DECEMBER, 1954

Radio-Television SERVICE DEALER

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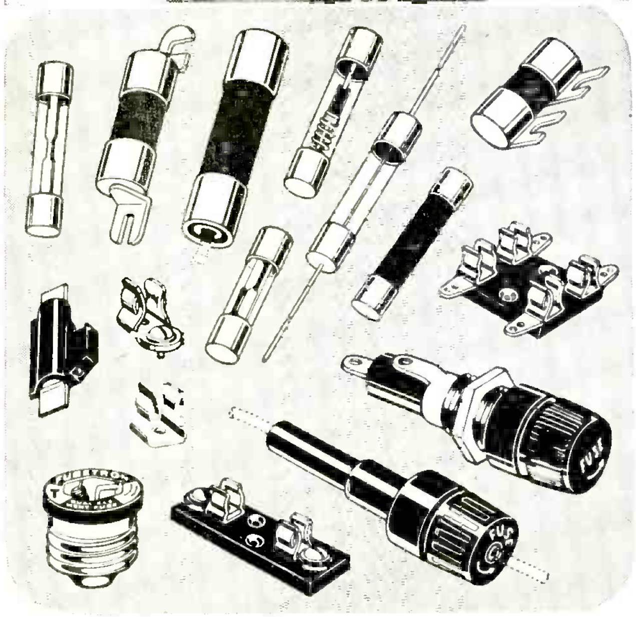

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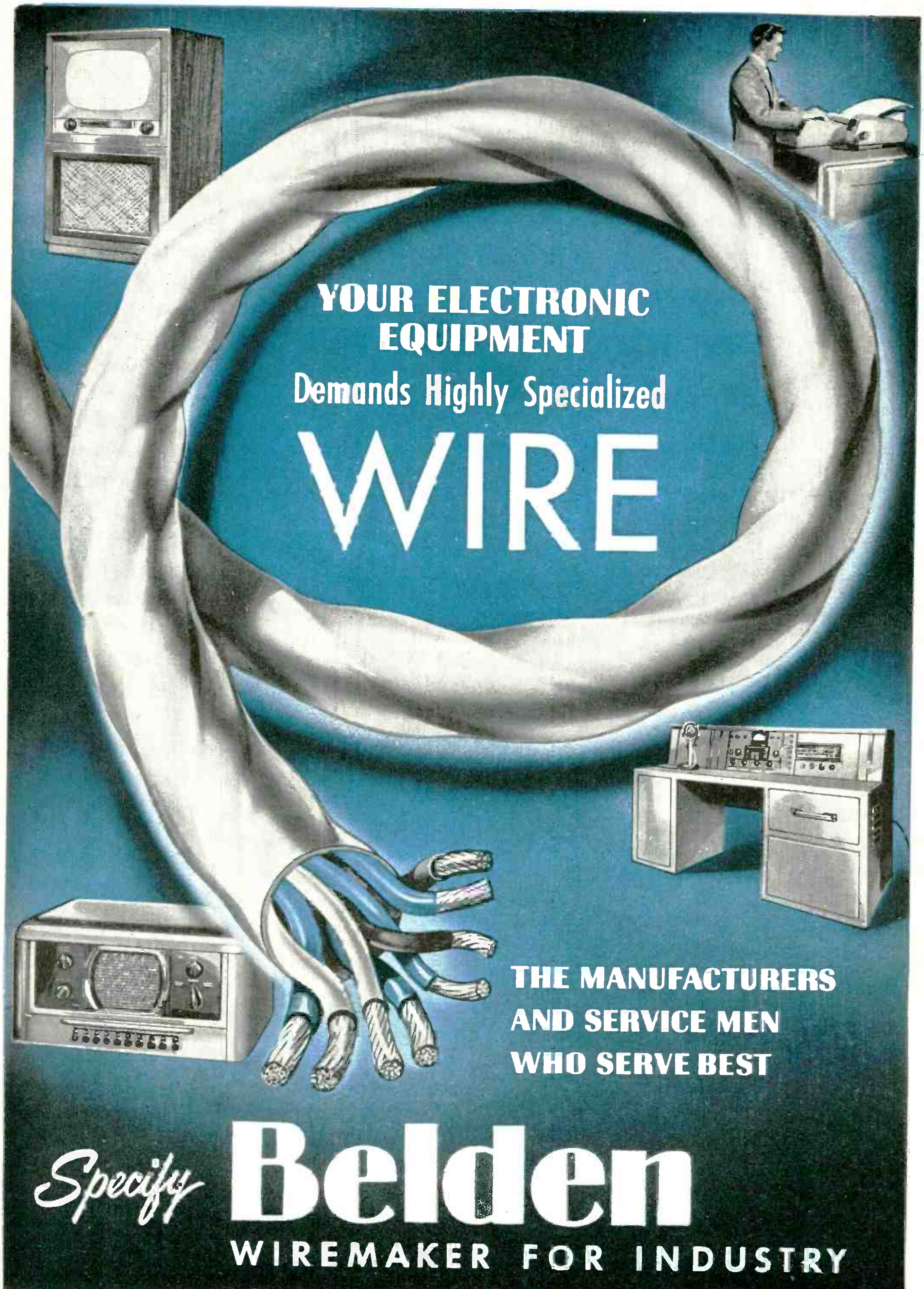
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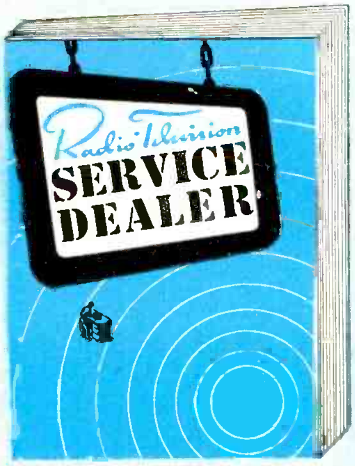

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VOL. 15, NO. 12 DECEMBER, 1954

FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

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EDITORIAL...

by S. R. COWAN
PUBLISHER

Lost Opportunities—Lost Dollars

Having been associated with professional servicemen for over 25 years I fully realize that most are much more service than sales-minded. By that I mean that the average serviceman will tackle with glee any repair job regardless of the difficulty involved whereas only "exceptional" servicemen make it their standard practice to *try* to sell something more than mere service—things like antenna rotators, long-play needles, portable battery sets, or that second TV set for the customer's bedroom.

For example, all servicemen will repair faulty record-players or they will replace defective cartridges whenever a customer *asks* to have such jobs attended to. But, does the *average* serviceman, having finished repairing a receiver, make it his *standard practice* to ask his customer leading, sales-pointed questions such as: "How is your record-player working?" — or: "How about letting me install a new, more efficient TV antenna or rotator so you'll get better reception?" Sorry to say, and practically all of you will concur, the answer is an emphatic NO! The average serviceman simply allows hundreds of potential sales opportunities — and fabulous additional earnings — to slide by him month after month. Let's review this sad condition more fully!

We all know that at present the country is what one could call "phonograph record crazy." With that in mind, during the past two months I have made a thorough market study of the record-player business and its attendant effect upon the earnings of the service profession. My findings will undoubtedly interest all independent servicemen, and particularly service dealers and service firm owners who have one or several technicians on their payrolls. Analyze the following facts carefully:

There are more than 67½ million record players of all types (from radio-phono combinations to portables) *now in general use* in this country. (As there are only 45 million homes, every other home has 2 record-players). Of the 67½ million record-players in use, 40 million are single-speed 78 RPM; 12 million are 2-speed 33 1/3 — 78; 2 million are 2-speed 33 1/3 — 45; 2 million are single-speed 45; and 11½ million are 3-speed 33 1/3 — 45 — 78.

During this year cartridge manufacturers sold to servicemen through parts distributors for replacement use almost 1½ million cartridges. This may not sound like an impressive figure if only given casual thought, but believe me, it is "peanuts" compared to what sales *might have been* had servicemen *tried* to get more replacement cartridge sales. Over 90% of the cartridges sold by servicemen this year were sold because the record-player owners gave their servicemen instructions to make the replacements. Less than 10% of the cartridges were bought by customers at the instigation of repairmen, or because servicemen "suggested" that they would get more enjoyment from their phonographs thereby.

As the public is record-player conscious, I urge *all* servicemen to get "sales-minded" immediately and from now on "go after" replacement cartridge sales at every opportunity — meaning whenever you have a conversation with any customer Also, when possible, ascertain if the customer wouldn't like to have his old (and probably obsolete single-play), unit replaced with a modern multi-speed turntable—a new tone arm—new long-play stylii, etc. Try this sales-minded policy in earnest for a while (and have your employed technicians do it too), and within a short time you will increase your earnings by hundreds of dollars, and probably you'll increase your technicians' earnings too, on a profit-sharing basis.

In like manner, it will pay handsomely to "go after" replacement antenna sales, remote-tuning device sales, rotator sales, and the like. If only 1 out of every 10 customers that you and your technicians have contact with becomes a buyer of some supplemental service or accessory, you will not only profit therefrom, but more important, you'll increase the customers' respect and Good Will for you as they will recognize in most cases that you acted as you did with their best interests in mind.

TV Receiver and Station Count

As of Oct. 1st, 1954 in 251 major markets there were 402 TV stations on the air, 112 of them being UHF and 286 VHF. By January 1955 an additional 29 VHF and 28 UHF stations expect to be in operation to give us a grand total of 463.

At this writing statisticians estimate that slightly over 32 million TV sets are in use of which slightly less than 1 million are UHF. An additional 3 million TV sets are on dealers' floors or are in distributors' stocks ready for delivery. There is a normal production-to-sales ratio at present, which is a good sign.

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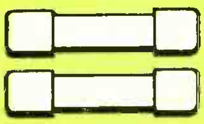
Burton browne advertising

Things are not as they seem
These two fuses look alike . . .
Until you look inside.



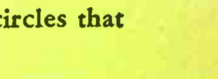
LITTELFUSE

DES PLAINES, ILLINOIS

This is not a spiral. **It is a series of concentric circles that do not join.**

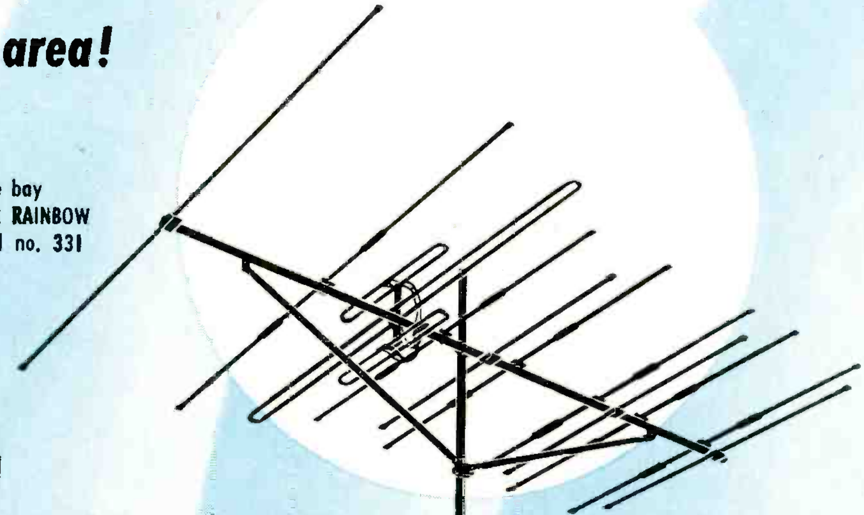
This fuse has a straight element—cannot be made more delicate than 1/16 amp. with normal blowing characteristics.

This fuse has a bridge construction (note short filament between electrodes). This type fuse may be rated as low as 1/500 amp. with precision blowing characteristics required for protection of extremely fine instruments. Without this construction pioneered by Littelfuse—the microscopically fine filament would break in shipment, in normal operating vibration or even from nearby footsteps.



Littelfuse leads all other fuse manufacturers in design patents on fuses.

this great all-channel antenna discovery is smashing sales and performance records in every TV area!



Single bay SUPER RAINBOW model no. 331

Stacked RAINBOW model no. 330-2

the CHAMPION RAINBOW*

brilliant black-and-white performance — and really ready for COLOR!

these 3 revolutionary, power-packed design features — found in no other antenna today!

1. **New spacing formula:** Radical new spacing arrangements between the directors and reflectors has, for the first time, extended the full efficiency and high gain of the basic narrow band Yagi over the *full width of an entire VHF band.*
2. **New "triple power" High Band directors and reflectors:** Three-section directors and reflectors, with insulated segments, provide combined power of three High Band Yagis, operating side by side, in phase.
3. **New "inter-mix" design:** Combines — into one single antenna — two separate, *independent* sets of directors and reflectors, one for High Band, one for Low Band. Each parasitic system operates *only* on its own band. Fullest efficiency — no compromise design.

PLUS Channel Master's patented, super-gain TRI-POLE . . . the unique triple-power dipole that made the Champion America's most wanted antenna.

Write for complete technical literature

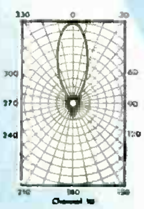
*Patent No. 2,691,730
Other Patents Pending

CHANNEL MASTER *creative engineering*

Here's how the RAINBOW out-performs the famous Champion:

	CHANNEL	2	3	4	5	6	7	8	9	10	11	12	13
Gain Over 1-Bay Champion	1-Bay RAINBOW	0 DB	0 DB	0 DB	+1 DB	+2 DB	+3 DB	+2.5 DB	+1 DB	+.5 DB	+.5 DB	+1.5 DB	+2.5 DB
	1-Bay SUPER RAINBOW	+1 DB	+1 DB	+1.5 DB	+2.5 DB	+3.5 DB	+3.5 DB	+3 DB	+2 DB	+1.5 DB	+2 DB	+3.5 DB	+4.5 DB
	CHANNEL	2	3	4	5	6	7	8	9	10	11	12	13
Gain Over Stacked Champion	Stacked RAINBOW	+1.5 DB	+2 DB	+1.5 DB	+1.5 DB	+2 DB	+.5 DB	+.5 DB	+0 DB	+0 DB	+0 DB	+1 DB	+1.5 DB
	Stacked SUPER RAINBOW	+2 DB	+2.5 DB	+3 DB	+3 DB	+4 DB	+.5 DB	+1 DB	+1 DB	+2 DB	+2 DB	+2.5 DB	+3.5 DB

horizontal polar pattern (relative voltage)



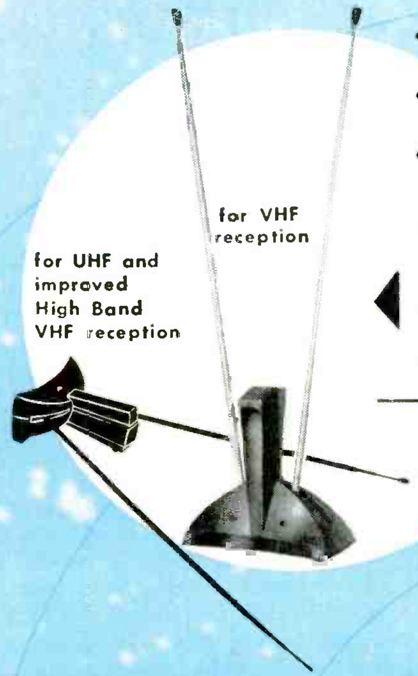
for fringe and super-fringe areas:

Super Rainbow, model no. 331
$37.50 list
stacked Super Rainbow, model no. 331-2
$75.70 list

for suburban and near-fringe areas:

Rainbow, model no. 330
$23.60 list
stacked Rainbow, model no. 330-2
$48.60 list

something new in indoor antennas



- features 3 telescoping sections.
- tilt-proof polystyrene base — cannot tip over.
- handsomely packaged for display.

the ALL-VU*

*all VHF . . . all UHF
the only indoor antenna with this "2-Way" feature.

model no. 381 6^{95} list

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the PRE-VU

for all-channel VHF reception only.
model no. 380
5^{95} list

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Aluminum Masting.
The new idea in antenna masting—

can never rust!

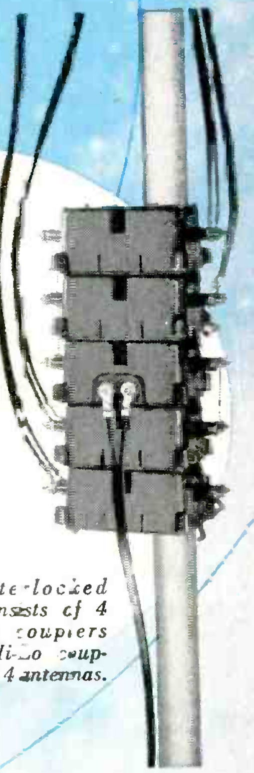
- in telescoping sections
- in swaged 5, 10, and 14 foot sections

Lightweight ALUMast is 1/3 the weight of steel, making it so easy to install — it swings right up! Stronger than steel, ALUMast is easier to stock and actually more economical.

brings you today's 5 newest installation ideas

for . . . more effective installations
. . . greater customer satisfaction
. . . higher profits for you!

SELECTENNA COUPLING SYSTEM



permits unlimited antenna combinations with only one transmission line!

- for the first time, you can tie together an unlimited combination of antennas, including separate antennas operating on the *same band.*
- ideal for areas currently using rotators, manually-operated selector switches, and "omni-directional" antennas.

list price
5^{42} each
including hardware and wire for joining couplers.

This inter-locked stack consists of 4 antenna couplers and 1 Hi-Lo coupler; joins 4 antennas.

TV ROTATOR

with features found in no other rotator today:

- flexible worm gear, built-in thrust bearing.
- removable motor, electrical and mechanical stops.
- weatherproof, lightweight, strong.
- straight-thru mast mounting, built-in chimney mount.
- extremely high torque.

Beautifully-styled cabinet has great consumer appeal — is smallest on market (2¾" x 4"). Finger-tip control bar.

model no. 9521, 49^{95} list

model no. 9520, without directional indicator, 44^{95} list

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WORLD'S LARGEST MANUFACTURER OF TELEVISION ANTENNAS

ASSOCIATION NEWS

NETSDA

A meeting of NETSDA was held in the Hotel Diplomat in New York, Sunday, November 14, and attended by delegates representing associations in New York State, Pennsylvania and New Jersey. The main topic of discussion was the license bills pending in various places. Association Counsel, Mr. Joseph Forman gave an excellent review of the New York City bill with some of the problems that had to be taken care of in the formation of the bill. The necessity of having a board established which would be as impartial as possible, composed of various segments of the industry, government and the public was made apparent, and it was generally agreed by delegates present that such an impartial board to examine applicants, issue licenses and take care of future discussions between licensees and the public, would be a primary prerequisite for a good license bill.

The next meeting will be in January, exact time and place to be determined at a later date.

PRSMA—Phila.

At the October 12, 1954, open meeting, P.R.S.M.A. presented Winston Electronics, Inc., manufacturers of Win-Tronix test equipment. The meeting was held in the Gold Room at the Broadwood Hotel, Broad and Wood Streets, here in Phila. Winston presented three speakers—Winston H. Starks—Ralph Weinger and Daniel Kursman who spoke on color television test equipment.

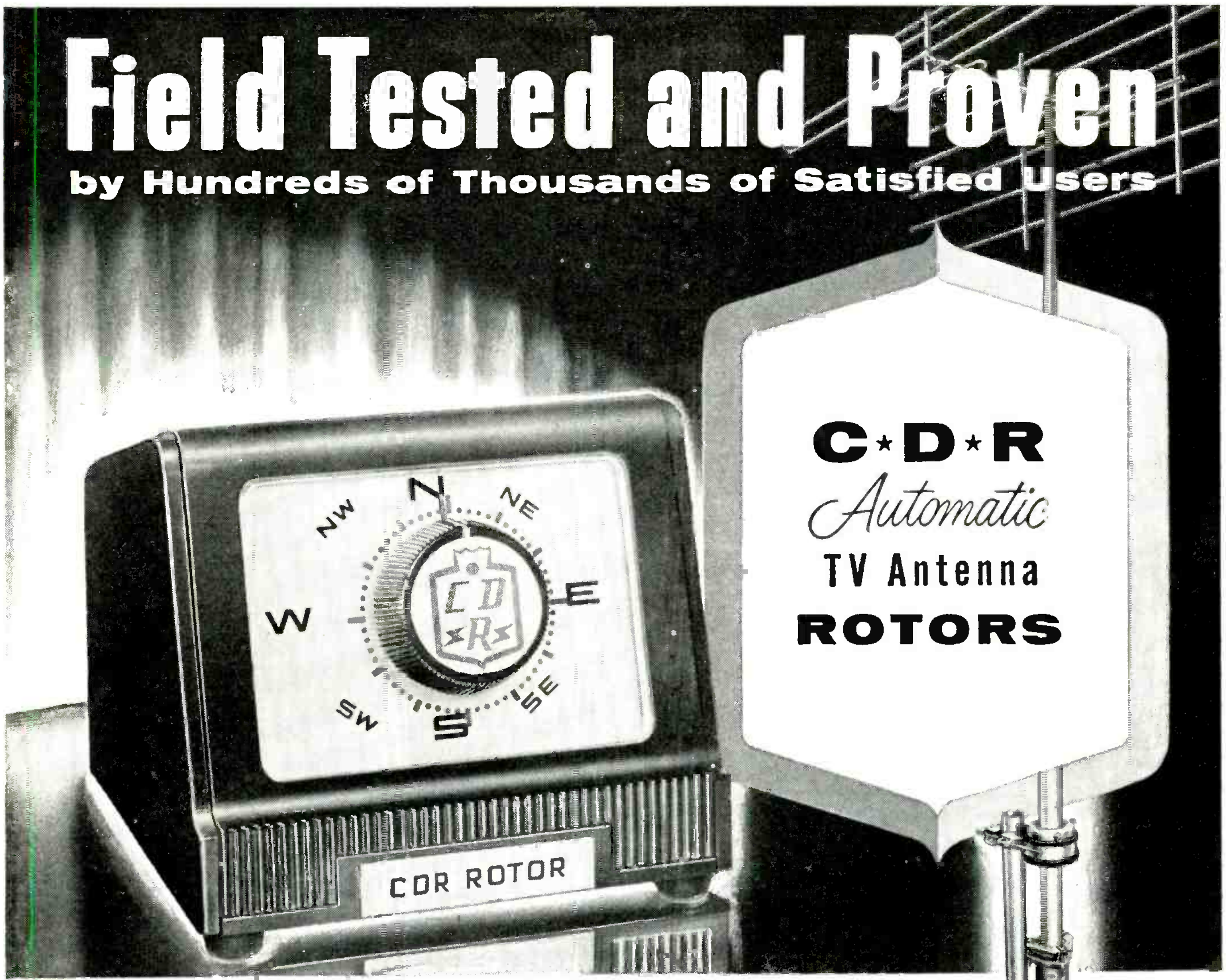
Because of a change in Color Telecast, the show that was to be presented that night at 7:30 to 8:00 P.M., was not put on the air and was not seen at the meeting. P.R.S.M.A. will try again to arrange a meeting when a color telecast can be seen.

NATESA

The receipt you issue is of extreme importance. It can bind you to many things of which you may be entirely unaware and can cause you untold trouble and cost. Legally, you are bound by common law to exercise certain care over any goods in your charge.

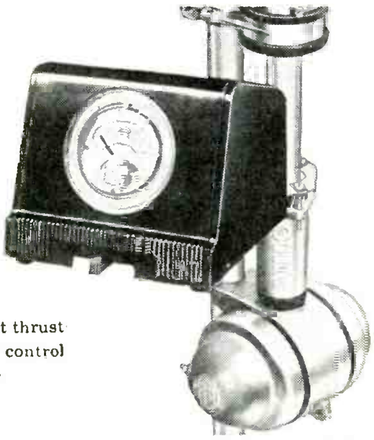
Because of this, every service shop is the grave-yard of many junks whose owners decide they don't want to spend money on to revive. One other aspect is

[*Continued on page 63*]



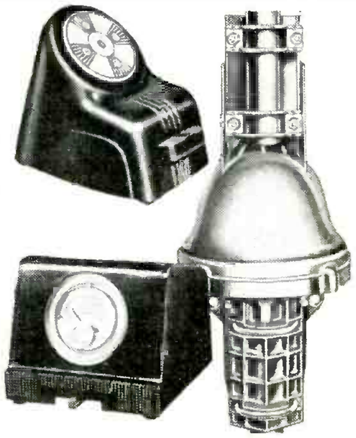
model AR-2 . . . complete AUTOMATIC rotor with thrust bearing . . . and handsome modern design cabinet, uses 4 wire cable

model AR-1 . . . same as AR-2 without thrust bearing



model TR-12
A special combination value consisting of complete rotor including thrust bearing. Handsome modern cabinet with meter control dial, uses 4 wire cable.

model TR-11
The same as the TR-12 without thrust bearing, complete with meter control dial cabinet, uses 4 wire cable



model TR-2
The heavy-duty rotor with plastic cabinet featuring "Compass Control", illuminated "perfect pattern" dial, uses 8 wire cable

model TR-4
The heavy-duty rotor complete with handsome, modern design cabinet with meter control dial, uses 4 wire cable.

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CLEVELAND 13, OHIO

CHROMINANCE Systems in Color TV Receivers

by BOB DARGAN
and SAM MARSHALL

Discussion of signal processing of chrominance signal in Q and I receiver.

Part 1

THE chrominance section of a color TV receiver is used to recover and and process color signals from the composite video signal. There are two types of chrominance systems used. These are the I & Q or "Ceiling Performance" and the R-Y and B-Y or "Economy" systems. The manner in which these two systems operate will now be considered from a general descriptive point of view. A more detailed analysis will follow subsequently.

Ceiling Performance and Economy Systems

In a previous chapter entitled, "Block Diagram Analysis of Color Transmission and Reception," the entire discussion was based on the I and Q system which provides for a 1.5 *mc* video frequency generation of certain colors which the eye can differentiate in fine detail and a 0.5 *mc* video frequency generation of other colors which the eye cannot differentiate in fine detail. Such a system provides the finest available in color reception, and a receiver designed around this system is commonly referred to as a "Ceiling Performance" receiver.

It is entirely possible to extract the color difference signals without making use of the individual I and Q signals. By doing this we lose the high definition color video frequencies from zero to 0.5 *mc*. Such a receiver, because of the fewer circuits required is called an "Economy Receiver".

A discussion of a general block diagram encompassing both systems now follows. It must be borne in mind that the diagram shown is typical of receivers in general and does not refer to any specific type.

On examining this block diagram, shown in *Fig. 1*, it will be observed that the video detector feeds the demodulated video *if* composite signal into the section marked composite video amplifier. Here the various signal components making up the composite video signal are extracted by means of traps and filters and fed to their respective sections for further processing. These signal components are the luminance signal, the horizontal and vertical sync

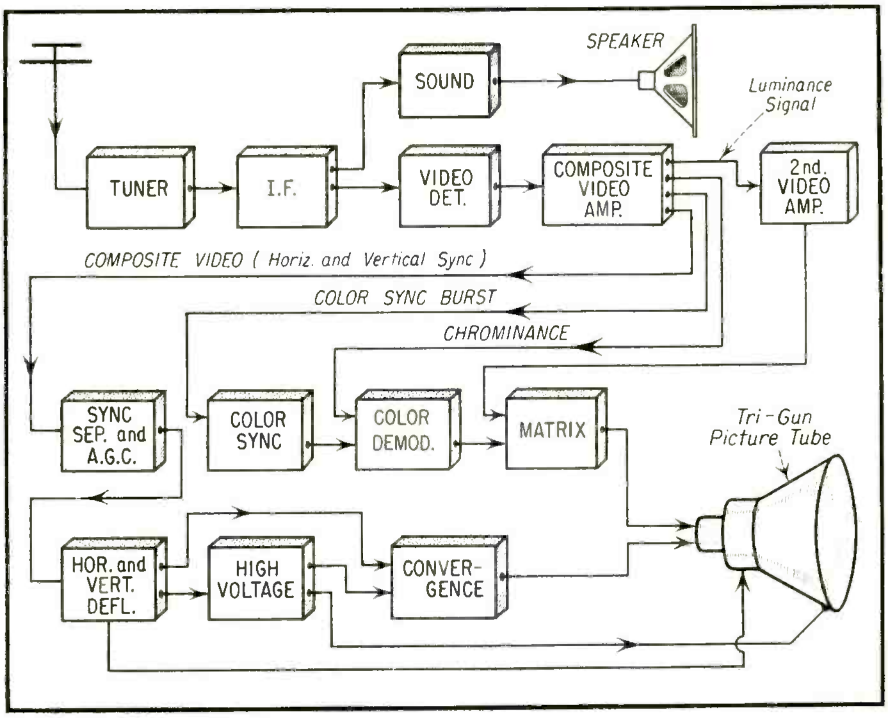


Fig. 1—A simplified block diagram of a general color TV receiver

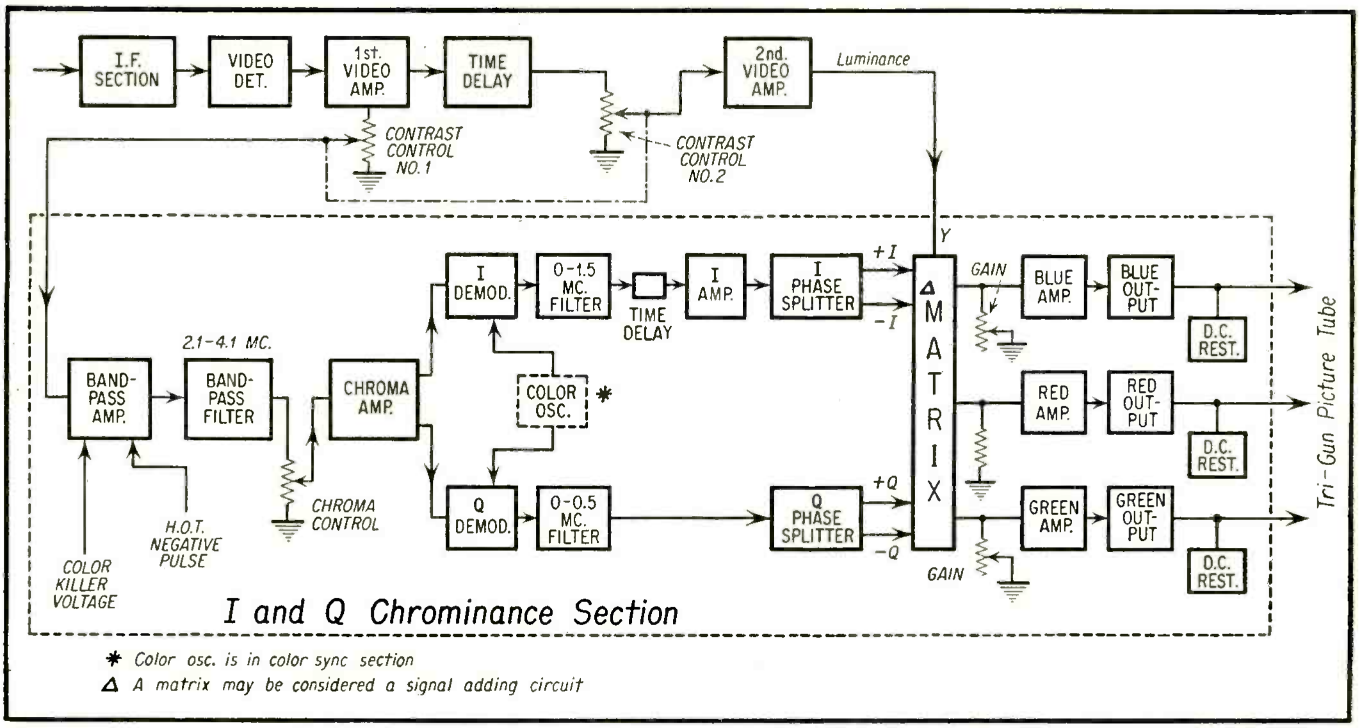


Fig. 2—The stages comprising the I and Q chrominance section.

pulses, the color sync burst and the chrominance signal.

Notice that the Y or luminance signal, which is equivalent to the black and white brightness information of the scene, is processed in a conventional manner through a 2nd video amplifier. From this point it is applied to the picture tube through the signal mixing network called the matrix. For a B & W transmission the signal in the luminance channel consists only of the black and white video signal and the standard B & W horizontal and vertical sync pulses. For a color transmission the luminance channel contains the Y signal and the horizontal and vertical color sync pulses.

