resistor, 68 ohms ½ w.	Cathode bias	.04
R310	RC20AE471M	Resistor, 470 ohms ½ w.	Screen decoupling	.05
R311	V-9927-2	Resistor, 4700 ohms ½ w.	IF damping	.11
R312	RC20AE151K	Resistor, 150 ohms ½ w.	Cathode bias	.05
R313	RC20AE471M	Resistor, 470 ohms ½ w.	Screen decoupling	.05
R316	RC20AE123K	Resistor, 12,000 ohms ½ w.	Sync take-off	.05
R317	RC20AE332K	Resistor, 3300 ohms ½ w.	Det. load	.05
•R319	V-9877-4	Control, 1500 ohms (assy. consists of R208, R319, SW501)	Picture control	2.15•
R320	RC20AE223K	Resistor, 22,000 ohms ½ w.	Damping	.06
R322	V-5924-3	Resistor, 3900 ohms 5 w.	Plate load	1.15
R323	RC20AE334K	Resistor, 330,000 ohms ½ w.	Divider	.05
R324	RC20AE334K	Resistor, 330,000 ohms ½ w.	Divider	.05
R325	RC20AE103K	Resistor, 10,000 ohms ½ w.	Brightness bleeder	.05
R326	RC30AE683K	Resistor, 68,000 ohms 1 w.	Divider	.09
R327	V-10914-1	Control, 50,000 ohms	Brightness	.80
R332	RC20AE474J	Resistor, 470,000 ohms ½ w.	AGC divider	.12
R336	V-9927-10	Resistor, 10,000 ohms ½ w.	IF damper	.10
R341	RC20AE100K	Resistor, 10 ohms ½ w.	1st IF grid	.06
R342	RC20AE221K	Resistor, 220 ohms ½ w.	Video amp. grid	.05
R343	V-9894-2	Control, 2 megohms	Focus	.75
T301	V-9882-7	Reactor	IF input	.60
T302	V-9879	Transformer	1st IF	1.30
T303	V-9879	Transformer	2nd IF	1.30
T304	V-9880	Transformer	3rd IF	1.30

SECTION 4 — SWEEP

Ref. No.	Part No.	Description	Function	List Price Each
C401	RCP10W4104M	Capacitor, .1 mfd 400 v.	Noise clipper coupling	.25
C403	RCM20B271K	Capacitor, 270 mmf	Sync sep. grid	.20
C404	RCP10W4103M	Capacitor, .01 mfd 400 v.	Vert. sync coupling	.24
C408	RCP10W4103K	Capacitor, .01 mfd 400 v.	Vert. MV coupling	.19
C410	RCP10W4503M	Capacitor, .05 mfd 400 v.	Cathode bypass	.24
C411	RCP10M6104M	Capacitor, .1 mfd 600 v.	Vert. coupling	.35
C412	RCP10W4503K	Capacitor, .05 mfd 400 v.	Pulse shaping net	.25

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PARTS LIST FOR V-2232-2 CHASSIS (continued)

Ref. No.	Part No.	Description	Function	List Price Each
•C413	V-11535-1	Capacitor, 150 mfd 50 v. (assy. consists of C413, C414, C440, C211)	Filter	$3.75•
•C414	V-11535-1	Capacitor, 30 mfd 450 v. (assy. consists of C413, C414, C440, C211)	Filter	3.75•
C415	V-9792-10510J	Capacitor, 51 mmf (used only with the V-11571-1 defl. yoke)	Transient damping	.25
✝ C415	V-9792-10430J	Capacitor, 43 mmf (used only with V-11571-2 defl. yoke)	Transient damping	•••
C416	RCP10W4254M	Capacitor, .25 mfd 400 v.	Hor. yoke return	.35
C421	RCM20B101K	Capacitor, 100 mmf	MV plate bypass	.22
C422	RCM20B101K	Capacitor, 100 mmf	MV coupling	.22
C423	V-10293-1	Capacitor, 10 mfd 450 v.	MV decoupling	1.25
C424	RCM30C392K	Capacitor, 3900 mmf	MV plate tank	1.17
C425	RCP10W4104M	Capacitor, .1 mfd 400 v.	MV plate decoupling	.25
C426	RCM20B391K	Capacitor, 390 mmf	Pulse shaping	.23
C427	RCP10M6103M	Capacitor, .01 mfd 600 v.	Coupling	.21
C428	RCP10W4104M	Capacitor, .1 mfd 400 v.	Screen bypass	.25
C429	RCP10M6104M	Capacitor, .1 mfd 600 v.	Screen bypass	.35
C431	V-9901-3	Capacitor, 500 mmf	HV filter	1.70
C432	RCP10W4603M	Capacitor, .06 mfd 400 v.	Linearity network	.22
C433	RCP10W4104M	Capacitor, .1 mfd 400 v.	Filter	.24
C434	V-9863-1	Capacitor, 800 mmf	Heater bypass	.20
C435	V-9863-1	Capacitor, 800 mmf	Heater bypass	.20
C437	V-5596	Capacitor, .005 mfd	Heater bypass	.25
C438	V-5596	Capacitor, .005 mfd	Heater bypass	.25
•C440	V-11535-1	Capacitor, 10 mfd 450 v. (assy. consists of C413, C414, C440, C211)	Decoupling	3.75•
•C441	V-9891	Capacitor, 30 mfd 350 v. (assy. consists of C220, C441, C501, C502)	Filter	4.35•
C443	RCP10W4103M	Capacitor, .01 mfd 400 v.	AGC delay	.20
C444	RCP10W4104M	Capacitor, .1 mfd 400 v.	Cathode bypass	.24
C445	RCP10W4254M	Capacitor, .25 mfd 400 v.	Filter	.35
C446	V-5596	Capacitor, .005 mfd	Cathode bypass	.25
C447	RCP10W4104M	Capacitor, .1 mfd 400 v.	Control bypass	.24
C451	RCM20B101K	Capacitor, 100 mmf	AFC cathode	.22
C452	RCM20B681K	Capacitor, 680 mmf	AFC plate bypass	.25
C453	RCM20B391K	Capacitor, 390 mmf	AFC coupling	.23
C454	RCP10W4103M	Capacitor, .01 mfd 400 v.	MV grid	.20
C455	RCP10W4502M	Capacitor, .005 mfd 400 v.	Coupling	.17
C456	RCP10W4104M	Capacitor, .1 mfd 400 v.	MV grid	.24
C457	V-11228-1	Capacitor, 5-40 mmf	MV trimmer	.35
C462	RCM20B151K	Capacitor, 150 mmf	AFC coupling	.20
C466	RCP10W4104M	Capacitor, .1 mfd 400 v.	HMV decoupling	.24
C469	RCM20B271K	Capacitor, 270 mmf	Cathode bypass	.20
C470	RCP10W4403M	Capacitor, .04 mfd 400 v.	Linearity network	.20
C472	RCM20B470K	Capacitor, 47 mmf	Sync sep. plate	.22
L401	V-6764	Coil	Ringing	1.45
L402	V-11545-1	Reactor	H. linearity	1.30
L404	V-4886-2	Reactor, 1.1 microhenries	Heater isolation	.38
L406	V-4886-2	Reactor, 1.1 microhenries	Heater decoupling	.38
L407	V-4886-2	Reactor, 1.1 microhenries	Heater isolation	.38
✝ L413	V-11546-3	Reactor	Width	1.40
R401	RC20AE472K	Resistor, 4700 ohms ½ w.	Keyed AGC grid	.05
R402	RC40AE183K	Resistor, 18,000 ohms 2 w.	AGC cathode	.18
R403	RC30AE472K	Resistor, 4700 ohms 1 w.	AGC screen	.09
R404	RC20AE224K	Resistor, 220,000 ohms ½ w.	Pos. bias limiting	.05
R405	RC20AE273K	Resistor, 27,000 ohms ½ w.	DC divider	.06
R406	RC20AE474K	Resistor, 470,000 ohms ½ w.	Sync sep. grid	.05
R407	RC20AE474K	Resistor, 470,000 ohms ½ w.	Coupling limiter	.05
R408	RC20AE473K	Resistor, 47,000 ohms ½ w.	Decoupling	.05
R409	RC20AE394K	Resistor, 390,000 ohms ½ w.	Sync sep. screen	.05
R411	RC20AE682K	Resistor, 6800 ohms ½ w.	Sig. divider	.05
R413	RC30AE104K	Resistor, 100,000 ohms 1 w.	Decoupling	.10
R415	RC20AE224K	Resistor, 220,000 ohms ½ w.	Bleeder	.05
R416	V-9813-4	Control, 250,000 ohms	Height	.75
R417	RC20AE564K	Resistor, 560,000 ohms ½ w.	Grid return	.05
R418	RC20AE122K	Resistor, 1200 ohms ½ w.	Cathode bias	.05

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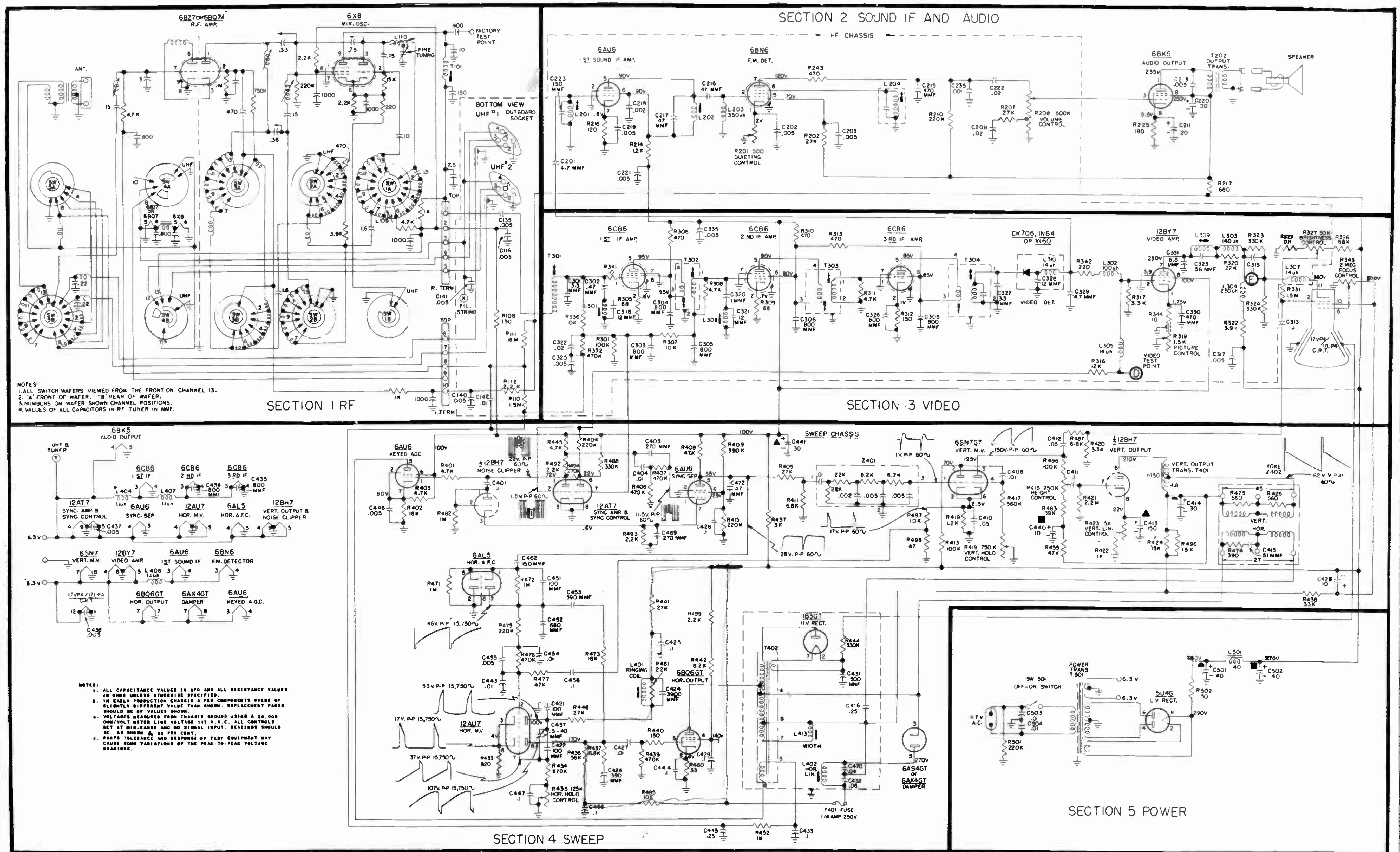
Ref. No.	Part No.	Description	Function	List Price Each
R419	V-9894-3	Control, 750,000 ohms	Vert. hold	$ .75
R420	RC20AE332K	Resistor, 3300 ohms ½ w.	Pulse shape net	.05
R421	RC20AE225K	Resistor, 2.2 megohms ½ w.	Grid return	.05
R422	RC20AE102K	Resistor, 1000 ohms ½ w.	Cath. bias	.05
R423	V-6463	Control, 5000 ohms	Vert. linearity	.76
R424	RC40AE153K	Resistor, 15,000 ohms 2 w.	Decoupling	.20
R425	RC20AE561K	Resistor, 560 ohms ½ w.	Transient damping	.05
R426	RC20AE561K	Resistor, 560 ohms ½ w.	Transient damping	.05
R433	RC20AE821K	Resistor, 820 ohms ½ w.	Cathode bias	.05
R434	RC20AE274J	Resistor, 270,000 ohms ½ w.	HMV grid	.15
R435	V-10915-1	Control, 125,000 ohms	Horiz. hold	.80
R436	RC20AE563K	Resistor, 56,000 ohms ½ w.	Plate load	.10
R437	RC20AE682K	Resistor, 6800 ohms ½ w.	Horiz. discharge	.05
R438	RC20AE333K	Resistor, 33,000 ohms ½ w.	Plate decoupling	.05
R439	RC20AE474K	Resistor, 470,000 ohms ½ w.	Grid return	.05
R440	RC20AE151M	Resistor, 150 ohms ½ w.	Suppressor	.06
R441	RC20AE273K	Resistor, 18,000 ohms ½ w.	HMV decoupling	.06
R442	V-11328-9	Resistor, 8200 ohms 5 w.	Screen decoupling	.75
R444	V-9927-7	Resistor, 330,000 ohms 1 w.	HV filter	.10
R445	RC20AE472K	Resistor, 4700 ohms ½ w.	Decoupling	.05
R446	RC20AE273K	Resistor, 27,000 ohms ½ w.	Plate load	.06
R452	RC20AE102K	Resistor, 1000 ohms ½ w.	AGC filter	.05
R455	RC20AE473K	Resistor, 47,000 ohms ½ w.	Decoupling	.05
R457	V-9375-4	Resistor, 3000 ohms 20 w.	Bleeder	1.35
R460	RC30AE330K	Resistor, 33 ohms 1 w.	Cathode bias	.11
R461	RC20AE223K	Resistor, 22,000 ohms ½ w.	Coil shunt	.06
R471	RC20AE105K	Resistor, 1 megohm ½ w.	AFC bleeder	.05
R472	RC20AE105K	Resistor, 1 megohm ½ w.	AFC cathode	.05
R473	RC20AE183K	Resistor, 18,000 ohms ½ w.	AFC take-off	.05
R474	RC20AE391K	Resistor, 390 ohms ½ w.	Transient damping	.08
R475	RC20AE224K	Resistor, 220,000 ohms ½ w.	Plate decoupling	.05
R476	RC20AE474K	Resistor, 470,000 ohms ½ w.	AFC delay	.05
R477	RC20AE473K	Resistor, 47,000 ohms ½ w.	Plate load	.05
R482	RC20AE105K	Resistor, 1 megohm ½ w.	Load	.05
R483	RC20AE393K	Resistor, 39,000 ohms ½ w.	Decoupling	.05
R485	RC20AE103M	Resistor, 10,000 ohms ½ w.	Decoupling	.05
R486	RC20AE104K	Resistor, 100,000 ohms ½ w.	Plate load	.05
R487	RC20AE682K	Resistor, 6800 ohms ½ w.	Pulse shape net	.05
R488	RC20AE334K	Resistor, 330,000 ohms ½ w.	Sync control plate	.05
R492	RC20AE222K	Resistor, 2200 ohms ½ w.	Signal divider	.05
R493	RC20AE222K	Resistor, 2200 ohms ½ w.	Cathode bias	.05
R494	RC20AE274K	Resistor, 270,000 ohms ½ w.	Divider	.06
R496	RC40AE153K	Resistor, 15,000 ohms 2 w.	Vert. decoupling	.20
R497	RC20AE103M	Resistor, 10,000 ohms ½ w.	Divider	.05
R498	RC20AE470K	Resistor, 47 ohms ½ w.	Divider	.05
R499	RC40AE222K	Resistor, 2200 ohms 2 w.	Dropping	.25
T401	V-10909-1	Transformer	Vertical output	3.90
T402	V-11548-2	Transformer	Hor. output & HV	13.75
Z401	V-11192-1	Filter	Integrating	1.30
Z402	V-11570-1	Yoke assembly (contains V-11571-1 defl. yoke)	Deflection	13.50

SECTION 5 — POWER

Ref. No.	Part No.	Description	Function	List Price Each
•C501	V-9891	Capacitor, 40 mfd 450 v. (assy. consists of C220, C441, C501, C502)	Filter output	4.35•
•C502	V-9891	Capacitor, 40 mfd 450 v. (assy. consists of C220, C441, C501, C502)	Filter input	4.35•
C503	V-5040-15	Capacitor, .01 mfd 600 v.	Line filter	.35
C504	V-5040-15	Capacitor, .01 mfd 600 v.	Line filter	.35
L501	V-6471-2	Reactor	LV filter	2.35
R501	RC30AE224M	Resistor, 22,000 ohms 1 w.	Protection	.10
R502	V-11328-8	Resistor, 50 ohms 10 w.	Current limiter	.75
•SW501	V-9877-4	Switch (assy. consists of R208, R319, SW501)	Off-on	2.15•
✝ T501	V-11544-2	Transformer	Power	19.00

✝ *New part number listed for the first time in Westinghouse radio or television service information.*
• *Sold only as complete assembly. Price shown covers complete assembly.*
•• *Price includes Federal Excise Tax.*
••• *Price furnished on request.*
NOTE: *All prices are subject to change without notice.*



CHASSIS NO. V-2232-2

FIG. 3 — SCHEMATIC DIAGRAM

IMPORTANT — Since many of the components are very critical, exact duplicates must be used for replacement purposes. However, any substitute supplied by Westinghouse will assure performance equal to or better than the list part.

MODEL H-755K21

CHASSIS ASSEMBLY V-2233-2

SERVICE NOTES

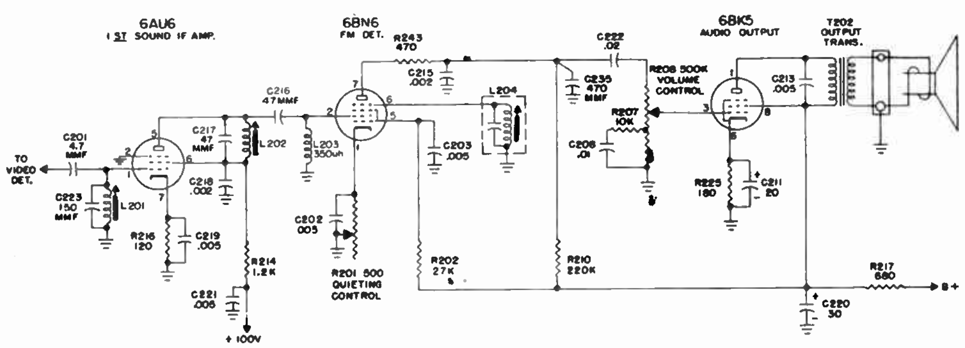


FIG. 1 — SOUND I-F AND AUDIO CIRCUITS IN V-2233-2 CHASSIS

For service information on the V-2233-2 chassis, refer to the H-740T21, H-742K21 and H-743K21 service notes and any supplementary information thereto. With a few exceptions the V-2233-2 chassis is the same as the V-2233-1 chassis used in Models H-740T21, H-742K21 and H-743K21. As shown in Fig. 1, the V-2233-2 chassis does not include the phono operation provisions nor the tone control which are in the V-2233-1 chassis. Another difference is the location of the horizontal hold, brightness, off-on-volume, and picture controls. In the V-2233-2 chassis, these controls are located as indicated in the Model H-723K21 service notes.

The following parts are used in the V-2233-2 chassis in lieu of the corresponding parts listed for the V-2233-1 chassis.

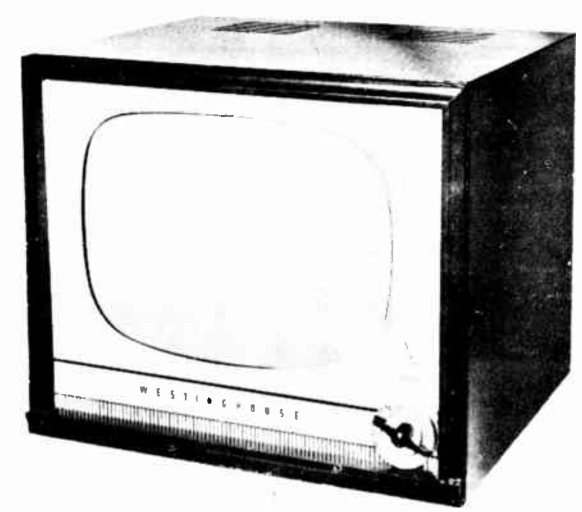
Ref. No.	*Part No.*	*Description*	*Function*	*List Price Each*
	V-11338-1	Belt, dial drive		$ .30
C215	RCP10W4102M	Capacitor, .001 mfd 400 v.	Tone compensation	.17
C235	RCM20B471K	Capacitor, 470 mmf	Bypass	.31
*R208	V-9877-4	Control, 500,000 ohms (assy consists of R208, R319, *SW501)	Volume	2.15*
*R319	V-9877-4	Control, 1500 ohms (assy consists of R208, R319, SW501)	Picture	2.15*
R327	V-10914-1	Control, 50,000 ohms	Brightness	$ .80
R419	V-9894-3	Control, 750,000 ohms	Vert. hold	.75
R435	V-10915-1	Control, 125,000 ohms	Horiz. hold	.80
*SW501	V-9877-4	Switch, (assy consists of R208, R319, SW501)	On-off	2.15*

H-755K21 MODEL PARTS

The following parts are used in Model H-755K21 in lieu of the model parts listed in the H-740T21, H-742K21 and H-743K21 service notes:

Part No.	*Description*	*List Price Each*
V-10924-3	Base, channel selector	$ .30
✝V-1274-2	Cabinet	65.47**
V-5860-14	Cable Assembly, speaker	.40
V-5684-2	Clip, plate to mask	.03
V-5522	Cord, AC power	1.25
V-10962-15	Cover Assembly, back	4.75
V-11501-1	Gasket, dust seal	.65
V-10261-7	Grille Cloth	1.75
V-9938-5	Knob, off-on-volume	.12
V-9939-6	Knob, picture	.15
V-10926-1	Knob, horiz. hold and brightness	.10
V-9940-4	Knob, fine tuning (rear)	.45
V-11146-2	Knob, channel selector	1.75
V-10929-2	Mask, picture tube	4.25
V-10932-2	Plate, mask	.25
V-11690-1	Plate, front glass	13.00
V-9770-1	Speaker, 10" PM	8.00**
V-10934-3	Spring, channel selector base	.06

✝ New part number listed for the first time in Westinghouse radio or television service information.
** Sold only as complete assembly.*
*** Price includes Federal Excise Tax.*
NOTE: All prices are subject to change without notice.



H-760T21
(WALNUT)

H-761T21
(MAHOGANY)

CHASSIS ASSEMBLY V-2233-2

MODELS H-760TU21 AND H-761TU21

These models are the same as H-760T21 and H-761T21 except that they contain a built-in all-channel UHF tuner.

SERVICE NOTES

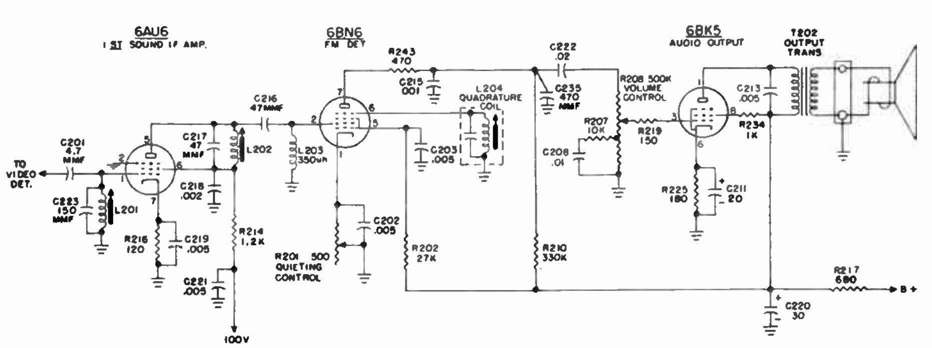


FIG. 1 — SOUND I-F AND AUDIO CIRCUITS IN V-2233-2 CHASSIS

For service information on the V-2233-2 chassis, refer to the H-740T21, H-742K21 and H-743K21 service notes and any supplementary information thereto. With a few exceptions the V-2233-2 chassis is the same as the V-2233-1 chassis used in Models H-740T21, H-742K21 and H-743K21. As shown in Fig. 1, the V-2233-2 chassis does not include the phono operation provisions nor the tone control which are in the V-2233-1 chassis. Another difference of the location of the horizontal hold, brightness, off-on-volume, and picture controls. In the V-2233-2 chassis, these controls are located as indicated in the H-723K21 service notes.

The following parts are used in the V-2233-2 chassis in lieu of the corresponding parts listed for the V-2233-1 chassis:

Ref. No.	*Part No.*	*Description*	*Function*	*List Price Each*
	V-11338-1	Belt, dial drive		$ .30
C215	RCP10W4102M	Capacitor, .001 mfd 400 v.	Tone compensation	.17
C235	RCM20B471K	Capacitor, 470 mmf	Bypass	.31
*R208	V-9877-4	Control, 500,000 ohms (assy. consists of R208, R319, SW501)	Volume	$ 2.15*
R210	RC20AE334K	Resistor, 330,000 ohms ½ w.	Plate load	.05
R219	RC20AE151M	Resistor, 150 ohms ½ w.	Suppressor	.06
R234	RC20AE102K	Resistor, 1000 ohms ½ w.	Decoupling	.05
*R319	V-9877-4	Control, 1500 ohms (assy. consists of R208, R319, SW501)	Picture	2.15*
R327	V-10914-1	Control, 50,000 ohms	Brightness	.80
R419	V-9894-3	Control, 750,000 ohms	Vert. hold	.75
R435	V-10915-1	Control, 125,000 ohms	Horiz. hold	.80
*SW501	V-9877-4	Switch (assy. consists of R208, R319, SW501)	On-Off	2.15*

H-760T21 AND H-761T21 MODEL PARTS

The following parts are used in Models H-760T21 and H-761T21 in lieu of the MODEL PARTS listed in the H-740T21, H-742K21 and H-743K21 service notes:

	Part No.	*Description*	*List Price Each*
	V-10841-1	Baffle and grille cloth assembly	$ .50
	V-11698-1	Baffle and grille cloth assembly (ventilation)	.45
	V-10924-2	Base, channel selector	.30
✢	V-1282-33	Cabinet (H-760T21)	33.15**
	V-1282-6	Cabinet (H-761T21)	29.86**
	V-5860-3	Cable Assembly, speaker	.27
	V-5684-2	Clip, plate to mask	.03
✢	V-10962-15	Cover Assembly, back	4.75
	V-11501-1	Gasket, dust seal	.65
	V-9938-4	Knob, off-on-volume	.10
	V-9939-5	Knob, picture	.15
	V-10926-1	Knob, horiz. hold and brightness	.10
	V-9940-3	Knob, fine tuning (rear)	.45
	V-11146-1	Knob, channel selector	1.95
	V-10929-1	Mask, picture	4.25
	V-10932-1	Plate, mask	.20
✢	V-11888-2	Plate, front glass (H-760T21)	***
✢	V-11888-1	Plate, front glass (H-761T21)	14.50
	V-10030-1	Speaker, 5¼" PM	3.90**
	V-10934-3	Spring, channel selector base	.06

✢ *New part number listed for the first time in Westinghouse radio or television service information*

* *Sold only as complete assembly. Price shown covers complete assembly.*

** *Price includes Federal Excise Tax.*

*** *Price furnished on request.*

NOTE: *All prices are subject to change without notice.*

SUPPLEMENTARY INFORMATION CHASSIS ASSEMBLY V-2233-2

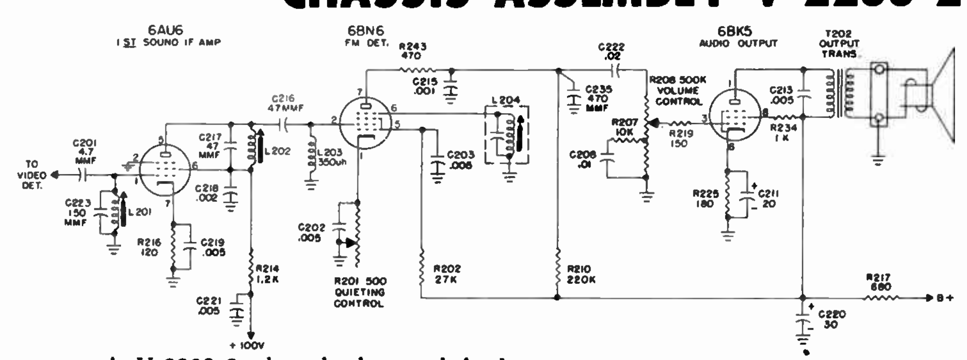


FIG. 1 — SOUND IF AND AUDIO CIRCUITS IN V-2233-2 CHASSIS

A V-2233-2 chassis is used in later production of Models H-751T21 and H-752T21. H-754K21. H-756K21 and H-757K21. H-758K21 and H-759K21.

For service information on the V-2233-2 chassis, refer to the H-740T21, H-742K21 and H-743K21 service notes and any supplementary information thereto. With a few exceptions, the V-2233-2 chassis is the same as the V-2233-1 chassis which is covered by the H-740T21, H-742K21 and H-743K21 service notes. As shown in Fig. 1, the V-2233-2 chassis does not include the phono operation provisions nor the tone control which are in the V-2233-1 chassis. Also different are the locations of the horizontal hold, brightness, off-on-volume, and picture controls. In the V-2233-2 chassis, these controls are located as indicated in the H-723K21 service notes.

The following parts are used in the V-2233-2 chassis in lieu of the corresponding parts listed for the V-2233-1 chassis:

Ref. No.	*Part No.*	*Description*	*Function*	*List Price Each*
	V-11338-1	Belt, dial drive		$ .30
C215	RCP10W4102M	Capacitor, .001 mfd 400 v.	Tone compensation	.17
C235	RCM20B471K	Capacitor, 470 mmf	Bypass	.31
*R208	V-9877-4	Control, 500,000 ohms (assy consists of R208, R319, SW501)	Volume	2.15*
R219	RC20AE151K	Resistor, 150 ohms ½ w.	Suppressor	.05
R234	RC20AE102K	Resistor, 1000 ohms ½ w.	Decoupling	.05
*R319	V-9877-4	Control, 1500 ohms (assy consists of R208, R319, SW501)	Picture	2.15*
R327	V-10914-1	Control, 50,000 ohms	Brightness	.80
R419	V-9894-3	Control, 750,000 ohms	Vert. hold	.75
R435	V-10915-1	Control, 125,000 ohms	Horiz. hold	.80
*SW501	V-9877-4	Switch (assy. consists of R208, R319, SW501)	On-off	2.15*

The MODEL PARTS listed in the original service notes apply regardless of which chassis is used.

* *Sold only as complete assembly. Price shown covers complete assembly.*
NOTE: *All prices are subject to change without notice.*

SUPPLEMENT NO. 1 TO MODELS H-750T21 AND H-753K21 SERVICE NOTES

SUPPLEMENTARY INFORMATION CHASSIS ASSEMBLY V-2233-3

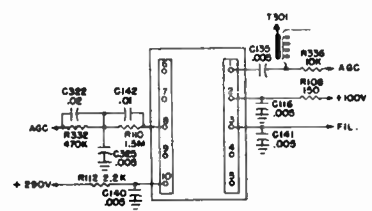


FIG. 1 — CONNECTIONS TO V-11485-1 TUNER

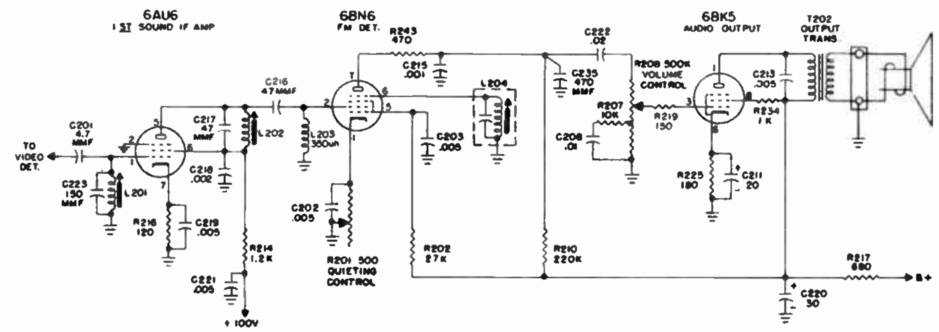


FIG. 2 — SOUND IF AND AUDIO CIRCUITS IN V-2233-3 CHASSIS

A V-2233-3 chassis is used in later production of Model H-750T21 and H-753K21.

For service information on the V-2233-3 chassis, refer to the H-740T21, H-742K21 and H-743K21 service notes and any supplementary information thereto. The information given for the V-2233-1 chassis applies also to the V-2233-3 chassis except as follows:

1. The V-2233-3 chassis contains a V-11485-1 RF tuner assembly. This tuner does not provide for the use of UHF sockets. Electrical connections to the tuner are as shown in Fig. 1.

2. As shown in Fig. 2, the V-2233-3 chassis does not include the phono operation provisions nor the tone control which are in the V-2233-1 chassis.

3. The locations of the horizontal hold, brightness, off-on-volume and picture controls are different. In the V-2233-3 chassis, these controls are located as indicated in the H-723K21 service notes.

The following parts are used in the V-2233-3 chassis in lieu of the corresponding parts listed for the V-2233-1 chassis:

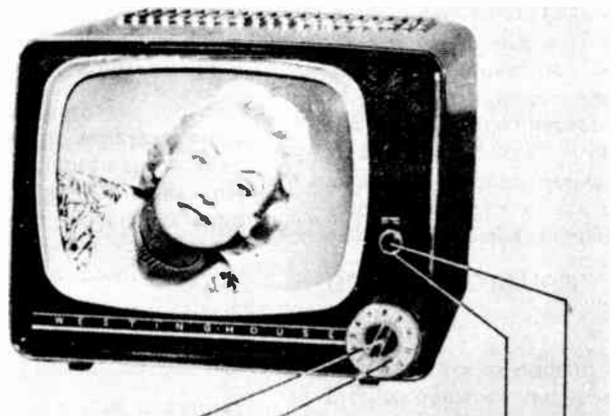
Ref. No.	*Part No.*	*Description*	*Function*	*List Price Each*
	V-11485-1	RF tuner assembly		$ 47.50
C215	RCP10W4102M	Capacitor, .001 mfd 400 v.	Tone compensation	.17
C235	RCM20B471K	Capacitor, 470 mmf	Bypass	.31
*R208	V-9877-4	Control, 500,000 ohms (assy consists of R208, R319, SW501)	Volume	2.15*
R219	RC20AE151K	Resistor, 150 ohms ½ w.	Suppressor	.05
R234	RC20AE102K	Resistor, 1000 ohms ½ w.	Decoupling	.05
*R319	V-9877-4	Control, 1500 ohms (assy consists of R208, R319, SW501)	Picture	2.15*
R327	V-10914-1	Control, 50,000 ohms	Brightness	.80
R419	V-9894-3	Control, 750,000 ohms	Vert. hold	.75
R435	V-10915-1	Control, 125,000 ohms	Horiz. hold	.80
*SW501	V-9877-4	Switch (assy consists of R208, R319, SW501)	On-off	2.15*

In later production, a different front glass plate is used. This part, listed under MODEL PARTS in the original H-750T21 and H-753K21 service notes, should be changed to read as follows:

✓ V-11858-1 Plate, front glass $14.50

The new front glass plate and the other MODEL PARTS apply regardless of which chassis is used.

✓ New part number listed for the firt time in Westinghouse radio or television service information.
** Sold only as complete assembly. Price shown covers complete assembly.*
NOTE: All prices are subject to change without notice.



MODEL H-716T17

CHASSIS ASSEMBLY V-2208-1

SERVICE NOTES

SPECIFICATIONS

FREQUENCY RANGES:

CHANNEL NUMBER	CHANNEL FREQUENCY (MC.)	VIDEO CARRIER FREQUENCY (MC.)	SOUND CARRIER FREQUENCY (MC.)	RECEIVER H-F OSCILLATOR FREQUENCY (MC.)
2	54 - 60	55.25	59.75	101
3	60 - 66	61.25	65.75	107
4	66 - 72	67.25	71.75	113
5	76 - 82	77.25	81.75	123
6	82 - 88	83.25	87.75	129
7	174 - 180	175.25	179.75	221
8	180 - 186	181.25	185.75	227
9	186 - 192	187.25	191.75	233
10	192 - 198	193.25	197.75	239
11	198 - 204	199.25	203.75	245
12	204 - 210	205.25	209.75	251
13	210 - 216	211.25	215.75	257

FINE TUNING RANGE:
1 mc. minimum; 2 mc. maximum

OPERATING VOLTAGE:
105 to 120 volts, 60 cycles A-C

POWER CONSUMPTION: .... 240 watts

AUDIO POWER OUTPUT:
Undistorted .... 1.8 watts
Maximum .... 2.8 watts

LOUDSPEAKER:
Type .... 5¼" P.M.
Voice Coil Impedance .. 3.2 ohms at 400 cycles

RECEIVER ANTENNA INPUT IMPEDANCE:
...... 300 ohms balanced or 72 ohms unbalanced

TUBE COMPLEMENT:
1 1B3GT .... High voltage rectifier
1 5U4G .... Low voltage rectifier
1 6AL5 .... Horizontal AFC
1 6AU5 .... Sound IF amplifier
1 6AU6 .... Sync separator
1 6BK5 .... Audio output
1 6BN6 .... FM detector
1 6BQ6GT .... Horizontal output
1 6BQ7 .... RF amplifier
3 6CB6 .... IF amplifiers
1 6J6 .... HF osc. and mixer
1 6SN7GT .... Vertical multivibrator
1 6W4GT .... Horizontal multivibrator
1 12AT7 .... Sync amp. and noise clipper
1 12AU7 .... Horizontal multivibrator
1 12BH7 .... Vert. output and keyed AGC
1 12BY7 .... Video amplifier
1 17HP4 .... Cathode ray tube

VIDEO CARRIER INTERMEDIATE FREQUENCY:
.... 45.75 mc.

VIDEO RESPONSE: .... 3.5 mc.

SOUND CARRIER INTERMEDIATE FREQUENCY:
.... 4.5 mc.

FOCUS: .... Electrostatic

SWEEP DEFLECTION: .... Magnetic

SCANNING: .... Interlaced 525 line

HORIZONTAL SCANNING FREQUENCY:
.... 15,750 CPS

VERTICAL SCANNING FREQUENCY: .... 60 CPS

FRAME FREQUENCY:
(picture repetition rate): .... 30 CPS

HIGH VOLTAGE WARNING

The danger accompanying shock is always present when the receiver is operated outside the cabinet or when the rear cover is removed from the cabinet. Only a person familiar with the precautions to be observed when working with high-voltage equipment should service this receiver.

CATHODE RAY TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves should be worn at all times when handling a cathode ray tube. The tube should not be handled in the vicinity of any person not so equipped. When handling the tube, always keep it away from the body.

Due to the large surface area of the tube and the high vacuum contained within, more than ordinary care is required to prevent shattering the tube. The large end of the bulb, particularly the rim of the viewing surface, must not be struck, scratched, or subjected to more than moderate pressure. If the tube binds during removal or replacement, determine the cause of the trouble — DO NOT FORCE THE TUBE.

An additional precaution is required when handling a cathode ray tube that has an aquadag coating on the outside of the tube. The outside aquadag coating forms one plate of a capacitor, and the inside coating to which the high voltage is applied serves as the other plate. The high voltage charge may be retained in this capacitor for a long time after the high voltage lead is disconnected. Since the charge could produce a shock that would startle the handler into dropping the tube, the charge should be dissipated before any handling of the tube is attempted. To dissipate the charge, place a jumper from the outside aquadag coating to the high voltage button on the tube. Due to the relatively high resistance of the aquadag, the jumper should be held in place for some time to insure complete discharge.

INSTALLATION INSTRUCTIONS

TO PREPARE THE RECEIVER FOR OPERATION:

Model H-716T17 is shipped in operating condition. There is no shipping material to be removed. Simply remove the receiver from its carton, and connect the AC plug to a 105 to 120 volt 60 AC outlet.

The receiver contains a built-in antenna for use in areas of normal reception. In such areas when the built-in antenna provides good reception, an external antenna is not required. However, in weak signal areas or under adverse conditions, it may be necessary to use an outside antenna.

The antenna terminals are located on the back of the receiver. If an external antenna is to be connected to the receiver, the built-in antenna wires must be disconnected from the terminals. This can be accomplished by loosening the terminal screws and removing all wires that can be removed without completely removing the terminal screws. The built-in antenna wires should be dressed in such a position that they do not touch the chassis or metal components. The lead-in wires from the external antenna should then be connected to the antenna terminals.

TO CHECK THE OPERATION OF THE RECEIVER:

1. Turn on the receiver by rotating the off-on-volume control clockwise.

2. Rotate the channel selector to the desired channel number.

3. Adjust the brightness control to a position where the picture screen is moderately lighted.

4. Check the ion trap magnet adjustment as outlined under ADJUSTMENTS.

5. Rotate the picture control to the position that provides best picture contrast.

6. If the picture moves up or down on the screen, the vertical hold control on the back of the receiver should be adjusted as explained under ADJUSTMENTS.

7. If the picture is pulled into diagonal bars or if the edge of the picture quivers or tends to fold over, adjust the horizontal control for correct synchronization. This control can be adjusted so that it will seldom be necessary to re-adjust it thereafter. To obtain this adjustment, tune in a TV station, and rotate the control to the middle of the range over which the picture is synchronized. If the middle of the sync range does not correspond approximately to the middle of the mechanical range, make the adjustments described under Horizontal Ringing Coil in the ADJUSTMENTS section. Check the adjustment of the horizontal control by switching to another channel and then back again. The picture should be stable when switching from channel to channel.

8. Rotate the fine tuning control to the position that provides best picture detail.

9. Re-adjustment of the brightness and picture controls may improve the picture shading. The correct balance between these controls produces the best picture. Once the brightness control has been adjusted to suit the preference of the user, it will seldom be necessary to re-adjust it.

10. Adjust the off-on-volume control for the desired sound volume.

11. Check the operation on all available TV stations.

12. If necessary, adjust the vertical linearity, height, horizontal linearity, width, focus, or centering as explained under ADJUSTMENTS.

ADJUSTMENTS

CATHODE RAY TUBE CUSHION

The CRT cushion must fit snugly against the flare of the CRT in order that the rear of the tube will be supported firmly. If this condition is not obtained, loosen the CRT cushion adjustment screws and the deflection yoke adjustment screw, slide the CRT cushion forward as far as possible, and re-tighten the screws.

DEFLECTION YOKE

The deflection yoke must be positioned as close as possible to the flare in the CRT. If adjustment is required, loosen the deflection yoke adjustment screw, slide the deflection yoke forward as far as possible, and re-tighten the screw. Note that the CRT cushion must fit snugly against the CRT flare as described previously.

The deflection yoke adjustment screw also permits the picture to be rotated to make it square with respect to the mask. To rotate the picture, loosen the deflection yoke adjustment screw and move it to the left or right. The picture will tilt to the left or right with the movement. Tighten the screw when the picture is squared in the mask.

FOCUS

The focus control is located on the back of the chassis as shown in Fig. 4. With the brightness and picture controls set at their normal operating positions, the focus control should be adjusted for best focus.

QUIETING CONTROL

The quieting control is located at the lower left on the back of the receiver and is adjusted by means of a screwdriver inserted through the hole in the back cover. This control, which determines the AM rejection characteristics of the sound system, is normally adjusted during alignment of the sound system as described under SOUND ALIGNMENT PROCEDURE and will not ordinarily require further adjustment. In very weak signal areas, however, a reduction in noise or hiss on the sound may be obtained by slightly re-adjusting the control.

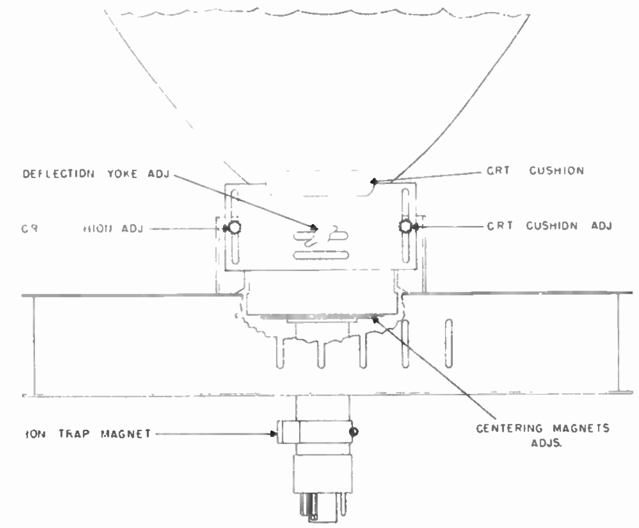


FIG. 1 — CRT ADJUSTMENTS

CENTERING

Centering is accomplished by rotating the centering magnet adjusting rings clockwise or counterclockwise as required. The two adjusting rings are located on the back of the deflection yoke as shown in Fig. 1. A tab projection on each of the rings serves to facilitate adjustment.

If difficulty is experienced in centering the picture or eliminating "neck shadows", make certain the CRT cushion is tight against the flare in the CRT. Also make certain that the deflection yoke is as far forward as possible.

ION TRAP MAGNET

It is extremely important that the ion trap magnet be correctly adjusted immediately after the set is first turned on during installation. This is true even though the set appears to be operating satisfactorily. When the magnet is not correctly oriented, the electron beam strikes the edge of the aperture in the anode top disc instead of moving cleanly through the hole. The resultant heat vaporizes the metal of the disc, thus releasing gas which has a harmful effect on the tube. Some of the vaporized material may be deposited on the screen of the tube and be apparent as darkened area. An excessively high setting of the brightness control will aggravate this condition. From this it is apparent that the brightness control should never be turned up to compensate for an incorrectly adjusted ion trap magnet. The tube can be ruined in a very short time under this condition.

To adjust the ion trap magnet, position the magnet approximately as shown in Fig. 1 with the color code mark facing upward, then rotate the magnet and move it forward and backward until the position is found where the picture is brightest. If the brightness peaks at two positions of the magnet, the position nearer the base of the tube is the correct one. Never move the ion trap magnet to remove a shadow from the raster if the brightness is decreased by so doing. Shadows should be removed by adjusting the position of the deflection yoke. *The ion trap magnet must always be adjusted for maximum picture brightness.*

HEIGHT AND VERTICAL LINEARITY

The height adjustment on the back of the chassis controls the overall height of the picture, and the vertical linearity adjustment controls the relationship between the vertical dimensions of the upper and the lower sections of the picture. A balance between the two controls is necessary to make the picture symmetrical and fill the mask vertically.

WIDTH AND HORIZONTAL LINEARITY

The width adjustment on the back of the chassis controls the overall width of the picture, and the horizontal linearity adjustment controls the relationship between the horizontal dimensions of the left and the right sections of the picture. A balance between the two controls is necessary to make the picture symmetrical with correct horizontal dimensions. These controls can be adjusted with a ¼" Spintite-type wrench.

VERTICAL HOLD

The vertical synchronization is controlled by the vertical hold adjustment on the back of the chassis. To adjust, rotate the control clockwise or counterclockwise until the picture is stabilized vertically. The adjustment should preferably be made on the weakest signal that is available, and a check should be made to see that the receiver pulls into sync on all channels.

HORIZONTAL RINGING COIL

The horizontal ringing coil (L401) should be adjusted as follows:

1. Short out the ringing coil with a short jumper wire.

2. Set the horizontal hold control to the middle of its range, and leave it in this position during the steps that follow.

3. Connect a VTVM to the junction of R477 and C456, located in the pin #2 grid circuit of the horizontal multivibrator, so as to measure the DC voltage between this point and ground.

4. With the receiver tuned to a TV station, adjust C457 (located near the horizontal multivibrator tube as shown in Fig. 4) for *zero* voltage on the meter. If zero voltage can be approached but not quite reached at one extreme of the C457 adjustment, it may be necessary to set the horizontal hold control slightly to one side of mid-position to obtain zero voltage.

5. Remove the jumper from across the ringing coil.

6. Adjust the ringing coil for *zero* voltage on the meter, and check the adjustment by switching to another channel and then back again. The receiver should pull into horizontal synchronization on all channels.

CRITICAL LEAD DRESS

Leads that are susceptible to R-F pickup with resulting interaction between stages must be dressed close to the chassis mounting plate. Leads in this category include heater, AGC, B plus, and the 100 volt bus leads. These leads must be long enough to permit dressing most of the path length close to the mounting plate. The heater wiring arrangement should not be altered.

Leads associated with the 41.25 mc. trap must be as short as possible and dressed away from the chassis.

Video peaking coils should be dressed away from the chassis and clear of adjacent parts.

The lead-in from the antenna terminals to the tuner must be dressed away from the I-F chassis to prevent an R-F "tweet" from interfering with the picture.

ALIGNMENT

TEST EQUIPMENT

To service these chassis, the following test equipment should be available:

1. R-F sweep generator that is capable of producing a 10 mc. sweep at a center frequency of 44 mc. The output must be adjustable from at least 100,000 microvolts down to a very low minimum, and the output must be flat at all positions of the attenuator.

2. Cathode ray oscilloscope, preferably one with a wide-band vertical deflection amplifier and a low-capacitance input probe. The oscilloscope should have good low-frequency response characteristics.

3. Signal generator or generators capable of producing an accurate unmodulated signal at 4.5 mc., 41.25 mc., 42.25 mc., 43.0 mc., 44.0 mc., 45.0 mc., and 45.75 mc. The accuracy of these frequencies is very important. If the signal generator does not include a crystal calibrator, a heterodyne frequency meter equipped with a crystal calibrator should be used to insure accuracy. The output level must be adjustable from at least 100,000 microvolts down to a very low minimum.

4. Vacuum tube voltmeter equipped with a high voltage multiplier probe for measurements up to 15,000 volts and an R-F probe for measuring R-F voltages.

GENERAL INFORMATION

The chassis and the test equipment should be bonded together by short lengths of heavy braided copper ribbon, and all interconnecting leads should be shielded and should be as short as possible consistent with ease in making connections. The effectiveness of the bonding can be checked during alignment by placing the hand on the chassis or test equipment case. If the response curve or meter reading changes, the bonding must be improved before the circuits are aligned.

It is important that the coaxial cable used to couple the sweep generator output to the receiver be terminated at its output end in the characteristic impedance of the sweep generator output circuit. To accomplish this, connect the appropriate value of resistance across the output leads at the open end of the cable. The oscilloscope vertical input cable and the generator output cables must be well separated from each other.

ALIGNMENT TOOL

To adjust the slugs in the common I-F transformers a special tool is required. This tool must fit into the .035" x .093" slot in slug. *An incorrectly designed tool will cause chipping of the slug.* A suitable tool is stocked under Westinghouse part number V-8345.

COMMON I-F ALIGNMENT PROCEDURE

The common I-F system uses over-coupled I-F transformers to obtain the required band width. In the alignment of this type system, the visual method of stage-by-stage alignment is used. A sweep generator is used to develop the I-F response curve on the oscilloscope, and an unmodulated signal generator (marker) is used to provide spot frequency indications on the curve.

With some of the I-F transformers, peaks may be obtained at two positions of the adjustment slugs. If a transformer is badly out of adjustment, it is advisable to turn the slug out (counterclockwise) as far as possible before beginning alignment. Then turn the slug clockwise until the first peak is reached. This procedure is recommended to obtain the correct peak rather than an undesired second peak which is sometimes obtained when the slug is turned farther clockwise.

The alignment procedure to be used is given in the following steps:

1. To avoid undesirable beat response during alignment, remove the 6BQ7 R-F amplifier tube from its socket and rotate the channel selector to channel 13. The channel selector is on channel 13 when the flat of the shaft is facing straight up.

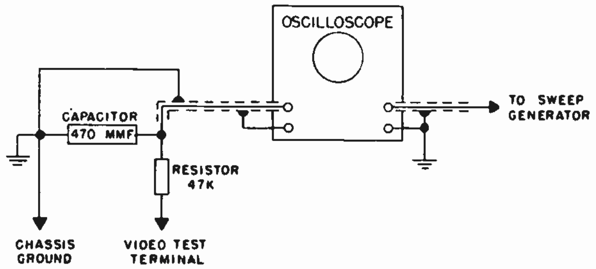


FIG. 2 — OSCILLOSCOPE CONNECTIONS

2. Connect the vertical input of the oscilloscope to the video test terminal (point "D" on Fig. 4) through the decoupling network shown in Fig. 2. The oscilloscope horizontal input should be connected to the sweep (synchronizing) output from the sweep generator *through well shielded leads.* Turn the sweep control on the oscilloscope to the "x" or "off" position.

3. Connect the negative terminal of a 9 volt bias battery to the AGC line, and connect the positive terminal to chassis ground.

4. Couple the marker generator output to the sweep generator output so that the two signals are applied together to the points specified in the steps that follow. Some sweep generators have facilities for connecting the marker output directly into the sweep generator. With other sweep generators, the marker can be coupled to the sweep by wrapping a few turns of insulated wire around the center conductor of the sweep generator output cable and connecting the marker generator to this wire. The loose coupling obtained in this manner is desirable because *excessive marker signal injection will distort the response curve.*

5. Adjust the sweep generator for a center frequency of 44 mc. with a sweep deviation of 10 mc.

6. Connect the high side of the sweep generator output cable directly to the control grid of the 3rd I-F amplifier, and connect the ground side of the cable to the chassis partition as close as possible to the ground point for the 3rd I-F amplifier tube. Keep the leads from the cable as short as possible.

7. Detune the plate circuit of the 2nd I-F amplifier by attaching an "alligator" or similar type clip to pin 5 of the 6CB6 2nd I-F amplifier tube. *Use care to avoid shock.* This step is necessary to avoid absorption of the signal that is applied at the 3rd I-F grid.

8. Adjust the oscilloscope vertical gain and the sweep generator output level to obtain a curve on the oscilloscope. To avoid a distorted curve, the recommended practice is to use maximum oscilloscope vertical gain and only enough sweep signal amplitude to obtain a good curve.

9. Set the marker generator to 44 mc. with the output attenuated until the marker pip is barely visible on the curve, and adjust the primary of the 3rd common I-F transformer, T304, until the 44 mc. marker pip is at the highest point on the response curve.

10. Adjust the secondary of T304 to make the top of the response curve symmetrical.

11. Make certain that the response curve coincides with Fig. 5A, using the marker to check at the appropriate frequencies. The 44 mc. pip must strike the center of the flat response region, the 42.25 mc. and 45.75 mc. points must be at equal heights, and the 43 mc. and 45 mc. points must be at equal heights. Re-adjust the primary and secondary of T304 if necessary to obtain these conditions.

12. Remove the detuning clip from the plate of the 2nd I-F amplifier tube, and attach it to the plate of the 1st I-F amplifier tube.

13. Move the sweep output connection from grid of the 3rd I-F amplifier to the grid of the 2nd I-F amplifier. Connect the ground side of the cable to the chassis partition as close as possible to the ground point for the 2nd I-F amplifier tube.

14. Adjust the primary of the 2nd common I-F transformer, T303, for maximum height of the response curve at 44 mc., and adjust the secondary of T303 to make the top of the curve symmetrical.

15. Make certain that the curve corresponds to Fig. 5B. The 44 mc. pip must strike the center of the flat response region, the 42.25 mc. and 45.75 mc. points must have equal heights, and the 43 mc. and 45 mc. points must have equal heights. Re-adjust the primary and secondary of T303 if necessary.

16. Remove the detuning clip from the plate of the 1st I-F amplifier.

17. Move the sweep output connection from the grid of the 2nd I-F amplifier to the grid of the 1st I-F amplifier, and connect the ground side of the cable as close as possible to the ground point for the 1st I-F amplifier tube.

18. Adjust the primary of the 1st common I-F transformer, T302, for maximum height of the response curve at 44 mc., and adjust the secondary of T302 to make the top of the curve symmetrical. If difficulty is experienced in aligning T302, adjust the adjacent channel interference trap, L308, to a higher frequency by rotating the slug completely counterclockwise. Complete information on the adjustment of L308 is given in step 26.

19. Make certain that the curve corresponds to Fig. 5C. The 44 mc. pip must strike the center of the flat response region, the 42.25 mc. and 45.75 mc. points must have equal height, and the 43 mc. and 45 mc. points must have equal heights. Re-adjust the primary and secondary of T302 if necessary.

20. Remove the sweep output connection from the 1st I-F amplifier grid, and couple it to the 6J6 mixer-oscillator tube through the coupling system illustrated in Fig. 3. This system provides adequate signal injection and at the same time provides shielding which prevents radiation of the signal. The device is constructed by flaring a piece of tubular copper braid over the top of the 6J6 tube and wrapping gummed tape over the braid to serve as insulation. The tube shield is then replaced over the tube with the braid protruding through the hole in the top of the shield. *The braid must not contact the chassis or the tube shield at any point.* The tube shield should be locked securely to its mounting base. Connect the high side of the sweep generator output cable to the copper braid, and connect the ground side to the nearest point on the chassis.

21. Rotate the slug of the 41.25 mc. trap (L301) completely clockwise.

22. It is possible to obtain two peaks when adjusting the primary of the I-F input coupling network, T101. located on the R-F tuner. These peaks

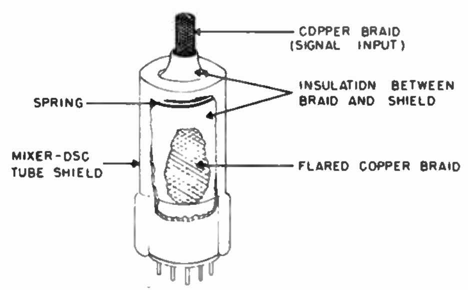


FIG. 3 — COUPLING SIGNAL GENERATOR TO MIXER TUBE

produce different overall bandwidths. The correct peak to use is normally the peak that occurs with the adjustment screw turned further counterclockwise.

Turn the adjustment screw of T101 completely counterclockwise. Then adjust T101 for maximum height of the response curve at 44 mc., and adjust the secondary of the I-F input coupling network, T301, to make the top of the curve symmetrical. If necessary, re-adjust T101 and T301 to make 44 mc. strike the center of the flat response region.

23. Set the marker generator to 41.25 mc., and increase the output until the pip is readily visible on the curve.

24. Adjust L301 to minimize the amplitude of the 41.25 mc. marker pip. L301 functions as a 41.25 mc. trap.

25. Make certain that the final response curve corresponds to Fig. 5D. Use the marker to check at the frequencies shown on the drawing. If necessary, re-adjust T101 and T301 to obtain the correct curve.

If the bandpass of the response curve is too narrow so that the 45.75 mc. marker occurs at less than 40 percent of maximum response, turn T101 clockwise until a second peak at 44 mc. is obtained. Adjust T301 for flat response at the top of the curve, and re-adjust T101 to center 44 mc. on the flat response.

26. L308 is the adjustment for the adjacent channel interference trap. If adjacent channel interference does not constitute a problem in the areas where the receiver is to be operated, L308 will not ordinarily require adjustment; however, the trap must not be mis-adjusted into the I-F response region. In areas where adjacent channel interference is not troublesome, L308 can be set to its highest tuneable frequency by rotating the slug completely counterclockwise, and it can be left in this position.

In areas where adjacent channel interference is evident, however, L308 should be adjusted to 47.25 mc. This can be accomplished in either of two ways. One is to connect an amplitude modulated signal generator that has an output of .02 volt or higher to the grid of the 1st I-F amplifier, and adjust the output frequency accurately to 47.25 mc. This will produce an indication on an oscilloscope connected to the video test terminal. Adjust L308 for minimum response on the oscilloscope. If a signal generator capable of this high output is not available, connect a good antenna to the receiver, and tune the receiver to the TV station on which the adjacent channel interference occurs, carefully adjusting the fine tuning control to its correct setting. Then, beginning with L308 in its completely counterclockwise position, rotate L308 clockwise until the position is found where the adjacent channel interference is eliminated. In some cases, the trap adjustment may affect the adjustment of T302. If this occurs, it will be necessary to repeat steps 17, 18 and 19.

4.5 MC. TRAP ALIGNMENT PROCEDURE

1. Connect the high side of the signal generator to the video test terminal (point "D" on Fig. 4) through a .001 mfd mica capacitor, and ground the low side to the chassis.

2. Adjust the signal generator to 4.5 mc. (unmodulated). The accuracy of this frequency is very important. If a crystal controlled signal generator is not available, the frequency should be checked with an accurate frequency meter.

3. Connect the common lead from the VTVM to the chassis, and connect the *R-F probe* from the VTVM to the cathode of the CRT. This point is shown as point "E" on Fig. 6. Note that this point is above ground potential and, therefore the R-F probe must contain a blocking capacitor.

4. Using a strong 4.5 mc. signal, adjust the 4.5 mc. trap, L309, for minimum indication on the meter.

SOUND ALIGNMENT PROCEDURE

The sound system can be aligned using either locally generated signals or a received TV signal. Since the latter method does not require signal generating equipment, it will be described first and will be followed by the procedure using locally generated signals.

To use an "air" TV signal for alignment:

1. Tune the receiver to a TV station and connect an attenuator between the receiver and the antenna so that the strength of the signal can be varied from weak to strong.

2. Set the quieting control (R201) located on the back of the chassis approximately to its mid-position.

3. Adjust the 4.5 mc. IF slugs (L201 and L202) for maximum program sound. If peaks occur at two different positions of the slug, use the peak that occurs when the slug is farthest counterclockwise. Reduce the signal to its lowest useable level and recheck the adjustments.

4. Apply a *strong* signal to the receiver, and adjust the quadrature coil (L204) for maximum program sound. If peaks occur at two different positions that are widely separated, use the one that occurs with the slug farthest counterclockwise. If two peaks occur within a *narrow* range of adjustment, sufficient signal is not being applied to the receiver or the quieting control is not set at the desired position.

5. Apply a very weak signal that allows noise to be heard and adjust the quieting control (R201) for minimum noise. The position at which the noise is minimized depends on the strength of the signal; therefore, the weakest useable station in the area should be used for this adjustment. This control determines the AM rejection characteristics of the sound system, and its correct setting is normally about mid-position. *Do not leave the quieting control set at its maximum counterclockwise position.*

To use locally generated signals for alignment:

1. Connect an oscilloscope or an AC voltmeter across the volume control for use as an indicator.

2. Apply a 4.5 mc. FM signal (deviation approximately 7.5 kc.) to the video test point (D on Fig. 4).

3. Using the lowest signal level that will produce an indication, adjust L201 and L202 for maximum output.

4. Using a *strong* signal, adjust L204 for maximum output.

5. Apply a 4.5 mc. AM signal (modulated apx. 30 percent) to the video test point.

6. Beginning with a very low signal level, increase the generator output, while rotating the quieting control back and forth, until the signal level is such that the AM output across the volume control dips to *zero* with a rise on each side as the quieting control is rotated. Set the quieting control for zero output at this signal level.

H. F. OSCILLATOR ALIGNMENT PROCEDURE

If the 6J6 oscillator tube is replaced, the different inter-electrode capacitance of the new tube may change the oscillator frequency enough to necessitate re-alignment of the oscillator.

Alignment of the oscillator on the high band is accomplished by adjusting the brass slug located adjacent to the vernier drive wheel on the front of the tuner. Alignment of the oscillator on the low band is accomplished by adjusting the brass slug on the lower front of the tuner. The adjustment procedure is as follows:

1. Set the fine tuning control to the middle of its range, and keep it in this position during the following adjustments. The control is set to the middle of its range when the set-screw in the fine tuning drive wheel is straight up.

2. Set the selector switch to the highest of the low-band (channels 2 through 6) stations operating in your vicinity.

3. Peak the low band adjustment slug (L109) for the best picture detail.

4. Set the selector switch to the highest of the high-band (channels 7 through 13) stations operating in your vicinity.

5. Peak the high band adjustment slug (L110) for the best picture detail.

6. Check the previously made low band adjustment, and if the tuning has changed repeat steps 2 and 3.

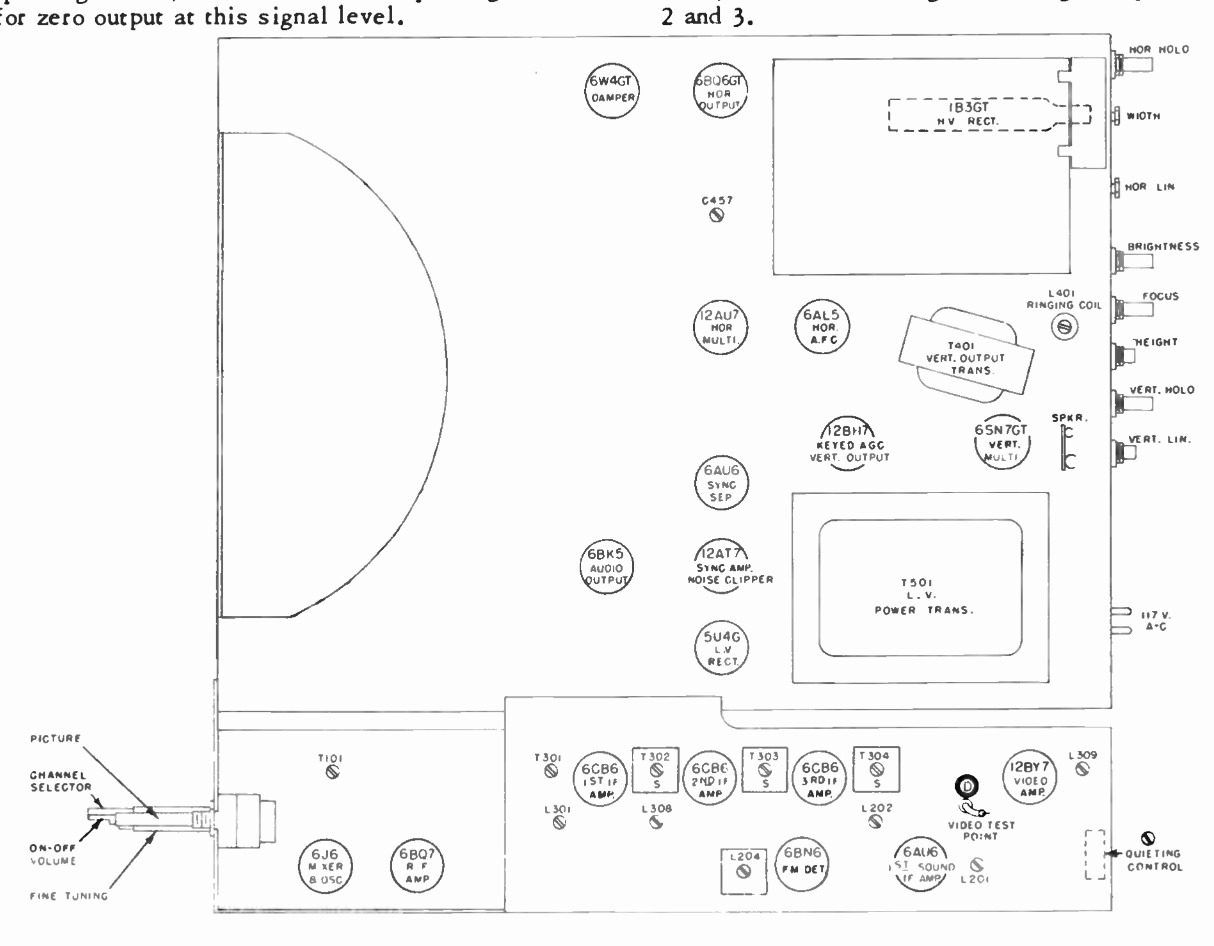


FIG. 4 — TOP VIEW OF CHASSIS

ALIGNMENT CHARTS

The information in these charts is condensed from the foregoing detailed information as a convenience to the service technician. It is recommended that the detailed information be studied before using the charts.

COMMON I-F SECTION

Remove the 6BQ7 RF amplifier tube from its socket, and turn the channel selector to channel 13.

Connect the oscilloscope to the video test terminal through the decoupling network shown in Fig. 2.

Connect a 9 volt bias battery to the AGC line.

Adjust the sweep generator for a center frequency of 44 mc. with a 10 mc. sweep deviation, and couple the marker generator to the sweep generator.

Step	*Connect Sweep and Marker Generators to —*	*Marker Use*	*Connect Detuning Clip to —*	*Adjust —*
1.	3rd I-F amp. grid	Check for equal response at 42.25 mc and 45.75 mc using weak signal. Also 43 mc and 45 mc.	2nd I-F amp. plate	Pri. of T304 for max. response and sec. of T304 for symmetrical curve shown in Fig. 5A.
2.	2nd I-F amp. grid	Same as step 1	1st I-F amp. plate	Pri. of T303 for max. response and sec. of T303 for symmetrical curve shown in Fig. 5B.
3.	1st I-F amp. grid	Same as step 1	Not used	Pri. of T302 for max. response and sec. of T302 for symmetrical curve shown in Fig. 5C.
4.	6J6 mixer through coupling device shown in Fig. 3.	Check at 44 mc. Marker pip must be at center of flat region on curve	Not used	Turn L301 adj. completely clockwise and adjust T101 for max. response. Adjust T301 for symmetrical top.
5.	Same as preceding step	Adjust to 41.25 mc. and increase output until pip is readily visible.	Not used	L301 to minimize amplitude of 41.25 mc. marker pip.
6.	Same as preceding step	Check curve at frequencies shown on Fig. 5.	Not used	Re-adjust T101 and T301 to obtain curve shown in Fig. 5D.
7.	Tune L308 to 47.25 mc. as described in step 26 of detailed information.			

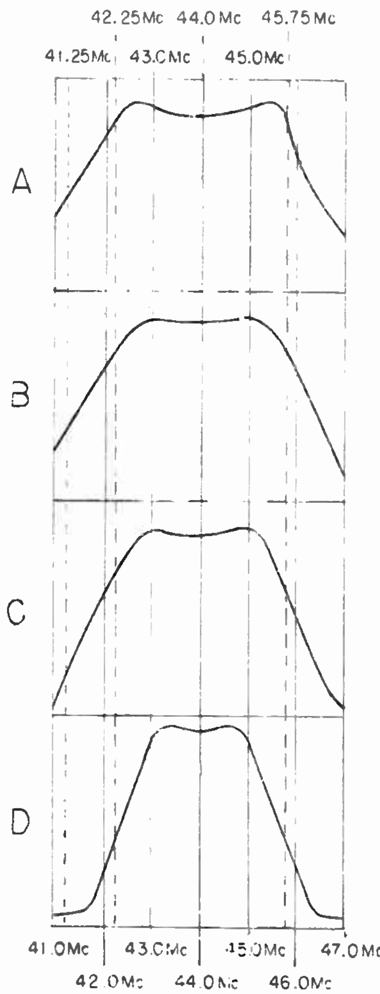


FIG. 5 — RESPONSE CURVES AT VARIOUS STAGES OF ALIGNMENT

4.5 MC. TRAP

Connect the signal generator to the video test terminal (point "D" on Fig. 4) through a .001 mfd capacitor.

Step	*Signal Gen. Frequency*	*VTVM Connections*	*Remarks*	*Adjust —*
1.	4.5 mc. unmodulated	RF probe to point "E" (see Fig. 6) and common lead to chassis.	Use strong signal from generator	L309 for minimum voltage

SOUND SECTION

Refer to SOUND ALIGNMENT PROCEDURE on page 7. Using a weak signal, adjust L201 and L202 for maximum response to a 4.5 mc. FM signal. Using a strong signal, adjust L204 for maximum response to a 4.5 mc. FM signal. Using a weak signal, adjust the quieting control for minimum AM noise.

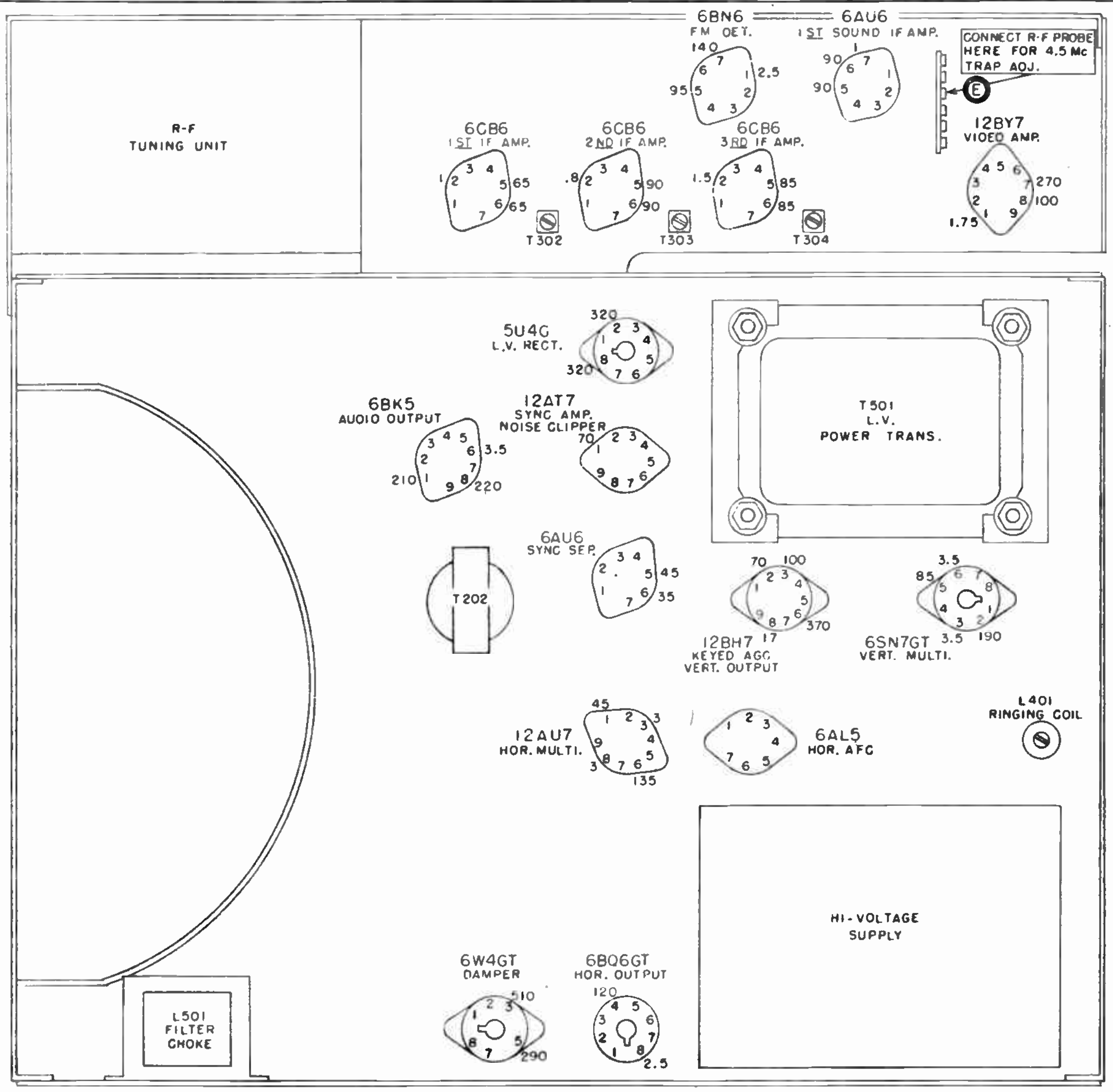


FIG. 6 — BOTTOM VIEW OF CHASSIS

PARTS LIST FOR MODEL H-716T17

When ordering parts, specify model number in addition to part number and description of part.

