FEBRUARY 1955

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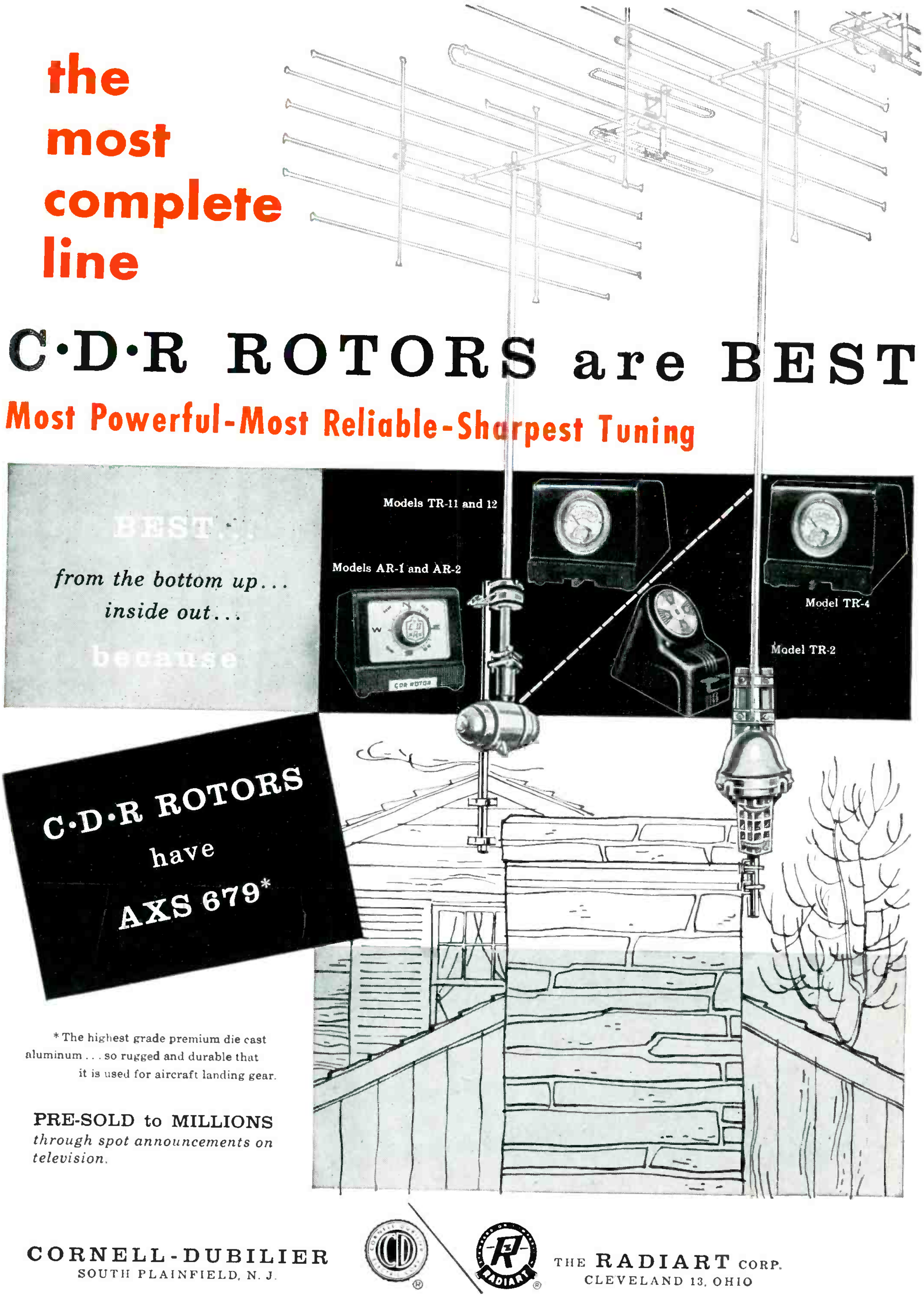

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VOL. 16, NO. 2 FEBRUARY, 1955

FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

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	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
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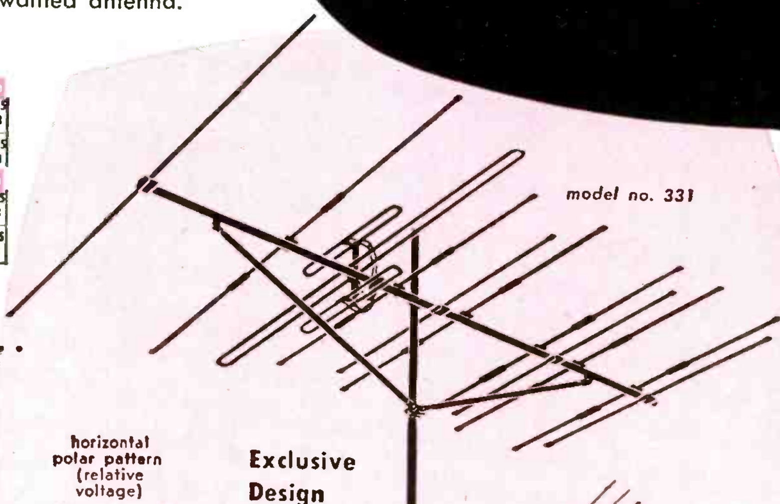

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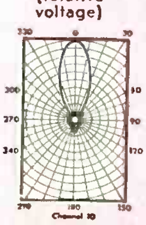

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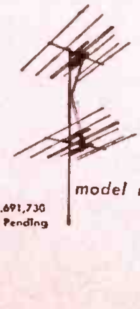

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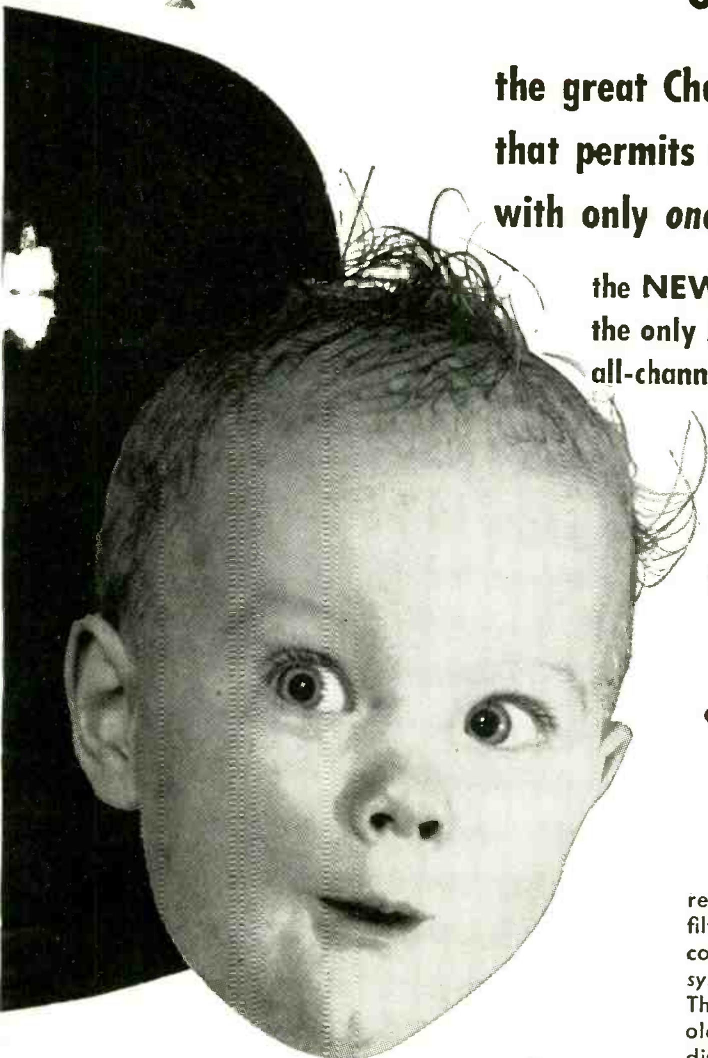

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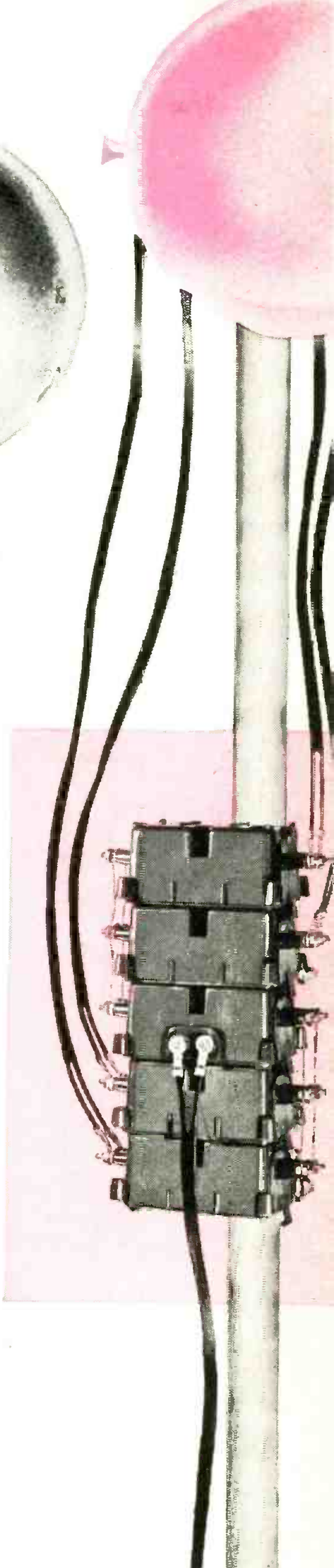

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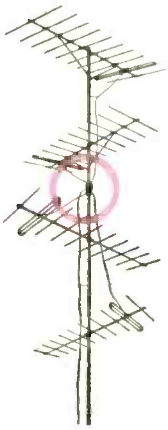

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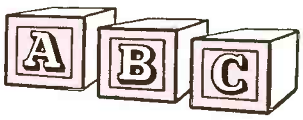

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EDITORIAL... by S. R. COWAN PUBLISHER

National Television Servicemen's Week

On frequent occasions during the past few years leading electronic and component manufacturers have run institutional advertisements in national consumer magazines lauding the integrity, skill and dependability of the nation's radio-television service dealers. Those cumulative efforts have contributed greatly to our goal—and the goal of all legitimate servicemen—that of regaining public confidence for established service dealers and independent service firms.

Now, as we report in detail elsewhere in this issue, we happily welcome the Radio Corporation of America Tube Division's announcement that the week of March 7-12, 1955 is to be "National Television Servicemen's Week." This RCA sponsored project has been registered officially with the Chamber of Commerce of the U.S. and it will undoubtedly prove to be another fine contribution toward improving public relations between the set-owning public and those of us whose livelihood stems from radio-television servicing.

There are 54,000 bonafide service firms and possibly 100,000 full time employee technicians now engaged in service work in the U.S.A. whose objective is to service the 33 million television sets and 150 million radio receivers of all types which are in use. Stated another way, over 2 billion electronic tubes are used daily by the radio-TV set-owning public. In addition, hundreds of millions of other tubes are in daily use in the countless thousands of industrial electronic installations of all types.

Too few people truly appreciate the enormous responsibility which is dependent upon the skill and integrity of those relatively few skilled men who have the commonplace occupational designation as "Servicemen." Thus, any enterprise which constructively informs the public of our status is worthwhile.

In 1955 "National Television Servicemen's Week" is obviously a project sponsored by a single leading manufacturer in our industry. Would it not be wonderful if the entire industry, manufacturers and distributors, would in appreciation of the radio-TV servicing profession, direct their efforts so that it would proclaim an all-industry—all manufacturer—recognized and sponsored project? Such an eventuality would not detract from RCA's having inaugurated it and I am sure that that big corporation which enjoys such a tremendous annual income from the servicing profession would not be adverse to the idea.

1954 TV Sales

RETMA sales figures for all of 1954 are not yet available but it is not too difficult to guess what they will approximate. We'd say that about 5,800,000 monochrome TV sets and possibly 25,000 color sets were bought by the public.

Time and experience lead us to believe that in 1955 monochrome TV set sales will run very close to the 1954 figure but color set sales might go as high as 200,000 units.

The big barrier to color set production is, of course, the color tube. For example, big independent set manufacturers such as Admiral and Motorola decry the lack of uniformity of tube size, and the very high initial cost. When color picture tubes can be made to sell in quantity for \$60 to \$75 the outlook for increased color set production will brighten.

TV Antenna Sales Potential

Approximately 30 million outdoor TV antennas are now in use, 70%—or 21 million having seen service for over 2 years, which in practically every case, makes them obsolete or far below par in efficiency. How about a replacement antenna sales campaign?

Correction

In our November Editorial page, under the caption: "New Type Manufacturer's Service Policy," we commented on a news item which *apparently* did not have official G.E. sanction. To set the matter straight we would like our readers to be aware of the official G.E. policy on this subject:

"The General Electric Company warranty, as it applies to *monochrome television receivers*, provides for the replacement of any component which fails within 90 days from the date the receiver is sold to the ultimate user. The picture tube is guaranteed for one year. This warranty does not provide for labor required for diagnosing or servicing the instrument.

"Effective June 1, 1954, the General Electric Company placed into effect a new warranty and service policy covering *radio* receivers (table radios, clock-radios and portables). This warranty provides for the replacement of defective parts *and* the necessary labor involved in such replacements, for failures occurring within 90 days from the date of sale to the ultimate customer. This free parts replacement and service is provided at Authorized General Electric Radio Service Stations, which are appointed directly from the factory."

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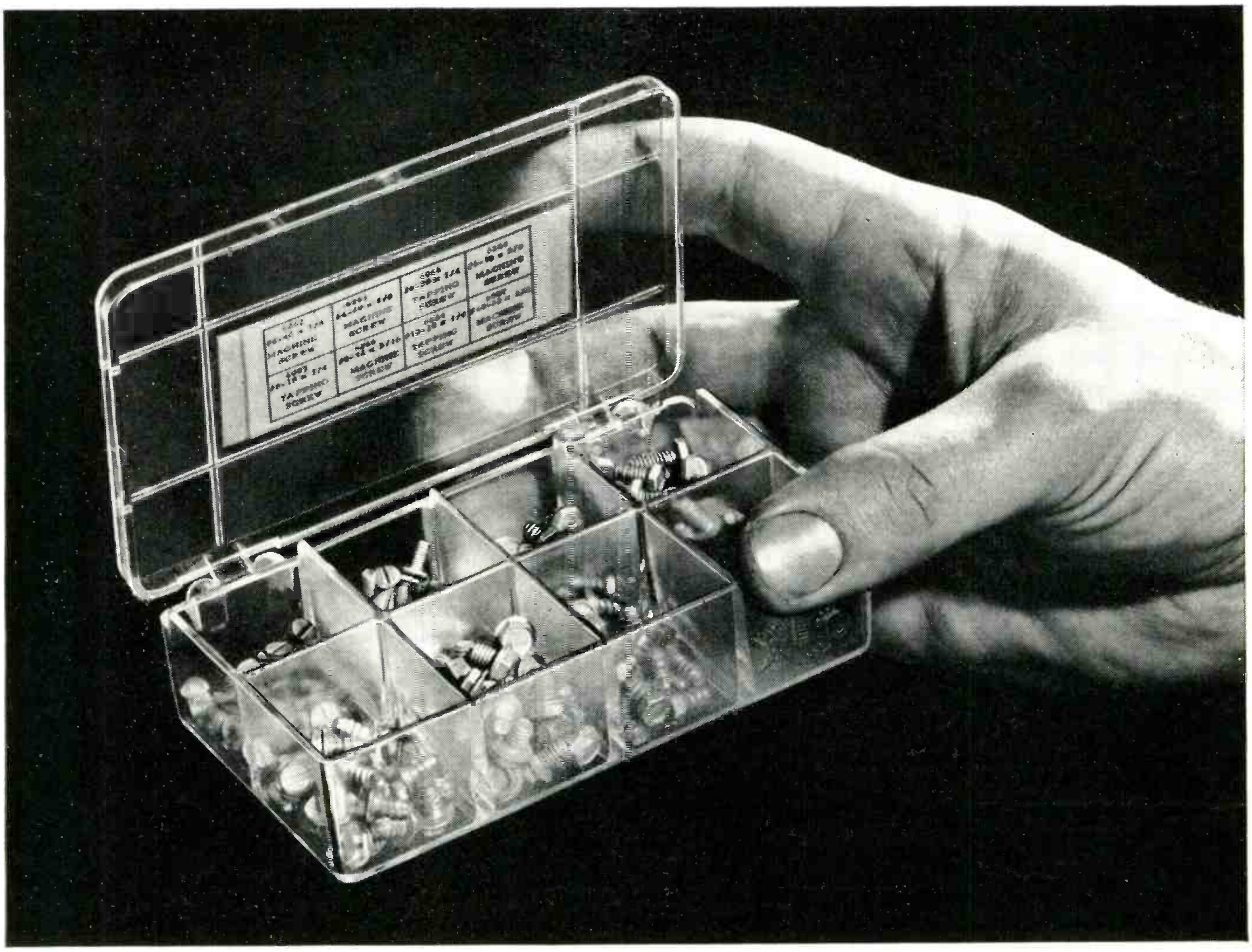