It can be seen that many of the sections are common to black and white (B & W) receivers. In general, there are four sections that actually have been added with the color picture tube to bring about a change to color television. These are a Color Sync section, a Chrominance section, a Matrix section and a Convergence section.

Briefly explained, the Color Sync section processes the color burst signal so that correctly phased 3.58 *mc* signals are developed and fed into the color demodulators.

The demodulators into which are fed the chrominance suppressed carrier color sideband signals, extract the I and Q or R-Y and B-Y signals from the chrominance signal and apply them to the Matrix section. The Matrix section mixes the luminance and I and Q (or R-Y and B-Y) signals so that the original primary colors are presented to the corresponding guns of the picture tube. The convergence section provides a means of producing color registration in the 3-gun shadow mask type of color picture tube.

In a conventional ceiling performance receiver, the color demodulators extract the I and Q signals from the chrominance signal. Following this the I and Q signals are fed into the matrix network where they are mixed with the Y signal to produce the primary red, green and blue signals.

In comparison, the economy receiver extracts the R-Y and B-Y signals from the chrominance signal. Following this, the R-Y and B-Y signals are mixed to produce the G-Y signal. Then all three color-difference signals are mixed or matrixed with the Y signal in a separate matrix, or directly in the picture tube via the grid and cathode terminals. The net result is the reproduction of the original primary red, green and blue signals. In the economy receiver it must be borne in mind that the processing of the chrominance signal to produce the R-Y and B-Y signals involves losing the 0.5 *mc* to 1.5 *mc* color sidebands signals. This will be explained in greater detail subsequently.

The I & Q Chrominance Section

Let us examine the stages that comprise the Chrominance section of a ceiling performance (I & Q) receiver. These are shown in *Fig.* 2. The color sideband signals applied to the chrominance section is obtained at the contrast potentiometer in the cathode of the video amplifier circuit. In certain receiver designs this contrast control may be located in a cathode follower stage so as to provide a low impedance source, thereby insuring less interference as the signal is coupled into the following stage.

To refresh the reader's memory it will be recalled (*Fig.* 3) that the detected video output contains luminance signals from zero to 4.1 *mc*, and a chrominance signal which extends from 2.1 to 4.1 *mc* around a 3.58 *mc* suppressed sub-carrier. This chrominance signal contains the double sideband information (from 0 to 0.5 *mc*) of both the "I" and "Q" signals and the single sideband information (from 0.5 *mc* to 1.5 *mc*) of the "I" signal.

The Bandpass Amplifier

Since signal information other than these chrominance signal frequencies might give rise to spurious circuit operation, that is noise signals at frequencies below 2.1 *mc* and crosstalk between the luminance and chrominance signals, it is desirable to suppress all other frequencies than those between 2.1 *mc* and 4.1 *mc*. For this reason the signal obtained at the contrast control #1 is coupled to a frequency limiting bandpass amplifier as shown in *Fig.* 2. In the plate circuit of this amplifier a filter is employed which restricts the output to a bandwidth of from 2.1 *mc* to 4.1 *mc*. See *Fig.* 4.

The bandpass amplifier is used to perform another function, which is the removal of the eight cycles of color burst. This is accomplished by blocking the bandpass amplifier tube for the period corresponding to the color burst. Blocking takes place by feeding a negative spike of the horizontal sweep frequency from the horizontal output transformer. This voltage spike cuts off the bandpass amplifier during the period of the color burst, thus preventing these pulses from being present in the bandpass amplifier. If the color burst signal were to pass through this stage the overall background of the color picture would be disturbed because of the presence of the recovered burst envelope in the blue output signal. This recovered burst has an amplitude equal to or greater than the horizontal sync signal and could easily cause the blue *dc* restorer to set up an excessive *dc* component.

Another signal fed to the bandpass amplifier is a color killer voltage which is derived from the color sync section. (See *Fig.* 2). This killer voltage causes the bandpass amplifier tube to be cut off when black and white signals are being received, thus preventing signals of any sort being present at the input of the demodulator during black and white programs. If the amplifier were not made inoperative at this time it would be possible for high frequency luminance and noise signals to pass through and eventually be applied as signals to the color grids thereby causing the appearance of *"confetti"* on the pix tube screen. Incidentally, some receivers apply the color killer voltage to the demodulator stages.

Chroma Control

Following the bandpass filter is a chroma control which permits adjustment of the intensity of the color signals entering the I and Q demodulators. This, in turn, results in an increase or decrease of the color signal voltages applied at the input to the matrix.

Also fed into the input of the matrix is the Y or luminance signal which adds luminance information to the above mentioned color signal. The amount of this added luminance may be controlled by the contrast control #2, *Fig.* 2.

It will be noted in *Fig.* 2 that contrast controls #1 and #2, which are the luminance and chrominance contrast controls respectively, are ganged together to provide for a single master contrast control action. This insures "tracking of the chrominance and luminance signals so that for any setting of the "Chroma" control the ganged arrangement of #1 and #2 will retain the correct ratio (relative amounts) of luminance and chrominance signals.

In the actual adjustment of a color TV receiver, for proper color and luminance, the sequence is as follows:

1. The chroma control is turned *off.*
2. The contrast control is turned *off.*
3. The brightness control is adjusted so that the screen is just below the point of illumination.
4. The contrast control is now turned up for the most pleasing black and white picture. Also the brightness control is readjusted to give a proper *black.*
5. The chroma control is now turned up until correct color saturation is obtained.
6. The Phase control is adjusted for proper hue by adjusting the phase control against known colors (such as skin-tones) until these colors appear as they should on the screen.

An analysis of these six steps points up the fact that the contrast control increases or decreases both the color and luminance signal at the same time. To increase the ratio of color signal to luminance, the chroma signal must be turned up. Conversely to decrease the ratio of color signal to luminance, the chroma signal must be turned down. Thus, the chroma control provides a means of controlling the color tints or saturation.

If the pre-set controls are properly adjusted in the chrominance section (particularly in the matrix and color amplifier gain circuits) then, varying the chroma control (see *Fig.* 2) should produce a variation of only the relative saturation of the color voltages applied to the picture tube and not the colors themselves. In fact, a check on the proper adjustment of the matrix and individual color gain controls is to vary the chroma control carefully and to observe the effect on the color picture tube screen. If these variations result in a change in color or hue the previously mentioned matrix and gain control adjustments are at fault. On the other hand, if varying the chroma control as outlined produces a change in color saturation only, the matrix and gain control adjustments are correct.

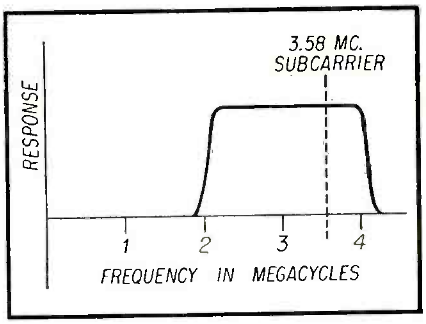


Fig. 4—Bandpass response of bandpass filter in output of bandpass amplifier.

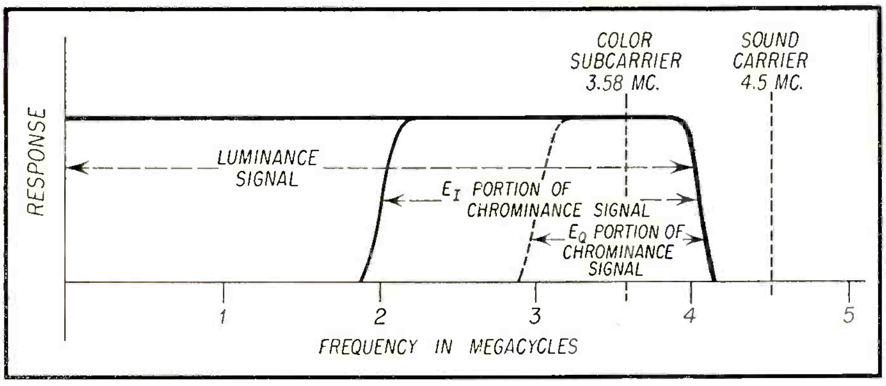


Fig. 3—Complete color picture signal pass band.

Chroma Amplifier

Following the bandpass amplifier and its filter network we usually find an additional stage known as the chroma amplifier. This stage increases the peak to peak amplitude of the color signal at the output of the chroma control and provides equal chrominance signal voltages to both the I and Q demodulators.

I & Q Demodulators

Before analyzing the action taking place in a demodulator it would be well to recall the original make-up of the chrominance signal. It will be recalled that the Q signal is made up of low video frequencies (0 to 0.5 *mc*) corresponding to the low acuity colors around purple and green and the I signal is made up of the high video frequencies (0 to 1.5 *mc*) corresponding to the high acuity colors around orange and cyan. It will also be recalled that the I and Q signals modulate a set of 3.58 *mc* quadrature carriers and are transmitted on a single suppressed carrier frequency as a pair of signals displaced by a phase angle of 90 degrees. The suppressed carrier Q signal is double sidebanded and the suppressed carrier I signal is double sidebanded up to 0.5 *mc* on each side of the carrier and single sidebanded from 0.5 *mc* to 1.5 *mc* on one side of the carrier. These two signals comprise the chrominance signal.

The primary purpose of the demodulator is to separate the I and Q suppressed carrier sidebands combined in the chrominance signal, and to reconvert them back into video frequencies identical to the original I and Q signals. To do this the input of each demodulator is fed the chrominance signal and a separate 3.58 *mc* oscillator signal, the latter being applied as follows: The phase of the first 3.58 *mc* signal fed to the I demodulator is in phase with the I component of the suppressed carrier chrominance signal, and the phase of the second 3.58 *mc* fed to the Q demodulator is in phase with the Q component of the suppressed carrier chrominance signal.

The plate circuits of these demodulators, under the above mentioned conditions contain signal products, which, in the case of the I demodulator is the I signal in its original video frequency form. The manner in which these transitions take place will be described in greater detail subsequently.

It might be pointed out that the action described above is strictly true for the I demodulator but not for the Q demodulator. The reason for this is as follows:

In the I demodulator the complete I signal is passed by the circuit because it is *in phase* with the first 3.58 *mc* oscillator signal applied. The Q signal being 90 degrees out of phase with the first 3.58 *mc* signal develops equal and opposite voltages in the plate circuit which cancel out because it is double sidebanded; so that the Q signal is rejected.

In the Q demodulator the complete Q signal is passed by the circuit because it is in phase with the second or quadrature 3.58 *mc* signal applied. The I signal, however, is rejected only for that portion of its spectrum where it is double sidebanded (0 to 0.5 *mc*) for the same reason that the double sidebanded Q signal is rejected in the I demodulator. From 0.5 *mc* to 1.5 *mc* the I signal is single sidebanded, and that portion of the I signal is not rejected in the Q demodulator. This component of I signal is referred to as "Quadrature Crosstalk," and must be eliminated. This is done by the insertion of a 0 to 0.5 *mc* filter in the output of the Q demodulator which effectively rejects the 0.5 to 1.5 *mc* quadrature crosstalk components previously referred to.

Referring to the block diagram of *Fig.* 2 it will be observed that the I demodulator contains a 0 to 1.5 *mc* filter. This filter in the I channel is primarily designed to provide attenuation of signals other than the 0 to 1.5 *mc* video color signals which may find their way through the demodulators. Such signals are derived from the luminance channel.

Time Delay Networks

The passage of the Q signal through the zero to 0.5 *mc* filter introduces a time delay which is somewhat greater

[*Continued on page 54*]

Weston Model 981
Proportional Mutual Conductance Tubechecker

understanding and servicing Horizontal Output Transformer circuits

by Oscar Fisch

PART 2

A discussion of the operating principles of horizontal output transformers, together with procedures designed to facilitate rapid servicing and replacement.

IN the previous installment the impedance matching function of the horizontal output transformer was discussed in some detail. It was pointed out that the matching of the impedance of the horizontal deflection coils (the load) to that of the horizontal output tube (the generator), is a necessary requirement if maximum power transfer is to be obtained.

This may all be interesting from a theoretical point of view, but it might be worth while at this point to examine the practical implications of impedance matching. Once again, a very close comparison can be made between the corresponding parts of a radio receiver and a TV receiver. In the radio receiver, the action taking place from the audio output tube to the speaker may be summarized as follows:

1. The audio output tube (see *Fig. 1A*) delivers power to the output transformer in the form of an audio signal current.

2. The output transformer delivers this power to the voice coil of the speaker.

3. The audio signal current through the voice coil produces a magnetic field, the strength of which varies in step with the strength of the current.

4. This varying magnetic field reacts with the steady field of the permanent magnet (or the electromagnet of an electro magnetic speaker). The reaction between these two fields results in a movement of the speaker cone and the consequent production of sound.

5. The greater the variations in the magnetic field through the voice coil, the louder will be the sound issuing from the speaker.

6. Thus, to get the loudest sound from the speaker, requires the delivery maximum power to the voice coil from the output tube. The output transformer provides this maximum possible power by matching the voice coil impedance to that of the output tube.

A step by step comparison with the action in a TV receiver shows a very close correspondence, as follows, and as illustrated by *Fig. 1B*.

1. The horizontal output tube delivers power to the horizontal output transformer in the form of a sawtooth horizontal sweep current.

2. The output transformer delivers this power to the horizontal deflection coils in the deflection yoke.

3. The sweep signal current, flowing through the horizontal deflection coils, produces a magnetic field through the neck of the picture tube. The strength of this field varies in step with the strength of the current.

4. This magnetic field is directly across the path of the electron beam within the cathode ray tube. As the beam passes through the field, it is deflected to the left or to the right, depending on the polarity of the field. The amount of deflection depends on strength of the magnetic field.

5. The greater the variation in magnetic field strength, the greater will be the deflection of the electron beam.

6. Thus, to produce the maximum deflection of the electron beam requires the delivery of a maximum current swing to the deflection coils. This in turn produces a maximum overall change in magnetic field strength. The horizontal output transformer provides for the delivery of maximum available power by matching the impedance of

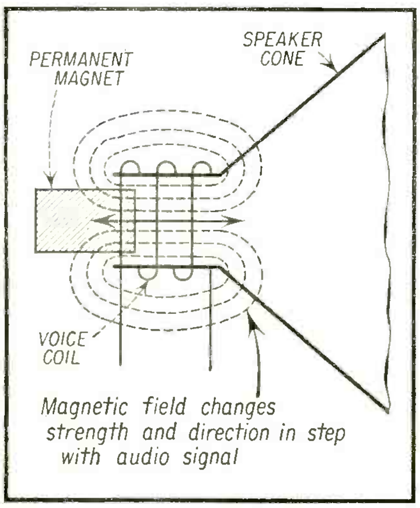


Fig. 1A—Action of magnetic field in speaker.

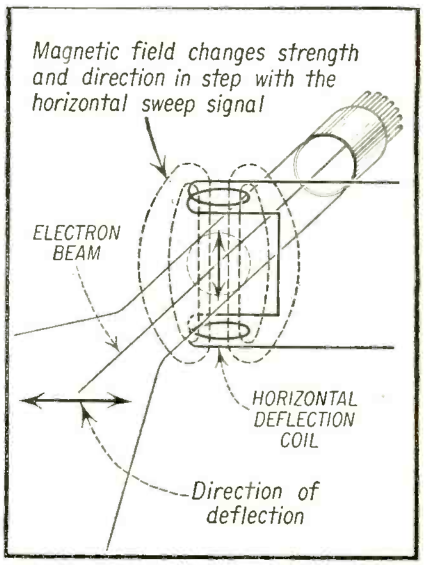


Fig. 1B—Action of magnetic field in horizontal defl. coils of CRT.

the deflection coil to that of the horizontal output tube.

How does all this bear on the problem a service technician faces when the horizontal output transformer must be r placed? Actually, it must be admitted hat what nearly always happens is that the technician hies himself to his favorite distributor and says "Hiya Jerry! I need a flyback for an Admiral 121 M 12A." Jerry then thumbs through the pages of a replacement catalog and comes up with a Stancor A-8134 or other make replacement flyback transformer. Another common procedure would be to get an exact replacement from the manufacturer. Neither of these procedures requires any extensive knowledge on the part of the technician, so why bother with all this business of impedance matching, deflection angles, etc., etc. Our answer is that when a serviceman understands these basic principles, he becomes more proficient in diagnosing and remedying troubles. This increased proficiency can be translated directly into dollars and cents by cutting down substantially on the time required for repairs.

In the light of the previous discussion, we might summarize the deflection power requirements as follows. Suppose a receiver uses a 19GP4 picture tube. Examining the characteristics of this tube shows that the deflection angle is 66°. This is the starting point for which the other components in the deflection circuit are designed. In *Fig. 2*, the line OA represents the electron beam of the left end of the raster, while OB is its position at the right hand end. The deflection angle of a CRT, in this case 66°, is the angle formed by these two extreme positions of the beam.

The force which is used to deflect the beam over this angle is derived from the saw tooth wave of current flowing through the deflection coils, as mentioned previously. *Fig. 3* is a graph of this current. A and B on the solid line graph are the maximum negative and positive values of the current through the coils, and at these current values the magnetic field deflects the beam to OA and OB respectively, in *Fig. 2*.

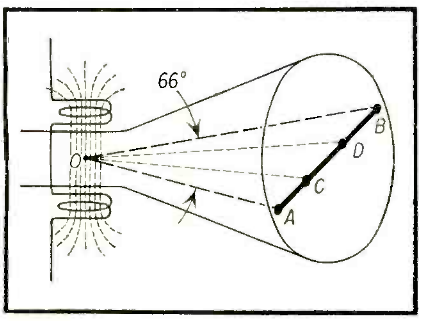


Fig. 2—Deflection angle of a CRT (19GP4).

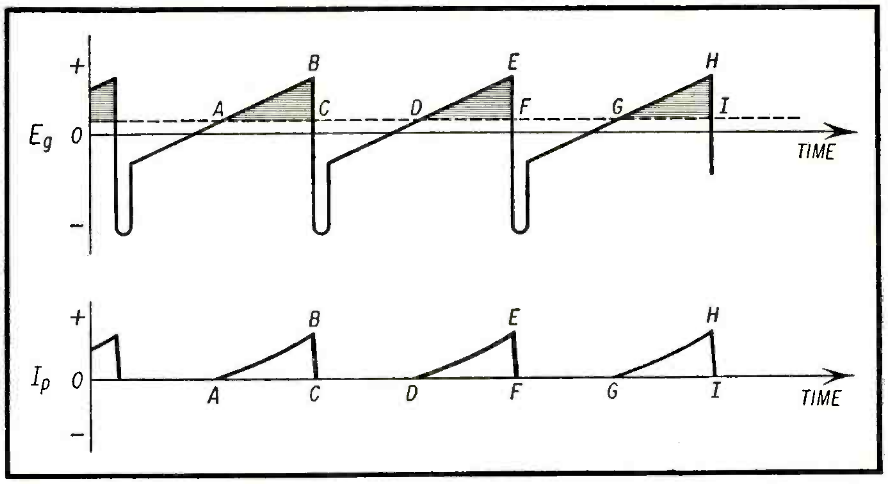


Fig. 4B—Signal voltage at grid of horizontal output tube. Current flows only during shaded portion of signal. Fig. 4C—Current flow in the plate circuit of the horizontal output tube.

The next step is to design the deflection coils so that the desired deflection may be produced with the available power from the output stage. Thus we have 70° yokes, 57° yokes, etc. If, for any reason, the current through the deflection coils is reduced, as shown by the dotted line of *Fig. 3*, the beam will be swept through a smaller angle. This would be the angle formed by CO and DO of *Fig. 2*, and of course indicates reduced width of the picture.

Obviously, an improper match could be responsible for such a reduction in sweep width. The properly designed horizontal output transformer, then forms the final connecting link in the chain between the horizontal output tube and the electron beam in the CRT.

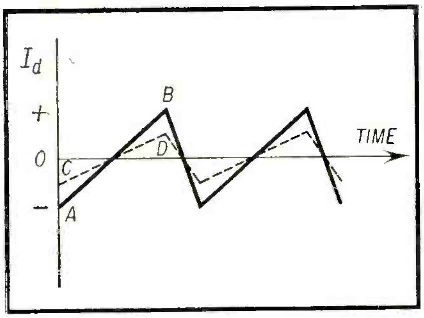


Fig. 3—Current through horizontal deflection coils, corresponding to deflections in Fig. 2.

This is why for example, flyback transformer and deflection yokes are frequently sold as matched sets for larger tube conversion jobs. This is also why the technician, when replacing either the flyback transformer or the deflection yoke must always consider whether the replacement part will provide proper matching.

Replacement transformers of the "universal" type are designed for angular deflections of from 50° to 70°. Any deflection angle within this range may be

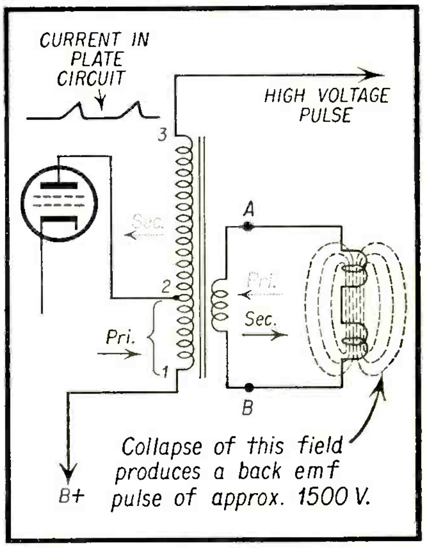


Fig. 4A—Production of H.V. pulse for 2nd anode.

handled by selecting the proper taps. For 24 inch picture tubes and larger, 90° deflection angles are used. The universal replacement transformer, therefore cannot be used in this application. Flyback transformers specifically designed for a 90° deflection must be used.

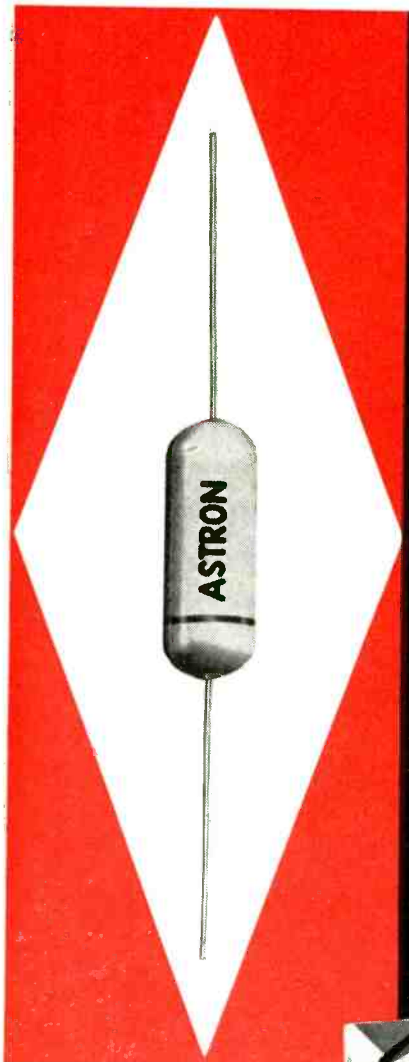
High Voltage Production

It was pointed out in the previous installment that the production of a high voltage for the picture tube second anode is another major function of the horizontal output transformer. This must be taken with a very slight grain of salt. There are a few receivers (very few) which use an *rf* power supply for high voltage production. These receivers use the basic horizontal output transformer, which is not concerned with high voltage production. For clarity, this is the only type we might truly call a horizontal output transformer.

The much more common type which

[*Continued on page 56*]

Worried about callbacks?



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sectionalized PRINTED CIRCUIT TV *receiver*

by **Walsco Electronics Corp.**

A unique TV receiver utilizing sectionalized printed circuit units in a vertical chassis of new design.

A NEW innovation in chassis design and construction which is entirely different than the conventional has just been announced by the Walsco Electronics Corporation. Its primary features are:

1. Nine printed-circuit plug-in assemblies (see Fig. 1), each quickly removable.
2. A vertical chassis with components and wiring visible from front or rear.
3. Remote control operation.

From the point of view of maintenance this receiver is almost a serviceman's dream. Upon removal of the rear panel (see Fig. 2) all parts and tube socket terminal are accessible for immediate checking. Also, because of the sectionalized feature of this receiver as is evident in the schematic (Fig. 3), important test points are at the technician's fingertips for quick testing and diagnosis. Finally, in cases where alignment adjustments are necessary, they too are immediately accessible.

Of even greater significance than the above, from the point of view of servicing, is the possible technique of stocking replacement strips and providing quick and immediate service by installing a complete strip for one in which any of the components is defective or misaligned. In this manner the customer receives a "factory-rebuilt" replacement, a technique which is used today in many fields for quicker service and greater profits.

The chassis design, especially with the remote control feature, lends itself to custom installations and cabinet design, with a flexibility that should satisfy the wildest-eyed interior decorator. Here again is an item the dealer or technician can sell with considerable latitude for the inclusion of accessories and installation charges.

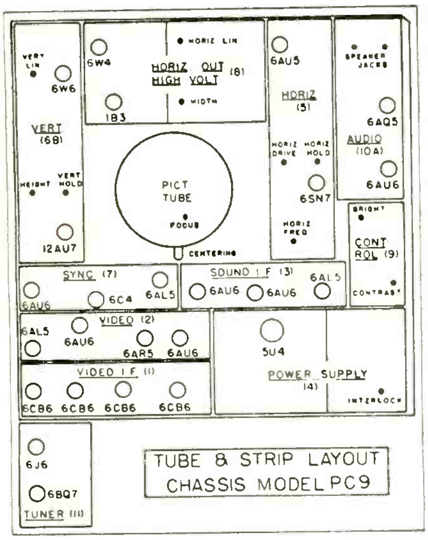


Fig. 1—Tube and printed circuit strip layout of Walsco Model PC9 TV receiver. Shown also are the various adjustment controls available for immediate adjustment.

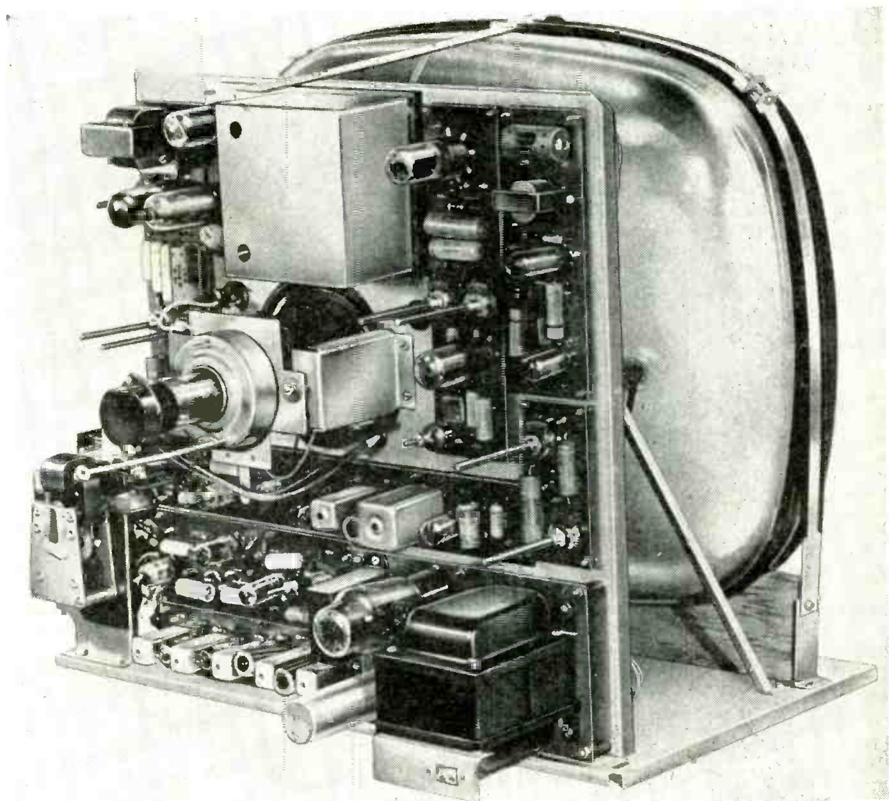
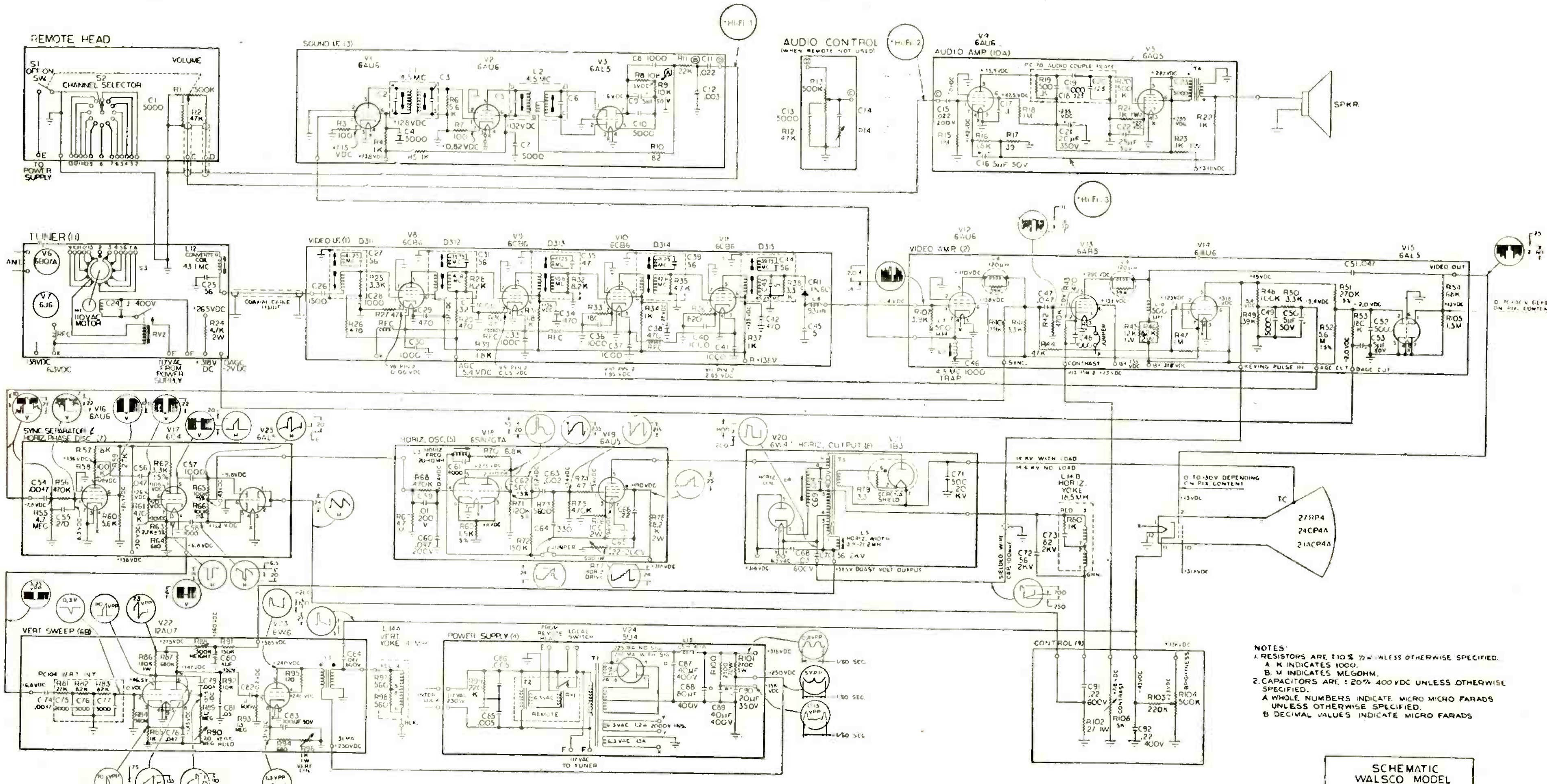


Fig. 2—Appearance of receiver on removal of rear panel.



NOTES:
1. RESISTORS ARE ±10% ½W UNLESS OTHERWISE SPECIFIED.
A. K INDICATES 1000.
B. M INDICATES MEGOHM.
2. CAPACITORS ARE ±20% 400VDC UNLESS OTHERWISE SPECIFIED.
A. WHOLE NUMBERS INDICATE MICRO MICRO FARADS UNLESS OTHERWISE SPECIFIED.
B. DECIMAL VALUES INDICATE MICRO FARADS

SCHEMATIC
WALSCO MODEL
PC-9
TELEVISION RECEIVER

Due to the service system designed into the WALSCO PC-9 chassis, service trouble can easily be diagnosed by aid of the following chart. The items are listed in order of decreasing probability. Degree of trouble is not noted.