MODEL PARTS

Part No.	*Description*	*List Price Each*
V-10021-1	Baffle and Grille Cloth Assy.	$2.30
V-1213-5	Cabinet	35.00**
V-5860-14	Cable Assembly, speaker	.40
V-5522	Cord, AC power	1.25
V-10928-4	Cover Assembly, back	4.50
V-9953-2	Escutcheon, channel	.95
V-9938-1	Knob, on-off-volume	.10
V-9939-1	Knob, picture control (rear)	.17
V-9940-1	Knob, fine tuning (rear)	.40
V-9941-1	Knob, channel selector	.65
V-6146-16	Knob, horizontal hold	.15
V-10778-1	Mask, picture tube	3.50
V-11606-1	Plate, front glass	9.50
V-10030-1	Speaker, 5¼" PM	3.90**
V-9985-1	Spring, escutcheon	.03
V-3668S	Washer, felt (picture knob)	.03
V-5421-6	Washer, felt (fine tuning knob)	.03

V-2208-1 CHASSIS PARTS

MISCELLANEOUS

*V-5426	Clip, IF mounting	.03
V-10110-1	Clip, tube cap (6BQ6GT)	.10
V-5906-7	Connector Assembly, high voltage	.50
V-9867-2	Cushion, yoke hood	.06
V-9928-2	Hood, yoke mounting	.50
V-9784-4	Magnet, ion trap	.55
V-5549	Plug, AC power (male)	.30
V-5926	Screw, wing, #8-32 (yoke)	.04
V-10038-1	Shield, miniature tube (6CB6, 6AU6 2nd sound IF, and crystal det.)	.06
V-10907-2	Socket Assembly, CRT	.80
V-10918-1	Socket Assembly, (12BH7)	.50
V-9888-1	Socket, miniature wafer (all 7 pin tubes and crystal)	.13
V-9889-1	Socket, miniature wafer (12AT7)	.15
V-4514-1	Socket, molded octal (5U4G, 6SN7GT, 6BQ6GT)	.17
V-4514-2	Socket, molded octal (6W4GT)	.15
V-8605	Socket and Capacitor, HV (includes C431, R444, L408)	3.25
V-10958-2	Socket, miniature wafer (12BY7, 6BK5, 12AU7)	.20
V-9922-18	Strap Assembly, CRT	.60
V-9914-1	Superstructure, yoke	1.30

⊬ New part number listed for the first time in Westinghouse radio or television service information.
** Sold only as complete assembly. Price shown covers complete assembly.*
*** Price includes Federal Excise Tax.*
**** Price furnished on request.*
NOTE: *All prices are subject to change without notice.*

SECTION 1 — R-F

Ref. No.	Part No.	Description	Function	List Price Each
C116	V-5596	Capacitor, .005 mfd (min)	Tuner decoupling	$ .25
C135	V-5596	Capacitor, .005 mfd	Tuner coupling	.25
C137	V-5596	Capacitor, .005 mfd	AGC bypass	.25
C138	RCP10W4503M	Capacitor, .05 mfd 400 v.	AGC filter	.24
C139	RCP10W4503M	Capacitor, .05 mfd 400 v.	AGC filter	.24
C140	V-5596	Capacitor, .005 mfd	Tuner bypass	.25
R108	RC20AE151K	Resistor, 150 ohms ½ w.	Tuner decoupling	.05
R110	RC20AE125K	Resistor, 1.2 megohms ½ w.	AGC divider	.10
R111	RC20AE475K	Resistor, 4.7 megohm ½ w.	AGC delay	.05
R112	RC20AE153K	Resistor, 15,000 ohms ½ w.	Brightness bleeder	.05
R113	RC20AE683K	Resistor, 68,000 ohms ½ w.	AGC divider	.05
	V-11485-1	RF Tuner Assembly (sub. for V-11385-1)		47.50

SECTION 2 — SOUND I-F AND AUDIO

Ref. No.	Part No.	Description	Function	List Price Each
C201	V-9926-3	Capacitor, 4.7 mmf	Sound take-off	.07
C202	V-5596	Capacitor, .005 mfd	Cathode bypass	.25
C203	V-5596	Capacitor, .005 mfd	Screen bypass	.25
C208	RCP10W4103M	Capacitor, .01 mfd 400 v.	Tone compensation	.20
C213	RCP10W6202M	Capacitor, .002 mfd 600 v.	Tone compensation	.17
C215	RCP10W6202M	Capacitor, .002 mfd 600 v.	Plate bypass	.17
C216	RCM20B470K	Capacitor, 47 mmf	4.5 mc. coupling	.22
C217	RCM20B470K	Capacitor, 47 mmf	IF tank	.22
C218	RCP10W6202M	Capacitor, .002 mfd 600 v.	Screen bypass	.19
C219	V-5596	Capacitor, .005 mfd	Cathode bypass	.25
*C220	V-9891	Capacitor, 30 mfd 350 v. elec. (assy. consists of C220, C441, C501, C502)	Audio decoupling	4.35*
C221	V-5596	Capacitor, .005 mfd	Line bypass	.25
C222	RCP10W4203M	Capacitor, .02 mfd 400 v.	Audio coupling	.18
C223	RCM20B151K	Capacitor, 150 mmf	IF tank	.20
L201	V-9882-5	Reactor	Sound IF grid	.60
L202	V-9882-2	Reactor	Sound IF plate	.70
L203	V-9915-2	Reactor, 350 microhenries	FM det. grid	.30
L204	V-11396-1	Coil, quadrature	FM det.	1.60
R201	V-11345-2	Resistor, variable (0-500 ohms)	Quieting control	1.40
R202	RC40AE223K	Resistor, 22,000 ohms 2 w.	Screen decoupling	.18
R207	RC20AE103M	Resistor, 10,000 ohms ½ w.	Tone compensation	.05
*R206	V-9877-1	Control, 500,00 ohms (assy. consists of R208, R319, SW501)	Volume	2.10*
R210	RC20AE334K	Resistor, 330,000 ohms ½ w.	Plate load	.05
R214	RC20AE122K	Resistor, 1200 ohms ½ w.	Screen decoupling	.05
R216	RC20AE121K	Resistor, 120 ohms ½ w.	Cathode bias	.06
R217	V-6984-8	Resistor (dog-bone type), 2700 ohms 5 w.	Decoupling	.40
R217	V-11328-7	Resistor, (flat metal type), 2500 ohms 5 w.	Decoupling	.65
R225	RC20AE121K	Resistor, 120 ohms ½ w.	Cathode bypass	.06
R243	RC20AE471M	Resistor, 470 ohms ½ w.	FM det. plate	.05
T202	V-9982-2	Transformer	Audio output	1.90

SECTION 3 — VIDEO

Ref. No.	Part No.	Description	Function	List Price Each
C301	V-9926-2	Capacitor, 3.3 mmf	1st IF tank	.10
C302	V-5658-11	Capacitor, .47 mmf	IF trap coupling	.08
C303	V-9863-1	Capacitor, 800 mmf	AGC decoupling	.20
C304	V-9863-1	Capacitor, 800 mmf	IF screen bypass	$ .20
C305	V-9863-1	Capacitor, 800 mmf	AGC decoupling	.20
C306	V-9863-1	Capacitor, 800 mmf	IF screen bypass	.20
C308	V-9863-1	Capacitor, 800 mmf	IF screen bypass	.20
C313	RCP10W4104M	Capacitor, .1 mfd 400 v.	CRT grid bypass	.24
C315	RCP10W4104M	Capacitor, .1 mfd 400 v.	Video bypass	.24
C317	V-5596	Capacitor, .005 mfd	Decoupling	.25
C318	R3CC20SL120K	Capacitor, 12 mmf	41.25 mc. trap	.19
C320	V-5658-1	Capacitor, 1.0 mmf	Adjacent channel trap	.08
C321	R3CC20SL120K	Capacitor, 12 mmf	Adjacent channel trap	.19
C323	RCM20B560K	Capacitor, 56 mmf	4.5 mc. trap	.20
C326	V-9863-1	Capacitor, 800 mmf	Cathode bypass	.20
C327	V-9926-2	Capacitor, 3.3 mmf	IF tank	.10
C328	R3CC20SL120K	Capacitor, 12 mmf	Plate bypass	.19
C329	V-9926-3	Capacitor, 4.7 mmf	Det. plate filter	.07
	V-10916-1	Crystal	Video detector	1.75
C330	RCM20B471K	Capacitor, 470 mmf	Cathode bypass	.31
C331	V-5658-12	Capacitor, 6.8 mmf	Vid. amp. plate	.10
L301	V-10771-1	Reactor, slug tuned	41.25 mc. trap	.70
L302	V-9915-1	Reactor, 100 microhenries	Video peaking	.30
L303	V-5902-1	Reactor, 140 microhenries	Video peaking	.45
L304	V-5902-5	Reactor, 250 microhenries	Video peaking	.39
L305	V-4886-1	Reactor, 14 microhenries	Sync decoupling	.55
L308	V-10771-1	Reactor, slug tuned	Adjacent channel trap	.70
L309	V-9882-3	Reactor, tuned	4.5 mc. trap	.70
L310	V-4886-1	Reactor, 14 microhenries	Decoupling	.55
R301	RC20AE333K	Resistor, 33,000 ohms ½ w.	AGC divider	.05
R304	RC20AE103M	Resistor, 10,000 ohms ½ w.	AGC decoupling	.05
R305	RC20AE680K	Resistor, 68 ohms ½ w.	Cathode bias	.04
R306	RC20AE272K	Resistor, 2700 ohms ½ w.	Screen decoupling	.05
R307	RC20AE103M	Resistor, 10,000 ohms ½ w.	Grid decoupling	.05
R308	V-9927-2	Resistor, 4700 ohms ½ w.	IF damping	.11
R309	RC20AE680K	Resistor, 68 ohms ½ w.	Cathode bias	.04
R310	RC20AE471M	Resistor, 470 ohms ½ w.	Screen decoupling	.05

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PARTS LIST FOR MODEL H-716T17 (continued)

Ref. No.	Part No.	Description	Function	List Price Each
R311	V-9927-2	Resistor, 4700 ohms ½ w.	IF damping	.11
R312	RC20AE151K	Resistor, 150 ohms ½ w.	Cathode bias	.05
R313	RC20AE471M	Resistor, 470 ohms ½ w.	Screen decoupling	.05
R316	RC20AE123K	Resistor, 12,000 ohms ½ w.	Sync take-off	.05
R317	RC20AE332K	Resistor, 3300 ohms ½ w.	Det. load	.05
•R319	V-9877-1	Control, 1500 ohms (assy. consists of R208, R319, SW501)	Picture control	2.10•
R320	RC20AE223K	Resistor, 22,000 ohms ½ w.	Damping	.06
R322	RC40AE822K	Resistor, 8200 ohms 2 w.	Plate load	.20
R323	RC20AE274K	Resistor, 270,000 ohms ½ w.	Divider	.06
R324	RC20AE274K	Resistor, 270,000 ohms ½ w.	Divider	.06
R326	RC30AE683K	Resistor, 68,000 ohms 1 w.	Divider	.09
R327	V-9916-1	Control, 50,000 ohms	Brightness	.65
R331	RC20AE155K	Resistor, 1.5 megohms ½ w.	Retrace suppression	.05
R334	RC40AE822K	Resistor, 8200 ohms 2 w.	Plate load	.20
R341	RC20AE100K	Resistor, 10 ohms ½ w.	1st IF grid	.06
R342	RC20AE221K	Resistor, 220 ohms ½ w.	Video amp. grid	.05
R343	V-9894-2	Control, 2 megohms	Focus	.75
R344	RC20AE220K	Resistor, 22 ohms ½ w.	Cathode bias	.09
T301	V-9882-7	Transformer	IF input	.60
T302	V-9879	Transformer	1st IF	1.30
T303	V-9879	Transformer	2nd IF	1.30
T304	V-9880	Transformer	3rd IF	1.40
		SECTION 4 — SWEEP		
C401	RCP10W4104M	Capacitor, .1 mfd 400 v.	Noise clipper coupling	.24
C403	RCM20B271K	Capacitor, 270 mmf	Sync sep. grid	.20
C404	RCP10W4103M	Capacitor, .01 mfd 400 v.	Vert. sync coupling	$ .24
C408	RCP10W4103K	Capacitor, .01 mfd 400 v.	Vert. MV coupling	.19
C409	RCM20B101K	Capacitor, 100 mmf	AGC grid	.22
C410	RCP10W4503M	Capacitor, .05 mfd 400 v.	Cathode bypass	.24
C411	RCP10M6104M	Capacitor, .1 mfd 600 v.	Vert. coupling	.35
C412	RCP10W4503K	Capacitor, .05 mfd 400 v.	Pulse shaping net.	.25
•C413	V-10306-1	Capacitor, 150 mfd 50 v. (assy. consists of C414, C413 and C440)	Cathode bypass	3.25•
•C414	V-10306-1	Capacitor, 30 mfd 450 v. (assy. consists of C414, C413 and C440)	Plate decoupling	3.25•
C415	V-9792-10560K	Capacitor, 56 mmf	Transient damping	.30
C416	RCP10W4254M	Capacitor, .25 mfd 400 v.	Hor. yoke return	.35
C421	RCM20B101K	Capacitor, 100 mmf	MV plate bypass	.22
C422	RCM20B101K	Capacitor, 100 mmf	MV coupling	.22
C423	V-10293-1	Capacitor, 10 mfd 450 v.	MV decoupling	1.25
C424	RCM30C392K	Capacitor, 3900 mmf	MV plate tank	1.17
C425	RCP10W4104M	Capacitor, .1 mfd 400 v.	MV plate decoupling	.25
C426	RCM20C821K	Capacitor, 820 mmf	Pulse shaping	.40
C427	RCP10M6103M	Capacitor, .01 mfd 600 v.	Coupling	.21
C428	RCP10M4104M	Capacitor, .1 mfd 400 v.	Screen bypass	.25
C429	RCP10M6104M	Capacitor, .1 mfd 600 v.	Screen bypass	.35
C430	RCP10M6603M	Capacitor, .06 mfd 600 v.	15,750 ripple filter	.25
C431	V-9901-3	Capacitor, 500 mmf	HV filter	1.70
C432	RCP10M6603M	Capacitor, .06 mfd 600 v.	Cathode bypass	.25
C433	RCP10W2504M	Capacitor, .5 mfd 200 v.	AGC filter	.50
C434	V-9863-1	Capacitor, 800 mmf	Filament bypass	.20
C435	V-9863-1	Capacitor, 800 mmf	Filament bypass	.20
C437	V-5596	Capacitor, .005 mfd	Heater bypass	.25
C438	V-5596	Capacitor, .005 mfd	Heater bypass	.25
•C440	V-10306-1	Capacitor, 10 mfd 450 v. (assy. consists of C413, C414, C440)	Filter	3.25•
•C441	V-9891	Capacitor, 30 mfd 350 v. (assy. consists of C220, C441, C501 C502)	Filter	4.35•
C443	RCP10W4103M	Capacitor, .01 mfd 400 v.	AGC delay	.20
C444	RCP10W4104M	Capacitor, .1 mfd 400 v.	Cathode bypass	.24

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Ref. No.	Part No.	Description	Function	List Price Each
C447	RCP10W4104M	Capacitor, .1 mfd 400 v.	Control bypass	.24
C451	RCM20B101K	Capacitor, 100 mmf	AFC cathode	.22
C452	RCM20B681K	Capacitor, 680 mmf	AFC plate bypass	.25
C453	RCM20B331K	Capacitor, 330 mmf	AFC coupling	.25
C454	RCP10W4103M	Capacitor, .01 mfd 400 v.	MV grid	.20
C455	RCP10W4502M	Capacitor, .005 mfd 400 v.	Coupling	.17
C456	RCP10W4104M	Capacitor, .1 mfd 400 v.	MV grid	.24
C457	V-11228-1	Capacitor, 5-40 mmf	MV trimmer	.35
C462	RCM20B101K	Capacitor, 100 mmf	AFC coupling	.22
C465	V-5596	Capacitor, .005 mfd	Screen bypass	.25
C468	V-9926-4	Capacitor, 2.2 mmf	Feedback	.07
L401	V-6764	Coil	Ringing	1.45
L402	V-9960	Reactor	Hor. linearity	1.25
L404	V-4886-2	Reactor, 1.1 microhenries	Heater isolation	.38
L406	V-4886-2	Reactor, 1.1 microhenries	Heater decoupling	.38
L407	V-4886-2	Reactor, 1.1 microhenries	Heater isolation	.38
L408	V-9099-5	Reactor, 2.7 microhenries	HV filament	.20
L411	V-9099-5	Reactor, 2.7 microhenries	Suppressor	.20
L412	V-4886-2	Reactor, 1.1 microhenries	Suppressor	.38
R401	RC20AE472K	Resistor, 4700 ohms ½ w.	Keyed AGC grid	.05
R404	RC20AE474K	Resistor, 470,000 ohms ½ w.	Positive bias limiting	.05
R405	RC20AE273K	Resistor, 27,000 ohms ½ w.	DC divider	.06
R406	RC20AE105K	Resistor, 1 megohm ½ w.	Sync sep. grid return	.05
R407	RC20AE474K	Resistor, 470,000 ohms ½ w.	Coupling limiter	.05
R408	RC20AE473K	Resistor, 47,000 ohms ½ w.	Decoupling	.05
R409	RC20AE394K	Resistor, 390,000 ohms ½ w.	Decoupling	.05
R411	RC20AE682K	Resistor, 6800 ohms ½ w.	Signal divider	.05
R413	RC30AE104K	Resistor, 100,000 ohms 1 w.	Decoupling	.10
R415	RC20AE224K	Resistor, 220,000 ohms ½ w.	Bleeder	.05
R416	V-9813-4	Control, 250,000 ohms	Height	.75
R417	RC20AE564K	Resistor, 560,000 ohms ½ w.	Grid return	.05
R418	RC20AE122K	Resistor, 1200 ohms ½ w.	Cathode bias	.05
R419	V-9894-3	Control, 750,000 ohms	Vertical hold	$ .75
R420	RC20AE332K	Resistor, 3300 ohms ½ w.	Pulse shape net	.05
R421	RC20AE225K	Resistor, 2.2 megohms ½ w.	Grid return	.05
R422	RC20AE471K	Resistor, 470 ohms ½ w.	Cathode bias	.06
R423	V-6463	Control, 5000 ohms	Vert. linearity	.76
R424	V-6984-5	Resistor, (dog-bone type), 10,000 ohms 5 w.	Vert. decoupling	.66
R424	V-11328-2	Resistor (flat metal type), 10,000 ohms 5 w.	Vert. decoupling	.90
R425	RC20AE561K	Resistor, 560 ohms ½ w.	Transient damping	.05
R426	RC20AE561K	Resistor, 560 ohms ½ w.	Transient damping	.05
R433	RC20AE821K	Resistor, 820 ohms ½ w.	Cathode bias	.05
R434	RC20AE304J	Resistor, 300,000 ohms ½ w.	Grid return	.15
R435	V-10509-1	Control, 125,000 ohms	Horiz. hold	.75
R436	RC20AE274K	Resistor, 270,000 ohms ½ w.	MV plate load	.06
R437	RC20AE123K	Resistor, 12,000 ohms ½ w.	Pulse shaping net	.05
R438	RC20AE333K	Resistor, 33,000 ohms ½ w.	Plate decoupling	.05
R439	RC20AE474K	Resistor, 470,000 ohms ½ w.	Grid return	.05
R440	RC20AE151K	Resistor, 150 ohms ½ w.	Suppressor	.06
R441	RC30AE563K	Resistor, 56,000 ohms 1 w.	Hor. MV decoupling	.10
R442	V-9600-11	Resistor, (dog-bone type), 12,000 ohms 10 w.	Screen decoupling	.95
R442	V-11328-1	Resistor (flat metal type), 12,000 ohms 10 w.	Screen decoupling	1.15
R443	RC20AE562K	Resistor, 5600 ohms ½ w.	AGC filter	.06
R444	V-9927-7	Resistor, 330,000 ohms 1 w.	HV filter	.10
R445	RC20AE392K	Resistor, 3900 ohms ½ w.	Decoupling	.04
R446	RC20AE273K	Resistor, 27,000 ohms ½ w.	Plate load	.06
R452	RC20AE103K	Resistor, 10,000 ohms ½ w.	AGC filter	.05
R454	RC20AE273K	Resistor, 27,000 ohms ½ w.	Damping	.06
R455	RC20AE104K	Resistor, 100,000 ohms ½ w.	Decoupling	.05
R457	V-11229-2	Resistor, 3000 ohms 25 w.	Voltage dropping	1.55
R460	RC30AE330K	Resistor, 33 ohms 1 w.	Cathode bias	.11
R461	RC20AE223K	Resistor, 22,000 ohms ½ w.	Coil shunt	.06
R471	RC20AE105K	Resistor, 1 megohm ½ w.	AFC bleeder	.05
R472	RC20AE105K	Resistor, 1 megohm ½ w.	AFC cathode	.05
R473	RC30AE154K	Resistor, 150,000 ohms 1 w.	Error take-off	.10

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PARTS LIST FOR MODEL H-716T17 (continued)

Ref. No.	*Part No.*	*Description*	*Function*	*List Price Each*
R474	RC30AE154K	Resistor, 150,000 ohms 1 w.	Limiting	.10
R475	RC20AE224K	Resistor, 220,000 ohms ½ w.	Plate decoupling	.05
R476	RC20AE474K	Resistor, 470,000 ohms ½ w.	AFC delay	.05
R477	RC20AE473K	Resistor, 47,000 ohms ½ w.	Plate load	.05
R482	RC20AE684K	Resistor, 680,000 ohms ½ w.	Load	.06
R483	RC20AE393K	Resistor, 39,000 ohms ½ w.	Decoupling	.05
R485	RC40AE393K	Resistor, 39,000 ohms 2 w.	Bleeder	.20
R486	RC20AE104K	Resistor, 100,000 ohms ½ w.	Plate load	.05
R487	RC20AE682K	Resistor, 6800 ohms ½ w.	Pulse shape net	.05
R489	RC40AE393K	Resistor, 39,000 ohms 2 w.	Screen decoupling	.20
R491	RC40AE682K	Resistor, 6800 ohms 2 w.	Tuner dropping	.18
R493	RC20AE102K	Resistor, 1000 ohms ½ w.	Cathode bias	.05
T401	V-10909-1	Transformer	Vertical output	3.90
T402	V-10214-1	Transformer	Hor. output and HV	13.15
T403	V-9902	Control	Width	1.55
Z401	V-11192-1	Filter	Integrating	1.30
Z402	V-10911-1	Yoke Assembly (contains V-10538-1 yoke)	Deflection	12.50

SECTION 5 — POWER

•C501	V-9891	Capacitor, 40 mfd 450 v. (assy. consists of C220, C441, C501, C502)	Filter input	4.35•
•C502	V-9891	Capacitor, 40 mfd 450 v. (assy. consists of C220, C441, C501, C502)	Filter input	4.35•
C504	V-5040-15	Capacitor, .01 mfd 600 v.	Line filter	.35
L501	V-6471-2	Reactor	LV filter	2.35
R501	RC30AE224M	Resistor, 220,000 ohms 1 w.	Protection	.10
R505	V-6597	Resistor, (dog-bone type), 50 ohms 10 w.	Voltage dropping	.45
R505	V-11328-8	Resistor (flat metal type), 50 ohms 10 w.	Voltage dropping	.75
•SW501	V-9877-1	Switch (assy. consists of R208, R319, SW501)	Off-on	2.10•
T501	V-9958-1	Transformer	Power	14.45

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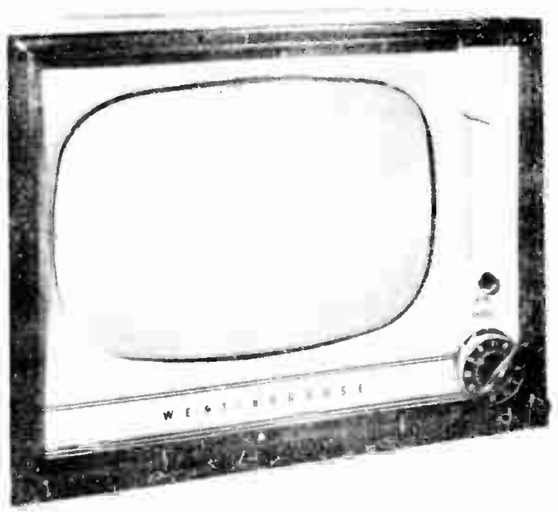
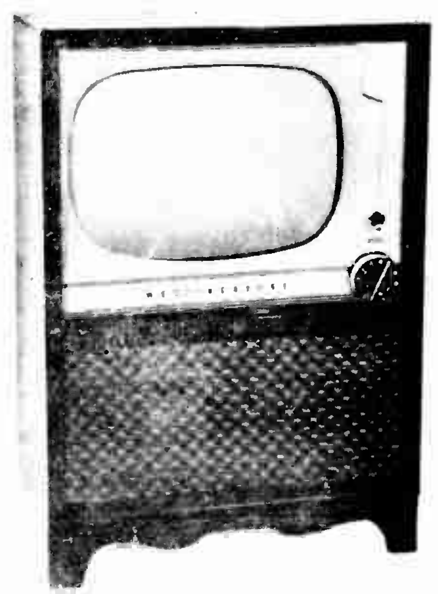


H-750T21



H-753K21

CHASSIS ASSEMBLY V-2221-1

SERVICE NOTES

For service information on the V-2221-1 chassis, refer to the H-716T17 service notes and any supplementary information thereto. With a few exceptions, the information given for the V-2208-1 chassis applies also to the V-2221-1 chassis.

The V-2221-1 chassis uses a 21" CRT (21FP4A) rather than the 17" CRT used with the V-2208-1 chassis. This necessitates the use of a different CRT strap and yoke superstructure which are listed below. Because of a different mechanical arrangement, the shafts on the volume and picture controls are longer in the V-2221-1 chassis, and the horizontal hold and brightness controls are located on the front of the chassis rather than the back. In addition, the V-2221-1 chassis uses a different power transformer (T501), deflection yoke assembly (Z402), and transient damping capacitor (C415) which are listed below.

The following parts are used in the V-2221-1 chassis. All other parts are the same as those listed for the V-2208-1 chassis in the H-716T17 service notes:

Ref. No.	*Part No.*	*Description*	*Function*	*List Price Each*
	V-11468-2	Strap Assembly, CRT		$ .30
	V-9914-2	Superstructure, yoke		1.30
•R208	V-9877-4	Control, 500,000 ohms	Volume	2.15•
•R319	V-9877-4	Control, 1500 ohms	Picture	2.15•
R327	V-10914-1	Control, 50,000 ohms	Brightness	.80
C415	V-9792-10330K	Capacitor, 33 mmf	Transient damping	.30
R435	V-10915-1	Control, 125,000 ohms	Horiz. hold	.80
Z402	V-10911-3	Yoke Assembly (contains V-10538-6 deflection yoke)	Deflection	12.50
Z402	V-10911-4	Yoke Assembly (contains V-10538-7 deflection yoke)	Deflection	12.50
•SW501	V-9877-4	Switch	On-off	2.15•
T501	V-9958-2	Transformer	Power	19.50

H-750T21 AND H-753K21 MODEL PARTS

The following parts are used in Models H-750T21 and H-753K21 in lieu of the MODEL PARTS listed in the H-716T17 service notes:

Part No.	*Description*	*List Price Each*
V-10841-1	Baffle and Grille Cloth Assembly (H-750T21)	$ .50
V-10924-4	Base, channel selector	.30
✝ V-1274-6	Cabinet (H-753K21)	48.26••
✝ V-1282-6	Cabinet (H-750T21)	29.86••
V-5860-14	Cable Assembly, speaker	.40
V-5684-2	Clip, plate to mask	.03
V-5522	Cord, AC power	1.25
✝ V-10962-14	Cover Assembly, back	4.50
V-10743-1	Foot, felt	.25
V-11501-1	Gasket, dust seal	.65
V-10749-6	Grille Cloth (H-753K21)	2.90
V-9938-1	Knob, on-off-volume	.10
V-9939-1	Knob, picture (rear)	.17
V-9940-1	Knob, fine tuning (rear)	.40
V-10676-1	Knob, channel selector	1.75
V-10926-1	Knob, horizontal and brightness	.10
V-10929-1	Mask, picture tube	4.25
V-10932-1	Plate, mask	.20
V-11625-1	Plate, front glass	15.00
V-9770-1	Speaker, 10" PM (H-753K21)	8.00••
V-10030-1	Speaker, 5¼" PM (H-750T21)	3.90••
V-10934-3	Spring, channel selector base	.06

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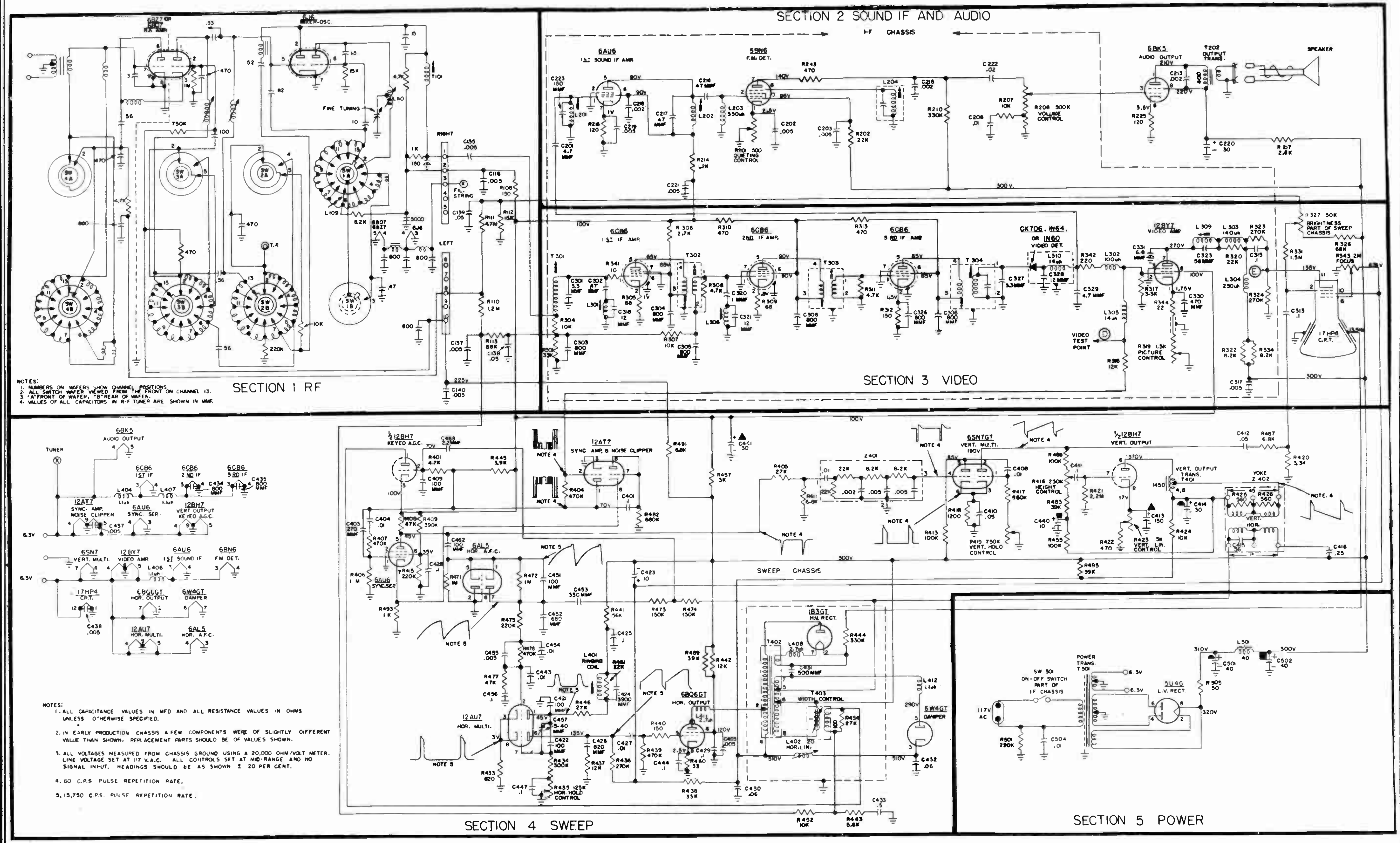


CHASSIS NO. V-2208-1

FIG. 7 — SCHEMATIC DIAGRAM

IMPORTANT—Since many of the components are very critical, exact duplicates must be used for replacement purposes. However, any substitute supplied by Westinghouse will assure performance equal to or better than the listed part.

MODEL H-730C21

SERVICE NOTES

TUBE COMPLEMENT:

TV Chassis:

1 1B3GT .... High voltage rectifier
1 5U4G .... Low voltage rectifier
1 6AK5 .... R-F amplifier
1 6AL5 .... Horizontal AFC
1 6AU5GT .... Horizontal output
1 6AU6 .... 1st sound I-F amplifier
1 6AU6 .... 2nd sound I-F amplifier
1 6AU6 .... Keyed AGC
1 6C4 .... Sync clipper
1 6CB6 .... 1st I-F amplifier
1 6CB6 .... 2nd I-F amplifier
1 6CB6 .... 3rd I-F amplifier
1 6SN7GT .... Vertical multivibrator
1 6T8 .. Ratio detector and 1st audio amplifier
1 6W4GT .... Horizontal damper
2 6W6GT .... Audio output
1 6X8 .... HF oscillator and mixer
1 12AT7 .. Sync amplifier and sync separator
1 12AU7 .... Horizontal multivibrator
1 12BH7 .... Vert. output and noise clipper
1 12BY7 .... Video output
1 21FP4A .... Cathode ray tube

AM/FM Chassis:

1 6AL5 .... FM detector
1 6AV6 .... AM det., AVC, and 1st audio amp.
2 6BA6 .... IF amplifier
1 6BJ6 .... FM RF amplifier
1 12AT7 .... HF osc., and mixer

TV ANTENNA INPUT IMPEDANCE:
...... 300 ohms balanced or 72 ohms unbalanced

TV VIDEO RESPONSE: .... 3.5 mc.

TV FOCUS: .... Electrostatic

TV SWEEP DEFLECTION: .... Magnetic

TV SCANNING: .... Interlaced, 525 Line

TV HORIZ. SCANNING FREQ: .... 15,750 CPS

TV VERT. SCANNING FREQ: .... 60 CPS

TV FRAME FREQ:
(picture repetition rate) .... 30 CPS

SPECIFICATIONS

TELEVISION FREQUENCY RANGES:

CHANNEL NUMBER	CHANNEL FREQUENCY (MC.)	VIDEO CARRIER FREQUENCY (MC.)	SOUND CARRIER FREQUENCY (MC.)	RECEIVER H-F OSCILLATOR FREQUENCY (MC.)
2	54 - 60	55.25	59.75	101
3	60 - 66	61.25	65.75	107
4	66 - 72	67.25	71.75	113
5	76 - 82	77.25	81.75	123
6	82 - 88	83.25	87.75	129
7	174 - 180	175.25	179.75	221
8	180 - 186	181.25	185.75	227
9	186 - 192	187.25	191.75	233
10	192 - 198	193.25	197.75	239
11	198 - 204	199.25	203.75	245
12	204 - 210	205.25	209.75	251
13	210 - 216	211.25	215.75	257

NOTE: Provisions for UHF reception are included. To activate UHF positions of the channel selector, small UHF units can be inserted into the UHF sockets at the rear of the RF tuner. The receiver will accommodate two such units, and each unit provides reception of one UHF channel. Installation instructions are furnished with the units.

AM/FM FREQUENCY RANGES:
Standard Broadcast .... 540 to 1600 kc.
Frequency Modulation .... 88 to 108 mc.

OPERATING VOLTAGE:
.... 105 to 120 volts, 60 cycles AC

POWER CONSUMPTION: .... 250 watts

AUDIO POWER OUTPUT:
Undistorted .... 6.5 watts
Maximum .... 10 watts

INTERMEDIATE FREQUENCIES:
TV Video Carrier .... 45.75 mc.
TV Sound .... 4.5 mc.
Amplitude Modulation .... 455 kc.
Frequency Modulation .... 10.7 mc.

SPEAKER:
Type .... 10" PM
Voice Coil Impedance .. 3.2 ohms at 400 cycles

HIGH VOLTAGE WARNING

The danger accompanying shock is always present when the receiver is operated outside the cabinet or when the rear cover is removed from the cabinet. Only a person familiar with the precautions to be observed when working with high-voltage equipment should service this receiver.

CATHODE RAY TUBE HANDLING PRECAUTIONS

Shatterproof goggles and heavy gloves should be worn at all times when handling a cathode ray tube. The tube should not be handled in the vicinity of any person not so equipped. When handling the tube, always keep it away from the body.

Due to the large surface area of the tube and the high vacuum contained within, more then ordinary care is required to prevent shattering the tube. The large end of the bulb, particularly the rim of the viewing surface, must not be struck, scratched, or subjected to more than moderate pressure. If the tube binds during removal or replacement, determine the cause of the trouble -- **DO NOT FORCE THE TUBE.**

An additional precaution is required when handling a cathode ray tube that has an aquadag coating on the outside of the tube. The outside aquadag coating forms one plate of a capacitor, and the inside coating to which the high voltage is applied serves as the other plate. The high voltage charge may be retained in this capacitor for a long time after the high voltage lead is disconnected. Since the charge could produce a shock that would startle the handler into dropping the tube, the charge should be dissipated before any handling of the tube is attempted. To dissipate the charge, place a jumper from the outside aquadag coating to the high voltage button on the tube. Due to the relatively high resistance of the aquadag, the jumper should be held in place for some time to insure complete discharge.

INSTALLATION INSTRUCTIONS

ANTENNA INFORMATION:

The receiver contains built-in antennas for use in areas of normal reception. In such areas when the built-in antennas provide good reception, external antennas are not required. However, in weak signal areas or under adverse conditions, it may be necessary to use an outside antenna.

Two sets of TV antenna terminals are located near the upper left corner of the TV section back cover, one marked UHF and the other marked STD. If an external TV antenna is to be used, disconnect the built-in TV antenna wires from the STD terminals and dress the wires in such a position that they do not touch the chassis or metal components. The lead-in wires from the external antenna should then be connected to the STD terminals. The UHF antenna terminals are not used unless UHF units are installed (see note under TELEVISION FREQUENCY RANGES on front cover).

If an external FM antenna is to be used, disconnect the built-in FM antenna wires from the two FM antenna terminals located on the rear of the shelf that supports the radio chassis, and connect the external antenna to these terminals. If desired, an external AM antenna can be connected to the solder terminal marked "EXTERNAL ANTENNA" on the loop antenna.

TO CHECK THE OPERATION OF THE RECEIVER:

1. Rotate the TV-radio-phono selector located on the radio panel completely counterclockwise (TV position).

2. Turn on the receiver by rotating the off-on and TV volume control clockwise.

3. Rotate the channel selector to the desired channel number. The two channel selector positions marked UHF are not operative unless UHF units have been installed (see note on front cover of this booklet). It should be noted that the channel selector position between 6 and 7 and the position between 13 and UHF are blank positions although the channel selector will come to rest in these positions.

4. Adjust the brightness control to a position where the picture screen is moderately lighted.

5. Check the ion trap magnet adjustment as outlined under ADJUSTMENTS.

6. Rotate the picture control to the position that provides best picture contrast.

7. If the picture moves up or down on the screen, the vertical hold control on the back of the receiver should be adjusted as explained under ADJUSTMENTS.

8. If the picture is pulled into diagonal bars or if the edge of the picture quivers or tends to fold over, adjust the horizontal control for correct synchronization. This control can be adjusted so that it will seldom be necessary to re-adjust it thereafter. To obtain this adjustment, tune in a TV station, and rotate the control to the middle of the range over which the picture is synchronized. If the middle of the sync range does not correspond approximately to the middle of the mechanical range, make the adjustments described under Horizontal Ringing Coil in the TELEVISION ADJUSTMENTS section. Check the adjustment of the horizontal control by switching to another channel and then back again. The picture should be stable when switching from channel to channel.

9. Rotate the fine tuning control to the position that provides best picture detail.

10. A re-adjustment of the brightness and picture controls may improve the picture shading.

11. Adjust the off-on and TV volume control for the desired sound volume.

12. Check the operation on all available TV stations.

13. If necessary, adjust the vertical linearity, height, horizontal linearity, width, focus or centering as explained under TELEVISION ADJUSTMENTS.

14. Rotate the TV-radio-phono selector to the center position (radio).

15. Rotate the FM-AM selector to its counterclockwise position (FM) and check the operation of the radio section on the FM band.

16. Rotate the FM-AM selector to its clockwise position (AM) and check the operation of the radio section on the broadcast band.

17. Rotate the TV-radio-phono selector completely clockwise (phono), and completely check the operation of the record changer.

TELEVISION ADJUSTMENTS

CATHODE RAY TUBE CUSHION

The CRT cushion must fit snugly against the flare of the CRT in order that the rear of the tube will be supported firmly. If this condition is not obtained, loosen the CRT cushion adjustment screws and the deflection yoke adjustment screw, slide the CRT cushion forward as far as possible, and re-tighten the screws.

DEFLECTION YOKE

The deflection yoke must be positioned as close as possible to the flare in the CRT. If adjustment is required, loosen the deflection yoke adjustment screw, slide the deflection yoke forward as far as possible, and re-tighten the screw. Note that the CRT cushion must fit snugly against the CRT flare as described previously.

The deflection yoke adjustment screw also permits the picture to be rotated to make it square with respect to the mask. To rotate the picture, loosen the deflection yoke adjustment screw and move it to the left or right. The picture will tilt to the left or right with the movement. Tighten the screw when the picture is squared in the mask.

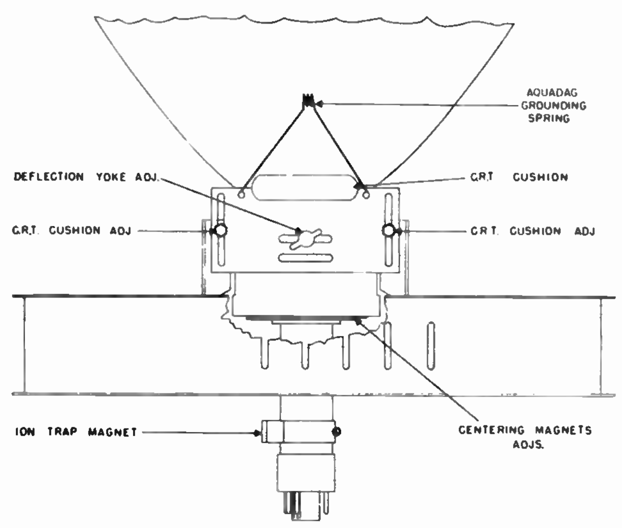


FIG. 1 — CRT ADJUSTMENTS

FOCUS

With the brightness and picture controls set at their normal operating positions, the focus control located on the back of the chassis should be adjusted for best focus.

CENTERING

Centering is accomplished by rotating the centering magnet adjusting rings clockwise or counterclockwise as required. The two adjusting rings are located on the back of the deflection yoke as shown in Fig. 1. A tab projection on each of the rings serves to facilitate adjustment.

If difficulty is experienced in centering the picture or eliminating "neck shadows", make certain the CRT cushion is tight against the flare in the CRT. Also make certain that the deflection yoke is as far forward as possible.

ION TRAP MAGNET

It is extremely important that the ion trap magnet be correctly adjusted immediately after the set is first turned on during installation. This is true even though the set appears to be operating satisfactorily. When the magnet is not correctly oriented, the electron beam strikes the edge of the aperture in the anode top disc instead of moving cleanly through the hole. The resultant heat vaporizes the metal of the disc, thus releasing gas which has a harmful effect on the tube. Some of the vaporized material may be deposited on the screen of the tube and be apparent as darkened area. An excessively high setting of the brightness control will aggravate this condition. From this it is apparent that the brightness control should never be turned up to compensate for an incorrectly adjusted ion trap magnet. The tube can be ruined in a very short time under this condition.

To adjust the ion trap magnet, position the magnet approximately as shown in Fig. 1 with the color code mark facing upward, then rotate the magnet and move it forward and backward until the position is found where the picture is brightest. If the brightness peaks at two positions of the magnet, the position nearer the base of the tube is the correct one. Never move the ion trap magnet to remove a shadow from the raster if the brightness is decreased by so doing. Shadows should be removed by adjusting the position of the deflection yoke. ***The ion trap magnet must always be adjusted for maximum picture brightness.***

HEIGHT AND VERTICAL LINEARITY

The height adjustment on the back of the chassis controls the overall height of the picture, and the vertical linearity adjustment controls the relationship between the vertical dimensions of the upper and the lower sections of the picture. A balance between the two controls is necessary to make the picture symmetrical and fill the mask vertically.

WIDTH AND HORIZONTAL LINEARITY

The width adjustment on the back of the chassis controls the overall width of the picture, and the horizontal linearity adjustment controls the relationship between the horizontal dimensions of the left and the right sections of the picture. A balance between the two controls is necessary to make the picture symmetrical with correct horizontal dimensions. These controls can be adjusted with a ¼" Spintite-type wrench.

VERTICAL HOLD

The vertical synchronization is controlled by the vertical hold adjustment on the back of the chassis. To adjust, rotate the control clockwise or counterclockwise until the picture is stabilized vertically. The adjustment should preferably be made on the weakest signal that is available, and a check should be made to see that the receiver pulls into sync on all channels.

HORIZONTAL RINGING COIL

The horizontal ringing coil (L401) should be adjusted as follows:

1. Short out the ringing coil with a short jumper wire.

2. Set the horizontal hold control to the middle of its range, and leave it in this position during the steps that follow.

3. Connect a VTVM to the junction of R477 and C456, located in the pin #2 grid circuit of the horizontal multivibrator, so as to measure the DC voltage between this point and ground.

4. With the receiver tuned to a TV station, adjust C457 (located near the horizontal multivibrator tube as shown in Fig. 4) for *zero* voltage on the meter. If zero voltage can be approached but not quite reached at one extreme of the C457 adjustment, it may be necessary to set the horizontal hold control slightly to one side of mid-position to obtain zero voltage.

5. Remove the jumper from across the ringing coil.

6. Adjust the ringing coil for *zero* voltage on

the meter, and check the adjustment by switching to another channel and then back again. The receiver should pull into horizontal synchronization on all channels.

CRITICAL LEAD DRESS IN TV CHASSIS

Leads that are susceptible to R-F pickup with resulting interaction between stages must be dressed close to the chassis mounting plate. Leads in this category include heater, AGC, B plus, and the 125 volt bus leads. These leads must be long enough to permit dressing most of the path length close to the mounting plate. The heater wiring arrangement should not be altered.

Leads associated with the 41.25 mc. trap must be as short as possible and dressed away from the chassis.

Video peaking coils should be dressed away from the chassis and clear of adjacent parts.

The lead from the width transformer to pin #5 of the 6AU6 AGC keying tube must be dressed close to the chassis and away from the ringing coil.

The lead-in from the antenna terminals to the tuner must be dressed away from the I-F chassis to prevent an R-F "tweet" from interfering with the picture.

TELEVISION ALIGNMENT

TEST EQUIPMENT

To service these chassis, the following test equipment should be available:

1. R-F sweep generator that is capable of producing a 10 mc. sweep at a center frequency of 44 mc. The output must be adjustable from at least 100,000 microvolts down to a very low minimum, and the output must be flat at all positions of the attenuator.

2. Cathode ray oscilloscope, preferably one with a wide-band vertical deflection amplifier and a low-capacitance input probe. The oscilloscope should have good low-frequency response characteristics.

3. Signal generator or generators capable of producing an accurate unmodulated signal at 4.5 mc., 41.25 mc., 42.25 mc., 43.0 mc., 44.0 mc., 45.0 mc., and 45.75 mc. The accuracy of these frequencies is very important. If the signal generator does not include a crystal calibrator, a heterodyne frequency meter equipped with a crystal calibrator should be used to insure accuracy. The output level must be adjustable from at least 100,000 microvolts down to a very low minimum.

4. Vacuum tube voltmeter equipped with a high voltage multiplier probe for measurements up to 15,000 volts and an R-F probe for measuring R-F voltages.

GENERAL INFORMATION

The chassis and the test equipment should be bonded together by short lengths of heavy braided copper ribbon, and all interconnecting leads should be shielded and should be as short as possible consistent with ease in making connections. The effectiveness of the bonding can be checked during alignment by placing the hand on the chassis or test equipment case. If the response curve or meter reading changes, the bonding must be improved before the circuits are aligned.

It is important that the coaxial cable used to couple the sweep generator output to the receiver be terminated at its output end in the characteristic impedance of the sweep generator output circuit. To accomplish this, connect the appropriate value of resistance across the output leads at the open end of the cable. The oscilloscope vertical input cable and the generator output cables must be well separated from each other.

ALIGNMENT TOOL

To adjust the slugs in the common I-F and 4.5 mc. I-F transformers a special tool is required. This tool must fit into the .035" x .093" slot in slug. *An incorrectly designed tool will cause chipping of the slug.* A suitable tool is stocked under Westinghouse part number V-8345.

COMMON I-F ALIGNMENT PROCEDURE

The common I-F system uses over-coupled I-F transformers to obtain the required band width. In the alignment of this type system, the visual method of stage-by-stage alignment is used. A sweep generator is used to develop the I-F response curve on the oscilloscope, and an unmodulated signal generator (marker) is used to provide spot frequency indications on the curve.

With some of the I-F transformers, peaks may be obtained at two positions of the adjustment slugs. If a transformer is badly out of adjustment, it is advisable to turn the slug out (counterclockwise) as far as possible before beginning alignment. Then turn the slug clockwise until the first peak is reached. This procedure is recommended to obtain the correct peak rather than an undesired second peak which is sometimes obtained when the slug is turned farther clockwise.

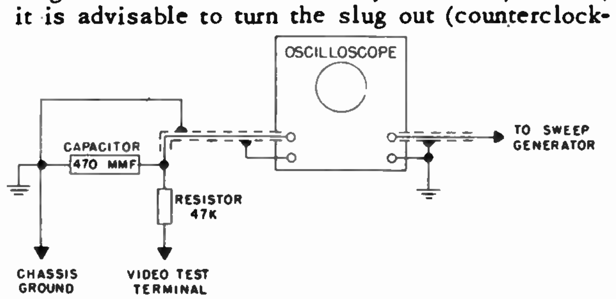


FIG. 2 — OSCILLOSCOPE CONNECTIONS

The alignment procedure to be used is given in the following steps:

1. To avoid undesirable beat response during alignment, remove the 6AK5 R-F amplifier tube from its socket and rotate the channel selector to channel 13. The channel selector is on channel 13 when the flat of the shaft is facing straight up.

2. Connect the vertical input of the oscilloscope to the video test terminal (point "D" on Fig. 4) through the decoupling network shown in Fig. 2. The oscilloscope horizontal input should be connected to the sweep (synchronizing) output from the sweep generator *through well shielded leads.* Turn the sweep control on the oscilloscope to the "x" or "off" position.

3. Connect the negative terminal of a 9 volt bias battery to the AGC line (point marked AGC Test Terminal on Fig. 4), and connect the positive terminal to chassis ground.

4. Couple the marker generator output to the sweep generator output so that the two signals are applied together to the points specified in the steps that follow. Some sweep generators have facilities for connecting the marker output directly into the sweep generator. With other sweep generators, the marker can be coupled to the sweep by wrapping a few turns of insulated wire around the center conductor of the sweep generator output cable and connecting the marker generator to this wire. The loose coupling obtained in this manner is desirable because *excessive marker signal injection will distort the response curve.*

5. Adjust the sweep generator for a center frequency of 44 mc. with a sweep deviation of 10 mc.

6. Connect the high side of the sweep generator output cable directly to the control grid of the 3rd I-F amplifier, and connect the ground side of the cable to the chassis partition as close as possible to the ground point for the 3rd I-F amplifier tube. Keep the leads from the cable as short as possible.

7. Detune the plate circuit of the 2nd I-F amplifier by attaching an "alligator" or similar type clip to pin 5 of the 6CB6 2nd I-F amplifier tube. *Use care to avoid shock.* This step is necessary to avoid absorption of the signal that is applied at the 3rd I-F grid.

8. Adjust the oscilloscope vertical gain and the sweep generator output level to obtain a curve on the oscilloscope. To avoid a distorted curve, the recommended practice is to use maximum oscilloscope vertical gain and only enough sweep signal amplitude to obtain a good curve.

9. Set the marker generator to 44 mc. with the output attenuated until the marker pip is barely visible on the curve, and adjust the primary of the 3rd common I-F transformer, T304, until the 44 mc. marker pip is at the highest point on the response curve.

10. Adjust the secondary of T304 to make the top of the response curve symmetrical.

11. Make certain that the response curve coincides with Fig. 5A, using the marker to check at the appropriate frequencies. The 44 mc. pip must strike the center of the flat response region, the 42.25 mc. and 45.75 mc. points must be at equal heights, and the 43 mc. and 45 mc. points must be at equal heights. Re-adjust the primary and secondary of T304 if necessary to obtain these conditions.

12. Remove the detuning clip from the plate of the 2nd I-F amplifier tube, and attach it to the plate of the 1st I-F amplifier tube.

13. Move the sweep output connection from grid of the 3rd I-F amplifier to the grid of the 2nd I-F amplifier. Connect the ground side of the cable to the chassis partition as close as possible to the ground point for the 2nd I-F amplifier tube.

14. Adjust the primary of the 2nd common I-F transformer, T303, for maximum height of the response curve at 44 mc., and adjust the secondary of T303 to make the top of the curve symmetical.

15. Make certain that the curve corresponds to Fig. 5B. The 44 mc. pip must strike the center of the flat response region, the 42.25 mc. and 45.75 mc. points must have equal heights, and the 43 mc. and 45 mc. points must have equal heights. Re-adjust the primary and secondary of T303 if necessary.

16. Remove the detuning clip from the plate the 1st I-F amplifier.

17. Move the sweep output connection from the grid of the 2nd I-F amplifier to the grid of the 1st I-F amplifier, and connect the ground side of the cable as close as possible to the ground point for the 1st I-F amplifier tube.

18. Adjust the primary of the 1st common I-F transformer, T302, for maximum height of the response curve at 44 mc., and adjust the secondary of T302 to make the top of the curve symmetrical. If difficulty is experienced in aligning T302, adjust the adjacent channel interference trap, L308, to a higher frequency by rotating the slug completely counterclockwise. Complete information on the adjustment of L308 is given in step 26.

19. Make certain that the curve corresponds to Fig. 5C. The 44 mc. pip must strike the center of the flat response region, the 42.25 mc. and 45.75 mc. points must have equal height, and the 43 mc. and 45 mc. points must have equal heights. Re-adjust the primary and secondary of T302 if necessary.

20. Remove the sweep output connection from the 1st I-F amplifier grid, and couple it to the 6X8 mixer-oscillator tube through the coupling system illustrated in Fig. 3. This system provides adequate signal injection and at the same time provides shielding which prevents radiation of the signal. The device is constructed by flar-

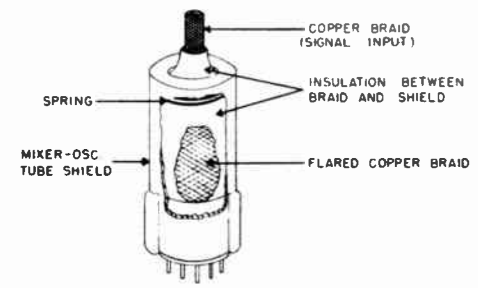


FIG. 3 — COUPLING SIGNAL GENERATOR TO MIXER TUBE

ing a piece of tubular copper braid over the top of the 6X8 tube and wrapping gummed tape over the braid to serve as insulation. The tube shield is then replaced over the tube with the braid protruding through the hole in the top of the shield. ***The braid must not contact the chassis or the tube shield at any point.*** The tube shield should be locked securely to its mounting base. Connect the high side of the sweep generator output cable to the copper braid, and connect the ground side to the nearest point on the chassis.

21. Rotate the slug of the 41.25 mc. trap (L301) completely clockwise.

22. It is possible to obtain two peaks when adjusting the primary of the I-F input coupling network, T101, located on the R-F tuner. These peaks produce different overall bandwidths. The correct peak to use is normally the peak that occurs with the adjustment screw turned further counterclockwise.

Turn the adjustment screw of T101 completely counterclockwise. Then adjust T101 for maximum height of the response curve at 44 mc., and adjust the secondary of the I-F input coupling network, T301, to make the top of the curve symmetrical. If necessary, re-adjust T101 and T301 to make 44 mc. strike the center of the flat response region.

23. Set the marker generator to 41.25 mc., and increase the output until the pip is readily visible on the curve.

24. Adjust L301 to minimize the amplitude of the 41.25 mc. marker pip. L301 functions as a 41.25 mc. trap.

25. Make certain that the final response curve corresponds to Fig. 5D. Use the marker to check at the frequencies shown on the drawing. If necessary, re-adjust T101 and T301 to obtain the correct curve.

If the bandpass of the response curve is too narrow so that the 45.75 mc. marker occurs at less than 40 percent of maximum response, turn T101 clockwise until a second peak at 44 mc. is obtained. Adjust T301 for flat response at the top of the curve, and re-adjust T101 to center 44 mc. on the flat response.

26. L308 is the adjustment for the adjacent channel interference trap. If adjacent channel interference does not constitute a problem in the area where the receiver is to be operated, L308 will not ordinarily require adjustment; however, the trap must not be mis-adjusted into the I-F response region. In areas where adjacent channel interference is not troublesome, L308 can be set to its highest tuneable frequency by rotating the slug completely counterclockwise, and it can be left in this position.

In areas where adjacent channel interference is evident, however, L308 should be adjusted to 47.25 mc. This can be accomplished in either of two ways. One is to connect an amplitude modulated signal generator that has an output of .02 volt or higher to the grid of the 1st I-F amplifier, and adjust the output frequency accurately to 47.25 mc. This will produce an indication on an oscilloscope connected to the video test terminal. Adjust L308 for minimum response on the oscilloscope. If a signal generator capable of this high output is not available, connect a good antenna to the receiver, and tune the receiver to the TV station on which the adjacent channel interference occurs, carefully adjusting the fine tuning control to its correct setting. Then, beginning with L308 in its completely counterclockwise position, rotate L308 clockwise until the position is found where the adjacent channel interference is eliminated. In some cases, the trap adjustment may affect the adjustment of T302. If this occurs, it will be necessary to repeat steps 17, 18 and 19.

SOUND I-F AND 4.5 MC. TRAP ALIGNMENT PROCEDURE

In the sound I-F alignment, a VTVM is used as the indicator instead of an oscilloscope. The procedure is as follows:

1. Connect the high side of the signal generator to the video test terminal (point "D" on Fig. 4) through a .001 mfd mica capacitor, and ground the low side to the chassis.

2. Connect the VTVM to the points indicated on the bottom view of the chassis, Fig. 6. The common lead should be connected to point "C" and the high lead should be connected to point "A". Set the meter on its 5 volt (-DC) scale.

3. Adjust the signal generator to 4.5 mc. (unmodulated). The accuracy of this frequency is very important. If a crystal controlled signal generator is not available, the frequency should be checked with an accurate frequency meter.

4. Adjust L201, L202 and the primary of T201 for maximum indication on the meter. ***During these adjustments keep the signal generator output adjusted so that the meter reading does not exceed 5 volts.***

5. Connect the common lead from the VTVM to point "A" (Fig. 6), and connect the high lead to point "B". Here it is important that the case and components of the VTVM are *not* grounded to the receiver chassis. Otherwise point "A" would be shorted to the chassis through the common lead.

6. Using the same signal generator amplitude and frequency as in step 4, adjust the secondary of T201 for *zero* voltage on the VTVM. As the adjustment is tuned through resonance, the voltage will rapidly change from one polarity to the opposite polarity. The point where the voltage is zero is the correct setting.

7. Connect the common lead from the VTVM to the chassis, and connect the ***R-F probe*** from the VTVM to the cathode of the CRT. This point is shown as point "E" on Fig. 6. Note that this point is above ground potential and, therefore the R-F probe must contain a blocking capacitor.

8. Using a strong 4.5 mc. signal applied as in step 1, adjust the 4.5 mc. trap, L309, for minimum indication on the meter.

H. F. OSCILLATOR ALIGNMENT PROCEDURE

If the 6X8 oscillator tube is replaced, the different inter-electrode capacitance of the new tube may change the oscillator frequency enough to necessitate re-alignment of the oscillator.

Alignment of the oscillator on the high band is accomplished by adjusting the brass slug located adjacent to the vernier drive wheel on the front of the tuner. Alignment of the oscillator on the low band is accomplished by adjusting the brass slug on the lower front of the tuner. The adjustment procedure is as follows:

1. Set the fine tuning control to the middle of its range, and keep it in this position during the following adjustments. The control is set to the middle of its range when the set-screw in the fine tuning drive wheel is straight up.

2. Set the selector switch to the highest of the low-band (channels 2 through 6) stations operating in your vicinity.

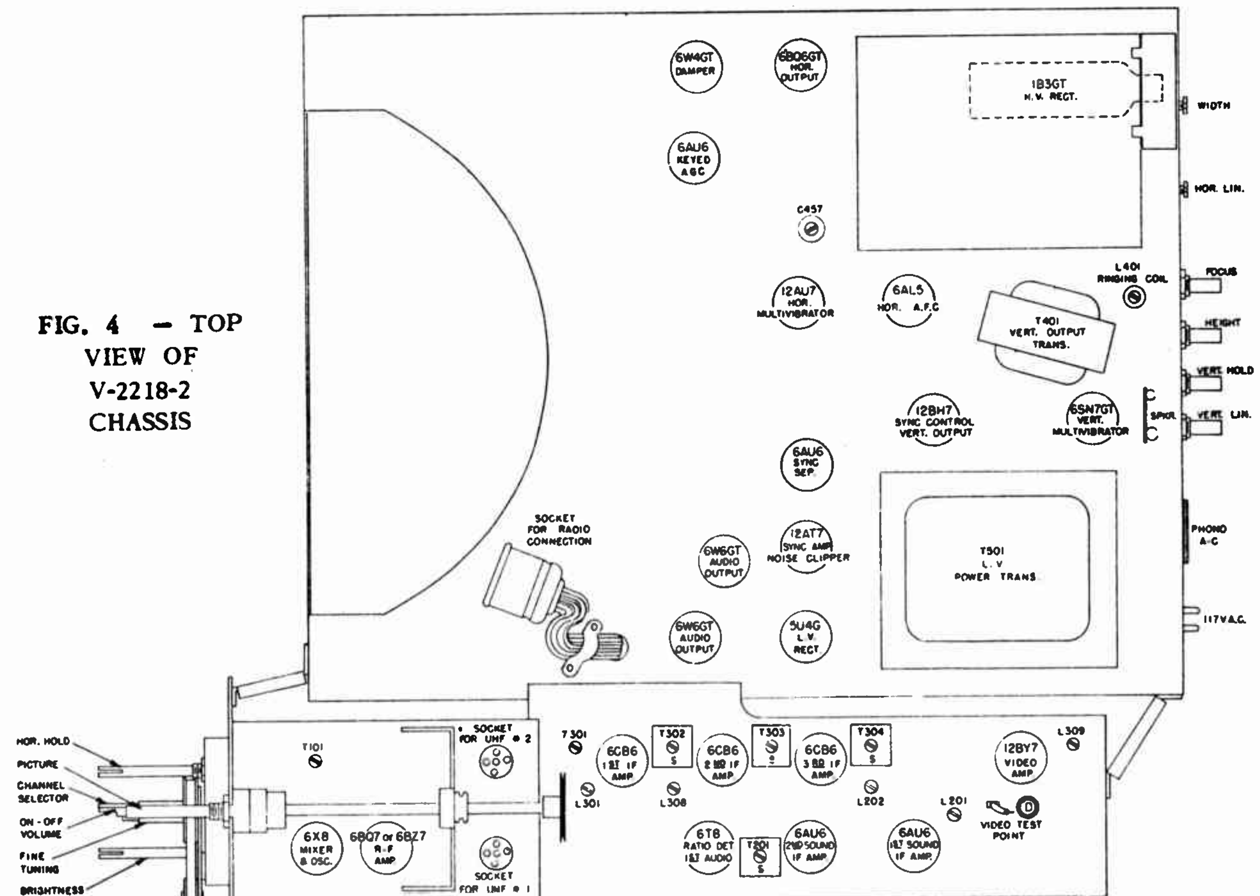
3. Peak the low band adjustment slug (L109) for the best picture detail.

4. Set the selector switch to the highest of and high-band (channels 7 through 13) stations operating in your vicinity.

5. Peak the high band adjustment slug (L110) for the best picture detail.

6. Check the previously made low band adjustment, and if the tuning has changed repeat steps 2 and 3.

FIG. 4 — TOP VIEW OF V-2218-2 CHASSIS



AM/FM ALIGNMENT

BROADCAST BAND

Connect an output meter across the speaker voice coil.

While making the following adjustments, keep the volume control set for maximum output and the signal generator output attenuated to avoid AVC action.

Step	Connect Signal Generator to —	Signal Generator Frequency	Radio Dial Setting	Adjust
1	Set the AM-FM switch to AM and the phono-radio-TV control to RADIO			
2	Stator of tuning capacitor (A) through a 0.1 mfd capacitor	455 kc.	minimum capacity	Pri. and sec. of T7 and T6 for max. output in order given

NOTE: If the I-F transformers are badly mis-aligned, it may be impossible to obtain sufficient output using the above system. In this event, it will be necessary to align each transformer separately. Start with the last I-F transformer and work forward, connecting the signal generator to the control grid of the tube preceding the transformer under alignment.

Step	Connect Signal Generator to —	Signal Generator Frequency	Radio Dial Setting	Adjust
3	Radiated signal (no actual connection)	1615 kc.	minimum capacity	AM osc. trimmer (D) for max. output
4	Radiated signal (no actual connection)	1400 kc.	tune to signal	AM ant. trimmer (B) for output max. (rock-in adjustment)

FM BAND

Do not align the FM circuits until all AM adjustments have been completed.

Step	Connect Signal Generator to —	Signal Generator Frequency	Radio Dial Setting	Adjust
1	Set the AM-FM switch to FM			
2	Connect two 100,000 ohm resistors (the resistances must be equal within 5 per cent) between pin No. 7 of the 6AL5 tube and ground as shown on the schematic diagram.			
3	Connect a V.T.V.M. between points "X" and "Y" (see schematic diagram).			
4	Pin No. 2 of 12AT7 through a 0.1 mfd mica capacitor	10.7 mc.	minimum capacity	Sec. of T4 for *zero* (use medium strength signal)
5	Connect the V.T.V.M. between point "Z" and ground			
6	Same as step 4	10.7 mc.	minimum capacity	Pri. of T4 and pri. and sec. of T3 and T2 for max.
7	Reconnect the V.T.V.M. between points "X" and "Y" and increase the signal strength 10 times			
8	Same as step 4	10.7 mc.	minimum capacity	Recheck sec. of T4 for *zero* voltage
9	Reconnect the V.T.V.M. between point "Z" and ground			
10	Same as step 4	10.7 mc.	minimum capacity	Pri. of T4 for maximum voltage
11	Remove the two 100,000 ohm resistors that were inserted in step 2			
12	FM ant. terminal through a 300 ohm non-inductive resistor	98 mc.	98 mc.	FM osc. core for maximum voltage
13	Same as step 12	98 mc.	98 mc.	FM R-F trimmer (C46) for maximum voltage
14	Same as step 12	105 mc.	tune to signal	FM R-F core for maximum voltage
15	Same as step 12	90 mc.	tune to signal	FM R-F trimmer (C46) for maximum voltage (rock-in)
16	Recheck steps 14 and 15 for tracking			

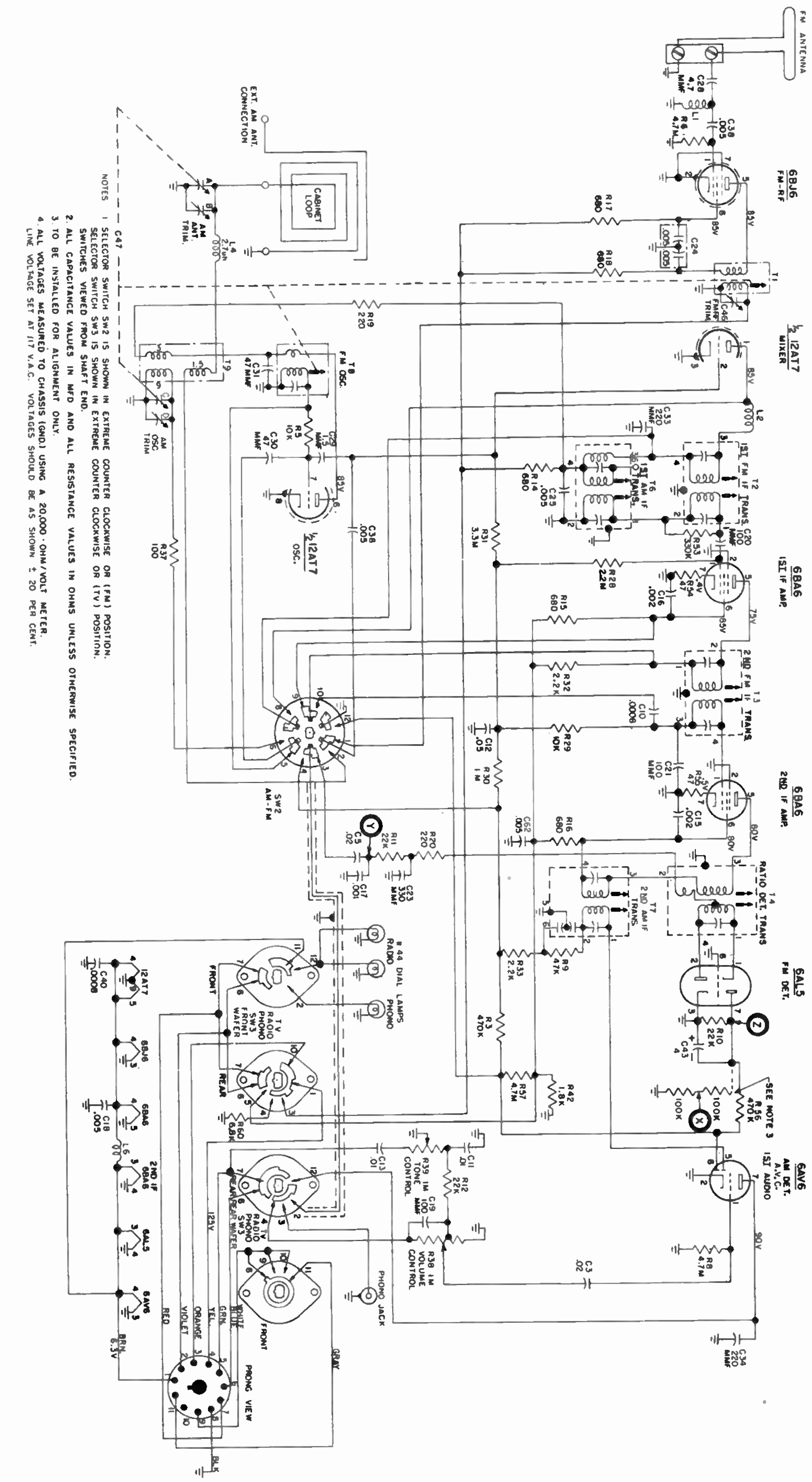


FIG. 10 — SCHEMATIC DIAGRAM OF RADIO CHASSIS

CHASSIS NO V-2180-9

TELEVISION ALIGNMENT CHARTS

The information in these charts is condensed from the foregoing detailed information as a convenience to the service technician. It is recommended that the detailed information be studied before using the charts.

COMMON I-F SECTION

Remove the 6AK5 RF amplifier tube from its socket, and turn the channel selector to channel 13.

Connect the oscilloscope to the video test terminal through the decoupling network shown in Fig. 2.

Connect a 9 volt bias battery to the AGC line.

Adjust the sweep generator for a center frequency of 44 mc. with a 10 mc. sweep deviation, and couple the marker generator to the sweep generator.

Step	*Connect Sweep and Marker Generators to —*	*Marker Use*	*Connect Detuning Clip to —*	*Adjust —*
1.	3rd I-F amp. grid	Check for equal response at 42.25 mc and 45.75 mc using weak signal. Also 43 mc and 45 mc.	2nd I-F amp. plate	Pri. of T304 for max. response and sec. of T304 for symmetrical curve shown in Fig. 5A.
2.	2nd I-F amp. grid	Same as step 1	1st I-F amp. plate	Pri. of T303 for max. response and sec. of T303 for symmetrical curve shown in Fig. 5B.
3.	1st I-F amp. grid	Same as step 1	Not used	Pri. of T302 for max. response and sec. of T302 for symmetrical curve shown in Fig. 5C.
4.	6X8 mixer through coupling device shown in Fig. 3.	Check at 44 mc Marker pip must be at center of flat region on curve	Not used	Turn L301 adj. completely clockwise and adjust T101 for max. response. Adjust T301 for symmetrical top.
5.	Same as preceding step	Adjust to 41.25 mc. and increase output until pip is readily visible.	Not used	L301 to minimize amplitude of 41.25 mc. marker pip.
6.	Same as preceding step	Check curve at frequencies shown on Fig. 5.	Not used	Re-adjust T101 and T301 to obtain curve shown in Fig. 5D.
7.	Tune L308 to 47.25 mc. as described in step 26 of detailed information			

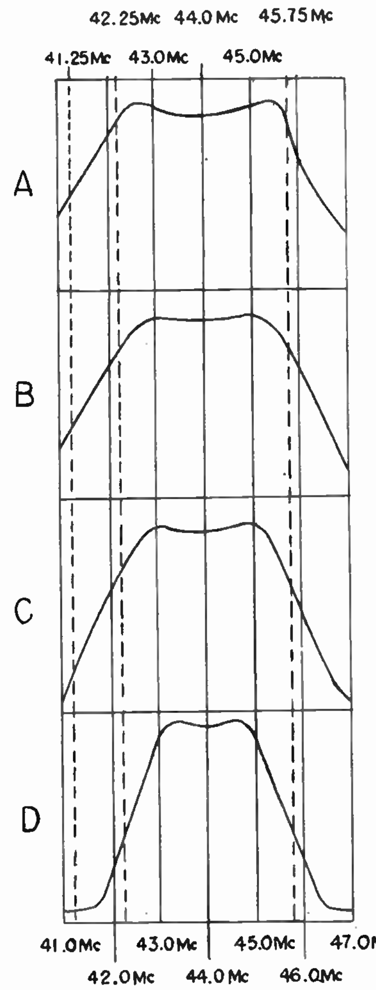


FIG. 5 — RESPONSE CURVES AT VARIOUS STAGES OF ALIGNMENT

SOUND I-F SECTION AND 4.5 MC. TRAP

Connect the signal generator to the video test terminal (point "D" on Fig. 4) through a .001 mfd capacitor.

Step	*Signal Gen. Frequency*	*VTVM Connections*	*Remarks*	*Adjust —*
1.	4.5 mc. unmodulated	Common lead to point "C" and high lead to point "A" as shown in Fig. 6.	Use 5 v. (-DC) scale on meter. Set sig. gen. output accordingly.	L201, L202 and pri. of T201 for max. voltage.
2.	4.5 mc. unmodulated	Common lead to point "A" and high lead to point "B" as shown in Fig. 6.	Use same sig. gen. output as in step 1	Sec. of T201 for zero voltage.
3.	4.5 mc. unmodulated	RF probe to point "E" (see Fig. 6) and common lead to chassis.	Use strong signal from generator	L309 for minimum voltage

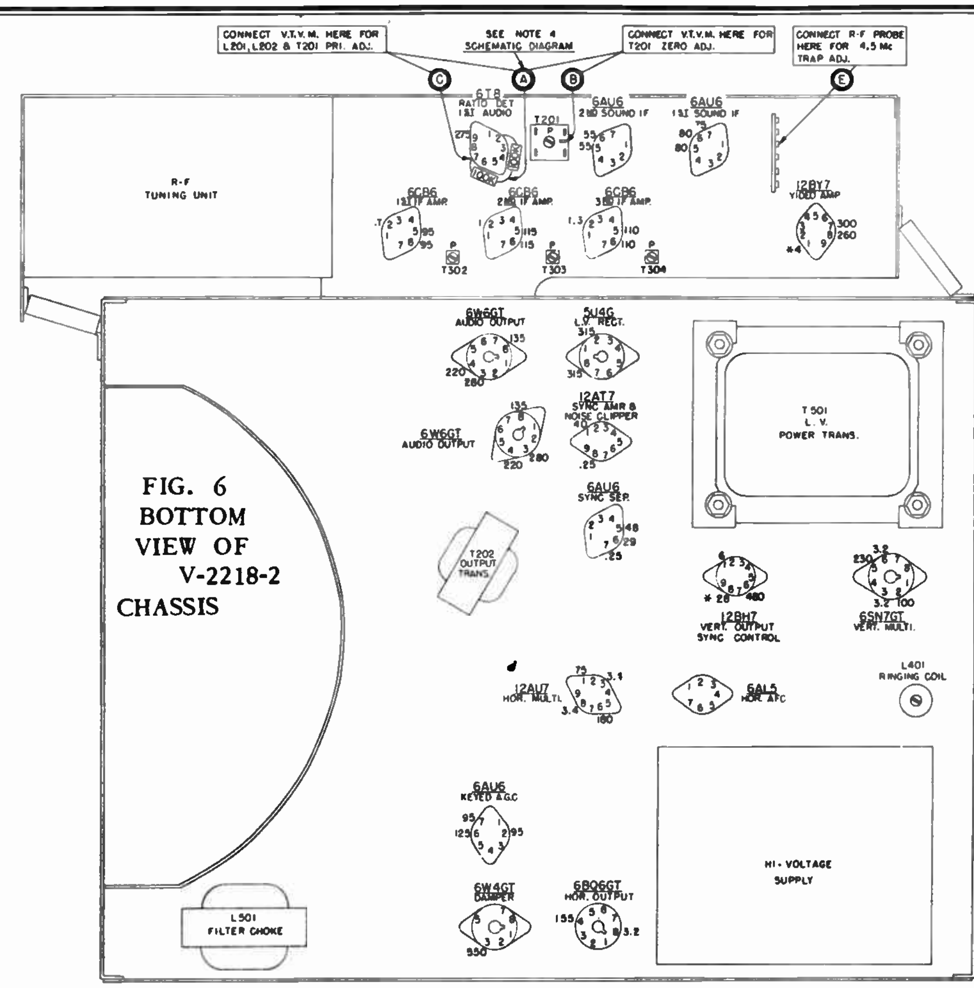


FIG. 6 BOTTOM VIEW OF V-2218-2 CHASSIS

* VOLTAGE MEASURED WITH CONTROL SET AT MAX. RESISTANCE.

MODEL H-730C21 PARTS LIST

When ordering parts, specify model number of set in addition to part number and description of part.

	Part No.	*Description*	*Price*
✓	V-10816-2	Antenna Assembly, AM loop	$1.50••
	V-5986-3	Antenna Assembly, FM dipole	.90••
	V-10924-3	Base, channel selector	.30
✓	V-1278-1	Cabinet	•••
	V-5860-14	Cable Assembly, speaker	.40
	V-4898-1	Catch, bullet	.06
	V-5684-2	Clip, plate to mask	.03
	V-5522	Cord, AC power	1.25
•	V-4349-16	Cord, phono AC power	.50
✓	V-10962-10	Cover Assembly, back	4.75
✓	V-11354-1	Dial, AM-FM	.50
✓	V-8609	Doors, matched pair (less hardware)	•••
✓	V-8610	Doors, center section (less hardware)	•••
✓	V-8611	Drawer, record changer (less hardware	•••
	V-10942-2	Gasket, dust seal	.75
✓	V-10749-7	Grille cloth	•••
	V-9091-1	Hinge, upper LH and lower RH	.30
	V-9091-2	Hinge, upper RH and lower LH	.30
	V-10339-1	Hinge, continuous	1.10
✓	V-9938-5	Knob, off-on-TV volume	.12
✓	V-9939-6	Knob, picture (rear)	.15
✓	V-9940-4	Knob, TV fine tuning (rear)	.45
✓	V-10408-8	Knob, AM-FM band selector and tone	.35
✓	V-10408-9	Knob, radio volume	.30
	V-10926-1	Knob, horiz. hold and brightness	.10
✓	V-11146-2	Knob, TV channel selector	1.75
✓	V-11149-3	Knob, radio tuning (rear)	.35
✓	V-11149-4	Knob, TV-radio-phono (rear)	.40
✓	V-10929-2	Mask, picture tube	4.25
	V-10024-1	Nut, speed (dial to cabinet)	.03
✓	V-11151-1	Nut, speed (dial wing to cabinet)	.03
✓	V-11291-6	Plate, front glass	•••
✓	V-11310-2	Plate, mask	.55
✓	V-11145-2	Pointer, radio dial	1.00
✓	V-11194-3	Pull, record changer drawer	•••
✓	V-11194-4	Pull, door (upper left)	•••
✓	V-11194-5	Pull, door (upper right)	•••
✓	V-11194-6	Pull, door (lower left and right)	•••
	V-10039-1	Slide mechanism, phono	2.85
✓	V-11439-1	Speaker, 10" PM	8.50••
	V-10934-1	Spring, channel selector base	.10
	V-4900-1	Strike, bullet	.03
✓	V-11417-1	Wing, dial	•••

V-2218-2 CHASSIS PARTS

MISCELLANEOUS

V-6090-1	Base, miniature tube (6T8)	$ .10
V-11388-1	Belt, dial drive	.30
V-5426	Clip, IF mounting	.03
V-11356-1	Cable and Socket Assy., TV to radio	1.85
V-5906-7	Connector Assembly, high voltage	.50
V-9867-2	Cushion, yoke hood	.06
V-9928-2	Hood, yoke mounting	.50
V-9784-4	Magnet, ion trap	.55

V-2218-2 CHASSIS PARTS (continued)

Part No.	Description	List Price Each
V-5549	Plug, AC power (male)	.30
V-5926	Screw, wing, #8-32 (yoke)	.04
V-10038-1	Shield, miniature tube (6CB6, 6AU6 2nd sound IF, and crystal det.)	.06
V-6090-2	Shield, miniature tube (6T8)	.15
V-10907-2	Socket Assembly, CRT	.80
V-10918-1	Socket Assembly, (12BH7)	.50
V-9888-1	Socket, miniature wafer (all 7 pin tubes and crystal)	.13
V-9889-1	Socket, miniature wafer (12AT7)	.15
V-9889-1	Socket, miniature wafer (12AT7)	.15
V-4195	Socket, molded octal (6W6GT)	.14
V-5405	Socket, molded (phono AC)	.28
V-8605	Socket and Capacitor Assy., HV (includes C431, R444, L408)	3.25
V-10958-2	Socket, miniature wafer (12BY7, 12AU7)	.20
V-4514-1	Socket, molded octal (5U4G, 6SN7GT, 6W6GT)	.17
V-4514-2	Socket, molded octal (6W4GT)	.15
V-5929-2	Socket, molded octal (6AU5GT)	.20
V-10970-1	Socket, UHF connector	.35
V-9922-16	Strap Assembly, CRT	.55
V-9914-5	Superstructure, yoke	1.40

SECTION 1 — R-F

Ref. No.	Part No.	Description	Function	List Price Each
C116	V-5596	Capacitor, .005 mfd (min)	Tuner decoupling	$ .25
C135	V-5596	Capacitor, .005 mfd	Tuner coupling	.25
C140	V-5596	Capacitor, .005 mfd	Tuner bypass	.25
R108	RC20AE151K	Resistor, 150 ohms ½ w.	Tuner decoupling	.05
R110	RC20AE155K	Resistor, 1.5 megohms ½ w.	AGC divider	.05
	V-11333-1	RF tuner assembly		47.50

SECTION 2 — SOUND I-F AND AUDIO

Ref. No.	Part No.	Description	Function	List Price Each
C201	V-9926-3	Capacitor, 4.7 mmf	Sound take-off	.07
C203	V-5596	Capacitor, .005 mfd (min)	Screen bypass	.25
C204	V-4637	Capacitor, elec., 4 mfd 50 v.	Ratio det. stabilizer	.85
C207	RCP10W6102M	Capacitor, .001 mfd 600 v.	De-emphasis net.	.18
C208	RCP10W4103M	Capacitor, .01 mfd 400 v.	Tone compensation	.20
C209	RCP10W4103M	Capacitor, .01 mfd 400 v.	Audio coupling	.20
C210	RCP10W4502M	Capacitor, .005 mfd 400 v.	Audio coupling	.17
•C211	V-9891	Capacitor, 30 mfd 350 v., elec. (assy. consists of C211, C212, C501 & C502)	Audio decoupling	4.35•
•C212	V-9891	Capacitor, 30 mfd 350 v., elec. (assy. consists of C211, C212, C501 & C502)	Audio decoupling	4.35•
C213	RCP10W6103M	Capacitor, .01 mfd 600 v.	Tone compensation	.19
C214	RCM20C821K	Capacitor, 820 mmf	De-emphasis net.	.40
C215	RCM20B151M	Capacitor, 150 mmf	Plate bypass	.20
C216	RCM20B470K	Capacitor, 47 mmf	I-F coupling	.22
C217	RCM20B151K	Capacitor, 150 mmf	IF tank	.20
C218	RCP10W6202M	Capacitor, .002 mfd 600 v.	Screen bypass	.19
C219	V-5596	Capacitor, .005 mfd	Cathode bypass	.25
C220	V-6570	Capacitor, 30 mfd 450 v. elec.	Cathode bypass	1.65
C221	V-5596	Capacitor, .005 mfd (min)	130 v. line bypass	.25
C222	RCP10W4203M	Capacitor, .02 mfd 400 v.	Audio coupling	.18
C223	RCM20B151K	Capacitor, 150 mmf	IF tank	.20
C230	RCM20B681K	Capacitor, 680 mmf	Feedback	.25
•C231	V-10786-1	Capacitor, 30 mfd 450 v. elec. (assy. consists of C231, C310, C440)	Filter	3.10•
C232	V-6570	Capacitor, 30 mfd 450 v.	Filter	1.65
C233	RCP10W4504M	Capacitor, .5 mfd 400 v.	Audio screen	.55
L201	V-9882-5	Reactor	Sound IF grid	.60
L202	V-9882-5	Reactor	Sound IF plate	.60
R202	RC20AE123K	Resistor, 12,000 ohms ½ w.	Screen decoupling	.05
R204	RC20AE273K	Resistor, 27,000 ohms ½ w.	De-emphasis net.	.06
R205	RC20AE123K	Resistor, 12,000 ohms ½ w.	Ratio det. load	.05
R207	RC20AE103M	Resistor, 10,000 ohms ½ w.	Tone compensation	.05
•R208	V-9877-4	Control, 500,000 ohms (assy. consists of R208, R319, SW501)	Volume	2.15•
R209	RC20AE106M	Resistor, 10 megohms ½ w.	Audio grid return	.05
R210	RC20AE334K	Resistor, 330,000 ohms ½ w.	Bleeder	.05
R211	RC20AE125K	Resistor, 1.2 megohms ½ w.	Audio grid return	.10
R212	V-6067-12	Resistor, 200 ohms ½ w.	Audio cathode	.25
R213	RC40AE153K	Resistor, 15,000 ohms 2 w.	B plus bleeder	.20
R214	RC30AE472K	Resistor, 4700 ohms 1 w.	Screen decoupling	.09
R215	RC20AE224K	Resistor, 220,000 ohms ½ w.	Grid return	.05
R216	RC20AE121K	Resistor, 120 ohms ½ w.	Cathode bias	.06
R217	V-11328-6	Resistor, 470 ohms 10 w.	Decoupling	.85
R218	RC20AE105K	Resistor, 1 megohm ½ w.	Audio degeneration	.05
R219	RC20AE151K	Resistor, 150 ohms ½ w.	Suppressor	.06
R227	RC20AE475K	Resistor, 4.7 megohms ½ w.	AGC divider	.05
R231	RC20AE223K	Resistor, 22,000 ohms ½ w.	Bleeder	.06
R232	RC20AE273K	Resistor, 27,000 ohms ½ w.	Bleeder	.06
R234	RC20AE470M	Resistor, 47 ohms ½ w.	Suppressor	.05
R235	RC20AE470M	Resistor, 47 ohms ½ w.	Suppressor	.05
R236	RC20AE151K	Resistor, 150 ohms ½ w.	Screen decoupling	.05
R237	RC20AE151K	Resistor, 150 ohms ½ w.	Screen decoupling	.05
R238	RC20AE105K	Resistor, 1 megohm ½ w.	Bias divider	.05
R239	RC30AE393K	Resistor, 39,000 ohms 1 w.	Suppressor	.09
R240	V-11328-3	Resistor, 15,000 ohms 5 w.	Voltage divider	.95
R241	RC20AE151K	Resistor, 150 ohms ½ w.	Suppressor	.05
R242	RC20AE125K	Resistor, 1.2 megohms ½ w.	Bias divider	.10
T201	V-9884	Transformer	Ratio detector	$ 2.05
T202	V-11360-1	Transformer	Audio output	2.80

SECTION 3 — VIDEO

Ref. No.	Part No.	Description	Function	List Price Each
C301	V-9926-2	Capacitor, 3.3 mmf	1st IF tank	.10
C302	V-5658-11	Capacitor, .47 mmf	IF coupling	.08
C303	V-9863-1	Capacitor, 800 mmf	AGC decoupling	.20
C304	V-9863-1	Capacitor, 800 mmf	IF screen bypass	.20
C305	V-9863-1	Capacitor, 800 mmf	AGC decoupling	.20
C306	V-9863-1	Capacitor, 800 mmf	IF screen bypass	.20
C308	V-9863-1	Capacitor, 800 mmf	IF screen bypass	.20
•C310	V-10786-1	Capacitor, 10 mfd 450 v., elec. (assy. consists of C231, C310 and C440)	Screen bypass	3.10•
C313	RCP10W4104M	Capacitor, .1 mfd 400 v.	Coupling	.24
C315	RCP10W4104M	Capacitor, .1 mfd 400 v.	Video bypass	.24
C317	V-5596	Capacitor, .005 mfd	Decoupling	.25
C318	R3CC20SL120K	Capacitor, 12 mmf	41.25 mc. trap	.19
C320	V-5658-1	Capacitor, 1.0 mmf	Adjacent channel trap	.08
C321	R3CC20SL120K	Capacitor, 12 mmf	Adjacent channel trap	.19
C322	RCP10W4103M	Capacitor, .01 mfd 400 v.	AGC filter	.20
C323	RCM20B560K	Capacitor, 56 mmf	4.5 mc. trap	.20
C325	V-5596	Capacitor, .005 mfd	AGC bypass	.25
C326	V-9863-1	Capacitor, 800 mmf	Cathode bypass	.20
C327	V-9926-2	Capacitor, 3.3 mmf	IF tank	.10
C328	R3CC20SL120K	Capacitor, 12 mmf	Plate bypass	.19
C329	V-9926-3	Capacitor, 4.7 mmf	Det. plate filter	.07
C330	RCM20B471K	Capacitor, 470 mmf	Cathode bypass	.31
C331	V-5658-12	Capacitor, 6.8 mmf	Video amp. plate	.10
	V-10916-1	Crystal	Video detector	1.75
L301	V-10771-1	Reactor, slug tuned	41.25 mc. trap	.70
L302	V-9915-1	Reactor, 100 microhenries	Video peaking	.30
L303	V-5902-1	Reactor, 140 microhenries	Video peaking	.45
L304	V-5902-5	Reactor, 250 microhenries	Video peaking	.39
L305	V-4886-1	Reactor, 14 microhenries	Sync decoupling	.55
L307	V-4886-1	Reactor, 14 microhenries	Video amp. decoupling	.55
L308	V-10771-1	Reactor, slug tuned	Adjacent channel trap	.70
L309	V-9882-3	Reactor, tuned	4.5 mc. trap	.70
L310	V-4886-1	Reactor, 14 microhenries	Decoupling	.55
R301	RC20AE333K	Resistor, 33,000 ohms ½ w.	AGC divider	.05
R305	RC20AE680K	Resistor, 68 ohms ½ w.	Cathode bias	.04
R306	RC20AE272K	Resistor, 2700 ohms ½ w.	Screen decoupling	.05
R307	RC20AE103M	Resistor, 10,000 ohms ½ w.	Grid decoupling	.05
R308	V-9927-2	Resistor, 4700 ohms ½ w.	IF damping	.11
R309	RC20AE680K	Resistor, 68 ohms ½ w.	Cathode bias	.04
R310	RC20AE471M	Resistor, 470 ohms ½ w.	Screen decoupling	.05
R311	V-9927-2	Resistor, 4700 ohms ½ w.	IF damping	.11
R312	RC20AE151K	Resistor, 150 ohms ½ w.	Cathode bias	.05
R313	RC20AE471M	Resistor, 470 ohms ½ w.	Screen decoupling	.05
R316	RC20AE123K	Resistor, 12,000 ohms ½ w.	Sync take-off	.05
R317	RC20AE332K	Resistor, 3300 ohms ½ w.	Video det. load	.05
R318	RC30AE683K	Resistor, 68,000 ohms 1 w.	Screen decoupling	.09
•R319	V-9877-4	Control, 1500 ohms (assy. consists of R208, R319, SW501)	Picture control	2.15•
R320	RC20AE223K	Resistor, 22,000 ohms ½ w.	Damping	.06
R322	RC40AE822K	Resistor, 8200 ohms 2 w.	Plate load	.20
R323	RC20AE224K	Resistor, 220,000 ohms ½ w.	Divider	.05

V-2218-2 CHASSIS PARTS (continued)

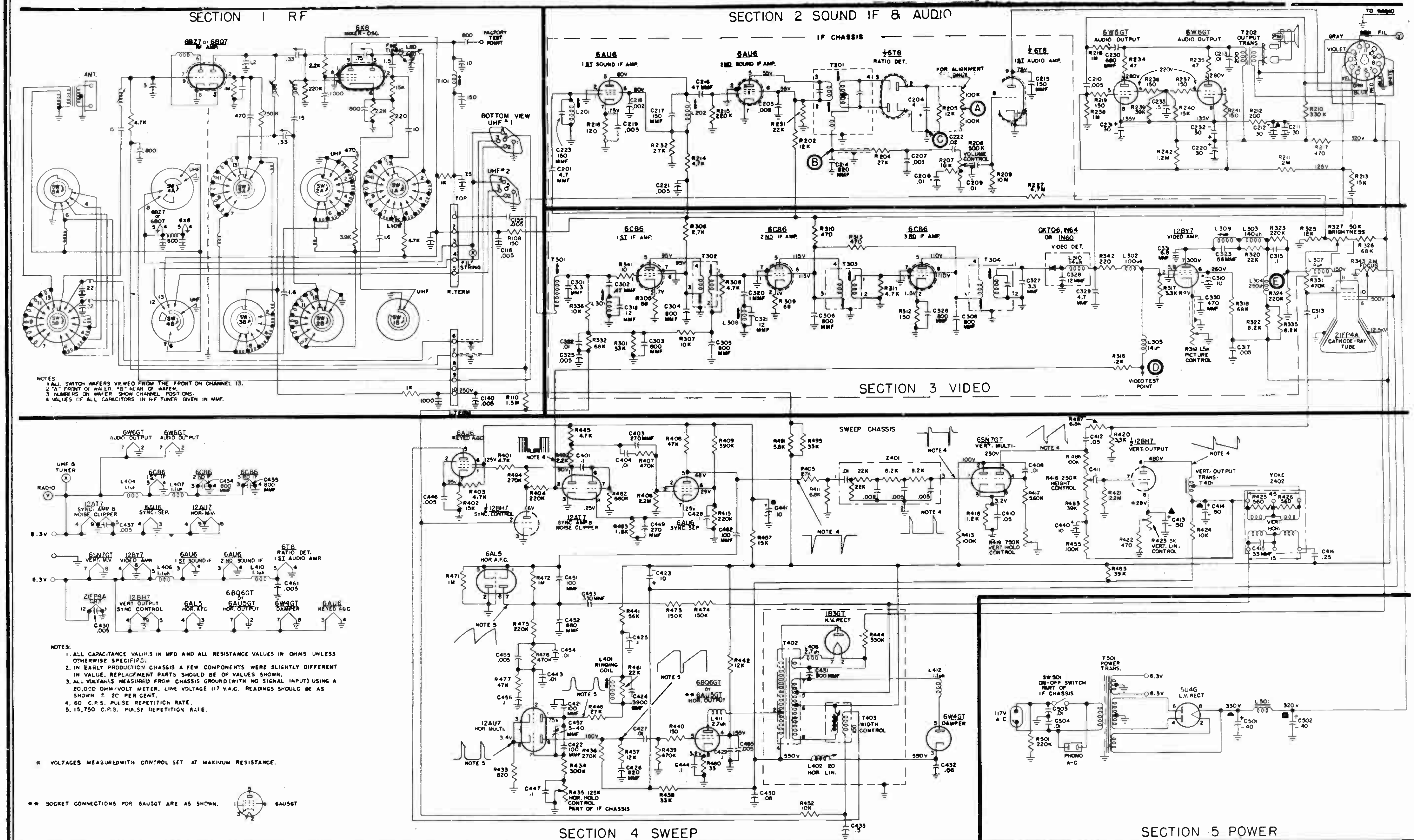
Ref. No.	Part No.	Description	Function	List Price Each
R324	RC20AE224K	Resistor, 220,000 ohms ½ w.	Divider	.05
R325	RC20AE123K	Resistor, 12,000 ohms ½ w.	Brightness bleeder	.05
R326	RC30AE683K	Resistor, 68,000 ohms 1 w.	Brightness divider	.09
R327	V-10914-1	Control, 50,000 ohms	Brightness	.80
R331	RC20AE474K	Resistor, 470,000 ohms ½ w.	Retrace line suppression	.05
R332	RC20AE683K	Resistor, 68,000 ohms ½ w.	AGC divider	.05
R335	RC40AE822K	Resistor, 8200 ohms 2 w.	Plate load	.20
R336	V-9927-10	Resistor, 10,000 ohms ½ w.	IF damping	.10
R341	RC20AE100K	Resistor, 10 ohms ½ w.	1st IF grid	.06
R342	RC20AE221M	Resistor, 220 ohms ½ w.	Video amp. grid	.05
R343	V-9894-2	Control, 2 megohms	Focus	.75
T301	V-9882-7	Transformer	IF input	.60
T302	V-9879	Transformer	1st IF	1.30
T303	V-9879	Transformer	2nd IF	$1.30
T304	V-9880	Transformer	3rd IF	1.40

SECTION 4 — SWEEP

Ref. No.	Part No.	Description	Function	List Price Each
C401	RCP10W4104M	Capacitor, .1 mfd 400 v.	Noise clipper coupling	.25
C403	RCM20B271K	Capacitor, 270 mmf	Sync sep. grid	.20
C404	RCP10W4103M	Capacitor, .01 mfd 400 v.	Vert. sync coupling	.24
C408	RCP10W4103K	Capacitor, .01 mfd 400 v.	Vert. MV coupling	.19
C410	RCP10W4503M	Capacitor, .05 mfd 400 v.	Cathode bypass	.24
C411	RCP10M6104M	Capacitor, .1 mfd 600 v.	Vert. coupling	.35
C412	RCP10W4503K	Capacitor, .05 mfd 400 v.	Pulse shaping net.	.25
•C413	V-10306-1	Capacitor, 150 mfd 50 v. (assy. consists of C414, C413 and C441	Cathode bypass	3.25•
•C414	V-10306-1	Capacitor, 30 mfd 400 v. (assy. consists of C414, C413 and C441)	Plate decoupling	3.25•
C415	V-9792-10330K	Capacitor, 33 mmf	Transient damping	.30
C416	RCP10W4254M	Capacitor, .25 mfd 400 v.	Hor. yoke return	.35
C421	RCM20B101K	Capacitor, 100 mmf	MV plate bypass	.22
C422	RCM20B101K	Capacitor, 100 mmf	MV coupling	.22
C423	V-10293-1	Capacitor, 10 mfd 450 v.	MV decoupling	1.25
C424	RCM30C392K	Capacitor, 3900 mmf	MV plate tank	1.17
C425	RCP10W4104M	Capacitor, .1 mfd 400 v.	MV plate decoupling	.25
C426	RCM20C821K	Capacitor, 820 mmf	Pulse shaping	.40
C427	RCP10M6103M	Capacitor, .01 mfd 600 v.	Coupling	.21
C428	RCP10W4104M	Capacitor, .1 mfd 400 v.	Screen bypass	.25
C429	RCP10M6104M	Capacitor, .1 mfd 600 v.	Screen bypass	.35
C430	RCP10M6603M	Capacitor, .06 mfd 600 v.	15,750 ripple filter	.25
C431	V-9901-3	Capacitor, 500 mmf	HV filter	1.70
C432	RCP10M6603M	Capacitor, .06 mfd 600 v.	Cathode bypass	.25
C433	RCP10W4504M	Capacitor, .5 mfd 400 v.	AGC filter	.55
C434	V-9863-1	Capacitor, 800 mmf	Heater bypass	.20
C435	V-9863-1	Capacitor, 800 mmf	Heater bypass	.20
C437	V-5596	Capacitor, .005 mfd	Heater bypass	.25
C438	V-5596	Capacitor, .005 mfd	Heater bypass	.25
•C440	V-10786-1	Capacitor, 10 mfd 450 v., elec. (assy. consists of C231, C310 and C440)	Decoupling	3.10•
•C441	V-10306-1	Capacitor, 10 mfd 450 v. (assy. consists of C441, C413 and C414)	Filter	3.25•
C443	RCP10W4103M	Capacitor, .01 mfd 400 v.	AFC delay	.20
C444	RCP10W4104M	Capacitor, .1 mfd 400 v.	Cathode bypass	.24
C446	V-5596	Capacitor, .005 mfd	Cathode bypass	.25
C447	RCP10W4104M	Capacitor, .1 mfd 400 v.	Control bypass	.24
C451	RCM20B101K	Capacitor, 100 mmf	AFC cathode	.22
C452	RCM20B681K	Capacitor, 680 mmf	AFC plate bypass	.25
C453	RCM20B331K	Capacitor, 330 mmf	AFC coupling	.25
C454	RCP10W4103M	Capacitor, .01 mfd 400 v.	MV grid	.20
C455	RCP10W4502M	Capacitor, .005 mfd 400 v.	Coupling	.17
C456	RCP10W4104M	Capacitor, .1 mfd 400 v.	MV grid	.24
C457	V-11228-1	Capacitor, 5-40 mmf	MV trimmer	.35
C461	V-5596	Capacitor, .005 mfd	Heater bypass	.25
C462	RCM20B101K	Capacitor, 100 mmf	AFC coupling	.22
C465	V-5596	Capacitor, .005 mfd	Screen bypass	.25
C469	RCM20B271K	Capacitor, 270 mmf	Cathode bypass	.20
L401	V-6764	Coil	Ringing	1.45
L402	V-9960	Reactor	Hor. linearity	1.25
L404	V-4886-2	Reactor, 1.1 microhenries	Heater isolation	.38
L406	V-4886-2	Reactor, 1.1 microhenries	Heater decoupling	.38
L407	V-4886-2	Reactor, 1.1 microhenries	Heater isolation	.38
L408	V-9099-5	Reactor, 2.7 microhenries	HV filament	.20
L410	V-4886-2	Reactor, 1.1 microhenries	Heater decoupling	.38
L411	V-9099-5	Reactor, 2.7 microhenries	Suppressor	.20
L412	V-4886-2	Reactor, 1.1 microhenries	Suppressor	.38
R401	RC20AE472K	Resistor, 4700 ohms ½ w.	Keyed AGC grid	.05
R402	RC40AE153K	Resistor, 15,000 ohms 2 w.	AGC cathode	.20
R403	RC30AE472K	Resistor, 4700 ohms 1 w.	AGC screen	.09
R404	RC20AE224K	Resistor, 220,000 ohms ½ w.	Positive bias limiting	.05
R405	RC20AE273K	Resistor, 27,000 ohms ½ w.	DC divider	.06
R406	RC20AE225K	Resistor, 2.2 megohms ½ w.	Grid return	.05
R407	RC20AE474K	Resistor, 470,000 ohms ½ w.	Coupling limiter	.05
R408	RC20AE473K	Resistor, 47,000 ohms ½ w.	Decoupling	.05
R409	RC20AE394K	Resistor, 390,000 ohms ½ w.	Sync sep. screen	.05
R411	RC20AE682K	Resistor, 6800 ohms ½ w.	Signal divider	.05
R413	RC30AE104K	Resistor, 100,000 ohms 1 w.	Decoupling	.10
R415	RC20AE224K	Resistor, 220,000 ohms ½ w.	Bleeder	.05
R416	V-9813-4	Control, 250,000 ohms	Height	.75
R417	RC20AE564K	Resistor, 560,000 ohms ½ w.	Grid return	.05
R418	RC20AE122K	Resistor, 1200 ohms ½ w.	Cathode bias	.05
R419	V-9894-3	Control, 750,000 ohms	Vertical hold	.75
R420	RC20AE332K	Resistor, 3300 ohms ½ w.	Pulse shape net.	.05
R421	RC20AE225K	Resistor, 2.2 megohms ½ w.	Grid return	.05
R422	RC20AE471K	Resistor, 470 ohms ½ w.	Cathode bias	.06
R423	V-6463	Control, 5000 ohms	Vert. linearity	.76
R424	V-11328-2	Resistor, 10,000 ohms 5 w.	Vert. decoupling	.90
R425	RC20AE561K	Resistor, 560 ohms ½ w.	Transient damping	.05
R426	RC20AE561K	Resistor, 560 ohms ½ w.	Transient damping	.05
R433	RC20AE821K	Resistor, 820 ohms ½ w.	Cathode bias	.05
R434	RC20AE304J	Resistor, 300,000 ohms ½ w.	Grid return	.15
R435	V-10915-1	Control, 125,000 ohms	Horiz. hold	.80
R436	RC20AE274K	Resistor, 270,000 ohms ½ w.	MV plate load	.06
R437	RC20AE123K	Resistor, 12,000 ohms ½ w.	Pulse shaping net.	.05
R438	RC20AE333K	Resistor, 33,000 ohms ½ w.	Plate decoupling	.05
R439	RC20AE474K	Resistor, 470,000 ohms ½ w.	Grid return	.05
R440	RC20AE151K	Resistor, 150 ohms ½ w.	Suppressor	.06
R441	RC30AE563K	Resistor, 56,000 ohms 1 w.	Hor. MV decoupling	.10
R442	V-11328-1	Resistor, 12,000 ohms 10 w.	Screen decoupling	1.15
R444	V-9927-7	Resistor, 330,000 ohms 1 w.	HV filter	.10
R445	RC20AE472K	Resistor, 4700 ohms ½ w.	Decoupling	.05
R446	RC20AE273K	Resistor, 27,000 ohms ½ w.	Plate load	.06
R452	RC20AE103K	Resistor, 10,000 ohms ½ w.	AGC filter	.05
R455	RC20AE104K	Resistor, 100,000 ohms ½ w.	Decoupling	.05
R457	V-11328-3	Resistor, 15,000 ohms 5 w.	AGC decoupling	.95
R460	RC30AE330K	Resistor, 33 ohms 1 w.	Cathode bias	.11
R461	RC20AE223K	Resistor, 22,000 ohms ½ w.	Coil shunt	.06
R471	RC20AE105K	Resistor, 1 megohm ½ w.	AFC bleeder	.05
R472	RC20AE105K	Resistor, 1 megohm ½ w.	AFC cathode	.05
R473	RC30AE154K	Resistor, 150,000 ohms 1 w.	Error take-off	.10
R474	RC30AE154K	Resistor, 150,000 ohms 1 w.	Limiting	.10
R475	RC20AE224K	Resistor, 220,000 ohms ½ w.	Plate decoupling	.05
R476	RC20AE474K	Resistor, 470,000 ohms ½ w.	AFC delay	.05
R477	RC20AE473K	Resistor, 47,000 ohms ½ w.	Plate load	.05
R482	RC20AE684K	Resistor, 680,000 ohms ½ w.	Load	.06
R483	RC20AE393K	Resistor, 39,000 ohms ½ w.	Decoupling	.05
R485	RC40AE393K	Resistor, 39,000 ohms 2 w.	Bleeder	.20
R486	RC20AE104K	Resistor, 100,000 ohms ½ w.	Plate load	.05
R487	RC20AE682K	Resistor, 6800 ohms ½ w.	Pulse shape net.	.05
R491	RC40AE562K	Resistor, 5600 ohms 2 w.	Tuner dropping	.25
R492	RC20AE222K	Resistor, 2200 ohms ½ w.	Signal divider	.05
R493	RC20AE182K	Resistor, 1800 ohms ½ w.	Cathode bypass	.05
R494	RC20AE274K	Resistor, 270,000 ohms ½ w.	Divider	.06
R495	RC20AE333M	Resistor, 33,000 ohms ½ w.	Tuner dropping	.05
T401	V-10909-1	Transformer	Vertical output	3.90
T402	V-10214-1	Transformer	Hor. output and HV	13.15
T403	V-9902	Control	Width	1.55
Z401	V-11192-1	Filter	Integrating	1.30
Z402	V-10911-3	Yoke Assembly (contains V-10538-6 deflection yoke)	Deflection	12.50
Z402	V-10911-4	Yoke Assembly (contains V-10538-7 deflection yoke)	Deflection	12.50

SECTION 5 — POWER

Ref. No.	Part No.	Description	Function	List Price Each
•C501	V-9891	Capacitor, 40 mfd 450 v. (assy consists of C211, C212, C501 and C502)	Filter input	4.35•
•C502	V-9891	Capacitor, 40 mfd 450 v. (assy consists of C211, C212, C501 and C502)	Filter input	4.35•
C503	V-5040-15	Capacitor, .01 mfd 600 v.	Line filter	.35
C504	V-5040-15	Capacitor, .01 mfd 600 v.	Line filter	.35
L501	V-6471-2	Reactor	LV filter	2.35
R501	RC30AE224M	Resistor, 220,000 ohms 1 w.	Protection	.10
•SW501	V-9877-4	Switch (assy consists of R208, R319, SW501)	Off-on	2.15•
T501	V-9958-2	Transformer	Power	19.50



CHASSIS NO. V-2218-2

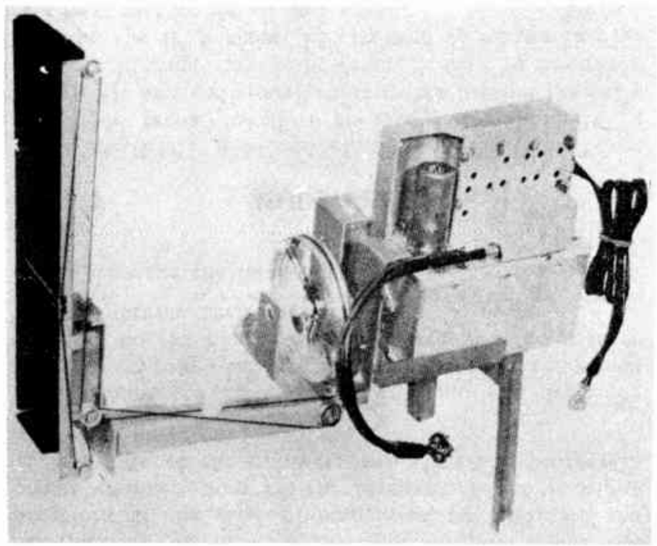
— SCHEMATIC DIAGRAM

IMPORTANT — Since many of the components are very critical, exact duplicates must be used for replacement purposes. However, any substitute supplied by Westinghouse will assure performance equal to or better than the list part.