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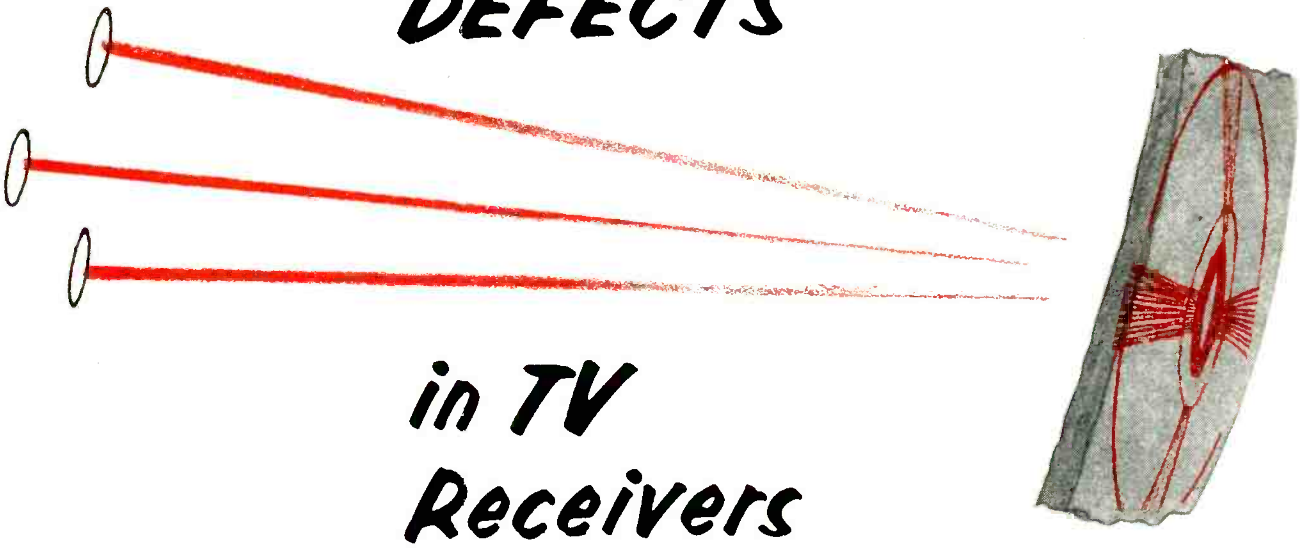
BRILLIANCY DEFECTS in TV Receivers



by MATTHEW MANDL

Author: *Mandl's Television Servicing.*

THERE are numerous circuit defects which cause either excessive or insufficient brilliancy. While many such troubles are associated with the brilliancy control system, there are many occasions where some other circuit is at fault. A general knowledge of the cause and effect factors which involve the brilliancy control and other circuits will be of material aid to the servicing technician in expediting the localization of the defective circuit when he encounters such troubles in the field.

Picture Tube Circuits

There are several methods for coupling the video signal to the input of the picture tube, and each procedure may develop brilliancy troubles because of defects peculiar to the circuit employed. One method employed is to couple the video signal energy to the grid of the picture tube by a coupling capacitor such as shown at *A* of *Fig. 1*. Since this upsets the *dc* level of the picture signal, a *dc* restorer circuit is usually employed. The *dc* restorer can be a diode vacuum tube or a diode germanium crystal. The *dc* restorer conducts during sync tips and charges C2 with a polarity as shown. This alters the picture tube grid bias and reestablishes the *dc* level. The proper function of the *dc* restorer is important for proper receiver brilliancy because the restorer circuit can be considered as an automatic brilliancy control. It reestablishes the proper amount of background shading so that it conforms closely to the scene originally televised at the studio. Thus, any servicing procedures involving the checking of incorrect brilliancy would involve replacing the *dc* restorer

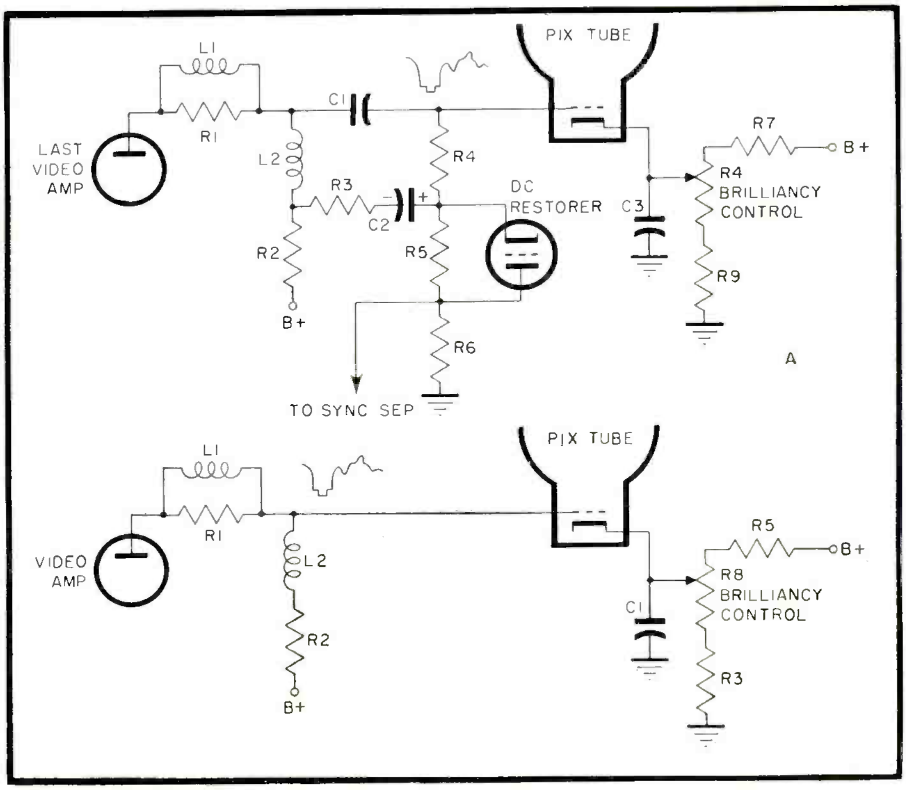


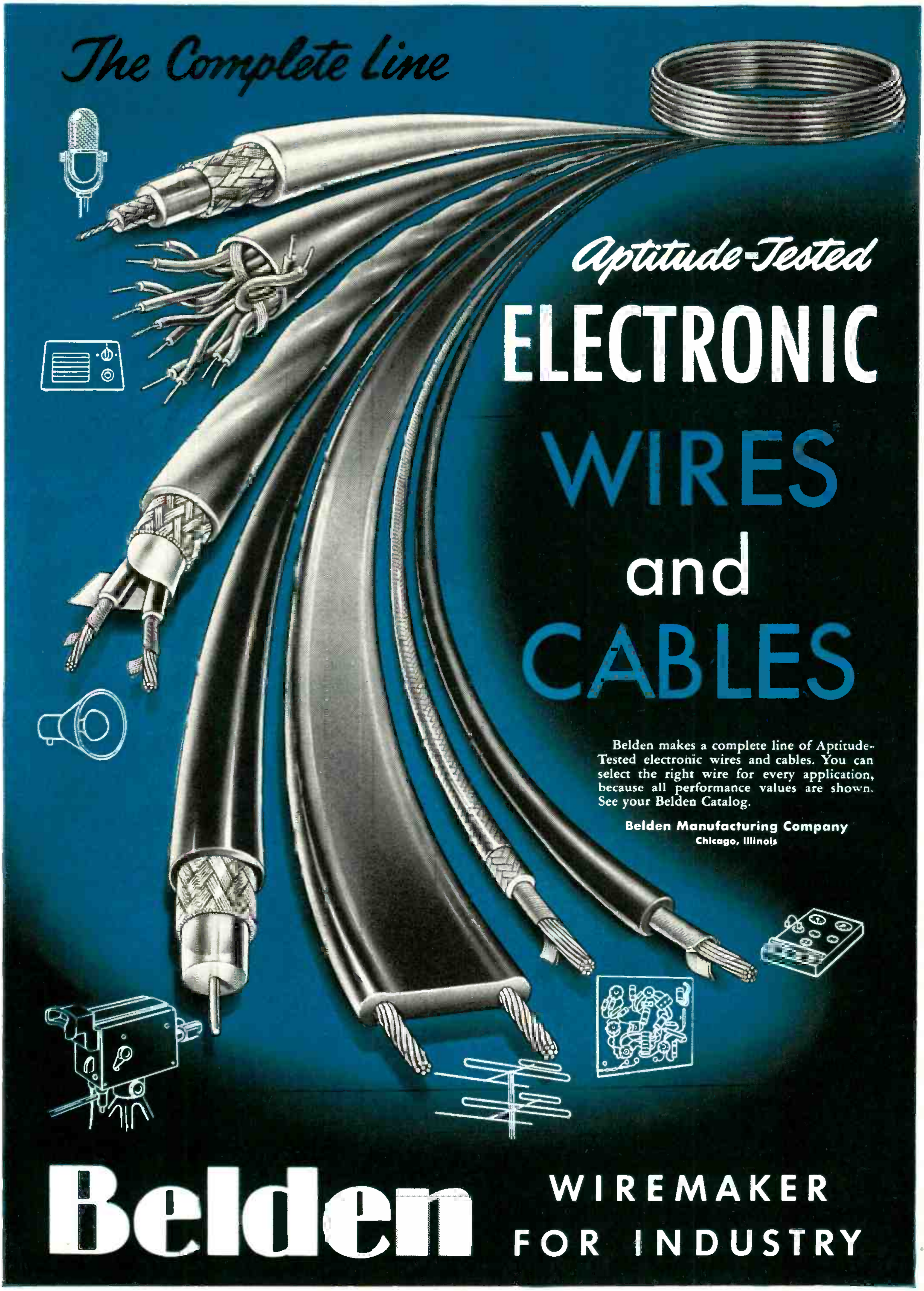
Fig. 1—Coupling methods to picture tube input.

tube as well as checking the components which feed the signal to the restorer circuit ($R3$ and $C2$). The grid leak network composed of resistors $R4$, $R5$, and $R6$ should also be tested and the individual values compared to those given in the service notes for the receiver.

When the video signal is applied to the grid of the picture tube such as at A, the brilliancy control is usually located in the cathode circuit. A bleeder network composed of several resistors is commonly employed. In the circuit shown at A, the bleeder consists of $R7$, $R4$, and $R9$, of which resistor $R4$ is a potentiometer. The B plus voltage is applied to the cathode of the picture tube by virtue of the movable arm of the potentiometer. This is similar in form to the conventional cathode resistor employed for bias purposes in other video or audio amplifier circuits. As the cathode is made more plus, the grid becomes more minus with respect to the cathode. Capacitor C3 prevents signal energy from developing across that portion of the bleeder tapped by the movable arm of $R8$ and hence eliminates C3 signal energy in the cathode circuit. If this capacitor shorts, it will short out a portion of the bleeder network and hence will ground the movable arm of the brilliancy control. This would cause an abnormal brilliancy because it would remove the bias established by the cathode resistive network. If capacitor C3 opens, however, it will have no effect on the brilliancy but it will cause degeneration since the varying signal across the cathode resistive network will establish bias variations which oppose the negative signal energy at the grid. Thus, if the signal on the grid of the picture tube were to develop a high negative amplitude, it would repel the beam current from the cathode and hence decrease the current through $R9$ and that portion of $R4$ which is in use. The decrease in current through the cathode resistive network would decrease the bias and thus tend to increase beam current. This is similar to the degenerative effects established in audio or video amplifiers when the cathode bypass is omitted.

Testing the circuit shown at A should consist of taking a voltage reading by employing a VTVM between the grid and the anode of the picture tube. With the VTVM attached, the brilliancy control should be varied. Negative bias at the grid of the picture tube should vary from a low value to well over 50 volts. If this is not the case, the voltage applied to the brilliancy control resistive network should be checked and compared with the recommended voltage given in the service notes. The voltage from the grid to chassis should also

[*Continued on page 13*]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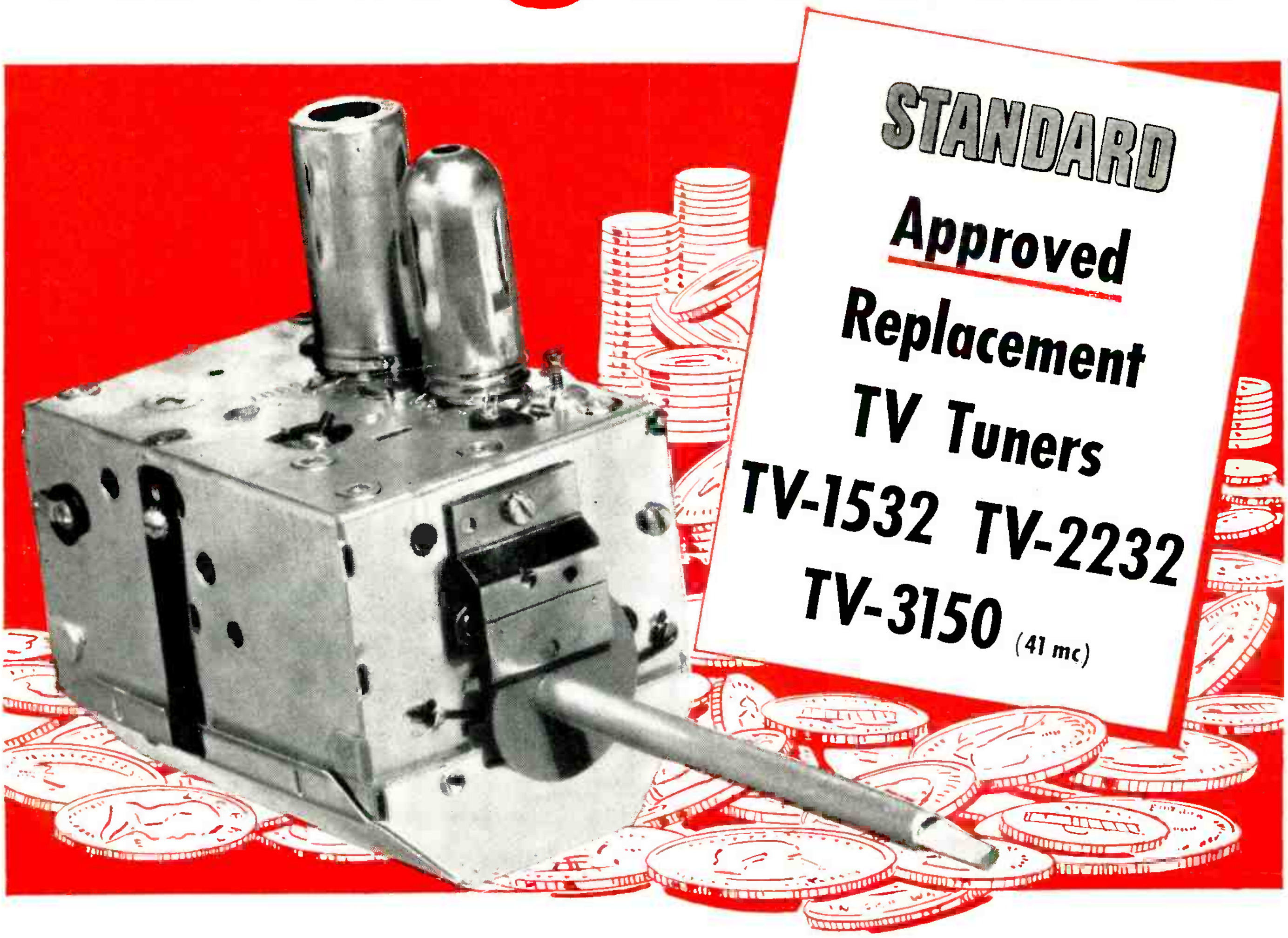

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[from page 10]

be read to ascertain any possible leakage by virtue of the coupling capacitor C1. If the latter is leaky, it will permit some of the video amplifier anode voltage to leak to the grid of the picture tube and thus lower the negative bias established by the brilliancy control setting. If there is any suspicion of leakage, one side of the coupling capacitor should be disconnected and the capacitor checked with a capacitor checker for both its capacitive value and its leakage in terms of the power factor.