Symptom

No Sound, but picture O.K.
- Audio amp. #10A
- Sound IF amp. #3
- Vol. Control
- Remote lead on tuner plug
- Speaker disconnected

No Picture, but raster lines on screen, Sound O.K.
- Video amp. #2
- Contrast control #9

No Sound, no picture but raster lines
- IF amp. #1
- Tuner
- Video amp. #2

No Sound, no picture, but raster lines with snow or noise flashes.
- Check ant. and ant. lead in wire at tuner.

Sound but no raster lines.
- Check for high voltage by sparking from ground to corona shield or picture tube anode. Do not leave shorted. Be careful of shock hazard.
- If there is HV—
  - Anode lead off
  - Ion Trap adjustment
  - Brightness control #9
  - Picture tube
- If no HV—
  - Horz. out. #8
  - Horz. osc. #5
  - Power supply #4 (damper fil. winding short)
  - Yoke
  - Vertical #6B (shorts boost voltage)

No Horz. sync. but vert. o.k.
- Adjust horz. freq. coil
- Sync. separator #7
- Horz. osc. #5
- Control strip (sawtooth)

No vert. sync., horz. sync. o.k.
- Vert. #6B
- Sync. #7
- Overload (signal too strong)
- Video amp. (AGC)
- I-F amp

No. vert. or horz. sync.
- Sync. #7
- Video Amp. #2
- Tuner mistuned

No vert.
- Vert. #6B
- Yoke
- Horz. out. #8 (bootstrap)

Set dead:
- Power supply #4
- On-off switch, relays, wiring, etc.
- Not plugged in or getting current

Tuner motor keeps running
- Short in remote head
- Short in selector switch
- Selector switch out of timing with tuner, detent.

Excessive snow in picture.
- Weak signal
- Poor antenna or lead-in
- Tuner 6BQ7A cutoff
- Video amp. (AGC, DAGC)

Since the possibility may exist that more than one section may be defective at the same time, first get a set working by using and leaving in good test strips. Then replace the test strips one by one with suspected strips until the defective one is found.

*Hi Fi Notes:
1, 2 & 3 refer to connections of this chassis to a separate high fidelity amplifier.

Fig. 3—Circuit diagram of Walsco, Model PC9 printed circuits receiver.

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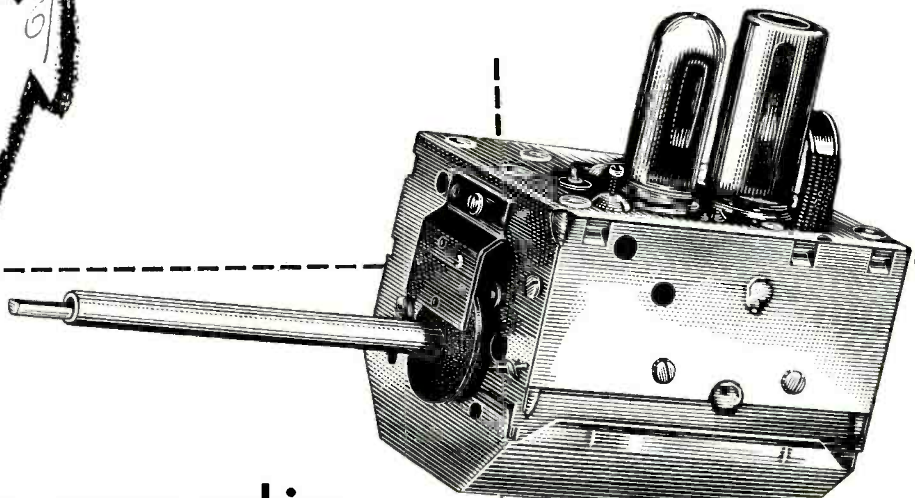

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Hundreds of TV set owners in your community will welcome the sharper, stronger pictures afforded by newer, more powerful Standard cascode and pentode tuners. And a completely new Standard replacement tuner often costs your customer *less* than the parts and labor required for a major repair to the original tuner.

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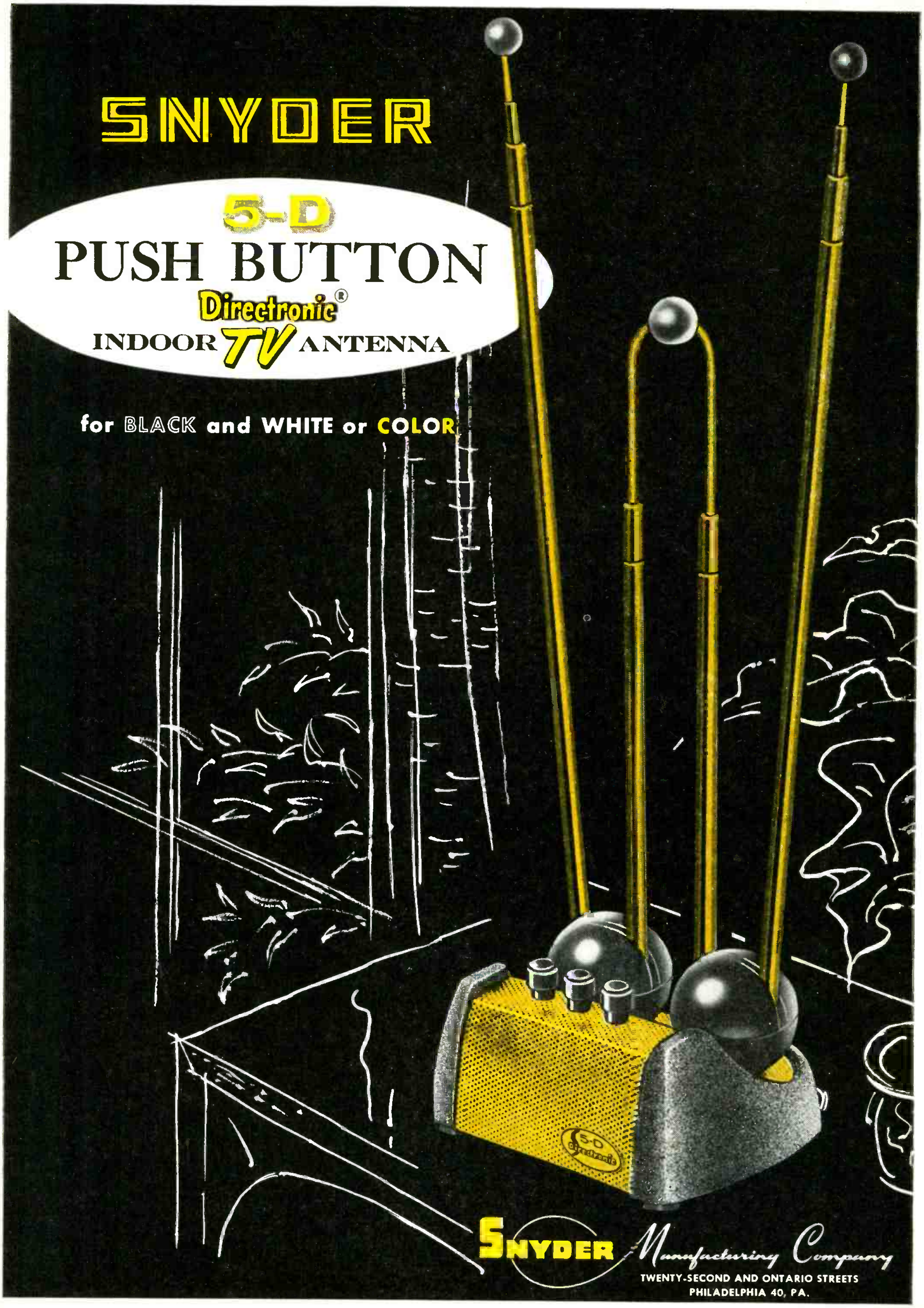
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TV INSTRUMENT CLINIC

PART 5

Based on CHALLENGE CLINIC demonstrations, this new series discusses many measurement and test problems raised by service technicians.

By ROBERT G. MIDDLETON

Field Engineer,
Simpson Electric Co.

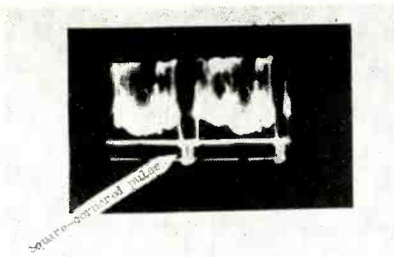


Fig. 1—Scopes with wide band vertical amplifiers display square corners on pulses.

Q. I have two scopes in the shop, but they do not show the same waveforms when testing horizontal sync pulses; also, when testing vertical sync pulses, the horizontal lines in the pattern appear much brighter than the vertical lines in the pattern. What is the reason for these troubles?

A. Scopes with wide-band vertical amplifiers display the square corners of pulses, as shown in *Fig. 1*. However, scopes with narrow-band vertical amplifiers round off the corners of pulses, as illustrated in *Fig. 2*. Waveform displays often exhibit considerable difference in the brightness of horizontal and vertical excursions in the pattern (*Fig. 3*) because of velocity modulation; i.e., the beam may be traveling faster in the vertical direction than in the horizontal direction; this difference in the speed of beam travel results in velocity modulation of the pattern brightness. Velocity modulation becomes less apparent when the vertical-gain control is reduced in setting, and the horizontal-gain control is advanced in setting. *To avoid distortion of high-frequency waveforms such as horizontal sync pulses, make direct connection of the video-amplifier output to the vertical-deflection plates to the CRT in the scope.*

Fig. 2—Rounded pulse display.

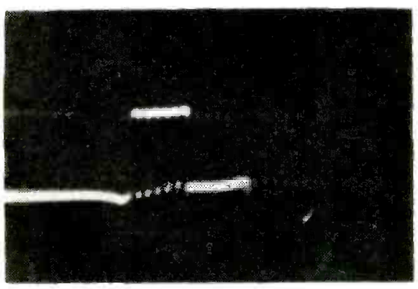


Fig. 3 — Difference in brightness caused by velocity modulation.

Q. When checking the video signal in some receivers, the vertical sync pulse appears to fall below the level of the horizontal pulses. Then, after the vertical pulse passes, the response rises again. What causes this trouble?

A. The situation noted above is illustrated in the photo of *Fig. 4B*. The vertical sync pulse falls in the display because of differentiating action in the video amplifier. For example, the coupling capacitor *C* shown in *Fig. 4A* may be found to be too small, or the grid-leak resistor *R* may be found to be too small. As a result, the theoretical signal shown in the diagram becomes distorted in practice as seen in the photo. (Note that the scope display is "upside down" with respect to the diagram.)

Q. My scope does not sync tightly on some of the waveforms encountered in the TV chassis. What can be done to improve the sync lock?

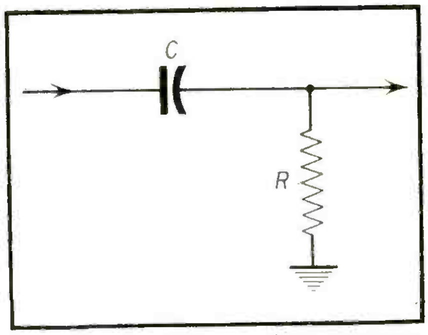


Fig 4A—An RC coupling arrangement such as used in a typical video amplifier stage.

A. A sync-sharpener may be used, as shown in *Fig. 5*. The sync-sharpener differentiates the waveform, and converts it into spikes which are usually more effective in locking the horizontal sweep circuit of the scope. Video signals are often difficult to lock because the camera signal is a random changing voltage; in such case, the operator will often find it advantageous to utilize the external sync facility of the scope. Switch the scope to external sync, and run a test lead from the external sync post to a point within a few inches of the picture tube screen. The pulse radiation from the picture tube will provide a clean tight locking voltage.

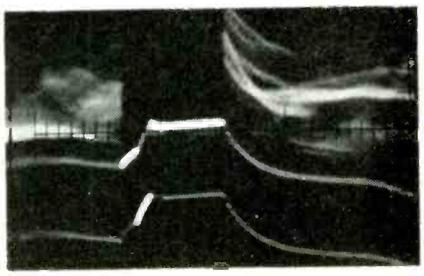


Fig. 4B—When the time constant RC is too small to accommodate the vertical blanking pedestal, the pedestal becomes differentiated (low frequencies are lost and shifted in phase).

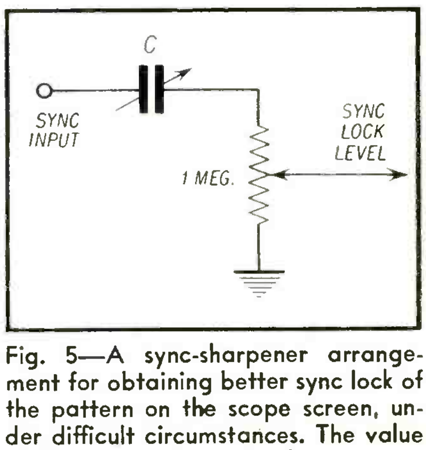
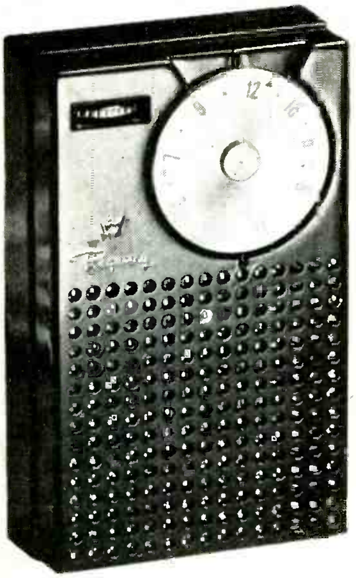


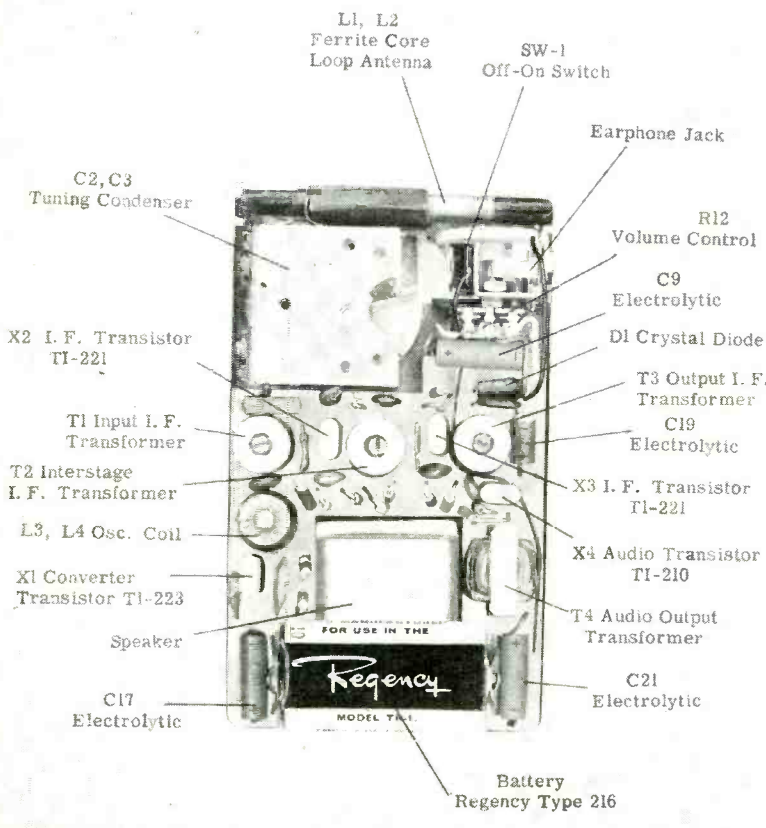
Fig. 5—A sync-sharpener arrangement for obtaining better sync lock of the pattern on the scope screen, under difficult circumstances. The value of C must be determined experimentally.

TRANSISTOR PORTABLE

The commercial applications of new components and circuitry continues without a letup as is evidenced by this revolutionary portable radio



Full view of transistor portable radio. Relative size compared to that of a teacup is shown in the upper right corner.



Exposed view of chassis shows various components corresponding to circuit diagram notations. Observe use of miniature components.

THE revolutionary pocket radio described below is the first in the history of the electronics industry to use transistors instead of tubes, and is now in production by Regency of Indianapolis.

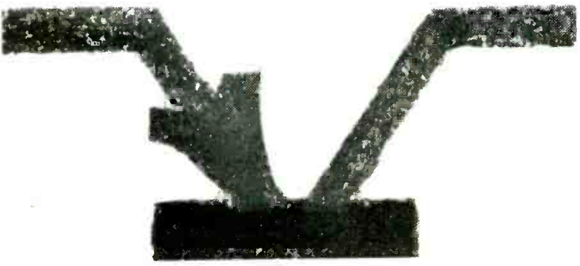
According to Mr. Edward C. Tudor, I.D.E.A. prexy, the Regency pocket radio represents the first commercial adaptation of the transistor to a radio. "We were able to achieve this—and the accompanying miniaturization—through close cooperation with Texas Instruments Incorporated of Dallas, who effectively engineered and produced the essential high performance transistors that made our radio possible," he said.

"The development of the transistor itself marks a significant milestone in the history of electronics," he said. "Just as its perfection and adaptation enabled us to manufacture the Regency pocket radio, so does its development promise to change the size, appearance and nature of hundreds of other items in our daily life—possibly even our way of life itself," he added. "We are pleased to have worked with Texas Instruments, a company so prominent in this important revolution in our industry. This transistor development, in our opinion, rivals their important exclusive production of silicon transistors and assures the industry of more developments to come," he added.

Technical Features

Some of the interesting technical features of this receiver are as follows:

The power supply is a single 22½ volt hearing aid battery. The power drain is approximately 4.3 *ma* with no signal, reducing to about 4 *ma* with *avc*



action on a local station. Battery life varies between 20 and 30 hours, depending on use.

New high performance NPN, grown junction germanium type transistors are used, developed by Texas Instruments Incorporated, for this receiver aplication. These are as follows (see schematic):

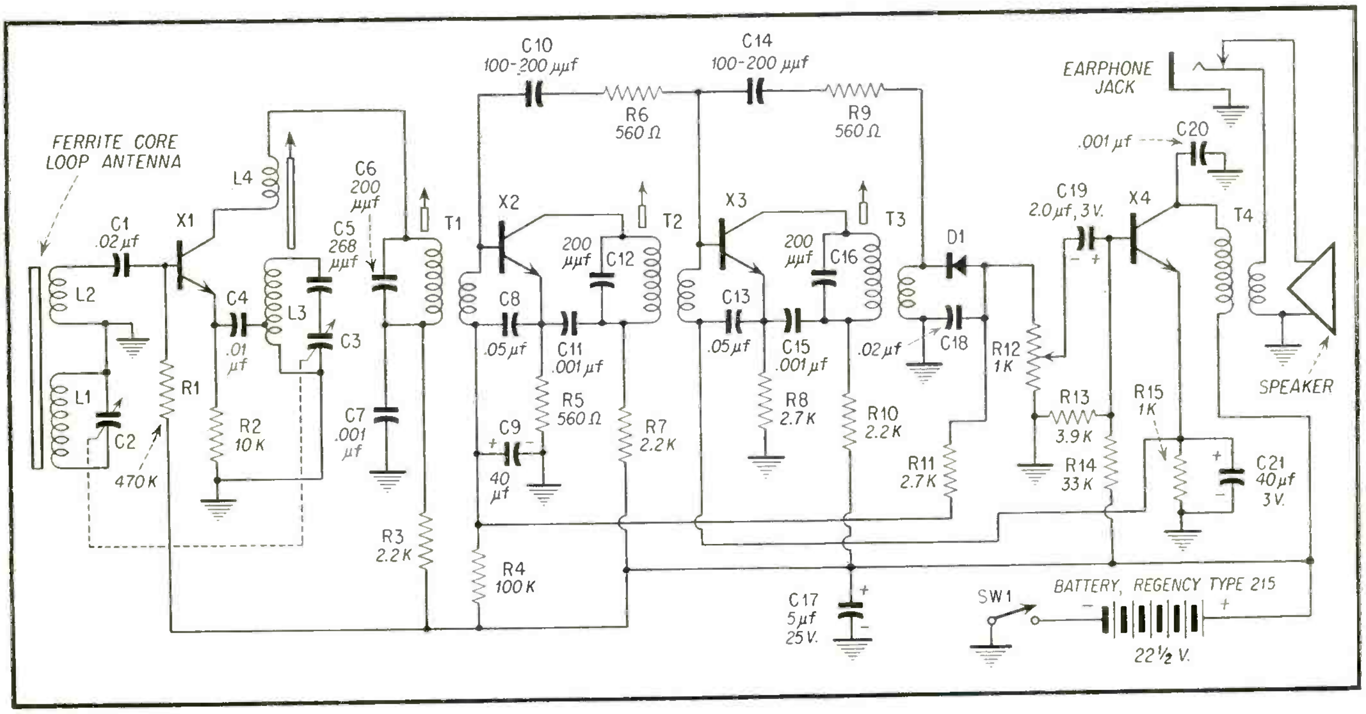
X1. Converter Oscillator—Texas Instruments No. TI-223

X2. First Intermediate Frequency Amplifier—Texas Instruments No. TI-221

X3. Second Intermediate Frequency Amplifier—Texas Instruments No. TI-221

X4. Output Audio Amplifier — Texas Instruments No. TI-210

D1. Is a germanium diode with a selected characteristic for low forward impedance at low signal levels
Raytheon—CK706A or
Tungsol—TS117



Circuit diagram of Regency Model TR-I transistor pocket radio receiver.

A new standard in electrical and mechanical perfection in all 32 new YAGI antennas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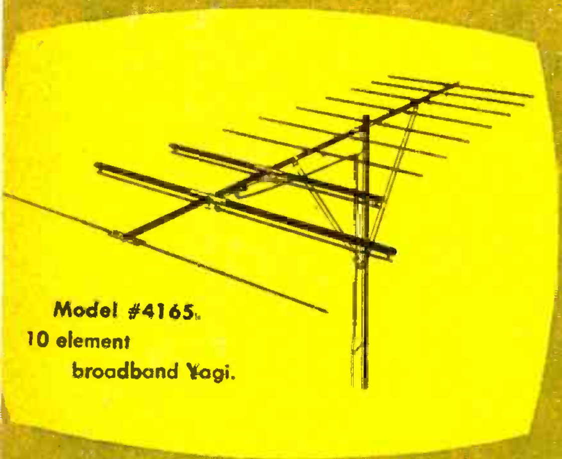
Model #4165. 10 element broadband Yagi.

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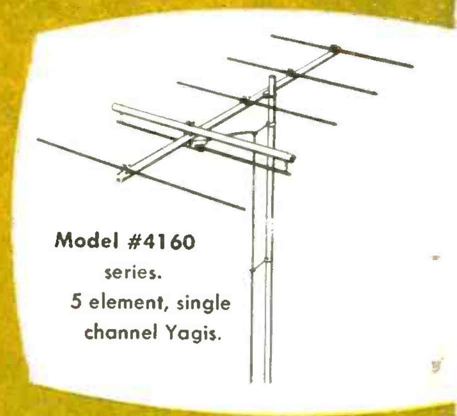
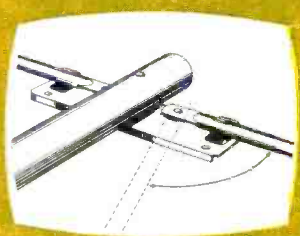

Model #4160 series. 5 element, single channel Yagis.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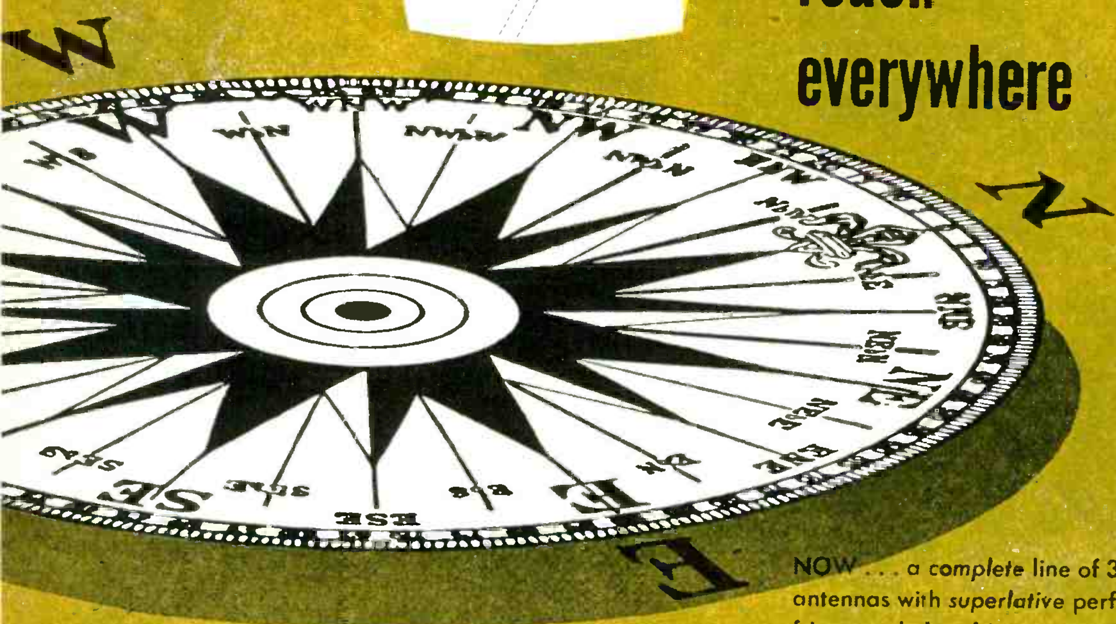

NOW . . . a complete line of 32 "futurized" Yagi antennas with *superlative* performance . . . for fringe and ultra-fringe areas; for black and white and color or all present and future channels. No loose hardware . . . completely pre-assembled using Walsco's exclusive "umbrella" snap-out design. Nothing compares at any price!

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"The Answer Man"

by BOB DARGAN

Do you have a vexing problem on the repair of some radio or TV set? If so, send it in to the Answer Man, care of this magazine. All inquiries acknowledged and answered.

Note: Only communications with Radio-TV Service Firm letterheads will be considered and answered. Please indicate make, model, and chassis number of receiver.

G.E. Model 24C101—Ripples in Pattern

Dear Answer Man:

I have a G.E. receiver Model 24C101 that has a peculiar condition in it. There are ripples in the picture but they are not horizontal or vertical ripples as far as I can determine. In examining the condition on a test pattern they seem to be more pronounced in the outer circle of the pattern. These waves seem more noticable at the top of the test pattern circle and are present with any channel selected.

I have checked the usual parts such as tubes, voltages, resistors, etc. The tubes have all been replaced and all voltages are correct as indicated in the service literature. The only thing that might be of help is the fact that this ripple can be affected a little with the horizontal hold control adjustments. At a certain point the waviness is reduced to a minimum but still is noticeable. Whan can be causing this trouble?

E. V.
Philadelphia, Pa.

The condition you have described is usually termed "Piecrusting" and is due to an open condenser in the automatic frequency control circuit of the horizontal oscillator.

The horizontal *afc* circuits provide a correction voltage to be applied to the horizontal oscillator circuit; and in this case to the reactance tube. This correction voltage should bring the oscillator to the proper operating frequency. However, if there is something wrong in the *afc* circuit so that an incorrect voltage is applied to the oscillator or its reactance tube the circuit will hunt for the correct frequency where the sync pulse is locked in with the deflection system. With this hunting process will be a slight shift in phase of certain portions of the picture. A group of horizontal lines will be shifted first to the right and then to the left as the horizontal oscillator hunts for the correct frequency and phase. The effect is a ripple on the outer circles of a test pattern or what can easily be recognized as "Piecrusting".

The *afc* circuit, because of a defective component, will over-correct in one direction by applying too much voltage to the horizontal oscillator circuit. This over-correction then causes the horizontal oscilator to shift in phase a slight amount. Then it will over-correct in the opposite direction. This results in a slight shift in certain portions of the picture, each horizontal sweep line not being directly below the previous line.

Varying the horizontal hold control will change the amount of ripple in the picture because this alters the horizontal oscillator voltage in phase. Therefore, varying the horizontal hold control will permit varying degrees of oscillator hunting and different amounts of ripple.

As shown in *Fig. 1* three filter condensers should be checked to determine which condenser is open. The most likely condenser to suspect is the .015 *uf* condenser in series with 68K resistor.

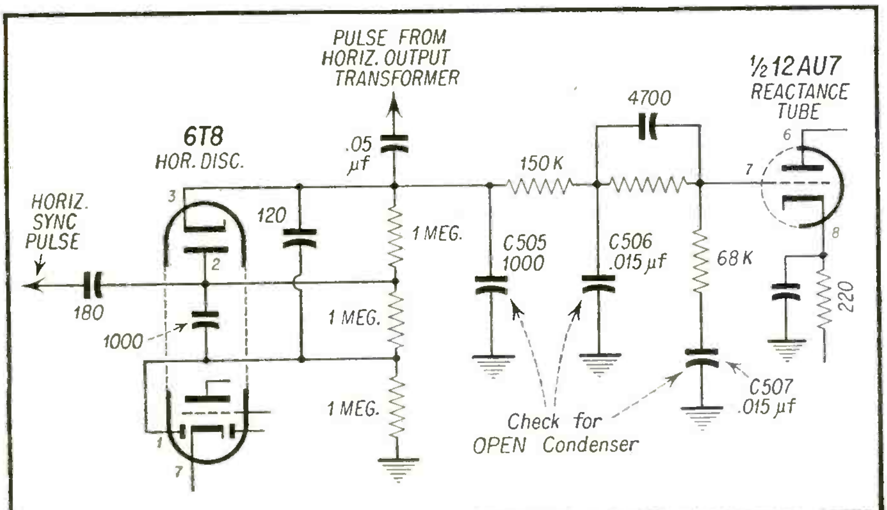


Fig. 1—G.E. Model 24C101 Horizontal Phase Comparer circuit and reactance tube.

Sylvania Chassis 1-510-1—Horizontal Drifts

Dear Answer Man:

In servicing a Sylvania Chassis 1-510-1 the reason for the receiver being taken to the shop was for poor vertical lock-in action. The integrator network was checked and found to be open. Another one was obtained and installed. Then I found that I also had horizontal sync trouble. The integrating network corrected the vertical sync trouble but the horizontal oscillator drifts as though there were no sync pulses to lock it in. I have gone over the circuits a number of times and I haven't been able to locate the trouble. Do you have any ideas on this one? Could there be something wrong in the new integrator network?

D. S.
St. Louis, Mo.

Undoubtedly what has hapened is that in the installation of the integrating network the terminals were reversed.

These small printed circuits are good and have been used in quite a number

[Continued on page 54]

A New TV Remote Control Tuner

by
Irvin R. Gwirtz
Remot-O-Matic
Los Angeles, Calif.

Description of a versatile TV remote control unit, a good source of income for the enterprising and sales-minded dealer or serviceman.

THE advent of remote control units for television receivers has opened another profit door for the TV dealer and technician. These accessories are now priced so that all owners of TV receivers can afford them. A little enterprise on the part of the dealer in making his customers aware of the advantages of this device should net him handsome returns in the way of sales and installation fees.

The De Luxe model of the Remot-O-Matic provides a remote unit which gives the user control of six functions, these being:

1. On-and-off control
2. Sound control
3. Brightness control
4. Contrast control
5. Channel switching
6. The convenience of taking the sound control away from the set so that the sound is controlled from the remote unit or at the set itself . . . as desired.

Described below are the installation instructions for the Remot-O-Matic remote control unit. These instructions are presented in order to give the technician an idea of the relative ease with which these units can be installed. Detailed wiring instructions have been omitted inasmuch as the wiring diagram shown on the next page is self-explanatory. However, detailed wiring instructions do come with every unit.

Installation Instructions:

1. Remove chassis from the cabinet and place it on working area so that the tuner is easily accessible.
2. The Motor Assembly is to be mounted directly behind the tuner with the shaft of the Motor Assembly lined with the shaft of the tuner as follows:

[There must be room for it . . . or the Remot-O-Matic Adapter kit must be used for interior installation.]