MODEL H-803

ALL-CHANNEL UHF TELEVISION TUNER

INSTALLATION AND SERVICE NOTES



GENERAL DESCRIPTION

Model H-803 All-Channel UHF Television Tuner is designed for use with Westinghouse television receivers that contain specific provisions for its use. Receivers that contain the necessary provisions have two UHF positions on the channel selector and two UHF sockets mounted on the rear of the tuner bracket. When the UHF tuner is correctly installed in such a receiver, reception of all the UHF television channels (14 through 83) is provided in addition to the VHF channels (2 through 13).

The UHF tuner contains an oscillator and a mixer circuit and can be tuned over the entire UHF TV spectrum. In the tuner, the UHF signal is converted to the intermediate frequency of the television receiver (center IF is 44 mc.), and this IF output is fed into the VHF tuner in the receiver. When the channel selector on the receiver is set to the UHF positions, the VHF oscillator in the receiver is disabled and the RF amplifier and mixer circuits serve as IF amplifier stages at 44 mc. Thus, the output of the UHF tuner is amplified in the VHF tuner and fed into the IF strip in the receiver.

IDENTIFICATION

In production, several different UHF tuners are used. They are designated V-11390-1, V-11390-2, V-11390-3, and V-11613-1, and the identifying numbers are stamped on each tuner. Figures 1, 2, 3, and 4 indicate the electrical and mechanical variations between tuners.

Model H-803 tuner assemblies are divided into six categories depending on the type of tuner employed and the type of receiver with which the assembly can be used. On tuner assemblies packed for field installation, the category is identified by a number following the basic model number (H-803) marked on the outside of the carton. The coding is as follows:

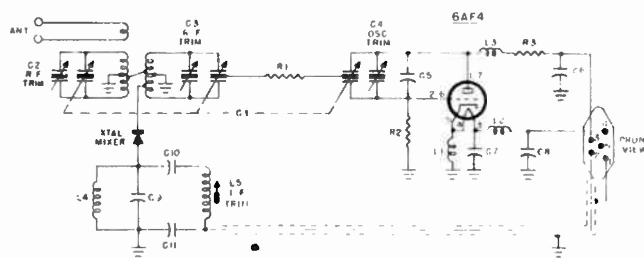


FIG. 1 — V-11390-1 TUNER

Marking on Outside of Carton	*Tuner Type*	*Type of Receiver With Which the Assembly Can Be Used*
H-803-1	V-11390-1, -2, or -3	21" Models
H-803-2	V-11390-1, -2, or -3	17" Models Except Those With Plastic Cabinets
H-803-3	V-11390-1, -2, or -3	17" Models With Plastic Cabinets
H-803-4	V-11613-1	21" Models
H-803-5	V-11613-1	17" Models Except Those With Plastic Cabinets
H-803-6	V-11613-1	17" Models With Plastic Cabinets

V-11390-1, -2 AND -3 CIRCUIT DESCRIPTIONS

As indicated in Figs. 1 and 2, the incoming UHF signal is coupled into the tuner through a 300 ohm balanced input circuit which is double tuned to provide the desired RF bandpass. Operating 45.75 mc. higher than the video carrier frequency of the received signal, the oscillator tuning is ganged with that of the bandpass circuit. A portion of the oscillator voltage is coupled into the bandpass circuit where it mixes with the incoming UHF signal. The difference frequency (center IF is 44 mc.) is extracted in the mixer circuit and fed through a shielded cable to the UHF socket on

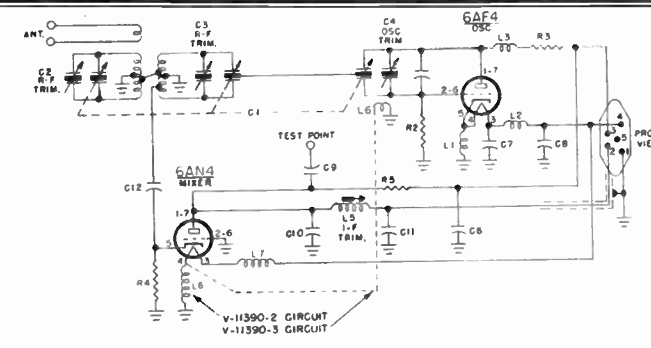


FIG. 2 — V-11390-2 AND V-11390-3 TUNERS

the television receiver. In the V-11390-1 tuner, a germanium crystal serves as the mixer, while the V-11390-2 and V-11390-3 tuners use a 6AN4 tube in a grounded-grid mixer circuit. Otherwise, the three tuners are basically alike.

V-11613-1 CIRCUIT DESCRIPTION

The bandpass circuit in the V-11613-1 tuner consists of two tuned sections as indicated on Fig. 3. Each section is a capacitor-tuned quarter-wave coaxial line, and the sections are over-coupled through the coupling loops, L3 and L4. Coupling of the UHF signal into the the circuit is effected through the antenna input coupling loops, L1 and L2, and the signal is fed from the bandpass circuit to the mixer through L6.

Also fed to the mixer (through L7) is a locally generated signal which is 45.75 mc. higher than the video carrier frequency of the received signal. This signal is not the fundamental output frequency of the oscillator, however. Instead, the oscillator operates at one-half frequency and its second harmonic is utilized. The second harmonic content of the oscillator output is increased by the action of the harmonic generating crystal and coupled into the oscillator doubler section through L8. Consisting of a quarter-wave coaxial line which is capacitor-tuned 45.75 mc. above the video carrier of the received signal, the oscillator doubler section selects the second harmonic of the oscillator and discriminates against the fundamental.

In the crystal mixer circuit, the difference frequency (center IF is 44 mc.) is derived from the UHF signal and the locally generated signal. A shielded cable carries the IF signal to the UHF socket on the television receiver.

INSTALLATION

To install a Model H-803 tuner, proceed as follows:

1. Remove the back cover, and remove the chassis from the cabinet.

2. Remove the wheel from the back end of the UHF drive shaft, and install the 13/16" pulley on the drive shaft.

3. Mount the tuner support bracket to the tuner and mounting plate assembly as shown in Fig. 4. The bracket is shock-mounted to the assembly by placing rubber

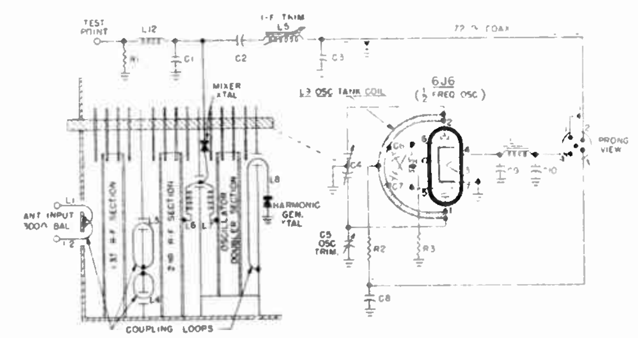


FIG. 3 — V-11613-1 TUNER

grommets in the two large mounting holes, inserting metal spacers inside the grommets, and using ½" self-tapping screws.

4. On models that have the on-off-volume and picture control mounted above the channel selector, loosen the 3/8" palnut which holds the control to the chassis.

5. Make certain the dial background bracket is fitted into the correct slots in the mounting plate assembly. As indicated on Fig. 4, the "A" slots are used for all 17" receivers and the "B" slots are used for all 21" receivers.

6. Place the tuner assembly as shown in Fig. 4. The slots in the mounting plate assembly must be placed over the tongues at the top of the UHF bracket and pressed down until firmly locked in place.

7. On models that have the on-off-volume and picture control mounted above the channel selector, the slot in the front lip of the mounting plate assembly must be positioned down over the shank of the control, between the palnut and the vertical section of chassis, and then tighten the palnut.

8. On models that have the on-off-volume and picture controls located other than above the channel selector, use a 6-32 screw, 6-32 nut and #6 lockwasher to secure the front lip of the mounting plate assembly to the vertical section of chassis. Insert the screw through the slot located near the center of the mounting plate lip and through the similar slot located near the center of the chassis vertical section, and apply the lockwasher and nut.

9. Insert a ¼" self-tapping screw into the hole located to the right of the palnut mentioned in step 7 or the screw mentioned in step 8, and tighten the screw.

10. Insert a ¼" self-tapping screw into the hole located in front of the mounting plate assembly slots which engage the tongues of the UHF bracket, and tighten the screw.

11. With the large pulley rotated to its maximum counterclockwise position, install the 19" drive string and spring as shown in Fig. 5.

12. Insert the UHF plug into the UHF socket farthest from the side of the chassis as indicated in Fig. 4. This socket corresponds to the UHF position next to channel 2 on the channel selector. *The socket nearer the side of the chassis is left unoccupied.*

13. With the large pulley rotated fully counterclockwise, see that the dial pointer is positioned as in-

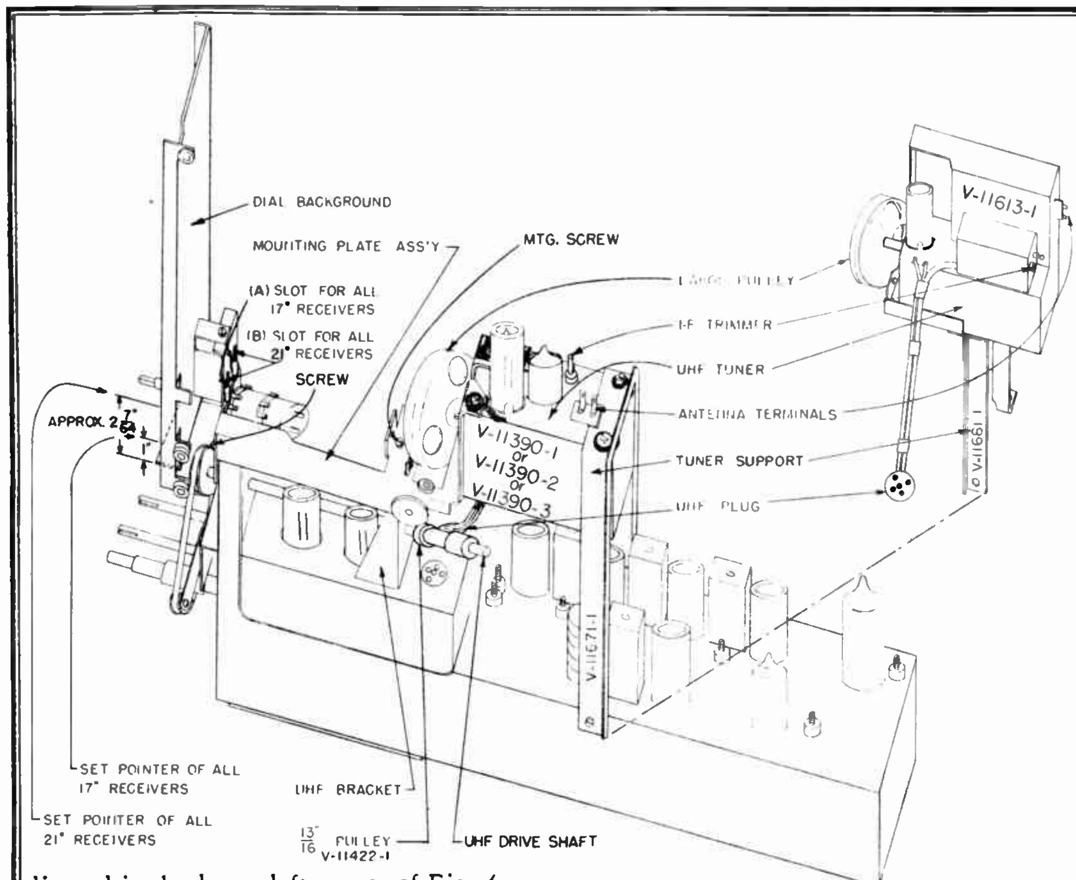


FIG. 4 — INSTALLATION DETAILS

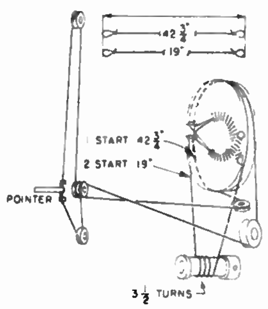


FIG. 5 — DIAL STRINGING

dicated in the lower left corner of Fig. 4.

14. Remove the plastic plate from the picture mask inside the cabinet by removing the clips which hold it in place.

15. Install the calibrated UHF dial in place of the plastic plate which was removed in step 14, and replace the clips.

16. Replace the chassis in the cabinet.

17. Connect a suitable antenna to the UHF antenna lead (SEE ANTENNA INFORMATION), and check the operation. If the dial pointer does not indicate the correct channel, turn off the receiver, reach in along the left side of the cabinet, and slide the pointer to the correct position.

18. Route the ribbon type antenna lead from the UHF tuner through the opening above the UHF antenna terminals on the back cover, and attached the lead to the UHF antenna terminals.

19. Replace the back cover.

ADJUSTMENTS

Model H-803 All-Channel UHF Television Tuner is shipped pre-adjusted to receive UHF channels 14 through 83, and additional adjustments are not normally required. In some cases, however, it may be desirable to adjust the IF trimmer, L5, located as shown in Fig. 4 for best picture detail and sound.

SERVICE

A high degree of precision is used in the manufacture of UHF television tuners. Critical factors include lead lengths, lead and component dress, and component sizes. In servicing UHF tuners, problems arise which are not encountered in ordinary service work. Therefore, troubleshooting inside the tuner is not recommended. Defective tuners should be returned through a Westinghouse distributor.

REPLACING V-11390-1, V-11390-2, OR V-11390-3 TUNER USED WITH MODELS H-803-1, H-803-2, AND H-803-3

1. Remove the two drive strings and springs from the large pulley.

2. Remove the tuner support.

3. Remove the UHF plug from its socket.

4. Unsolder the ground strap from the tuner.

5. Release the tuner from the mounting plate assembly by removing the two self-tapping screws used to shock-mount the tuner.

6. Loosen the two small set screws in the hub of the large pulley, and remove the pulley.

7. With the tuning shaft of the replacement tuner rotated completely counterclockwise, place the large pulley on the shaft so that the opening in the rim of the pulley is as indicated in Fig. 5. Tighten the set screws in the hub of the pulley.

8. Place the tuner in position, and install the shock-mount screws.

9. Solder the ground strap to the tuner, and install the tuner support.

10. String the two dial drive cords, and see that the dial pointer is positioned as shown in Fig. 4 with the large pulley rotated completely counterclockwise.

11. Insert the UHF plug into the UHF socket farthest from the side of the chassis.

12. Check the dial calibration using an air signal. If the dial pointer does not indicate the correct channel, turn off the receiver, reach in along the left side of the cabinet, and slide the pointer to the correct position.

REPLACING V-11613-1 TUNER USED WITH MODELS H-803-4, H-803-5 AND H-803-6

1. Remove the UHF plug from its socket.

2. Remove the two drive strings and springs from the large pulley.

3. Remove the self-tapping screw which secures the front lip of the mounting plate to the vertical section of chassis.

4. Loosen the off-on-volume and picture control planut or remove the 6-32 screw (whichever is used to secure the front lip of the mounting plate).

5. Remove the self-tapping screw which secures the the mounting plate to the UHF bracket.

6. Remove the two self-tapping screws that secure the tuner support to the receiver chassis.

7. Release the mounting plate assembly from the UHF bracket by pulling straight up.

8. Remove the tuner by removing the three screws from the side of the tuner.

9. Mount the replacement tuner by replacing the three screws in the side.

10. Mount the assembly to the chassis by replacing the items removed in the preceding steps.

11. Check the dial calibration using an air signal. If the dial pointer does not indicate the correct channel, turn off the receiver, reach in along the left side of the cabinet, and slide the pointer to the correct position.

ANTENNA INFORMATION

Antenna requirements for satisfactory UHF television reception are determined by the signal conditions in the particular locality. Some of the possibilities are as follows:

1. In areas where signals are strong and reflections are not troublesome, satisfactory reception may be obtained by using the existing VHF antenna (built-in or external) for both VHF and UHF. This can be done by connecting two jumper wires from the UHF antenna terminals to the STD antenna terminals so as to connect the two sets of terminals in parallel. If this method is used, make certain that it does not adversely affect reception on the standard VHF channels.

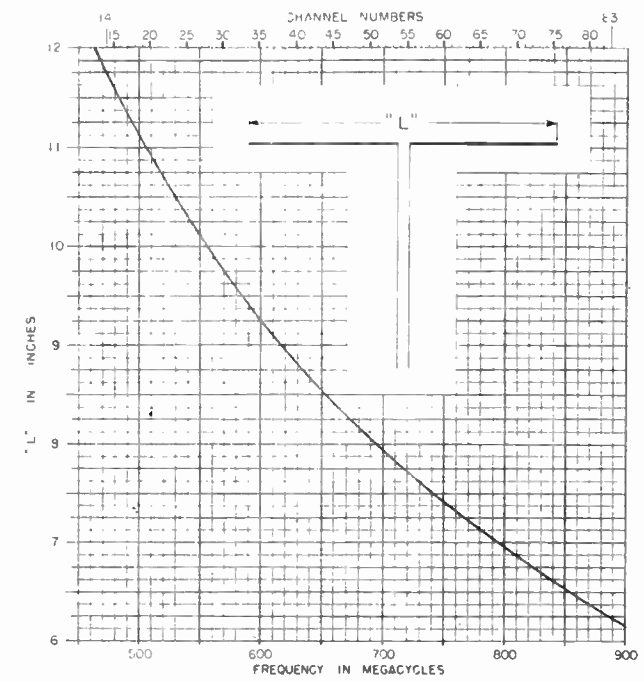


FIG. 6 — UHF DIPOLE ANTENNA LENGTH

If an external antenna is used for VHF reception, satisfactory UHF reception may be obtained by connecting the built-in VHF antenna to the UHF antenna terminals.

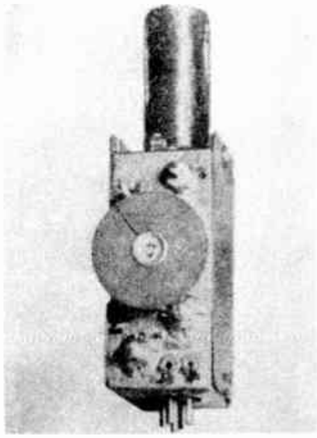
2. A simple, resonant dipole antenna may provide satisfactory reception in medium-signal areas. The chart, Fig. 6, gives the total length of a half-wave element for any frequency in the UHF television spectrum.

3. Where signals are weak or reflections are troublesome, a high-gain, directive antenna system should be used. Typical of this type of antenna are the corner reflector, the rhombic, and the Yagi.

PARTS LIST FOR MODEL H-803

Part No.	*Description*	*List Price Each*
✛ V-11431-1	Background, dial	$ .15
✛ V-11424-1	Cable Assembly (V-11390 tuners)	.90
V-3219S	Cord, dial drive (100' spool)	1.40
✛ V-11430-1	Dial, UHF 21" (H-803-1, H-803-4)	1.00
✛ V-11580-1	Dial, UHF 17" (H-803-2, H-803-5)	1.10
✛ V-11581-1	Dial, UHF 17" Plastic (H-803-3, H-803-6)	1.75
✛ V-11426-2	Pointer	.25
✛ V-11428-1	Pulley Assembly, large (V-11390 tuners)	1.15
✛ V-11422-1	Pulley, UHF drive string	.45
V-10076-1	Spring, dial drive	.03
✛ V-11390-3	Tuner Assembly (H-803-1, -2, -3)	•
✛ V-11613-1	Tuner Assembly (H-803-4, -5, -6)	•

✛ *New part number listed for the first time in Westinghouse radio or television service information.*
• *Price furnished on request.*
NOTE: All prices are subject to change without notice.



MODEL H-802
UHF RECEPTOR
SERVICE NOTES

DESCRIPTION

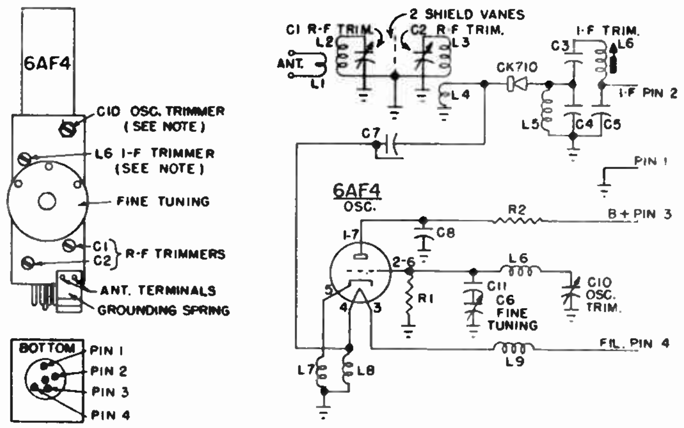
Model H-802 UHF Receptors are designed for use with Westinghouse television receivers that contain specific provisions for their use. Receivers that contain the necessary provisions will accommodate two UHF Receptors, and each receptor used will provide reception on one UHF television channel. If only one UHF station is active in a particular locality, only one UHF Receptor is required. If two UHF stations transmit in the locality, they can both be received by installing two UHF Receptors. The UHF reception provided by these receptors is in addition to the standard VHF reception provided by the VHF tuner in the television receiver.

Each receptor contains a local oscillator which employs a 6AF4 tube and operates 45.75 mc. *higher* than the video carrier frequency of the received UHF signal. The oscillator frequency is initially adjusted by the oscillator trimmer, C10, and fine tuning is provided by the fine tuning capacitor which is mechanically coupled to the fine tuning control on the television receiver. Suitable band-pass circuits tuned to the frequency of the received signal by the R-F trimmers (C1 and C2) serve as the antenna input circuit in each receptor. The incoming UHF signal mixes with the local oscillator signal in a crystal mixer circuit, and the resultant I-F output (center frequency is 44 mc.) is fed to the R-F amplifier in the television receiver. When the channel selector on the television receiver is set to either of the UHF positions, the R-F amplifier and mixer circuits in the television receiver serve as I-F amplifiers at 44 mc., and the VHF oscillator is disabled. Thus, the 44 mc. output of the UHF Receptor is amplified in these circuits and fed into the I-F strip in the receiver.

IDENTIFICATION

Model H-802 Receptors are shipped pre-adjusted to receive a particular UHF channel. The channel to which the receptor is tuned is marked on the label which is attached to the unit.

In addition, the receptors are divided into categories depending on the frequency range covered by each. The identifying markings which are stamped on the receptors and the corresponding frequency coverages are as follows:



NOTE: PHYSICAL LOCATIONS OF I-F AND OSC. TRIMMERS ARE INTERCHANGED IN SOME RECEPTORS MARKED V-11213.

FIG. 1 — MODEL H-802 UHF RECEPTOR

Receptors Marked —	*Can Be Tuned To —*
V-11900-1	Channels 14 through 29
V-11900-2	Channels 28 through 43
V-11900-3	Channels 43 through 58
V-11900-4	Channels 58 through 73
V-11900-5	Channels 73 through 83
V-11213 (early production)	Special ranges

INSTALLATION

To install a UHF Receptor:

1. Remove the rear of the television receiver.

2. Plug the receptor into either of the two UHF sockets located on the rear of the VHF tuner mounting plate in the television receiver. If the receptor is plugged into the socket nearer the side of the chassis, the UHF position nearer channel 13 on the channel selector is activated. If the receptor is plugged into the socket nearer the center of the chassis, the UHF position next to channel 2 on the channel selector is activated. The receptor should be seated firmly in the socket with the slots in the top of the receptor engaging the top of the VHF tuner bracket. If the center tongue of the tuner bracket is bent too far toward the back of the cabinet, it will catch the top of the receptor and prevent proper insertion. In this event, bend the center tongue toward the front of the cabinet just enough to allow insertion of the receptor. The sharp bend in the center tongue must bear on the top of the receptor when the receptor is fully seated. The fine tuning wheel on the receptor must engage the drive wheel located on the shaft between the two sockets. If the two wheels are not correctly aligned, undue pressure will be required to mesh the wheels, and the drive torque will be excessive. In this event, loosen the set screw in the metal drive wheel and slide the wheel to the correct position on the shaft.

3. Connect the ribbon-type antenna lead from the receptor to the UHF antenna terminals on the back cover of the receiver. To prevent impaired reception which may result if the antenna lead runs close to the receiver chassis, the lead should be passed through the same clip that supports the VHF antenna lead, but do not allow the two antenna leads to run close together for any appreciable distance.

4. Replace the rear cover of the television receiver.

5. Make appropriate antenna arrangements (see ANTENNA INFORMATION), and check the operation.

ADJUSTMENTS

It is desirable to check for best adjustment each time a receptor is installed. This is accomplished as follows:

1. Rotate the fine tuning wheel on the receptor to its center frequency position. The fine tuning capacitor is centered when the middle hole in the rim of the wheel is straight up from the center of the wheel.

2. Rotate the channel selector on the receiver to the appropriate UHF position (see step 2 under INSTALLATION).

3. Rotate the oscillator trimmer (C10) to the position that provides best picture detail. *NOTE: Since the units are pre-adjusted for a particular frequency, only a slight re-adjustment at most should be needed to bring in the station. If the station is not received, make certain the antenna facilities are adequate before moving the oscillator trimmer far from its original setting.*

4. Rotate the R-F trimmers (C1 and C2) to the positions that provide best picture detail. *NOTE: If the R-F trimmers are rotated too far counterclockwise, they will be detached from the unit, and the procedure given under SERVICE must be followed to avoid damage when replacing the screws.*

5. Rotate the I-F trimmer (L6) for best picture detail. This trimmer has a broad tuning characteristic and is effective mostly in weak signal areas.

SERVICE

Troubleshooting inside the UHF Receptor is not recommended.

There are critical adjustments inside. One critical adjustment consists of two shield vanes located between the R-F coils (L2 and L3) which determine the coupling between the coils. Since special equipment and techniques are required to make the adjustments, care must be exercised to avoid altering the original factory placement of wires and components.

The R-F trimmers (C1 and C2) will detach from the unit if they are rotated too far counterclockwise. If this occurs, the following procedure should be used to avoid damaging the ceramic part of the trimmer when replacing the screw:

1. With the screw removed from the unit and the metal locking device placed on the screw, rotate the locking device until it is near the head of the screw.

2. Insert the screw in place and rotate it clockwise several full turns.

3. While keeping the screw from turning, rotate the locking device clockwise until it is moderately tight against the outside of the receptor.

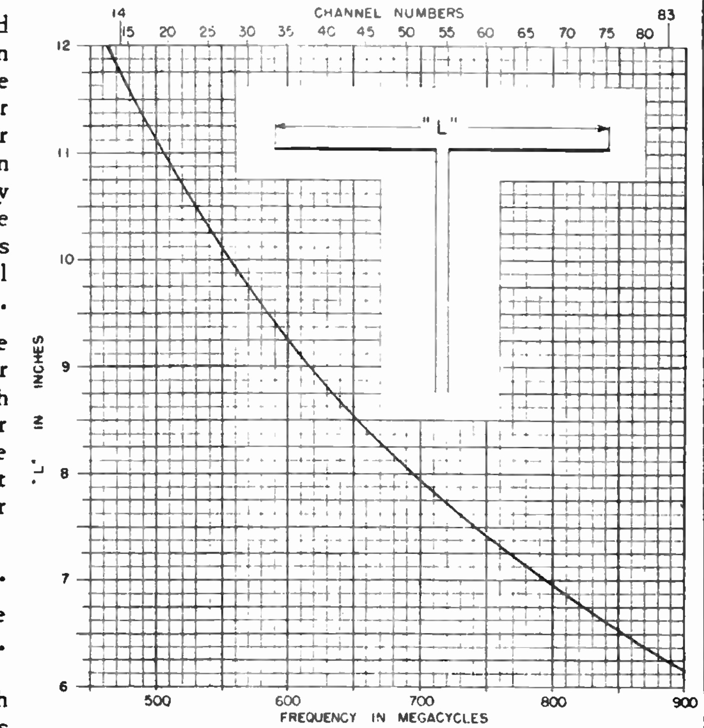


FIG. 2 — UHF DIPOLE ANTENNA LENGTH

ANTENNA INFORMATION

Antenna requirements for satisfactory UHF television reception are determined by the signal conditions in the particular locality. Some of the possibilities are as follows:

1. In areas where signals are strong and reflections are not troublesome, satisfactory reception may be obtained by using the existing VHF antenna (built-in or external) for both VHF and UHF. This can be done by connecting two jumper wires from the UHF antenna terminals to the STD antenna terminals so as to connect the two sets of terminals in parallel. If this method is used, make certain that it does not adversely affect reception on the standard VHF channels.

If an external antenna is used for VHF reception, satisfactory UHF reception may be obtained by connecting the built-in VHF antenna to the UHF antenna terminals.

2. If the above methods are not satisfactory, a simple, resonant dipole antenna may provide satisfactory reception in medium-signal areas. The chart, Fig. 2, gives the total length of a dipole element for any frequency in the UHF television spectrum.

3. Where signals are weak or reflections are troublesome, a high gain, directive antenna system should be used. Typical of this type of antenna are the corner reflector, the rhombic, and the Yagi.

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MODEL	TYPE	SCREEN	TV CHASSIS	RADIO CHASSIS
L1812E or R	Table	17" Rectangular	19L26	None
L1820E or R	Table	17" Rectangular	19L26	None
L1846E or R	Console	17" Rectangular	19L25	None
L2229E or R	Table	21" Rectangular	19L28	None
L2235E or R	Table	21" Rectangular	19L28	None
L2236E or R	Table	21" Rectangular	19L27	None
L2258E or R	Console	21" Rectangular	19L27	None
L2259E or R	Console	21" Rectangular	21L21	None
L2260R	Console	21" Rectangular	21L21	None
L2261E or H	Console	21" Rectangular	21L21	None
L2262C	Console	21" Rectangular	19L27	None
L2262R	Console	21" Rectangular	19L27	None
L2266R	Console	21" Rectangular	21L21	None
L2267E or H	Console	21" Rectangular	21L21	None
L2270	Console	21" Rectangular	21L21	None
L2281 or E	Combination	21" Rectangular	19L27	4L03
L2281R	Combination	21" Rectangular	19L27	4L03
L2285R	Combination	21" Rectangular	19L27	8L20
L2287R	Combination	21" Rectangular	21L21	10L20
L2291E	Combination	21" Rectangular	21L21	10L20
L2571R	Console	24" Rectangular	22L20	None
L2572R	Console	24" Rectangular	22L20	None
L2573E	Console	24" Rectangular	22L20	None
L2574R	Console	24" Rectangular	22L20	None
L2575E	Console	24" Rectangular	22L20	None
L2592R	Combination	24" Rectangular	22L20	10L20
L2593H	Combination	24" Rectangular	22L20	10L20
L2876E	Console	27" Rectangular	22L20	None
L2876R	Console	27" Rectangular	22L20	None
L2878R	Console	27" Rectangular	22L20	None
L2879E	Console	27" Rectangular	22L20	None
L2894HU	Combination	27" Rectangular	22L20	10L20

SUFFIX "U" FOLLOWING THE MODEL NUMBER INDICATES A RECEIVER EQUIPPED WITH THE ZENITH CONTINUOUS TUNER

ANTENNA IMPEDANCE	POWER SUPPLY	FINISH
300 Ohms	110 Volts - 60 Cycles AC	E - Blonde
TV AUDIO OUTPUT	19L Series 185 Watts	R - Mahogany
Undistorted 2.5 Watts	21L Series 225 Watts	H - Cherry
Maximum 4.4 Watts	22L Series 255 Watts	C - Copper Tone Mahog.

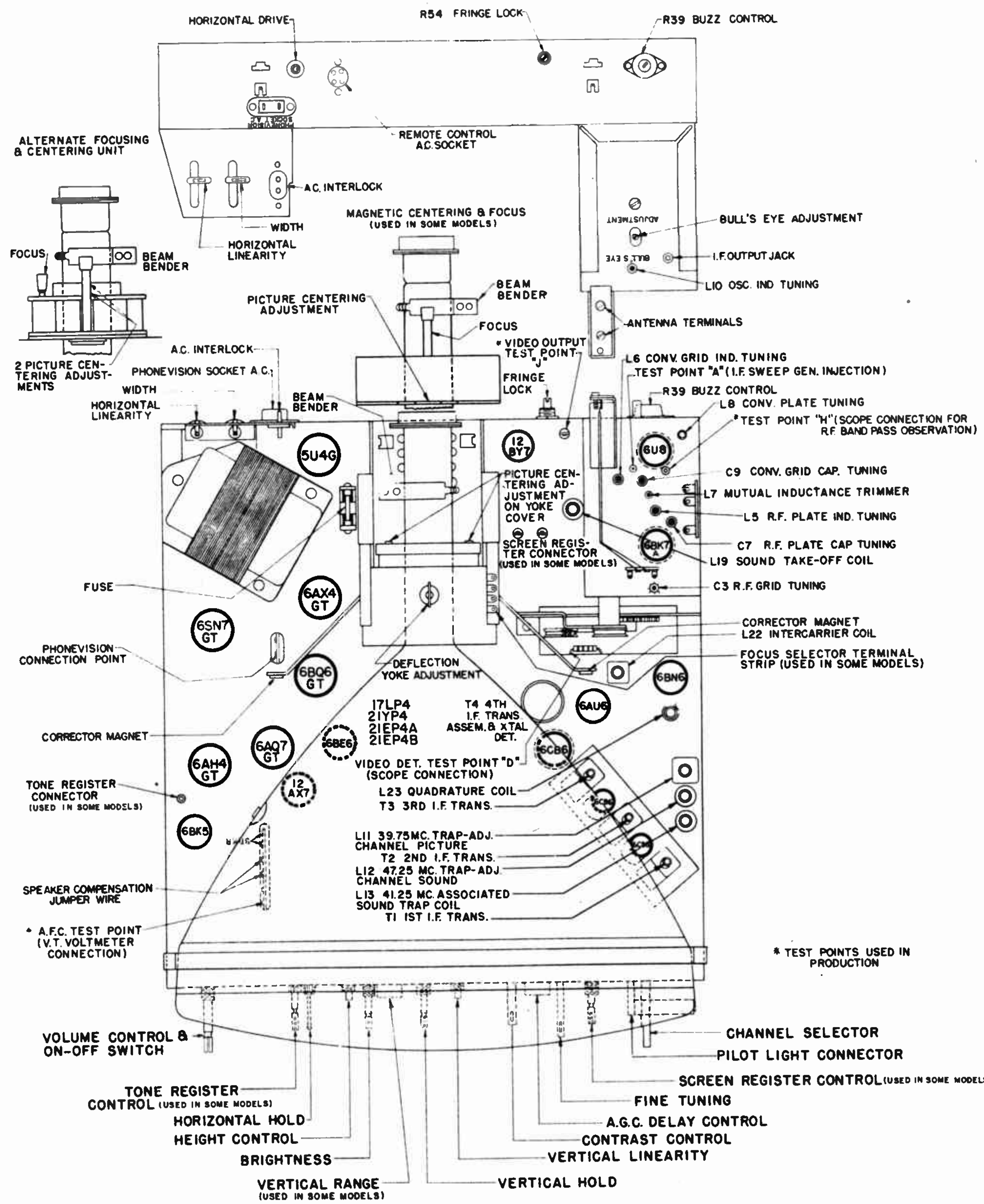


Fig. 1 Representative Chassis Layout "L" Models.

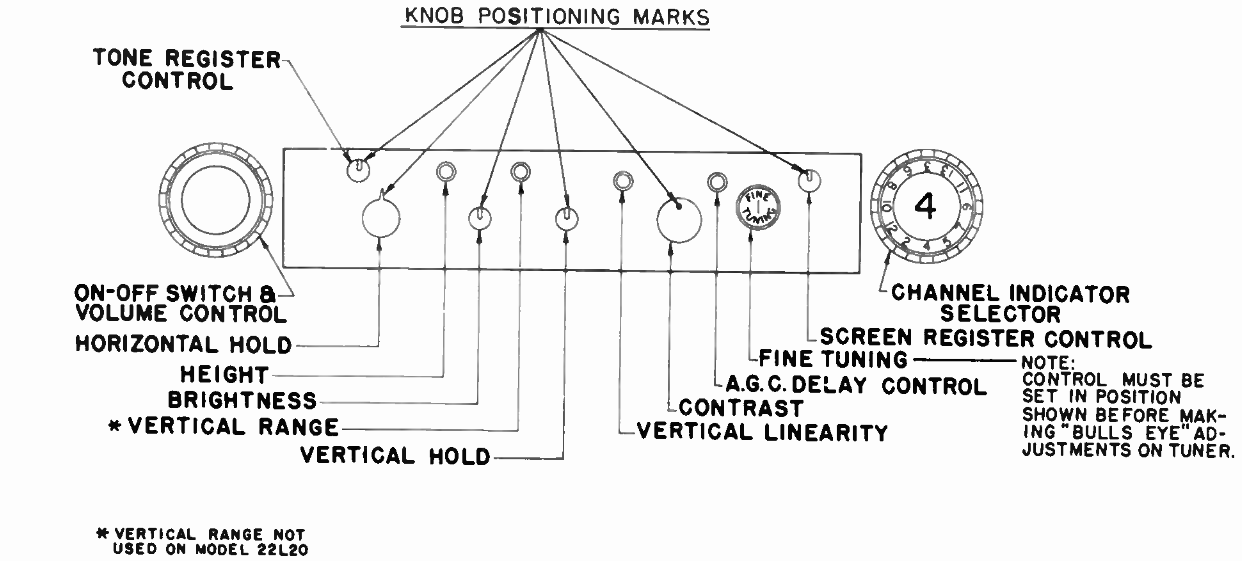


Fig. 2 Control Panel Layout 19L25, 19L27 & 22L20 Chassis.

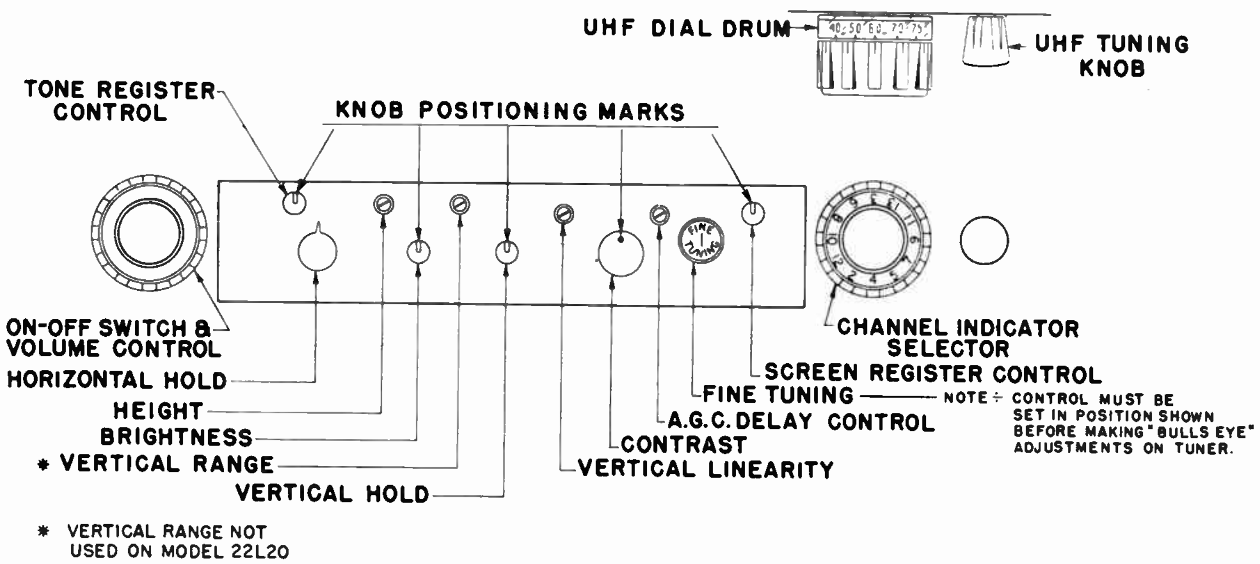


Fig. 3 Control Panel Layout 19L25U, 19L27U & 22L20U Chassis.

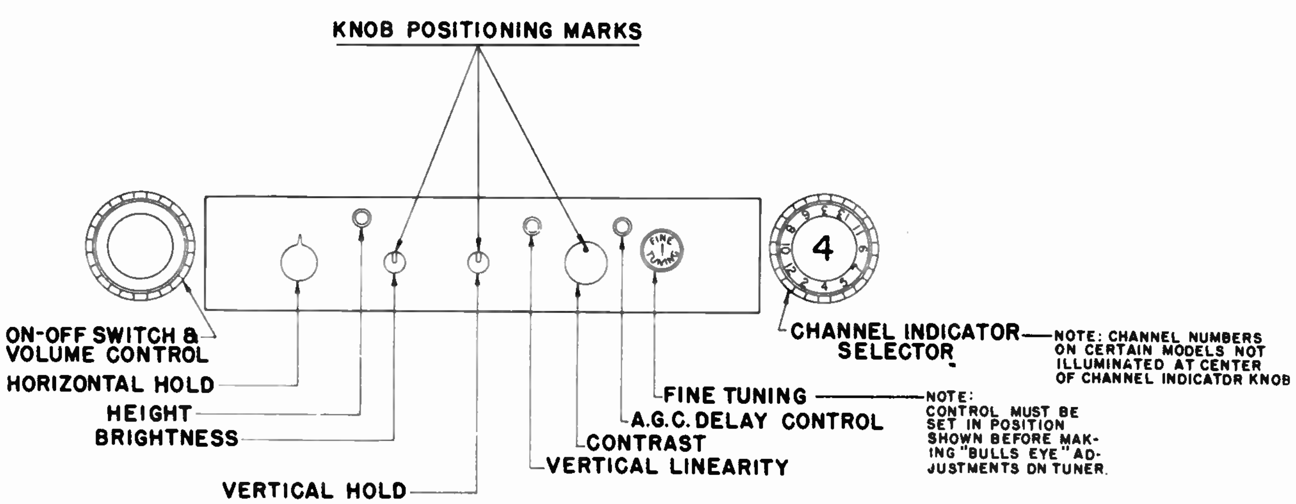


Fig. 4 Control Panel Layout 19L26 & 19L28 Chassis.

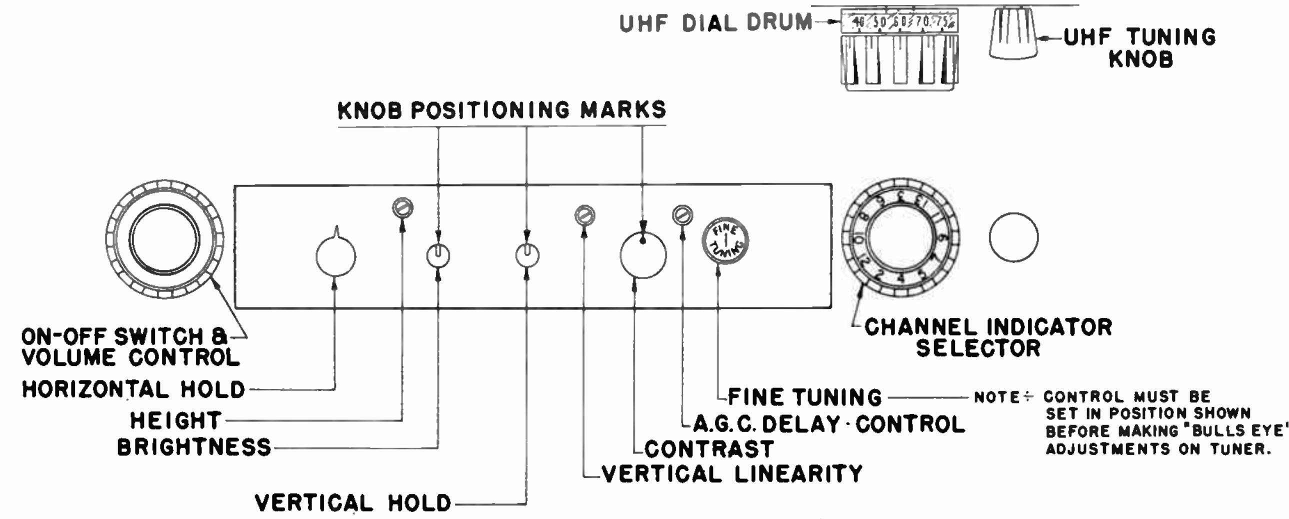


Fig. 5 Control Panel Layout 19L26U & 19L28U Chassis.

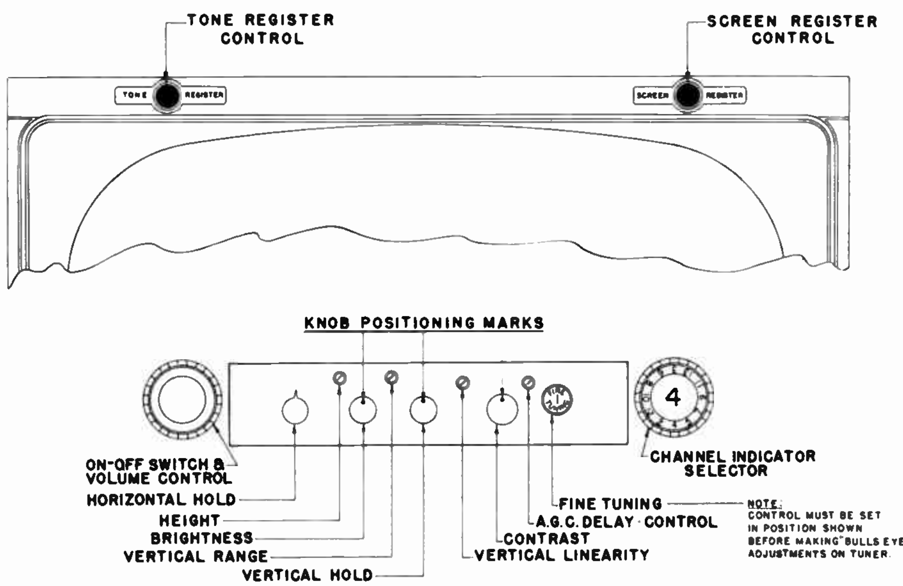


Fig. 6 Control Panel Layout 21L21 Chassis.

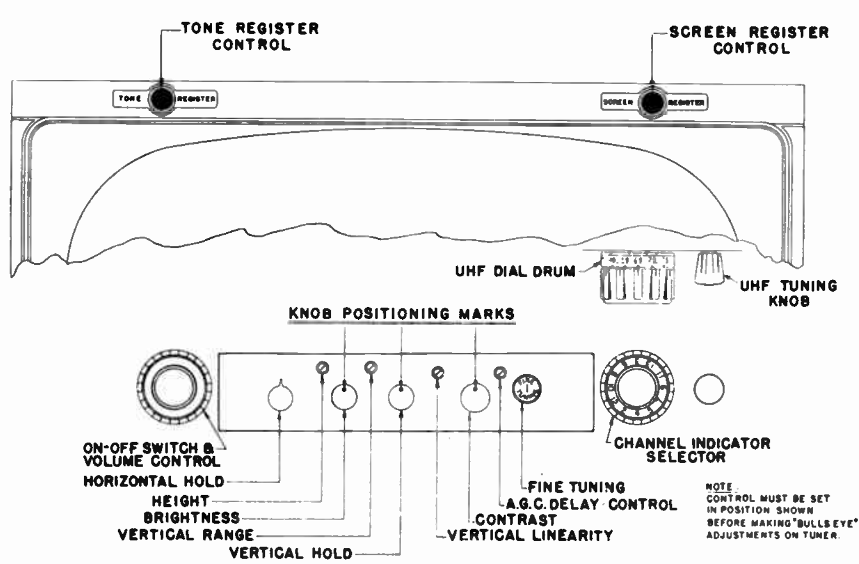


Fig. 7 Control Panel Layout 21L21U Chassis.

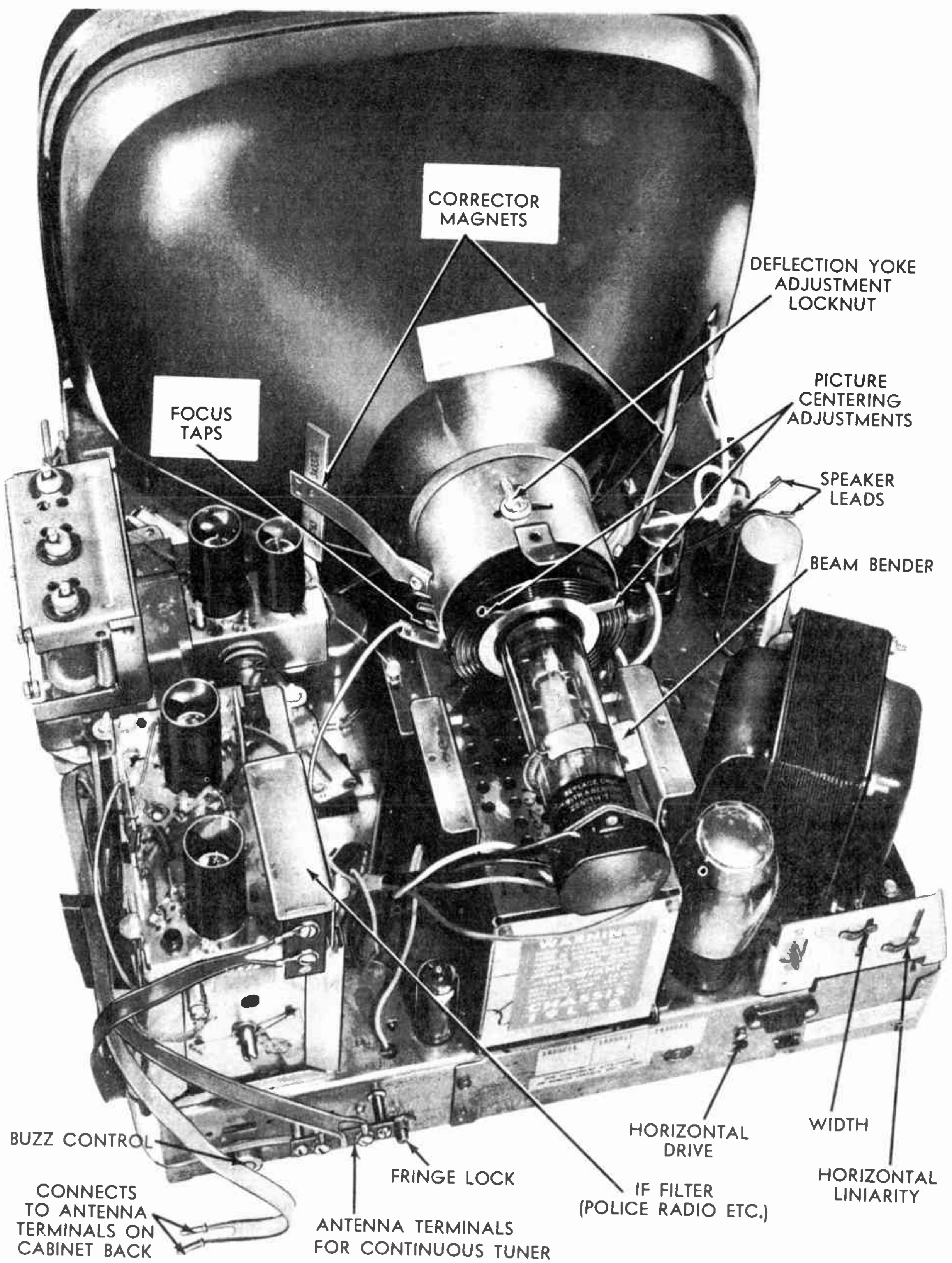


Fig. 8 Top View 19L"U" Series Receivers.

INTRODUCTION

The 19L25, 19L26, 19L27, 19L28, 21L21 and 22L20 chassis described in this manual are basically alike. Alignment and adjustment procedures are identical. The slight differences which exist are as follows:

19L25: This chassis utilizes a 17 inch rectangular picture tube and is the basic chassis.

19L26: This chassis is the same as the 19L25 without the screen and tone register controls.

19L27: This is the 19L25 chassis with a 21 inch picture tube.

19L28: This is the 19L26 chassis with a 21" picture tube.

21L21: This chassis is the same as the basic 19L25 chassis except for the 21 inch picture tube and the addition of a 5U4G low voltage rectifier and a 1X2A tube in the high voltage circuit. The 1X2A is used in conjunction with the 1B3GT rectifier to boost the picture tube second anode voltage to 18.5 Kv. This chassis uses a 6CD6 in the horizontal output circuit. PM focusing and centering is utilized.

22L20: This chassis is similar to the 21L21 chassis but has a separate power supply and utilizes either the 24 or 27 inch picture tube. The 12AX7 used as the vertical oscillator in all other "L" chassis is used in the interlace circuit of this chassis. This circuit is designed to utilize the actual vertical pulse for triggering, rather than depending on the voltage build-up across an intergrating network. In this circuit the first of the six serration of the vertical pulse is differentiated, clipped by the 12AX7 (used as a diode) and applied to the 6SN7GT vertical oscillator. By using the actual pulse for triggering, the time relationship between alternate fields remains constant and positive interlacing results. This chassis utilizes the 6AV5GT vertical output and the 6AS4GT damper.

All models have provisions for reception of the new Ultra High Frequency stations by the simple addition of UHF strips as required. Connections are also provided for easy addition of Phonevision.

TUBE COMPLEMENT

19L25-19L26-19L27-19L28 CHASSIS

SYMBOL	TUBE	FUNCTION
V1	6BK7A	RF Amplifier
V2	6U8	V2A Mixer V2B RF Oscillator
V3	6CB6	1st IF Amplifier
V4	6CB6	2nd IF Amplifier
V5	6CB6	3rd IF Amplifier
V6	12BY7	Video Amplifier
V7	6AU6	Sound Limiter
V8	6BN6	Audio Detector
V9	6BK5	Sound Output
V10	12AX7	V10A AGC Amplifier V10B Vertical Oscillator
V11	6BE6	Sync Clipper
V12	6AH4GT	Vertical Output
V13	6AQ7GT	V13A Horiz. Phase Detector V13B Horizontal Control
V14	6SN7GT	V14A Horizontal Oscillator V14B Horizontal Discharge
V15	6BQ6GT/G	Horizontal Output
V16	1B3GT	High Voltage Rectifier
V17	6AX4GT	Damper
V18	5U4G	Low Voltage Rectifier
V19	17LP4	19L25 and 19L26 Chassis
V19	21YP4	19L27-19L28 Chassis

TUBE COMPLEMENT

21L21 CHASSIS

SYMBOL	TUBE	FUNCTION
V1	6BK7A	RF Amplifier
V2	6U8	V2A Mixer V2B RF Oscillator
V3	6CB6	1st IF Amplifier
V4	6CB6	2nd IF Amplifier
V5	6CB6	3rd IF Amplifier
V6	12BY7	Video Amplifier
V7	6AU6	Sound Limiter
V8	6BN6	Audio Detector
V9	6BK5	Sound Output
V10	12AX7	V10A AGC Amplifier V10B Vertical Oscillator
V11	6BE6	Sync Clipper
V12	6AH4GT	Vertical Output
V13	6AQ7GT	V13A Horiz. Phase Det. V13B Horizontal Control
V14	6SN7GT	V14A Horizontal Osc. V14B Horizontal Disch.
V15	6CD6G	Horizontal Output
V16	1B3GT	High Voltage Rectifier
V17	6AX4GT	Damper
V18	1X2A	High Voltage Adder
V19	5U4G	Low Voltage Rectifier
V20	5U4G	Low Voltage Rectifier
V21	21EP4A or B	Picture Tube

TUBE COMPLEMENT
22L20 CHASSIS

SYMBOL	TUBE	FUNCTION
V1	6BK7A	RF Amplifier
V2	6U8	V2A Mixer V2B RF Oscillator
V3	6CB6	1st IF Amplifier
V4	6CB6	2nd IF Amplifier
V5	6CB6	3rd IF Amplifier
V6	12BY7	Video Amplifier
V7	6AU6	Sound Limiter
V8	6BN6	Sound Detector
V9	6BK5	Sound Output
V10	12AX7	V10A AGC Amplifier V10B Vertical Sync

V11	6BE6	Sync Clipper
V12	6SN7GT	Vertical Oscillator
V13	6AV5GT	Vertical Output
V14	6AQ7GT	V14A AFC V14B Horizontal Control
V15	6SN7GT	V15A Horizontal Osc. V15B Horizontal Disch.
V16	6CD6G	Horizontal Output
V17	1B3GT	High Voltage Rectifier
V18	6AS4GT	Damper (or 6AX4GT)
V19	1X2A	High Voltage Adder
V20	5U4	Low Voltage Rectifier
V21	5U4	Low Voltage Rectifier
V22	24CP4A 27EP4 24TP4	Picture Tube

CONTROLS AND FUNCTIONS

Location of the various receiver controls is shown on Page 2. After the receiver has been properly adjusted, the serviceman should remove the Horizontal Hold, Brightness, Fine Tuning, Vertical Hold, and Contrast Control knobs and re-position them so that the knob markers face upward. The positioning of the knobs will aid the customer in resetting the controls should they be accidentally moved. A brief description of each control follows:

CHANNEL SELECTOR SWITCH: Is used to switch the pre-tuned RF strip into operating position for reception of the particular channel desired.

SCREEN REGISTER: This control is used to vary the response of the video amplifier much the same as a tone control varies the audio response. Clockwise rotation accentuates the high frequencies thus adding crispness to the picture, oftentimes improving the quality of the transmitted picture, particularly old films, etc. Counterclockwise rotation of this control is instrumental in reducing the ringing effect (halos, etc.) of certain transmissions and is particularly useful in fringe areas where some smearing of the snow and noise results in a much improved picture. Under normal picture conditions the setting of the control is usually near the center of its range. MIS-ADJUSTMENT OF THIS CONTROL ON A NORMAL PICTURE MAY RESULT IN A SMEARED OR OTHERWISE INFERIOR PICTURE. (NOTE-A number of 21L21 Chassis have been produced in which the screen register action is in reverse to the above. These receivers can be identified by a 100 ohm resistor which is connected to the screen register cable connecting plug)

FINE TUNING CONTROL: Provides a means of varying the frequency of the local oscillator to compensate for any frequency deviation which may result from tube and circuit variations. In operating this control it will be found that the range of sound is quite broad. Proper setting is the point where the best picture is obtained within the range of best sound.

TONE REGISTER: The tone control is used on all chassis except the 19L26 and 19L28. This control, which consists of a 1 Megohm potentiometer and a .004 Mfd capacitor across the audio detector output, is to be adjusted to the user's preference. Clockwise rotation accentuates the high audio frequencies while counterclockwise rotation accentuates the lows. In fringe or noisy areas, the tone control may be effectively used in the reduction of background noise which may accompany the sound.

VERTICAL HOLD CONTROL
VERTICAL HOLD RANGE CONTROL: The combination of these controls provide a means of changing the cathode resistance of the vertical oscillator to effect synchronization of the vertical sweep with the transmitted sync pulses. Adjustment is made by setting the Vertical Hold Control in the center of its range and adjusting the Vertical Hold Range Control for proper sync. Improper adjustment will cause the picture to "roll" vertically.

HEIGHT CONTROL: The Height Control is part of the vertical oscillator plate load. It is used in conjunction with the vertical linearity control to adjust the size of the picture vertically.

VERTICAL LINEARITY CONTROL: The Vertical Linearity Control is in the cathode circuit of the vertical output tube and is used to shift the operating point of the tube so that the sweep is amplified along that portion of the plate current curve which results in a linear output.

HORIZONTAL LINEARITY CONTROL: The Horizontal Linearity Control should be adjusted for best horizontal symmetry while observing a test pattern on the screen. The position of the horizontal drive and width controls also affect linearity and possible interaction of these controls must be taken into consideration when making linearity adjustments.

WIDTH CONTROL: Two windings in a series shunt arrangement are used to vary the current through the deflection yoke.

HORIZONTAL DRIVE CONTROL: The Horizontal Drive Control is a capacitive divider which is used to regulate the magnitude of horizontal sweep voltage applied to the grid of the horizontal output tube. Counterclockwise rotation of this control increases drive while clockwise rotation reduces drive. To obtain the greatest possible life out of the horizontal output tube, the drive should be adjusted to obtain maximum picture width. After this has been done, any excess or deficiency in width can be compensated for with the Width Control.

Fig. 9 Receiver Correctly Adjusted On Test Pattern.

FOCUS CONTROL: A three position tap is used to obtain proper focusing on all 19L series receivers. Select the tap which results in best focus.

In the 21L21 and 22L20 chassis, PM focusing is utilized. The adjustment is made at the neck of the picture tube.

BRIGHTNESS CONTROL: Controls the cathode voltage of the picture tube to afford control of picture brilliance. Must be operated in conjunction with the Contrast Control for best picture contrast.

CONTRAST CONTROL: Control is in the plate circuit of the 12BY7 video amplifier. It regulates the magnitude of video signal applied to the cathode of the picture tube.

HORIZONTAL HOLD CONTROL: The Horizontal Hold Control is used to tune the horizontal oscillator to the frequency of the transmitted sync pulses.

ADJUSTMENTS AND ALIGNMENT

THE FRINGE LOCK CIRCUIT

The fringe lock is a newly developed circuit, utilizing a 6BE6 heptode, which can be adjusted to assure sync stability over the wide range of noise and signal levels encountered in different areas. In this circuit the output of the crystal detector, approximately -3 volts peak to peak, is fed to grid #1 of the 6BE6. The same signal, after it has been inverted and amplified to approximately 40 volts peak to peak by the first video amplifier, is applied to grid #3 which in this circuit is the signal grid. The fringe lock control is used to pre-set the bias on grid #1 so that the normal 3 volt signal allows proper sync clipping action, i.e. the sync pulses, which have been stripped from the composite video signal appearing at grid #3, will appear at the plate. If a noise pulse drives grid #1 beyond the 2 volt level, plate current cutoff occurs and the noise pulse cannot get through to falsely trigger the sweep oscillators. On rare occasions, a strong noise pulse may occur at the time of the sync pulse and the tube likewise will cut off, however, the flywheel action of the sweep oscillators will maintain sync during this brief period. The entire fringe lock system is based on the fact that the loss of an occasional sync pulse is to be preferred over having a noise pulse get through to falsely trigger the sweep oscillator.

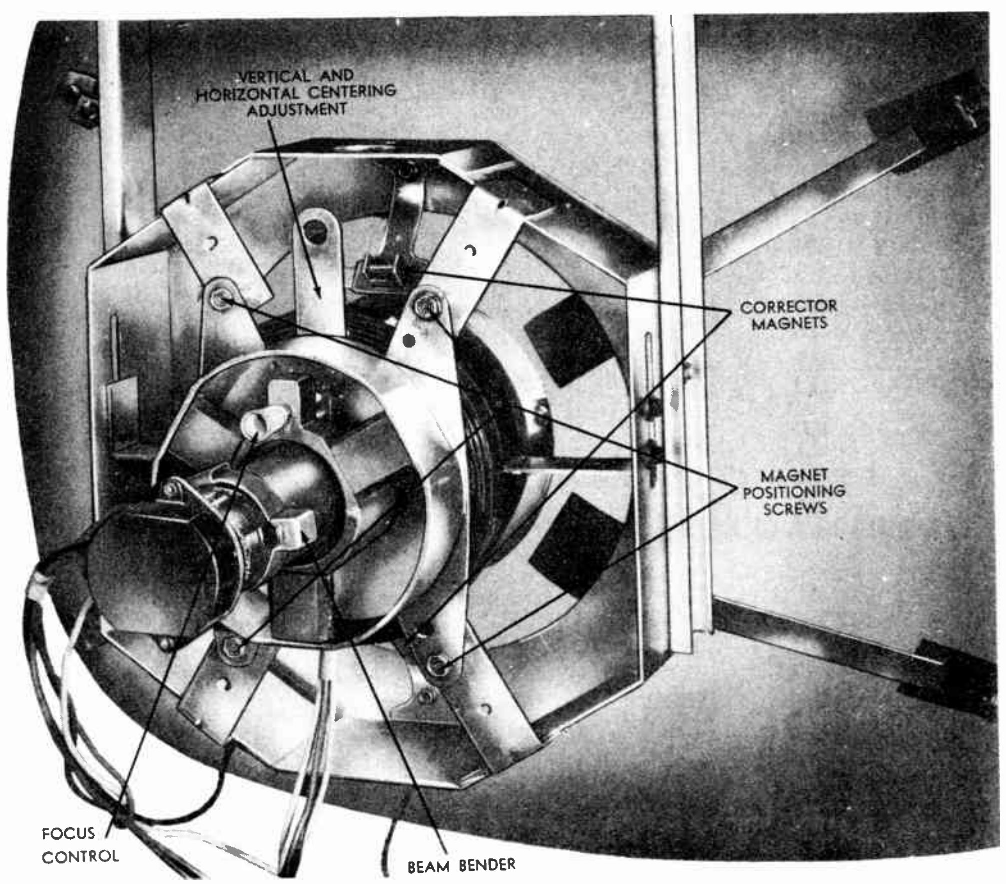


Fig. 10 Adjustments on Neck of Picture Tube 22L20 Chassis. Focusing and Centering Adjustments for the 21L21 Chassis are similar.

FRINGE LOCK ADJUSTMENT

1. Turn the fringe lock control fully clockwise and then back it off approximately 1/4 turn. Adjust the vertical and horizontal hold controls and check operation of the receiver to see that it syncs normally when the turret is switched from channel to channel.

2. If the picture jitters or shows evidence of delay, tearing, split phase, etc., back down the fringe lock control further, a few degrees at a time, each time re-adjusting the hold controls and switching from channel to channel until normal sync action is obtained. It will be found that under normal signal conditions, the correct adjustment will be near the counterclockwise position of the control.

3. In fringe and noisy areas, the best adjustment will be found at or near the maximum clockwise position of the control, however, do not automatically turn the fringe lock fully clockwise in fringe areas as has been done on previous models. Always follow the procedure outlined.

CORRECTOR MAGNET ADJUSTMENT

Two corrector magnets (See Fig. 8) are used in all chassis to obtain straight, sharply focused sweep lines across the face of the picture tube. In the 22L20 chassis, the corrector magnets are mounted top and bottom. The corrector magnets are mounted on the deflection coil mounting brackets and can be moved in and out or up and down by bending the flexible arms which support them. The corrector magnets are adjusted at the factory and should not require re-adjustment unless accidentally bent out of position. If this occurs, adjustment can then be made as follows:

1. With the vertical and horizontal size controls, reduce the size of the picture to a point where the four corners and sides of the picture are visable. (In some receivers it may not be possible to reduce the picture size sufficiently to see all the sides and in this case it may be necessary to shift the picture with the centering control to view one side at a time.)

2. Bend the corrector magnet arms until the corners become right angles and the top of the raster is parallel with the bottom and the left side is parallel with the right side. After adjustment, the picture should be restored to normal size.

NOTE: Mis-adjustment of the corrector magnets may cause pincushioning, barreling, keystoning, poor linearity, etc.

CENTERING ADJUSTMENT

In the 19L series, the centering assembly is built into the yoke housing. This assembly is made up of two magnetic rings which can be rotated by means of tabs. Centering is accomplished by gradually rotating the tabs with respect to each other then rotating both tabs simultaneously until the picture is centered.

In the 21L and 22L series, PM focusing and centering is utilized. The top screwdriver adjustment on the centering assembly is used to move the picture up or down and the bottom adjustment for side to side movement. The center adjustment is for focusing.

In some 21L and 22L receivers, a single centering lever is used for both vertical and horizontal centering. The up down movement of this lever moves the picture horizontally while a left-right movement moves the picture vertically. A screwdriver adjustment is provided for focusing.

BULLS EYE TUNER ADJUSTMENTS

To adjust the receiver for bulls-eye tuning, set the fine tuning control to its approximate center position as shown in Fig 2. Without further adjustment of the fine tuning control insert a 68-21 alignment wrench into the tuner (See Fig.11) and adjust each operating channel to resonance. It will be noted that tuning to one side of resonance results in a faded, washed-out picture with the spacing between the wedge lines fogged and tuning in the opposite direction causes the spaces between the lines to clear up. However, going beyond this point causes the picture to take on a "wormy" appearance from sound getting into the picture. Correct adjustment is obtained by tuning to the "wormy" picture and then backing the control off slightly until the picture clears up.

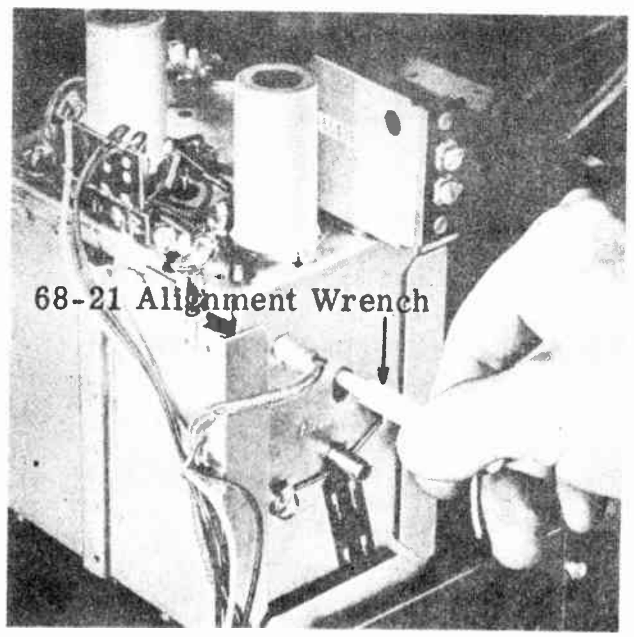


Fig. 11 Bulls-eye Tuning Adjustment.

AFC ADJUSTMENT

The AFC adjustment can effectively be made by setting the horizontal hold control L26 to a position where it is virtually impossible to "throw" the receiver out of horizontal sync when switching from channel to channel.

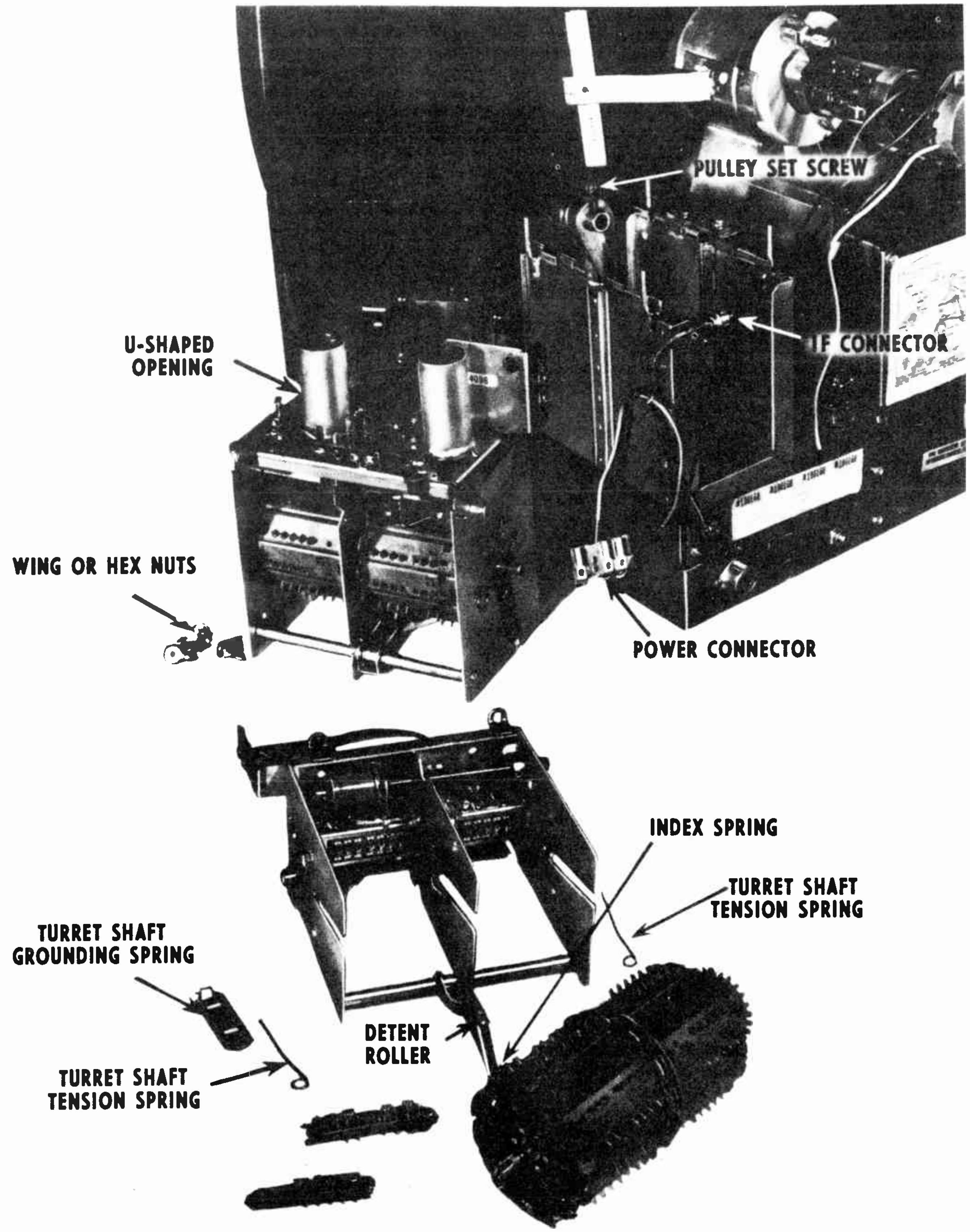


Fig. 12 Removing Turret Tuner.

REMOVING TURRET TUNER FROM CHASSIS

1. Pull out the power and IF connector cables and disconnect the antenna transmission line.

2. Look through the U shaped opening (See Figure 12) in the top of the tuner and rotate the fine tuning control until the allen head set screw (or paint mark on some tuners) is straight up.

3. Loosen (do not remove) the hex head set screw in the turret dial cord pulley assembly.

4. Slide the pulley towards the front of the chassis until it clears the fine tuning shaft.

5. Remove the four hex nuts and gently pull the tuner assembly straight out of its case.

REMOVING CHANNEL STRIPS

1. To insure proper indexing, carefully note the channel to which the receiver is tuned so that the tuner drum can be rotated back to this channel before the unit is reassembled.

2. Rotate the turret drum until the strip to be removed is readily accessible.

3. Insert a small screwdriver in the slot (See Fig.13). Push in the direction of arrow until the channel strip clears the drum slot then lift straight out in direction of screwdriver shaft. Some strips have a round hole instead of a slot and a pointed tool is used in place of the screwdriver.

CAUTION: TO AVOID DAMAGE TO CHANNEL STRIPS, DO NOT USE PRYING ACTION IN REMOVING STRIPS.

REMOVING TURRET DRUM ASSEMBLY

1. Use long nose pliers and remove the two turret shaft tension springs from the front and rear of the tuner assembly. Unsolder and slide the bronze turret shaft grounding springs out of their slots at the front and rear of the tuner.

2. With a pair of long nose pliers, grasp the first turn of the spiral index spring and lift spring off its hook. This takes pressure off the detent arm and may cause the roller to fall out and become lost.

3. Slide the drum out of its slot. Reverse this procedure to re-assemble the tuner.

SERVICING THE TURRET TUNER

In servicing tuners, satisfactory operation can be obtained by removing the tuner from its case and plugging in the power and IF connectors. For further convenience, it may be desirable to use a test chassis in which these leads have been extended 10 to 20 inches.

IMPORTANT: It must be remembered that most repairs in the turret tuner will require realignment of the tuned circuits.

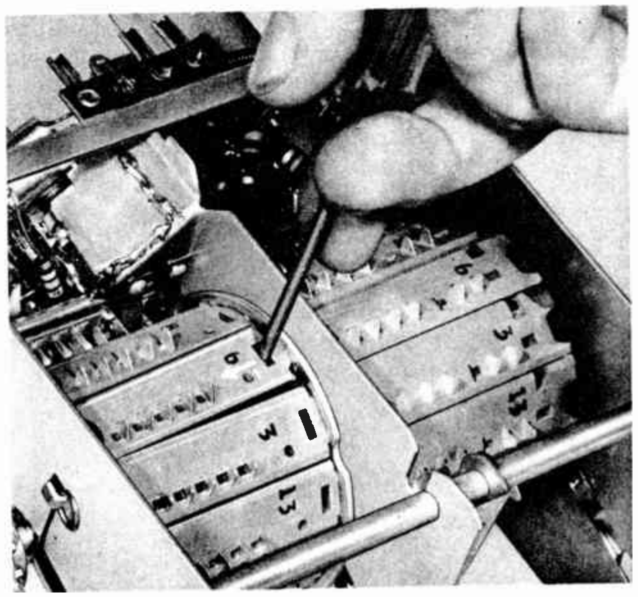


Fig. 13 Removing Channel Strips.

In replacing a 22-2404 feed through capacitor, unsolder the top and bottom leads and the center ground connection. Do not use excess heat or solder when making connections.

Some of the component parts in the tuner cannot be replaced without removing the fine tuning control and bracket assembly. This bracket can be removed as follows:

1. Unsolder the fine tuning capacitor lead.

2. Loosen the Allen head set screw on the fine tuning shaft collar and remove fine tuning shaft.

3. Remove the self tapping screw from the center top of the tuning capacitor mounting bracket, loosen the three remaining screws and remove the bracket. Reverse the above procedure when the tuner is reassembled.