The brilliancy control potentiometer should also be tested for an intermittent or open condition. Initially, the VTVM can be placed from cathode to chassis and the brilliancy control varied. The voltage should range from a low value to well over 50 volts for most picture tubes. If there is a rapid fluctuation of the meter needle the receiver can be shut off and an additional check made by taking an ohmic reading of the brilliancy control to ascertain whether or not the control operates smoothly and without interruption. If the control is intermittent or otherwise defective the recommended procedure is to replace it rather than to treat it with volume control cleaning fluids. The application of such chemicals will only be a temporary measure since there is a constant current flow through the brilliancy control because of the B plus bleeder network to ground. The constant current flow helps to maintain a constant *dc* voltage at the cathode, but at the same time increases the likelihood of resistor breakdown.

Direct Coupling

Another method for applying the video signal to the grid of the picture tube is shown in the lower drawing *B* of *Fig. 1*. Here, direct coupling is used since no intervening coupling capacitor blocks the *dc* anode voltage of the video amplifier from the grid of the picture tube. Thus, the same B voltage which is applied to the video amplifier anode is also present at the grid of the picture tube. Since the picture tube grid must be negative with respect to the cathode, it is necessary to increase the cathode potential to a value higher than the grid potential. Thus, if the positive voltage at the grid is 200 volts, the cathode would have to have 250 volts on it in order to make the grid negative by 50 volts with respect to the cathode.

Direct coupling eliminates the necessity for a *dc* restorer circuit, since the *dc* level of the video signal information is not upset as is the case with the circuit in *Fig. 1A*. The direct coupling used at *Fig. 1B* means that a VTVM reading from grid to chassis will indicate a high positive potential at the grid. The reading from the cathode to the chassis will also indicate a high positive potential. A reading between *grid* and *cathode*, however, should again show the grid negative with respect to the cathode. As the brilliancy control is varied, the negative potential read between grid and cathode should also change between a low negative value to well over 50 volts for most of the screen sizes currently employed.

Improper brilliancy in the lower circuit may be caused by an incorrect voltage relationship between the B voltage at the picture tube grid and the B voltage at the cathode. Hence, the load resistor *R2* is a contributing factor as well as the voltage established by the bleeder network, *R3*, *R8*, and *R5*. In this circuit a defective video amplifier tube can also contribute to brilliancy control troubles. If this tube is gassy and an excessive current flow is created, it will upset the voltage relationships between picture tube grid and cathode. The same voltage upset holds true if the video amplifier tube emission is low. Less current flows through the anode circuit and a smaller voltage drop occurs across *R2*. Again, the critical voltage relationship between the picture tube grid and cathode of the direct coupled system is disturbed.

Checking factors, therefore, must include a test of the video amplifier tube as well as the voltages between kinescope grid and chassis, cathode and chassis, and grid and cathode. Reference should be made to the service notes for the receiver as a check against the voltages read during the testing procedure.

Cathode Coupling

Either the capacitive-coupled method shown at *A* or the directly coupled method shown below is encountered in circuits where the video signal is applied to the *cathode* of the picture tube rather than the *grid*. Cathode feeding of the signal is employed when the composite video signal output at the last video amplifier is positive-going. When such is the case, the brilliancy control is usually located in the grid circuit. A typical example of such a circuit is shown at *Fig. 2* which is employed in the Admiral chassis 22A3 receiver and in many other receivers manufactured by other companies. Capacity coupling could be employed in a fashion similar to that shown in *Fig. 1A*, or direct coupling can be used as shown in *Fig. 2*.

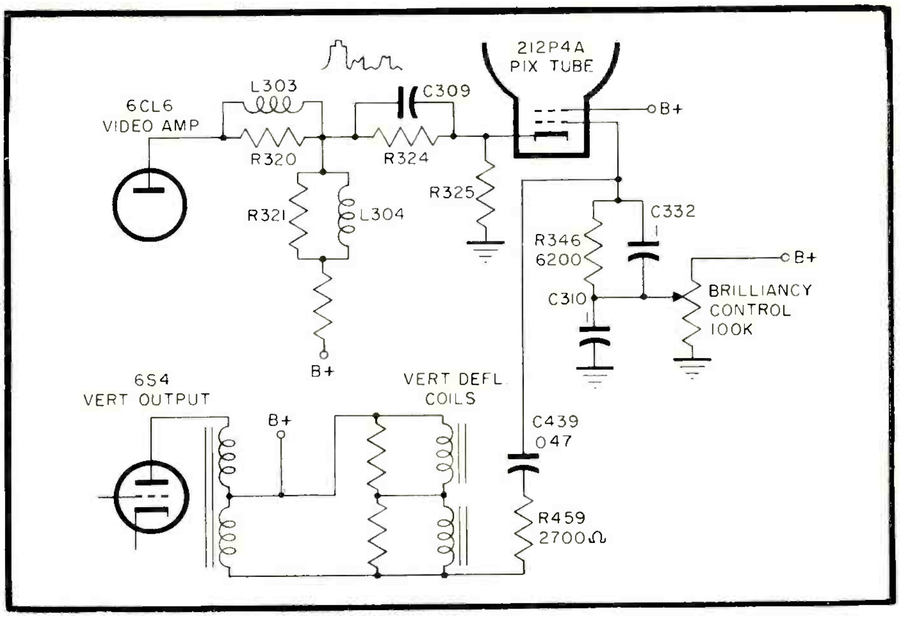


Fig. 2—Partial schematic of Admiral chassis 22A3 receiver showing cathode fed signal from video amplifier to pix tube.

The testing procedures heretofore detailed also apply to this circuit. The grid must still be minus with respect to the cathode, regardless of whether a coupling capacitor or direct coupling is employed.

Poor gain in the tuner, the video *if* amplifiers, the detector, or the video amplifier can simulate a brilliancy defect because the weak signal will cause the picture to have a washed-out appearance. In such cases the contrast control can be advanced fully and the picture will still have an abnormally white appearance because of low signal amplitude. While this is not actually a defect in the brilliancy itself, it can be mistakenly interpreted as such.

The video signal at the grid of the picture tube can be observed by using an oscilloscope. The amplitude of the

[Continued on page 54]

CHROMINANCE Systems in Color TV Receivers

by BOB DARGAN
and SAM MARSHALL

Part 3

ONE of the most interesting circuits in the color TV receiver is the stage containing the color demodulators, also called synchronous detectors. A clearer understanding of its operation will perhaps be gained by a brief block diagram review of the overall demodulation procedure. The two signals entering the demodulator are the chrominance signal and the pair of 3.58 *mc* oscillator signals in quadrature with each other. The former are derived directly from the composite video signal, and the latter from a local 3.58 *mc* oscillator.

The overall relation of the chrominance and quadrature color sync signals in the transmitter and receiver are shown in block diagram form in *Fig. 1.* At the transmitter, two separate color-difference signals such as A and B may be instantaneously transmitted on the same frequency provided they are separated in phase by an angle of 90 degrees. This angle may be obtained by feeding one 3.58 *mc* signal into balanced modulator A and a second 3.58 *mc* signal, 90 degrees out of phase with the first 3.58 *mc* signal into modulator B. The second 3.58 *mc* (3.58 *mc* $\angle 90°$) signal may be obtained by feeding the first 3.58 *mc* signal through a 90 degree phase shifting circuit as shown in the diagram.

Balanced modulators A and B are essentially mixing circuits much the same as mixers in conventional superhetrodynes. Thus, sum and difference frequency signals are present in the output of the A modulator as follows:

3.58 *mc* + f_A
3.58 *mc* − f_A

The 3.58 *mc* signal will not be present in the output circuit, being cancelled by the equal and opposite 3.58 *mc* signal currents which flow in the plate circuit of balanced modulator A. In a similar manner the sum and difference frequency signals produced in the output of the B modulator are:

3.58 *mc* $\angle 90°$ + f_B
3.58 *mc* $\angle 90°$ − f_B

These sum and difference signals are, in effect, the upper and lower sidebands of a 3.58 *mc* suppressed subcarrier.

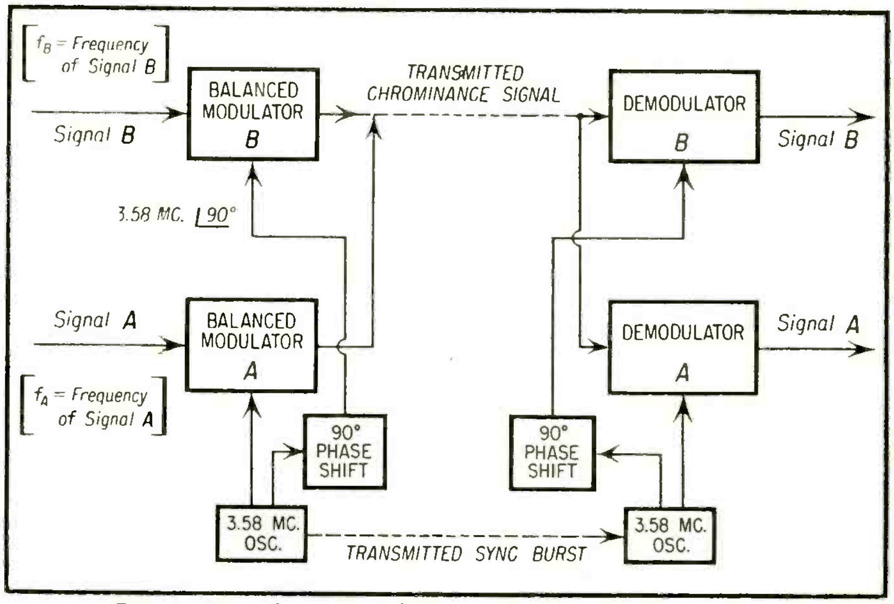
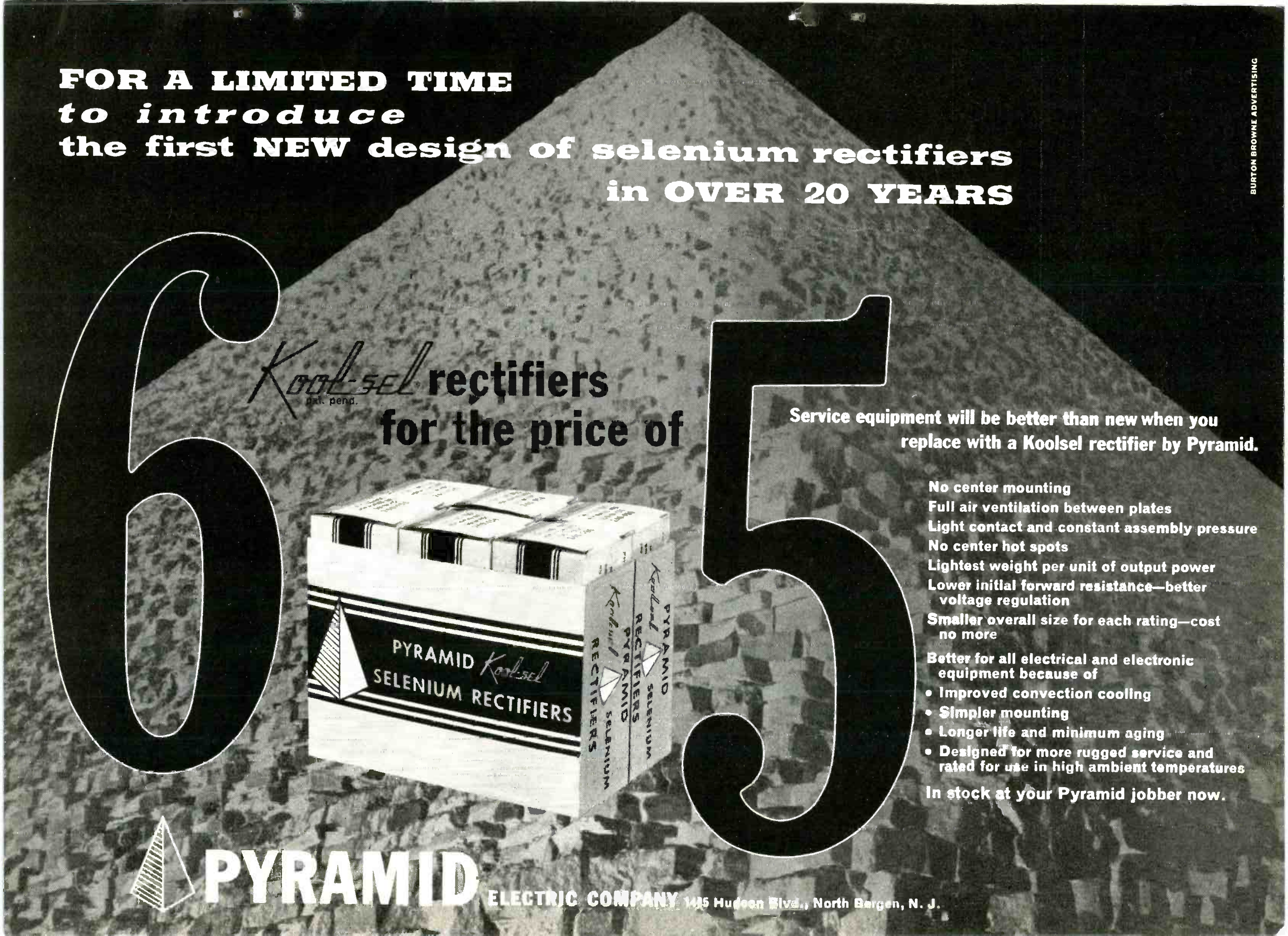


Fig. 1—Two-Phase modulation and demodulation system.

How Sidebands Are Shown Graphically

The manner in which the vectors of a pair of upper and lower sideband signals appear to rotate around a suppressed carrier vector may be shown as indicated in *Fig. 2.* At the outset it should be borne in mind that vector rotation is measured conventionally in a *counter-clockwise* direction. For reasons which will be explained shortly the two sidebands are shown as vectors which seem to rotate in *opposite directions* around a fixed subcarrier axis. From the preceding statement this dual rotation might appear as a contradictory concept. However, as we shall shortly see, these arrows indicate only the *relative motion* of the *sidebands* with respect to the subcarrier. The upper sideband, having a higher frequency than the subcarrier is shown as a faster rotating vector. Thus, it has a *relative*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counter-clockwise direction with respect to the subcarrier. On the other hand, the lower sideband which has a lower frequency than the subcarrier has a *relative clockwise direction* with respect to the subcarrier.

Clock Analogy of Sideband Additions

An analogy which might clarify to some extent this relative speed concept and the manner in which sidebands contribute to the overall modulated signal is presented with the aid of *Fig. 3*. Here we see a clock with three hands which, in contrast to a conventional clock, rotates in a *counter-clockwise* direction. We will assume a condition where the A-Hand of the clock rotates faster than the C-hand by a certain amount and slower than the B-Hand by an equal amount. Thus, the A-Hand rotates at 4 *rps* (revolutions per second), the B-Hand at 5 *rps*, and the C-Hand at 3 *rps*. Notice that the A-Hand is slower than the B-Hand by 1 *rps* and faster than the C-Hand by 1 *rps* (an equal amount).