Select the location to be used for mounting the brackets (Figure 1). Various designs of chassis allow for different locations for the mounting brackets. In Figures 2, 3 and 4 you will see three different locations and methods for mounting the brackets. These three locations and methods cover nearly all possibilities, however, the brackets are so constructed that they allow for wide range of positioning in increments of 1/16".

3. Where the methods in Figure 2 or Figure 3 apply, take the following steps:

   A. Decide on the surface where you intend to mount the bracket whether it be on the side of the chassis or the main base of the chassis.

   B. Place brackets of Figure 1 together to form complete mounting brackets as shown in Figure 5.

4. Mount the Motor Assembly to bracket B (Figure 1) and secure with two #8 screws and lock washers . . . into the mounting studs of the Motor Assembly.
5. We have a 6" shaft on the Motor Assembly which may be cut to any length. Place the Motor Assembly in the approximate position you have in the chassis and thus determine the length of shaft needed. It is important that a gap of from 1/32" to 1/8" be maintained between the shaft of the tuner and the shaft of the motor.

Note: If the tuner shaft does not protrude through the rear wall of the tuner, it will be necessary to drill a hole in the rear wall of tuner so that the coupler can slide onto the tuner shaft without binding.

[*Continued on page 55*]

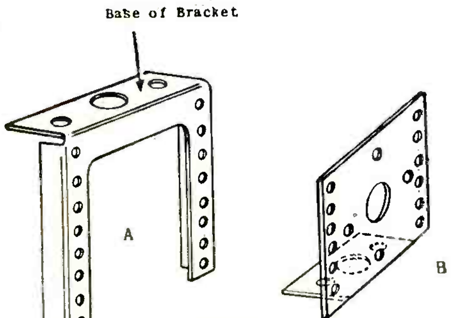


Figure 1

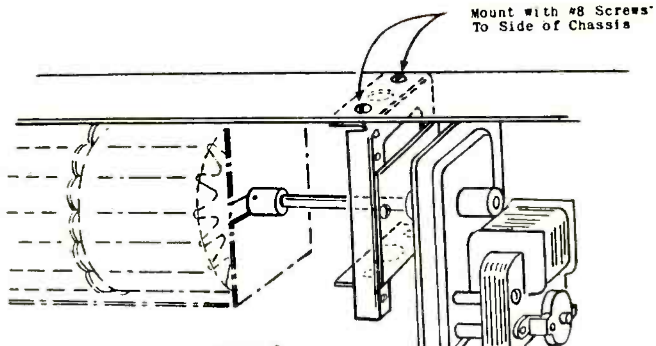


Figure 2

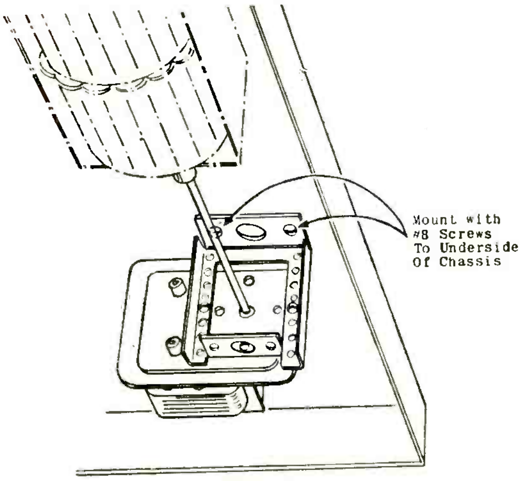


Figure 3

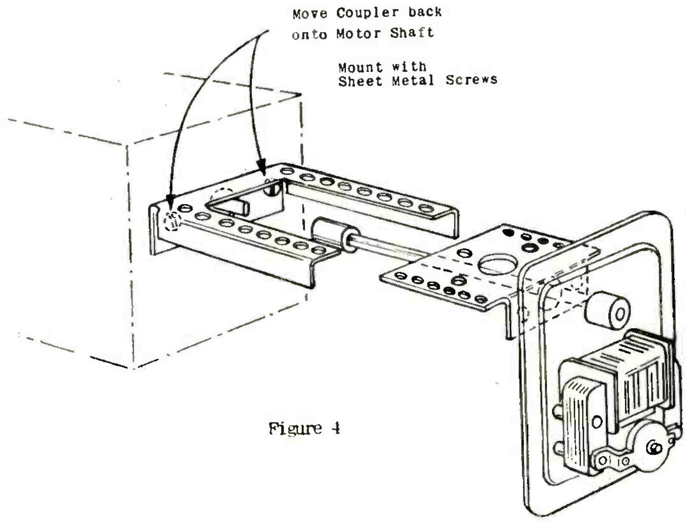


Figure 4

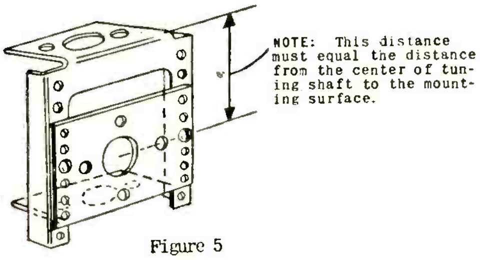


Figure 5

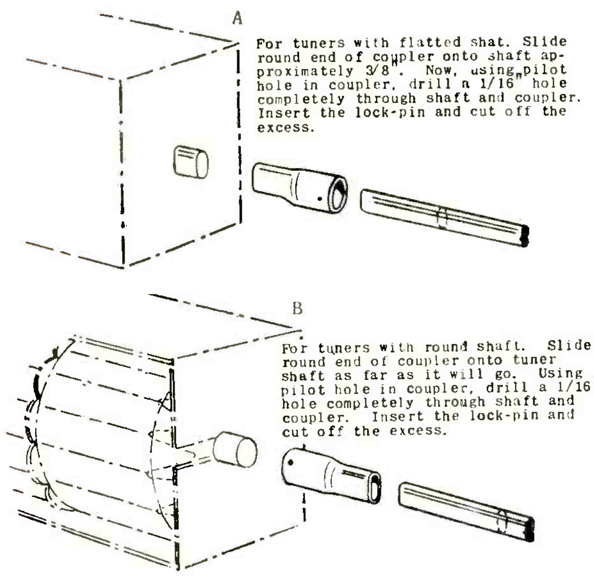
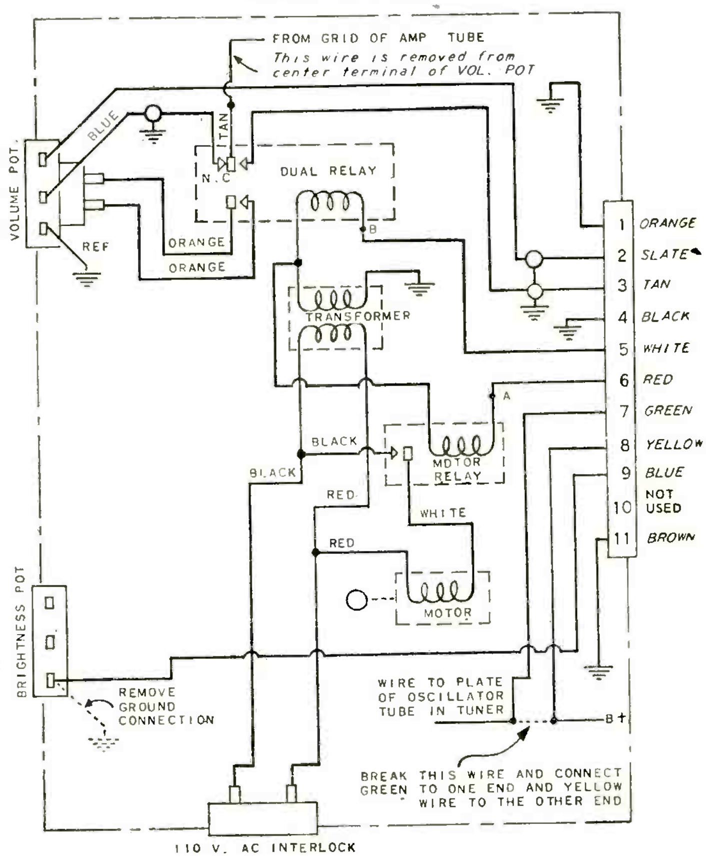


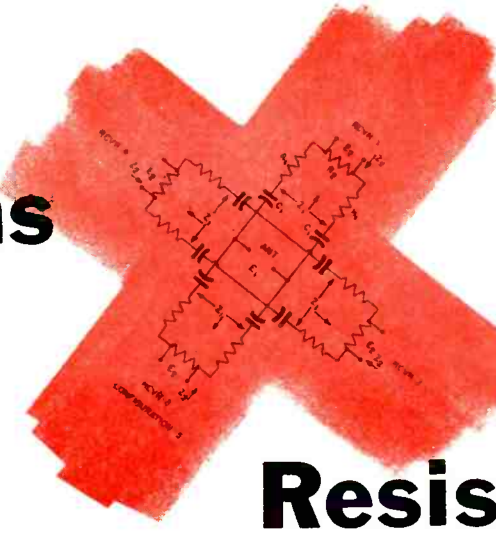
Figure 6

WIRING DIAGRAM



1154 REMOT-O-MATIC L.A. CALIF

applications of Resistive Networks



by J. C. Geist

Comprehensive design data and applications of resistive networks in TV measurements and antenna signal termination and distribution.

MOST technicians have used resistive networks in some phase of TV service work. However, there does not seem to be a general recognition of the wide variety of uses these simple devices can serve as auxiliary service aids. *Table 1* lists a number of different types of resistive networks and the pertinent characteristics of each type. The table in turn refers to the applicable circuit configurations which are shown in the attached drawings. While it is true that for most of the applications listed, there are other devices available with less signal losses and more refined characteristics, the resistive network generally represents the simplest, least expensive and most convenient answer when the losses can be tolerated. Furthermore, when arranged compactly, using short lead lengths, the resistive network will be useful over extremely wide frequency ranges. Simple networks made up of standard composition resistors will give good performance over the entire range covered by the high and low television *vhf* channels. With sufficient care in construction using the smallest resistors and very short lead lengths this range can even be extended into the *uhf* television band. Some of the ways in which these networks can be advantageously put to use are discussed below.

TABLE 1

Network	Configuration	Resistor Values in Ohms	Nominal Z1 in Ohms	Nominal Z2 in Ohms	E2/E1	Insertion Loss in db
A	1	R1 = 110 R2 = 82 R3 = 150	72	300	54	5.3
B	1	R1 = 130 R2 = 56 R3 = 150	50	300	52	5.7
C	2	R1 = 82 R2 = 220	300	300	.32	10
D	2	R1 = 120 R2 = 68	300	300	10	20
E	3	R1 = 82 R2 = 160 R3 = 220	300	300	.10	20
F	4	R1 = 100 R2 = 140	72	72	.32	10
G	4	R1 = 360 R2 = 68	72	72	10	20

Table 1—Characteristics of configurations discussed in the text.

TABLE 2

Antenna Distribution Networks

Configuration	Receiver Outlets	Resistor Values in Ohms	Nominal Z1 in Ohms	Antenna Line Termination in Ohms	Z2 in Ohms	E2/E1	Insertion Loss in db	Receiver Isolation in db
5	2	R_1 = 200 R_2 = 680	600	$\frac{600}{2}$ = 300	300	.35	9	19
5	3	R_1 = 360 R_2 = 510	900	$\frac{900}{3}$ = 300	300	.21	14	28
5	4	R_1 = 560 R_2 = 390	1200	$\frac{1200}{4}$ = 300	300	13	18	36
6	2	R_1 = 240 R_2 = 180 R_3 = 62	600	$\frac{600}{2}$ = 300	300	.14	17	34

Table 2—Resistor values and characteristics for different combinations of impedance and number of receivers in the system.

Sweep Generator/Receiver Impedance Matching

When a sweep-frequency signal generator is used for TV tuner alignment the transmission line from the generator must be terminated in its characteristic impedance. If the termination is not of the correct value the transmission line will act as a frequency sensitive tuning element (VSWR varying with frequency) and thus cause an erroneous indication of the bandwidth characteristic of the tuner. Most sweep generators utilize a low-impedance unbalanced (one side grounded) coax output to simplify output attenuator construction and to reduce leakage. Since the tuner has a balanced (neither side grounded) antenna input with an impedance of 300 ohms it is necessary for the generator coax to be terminated by a device which will match the high receiver impedance to the low coax impedance and at the same time convert from a balanced to an unbalanced circuit. Networks A or B, depending on the generator coax impedance, are designed to do this job. The resistive network does not provide a completely balanced output as do other devices such as *rf* transformers or "balun" transmission line networks and it introduces greater loses than these latter devices. However, the resistive network provides an output sufficiently close to perfect balance to accomplish a satisfactory termination, and at the same time offers the advantages of extreme simplicity and usefulness over a wide frequency range. The relatively low

[*Continued on page* 57]

AUDIO ADAPTATIONS for Profitable Servicing

by **Gil Tint**

Practical and profitable suggestions for increasing the utility of Hi-Fi systems

THIS article provides a number of adaptations that may be made to obtain more versatile performance of audio equipment where a hi-fi installation has already been made. The modifications outlined herein do not require chassis pulling or alteration. All work is done primarily by means of adapters and external mountings.

An effective way to satisfy the hi-fi customer is to provide him with "extras"—features which make his installation more than just an interconnected group of ready-made components. What is nice about these modifications is that, while they not only make an audio system more attractive, they are also simple to install and add very little to the audio man's costs. Here are a few such additions which the writer has found quite useful.

Feeding TV Sound Through the HI-FI System

Almost every TV ad one sees stresses the advantages of FM sound. The average consumer is led to believe that his set is capable of wide range audio reproduction. Unhappily, this is not the case. After the sound information passes (relatively unscathed) through the tuner, *if* stages, and FM detector, it is squeezed through one single-ended audio stage and fed to a speaker just about up to reproducing a telephone conversation faithfully. Why waste this hi-fi potential? This is a good question to ask the customer—from a sales point of view. Invariably, he will welcome the chance to improve his TV sound by utilizing his audio system. The necessary circuit changes could be made by pulling the chassis, drilling the required holes, mounting a terminal strip and making the electrical changes. As every technician knows, however, chassis-pulling involves extra time and labor and should be avoided where possible. The advantages of the methods described here are that all work takes place on the top side of the chassis, and the adapters can be prepared during free time and merely plugged in when needed.

First an "S" type of socket (*Fig. 1*, item A) is fitted into the shell of a tube base (B). The #5 pin of the "S" socket is grounded, thereby grounding out the grid of the audio output tube. The #5 pin of the tube base (B) connects internally to the output connection of the first audio tube so that a lead connected to this point may be brought out to the hi-fi power amplifier.

The diagram in the lower right hand corner of *Fig. 1* shows how this modification renders the output stage of the TV receiver inoperative. The incoming signal, on the other hand, is transferred through the connecting cable to the desired hi-fi audio amplifier and speaker combination.

A shielded cable length of no more than 5 feet is practical in this case because of the high impedance circuit involved. Excessive hum pick-up and high-frequency attenuation would result if a longer cable were used. Aside from the cable, the only materials needed are the tube base of an old octal tube, a suitable phono-input connector and an Amphenol "S" type octal socket, 78-S8. This socket is perfect for this application since it exactly fits the tube base. A hole should be drilled in the side of the base near pin 5 for bringing out the audio lead. After making the electrical connections, some speaker cement

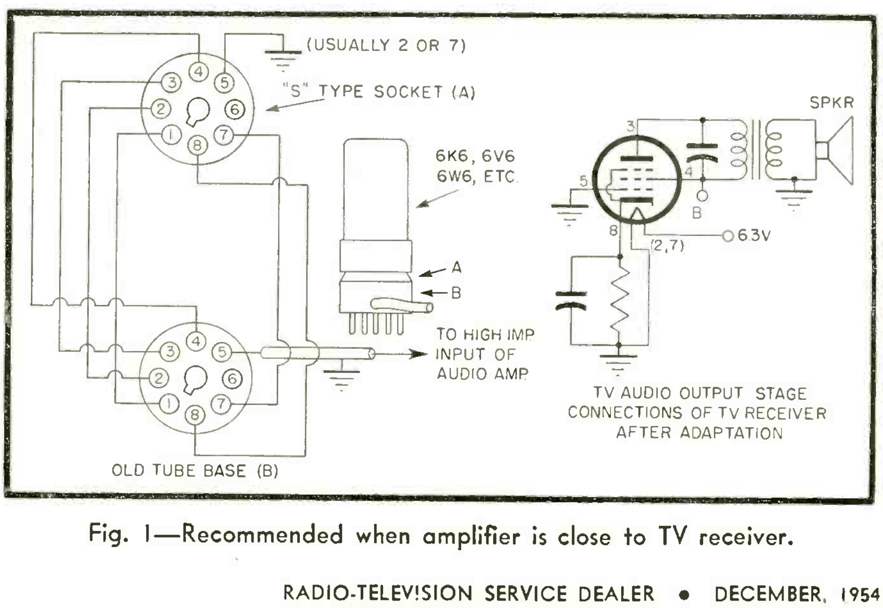


Fig. 1—Recommended when amplifier is close to TV receiver.

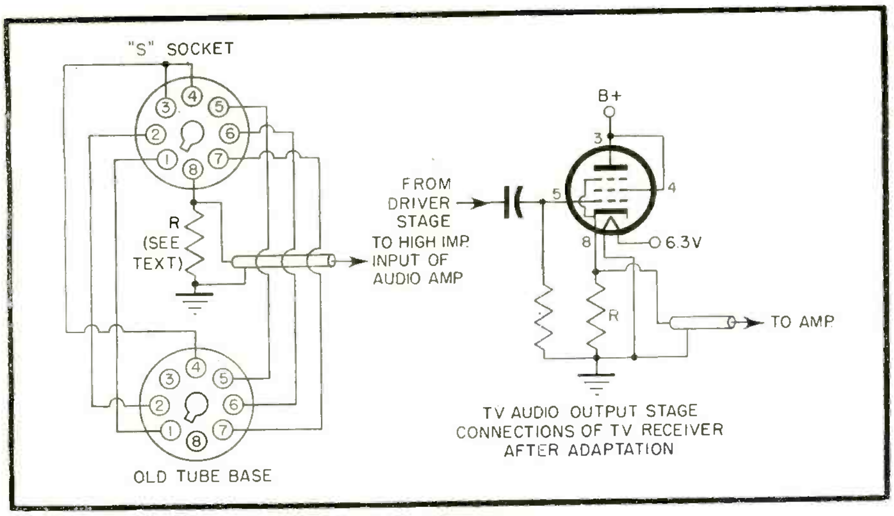
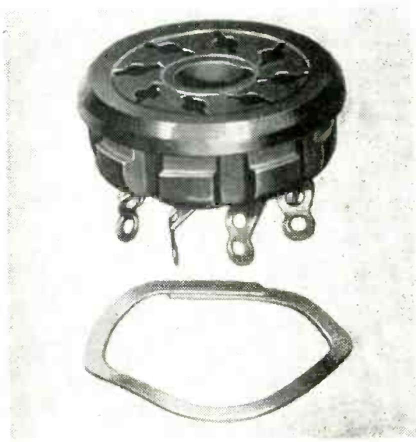


Fig. 2—Cathode follower for remote connections.



An "S" type Octal Socket.

should be applied where the socket and base meet. When the joint has dried, the original tube can be replugged into the adapter, and the adapter plugged into the power output stage of the TV set. It is important that the audio output then be connected to the high impedance input of the audio amplifier. Overloading and distortion will result if the pre-amplifier input is used.

A metal tube of the same type can be adapted by the above method if precautions are taken to see that pin 1 on the tube socket has not been used as a *dc* tie-point by the manufacturer. This condition would render the tube shell hot to ground and create a shock hazard.

Adapter for More Remote Locations

Figure 2 illustrates a variation of the above which can be used when the TV receiver is remotely located from the audio amplifier. Before trying this one, however, the customer should be warned that having the sound come from a different point in the room from the picture might seem peculiar at first. Adjusting to it isn't difficult, though, and the improved quality will be worth the effort. As above, only octal tubes

[*Continued on page* 49]

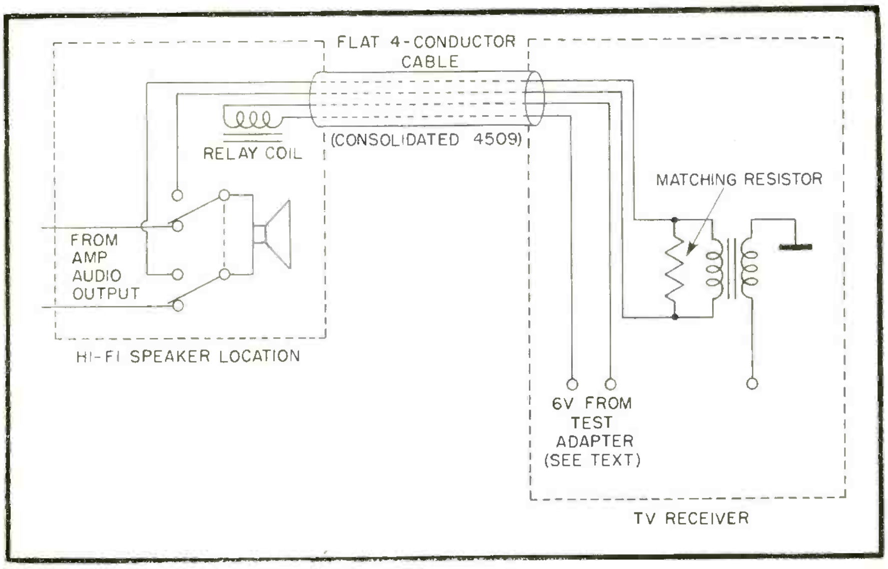


Fig. 3—Automatic switching of Hi-Fi speaker to TV output.

The Work Bench

by PAUL GOLDBERG

THIS installment is devoted to three sync amplifier problems. The use of the oscilloscope is extremely important in hunting down these faults. Equally important is the manufacturer's service data which usually contains the correct waveforms at the important places.

Admiral 21C1—Lack of horizontal and vertical hold

The receiver was turned on and it was observed that the horizontal and vertical hold would break as the contrast was lowered; however, at maximum contrast, the picture would hold properly. As this seemed to be a composite sync problem, V403, 12AU7, the sync separator and clipper, and V401B, 1/2 6SN7, sync inverter were individually replaced but without effect.

Before going any further, the diagram was consulted. The composite sync, video and blanking voltage is fed through a coupling network consisting of *R323*, *R329*, *C315*, *C308*, to V403A. The low plate voltage (32 volts) on V403A, Sync Separator, developed by *R418*, and *R417*, and the cut-off grid leak bias provided by *R414* and *C308* allow only the most positive peaks (sync pulses) to cause plate current flow. In this manner the blanking and video voltage is eliminated and only the sync pulses are amplified. V403B is the sync clipper, and because of the low plate voltage caused by *R420* and the grid leak bias caused by *C409*, and *R416*, the negative sync and noise pulses drive the tube to cut-off; thus achieving the desired clipping

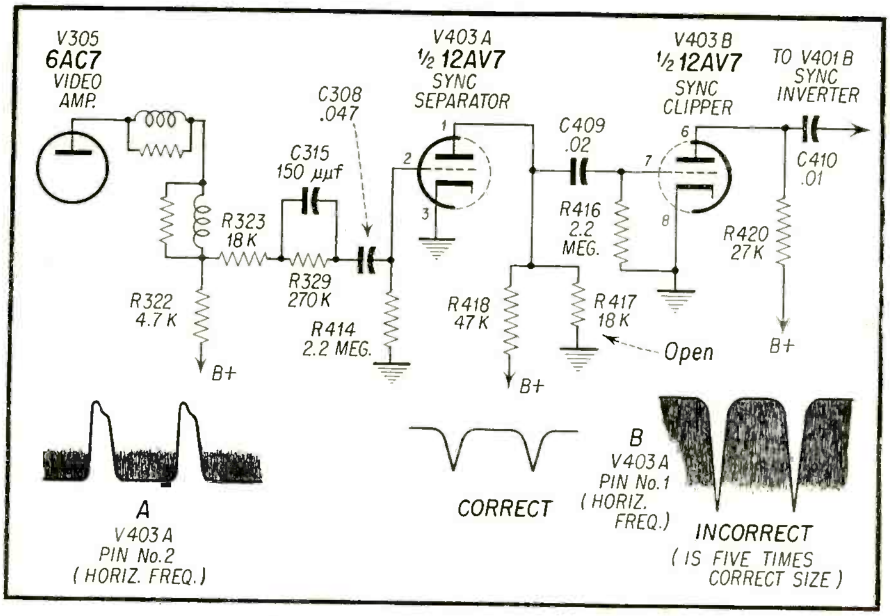


Fig. 1—Partial schematic of Admiral 21C1 sync section.

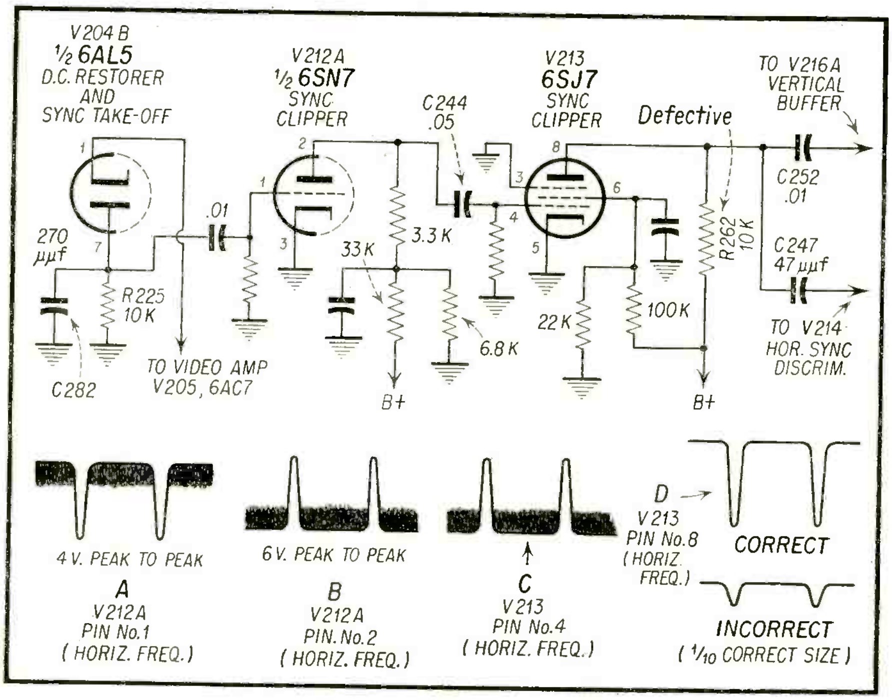


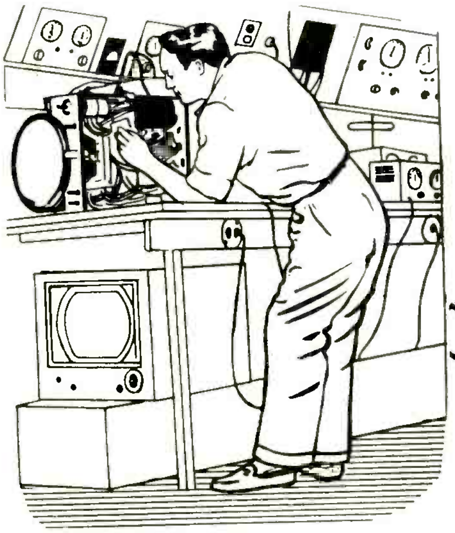
Fig. 2—Partial schematic of DuMont RA 103C sync section.

and limiting of the noise and sync pulses.

To get back now, the scope was set up to check a few wave forms. A wave form check was made at pin #2 of 403A, but it was found to check correctly with the manufacturer's service data. (Ref. to *Fig. 1A*). Next, a waveform check was made at pin #1 of V403A. However, here the waveform did not check correctly with the manufacturer's data. (Ref. to *Fig. 1B*). In fact, the waveform measured about five times its correct size.

Now that the locality of the trouble had been placed, a voltage check was made at pin #1 of V403A. The voltage measured 130 volts positive. The diagram called for 32 volts positive. Next, *R417* and *R418* were resistance checked. *R418* measured correctly but *R417*, 18K, was found to be open. It was immediately replaced and the receiver now functioned properly.

Because *R417* opened, the plate voltage jumped from 32 volts to 130 volts. With this plate voltage the negative grid leak bias developed was not



This Month:

SYNC AMPLIFIER PROBLEMS

enough to cut off V403A. Thus, the complete signal at the grid, pin #2, of V403A, appeared at the plate, pin #1. Therefore, because no elimination of the video and blanking pulses could take place in V403A, the video and blanking pulses triggered the horizontal and vertical oscillators, causing poor vertical and horizontal hold condition.

Du Mont RA 103C—Vertical roll and horizontal wobble

In this receiver it was observed that when the contrast was increased or decreased, even slightly, the picture would roll vertically. The picture also had a bad horizontal wobble. In fact, tapping any component in the horizontal sync or oscillator section caused the picture to wobble horizontally.

This was definitely a composite sync problem, so V212A, V213, and V204B, the composite sync clippers and the *dc* restorer were replaced individually, but with no effect. The oscilloscope was next set up to make a few waveform checks and the diagram referred to.

Since negative composite sync pulses appear across *R*225, V204B, the diode rectifier, acts not only as a *dc* restorer, but as a sync separator. V212A, and V213 are the sync clippers. They manage to clip the signal at both ends. V212A, accomplishes this by virtue of a low plate voltage (+ 19 volts) and V213, 6SJ7, accomplishes this by virtue of a low screen voltage (+ 50 volts). In other words, the composite sync signal at both control grids drives the tubes into saturation and into cut off. Thus, the composite sync level is kept rather constant at the output of V213 because of the limiting action of these tubes.

A waveform check was made first, at pin #1 of V212A. Here the waveform checked correctly with the service data (refer to *Fig. 2A*). Next, a waveform check was made at pin #2 of V212A and here again the waveform was correct. (Ref. to *Fig. 2B*). A waveform check was now made at pin #4, the grid of V213. This was also correct (Ref. to *Fig. 2C*). At pin #8 the plate of V213, however, the waveform was found to be one tenth its proper size (Ref. to *Fig. 2D*).

Voltage measurements were next taken at the plate and screen of V213. The screen voltage checked correctly at around 50 volts positive, but the plate voltage measured about 300 volts positive. It seemed that *R*262, 10K, was not dropping any voltage because the B+ side of this resistor also measured about 300 volts positive. *R*262 was then resistance checked and was found to measure about 200 ohms. *C*244, *C*252, and *C*247 were next measured for voltage leakage because of the possibility of their causing the defective *R*262. But all these condensers checked satisfactorily. The 6SJ7, V213 also checked okay. Thus, it was assumed that the low wattage rating of this resistor was the cause of its failure. This half watt resistor was now replaced with a new 2 watt 10K resistor (to be safe), and now the receiver functioned properly.

It is easy to understand that if *R*262, 10K, the load resistor across which is developed the composite sync pulse voltage, drops in resistance to 200 ohms, the load voltage will not be large enough to cause the vertical and horizontal oscillators to be triggered properly.

RCA 630 TS—Pulling at top of pix and vertical slipping

The receiver was turned on and it was observed that there was a quivering and pulling at the top of the picture. It

[Continued on page 49]

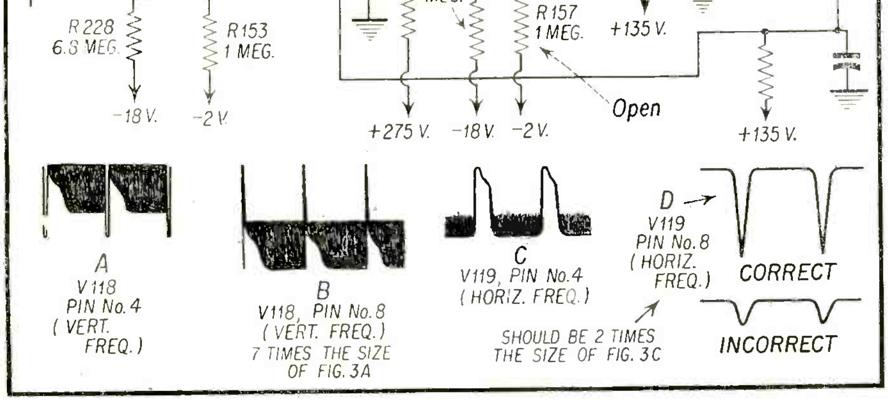


Fig. 3—Partial schematic of RCA 630TS sync section.