DOUBLE DELAYED GATED AGC

In order to obtain the best possible performance in fringe and weak signal areas, it is important that the application of AGC voltage to the 6BK7A RF tube be withheld until the signal level reaches approximately 500 microvolts at the antenna input. The noise figure of the tuner will be optimized only under this condition of no AGC voltage. To accomplish this, the cathode of the 6CB6 1st IF tube is approximately 8 volts positive by virtue of the drop through the cathode resistor of the 6CB6 3rd IF. This voltage plus the voltage which results from current flow through the tube makes the grid of the 6CB6 1st IF approximately 9.3 volts negative with respect to its cathode. It should be noted here that the bias voltage for the 3rd IF is obtained across the 100 ohm portion of the cathode resistor only. The voltage at the junction of the two resistors varies from 8 volts with no signal to 4 volts with strong signals. The 2nd IF tube is in series with the 1st IF tube and any changes in the plate current of the 1st IF tube will also change

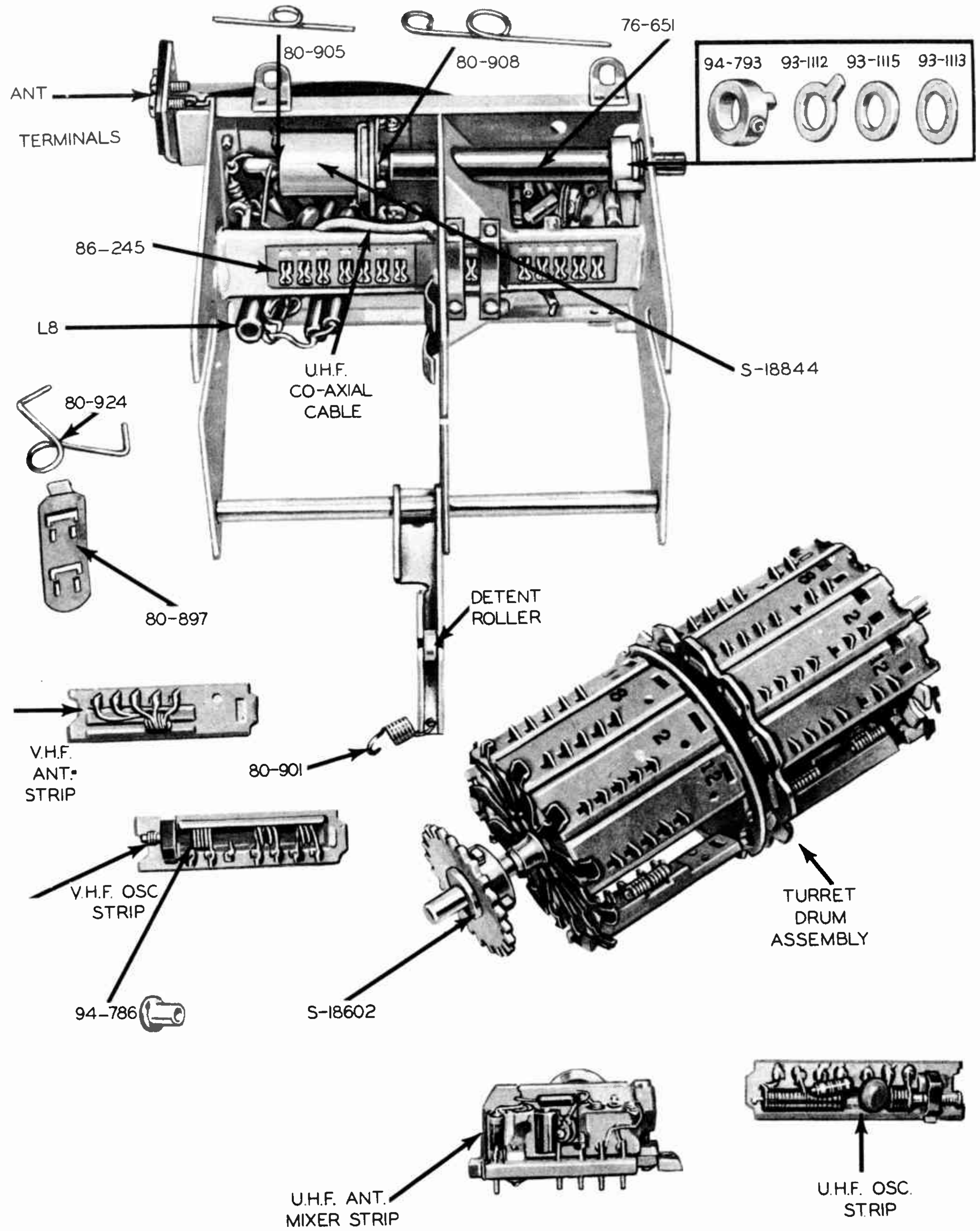


Fig. 14 Exploded View of Turret Tuner.

the 2nd IF tube thus the 2nd IF tube is also controlled indirectly by the AGC.

Under weak signal conditions, the output of the AGC tube at point "E" is approximately 8 volts positive. This positive voltage however, does not reach the grid of the 6BK7A because of the 2.2 megohm resistor. Actually the grid of this tube is slightly negative because of contact potential developed as a result of the high resistance in its grid circuit (2.2 megohms). The 8 volts positive voltage however, is applied to the grid of the 6CB6 1st IF but because the cathode is 9.3 volts positive the grid is actually 1.3 volts negative with respect to its cathode and AGC control of the IF results under weak signal conditions.

When the receiver is used with normal signals, the signal voltage applied to the grid of the AGC tube will increase and as a result the output of the AGC tube will become 4 to 5 volts negative. This negative voltage will be applied to the 6BK7A through the 2.2 megohm resistor thus both the RF and IF stages will then be controlled by the AGC.

With the application of a negative AGC voltage to the 6BK7A tube under normal signal conditions, the noise figure of the tuner will not be optimized as under weak signal conditions, however, this is not a consideration with normal signal levels.

AGC ADJUSTMENTS

IMPORTANT: THE AGC CONTROL CANNOT BE USED IN ANY WAY TO IMPROVE THE RECEIVER SENSITIVITY. The sole function of this control is to set the level applied to the video amplifier (12BY7) tube so that the output of this tube is approximately 100 volts peak (100% modulated video signal) for application to the picture tube cathode.

The adjustment can also be made by connecting a calibrated oscilloscope through a 10K isolation resistor, to test point "D" (See Fig.16) and, while receiving the strongest TV signal adjust the AGC delay control for 2.5 volts (2.75V on 19L26 and 28 models) peak output.

Satisfactory adjustment can also be made by observing the picture and slowly turning the AGC delay control from its maximum clockwise position, counterclockwise until a point is reached where the picture distorts and buzz is heard in the sound. The control should then be turned slowly clockwise and set at a point comfortably below this level of intercarrier buzz, picture distortion and improper sync.

CAUTION: Misadjustment of the AGC delay control can result in a washed-out picture, distorted picture, buzz in sound OR COMPLETE LOSS OF PICTURE AND SOUND.

ALIGNMENT

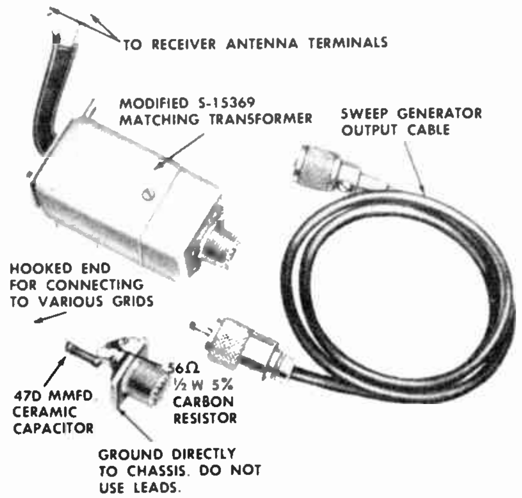


Fig. 15 IF-RF Alignment Fixtures

A suitable sweep generator in conjunction with an accurate marker must be used for alignment work. It is very important to have the sweep generator output cable properly terminated and to check whether or not its attenuator is reactive. If the attenuator is reactive or if the output cable is improperly terminated, correct alignment cannot be made since the degree of attenuation then may change the shape as well as the amplitude of the response curve. The position of the attenuator should only vary the amplitude and not the shape of the response curve.

CALIBRATING THE OSCILLOSCOPE

When aligning the RF and IF stages of the receiver, it is necessary to measure detector peak output.

This may be done with a voltage calibrator used in conjunction with an oscilloscope. If a calibrator is not available, the oscilloscope can be calibrated with a known DC voltage. To make the calibration, connect the ground lead of the vertical input cable to the negative side of a 3 volt battery supply. Turn the horizontal gain control fully counterclockwise. With the "hot" lead, make a momentary contact to the positive connection on the battery and observe the instantaneous spot deflection on the screen. Discharge the scope input capacitor by shorting out the leads and repeat the procedure, each time readjusting the scope vertical gain until the spot deflects 3 large divisions on the screen. Each division then represents 1 volt peak. The position of the vertical gain control should be marked for future reference.

VIDEO IF ALIGNMENT

1. Connect the negative lead of a 2 volt battery supply to terminal "E" (Fig.36) and the positive lead to chassis. The bias supply should be made variable so that it can be varied from negative 3 volts to positive 3 volts. Keep the supply leads short.

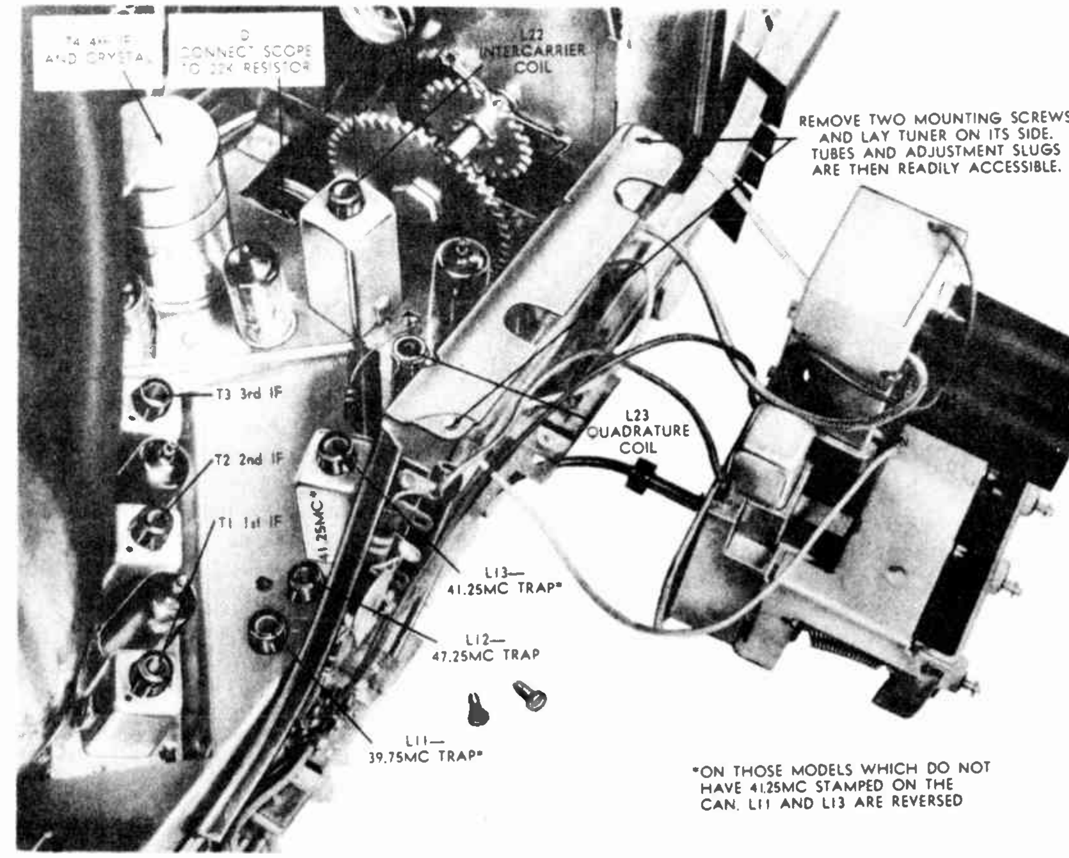


Fig. 16 IF Alignment Guide.

2. Connect the calibrated oscilloscope through a 10,000 ohm isolation resistor between terminal "D" and chassis. The sweep generator input to the receiver should be adjusted for 3 volts peak to peak detector output. Do not exceed this output level during any of the adjustments.

3. Feed the output from the sweep generator through the special termination unit shown in Fig. 15 to point "C" (Pin 1 of 6CB6, 3rd IF). Adjust the generator until a pattern similar to Fig. 17 is obtained.

4. Set the Marker Generator to 45.75 Mc and alternately adjust the top and bottom slugs of the 4th IF transformer for maximum gain with the 41.25 Mc and 45.75 Mc markers positioned as shown in fig. 17

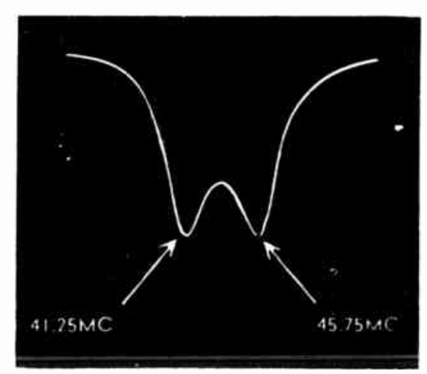


Fig. 17 4th IF Response.

If the correct response curve cannot be obtained in this step, check the position of the two slugs to see that they are entering their respective coils from the opposite ends of the coil form. The position of the slugs near the center of the coils may change the coefficient of coupling, making correct alignment difficult if not impossible.

5. Connect the sweep generator cable to terminal "A" (Mixer Grid). In this step it may be necessary to temporarily reduce the bias to zero or even to go to a slightly positive voltage in order to see the highly attenuated trap slots with the oscilloscope vertical gain near maximum.

6. Adjust the 47.25 Mc, 41.25 Mc and 39.75 Mc traps for minimum marker amplitude (See Fig.18 . It can

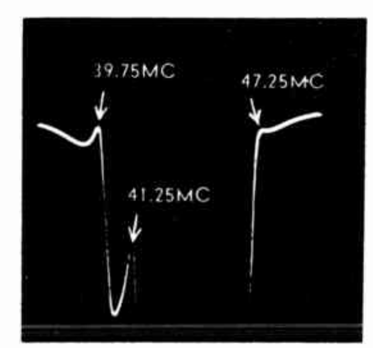


Fig. 18 Exploded View of Trap.

be seen that maximum oscilloscope gain has been used and as a result the top of the response curve has been "run off" the oscilloscope screen in order to see a "blow-up" of the trap slots.

7. Readjust the bias to -2 volts and set the oscilloscope vertical gain to the calibrated position. Adjust the sweep generator for a 3 volt peak to peak output from the video detector.

8. With the test equipment set up as in Step 7, alternately adjust the 2nd IF, 3rd IF, 1st IF and the converter plate coil until an overall response curve similar to Fig19 is obtained. It will be found that the 2nd IF affects the low side (42.75 Mc) and the 3rd IF the high side of the response curve. If the proper response curve cannot be obtained by an alternate adjustment of the above trimmers, it may be necessary to retouch the 4th IF transformer.

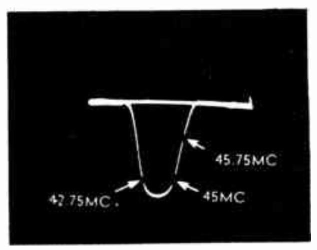


Fig. 19 Overall IF Response.

TURRET TUNER AND RF CHASSIS ALIGNMENT

The RF chassis adjustments have been made at the factory and normally do not require readjustment in the field unless tampered with. If adjustment becomes necessary check the overall IF response and proceed as follows:

1. Temporarily ground the turret AGC by connecting a jumper between the AGC bus (yellow lead) and chassis.

2. Connect the calibrated oscilloscope to the feed through terminal "H" (Fig. 1) through a 10K isolation resistor. This terminal is the screen of the 6U8 mixer.

3. Use the S-15369 matching transformer (Fig. 15) and feed the output from the sweep generator to the antenna terminals of the receiver.

4. Turn the channel selector to Channel 4 and adjust the sweep generator until a response curve somewhat similar to Fig. 20 is obtained.

5. Study Fig. 1 and adjust the converter grid capacitor (C9), the RF plate capacitor (C7) and the RF grid capacitor (C3) until a response curve similar to Fig. 20 is obtained.

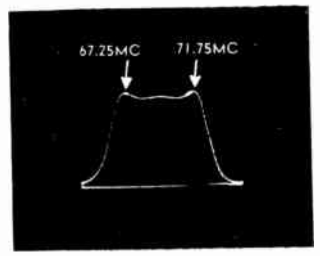


Fig. 20 Channel 4 RF Response.

6. Turn the channel selector to Channel 11 and adjust the sweep generator until a response somewhat similar to Fig. 21 is obtained. Adjust L5 and L6 to obtain symmetry. If the band pass is too great or too narrow also adjust L7.

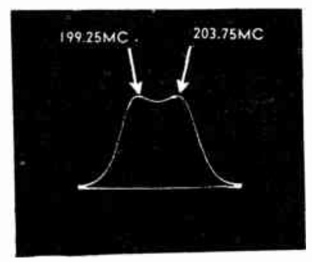


Fig. 21 Channel 11 RF Response.

7. Repeat steps 5 and 6 until the best overall symmetry is obtained. REMOVE AGC JUMPER.

MASTER OSCILLATOR ALIGNMENT

The master oscillator adjustment is to be made only if resonance cannot be obtained with the strip oscillator adjustment wrench with the fine tuning control in its center position, and after it has been determined that the channel strip itself is not at fault.

If channels 2 through 6 can be made to resonate with the bull's-eye adjustment at the rear of the turret and the high channels do not resonate, a slight readjustment of the oscillator inductance L10 (See Fig. 1) may be necessary to affect resonance on the high channels.

If the fine tuning capacitor is replaced, proper alignment of the fine tuning mechanism can be made as follows:

1. Remove the turret from the chassis (See Page 13).

2. Turn the tuning capacitor shaft until the allen head screw, as viewed through the U-shaped opening, is straight up. NOTE: On those models with a paint mark on the shaft see page 18.

3. Insert an allen wrench through the opening and loosen the screw. Leave the allen wrench in, partially slide out the shaft and tape it to prevent the stop mechanism from falling out or being turned out of position.

4. The tuning capacitor bracket can be removed by removing the four self-tapping screws which hold it in place. Unsolder the tuning capacitor lead replace capacitor and re-assemble bracket on the RF chassis. DO NOT TIGHTEN ALLEN HEAD SCREW.

5. Use a sweep generator on Channel 4 or tune in a station on the lowest available channel and turn the turret shaft until resonance is obtained. This should be approximately 2-1/4 turns from either end of the fine tuning capacitor range. Turn the collar until the allen head screw is straight up as viewed through the opening and tighten screw.

6. Check the fine tuning knob to see that it is in the center of its mechanical range.

7. Insert the dial cord pulley over the turret shaft and tighten set screw. If the set screw is in a position where it is difficult to tighten, the fine tuning shaft can be held in place and the pulley can be made to slip the dial cord until the pulley is in a position where the set screw is readily accessible.

8. It may be necessary to readjust the oscillator inductance L10 (See Fig. 1) for proper bull's-eye operation on the high channels (7-13).

NOTE: On some models, the mechanism described above has been replaced by a tuning capacitor which has a built-in stop. Proper mechanical alignment is indicated when the paint mark, as viewed through the U-shaped opening in the turret, is straight up when the fine tuning knob is in the position as shown in Figure 2 If adjustment becomes necessary, proceed as follows:

1. Loosen (do not remove) the hex head set screw in the turret dial cord pulley assembly.

2. Slide the pulley towards the front of the chassis until it clears the fine tuning capacitor shaft.

3. Turn the fine tuning capacitor shaft fully counterclockwise then rotate 1/2 turn clockwise. At this point the paint mark on the shaft should be straight up as viewed through the U shaped opening.

4. See that the fine tuning knob is in the position shown in Figure 2 , replace the drive pulley on the tuning capacitor shaft and tighten locknut.

SOUND ALIGNMENT

Proper alignment of the 4.5 Mc intercarrier sound channel can only be obtained if the signal to the receiver antenna terminals is reduced to a level below the limiting point of the 6BN6 Gated Beam Detector. This level can be easily identified by the "hiss" which then accompanies the sound.

Various methods may be used to reduce the signal level, however, it is recommended that a step attenuator similar to the S-17203 unit be used for most satisfactory results. To prevent leakage, certain precautions must be taken when connections are made. Use as short a lead as possible between the attenuator and receiver antenna terminals and approximately 6 feet of 300 ohm shielded line between the antenna transmission line and the attenuator. The shield from the transmission line should be connected to the attenuator and the attenuator itself grounded to the TV chassis under test.

After the connections have been made, proceed as follows:

1. Tune in a tone modulated TV signal and adjust the step attenuator until the signal is reduced to a level where "hiss" is heard with the sound.

2. Adjust the sound take-off coil L19 (top and bottom slugs), intercarrier coil L22, quadrature coil L23 and buzz control R39 for the cleanest sound and minimum buzz. It must be remembered that any of these adjustments may cause the "hiss" to disappear and further reduction of the signal will be necessary so that the "hiss" does not disappear during alignment.

If intercarrier buzz is in evidence, after all normal sound adjustments have been made, the cause may be attributed to one or more of the following:

1. Improper adjustment of the AGC delay control.

2. Defective 6AU6 sound limiter.

3. Extremely high signal levels which require attenuation in the antenna circuit.

4. Transmitter over modulation.

ADJUSTMENT OF THE S19670 CONTINUOUS TUNER

The Zenith continuous tuner has been aligned at the factory with precision test equipment. Adjustments should not be attempted in the field unless adequate test equipment is available. Any attempt to peak one particular channel will cause serious degradation of the other channels.

In aligning the UHF continuous tuner, it may be difficult to obtain a UHF marker generator for alignment. If a marker generator is unavailable, it is possible to use a TV signal or another receiver, equipped with a S-19670 tuner, which is known to be calibrated, as a marker. If the latter method is used, all that is necessary is to loosely couple the two tuners (operate them close together) to inject a marker. The oscillator in the UHF tuner operates fundamental plus the IF frequency, i.e., when the tuner is tuned to channel 14, its oscillator frequency is 517 MC. When the tuner is on channel 83, its oscillator operates on 931 MC. Therefore, a marker source from 517 to 931 MC for all channels above 22 is available. In practical use, the dial of the signal source tuner is set to channel 14 when an oscillator frequency for channel 22 is needed.

i.e., subtract 8 channels for the oscillator frequency required. To obtain a channel 83 marker, set the source receiver to channel 75.

If alignment becomes necessary, the 6BK7A and 6AU6 40 MC IF stages are to be aligned first before the UHF RF alignment is attempted. The complete IF-RF alignment is as follows:

1. Switch the receiver to the UHF position. (The UHF tuning knob is also used to actuate the UHF-VHF change-over switch. When the knob is pushed in, the receiver is in VHF position and when pulled out to the stop, in the UHF position).

2. Set up the test equipment as outlined under Video IF alignment on page 15.

3. Connect the signal generator to test point "X" (See Figure 25) and adjust L9 to obtain a response curve similar to the overall response as in Figure 19. Use only enough signal to obtain 3 volts peak detector output.

4. Through the matching network as shown in Figure 22 couple the tuner to the sweep generator. The

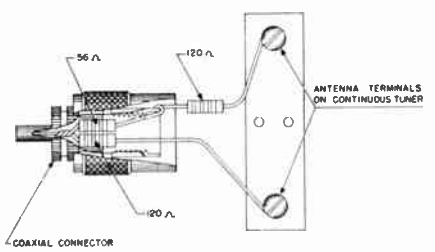


Fig. 22 Matching Network Required for UHF alignment.

matching network can be made by using a coaxial connector (without cable) and the necessary resistors. The 300 Ohm miniature line, which is part of the tuner assembly, is long enough (when the UHF antenna terminal strip is removed from chassis) for connecting directly to the terminating network when the network is plugged directly into the sweep generator.

5. Set the UHF tuning knob to channel 54. When this is done, the rocker arm on the tuner should be in the horizontal position. If the rocker arm is not horizontal loosen the set screw (See Figure 24) and adjust tuner shaft so that arm is horizontal with the indicator on channel 54.

6. Do not adjust the oscillator unless it is known that it is off calibration by more than 3 channels as checked by receiving a UHF station or by use of a UHF marker generator.

7. Adjust sweep generator to obtain a band pass response on channel 54 and set C3 so that the marker (osc.) falls at the 50% point on the response curve (See Figure 23). When adjusting the oscillator, the image (weaker response) and the fundamental will appear. The response towards the counter-clockwise position of C3 in the proper response.

8. Adjust C2 (mixer), C1 (ant.) and C8 (IF) for maximum amplitude of the response curve using just enough

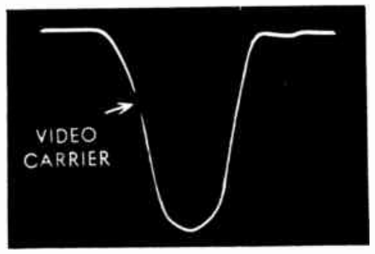


Fig. 23 UHF Response Curve.

signal to obtain 3 volt detector output. Adjustment C8 is very broad, however, it has an important bearing on noise figure.

9. Turn the UHF tuning indicator to channel 14 (or 22 if markers are not available). Adjust sweep to obtain response as in step 8 and check calibration. If the oscillator is off more than 3 channels, use a pair of slip joint pliers and adjust the oscillator travel adjustment to scale. CAUTION when adjusting the travel adjustments, it is possible to move the rocker arm out of its bearing and get an incorrect setting. Check to see that the rocker arm remains seated at all times. After the oscillator is adjusted, set the mixer and antenna travel adjustments for maximum response.

10. Turn the UHF tuning indicator to channel 83 and check for calibration as on 54 and 14. Set C13 to scale and adjust C11 and C12 for maximum response.

11. Check calibration on channels 14, 54 and 83. It may be necessary to repeat steps 7, 8, 9 and 10 to obtain best overall performance.

SPECIAL TEST EQUIPMENT FOR TV

11-118	9ft. AC Test Cord
68-13	Alignment Tool
68-14	Tuning Wand
68-19	Nylon Alignment Wrench
68-20	Nylon Alignment Wrench
68-21	Nylon Alignment Wrench
95-1234	250 Watt Isolation Transformer

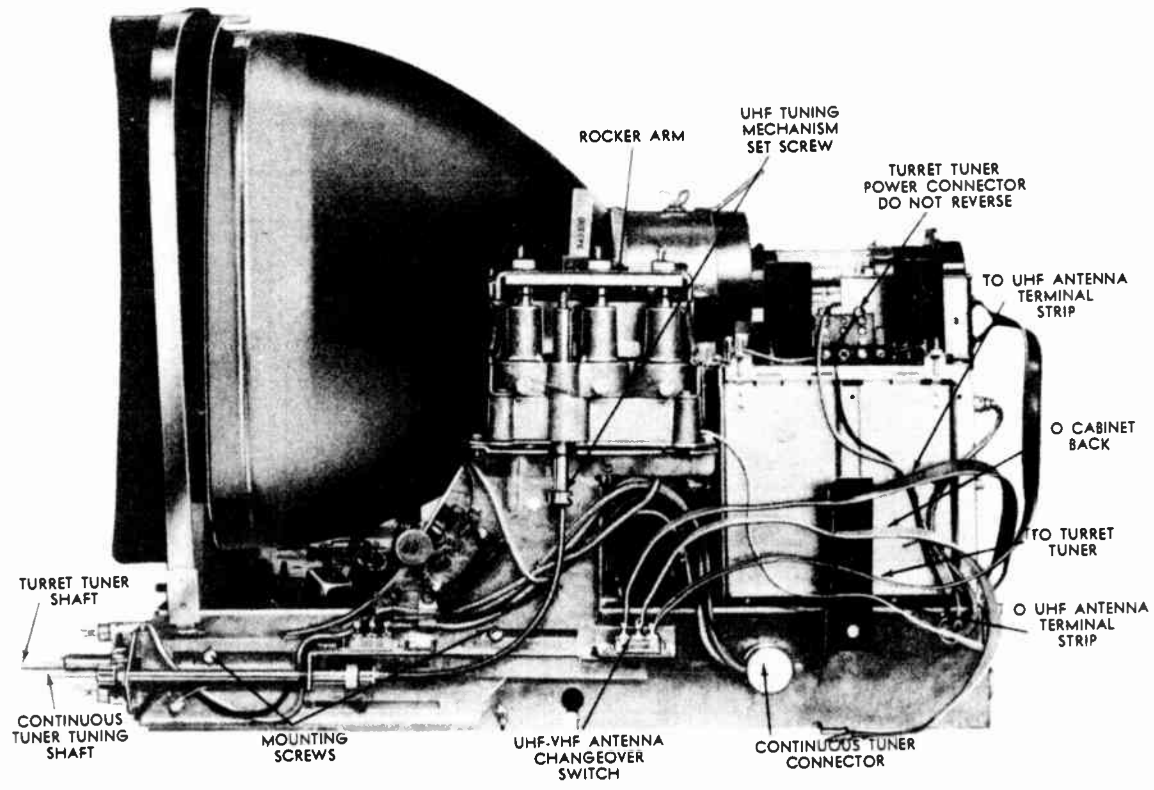


Fig. 24 "U" Models with S-19670 Continuous Tuner Installed.

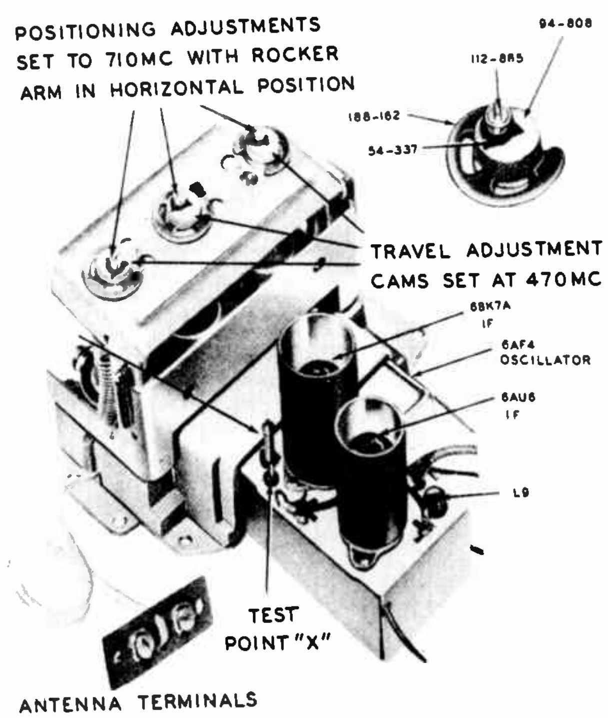


Fig. 25 Top View S-19670 Tuner.

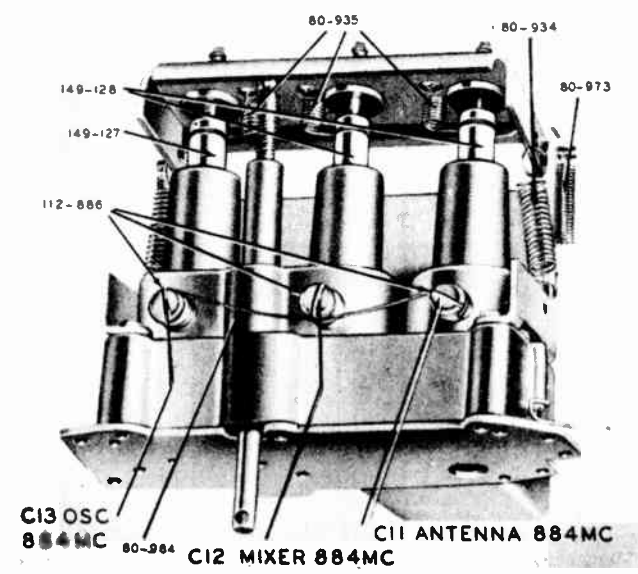


Fig. 26 Side View S-19670 Tuner.

CIRCUIT LEGEND

DIAG. NO.	PART NO.	DESCRIPTION	R.F.	VIDEO	SWEEP	POWER
C1	22-2404	400 MMF FT GMV 500 V	L			
C2	22-8	470 MMF GMV 500 V		L		
C3	22-2221	2.5-8.0 MMF TRIM. CAP 500 V	L			
C4	22-2408	2.2 MMF 5% 500 V	L			
C5	22-2403	100 MMF -5%+6% 500 V	L			
C6	22-2331	840 MMF GMV 500 V	L			
C7	22-2504	.7 - 3 MMF 500 V	L			
C8	22-2407	120 MMF 5% 500 V	L			
C9	22-2504	.7 - 3 MMF 500 V	L			
C10	22-2406	10 MMF 2 1/2% 500 V	L			
C11	22-2434	2 MMF .5 MMF 500 V	L			
C12	22-2469	5.5 MMF .5 MMF 500 V	L			
C13	22-2500	4.5 MMF .5 MMF 500 V	L			
C14	22-2411	1. MMF .5 MMF 500 V	L			
C15	22-2217	470 MMF 500 V		L		
C16	22-2366	5 MMF .5 MMFD CER. DISC. 500 V		L		
C17	22-2381	5 MMF .5 MMFD CER. DISC. 500 V		L		
C18	22-2401	6 MMF .5 MMFD CER. DISC. 500 V		L		
C19	22-7	.001 MFD GMV 500 V		L		
C20	22-2198	.47 MFD 200 V		L		
C21	22-2309	330 MMF 10% 500 V		L	EF	
C22	22-2302	[illegible] MMF 10% 500 V		L	F	
C23	22-2310	560 MMF 10% 500 V		L		
C24	22-2363	4.5 MMF .5 MMFD 500 V		L		
C25	22-2375	7 MMF 1 MMFD 500 V		L		
C26 AC		[illegible] MFD ELECTRO 350 V			AC	
C26 BC	22-2476	[illegible] MFD ELECTRO 25 V			AC	
C26 CC		[illegible] MFD ELECTRO 25 V			AC	
C27	22-2477	[illegible] MFD 300 V		EF	AC	
C28 AD		[illegible] MFD ELECTRO 475 V			ABCDE	
C28 BD	22-2479	[illegible] MFD ELECTRO 400 V			ABCDE	
C28 CD	(RED DOT)	[illegible] MFD ELECTRO 350 V			ABCDE	
C28 DD		100 MFD 50 V			ABCDE	
C29	22-2567	47 MMF [illegible] CER. DISC. 500 V		L		
C30	22-2343	3.3 MMF 20% GIMMIC 500 V		L		
C31	22-[illegible]	.01 MFD GMV 500 V		L	L	
C32	22-2305	47 MMF 10% 500 V		L	L	
C33	22-1777	.1 MFD 200 V		L	L	
C34	22-2248	.0033 MFD 10% 600 V			L	
C35	22-2403	50 MMF 500 V		L		
C36	22-2400	470 MMF 10% 500 V		L		
C37	22-1775	2 x .01 MFD 500 V		L		
C38	22-2378	10 MMF 10% 500 V		L		
C39	22-1770	.047 MFD 200 V		L		
C40	22-2320	500 MMF 500 V		L		
C41	22-[illegible]	[illegible] MFD 500 V			ACEF	
C42 AC		[illegible] MFD ELECTRO 400 V		EF	AC	
C42 BC	22-2437	40 MFD ELECTRO 400 V		EF	AC	
C42 CC	(WHITE DOT)	20 MFD ELECTRO 400 V		EF		
C43	22-2208	.0056 MFD 10% 500 V			[illegible]	
C44	22-8	.002 MFD 500 V				
C45	22-1885	2200 MMF 600 V			L	
C46	22-2452	.015 MFD 200 V			L	
C47	22-1619	220 MMF 10% 500 V			ABCDE	
C48	22-2126	.001 MFD 10% 500 V			ABCDE	
C49	22-2124	.0022 MFD 10% 600 V			ABCDE	
C50	22-1850	.1 MFD 600 V			L	
C51	22-2107	.022 MFD 200 V			L	
C52	22-1631	56 MMF 10% 500 V			ABCDE	
C53	22-1256	75 MMF 5% 500 V			ABCDE	
C54	22-2127	.001 MFD 600 V			L	
C55	22-[illegible]	.0047 MFD 10% 200 V			L	
C56	22-[illegible]	.15 MFD 10% 200 V			L	
C57	22-2120	680 MMF 10% 500 V			L	
C58	22-1755	1500 MMF 400 V			L	
C59	22-2416	1100 MMF 10% 500 V			L	
C60	22-2112	.001 MFD 500 V			L	
C61	22-2387	390 MMF 10% 500 V			L	
C62	22-2460	270 MMF 10% 500 V			ABCD	
C63	22-2398	HOR. DRIVE TRIMMER			L	
C64	22-1775	.047 MFD 400 V			L	
C65	22-2340	.1 MFD 10% 400 V			L	
C66	22-2341	.15 MFD 10% 400 V			L	
C67	22-2159	.33 MFD 200 V			BD	
C68	22-1832	500 MMF CAP. 20 KV			L	
C69	22-2501	.0056 MFD 10% 400 V			L	
C70	22-2309	330 MMF 10% 500 V		EF	EF	
C71	22-1886	.0047 MFD 10% 600 V			EF	
C72	22-1784	.01 MFD 10% 400 V			ABCD	
C73 AD		80 MFD ELECTRO 400 V			BC	
C73 BD		40 MFD ELECTRO 400 V			BC	
C73 CD	22-2356	30 MFD ELECTRO 400 V			BC	
C73 DD	(BLUE DOT)	40 MFD ELECTRO [illegible]			BD	
C74 AC		40 MFD ELECTRO 450 V				F
C74 BC	22-2467	20 MFD ELECTRO 450 V				F
C74 CC	(YELLOW DOT)	10 MFD ELECTRO 400 V			F	
C75	22-2497	.0022 1000 V			F	
C76	22-1606	.047 600 V			F	
C77 AD		40 MFD ELECTRO 450 V			F	
C77 BD		10 MFD ELECTRO 450 V			F	
C77 CD	22-2463	[illegible] MFD ELECTRO 450 V			F	
C77 DD	(BLACK DOT)	100 MFD ELECTRO 50 V			F	
C78	22-1847	.0047 200 V			F	
C79	22-2225	.0033 10% 400 V			EF	
C80	22-[illegible]	100 MMF 10% 500 V			F	
C81	22-2061	20 MMF 5% 500 V			F	
C82	22-1776	.0033 MFD 600 V			L	
C83	22-2508	680 MMF 1000 V			BD	
C84	22-1850	.015 MFD 10% 200 V			BD	
PL-1	100-158	PILOT LIGHT			L	
A1	67-1	INTEGRATOR			ABCDE	
CX		SUPPLIED WITH DEFLECTION YOKE			L	
X1	103-1	DIODE CRYSTAL		L		

DIAG. NO.	PART NO.	DESCRIPTION	R.F.	VIDEO	SWEEP	POWER
R1	63-1650	47K OHM 1/2 W	L		L	
R2	63-1897	470K OHM 10% 1/2 W	L			
R3	63-1884	220K OHM 1/2 W	L			
R4	63-1842	22K OHM 1/2 W	L		L	
R5	63-1729	47 OHM 10% 1/2 W	L			
R6	63-1869	100K OHM 10% 1/2 W	L	L	L	
R7	63-1613	4.7K OHM 10% 1/2 W	L		L	
R8	63-1772	470 OHM 1/2 W	L	L		
R9	63-1756	220 OHM 1/2 W	L			
R10	63-1866	82K OHM 10% 1/2 W	L			
R11	63-3170	10K OHM 2 W	L			
R12	63-1796	2.2K OHM 10% 1/2 W	L			
R13	63-1737	68 OHM 1/2 W		L		
R14	63-1733	56 OHM 10% 1/2 W		L		
R15	63-1841	22K OHM 10% 1/2 W		L		
R16	63-1621	5600 OHM 1/2 W		L		
R17	63-1708	15 OHM 10% 1/2 W		L		
R18						
R19	63-1873	120K OHM 10% 1/2 W		L		
R20	63-[illegible]	[illegible] OHM 10% 1/2 W		L	F	
R21	63-1749	100 OHM 10% 1/2 W		L	EF	
R22	63-1757	220 OHM 10% 1/2 W		L		
R23	63-3178	10K OHM 10% 2 W		L		
R24	63-1719	27 OHM 10% 1/2 W			ACEF	
R25	63-2653	200 OHM SCREEN REGISTER			ACF	
R26						
R27	63-1862	56K OHM 10% 1/2 W	L			
R28	63-2599	3.3K OHM 10% 4 W		L		
R29	63-1827	10K OHM 10% 1/2 W		L		
R30	63-1803	2.7K OHM 10% 1/2 W		L		
R31	63-1785	1K OHM 10% 1/2 W		L	F	
R32	63-2359	15K CONTRAST CONTROL		L		
R33	63-1683	[illegible]K OHM 10% 1/2 W		L	L	
R34	63-1870	100K OHM 1/2 W			L	
R35	63-2637	200K BRIGHTNESS CONTROL			L	
R36	63-1925	2.2 MEGOHM 1/2 W		L		
R37	63-3162	330 OHM 10% 1 W		L		
R38	63-2787	100K OHM 10% 1 W		L	BD	
R39	63-3167	800 OHM BUZZ CONTROL		L		
R40	63-1779	680 OHM 1/2 W		L		
R41	63-3160	33K OHM 2 W		L		
R42	63-1890	330K OHM 10% 1/2 W		L		
R43	63-2635	1 MEGOHM TONE REGISTER			ACF	
R44	63-1769	1K OHM 1/2 W		L		
R45	63-2777	500K OHM VOLUME CONTROL			AB	
R46	63-1754	160 OHM 10% 1/2 W			ABCD	
R47	63-1628	10K OHM 1/2 W			ACE	
R48	63-[illegible]	470 OHM 10% 1 W			L	
R49	63-1982	100K OHM 10% 2 W			L	
R50	63-1896	470K OHM 1/2 W			L	
R51	63-1904	680K OHM 10% 1/2 W		L	L	
R52	63-1810	3.9K OHM 10% 1/2 W			L	
R53	63-2156	4K OHM AGC DELAY		L		
R54	63-2605	7.5 MEGOHM FRINGE LOCK VERT. SIZE		L	F	
R55	63-1918	1.5 MEGOHM 10% 1/2 W			L	
R56	63-1157	47K OHM 10% 2 W			ACEF	
R57	63-1898	33K OHM 10% 1/2 W			ABCDE	
R58	63-2394	7.5 MEGOHM VERTICAL SIZE			ABCDE	
R59	63-1939	4.7 MEGOHM 10% 1/2 W			AC	
R60	63-1880	160K OHM 10% 1/2 W			ACE	
R61	63-2634	2500 OHM VERTICAL HOLD			ACE	
R62	63-2156	4K OHM VERTICAL RANGE			ACE	
R63						
R64	63-1655	47K OHM 10% 1/2 W			L	
R65	63-1534	15K OHM 10% 1/2 W			ACEF	
R66	63-1744	1.0 OHM 1/2 W			L	
R67	63-[illegible]	1.6 MEGOHM 10% 1/2 W			ABCDE	
R68	63-2273	620 OHM 5% 1 W			AC	
R69	63-2615	1500 OHM VERTICAL LINEARITY			ABCE	
R70	63-1775	[illegible] OHM 10% 1/2 W			ABCDE	
R71	63-1290	560 OHM 10% 1 W			ABCE	
R72	63-1911	1 MEGOHM 10% 1/2 W			L	
R73	63-1771	470 OHM 10% 1/2 W			L	
R74	63-2145	10K OHM 2 W			L	
R75	63-1195	47K OHM 10% 1 W			L	
R76	63-2130	150K OHM 10% 1 W			ABCDE	
R77	63-2364	18K OHM 10% 2 W			ABCD	
R78	63-856	22K OHM 10% 1 W			L	
R79	63-1970	3.3K OHM 2 W			AC	
R80	63-2126	1.0 OHM 10% 1/2 W			ABCD	
R81	63-1846	33K OHM 1/2 W			ABCD	
R82	63-2695	2.2 OHM 10% 2 W		L		
R83	63-3171	1 MEGOHM TONE CONTROL			L	
R84	63-966	4700 OHM 2 W			LF	
R85	63-2265	330 OHM 1 W			EF	
R86	63-1932	3.3 MEGOHM 10% 1/2 W			E	
R87	63-1670	150K OHM 10% 1/2 W			E	
R88	63-2815	2.5 MEGOHM [illegible] W			EF	
R89	63-2114	2.2 OHM 10% 1/2 W			E	
R90	63-2224	150 OHM 1 W			E	
R91	63-942	15K OHM 10% 2 W			[illegible]	
R92	63-1061	12K OHM 10% 2 W			E	
R93	63-2606	30 OHM 2 W			E	
R94	63-2612	VERTICAL LINEARITY			EF	
R95	63-3172	SCREEN REGISTER			E	
R96	63-2636	VOLUME CONTROL			CEEF	
R97	63-3166	1000 OHM 5% 1 W			[illegible]	
R98	63-2696	VERTICAL HOLD			[illegible]	
R99	63-3162	470 OHM 1 W			E	
R100	63-1193	27K OHM 10% 1 W			F	
R101	63-1752	1500 OHM 10%			F	
R102	63-1789	1200 OHM 10%			F	
R103	63-1905	680K OHM			F	
R104	63-2654	8.2 OHM 10%			F	
R105	63-1543	33K OHM 10% 2 W			F	
R106	63-1623	47 OHM 2 W			F	
R107	63-1912	1 MEGOHM			F	
R108	63-3169	220K OHM 10% 2 W			F	

DIAG.	PART	DESCRIPTION	R.F.	VIDEO	SWEEP	POWER
L1	20-391	R.F. CHOKE ASSEMBLY	L			
L2	S-16884	FILAMENT CHOKE		L		
L3	S-20503	I.F. TRAP COIL ASSEMBLY	L			
L4	20-431	INTERSTAGE CASCODE COIL	L			
L5	20-464	R.F. PLATE IND. TRIMMER COIL	L			
L6	20-485	CONVERTER GRID IND. TRIMMER COIL	L			
L7	12-1904	MUTUAL IND. TRIMMER	L			
L8	S-20139	CONVERTER PLATE COIL ASSEMBLY	L			
L9	S-16859	OSCILLATOR PLATE COIL ASSEMBLY	L			
L10	20-447	OSCILLATOR IND. TRIMMER COIL	L			
L11	S-20260	ADJACENT CHANNEL PIX TRAP COIL ASSEMBLY		L		
L12	S-18210	ADJACENT CHANNEL SOUND TRAP COIL ASSEM.		L		
L13	S-19958	ASSOCIATED CHANNEL SOUND TRAP COIL ASSE		L		
L14	S-19955	4TH VIDEO I.F. WINDING ASSEMBLY		L		
L15	S-19954	DETECTOR SERIES PEAKING COIL ASSEMBLY		L		
L16	S-15126	TWEET COIL ASSEMBLY		L		
L17	S-19953	DETECTOR SHUNT PEAKING COIL ASSEMBLY		L		
L18	S-19669	SCREEN REGISTER COIL ASSEMBLY			AC	
L19	S-19859	SOUND TAKE OFF COIL ASSEMBLY		L		
L20	S-20021	VIDEO SERIES PEAKING COIL ASSEMBLY		L		
L21	S-17958	VIDEO SHUNT PEAKING COIL ASSEMBLY		L		
L22	S-20219	INTERCARRIER COIL ASSEMBLY		L		
L23	S-19001	QUADRATURE COIL ASSEMBLY		L		
L24						
L25						
L26	S-19743	HORIZONTAL OSCILLATOR COIL ASSEMBLY			L	
L27	S-16748	WIDTH COIL ASSEMBLY			ACEF	
L28	S-18570	LINEARITY COIL ASSEMBLY			ABCD	
L29						
L30						
L31						
L32						
L33						
L34						
L35	S-19342	HORIZONTAL LINEARITY COIL			EF	
L36	S-20367	TRAP COIL ASSEMBLY			ABCDE	
L37	S-19485	WIDTH COIL ASSEMBLY			BD	
L38	S-20438	TRAP COIL ASSEMBLY			F	
T22	95-1311	POWER TRANSFORMER			L	
T21	S-20099	HORIZONTAL SWEEP TRANSFORMER			F	
T20	95-1340	AUDIO OUTPUT TRANSFORMER			BD	
T19	95-1356	DEFLECTION COIL			F	
T18	95-1352	VERTICAL OUTPUT TRANSFORMER			F	
T17	95-1334	CHOKE				F
T16	95-1170	CHOKE				F
T15	95-1353	POWER TRANSFORMER				F
T14	S-19728	HORIZONTAL SWEEP TRANSFORMER			BD	
T13	S-19032	HORIZONTAL SWEEP TRANSFORMER			E	
T12	95-1358	DEFLECTION COIL			E	
T11	95-1346	FILTER CHOKE			E	
T10	S-18567	HORIZONTAL SWEEP TRANSFORMER ASSEMBLY			AC	
T9	95-1346	FILTER CHOKE			ABCD	
T8	95-1298	POWER TRANSFORMER			ABCD	
T7	95-1357	DEFLECTION COIL			ABCD	
T6	95-1361	VERTICAL OUTPUT TRANSFORMER			ABCD	
T5	95-1336	AUDIO OUTPUT TRANSFORMER			ABCD	
T4	S-19656	4TH VIDEO I.F. TRANSFORMER ASSEMBLY		L		
T3	S-19952	3RD VIDEO I.F. TRANSFORMER ASSEMBLY		L		
T2	S-17907	2ND VIDEO I.F. TRANSFORMER ASSEMBLY		L		
T1	S-16739	1ST VIDEO I.F. TRANSFORMER ASSEMBLY		L		

"L" DESIGNATES USED ON ALL CHASSIS.

"A" DESIGNATES 19L25 CHASSIS
"B" DESIGNATES 19L26 CHASSIS
"C" DESIGNATES 19L27 CHASSIS

"D" DESIGNATES 19L28 CHASSIS
"E" DESIGNATES 21L21 CHASSIS
"F" DESIGNATES 22L20 CHASSIS

Fig. 29 Circuit Legend.

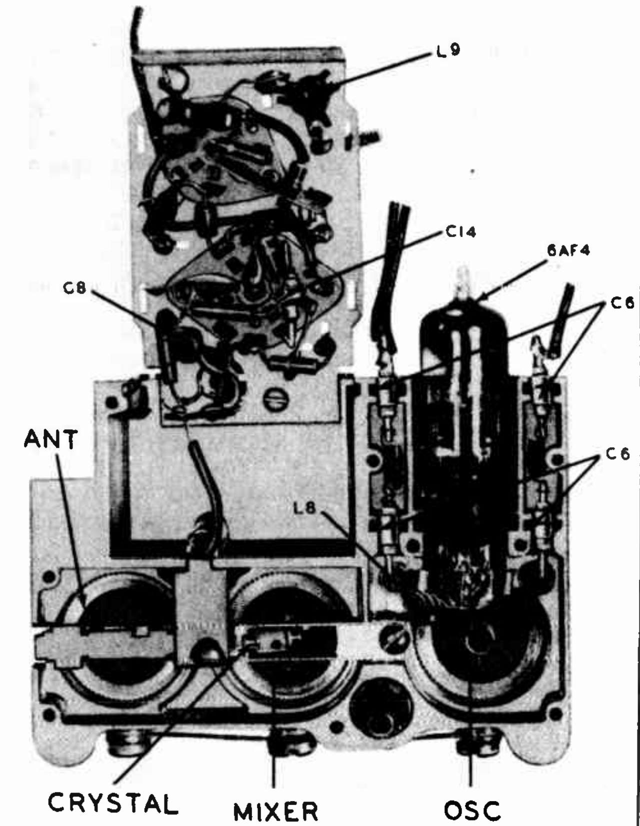


Fig. 27 Bottom View S-19670 Continuous Tuner.

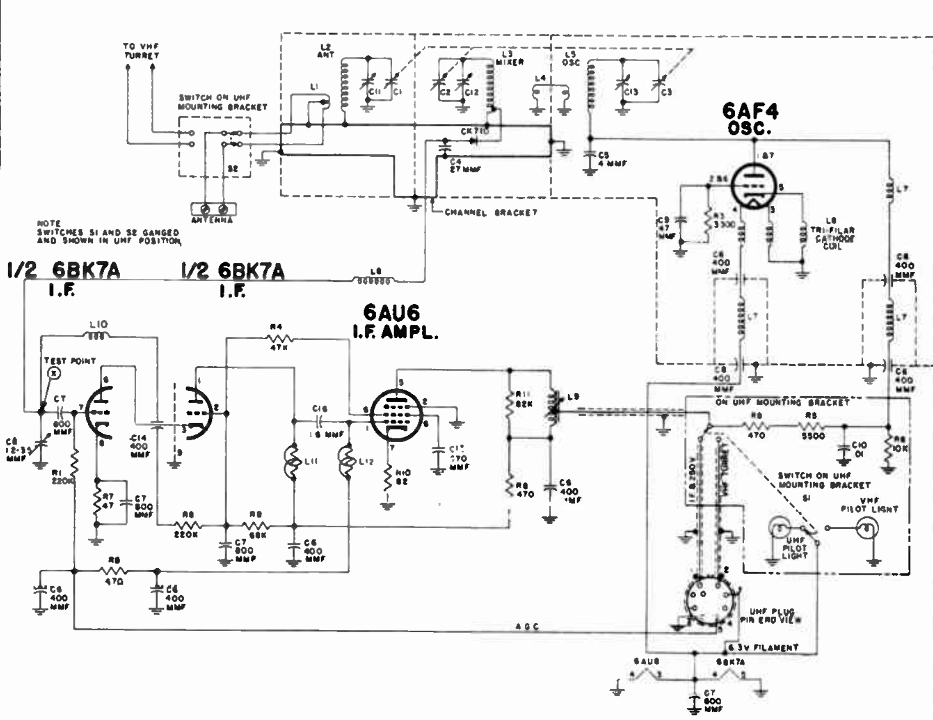


Fig. 28 Schematic Diagram S-19670 Continuous Tuner.

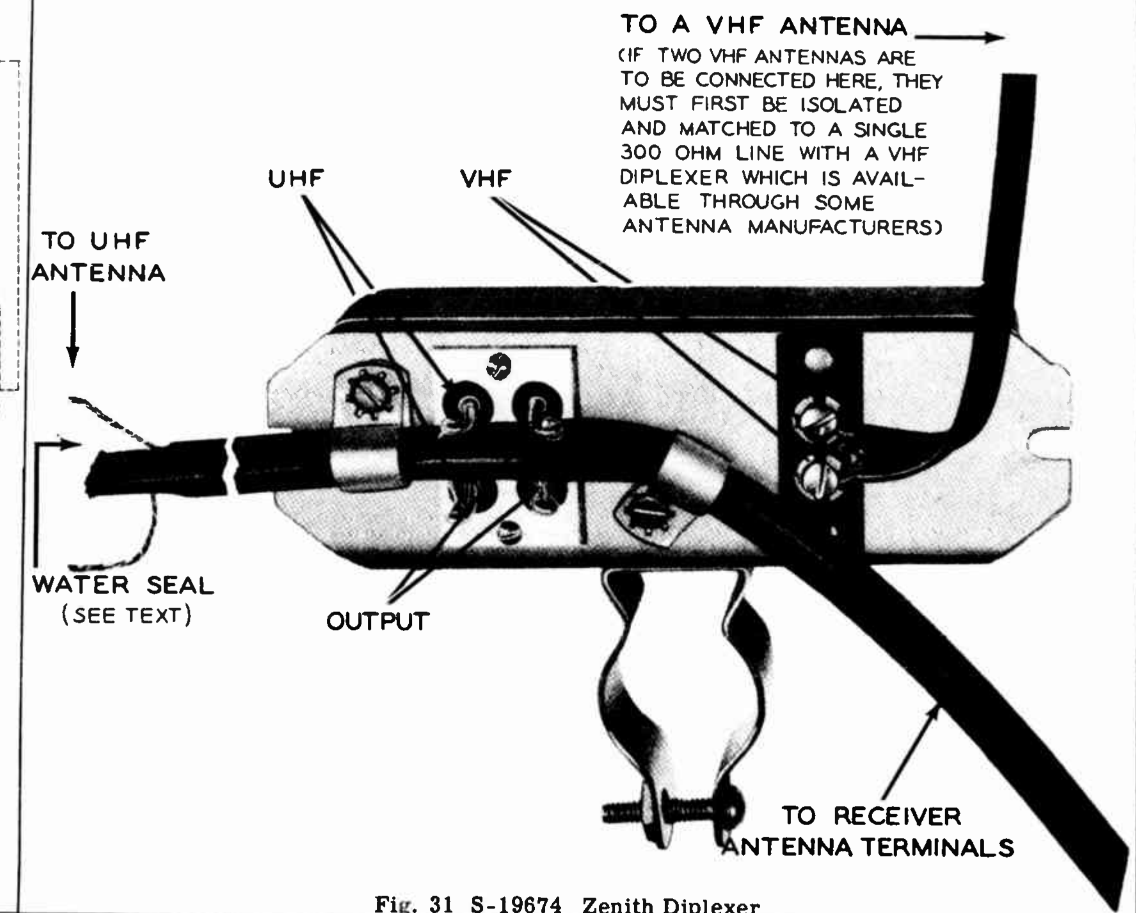


Fig. 31 S-19674 Zenith Diplexer

ITEM NO	PART NO	DESCRIPTION
C1	149-128	ANTENNA SLUG
C2	149-128	MIXER SLUG
C3	149-127	OSCILLATOR SLUG
C4	22-2509	27 MMF ±1 MMF CER DISC CAP 500V
C5	22-2454	4 MMF ±1/2 MMF " " " 500V
C6	22-2404	400 MMF GMV FT CAP 500V
C7	22-2331	800 MMF GMV CER DISC CAP 500V
C8	22-2405	12-35 MMF CER TRIM CAP 500V
C9	22-1867	47 MMF CER DISC CAP 500V
C10	22-3	.01 MFD -20+100% 500V
C11	112-886	ANTENNA TRIMMER
C12	112-886	MIXER TRIMMER
C13	112-886	OSCILLATOR TRIMMER
C14	22-2503	400 MMF GMV FT CAP 500V
C15	22-2302	470 MMF CER 500V
C16	22-2428	1.8 MMF MOULDED GIMMIC 500V

L1	S-19683	FINAL ANT LEAD ASSEM
L2	20-426	ANT TUNING COIL
L3	20-424	MIXER TUNING COIL
L4	20-488	COUPLING COIL
L5	20-426	OSC TUNING COIL
L6	S-20535	GRID COIL ASSEM
L7	20-425	R.F. CHOKE
L8	20-423	TRI-FILAR CATHODE COIL
L9	S-20608	PENTODE PLATE COIL ASSEM
L10	S-19641	NEUTRALIZING COIL ASSEM
L11	S-20607	CASCODE PLATE COIL ASSEM
L12	S-20610	PENTODE GRID COIL ASSEM

R1	63-1884	220K OHM 20% 1/2 W
R2	63-1883	220K OHM 10% 1/2 W
R3	63-1808	3300 OHM 10% 1/2 W
R4	63-1855	47K OHM 10% 1/2 W
R5	63-3136	5500 OHM 10% VE 10 W
R6	63-1198	10K OHM 10% 2 W
R7	63-1729	47 OHM 10% 1/2 W
R8	63-1772	470 OHM 20% 1/2 W
R9	63-1862	68K OHM 10% 1/2 W
R10	63-1740	82 OHM 10% 1/2 W
R11	63-1866	82K OHM 10% 1/2 W

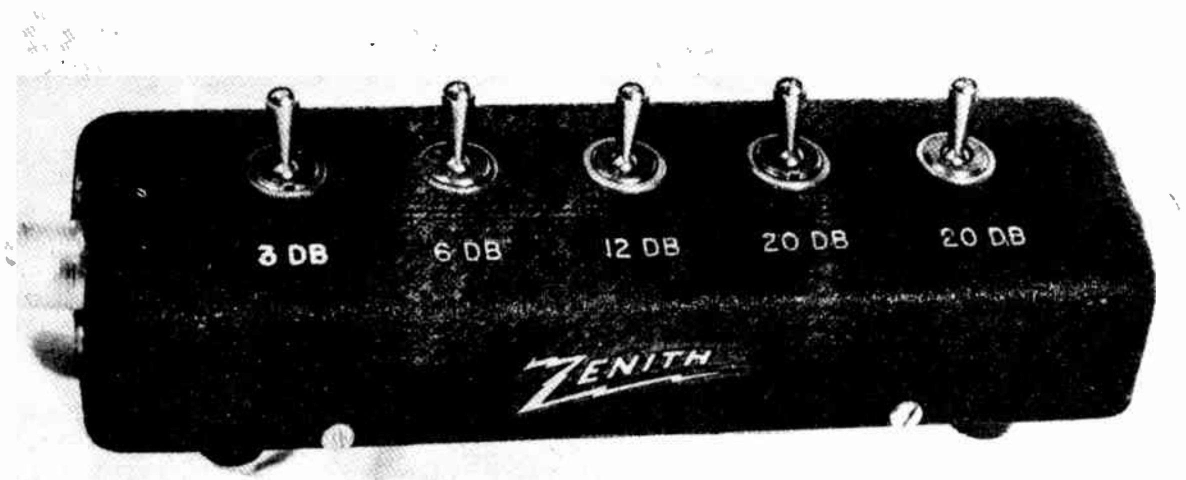


Fig. 30 S-17203 Zenith Step Attenuator.

The Zenith Diplexer is a high quality matching unit which makes it possible to use a single, low-loss tubular transmission line, part number 91-1514, for a combination UHF-VHF antenna system. (Certain tubular lines do not have double wall construction and cannot be sealed in the manner outlined below.)

The finest low-loss materials are employed in the Zenith Diplexer. Plexiglass insulation is used at the UHF connection points to prevent moisture absorption. The capacitors in the filter portions of the Diplexer are of the highest quality ceramics and the inductances are especially treated for humidity.

The Diplexer has three pairs of terminals.

a. The pair marked "VHF" are to be connected to the VHF antenna.

b. The middle pair marked "Output" are to be connected to the transmission line leading to the TV receiver.

c. The pair marked "UHF" are for the UHF antenna connection.

INSTALLATION PROCEDURE

Transmission lines for UHF frequencies must be of the low-loss tubular type. The flat ribbon line such as is used on VHF seriously attenuates the UHF signals when wet or contaminated by foreign material, such as soot, etc.

When installing a Diplexer, it is of utmost importance to seal the 300 ohm tubular line to prevent water from entering the hollow interior of the tube. In order to do this, the tube must not be cut or punctured for its entire length from the UHF antenna to the TV receiver. It is necessary, however, to pull the wires out to make the Diplexer connections as illustrated. To do this without puncturing the tube, proceed as follows:

1. Approximately 6 feet (length determined by distance between Diplexer and UHF antenna terminals) from one end of the tubular line, slice off one inch of ridge on both sides until the wires are exposed. Use extreme care not to cut any of the strands when slicing off the ridge. The knife should not be too sharp.

2. Insert a pointed tool and pull up the center of each wire and cut it in half.

3. Pull out the four ends and solder to the connecting

terminals as shown in the illustration. When the wires are pulled out in this manner, the inner wall is not punctured and the cable remains water tight.

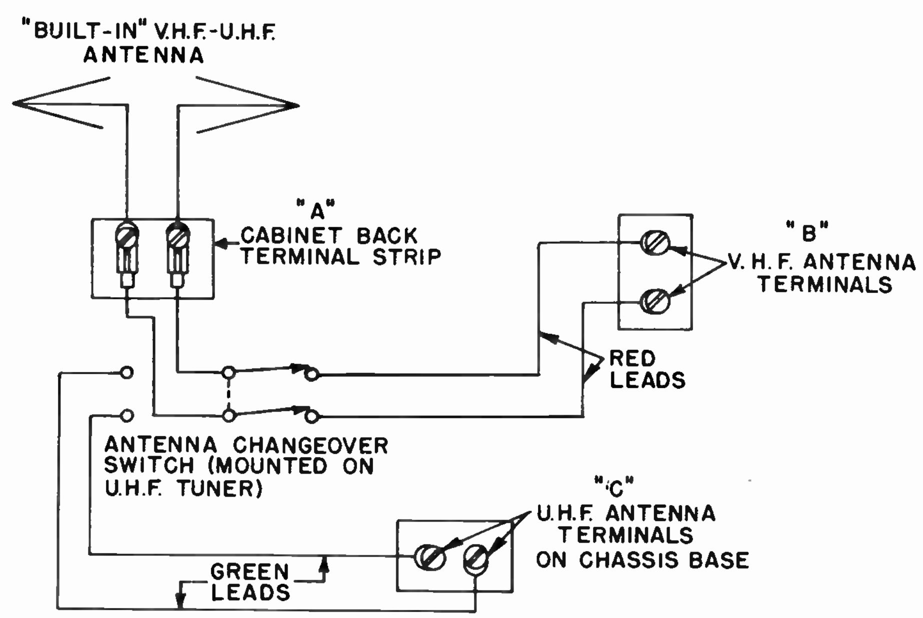
4. Affix the two plastic clamps to secure the line.

5. Mount the Diplexer on the mast FACE DOWN to prevent rain or snow from collecting on the plexiglass insulator.

6. Cut off excess tubular line and prepare the line for making connections to the UHF antenna. To do this, refer to step 1 and peel off approximately two inches of wire from each side, at the end of the cable. Cut off the tube so that it extends one inch. With a pair of long nose pliers, grasp the tube and flatten it. While holding the line flat, run a hot iron over the end until the tube is permanently sealed. Connect the leads to the terminals of the UHF antenna.

7. Run a piece of flat 300 ohm line from the VHF terminals on the Diplexer to the VHF antenna. Secure connections.

8. When running the line from the Diplexer to the receiver, use stand-off insulators and use extreme care to keep the line as far from metal pipes, gutters, etc. as is practical. Outside, at the point of entrance to the house, cut off the tubular line and splice on a flat piece of 300 ohm line from this point to receiver. Leave the tubular line open and facing downward so that any water which results from condensation can run out.



UHF-VHF Antenna Connections.

ANTENNA CONNECTIONS

On TV receivers incorporating the UHF continuous tuner there are three pairs of terminals at the rear, labeled A, B and C which enable the receiver to operate with any one of the following antenna combinations:

1. USE OF THE BUILT-IN ANTENNA FOR VHF AND UHF

See illustration for connections. The receiver is shipped from the factory connected in this manner.

2. USE OF A COMBINED VHF AND UHF ANTENNA SYSTEM WITH A ZENITH DIPLEXER AND A SINGLE TRANSMISSION LINE

Disconnect the built-in antenna from terminals "A" and connect the combined UHF-VHF antenna transmission line at this point. If you are near the station, it may be found that an existing VHF antenna works satisfactorily on UHF and should be connected in this same manner.

3. USING THE BUILT IN ANTENNA FOR VHF IN CONJUNCTION WITH EXTERNAL UHF ANTENNA

Connections are made as in illustration. Disconnect the green leads and connect the UHF antenna to terminal "C".

4. USE OF THE BUILT-IN ANTENNA FOR VHF IN CONJUNCTION WITH AN EXTERNAL VHF ANTENNA

See illustration. Disconnect red leads and connect VHF antenna to terminals "B"

5. USE OF SEPARATE EXTERNAL ANTENNAS FOR VHF AND UHF

Disconnect both the red and green leads and connect the external VHF antenna to terminals "B" and the external UHF antenna to terminals "C". This type of connection is recommended in fringe areas since the UHF-VHF changeover switch (which introduces a slight loss on some channels) is by-passed.

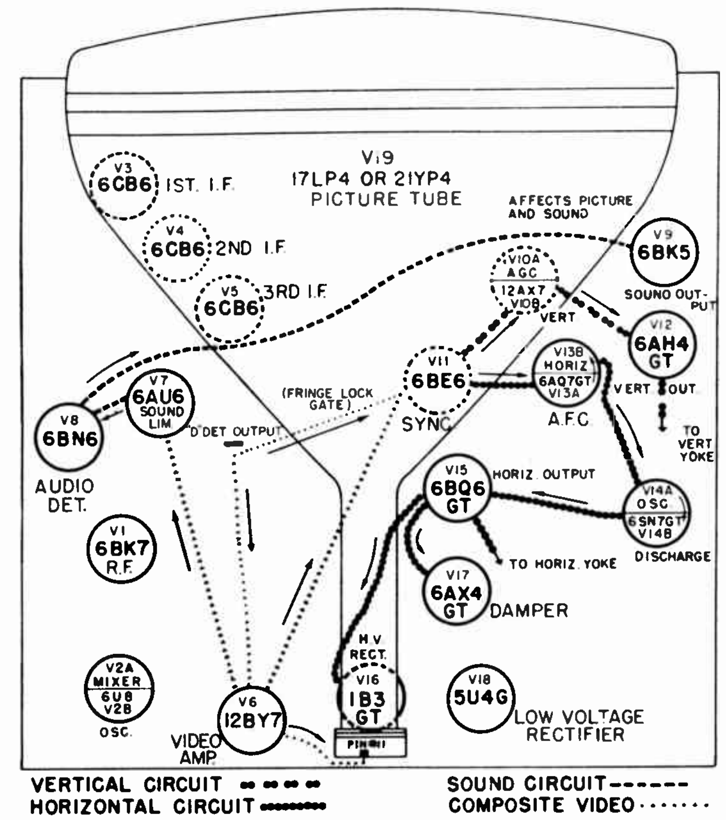


Fig. 32 Signal Path Chart 19L Series Receivers.

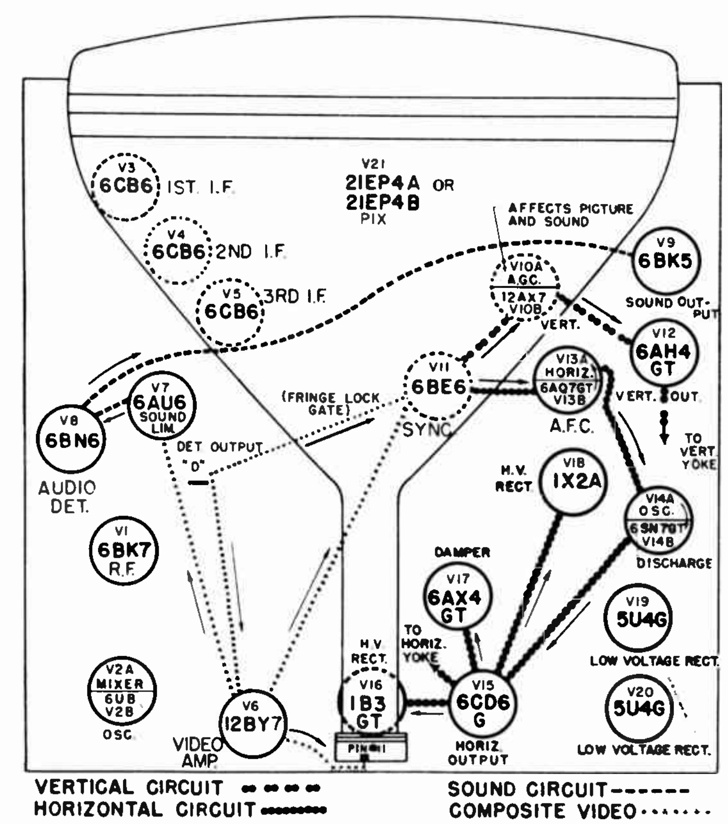


Fig. 33 Signal Path Chart 21L21 Chassis.

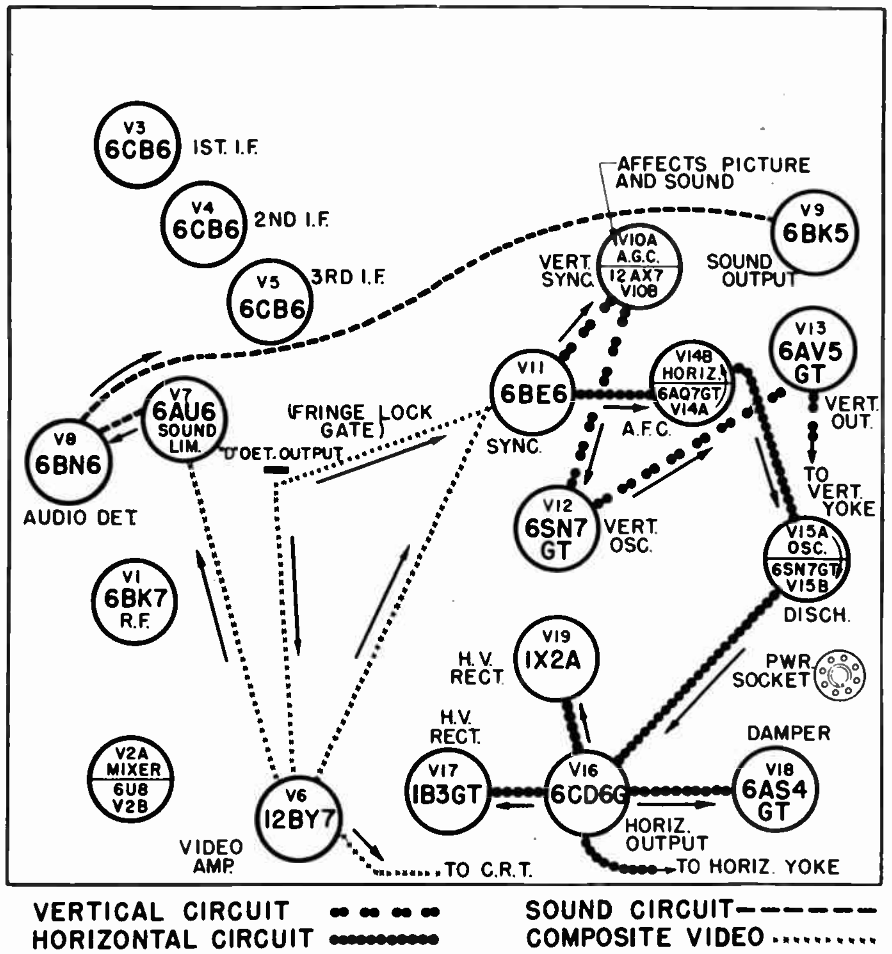


Fig. 34 Signal Path Chart 22L20 Chassis.

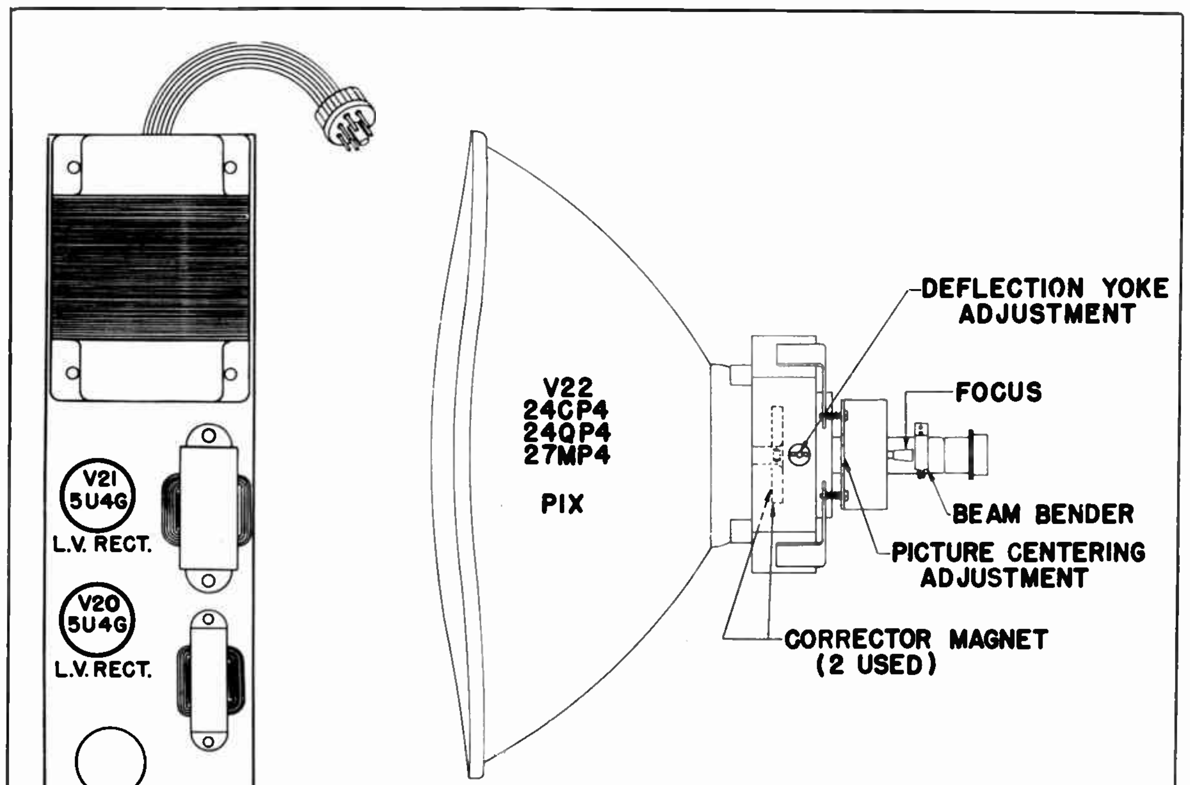
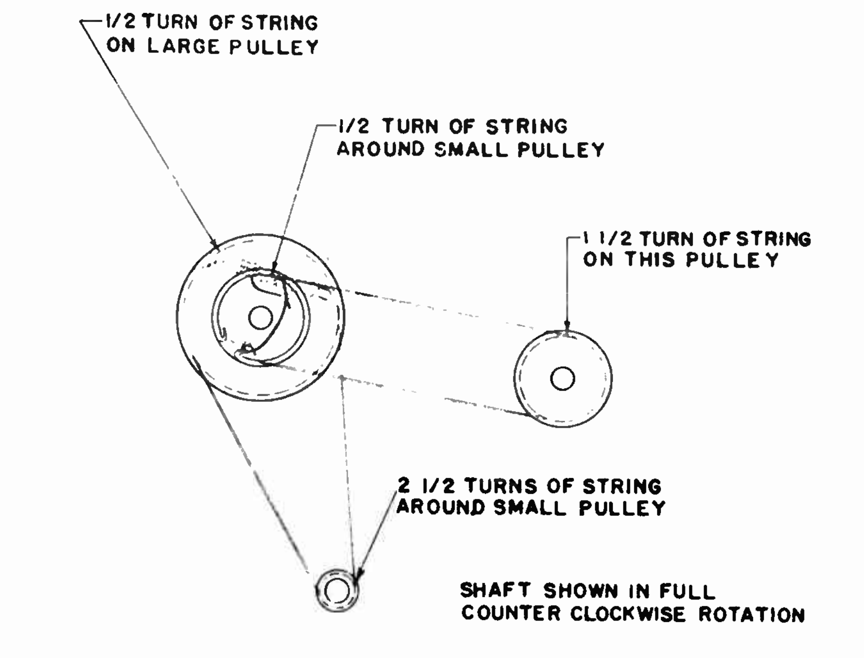


Fig. 35 Power Supply and Picture Tube Mounting 22L20 Chassis.

VHF-UHF FREQUENCY ALLOCATIONS

Chan. No.	Frequency Band (Mc)	Video Carrier	Audio Carrier	Chan. No.	Frequency Band (Mc)	Video Carrier	Audio Carrier
2	54-60	55.25	59.75	43	644-650	645.25	649.75
3	60-66	61.25	65.75	44	650-656	651.25	655.75
4	66-72	67.25	71.75	45	656-662	657.25	661.75
5	76-82	77.25	81.75	46	662-668	663.25	667.75
6	82-88	83.25	87.75	47	668-674	669.25	673.75
7	174-180	175.25	179.75	48	674-680	675.25	679.75
8	180-186	181.25	185.75	49	680-686	681.25	685.75
9	186-192	187.25	191.75	50	686-692	687.25	691.75
10	192-198	193.25	197.75	51	692-698	693.25	697.75
11	198-204	199.25	203.75	52	698-704	699.25	703.75
12	204-210	205.25	209.75	53	704-710	705.25	709.75
13	210-216	211.25	215.75	54	710-716	711.25	715.75
14	470-476	471.25	475.75	55	716-722	717.25	721.75
15	476-482	477.25	481.75	56	722-728	723.25	727.75
16	482-488	483.25	487.75	57	728-734	729.25	733.25
17	488-494	489.25	493.75	58	734-740	735.25	739.75
18	494-500	495.25	499.75	59	740-746	741.25	745.75
19	500-506	501.25	505.75	60	746-752	747.25	751.75
20	506-512	507.25	511.75	61	752-758	753.25	757.75
21	512-518	513.25	517.75	62	758-764	759.25	763.75
22	518-524	519.25	523.75	63	764-770	765.25	769.75
23	524-530	525.25	529.75	64	770-776	771.25	775.75
24	530-536	531.25	535.75	65	776-782	777.25	781.75
25	536-542	537.25	541.75	66	782-788	783.25	787.75
26	542-548	543.25	547.75	67	788-794	789.25	793.75
27	548-554	549.25	553.75	68	794-800	795.25	799.75
28	554-560	555.25	559.75	69	800-806	801.25	805.75
29	560-566	561.25	565.75	70	806-812	807.25	811.75
30	566-572	567.25	571.75	71	812-818	813.25	817.75
31	572-578	573.25	577.75	72	818-824	819.25	823.75
32	578-584	579.25	583.75	73	824-830	825.25	829.75
33	584-590	585.25	589.75	74	830-836	831.25	835.75
34	590-596	591.25	595.75	75	836-842	837.25	841.75
35	596-602	597.25	601.75	76	842-848	843.25	847.75
36	602-608	603.25	607.75	77	848-854	849.25	853.75
37	608-614	609.25	613.75	78	854-860	855.25	859.75
38	614-620	615.25	619.75	79	860-866	861.25	865.75
39	620-626	621.25	625.75	80	866-872	867.25	871.75
40	626-632	627.25	631.75	81	872-878	873.25	877.75
41	632-638	633.25	637.75	82	878-884	879.25	883.75
42	638-644	639.25	643.75	83	884-890	885.25	889.75



DIAL CORD DRIVE

RADIO CH. 8L20

The 8L20 chassis incorporates a superheterodyne circuit with two stages of IF, on the FM Band, and one stage on the AM Band. There is one stage of RF amplification on all Bands.

When adjustments are made on the 8L20 chassis, a line isolation transformer (110 V input to 110 V output) is recommended in order to avoid a "hot" chassis. If an isolation transformer is not available, check the AC voltage between chassis and bench ground and if there is any indication of voltage, reverse the plug before handling the set.

FM RF Alignment: The tunning slugs are attached to threaded shafts and the slugs are varied in the field of the coils by turning the shafts clockwise or counter-clockwise. After adjustment the shafts must be secured with a drop of speaker cement.

AM and FM IF Alignment: The AM and FM IF transformers in this receiver are of the new permeability tuned type. The advantage of an IF transformer of this type is its extreme stability under various humidity and temperature conditions. The upper coil is the secondary and the lower the primary. When adjusting these IF transformers the tuning wrench 68-19 can be inserted into the top slug, rotated until maximum output is obtained and then dropped down to the lower slug and the same operation repeated. The tuning wrench is so designed that turning one slug does not affect the adjustment of the other.

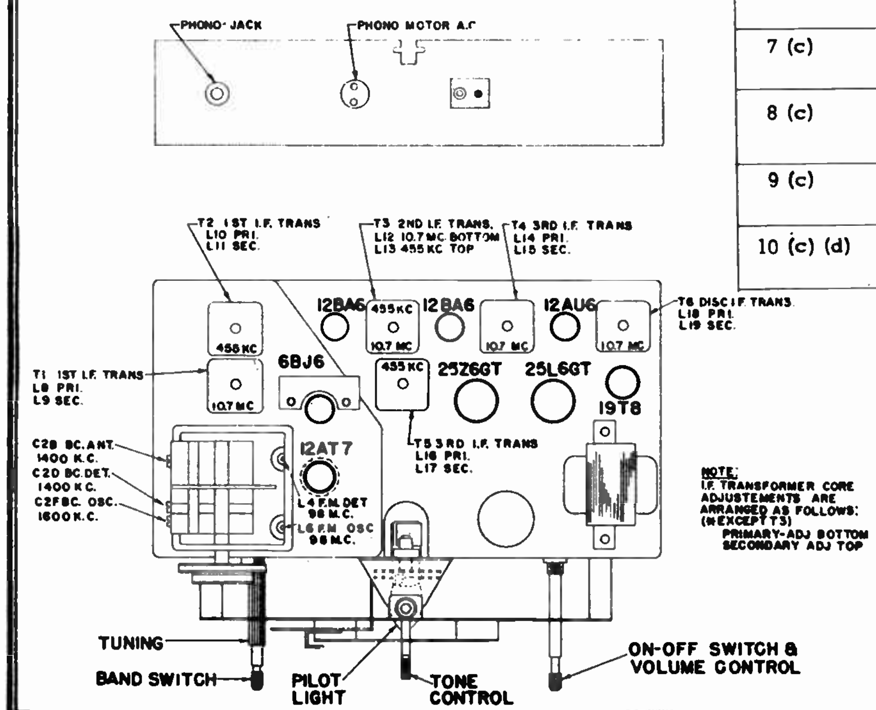
FM IF Alignment: Because ot the wide band pass, it is desirable to use a FM signal generator and a cathode ray oscilloscope when aligning the FM IF channel. If visual alignment equipment is unavailable, reasonably accurate alignment can be made by following the procedure outlined below.

FM Discriminator Alignment: When the secondary of the discriminator is aligned (operation 5) use sufficient signal input to get a good positive and negative indication before setting the slug for zero reading. A center zero indicating meter is recommended for this adjustment, but is not absolutely necessary. Reversing the leads of a non-zero center meter, or observing closely when the meter starts to go to the left (negative) of zero will give the same results.

ALIGNMENT PROCEDURE

Operation	Connect Oscillator To	Dummy Antenna	Input Signal Frequency	Band	Set Dial To	Adj. Trimmers	Purpose
1	Pin 2 12AT7 Converter	.05 Mfd.	455 Kc. Modulated	BC	600 Kc.	L10, 11, 13, 16 & 17	Align I.F. channel for maximum output.
2	2 turns loosely cpld. to wavemagnet		1600 Kc. Modulated	BC	1600 Kc.	C2F	Set oscillator to dial scale.
3	2 turns loosely cpld. to wavemagnet		1400 Modulated	BC	1400 Kc.	C2D, C2B	Align detector and antenna stage.
4 (a)	Pin 1 (grid) on 12AU6 Limiter.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L18 coil slug Primary discr.	Align primary of discriminator for maximum reading.
5 (b)	Pin 1 (grid) on 12AU6 limiter	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L19 coil slug sec. of discr.	Adjust secondary ot discriminator for zero reading
6 (c)	Pin 1 (grid) on 12BA6 2nd I.F.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L14 and L15 Pri. & Sec. of 3rd IF trans.	Align 3rd. IF transformer for maximum reading.
7 (c)	Pin 1 (grid) on 12BA6 1st IF.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		Adjust L12 for maximum reading.	Align 2nd IF transformer for maximum reading.
8 (c)	Pin 2 (grid) on 12AT7 converter tube socket.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L8 and L9 Prim and Sec. of 1st IF transformer	Align 1st IF transformer for maximum reading.
9 (c)	Antenna Post FM (Remove line ant.)	270 ohms	98 Mc. Unmodulated	FM 100	98 Mc.	L6 Osc. Coil Slug.	Set Oscillator to dial scale.
10 (c) (d)	Antenna Post FM (Remove line ant.)	270 ohms	98 Mc. Unmodulated	FM 100	98 Mc.	L4 Det. Coil Slug	Align det. stage to maximum reading.

TUBE AND TRIMMER LOCATION



IMPORTANT

Alignment of this chassis will in most cases be unnecessary unless an IF or RF transformer ir replaced or the adjustments have been tampered with.

Correct alignment can only be made if the following procedure is followed:

A vacuum tube voltmeter with an isolation resistor of 2,000,000 ohms in series with the hot lead will serve for FM adjustments. This lead should be shielded.

An AC output meter connected across the primary or secondary of the output transformer will be satisfactory for all AM adjustments.