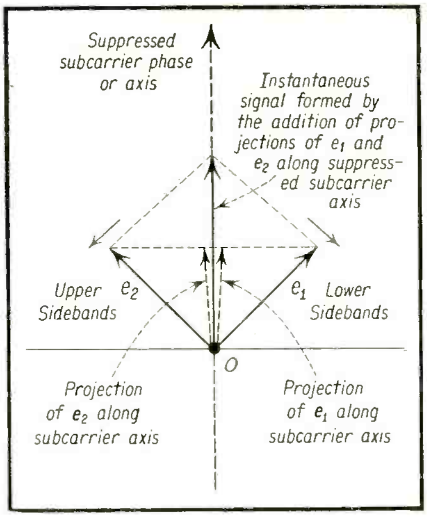


Fig. 2—Upper and lower sidebands shown as a pair of oppositely rotating vectors around subcarrier axis.

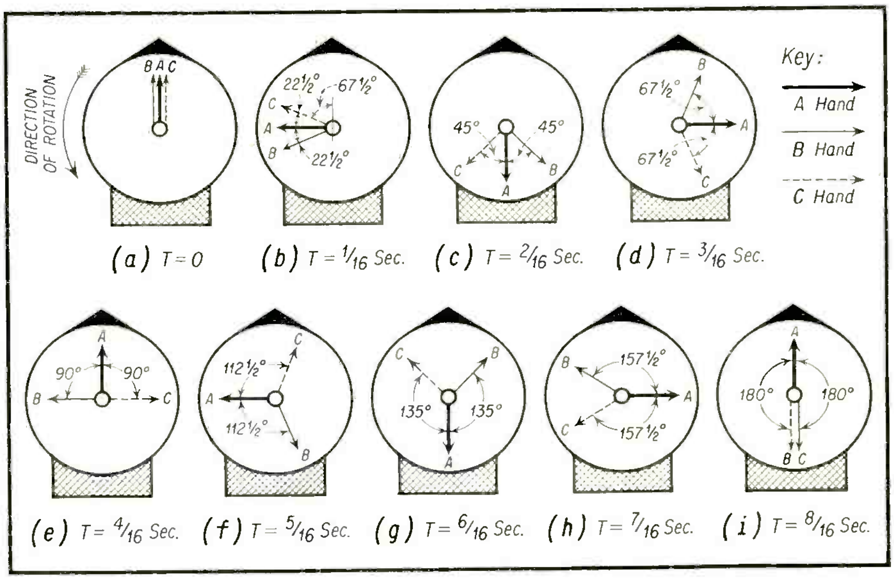


Fig. 3—Clock analogy to motion of sidebands around the subcarrier axis. Here all hands are shown at different time increments (1/16 sec.) with respect to zero time (T = O). Notice equal angles of C and B hands.

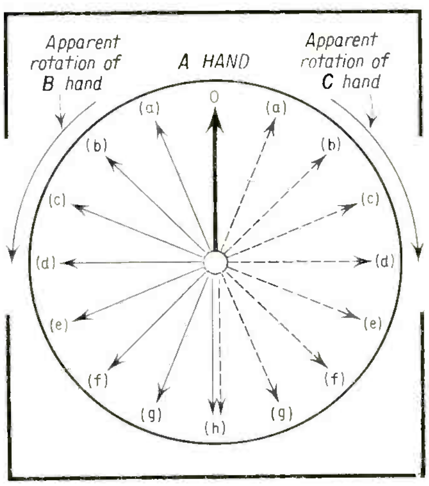


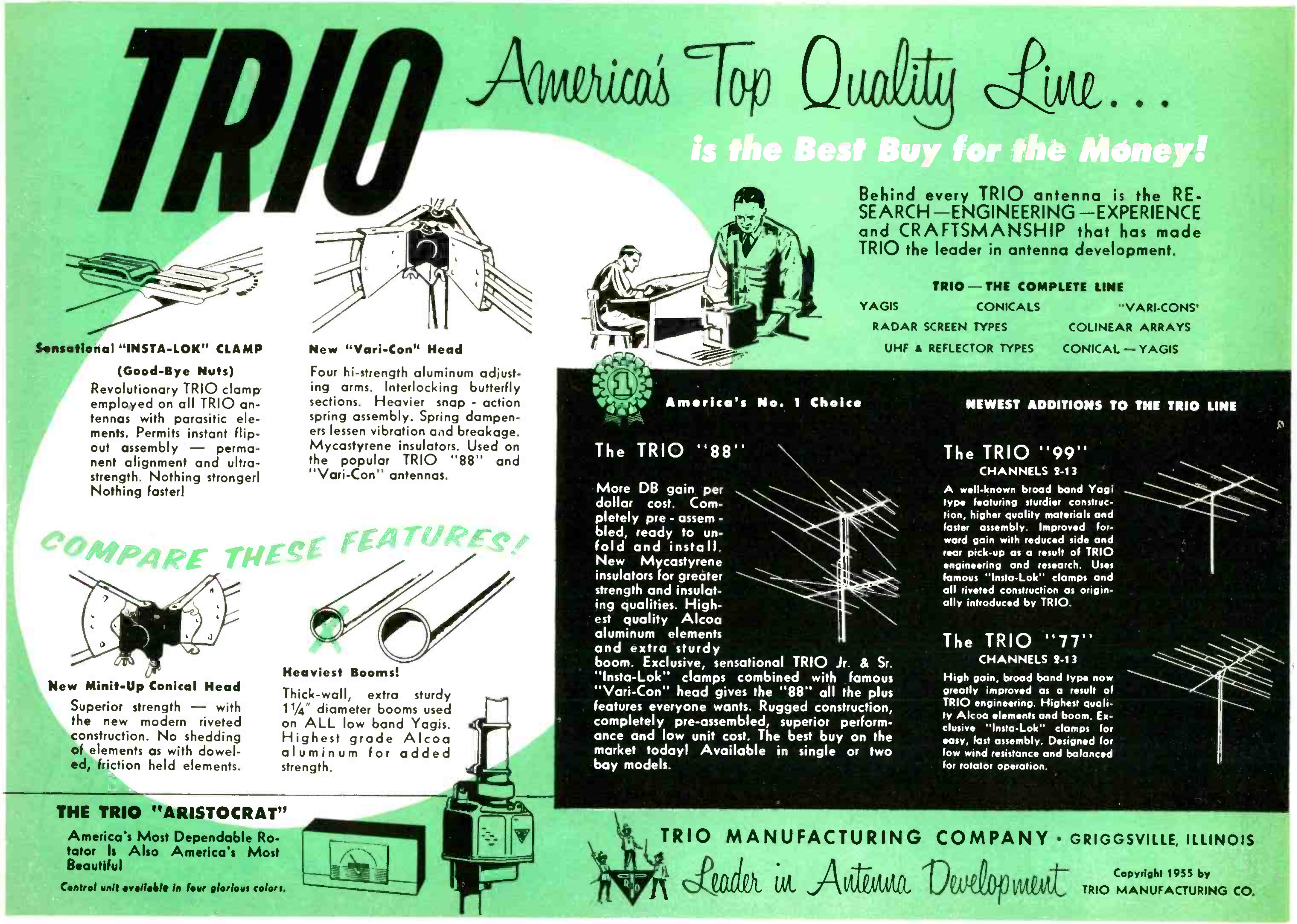
Fig. 4—Relative motion of B and C hands with respect to A hand. The A hand is kept vertical.

At zero time, T = O (a) all hands lie in the same position.

At T = 1/16 *sec* (b) the A-Hand travels ¼ cycle or 90°. During this time the C-Hand, moving at ¾ the speed of the A-Hand, travels 67½° and *lags* the A-Hand by 22½°. The B-Hand, which moves at 5/4 the speed of the A-Hand, travels 90 + 22½ = 112½°, and *leads* the A-Hand by 22½°. Thus, for ¼ revolution of the A-Hand the C-Hand is behind, and the B-Hand is ahead of, the A-Hand by equal angles.

At T = ⅛ *sec* (c) the B-Hand picks up 22½° and the C-Hand is further

[*Continued on page 19*]



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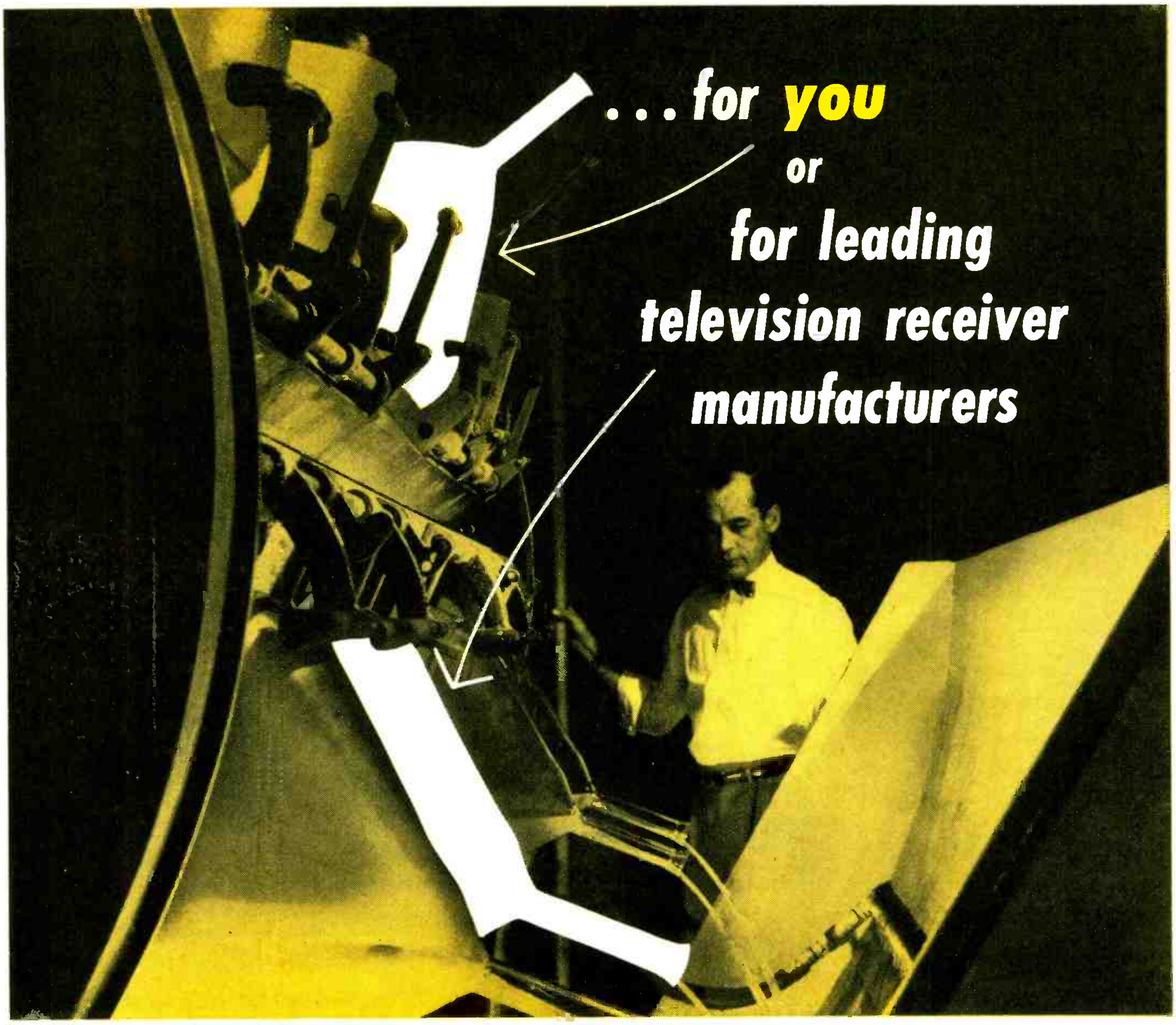

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[from page 16]

delayed 22½° with reference to the A-Hand, so that the angular difference is now 45°.

Notice that with each ¼ *sec* the angular difference between the A-Hand and the other two hands increases by equal amounts, so that the A-Hand remains always symmetrically placed between the other two hands. The nine cases we show in *Fig.* 3 amply illustrate this point.

We may now show (*Fig.* 4) the positions of the B and C Hands with respect to the A-Hand only, the clock being rotated so that for each time interval the A-Hand appears in a vertical direction. Notice that for each increment of time (1/16 *sec*) the faster B-Hand seems to rotate *counter-clockwise* with respect to the A-Hand, and the slower C-Hand seems to rotate *clockwise* with respect to the A-Hand. Observe also that the B and C-Hands at any instant are symmetrically disposed around the A-Hand.

Remember that this relative rotation is *apparent* and with respect to the A-Hand only. Actually, all hands are rotating in a counter-clockwise direction. This concept of relative rotation is important in understanding sideband phenomena in modulation systems.

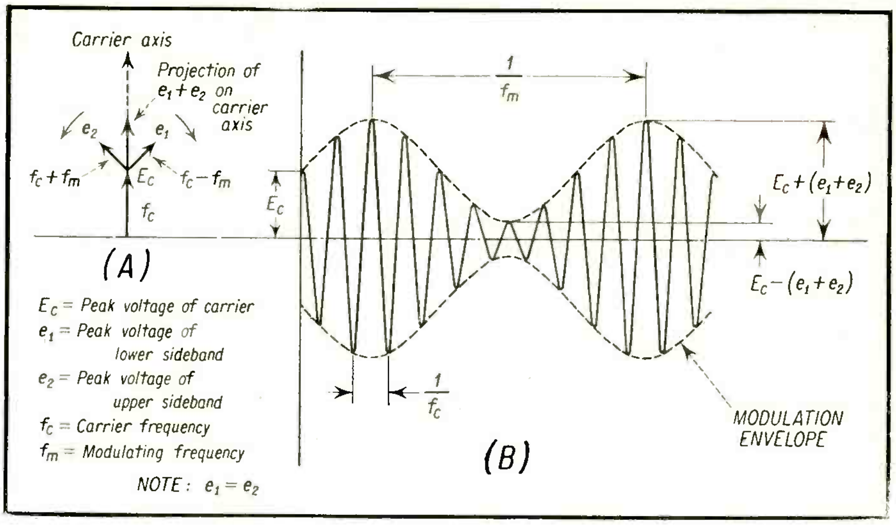

Fig. 5—(A) How sidebands are added to carrier in conventional AM system. In (B) we observe how rotation of sidebands results in projected voltages on carrier. These add to and subtract from carrier voltage to produce an envelope of voltages for a complete period of the modulating cycle.

Rotation of Sideband Vectors Around a Carrier

The manner in which sidebands rotate about a carrier in a conventional AM modulated carrier is somewhat analogous to the previous analysis. In *Fig. 5-A* we show how the sidebands position themselves at a particular instant with reference to the carrier. Here the carrier is represented as a peak voltage by the vector E_c, the upper sideband by e_2, and the lower sideband by e_1. Notice that e_2 which has a higher frequency than E_c is assumed to rotate in a counter-clockwise direction. By the same token e_1 which has a lower frequency than E_c is assumed to rotate clockwise with respect to E_c. As these sidebands rotate about the carrier axis, they must be considered as forces which have components along the carrier axis. These forces or voltages add to or subtract from the carrier voltage, thereby resulting in the formation of the familiar AM Envelope (*Fig. 5-B*).

It is important to keep in mind that the *resultant sum of the sideband vectors is always in phase with the carrier.* This means that if in a system involving various signals we assign an arbitrary phase to the carrier, this phase will not be altered by the addition of its sidebands. Thus, if we make arrangements for the phase of the carrier to be in a vertical "up" position as shown, it will remain in this position for the full gamut of sidebands present.

Production of Chrominance Signal

These principles may now be applied to suppressed carrier sideband transmission. Here, we have no carrier to which the upper and lower sidebands may be added. These sidebands, by themselves, produce a resultant signal. The manner in which this signal is generated is shown in *Fig. 6.* It is obvious that this resultant signal has the same frequency as the subcarrier. This signal may be represented, therefore, as a vector lying in the same phase as the subcarrier. The vector represents the sum of the peak amplitudes of the sideband vectors projected on the subcarrier axis. This is the signal found in the output of either modulator A or B in *Fig. 1.* Note that for the second half of the modulation cycle the subcarrier suffers a complete 180° phase reversal.