THE DETROIT SERVICEMEN'S SHOW

Photos courtesy of Michigan Press Photo Service

A number of distributors get together to put on a show for servicemen primarily with unparalleled results.

THE First Detroit Electronic Parts Show, staged at the Whitehall Bldg., State Fairgrounds, Detroit, Michigan on November 2nd and 3rd, 1954, attracted *6100* Radio and TV Dealers and Servicemen from the Greater Detroit area. The show was a great success.

The twelve independent electronic parts jobbers in Greater Detroit who sponsored the show in co-operation with manufacturers and members of the Wolverine Chapter of Representatives feel highly satisfied to have been of service to the Radio TV Service-Industry.

The show was opened by *Lt. Governor Clarence A. Reid and Peggy Lee, well known recording artist.* Mr. H. Hirt, Secr.-Treasury of Radio Specialties Co. was chairman of the event. Governor Williams sent his best wishes by telegram.

Following are some of the comments from a cross-section of the industry:

(1) *H. H. Rainier,* Mgr. Electronic Product Sales, Sylvania Electric Products, Inc.

Sylvania wishes to congratulate the Greater Detroit Distributors on their first undertaking of a show directed to dealers. This kind of effort demonstrates genuine sincerity on the part of the electronic distributors to bring the servicemen into direct contact with manufacturers and their products. Sylvania as a manufacturer who has always felt a close alliance with the service industry, feels that this initial venture by the Detroit Distributors was an outstanding success. We at Sylvania have attended many similar shows and we feel the Detroit Show is one of the best we have attended. Best wishes for continued success.

(2) *H. Kalker,* General Sales Manager, Sprague Products Co.

Let me congratulate you and your committee for a very fine job in presenting the first Dealer Servicemen Show in Detroit, sponsored by the Distributors and the Representatives. Despite the inclement weather, I was pleasantly surprised at the thousands of Dealers, Shop Owners and Servicemen who came to the show, their hungry desire for information was well proven by the fact that by late evening most Manufacturers ran out of thousands of their pieces of literature. It is my hope that you will continue this program on an annual basis and that you have the Distributors, with the help of the Manufacturer, man the booths as these people are really your customers and not direct customers of the Manufacturers.

I am sure that in the next few months, you will have found that this Show has helped considerably in cementing a more personal and friendly relationship in addition to a business relationship between the Distributors, Representatives and Manufacturers. I was very happy to have had the privilege and opportunity to see the show in person.

(3) *John T. Thompson,* Sales Mgr., General Electric Co.

You and your committee are certainly to be congratulated on the complete success of the first dealer parts show conducted in the Detroit area. As far as I know, this is the first cooperative show of this type ever held for dealers and their technicians in the electronics service industry. Its complete success reflects the hunger of the dealer and his television and radio service technicians for more product information and guidance from his distribution suppliers and their manufacturing sources. We in the Tube Dept. of the General Electric Co., felt it a real privilege to participate with you in this progressive industry step and wish to assure you of our complete support in future activities of this type.

Mr. H. Hirt, chairman of the show.

(4) *E. D. Powers,* Exec. Vice President of Thordarson-Meissner

I am truly amazed at the tremendous outpouring of TV & Radio Technicians who attended the 2 day show. I have been to components expositions all over the United States and have never seen the equal of the attendance at the State Fairgrounds. This is especially phenomenal when you consider that this is the first show exclusively for servicemen and technicians of its type ever attempted in the entire country. It is indeed a tribute to the imagination, planning and splendid organization of the electronic parts distributors of Greater Detroit, under the very capable chairmanship of H. Hirt of Radio Specialties Co., 456 Charlotte. The Radio & TV parts distributors of the U. S. can well take example from this excellent and inspired type of good merchandising in bringing the manufacturers of complex equipment in direct contact with the ultimate users of their products. It cannot help but generate good will, trust and greater cooperation among maker, distributor and servicemen.

Mfr: Majestic **Model No.** 121B

Card No. MAJ 121-1

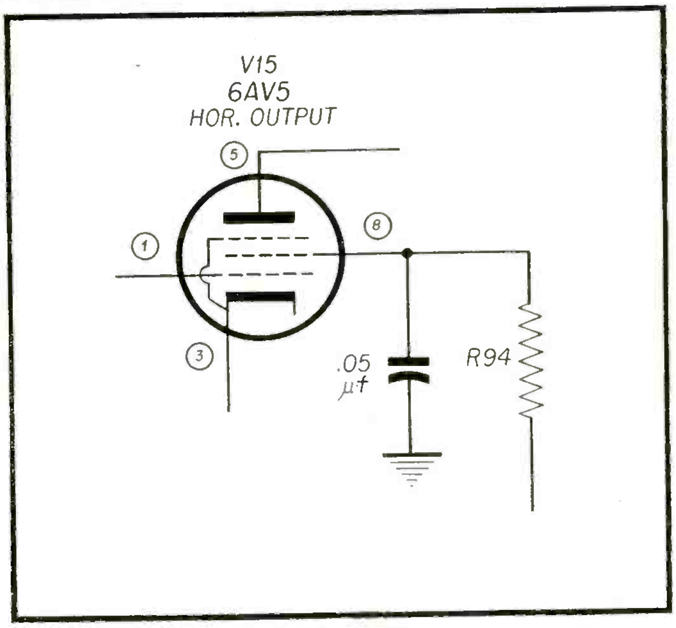
Section Affected: Raster

Symptom: No high voltage

Cause: Defective component

What to Do:

Replace: *R94* (5K, 5 watt)—open



Mfr: Majestic **Model No.** 121B

Card No. MAJ 121-2

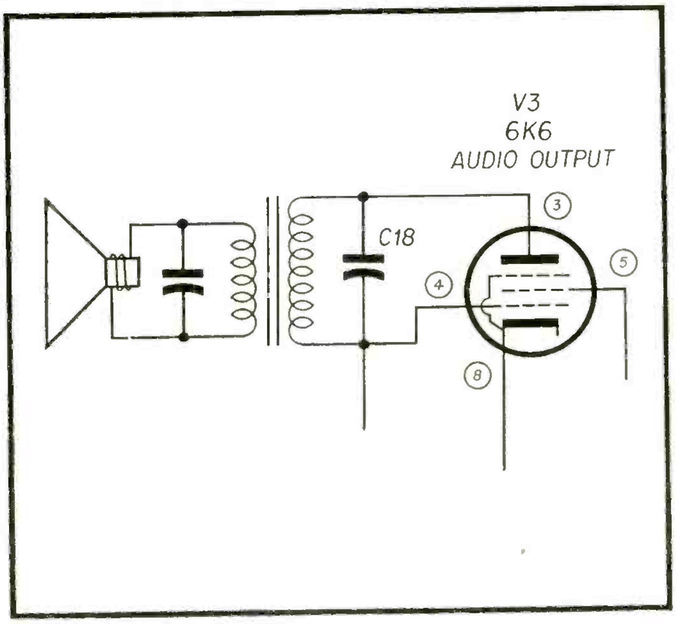
Section Affected: Sound

Symptom: No sound

Cause: Defective component

What to Do:

Replace: *C18* (.005 *μf*)—shorted



Mfr: Majestic **Model No.** 121B

Card No. MAJ 121-3

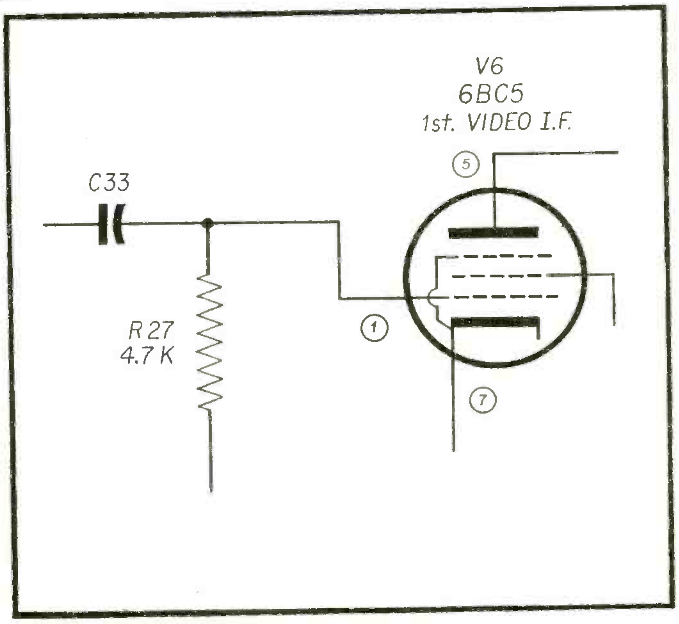
Section Affected: Pix

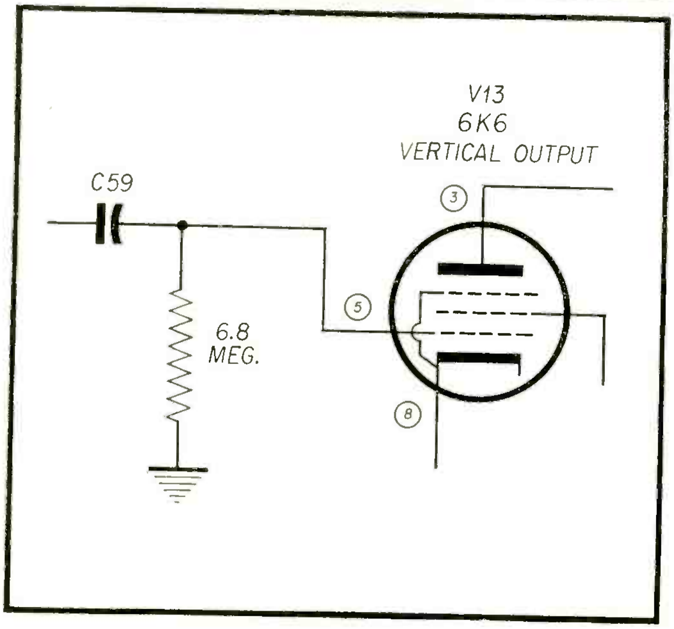
Symptom: Video overload

Cause: Defective component

What to Do:

Replace: *C33* (100 *μμf*)—leaking





Mfr: Majestic **Model No.** 121B

Card No. MAJ 121-4

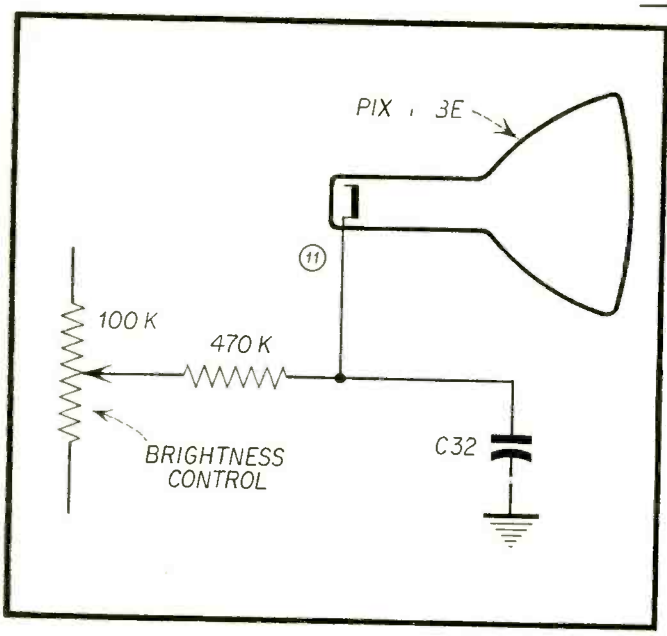
Section Affected: Raster

Symptom: Vertical foldover at bottom

Cause: Defective component

What to Do:

Replace: *C59* (0.1 μf)—leaky



Mfr: Majestic **Model No.** 121B

Card No. MAJ 121-5

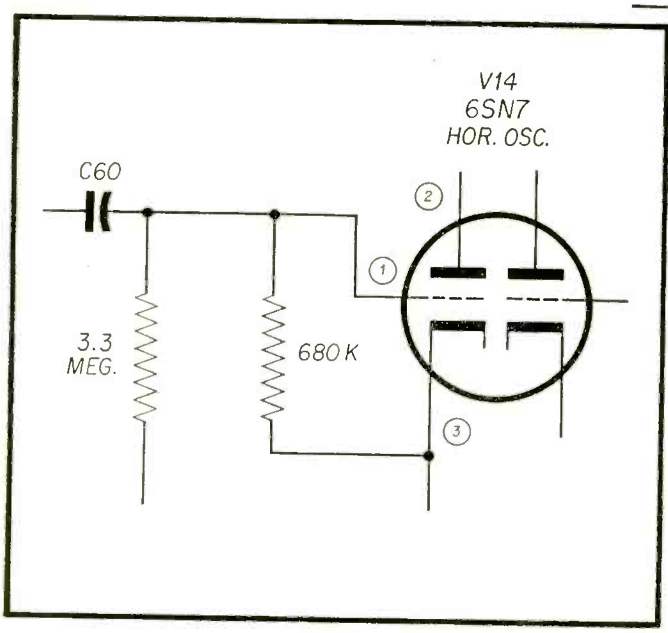
Section Affected: Raster

Symptom: No control of brightness

Cause: Defective component

What to Do:

Replace: *C32* (.05 μf)—shorted



Mfr: Majestic **Model No.** 121B

Card No. MAJ 121-6

Section Affected: Sync

Symptom: Horizontal frequency drift

Cause: Defective component

What to Do:

Replace: *C60* (.002 μf)—leaky

Mfr: Philco **Model No.** 50-T1600, 51-T1600, etc.

Card No: PH1600-1 **Code No.** 121 and 122

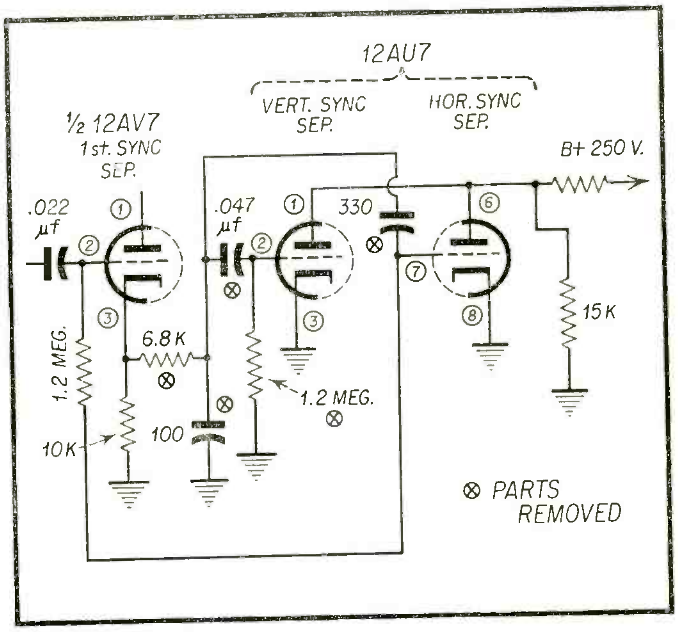
Section Affected: Sync

Symptom: Critical sync action under difficult reception conditions

Reason for Change: Circuit improvement

What to Do:
Remove: 6.8K, 1.2 meg resistors as shown also 100 μμf, .047 μf and 330 μμf condensers as shown
Install: Parts and rewire as shown in Card No. PH1600-2

(continued on Card No. PH 1600-2)



(continued from Card No. Ph 1600-1)

Mfr: Philco **Model No.** 50-T1600, 51-T1600, etc.

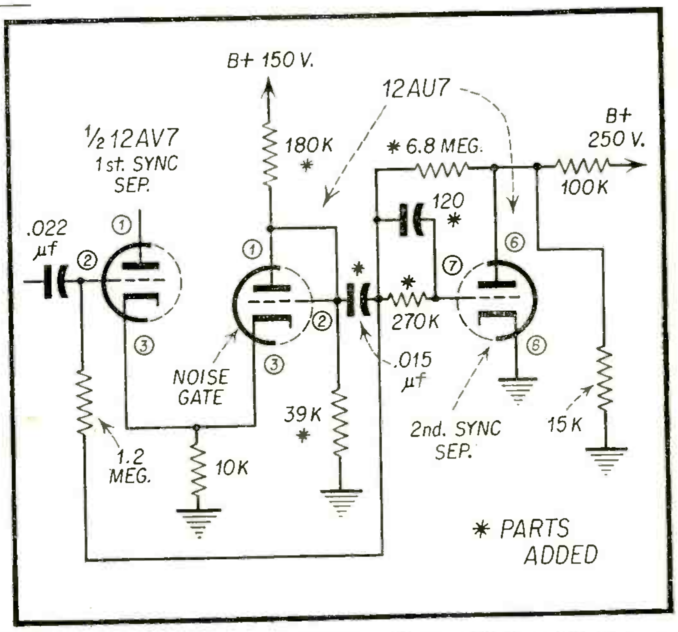
Card No: PH1600-2 **Code No.** 121 and 122

Section Affected: Sync

Symptom: Critical sync under difficult reception conditions

Reason for Change: Circuit improvement

What to Do:
Install: 39K, 180K, 270K, 6.8K, 100K, resistors as shown
Also, .015 μf, 120 μμf condensers as shown
Rewire: As shown



Mfr: Philco **Model No.** 50-T1600, 51-T1600, etc.

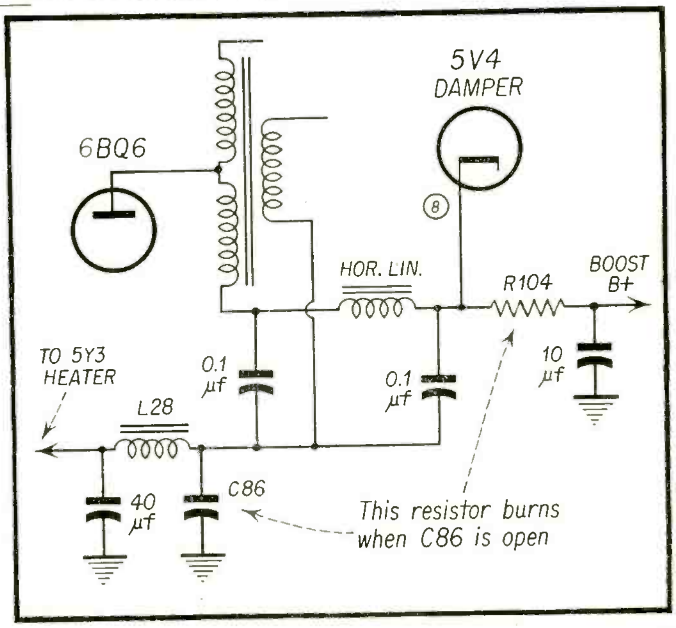
Card No: PH1600-3 **Code No.** 121 and 122

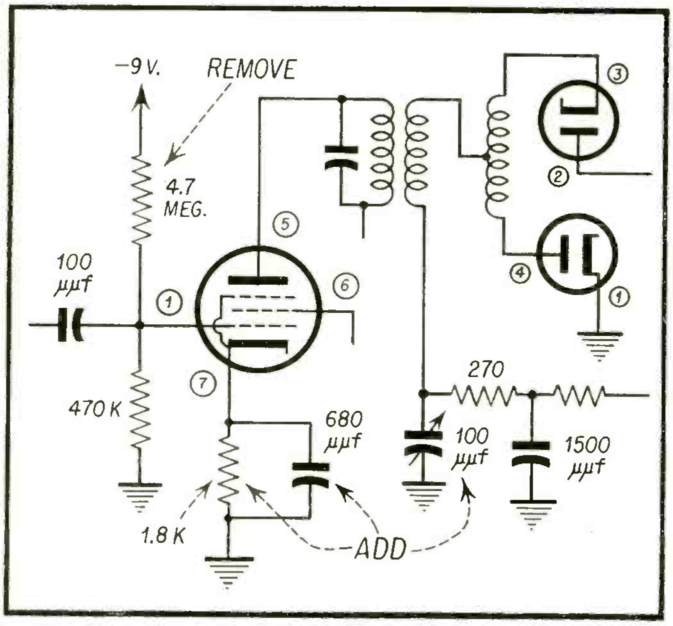
Section Affected: Raster

Symptom: No raster, no high voltage; *R104* (4.7K) resistor burns

Cause: *C86* (40 μf) is open, causing horizontal *rf* energy to flow completely through *R104* (4.7K) which burns up.

What to Do:
Replace: C86 (40 μf)
Also R104 (4.7K)





Mfr: Philco
Model No. 50-T1600, 51-T1600, etc.

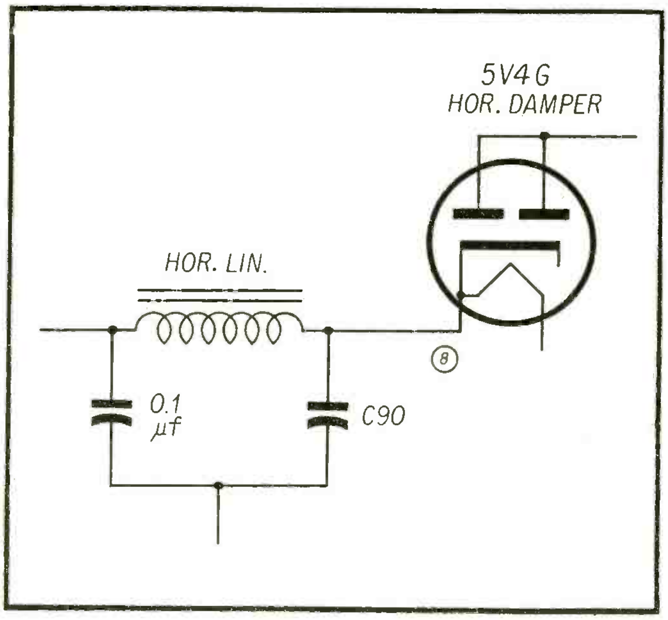
Card No: 50T-1600-4
Code No. 121 and 122

Section Affected: Audio

Symptom: Intercarrier buzz

Cause: Insufficient AM rejection

What to Do:
Remove: 4.7 meg resistor
Add: 680 μμf condenser
Also, 100 μμf adjustable condenser and 1.8K resistor



Mfr: Philco
Model No. 50-T1600, 51-T1600, etc.

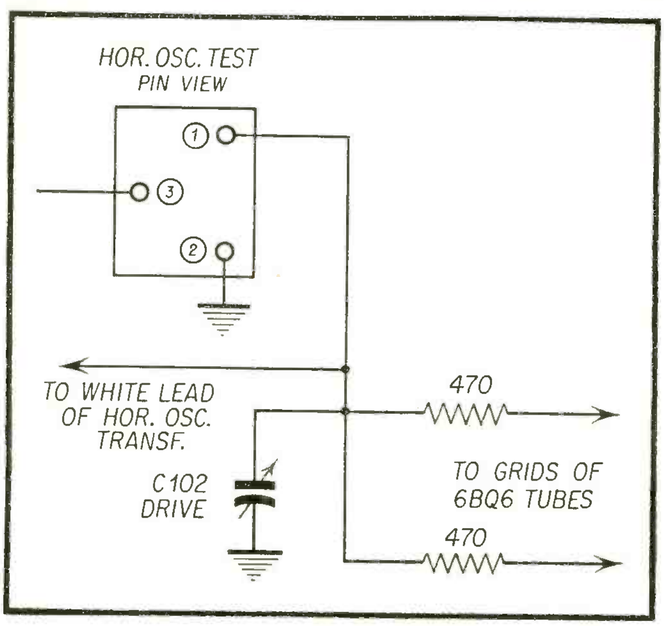
Card No: PH50T1600-5
Code No. 121 and 122

Section Affected: Pix

Symptom: Poor Horizontal linearity

Cause: Open condenser

What to Do:
Replace: *C90* (.1 μf)



Mfr: Philco
Model No. 50-T1600, 51-T1600, etc.

Card No: PH1600-6

Section Affected: Raster

Symptom: Intermittent raster, bias on 6BQ6GT intermittent

Cause: Defective drive capacitor (mica cracked)

What to Do:
Check: *C102* (horizontal drive control), note condition of mica and replace

Mfr: RCA **Chassis No.** KCS 81

Card No: RC81-1

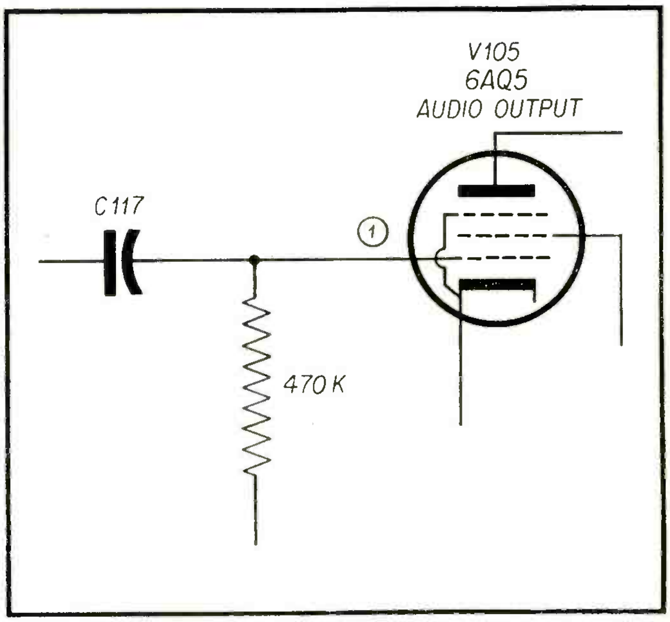
Section Affected: Sound

Symptom: Raspy sound

Cause: Leaky Condenser

What to Do:

Replace: *C117* (.01 μf)



Mfr: RCA **Chassis No.** KCS 81

Card No: RC81-2

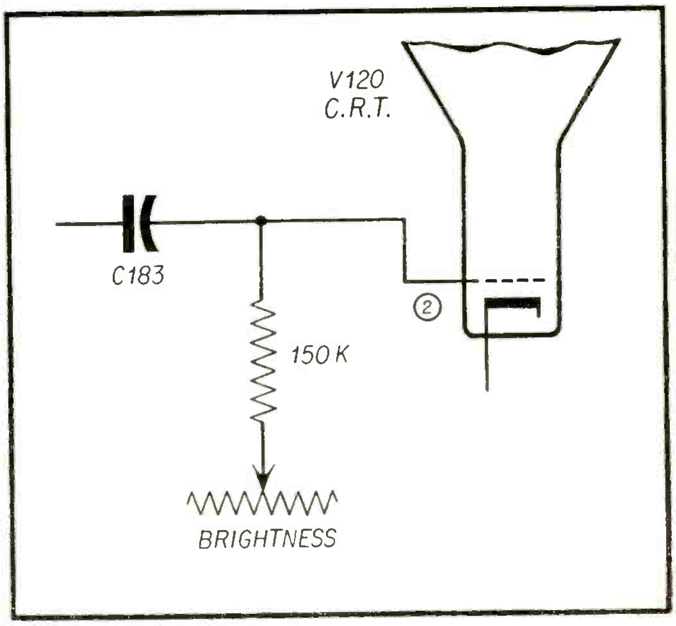
Section Affected: Raster

Symptom: No control of brightness

Cause: Shorted condenser

What to Do:

Replace: *C183* (.1 μf)



Mfr: RCA **Chassis No.** KCS 81

Card No: RC81-3

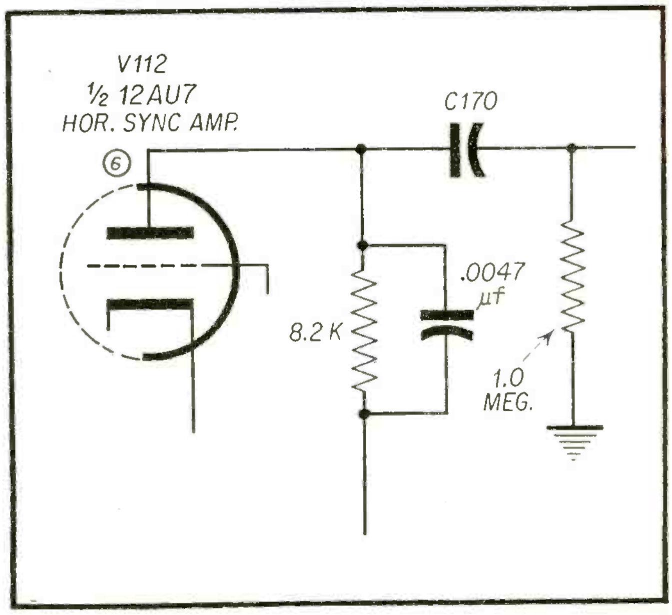
Section Affected: Sync

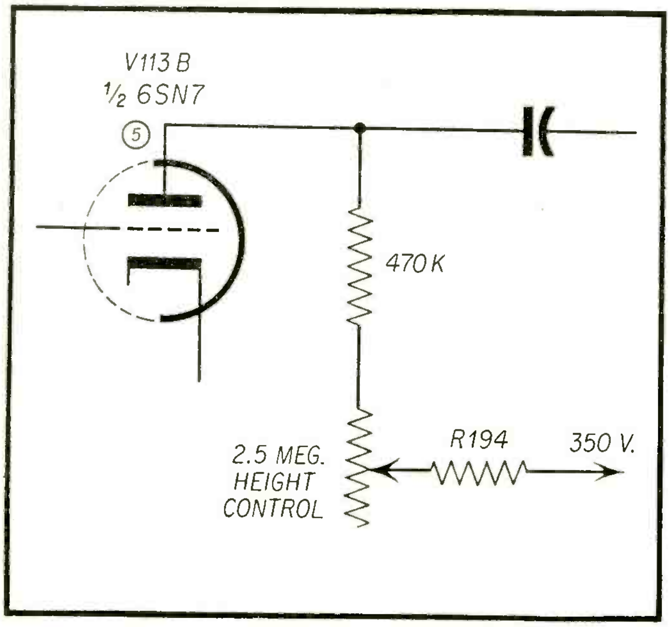
Symptom: Critical horizontal and vertical sync

Cause: Shorted condenser

What to Do:

Replace: *C170* (.01 μf)





Mfr: RCA **Chassis No.** KCS 81

Card No: RC81-4

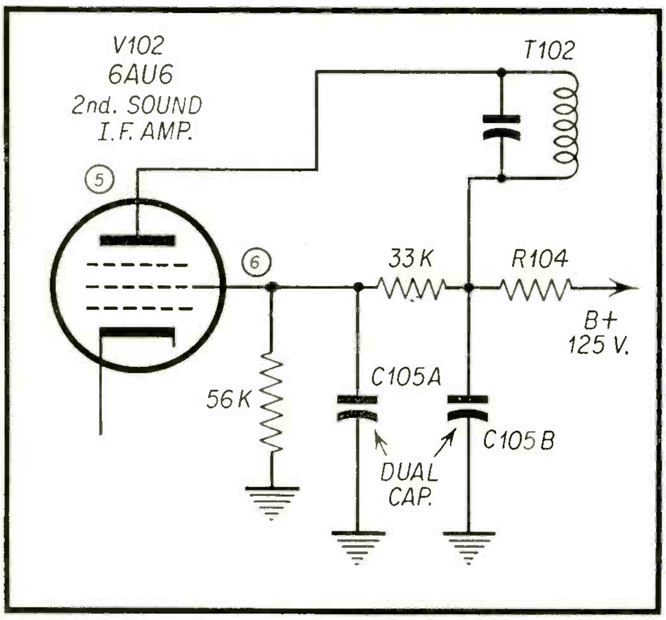
Section Affected: Raster

Symptom: Insufficient height

Cause: Resistor increases in value

What to Do:

Replace: *R194* (220K)