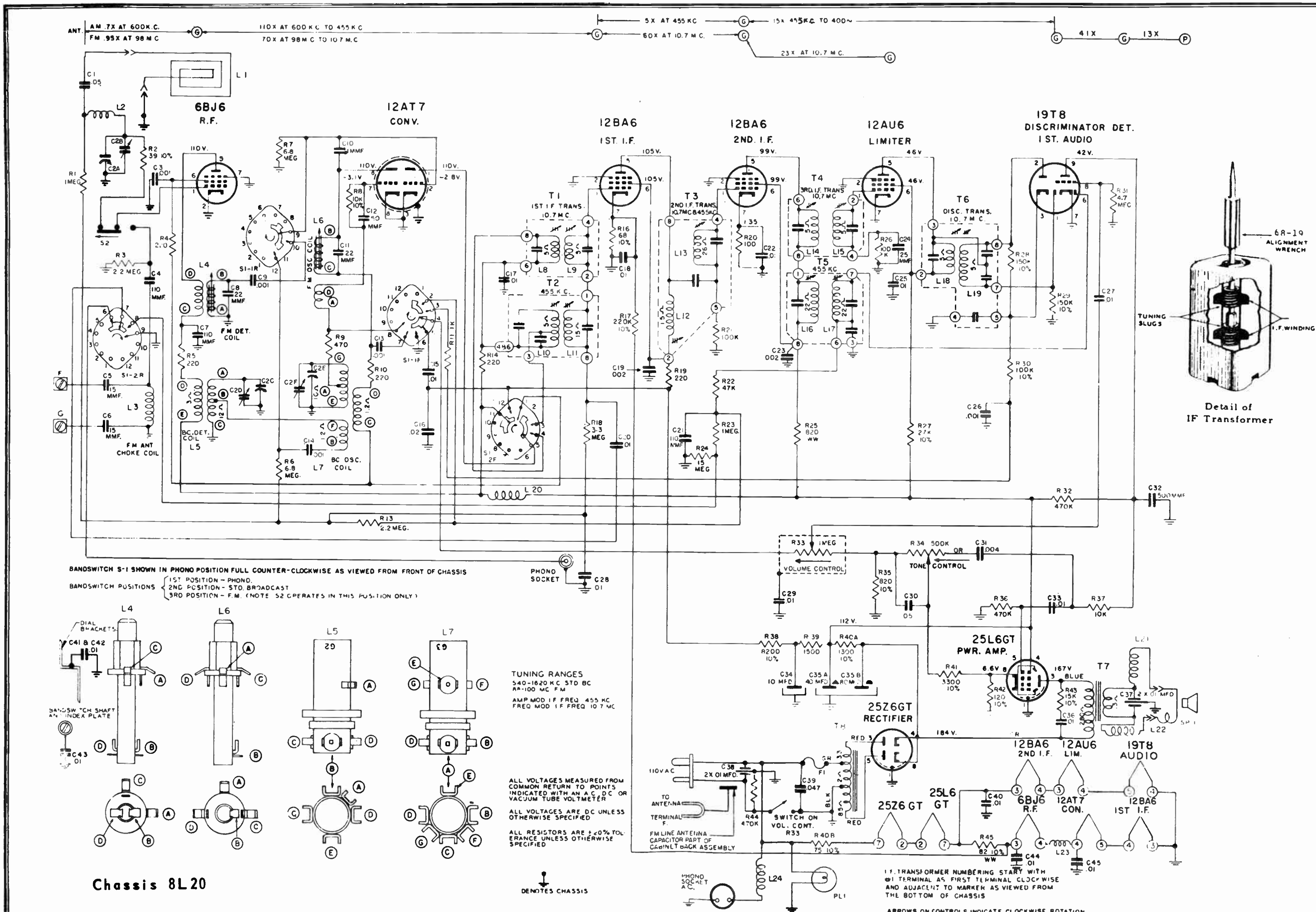
The signal generator output should be kept just high enough to get an indication on the meter.

(a) Vacuum Tube Voltmeter Lug 7 on discriminator transformer to chassis (half discriminator load).

(b) Vacuum Tube Voltmeter Lug 5 on discriminator transformer to chassis (full discriminator load).

(c) Vacuum Tube Voltmeter from Limiter Grid to Chassis.

(d) Loosen Slugs by applying a hot. iron to the cement.



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RADIO Ch. 8L20, Ch. 19L27

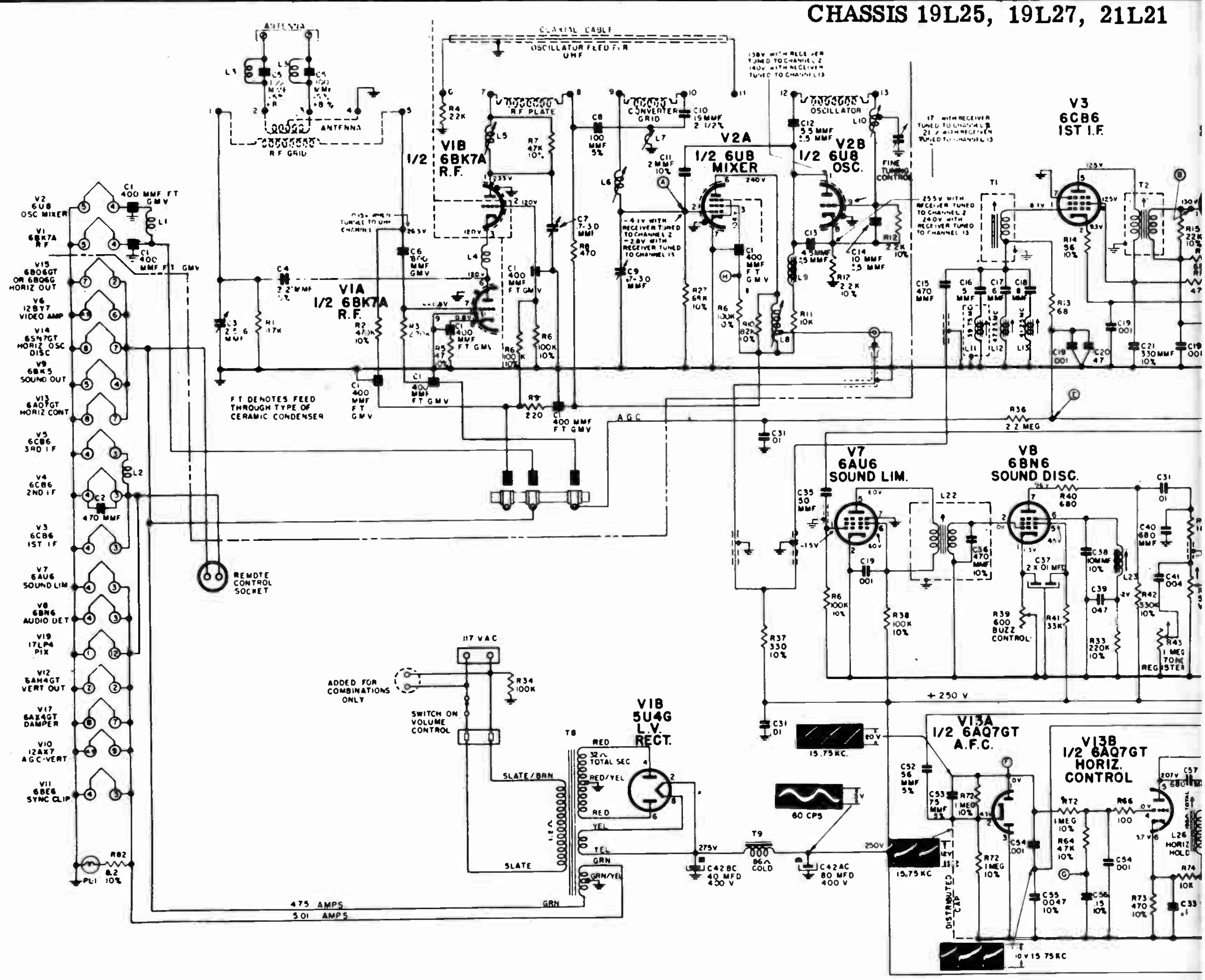
PARTS LIST

PART NO.	DIAG. NO.	DESCRIPTION		PRICE
		CHASSIS 8L20		
12-1794		Candolm Mtg. Bracket		.30
20-337		R. F. Choke Coil (4 used)		.20
22-3	C15,27,41	.01 Mfd. Ceramic	500V (16 used)	.26
22-4	C31	.004 Mfd. Ceramic	500V	.26
22-5	C4,7,21	110 Mmfd. Ceramic	500V (3 used)	.26
22-669	C36	.01 Mfd.	600V	.20
22-829	C1,30	.05 Mfd.	200V (2 used)	.20
22-854	C32	.0005 Mfd.	600V	.20
22-1220	C19,23	.002 Mfd.	600V (2 used)	.20
22-1367	C12	50 Mmfd. Ceramic	500V	.33
22-1379	C16	.02 Mfd. Ceramic	400V	.20
22-1506	C8,11	22 Mmfd. Ceramic	500V (2 used)	.33
22-1507	C24	25 Mmfd. Ceramic	500V	.33
22-1676	C2,9,13,14	.001 Mfd. Ceramic	500V (4 used)	.40
22-1717	C26	.001 Mfd.	200V	.20
22-1762	C10	1 Mmfd. Ceramic	500V	.20
22-1775	C39	.047 Mfd. Molded	400V	.26
22-2105	C35A,35B	Electrolytic 80/250V 40/250V		3.00
22-2140	C5,6	15 Mmfd. Ceramic	500V (2 used)	.20
22-2154	C34	Electrolytic 10/250V		1.25
22-2276	C37,38	Dual Ceramic .01 Mfd.-.01 Mfd.	500V	.50
22-2400	C2A,B,C,D, E,F	Three Section Variable		4.10
44-25		Phono Jack		.20
54-139		3/8-32 x 9/16 Palnut (1 Mt. ea. 63-2131, 63-2132		.01
54-271		6-32 x ¼ Palnut (8 Mt. Transf.)		.01
54-292		Speed Nut (Part of S-17165)		.01
58-128		Two Prong Plug (A.C. Interlock)		.15
63-1576	R38	8200 Ohm 1 W Ins. 10%		.24
63-1726	R20	39 Ohm ½ W Ins. 10%		.21
63-1736	R16	68 Ohm ½ W Ins. 10%		.21
53-1744	R20	100 Ohm ½ W Ins. 20%		.21
63-1758	R10,14,19	220 Ohm ½ W Ins. 20% (5 used)		.21
63-1772	R9	470 Ohm ½ W Ins. 20%		.21
63-1782	R35	820 Ohm ½ W Ins. 10%		.21
63-1786	R11	1 K Ohm ½ W Ins. 20%		.21
63-1793	R39	1500 Ohm ½ W Ins. 20%		.21
63-1806	R41	3300 Ohm ½ W Ins. 10%		.21
63-1827	R8	10 K Ohm ½ W Ins. 10%		.21
63-1828	R37	10 K Ohm ½ W Ins. 20%		.21
63-1834	R43	15 K Ohm ½ W Ins. 10%		.21
63-1845	R27	27 K Ohm ½ W Ins. 10%		.21
63-1856	R22	47 K Ohm ½ W Ins. 20%		.21
63-1869	R30	199K Ohm ½ W Ins. 10%		.21
63-1870	R21,26	100K Ohm ½ W Ins. 20% (2 used)		.21
63-1876	R28,29	150K Ohm ½ W Ins. 10%		.21
63-1898	R32,36,44	470K Ohm ½ W Ins. 20% (3 used)		.21
63-1904		680K Ohm ½ W Ins. 10%		.21
63-1912	R1,23	1 Meg Ohm ½ W Ins. 20% (2 used)		.21
63-1926	R3,13	2.2Meg Ohm ½ W Ins 20%		.21
63-1933	R18	3.3Meg Ohm ½ W Ins 20%		.21
63-1940	R31	4.7Meg Ohm ½ W Ins 20%		.21
63-1947	R6,7	6.8Meg Ohm ½ W Ins 20% (2 used)		.21
63-1961	R24	15Meg Ohm ½ W Ins 20%		.21
63-1981	R42	120 Ohm 1 W Ins. 10%		.24
63-2068	R40A,40B	2 Section Candohn		1.00
63-2091	R25	820 Ohm ½ W Ins. 20%		.21
63-2131	R33	Volume Control & Switch		1.81
63-2132	R34	Tone Control		1.20
63-2428	R45	82 Ohm 2 WWW Ins. 10%		.33
73-131		6-32 X 3/8 Slab Hd. Set Screw		.03

PART NO.	DIAG. NO.	DESCRIPTION	PRICE
78-351		Socket, Two Contact	.18
78-755		Socket, Octal Tube (2 used)	.18
78-850		Socket, Min Tube 9 Contact	.35
78-869		Socket, Min Tube	.20
78-870		Socket, Min Tube (2 used)	.15
78-871		Socket, Min Tube (2 used)	.15
78-895		Dial Light Socket & Wire	.45
80-69		Dial Cord Spring	.05
80-747		Dial Cord Spring	.10
80-780		Iron Core Tension Spring	.05
80-781		Turner Arm Tension Spring	.06
80-865		Ground Spring	.05
80-868		Ground Spring	.15
83-1882		Insulation Strip (Part of S-17821)	.02
85-505	S2	S.P.D.T. Switch	.90
85-534	S1	Band Switch	
93-2		Brass Washer (1 Mt. 22-2154)	.01
93-432		Steel Washer (2 Mt. S-17149)	
93-544		Bakelite Washer (1 Mt. S-17149)	
93-1039		Gang Mtg. Cup Washer (2 used)	.01
93-1061		Insulating Shoulder Washer (3 Mt. S-17149)	.02
94-598		R.F. Plate Mtg. Bushing (3 used)	.01
94-732		Pointer Pulley Bushing (Part of S-17165, Mt. with 54-292)	.30
95-1102	T5	2nd IF Transformer	1.60
95-1150	T4	2nd IF Transformer	2.25
95-1153	T6	Discriminator Transformer	2.25
95-1188	T8	Auto Transformer	1.30
95-1201	T1	1st IF Transformer (FM)	1.50
95-1248	T2	1st IF Transformer (BC)	1.60
95-1251	T3	2nd IF Transformer	1.65
95-1272	T7	Speaker Output Transformer	2.00
112-802		4-24 X 5/8 Rd. Hd. Self Tap Screw (1 Mt. 80-780)	.03
113-8		6-32 X ¼ Hex Hd. Mach. Screw (2 Mt. 85-534)	.02
113-15		6-32 X 5/16 Hex Hd. Mach. Screw (2 Mt. 22-2400)	.02
113-33		4-40 X ¼ Hex Hd. Mach. Screw (2 Mt. 85-505)	.02
113-43		6-32 X 5/16 Hex Hd. Self Tap Screw (1 Mt. S-17149)	.03
114-262		8-82 X 7/16 Hex Hd. Self Tap Screw (2 Mt. S-17149)	.02
114-292		6-32 X 5/8 Hex Hd. Self Tap Screw (3 used)	.01
114-297		6-32 X ¼ Hex Hd. Self Tap Screw (2 Mt. S-17165)	.01
125-62		Rubber Grommet (3 used)	.02
125-85		Rubber Grommet (1 Mt. Ea. S-15691, S-15743)	.05
126-618		Min Tube Shield	.02
136-25	F1	Fuse ¾ Amp.	.30
148-122		Turner Arm	.20
149-95		Iron Core & Spring (2 used)	.30
188-30		Retaining Ring (For S-17155)	.02
188-150		Retaining Ring (For S-17157)	.02
S-13997		Filament Choke Coil	.40
S-15691	L6	FM Oscillator Coil	.40
S-15743	L4	FM Detector Coil	.65
S-16344	L5	B' cast Detector Coil	.60
S-16345	L7	B' cast Oscillator Coil	.60
S-16408	L3	Antenna Choke Coil	.25
S-16838		Speaker Cable & Eyelet	.35
S-17149		Dial Scale & Bracket	1.50
S-17155		Tuning Shaft & Pulley	.35
S-17157		Pointer & Pulley	.55
S-17158		Dial Cord & Eyelet - Long	.07
S-17159		Dial Cord & Eyelet - Short	.06
S-17165		Bracket & Pulley Bushing	.35
S-17819		Wire & Clip (For Ant. Switch)	
S-17821		Switch Arm & Insulator Strip	.10

Prices shown are suggested list prices and are subject to change without notice.

CHASSIS 19L25, 19L27, 21L21



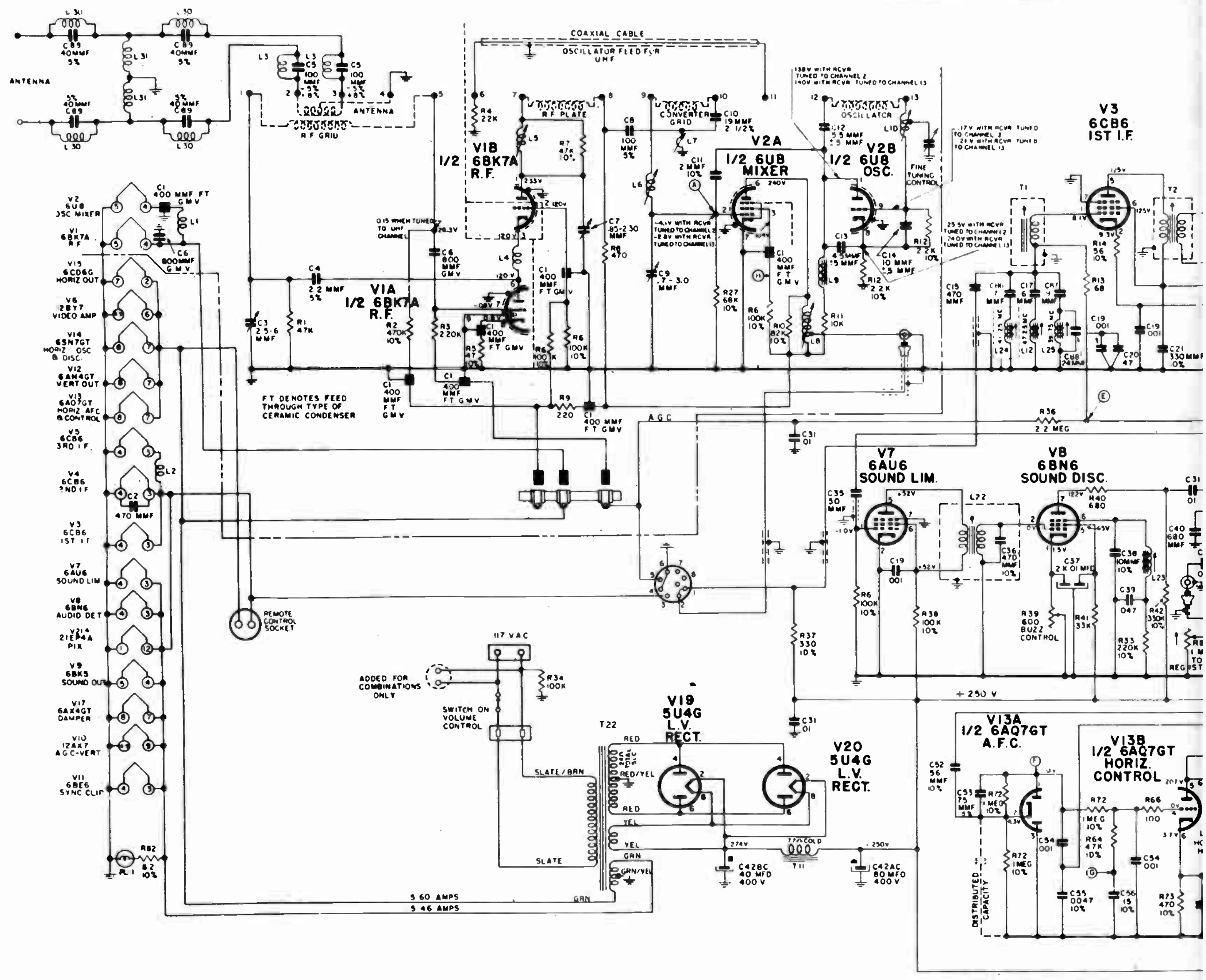
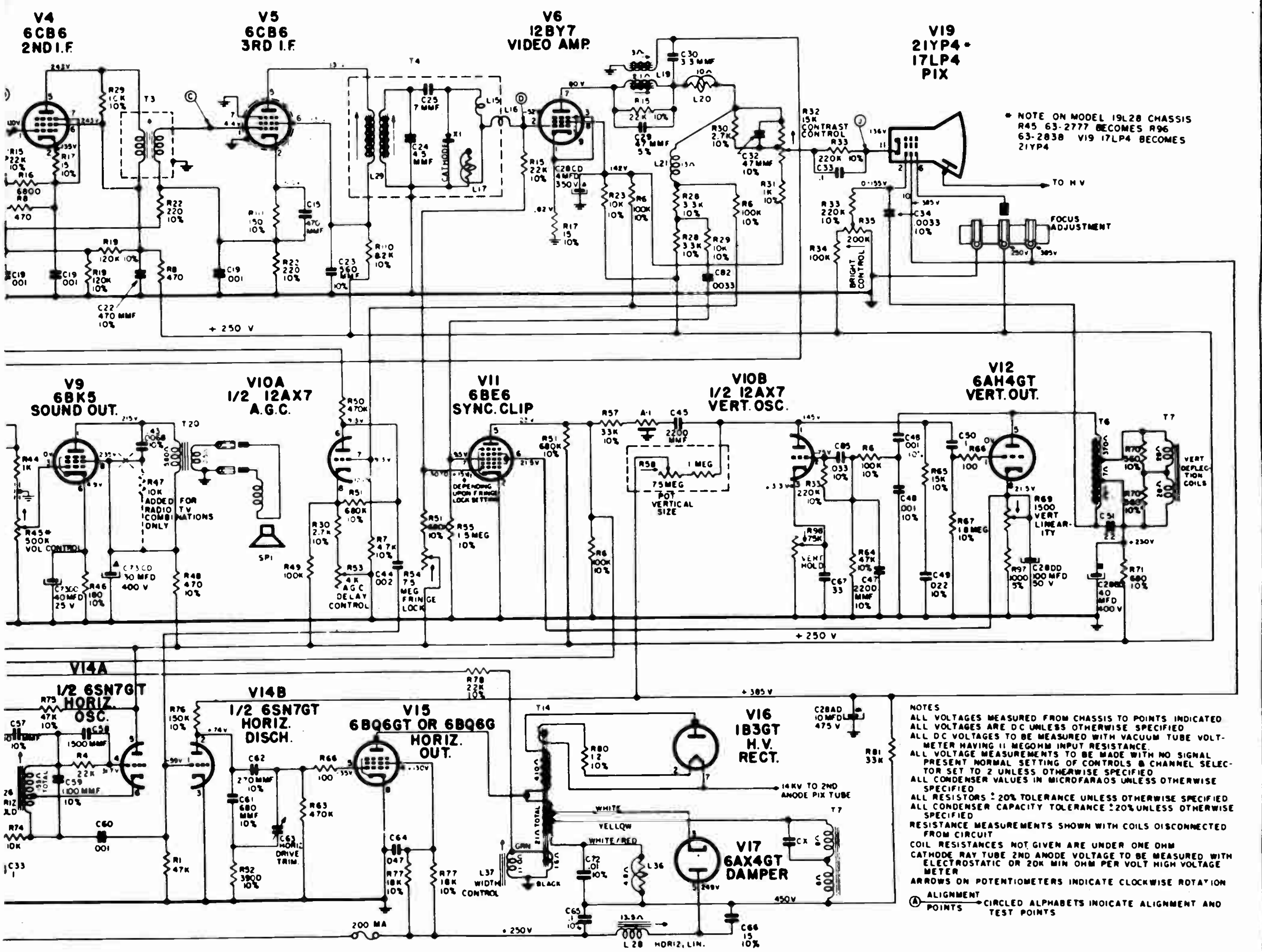


Fig. 36 Schematic Diagram 19L26 & 19L28 Chassis.



NOTES
ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED
ALL VOLTAGES ARE DC UNLESS OTHERWISE SPECIFIED
ALL DC VOLTAGES TO BE MEASURED WITH VACUUM TUBE VOLTMETER HAVING 11 MEGOHM INPUT RESISTANCE.
ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT NORMAL SETTING OF CONTROLS & CHANNEL SELECTOR SET TO 2 UNLESS OTHERWISE SPECIFIED
ALL CONDENSER VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ± 20% TOLERANCE UNLESS OTHERWISE SPECIFIED
ALL CONDENSER CAPACITY TOLERANCE ±20% UNLESS OTHERWISE SPECIFIED
RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT
COIL RESISTANCES NOT GIVEN ARE UNDER ONE OHM
CATHODE RAY TUBE 2ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K MIN OHM PER VOLT HIGH VOLTAGE METER
ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION
Ⓐ ALIGNMENT POINTS → CIRCLED ALPHABETS INDICATE ALIGNMENT AND TEST POINTS

Price .5-1102 T2 2nd IF Transf. 1.60
95-1367 T3 Output Transf.
.03 113-13 6-32 x 7/16 Hex Hd. Mach. Screw (2 Mt. Gang) .02
used) .26 114-67 6-32 x 7/16 Hex Hd. Mach. Screw (1 Mt. Gang) .01
used) .26 114-393 6-32 x 1 3/8 Hex Hd. Mach. Screw (1 Mt. 212-13) .02
.26 114-432 6-18 x 1 7/8 Hex Hd. Self Tap Screw (1 Mt. 63-3190)
.26 125-17 Rubber Grommet (3 Mt. Gang) .03
.20 149-85 Iron Core (Part of S-20612) .10
used) .20 166-65 Rubber Bumper (1 used on Gang) .02
.20 188-149 Retaining Ring (for S-20615) .02
.40 212-13 SE1 Selenium Rectifier 100 MA 1.80
2.75 S-20612 L2 Oscillator Coil
S-20614 Dial Cord & Eyelet
.20 S-20615 Tuning Shaft & Pulley
.24 S-20619 Terminal & Wire (Green)
.01 S-20620 Terminal & Wire (White)
.01
.01
.35
.21
.21
.21
.21
.21
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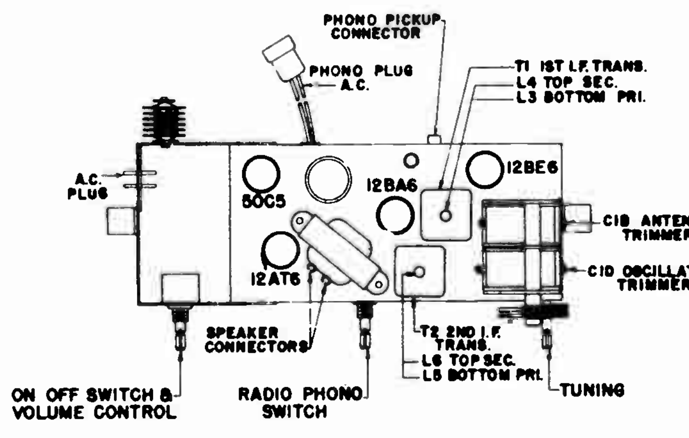
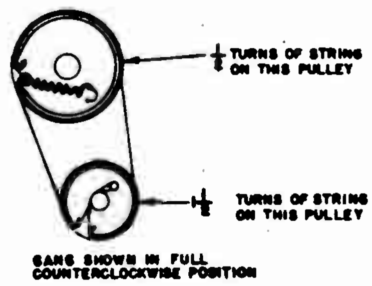
.21
.21
.24
.33



.03
.15
.15
.20
.03
.04
.01
.05
.10
.03

.01
.01
.01
.05
1.60

TUBE, TRIMMER LOCATION, DIAL CABLE DRAWING AND DETAILED VIEW OF I. F. TRANSFORMERS.

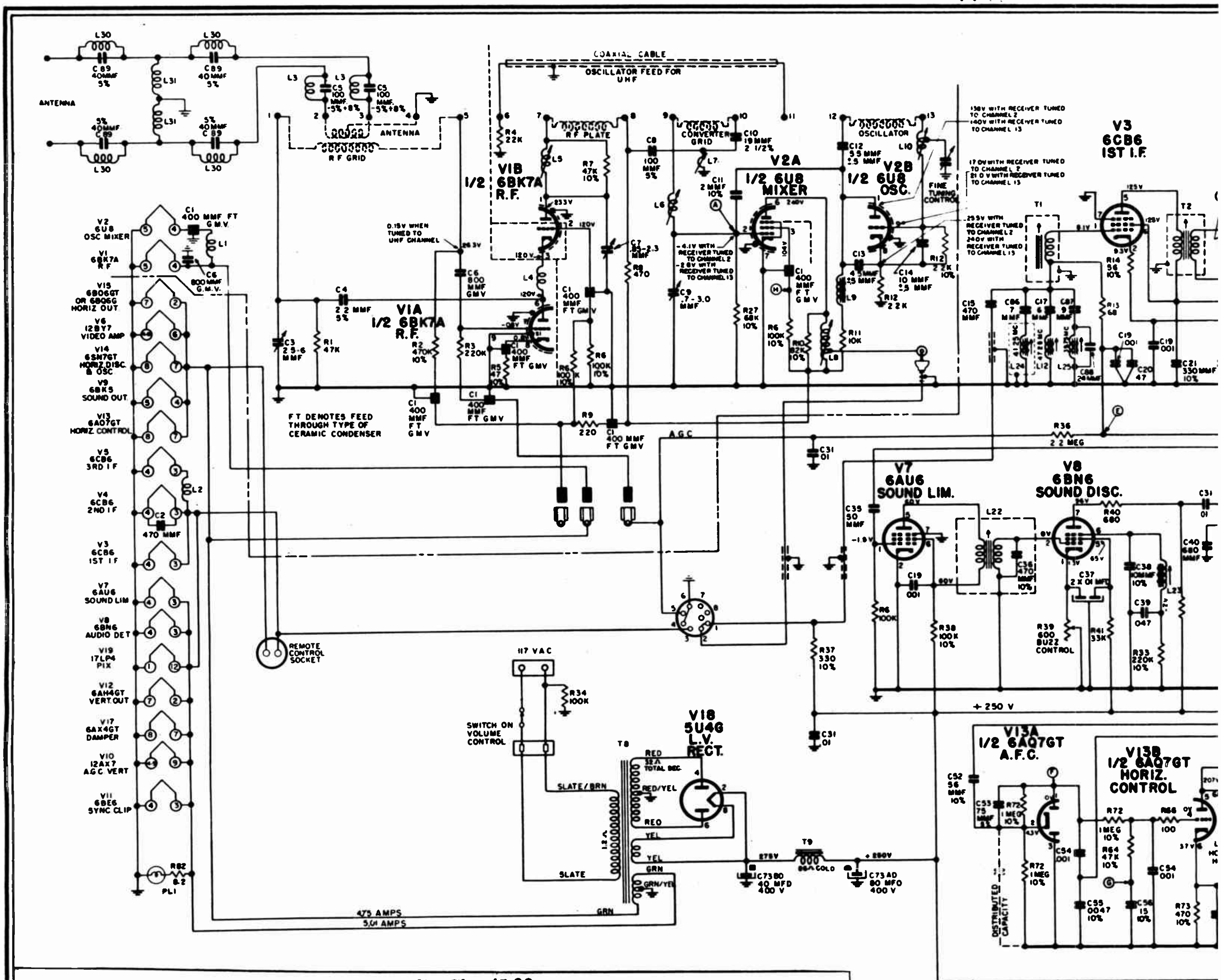


DIAL CORD DRIVE

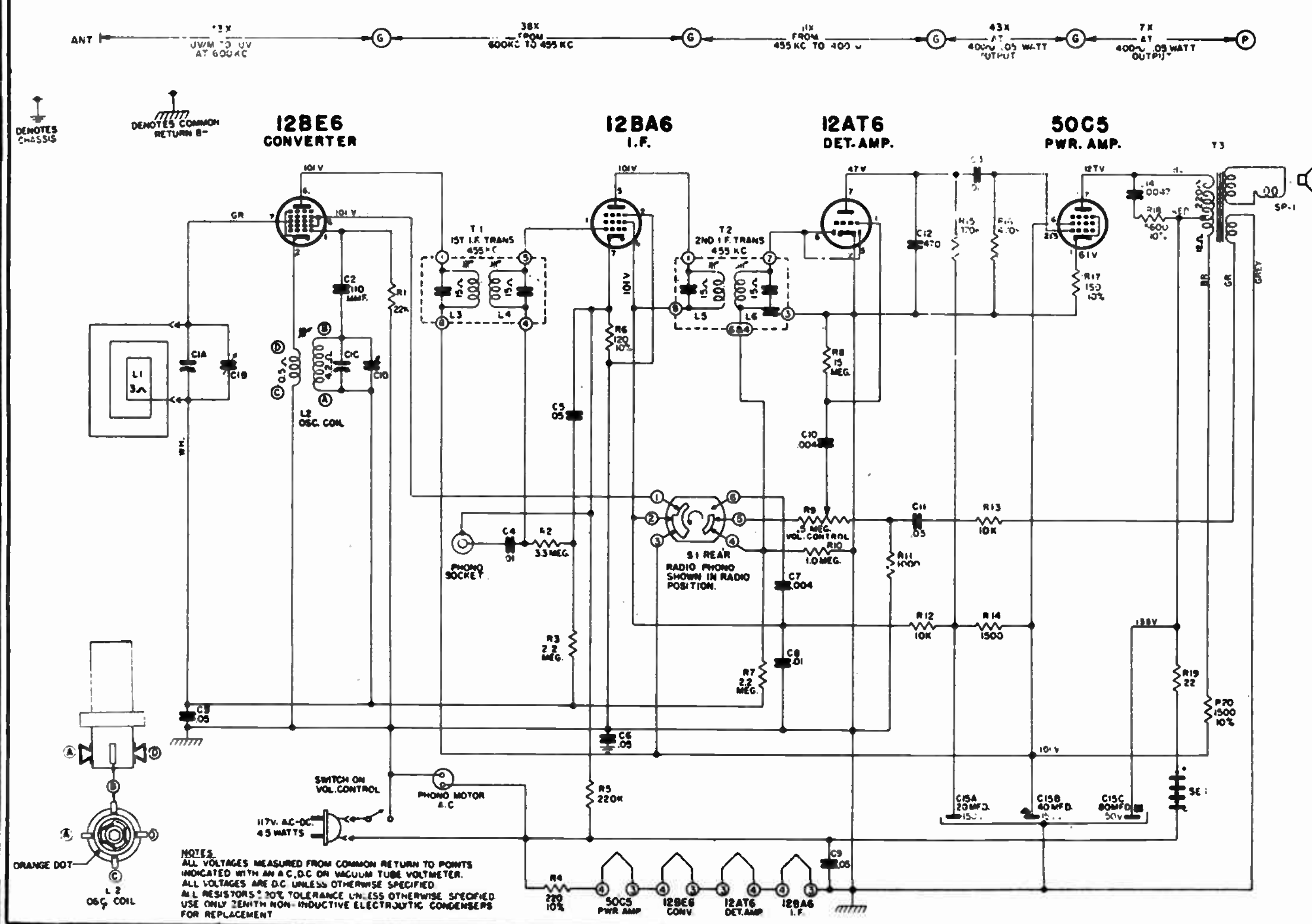
The I.F. transformers incorporated in this reveiver are of the new permeability tuned type. The advantage of an I.F. transformer of this type is its extreme stability under various humidity and temperature conditions. The upper coil is the secondary and the lower the primary. When adjusting these I.F. transformers the tuning wrench 68-19 can be inserted into the top slug, rotated until maximum output is obtained and then dropped down to the lower slug and the same operation repeated. The tuning wrench is so designed that turning one slug does not affect the adjustment of the other.

ALIGNMENT PROCEDURE

OPERATION	CONNECT OSCILLATOR TO	DUMMY ANTENNA	INPUT SIG. FREQUENCY	SET DIAL AT	TRIMMERS	PURPOSE
1	Converter Grid	.5 Mfd.	455 Kc.	600 Kc.	3, 4, 5, 6	For I.F. Alignment
2	Single Turn Loosely Coupled to Wave Magnet	--	1620 Kc.	1620 Kc.	C1D	Set Oscillator to Dial Scale.
3		--	1400 Kc.	1400 Kc.	C1B	Antenna Alignment



Radio Ch. 4L03



Part No.	Diag. No.	Description	
19-249		Coil Mtg. Clip	
22-3	C4, 13	.01 Mfd. Ceramic Disc	500V (2
22-4	C7, 10	.004 Mfd. Ceramic Disc	500V (2
22-5	C2	110 Mmfd. Ceramic Disc	500V
22-6	C12	470 Mmfd. Ceramic Disc	500V
22-826	C8	.01 Mfd.	200V
22-829	C3, 5, 6	.05 Mfd.	200V (4
22-1158	C11	.05 Mfd.	200V
22-1783	C14	.0047 Mfd.	400V
22-2272	C15A, B, C	Electrolytic 20/150V 40/150V 80/150V	
22-2512	C1A, B, C, D	Two Section Gang	
44-25		Phono Jack	
52-188		Two Prong Receptacle & Cable	
54-34		Hex Nut (1 Mt. 212-13)	
54-139		Palnut (1 Mt. Ea. 63-2909, 85-539)	
54-271		Palnut (1 Mt. Ea. 95-1101, 95-1102)	
58-209		Two Prong Plug - AC	
63-1747	R6	120 Ohm 1/2 W Ins. 10%	
63-1786	R11	1 K Ohm 1/2 W Ins. 20%	
63-1793	R14	1500 Ohm 1/2 W Ins. 20%	
63-1817	R18	5600 Ohm 1/2 W Ins. 10%	
63-1828	R12, 13	10 K Ohm 1/2 W Ins. 20% (2 used)	
63-1842	R1	22 K Ohm 1/2 W Ins. 20%	
63-1884	R5	220 K Ohm 1/2 W Ins. 20%	
63-1898	R16	470 K Ohm 1/2 W Ins. 20% (2 used)	
63-1912	R10	1 Meg Ohm 1/2 W Ins. 20%	
63-1926	R3, 7	2.2 Meg Ohm 1/2 W Ins. 20% (2 used)	
63-1933	R2	3.3 Meg Ohm 1/2 W Ins. 20%	
63-1961	R8	15 Meg Ohm 1/2 W Ins. 20%	
63-1977	R17	150 Ohm 1 W Ins. 10%	
63-2321	R20	1500 Ohm 2 W Ins. 10%	
63-2359	R19	22 Ohm 1 W Ins. 10%	
63-2909	R9	Volume Control & Switch	
63-3190	R4	220 Ohm 6 WWW Ins. 10%	
78-275		Socket, Electrolytic	
78-806		Socket, Min. 7 Pin Wafer	
78-807		Socket, Min. 7 Pin Wafer	
78-962		Socket, Min. 7 Pin Molded	
80-402		Dial Cord Tension Spring	
83-341		One Lug Term. Strip	
83-1119		Phono Jack Ins. Strip	
83-1192		One Lug Term. Strip	
83-1454		Five Lug Term. Strip	
83-2115		Rectifier Insulating Strip	
85-539	S1	Phono-Radio Switch	
93-125		#6 Int. Lockwasher (1 Mt. Gang)	
93-1020		Fibre Washer (2 Mt. 63-3190)	
94-334		Gang Mtg. Bushing (3 used)	
94-812		Coil Insert (Part of S-20612)	
95-1101	T1	1st IF Transf.	

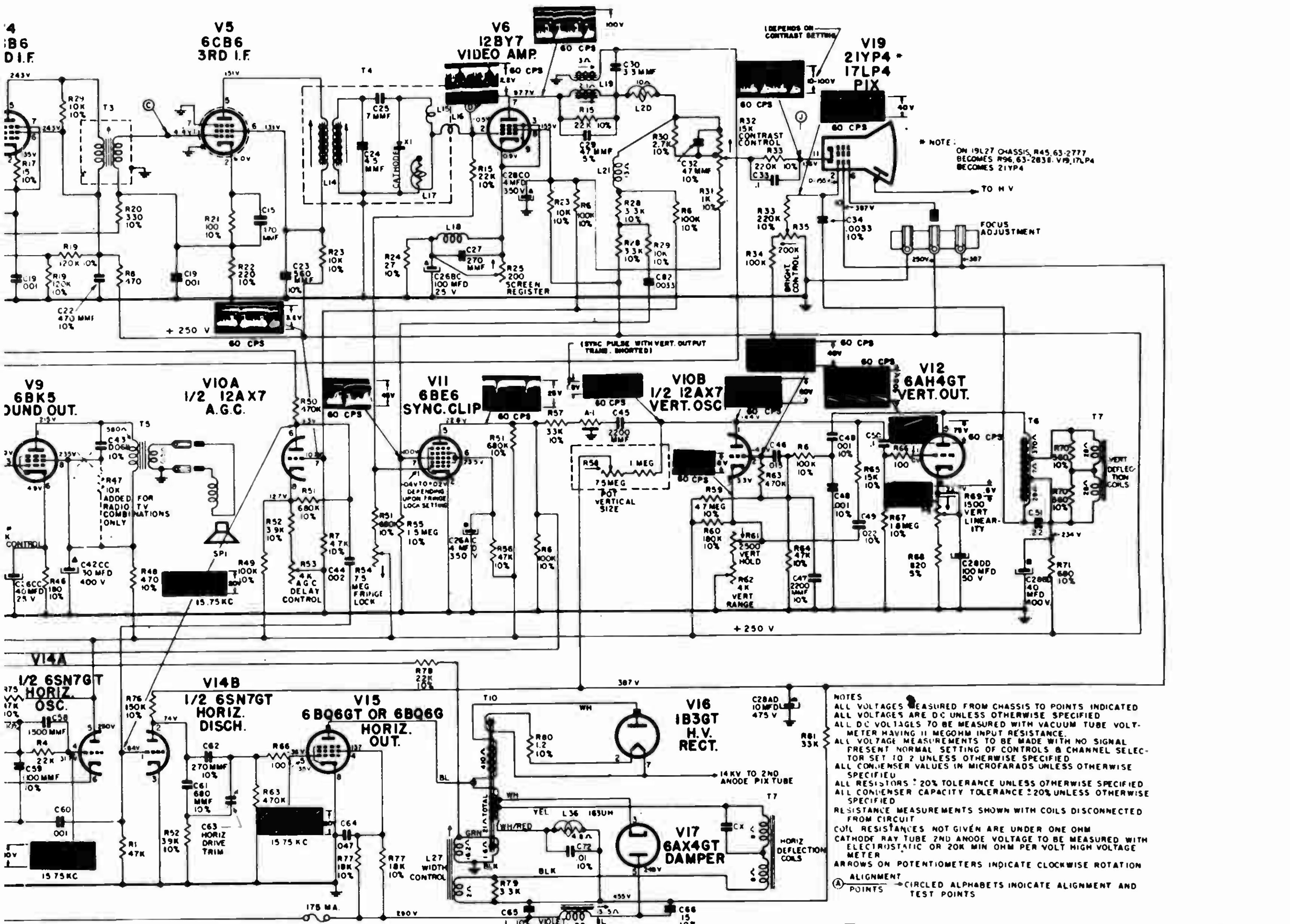
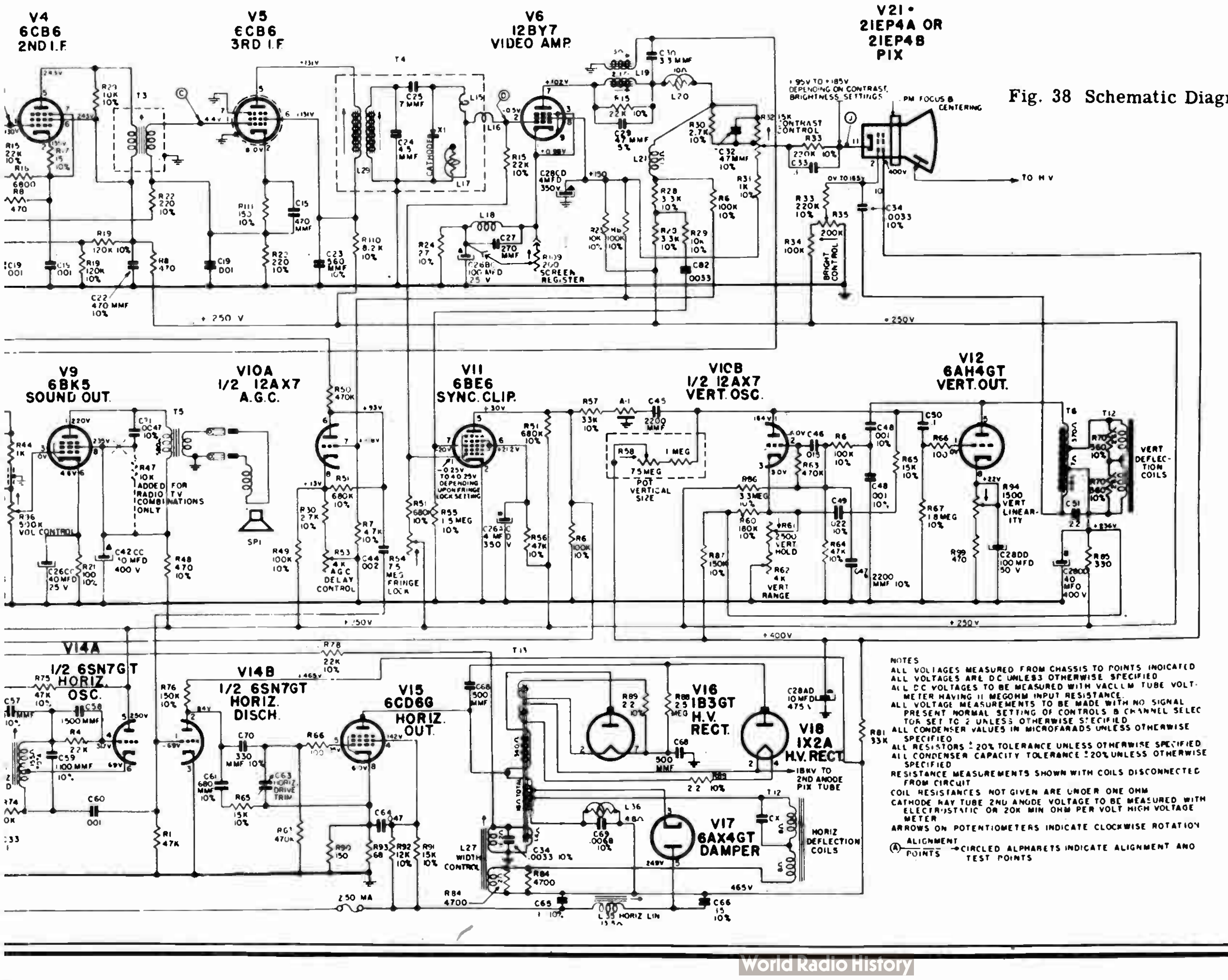


Fig. 37 Schematic Diagram 19L25 & 19L27 Chassis.

Fig. 38 Schematic Diagram 21L21 Chassis.



Part No.	Diag. No.	Description		Price
		CHASSIS 10L20		
11-85		Line Cord & Plug		.65
20-337	L3, 28, 30	R. F. Choke Coil (8 used)		.20
22-3	C15, 21, 49	.01 Mfd. Ceramic	500V (11 used)	.26
22-5	C3, 9, 26	110 Mmfd. Ceramic	500V (4 used)	.26
22-365	C32	100 Mmfd. Molded Mica	500V	.20
22-417	C40, 42	.1 Mfd.	600V (2 used)	.26
22-455	C41	.01 Mfd. Molded	1200V	.26
22-492	C16	.002 Mfd.	600V	.20
22-829	C1	.05 Mfd.	200V	.20
22-830	C39	.02 Mfd.	600V	.20
22-1127	C36	.02 Mfd.	400V	.20
22-1135	C18	.005 Mfd.	600V	.20
22-1220	C23	.002 Mfd.	600V (2 used)	.20
22-1367	C14	50 Mmfd. Ceramic	500V	.33
22-1506	C7, 13	22 Mmfd. Ceramic	500V (2 used)	.33
22-1612	C44A, 44B	Electrolytic 40/450V 40/450V		3.50
22-1668	C27	200 Mmfd. Ceramic	500V	.25
22-1676	C6, 8, 11	.001 Mfd. Ceramic	500V (4 used)	.40
22-1762	C12	1 Mmfd. Ceramic	500V	.20
22-1782	C46	.0047 Mfd. Molded	600V	.26
22-1887	C29	25 Mmfd. Ceramic	500V	.26
22-1962	C30	750 Mmfd. Ceramic	500V	
22-2140	C4, 5	15 Mmfd. Ceramic	500V (3 used)	.20
22-2243	C48A, 48B	Electrolytic 20/350V 40/450V		3.00
22-2276	C45, 47	Dual Ceramic .01 Mfd. - .01 Mfd.	500V	.50
22-2400	C2A, B, C, D, E, F	Three Section Variable		4.10
22-2493	C35	.3 Mfd. Molded	200V	
22-2494	C43	.0005 Mfd.	1600 V	
54-31		Hex Nut (4 Mt. 95-1253)		.01
54-139		Palnut (1 Mt. 63-2891)		.01
54-271		Palnut (9 Mt. Transf.)		.01
54-361		Speed Nut (1 Mt. S-17258		
63-1452	R40	270 Ohm 2 WWW Ins.	10%	.33
63-1571	R20	6800 Ohm 2 W Ins.	10%	.33
63-1716	R12	22 Ohm ½ W Ins.	20%	.21
63-1723	R2	33 Ohm ½ W Ins.	20%	.21
63-1737	R17	68 Ohm ½ W Ins.	20%	.21
63-1744	R21	100 Ohm ½ W Ins.	20%	.21
63-1758	R4, 5	220 Ohm ½ W Ins.	20% (3 used)	.21
63-1771	R35	470 Ohm ½ W Ins.	10%	.21
63-1772	R7	470 Ohm ½ W Ins.	20%	.21
63-1778	R36	680 Ohm ½ W Ins.	10%	.21
63-1786	R11, 13	1 K Ohm ½ W Ins.	20% (2 used)	.21
63-1789	R34	1200 Ohm ½ W Ins.	10%	.21
63-1793	R19	1500 Ohm ½ W Ins.	20%	.21
63-1799	R44	2200 Ohm ½ W Ins.	10%	.21
63-1820	R14	6800 Ohm ½ W Ins.	10%	.21
63-1827	R9, 46	10 K Ohm ½ W Ins.	10% (2 used)	.21
63-1841	R15	22 K Ohm ½ W Ins.	10%	.21
63-1842	R24, 25	22 K Ohm ½ W Ins.	20% (2 used)	.21
63-1845	R27	27 K Ohm ½ W Ins.	10%	.21
63-1856	R42	47 K Ohm ½ W Ins.	20%	.21
63-1869	R29	100 K Ohm ½ W Ins.	10%	.21
63-1870	R23	100 K Ohm ½ W Ins.	20%	.21
63-1876	R28, 30	150 K Ohm ½ W Ins.	10% (2 used)	.21
63-1884	R26	220 K Ohm ½ W Ins.	20% (2 used)	.21
63-1887	R39	270 K Ohm ½ W Ins.	10%	.21
63-1894	R41, 43	390 K Ohm ½ W Ins.	10% (2 used)	.21
63-1898	R45, 49	470 K Ohm ½ W Ins.	20% (2 used)	.21
63-1912	R1	1 Meg Ohm ½ W Ins.	20%	.21
63-1926	R3, 6, 18	2.2 Meg Ohm ½ W Ins.	20% (4 used)	.21
63-1940	R31	4.7 Meg Ohm ½ W Ins.	20%	.21
63-2091	R22	820 Ohm ½ WWW Ins.	20%	.21
63-2142	R47	130 Ohm 5 W Zip	10%	.43
63-2297	R50	2700 Ohm 2 W Ins.	10%	
63-2864	R48A, 48B	Candohm		
63-2891	R37	Volume Control & Switch		

Part No.	Diag. No.	Description	Price
78-6..			
78-755			
78-807		Socket, Min.	
78-850		Socket, Min. Tube 9 Contact	
78-869		Socket, Min. Tube	
78-870		Socket, Min. Tube (2 used)	
78-871		Socket, Min. Tube	.15
78-897		Socket, Two Contact	.10
78-898		Dial Light Socket & Wire	.35
80-69		Dial Cord Spring	.05
80-747		Dial Cord Spring	.10
80-780		Iron Core Tension Spring (3 used)	.05
80-781		Tuner Arm Tension Spring	.06
80-865		Ground Spring	.05
80-868		Ground Spring	.15
83-1640		IF Transf. Support Strip (5 used)	.03
85-505	S2	S. P. D. T. Switch	.90
85-531	S1	Band Switch	
93-2		Brass Washer (1 Mt. 63-2869)	.01
93-127		No. 10 Int. Lockwasher (4 Mt. 95-1253)	.01
93-1039		Gang Mtg. Cup Washer (2 used)	.01
94-598		R. F. Plate Mtg. Bushing	.01
95-1150	T3, 5	2nd & 3rd IF Transformer (F. M.)	2.25
95-1153	T7	Discriminator Transformer	2.25
95-1201	T1	1st IF Transformer (F. M.)	1.50
95-1248	T2	1st IF Transformer (B. C.)	1.60
95-1249	T4	2nd IF Transformer (B. C.)	1.60
95-1253	T8	Power Transformer	12.50
95-1254	T6	3rd IF Transformer (B. C.)	1.60
95-1355	T9	Speaker Output Transformer	
100-67	PL1, PL2	Dial Light Bulb (2 used)	.11
112-802		4-24 x 5/8 Rd. Hd. Self Tap Screw (Mt. 148-122)	.03
113-8		6-32 x 1/4 Hex Hd. Mach. Screw (2 Mt. 85-531)	.02
113-15		6-32 x 5/16 Hex Hd. Mach Screw (2 Mt. 22-2400)	.02
113-33		4-40 x 1/4 Hex Hd. Mach. Screw (2 Mt. 85-505)	.02
114-39		8-32 x 1/4 Hex Hd. Self Tap Screw (4 Mt. S-17258)	.01
114-43		10-32 x 3/8 Hex Wash Hd Mach. Screw (4 Mt. 95-1253)	.01
114-292		6-32 x 5/8 Hex Hd. Self Tap Screw (3 used)	.01
114-297		6-32 x 1/4 Hex Hd. Self tap Screw (2 Mt. 95-1355)	.01
114-329		6-18 x 3/8 Hex Hd. Self Tap Screw (1 Mt. S-17258)	
25-62		Rubber Grommet (3 used)	.02
25-85		Rubber Grommet (2 used)	.05
26-618		Min. Tube Shield	.02
36-24	F1	2 Amp. Fuse	.25
148-122		Tuner Arm	.20
149-95		Iron Core & Spring (2 used)	.30
188-30		Retaining Ring (S-17155)	.02
188-150		Retaining Ring (S-17157)	.02
S-13997	L7	Filament Choke Coil	.40
S-15691	L8	F. M. Oscillator Coil	.40
S-15743	L5	F. M. Detector Coil	.65
S-16344	L6	B'cast Detector Coil	.60
S-16345	L9	B'cast Oscillator Coil	.60
S-16408	L4	Antenna Choke Coil	.25
S-17155		Tuning Shaft & Pulley	.35
S-17157		Pointer & Pulley Assem.	.55
S-17158		Dial Cord & Eyelet -- Long	.07
S-17159		Dial Cord & Eyelet -- Short	.06
S-17257		Speaker Cable & Eyelet	.35
S-17258		Dial Scale & Bracket	1.50
S-17821		Switch Arm & Insulator Strip	.10
S-20223		Bracket & Pulley Bushing Assem.	

Prices shown are suggested list prices and are subject to change without notice.

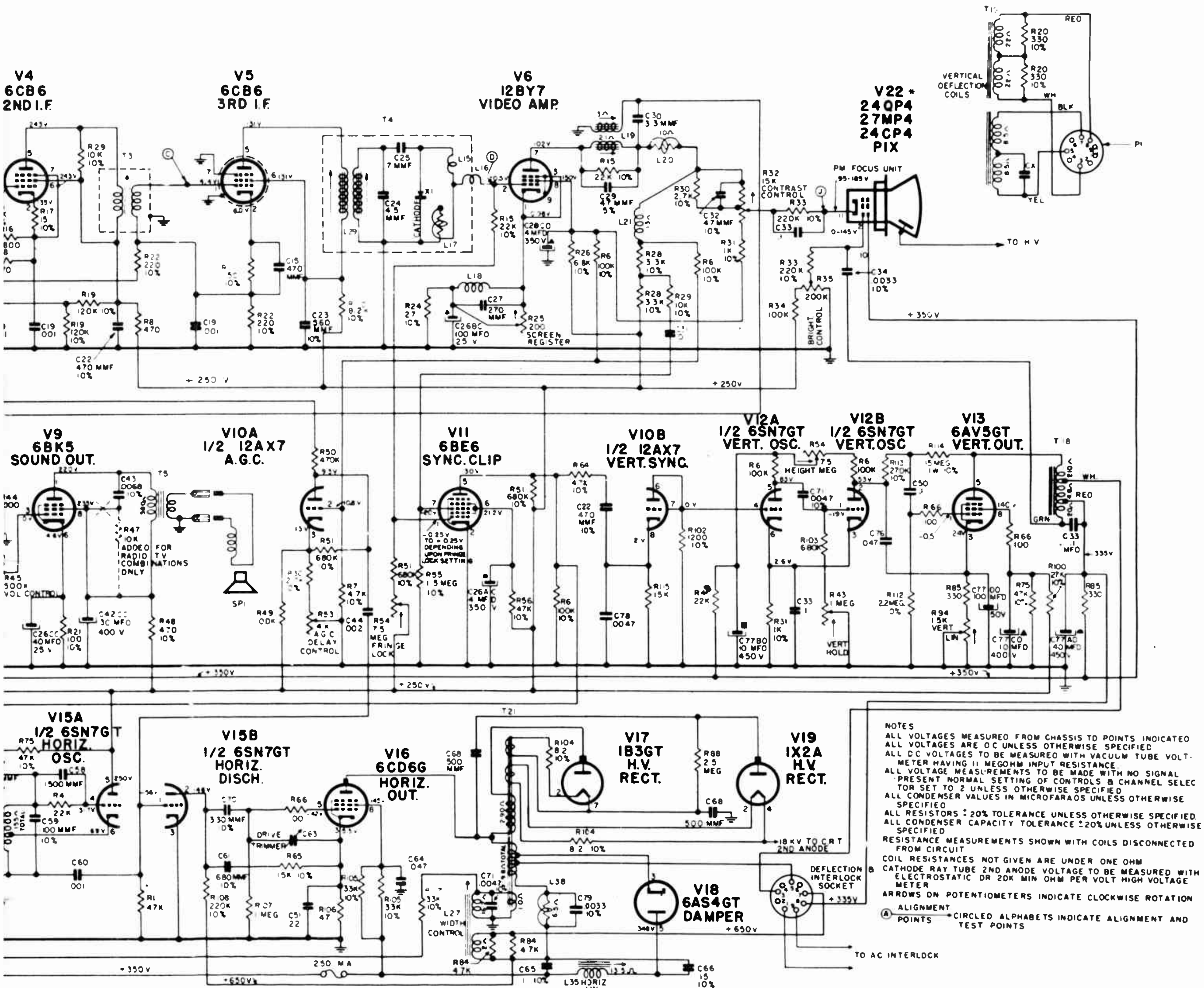


Fig. 39 Schematic Diagram 22L20 Chassis.

ALIGNMENT PROCEDURE

Operation	Connect Oscillator To	Dummy Antenna	Input Signal Frequency	Band	Set Dial To	Adj. Trimmers	Purpose
1	Pin 2 12AT7 Converter	.05 Mfd.	455 Kc. Modulated	BC	600 Kc.	L14, 15, 18, 19, 22 & 23	Align I. F. channel for maximum output.
2	2 turns loosely cpld. to wavemagnet		1600 Kc. Modulated	BC	1600 Kc.	C2E	Set oscillator to dial scale.
3	2 turns loosely cpld. to wavemagnet		1400 Kc. Modulated	BC	1400 Kc.	C2C, C2B	Align detector and antenna stage.
4 (a)	Pin 1 grid on 6AU6 limiter	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L 24	Align primary of discriminator for maximum reading.
5 (b)	Pin 1 (grid) on 6AU6 limiter	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L 25	Adjust secondary of discriminator for zero reading.
6 (c)	Pin 1 (grid) on 6 BA6 2nd. IF.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L 20, 21	Align 3rd. IF transformer for Maximum reading.
7 (c)	Pin 1 (grid) on 6BA6 1st. IF.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L16, 17	Align 2nd IF transformer for maximum reading.
8 (c)	Pin 2 (grid) on 12AT7 converter	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L12, 13	Align 1st. IF transformer for maximum reading.
9 (c)	Antenna Post FM (Re-	270 ohms	98 Mc. Unmodulated	FM 100	98 Mc.	L8 Osc. Coil Slug.	Set Oscillator to dial scale.
10 (c) (d)	move line ant.)	270 ohms	98 Mc. Unmodulated	FM 100	98 Mc.	L5 Det. Coil Slug	Align det. stage to maximum reading.

IMPORTANT

Alignment of this chassis will in most cases be unnecessary unless an IF or RF transformer is replaced or the adjustments have been tampered with.

Correct alignment can only be made if the following procedure is followed:

A vacuum tube voltmeter with an isolation resistor of 2,000,000 ohms in series with the hot lead will serve for FM adjustments. This lead should be shielded.

An AC output meter connected across the primary or secondary of the output transformer will be satisfactory for all AM adjustments.

The signal generator output should be kept just high enough to get an indication on the meter.

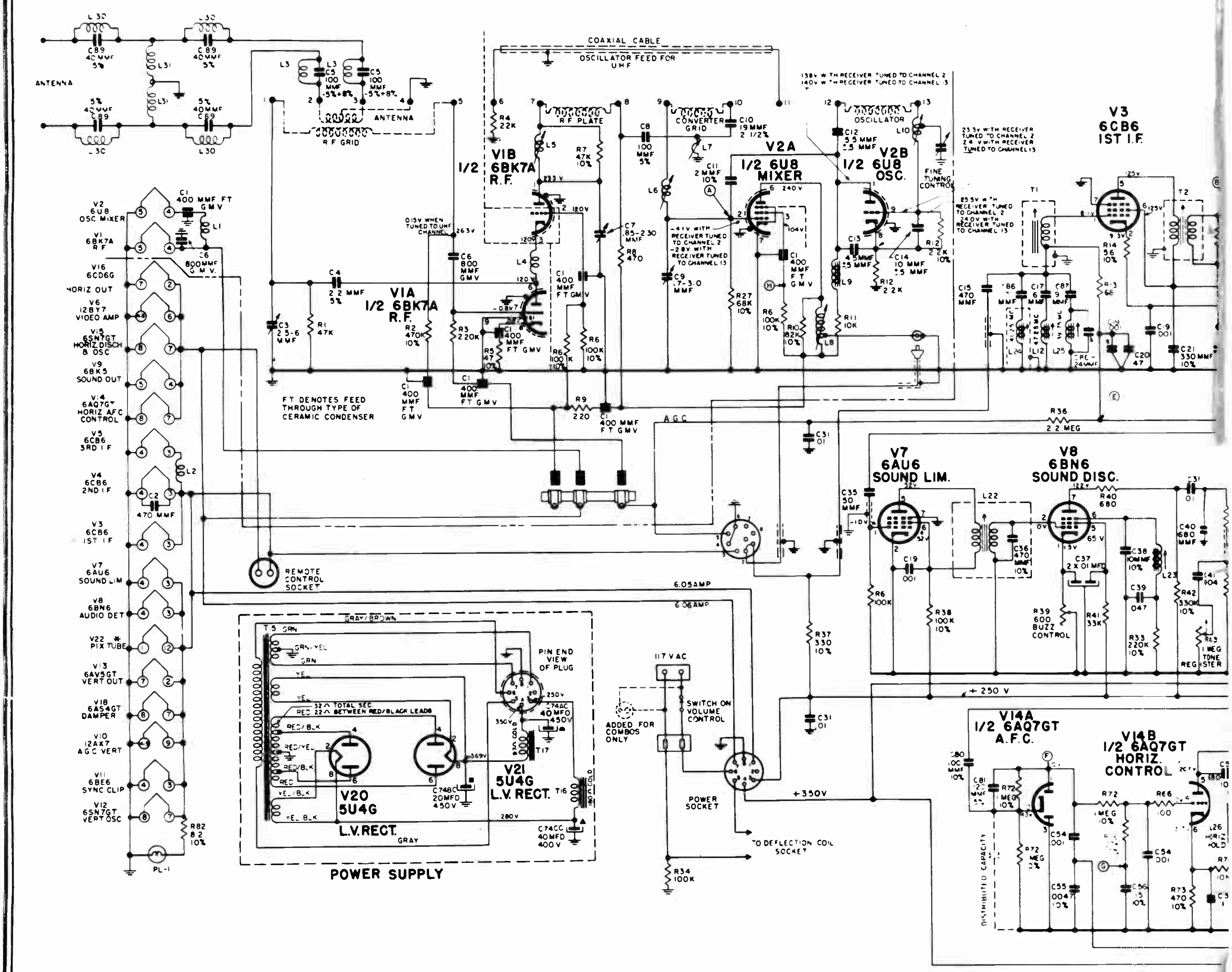
This position of an oscillation will sometimes vary with different cartridges, and in this case readjustment of C16 must be made.

(a) Vacuum Tube Voltmeter Lug 7 on discriminator transformer to chassis (Half discriminator load).

(b) Vacuum Tube Voltmeter Lug 5 on discriminator transformer to chassis (Full discriminator load).

(c) Vacuum Tube Voltmeter from Limiter Grid to Chassis.

(d) Loosen Slugs by applying a hot iron to the cement.



Radio Ch. 10L20

The 10L20 chassis incorporates a superheterodyne circuit with two stages of IF, on the FM Band, and two stages on the AM Band. There is one stage of RF amplification on all bands.

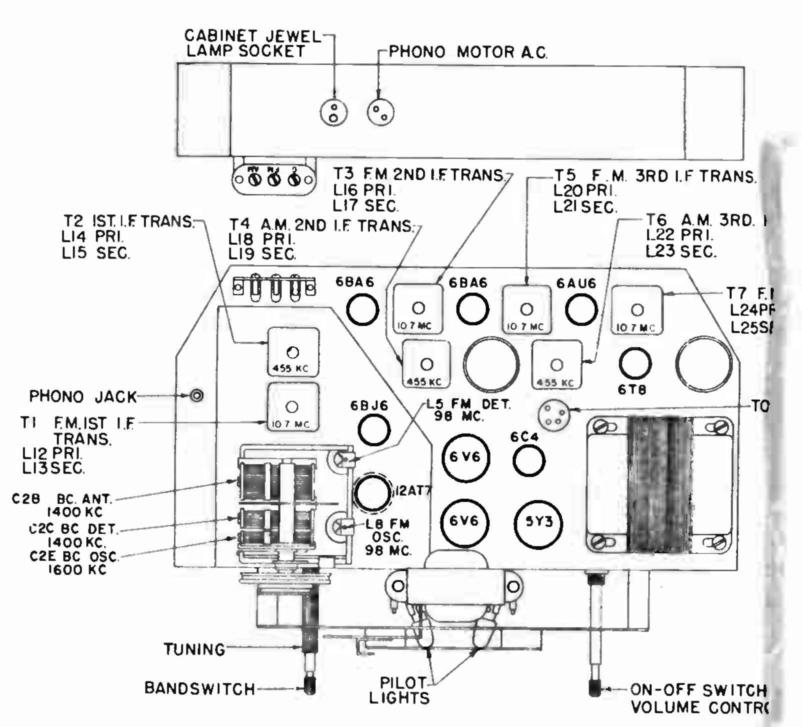
FM RF Alignment: The tuning slugs are attached to threaded shafts and the slugs are varied in the field of the coils by turning the shafts clockwise or counter-clockwise. After adjustment the shafts must be secured with a drop of speaker cement.

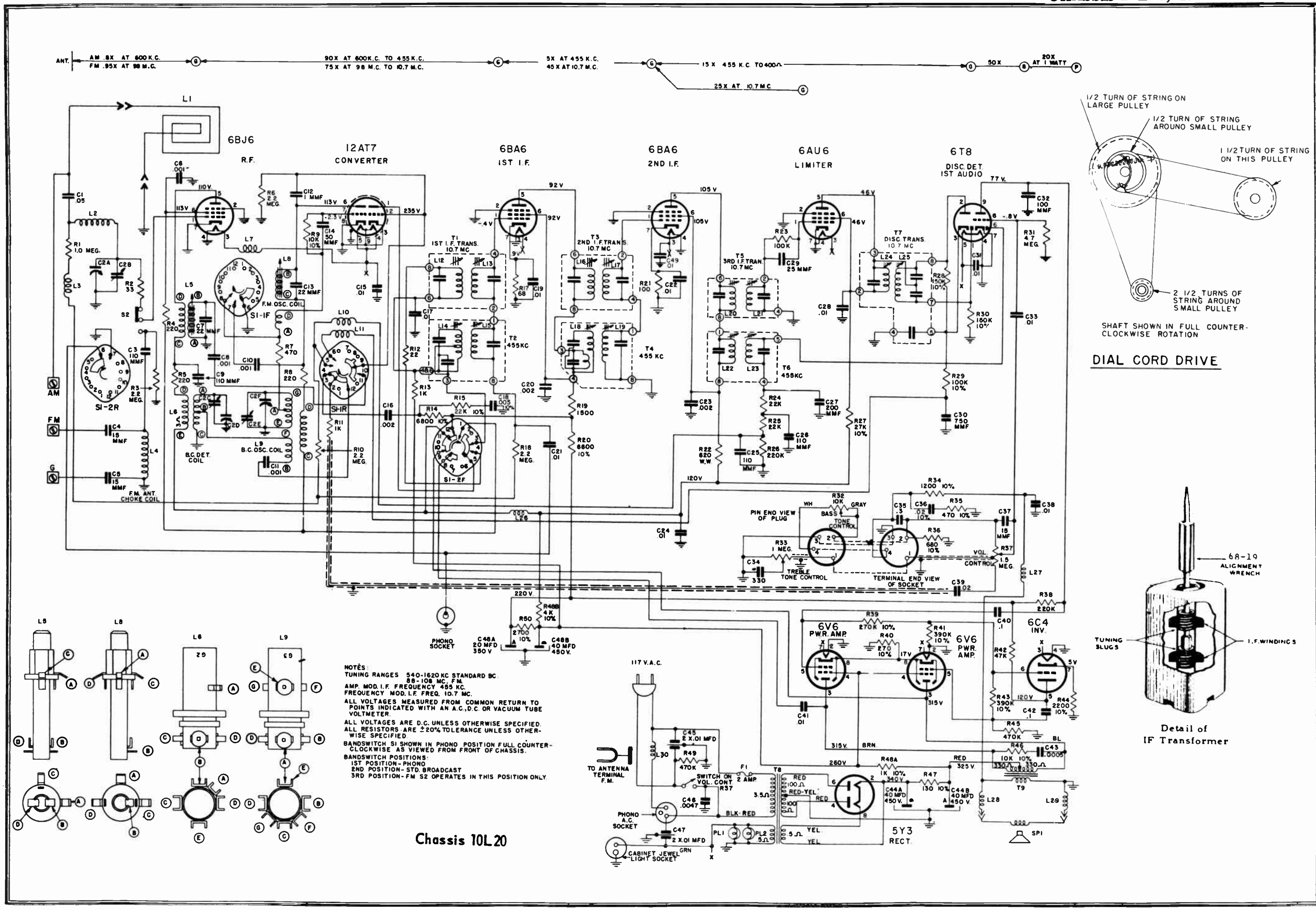
AM and FM Alignment: The AM and FM IF transformers in this receiver are of the new permeability tuned type. The advantage of an IF transformer of this type is its extreme stability under various humidity and temperature conditions. The upper coil is the secondary and the lower the primary. When adjusting these IF transformers the tuning wrench 68-19 can be inserted into the top slug, rotated until maximum output is obtained and then dropped down to the lower slug and the same operation repeated. The tuning wrench is so designed that turning one slug does not affect the adjustment of the other.

FM IF Alignment: Because of the wide band pass, it is desirable to use a FM signal generator and a cathode ray oscilloscope when aligning the FM IF channel.

If visual alignment equipment is unavailable, reasonably accurate alignment can be made by following the procedure outlined below.

FM Discriminator Alignment: When the secondary of the discriminator is aligned (operation 5) use sufficient signal input to get a good positive and negative indication before setting the slug for a zero reading. A center zero indicating meter is recommended for this adjustment, but is not absolutely necessary. Reversing the leads of a non-zero center meter, or observing closely when the meter starts to go to the left (negative) of zero will give the same results.




6BJ6
R.F.
12AT7
CONVERTER
6BA6
1ST I.F.
6BA6
2ND I.F.
6AU6
LIMITER
6T8
DISC. DET.
1ST AUDIO
6V6
PWR. AMP.
6V6
PWR. AMP.
6C4
INV.
5Y3
RECT.
DIAL CORD DRIVE
1/2 TURN OF STRING ON LARGE PULLEY
1/2 TURN OF STRING AROUND SMALL PULLEY
1 1/2 TURN OF STRING ON THIS PULLEY
2 1/2 TURNS OF STRING AROUND SMALL PULLEY
SHAFT SHOWN IN FULL COUNTER-CLOCKWISE ROTATION
68-19 ALIGNMENT WRENCH
TUNING SLUGS
I.F. WINDINGS
Detail of IF Transformer
NOTES:
TUNING RANGES 540-1620 KC STANDARD BC.
88-108 MC. FM.
AMP. MOD. I.F. FREQUENCY 455 KC.
FREQUENCY MOD. I.F. FREQ. 10.7 MC.
ALL VOLTAGES MEASURED FROM COMMON RETURN TO POINTS INDICATED WITH AN A.C., D.C. OR VACUUM TUBE VOLTMETER.
ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.
ALL RESISTORS ARE ±20% TOLERANCE UNLESS OTHERWISE SPECIFIED.
BANDSWITCH S1 SHOWN IN PHONO POSITION FULL COUNTER-CLOCKWISE AS VIEWED FROM FRONT OF CHASSIS.
BANDSWITCH POSITIONS:
1ST POSITION - PHONO
2ND POSITION - STD. BROADCAST
3RD POSITION - FM S2 OPERATES IN THIS POSITION ONLY
Chassis 10L20

NUMERICAL PARTS LIST

Part No.	Description	Suggested List Price
	S-19970 TURRET TUNER	
12-2044	Filter mtg. bracket	
20-391	R. F. choke	.10
20-431	Interstage cascode coil	.10
20-447	Osc. inductance trimmer coil	.20
20-484	R. F. plate trimmer coil	.20
20-485	Converter grid inductance trimmer coil	.20
20-487	Ant. trap coil	.10
21-33	Index roller	.10
22-2221	Ceramic trimmer (Part of S-19916)	.25
22-2331	800 mmfd ceramic disc	.26
22-2403	Ceramic disc	.20
22-2404	Feed-thru cond. 400 mmfd. 500V (8 used)	.30
22-2406	19 mmfd ceramic	.30
22-2407	100 mmfd ceramic	.30
22-2411	10 mmfd ceramic disc.	.20
22-2434	2 mmfd molded 500V	.15
22-2453	Ceramic trimmer	.25
22-2468	2.2 mmfd molded	.20
22-2499	5.5 mmfd ceramic disc.	.25
	Or 22-2413 5.5 mmfd ceramic disc.	.20
22-2500	4.5 mmfd ceramic disc.	.20
	Or 22-2383 4.5 mmfd ceramic disc.	.55
22-2504	Trimmer	.60
22-2511	40 mmfd ceramic disc. 500V	
44-30	Connector jack	.30
52-622	Shielded lead	.35
52-663	Two conductor cable (for S-20503)	.10
54-34	6-32 x 1/4 hex nut (4 mt. S-18840)	.01
54-337	Tension nut (for 112-857)	.02
57-1960	Stop plate (2 used with 80-897)	.02
63-1729	47 ohm 1/2 W Ins. 10%	.21
63-1758	220 ohm 1/2 W Ins. 20%	.21
63-1772	470 ohm 1/2 W Ins. 20%	.21
63-1779	2200 ohm 1/2 W Ins. 10% (2 used)	.21
63-1813	4700 ohm 1/2 W Ins. 10%	.21
63-1842	22 K ohm 1/2 W Ins. 20%	.21
63-1856	47 K ohm 1/2 W Ins. 20%	.21
63-1862	68 K ohm 1/2 W Ins. 10%	.21
63-1866	82 K ohm 1/2 W Ins. 10%	.21
63-1869	100K ohm 1/2 W Ins. 10%	.21
63-1884	220 K ohm 1/2 W Ins. 20%	.21
63-1897	470 K ohm 1/2 W Ins. 10%	.21
63-3170	10 K ohm 2 W Ins. 20%	.33
73-40	6-32 x 1/8 Allen hd set screw	.10
73-141	8-32 x 3/8 slab hd set screw (2 part of S-18602)	.04
76-650	Index arm shaft	.35
76-651	Fine tuning shaft	.35
78-934	Socket, min. tube	.35
78-944	Socket, min. tube	.30
80-897	Turret shaft ground spring	.05
80-901	Index spring	.05
80-905	Trimmer tension spring (used with S-18839)	.02

Part No.	Description	Suggested List Price
80-908	Shaft grounding spring (used with S-18839)	.10
80-924	Turret shaft tension spring (2 used)	.06
83-2016	Terminal strip (male)	.20
83-2119	Ant. terminal strip (part of S-20213)	.20
86-245	Stator terminal (13-part of S-19758)	.05
86-247	Insulated feed - through terminal	.10
93-1103	Steel washer	.01
93-1112	Special washer	.01
93-1113	Flat washer	.03
93-1115	Steel washer	.03
94-793	Fine tuning stop bushing	.20
94-804	Nylon bushing	.10
112-856	Inductance adjusting screw	.03
112-857	Trimmer adjusting screw	.02
112-882	Inductance adjusting screw (14 used)	.03
114-180	6-20 x 1/4 hex hd self tap screw (4 used)	.01
126-693	Chassis shield	.10
126-724	Tube shield (2 used)	.03
148-135	Index arm	.15
149-119	Iron core (S-18859)	.15
149-121	Iron core (S-18839)	.20
188-148	Retaining ring (76-650)	.02
188-156	Trimmer cup retaining ring (used with S-18839)	.10
199-165	Sleeve (Part of S-18844)	.04
S-18602	Gear, bushing & set screw	.30
S-18799	Shaft, plate & spring assem. (drum)	1.50
S-18839	Trimmer shaft & core	.60
S-18840	Tuner cover assem.	2.25
S-18843	Center shield & spring	.80
S-18844	Trimmer cup & sleeve (used with S-18839)	.25
S-18848	Center shield assem. (small)	.50
S-18859	Osc. plate choke assem.	.35
S-19758	Stator strip assem.	1.50
S-19842	Ant. strip assem. channel 2	1.00
S-19843	Ant. strip assem. channel 3	1.00
S-19844	Ant. strip assem. channel 4	1.00
S-19845	Ant. strip assem. channel 5	1.00
S-19846	Ant. strip assem. channel 6	1.00
S-19847	Ant. strip assem. channel 7	1.00
S-19848	Ant. strip assem. channel 8	1.00
S-19849	Ant. strip assem. channel 9	1.00
S-19850	Ant. strip assem. channel 10	1.00
S-19851	Ant. strip assem. channel 11	1.00
S-19852	Ant. strip assem. channel 12	1.00
S-19853	Ant. strip assem. channel 13	1.00
S-19862	Osc. strip assem. channel 2	1.00
S-19863	Osc. strip assem. channel 3	1.00
S-19864	Osc. strip assem. channel 4	1.00
S-19865	Osc. strip assem. channel 5	1.00
S-19866	Osc. strip assem. channel 6	1.00
S-19867	Osc. strip assem. channel 7	1.00

Part No.	Description	Suggested List Price
S-19868	Osc. strip assem. channel 8	1.00
S 19869	Osc. strip assem. channel 9	1.00
S-19870	Osc. strip assem. channel 10	1.00
S-19871	Osc. strip assem. channel 11	1.00
S-19872	Osc. strip assem. channel 12	1.00
S-19873	Osc. strip assem. channel 13	1.00
S-19916	Trimmer & capacitor	.55
S-20139	Converter plate coil assem.	.60
S-20181	Trimmer & insulator	.15
S-20499	Trap mtg. strip (used with S-20503)	.10
S-20500	Housing bracket assem. (used with S-18839)	.30
S-20503	IF trap coil & Capacitor (2 used with S-20499)	.55
S-20602	K,K-3 & L IF Filter for elimination of police and armateur radio interference	
	12-2044 Bracket to mount S-20602	
S-19970	Turret tuner complete	60.00
S-20254	Turret tuner service replacement for S-19970 (is S-19970 less strips, cover, etc.)	40.00

TUBES

1 6U8 1 6BK7A

VIDEO CHASSIS PARTS LIST

Part No.	Description	Suggested List Price
12-1889	Shaft retaining bracket (76-677)	.02
12-1997	Shaft retaining bracket (76-680)	.01
12-2017	Turret shaft retaining bracket (76-679)	.01
19-178	Cond. retaining clip (2 used)	.07
22-3	.01 mfd ceramic disc. 500V (3 used)	.26
22-6	470 mmfd ceramic disc 500V	.26
	Or 22-2470 470 mmfd ceramic disc 500V	.25
22-7	.001 mfd ceramic disc 500V (6 used)	.26
22-1777	.1 mfd molded 200V	.26
22-1778	.047 mfd molded 200V	.26
22-1874	7 mmfd ceramic 500V	.26
	Or 22-2375 7 mmfd ceramic disc 500V	.26
22-1895	10 mmfd ceramic 500V	.35
	Or 22-2378 10 mmfd ceramic 500V	.35
22-2050	5 mmfd ceramic 500V	.30
	Or 22-2380 5 mmfd ceramic disc 500V	.30
22-2051	6 mmfd ceramic 500V	.35
	Or 22-2381 6 mmfd ceramic disc 500V	.35
22-2146	.47 mfd molded 200V	.60
22-2217	470 mmfd ceramic 500V	.25
22-2276	2 x .01 mfd ceramic 500V	.50
22-2302	470 mmfd ceramic 500V	.35
22-2309	330 mmfd ceramic 500V	.26
22-2310	560 mmfd ceramic 500V	.35
22-2320	680 mmfd ceramic 500V	.26
22-2325	47 mmfd ceramic 500V	.26
22-2343	3.3 mmfd molded 500V	.26
22-2383	4.5 mmfd ceramic disc 500V	.55
22-2460	50 mmfd molded 500V	.20
22-2466	47 mmfd ceramic 500V	.35
	Or 22-2467 47 mmfd ceramic disc 500V	.35
22-2480	470 mmfd mica 500V	.50
22-2481	8 mmfd ceramic disc 500V	.20
24-572	IF transf. shield cover	.05
24-588	IF transf. shield top cover	.10
25-2	Cotter pin	.03
52-641	Shielded lead (used with 58-214)	.25
52-642	Shielded lead	.30
52-643	Shielded lead	.35
54-139	3/8 -32 x 9/16 hex palnut (1 mt. ea. 63-2805--63-2854)	.01
54-271	6-32 x 1/4 hex palnut (14 used)	.01
54-326	1/4-28 x 7/16 hex nut (1 for S-19637)	.02
58-214	Connector plug (used with 52-641)	.10
63-1708	15 ohm 1/2 W Ins. 10%	.21
63-1733	56 ohm 1/2 W Ins. 10%	.21
63-1737	68 ohm 1/2 W Ins. 20%	.21
63-1743	100 ohm 1/2 W Ins. 10%	.21
63-1757	220 ohm 1/2 W Ins. 10% (2 used)	.21
63-1772	470 ohm 1/2W Ins. 20% (2 used)	.21
63-1779	680 ohm 1/2 W Ins. 20%	.21
63-1785	1 K ohm 1/2 W Ins. 10%	.21
63-1786	1 K ohm 1/2 W Ins. 20%	.21
63-1803	2700 ohm 1/2 W Ins. 10%	.21
63-1821	6800 ohm 1/2 W Ins. 20%	.21
63-1827	10 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1838	18 K ohm 1/2 W Ins. 10%	.21
63-1841	22 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1869	100 K ohm 1/2 W Ins. 10% (3 used)	.21
63-1873	120 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1883	220 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1890	330 K ohm 1/2 W Ins. 10%	.21
63-1904	680 K ohm 1/2 W Ins. 10%	.21
63-1926	2.2 Meg ohm 1/2 W Ins. 20%	.21
63-2159	Delay & vertical range control	1.20
63-2781	100 K ohm 1W Ins. 10%	.24
63-2805	Fringe lock control	1.20
63-2854	Contrast control	1.20
63-2898	8.2 ohm 2 www Ins. 10%	.33
63-2899	3300 ohm 4 www Ins. 10% (2 used)	.50
	Or 63-1571 6800 ohm 2 W Ins. 10% (4 used)	.33
63-3179	15 K ohm 1 W Ins. 10%	.24
63-3180	33 K ohm 2 W Ins. 20%	.33
64-6	Rivet 1/8 dia x 3/16 (2--78-922)	.01
64-27	Rivet 1/8 dia x 1/8 (2 mt. ea. 63-2159--63-3167--83-1760--83-1974--83-1809)	.01
64-88	Rivet .088 x 1/8 (2 mt. 78-949)	.01
64-158	Rivet .088 x 7/32 (2 mt. 78-917)	.01
64-183	Rivet .088 x 3/16 (2 mt. ea. 78-788, 916, 917)	.01
64-414	Rivet 1/8 dia x 5/32 (mt. 83-1954, 1956, 1987)	.01
64-525	Brass eyelet (for 76-677)	.01
64-538	Brass eyelet (used with pulley & gear)	.05

Part No.	Description	Suggested List Price
73-140	8-32 x 1/4 hex hd mach screw (used with S-19131)	.05
73-141	8-32 x 3/8 slab hd set screw (2 part of S-18602)	.04
76-677	Fine tuning shaft	.10
76-679	Turret tuning shaft	.80
76-680	Contrast control shaft	.10
78-846	Socket, min. tube	.20
78-916	Socket, min. tube	.15
78-917	Socket, min. tube	.25
78-922	Socket, eight contact connector	.30
78-949	Socket, min tube- molded	.20
80-69	Drive cord tension spring	.05
83-1760	Seven lug terminal strip	.15
83-1809	Single lug terminal strip	.05
83-1954	Seven lug terminal strip	.15
83-1956	Five lug terminal strip	.10
83-1974	Ten lug terminal strip	.20
83-1987	Two lug terminal strip	.05
83-2095	Pin jack terminal strip (female)	.10
83-2098	Insulating strip	.04
83-2136	Insulating strip	.03
93-1133	Washer (used with 97-423)	.03
97-423	Idler stud (used with S-19637)	.04
103-1	Crystal diode (1N64)	1.20
113-9	8-32 x 1/4 hex hd mach screw (4 mt. S-19970)	.02
114-201	8-32 x 5/16 hex hd self tap screw (8 used)	.01
125-89	Rubber grommet (mt. S-19959)	.06
126-661	Tube shield (6CB6)	.10
149-71	Iron core (S16984)	.10
149-85	Iron core (S19959)	.10
149-96	Iron core (S-20219)	.10
149-110	Iron core (S-17907)-S-19001--S-19952)	.15
149-111	Iron core (S-18210--S-20290--S-19736--S-19958)	.15
199-179	Coupling sleeve (76-680)	.03
S-15128	Choke coil assem. (Part of S-19956)	.25
S-16092	Coil shield & lug (Part of S-19736)	.30
S-16984	Filament choke coil assem.	.30
S-17907	2nd Video IF transformer assem.	.90
S-17916	Coil shield & lug (1 for ea. S-17907--S-19952)	.20
S-17958	Video shunt peaking coil	.35
S-18210	Adjacent channel sound trap coil	.85
S-18602	Gear, bushing & set screw	.30
S-18741	4th Video IF shield & lug (round for S-19956)	.20
S-18826	Ground spring & IF shield	.25
S-19001	Quadrature coil assem.	1.60
S-19131	Pulley & bushing	.25
S-19147	Drive cord & eyelet	.10
S-19235	Bracket assem.	.35
S-19238	Fine tuning pulley & bracket	.20
S-19637	Idler gear	.40
S-19714	Coil shield & lug (for S-20219)	.25
S-19736	1st Video IF transformer	.85
S-19952	3rd video IF transformer	.70
S-19953	Detector shunt peaking coil (Part of S-19956)	.35

Part No.	Description	Suggested List Price
S-19954	Detector series peaking coil (Part of S-19956)	.35
S-19956	4th Video IF transformer	4.75
S-19957	Shield & lug (rectangular)	.55
S-19958	Associated sound trap coil	.40
S-19959	Sound take - off coil	.40
S-19965	Bracket & plate	.20
S-19970	Turret tuner complete (for parts list see Page)	60.00
S-20254	Turret tuner - service replacement for S-19970	40.00
S-20219	Intercarrier coil	.35
S-20288	Coil shield & lug (for S-20290)	.05
S-20290	Adjacent channel picture trap coil	.35

TUBES

3	6CB6	1	6AU6
1	6BN6	1	12BY7

19L25 MAIN CHASSIS PARTS

Part No.	Description	Suggested List Price
12-1870	C.R. tube support bracket (Yoke mtg.)	.40
12-1871	Interlock mtg. bracket (Part of S-18579)	.15
12-1955	Chassis mounting bracket (4 used)	.10
15-98	Socket cap (Part of S-19636)	.45
15-101	Plate insulator cap (used with sweep-1B3GT)	.15
15-103	Plate insulator cap (used with sweep)	.10
19-178	Cond. retaining clip (2 used)	.07
22-4	.004 mfd ceramic disc 500V	.26
22-8	.002 mfd ceramic disc 500V	.26
22-1256	75 mmfd molded mica 500V	.20
22-1775	.047 mfd molded 400V	.26
22-1776	.0033 mfd molded 600V	.26
22-1777	.1 mfd molded 200V	.26
22-1784	.01 mfd molded 400V	.20
22-1785	.0015 mfd molded 400V	.20
22-1814	.0022 mfd molded 600V	.26
22-1831	56 mmfd molded mica 500V	.26
22-1841	.1 mfd molded 600V	.45
22-1842	.0047 mfd molded 200V	.26
22-1845	.0022 mfd molded 600V	.26
22-2112	.001 mfd ceramic 500V	.30
22-2125	680 mmfd mica 500V	.35
22-2127	.001 mfd molded 600V (2 used)	.26
22-2128	.001 mfd molded 600V (2 used)	.26
22-2129	.022 mfd molded 600V	.35
22-2166	.15 mfd molded 200V	.45
22-2167	.22 mfd molded 200V	.45
22-2248	.0033 mfd molded 600V	.26
22-2268	.0068 mfd molded 600V	.35
22-2340	.1 mfd molded 400V	.40
22-2341	.15 mfd molded 400V	.45
22-2387	680 mmfd ceramic 500V	.35
22-2398	Trimmer	.60
22-2416	1080 mmfd mica 500V	.60

Part No.	Description	Suggested List Price
22-2437	Electrolytic 80/400V 40/400V 30/400V	6.00
22-2452	.015 mmfd molded 200V	.25
22-2477	270 mmfd ceramic 500V	.30
22-2478	Electrolytic 4/350V 100/25V 40/25V	2.50
22-2479	Electrolytic 10/475V 40/400V 4/550V 100/50V	4.00
22-2498	270 mmfd ceramic 500V	.25
24-583	Sweep housing cover - top	.25
24-584	Sweep housing cover - back	.05
43-209	Sweep housing	.85
54-139	3/8-32 x 9/16 hex palnut (1 mt. 63-2815--2834--2835--2837--2853--2859 & S-19908)	.01
57-1718	Tube socket retaining plate (used only when 78-801 is used)	.01
57-1804	Socket mtg. plate (Part of S-19636)	.20
58-209	Two prong plug (A.C.) (part of S-18579)	.35
	Or 58-202 two prong plug (A.C.)	.15
63-958	22 K ohm 1 W Ins. 10%	.24
63-1157	47 K ohm 2W Ins. 10%	.33
63-1194	47 K ohm 1W Ins. 10%	.24
63-1719	27 ohm 1/2 W Ins. 10%	.21
63-1744	100 ohm 1/2 W Ins. 20% (3 used)	.21
63-1754	180 ohm 1/2 W Ins. 10%	.21
63-1771	470 ohm 1/2 W Ins. 10%	.21
63-1775	560 ohm 1/2 W Ins. 10% (2 used)	.21
63-1803	2700 ohm 1/2 Ins. 10%	.21
63-1810	3900 ohm 1/2 W Ins. 10%	.21
63-1813	4700 ohm 1/2 W Ins. 10%	.21
63-1834	15 K ohm 1/2 W Ins. 10%	.21
63-1842	22 K ohm 1/2 W Ins. 20%	.21
63-1848	33 K ohm 1/2 W Ins. 10%	.21
63-1849	33 K ohm 1/2 W Ins. 20%	.21
63-1855	47 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1856	47 K ohm 1/2 W Ins. 20%	.21
63-1869	100 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1870	100 K ohm 1/2 W Ins. 20% (2 used)	.21
63-1880	180 K ohm 1/2 W Ins. 10%	.21
63-1883	220 K ohm 1/2 W Ins. 10%	.21
63-1898	470 K ohm 1/2 W Ins. 20% (3 used)	.21
63-1904	680 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1911	1 meg ohm 1/2 W Ins. 10% (3 used)	.21
63-1918	1.5 meg ohm 1/2 W Ins. 10%	.21
63-1922	1.8 meg ohm 1/2 W Ins. 10%	.21
63-1939	4/7 meg ohm 1/2 W Ins. 10%	.21
63-1970	3300 ohm 2 W Ins. 20%	.33
63-1982	100 K ohm 2 W Ins. 10%	.33
63-2129	1.2 ohm 1/2 WWW Ins. 10%	.21
63-2130	150 K ohm 1 W Ins. 10%	.24
63-2145	10 K ohm 2 W Ins. 20%	.33
63-2159	Vertical range control	1.20
63-2273	820 ohm 1 W Ins. 5%	.24
63-2290	680 ohm 1 W Ins. 10%	.24
63-2364	18 K ohm 2 W Ins. 10% (2 used)	.36
63-2394	Vertical size control	1.20
63-2398	470 ohm 1 W Ins. 10%	.24
	Or 63-1222 470 ohm 1 W Ins. 10%	.24
63-2777	Volume control & switch	1.81
63-2815	Vertical linearity control	1.20
63-2834	Vertical hold control	1.20

Part No.	Description	Suggested List Price
63-2835	Tone control	1.20
63-2837	Brightness control	1.20
63-2853	Screen control	1.20
63-3186	330 ohm 1 W Ins. 10%	.24
6402	Rivet 1/8 dia x 5/16 (6 mt. 78-709)	.01
64-4	Rivet 1/8 dia x 1/4 (2 mt. 78-840)	.01
64-5	Rivet 1/8 dia x 7/32 (2 mt. 58-202)	.01
64-6	Rivet 1/8 dia x 3/16 (2 mt. 78-351)	.01
64-7	Rivet 1/8 dia x 5/32 (2 mt. ea. 78-755 & 834)	.01
64-27	Rivet 1/8 dia x 1/8 (2 mt. ea. 63-2159 & 78-966).	.01
64-31	Rivet 1/8 dia x 11/32 (MT. 78-801 --1 for S-19636	.01
64-88	Rivet .088 x 1/8 (2 mt. 78-939)	.01
64-183	Rivet .088 x 3/16 (mt. 78-788 & 916)	.01
64-414	Rivet 1/8 x 5/32 (mt. 83-1953--1954--1974--2030--2099)	.01
78-351	Socket, two contact	.18
78-706	Socket, octal tube (Part of S-19293)	.20
78-709	Socket, octal tube (3 used)	.20
78-755	Socket, octal tube	.18
78-801	Socket, octal tube (used with 57-1718 as Alt. for 78-709)	.15
78-834	Socket, octal tube	.25
78-840	Socket, two contact	.30
	Or 78-966 Socket, two contact	.30
78-846	Socket, min. tube	.20
78-939	Socket, min. tube	.35
78-768	Socket	
78-977	Socket, min. tube	.15
80-802	Iron core retaining spring (1 ea. S-18580--S-18748)	.06
80-878	Plate cap contact spring (sweep)	.09
80-885	Snap spring (2 - sweep)	.05
80-889	C R tube ground spring (sweep)	.10
80-892	Tube plate clip spring (used with 15-103)	.10
80-950	Anode connector spring (sweep)	.10
80-970	Shaft grounding spring	.08
83-1840	Armite insulating strip (sweep)	.02
83-1883	Fuse mtg. strip	.25
83-1953	Five lug terminalstrip	.10
83-1954	Seven lug terminal strip (4 used)	.15
83-1974	Ten lug terminal strip	.20
83-1979	Rubber channel strip (sweep)	.10
83-2030	Seven lug terminal strip	.15
83-2078	Four lug terminal strip (Part of S-19737)	.15
83-2099	Eleven lug terminal strip	.25
83-2137	Eight lug terminal strip (sweep)	.15
87-1	Integrator unit	.26
93-2	Brass washer (part of S-19636)	.01
93-842	Steel washer (sweep)	.02
93-1127	Fibre Washer (mt. 78-709)	.01
93-1156	Spring washer (mt. S-19743)	
94-767	Rubber bushing (2 sweep)	.15
95-1298	Power transformer	22.50
95-1339	Audio output transformer	2.25
95-1346	Filter choke	2.25
95-1357	Deflection coil	12.00

Part No.	Description	Suggested List Price
95-1361	Vertical output transformer	3.50
100-166	Pilot light bulb	.20
112-88	8-32 thumbscrew (sweep)	.06
113-18	6-32 x 5/16 hex hd mach screw (1 mt. 22-2457)	.02
113-21	8-32 x 1/4 hex hd mach screw (mt. S-20335 & 6)	.02
114-102	6-32 x 3/8 hex hd self tap screw (mt. 83-1883)	.01
114-201	8-32 x 5/16 hex hd self tap screw (28 used)	.01
114-248	6-20 x 5/16 hex hd self tap screw (2 mt. ea. S-18763)	.01
114-336	10-32 x 5/16 hex hd self tap screw (3 mt. 95-1298)	.03
114-396	8-32 x 3/8 hex hd self tap screw (4 mt, 12-1870)	.04
114-415	8-32 x 3/4 hex hd self tap screw (mt. 152-218--S-19636)	.03
125-17	Rubber grommet (sweep -- S19636)	.03
125-26	Rubber grommet (mt. 78-709)	.03
136-27	Fuse 175MA	.20
149-101	Iron core & spring (for S-18748)	.35
149-118	Iron core & spring (for S-18570)	.20
149-131	Iron core (Part of S-19743)	.15
152-218	C R tube support block (2 used)	.35
199-175	Shielded paper sleeve	.04
S-18566	Winding only for S-18567	3.25
S-18567	Horiz. sweep transf.	6.50
S-18570	Horiz. linearity control coil assem.	.50
S-18579	Plug & bracket (interlock)	.50
S-18748	Width control coil assem.	1.00
S-18763	Corrector magnet (2 sweep)	.30
S-19293	Socket, resistor & wire(sweep)	.60
S-19545	C R tube socket & terminal	1.60
S-19636	Socket shell & mtg. plate (sweep)	.60
S-19737	Terminal strip & wire (sweep)	.40
S-19743	Horiz. osc. coil	1.50
S-19898	Centering device & yoke cover	.80
S-19969	Screen registor coil	.30
S-20079	Mtg. bracket & lug (for sweep transf.)	.20
S-20335	Pilot light bracket & wire	.45
S-20336	Pilot light mtg. bracket	.20
S-20367	Trap coil	.75

TUBES

1 12AX7	1 6AQ7GT	1 6AH4GT
1 6AX4GT	1 5U4G	1 6BQ6GT
1 6BE6	1 1B3GT	or 6GQ6G
1 6SN7GTA	1 6BK7A	

NOTE: See Model parts list for C. R. tube, mtg. strap, dust seal strip and beam bender.