Fig. 7 shows a typical modulator stage in which the sideband signals described above are developed. A color-difference signal of waveform A enters a phase splitter and is applied so that

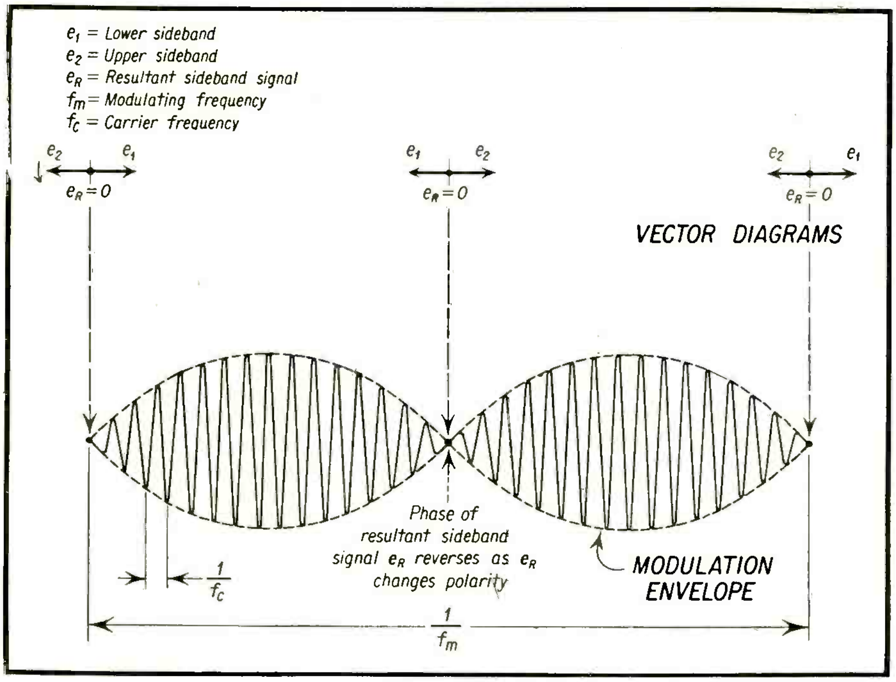

Fig. 6—A plot of the instantaneous phase and amplitude of the resultant sideband information. Corresponding vector diagrams are shown for 90° intervals of the modulating cycle.

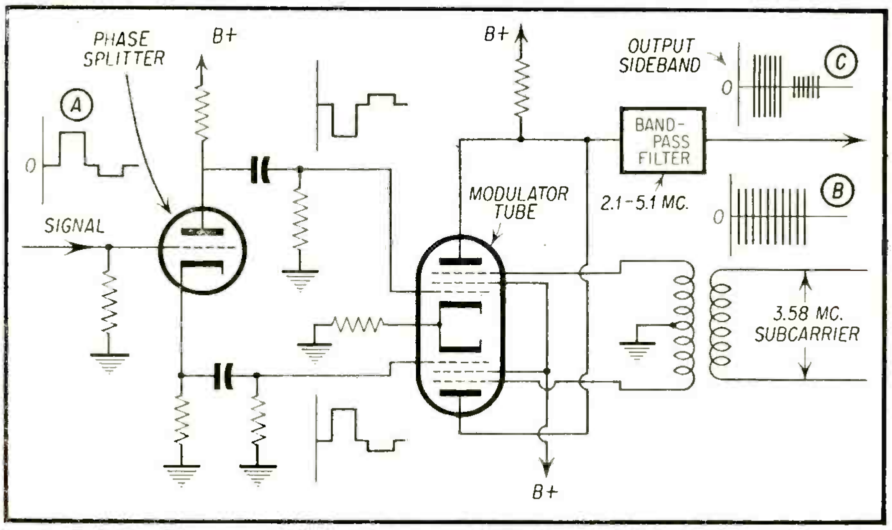

Fig. 7—Simplified diagram of a balanced modulator. The color-difference signal entering the phase splitter is applied so that the signals at the grids of the modulator tube are 180° out of phase with each other. Signal (A) combines with the 3.58 mc oscillator signal to produce the sideband output signal.

the signals at the grids of the modulator tube are 180° out of phase with each other. Signal A combines with the 3.58 *mc* oscillator producing the output sideband signal. The latter represents the instantaneous effects of the products in the plate circuit of the color-difference signals and the 3.58 *mc* subcarrier.

Generally, a clearer concept of the above action may be obtained from a voltage or vector study. Thus, from *Fig. 8* we observe in (a) how an upper and a lower sideband signal combine to form Signal A in *Fig. 1*. In (b) we show how Signal B, the quadrature sideband resultant signal, is developed. The products of the signals in both balanced demodulators are then combined to form the resultant signal shown in (c) which is the chrominance signal. In (d) we indicate how different values of color-difference signals may produce chrominance signals of different relative phases and amplitudes.

An instantaneous voltage analysis of a typical chrominance signal is shown in *Fig. 9*. In (A) we show the output of modulator A. In (B) we show the output of modulator B. In (C) we show how signals produce the resultant chominance signal, *Ec*. In (D) we show *Ec* by itself. In (E) we again show the complete process as a vector diagram. Notice how much simpler the vector diagram is to work with. The vector diagram readily produces the amplitude and phase angle of E_c relative to E_A and E_B.

Color Sync Signals

Reference to *Fig. 1* shows how the chrominance signal is transmitted and received by the demodulator or synchronous detector in the receiver. Notice that to recover the original color-difference signals, we make use of a locally generated 3.58 *mc* signal synchronized with the 3.58 *mc* signal of the transmitter. This 3.58 *mc* signal is developed in an automatic phase controlled (APC) color sync system shown in block diagram form in *Fig. 10*. A

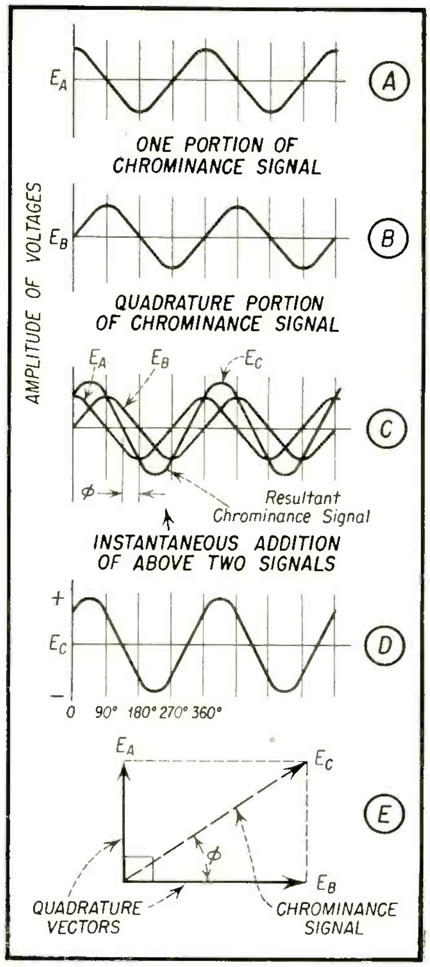

Fig. 9—The two resultant sideband signals in quadrature add vectorially to produce the resultant chrominance signal. Waveform additions are shown from (A) to (D). Vector addition shown at E.

detailed explanation of this system has been covered in a previous chapter. In this chapter we simply acknowledge that two 3.58 *mc* signals are available for demodulating purposes. These signals are in quadrature and are related to the color burst signal as indicated in

[*Continued on page 59*]

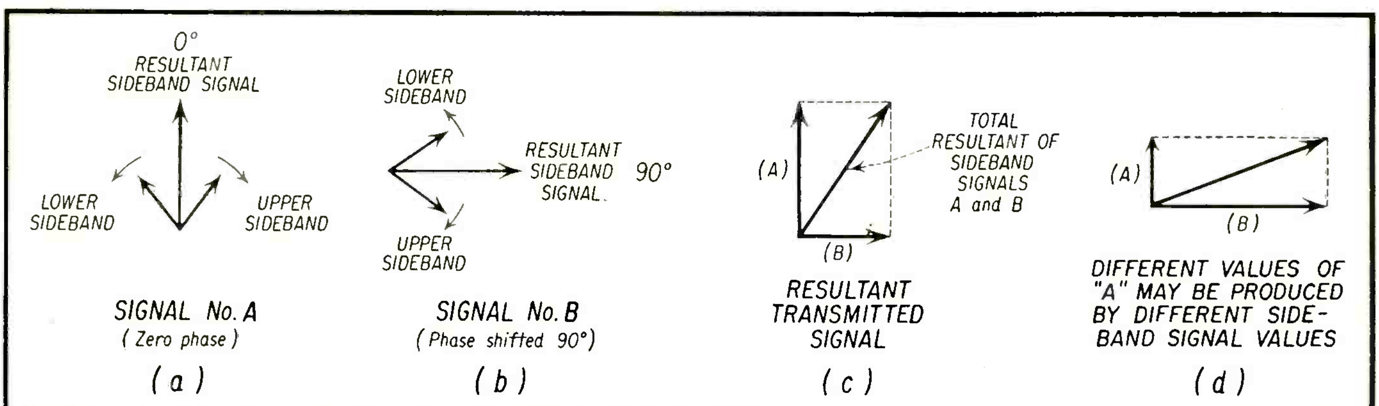

Fig. 8—Vector diagrams of signals (A) and (B) combined by two-phase modulation process. Above signals contain resultant sideband energy contents of original signals (A) and (B).

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★C-2991	3	A-3128	2	★MWC-2	7	BC-353	12	BC-547	14
C-2993	3	A-3129	2	★MWC-3	7	BC-354	12	BC-548	14
★C-2994	3	A-3130	2	★MWC-4	7	BC-355	12	BC-549	14
★C-2995	3	A-3131	2	★MWC-5	7	BC-360	12	BC-550	14
★C-2996	3	A-3132	2	★MWC-6	7	BC-361	12	SW-600	14
A-2998	2	A-3133	2			BC-362	12	SW-601	14
A-2999	2	★P-3138	7			BC-363	12	SW-602	14
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A-3005	2	P-3147	5			BC-368	12	SW-607	14
A-3008	8	P-3148	5			BC-369	12	SW-620	14
A-3013	2	P-3149	5	★TV-100	10	BC-370	12	SW-621	14
A-3014	2	P-3150	5	★TV-101	10	BC-371	12	SW-622	14
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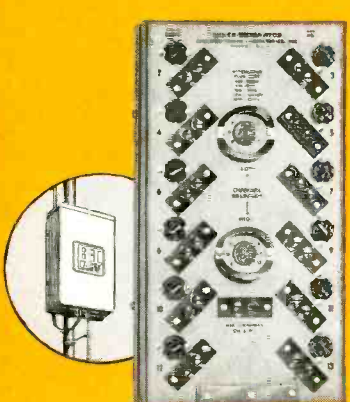

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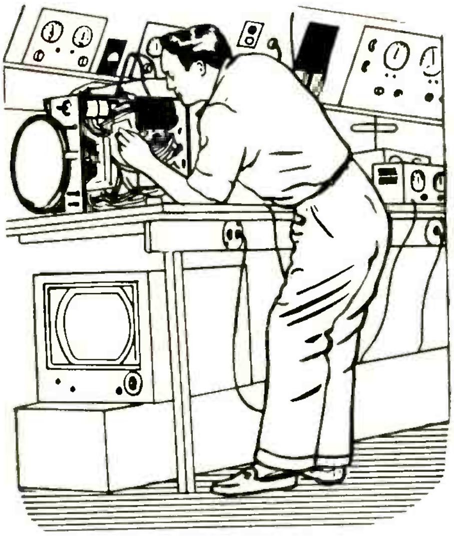

The Work Bench

by PAUL GOLDBERG

This Month:

BRIGHTNESS PROBLEMS

THIS installment is devoted to two brightness problems. In all of these problems, the high voltage is O.K. Too often the serviceman blames the picture tube for a no-brightness condition when actually it is a defective component in the receiver. Mistakes of this kind are time-consuming and costly.

General Electric 830—T version

The customer who brought the receiver into the shop advised us that he had replaced the picture tube because he thought it was the reason for the no brightness condition. The receiver was set up on the bench and turned on. No variation of the brightness control could cause brightness to appear. The high voltage was checked and was found to be satisfactory.

When a condition such as this arises, there are certain tube voltage conditions which exist, that is, the voltages on the cathode, control grid, or screen grid (first anode) are such that the brightness is cut off. The diagram was now consulted. The control grid of the tube (a 12KP4) is directly fed from the plate of the video amplifier V7B. Therefore, a defective component that lowers this plate voltage (makes it more negative) could cut off the picture tube brightness. With most picture tubes, a negative grid to cathode voltage (screen and second anode voltage being normal) of 45 to 55 volts is enough to cut off the picture tube brightness. Defective components in the blanking circuits also cause many brightness problems. The blanking voltages are usually fed to either the screen, control grid, or cathode of the picture tube. Thus a shorted condenser, such as *C110*—.02 μf (see *Fig. 1*) would place a high positive voltage on the cathode of the 12KP4 and cut off the brightness.

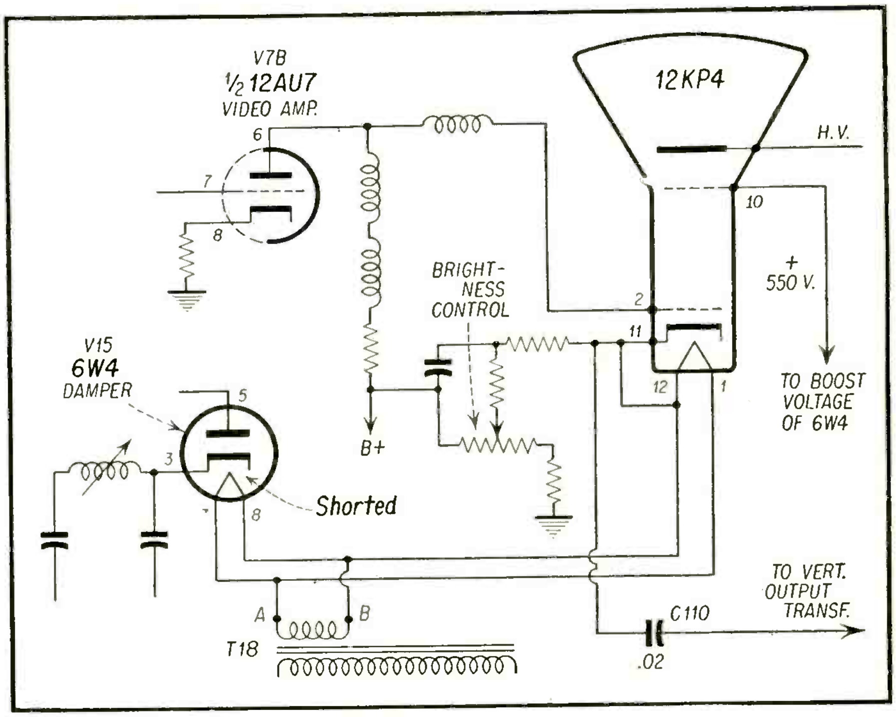

Fig. 1—Partial schematic of General Electric 830T.

Knowing these facts, a voltage measurement was taken at pin #2, the grid, of the 12KP4, and the meter read about 185 volts positive which was correct. Next, a voltage measurement was taken at the cathode, pin #11. Here, the meter read about 550 volts positive which was completely incorrect. The meter should have read about 225 volts at the cathode with normal settings of the brightness and contrast control.

Knowing that the cathode circuit of the 12KP4 could only obtain 550 volts from the boost voltage supply at the 6W4, both these circuits were studied carefully in the diagram. The filament transformer, section A and B, which provides the filament voltage for the 12KP4 and the 6W4, is ungrounded. The cathode of the 12KP4 is tied to its filament. Now, if the 6W4 has its filament shorted to its cathode internally, the 550V boost voltage, will appear at the 12KP4 cathode and cut off the picture tube brightness.