Mfr: RCA **Chassis No.** KCS 81

Card No: RC81-5

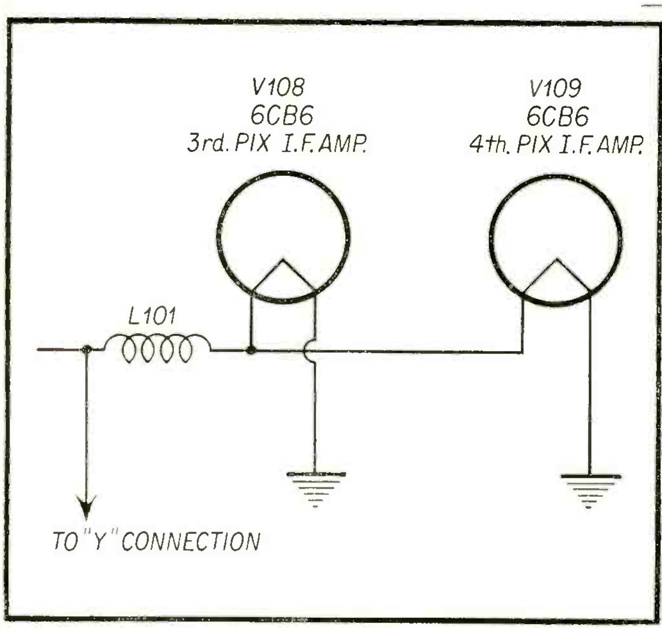
Section Affected: Audio

Symptom: No Audio

Cause: Shorted condenser; and resistor changed in value caused by shorted condenser

What to Do:

Replace: *C105B* (.01 μf)
Also, R104 (IK)



Mfr: RCA

Card No: RC81-6

Section Affected: Sound & pix; V108, V109

Symptom: No sound, no pix

Cause: Open filament choke

What to Do:

Replace: *L101* (filament choke)

PHILCO

Code 140, Chassis R-191, D-191

TUBE LIST

RF CHASSIS R-191

SYMBOL	TYPE	CIRCUIT FUNCTION
V1	6BZ7	R-F Amp
V2	6X8	Oscillator-Mixer
V3, V4, V5	6CB6	Video I-F Amp
V6	6AU6	Video Amp
V7	6AQ5	Video Output Amp
V8	6AU6	Sound I-F Amp
V9	6T8	Ratio Detector, First Audio, and Tuner A-G-C Clamp
V10	6V6G	Audio Output
V11	6CS6	Sync Separator
V19	17YP4 or 21ZP4A	Picture Tube

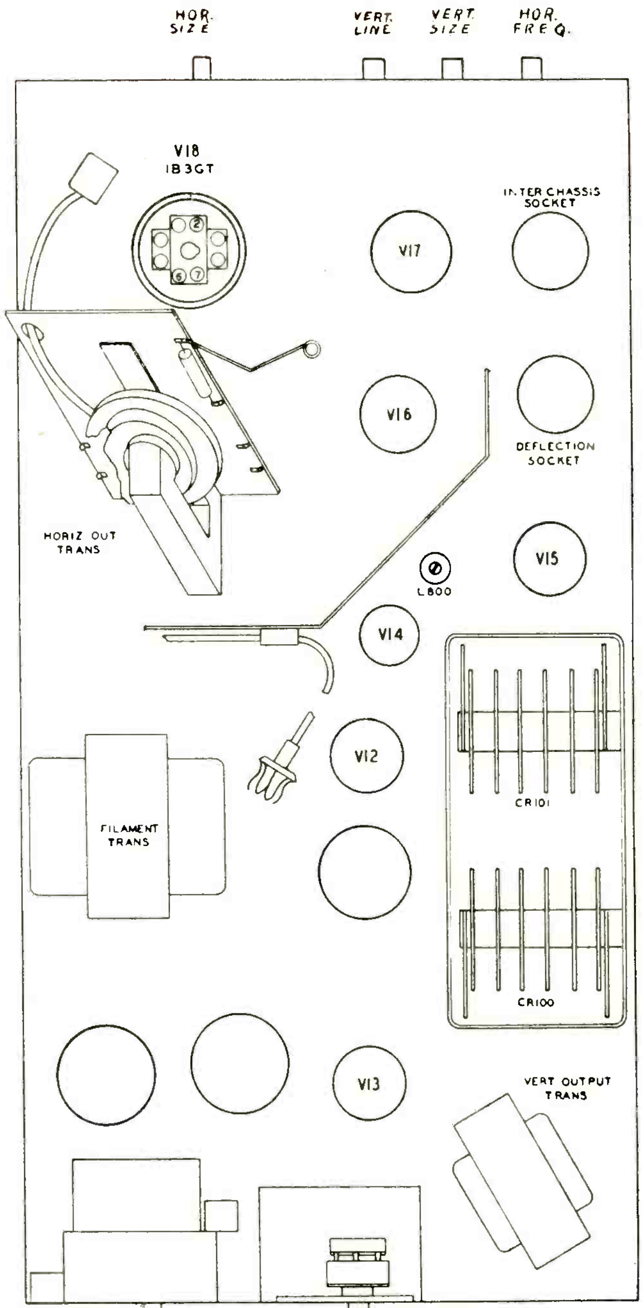
DEFLECTION CHASSIS D-191

SYMBOL	TYPE	CIRCUIT FUNCTION
V12	12AU7	Phase Splitter, Vert. Oscillator
V13	12B4	Vert. Output
V14	6AL5	Hor. Phase Comparer
V15	12AU7	Hor. Osc.
V16	6BQ6GT	Hor. Output
V17	6AX4GT	Hor. Damper
V18	1B3GT	H. V. Rectifier

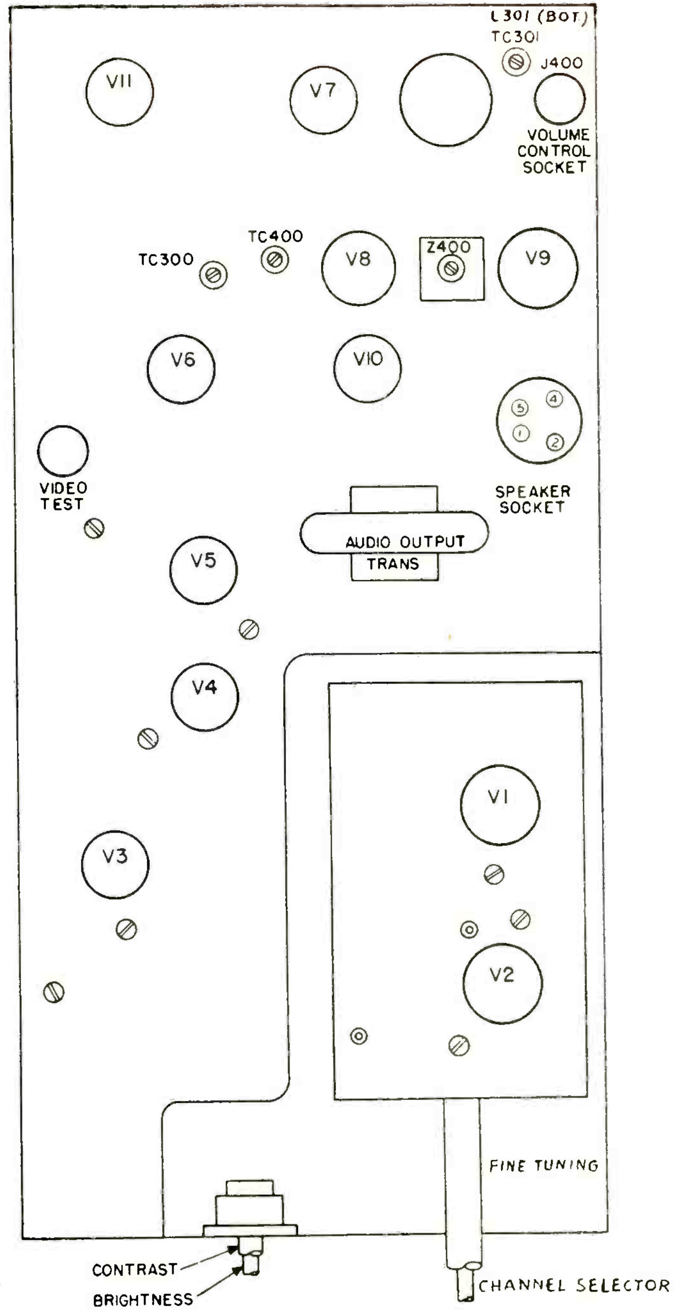
KEY VOLTAGES

B+, plate of damper,	V17 pin 5	260 vdc
Boosted B+, cath. of damper,	V17 pin 3	420 vdc
Plate(s) of VERT. OSC.,	V12 pin 6	149 to 202 vdc
Plate of Vert. Out.,	V13 pin 9	205 vdc
Plate(s) of Hor. Osc.,	V15 pin 1	165 vdc
	pin 6	170 vdc
Grid of Hor. Out.,	V16 pin 5	—38 vdc

All voltages are measured with a VTVM connected between the tube pins and chassis.



Deflection Chassis D-191, Base Layout



R-F CHASSIS R-191, TOP VIEW, SHOWING LOCATIONS OF ADJUSTMENTS

ADJUSTMENTS

B SUPPLY FUSE REPLACEMENT

The B supply protective fuse, F100, is wired into the low-voltage section, and is in series with the selenium rectifiers. For replacement, use a 1.6-ampere delayed-action type fuse, Philco Part No. 45-2656-23.
CAUTION: Discharge the circuit before replacing the fuse.

HORIZONTAL-OSCILLATOR ADJUSTMENT

To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

1. Reduce the width of the picture until approximately 1 inch of blank screen appears at the right-hand and left-hand sides of the picture.
2. Increase the BRIGHTNESS control setting until the blanking becomes visible. This will appear as a dark vertical bar on each side of the picture.
3. Connect a .1 μf. condenser from the test point, adjacent to TC800, to ground. (The plate side of the horizontal ringing coil, L800, is connected to the test point.)
4. Set the HORIZONTAL HOLD control to the approximate center of its mechanical rotation.
5. Adjust the HORIZ HOLD CENTERING control unit equal portions of the blanking bar appear on both sides of the picture.
6. Remove the .1-μf. condenser from the test point.
7. Adjust the horizontal ringing coil, L800, until equal portions of the blanking bar again appear on both sides of the picture.
8. Rotate the HORIZONTAL HOLD control through its range. The picture should fall out of sync on both sides of the center of its rotation. If the picture does not fall out of sync on both sides, readjust the HORIZ HOLD CENTERING control.
9. Rotate the HORIZONTAL HOLD control through its range, and observe the number of diagonal blanking bars that appear just before the picture pulls into sync. The pull-in should occur with from 1 to 2 diagonal bars when the sync position is approached from either direction. If proper pull-in is not obtained, repeat the above procedure.

VIDEO PEAKING-COIL ADJUSTMENT

The video peaking coil, L303, is adjusted at the factory for proper transient response of the video circuits. Ordinarily, this coil will require no further adjustment by the serviceman. On any station where excessive overshoot or excessive smear is present, a slight adjustment of L303 may improve the picture quality on that station; however, this adjustment may sacrifice the quality on other channels. If L303 is replaced in servicing, adjustment will be required.

Before adjusting L303, check the tuner alignment and i-f alignment. (Never adjust L303 until the alignment of the receiver is correct.) Then tune in a station and adjust L303 until there are no trailing whites or smear in the picture. Turning TC301 clockwise reduces trailing whites and overshoot; turning TC301 counterclockwise reduces picture smear and increases trailing whites. The proper position is the point where no smear or trailing whites appear in the picture.

The above procedure for adjustment of TC301 applies to a particular station exhibiting smear or overshoot. After TC301 is adjusted, reception on all the other stations should be checked, to make certain that the adjustment has not impaired the picture quality.

OSCILLATOR ALIGNMENT

General

Tuning cores are provided in the oscillator coils at channels 13, 11, 9, 7, 6, and 4. By adjusting these tuning cores, all channels may be placed on frequency. This procedure should be carried out with the highest frequency channel first, since the alignment of each channel affects the alignment of all the channels below it in frequency. The channel adjustments are so arranged that, with one exception, each adjustment corrects the tuning of more than one channel. The coverage of the various adjustments is as follows:

CHANNEL ADJUSTMENT	CHANNELS CORRECTED BY ADJUSTMENT
13	13 and 12
11	11 and 10
9	9 and 8
7	7 only
6	6 and 5
4	4, 3, and 2

The FINE TUNING cam should be preset for all adjustments by placing the stop on the FINE TUNING cam between the Channel 7 and 8 holes on the front plate of the tuner.

PROCEDURE USING STATION SIGNAL

The following simplified procedure may be used to align the oscillator when the television i-f alignment is satisfactory and a station signal is available:

1. Mechanically preset the FINE TUNING cam to the center of its range (see figure 4).
2. Tune in the highest-frequency channel to be received.
3. Adjust the tuning core for that channel, or the next higher channel, for the best picture; that is, starting with sound in the picture, turn the tuning core until the sound disappears. Repeat for each channel received in the area.

PHILCO TROUBLE SHOOTING CHART

NO RASTER—NO SOUND
Power input circuit
Check B+ Fuse F100 (1.6 Amps.)
Check selenium rectifiers CR100 and CR101

WEAK PIX—SOUND AND RASTER OK
Tuner fine tuning
Contrast con.
V3, V4, V5, V6, V7
Check Vid. Det. xstal CD200 (1N64)

POOR HOR. LIN.
Width con.
V16, V17
Check 0.047 μf cap. connected to terminal T1 of hor. out. trans.
Hor. Out trans.

PIX JITTER SIDEWAYS
Hor. Hold and Freq. con.
Check adjustment of TC800
Check 0.01 μf cap. connected to pin 7 of V15
Check 1000 $\mu\mu f$ cap. connected to pin 7 of V15

PIX JITTER UP & DOWN
Vert. Hold and Contrast con.
V11, V12
Check Vid. Det. xstal CD200 (1N64)

SMEARED PIX
Tuner fine tuning
Contrast con.
V3, V4, V5, V6, V7
Check Vid. Det. and Amp. peaking coils
Check Vid. Det. xstal CD200 (1N64)
IF and RF alignment
Check adjustment of TC301

POOR PIX DETAIL
Tuner fine tuning
Focus con.
V3, V4, V5
Check Vid. Det. and Amp. peaking coils
IF and RF alignment

SOUND BARS IN PIX
Tuner fine tuning
V1, V2, V3, V4, V5, V6
Check adjustment of TC300
IF and RF alignment

ENGRAVED EFFECT IN PIX
Tuner fine tuning
Contrast con.
V1, V2, V3, V4, V5, V6, V7, V19
Check adjustment of TC301
Check Vid. Det. xstal CD200 (1N64)
Check Vid. Det. and Amp. peaking coils

VERT. BARS
V16, V17
Check 68 $\mu\mu f$ cap. connected to yoke terminals Y1 and Y2
Defl. yoke ringing

PIX BENDING
Hor. Hold and Freq. con.
Check adjustment of TC800
V11, V12, V14, V15, V16
Check 2000 $\mu\mu f$ and 0.01 μf caps. connected to pin 7 of V14

INSUFFICIENT BRIGHTNESS
Ion trap
Brightness con.
V16, V17, V18, V19
Low line voltage

EXCESSIVE RASTER (PIX SIZE)
Size
Hor. and Vert. con.
V16, V17, V18, V19

INSUFFICIENT RASTER WIDTH
Width con.
V16, V17
Check selenium rectifiers CR100 and CR101
Check 390 and 5000 $\mu\mu f$ caps. connected to pin 1 of V15
Hor. Out. trans.
Low line voltage

INSUFFICIENT RASTER HEIGHT
Vert. Size and Lin. con.
V12, V13
Check 0.1 μf cap. connected to pin 2 of V13
Check B+ voltage
Check 0.015 μf cap. connected to red lead of Vert. Osc. trans.
Vert. Out. trans.
Low line voltage

NO VERT. DEFL.
V12, V13
Check 0.1 μf cap. connected to pin 2 of V13
Check 0.015 μf cap. connected to red lead of Vert. osc. trans.
Vert. Defl. coils (yoke)
V. O. T. and Vert. Osc. trans.

NO HOR. OR VERT. SYNC.—PIX SIGNAL OK
V11, V12
Check 0.047 μf cap. connected to pin 2 of V12

NO HOR. SYNC.—VERT. SYNC. OK
Hor. Hold and Freq. con.
Check adjustment of TC800
V12, V14, V15, V16
Check 390 $\mu\mu f$ cap. connected to pin 2 of V15

DISTORTED SOUND
Tuner fine tuning
V2, V8, V9, V10
Check Vid. Det. xstal CD200 (1N64)
Check 0.0068 μf cap. connected to pin 5 of V10
Sound and Vid. IF alignment TC400, Det. alignment Z400

STEWART WARNER

Model 9132-A

TUBE LIST

SYMBOL	TYPE	CIRCUIT FUNCTION
V1	6AU6	1st Sound IF Amp.
V2	6AU6	2nd Sound IF Amp.
V3	6T8	Sound Discr.-Sound Amp.
V4	6U6GT	Sound Out.
V5	6J6	Mixer-Osc.
V6	6BQ7 or 6BZ7	RF Amp.
V7	6AU6	1st Vid. IF Amp.
V8	6AU6	2nd Vid. IF Amp.
V9	6AU6	3rd Vid. IF Amp.
V10	6CB6	4th Vid. IF Amp.
V11	6AL5	Vid. Det., DC Restorer
V12	6AU6	Vid. Amp.
V13	6BE6	Gated Sync. Sep.
V14	6K6GT	Vid. Out.
V15	21AP4	Picture tube
V16	6AU6	AGC Amp.
V17	12AT7	Sync Slipper, Phase Splitter
V18	6AL5	Hor. AFC Phase Det.
V19	6SN7GT	Hor. Osc.
V20	6CD6G	Hor. Out.
V21	1B3GT	HV Rect.
V22	6W4GT	Damper
V23	6X5GT	Rect.
V24	5U4G	Rect.
V25	6J5GT	Vert. Osc.
V26	6S4	Vert. Out.

KEY VOLTAGES

B+, plate of damper,
V22 pin 5 330 vdc

Boosted B+, cath. of damper,
V22 pin 3 480 vdc

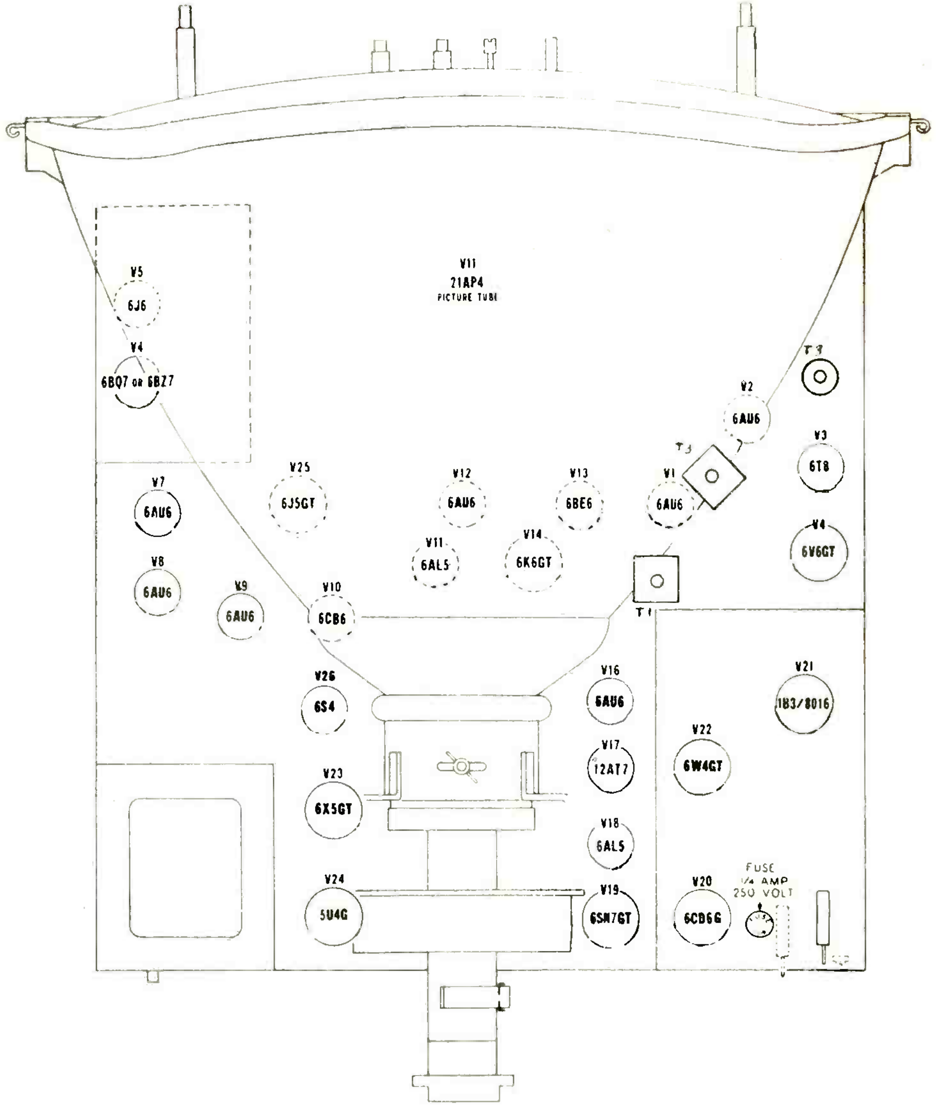
Plate(s) of VERT. OSC.,
V25 pin 3 75 vdc

Plate of Vert. Out.,
V26 pin 9 420 vdc

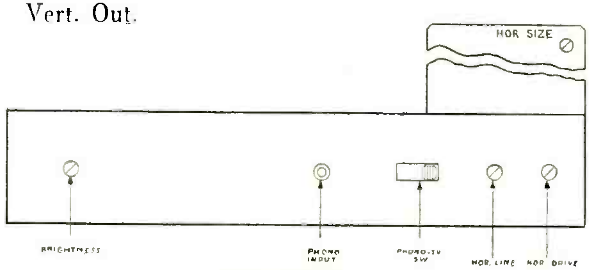
Plate(s) of Hor. Osc.,
V10 pin 2 310 vdc
pin 5 110 vdc

Grid of Hor. Out.,
V20 pin 5 —13 vdc

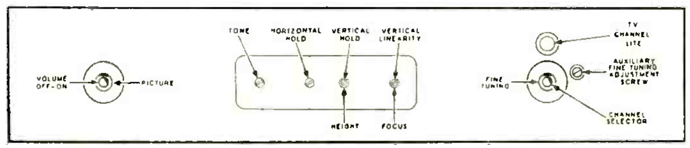
All voltages are measured with a VTVM connected between the tube pins and chassis.



TOP VIEW



REAR CONTROLS



FRONT CONTROLS

ADJUSTMENTS

ADJUST ION TRAP

If screen remains dark or is only dimly illuminated when "Brightness" control is turned clockwise, the ion trap may require adjustment.

The ion trap is located on the neck of the picture tube and consists of a magnet held in position by metal bands.

With "Brightness" control (located at rear of receiver) set approximately ½ turn clockwise, rotate the entire ion trap assembly while sliding it back and forth until picture tube screen is illuminated to maximum brilliance. Reduce "Brightness" control setting and repeat this operation to assure accurate positioning of iron trap.

Do not turn "Brightness" control to its maximum clockwise position until ion trap is correctly adjusted—failure to observe this precaution may result in damage to the picture tube.

CAUTION: There is only ONE correct setting of the ion trap. This position is attained when maximum brilliancy occurs on the picture tube screen. If defocusing of picture or neck shadow results, DO NOT adjust position of ion trap. Failure to observe this precaution will result in an ion burn (brown spot) on the face of the picture tube. Since this condition is brought about by lack of proper ion trap adjustment at time of receiver installation, the picture tube will not be eligible for warranty adjustment.

AUXILIARY FINE TUNING ADJUSTMENT

It is found that the tuning range of the "Fine Tuning" control is inadequate to permit correct tuning of a station in its assigned channel, then adjustment of the "Auxiliary Fine Tuning" screw will be necessary. This special screw is accessible after removal of the "Channel Selector" and "Fine Tuning" knobs. They may be removed by merely pulling them forward.

Adjustment of the "Auxiliary Fine Tuning" screw may be undertaken in accordance with the following procedure.

a. Set "Channel Selector" to desired channels; then remove this knob.

b. Set "Fine Tuning" knob to the center of its range; then remove this knob. The flat portion of the main tuning shaft (outer shaft) should now be in the uppermost position. Note the location of the "Auxiliary Fine Tuning" adjustment screw on receiver chassis.

c. Using a thin screwdriver (preferably non-metallic), adjust the setting of "Auxiliary Fine Tuning" screw for correct tuning of the desired television station. CAUTION: Do not attempt to rotate this screw more than two full turns in either direction, as further rotation may release it from the thread clip within the tuning mechanism and the coil for that channel (located in R.F. Tuner Unit) would then have to be removed in order to restore the screw to the correct position. If a metal screwdriver is used, detuning occurs when the screwdriver is removed but it will be noted that this degree of detuning can now be compensated by resetting the "Television Fine Tuning" control (outer shaft). Thus the range of the "Television Fine Tuning" control (after knob is replaced on the shaft) will be adequate to tune in the station.

d. This completes the adjustment of the "Auxiliary Fine Tuning" screw for one channel. Identical screws are provided on each channel and they are all accessible thru the same opening in the tuning mechanism as each successively moves into position when the "Channel Selector" knob is rotated.

HORIZONTAL LINEARITY

Improper horizontal linearity causes the circular test pattern to appear condensed on the right edge of the screen and extended on the left edge or vice versa. Adjust for proper linarity by using "Horizontal Linearity" control located at rear of chassis. In event that proper horizontal linearity cannot be obtained by adjusting this control, then check the setting of the "Horizontal Drive" control to be sure it has been correctly adjusted.

HORIZONTAL DRIVE

The "Horizontal Drive" control located at rear of chassis should be rotated clockwise to a point just prior to where the picture tube brilliancy and size decrease. Then adjust this control ½ turn counter-clockwise.

ELIMINATING SEMI-CIRCULAR SHADOW

This shadow is caused by the electron stream striking the neck of the tube and it can generally be corrected by applying one or a combination of the following procedures:

Make sure deflection yoke is symmetrically positioned with respect to the neck of the picture tube by loosening the three wing nuts and adjusting yoke position.

Should a change in height of the deflection yoke be required to obtain symmetry of yoke around neck of picture tube, it will be necessary to loosen the four wing nuts (two nuts located on each leg of mounting frame) and raise or lower yoke as required. After adjustment has been completed be sure to retighten nuts securely.

BRIGHTNESS

The "Brightness" control (located at rear of receiver Chassis) should be initially adjusted in conjunction with the "Contrast" control for the brightness level desired by set owner—check all active station channels. Too much brightness will have the same effect as too little contrast, and vice versa, therefore, it is necessary to strike a proper balance between contrast and brilliance.

STEWART-WARNER TROUBLE SHOOTING CHART

VERT. BARS
Hor. Drive con.
V20, V22
Check 56 μμf cap. connected to yoke socket terminal 6
Defl. yoke ringing

PIX BENDING
Hor. Hold. con.
V16, V18, V19, V20
Check 0.05 μf and 5000 μμf caps. connected to pin 1 of V19

EXCESSIVE RASTER (PIX SIZE)
Hor. Drive con.
Hor. and Size Sync. con.
V15, V20, V21

RASTER BLOOMING
Hor. Drive con.
V15, V20, V21, V22, V23, V24
Check HV Filter cap.
Check 1 Meg Ω Res. connected to HV Filter cap.

INSUFFICIENT RASTER WIDTH
Hor. Drive and Size con.
V20, V22, V23, V24
Check 270 and 390 μμf caps. connected to pin 5 of V19
Hor. Out. trans.
Low line voltage

INSUFFICIENT RASTER HEIGHT
Vert. Size and Lin. con.
V23, V24, V25, V26
Check 0.1 μf cap. connected to pin 6 of V26
Check 0.05 μf cap. connected to pin 6 of V26 through a 6.8k Ω res.
Vert. Out. trans.
Low line voltage

NO VERT. DEFL.
V25, V26
Check 0.1 μf cap. connected to pin 6 of V26
Check 0.05 μf cap. connected to pin 6 of V26 through a 6.8k Ω res.
Vert. Defl. coils (yoke)
V. O. T. and Vert. Osc. trans.

NO VERT. SYNC.—HOR. SYNC. OK
Vert Hold con.
Vert. Int. network
V13, V16, V17
Check 4700 μμf cap. connected to pin 5 of V25

NO HOR. OR VERT. SYNC.—PIX SIGNAL OK
V13, V16, V17
Check 0.05 μf cap. connected to pin 7 of V13
Check 0.05 μf cap. connected to pin 2 of V17

NO HOR. SYNC.—VERT. SYNC. OK
Hor. Hold con.
V17, V18, V19
Check 330 μμf cap. connected to pin 2 of V19

DISTORTED SOUND
Tuner fine tuning
V1, V2, V3, V4, V6
Check 0.005 μf cap. connected to pin 5 of V1
Sound and Vid. IF alignment T1, T2
Det. alignment T3

NO SOUND—PIX OK
Tuner fine tuning
Vol. con.
V1, V2, V3, V4
Speaker (open voice coil or defective connection)
Sound and Vid. IF alignment T1, T2
Det. alignment

SYNC. BUZZ IN SOUND
Tuner fine tuning
V1, V2, V3, V11, V16
Sound IF and Det. alignment T1, T2, T3

NO RASTER—NO SOUND
V23, V24
Power input circuit
Check B+ fuse (1 Amp.)

NO RASTER—SOUND OK
Brightness con.
Check HV Fuse (0.25 Amps.)
Ion trap
V15, V19, V20, V21, V22
HV trans. Hor. yoke CRT connections

WEAK PIX—SOUND AND RASTER OK
Tuner fine tuning
Contrast con.
V5, V6, V7, V8, V9, V10, V11, V12, V14, V16

POOR HOR. LIN.
Hor. Lin. and Drive con.
V20, V22
Check 0.05 μf caps. connected to Hor. Lin. Coil
Hor. Out. trans.

POOR VERT. LIN.
Vert. Size and Lin. con.
V25, V26
Check 0.1 μf caps. connected to pin 6 of V26
Check 100 μf Elec. cap. connected to pin 2 of V26
Vert. Out. trans.

PIX JITTER SIDEWAYS
Hor. Hold Con.
V18, V19, V20
Check 0.01 and 0.05 μf caps. connected to pin 1 of V18

SMEARED PIX
Tuner fine tuning
Contrast con.
V7, V8, V9, V10, V11, V12, V14, V16
Check Vid. Det. and Amp. peaking coils
Check 0.05 μf cap. connected to pin 5 of V14
IF and RF alignment

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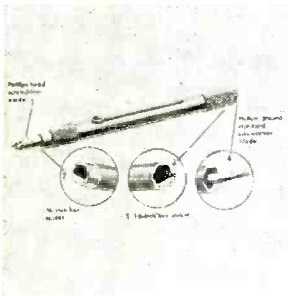
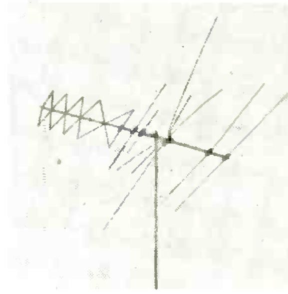


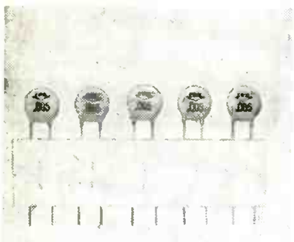
CBS-Hytron 4-Way Tool

CBS-Hytron, Danvers, Mass., has announced a 4-Way Tool consisting of: a slotted steel barrel with hex sockets, ¼-inch at one end, 5/16-inch at the other; a double-ended screwdriver blade . . . one end with Phillips head, the other standard . . . which slides inside the barrel; and a knurled setscrew to lock the sliding blade into any one of three recessed positions within the slotted barrel. When the sliding blade is centered within the barrel, either hex socket can be used.

JFD Jet-Helix

The combination of the special flat plane conical, which proved exceptionally successful in the JFD Super-Jet, and the microwave helix, makes this a revolutionary antenna design for real dynamic performance. The Jet-Helix is completely constructed from Alcoa Aluminum, and highly engineered for the best reception ever achieved. The helix exhibits unusually high gain and directivity. For info, write JFD Mfg. Co., 6101 16 Ave., Brooklyn 4, N.Y.