19L26 MAIN CHASSIS PARTS

Part No.	Description	Suggested List Price
12-1870	C R tube support brkt. (yoke) (part of S-20408)	.40
12-1871	Interlock mtg. brkt. (Part of S-18579)	.15
12-1955	Chassis mtg. bracket (4 used)	.10
15-98	Socket cap (Part of S-19636)	.45
15-101	Plate insulator cap (used with sweep -1B3GT)	.15
15-103	Plate insulator cap	.10
19-178	Cond. retaining clip (3 used)	.07
22-8	.002 mfd ceramic disc. 500V	.26
22-1256	75 mmfd molded mica 500V	.20
22-1775	.047 mfd molded 400V	.26
22-1777	.1 mfd molded 200V	.26
22-1784	.01 mfd molded 400V	.20
22-1785	.0015 mfd molded 400V	.20
22-1814	.0022 mfd molded 600V	.26
22-1831	56 mmfd molded mica 500V	.26
22-1841	.1 mfd molded 600V	.45
22-1842	.0047 mfd molded 200V	.26
22-1845	.0022 mfd molded 600V	.26
22-2112	.001 mfd ceramic 500V	.30
22-2125	680 mmfd mica 500V	.35
22-2127	.001 mfd molded 600V (2 used)	.26
22-2128	.001 mfd molded 600V (2 used)	.26
22-2159	.33 mfd molded 200V	.35
22-2166	.15 mfd molded 200V	.45
22-2167	.22 mfd molded 200V	.45
22-2248	.0033 mfd molded 600V	.26
22-2268	.0068 mfd molded 600V	.35
22-2340	.1 mfd molded 400V	.40
22-2341	.15 mfd molded 400V	.45
22-2358	Electrolytic 80/400V 40/400V 30/400V 40/25V	5.50
22-2387	680 mmfd ceramic 500V	.35
22-2398	Trimmer	.60
22-2416	1080 mmfd mica 500V	.60
22-2479	Electrolytic 10/475V 40/400V 4/350V 100/50V	2.50
22-2498	270 mmfd ceramic 500V	.25
22-2510	.033 mfd molded 200V	.35
24-583	Sweep housing cover - top	.25
24-584	Sweep housing cover - back	.05
43-209	Sweep housing	.85
54-139	3/8-32 x 9/16 hex palnut (1 mt. ea. 63-2837--2859--2815--2834--S-19908)	.01
57-1718	Tube socket retaining plate (used only when 78-801 is used)	.01
57-1804	Socket mtg plate (Part of S-19636)	.20
58-209	Two prong socket AC (Part of S-18579)	.35
	Or 58-202 Two prong socket AC (Part of S-18579)	.15
63-958	22 K ohm 1 W Ins. 10%	.24
63-1194	47 K ohm 1 W Ins. 10%	.24
63-1708	15 ohm 1/2 W Ins. 10%	.21
63-1744	100 Ohm 1/2 W Ins. 20% (3 used)	.21
63-1754	180 ohm 1/2 W Ins. 10%	.21
63-1771	470 ohm 1/2 W Ins. 10%	.21
63-1775	560 ohm 1/2 W Ins. 10% (2 used)	.21
63-1803	2700 ohm 1/2 W Ins. 10%	.21
63-1810	3900 ohm 1/2 W Ins. 10%	.21
63-1813	4700 ohm 1/2 W Ins. 10%	.21
63-1834	15 K ohm 1/2 W Ins. 10%	.21
63-1842	22 K ohm 1/2 W Ins. 20%	.21
63-1848	33 K ohm 1/2 W Ins. 10%	.21

Part No.	Description	Suggested List Price
63-1849	33 K ohm 1/2 W Ins. 20%	.21
63-1855	47 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1856	47 K ohm 1/2 W Ins. 20%	.21
63-1869	100 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1870	100 K ohm 1/2 W Ins. 20% (2 used)	.21
63-1883	220 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1898	470 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1904	680 K ohm 1/2 W Ins. 10% (2 used)	.21
63-1911	1 meg ohm 1/2 W Ins. 10% (3 used)	.21
63-1918	1.5 meg ohm 1/2 W Ins. 10%	.21
63-1922	1.8 meg ohm 1/2 W Ins. 10%	.21
63-1982	100 K ohm 2 W Ins. 10%	.33
63-2130	150 K ohm 1 W Ins. 10%	.24
63-2145	10 K ohm 2 W Ins. 20%	.33
63-2290	680 ohm 1 W Ins. 10%	.24
63-2364	18 K ohm 2 W Ins. 10% (2 used)	.36
63-2394	Vertical size control	1.20
63-2398	470 ohm 1 W Ins. 10%	.24
	Or 63-1222 470 ohm 1 WWW Ins. 10%	.24
63-2777	Volume control & switch	1.81
63-2815	Vertical linearity control	1.20
63-2837	Brightness control	1.20
63-2896	Vertical hold control	1.20
63-3186	330 ohm 1 W Ins. 10%	.24
63-3188	1 K ohm 1 W Ins. 5%	.24
64-2	Rivet 1/8 dia x 5/16 (mt. 78-709)	.01
64-4	Rivet 1/8 dia x 1/4 (mt. 78-840)	.01
6 4	Rivet 1/8 dia x 7/32 (mt. 58-202)	.01
64-6	Rivet 1/8 dia x 3/16 (mt. 78-851--58-209)	.01
64-7	Rivet 1/8 dia x 5/32 (mt. 78-755--78-834)	.01
64-27	Rivet 1/8 dia x 1/8 (mt. 78-966)	.01
64-31	Rivet 1/8 dia x 11/32 (mt. 78-801, 1 part of S-19636)	.01
64-88	Rivet .088 dia x 1/8 (mt. 78-939)	.01
64-183	Rivet .088 dia x 3/16 (mt. 78-788--78-916)	.01
64-414	Rivet 1/8 dia x 5/32 (mt. 83-1953--1954--1974--2030--2099)	.01
78-351	Socket, two contact	.18
78-706	Socket, octal tube (Part of S-19293)	.20
78-709	Socket, octal tube (3 used)	.20
78-755	Socket, octal tube (2 used)	.18
78-801	Socket, octal tube (used with 57-1718 as alt for 78-709)	.15
78-834	Socket, octal tube	.25
78-840	Socket, two contact	.30
	Or 78-966 socket, two contact	.30
78-846	Socket, min. tube	.30
78-939	Socket, min. tube	.20
78-968	C R tube socket & wire	1.00
78-977	Socket, min tube	.15
80-802	Iron core retaining spring (1 ea. S-18570--S-19486)	.06
80-878	Plate cap contact spring (sweep)	.09
80-885	Snap spring (2 sweep)	.05
80-889	C R tube ground spring (sweep)	.10
80-892	Tube plate clip spring (used with 15-103)	.10
80-950	Anode connector spring (sweep)	.10
80-970	Shaft grounding spring	.08

Part No.	Description	Suggested List Price
83-1840	Armite insulating strip (sweep)	.02
83-1883	Fuse mtg. strip	.25
83-1953	Five lug terminal strip	.10
83-1954	Seven lug terminal strip (4 used)	.15
83-1974	Ten lug terminal strip	.20
83-1979	Rubber channel strip (sweep)	.10
83-2030	Seven lug terminal strip	.15
83-2078	Four lug terminal strip (Part of S-19737)	.15
83-2099	Eleven lug terminal strip	.25
83-2137	Eight lug terminal strip (sweep)	.15
83-2147	Slide strip (Part of S-20408)	.01
87-1	Integrator unit	.26
93-2	Brass washer (Part of S-19636)	.01
93-842	Steel washer (sweep)	.02
93-1127	Fibre washer (mt. 78-709)	.01
93-1156	Spring washer (mt. S-19743)	
94-767	Rubber bushing (2 sweep)	.15
95-1298	Power transformer	22.50
95-1340	Audio output transformer	1.80
95-1346	Filter choke	2.25
95-1357	Deflection coil	12.00
95-1361	Vertical output transformer	3.50
100-166	Pilot light bulb	.20
112-88	8-32 thumb screw	.06
113-18	6-32 x 5/16 hex hd mach screw (1 mt. 22-2457)	.02
113-21	8-32 x 1/4 hex hd mach (mt. S-20335-6)	.02
114-102	6-32 x 3/8 hex hd self tap screw (mt. 83-1883)	.01
114-201	8-32 x 5/16 hex hd self tap screw (28 used)	.01
114-248	6-20 x 5/16 hex hd self tap screw (mt. S-18763)	.01
114-336	10-32 x 5/16 hex hd self tap screw (3 mt 95-1298)	.03
114-396	8-32 x 3/8 hex hd self tap screw (mt. S-20408)	.04
114-415	8-32 x 3/4 hex hd self tap screw (mt. 152-218 S-19636)	.03
125-17	Rubber grommet (mt. S-19636)	.03
125-26	Rubber grommet (mt. 78-709)	.03
136-27	Fuse 175 MA	.20
149-101	Iron core & spring (for S-19486)	.35
149-118	Iron core & spring (for S-18570	.20
149-31	Iron core (part of S-19743)	.15
152-218	C R tube support block (2 used)	.35
199-175	Shielded paper sleeve	.04
S-18570	Horizontal linearity control coil	.50
S-18579	Plug & bracket (interlock)	.50
S-18763	Corrector magnet (2 - sweep)	.30
S-19293	Socket, resistor & wire (sweep)	.60
S-19486	Width control coil assem.	.55
S-19545	C R tube socket & terminal	1.60
S-19636	Socket shell & mtg. plate (sweep)	.60
S-19728	Horizontal sweep transf.	6.50
	S-19854 Winding only for S-19728	2.50
S-19737	Terminal strip & wire (sweep)	.40
S-19743	Horizontal oscillator coil	1.50
S-19898	Centering device & yoke cover (Part of 95-1357)	.80
S-20079	Mtg. brkt. & lug (for sweep transf.)	.20

Part No.	Description	Suggested List Price
S-20335	Pilot light bracket & wire	.45
S-20336	Pilot light mtg. bracket	.20
S-20367	Trap coil assem.	.75
S-20408	Bracket & strip (sweep)	.45

TUBES

1 12AX7	1 6AQ7GT	1 6AH4GT
1 6AX4GT	1 5U4G	1 6BQ6GT
1 6BE6	1 1B3GT	OR 6BQ6G
1 6SN7GT	1 6BK5	

NOTE: See model parts list for C R tube, mtg. strap, dust seal strip and beam bender.

21L21 MAIN CHASSIS PARTS

Part No.	Description	Suggested List Price
12-1871	Coil & interlock mtg. bracket (Part of S-18579)	.15
12-1926	Tube support bracket (used with 78-950 for 1B3GT)	.15
12-1955	Chassis mtg. bracket (4 used)	.10
15-98	Socket cap (Part of S-19636)	.45
15-101	Plate insulator cap (2 used with sweep assembly)	.15
17-121	Cable clamp (2 part of 95-1311)	.20
19-177	Anode clip (Part of S-15392)	.15
19-178	Cond. retaining clip (2 used)	.07
22-4	.004 mfd. Ceramic disc 500V	.26
22-8	.002 mfd. Ceramic disc 500V	.26
22-1256	75 mmfd molded mica 500V	.20
22-1775	.047 mfd molded 400V	.26
22-1776	.0033 mfd molded 600V	.26
22-1777	.1 mfd molded 200V	.26
22-1785	.0015 mfd molded 400V	.20
22-1814	.0022 mfd molded 600V	.26
22-1831	56 mmfd molded mica 500V	.26
22-1832	500 mmfd molded mica 20,000V (2 used)	2.25
22-1841	.1 mfd molded 600V	.45
22-1842	.0047 mfd molded 200V	.26
22-1845	.0022 mfd molded 600V	.26
22-1849	.0047 mfd molded 600V	.26
22-2112	.001 mfd ceramic 500V	.30
22-2125	680 mmfd mica 500V	.35
22-2127	.001 mfd molded 600V (2 used)	.26
22-2128	.001 mfd molded 600V (2 used)	.26
22-2129	.022 mfd molded 600V	.35
22-2166	.15 mfd molded 200V	.45
22-2167	.22 mfd molded 200V	.45
22-2248	.0033 mfd molded 600V (2 used)	.26
22-2309	330 mmfd ceramic 500V	.26
22-2340	.1 mfd molded 400V	.40
22-2341	.15 mfd molded 400V	.45
22-2387	680 mmfd ceramic 500V	.35
22-2398	Single section trimmer	.60
22-2416	1080 mmfd mica 500V	.60
22-2452	.015 mfd molded 200 V	.25
22-2478	Electrolytic 4/350V 100/25V 40/25V	2.50
22-2479	Electrolytic 10/475V 40/400V 4/350V 100/50V	4.00
22-2501	.0068 mfd molded 400V	
24-583	Sweep housing cover - top	.25
24-584	Sweep housing cover - back	.05

Part No.	Description	Suggested List Price
43-209	Sweep housing	.85
54-34	6-32 x 1/4 hex nut (mt 22-1832)	.003
54-139	3/8-32 x 9/16 hex palnut (1 mt each 63-2812, 2834, 2837, 2838, 2394)	.008
57-1718	Tube socket retaining plate (used only when 78-801 is used)	.01
58-1804	Socket mtg. plate (Part of S-19636)	.20
58-209	Two prong plug (Part of S-18579)	.35
58-202	Two prong plug (Part of S-18579)	.15
63-942	15 K ohm 2 W ins. 10%	.36
63-958	22 K ohm 1 W ins. 10%	.24
63-966	4700 ohm 2 W ins. 20% (2 used)	.36
63-1091	12 K ohm 2 W ins. 10%	.33
63-1157	47 K ohm 2 W ins. 10%	.33
63-1194	47 K ohm 1 W ins. 10%	.24
63-1750	150 ohm 1/2 W ins. 10%	.21
63-1744	100 ohm 1/2 W ins. 20%	.21
63-1771	470 ohm 1/2 W ins. 10%	.21
63-1775	560 ohm 1/2 W ins. 10% (2-part of 95-1358)	.21
63-1803	2700 ohm 1/2 W ins. 10%	.21
63-1813	4700 ohm 1/2 W ins. 10%	.21
63-1834	15 K ohm 1/2 W ins. 10% (2 used)	.21
63-1842	22 K ohm 1/2 W ins. 20%	.21
63-1848	33 K ohm 1/2 W ins. 10%	.21
63-1855	47 K ohm 1/2 W ins. 10% (2 used)	.21
63-1856	47 K ohm 1/2 W ins. 10% (2 used)	.21
63-1869	100 K ohm 1/2 W ins. 10% (2 used)	.21
63-1870	100 K ohm 1/2 W ins. 20% (2 used)	.21
63-1876	150 K ohm 1/2 W ins. 10%	.21
63-1880	180 K ohm 1/2 W ins. 10%	.21
63-1883	220 K ohm 1/2 W ins. 10%	.21
63-1898	470 K ohm 1/2 W ins. 10% (3 used)	.21
63-1904	680 K ohm 1/2 W ins. 10% (2 used)	.21
63-1911	1 meg ohm 1/2 W ins. 10% (3 used)	.21
63-1918	1.5 meg ohm 1/2 W ins. 10%	.21
63-1922	1.8 meg ohm 1/2 W ins. 10%	.21
63-1932	3.3 meg ohm 1/2 W ins. 10%	.21
63-1982	100 K ohm 2 W ins. 10%	.33
63-2114	2.2 ohm 1/2 W WW ins. 10%	.21
63-2130	150 K ohm 1 W ins. 10%	.24
63-2145	10 K ohm 2 W ins. 20%	.33
63-2159	Vertical range control	1.20
63-2284	150 ohm 1 W ins. 20%	.24
63-2286	330 ohm 1 W ins. 20%	.24
63-2394	Vertical size control	1.20
63-2398	470 ohm 1 W ins. 10% or 63-1222 470 ohm 1 W WW ins. 10%	.24
63-2808	68 ohm 2 W ins. 20%	.33
63-2816	2.5 meg ohm 2 W ins. 20% (special) (used on 78-706)	.33
63-2834	Vertical hold control	1.20
63-2837	Brightness control	1.20
63-2838	Volume control & switch	1.81
63-2865	Vertical linearity control or 63-2812 Vertical linearity control	1.81
63-3186	330 ohm 1 W ins. 10%	.24
63-3187	470 ohm 1 W ins. 20%	.24
87-1	Integrator unit	.26
95-1311	Power transformer	30.00

Part No.	Description	Suggested
95-1339	Audio output transformer	2.25
95-1348	Filter choke	
95-1358	Deflection coil	
95-1361	Vertical output transformer	3.50
100-166	Pilot light bulb	.20
S-18579	Plug & bracket (interlock)	.50
S-18748	Horiz. width control coil assem.	1.00
S 18763	Corrector magnet (2 used-sweep)	.30
S-19032	Horizontal sweep transf.	6.50
	S-19079 winding only for S-19032	2.75
S-19040	Anode clip & wire	.50
S-19342	Horiz. linearity control coil	
S-19342	Horiz. linearity control coil assem.	.80
S-19636	Socket shell & mtg. plate (sweep-1B3GT)	.60
S-19662	C. R. tube support assem. (sweep)	.70
S-19743	Horizontal oscillator coil assem.	1.50
S-20079	Transformer mtg. brkt & lug (sweep)	.20
S-20335	Pilot light bracket & wire	.45
S-20336	Pilot light mtg. bracket	.20
S-20367	Trap coil assem.	.75
S-20377	PM focus & centering assem. or S-19661 PM focus & centering assem.	8.50

TUBES

1 12AX7	1 6AQ7GT	1 6BK5
1 6CD6G	2 5U4G	1 6AH4GT
1 6BE6	1 6AX4GT	1 1X2A
1 6SN7GT	1 1B3GT	or 1X2B

Note - C. R. tube, mtg. strap, beam bender, etc. are listed on Model Parts list.

CABINET PARTS MODEL L1846R

49-738	Speaker 10" PM	8.75
	Or 49-649 Speaker 10" P.M.	11.75

MODEL L1846E - CHASSIS 19L25

49-738	Speaker 10" P.M.	8.75
Or 49-649	Speaker 10" P.M.	11.75

MODEL L1812R - CHASSIS 19L26

49-719	Speaker 4" PM	4.50

MODEL L1812E - CHASSIS 19L26

49-719	Speaker 4" PM	4.50

MODEL L1820R - CHASSIS 19L26

49-741	Speaker 5 1/4" PM	5.50

MODEL L1820E - CHASSIS 19L26

49-741	Speaker 5 1/4 PM	5.50

CHASSIS 19L27 SAME AS CHASSIS 19L25 EXCEPT

OMIT

63-2777	Volume control & switch	
152-218	C R tube support block (2 used)	

Part No.	Description	Suggested List Price
ADD		
63-2838	Volume control & switch	1.81
152-227	C R tube support block (2 used)	.30

MODEL L2236R - CHASSIS 19L27

49-696	Speaker 5 1/4 PM	6.00

MODEL L2236E - CHASSIS 19L27

49-696	Speaker 5 1/4 PM	6.00

MODEL L2258R - CHASSIS 19L27

49-738	Speaker, 10" PM Or alternate 49-649 speaker	8.75

MODEL L2258E - CHASSIS 19L27

49-738	Speaker 10" PM Or alternate 49-649 Speaker	8.75

MODEL L2262R - CHASSIS 19L27

49-738	Speaker 10" PM Or Alternate 49-649 Speaker	8.75

MODEL L2262C - CHASSIS 19L27

49-738	Speaker 10" PM	8.75

MODEL L2285R - TV CHASSIS 19L27 - RADIO CHASSIS 8L20 - RECORD CHANGER S-14054

49-728	Speaker 10" PM	10.00

MODEL L2259R USING 21L21 CHASSIS

49-738	Speaker 10" PM	8.75
	49-649 Speaker Alternate	11.75

MODEL L2259R USING CHASSIS 21L21

49-738	Speaker 10" PM	8.75
	49-649 Speaker-Alternate	11.75
63-3171	Tone control	1.20
63-3172	Screen control	1.20

MODEL L2267E

49-738	Speaker 10 inch PM	8.75
	49-649 Speaker - alternate	11.75
63-3171	Tone control	1.20
63-3172	Screen control	1.20

MODEL L2267H

49-738	Speaker, 10 inch PM	8.75
	49-649 Speaker - alternate	11.75
63-3171	Tone control	1.20
63-3172	Screen control	1.20

MODEL L2270

49-738	Speaker, 10 inch PM	8.75
	49-649 speaker - alternate	11.75
63-3171	Tone control	1.20
63-3172	Screen control	1.20

MODEL L2287R

49-740	Speaker, 12 inch PM	
63-1828	10 K ohm 1/2 W ins. 20%	.21
63-2892	Tone control-treble (radio)	
63-2893	Tone control-bass (radio)	
63-3171	Tone control (TV)	1.20
63-3172	Screen control	1.20

MODEL L2291E

49-740	Speaker 12 inch PM	
63-1828	10 K ohm 1/2 W ins. 20%	.21
63-2892	Tone control - treble (radio)	
63-2893	Tone control - bass (radio)	
63-3171	Tone control - TV	1.20
63-3172	Screen control - TV	1.20

MODEL L2261E

49-738	Speaker 10 inch PM	8.75
	49-649 speaker - alternate	11.75
63-3171	Tone control	1.20
63-3172	Screen control	1.20

MODEL L2261H

49-738	Speaker, 10 inch PM	8.75
	49-649 Speaker-alternate	11.75
63-3171	Tone control	1.20
63-3172	Screen control	1.20

MODEL L2266R

49-738	Speaker 10 inch PM	8.75
	49-649 speaker - alternate	11.75
63-3171	Tone control	1.20
63-3172	Screen control	1.20

MODEL L2260R

49-738	Speaker 10 inch PM	8.75
	49-649 speaker - alternate	11.75
63-3171	Tone control	1.20
63-3172	Screen control	1.20

MAIN CHASSIS 22L20

22-4	.004 mfd ceramic disc 500V	.26
22-8	.002 mfd ceramic disc 500V	.26
22-1442	100 mmfd molded mica 500V	.27
22-1775	.047 mfd molded 400V	.26
22-1776	.0033 mfd molded 600V	.26
22-1777	.1 mfd molded 200V (3 used)	.26
22-1785	.0015 mfd molded 400V	.20
22-1832	500 mmfd molded 20,000V (2 used)	2.25
22-1841	.1 mfd molded 600V	.45
22-1842	.0047 mfd molded 200V	.26
22-1844	.047 mfd molded 600V	.35
22-1847	.0047 mfd molded 200V	.26
22-1849	.0047 mfd molded 600V	.26
22-2112	.001 mfd ceramic 500V	.30
22-2125	680 mmfd mica 500V	.35
22-2127	.001 mfd molded 600V (2 used)	.26
22-2166	.15 mfd molded 200V	.45
22-2167	.22 mfd molded 200V	.45
22-2226	.0033 mfd 400V	.26
22-2248	.0033 mfd molded 600V	.26

Part No.	Description	Suggested List Price
22-2302	470 mmfd ceramic 500V	.35
22-2309	330 mmfd ceramic 500V	.26
22-2340	.1 mfd molded 400V	.40
22-2341	.15 mfd molded 400V	.45
22-2387	680 mfd ceramic 500V	.35
22-2398	Trimmer	.60
22-2416	1080 mmfd mica 500V	.60
22-2478	Electrolytic 4/350V 100/25V 40/25V	2.50
22-2483	Electrolytic	
22-2484	.0068 mfd molded 1000V	
22-2505	120 mmfd molded mica	
24-583	Sweep housing cover-top	.25
24-584	Sweep housing cover back	.05
43-209	Sweep transf. housing	.85
63-958	22 K ohm 1 W ins. 10%	.24
63-966	4700 ohm 2 W ins. 20% (2 used)	.36
63-1157	47 K ohm 2 W ins. 10%	.33
63-1192	27 K ohm 1 W ins. 10%	.24
63-1194	47 K ohm 1 W ins. 10%	.24
63-1543	33 K ohm 2 W ins. 10% (2 used)	
63-1743	100 ohm 1/2 W ins. 10%	.21
63-1744	100 ohm 1/2 W ins. 20% (4 used)	.21
63-1771	470 ohm 1/2 W ins. 10%	.21
63-1785	1 K ohm 1/2 W ins. 10%	.21
63-1789	1200 ohm 1/2 W ins. 10%	.21
63-1810	2700 ohm 1/2 W ins. 10%	.21
63-1813	4700 ohm 1/2 W ins. 10%	.21
63-1834	15 K ohm 1/2 W ins. 10%	.21
63-1842	22 K ohm 1/2 W ins. 20% (2 used)	.21
63-1855	47 K ohm 1/2 W ins. 10% (2 used)	.21
63-1856	47 K ohm 1/2 W ins. 20%	.21
63-1869	100 K ohm 1/2 W ins. 10% (3 used)	.21
63-1870	100 K ohm 1/2 W ins. 20% (3 used)	.21
63-1883	220 K ohm 1/2 W ins. 10%	.21
63-1887	270 K ohm 1/2 W ins. 10%	.21
63-1898	470 K ohm 1/2 W ins. 20%	.21
63-1904	680 K ohm 1/2 W ins. 10% (2 used)	.21
63-1905	680 K ohm 1/2 W ins. 20%	.21
63-1911	1 meg ohm 1/2 W ins. 20% (3 used)	.21
63-1912	1 meg ohm 1/2 W ins. 20%	.21
63-1918	1.5 meg ohm 1/2 W ins. 10%	.21
63-1925	2.2 meg ohm 1/2 W ins. 10%	.21
63-1982	100 K ohm 2 W ins. 10%	.33
63-1983	47 ohm 2 W ins. 20%	.33
63-2145	10 K ohm 2 W ins. 20%	.33
63-2286	330 ohm 1 W ins. 20% (2 used)	.24
63-2398	470 ohm 1 W ins. 10% or 63-1222 470 ohm 1 W WW ins. 10%	.24 .24
63-2805	Vertical size control	1.20
63-2812	Vertical linearity control	1.81
63-2816	Special hi-voltage resistor	.33
63-2835	Vertical hold & tone control (2 used)	1.20
63-2837	Brightness control	1.20
68-2838	Volume control & switch	1.81
68-2853	Screen control	1.20
63-2894	8.2 ohm 1/2 W WW ins. 10%	
63-3166	220 K ohm 2 W ins. 10%	.33
63-3189	470 ohm 1 W ins. 10%	
63-3191	15 meg ohm 1 W ins. 10%	

Part No.	Description	Suggested List Price
95-1339	Audio output transformer	2.25
95-1352	Vertical output transformer	
136-22	Fuse (250 MA)	.25
149-101	Iron core & spring (for S-18748)	.35
149-118	Iron core & spring (for S-19342)	.20
149-131	Iron core (Part of S-19743)	.15
S-18748	Width control coil assem. (mtd on S-18579)	1.00
S-19342	Horiz. linearity control coil assem. (mtd. on S-18579)	.80
S-19743	Horizontal oscillator coil assem.	1.50
S-20099	Horizontal sweep transformer	
S-20195	Winding only for S-20099	
S-20438	Trap coil assem.	-

S-20127 POWER SUPPLY PARTS LIST

22-2487	Electrolytic	
95-1170	Filter choke	2.00
95-1334	Filter choke	2.75
95-1353	Power transformer	

MODEL L2572R

49-738	Speaker, 10 inch PM	8.75
	49-649 speaker is alt.	11.75

C. R. TUBE & MTG. ASSEMBLY

S-20344	PM focus & centering assem.	
S-20358	Focus unit mtg. bracket	
S-20360	Corrector magnet assem. (2 used)	

MODEL L2573E

49-738	Speaker 10 inch PM	8.75
	49-649 speaker is alt.	11.75

MODEL L2574R

49-738	Speaker 10 inch PM	8.75
	49-649 speaker is alt.	11.75

MODEL L2575E

49-738	Speaker 10 inch PM	8.75
	49-649 speaker is alt.	11.75

MODEL L2592R
MODEL L2593H
TV CHASSIS 22L20
RADIO CHASSIS 10L20
RECORD CHANGER S-14053

49-740	Speaker 12 inch PM	
63-1828	10 K ohm 1/2 W ins. 20%	.21
63-2892	Tone control - treble	
63-2893	Tone control - bass	
S-18812	Loop loading coil assem.	.65
S-19472	Low impedance loop, clip & strip	1.00

MODEL L2876E

49-743	Speaker 10 inch PM	

C. R. TUBE AND MTG. ASSEMBLY

12-2025	Yoke mtg. bracket	
12-2029	Mtg. bracket (2 used)	
95-1359	Deflection yoke	
S-17461	Beam bender unit	1.50
S-20344	PM focus & centering assem.	
S-20358	Focus unit mtg. bracket	
S-20360	Corrector magnet (2 used)	

MODEL L2876R

49-743	Speaker, 10 inch PM	

MODEL L2878R

49-743	Speaker, 10 inch PM	

MODEL 2879E

49-743	Speaker 10 inch PM	

MODEL L2281 & R & E
TV CHASSIS 19L27
RADIO CHASSIS 4L03
RECORD CHANGER S-14054

49-745	Speaker 7 1/2 PM	
63-1828	10 K ohm 1/2 W ins. 20%	.21

CHASSIS 19L28

CHASSIS 19L28 SAME AS CHASSIS 19L26 EXCEPT:

OMIT

63-2777	Volume control & switch	

ADD

63-2838	Volume control & switch	1.81

MODEL L2229R

49-696	Speaker 5 1/4 PM	6.00

MODEL L2229E

49-696	Speaker 5 1/4 inch PM	6.00

MODEL L2235R

49-741	Speaker, 5 1/4 inch PM	5.50

MODEL L2235E

49-741	Speaker 5 1/4 inch PM	5.50

MODEL L2571R

49-738	Speaker, 10 inch PM	8.75
	or 49-649 speaker-alternate	11.75

C. R. TUBE & MTG. ASSEMBLY

95-1359	Deflection yoke	
S-17461	Beam bender unit	1.50
S-20344	PM focus & centering assem.	
S-20358	Focus unit mtg. bracket assem.	
S-20360	Corrector magnet assem.	

REVISED CHASSIS AND MODEL INFORMATION "K" AND "K-3" SERIES TELEVISION RECEIVERS

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The K-3 series of Zenith television receivers are similar to the "K" series

The S-18770 turret tuner as originally used in the "K" series will also be used in early production K-3 receivers. Later production K-3 receivers will utilize the S-19840 tuner. The two tuners are directly interchangeable as complete units, however the VHF channel strips are not. The S-19840 tuner will have the part number stamped in its frame and the channel strips will have the suffix letter "A" stamped after the channel number.

Although the alignment procedure remains the same, a marked improvement in sound performance has been attained in the K-3 series by the utilization of new, more sharply tuned sound IF transformers.

In all K-3 receivers and in late production "K" receivers, cathode trap L13, has been omitted and the 41.25 Mc sound trap L9 moved from the rear of the chassis to the position originally occupied by L13. Improvements in intercarrier sound transformer design obviates the need for the cathode trap. In aligning receivers in which cathode trap L13 has been omitted, follow the procedure as outlined omitting steps 11 and 12.

In the 21K20-3 chassis, the 6AH4Gt damper tube replaced the 6V3 damper originally used in the 21K20 chassis.

A three position tap is used for focusing the picture tube in the 19K20-3, 19K22-3, 19K23-3, and the 19K24-3 chassis. The 21K20-3 chassis utilizes PM focusing and centering.

MODEL	SCREEN	TV CHASSIS	RADIO CHASSIS
K1812E (or -3)	17"	19K22 (or -3)	None
K1812R (or -3)	17"	19K22 (or -3)	None
K1815E & R	17"	19K20	None
K1820E (or -3)	17"	19K20 (or -3)	None
K1820R (or -3)	17"	19K20 (or -3)	None
K1846E (or -3)	17"	19K20 (or -3)	None
K1846R (or -3)	17"	19K20 (or -3)	None
K1850E & R	17"	19K20	None
K1880R (or -3)	17"	19K20 (or -3)	8H20Z
K2229E (or -3)	21"	19K24 (or -3)	None
K2229R (or -3)	21"	19K24 (or -3)	None
K2230E & R	21"	21K20	None
K2235E (or -3)	21"	19K23 (or -3)	None
K2235R (or -3)	21"	19K23 (or -3)	None
K2240E & R	21"	21K20	None
K2258E (or -3)	21"	19K23 (or -3)	None
K2258R (or -3)	21"	19K23 (or -3)	None
K2260R (or -3)	21"	21K20 (or -3)	None
K2262R (or -3)	21"	19K23 (or -3)	None
K2263E (or -3)	21"	21K20 (or -3)	None
K2266R (or -3)	21"	21K20 (or -3)	None
K2267E (or -3)	21"	21K20 (or -3)	None
K2268R	21"	21K20	None
K2270R	21"	21K20	None
K2271H (or -3)	21"	21K20 (or -3)	None
K2286R (or -3)	21"	19K23 (or -3)	7K21
K2287R (or -3)	21"	21K20 (or -3)	8H20Z
K2290R	21"	21K20	10H20Z
K2291E (or -3)	21"	21K20 (or -3)	10H20Z
K2872R	27"	28K20	None
K2873E	27"	28K20	None

POWER SUPPLY
110 Volts - 60 Cycles AC

K18 Series 175 Watts
K21 Series 235 Watts
K28 Series 345 Watts

TV AUDIO OUTPUT
Undistorted 2.5 Watts
Maximum 4.4 Watts
(28K20 Und. 5, Max. 8 Watts)

ANTENNA IMPEDANCE
300 Ohms

REFERENCE CHART OUTLINING DIFFERENCES IN THE K-3 CHASSIS

Chassis	Tubes	Picture Tube	Screen Register	Tone Register	Focus	Vertical Range Control	Pilot Light
19K20-3	19	17LP4	Yes	Yes	3 position tap	Yes	Yes
19K22-3	19	17LP4	No	No	3 position tap	No	No
19K23-3	19	21FP4A	Yes	Yes	3 position tap	Yes	Yes
19K24-3	19	21FP4A	No	No	3 position tap	No	No
21K20-3	21	21EP4A	Yes	Yes	magnetic (screwdriver adjustment)	Yes	Yes
28K20	28	27AP4A	Yes	Yes	electrostatic (screwdriver adjustment)	Yes	Yes

"K" SERIES SERVICE DATA

This is the latest service data on the "K" series TV receivers. In using the information, it must be remembered that the suggestions offered are to be used only in those instances where the particular problem arises. Wholesale modifications in unaffected areas may lead to further difficulties.

21K20Z CHASSIS

This chassis is the same as the 21K20 chassis, except for the utilization of a 21EP4A magnetically focused picture tube, and the S-19961 PM focus and centering assembly. This assembly is similar to, and adjusted in the same way, as the unit previously used in the 20H20 chassis.

PROPER ADJUSTMENT OF CONTRAST CONTROL

The "K" series receivers have been designed with considerable contrast reserve which, when properly used, results in an outstanding picture. However, if the contrast setting is advanced too far in noisy areas, more snow and noise will be in evidence than in a receiver having limited contrast range. Therefore, when making comparison checks, always adjust both receivers to the same contrast level.

ARCING IN NECK OF 21" PICTURE TUBES

This condition is usually caused by loose particles inside the picture tube shifting into the gun structure, causing high voltage breakdown. Arcing does not necessarily indicate that the picture tube is defective, as in many instances the "short" burns itself out. There have been many cases where the "short" was cleared by removing the picture tube from the chassis, holding it face down and gently tapping the bell. The picture tube should only be replaced if it has been determined that the "short" cannot be cleared in the afore mentioned manner.

TEMPORARY CHANGE IN VERTICAL HOLD RANGE CONTROL CIRCUIT

Several thousand "K" chassis have been shipped in which the vertical hold range control has been left disconnected, and in its place a single 2200 or 3300 ohm resistor, or a parallel combination of these two substituted. The reason the controls were left unused is that they were found to be sub-standard after being riveted to the chassis.

PICTURE SHRINKS HORIZONTALLY

This condition may be caused by an increase in value of the 150K resistor in the plate (pin 2) circuit of the 6SN7GT horizontal discharge tube. Replace with a 150K 1W resistor.

HORIZONTAL PULL ON TOP OF RASTER

With certain types of transmitted signals, a definite pull can be noticed on top of the raster. To correct this condition, replace the .01 mfd. coupling capacitor (C44 in the grid circuit of the 6BE6 sync clipper) with a .0022 mfd. capacitor.

HORIZONTAL PULLING AND INSTABILITY ON COMMUNITY ANTENNA SYSTEMS

On some community distribution systems, considerable hum may be introduced into the receiver input. If this hum appears in the detector output it may cause sync instability or pulling on top of the raster. Correction can be made by replacing the .01 mfd. capacitor (C44) in the grid circuit of the 6BE6 sync clipper with a .0022 mfd. unit.

PICTURE FLICKER

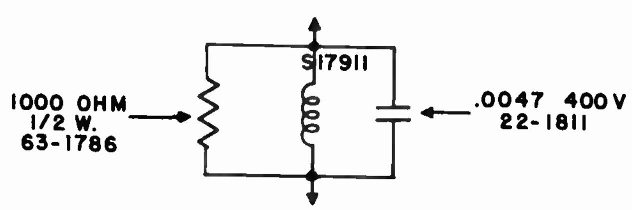
Fluctuations in line voltage often cause picture flicker. This condition can be remedied by increasing the 2nd video plate decoupling capacitor (C23) from 20 to 100mfd.

AIRPLANE FLUTTER

It may be desirable to speed up the AGC action in some areas to compensate for rapid changes in signal level caused by fading and airplane reflections. To accomplish this, replace the .47 mfd. AGC capacitor C18 with a .047 mfd. unit of the same type. In addition, change the .01 mfd 6BE6 coupling capacitor (C44) to .0022 mfd.

RINGING OR WHITE STRIPES IN "K" SERIES RECEIVERS

This condition can usually be corrected by readjusting the horizontal drive control, or by replacing the 6CD6 tube. In more stubborn cases, it may be necessary to dress peaking coil L22 and the contrast and picture control leads as far from the sweep transformer cage as is practical. Also to insert the following network in series with the red-white lead of the sweep transformer.



SERVICING "K" TUNERS

Many tuners can be satisfactorily repaired in the field, thus eliminating unnecessary delays, handling and shipping charges.

In some tuners, the bulls eye adjustment had been screwed too far into the strip causing the slug to remain in a fixed position when turned. To correct this condition, remove the channel strip, lift up the spring clip which holds the adjustment screw in place and reinstall the slug so that it moves in and out when turned.

In servicing tuners, satisfactory operation can be obtained by removing the tuner from its case and plugging in the power and IF connectors. For further convenience, it may be desirable to use a test chassis in which these leads have been extended 10 to 20 inches. In replacing a 22-2404 feed through capacitor, unsolder the top and bottom leads and the center ground connection. Do not use excess heat or solder when making connections.

Some of the component parts in the tuner cannot be replaced without removing the fine tuning control and bracket assembly. This bracket can be removed as follows:

1. Unsolder the fine tuning capacitor leads.
2. Loosen the Allen head set screw on the fine tuning shaft collar and remove fine tuning shaft.
3. Remove the self tapping screw from the center top of the tuning capacitor mounting bracket, loosen the three remaining screws and remove the bracket. Reverse the above procedure when the tuner is re-assembled.

CHANGE IN PICTURE TUBE GASKET

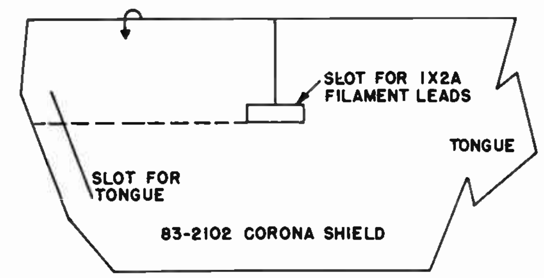
The upper half of the gasket was removed to comply with Underwriters specifications which require the picture tube to have sufficient air relief should an implosion occur. Insufficient air relief could cause the safety glass to be blown out.

LOW SENSITIVITY ON UHF

A number of tuners have been returned to the factory because of poor performance on UHF. These tuners had excessive leakage in the coaxial cable which is used to inject the oscillator signal on UHF. To check the cable, switch the tuner to a VHF position, unsolder the ground end of the 22K resistor R7, and check for leakage using the highest megohm scale on a vacuum tube voltohmeter. If the meter shows anything but infinite resistance, replace the cable.

ARCING BETWEEN THE 1X2A TUBE AND ADJACENT COMPONENTS

In areas of high humidity, high voltage breakdown may occur between the 1X2A tube and adjacent components, particularly the 6SN7GT tube. To correct this condition, install a 83-2102 polystyrene corona shield around the 1X2A tube and socket assembly.



To install the corona shield, bend on broken line, (See illustration) and hold down one half of the shield, slip this half under the filament leads and wrap around the 1X2A tube. Insert tongue through the slot to secure shield.

REMOVAL OF CATHODE TRAP L13

In late production "K" receivers, cathode trap L13 has been omitted, and the 41.25 Mc. sound trap L9 moved from the rear of the chassis to the position originally occupied by L13. Recent improvements in inter-carrier sound transformer design obviates the need for a cathode trap.

SPURIOUS RADIATION FROM THE HORIZONTAL OUTPUT TUBE

We have received reports from fringe areas of floating visible disturbance in various shapes and forms which appear on the right side of the picture tube screen. This condition is caused by 15.75 Kc. harmonics radiated by the horizontal output tube and usually appear when the receiver is switched to an unused channel, and disappearing when a station is tuned in. If it does not disappear when a station is tuned in, readjust the horizontal drive control, or replace the horizontal output tube.

ADJUSTMENTS AND ALIGNMENT

THE FRINGE LOCK CIRCUIT

The fringe lock is a newly developed circuit, utilizing a 6BE6 heptode, which can be adjusted to assure sync stability over the wide range of noise and signal levels encountered in different areas. In this circuit the output of the crystal detector, approximately -2 volts peak to peak, is fed to grid #1 of the 6BE6. The same signal, after it has been inverted and amplified to approximately 40 volts peak to peak by the first video amplifier, is applied to grid #3 which in this circuit is the signal grid. The fringe lock control is used to pre-set the bias on grid #1 so that the normal 2 volt signal allows proper sync clipping action, i.e. the sync pulses, which have been stripped from the composite video signal appearing at grid #3, will appear at the plate. If a noise pulse drives grid #1 beyond the 2 volt level, plate current cutoff occurs and the noise pulse cannot get through to falsely trigger the sweep oscillators. On rare occasions, a strong noise pulse may occur at the time of the sync pulse and the tube likewise will cut off, however, the flywheel action of the sweep oscillators will maintain sync during this brief period. The entire fringe lock system is based on the fact that the loss of an occasional sync pulse is to be preferred over having a noise pulse get through to falsely trigger the sweep oscillator.

FRINGE LOCK ADJUSTMENT

1. Turn the fringe lock control fully clockwise and then back it off approximately 1/4 turn. Adjust the vertical and horizontal hold controls and check operation of the receiver to see that it syncs normally when the turret is switched from channel to channel.

2. If the picture jitters or shows evidence of delay, tearing, split phase, etc., back down the fringe lock control further, a few degrees at a time, each time re-adjusting the hold controls and switching from channel to channel until normal sync action is obtained. It will be found that under normal signal conditions, the correct adjustment will be near the counterclockwise position of the control.

3. In fringe and noisy areas, the best adjustment will be found at or near the maximum clockwise position of the control.

CORRECTOR MAGNET ADJUSTMENT

Two corrector magnets are used (See Fig. 7) to obtain straight, sharply focused sweep lines across the face of the picture tube. These magnets are mounted on the deflection coil mounting bracket and can be moved in and out or up and down by bending the flexible arms which support them. The corrector magnets are adjusted at the factory and should not require re-adjustment unless accidentally bent out of position. If this occurs, adjustment can then be made as follows:

1. With the vertical and horizontal size controls, reduce the size of the picture to a point where the four corners and sides of the picture are visable.

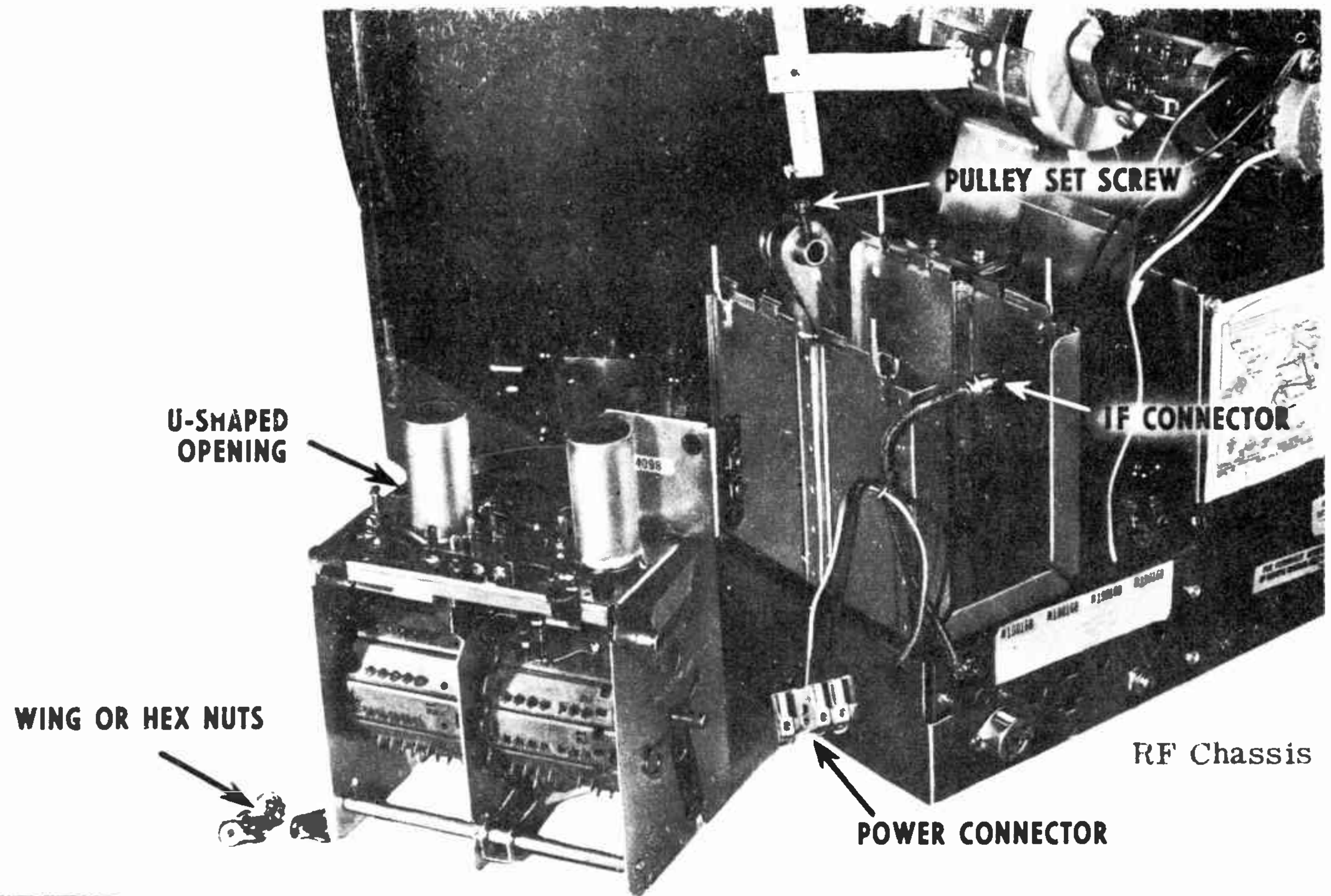
2. Bend the corrector magnet arms until the corners become right angles and the top of the raster is parallel with the bottom and the left side is parallel with the right side. After adjustment, the picture should be restored to normal size.

NOTE: Mis-adjustment of the corrector magnets may cause pincushioning, barreling, keystoning, poor linearity, etc.

CENTERING ADJUSTMENTS

Two types of centering assemblies have been used in production.

The S-18118 assembly consists of two magnetic rings mounted in two movable washers. The washers are provided with tabs so that the magnets can be turned independently of each other to vary the total magnetic flux. This unit is installed approximately 3/4" behind the yoke to prevent the yoke from demagnetizing the ring type magnets. Adjustment is made by gradually rotating the tabs with respect to each other and rotating the entire unit until the picture is centered.



RF Chassis

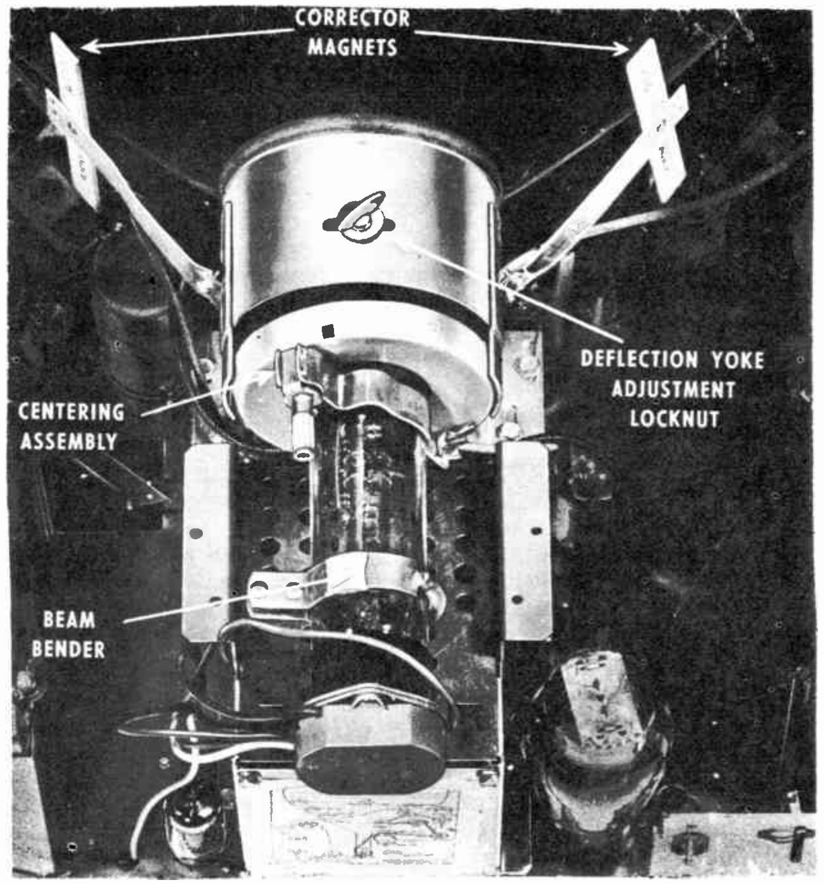


Fig. 7 Adjustments on Neck of Picture Tube

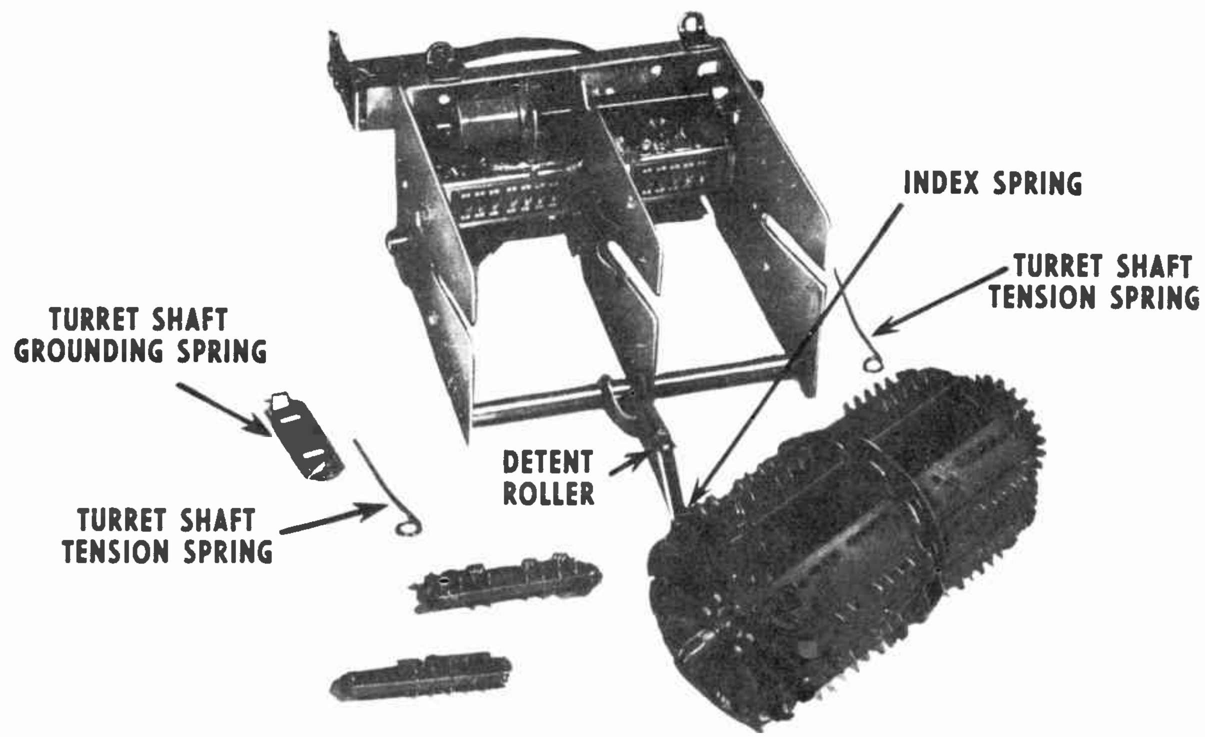


Fig. 8 Exploded View of Turret Tuner

The S-18439 assembly (See Fig. 7) utilizes a small bar type magnet which can be turned by means of a knurled shaf‘. This assembly can be installed within 1/8" of the yoke and is adjusted by turning the knurled shaft and rotating the entire unit until the picture is centered on the screen.

AFC ADJUSTMENTS

The AFC adjustment can effectively be made by setting the horizontal hold control L27 to a position where it is virtually impossible to "throw" the receiver out of horizontal sync when switching from channel to channel.

BULLS-EYE TUNER ADJUSTMENTS

To adjust the receiver for bulls-eye tuning, set the fine tuning control to its approximate center position as shown in Fig. 4 . Without further adjustment of the fine tuning control insert a 68-21 alignment wrench into the tuner (See Fig. 10) and adjust each operating channel to resonance. It will be noted that tuning to one side of resonance results in a faded, washed-out picture with the spacing between the wedge lines fogged and tuning in the opposite direction causes the spaces between the lines to clear up. However, going beyond this point causes the picture to take on a "wormy" appearance from sound getting into the picture. Correct adjustment is obtained by tuning to the "wormy" picture and then backing the control off slightly until the picture clears up.

REMOVING TURRET TUNER FROM CHASSIS

1. Pull out the power and IF connector cables and disconnect the antenna transmission line.

2. Look through the U-shaped opening (See Fig. 8) in the top of the tuner and rotate the fine tuning control until the allen head screw on the fine tuning shaft is straight up.

3. Loosen (do not remove) the hex head set screw in the turret dial cord pulley assembly.

4. Slide the pulley towards the front of the chassis until it clears the fine tuning shaft.

5. Remove the four wing or hex nuts and gently pull the tuner assembly straight out of its case.

REMOVING CHANNEL STRIPS

1. Remove the tuner from the case and lay on its side.

2. Rotate the turret drum until the strip to be removed is readily accessible.

3. Insert a small screwdriver in the slot (See Fig. 9). Push in the direction of arrow until the channel strip clears the drum slot then lift straight out in direction of screwdriver shaft.

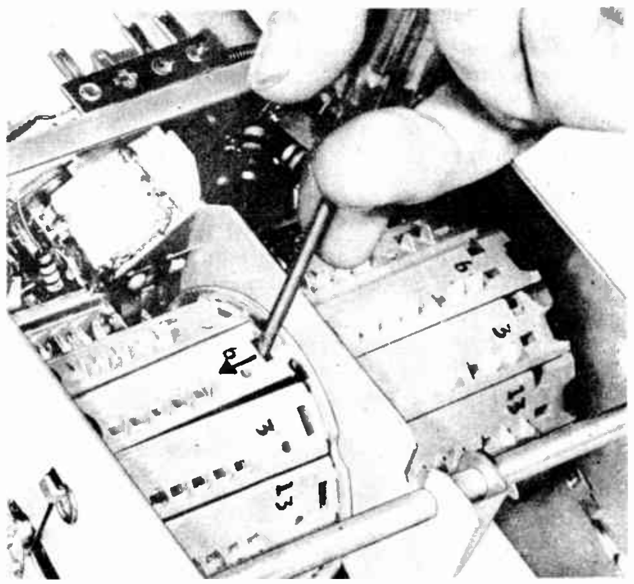


Fig. 9 Removing Channel Strips
CAUTION: DO NOT PRY

CAUTION: TO AVOID DAMAGE TO CHANNEL STRIPS, DO NOT USE PRYING ACTION IN REMOVING STRIPS.

REMOVING TURRET DRUM ASSEMBLY

1. Use long nose pliers and remove the two turret shaft tension springs from the front and rear of the tuner assembly. Slide the bronze turret shaft grounding spring out of its slot at the rear of the tuner.

2. With a pair of long nose pliers, grasp the first turn of the spiral index spring and lift spring off its hook. This takes pressure off the detent arm and may cause the roller to fall out and become lost.

3. Slide the drum out of its slot. Reverse this procedure to re-assemble the tuner.

DOUBLE DELAYED GATED AGC

In order to obtain the best possible performance in fringe and weak signal areas, it is important that the application of AGC voltage to the 6BK7 RF tube be withheld until the signal level reaches approximately 500 microvolts at the antenna input. The noise figure of the tuner will be optimized only under this condition of no AGC voltage. To accomplish this, the cathode of the 6CB6 1st IF tube is approximately 8 volts positive by virtue of the drop through the cathode resistor of the 6CB6 3rd IF. This voltage plus the voltage which results from current flow through the tube makes the grid of the 6CB6 1st IF approximately 9.3 volts negative with respect to its cathode. It should be noted here that the bias voltage for the 3rd IF is obtained across the 100 ohm portion of the cathode resistor only. The voltage at the junction of the two resistors varies from 8 volts with no signal to 4 volts with strong signals. The 2nd IF tube is in series with the 1st IF tube and any changes in the plate current of the 1st IF tube will also change the 2nd IF tube thus the 2nd IF tube is also controlled indirectly by the AGC.

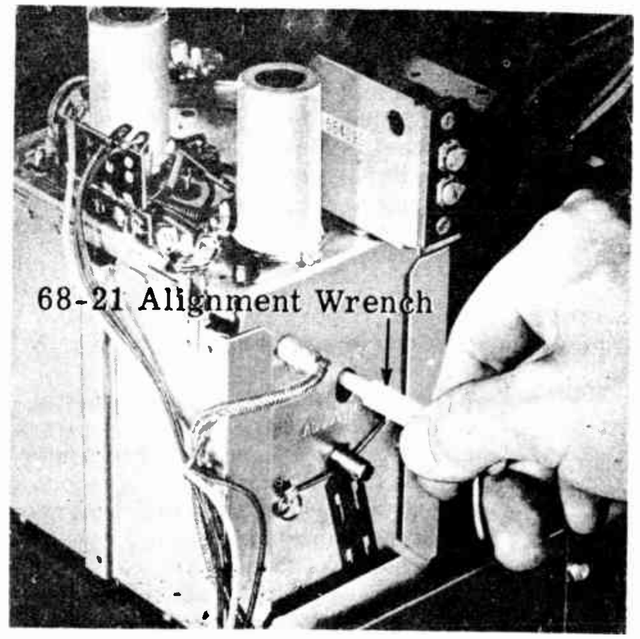


Fig. 10 Bull's-eye Tuning Adjustment

Under weak signal conditions, the output of the AGC tube at point "F" is approximately 8 volts positive. This positive voltage however, does not reach the grid of the 6BK7 because of the 2.2 megohm resistor. Actually the grid of this tube is slightly negative because of contact potential developed as a result of the high resistance in its grid circuit (2.2 megohms). The 8 volts positive voltage however, is applied to the grid of the 6CB6 1st IF but because the cathode is 9.3 volts positive the grid is actually 1.3 volts negative with respect to its cathode and AGC control of the IF results under weak signal conditions.

When the receiver is used with normal signals, the signal voltage applied to the grid of the AGC tube will increase and as a result the output of the AGC tube will become 4 to 5 volts negative. This negative voltage will be applied to the 6BK7 through the 2.2 megohm resistor thus both the RF and IF stages will then be controlled by the AGC.

With the application of a negative AGC voltage to the 6BK7 tube under normal signal conditions, the noise figure of the tuner will not be optimized as under weak signal conditions, however, this is not a consideration with normal signal levels.

AGC ADJUSTMENTS

The AGC delay control can be adjusted from the front of the cabinet.

Connect the calibrated oscilloscope through a 10K isolation resistor to terminal "E" (Fig. 25). Select the strongest TV signal and observe the deflection on the oscilloscope screen. Adjust the AGC delay control for 2 volt peak output.

Satisfactory adjustment can also be made by observing the picture and slowly turning the AGC delay control from its maximum clockwise position, counterclockwise until a point is reached where the picture distorts and buzz is heard in the sound. The control should then be turned slowly clockwise and set at a point comfortably below this level of intercarrier buzz, picture distortion and improper sync.

CAUTION: Misadjustment of the AGC delay control can result in a washed-out picture, distorted picture, buzz in sound OR COMPLETE LOSS OF PICTURE AND SOUND.

ALIGNMENT

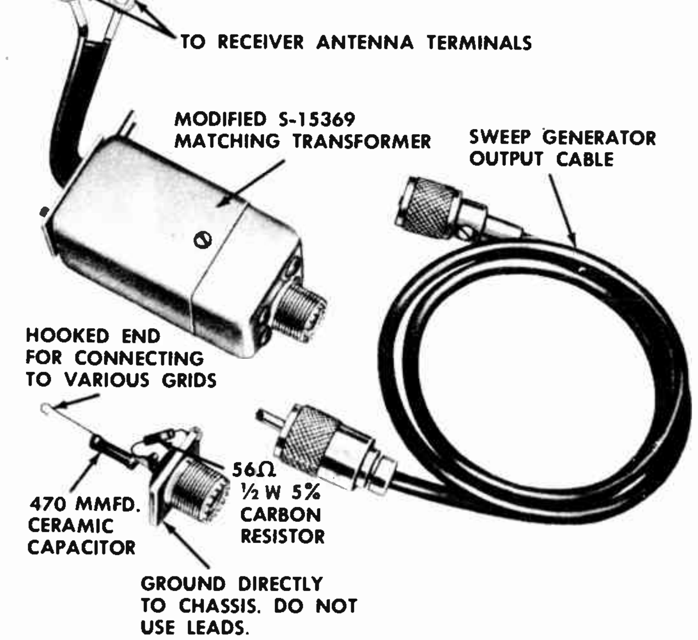


Fig. 11 IF-RF Alignment Fixtures

A suitable sweep generator in conjunction with an accurate marker must be used for alignment work. It is very important to have the sweep generator output cable properly terminated and to check whether or not its attenuator is reactive. If the attenuator is reactive or if the output cable is improperly terminated, correct alignment cannot be made since the degree of attenuation then may change the shape as well as the amplitude of the response curve. The position of the attenuator should only vary the amplitude and not the shape of the response curve.

CALIBRATING THE OSCILLOSCOPE

When aligning the RF and IF stages of the receiver,

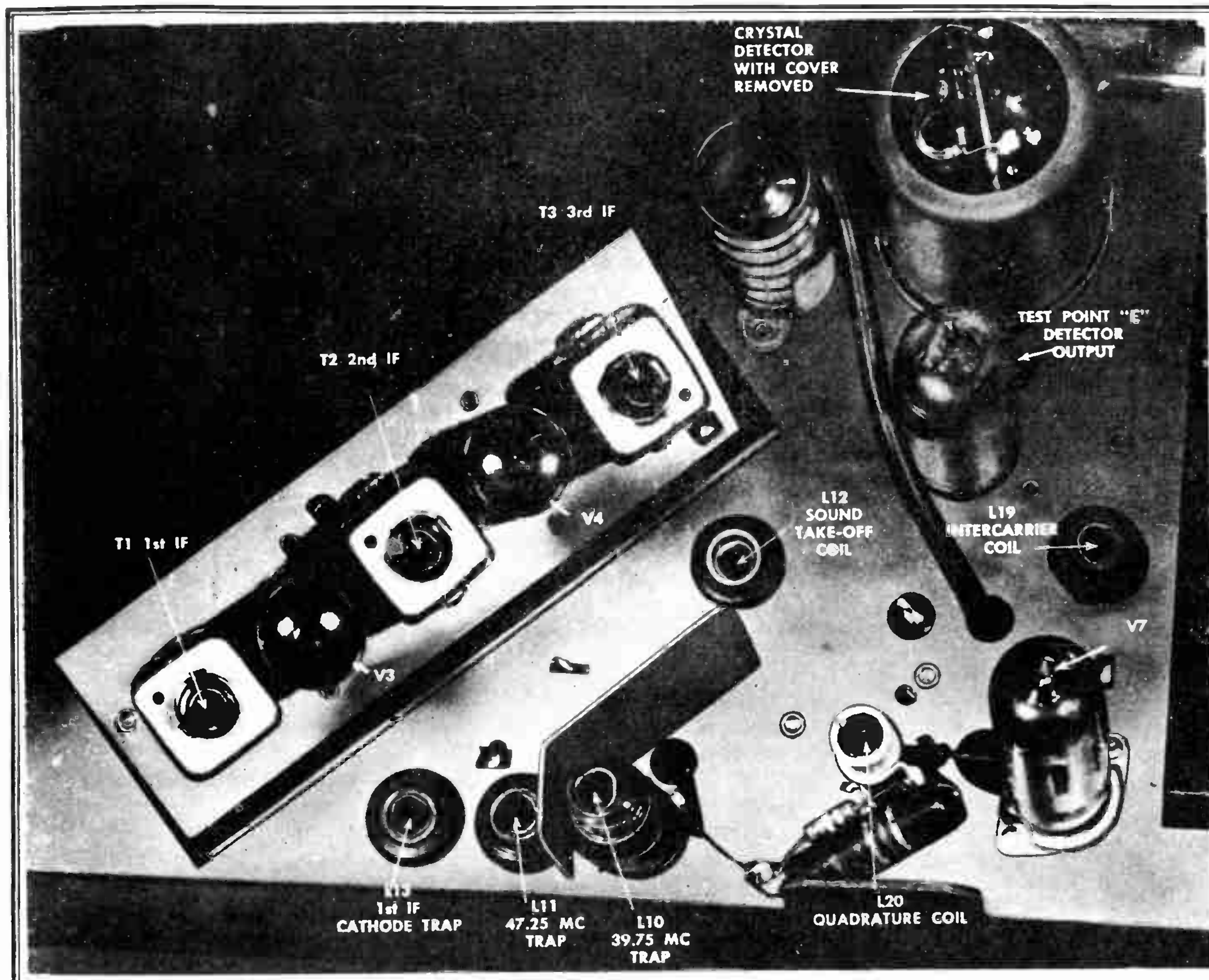


Fig. 12 IF Alignment Guide

it is necessary to measure detector peak output.

This may be done with a voltage calibrator used in conjunction with an oscilloscope. If a calibrator is not available, the oscilloscope can be calibrated with a known DC voltage. To make the calibration, connect the ground lead of the vertical input cable to the negative side of a 3 volt battery supply. Turn the horizontal gain control fully counterclockwise. With the "hot" lead, make a momentary contact to the positive connection on the battery and observe the instantaneous spot deflection on the screen. Discharge the scope input capacitor by shorting out the leads and repeat the procedure, each time readjusting the scope vertical gain until the spot deflects 3 large divisions on the screen. Each division then represents 1 volt peak. The position of the vertical gain control should be marked for future reference.

VIDEO IF ALIGNMENT

1. Connect the negative lead of a 2 volt battery supply to terminal "F" (Fig. 25) and the positive lead to chassis. The bias supply should be made variable so that it can be varied from negative 3 volts to positive 3 volts. Keep the supply leads short.

2. Connect the calibrated oscilloscope through a 10,000 ohm isolation resistor between terminal "E" and chassis. The sweep generator input to the receiver should be adjusted for 2 volts peak to peak detector output. Do not exceed this output level during any of the adjustments.

3. Feed the output from the sweep generator through the special termination unit shown in Fig. 11 to point "D" (Pin 1 of 6CB6, 3rd IF). Adjust the generator until a pattern similar to Fig.14 is obtained.

4. Set the Marker Generator to 44 Mc and alternately adjust the top and bottom slugs and the coupling adjustment of the 4th IF transformer for maximum gain and symmetry with the 44 Mc Marker in the center of the response curve. The wire rod type of coupling adjustment utilizes an insulated sleeve by means of which coupling can be changed by turning the rod in or out.

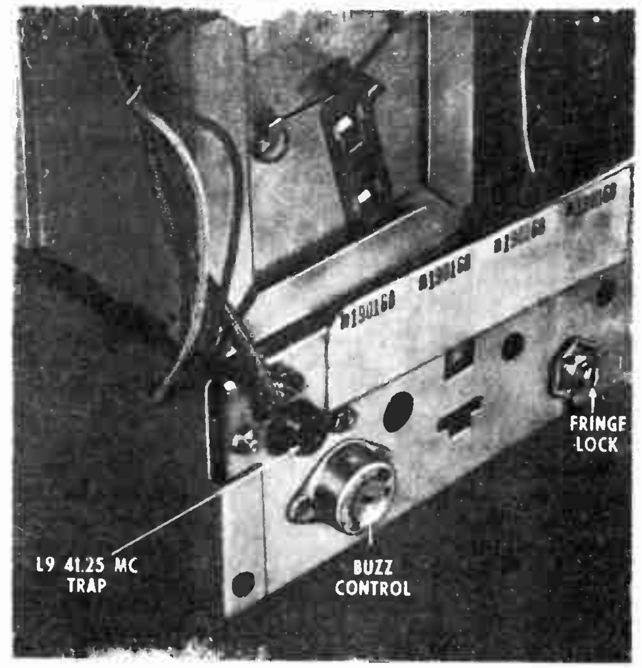


Fig. 13 41.25 Mc Trap

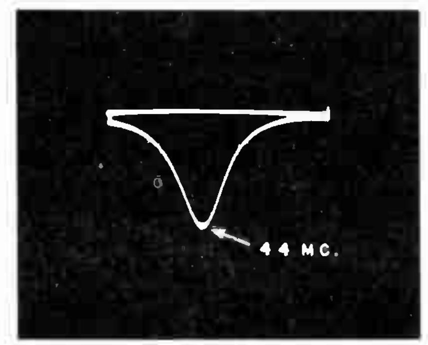


Fig. 14 4th IF Response

If the correct response curve cannot be obtained in this step, check the position of the two slugs to see that they are entering their respective coils from the opposite ends of the coil form. The position of the slugs near the center of the coils may change the coefficient of coupling, making correct alignment difficult if not impossible.

5. Connect the sweep generator cable to point "C". Adjust the attenuator for a 2 volt peak to peak detector output.

6. As a preliminary adjustment for the 3rd IF, turn the bottom slug half way into its coil and the top slug completely out of its coil. Alternately adjust the top and bottom slugs until a pattern somewhat similar to Fig. 15 is obtained. When the tuning slugs are properly positioned each slug will move both humps of the response curve.

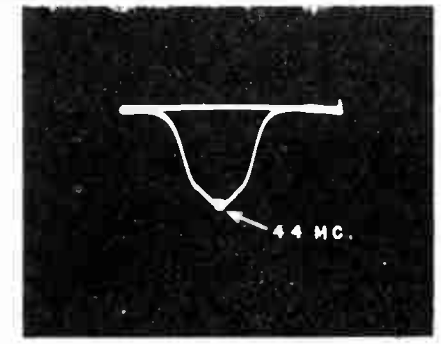


Fig. 15 3rd IF Response

7. Connect the sweep generator cable to terminal "B" (Converter Grid). In this step it may be necessary to disconnect the bias battery and temporarily ground the AGC in order to see the highly attenuated trap slots with the oscilloscope vertical gain near maximum.

8. Adjust the 47.25 Mc, 41.25 Mc and 39.75 Mc traps for minimum marker amplitude (See Fig. 16). It can be seen that maximum oscilloscope gain has been used and as a result the top of the response curve has been "run off" the oscilloscope screen in order to see a "blow-up" of the trap slots.

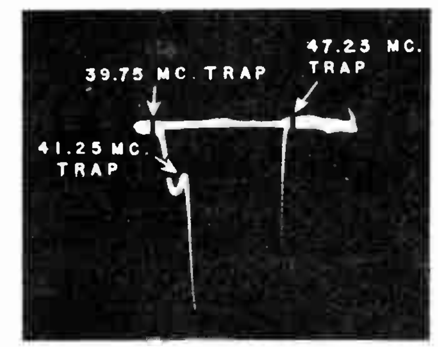


Fig. 16 Exploded View of Traps

9. Re-connect the bias battery and readjust the oscilloscope to the calibrated position. Adjust the sweep generator for a 2 volt peak to peak output from the video detector. Bear in mind that only one tuning slug is used in each of the following stages to be aligned.

10. With the test equipment set up as in Step 10, alternately adjust the converter plate coil, the 2nd IF and the 1st IF transformers until an overall response curve similar to Fig. 17 is obtained. If the proper response curve cannot be obtained, it may be necessary to retouch the 4th IF coupling adjustment or make a slight readjustment of the other stages to obtain the correct overall response curve.

11. Adjust the bias so that point "F" is 3 volts positive with respect to ground. Reduce the signal generator input to obtain 2 volts peak to peak output at terminal "E". The response curve should be similar to the solid line portion of Fig. 18 . At this point, adjust the cathode trap L13 to flatten the 45 Mc hump in the response curve as much as possible. It will be noted that with proper alignment some tuned circuits will flatten out more than others, as illustrated by the broken lines.

12. Readjust the bias to negative 2 volts as in Step 9 and check the overall response as in Step 10. A slight readjustment may be necessary after trap L13 has been aligned.

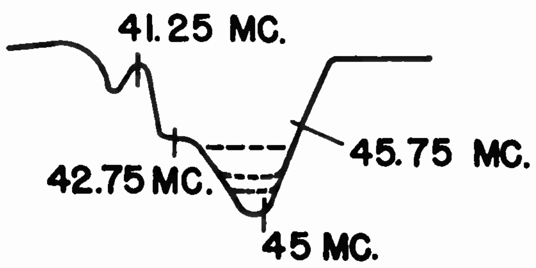


Fig. 18 Cathode Trap Response

IMPORTANT: The purpose of this procedure is to obtain a response curve similar to Fig. 17. The curves for the other stages may or may not be the same as those shown in the manual after the overall curve has been obtained.

TURRET TUNER AND RF CHASSIS ALIGNMENT

The RF chassis adjustments have been made at the factory and normally do not require readjustment in the field unless tampered with. If adjustment becomes necessary proceed as follows:

1. Connect the negative lead of a 1 volt bias supply to terminal "F" (Fig. 25) and the positive lead to chassis.

2. Connect the calibrated oscilloscope to the feed through terminal "X" (Fig. 1) through a 10K isolation resistor. This terminal is the screen of the 6U8 mixer and is used in preferance to terminal "A" in order to obtain greater amplification for the average oscilloscope.

3. Use the S-15369 matching transformer (Fig. 11) and feed the output from the sweep generator to the antenna terminals of the receiver.

4. Turn the channel selector to Channel 3 and adjust the sweep generator until a response curve somewhat similar to Fig. 19 is obtained.

5. Study Fig. 1 and adjust the converter grid capacitor (C22), the RF plate capacitor (C5) and the RF grid capacitor (C2) until a response curve similar to Fig. 19 is obtained.

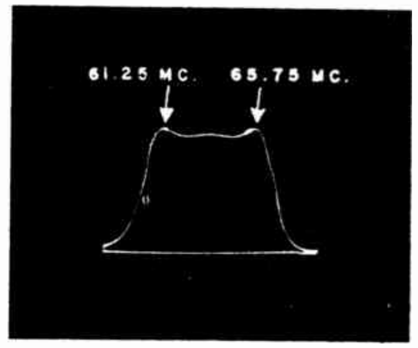


Fig. 19 Channel 3 RF Response

6. Turn the channel selector to Channel 13 and adjust the sweep generator until a response somewhat similar to Fig. 20 is obtained. Adjust L3 and L4 to obtain symmetry.

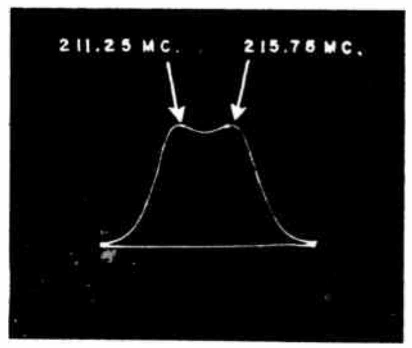


Fig. 20 Channel 13 RF Response

7. Repeat steps 5 and 6 until the best overall symmetry is obtained.

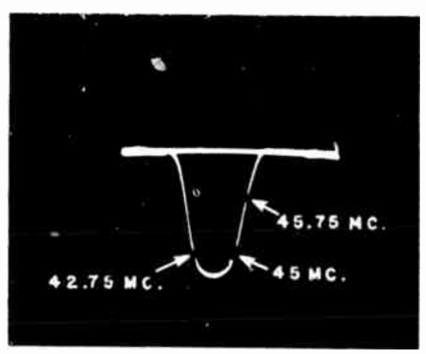


Fig. 17 Overall IF Response

MASTER OSCILLATOR ALIGNMENT

The master oscillator adjustment is to be made only if resonance cannot be obtained with the strip oscillator adjustment wrench with the fine tuning control in its center position (the allen head screw on the fine tuning shaft straight up as viewed through the U-shaped opening in the top of the tuner), and after it has been determined that the channel strip itself is not at fault.