The 6W4 was then resistance-checked, filament to cathode, and found to be shorted. When the 6W4 was replaced, the receiver functioned correctly with the proper brightness because the filament circuit of the 6W4 is ungrounded, the boost voltage is not affected even though there is a filament to cathode short. Thus, it is seen how a 6W4 cathode to filament short may result in no-brightness condition.

Zenith Chassis 27F20

The receiver was turned on and it was observed that there was no brightness and that varying the brightness

[*Continued on page 54*]

Fig. 1—Distorted effect produced by using a crystal probe in circuits which have already been detected. A direct probe should be used for this type of measurement.

Q. When I test the video signal in the video amplifier with a scope and crystal probe, the vertical sync pulse appears to be turned upside down and becomes distorted. Is the probe defective?

A. The difficulty is due to improper test conditions. A crystal probe should not be used with the scope *after* the picture detector, because use of the probe in these circuits constitutes a second detection of the signal, which distorts the pulse display as seen in *Fig. 1.* Use a direct type of connection to the scope when testing in video-amplifier circuits.

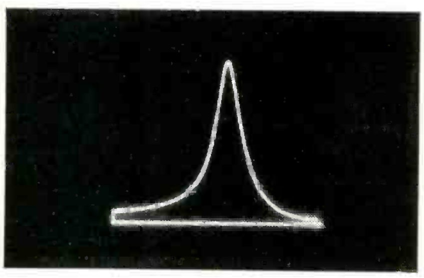

Fig. 2—Bandwidth of a tuned head such as used to troubleshoot sync buzz in *if* circuits is about .5 *mc.*

Q. What is the bandwidth of a tuned head, such as used to troubleshoot sync buzz in i-f circuits?

A. The response of such a tuned head, shown in *Fig. 2,* is approximately 0.5 *Mc.*

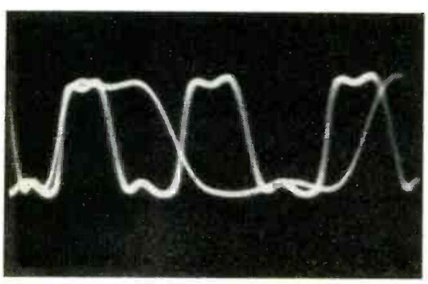

Fig. 3—Scope pattern indicates poor overall frequency response.

TV INSTRUMENT CLINIC

PART 8

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

By ROBERT G. MIDDLETON

Chief Field Engineer, Simpson Electric Co. Author of "Pix-O-Fix Troublefinder Guide," published by Rinehart & Co.; "TV Troubleshooting & Repair Guidebook," Vols. I & II; and co-author (with Alfred A. Gherardi) of "How to Use Test Probes," published by John F. Rider, Publisher.

Q. When a reproduced square wave sags in the middle, and is rounded at the corners, what fault is indicated in the video amplifier?

A. This situation, shown in *Fig. 3,* shows poor low-frequency response, poor high-frequency response, and abnormal medium-frequency response.

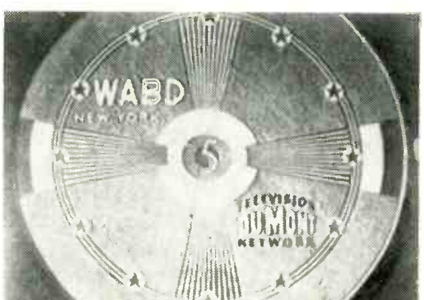

Fig. 4—Normal test pattern.

Q. Why would the vertical wedges in a test pattern appear darker than the horizontal wedges?

A. This distortion, shown in *Fig. 5* (compare normal test pattern in *Fig. 4*), is the result of high-frequency peaking in some of the signal circuits; it can also result from impedance mismatch between lead-in and receiver, and between lead-in and antenna.

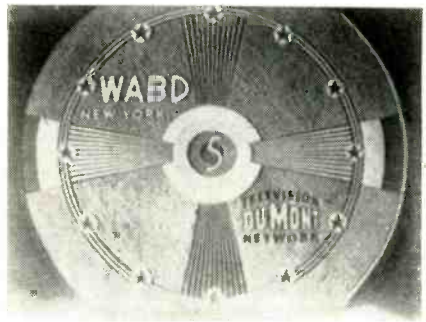

Fig. 5—High frequency peaking will cause vertical wedges in test pattern to appear darker than horizontal wedges. Compare test pattern with one in *Fig. 4.*

Q. When checking the integrator circuit, the scope often shows the baseline of the trace to be thickened, and the flyback shows a small sawtooth voltage waveform. Is this because the greater speed of the flyback expands the detail of the waveform?

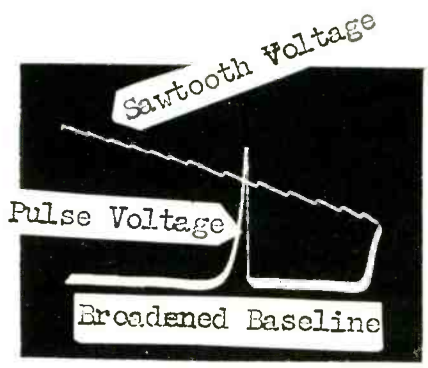

Fig. 6—A 60-cycle waveform with some 15,750-cycle information superimposed. The 15,750 cycle component broadens the baseline of the 60-cycle component.

A. Yes. This situation is illustrated in *Fig. 6.* This is an artifice which is frequently useful to determine the fine detail of a waveform when the horizontal sweep rate of the scope is inadequate. The particular portion of the pattern which appears on the flyback trace can be controlled by adjusting the level of the sync control on the scope panel.

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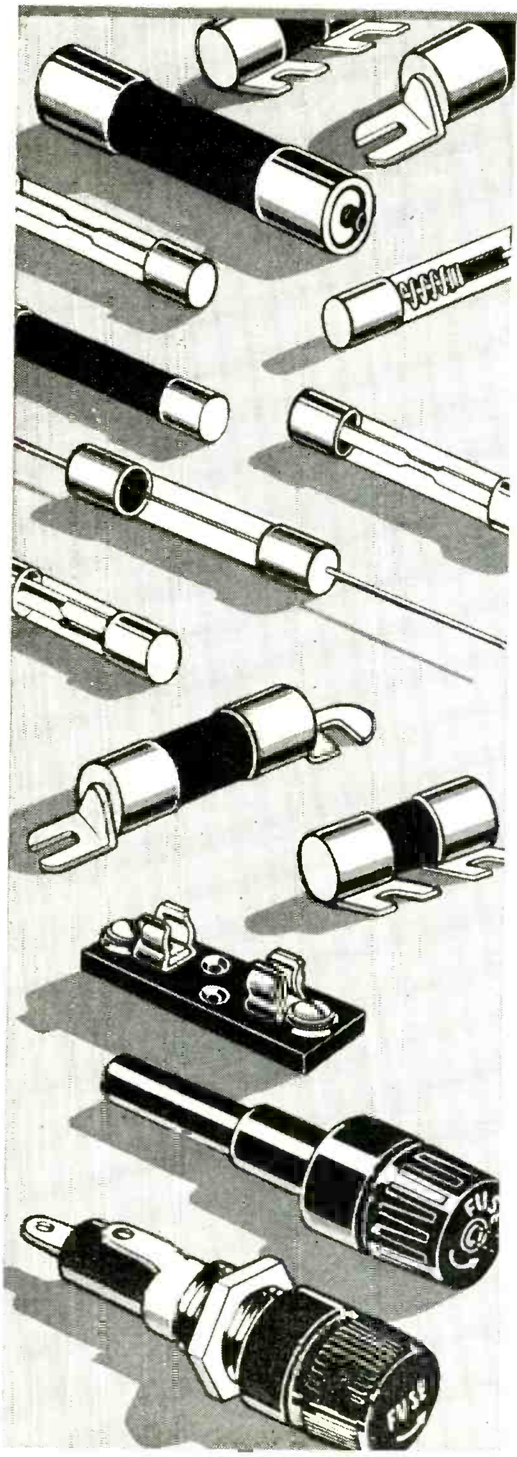

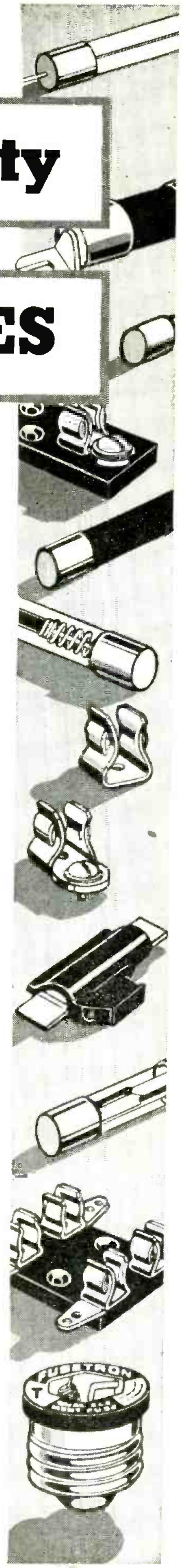

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color convergence with a white dot-linearity generator

by
Winston H. Starks
President and Chief Engineer
Winston Electronics Inc.

THE introduction of color television has created service problems which require the use of new test instruments and new techniques. A major portion of the color service problems are associated directly with the 15, 19, 21 and 22 inch tricolor kinescopes. These new kinescopes utilize three electron guns, a phosphor screen composed of thousands of tiny dots of red, blue and green phosphors, and a *shadow mask* structure placed near the phosphor screen. As the three electron beams sweep back and forth it is required that they pass through the holes in the shadow mask in a way that will make them strike the correct color dots. That is, the "red beam" must always strike red phosphor dots, the "blue beam" must always strike blue dots and the "green beam" must always strike green dots. If the beams do not strike the correct dots then the kinescope is said to be *mis-converged*. A color kinescope which is mis-converged will cause either a monochrome or a color picture to have *halos of color*, sometimes referred to as *color bleeding*. Mis-convergence will be most noticeable at points in the picture which have sharp changes of contrast. This defect in picture reproduction is much the same as the mis-registration effects sometimes seen in poorly printed multi-color pictures.

It will be found convenient to think of the image on the color kinescope as being made up of three pictures: a red picture, a blue picture and a green picture. The problem of convergence is simply one of making the three pictures superimpose so that there is no overlapping of any one color. Actually the adjustments are not complicated but they are time-consuming since there are at least 9 controls which must be set in the proper order and by the correct methods.

Test Equipment for Convergence

It would be next to impossible to obtain a satisfactory convergence alignment by using only the transmitted picture. A blank raster will give no indication at all of mis-convergence. Since convergence trouble is shown up best by sharp, bright points in a picture, it is evident that a pattern consisting of a large number of *small white dots* would be the most suitable pattern for trouble-shooting and alignment of convergence. The need for more accurate adjustment of picture linearity and size controls in color TV receivers makes it important that a convergence generator also include provisions for generating vertical and horizontal bars. If the convergence adjustments have been thrown far off their correct settings by a "knob twister" it may be necessary to use an oscilloscope for a part of the convergence procedure.

Fig. 1—White Dot-Linearity Generator (Win-Tronix Model 160)

The White Dot-Linearity Generator

Servicemen who are now receiving their first color TV service calls are finding convergence to be one of the most prevalent service problems. This is due to the many factors which can upset convergence, plus the possibility that convergence can never be quite perfect in the corners of the screen. The convergence problem has elevated the White Dot-Generator to a plate of importance ranking with the multimeter and the oscilloscope.

A typical convergence and linearity pattern generator is the White Dot-Linearity Generator, shown in *Fig. 1*. This generator provides a modulated *rf* output signal for ease of connection to the TV receiver. The Function switch gives a selection of the following:

1. Large White Dots: 10 to 11 vertical rows of dots—for convergence viewed through a mirror (also for linearity and picture size adjustment).

2. Small White Dots: 15 to 16 vertical rows of dots—for fine adjustment of convergence when viewing kinescope directly.
3. Vertical White Bars: For horizontal linearity and picture width adjustment.
4. Horizontal Bars: For vertical linearity and picture height adjustment.

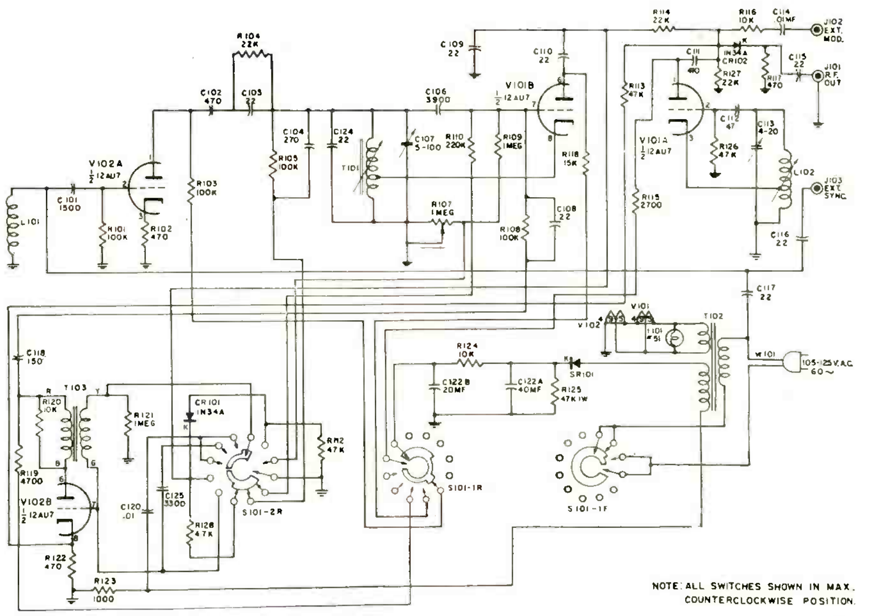

Fig. 2—Circuit diagram of Win-Tronix Model 160 White Dot-Linearity Generator which produces patterns for color kinescope convergence or sweep circuit adjustments. RF carrier tunes from Channel 2 to 6.

Circuit Description of White Dot-Generator

The schematic of the Model 160 is shown in *Fig.* 2. An *rf* oscillator tube V101A provides the *rf* carrier signal which is tuned from Channel 2 through 6 by the control *C113*. The Bar-Dot oscillator V101B produces the dot or vertical bar signals, depending on which components are switched into the circuit. V101B operates as a blocking oscillator when producing the dot modulation. It functions as an *L-C* oscillator when producing vertical bar modulation. These modulation signal voltages are shaped by the crystal CR101 before they are mixed in the Crystal Modulator CR102.

V102B is the 60 cycle Vertical Sync Pulse Generator. It is locked in step with the power line frequency to eliminate hum weave in the pattern. An output signal from this generator is applied to the Crystal Modulator to give the dot pattern a 60 cycle sync pulse. The Dot Oscillator V101B is also locked to a multiple of the 60 cycle pulse generator. This arrangement of interlocked frequencies is necessary to reduce vertical *dot jitter* and *hum weave.*

In order to provide horizontal sync, a small amount of 15 *kc* signal is picked up from the TV receiver through the power line (or by direct pickup with an external sync lead) and fed to the Stabilizer tube V102, which shapes the 15 *kc* signal and serves to control the frequency of the Dot-Bar oscillator V101B. It is interesting to note that while V101B is generating a dot pattern composed of a multiplicity of frequencies, it is being synchronized simultaneously by the 15 *kc* Stabilizer tube V102A and the 60 cycle Vertical Pulse Generator V102B.

Applications

The Model 160 White Dot-Linearity Generator enables alignment of all color convergence circuits as well as sweep circuit adjustment of monochrome and color receivers.

Special Color TV Applications of the White Dot Pattern:

1. Static Convergence by beam magnet adjustment,
2. DC Convergence test and adjustment,
3. Deflection Yoke positioning for best dynamic convergence,
4. Vertical Dynamic Shape adjustment,
5. Vertical Dynamic Amplitude adjustment,
6. Horizontal Dynamic Phase adjustment,
7. Horizontal Dynamic Amplitude adjustment.

Additional applications for monochrome or color TV include the adjustment and testing of horizontal linearity, raster width, vertical linearity, raster height, yoke positioning, picture centering and focus.