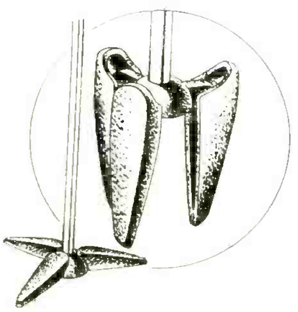


Erie "Pallet-Pak"

Erie Resistor Corporation, Distributor Division, 50 E. Wynnewood Rd., Wynnewood, Pa., announces a new method of bulk packaging ERIE Disc Ceramicons at no extra cost, which it has named "Pallet-Pak." Five discs are inserted between two strips of cardboard and stapled in position between the leads, eliminating tangled leads and providing an easily identified, easily handled, and quickly inventoried item.

"Corridor" Speech Master

The Jensen Manufacturing Company of this city is now producing a reproducer specially designed for two-direction sound coverage in corridors or offices. The new unit, Model RK-61, has a heavy drawn steel case with extended perforations on both sides to permit high quality speech coverage in both directions while offering complete protection to the heavy duty six-inch loudspeaker driver unit.

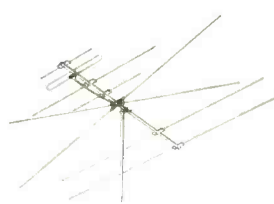


Snyder Mike Stand

A new floor stand has been introduced by Snyder Manufacturing Company of Philadelphia. The stand is a floor model and is coded the MS-2. 32½ inches collapsed, its chrome plated 2-section telescopic staffs extend to 61½ inches and are held securely by the Snyder Sure-Grip Lock with Velvet Action. The Base, of gray crackle finish cast iron, is light in weight. Additional information may be obtained by writing to Dick Morris at Snyder Mfg. Co., Philadelphia 40, Pa.

Clear Beam Antenna

Clear Beam Antenna Corp. announces availability of the "Big Chief," an all new high gain antenna combining the principles of the giant conical with a Yagi. This antenna provides servicemen with a functional type high gain all-band unit designed to cover all channels 2 to 13. Snap-open construction and special die-formed hardware provide easy assembly. The use of wider diameter tubing on the low band section of the antenna affords improved sensitivity.

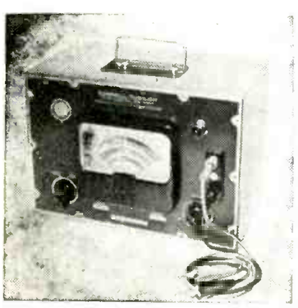


Raytheon Set Jackets

"Make your TV set match your room decor" is the theme of a new display featuring the "jacket wardrobe" of Raytheon's 17-inch and 21-inch Challenger sets. The full-color display measures 2 by 3 feet, stands securely on top of the 17-inch set through a combination of die-cut design and easel back, and contains swatches of the fabrics used for the ten slip-on jackets. For details, write Raytheon Mfg. Co., 801 N. Michigan Ave., Chicago 11, Ill.

Regency FM-AM Tuner

A new FM-AM professional tuner, Model AF-250, is now being manufactured by Regency which utilizes a genuine Armstrong circuit with two limiters, and has separate FM and AM circuits from antenna to output. AFC on FM provide maximum fidelity at all times. The unit is of cast polystyrene over black krinkle steel. For information, write Regency, a division of I.D.E.A., Inc., 7900 Pendleton Pike, Indianapolis 26, Ind.

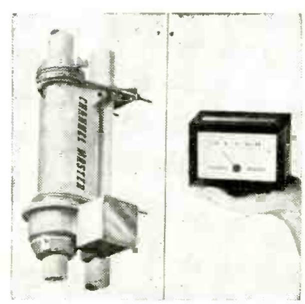


Cornell-Dubilier Flyback Checker

The CD "Flyback Transformer and Yoke Checker" is extremely sensitive and can detect even a single short circuited turn in the windings by indicating inductance change. The instrument, called the CD model BF-80, employs an oscillator circuit, a 6V6 vacuum tube and a 4½" microammeter with separate indicator scales for short tests, continuity tests, and yoke tests. For further information write: Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

Channel Master Roto-King

Development of the Roto-King new antenna rotator has been announced by Channel Master Corporation, Ellenville, N.Y. The rotator is designed to provide the set-owner with hair-line accuracy in pin-pointing TV stations. Its many features include a flexible worm gear which eliminates the danger of gear-slipping, back-lash, and binding, assuring a longer life and positive control, and its midget control cabinet, the smallest cabinet on the market, measuring just 2¾" x 4".



WORK BENCH

[*from page* 35]

was also noted that when the contrast was decreased slightly, the picture would slip vertically. Evidently, this was a composite sync problem. Therefore, V118, 6SK7, the first sync amplifier, V119, 6SH7, the sync separator, and V120A, the second sync clipper were replaced individually but did not solve the problem. Just as a slight possibility, V114B, 6AL5, the *dc* restorer was also replaced.

The oscilloscope was next set up to check a few waveforms, and the diagram consulted. The 6SK7, V118, is a remote cut off type tube which is grid biased by the bleeder network, *R228* and *R153*. The signal arriving at the grid of V118 is in a negative direction.

Knowing these facts, a waveform check was made at pin #4 of V118 but the waveform checked correctly with the manufacturer's service data (Ref. to *Fig. 3A*). Next a waveform check was made at pin #8 of V118 and this waveform also checked correctly with the manufacturer's notes (Ref. to *Fig. 3B*).

V119, the sync separator was then considered. This tube is grid biased by the bleeder network *R156* and *R157*. The operating voltages applied to the grid, screen and plate are such that the negative or bottom portion of the applied positive going signal is cut off. Thus, the video and blanking pulses are removed and only the sync pulses appear at the plate of V119. Knowing this, a waveform check was now made at pin #4 of V119. This waveform checked correctly, yet it seemed to quiver a bit too much (Ref. to *Fig. 3C*). However, on checking pin #8, the plate of V119 we found trouble. Instead of being twice the size of that at pin #4 of V119 the waveform was about the same size. Moreover, it appeared to quiver entirely too much (Ref. to *Fig. 3D*).

A voltage measurement was then taken at the grid of V119, pin #4. Instead of measuring about —5 volts, it measured about —18 volts. The receiver was then turned off and a resistance check was made of *R156* and *R157*. *R156* checked properly but *R157* measured infinite. *R157*, 1 megohm, was then replaced with a new 1 meg resistor and the receiver now functioned properly.

With *R157* open and —18 volts applied to the grid only the uppermost positive tips of the sync pulses would cause V119, 6SH7, to conduct. Thus, because of the small sync pulse voltage applied to the horizontal and vertical oscillators, the picture would slip vertically and pull horizontally.

AUDIO ADAPTATIONS

[*from page* 33]

such as the 6K6, 6V6, 6W6 etc. can be adapted.

Again an "S" type socket and an old tube base are connected together, but this time as shown in *Fig.* 2. This results in the plate and screen of the output tube of the TV receiver being connected together so that the tube performs as a triode. Observe also that the plate of the tube is connected to B+, and that the signal output is taken off the cathode. Thus, this stage becomes a cathode follower with a low impedance output which may be connected into a low impedance load. Systems between signal sources and loads using low impedance circuits produce a minimum of noise and interference voltage pickup in the lines, so that long lengths of wire may be connected between the cathode output terminals and the distant power amplifier input without excessive noise or hum pickup.

[*Continued on page* 52]

Television CRT manufacturers' sales of cathode ray tubes in September topped the 1.1 million mark to establish a new high in monthly unit sales, as reported by the Radio-Electronics-Television Manufacturers Association. Receiving tube sales in September gained by over 16 percent from August and were at the highest level since June of last year. Nearly 1 million television receivers were sold at retail during September, bringing sales for the first nine months of this year to the highest point on record. TV set sales in September more than doubled the August rate and radio sales were at the highest level this year, the Association added.

The Sprague Electric Company has started construction of a 13,000 square foot, one-story building in the Venice section of oLs Angeles, Calif. to house all its Southern California operations. The building, in contemporary modern California architectural style of stone, glass, and cinder block, is epected to be completed in the spring of 1955. The Sprague company will then move from its present rented quarters in Culver City.

One-year warranties on TV picture tubes appear to be on the way out. On December 1, GE and DuMont will switch to six-month warranties on all sales of replacement CR tubes. A change to 12-month pro-rata warranty systems has already been made by RCA and Sylvania. The industry policy in regard to tubes sold to set manufacturers, but it is possible that these warranties may be reduced to a period of six months, early next year.

A new record care kit, ready in time for Christmas business, has been announced by Walco Products, Inc., East Orange, N. J. Designed to appeal to anyone with a record collector or hi-fi fan on his (or her) Christmas list, the kit contains a 6 oz. can of Walco Stati-Clean, popular anti-static spray cleaner for records; 2 packages of Walco Discovers—protective record sleeves made of the soft plastic, polyethylene; a book on record care by a leading audio expert, and a small camel's hair brush for cleaning dust from phonograph needle tips.

Latest developments in the Color TV field: Initial quantities of a pre-production run of RCA Victor's new 21-inch color television receiver, for demonstration purposes only, have been shipped to distributors in key color TV Markets. . . . Muntz TV, Inc., hopes to have a color set on the market in February, Earl W. Muntz, president, said recently. The color tube used will probably be CBS-Columbia's. . . . Magnavox will venture into color television for the first time next year with a 21-inch console incorporating a 21-inch round shadow mask color tube. . . . The U. S. Patent Office has granted Dr. Ernest O. Lawrence, a Nobel Prize physicist, a patent covering a basic invention for better and less expensive color television picture tubes. All Lawrence tubes embody the basic principle of post-deflection focusing and electronic color registration which makes it possible to build color stability in the tube itself. . . .

The "Dragnet" TV show, about the first of next year, will feature an exposé of a television service "racketeer." A. W. Bernsohn, managing director of the National Appliance and Radio-TV Dealers Association, announced that the script has been prepared by Dragnet Productions, Inc., with the cooperation of the Los Angeles Electric League and NARDA. Frank J. Moch, NATESA president, voiced apprehension at the announcement of the project, recalling that one of the earlier "Dragnet" scripts on the same subject proved quite derogatory to the industry; however, he expressed the hope that "anything controversial" may have been avoided this time by virtue of NARDA's editing of the script.

As of late, a great number of radio and television set manufacturers have been striving to build more compact units. As a result of this, the speaker must, of course, also be reduced. Since the dimension most important in this respect is the depth, there is an ever increasing number of shallow speakers being used. So as to offer the serviceman a suitable replacement speaker for these sets, Oxford electric has developed a series of shallow speakers which is identified as the "H" Series. These units have all the characteristics of the conventional replacement speakers. The "H" Series is limited to five sizes, which will be sufficient for almost all replacements.

A turn-out of some 250 service people attended the first 1954 meeting of the Service Managers' Organization of New York held at the New York Trade School on Wednesday, September 29th, according to Donald Packer, Service Manager of Olympic Radio & Television Inc., who sponsored the meeting.

OLYMPIC'S Chief Engineer, Lee Seigmund, spoke about service considerations of OLYMPIC'S new vertical chassis.

Norman B. Krim, Vice-President and General Manager Raytheon's Receiving and Cathode Ray Tube Operations, congratulates F. Edward Anderson, Distributor Tube Sales Manager, on completion of 25 years of continuous service. Mr. Anderson directs the replacement sales of Receiving, Picture and Industrial Tubes, including Semi-conductor Diodes and Transistors to over 600 distributor accounts. Mr. Anderson is a member of the Radio Oldtimers Club and is well known throughout the radio and television industry.

An agreement by GE field TV-radio service executives has been reached by which GE radio repair work will be channelled through independent service shops throughout Pennsylvania. A ninety-day free-labor policy has been inaugurated by GE for its radio line, by which all sets will be serviced by their distributors during the length of the guarantee period. GE, during a recent meeting with the Federation of Radio Service Men's Associations of Pennsylvania, declared that it did not want to exploit the service business and compete with service and appliance dealers.

AUDIO ADAPTATIONS

[from page 49]

The TV receiver schematic must be referred to for two reasons. The first is to make sure that the cathode resistor of the output stage is returned to ground—not B minus. Those circuits employing an ungrounded B minus supply do not lend themselves to this adaptation due to the high voltage difference between the two chassis. The second is to note the value of the cathode bias resistor. Since there is negligible *dc* drop in the TV audio output transformer, the B plus screen voltage can be applied to the plate without disturbing the rest of the circuit—thereby allowing the use of the cathode load resistor, *R*, of the same value as the old one.

The same materials are used as described in the previous section with the addition of the load resistor. Notice that the cable is connected to the socket this time, instead of the base. The cathode follower's inherent degeneration also makes it desirable from the point of view of reduced amplitude distortion. This increase in fidelity, however, is obtained at the expense of a loss in gain. With the rather low value of load resistor used here, the stage gain is somewhere between 0.35 and 0.50—low even for a cathode follower. This should not prove a serious drawback in most cases, however, since the audio amplifier has ample reserve gain to make up for this loss.

Although most amplifiers contain an input grid coupling condenser, it pays to check the schematic for its presence. If there isn't any, a .01 *uf* paper condenser should be inserted at the amplifier end of the cable. Without this condenser, the grid would be driven several volts positive, causing excessive plate dissipation and distortion.

If, as is probable, these changes result in a duplication of volume controls, the amplifier control should be set at some high level and the volume varied at the TV set. This prevents the possibility of overdriving the earlier voltage in the receiver to make up for the loss in the cathode follower.

Speaker Switching by Means of Relays

If the customer's TV set uses a miniature audio output tube, such as a 6AQ5 (in which case the above adapters cannot be used because of the glass-to-metal seal) or his is one of those rare sets with a fairly good push-pull audio section, a great improvement in performance can be obtained by substituting the hi-fi speaker of his hi-fi system for the small commercial one used in most receivers. Fig. 3 indicates a method by which this can be done without the addition of any switches or controls. Here a relay automatically throws in the hi-fi speaker only when the TV set is turned on. A double-pole-double throw, 6 volt *ac* relay is mounted on the rear of the hi-fi speaker enclosure and connected as shown.

It is not advisable to mount the relay at the TV set since this might lengthen the speaker cable considerably, possibly causing high frequency oscillations in feedback type amplifiers. Four conductor flat cable is practical for this job since it can be laid under the carpet.

Voltage for energizing the relay coil is obtained from the filament terminals of any 6 volt tube in the receiver. These terminals are made accessible by the use of a Vector test adapter, type "T", which is plugged between the tube socket and the tube.

This will not work with a set with either series or series-parallel filament strings, since the filament current would be changed. It is also a good idea to choose a tube whose filaments are returned to ground rather than some positive *dc* voltage. High *dc* voltages can cause trouble if the relay frame is grounded to the chassis by its mounting stud.

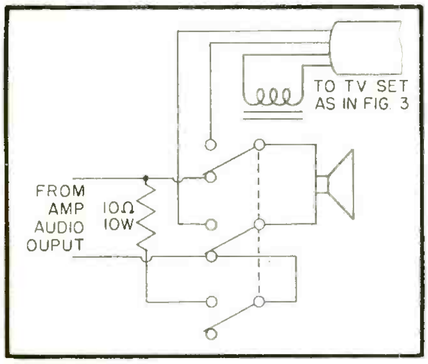


Fig. 4—Use of 3-pole relay to maintain permanent loading of audio output transformer.

Constant Loading on Output Transformer

With the above arrangement, it is possible to damage the hi-fi audio output transformer if the hi-fi audio system is turned on while the TV set is on. *Fig.* 4 shows how this hazard can be avoided at a slightly greater expense. By using a three-pole, double-throw relay, the transformer is loaded with a 10 ohm, 10 watt resistor when the TV set is in use, thereby maintaining a load on the hi-fi output stage under all switching conditions.

The matching resistor of *Fig.* 3 will be necessary when the speaker has a different impedance from the TV output transformer. A 10 ohm, 5 watt resistor is a good compromise for most cases.

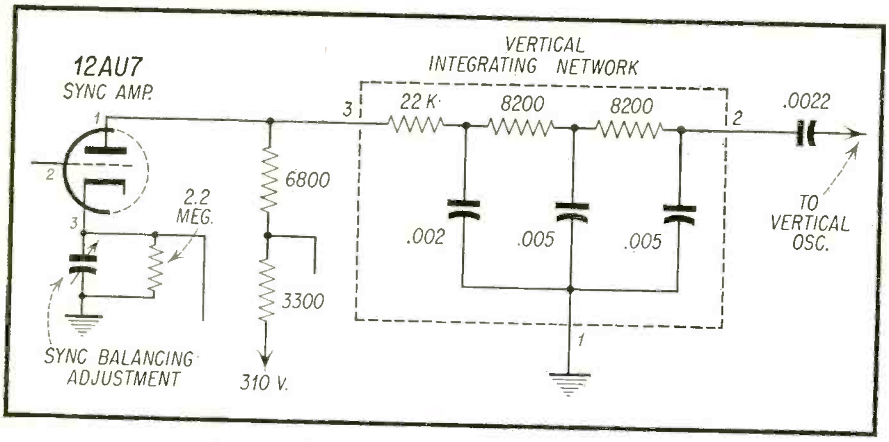


Fig. 2—Correct integrator wiring circuit.

ANSWERMAN

[*from page 27*]

of manufacturers TV receivers. But they do fail occasionally. What happens is that they open up inside at one of the leads. In the installation of the replacement integrating network several technicians have wired the new part in backwards.

Consider what would happen in *Fig.* 2 if the point 3 were connected to the .0022 *uf* condenser and point 2 were connected to the 6800 ohm resistor. The .005 *uf* condenser of the integrator network would short most of the horizontal pulse to ground leaving very little pulse to be used by the horizontal oscillator for lock-in purposes. However, the reactance of the .005 *uf* condenser to the vertical 60 cycle pulses would not be too low and there would be enough signal available at the output to hold the vertical oscillator in sync.

COLOR

[*from page 14*]

than that introduced by the filter in the I demodulator. To make both the I and Q signals arrive simultaneously at the matrix network a slight additional delay network is introduced in the I demodulator. Still on the subject of time delay it would be appropriate at this time to point out that the luminance channel which has negligible time delay is also provided with a time delay network. The latter brings the luminance signal into the matrix network at the exact same time as the I and Q signals.

Phase Splitter

In the I channel the I voltage is amplified and passed on to the phase splitter, whereas in the Q channel no amplification is necessary so that the output from the Q demodulator is coupled directly to its phase splitter. The purpose of the two phase splitters is to obtain both positive and negative polarity I and Q signal voltages. The positive and negative I and Q signals now enter a matrix network into which the Y signal is also fed.

Five signals are now available at the input of the matrix network. These are +I, –I, +Q, –Q, and Y. These five signals combine with each other in the matrix to produce the original red, green and blue color signals. The mathematical relationships are as follows:

$$R = .96I + .62Q + Y$$
$$B = -1.101I + 1.7Q + Y$$
$$G = -0.281I - .64Q + Y$$

These primary color voltages are then fed to the color signal amplifiers which are controlled by potentiometers, except for the red amplifier stage which employs a fixed gain network. These potentiometers are set entirely by the requirements of the phosphor efficiency of the color picture tube and their adjustments will be discussed in detail in a later chapter.

Following each individual color amplifier a color output stage may be found depending on the receiver design. The red, blue and green voltages are then applied to the respective electron guns of the tri-gun picture tube.

DC restoration is incorporated at this point. The use of *dc* restorers is essential to the proper presentation of color pictures. Whereas the omission of the *dc* component in a monochrome receiver is not serious because a turn of the "Brightness" knob can compensate for this loss, such a simple correction is not available to the operator of the color receiver. Although the "brightness or background" control of the color receiver does control all three guns simultaneously it does not affect them equally. The ratio of the different gun effects are dictated by the relative phosphor efficiencies and cannot be used to correct for defective video presentation, as would occur in the absence of the three *dc* components.

REMOTE CONTROL

[*from page* 29]

6. Now place the unit back in the chassis and pick up location of mounting holes from the mounting bracket making sure that the shafts are perfectly aligned and the gap above-mentioned is maintained. Then drill two holes with a #19 drill.
7. Before making units secure to chassis, determine the proper method of coupling the tuner shaft (Figure 6).
8. Placing the Motor Assembly back in chassis, slide it forward so that coupler engages both shafts and secure brackets in position. #8 screw assemblies.
9. Where the method in Figure 4 applies, take the following steps: Place the base of mounting bracket A against rear wall of tuner so that large hole in the base centers around the tuner shaft. (NOTE: If the tuner shaft does not protrude through rear wall of tuner, it will be necessary to drill a hole in rear wall of the tuner so that the coupler can slide onto the tuner shaft without binding.)
10. Pick up mounting hole locations from mounting bracket and drill two #29 holes in the tuner case. Mount with two #8 sheet metal screws and lock washers.
11. Mount the Motor Assembly to bracket B as shown in Figure 4 and secure with two #8 screws and lock washers into the mounting studs of the Motor Assembly. (Motor Assembly in Figure 4 can be rotated 180° and then mounted if space so demands.)
12. Bracket B may now be mounted onto Bracket A dependent upon space limitations. The motor shaft should be cut at whatever length is desirable so that Bracket B can be bolted to Bracket A as space allows. It is important that a gap of from 1/32" to ⅛" be maintained between the shaft of the tuner and the shaft of the motor.
13. Now attach the coupler as shown in Figure 6A.
14. Slide the coupler onto the tuner shaft and bolt the brackets in place. Use #8 screw assemblies.
15. Mount the Relay Assembly in any convenient location preferably on the rear of the chassis using #8 screws. (Bear in mind that the female disconnect plug will require a corresponding hole in the cabinet-back.)
16. The unit is now ready for wiring. Follow the wiring diagram, using tag attached to the Relay Assembly for sequence of wiring. PAY STRICT ATTENTION TO

THE COLOR CODE. Be sure to recheck your wiring. Then plug REMOT-O-MATIC male plug into female plug on the Relay Assembly. On the remote unit, set the fine tuning knob up to its maximum (clockwise). Turn the set on at the set itself and align all operating channels to the center of the fine tuning range. Now shut the set off at the set and turn the brightness control on the set itself to its maximum position (clockwise).

From the remote unit, turn the set on and operate each control on REMOT-O-MATIC to prove your wiring. Then turn off the set.

17. Re-install the chassis into the cabinet. Make a hole in the cabinet-back where male plug is to engage female plug. Replace cabinet-back. Turn Remot-O-Matic over to your customers so that they may now really enjoy television.

HORIZONTAL OUTPUT TRANSFORMERS

[*from page 17*]

is the subject of our discussion is termed, as previously mentioned, a "horizontal output and high voltage" transformer, or simply a "flyback" transformer.

Figure 4 is a simplified schematic for the purpose of explaining the production of the high voltage to be used for the 2nd anode of the picture tube. A logical starting point in this explanation is at the grid of the horizontal output tube. The driving voltage at this point is the modified sawtooth or trapezoidal wave of voltage shown in *Fig. 4B*. The horizontal output tube is biased with a voltage sufficiently negative so that current will flow through the tube only when the signal rises above the dotted line of *Fig. 4B*. The output tube therefore conducts between A and C, D and F, and G and I. It is cut off between B and C and also between D and E. It can be seen then, that the current in plate circuit will have the form shown in *Fig. 4C*. This is the current flowing through the section of the autotransformer winding from top #2 to top #1 in *Fig. 4A*.

As the plate current rises from A to B, a similar current is induced in the secondary circuit; similar that is, in wave form. Actually, the current in the secondary circuit is larger than that in the primary because of the step down ratio in the transformer. If this sounds strange, just recall that when the voltage is stepped down, the current is stepped up. As this current flows through the horizontal deflection coils, it builds up a steadily increasing magnetic field around these coils. This of course is the field which is responsible for the deflection of the electron beam. At points corresponding to B, E, and H of *Fig. 4C*, the magnetic field reaches its maximum value and then suddenly drops to zero. (Note. Actually, a shock excited oscillation begins at points B, E, and H. In the interest of simplicity and clarity, this action of the circuit will be omitted now and discussed in detail when the damping circuit is taken up.) Since the collapse of the field is very rapid, and since one of the factors which determines the size of the induced or back *e.m.f.* is the speed with which the lines of force cut the turns of wire in the yoke, there results across the yoke a high pulse of back *e.m.f.* This pulse reaches a value of approximately 1500 volts.

Notice, from *Fig. 4A*, that since this pulse appears across the terminals of the deflection coil, it must also appear across the terminals of the secondary winding of transformer, since these points are electrically the same. Now it is important to note that when the signal was being traced through from left to right, the transformer was a step down transformer, that is, fewer turns on the secondary than on the primary. However, in following the pulse of back *e.m.f.* from right to left, starting at the yoke, the transformer, working in reverse, steps up this rule of voltage. Terminals A and B, in *Fig. 4A* for example may be considered as the primary for the pulse, and terminals 1 and 3 the secondary. Depending on the design of the transformer, the pulse may be stepped up to a value of from approximately 9 KV for some of the 10 inch receivers to as high as 20 KV for some present day receivers.

[To Be Continued]

RESISTIVE NETWORKS

[*from page 31*]

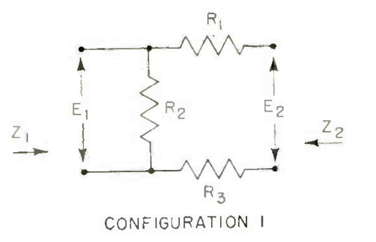


Fig. 1—Unbalanced to balanced load network.

value of loss encountered can normally be compensated for by merely advancing the signal generator output.

An impedance match is not considered essential when a fixed-frequency generator is being used since the mismatch would normally only introduce errors in the indicated microvolt output, a measurement which is not accurate anyway with inexpensive signal generators. It follows of course that when accurate signal strength measurements are being made a proper generator-to-receiver impedance match should be provided. The loss introduced by the matching network must of course be taken into account in determining absolute values of receiver input.

This simple little device may take on considerable importance in *uhf* work. While tuner alignment has not constituted a major problem in *vhf* receivers it seems possible that it will in *uhf* equipment. If so, a matching device effective over a wide frequency range will be necessary for satisfactory results. It may also be necessary in recovering sufficient signal voltage to adjust antenna coupling in *uhf* tuners to provide proper antenna transmission line impedance matching, in which case it will be absolutely essential to have the test line properly terminated.

Transmission Line Termination

The antenna input impedance of a TV tuner may vary widely (as much as 10 to 1) for different channels. Hence any signal generator-to-receiver impedance matching device which depends on the reflected impedance of the tuner input will be subject to considerable mismatch. For instance, with either a transformer match or a generator with a direct 300 ohms output a tuner input impedance of 3000 ohms would reflect a 10 to 1 mismatch to the transmission line. Under these conditions, alignment procedures could not be expected to give satisfactory results. It is therefore necessary to use an isolation termination such as Network C with direct output, transformer-matched or "balun"-matched sweep generators.

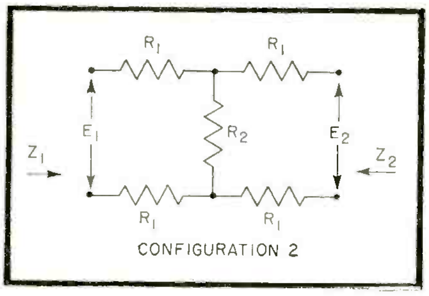


Fig. 2—Isolation network for regulating impedance across generator as load impedance varies.

With this isolating network designed for input and output impedances of 300 ohms the input impedance will vary only from 267 ohms to 370 ohms as the tuner input impedance varies from 30 to 3000 ohms. It is interesting to note that with Network A, designed for 72 ohms, a like change of tuner input impedance would cause the transmission line termination to vary only from 64 to 80 ohms, a variation small enough so as not to require an additional isolation network.

The isolation terminating network should also be found useful in reducing ghosts in troublesome installations using unusually long transmission lines. If the antenna transmission line is sufficiently mismatched at the receiver end a portion of the received signal will be reflected back toward the antenna and if the line and the antenna are sufficiently mismatched, as they are sure to be at some frequencies, the reflected signal will be re-reflected back to the receiver. These reflected signals if sufficiently strong will cause multiple ghosts on the picture. Proper termination of the line at either end will eliminate these reflections and the resulting ghosts; a job made to order for Network C since it will maintain proper impedance match at the receiver end of the line for all channels regardless of variations in the receiver input impedance. Of course the signal will have to be sufficiently strong to provide a satisfactory picture after suffering the network loss. Note that the losses given in Table 1 are for networks terminated with the rated output (Z2) impedance. This loss will vary with the actual value of antenna input impedance. For instance the loss in Network C will vary from 24.4 to 5.6 db as the antenna input impedance is varied from 30 to 3000 ohms.

Signal Attenuation Applications

Resistor networks may also be used to reduce the signal strength by a required amount while maintaining the proper transmission line impedance termination. Two examples of such applications are discussed below.

In cases of excessive signal strength it is desirable to reduce the signal with an attenuator rather than by rotating the antenna away from the station direction. The attenuator will help to provide a good transmission line termination and will also reduce the susceptability to

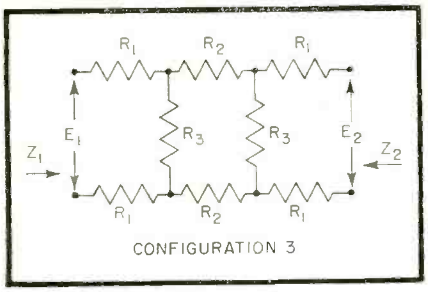


Fig. 3—Attenuation sections in cascade.

ghosts from reflected signals. Station location relative to the receiving location may in some cases dictate the use of a network of suitable attenuation to reduce the signal level from a close signal to within the *agc* range of the receiver while at the same time allowing sufficient signal level from more distant stations.

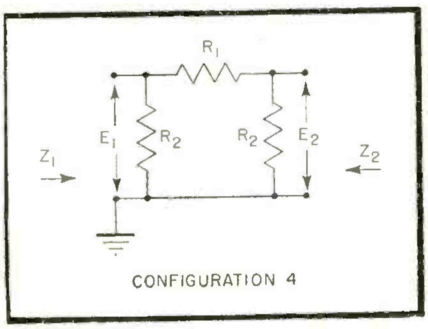


Fig. 4—Attenuation network for use with 72-ohm lines.

Another use for the attenuation network is in service testing. To insure proper operation of sync circuits a test should be made to insure picture sync under weak signal conditions. Resistor networks provide a convenient means for reducing the signal level for such checks. The amount of attenuation may be varied by selection of the proper resistor values to reduce the signal while still maintaining the desired input and output impedances. Network C and D for 300 ohm balanced line provide 10 db and 20 db attenuation respectively. For values greater than 20 db it is desirable to use two attenuation sections in cascade as in Network E. in this arrangement individual resistor valued remain small thus reducing leakage so that the network will provide attenuation at higher frequencies.

Networks F and G provide 10 and 20 db attenuation respectively for use with 72 ohm coax transmission line. Note that with these networks the terminal which is common to the input and output must be connected to the shield side of the transmission line.

Antenna Distribution

When sufficient signal strength is available a resistor network may be used as a convenient means of feeding several receivers from a single antenna. This simple device has the advantages of requiring no power and of operating uniformly over a wide frequency range. Furthermore the inherent insertion loss provides a good degree of isolation between receivers so as to minimize the possibility of the different receivers on the same antenna system interfering with each other.

A network arrangement for this application is Configuration 5. Table 2 lists the resistor values and pertinent characteristics for different combinations of impedance and number of receivers in the system. Resistor values have been selected to provide the minimum insertion loss while maintaining proper impedance values. For less than

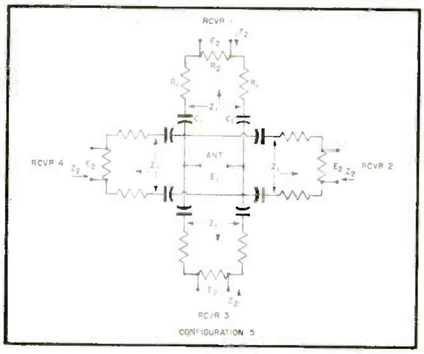


Fig. 5—Network arrangement for feeding several receivers from a single antenna system.

four receiver outlets only the appropriate number of outlet networks of the values shown in Table 2 would be connected. The isolating capacitors, C, are included to prevent power current from flowing between two receivers which have the power and antenna circuits connected to the chassis.