If channels 2 through 6 can be made to resonate with the bull's-eye adjustment at the rear of the turret and the high channels do not resonate, a slight re-adjustment of the oscillator inductance L7 (See Fig. 6) may be necessary to affect resonance on the high channels.

If the fine tuning capacitor is replaced, proper alignment of the fine tuning mechanism can be made as follows:

1. Remove the turret from the chassis

2. Turn the turret tuning shaft until the allen head screw, as viewed through the U-shaped opening, is straight up.

3. Insert an allen wrench through the opening and loosen the screw. Leave the allen wrench in, partially slide out the shaft and tape it to prevent the stop mechanism from falling out or being turned out of position.

4. The tuning capacitor bracket can be removed by removing the four self-tapping screws which hold it in place. Unsolder the tuning capacitor leads, replace capacitor and re-assemble bracket on the RF chassis. DO NOT TIGHTEN ALLEN HEAD SCREW.

5. Use a sweep generator on Channel 3 or tune in a station on the lowest available channel and turn the turret shaft until resonance is obtained. This should be approximately 2-1/4 turns from either end of the fine tuning capacitor range. Turn the collar until the allen head screw is straight up as viewed through the opening and tighten screw.

6. Check the fine tuning knob to see that it is in the position shown in Fig. 4. (Center of mechanical range)

7. Insert the dial cord pulley over the turret shaft and tighten set screw. If the set screw is in a position where it is difficult to tighten, the fine tuning shaft can be held in place and the pulley can be made to slip the dial cord until the pulley is in a position where the set screw is readily accessible.

8. Remove the allen wrench. Proper alignment is indicated when the fine tuning control is in its center position and the allen head screw is straight up as viewed through the U-shaped opening.

9. It may be necessary to readjust the oscillator inductance L7 (See Fig. 6) for proper bull's-eye operation on the high channels (7-13).

SOUND ALIGNMENT

Proper alignment of the 4.5 Mc intercarrier sound channel can only be obtained if the signal to the receiver antenna terminals is reduced to a level below the limiting point of the 6BN6 Gated Beam Detector. This level can be easily identified by the "hiss" which then accompanies the sound.

Various methods may be used to reduce the signal level, however, it is recommended that a step attenuator similar to the S-17203 unit be used for most satisfactory results. To prevent leakage, certain precautions must be taken when connections are made. Use as short a lead as possible between the attenuator and receiver antenna terminals and approximately 6 feet of 300 ohm shielded line between the antenna transmission line and the attenuator. The shield from the transmission line should be connected to the attenuator and the attenuator itself grounded to the TV chassis under test.

After the connections have been made, proceed as follows:

1. Tune in a tone modulated TV signal and adjust the step attenuator until the signal is reduced to a level where "hiss" is heard with the sound.

2. Adjust the sound take-off coil L12 (top and bottom slugs), intercarrier coil L19, quadrature coil L20 and buzz control R30 for the cleanest sound and minimum buzz. It must be remembered that any of these adjustments may cause the "hiss" to disappear and further reduction of the signal will be necessary so that the "hiss" does not disappear during alignment.

If intercarrier buzz is in evidence, after all normal sound adjustments have been made, the cause may be attributed to one or more of the following:

1. Improper adjustment of the AGC delay control.

2. Defective 6U8 intercarrier sound amplifier.

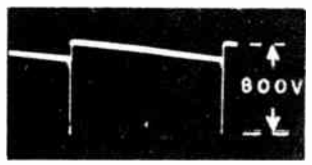
3. Extremely high signal levels which require attenuation in the antenna circuit.

4. Transmitter overmodulation.

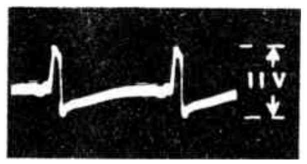
SPECIAL TEST EQUIPMENT FOR TV

11-118	9 ft. AC Test Cord for "K" Models
68-13	Alignment Tool
68-14	Tuning Wand
68-19	Nylon Alignment Wrench
68-20	Nylon Alignment Wrench
68-21	Nylon Alignment Wrench
95-1234	250 Watt Isolation Transformer

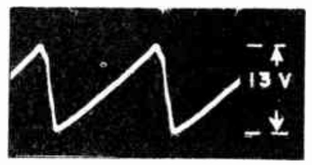
The waveforms illustrated on this page and the peak to peak voltages indicated thereon represent an average 19K20 chassis. These waveforms and voltages however, are applicable to other chassis in the "K" line. For best results, the oscilloscope horizontal sweep should be adjusted to a sub-multiple frequency of the waveform under observation.



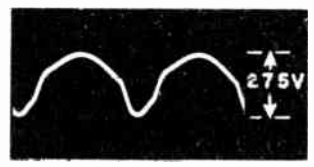
Pin 5 6AH4 (V12)
60 cycles



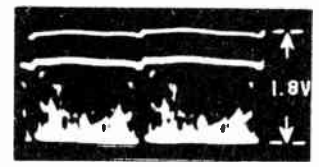
Pin 2 6AQ7GT (V13B)
15.75 Kc.



Pin 1 6AQ7GT (V13B)
15.75 Kc.

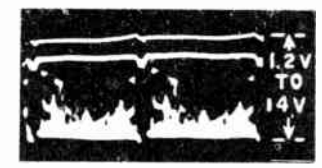


Pin 4 6SN7GT (V14A)
15.75 Kc.

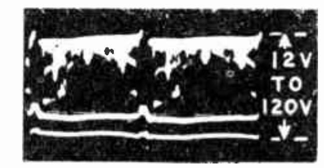


Pin 2 6U8 (V6A)
60 cycles

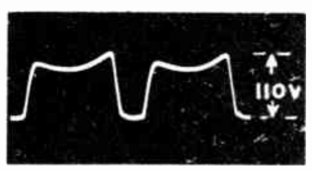
Pin 2 12AU7 (V10A)
60 cycles



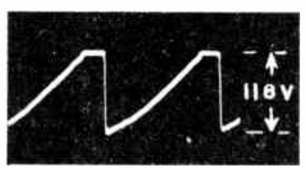
Pin 7 12AU7 (V10B)
voltage depends on
contrast setg.-60 cps



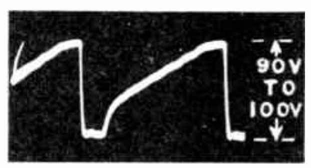
Pin 11 pix tube (V19)
voltage depends on
contrast setg.-60 cps



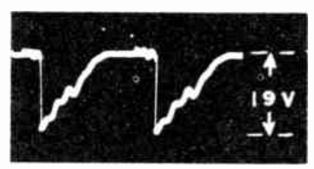
Pin 1 6SN7GT (V14B)
15.75 Kc.



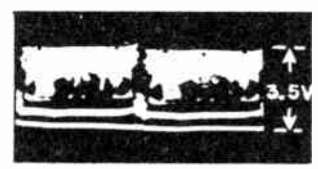
Pin 2 6SN7GT (V14B)
15.75 Kc.



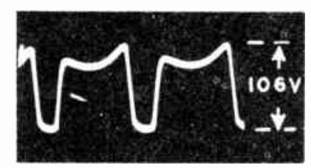
Junction of R66 &
C16 15.75 Kc.



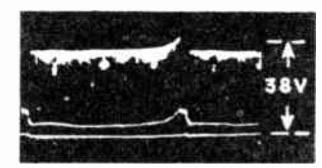
Pin 8 6BQ6GT (V15)
15.75 Kc.



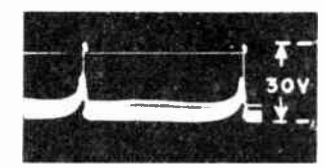
Pin 7 12AX7 (V9A)
60 cycles



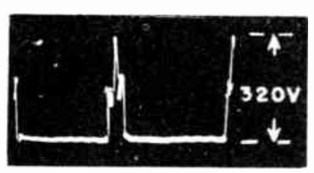
Pin 6 12AX7 (V9A)
60 cycles



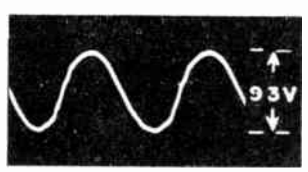
Pin 7 6BE6 (V11)
60 cycles



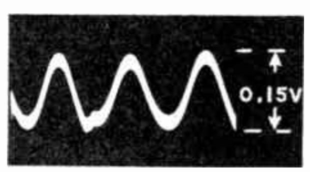
Pin 5 6BE6 (V11)
60 cycles



Junction of R61 &
L28 15.75 Kc



Pin 5 6AX4GT (V16)
15.75 Kc.

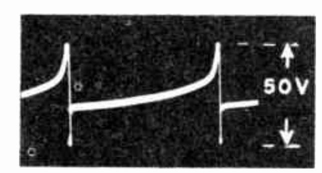


Junction of R62 &
C29AD 60 cycles

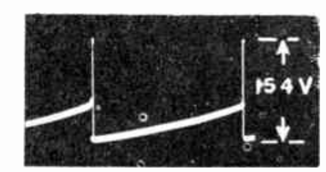
Junction of C37AD &
T9 60 cycles

Pin 5 6BE6 (V11)
15.75 Kc.

Pin 1 12AX7 (V9B)
with red & bl of T6
shorted 60 cycles



Pin 2 12AX7 (V9B)
60 cycles



Junction of C49, R56
& R66 60 cycles

Fig. 21 Waveforms and Peak to Peak Voltages

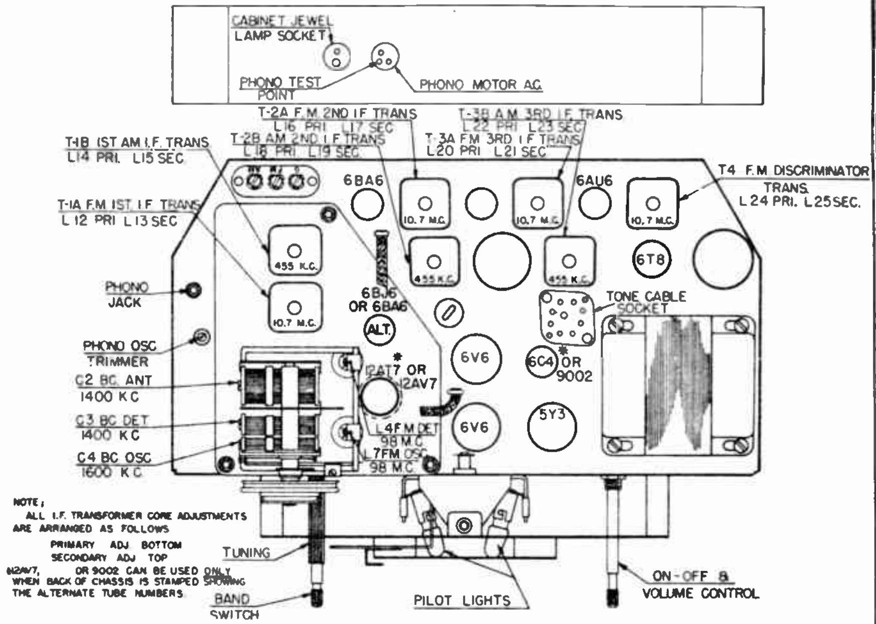
The 10H20Z chassis incorporates a superheterodyne circuit with two stages of IF, on the FM Band, and two stages on the AM Band. There is one stage of RF amplification on all bands.

FM RF Alignment: The tuning slugs are attached to threaded shafts and the slugs are varied in the field of the coils by turning the shafts clockwise or counter-clockwise. After adjustment the shafts must be secured with a drop of speaker cement.

AM and FM Alignment: The AM and FM IF transformers in this reciever are of the new permeability tuned type. The advantage of an IF transformer of this type is its extreme stability under various humidity and temperature conditions. The upper coil is the secondary and the lower the primary. When adjusting these IF transformers the tuning wrench 68-19 can be inserted into the top slug, rotated until maximum output is obtained and then dropped down to the lower slug and the same operation repeated. The tuning wrench is so designed that turning one slug does not affect the adjustment of the other.

FM IF Alignment: Because of the wide band pass, it is desirable to use a FM signal generator and a cathode ray oscilloscope when aligning the FM IF channel. The instruction book for the Zenith Model 800 Signal Generator (Form Z8001) covers complete FM alignment procedure. If visual alignment equipment is unavailable, reasonably accurate alignment can be made by following the procedure outlined below.

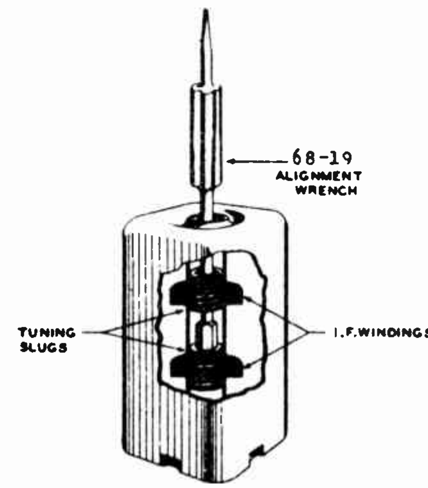
FM Discriminator Alignment: When the secondary of the discriminator is aligned (operation 5) use sufficient signal input to get a good positive and negative indication before setting the slug for zero reading. A center zero indicating meter is recommended for this adjustment, but is not absolutely necessary. Reversing the leads of a non-zero center meter, or observing closely when the meter starts to go to the left (negative) of zero will give the same results.



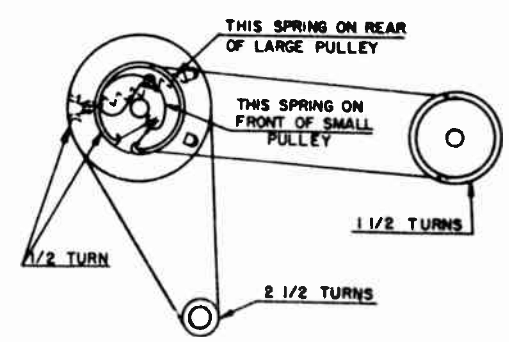
TUBE AND TRIMMER LOCATION

ALIGNMENT PROCEDURE

Operation	Connect Oscillator To	Dummy Antenna	Input Signal Frequency	Band	Set Dial To	Adj. Trimmers	Purpose
1	Pin 2 12AT7 or 12AV7 Converter	.05 Mfd.	455 Kc. Modulated	BC	600 Kc.	Adj. Pri. and Sec. T1B, T2B, T3B	Align I. F. channel for maximum output.
2	2 turns loosely cpld. to wavemagnet		1600 Kc. Modulated	BC	1600 Kc.	C4	Set oscillator to dial scale.
3	2 turns loosely cpld. to wavemagnet		1400 Kc. Modulated	BC	1400 Kc.	C3, C2	Align detector and antenna stage.
4 (a)	Pin 1 (grid) on 6 AU6 limiter.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		Adj. Primary of Discriminator T4	Align primary of discriminator for maximum reading.
5 (b)	Pin 1 (grid) on 6 AU6 limiter.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		Adj. Secondary of Discriminator T4	Adjust secondary of discriminator for zero reading.
6 (c)	Pin 1 (grid) on 6 BA6 2nd. I F.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		Adj. Pri. and Sec. T3A	Align 3rd. IF transformer for maximum reading.
7 (c)	Pin 1 (grid) on 6BA6 1st. IF.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		Adj. Pri. and Sec. T2A	Align 2nd IF transformer for maximum reading.
8 (c)	Pin 2 (grid) on 12AT7 or 12AV7 converter tube socket	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		Adj. Pri. and Sec. T1A	Align 1st. IF transformer for maximum reading.
9 (c)	Antenna Post FM (Remove line ant.)	270 ohms	98 Mc. Unmodulated	FM 100	98 Mc.	L7 Osc. Coil Slug.	Set Oscillator to dial scale.
10 (c) (d)		270 ohms	98 Mc. Unmodulated	FM 100	98 Mc.	L4 Det. Coil Slug	Align det. stage to maximum reading.



Detail of IF Transformer



DIAL CORD DRIVE

IMPORTANT

Alignment of this chassis will in most cases be unnecessary unless an IF or RF transformer is replaced or the adjustments have been tampered with.

NOTE: If 12AT7 is replaced by a 12AV7 or vice versa the RF portion of this receiver must be realigned.

Correct alignment can only be made if the following procedure is followed:

A vacuum tube voltmeter with an isolation resistor of 2,000-000 ohms in series with the hot lead will serve for FM adjustments. This lead should be shielded.

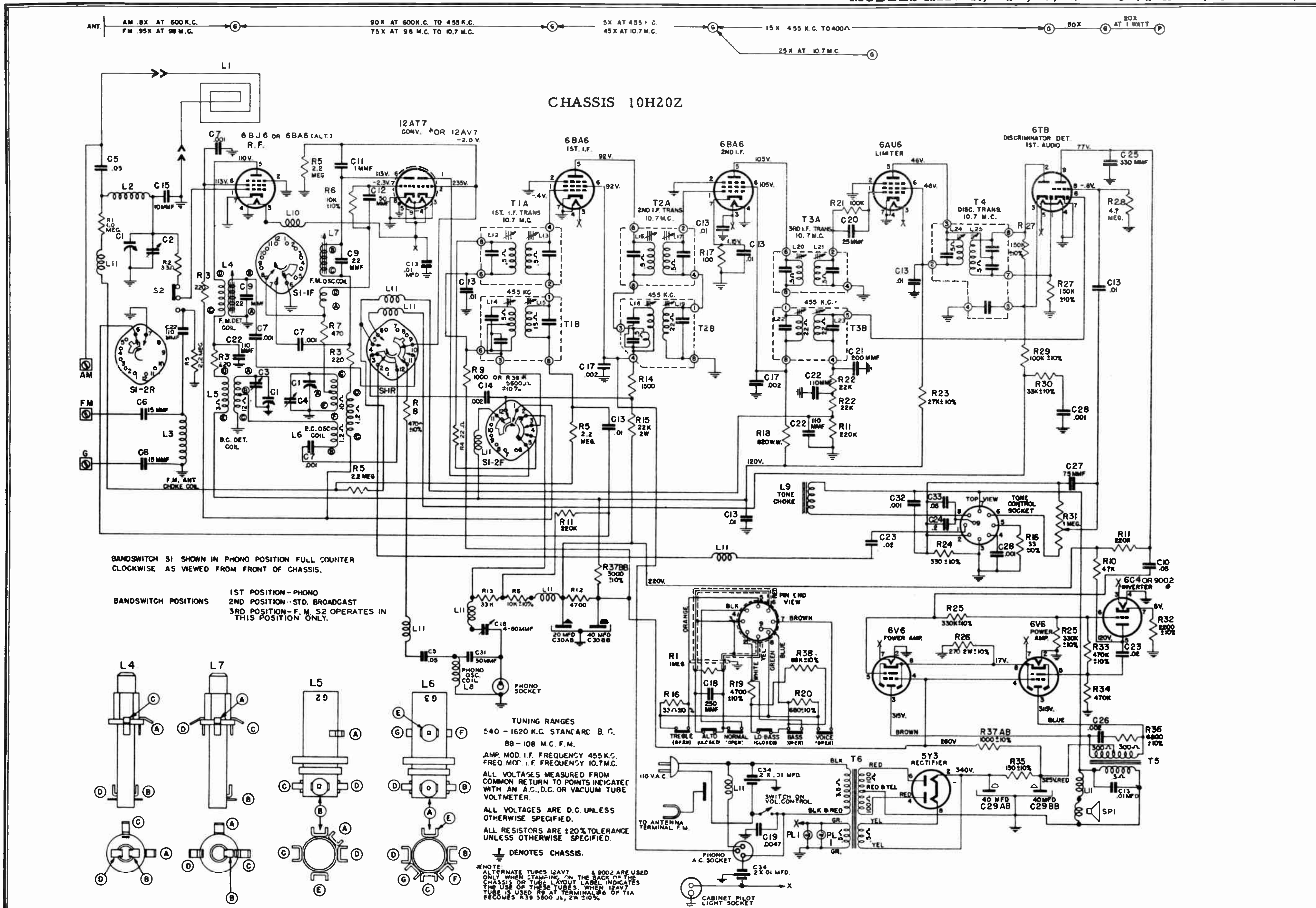
An AC output meter connected across the primary or secondary of the output transformer will be satisfactory for all AM adjustments.

The signal generator output should be kept just high enough to get an indication on the meter.

In the event the reeeiver oscillates during phono operation, adjust C16 4-80 mmf. capacitor to a point at which the oscillation ceases.

This position of no oscillation will sometimes vary with different cartridges, and in this case readjustment of C16 must be made.

(a) Vacuum Tube Voltmeter Lug 7 on discriminator transformer to chassis (Half discriminator load).
(b) Vacuum Tube Voltmeter Lug 5 on discriminator transformer to chassis (Full discriminator load).
(c) Vacuum Tube Voltmeter from Limiter Grid to Chassis.
(d) Loosen Slugs by applying a hot iron to the cement.


CHASSIS 10H20Z
ANT. AM .8X AT 600 K.C. FM .95X AT 98 M.C.
90X AT 600K.C. TO 455 K.C.
75X AT 98 M.C. TO 10.7 M.C.
5X AT 455 K.C.
45X AT 10.7 M.C.
15X 455 K.C. TO 400~
25X AT 10.7 M.C.
50X
20X AT 1 WATT
6BJ6 OR 6BA6 (ALT.) R.F.
12AT7 CONV. *OR 12AV7
6BA6 1ST. I.F.
6BA6 2ND I.F.
6AU6 LIMITER
6T8 DISCRIMINATOR DET. 1ST. AUDIO
T1A 1ST. I.F. TRANS 10.7 M.C.
T2A 2ND I.F. TRANS 10.7 M.C.
T3A 3RD I.F. TRANS 10.7 M.C.
T4 DISC. TRANS. 10.7 M.C.
L9 TONE CHOKE
TOP VIEW TONE CONTROL SOCKET
6C4 OR 9002 INVERTER
6V6 POWER AMP.
6V6 POWER AMP.
5Y3 RECTIFIER
PIN END VIEW
TREBLE (OPEN) ALTO (KICKER) NORMAL (OPEN) LO BASS (CLOSED) BASS (OPEN) VOICE (OPEN)
110 V.A.C.
SWITCH ON VOL. CONTROL
TO ANTENNA TERMINAL F.M.
PHONO A.C. SOCKET
CABINET PILOT LIGHT SOCKET
PHONO OSC. COIL L8
PHONO SOCKET
F.M. ANT CHOKE COIL
B.C. DET. COIL
B.C. OSC COIL
F.M. DET. COIL
F.M. OSC COIL
BANDSWITCH S1 SHOWN IN PHONO POSITION FULL COUNTER CLOCKWISE AS VIEWED FROM FRONT OF CHASSIS.
BANDSWITCH POSITIONS
1ST POSITION - PHONO
2ND POSITION - STD. BROADCAST
3RD POSITION - F.M. S2 OPERATES IN THIS POSITION ONLY.
TUNING RANGES
540 - 1620 K.C. STANDARD B.C.
88 - 108 M.C. F.M.
AMP. MOD. I.F. FREQUENCY 455 K.C.
FREQ MOD. I.F. FREQUENCY 10.7 M.C.
ALL VOLTAGES MEASURED FROM COMMON RETURN TO POINTS INDICATED WITH AN A.C., D.C. OR VACUUM TUBE VOLTMETER.
ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.
ALL RESISTORS ARE ±20% TOLERANCE UNLESS OTHERWISE SPECIFIED.
DENOTES CHASSIS.
*NOTE
ALTERNATE TUBES 12AV7 & 9002 ARE USED ONLY WHEN STAMPING ON THE BACK OF THE CHASSIS OR TUBE LAYOUT LABEL INDICATES THE USE OF THESE TUBES. WHEN 12AV7 TUBE IS USED R9 AT TERMINAL #6 OF T1A BECOMES R39 5600 Ω, 2W ±10%
L4
L7
L5
L6

Chassis 8H20Z

PARTS LIST

Dial Assembly

Part No.	Diag. No.	Description	Price
78-895		Dial Light Socket & Wire	.45
80-69		Dial Cord Spring	.05
80-746		Pulley Retaining Spring	.02
80-747		Dial Cord Spring	.10
114-262		8-32 x 7/16" x 1/4" A.F. Hex Hd. S.T. (2 used on S-17149)	.02
114-297		6-32 x 1/4" lg. x 1/4" Hex. Hd. (2 used on S-17165)	.01
148-122		Tuner Arm	.20
188-30		Retaining Ring (Used on S-17155)	.02
S-17149		Dial Scale & Brkt. Assem.	1.50
S-17155		Tuning Shaft & Pulley Assem.	.35
S-17157		Pointer & Pulley Assem.	.55
S-17158		Dial Cord & Eyelet Assem. (Long)	.07
S-17159		Dial Cord & Eyelet Assem. (Short)	.06
S-17165		Brkt. & Pulley Bushing Assem.	.35

Coils & Chokes

Part No.	Diag. No.	Description	Price
20-337	L22	R.F. Choke Coil (6 Used)	.20
95-1102	T3B	2nd. I. F. Trans.	1.60
95-1150	T3A	2nd. I. F. Trans.	1.50
95-1153	T4	Discriminator Transf.	1.50
95-1201	T1A	1st. I. F. Trans.	1.50
95-1248	T1B	1st. I. F. Trans.	1.60
95-1251	T2	2nd. I. F. Trans.	1.65
S-12603	L20	Phono Osc. Coil Assem.	.75
S-13997	L21	Filament Choke Coil Assem.	.40
S-15691	L5	F.M. Osc. Coil Assem.	.40
S-15743	L3	F.M. Detector Coil Assem.	.65
S-16344	L4	Broadcast Detector Coil Assem.	.60
S-16345	L6	Broadcast Osc. Coil Assem.	.60
S-16408	L2	Antenna Choke Coil Assem.	.25

Condensers

Part No.	Diag. No.	Description		Voltage	Price
22-3	C7	.01 Mfd. Ceramic	(12 Used)	500V	.26
22-4	C21	.004 Mfd. Ceramic		500V	.26
22-5	C8	110 Mmfd. Ceramic (or 22-1669)	(3 used)	500V	.26
22-177	C19	.2 Mfd.		400V	.33
22-669	C22	.01 Mfd.		600V	.20
22-827	C15	.1 Mfd.		200V	.23
22-829	C5	.05 Mfd.	(2 used)	200V	.20
22-854	C24	.0005 Mfd.		600V	.20
22-1220	C14	.002 Mfd.	(2 used)	600V	.20
22-1367	C13	50 Mmfd. Ceramic	(2 used)	500V	.33
22-1506	C10	22 Mmfd. Ceramic	(2 used)	500V	.33
22-1507	C28	25 Mmfd. Ceramic		500V	.33
22-1676	C11	.001 Mfd. Ceramic	(4 used)	500V	.40
22-1717	C20	.001 Mfd.		200V	.20
22-1762	C12	1 Mmfd. Ceramic		500V	.20
22-1775	C18	.047 Mfd. (Molded)		400V	.26
22-1863	C23	10 Mmfd. Ceramic		500V	.25
22-2104	C1	Three Section Variable			3.80
22-2105	C26, 27	Elect. 80-40 Mfd.		250V	3.00
22-2140	C6	15 Mmfd. Ceramic	(2 used)	500V	.20
22-2154	C25	Elect. 10 Mfd.		250V	1.25
22-2240	C16	Trimmer Cond.			.40
22-2276	C29	Dual Ceramic .01 Mfd. - .01 Mfd.	(3 used)	500V	.50

Resistors

Part No.	Diag. No.	Description	Price
63-1726	R33	39 Ohm 1/2W 10% Ins. Res.	.21
63-1744	R14	100 Ohm 1/2W 20% Ins. Res.	.21
63-1758	R1	220 Ohm 1/2W 20% Ins. Res. (5 used)	.21
63-1768	R4	390 Ohm 1/2W 10% Ins. Res.	.21
63-1772	R6	470 Ohm 1/2W 20% Ins. Res.	.21
63-1782	R21	820 Ohm 1/2W 10% Ins. Res.	.21
63-1806	R25	3300 Ohm 1/2W 10% Ins. Res.	.21
63-1814	R17	4700 Ohm 1/2W 20% Ins. Res.	.21
63-1827	R5	10K Ohm 1/2W 10% Ins. Res.	.21
63-1828	R29	10K Ohm 1/2W 20% Ins. Res.	.21
63-1834	R28	15K Ohm 1/2W 10% Ins. Res.	.21
63-1845	R24	27K Ohm 1/2W 10% Ins. Res.	.21
63-1856	R10	47K Ohm 1/2W 20% Ins. Res. (3 used)	.21
63-1859	R34	56K Ohm 1/2W 10% Ins. Res.	.21
63-1869	R31	100K Ohm 1/2W 10% Ins. Res.	.21
63-1870	R20	100K Ohm 1/2W 20% Ins. Res. (2 used)	.21
63-1876	R30	150K Ohm 1/2W 10% Ins. Res. (2 used)	.21
63-1884	R8	220K Ohm 1/2W 20% Ins. Res. (2 used)	.21
63-1898	R9	470K Ohm 1/2W 20% Ins. Res. (2 used)	.21
63-1912	R12	1 Megohm 1/2W 20% Ins. Res. (3 used)	.21
63-1926	R7	2.2 Megohm 1/2W 20% Ins. Res. (2 used)	.21
63-1940	R32	4.7 Megohm 1/2W 20% Ins. Res.	.21
63-1947	R3	6.8 Megohm 1/2W 20% Ins. Res. (2 used)	.21
63-1954	R13	10 Megohm 1/2W 20% Ins. Res.	.21
63-1981	R26	120 Ohm 1W 10% Ins. Res.	.24
63-2068	R18, 19	Two Section Candohm	1.00
63-2091	R15	820 Ohm W.W. 1/2W 20% Ins. Res.	.21
63-2093	R27	47 Ohm W.W. 1W 10% Ins. Res.	.24
63-2131	R22	Volume Control & Switch	1.81
63-2132	R11	Tone Control	1.20

Miscellaneous

Part No.	Diag. No.	Description	Price
44-25		Phono Jack	.12
54-139		3/8-32 x 9/16 Palnut (1 ea. used on 63-2131 & 63-2132)	.01
54-271		6-32 x 1/4" Palnut steel cad. (1 ea. used on 95-1102-95-1150-1251-1153 & 2 ea. used on 95-1201 & 1248)	.01
58-128		Two Prong Plug	.15
78-755		Octal Tube Socket (2 used)	.18
78-869		Miniature Tube Socket	.20
78-870		Miniature Tube Socket (3 used)	.15
78-871		Miniature Tube Socket	.15
78-896		Three Contact Socket	.10
78-903		Miniature Tube Socket (9 Contact)	.30
80-780		Iron Core Tension Spring (3 used)	.05
80-781		Tuner Arm Tension Spring	.06
80-865		Ground Spring (2 used)	.05
80-868		Ground Spring (2 used)	.15
85-505	S2	S.P.D.T. Switch (Ant.)	.90
85-506	S1	Band Switch	3.25
93-1039		Gang Mtg. Cup Washer (2 used)	.01
95-1188	T6	Auto Trans.	4.30
95-1272	T5	Speaker Output Trans.	2.00
126-618		Miniature Tube Shield	.02
149-95		Iron Core & Spring	.30
S-16838		Speaker Cable & Eyelet Assem.	.35

Chassis 10H20Z

COILS & CHOKES

Part No.	Diag. No.	Description	Price
20-337	L11	R.F. Choke Coil (10 used)	.20
95-1150	T2A, 3A	2nd. & 3rd. I.F. Trans. (F.M.)	1.50
95-1153	T4	Discriminator Trans.	1.50
95-1201	T1A	1st. I.F. Trans. (F.M.)	1.50
95-1248	T1B	1st. I.F. Trans. (B.C.)	1.60
95-1249	T2B	2nd. I.F. Trans. (B.C.)	1.60
95-1254	T3B	3rd. I.F. Trans. (B.C.)	1.60
S-12603	L8	Phono Osc. Coil Assem.	.75
S-13800	L9	Tone Choke Assem.	.60
S-13997	L10	Filament Choke Coil Assem.	.40
S-15691	L7	F.M. Osc. Coil Assem.	.40
S-15743	L4	F.M. Det. Coil Assem.	.65
S-16344	L5	Broadcast Det. Coil Assem.	.60
S-16345	L6	Broadcast Osc. Coil Assem.	.60
S-16408	L3	Ant. Choke Coil Assem.	.25

CONDENSERS

Part No.	Diag. No.	Description	Voltage	Price
22-3	C13	.01 Mfd. Ceramic (9 used)	500V	.26
22-5	C22	110 Mmfd. Ceramic (or 22-1669) (4 used)	500V	.26
22-171	C10	.05 Mfd.	600V	.33
22-178	C33	.05 Mfd.	200V	.20
22-348	C32	.001 Mfd. (Molded)	500V	.26
22-492	C14	.002 Mfd.	600V	.20
22-829	C5	.05 Mfd. (2 used)	200V	.20
22-830	C23	.02 Mfd. (2 used)	600V	.20
22-1203	C28	.001 Mfd. (2 used)	600V	.20
22-1220	C17	.002 Mfd. (2 used)	600V	.20
22-1256	C27	75 MMfd. (molded)	500V	.20
22-1367	C12	50 Mmfd. Ceramic	500V	.33
22-1506	C9	22 Mmfd. Ceramic (2 used)	500V	.33
22-1531	C24	.2 Mfd.	200V	.20
22-1612	C29AB C29BB	Elect. 40 Mfd. 40 Mfd.	450V	3.50
22-1645	C25	330 Mmfd. (molded)	500V	.20
22-1668	C21	200 Mmfd. Ceramic	500V	.20
22-1676	C7	.001 Mfd. Ceramic (4 used)	500V	.40
22-1745	C18	250 Mmfd. Ceramic	500V	
22-1761	C31	50 Mmfd. Ceramic	500V	.20
22-1762	C11	1 Mmfd. Ceramic	500V	.20
22-1782	C19	.0047 Mfd. (molded)	600V	.26
22-1802	C26	.002 Mfd.	1600V	.26
22-1863	C15	10 Mmfd. Ceramic	500V	.25
22-1887	C20	25 Mmfd. Ceramic	500V	.26
22-2104	C1	Three Section Variable		3.80
22-2140	C6	15 Mmfd. Ceramic (2 used)	500V	.20
22-2243	C30AB C30BB	Elect. 20 Mfd. - 350V x 40 Mfd.	450V	3.00
22-2251	C16	Trimmer Cond.		.35
22-2276	C34	Dual Ceramic .01 Mfd. - .01 Mfd.	500V	.50

DIAL ASSEMBLY

Part No.	Diag. No.	Description	Price
78-898		Dial Light Socket & Wire	.35
80-69		Dial Cord Spring	.05
80-746		Pulley Retaining Spring	.02
80-747		Dial Cord Spring	.10
100-67	PL1	Dial Light Bulb	.11
188-30		Retaining Ring (used on S-17155)	.02
S-17155		Tuning Shaft & Pulley Assem.	.35
S-17157		Pointer & Pulley Assem.	.55
S-17158		Dial Cord & Eyelet Assem. (Long)	.07
S-17159		Dial Cord & Eyelet Assem. (Short)	.06
S-17258		Dial Scale & Brkt. Assem.	1.50
S-17261		Brkt. & Pulley Bushing Assem.	.30

RESISTORS

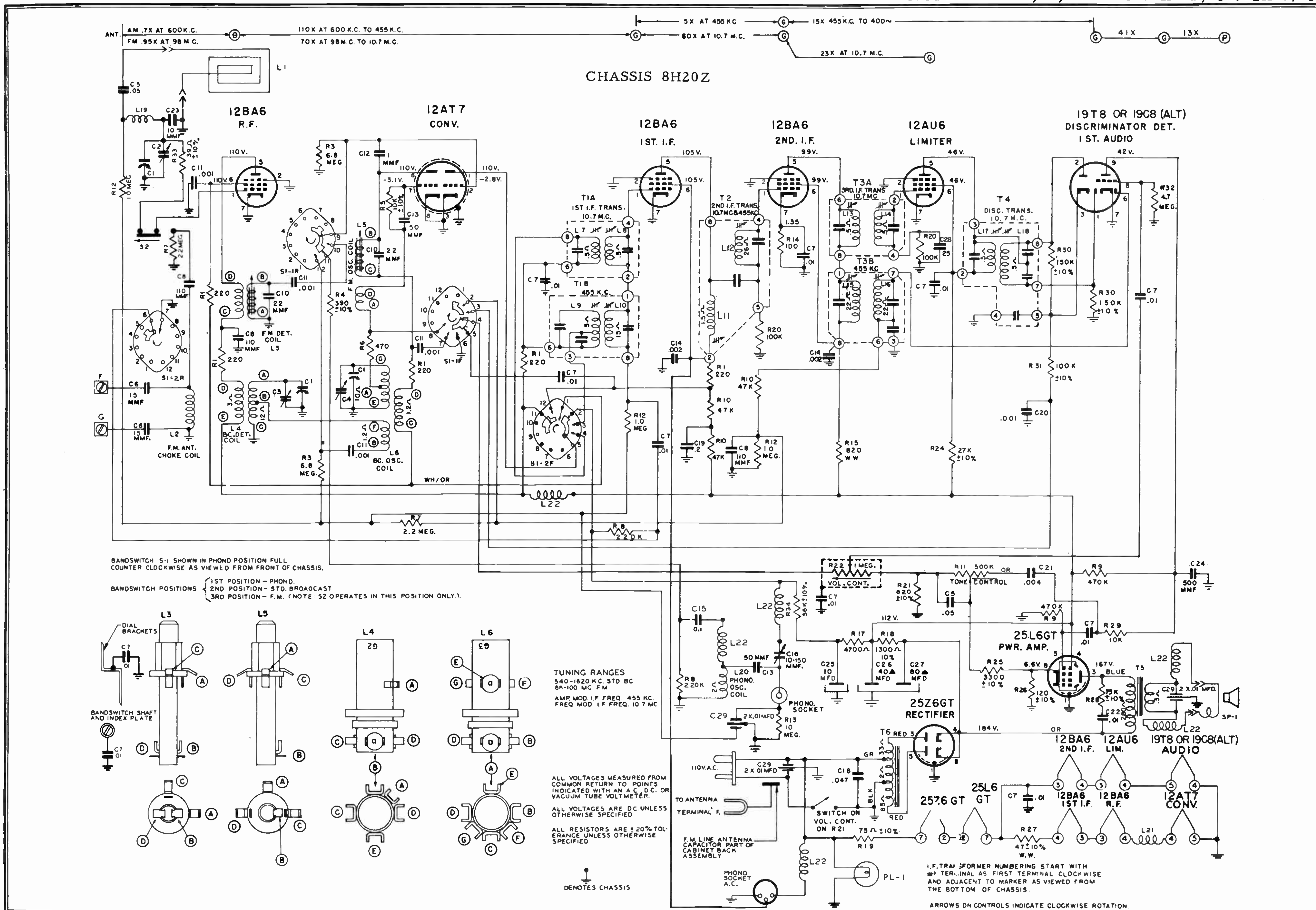
Part No.	Diag. No.	Description	Price
63-966	R12	4700 ohm 2W 20% Carb. Res.	.19
63-1193	R39	5600 ohm 2W 10% Ins. Res. (used only when 12AV7 is used or 63-2064)	.36
63-1452	R26	270 ohm W.W. 2W 10% Ins. Res.	.33
63-1716	R4	22 ohm 1/2W 20% (or 63-2446 if req.) Ins. Res.	.21
63-1722	R16	33 ohm 1/2W 10% Ins. Res.	.21
63-1723	R2	33 ohm 1/2W 20% Ins. Res.	.21
63-1744	R17	100 ohm 1/2W 20% Ins. Res.	.21
63-1758	R3	220 ohm 1/2W 20% Ins. Res. (3 used)	.21
63-1764	R24	330 ohm 1/2W 10% Ins. Res.	.21
63-1771	R8	470 ohm 1/2W 10% Ins. Res.	.21
63-1772	R7	470 ohm 1/2W 20% Ins. Res.	.21
63-1778	R20	680 ohm 1/2W 20% Ins. Res.	.21
63-1786	R9	1000 ohm 1/2W 20% Ins. Res. (used only when 12AT7 is used)	.21
63-1793	R14	1500 ohm 1/2W 20% Ins. Res.	.2.
63-1799	R32	2200 ohm 1/2W 10% Ins. Res.	.21
63-1813	R19	4700 ohm 1/2W Ins. Res.	.21
63-1820	R36	6800 ohm 1/2W 10% Ins. Res.	.21
63-1827	R6	10K ohm 1/2W 10% Ins. Res. (2 used)	.21
63-1842	R22	22K ohm 1/2W 20% Ins. Res. (2 used)	.21
63-1845	R23	27K ohm 1/2W 10% Ins. Res.	.21
63-1848	R30	33K ohm 1/2W 10% Ins. Res.	.21
63-1849	R13	33K ohm 1/2W 20% Ins. Res.	.21
63-1856	R10	47K ohm 1/2W 20% Ins. Res.	.21
63-1862	R38	68K ohm 1/2W	.21
63-1869	R29	100K ohm 1/2W 10% Ins. Res.	.21
63-1870	R21	100K ohm 1/2W 20% Ins. Res.	.21
63-1876	R27	150K ohm 1/2W 10% Ins. Res. (2 used)	.21
63-1884	R11	220K ohm 1/2W 20% Ins. Res. (3 used)	.21
63-1890	R25	330K ohm 1/2W 10% Ins. Res. (2 used)	.21
63-1897	R33	470K ohm 1/2W 10% Ins. Res.	.21
63-1898	R34	470K ohm 1/2W 20% Ins. Res.	.21
63-1912	R1	1 Megohm 1/2W 20% Ins. Res.	.21
63-1926	R5	2.2 " 1/2W 20% Ins. Res. (4 used)	.21
63-1940	R28	4.7 " 1/2W 20% Ins. Res.	.21
63-2091	R18	820 ohm W.W. 1/2W 20% Ins. Res.	.21
63-2138	R37AB R37BB	Candohm	1.10
63-2139	R31	Volume Control & Switch	1.81
63-2141	R15	22K ohm 2W 20% Ins. Res.	.33
63-2142	R35	130 ohm 5W 10% Zipohm	.43

MISCELLANEOUS

Part No.	Diag. No.	Description	Price
11-85		Line Cord & Plug (6 ft. lg.)	.65
19-212		Transformer Mtg. Clip (2 used on 95-1252)	.04
54-306		Speed Nut (used on S-13800)	.06
57-1736		Chassis Bottom Plate	.60
78-580		Nine Contact Socket	.22
78-644		Phono Connector Socket	.12
78-755		Octal Tube Socket (3 used)	.18
78-807		Miniature Tube Socket	.15
78-869		Miniature Tube Socket	.20
78-870		Miniature Tube Socket (3 used)	.15
78-871		Miniature Tube Socket	.15
78-896		Three Contact Socket	.10
78-897		Two Contact Socket	.10
78-903		Miniature Tube Socket (9 contact)	.30
80-780		Iron Core Tension Spring (3 used)	.05
80-781		Tuner Arm Tension Spring	.06
80-865		Ground Spring	.05
80-868		Grounding Spring	.15
85-505	S2	S.P.D.T. Switch (Ant.)	.90
85-508	S1	Band Switch	3.25
93-965		Rubber Washer (used on S-13800)	.02
93-1039		Gang Cond. Mtg. Cup Washer (2 used)	.01
95-1252	T5	Speaker Output Trans.	2.50
95-1253	T6	Pwr. Trans.	12.50
113-43		6-32 x 5/16 Hex Hd. S.T. (used on S-17258)	.03
114-39		8-32 x 1/4 lg. x 1/4 Hex Hd. (2 used on S-17258 & 4 used on 57-1736)	.60
126-618		Miniature Tube Shield	.02
148-122		Tuner Arm	.20
149-95		Iron Core & Spring (2 used)	.30
S-17257		Speaker Cable & Eyelet Assem.	.35

RADIORGAN ESCUTCHEON ASSEM.

Part No.	Diag. No.	Description	Price
76-444		Radiorgan Knob Shaft	.04
114-297		#6 x 1/4" Hex Hd. S.T. (2 used on S-17252 & S-17253)	.01
S-17246		Radiorgan Knob & Eyelet Assem. (Treble)	.20
S-17247		Radiorgan Knob & Eyelet Assem. (Voice)	.20
S-17248		Radiorgan Knob & Eyelet Assem. (Alto)	.20
S-17249		Radiorgan Knob & Eyelet Assem. (Bass)	.20
S-17250		Radiorgan Knob & Eyelet Assem. (Lo Bass)	.20
S-17251		Radiorgan Knob & Eyelet Assem. (Normal)	.20
S-17252		Radiorgan Esc. & Knob Assem. (R.H.)	1.55
S-17253		Radiorgan Esc. & Knob Assem. (L.H.)	1.55
S-17255		Radiorgan Cable Assem.	2.60


CHASSIS 8H20Z
ANT. AM .7X AT 600K.C.
FM .95X AT 98 M.C.
110X AT 600 K.C. TO 455 K.C.
70X AT 98 M.C. TO 10.7 M.C.
5X AT 455 KC
80X AT 10.7 M.C.
15X 455 K.C. TO 400~
23X AT 10.7 M.C.
41X
13X
12BA6 R.F.
12AT7 CONV.
12BA6 1ST. I.F.
12BA6 2ND. I.F.
12AU6 LIMITER
19T8 OR 19C8 (ALT) DISCRIMINATOR DET. 1ST. AUDIO
25L6GT PWR. AMP.
25Z6GT RECTIFIER
F.M. ANT. CHOKE COIL
BC. DET. COIL
BC. OSC. COIL
FM DET. COIL L3
F.M. OSC. COIL
PHONO. OSC. COIL
PHONO. SOCKET
VOL. CONT.
TONE CONTROL
SWITCH ON VOL. CONT. ON R21
BANDSWITCH S-1 SHOWN IN PHONO POSITION FULL COUNTER CLOCKWISE AS VIEWED FROM FRONT OF CHASSIS.
BANDSWITCH POSITIONS
1ST POSITION - PHONO.
2ND POSITION - STD. BROADCAST
3RD POSITION - F.M. (NOTE S2 OPERATES IN THIS POSITION ONLY.)
DIAL BRACKETS
BANDSWITCH SHAFT AND INDEX PLATE
TUNING RANGES
540-1620 K.C. STD BC
88-100 MC F.M.
AMP. MOD. I.F. FREQ. 455 KC.
FREQ. MOD. I.F. FREQ. 10.7 MC
ALL VOLTAGES MEASURED FROM COMMON RETURN TO POINTS INDICATED WITH AN A.C. D.C. OR VACUUM TUBE VOLTMETER.
ALL VOLTAGES ARE DC UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE ±20% TOLERANCE UNLESS OTHERWISE SPECIFIED
DENOTES CHASSIS
110V.A.C.
TO ANTENNA TERMINAL F.
F.M. LINE ANTENNA CAPACITOR PART OF CABINET BACK ASSEMBLY
PHONO SOCKET A.C.
I.F. TRANSFORMER NUMBERING START WITH #1 TERMINAL AS FIRST TERMINAL CLOCKWISE AND ADJACENT TO MARKER AS VIEWED FROM THE BOTTOM OF CHASSIS.
ARROWS ON CONTROLS INDICATE CLOCKWISE ROTATION

The 8H20Z chassis incorporates a superheterodyne circuit with two stages of IF, on the FM Band, and one stage on the AM Band. There is one stage of RF amplification on all Bands.

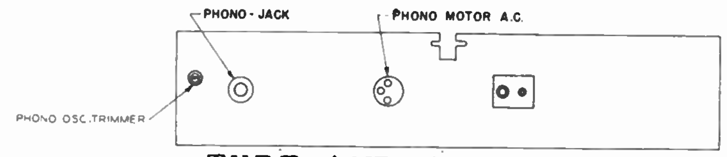
When adjustments are made on the 8H20Z chassis, a line isolation transformer (110 V input to 110V output) is recommended in order to avoid a "hot" chassis. If an isolation transformer is not available, check the AC voltage between chassis and bench ground and if there is any indication of voltage, reverse the plug before handling the set.

FM RF Alignment: The tunning slugs are attached to threaded shafts and the slugs are varied in the field of the coils by turning the shafts clockwise or counter-clockwise. After adjustment the shafts must be secured with a drop of speaker cement.

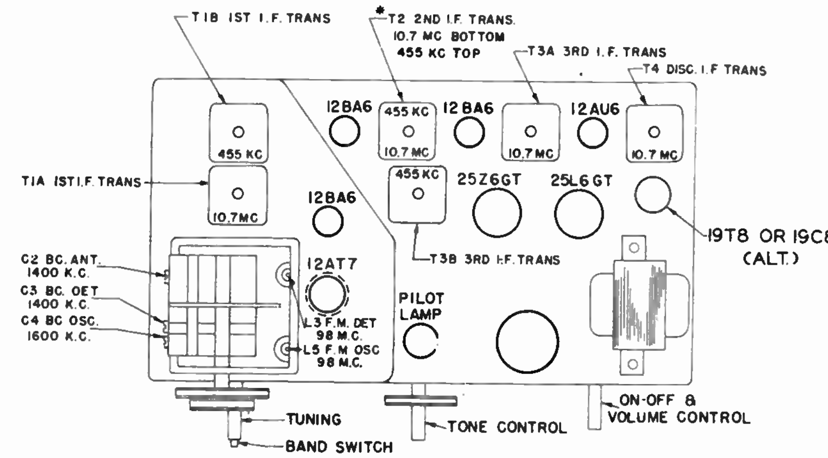
AM and FM IF Alignment: The AM and FM IF transformers in this receiver are of the new permeability tuned type. The advantage of an IF transformer of this type is its extreme stability under various humidity and temperature conditions. The upper coil is the secondary and the lower the primary. When adjusting these IF transformers the tuning wrench 68-19 can be inserted into the top slug, rotated until maximum output is obtained and then dropped down to the lower slug and the same operation repeated. The tuning wrench is so designed that turning one slug does not affect the adjustment of the other.

FM IF Alignment: Because of the wide band pass, it is desirable to use a FM signal generator and a cathode ray oscilloscope when aligning the FM IF channel. The instruction book for the Zenith Model 800 Signal Generator (Form Z8001) covers complete FM alignment procedure. If visual alignment equipment is unavailable, reasonably accurate alignment can be made by following the procedure outlined below.

FM Discriminator Alignment: When the secondary of the discriminator is aligned (operation 5) use sufficient signal input to get a good positive and negative indication before setting the slug for zero reading. A center zero indicating meter is recommended for this adjustment, but is not absolutely necessary. Reversing the leads of a non-zero center meter, or observing closely when the meter starts to go to the left (negative) of zero will give the same results.

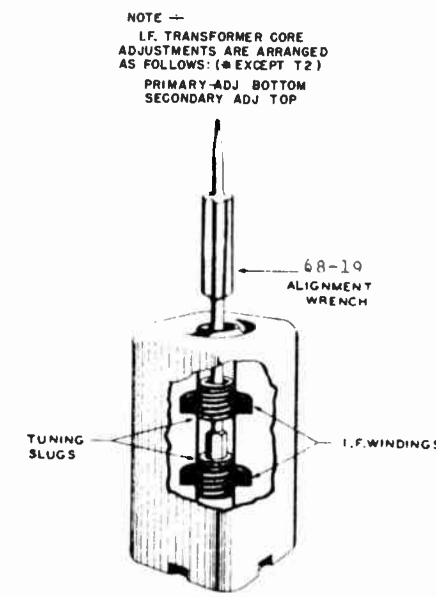


TUBE AND TRIMMER LOCATION

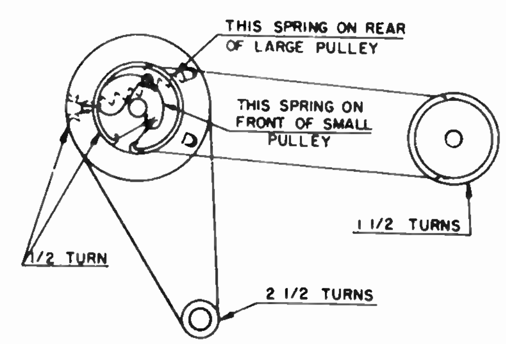


ALIGNMENT PROCEDURE

Operation	Connect Oscillator To	Dummy Antenna	Input Signal Frequency	Band	Set Dial To	Adj. Trimmers	Purpose
1	Pin 2 12AT7 Converter	.05 Mfd.	455 Kc. Modulated	BC	600 Kc.	L9, 10, 12 15 & 16	Align I. F. channel for maximum output.
2	2 turns loosely cpld. to wavemagnet		1600 Kc. Modulated	BC	1600 Kc.	C4	Set oscillator to dial scale.
3	2 turns loosely cpld. to wavemagnet		1400 Kc. Modulated	BC	1400 Kc.	C3, C2	Align detector and antenna stage.
4 (a)	Pin 1 (grid) on 12AU6 limiter.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L17 coil slug Primary discr.	Align primary of discriminator for maximum reading.
5 (b)	Pin 1 (grid) on 12AU6 limiter.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L18 coil slug sec. of discr.	Adjust secondary of discriminator for zero reading.
6 (c)	Pin 1 (grid) on 12BA6 2nd. I F.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L13 and L14 Pri. & Sec. of 3rd. IF trans.	Align 3rd. IF transformer for maximum reading.
7 (c)	Pin 1 (grid) on 12BA6 1st. IF.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		Adjust L11 for maximum reading.	Align 2nd IF transformer for maximum reading.
8 (c)	Pin 2 (grid) on 12AT7 converter tube socket.	.05 Mfd.	10.7 Mc. Unmodulated	FM 100		L7 and L8 Prim. and Sec. of 1st. IF transformer.	Align 1st. IF transformer for maximum reading.
9 (c)	Antenna Post FM (Remove line ant.)	270 ohms	98 Mc. Unmodulated	FM 100	98 Mc.	L5 Osc. Coil Slug.	Set Oscillator to dial scale.
10 (c) (d)		270 ohms	98 Mc. Unmodulated	FM 100	98 Mc.	L3 Det. Coil Slug	Align det. stage to maximum reading.



Detail of IF Transformer



DIAL CORD DRIVE

IMPORTANT

Alignment of this chassis will in most cases be unnecessary unless an IF or RF transformer is replaced or the adjustments have been tampered with.

Correct alignment can only be made if the following procedure is followed:

A vacuum tube voltmeter with an isolation resistor of 2,000,000 ohms in series with the hot lead will serve for FM adjustments. This lead should be shielded.

An AC output meter connected across the primary or secondary of the output transformer will be satisfactory for all AM adjustments.

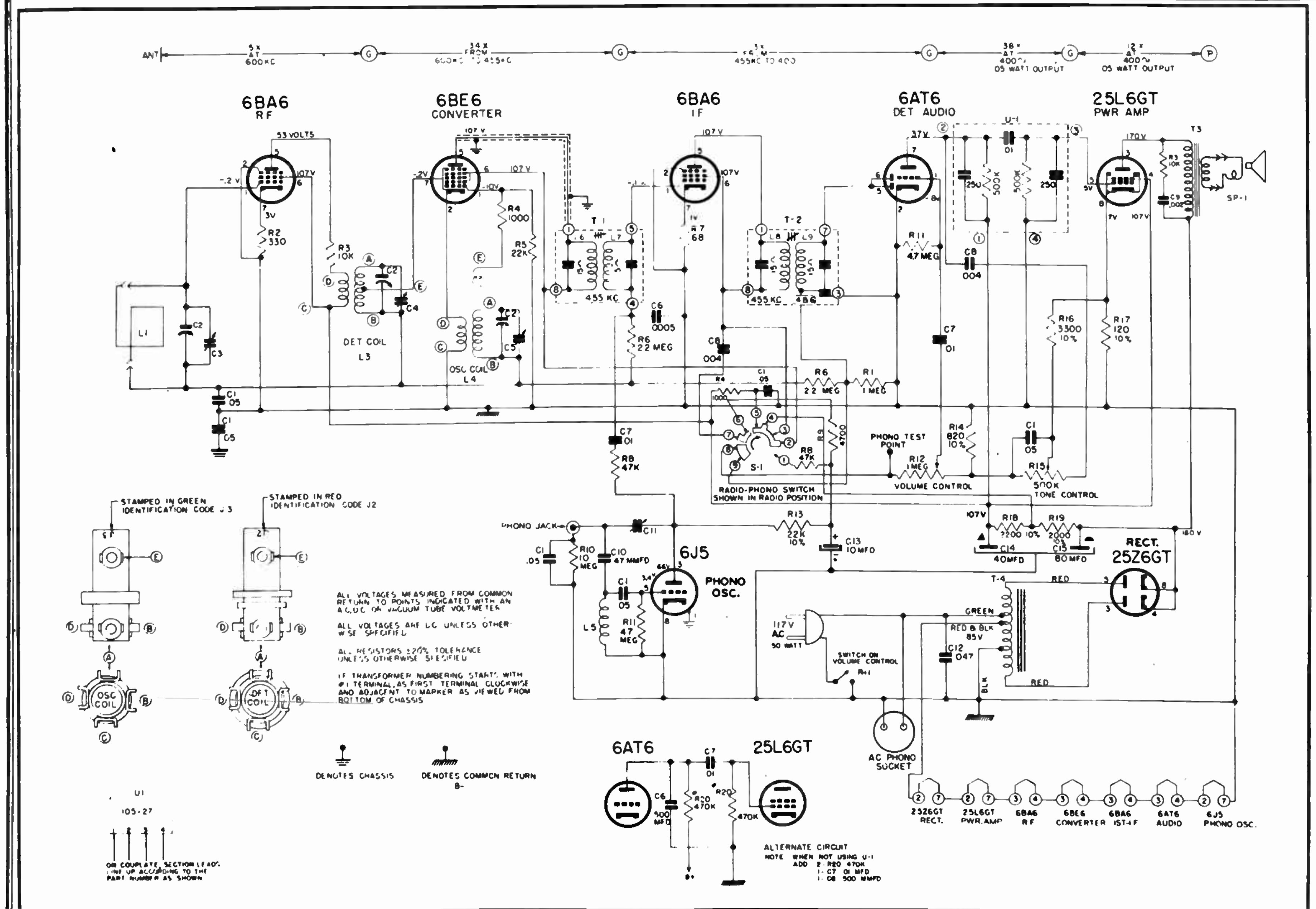
The signal generator output should be kept just high enough to get an indication on the meter.

(a) Vacuum Tube Voltmeter Lug 7 on discriminator transformer to chassis (half discriminator load).

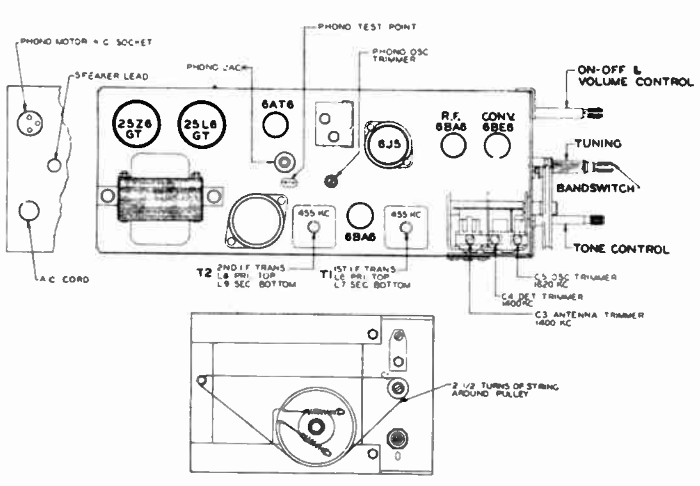
(b) Vacuum Tube Voltmeter Lug 5 on discriminator transformer to chassis (full discriminator load).

(c) Vacuum Tube Voltmeter from Limiter Grid to Chassis.

(d) Loosen Slugs by applying a hot iron to the cement.



CHASSIS 7K21 USED ON MODEL K2286R



TUBE, TRIMMER LOCATION, DIAL CABLE DRAWING AND DETAILED VIEW OF I.F. TRANSFORMERS.

The I.F. transformers incorporated in this reveiver are of the new permeability tuned type. The advantage of an I.F. transformer of this type is its extreme stability under various humidity and temperature conditions. The upper coil is the secondary and the lower the primary. When adjusting these I.F. transformers the tuning wrench 68-19 can be inserted into the top slug, rotated until maximum output is obtained and then dropped down to the lower slug and the same operation repeated. The tuning wrench is so designed that turning one slug does not affect the adjustment of the other. In the event the receiver oscillates during phono operation, adjust C11 4-80 mmf. capacitor to a point at which the oscillation ceases.
This position of no oscillation will sometimes vary with different cartridges, and in this case readjustment of C11 must be made.

Part No.	Diag. No.	Description				Price
11-109		Line Cord & Plug				.45
12-1589		Volume Control Mtg. Bracket.				.05
19-189		Coil Mtg. Clip				.02
22-3	C7	.01 Mfd. Ceramic Cond. (2 used)			500V	.26
22-4	C8	.004 Mfd. Ceramic Cond. (2 used)			500V	.26
22-829	C1	.05 Mfd. Cond. (6 used)			200V	.20
22-854	C6	.0005 Mfd. Cond.			600V	.20
22-1220	C9	.002 Mfd. Cond.			600V	.20
22-1775	C12	.047 Mfd. Cond.			400V	.26
22-2240	C11	Trimmer				.40
22-2360	C10	47 Mmfd. Cond.			500V	.25
22-2390	C13	Electrolytic 10 Mfd.			250V	1.40
22-2391	C14,C15	Electrolytic 40-80 Mfd.			250V	3.50
22-2392	C2	Three Section Gang				1.25
49-714	SP1	7-1/2'' PM Speaker				7.00
		ZC7512G Cone & Voice Coil				2.63
54-139		Palnut (1 used on ea. 63-2787, 63-2788 & 85-519				.01
54-271		Palnut (1 used on ea. 95-1101, 95-1102)				.01
57-1750		Shaft Locking Plate				.04
63-949	R18	2200 ohm 1W	10%	Ins.	Res.	.24
63-1737	R7	68 ohm 1/2W	20%	''	''	.21
63-1765	R2	330 ohm 1/2W	20%	''	''	.21
63-1782	R14	820 ohm 1/2W	10%	''	''	.21
63-1786	R4	1K ohm 1/2W (2 used)	20%	''	''	.21
63-1806	R16	3300 ohm 1/2W	10%	''	''	.21
63-1814	R9	4700 ohm 1/2W	20%	''	''	.21
63-1828	R3	10K ohm 1/2W (2 used)	20%	''	''	.21
63-1841	R13	22K ohm 1/2W	10%	''	''	.21
63-1842	R5	22K ohm 1/2W	20%	''	''	.21
63-1856	R8	47K ohm 1/2W (2 used)	20%	''	''	.21
63-1912	R1	1 Megohm 1/2W	20%	''	''	.21
63-1926	R6	2.2 Megohm 1/2W (2 used)	20%	''	''	.21
63-1940	R11	4.7 Megohm 1/2W (2 used)	20%	''	''	.21
63-1954	R10	10. Megohm 1/2W	20%	''	''	.21
63-1981	R17	120 Ohm 1W	10%	''	''	.24
63-2787	R12	Volume Control & Switch				1.81
63-2788	R15	Tone Control				1.20
63-3151	R19	2K ohm 5W WW Vit. Enam.	10%	''	''	1.00
78-274		Electrolytic Socket				.03
78-461		Two Contact Socket				.07
78-709		Octal Tube Socket				.20
78-755		Octal Tube Socket (2 used)				.18
78-807		Min. Tube Socket (4 used)				.15
80-209		Dial Cord Tension Spring (2 used)				.03
85-519	S1	Radio-Phono Switch				1.40
94-334		Gang Mtg. Bushing (2 used)				.01
95-1101	T1	1st IF Transformer				1.60
95-1102	T2	2nd IF Transformer				1.60
95-1299	T4	Auto Transformer				5.25
95-1300	T3	Speaker Output Transformer				2.00
105-27	U1	Couplate Unit				.80
113-8		6-32x1/4'' Hex Hd. Mach. Screw (1 for 22-2247)				.02
113-13		6-32x7/16 Hex Hd. Mach. Screw (1 for gang)				.02
114-39		8-32x1/4 Hex Hd. S.T. Screw (1 for 57-1750) (4 for Gang)				.01
114-67		6-32x7/16 Hex Hd. Mach Screw (1 for Gang)				.01
114-297		6-32x1/4 Hex Hd. S.T. Screw (2 to Mt. 12-1589)				.01
125-17		Rubber Grommet (3 used on Gang)				.03
125-81		Strain Relief Grommet				.05
125-82		Strain Relief Grommet				.05
188-60		Retaining Ring (used on S-18684)				.02
S-12603	L5	Phono Osc. Coil Assem.				.75
S-18682	L4	Osc. Coil Assem.				.85
S-18683	L3	Det. Coil Assem.				.80
S-18684		Tuning Shaft & Pulley Assem.				.60
S-18687		Bracket, Stud & Terminal Strip (for gang)				1.10
S-18689		Dial Cord & Eyelet				.10
S-18953		Volume Control Extension Shaft & Coupling Assem.				.60
S-19312	L1	Wavemagnet Assembly				

Prices shown are suggested list prices and are subject to change without notice.

Zenith Radio Corporation

ALIGNMENT PROCEDURE

OPERATION	CONNECT OSCILLATOR TO	DUMMY ANTENNA	INPUT SIG. FREQUENCY	SET DIAL AT	TRIMMERS	PURPOSE
1	Convertor Grid	.5 Mfd.	455 Kc.	600 Kc.	L6, 7, 8 & 9	For I.F. Alignment
2	Single Turn Loosely Coupled to Wave Magnet	--	1620 Kc.	1620 Kc.	C-5	Set Oscillator to Dial Scale.
3		--	1400 Kc.	1400 Kc.	C-4	Detector Alignment
4		--	1400 Kc.	1400 Kc.	C-3	Antenna Alignment

NUMERICAL PARTS LIST

Diag No.	Part No.	Description	Suggested List Price
		S-19840 TURRET TUNER	
	12-1964	Mutual inductance trimmer (part of S-20181)	
	20-389	I F trap coil	.10
	20-391	R F choke	.10
	20-393	R F plate inductance trimmer coil	.20
	20-429	Converter grid inductance trimmer coil	.15
	20-431	Interstage cascode coil	.10
	20-447	Osc inductance trimmer coil	
	21-33	Index roller	.10
	22-2221	Ceramic trimmer (used on S-19916)	.25
	22-2331	800 mmfd ceramic disc	.26
	22-2383	4.5 mmfd ceramic disc	.55
	22-2403	100 mmfd. ceramic disc (2 used)	.20
	22-2404	Feed-thru cond. 400 mmfd 500V (8 used)	.30
	22-2406	19 mmfd ceramic	.30
	22-2407	100 mmfd ceramic	.30
	22-2411	10 mmfd ceramic disc	.20
	22-2413	5.5 mmfd ceramic disc	.20
	22-2434	2 mmfd molded 500V	.15
	22-2453	Ceramic trimmer	.25
	22-2468	2.2 mmfd. molded (used on S-19916)	.20
	44-30	Connector jack	.30
	52-622	Shielded lead	.35
	54-34	6-32x1/4 hex nut (4 for S-18840)	.01
	54-337	Tension nut (for 112-857)	.02
	63-1729	47 ohm 1/2w 10% Ins.Res.	.21
	63-1772	470 ohm 1/2w 20% " "	.21
	63-1799	2200 ohm 1/2w 10% " "	.21
	63-1813	4700 ohm 1/2w 10% " "	.21
	63-1842	22K ohm 1/2w 20% " "	.21
	63-1856	47K ohm 1/2w 20% " "	.21
	63-1869	100K ohm 1/2w 10% " "	.21
	63-1884	220K ohm 1/2w 20% " "	.21
	63-1897	470K ohm 1/2w 10% " "	.21
	63-2286	330 ohm 1w 20% " "	.24
	63-3170	10K ohm 2w 20% " "	.33
	73-40	6-32x1/8 allen hd. set screw	.10
	73-141	8-32x3/8 slab hd. set screw (2 for S-18602)	.04
	76-650	Index arm shaft	.35
	76-651	Fine tuning shaft	.35
	78-934	Min. tube socket	.35
	78-944	Min. tube socket	.30
	80-897	Turret shaft ground spring	.05
	80-901	Index spring	.05
	80-905	Trimmer tension spring	.02
	80-908	Shaft grounding spring	.10
	80-924	Turret shaft tension spring	.06
	83-2018	Connector strip	.01
	86-245	Stator terminal (13 used on stator strip)	.05
	86-247	Insulated feed through terminal	.10
	93-1103	Steel washer	.01
	93-1112	Special washer	.01
	93-1113	Flat washer	.03
	93-1115	Steel washer	.03
	94-786	Coil spacer bushing	.04
	94-793	Fine tuning stop bushing	.20
	94-804	Nylon bushing	.10
	112-856	Inductance adjusting screw	.03
	112-857	Trimmer adjusting screw (4 used)	.02
	112-882	Inductance adjusting screw (12 used)	.03
	114-180	6-20x1/4 hex hd. s.t. screw (4 used)	.75
	126-693	Chassis shield	.10
	126-695	Tube shield	.20
	126-721	Tube shield	.15
	148-135	Index arm	.15
	149-119	Iron core	
	149-121	Iron core	
	188-148	Retaining ring (76-650)	.02
	188-156	Trimmer cup retaining ring	.10
	194-30	Insulator (part of S-20181)	
	S-18602	Gear, bushing & set screw	.30
	S-18799	Shaft, plate & spring assem.	1.50
	S-18837	Fine tuning brkt. assem.	.60
	S-18839	Trimmer shaft & core	.60
	S-18840	Tuner cover assem.	2.25
	S-18843	Center shield & spring assem.	
	S-18844	Trimmer cup & sleeve assem.	.25
	S-18848	Center shield assem. - small	
	S-18857	Converter plate coil assem.	.60
	S-18858	I F trap coil & cap assem.	.55
	S-18859	Osc. plate choke assem.	.35
	S-19758	Stator strip assem.	
	S-19840	Turret tuner complete	
	S-20145	Service replacement turret tuner (S-19840 less cover, strips, etc.)	
	S-19842	Ant. strip assem. Channel #2	
	S-19843	" " " " #3	
	S-19844	" " " " #4	
	S-19845	" " " " #5	
	S-19846	" " " " #6	
	S-19847	" " " " #7	
	S-19848	" " " " #8	
	S-19849	" " " " #9	
	S-19850	" " " " #10	
	S-19851	" " " " #11	
	S-19852	" " " " #12	
	S-19853	" " " " #13	
	S-19862	Osc. strip assem. Channel #2	
	S-19863	" " " " #3	
	S-19864	" " " " #4	
	S-19865	" " " " #5	
	S-19866	" " " " #6	
	S-19867	" " " " #7	
	S-19868	" " " " #8	
	S-19869	" " " " #9	
	S-19870	" " " " #10	
	S-19871	" " " " #11	
	S-19872	" " " " #12	
	S-19873	" " " " #13	
	S-19916	Trimmer & cap	
	S-20060	Ant. term. strip & brkt.	
	S-20181	Trimmer & insulator	

TUBES

1 6U8 1 6BK7A

Diag. No.	Part No.	CHASSIS 21K20 Description	Suggested List Price
	12-1758	Horiz. Csc. Coil Brkt.	.05
	12-1926	Tube Support Brkt. (Sweep)	
	15-98	Socket Cap (Sweep)	.45
	15-101	Plate Insulator Cap (2 used) (Sweep)	
	19-178	Cond. Retaining Clip	.07
	19-233	Coil Clip	.07
C30	22-3	.01 Mfd Ceramic (5 used) 500V	.26
C36	22-4	.004 Mfd Ceramic 500V	.26
C12	22-6	470 Mmfd Ceramic (4 used) 500V	.26
C15	22-7	.001 Mfd Ceramic (6 used) 500V	.26
C39	22-8	.002 Mfd Ceramic 500V	.26
C28	22-1608	27 Mmfd Ceramic 500V (or 22-2396 27 Mmfd Ceramic 500V)	.45
C71	22-1762	1 Mmfd Molded 500V	.20
C63	22-1775	.047 Mfd Molded 400V	.26
C59	22-1777	.1 Mfd Molded 200V	.26
C45	22-1778	.047 Mfd 200V	.26
C57	22-1785	.0015 Mfd Molded 400V	.20
C47	22-1814	.0022 Mfd Molded 600V	.26
C42	22-1825	.22 Mfd Molded 400V	.50
C52	22-1831	56 Mmfd Molded Mica 500V	.26
C17	22-1832	500 Mmfd Molded (2 used) 20,000V	2.25
C49	22-1841	.1 Mfd Molded 600V	.45
C61	22-1842	.0047 Mfd Molded 200V	.26
C44	22-1843	.01 Mfd Molded 600V	.26
C40	22-1844	.047 Mfd Molded 600V	.35
C46	22-1845	.0022 Mfd Molded 600V	.26
C21	22-1849	.0047 Mfd Molded 600V	.26
C68	22-1850	.015 Mfd 200V	.26
C24	22-1874	7 Mmfd Ceramic 500V (or 22-2375 7 Mmfd Ceramic 500V)	.26
C26	22-1876	47 Mmfd Ceramic (2 used) 500V (or 22-2376 47 Mmfd Ceramic 500V)	.35
C34	22-1895	10 Mmfd Ceramic (or 22-2378 10 Mmfd Ceramic 500V) 500V	.35
C13	22-2050	5 Mmfd Ceramic (or 22-2380 5 Mmfd Ceramic 500V) 500V	.30
C14	22-2051	6 Mmfd Ceramic (or 22-2381 6 Mmfd Ceramic 500V) 500V	.35
C51	22-2127	.001 Mfd Molded (2 used) 600V	.26
C69	22-2128	.001 Mfd Molded (2 used) 600V	.26
C67	22-2129	.022 Mfd Molded 600V	.35
C18	22-2146	.47 Mfd Molded 200V	.60
C54	22-2166	.15 Mfd Molded 200V	.45
C31	22-2167	.22 Mfd Molded 200V	.45
C70	22-2248	.0033 Mfd 600V	.26
C19	22-2268	.0068 Mfd Molded 600V	
C33	22-2276	Dual .01 Mfdx.01 Mfd Ceramic 500V	.50
C20	22-2302	470 Mmfd Ceramic (2 used) 500V	.35
C16	22-2309	330 Mmfd Ceramic 500V	.26
C25	22-2310	560 Mmfd Ceramic 500V	.35
C64	22-2340	.1 Mfd Molded 400V	.40
C65	22-2341	.15 Mfd Molded 400V	.45
C27	22-2343	3.3 Mmfd Ceramic 500V	.26
C37AD, BD,CD, DD	22-2358	Electrolytic 80-400V 40-400V, 30-400V, 40-25V	
C50AD, BD,CD, DD	22-2368	Electrolytic 40-400V 10-475V, 100-50V 10-25V	
C56	22-2387	680 Mmfd Ceramic 500V	
C23	22-2389	Electrolytic 20 Mfd 400V	
C62	22-2398	Single Section Trimmer	
C58	22-2416	1080 Mmfd Mica 500V	
C29AD, BD,CD, DD	22-2418	Electrolytic 60-350V 4-350V, 100-25V 40-25V	
C1	22-2420	20 Mmfd Ceramic 500V	
C32	22-2431	.0082 Mfd Molded 200V	
	24-572	IF Transf. Shield Cover	.05
	24-583	Sweep Housing Cover-Top	
	24-584	Sweep Housing Cover-Back	
	24-588	IF Transf. Shield Top Cover	
	25-2	Cotter Pin	
	43-209	Sweep Transf. Housing	
	52-619	Shielded Lead	
	52-625	Shielded Lead	
	54-34	6-32x1/4 Hex Nut (Sweep)	.01
	54-139	3/8-32x9/16 Hex Palnut	.01
	54-271	6-32x1/4 Hex Palnut - Inverted	.01
	54-326	1/4-28x7/16 Hex Nut x 5/32 thk.	
	57-1718	Tube Socket Retaining Plate (used only when 78-801 is used)	.01
	57-1804	Socket Mtg. Plate (Sweep)	
	58-202	Two Prong Plug A.C. (part of S-18579)	
R90	63-942	15K ohm 2W 10% Ins.Res.	
R61	63-958	22K ohm 1W 10% " "	
R87	63-966	4700 ohm 2W 20% " "	
R79	63-1055	22K ohm 1W 20% " "	
	63-1091	12K ohm 2W 10% " "	
R54	63-1101	8200 ohm 2W 10% " "	.36
R85	63-1188	39K ohm 1W 10% " "	.24
R77	63-1194	47K ohm 1W 10% " "	.24
R35	63-1198	10K ohm 2W 10% " "	.36
R21	63-1573	2700 ohm 1W 10% " "	.24
R26	63-1579	6200 ohm 2W 5% " "	.33
R89	63-1623	12K ohm 2W 10% " "	
R16	63-1708	15 ohm 1/2W 10% " "	
R43	63-1733	56 ohm 1/2W 10% " "	.21
R12	63-1737	68 ohm 1/2W 20% " "	.21
R75	63-1740	82 ohm 1/2W 10% " "	.21
R19	63-1743	100 ohm 1/2W 10% " "	.21
R66	63-1744	100 ohm 1/2W 20% " "	.21
R44	63-1757	220 ohm 1/2W 10% " "	.21
R20	63-1764	330 ohm 1/2W 10% " "	.21
R80	63-1765	330 ohm 1/2W 10% " "	
R18	63-1771	470 ohm 1/2W 10% " "	.21
R8	63-1772	470 ohm 1/2W 20% " "	.21
R59	63-1775	560 ohm 1/2W 10% " "	.21
R27	63-1777	680 ohm 1/2W 5% " "	
	63-1778	680 ohm 1/2W 10% " "	.21
R91	63-1786	1K ohm 1/2W 20% " "	.21
R10	63-1799	2200 ohm 1/2W 10% " "	.21
R39	63-1810	3900 ohm 1/2W 10% " "	.21
R14	63-1820	6800 ohm 1/2W 10% " "	.21
R41	63-1824	8200 ohm 1/2W 10% " "	.21
R72	63-1827	10Kohm 1/2W 10% " "	.21
R28	63-1828	10K ohm 1/2W 20% " "	.21
R71	63-1834	15K ohm 1/2W 10% " "	.21

Part No.		Description	Suggested List Price
R23	63-1841	22K ohm 1/2W 10% " "	.21
R7	63-1842	22K ohm 1/2W 20% " "	.21
R15	63-1845	27K ohm 1/2W 10% " "	.21
R52	63-1848	33K ohm 1/2W 10% " "	.21
R17	63-1855	47K ohm 1/2W 10% " "	.21
R1	63-1856	47K ohm 1/2W 20% " "	.21
R76	63-1859	56K ohm 1/2W 10% " "	.21
R5	63-1869	100K ohm 1/2W 10% " "	.21
R4	63-1873	120K ohm 1/2W 10% " "	.21
R51	63-1876	150K ohm 1/2W 10% (2 used) " "	.21
	63-1880	180K ohm 1/2W 10% Ins. Res.	.21
R29	63-1883	220K ohm 1/2W 10% " "	.21
R36	63-1884	220K ohm 1/2W 20% " "	.21
R31	63-1890	330K ohm 1/2W 10% " "	.21
R93	63-1896	470K ohm 1/2W 5% " "	.21
R2	63-1897	470K ohm 1/2W 10% " "	.21
R49	63-1898	470K ohm 1/2W 20% " "	.21
R37	63-1904	680K ohm 1/2W 10% " "	.21
R42	63-1911	1 Megohm 1/2W 10% " "	.21
R53	63-1912	1 Megohm 1/2W 20% " "	.21
R50	63-1918	1.5 Megohm 1/2W 10%" "	.21
R56	63-1922	1.8 Megohm 1/2W 10%" "	.21
R3	63-1926	2.2 Megohm 1/2W 20%" "	.21
R82	63-1932	3.3 Megohm 1/2W 10%" "	.21
R92	63-1937	4.3 Megohm 1/2W 5% " "	
R38	63-1982	100K ohm 2W 10% " "	.33
R30	63-2050	Bias Control	.50
R25	63-2114	2.2 ohm WW 1/2W 10% Ins. Res.	.21
R40	63-2159	Delay & Vertical Range Control	1.20
R88	63-2284	150 ohm 1W 20% Ins. Res.	
R86	63-2286	330 ohm 1W 20% " "	
	63-2379	3900 ohm 1/2W 10% " "	
R55	63-2394	Vertical Size Control	
R34	63-2398	470 ohm 1W 10% " " (or 63-1222 470 ohm 1W WW 10% Ins. Res.)	
	63-2791	12K ohm 1/2W 10% Ins. Res.	
R62	63-2794	Candohm	
R73	63-2795	Vertical Hold Control	
R81	63-2804	Vol. Control & Switch	
R24	63-2805	Focus Control & Fringe Lock	
R47	63-2808	68 ohm 2W 20% Ins. Res.	
R32	63-2810	Tone Control	
R83	63-2812	Vertical Linearity Control	
R58	63-2816	2.5 Megohm 2W 20% (Special)	
R22	63-2824	Picture Control	
R13	63-2825	Brightness & Contrast Control	
A1	87-1	Integrator Unit	.26
	95-1294	Audio Output Transf.	3.25
T11	95-1306	Deflection Coil (Sweep)	
	95-1309	Vertical Output Transf.	
T12	95-1310	Filter Choke	
T13	95-1311	Power Transf.	
	97-407	Idler Stud (Mtg. S-18574)	
X1	103-1	Crystal Diode (1N64)	
L14	S-15128	Choke Coil Assem. (2 used) (1 on S-18590)	.25
	S-15392	Anode Clip, Terminal & Washer Assembly	.20
	S-16092	Coil Shield & Lug (part of S-18589)	
L17	S-16984	Filament Choke Coil Assembly	.30
L27	S-17114	Horiz. Osc. Coil Assem.	1.20
	S-17164	Beam Bender Unit	1.65
L33	S-17343	1st Video Peaking Coil Assembly	
	S-17907	2nd Video IF Transf. Assembly	.90
L15	S-17911	Detector Shunt Peaking Coil Assem. (part of S-18590)	.40
L22	S-17958	2nd Video Shunt Peaking Coil Assembly	.35
L9	S-18209	Associated Sound Trap Coil Assembly	.60
L11	S-18210	Adjacent Channel Sound Trap Coil Assembly	.85
	S-18439	Mech. Centering Assembly (or S-18118)	1.40
L12	S-18568	Sound Take-Off Assembly	
	S-18574	Gear & Bushing Assembly	
	S-18576	Brkt. & Lug (Mtg. Sweep Transformer)	
	S-18579	Plug & Brkt. Assembly	
	S-18589	1st Video IF Transf. Assem.	
	S-18590	4th Video IF Transf. Assem.	
	S-18602	Gear, Bushing & Set Screw	
	S-18730	3rd Video IF Transf. Assem.	
L32	S-18740	4th Video IF Winding Assem. (part of S-18590)	
	S-18741	4th Video IF Shield & Lug Assem. (part of S-18590)	
	S-18742	Plate & Terminal Assem. (part of S-18590)	
L10	S-18744	Adjacent Channel Picture Trap Coil Assem.	
L28	S-18748	Horiz. Width Control Coil Assembly	1.00
L23	S-18749	3rd Video Shunt Peaking Coil Assembly	
L24	S-18750	3rd Video Series Peaking Coil Assembly	
L16	S-18751	Detector Shunt Peaking Coil Assem. (part of S-18590)	
	S-18753	Shield & Lug Assem.	
	S-18763	Corrector Magnet Assem. (Sweep)	
L20	S-19001	Quadrature Coil Assembly	
L13	S-19002	Trap Coil Assembly	
	S-19003	Coil Shield & Lug Assem.	
	S-19006	Intercarrier Coil Assem.	
	S-19029	Shielded Lead & Plug Assem.	
	S-19032	Horiz. Sweep Transf. Assem.	
	S-19040	Anode Clip & Wire Assem. (Sweep)	
	S-19079	Winding Assem. for Horiz. Sweep (part of S-19032)	
L29	S-19342	Horiz. Linearity Control Assembly	

28K20 CHASSIS

Parts used in the 28K20 chassis are the same as for the 21K20 chassis with the following additions:

Condensers

22-2396	27 Mmfd. ceramic disc 500V	.45
22-2375	7 Mmfd. ceramic disc 500V	.26
22-2376	47 Mmfd. ceramic disc 500V	.35
22-2378	10 Mmfd. ceramic 500V	.35
22-2380	5 Mmfd. ceramic disc 500V	.30
22-2381	6 Mmfd. ceramic disc 500V	.35
22-2319	Electrolytic 45/450V 10/475V 100/50V	4.50
22-2437	Electrolytic 80/400V 40/400V 30/400V	6.00
22-2448	Electrolytic 80/400V 40/400V 40/25V	5.50
52-600	Shielded lead	.25
58-204	Connector plug (part of S-19029)	.10

Resistors

63-1915	1.2 Meg. 1/2w 10% Ins. Res. (2 used)	.21
63-2287	330 ohm 2w 20% " " (2 used)	.33
63-3158	220 ohm 2w 10% " " (2 used)	.33
64-525	Brass eyelet (used with 76-663)	.01
78-957	C.R. tube socket & wire	1.25
93-1126	Washer (used with S-19637)	.03
95-1324	Audio output trans.	2.75
95-1326	Vertical output transf.	7.50
97-419	Idler stud (used with S-19637)	.20
S-19391	Interlock brkt. & plug	.40
S-19393	Wire & terminal assem.	.50
S-19637	Idler gear assem.	.40
S-19696	Coil shield & lug assem.	.60
S-19736	1st video IF transf. assem.	.85

TUBES

1 12AX7	1 6BE6	2 6J5
1 12AU7	1 6SN7GT	1 6U8
3 6CB6	1 6AQ7GT	2 6BK5
1 6BN6		2 6AH4GT

27AP4A -- C.R. Tube

S-19440 POWER SUPPLY USED WITH THE 28K20 CHASSIS

Condensers

22-1775	.047 Mfd. molded	400V	.26
22-1811	.0047 Mfd. molded	400V	.26
22-1832	500 Mmfd. molded (2 used)	20,000V	2.25
22-2309	330 Mmfd. ceramic	500V	.26
22-2340	.1 Mfd. molded	400V	.40
22-2341	.15 Mfd. molded	400V	.45
22-2387	680 Mmfd. ceramic	500V	.35
22-2398	Single section trimmer		.60
22-2438	Electrolytic 40/450V 20/450V 20/25V		3.50
22-2439	.018 Mfd. molded	400V	.30
58-172	Nine prong plug		.30

Resistors

63-1157	47K ohm 2w 10% Ins. Res.	.33
63-1192	27K ohm 1w 10% " "	.24
63-1457	39K ohm 2w 10% " "	.33
63-1581	4.7 ohm 1/2w 10% " " (2 used)	.21
63-1744	100 ohm 1/2w 20% " " (4 used)	.21
63-1835	15K ohm 1/2w 20% " "	.21
63-1855	47K ohm 1/2w 10% " "	.21
63-1898	470K ohm 1/2w 20% " "	.21
63-2396	100 ohm 2w 20% " " (2 used)	.33
63-2816	2.5 Meg. 2w 20% " " (Special)	.33
63-3157	2200 ohm 10w 20% Vit. Enam.	.90
63-3159	270K ohm 1w 10% Ins. Res.	.24
63-3166	220K ohm 2w 10% " "	.33
S-19408	Horizontal sweep transf.	10.00
S-19409	Width control coil assem.	1.00
S-19411	Horizontal linearity control coil assembly	.60
S-19427	Anode terminal & wire assem.	.55
S-19428	Socket & resistor assem.	.80
S-19434	Housing & cover assem.	2.75
S-19435	Plug & cable assem.	1.00
S-19440	Power supply complete (not stocked)	
S-19515	Winding assem. (Part of S-19408)	4.50
S-19735	Horizontal linearity coil (fixed)	.90

TUBES

2 1B3GT	2 5U4G
1 6J5	2 6CD6G
2 6V3	

S-19477 YOKE & MTG. BRKT. ASSEM. PARTS LIST

S-17461	Beam bender assem.	1.50
S-18439	Mech. centering assem.	1.40
S-19527	Magnet & brkt. (3 used on S-19540 & 1 on S-19539)	
S-19477	Def. yoke & mtg. brkt. comp.	39.00
S-19539	Magnet & mtg. brkt. assem.	1.60
S-19540	Yoke mtg. brkt. assem.	4.00

Model K2230E & R	Model K2267E
" K2240E & R	" K2268R
" K2260R	" K2270R & H
" K2263E	" K2287R
" K2266R	" K2290R

Model K2291E

K2229EZ	K2235RZ
K2229RZ	K2262RZ

K2286RZ

Model K2229EZ same as Model K2229E
" K2229RZ " " " K2229R
" K2235RZ " " " K2235R
" K2262RZ " " " K2262R
" K2286RZ " " " K2286R

Model K2258RZ same as Model K2258R

19K23-3 MAIN CHASSIS

C30	22-3	.01 mfd ceramic disc (2 used) 500V	.26
C36	22-4	.004 mfd ceramic disc 500V	.26
C39	22-8	.002 mfd ceramic disc 500V	.26
C53	22-1256	75 mmfd molded mica 500V	.20
C63	22-1775	.047 mfd molded 400V	.26
C59	22-1777	.1 mfd molded 200V	.26
C57	22-1785	.0015 mfd molded 400V	.20
C52	22-1831	56 mmfd molded mica 500V	.26
C49	22-1841	.1 mfd molded 600V	.45
C61	22-1842	.0047 mfd molded 200V	.26
C46	22-1845	.0022 mfd molded (2 used) 600V	.26
C82	22-2112	.001 mfd ceramic 500V	.30
C81	22-2125	680 mmfd mica 500V	.35
C51	22-2127	.001 mfd molded (2 used) 600V	.26
C69	22-2128	.001 mfd molded (2 used) 600V	.26
C67	22-2129	.022 mfd molded 600V	.35
C54	22-2166	.15 mfd molded 200V	.45
C31	22-2167	.22 mfd molded 200V	.45
C70	22-2248	.0033 mfd molded 600V	.26
C19	22-2268	.0068 mfd molded 600V	.35
C64	22-2340	.1 mfd molded 400V	.40
C65	22-2341	.15 mfd molded 400V	.45
C37AD, BD,CD, DD	22-2358	Electrolytic 80/400V 40/400V 30/400V 40/25V	5.50
C50AD, BD,CD, DD	22-2368	Electrolytic 40/400V 10/475V 100/50V 10/25V	3.75
C56	22-2387	680 mmfd ceramic 500V	.35
C58	22-2416	1080 mmfd mica 500V	.60
C76AD, BD,CD, DD	22-2443	Electrolytic 50/350V 20/400V 80/25V 40/25V	4.00
C66	22-2452	.015 mmfd molded 200V	.25
C79	22-2457	Trimmer	.55
C80	22-2458	220 mmfd ceramic 500V	.20
C83	22-2469	1 mfd molded 200V	1.20
R61	63-958	22K ohm 1w 10% Ins. Res.	.24
R97	63-1192	27K ohm 1w 10% " "	.24
R77	63-1194	47K ohm 1w 10% " "	.24
R66	63-1744	100 ohm 1/2w 20% " " (3 used)	.21
R46	63-1750	150 ohm 1/2w 10% " "	.21
R18	63-1771	470 ohm 1/2w 10% " " (2 used)	.21
R80	63-1774	560 ohm 1/2w 5% " "	.21
R59	63-1775	560 ohm 1/2w 10% " " (2 used)	.21
R39	63-1810	3900 ohm 1/2w 10% " "	.21
R41	63-1824	8200 ohm 1/2w 10% " "	.21
R91	63-1834	15K ohm 1/2w 10% " "	.21
R113	63-1835	15K ohm 1/2w 20% " "	.21
R7	63-1842	22K ohm 1/2w 20% " "	.21
R52	63-1848	33K ohm 1/2w 10% " "	.21
R96	63-1849	33K ohm 1/2w 20% " "	.21
R17	63-1855	47K ohm 1/2w 10% " "	.21

R1	63-1856	47K ohm 1/2w 20% " " (2 used)	.21
R5	63-1869	100K ohm 1/2w 10% " " (2 used)	.21
R102	63-1870	100K ohm 1/2w 20% " "	.21
R94	63-1880	180K ohm 1/2w 10% " "	.21
R29	63-1883	220K ohm 1/2w 10% " "	.21
R31	63-1890	330K ohm 1/2w 10% " "	.21
R49	63-1898	470K ohm 1/2w 20% " " (3 used)	.21
R37	63-1904	680K ohm 1/2w 10% " "	.21
R42	63-1911	1 Meg. 1/2w 10% " " (3 used)	.21
R50	63-1918	1.5 Meg. 1/2w 10% " "	.21
R56	63-1922	1.8 Meg. 1/2w 10% " "	.21
R76	63-1939	4.7 Meg. 1/2w 10% " "	.21
R67	63-1970	3300 ohm 2w 20% " "	.33
R38	63-1928	100K ohm 2w 10% " "	.33
R68	63-2129	1.2 ohm ww 1/2w 10% " "	.21
R74	63-2130	150K ohm 1w 10% " "	.24
R35	63-2145	10K ohm 2w 20% " "	.33
R40	63-2159	Vertical range control	1.20
R60	63-2290	680 ohm 1w 10% Ins. Res.	.24
R64	63-2364	18K ohm 2w 10% " " (2 used)	.36
R55	63-2394	Vertical size control	1.20
R34	63-2398	470 ohm 1w 10% " "	.24
		Or 63-1222 470 ohm 1w ww 10% Ins. Res.	.24
R33	63-2777	Volume control & switch	1.81
R62	63-2794	Candohm	.85
R57	63-2815	Vertical linearity control	1.20
R73	63-2834	Vertical hold control	1.20
R51	63-2835	Tone control	1.20
R69	63-2836	Screen control	1.20
R48	63-2837	Brightness control	1.20
A1	87-1	Integrator unit	.26
	93-2	Brass washer (1 on S-19636 & 1 to mt. 63-2794)	.01
	93-965	Rubber washer (1 for sweep)	.02
	93-1127	Fibre washer (2 ea. 78-709)	.01
	94-767	Rubber bushing (2 for sweep)	.15
T9	95-1280	Filter choke	3.50
T8	95-1298	Power trans.	22.50
T6	95-1309	Vertical output trans.	5.00
T7	95-1335	Deflection coil	13.50
T5	95-1339	Audio output trans.	2.25
	S-17164	Beam bender unit	1.65
L33	S-17343	1st video peaking coil	.35
	S-18566	Winding only for S-18567	3.25
T10	S-18567	Horiz. sweep trans.	6.50
L29	S-18570	Horiz. Linearity control coil	.50
	S-18576	Mtg. brkt. & lug for sweep	.35
	S-18579	Plug & brkt. (interlock)	.50
L28	S-18748	Horiz. width control coil	1.00
	S-18761	Strap & brkt. L.H.	.30
	S-18762	Strap & brkt. R.H.	.30
	S-18763	Corrector magnet assem. (2 for sweep)	.30
	S-18926	Dust seal strip assem.	1.30
	S-19293	Socket, resistor & wire (sweep)	.60
	S-19545	C.R. tube socket assem.	1.60
	S-19636	Socket shell & mtg. plate (sweep)	.60
L27	S-19743	Horiz. osc. coil assem.	1.50
	S-19898	Centering device & yoke cover (part of 95-1335)	
	S-20016	Yoke brkt. assem.	

TUBES

1 12AX7 1 6SN7GT 1 1B3GT
1 12AV7 1 6AQ7GT 1 6BK5
1 6AX4GT 1 5U4G 1 6AH4GT
1 6BE6 1 6BQ6GT or 6BQ6G
17LP4 C. R. Tube

VIDEO CHASSIS

C30	22-3	.01 mfd. ceramic disc 500V	.26
C12	22-6	470 mmfd. ceramic 500V	.26
		Or 22-2470 470 mmfd. ceramic 500V	
C15	22-7	.001 mfd. ceramic disc (5 used) 500V	.26
C71	22-1762	1 mmfd. molded 500V	.20
C45	22-1778	.047 mfd. molded 200V	.26
C42	22-1825	.22 mfd. molded 400V	.50
C40	22-1844	.047 mfd. molded 600V	.35
C24	22-1874	7 mmfd. ceramic 500V	.26
		Or 22-2375 7 mmfd. ceramic disc 500V	.26
C34	22-1895	10 mmfd. ceramic 500V	.35
		Or 22-2378 10 mmfd. ceramic 500V	.35
C13	22-2050	5 mmfd. ceramic (2 used) 500V	.30
		Or 22-2380 5 mmfd ceramic disc 500V	.30
C14	22-2051	6 mmfd. ceramic (2 used) 500V	.35
		Or 22-2381 6 mmfd. ceramic disc 500V	.35
C18	22-2146	47 mfd. molded 200V	.60
C1	22-2217	470 mmfd. ceramic (2 used) 500V	.25
C33	22-2276	2 x .01 mfd. ceramic 500V	.50
C20	22-2302	470 mmfd. ceramic 500V	.35
C16	22-2309	330 mmfd. ceramic 500V	.26
C25	22-2310	560 mmfd. ceramic 500V	.35
C38	22-2320	680 mmfd. ceramic 500V	.26
C27	22-2343	3.3 mmfd ceramic 500V	.26
C32	22-2431	.0082 mfd. molded 200V	.30
C77	22-2456	180 mmfd mica 500V	.30
C28	22-2459	27 Mmfd. ceramic 500V	.20
		Or 22-2396 27 mmfd. ceramic disc 500V	.45
C78	22-2460	50 mmfd. molded 500V	.20
C26	22-2466	47 mmfd. ceramic 500V	.35
		Or 22-2467 47 mmfd. ceramic disc 500V	
	24-572	I F. trans. shield cover	.05
	24-588	I F trans. shield top cover	.10
	25-2	Cotter pin	.03
	54-139	3/8x32x9/16 hex palnut (1 ea. 63-2805 & 63-2833)	.01
	54-271	6-32x1/4 hex palnut (12 used)	.01
	54-326	1/4-28x7/16 hex nut (1 for gear & brkt. assem.)	.02

	58-204	Connector plug (part of S-19709)	.10
R79	63-1055	22K ohm 1w 20% Ins.Res.	.24
R54	63-1101	8200 ohm 2w 10% " "	.36
R21	63-1573	2700 ohm 1w 10% " "	.24
R26	63-1579	6200 ohm 2w 5% " "	.33
R16	63-1708	15 ohm 1/2w 10% " "	.21
R43	63-1733	56 ohm 1/2w 10% " "	.21
R12	63-1737	68 ohm 1/2w 20% " "	.21
R75	63-1740	82 ohm 1/2w 10% " "	.21
R19	63-1743	100 ohm 1/2w 10% " "	.21
R44	63-1757	220 ohm 1/2w 10% (2 used) " "	.21
R20	63-1764	330 ohm 1/2w 10% " "	.21
R8	63-1772	470 ohm 1/2w 20% (2 used) " "	.21
R27	63-1777	680 ohm 1/2w 5% " "	.21
R111	63-1779	680 ohm 1/2w 20% " "	.21
R91	63-1786	1K ohm 1/2w 20% " "	.21
R10	63-1799	2200 ohm 1/2w 10% " "	.21
R39	63-1810	3900 ohm 1/2w 10% " "	.21
R14	63-1821	6800 ohm 1/2w 20% " "	.21
R28	63-1823	8200 ohm 1/2w 5% " "	.21
R71	63-1834	15K ohm 1/2w 10% " "	.21
R23	63-1841	22K ohm 1/2w 10% (2 used)	.21
R15	63-1845	27K ohm 1/2w 10% (2 used) " "	.21
R78	63-1859	56K ohm 1/2w 10% " "	.21
R5	63-1869	100K ohm 1/2w 10% " "	.21
R4	63-1873	120K ohm 1/2w 10% " "	.21
R29	63-1883	220K ohm 1/2w 10% " "	.21
R36	63-1884	220K ohm 1/2w 20% " "	.21
R31	63-1890	330K ohm 1/2w 10% " "	.21
R93	63-1896	470K ohm 1/2w 5% " "	.21
R49	63-1898	470K ohm 1/2w 20% " "	.21
R42	63-1911	1 Meg. 1/2w 10% " "	.21
R53	63-1912	1 Meg. 1/2w 20% " "	.21
R3	63-1926	2.2 Meg. 1/2w 20% " "	.21
R92	63-1937	4.3 Meg. 1/2w 5% " "	.21
R112	63-1969	1800 ohm 1w 10% " "	.21
R40	63-2159	AGC delay & vertical range control (2 used)	1.20
	63-2379	3900 ohm 1/2w 10% " "	.21
	63-2791	12K ohm 1/2w 10% " "	.21
R24	63-2805	Fringe lock control	1.20
R115	63-2833	Contrast control	1.20
R30	63-3167	Bias control	.50
X-1	103-1	Crystal diode (1N64)	1.20
L14	S-15128	Choke coil assem. (part of S-18590)	.25
	S-16092	Coil shield & lug (part of S-19736)	.30
L17	S-16984	Filament choke coil	.30
T2	S-17907	2nd video I F trans.	.90
L15	S-17911	Detector shunt peaking coil (part of S-18590)	.40
	S-17916	Coil shield & lug assem. (S-17907 & S-18730)	.20
L22	S-17958	2nd video shunt peaking coil	.35
L9	S-18209	Associated sound trap coil	.60
L11	S-18210	Adjacent channel sound trap coil	.85
L12	S-18568	Sound take off coil	.75
T4	S-18590	4th video I F trans.	5.25

	S-18602	Gear, bushing & set screw	.30
T3	S-18730	3rd video I F trans.	1.20
L32	S-18740	4th video I F trans.	
	S-18741	4th video I F shield & lug	.20
L10	S-18744	Adjacent channel picture trap coil	.50
L23	S-18749	3rd video shunt peaking coil	.45
L24	S-18750	3rd video series peaking coil	.35
L16	S-18751	Detector shunt peaking coil	.40
	S-18753	Shield & lug	.25
	S-18826	Ground spring & I F shield	.25
L20	S-19001	Quadrature coil	1.60
	S-19709	Shielded lead & plug	.45
L51	S-19712	Intercarrier coil	
	S-19714	Coil shield & lug (S-19712)	
T1	S-19736	1st video I F trans.	.85
	S-19840	Turret tuner	

TUBES

3 6CB6 1 6BN6 1 6U8

19K23Z CHASSIS

19K23Z chassis is the same as 19K23 with the following exceptions:

OMIT:

63-2805	Focus control & fringe lock (omit 1 only)	
78-945	C.R. tube socket & wire	
95-1335	Deflection coil (or 95-1306)	
S-19898	Centering devise & yoke cover (part of 95-1335)	

TUBES

21FP4A -- C.R. Tube

ADD:

78-964	C.R. tube socket & wire	1.00
80-744	PM focus mtg. spring (4 used)	.02
95-1306	Deflection coil	12.50
114-324	10-32x1-1/4 hex hd. mach. screw (4 used)	.03
S-19661	PM focus centering assem.	8.50
S-19662	C.R. tube support brkt. assem.	1.00

CHASSIS 21K20Z

21K20Z chassis is the same as 21K20 with the following exceptions:

OMIT:

22-1843	.01 Mfd. molded	600V		
22-1849	.0047 Mfd. molded	600V		
22-1850	.015 Mfd.	200V		
22-2389	Electrolytic 20 Mfd.	400V		
63-1198	10K ohm 2w	10%	Ins.Res.	
63-1834	15K ohm 1/2w	10%	Ins.Res.	
63-1820	6800 ohm 1/2w	10%	Ins.Res.	
63-1918	1.5 Meg. 1/2w	10%	Ins.Res.	
63-2050	Bias control			
78-945	CR tube socket & wire			
97-407	Idler stud			
136-23	Fuse			

152-212	CR tube support block	
199-173	Rubber sleeve (used with S-18941)	
S-17164	Beam Bender unit	
S-18574	Gear & bushing	
S-19003	Coil shield & lug	
S-18439	Mech. centering assem. (or S-18118)	

TUBES

1X2A

21FP4A -- C.R. Tube

ADD:

12-1955	Chassis mtg. brkt. (4 used)				.10
22-2112	.001 Mfd. ceramic	500V			.30
22-2125	680 Mmfd. mica	500V			.35
22-2167	.22 Mfd. molded	200V			.45
22-2320	680 Mmfd. ceramic	500V			.26
22-2447	Electrolytic 100 Mfd.	400V			4.10
22-2452	.015 Mfd.	200V			.25
63-1764	330 ohm	1/2w	10%	Ins. Res.	.21
63-1779	680 ohm	1/2w	20%	Ins. Res.	.21
63-1796	1800 ohm	1/2w	10%	Ins. Res.	.21
63-1821	6800 ohm	1/2w	20%	Ins. Res.	.21
63-1835	15K ohm	1/2w	20%	Ins. Res.	.21
63-1870	100K ohm	1/2w	20%	Ins. Res.	.21
63-1919	1.5 Meg.	1/2w	20%	Ins. Res.	.21
63-2145	10K ohm	2w	20%	Ins. Res.	.33
63-3167	Bias control				.50
78-964	C.R. tube socket & wire				1.00
80-744	PM focus mtg. spring (4 used)				.02
97-419	Idler stud				.25
136-22	Fuse 250 M.A.				.25
152-219	C.R. tube support block				.30
S-17461	Beam Bender unit				1.50
S-19637	Idler gear assem.				.40
S-19661	PM focus & centering assem.				8.50

Model K1812E-3

49-719	4"PM speaker	4.50

Model K1812R-3

49-719	4" PM speaker	4.50

CABINET PARTS K1815E

49-696	5-1/4" PM Speaker	6.00
	ZC5093 Cone & Voice Coil	1.73

CABINET PARTS K1815R

49-696	5-1/4" PM Speaker	6.00
	ZC5093 Cone & Voice Coil	1.73

Model K1820E-3

49-696	5-1/4" PM speaker	6.00
	ZC5093 Cone & voice coil	1.73

Model K1820R-3

49-696	5-1/4" PM speaker	6.00
	ZC5093 Cone & voice coil	1.73

Model K1846E-3

49-649	10" PM speaker	11.75
	ZC10161 Cone & voice coil	3.41

Model K1846R-3

49-649	10" PM speaker	11.75
	ZC 10161 Cone & voice coil	3.41

CABINET PARTS K1850R

49-649	10" PM Speaker	11.75
	ZC10161 Cone & Voice Coil	3.41

Model K1880R-3

49-728	10" PM speaker	10.00
	ZC1016D Cone & voice coil	3.41
63-1828	10K ohm 1/2w 20% Ins. Res.	.21

Model K2229E

49-696	5-1/4" PM speaker	6.00
	ZC5093 Cone & voice coil	1.73

Model K2229E-3

49-696	5-1/4" PM speaker	6.00

Model K2229R-3

49-696	5-1/4" PM speaker	6.00

CABINET PARTS K2230E

SP1	49-696	5-1/4" PM Speaker	6.00
		ZC5093 Cone & Voice Coil	1.73

CABINET PARTS K2230R

SP1	49-696	5-1/4" PM Speaker	6.00
		ZC5093 Cone & Voice Coil	1.73

Model K2235E-3

49-696	5-1/4" PM speaker	6.00

Model K2235R

49-696	5-1/4" PM speaker	6.00
	ZC5093 Cone & voice coil	1.73

Model K2235R-3

49-696	5-1/4" PM speaker	6.00

CABINET PARTS K2240E

Model K2240E is the same as Model K2263E except the following:

49-696	5-1/4" PM Speaker	6.00
	ZC5093 Cone & Voice Coil	1.73

CABINET PARTS K2240R

Model K2240R is the same as Model K2260R except the following:

ADD:

49-696	5-1/4" PM Speaker	6.00
	ZC5093 Cone & Voice Coil	1.73

Model K2258E-3

49-649	10" PM speaker	11.75

Model K2258R-3

49-649	10" PM speaker	11.75

Model K2260R-3

49-649	10" PM speaker	11.75
63-3171	Tone control	
63-3172	Screen control	

Model K 2262R

49-649	10" PM speaker	11.75
	ZC10161 Cone & voice coil	3.41

Model K2262R-3

49-649	10" PM speaker	11.75

Model K2263E-3

49-649	10" PM speaker	11.75
63-3171	Tone control	
63-3172	Screen control	

Model K2266R-3

49-649	10" PM speaker	11.75
63-3171	Tone control	
63-3172	Screen control	

Model K2267E-3

49-649	10" PM speaker	11.75
63-3171	Tone control	
63-3172	Screen control	

Model K2270R & H

49-649	10" PM speaker	11.75
	ZC10161 Cone & voice coil	3.41

Model K2271H-3

49-649	10" PM speaker	11.75
63-3171	Tone control	
63-3172	Screen control	

Model K2286R

49-714	7-1/2" PM speaker	7.00
	ZC7512G Cone & voice coil	2.63
63-1828	Resistor 10K ohm 1/2 w 20% Ins.	.21

Model K2286R-3

49-714	7-1/2" speaker	7.00
63-1828	10K ohm 1/2w 10% Ins. Res.	.21

Model K2287R-3

49-694	12" PM speaker	17.50
63-1828	10K ohm 1/2w 10% Ins. Res.	.21
63-3171	Tone control	
63-3172	Screen control	

CABINET PARTS K2290R

	49-704	12" PM Speaker (alt. is 49-694)	10.00
		ZC1216F Cone & Voice Coil	4.60
R28	63-1828	10K ohm 1/2W 20% Ins.Res.	.21

Model K2291E-3

63-1828	10K ohm 1/2 w 20% Ins. Res.	.21
63-3171	Tone control	
63-3172	Screen control	
49-694	12" PM speaker	17.50

Model K2872R

49-649	10" PM speaker (2 used)	11.75
	ZC10161 Cone & voice coil	3.41
S-19440	Power supply assem. complete	
S-19477	Def. yoke & mtg. brkt. assem.	39.00

MODEL K2872R-3

49-649	Speaker 10" PM (2 used)	11.75
S-19440	Power Supply (not stocked complete for parts list see S-19440--28K20 Chassis)	
S-19477	Deflection yoke & Mtg. Bracket (for parts list see S-19477--28K20 Chassis)	39.00

Model K2873E

49-649	10" PM speaker (2 used)	11.75
	ZC10161 Cone & voice coil	3.41
S-19440	Power supply assembly	
S-19477	Def. yoke & mtg. brkt. assem.	39.00

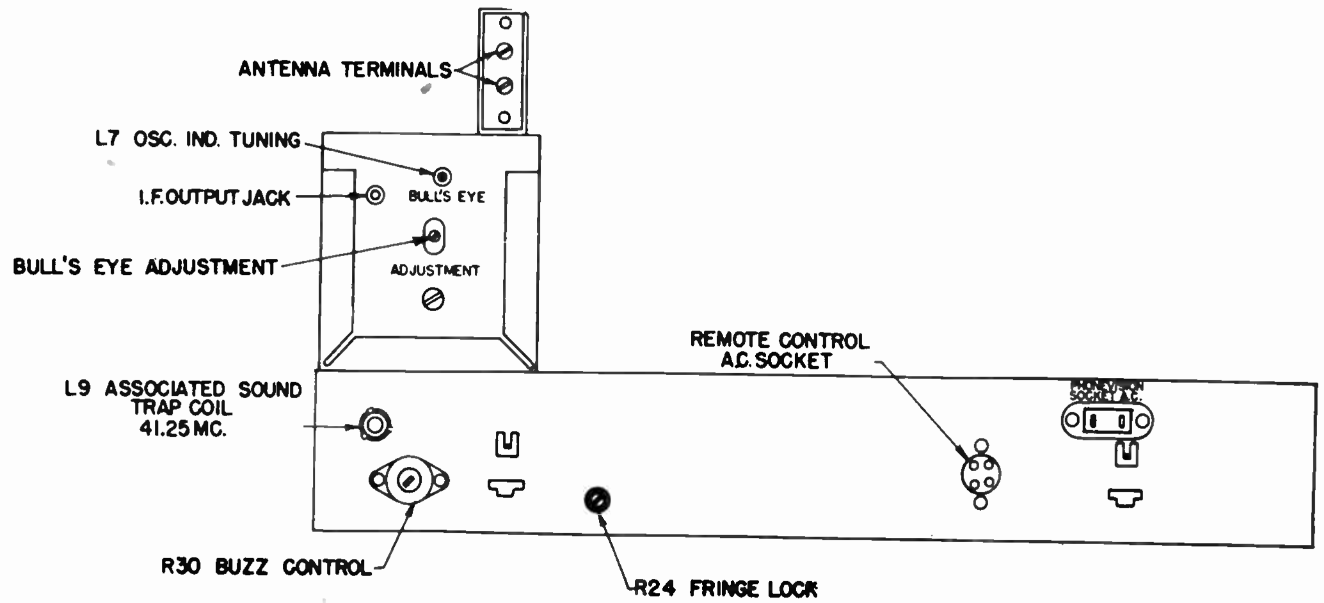
MODEL K2873E-3

49-649	Speaker 10" PM	11.75
S-19440	Power supply (not stocked complete for parts list see S-19440--28K20 Chassis)	
S-19477	Deflection yoke & Mtg. Bracket (for parts list see S-19477--28K20 Chassis)	39.00

TUBE COMPLEMENT

28K20 CHASSIS

SYMBOL	TUBE	FUNCTION
V1	6BK7	V1A RF Amplifier V1B RF Amplifier
V2	6U8	V2A Mixer V2B RF Oscillator
V3	6CB6	1st IF Amplifier
V4	6CB6	2nd IF Amplifier
V5	6CB6	3rd IF Amplifier
V6	6U8	V6A 1st Video Amp. V6B Intercarrier Sound Amp.
V7	6BN6	Audio Limiter Detector
V8	6J5	Sound Inverter
V9	6BK5	Sound Output
V10	6BK5	Sound Output
V11	12AX7	V11A AGC Amplifier V11B Vertical Sync
V12	12AU7	V12A 2nd Video Amp. V12B Video Output
V13	6BE6	Sync Clipper
V14	6SN7GT	V14A Vertical Oscillator V14B Vertical Oscillator
V15	6AH4GT	Vertical Output
V16	6AH4GT	Vertical Output
V17	6AQ7GT	V17A Horizontal Phase Det. V17B Horizontal Control
V18	6J5	Horizontal Oscillator
V19	5U4	Rectifier
V20	5U4	Rectifier
V21	6J5	Horizontal Discharge
V22	6CD6G	Horizontal Output
V23	6CD6G	Horizontal Output
V24	1B3GT	H.V. Rectifier
V25	1B3GT	H.V. Rectifier
V26	6V3	Damper
V27	6V3	Damper
V28	27AP4A	Picture Tube



Adjustments at Rear of 28K20 Chassis

CIRCUIT LEGEND

COMPONENTS REQUIRING A STAMPED ZENITH PART NUMBER SHALL BE FOLLOWED BY WORD CODE LETTER UNLESS OTHERWISE SPECIFIED

DIAG. NO.	PART NO.	DESCRIPTION	R.F.	VIDEO	SWEEP	POWER
C1	22-2217	470 MMF 500 V		K3		
C2	22-2221	2.5-6 MMF. TRIM. CAP.	K3			
C3						
C4	22-2407	100 MMF 5% 500 V	K3			
C5	22-2453	.85-2.80 MMF TRIM. CAP.	K3			
C6	22-2404	400 MMF. F.T. B.H.V. 500 V	K3			
C7	22-2406	10 MMF 2 1/2% 500 V.	K3			
C8	22-2411	10 MMF .5 MMF 500 V.	K3			
C9	22-2413	5.5 MMF .5 MMF 500 V.	K3			
C10	22-2383	4.5 MMF .5 MMF 500 V.	K3			
C11	22-2434	2 MMF .5 MMF 500 V.	K3			
C12	22-6	470 MMF GMV 500 V.		K3		
C13	22-2050	5 MMF 500 V.		K3		
C14	22-2051	6 MMF 500 V		K3		
C15	22-7	.001 MFD. GMV 500 V		K3		
C16	22-2309	330 MMF 10% 500 V		K3	E	F
C17	22-1832	500 MMF 20 KV			ABCDE	F
C18	22-2146	.47 MFD 200 V		K3		
C19	22-2266	.0068 MFD 10% 600 V			ABCD	
C20	22-2302	470 MMF 10% 500 V		K3		F
C21	22-1849	.0047 MFD. 10% 600 V			E	
C22	22-2453	.85-2.80 MMF TRIM. CAP.	K3			
C23	22-1776	.0033 MFD 600 V			AB	
C24	22-1874	7 MMF 500 V		K3		
C25	22-2310	560 MMF 10% 500 V		K3		
C26	22-2466	47 MMF 5% 500 V		K3		
C27	22-2393	3.3 MMF 500 V.		K3		
C28	22-2459	27 MMF 500 V		K3		
C29AD	22-2418	80 MFD ELECTROLYTIC 350 V			EF	
C29BD		5 MFD ELECTROLYTIC 150 V.			EF	
C29CD		100 MFD ELECTROLYTIC 25 V			EF	
C29DD	RED DOT	40 MFD ELECTROLYTIC 25 V			EF	
C30	22-3	.01 MFD GMV 500 V		K3	K3	
C31	22-2187	.22 MFD 20% 200 V.			ABCDE	
C32	22-2431	.0082 10% 200 V		K3		
C33	22-2276	2 A .01 MFD 500 V		K3		
C34	22-1895	10 MMF 10% 500 V.		K3		
C35	22-2403	100 MMF -5% 48L 500 V	K3			
C36	22-4	.004 MFD GMV 500 V.			AB EF	
C37AD		40 MFD ELECTROLYTIC 400 V		EF	ABCD	
C37BD	22-2358	40 MFD ELECTROLYTIC 400 V		EF	ABCD	
C37CD		30 MFD ELECTROLYTIC 400 V		EF	ABCD	
C37DD	BLUE DOT	40 MFD ELECTROLYTIC 25 V.		EF	ABCD	
C38	22-2320	680 MMF 500 V.		ABCD F		
C39	22-8	.002 MFD. GMV 500 V			K3	
C40	22-1894	.047 MFD 600 V		K3		
C41	22-2447	100 MFD 400 V.		EF		
C42	22-1825	.22 MFD 400 V.		K3		
C43	22-1811	.0047 MFD 10% 400 V.				F
C44						
C45	22-1778	.047 MFD 200 V		K3	F	
C46	22-1845	2200 MMF 600 V.			ABCDE	
C47	22-1834	200 MMF 10% 600 V.			CDE	
C48	22-2439	.018 MFD 10% 400 V.				F
C49	22-1841	1 MFD 600 V			K3	
C50AD		40 MFD ELECTROLYTIC 400 V.			ABCDE	
C50BD	22-2366	10 MFD ELECTROLYTIC 475 V			ABCDE	
C50CD	GREEN	100 MFD ELECTROLYTIC 50 V.			ABCDE	
C50DD		10 MFD ELECTROLYTIC 25 V			ABCDE	
C51	22-2127	.001 MFD 600 V.			K3	
C52	22-1831	56 MMF 10% 500 V.			K3	
C53	22-1256	75 MMF 5% 500 V			K3	
C54	22-2166	.15 MFD 10% 200 V			K3	
C55	22-1774	.0033 MFD 20% 1000 V			F	
C56	22-2387	680 MMF 10% 500 V			K3	F
C57	22-1785	1500 MMF 400 V			K3	
C58	22-2416	1100 MMF 10% 500 V.			K3	
C59	22-1777	.1 MFD 200 V.			K3	
C60						
C61	22-1842	.0047 MFD 10% 200 V.			ABCDE	
C62	22-2398	DRIVE TRIMMER			E	F
C63	22-1775	.047 MFD 400 V.			ABCDE	F
C64	22-2340	.1 MFD 10% 400 V.			ABCDE	F
C65	22-2341	.15 MFD 10% 400 V.			ABCDE	F
C66	22-2452	.015 MFD 200 V			ABE	
C67	22-2129	.022 MFD 10% 600 V.			ABCDE	F
C68	22-1850	.015 MFD 10% 200 V			CD	
C69	22-2128	.001 MFD 10% 600 V.			ABCDE	
C70	22-2249	.0023 MFD 10% 600 V.			K3	
C71	22-1762	1 MMF GIMMICK		K3		
C72AD		90 MFD ELECTROLYTIC 400 V.			F	
C72BD	22-2437	10 MFD ELECTROLYTIC 400 V.			F	
C72CD	WHITE	30 MFD. ELECTROLYTIC 400 V.			F	
C73AD		45 MFD ELECTROLYTIC 450 V.			F	
C73BD	22-2319	10 MFD ELECTROLYTIC 475 V.			F	
C73CD	YELLOW	100 MFD ELECTROLYTIC 50 V.			F	
C74AD		80 MFD ELECTROLYTIC 400 V.		F		
C74BD	22-2448	40 MFD ELECTROLYTIC 400 V.		F		
C74CD	ORANGE	40 MFD ELECTROLYTIC 25 V.		F		
C75AD		40 MFD ELECTROLYTIC 450 V.				F
C75BD	22-2438	20 MFD ELECTROLYTIC 450 V.				F
C75CD	BLACK	20 MFD ELECTROLYTIC 25 V.				F
C76AD		20 MFD ELECTROLYTIC 400 V.			ABCD	
C76BD	22-2443	50 MFD ELECTROLYTIC 350 V.			ABCD	
C76CD	VIOLET	80 MFD ELECTROLYTIC 25 V.			ABCD	
C76DD		40 MFD ELECTROLYTIC 25 V.			ABCD	
C77	22-2456	180 MMF 10% 500 V.		K3		
C78	22-2460	50 MMF 500 V.		K3		
C79	22-2457	HORIZONTAL DRIVE TRIMMER			ABCD	
C80	22-2458	220 MMF 10% 500 V.			ABCD	
C81	22-2125	690 MMF 10% 500 V.			K3	
C82	22-2112	.001 MFD 500 V.			K3	
C83	22-2469	1 MFD MOLDED 200 V.			AB	
C84	22-2468	2.2 MMF 5% 500 V.	K3			
C85	22-2331	800 MMF GMV 500 V.	K3			
PL-1	100-67	PILOT LIGHT		ABEF		
A1	87-1	INTEGRATOR			ABCDE	
C4		SUPPLIED WITH DEFLECTION YOKE			K3	
X1	100-1	DIODE CRYSTAL		K3		

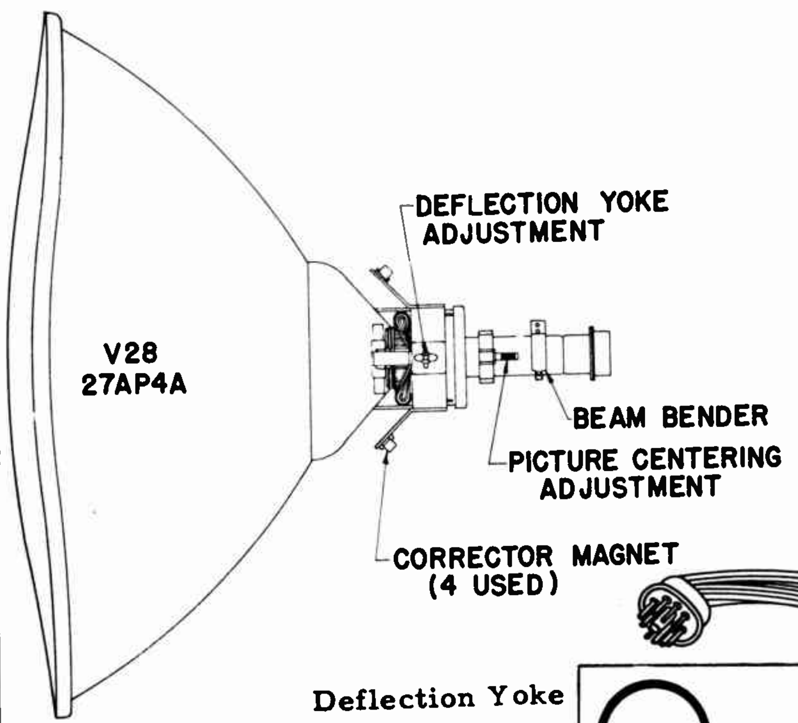
DIAG. NO.	PART NO.	DESCRIPTION	R.F.	VIDEO	SWEEP	POWER
R1	63-1856	47K OHM 1/2 W	K3		ABCDE	F
R2	63-1897	470K OHM 10% 1/2 W	K3		CD	F
R3	63-1926	2.2 MEGOHM 1/2 W		K3		
R4	63-1873	120K OHM 10% 1/2 W	K3	K3		
R5	63-1869	100K OHM 10% 1/2 W	K3	K3	K3	
R6	63-1813	4.7K OHM 10% 1/2 W	K3			
R7	63-1842	22K OHM 1/2 W	K3		K3	
R8	63-1772	470 OHM 1/2 W	K3	K3		
R9	63-1814	4700 OHM 1/2 W	K3			
R10	63-1789	2200 OHM 10% 1/2 W	K3	K3	F	
R11 *	63-3171	1 MEGOHM TONE CONTROL			E	
R12	63-1737	68 OHM 1/2 W		K3		
R13	63-2825	DUAL CONTROL			EF	
R14	63-1821	6800 OHM 1/2 W		K3		
R15	63-1845	27K OHM 10% 1/2 W		K3	F	
R16	63-1708	15 OHM 10% 1/2 W		K3		
R17	63-1856	47K OHM 10% 1/2 W			K3	F
R18	63-1771	470 OHM 10% 1/2 W		EF	K3	
R19	63-1743	100 OHM 10% 1/2 W		K3	E	
R20	63-1764	330 OHM 10% 1/2 W		K3		
R21	63-1573	2700 OHM 10% 1 W		K3		
R22	63-2824	5K OHM PICTURE CONTROL		F		
R23	63-1841	22K OHM 10% 1/2 W		K3		
R24	63-2805	7.5 MEGOHM HEIGHT AND FRINGE		K3	F	
R25	63-2114	2.2 OHM 10% 1/2 W			F	
R26	63-1579	6.2K OHM 5% 2 W		K3		
R27	63-1777	680 OHM 5% 1/2 W		K3		
R28	63-1823	8200 OHM 5% 1/2 W		K3		
R29	A3-1883	220K OHM 10% 1/2 W		K3	K3	F
R30	63-3167	600 OHM BUZZ CONTROL		K3		
R31	63-1790	330K OHM 10% 1/2 W		K3	ABCDE	
R32	63-2810	1 MEGOHM TONE AND VERTICAL HOLDCONTROL		F	F	
R33	63-2777	500K OHM VOLUME CONTROL			A C	
R34	63-2394	470 OHM 10% 1 W			ABCDE	
R35	63-2145	10K OHM 2 W			K3	
R36	63-1884	220K OHM 1/2 W	K3	K3		
R37	63-1904	680K OHM 10% 1/2 W			K3	
R38	63-1962	100K OHM 10% 2 W			K3	
R39	63-1810	3990 OHM 10% 1/2 W		K3	K3	
R40	63-2159	4K OHM A.G.C. VERTICAL RANGE		K3	AB E	
R41	63-1824	8200 OHM 10% 1/2 W			K3	
R42	63-1911	1 MEGOHM 10% 1/2 W		K3	K3	
R43	63-1733	56 OHM 10% 1/2 W		K3	F	
R44	63-1767	220 OHM 10% 1/2 W		K3		
R45 *	63-3172	5K SCREEN REGISTER CONTROL			E	
R46	63-1760	150 OHM 10% 1/2 W			ABCD	
R47	63-1581	4.7 OHM 10% 1/2 W				F
R48	63-2837	200K OHM BRIGHTNESS			ABCD	
R49	63-1898	470K OHM 10% 1/2 W		K3	K3	F
R50	63-1918	1.5 MEGOHM 10% 1/2 W			K3	
R51	63-2835	1 MEGOHM TONE REGISTER CONTROL			AB	
R52	63-1848	33K OHM 10% 1/2 W			ABCDE	
R53	63-1912	1 MEGOHM 1/2 W		K3		
R54	63-1801	8.2K OHM 10% 2 W		K3		
R55	63-2394	VERTICAL SIZE CONTROL			ABCD	
R56	63-1922	1.8 MEGOHM 10% 1/2 W			ABCDE	
R57	63-2815	1500 OHM VERTICAL LINEARITY CONTROL			ABCD	
R58	63-2816	2.8 MEGOHM 2 W			E	F
R59	63-1775	560 OHM 10% 1/2 W			K3	
R60	63-2290	680 OHM 10% 1 W			ABCD	
R61	63-958	22K 10% 1 W			ABCDE	
R62	63-2794	5K CARBOHM 7 W			K3	
R63	63-1729	47 OHM 10% 1/2 W	K3			
R64	63-2364	18K OHM 10% 2 W			ABCD	
R65	63-2808	68 OHM 2 W			E	
R66	63-1744	100 OHM 1/2 W			K3	F
R67	63-1970	3300 OHM 2 W			AB	
R68	63-2129	1.2 OHM 10% 1/2 W			ABCD	
R69	63-2836	5K SCREEN REGISTER CONTROL			AB	
R70	63-3170	10K OHM 2 W	K3			
R71	63-1636	15K OHM 10% 1/2 W			ABCDE	F
R72	63-2838	500K VOLUME CONTROL			BDE	
R73	63-2834	2.5K OHM VERTICAL HOLD CONTROL			ABCDE	
R74	63-2136	150K OHM 10% 1 W			ABCDE	
R75	63-1749	82 OHM 10% 1/2 W		K3		
R76	63-1939	4.7 MEGOHM 1/2 W			AB	
R77	63-1134	47K OHM 10% 1 W			K3	
R78	63-1859	56K OHM 10% 1/2 W		K3		
R79	63-1055	22K OHM 1 W		K3		
R80	63-1744	560 OHM 5% 1/2 W			AB	
R81	63-2804	VOLUME CONTROL			F	
R82	63-1932	3.3 MEGOHM 10% 1/2 W			EF	
R83	63-2812	1500 OHM VERTICAL LINEARITY CONTROL			EF	
R84	63-3157	2200 OHM 20% 10 W				F
R85	63-1828	10K OHM 1/2 W			ABE	
R86	63-2286	330 OHM 10% 1 W	K3		E	
R87	63-366	4700 OHM 2 W			E	
R88	63-2284	150 OHM 1 W			E	
R89	63-1091	12K OHM 10% 2W			E	
R90	63-942	15K OHM 10% 2 W			E	
R91	63-1706	1K OHM 10% 1/2 W		K3		
R92	63-1837	4.3 MEGOHM 5% 1/2 W		K3		
R93	63-1896	470K OHM 5% 1/2 W		K3		
R94	63-1880	180K OHM 10% 1/2 W			AB E	
R95	63-1457	39K OHM 10% 2 W				F
R96	63-1849	33K OHM 1/2 W			ABCD	
R97	63-1192	33K OHM 10% 1 W			AB E	F
R98	63-1157	47K OHM 10% 2 W				F
R99	63-2386	100 OHM 20% 2 W				
R100	63-1785	1K OHM 10% 1/2 W			F	
R101	63-1919	1.2 MEGOHM 10% 1/2 W			F	
R102	63-1870	100K OHM 20% 1/2 W			K3	
R103	63-1789	1200 OHM 10% 1/2 W			F	
R104	63-1838	18K OHM 10% 1/2 W			F	
R105	63-2287	330 OHM 20% 2W			F	
R106	63-949	2200 OHM 10% 1 W			F	
R107	63-3158	220 OHM 10% 2 W			F	
R108	63-1953	10 MEGOHM 10% 1/2 W			CD	
R109	63-2281	100K OHM 10% 1 W			CD	
R110	63-1781	820 OHM 5% 1/2 W			CD	
R111	63-1779	680 OHM 20% 1/2 W		K3		
R112	63-1969	1800 OHM 10% 1 W		ABCD		
R113	63-1815	150 OHM 20% 1/2 W			ABCDE	
R114	63-1887	270K OHM 10% 1/2 W	K3			
R115	63-2833	CONTRAST CONTROL		ABCD		
R116	63-3166	220K OHM 10% 2 W				F

DIAG.	PART	DESCRIPTION	R.F.	VIDEO	SWEEP	POWER
L1	5-18858	I.F. TRAP COIL ASSEMBLY	K3			
L2	20-431	INTERSTAGE CASCODE COIL	K3			
L3	20-393	R.F. PLATE IND. TRIMMER COIL	K3			
L4	20-429	CONVERTER GRID IND. TRIMMER COIL	K3			
L5	12-1944	INDUCTANCE TRIMMER	K3			
L6	5-18857	CONVERTER PLATE COIL	K3			
L7	20-447	OSCILLATOR INDUCTANCE TRIMMER COIL	K3			
L8	5-18855	OSCILLATOR PLATE CHOKE	K3			
L9	5-18205	ASSOCIATED SOUND TRAP COIL		K3		
L10	5-18714	ADJACENT PIX TRAP COIL		K3		
L11	5-17210	ADJACENT SOUND TRAP COIL		K3		
L12	5-18568	SOUND TAKE OFF COIL		K3		
L13						
L14	5-15128	CHOKE COIL		K3		
L15	5-17911	DETECTOR PEAKING COIL		K3		
L16	5-18751	DETECTOR SHUNT PEAKING COIL		K3		
L17	5-16984	FILAMENT CHOKE		K3		
L18	5-19360	1ST VIDEO PEAKING COIL		CD		
L19						
L20	5-19001	QUADRATURE COIL		K3		
L21	20-391	R.F. CHOKE	K3			
L22	5-17958	2ND VIDEO PEAKING COIL		K3		
L23	5-18749	3RD VIDEO SHUNT PEAKING COIL		K3		
L24	5-18750	3RD VIDEO SERIES PEAKING COIL		K3		
L25	IM 77	1/2 OF VERTICAL DEFLECTION COIL			AB	
L26	IM 77	1/2 OF VERTICAL DEFLECTION COIL			AB	
L27	5-19743	HORIZONTAL OSCILLATOR COIL			ABCDE	
L28	5-18748	HORIZONTAL WIDTH COIL			AB E	
L29	5-18570	HORIZONTAL LINEARITY COIL			ABCD	
L30	IM 77	1/2 OF HORIZONTAL DEFLECTION COIL			AB	
L31	IM 77	1/2 OF HORIZONTAL DEFLECTION COIL			AB	
L32	5-18740	4TH I.F. WINDING ASSEMBLY		K3		
L33	5-17343	1ST VIDEO PEAKING COIL			AB EF	
L34	IM 111	1/2 OF HORIZONTAL DEFLECTION COIL			E	
L35	IM 111	1/2 OF HORIZONTAL DEFLECTION COIL			E	
L36	IM 111	1/2 OF VERTICAL DEFLECTION COIL			E	
L37	IM 111	1/2 OF VERTICAL DEFLECTION COIL			E	
L38	5-19410	HORIZONTAL LINEARITY COIL (FIXED)				F
L39	5-19411	HORIZONTAL LINEARITY CONTROL				F
L40	5-19409	WIDTH CONTROL COIL				F
L41	IM 119	1/2 OF HORIZONTAL DEFLECTION COIL				F
L42	IM 119	1/2 OF HORIZONTAL DEFLECTION COIL				F
L43	IM 119	1/2 OF VERTICAL DEFLECTION COIL				F
L44	IM 119	1/2 OF VERTICAL DEFLECTION COIL				F
L45	5-19486	WIDTH CONTROL COIL			CD	
L46	5-19735	HORIZONTAL LINEARITY COIL				F
L47	IM 123	1/2 OF VERTICAL DEFLECTION COIL			CD	
L48	IM 123	1/2 OF VERTICAL DEFLECTION COIL			CD	
L49	IM 123	1/2 OF HORIZONTAL DEFLECTION COIL			CD	
L50	IM 123	1/2 OF HORIZONTAL DEFLECTION COIL			CD	
L51	5-19712	INTERCARRIER COIL		K3		
L52	5-19342	HORIZONTAL LINEARITY COIL			E	
L53	5-17334	HORIZONTAL OSCILLATOR COIL			F	
T24	5-19728	HORIZONTAL SWEEP TRANSFORMER				
T23	95-1337	DEFLECTION YOKE			CD	
T22	95-1340	AUDIO OUTPUT TRANSFORMER			CD	
T21	95-1326	VERTICAL OUTPUT TRANSFORMER			F	
T20	95-1170	FILTER CHOKE			F	
T19	95-1325	DEFLECTION YOKE			F	
T18	95-1324	AUDIO OUTPUT TRANSFORMER			F	
T17	95-1323	POWER TRANSFORMER				F
T16	95-1334	FILTER CHOKE				F
T15	5-19408	HORIZONTAL SWEEP TRANSFORMER				F
T14	5-19032	HORIZONTAL SWEEP TRANSFORMER			E	
T13	95-1311	POWER TRANSFORMER			E	
T12	95-1310	FILTER CHOKE			E	
T11	95-1306	DEFLECTION YOKE			E	
T10	5-18567	HORIZONTAL SWEEP TRANSFORMER			AB	
T9	95-1280	FILTER CHOKE			ABCD	
T8	95-1298	POWER TRANSFORMER			ABCD	
T7	95-1335	DEFLECTION YOKE			AB	
T6	95-1309	VERTICAL OUTPUT TRANSFORMER			ABCDE	
T5	95-1339	AUDIO OUTPUT TRANSFORMER			ABE	
T4	5-18590	4TH I.F. TRANSFORMER ASSEMBLY		K3		
T3	5-18730	3RD I.F. TRANSFORMER ASSEMBLY		K3		
T2	5-17907	2ND I.F. TRANSFORMER ASSEMBLY		K3		
T1	5-19736	1ST I.F. TRANSFORMER ASSEMBLY		K3		

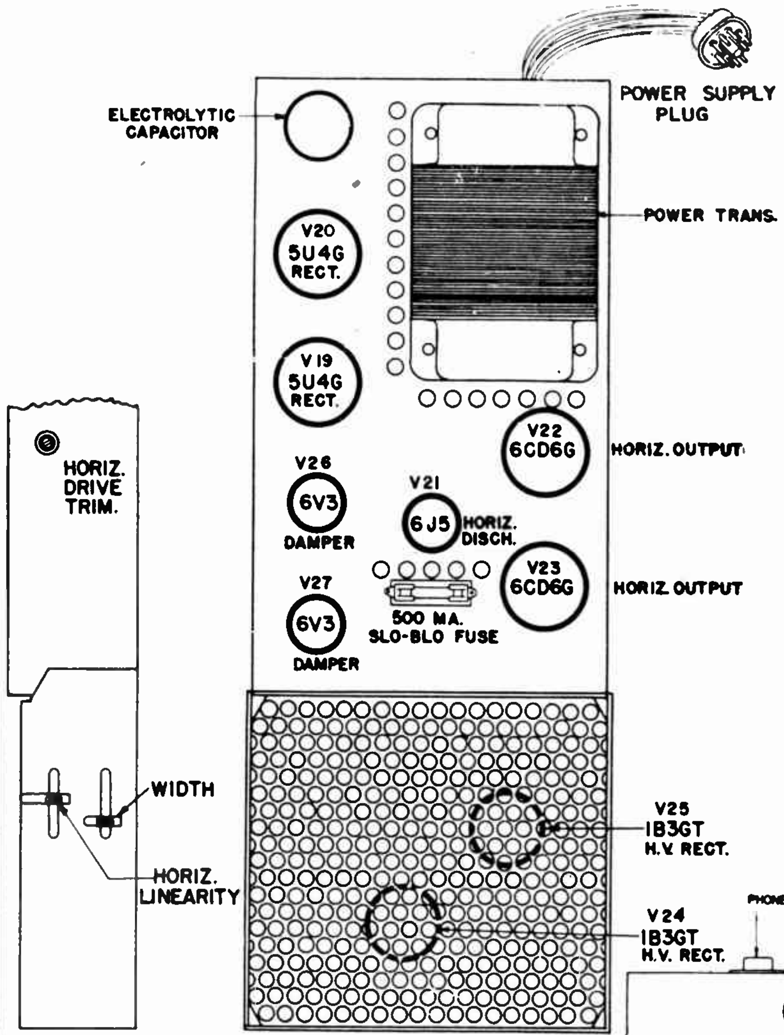
"A" DESIGNATES 19K20-3
"B" DESIGNATES 19K23-3
"C" DESIGNATES 19K22-3
"D" DESIGNATES 19K24-3
"E" DESIGNATES 21K20-3
"F" DESIGNATES 28K20

"K3" DESIGNATES ALL CHASSIS

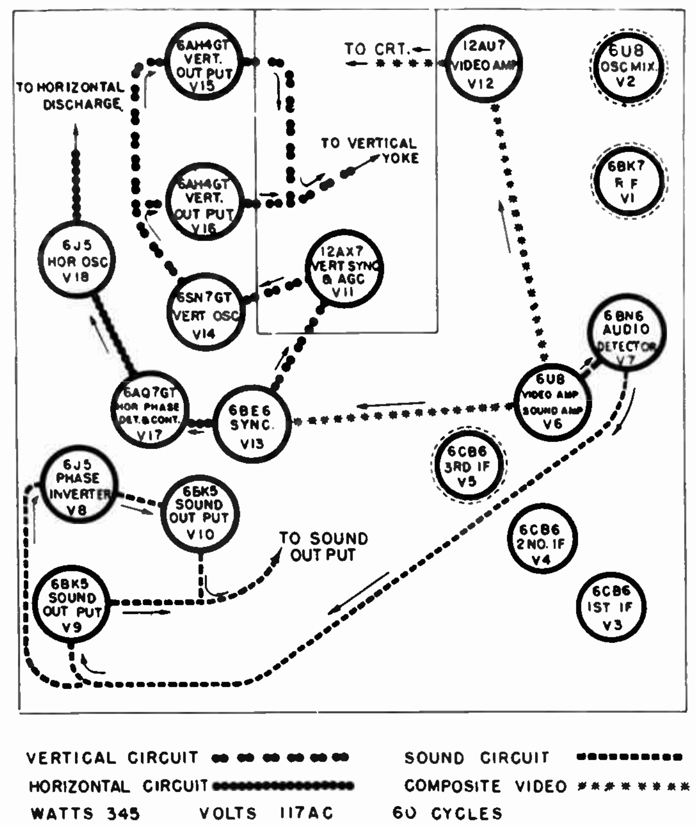
R OR BEZEL



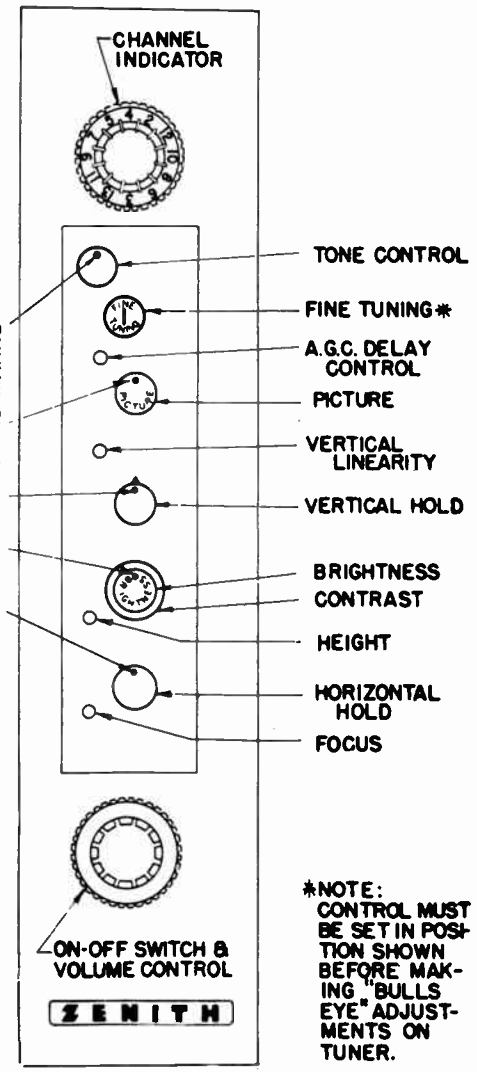
Deflection Yoke



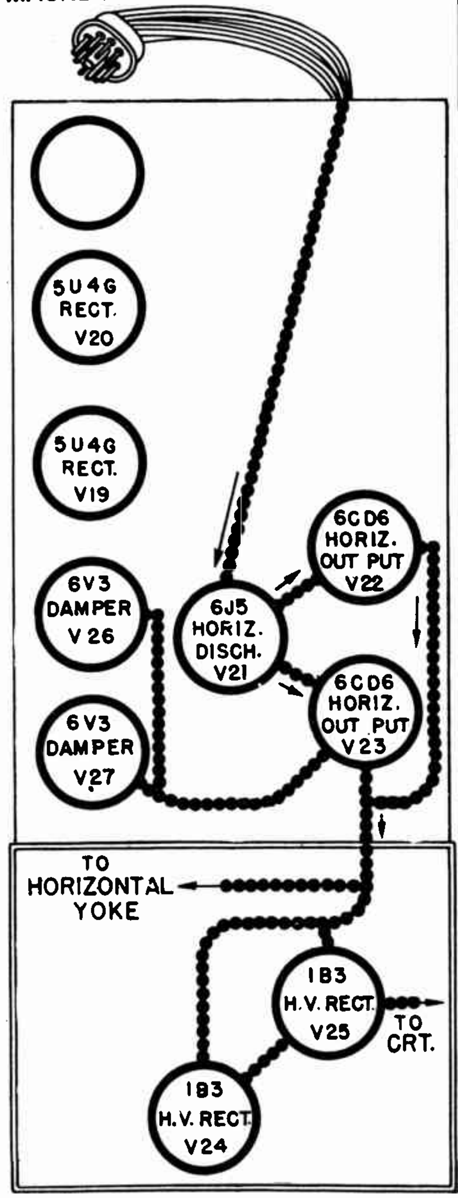
28K20 Power Supply Chassis



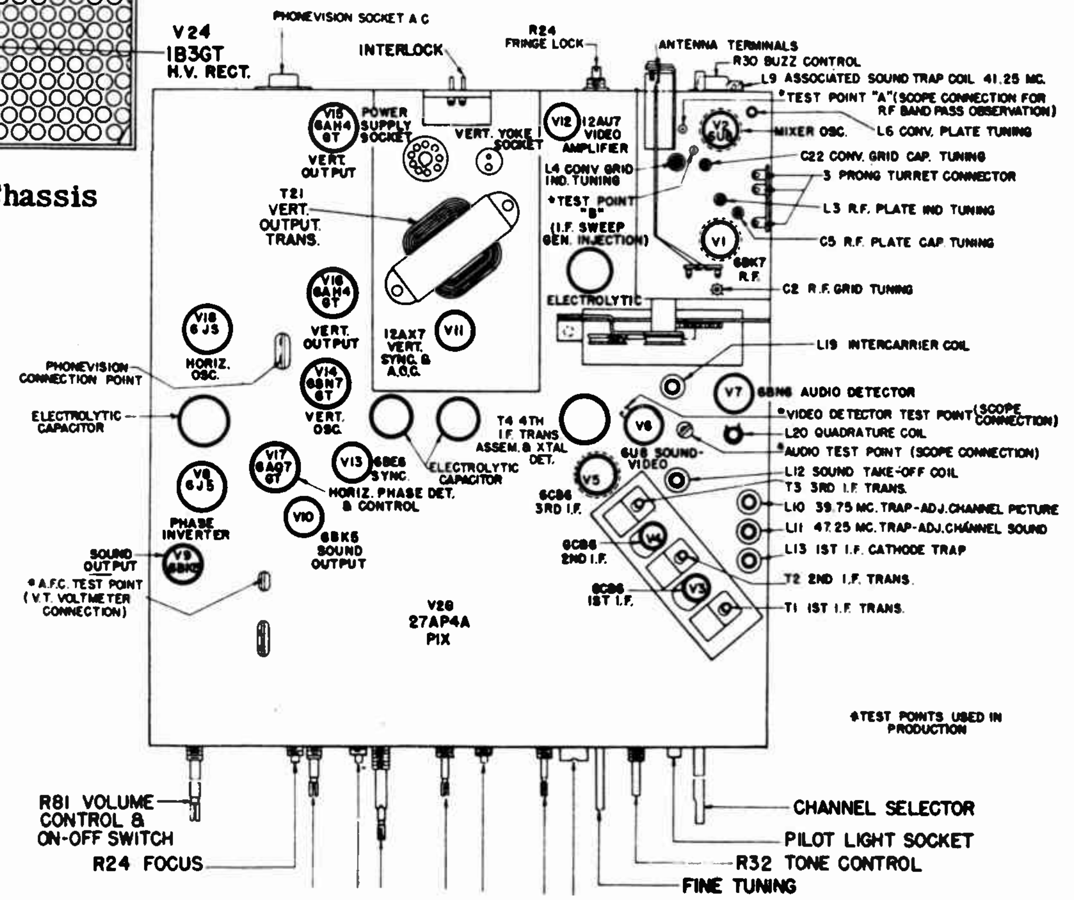
Chassis Signal Path Chart



Front Panel Controls 28K20 Chassis



Power Supply Signal Path



Tube and Trimmer Layout 28K20 Chassis

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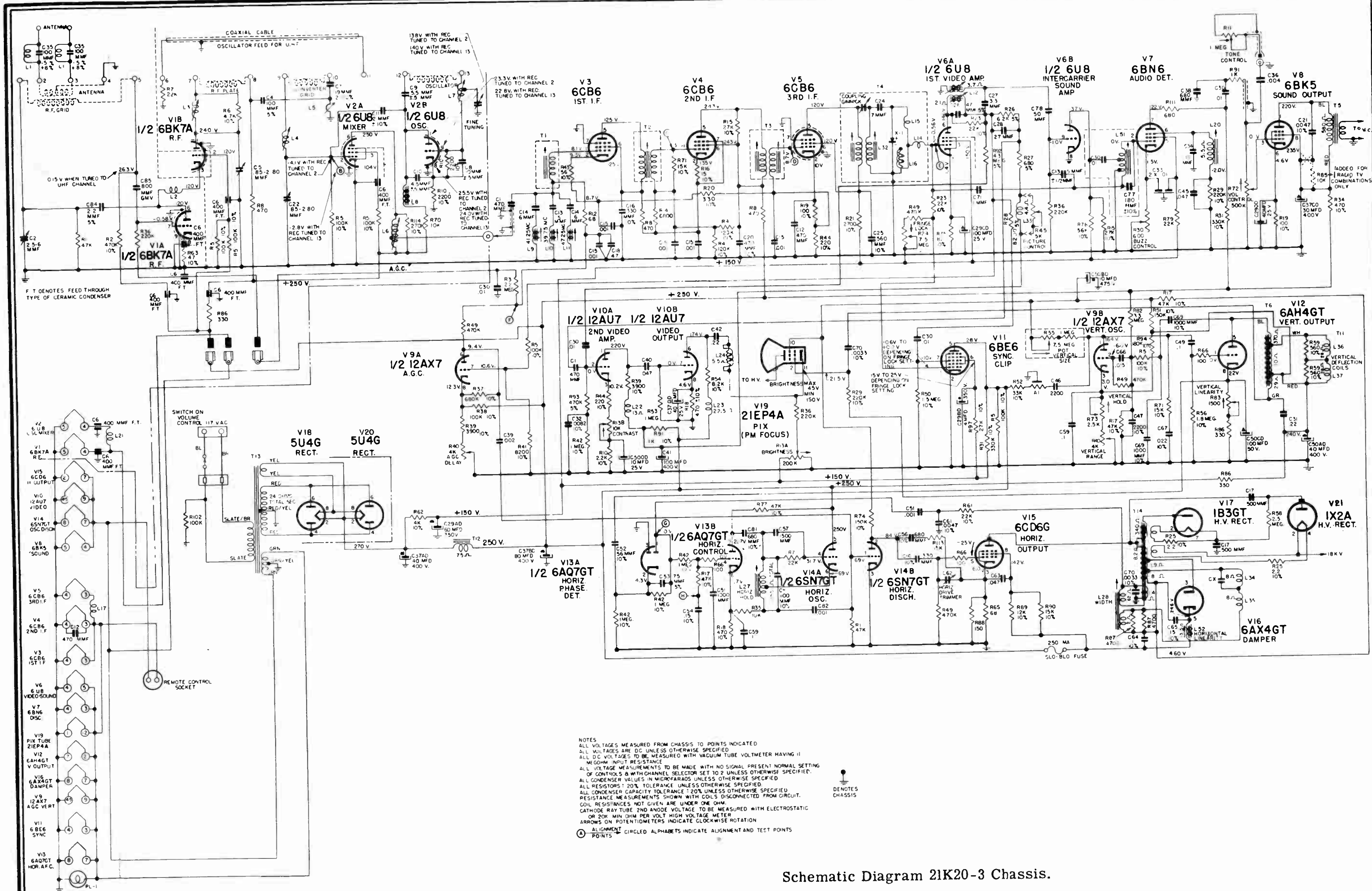
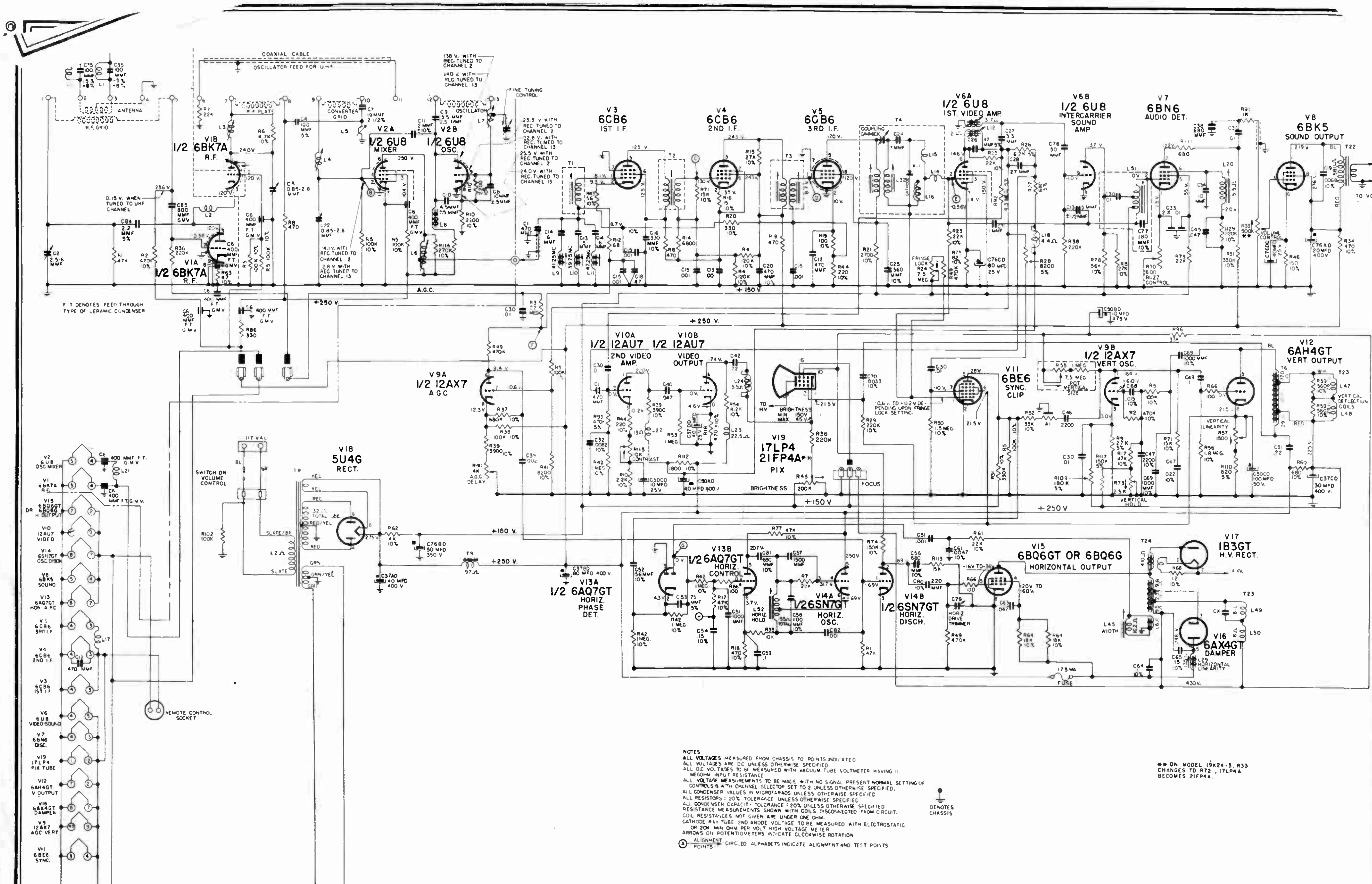
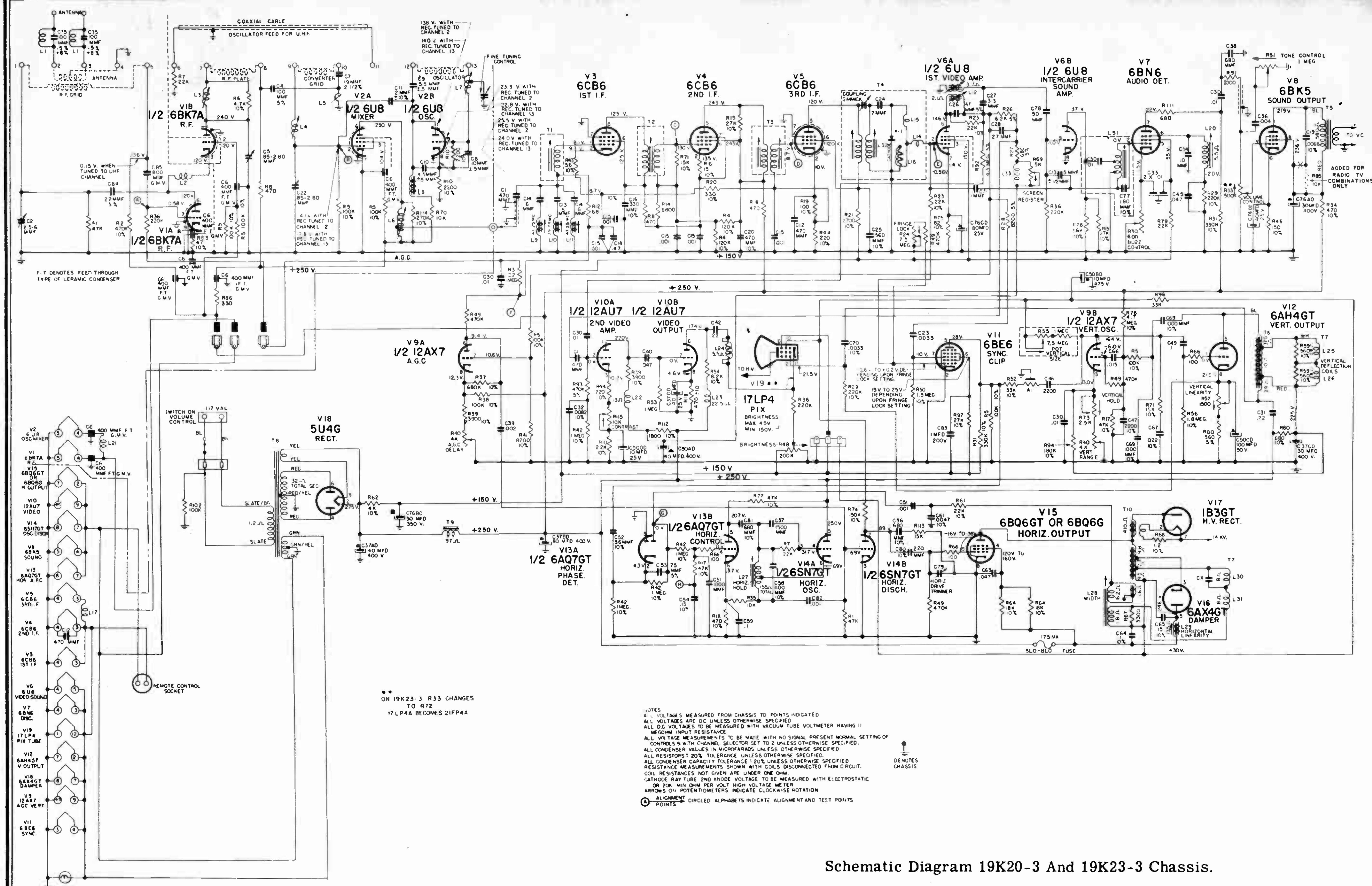


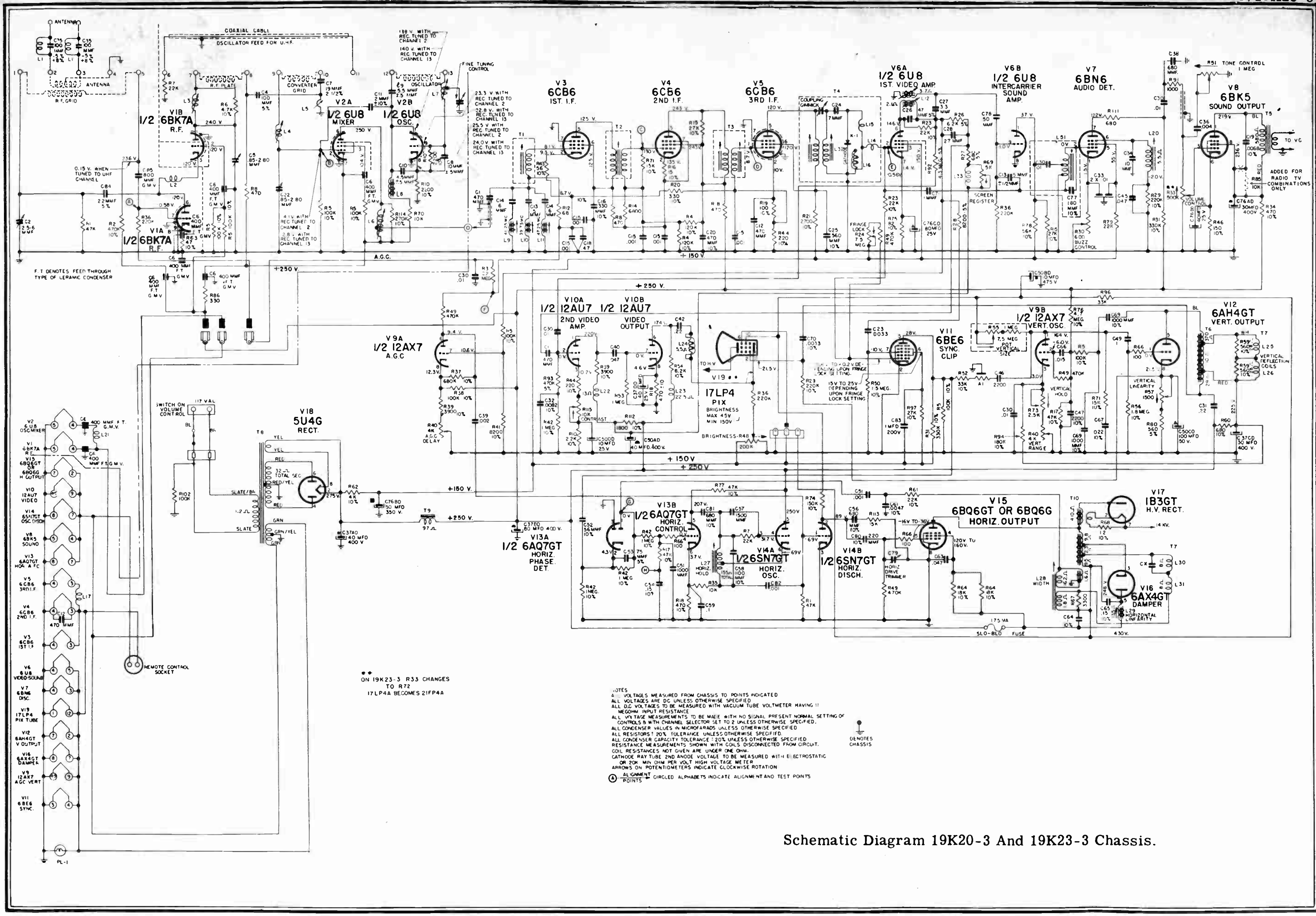
Schematic Diagram 21K20-3 Chassis.



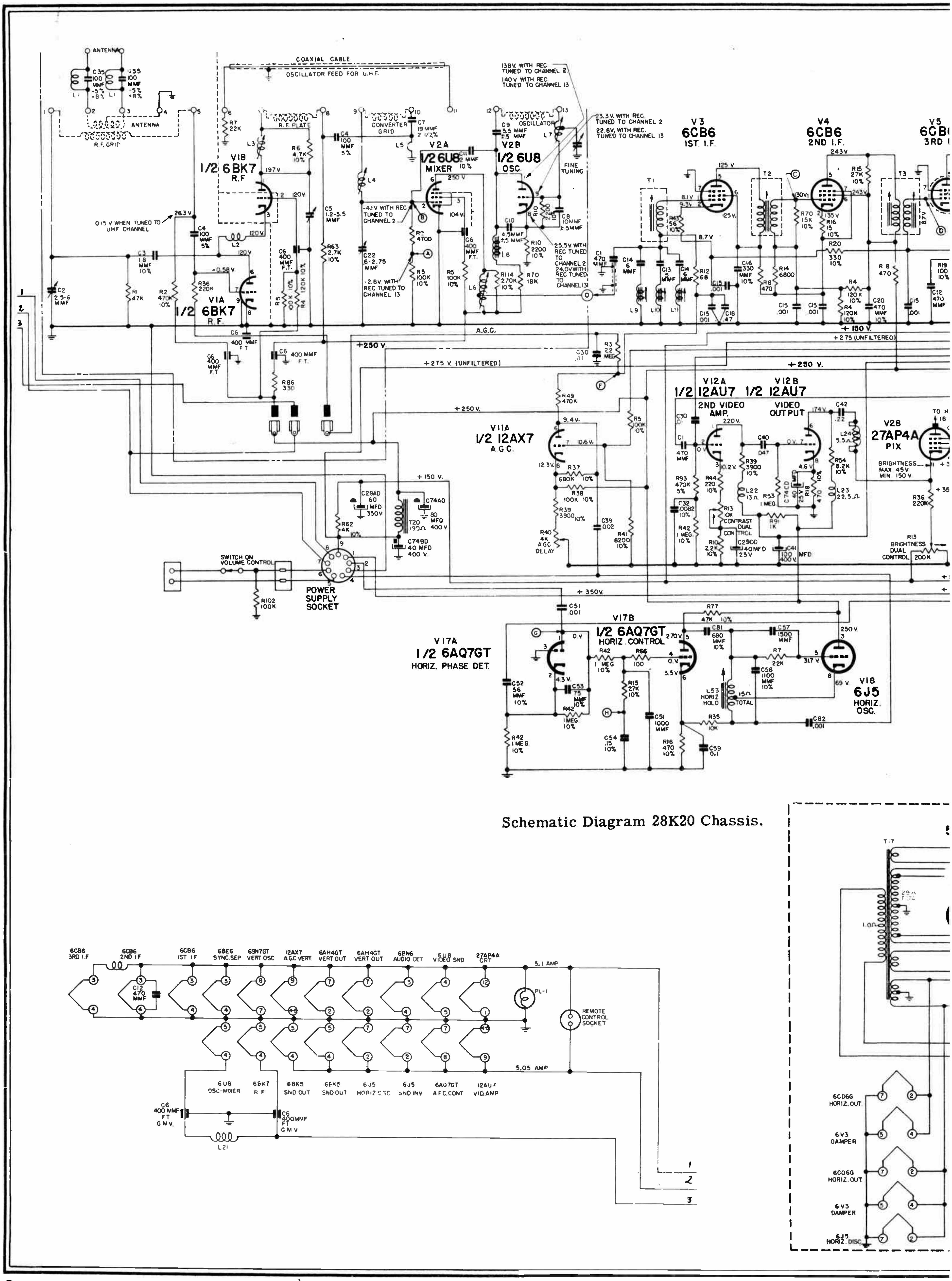
Schematic Diagram 19K22-3 And 19K24-3 Chassis.



Schematic Diagram 19K20-3 And 19K23-3 Chassis.

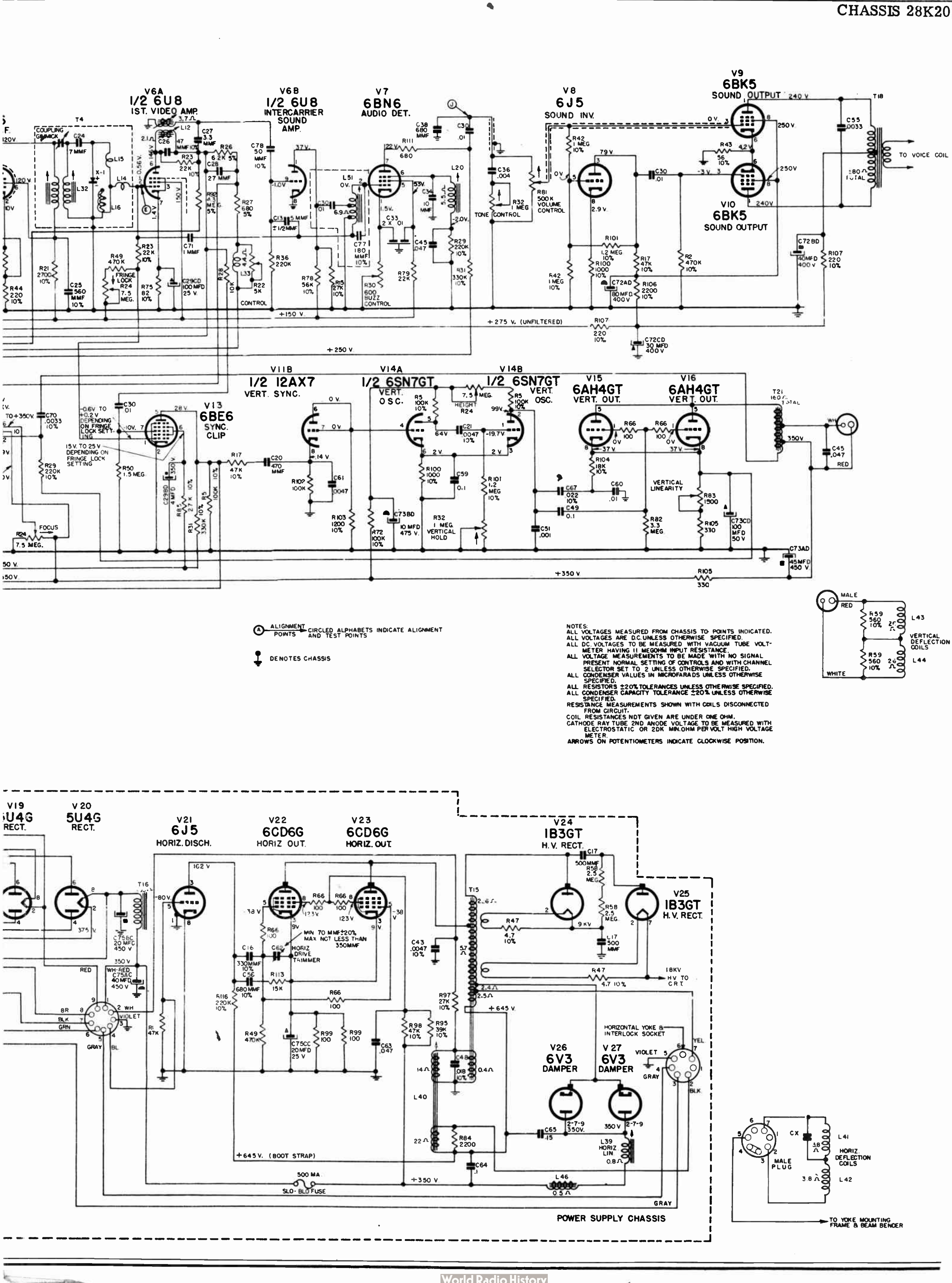


Schematic Diagram 19K20-3 And 19K23-3 Chassis.

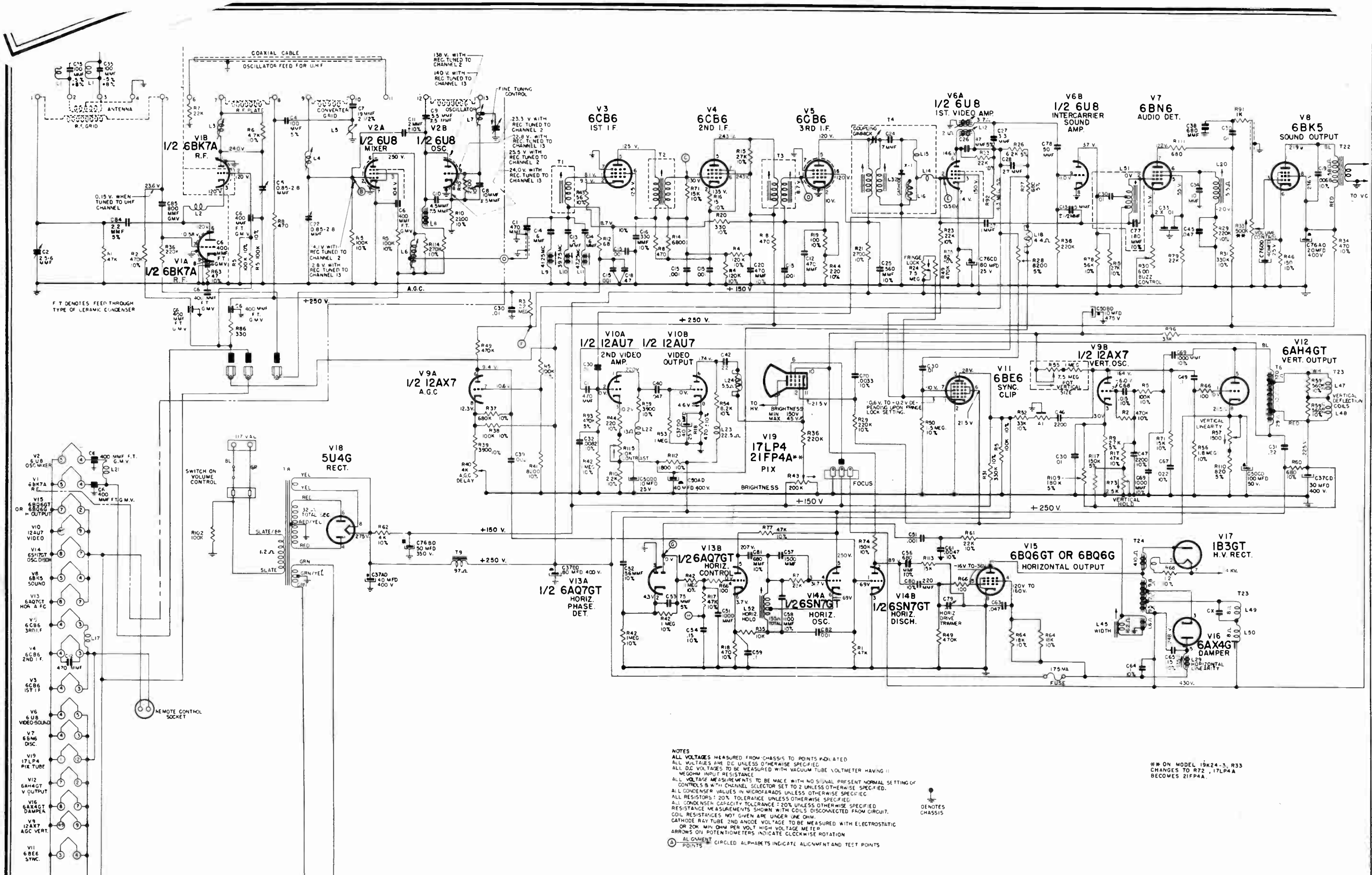


Schematic Diagram 28K20 Chassis.

CHASSIS 28K20



NOTES:
ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.
ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.
ALL DC. VOLTAGES TO BE MEASURED WITH VACUUM TUBE VOLTMETER HAVING 11 MEGOHM INPUT RESISTANCE.
ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT NORMAL SETTING OF CONTROLS AND WITH CHANNEL SELECTOR SET TO 2 UNLESS OTHERWISE SPECIFIED.
ALL CONDENSER VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
ALL RESISTORS ±20% TOLERANCES UNLESS OTHERWISE SPECIFIED.
ALL CONDENSER CAPACITY TOLERANCE ±20% UNLESS OTHERWISE SPECIFIED.
RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT.
COIL RESISTANCES NOT GIVEN ARE UNDER ONE OHM.
CATHODE RAY TUBE 2ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K MIN. OHM PER VOLT HIGH VOLTAGE METER.
ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE POSITION.



Schematic Diagram 19K22-3 And 19K24-3 Chassis.