Note that in the Configuration 5 network the isolation between receivers is increased as the network loss is increased so that, providing sufficient signal

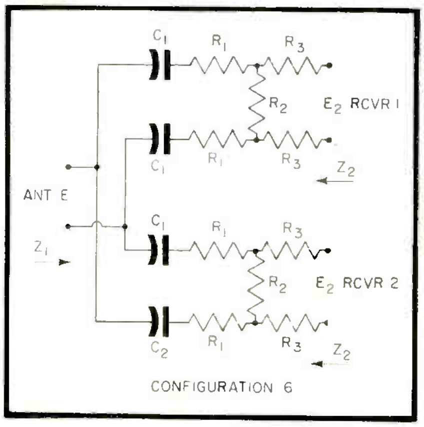


Fig. 6—Two-outlet network with increased attenuation.

strength is available, the increased loss is an advantage in increasing receiver isolation. A two-outlet network with increased receiver isolation is shown as Configuration 6. The values for this arrangement are also shown in Table 2.

Availability

A number of the networks described herein are available commercially either in printed circuit form or as assemblies of carbon composition resistors in small plastic boxes. Those that are not readily available can be easily assembled in the shop. The accompanying photograph shows one of the 300/300 ohm, 20 db attenuators listed in Table 1 which has been assembled into a small plastic Walsco hardware box.

One of the 300/300 ohm, 20 db attenuators listed in Table 1 assembled in small plastic container.

A four-receiver antenna network, Configuration 5, consisting of parts mounted on a lucite panel in a physical arrangement similar to that shown in the schematic has been found by the author to give good performance. The isolation in this network is sufficient so that disconnecting any number or receivers does not appreciably affect the performance of those remaining connected.

While the networks described herein are basically quite simple devices as evident from the accompanying photograph, care must be used in their assembly to insure best performance. Particularly for use in the *uhf* TV band, small resistors with very short lead lengths must be used. The very small 1/10-watt carbon composition resistors are well suited to this application since they allow closer spacing and smaller overall size. Extreme care must be taken in the soldering operation to prevent excessive heat from causing damage to or changing the value of the resistors. The heat from the soldering iron applied close to the resistor body can easily cause a permanent increase in resistance of over 10%. Probably the best soldering technique for this application consists of first scraping or sanding the resistor leads and then generously but quickly tinning both the terminals and the resistor leads. Then, after securing the leads to the terminals, and while holding the resistor lead with long nose pliers close to th body, quickly solder each terminal without the addition of any more solder. In this manner the time of heat application is held to a minimum and the pliers help to soak up some heat and keep down the temperature of the resistor body.

Radio-Television Service Dealer Annual Index for 1954

ANSWERMAN

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GUEST EDITORIAL

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TRADE FLASHES

TRADE LITERATURE

VIDEO SPEED SERVICING SYSTEMS

WORKBENCH

ASSOCIATION NEWS

[from page 8]

the problem of handling sets through an intermediary who later claims the set was not his so he wants the set returned without charge. Storage of these "orphans" and protection against losses pose serious and costly problems.

To overcome this situation, a new form of receipt, shown below, has been developed and proved very efficient.

RECEIPT

In consenting to the removal of or acceptance for service of the unit described on this receipt, the undersigned states that it is his her property and that service is being assumed by the company with the understanding that the set will be stored for a period of not more than 30 days following notice of completion of service, phone or post card notice is deemed sufficient. After 30 days, it is agreed that a storage and protection fee of 25c per day will be added to the billing. It is further agreed that should the goods not be claimed after 60 days from date of this receipt and should no other previous arrangement in writing be agreed upon, the company has the authority to junk, sell or in any other way dispose of the goods and be completely released of any and all claims against it arising from the transaction covered by this receipt.

Signed ____________________
Set Owner

Signed ____________________
Company

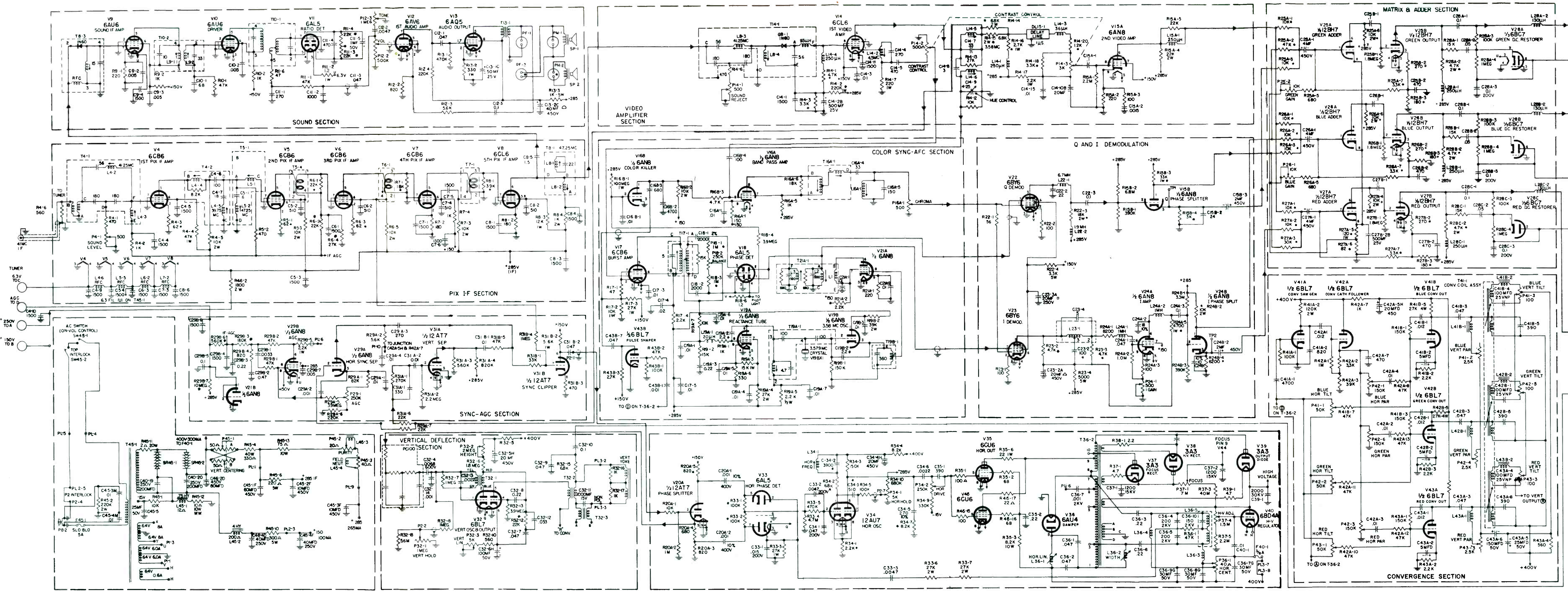
Date ____________________

RTSA—Pittsburgh

The RTSA of Pittsburgh, Inc., is in the process of setting up a course in TV Training to upgrade the qualified technician. This subject was brought up the last regular meeting, and quite some enthusiasm was shown by the show of hands.

Advertising Index

(72 pages in this issue, including complete TV Service Sheets)



NOTE:

UNLESS OTHERWISE NOTED
1. ALL CAPACITORS MARKED LESS THAN 1, IN MFD.
2. ALL CAPACITORS MARKED MORE THAN 1, IN MMF.
3. ALL RESISTORS IN OHMS
4. ALL RESISTORS ½ W ± 10% UNLESS SHOWN OTHERWISE.
5. ALL • DENOTES 5%
6. ALL CAPACITORS EXCEPT ELECTROLYTIC ± 20% UNLESS SHOWN OTHERWISE.

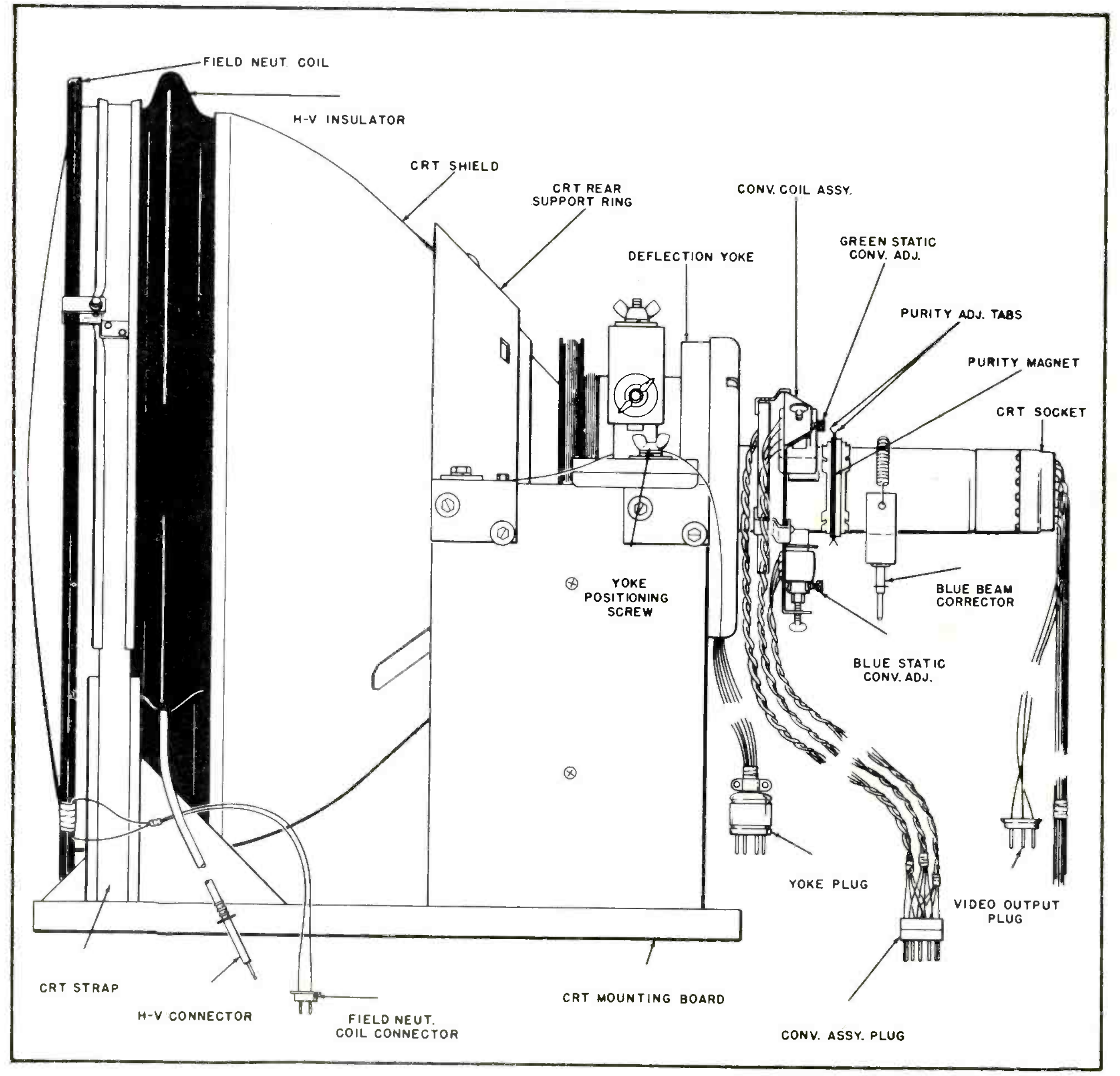
6-23-54
7-12-54

RADIO-TELEVISION SERVICE DEALER
COMPLETE TV SERVICE INFORMATION SHEETS

CBS-COLUMBIA

COLOR TELEVISION RECEIVER PRELIMINARY SERVICE DATA

MODEL 205



Picture tube assembly.

Specifications

Picture Tube
Type: CBS Hytron 19VP22
Dimensions: 19-inch round, all glass. Viewing area 205 square inches

Operating Controls
Station Selector, Fine and UHF Tuning, Vertical and Horizontal Hold, Contrast, Volume, Tone, Chroma and Hue

Power Rating
Source: 105—120 volts 60-cycle AC
Consumption: 500 Watts

Number of Tubes
41 tubes plus 3 rectifiers, 2 selenium rectifiers and 3 crystal diodes

Ant. Input Impedance
VHF: 300 ohms balanced
UHF: 300 ohms balanced

Frequency Range
Channels 2 through 82

Intermediate Frequencies

Video IF	45.75 mc
Sound IF	41.25 mc
Sound Intercarrier Freq.	4.5 mc
Color Subcarrier Freq.	42.17 mc
Adjacent Channel Sound Trap Freq.	39.75 mc
Adjacent Channel Video Trap Freq.	47.25 mc
Accompanying Channel Sound for less than 10% distortion	41.25 mc

Crt High Voltage
26 kv adjusted

Loudspeakers
Size: Two, 6½ in x 9¼ in. speakers
Voice Coil: 3.2 ohms at 400 cycles

Focus
Electrostatic

Deflection
Electromagnetic

Convergence
Static: PM Magnetic
Dynamic: Electromagnetic

Cabinet Dimensions

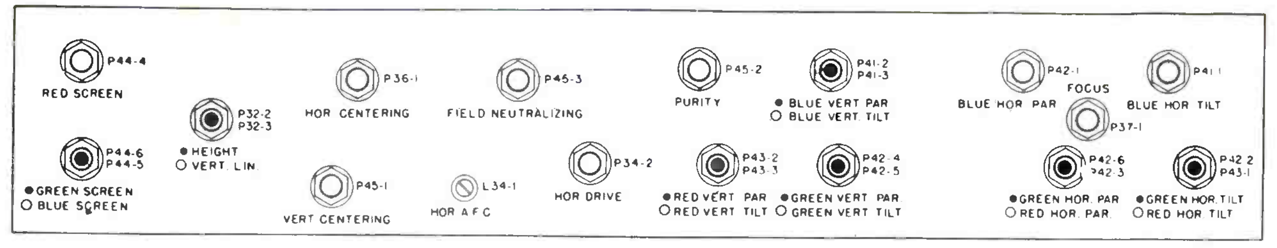
Model	Width	Height	Depth
205C1 Console	34¼	42-11/16	26-1/16
205C2 Console w/Doors	34¼	42-11/16	26-15/16

Tube Complement

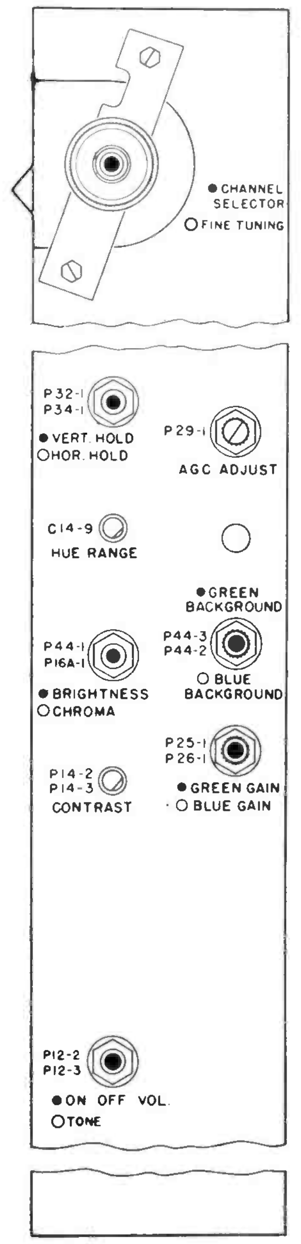
Symbol	Type	Function
V1	6BZ7	RF Amplifier
V2	6N8	Mixer and Oscillator
V3	6AF4	UHF Oscillator
V4	6CB6	1st IF
V5	6BC6	2nd IF
V6	6BC6	3rd IF
V7	6CB6	4th IF
V8	6CL6	5th IF
V9	6AU6	Sound IF Amplifier
V10	6AU6	Driver
V11	6AL5	Ratio Detector
V12	6AU6	Audio Amplifier
V13	6AQ5	Audio Output
V14	6CL5	1st Video Amplifier
V15	6AN8	2nd Video Amplifier—Q Phase Splitter
V16	6AN8	Band Pass Amp.—Color Killer
V17	6CB6	Burst Amplifier
V18	6AL5	Phase Det.
V19	6AN8	Reactance Tube—3.58 mc Oscillator
V20	12AT7	Horizontal Phase Splitter
V21	6AN8	1 Amplifier—AGC Clamp
V22	6BY6	Q Demodulator
V23	6BY6	I Demodulator
V24	6AN8	I Amplifier—I Phase Splitter
V25	12BH7	Green Adder—Green Output
V26	12BH7	Blue Adder—Blue Output
V27	12BH7	Red Adder—Red Output
V28	6BC7	Green Red Blue DC Restorers
V29	6AN8	AGC Amp—Horiz. Sync Separator
V31	12AT7	Vert. Sync Separator—Sync Clipper
V32	6BL7	Vert. Oscillator—Vert. Output
V33	6AL5	Horizontal Phase Det.
V34	12AU7	Horizontal Oscillator
V35	6CU6	Horizontal Output
V36	6AU4	Damper
V37	3A3	HV Rectifier
V38	3A3	HV Rectifier
V39	3A3	HV Rectifier
V40	6BD4	HV Regulator
V41	6BL7	Convergence sawtooth Gen-Blue conv. Output
V42	6BL7	Green conv. Output—Conv. Cathode Follower
V43	6BL7	Pulse Shaper—Red. Conv. Output
V44	19VP22	Colorton CRT
V46	6CU6	Horizontal Output

Warning – High Voltage

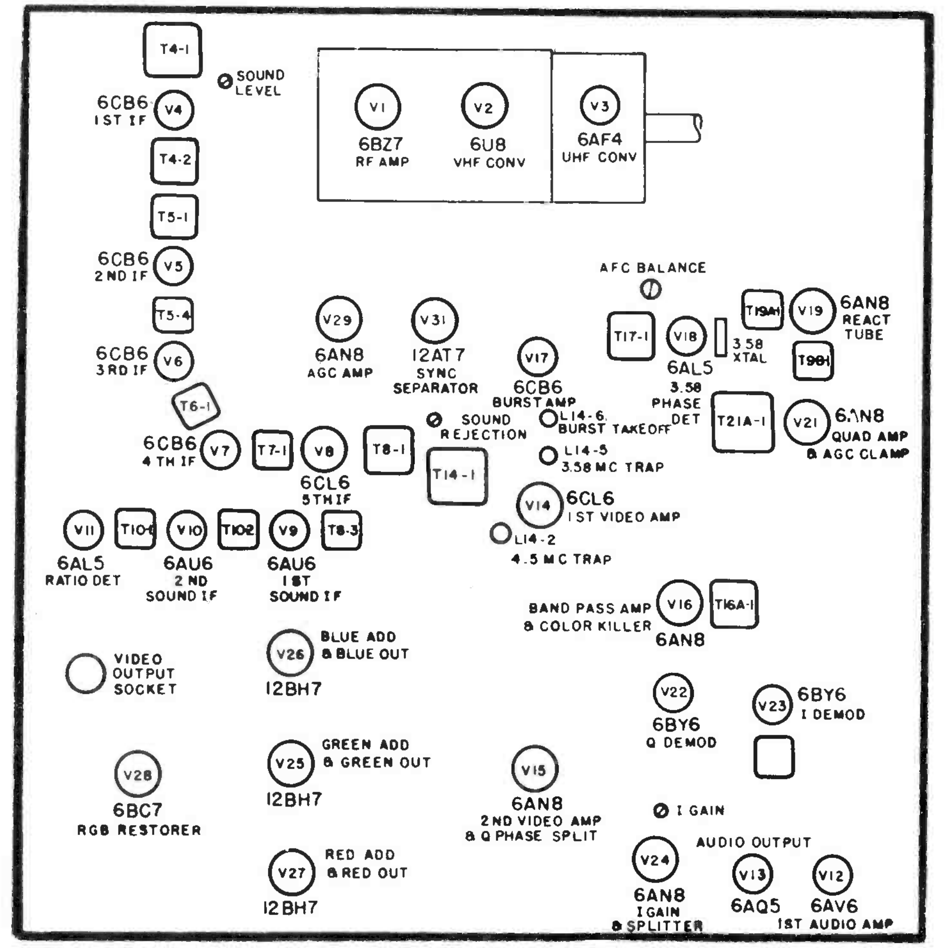
POTENTIALS AS HIGH AS 26,000 VOLTS ARE PRESENT WHEN THIS RECEIVER IS OPERATING. OPERATION OF THE RECEIVER OUTSIDE THE CABINET OR WITH COVERS REMOVED INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH-VOLTAGE EQUIPMENT.



Deflection chassis front controls.



Signal chassis front controls.



Top view of signal chassis

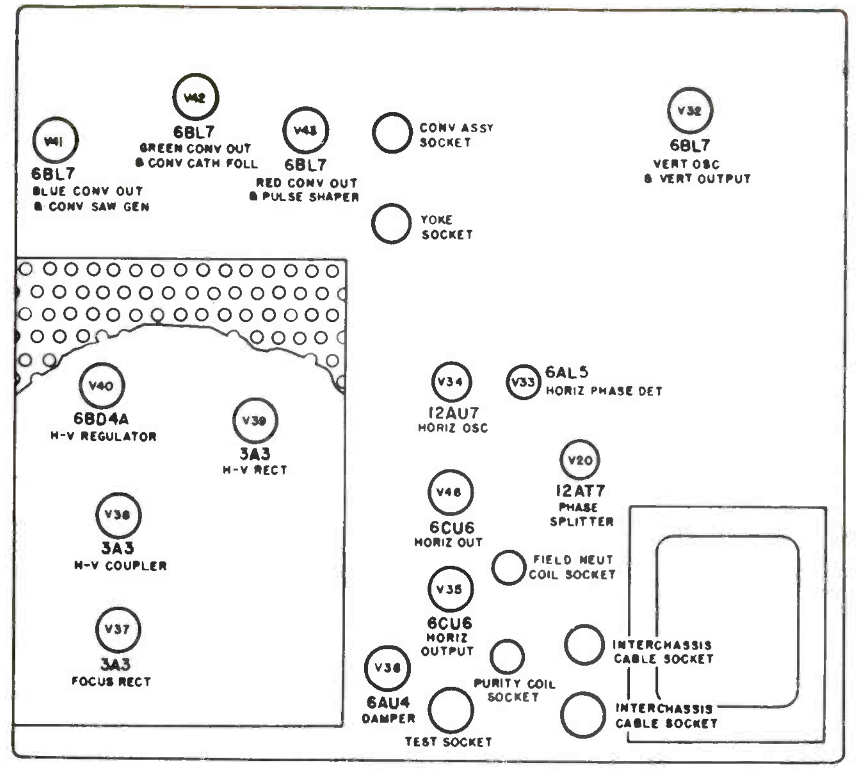
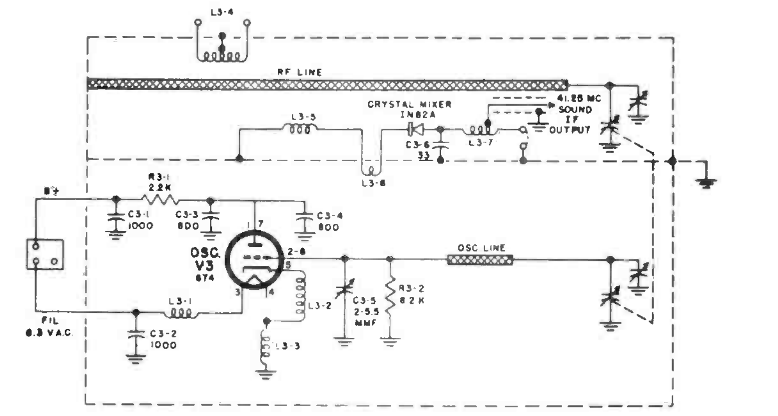
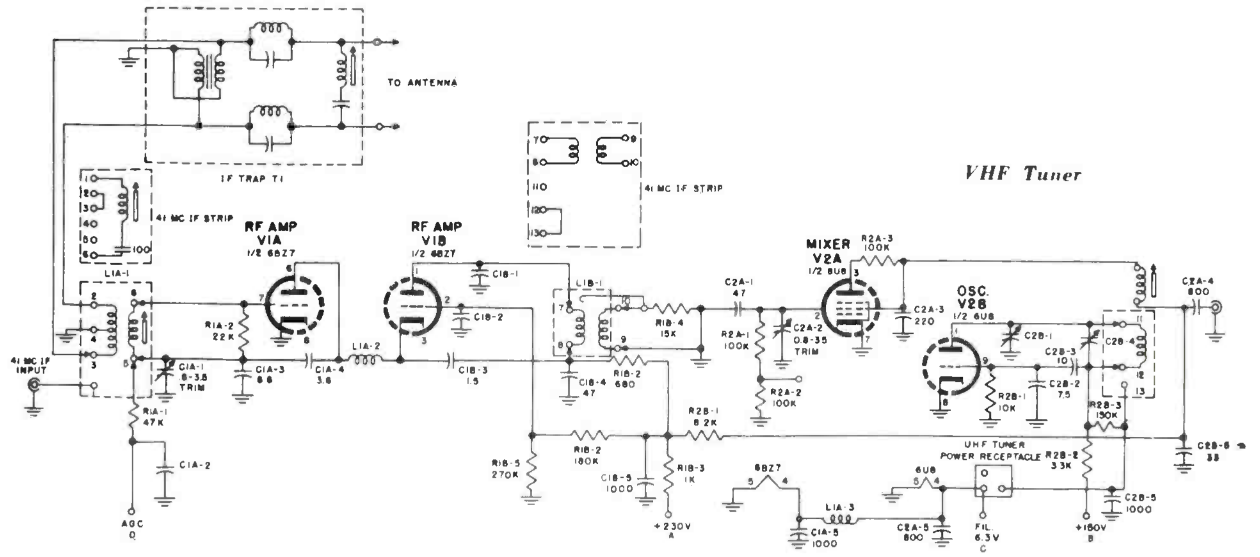


Fig. 9—Top view of deflection chassis

UHF Tuner





VHF Tuner

PRECISION

Announces a **NEW**
BASIC TEST INSTRUMENT

...for Laboratory and Test Bench
...for Engineer and Technician

THE MODEL

E-300

SINE-SQUARE WAVE SIGNAL GENERATOR

(AUDIO-VIDEO RANGE)

GENERAL SPECIFICATIONS:

★ **VARIABLE-FREQUENCY SINE-WAVE RANGES:**
for testing audio amplifiers, low frequency RF amplifiers, etc.:
Continuous Coverage from 20 Cycles to 200 Kilocycles in Four Bands.

★ **VARIABLE FREQUENCY SQUARE-WAVE RANGES:**
for analyzing audio amplifiers, wide-range amplifiers, etc.:
20 Cycles through 20,000 Cycles in Three Bands.

★ **FOUR FIXED, HIGH-FREQUENCY SQUARE WAVES:**
for analysis of video and other wide-band amplifiers up to 20MC band-width:
50 KC — 100 KC — 250 KC — 500 KC steps.

★ **OUTPUT CHARACTERISTICS:**
Variable Frequency Ranges: 0-2000 ohms, 0-10 volts RMS, flat within ±1 db.
Accuracy: ±2% from 50 cps. to 200 KC. ±1 cps. from 20 cps. to 50 cps.
Distortion: Less than 1% from 20 cycles through 200 KC.
20 KC Square-Wave Rise Time: .5 microseconds.
Fixed High Frequency Square-Waves: 0-250 ohms, 0-5 volts P-P
Rise Time: .05 microsecond • **Overshoot:** Negligible

★ **TUBE COMPLEMENT:** 1-5879, 1-6CL6, 1-6J6, 2-6AU6, 1-6BL7, 1-6AH6, 1-6X4.

★ **SEPARATE OUTPUT CIRCUITS:** for the variable and fixed frequency ranges. Dual pilot lamps automatically indicate the active output jacks.

★ **TERMINATED, LOW-LOSS, HIGH FREQUENCY COAXIAL OUTPUT CABLE:**
transmits the H.F. square waves to circuits under test, without distortion.

★ **EXTERNAL 'SYNC' TERMINAL POST:**
for synchronizing oscillograph horizontal sweep to H.F. square-wave.

★ **ETCHED-ANODIZED TUNING DIAL and PANEL:** NO-glare, engine-turned dial finish and soft-black panel field afford utmost visibility and ease of reading.

MODEL E-300: in black, ripple finished, portable steel case — 10½x12x6". Complete with tubes, coaxial output cable and operating manual.

Net Price $175.00

THE NEW SERIES E-300 has been especially developed to answer many modern electronic amplifier testing problems which cannot be handled with just the usual complement of test instruments.

The Series E-300 provides accurate sine and square wave signals for direct performance testing of:

High Fidelity Audio Amplifiers
TV Video Amplifiers
Carrier Current Systems
. . . and other wide range devices, etc.

Sine-Square Wave Analysis, with the Series E-300, streamlines amplifier test procedure and assures more uniformly high standards of apparatus performance, because sine-square wave testing is a most reliable indicator of:

Frequency Response
Phase Shift
Amplitude Distortion, etc.

The operating Manual for the Series E-300 has been especially prepared to describe the basic techniques of sine-square wave testing. The information establishes a foundation that will permit the operator to interpret sine-square wave-forms in terms of frequency response, distortion, etc.

You may obtain this comprehensive Manual, at only 25¢ per copy, to cover cost of printing and handling. Write directly to factory.

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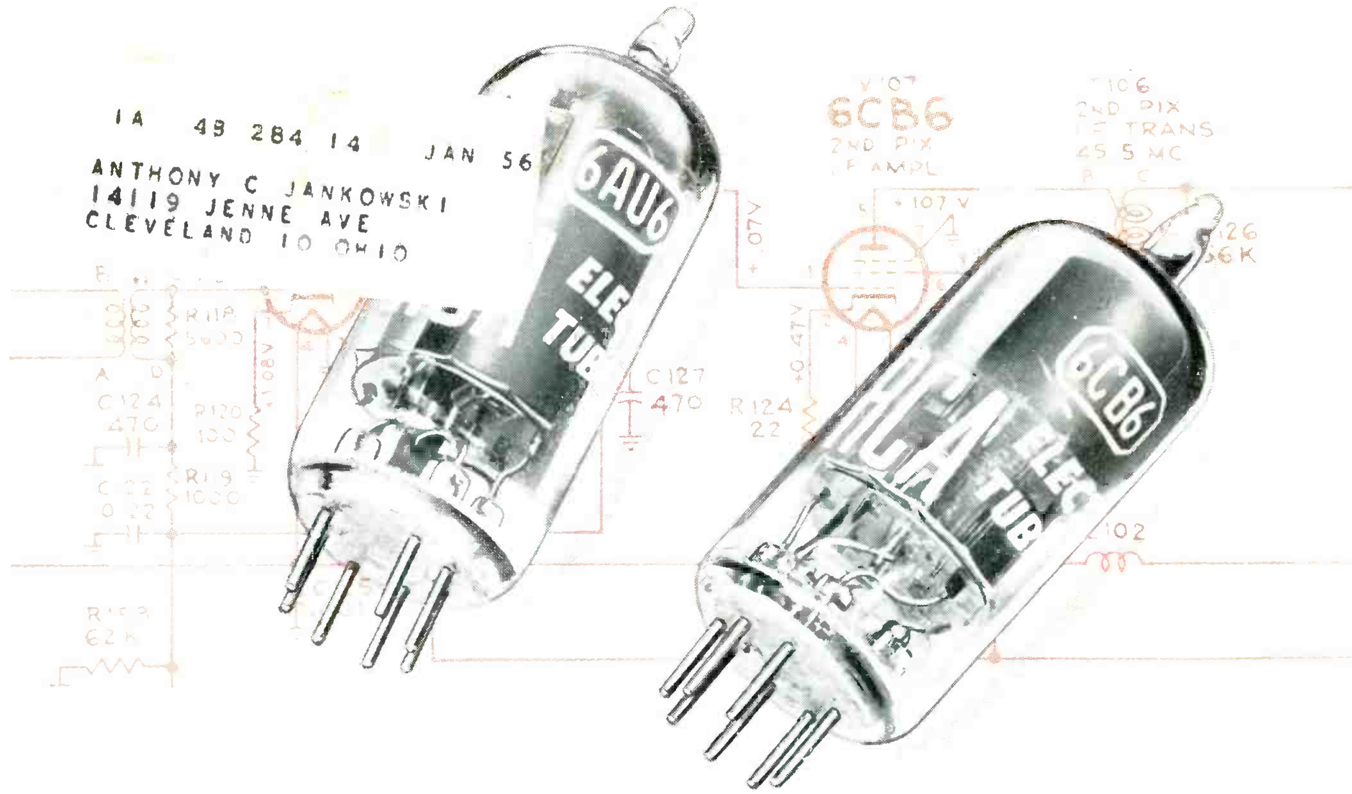

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