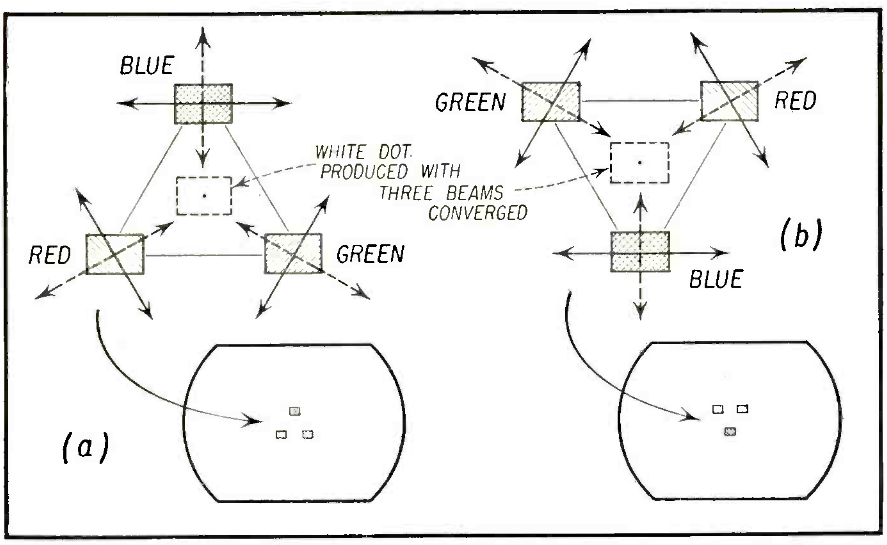

Fig. 3—The center dot triangle is pictured here to show different conditions of misconvergence. The position of the color dots in (a) indicates insufficient *dc* convergence voltage. Excessive *dc* convergence voltage is indicated by the position of the color dots in (b). Both conditions may be due to the improper adjustment of the *dc* convergence control. Dotted lines show direction of dot movement produced by *dc* convergence control. Beam magnet dot motion shown by solid lines.

Preparation for Color Convergence

Convergence of a color TV receiver may be accomplished by producing a white dot pattern on the color kinescope and then adjusting all of the convergence controls in the proper order to produce a pattern with the minimum amount of color fringing on the dots. *Figs.* 3 through 7 illustrate the various

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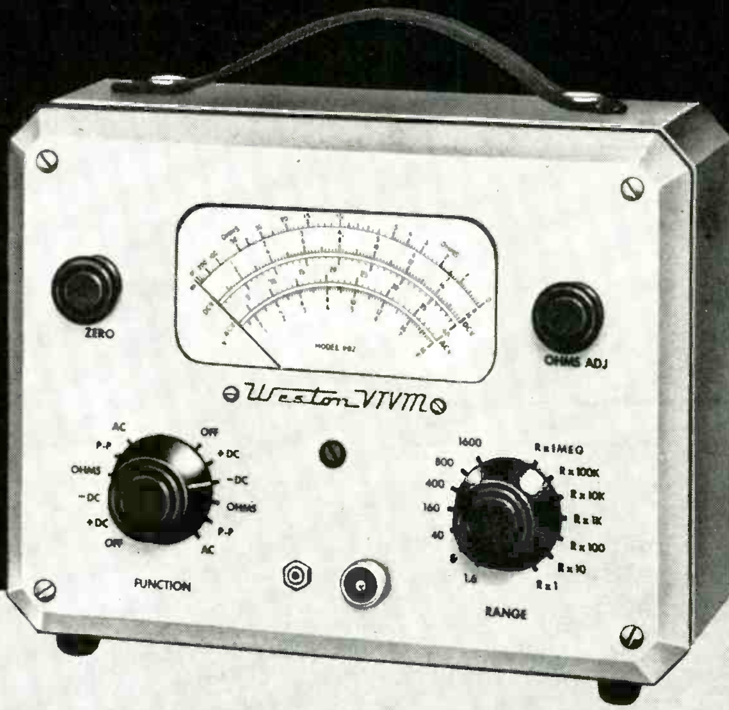
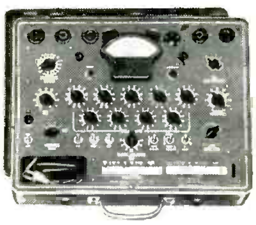
peak to peak measurement with input impedance of 10 megohms shunted by a capacitance of only *15 micromicrofarads!*



the 980 line VACUUM TUBE VOLTMETER

Model 982

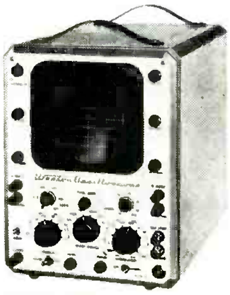
Other 980 Line Instruments



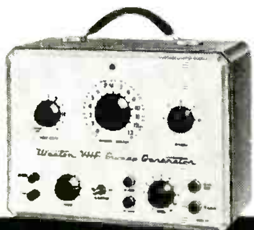
Model 981
Tubechecker

Model 980
Analyzer

Model 985
Calibrator



Model 983
Oscilloscope



Model 984
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D-C and Peak to Peak Volts	1.6	8	40	160	400	800	1600
A-C Volts	1.6	8	40	160	400	800	1200
Low-C Peak to Peak Volts	16	80	400	1600			
Ohms	X1Meg	X100K	X10K	X1K	X100	X10	X1

(10 ohms center)

Frequency Response—to 300 KC on peak to peak; to 2 KC on AC rms; to 300 MC with RF probe, (available as accessory).

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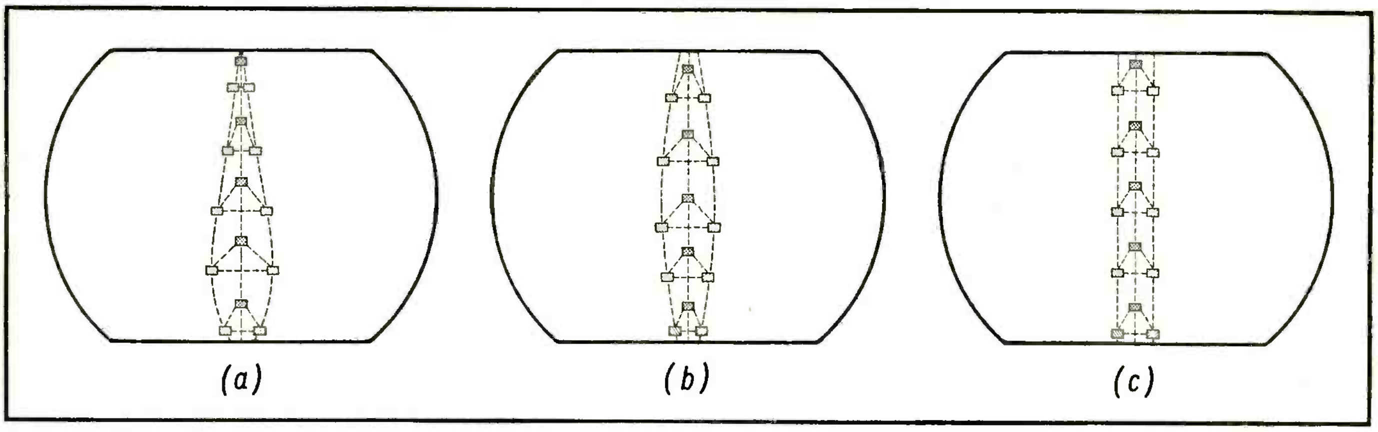

Fig. 4a—Vertical center row of dots showing incorrect adjustment of vertical shape (phase) control or tilt control.

Fig. 4b—Vertical center row of dots showing correct vertical shape with incorrect vertical dynamic amplitude adjustment.

Fig. 4c—Vertical center row of dots showing correct vertical shape and amplitude. Adjustment of *dc* convergence would now converge the center row of dots.

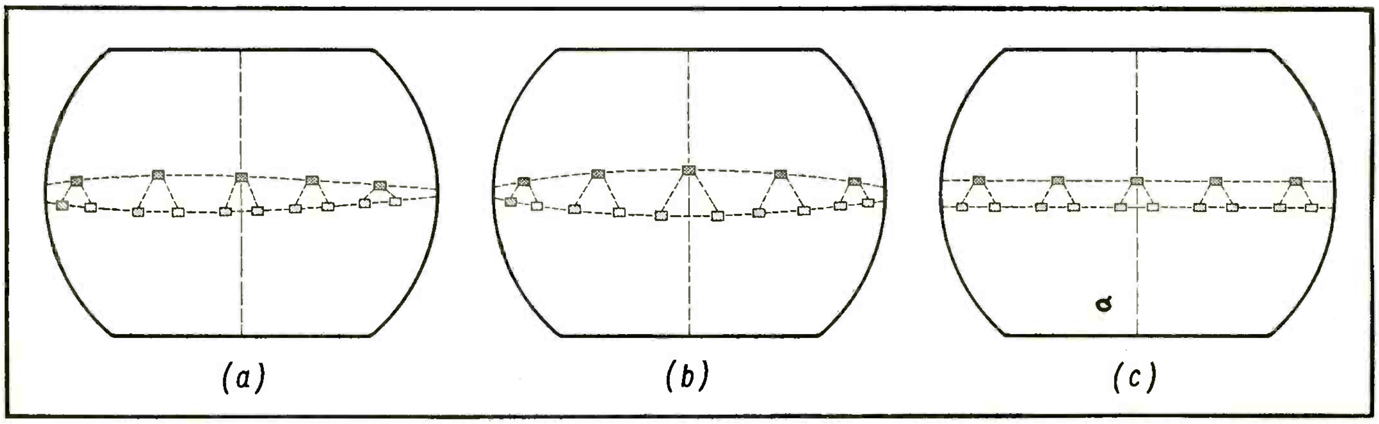

Fig. 5a—Horizontal center row of dots showing incorrect adjustment of horizontal dynamic phase control, or horizontal tilt controls. Compare with Fig. 5b.

Fig. 5b—Horizontal center row of dots showing correct horizontal dynamic phase (or tilts) with incorrect dynamic amplitudes.

Fig. 5c—Correct horizontal dynamic phase (or tilts) and correct horizontal dynamic amplitude. Adjustment of *dc* convergence would now converge the center row.

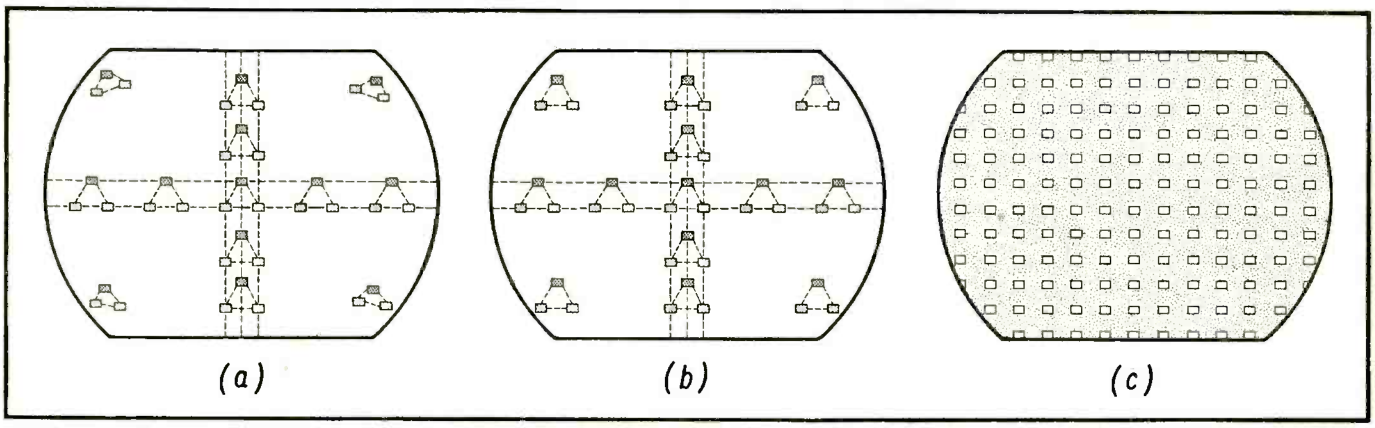

Fig. 6a—Symmetrical and equal triangles in both V. and H. center rows indicate correct dynamic adjustments. Unequal corner triangles means misconvergence due to yoke.

Fig. 6b—Following up on Fig. 6a, improved convergence in corners may be obtained by a better positioning of the deflection yoke.

Fig. 6c—After obtaining the best possible dynamic adjustment the application of *dc* convergence voltage should converge all triangles to form white dots as shown above.

dot patterns which will be useful in the alignment and troubleshooting of convergence circuits.

Before attempting convergence work the serviceman should make certain that all tubes and components are operating normally. It would be a great waste of time to attempt alignment if poor convergence has developed due to low anode voltage or a weak horizontal output tube. Then, all sweep circuit adjustments should be checked and properly set. Also, the high voltage should be measured and checked.

[Continued on page 50]

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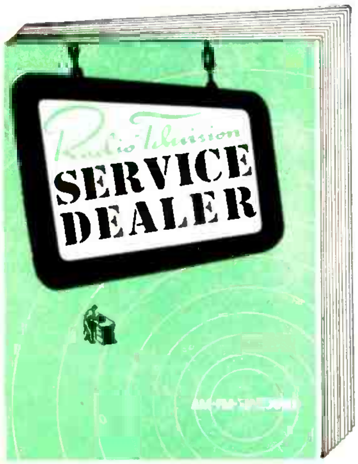

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Mfr: Andrea **Model No.** T-VL16

Card No: ANVL16-1

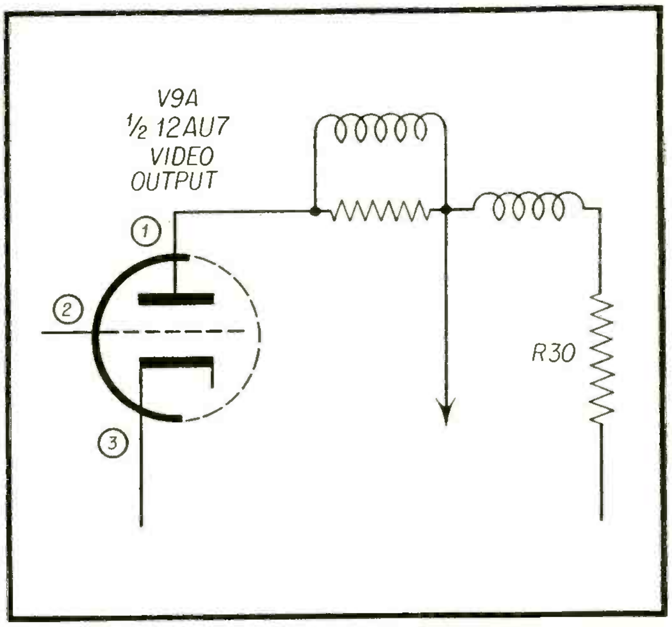
Section Affected: Pix

Symptom: Pix smeared and weak

Cause: Plate load resistor increased in value

What to Do:

Replace: *R30* (3.3K)



Mfr: Andrea **Model No.** T-VL16

Card No: ANVL16-2

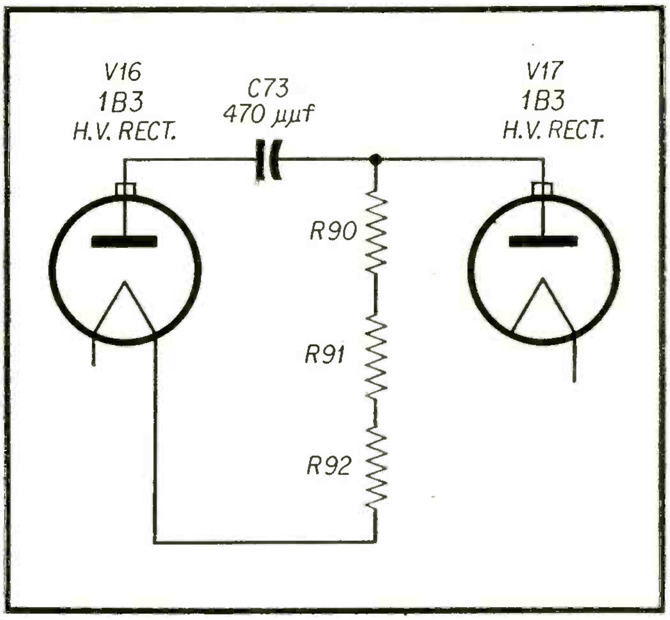
Section Affected: Raster

Symptom: Blooming

Cause: High voltage string resistors increase in value

What to Do:

Replace: *R90, R91, R92* (all 470K)



Mfr: Andrea **Model No.** T-VL16

Card No: ANVL16-3

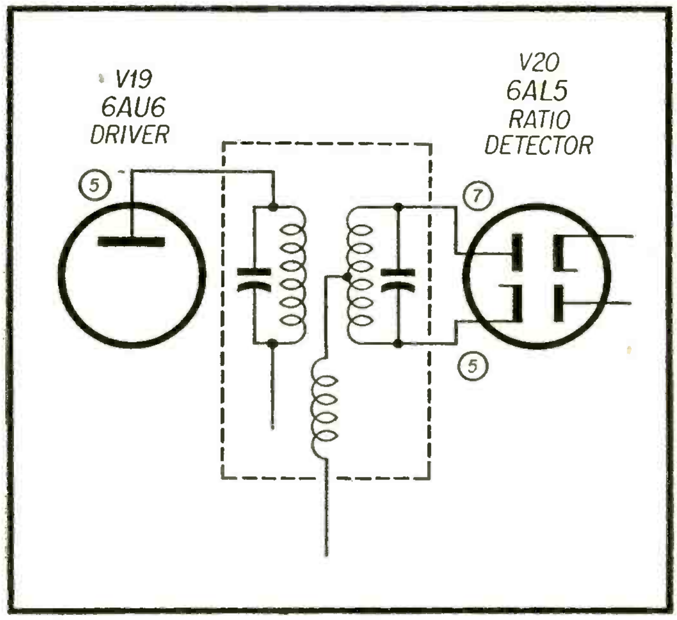
Section Affected: Sound

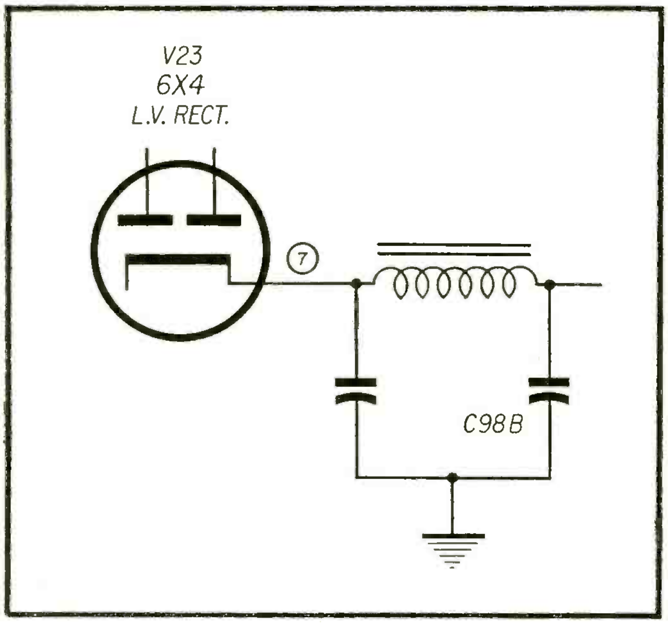
Symptom: Noise in sound

Cause: Sound discriminator transformer shorts intermittently

What to Do:

Replace: Sound discriminator transformer





Mfr: Andrea **Model No.** T-VL16

Card No: ANVL16-4

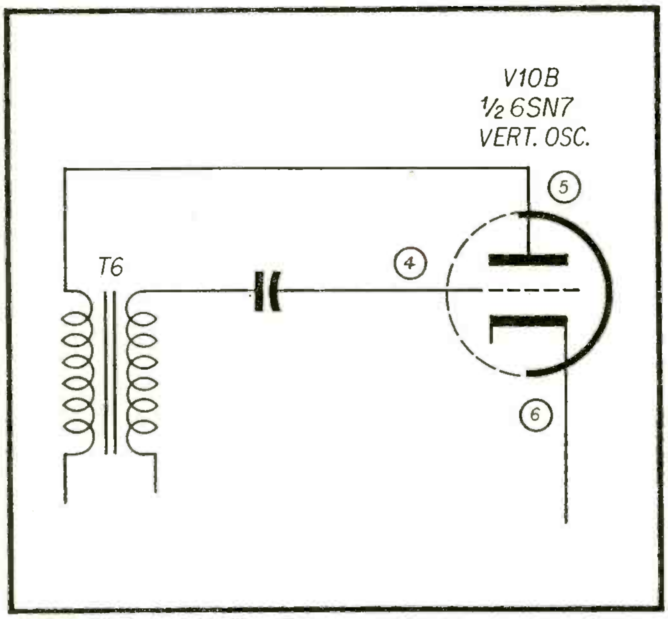
Section Affected: Sound

Symptom: Loud hum in sound

Cause: Open or leaky output filter condenser

What to Do:

Replace: *C98B* (30 μf)



Mfr: Andrea **Model No.** T-VL16

Card No: ANVL16-5

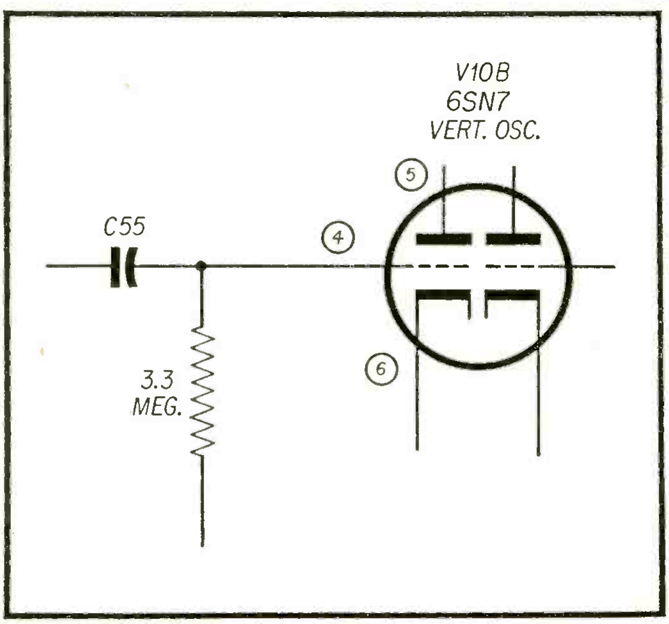
Section Affected: Raster

Symptom: No vertical sweep

Cause: Shorted primary to secondary of vertical blocking transformer

What to Do:

Replace: *T6* vertical blocking transformer



Mfr: Andrea **Model No.** T-VL16

Card No: ANVL16-6

Section Affected: Sync

Symptom: Horizontal frequency drift

Cause: Leaky coupling condenser

What to Do:

Replace: *C55* (.002 μf)

Mfr: Arvin **Chassis No.** TE 276

Card No: AR276-1

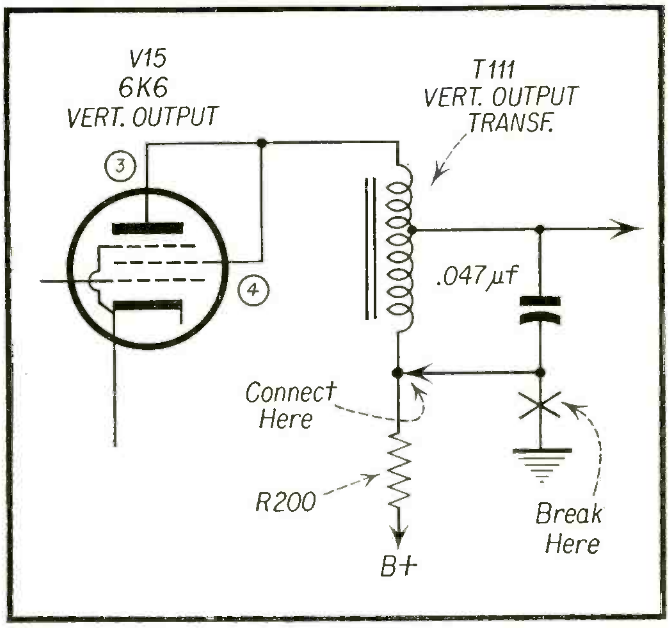
Section Affected: Sound

Symptom: Buzz in speaker with volume control at minimum

Reason for Change: Reduce vertical sync pickup through chassis

What to Do:

Remove: Ground side of *C178* and connect to junction of *T-111* and *R200* (1K)



Mfr: Arvin **Chassis No.** TE 276

Card No: AR276-2

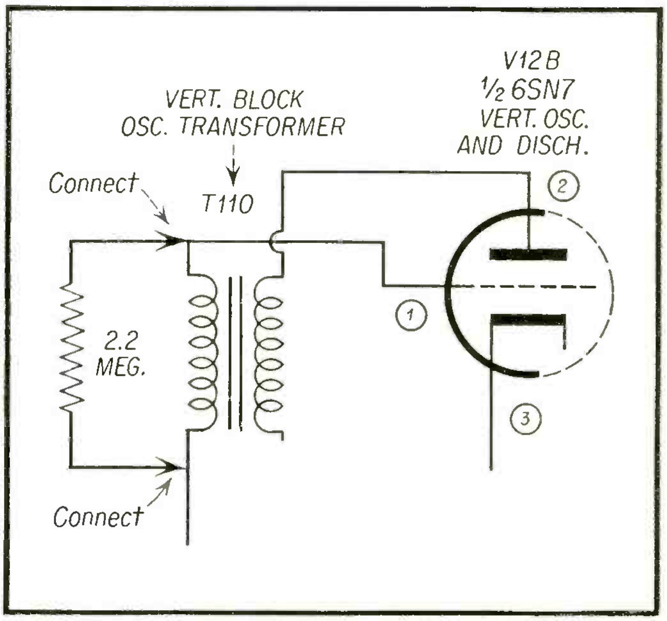
Section Affected: Sync

Symptom: White horizontal band at top of pix, and touchy vertical hold

Reason for Change: Damp out parasitics

What to Do:

Add: 2.2 meg resistor across primary of *T110* (vertical blocking oscillator transformer)



Mfr: Arvin **Chassis No.** TE 276

Card No: AR276-3

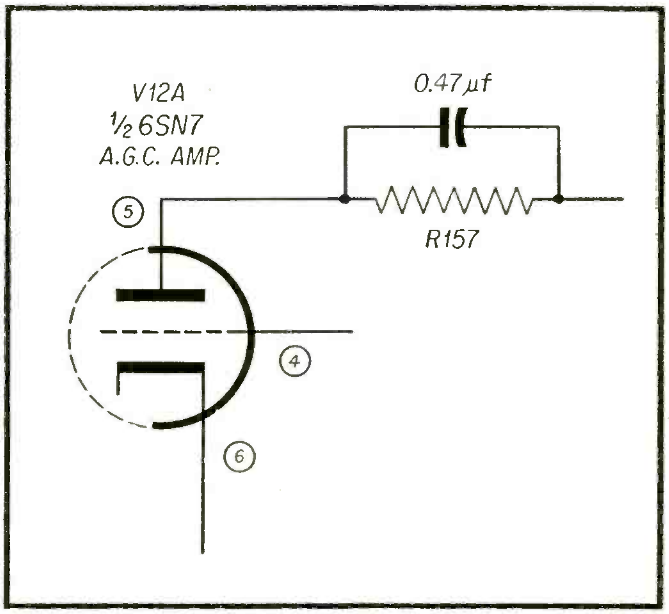
Section Affected: Sound

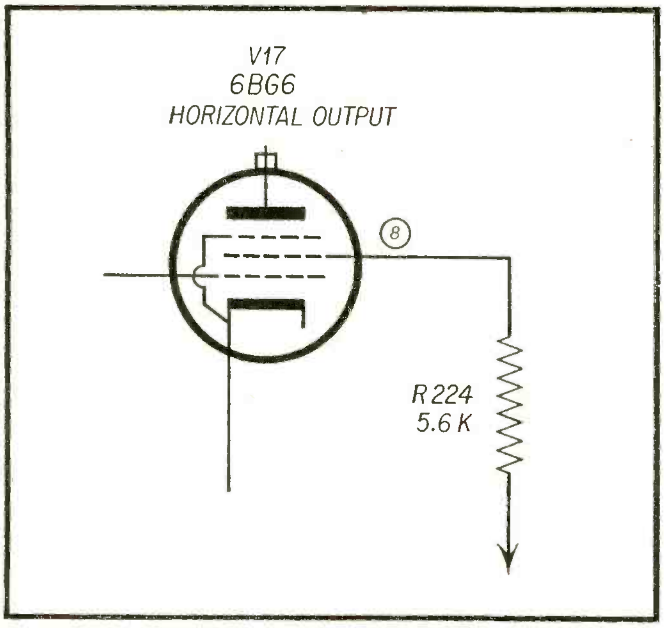
Symptom: Buzz in sound on strong signals

Reason for Change: Circuit improvement

What to Do:

Replace *R157* (120K) with 75K resistor





Mfr: Arvin **Chassis No.** TE 276

Card No: AR276-4

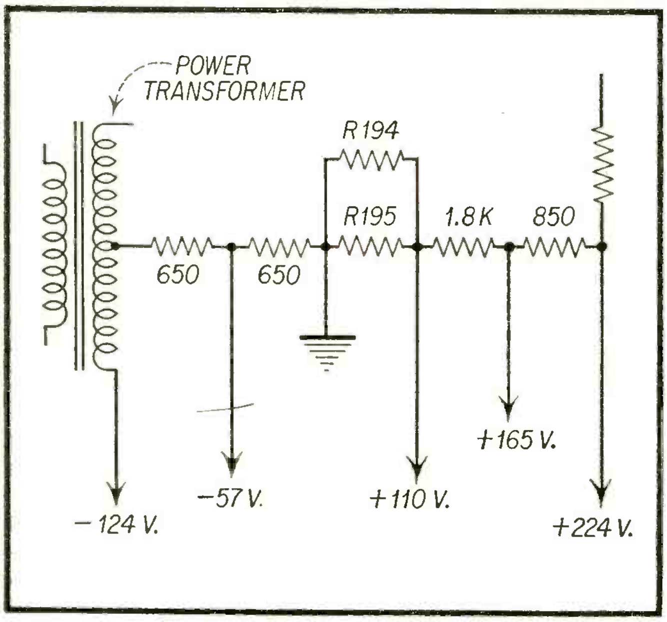
Section Affected: Raster

Symptom: Intermittent high voltage — *R224* (5.6K) overheats

Cause: Resistor overloads

What to Do:

Replace: *R224* (5.6K-2W) with 5.6K-5W



Mfr: Arvin **Chassis No.** TE 276

Card No. AR276-5

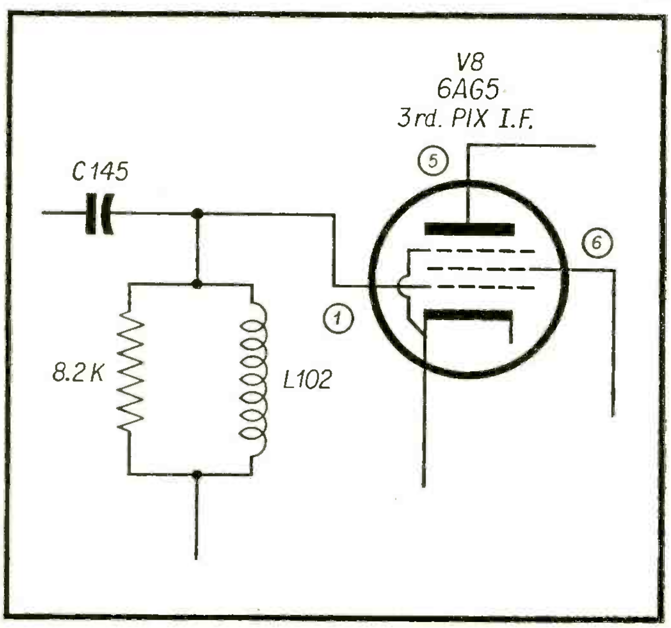
Section Affected: Sync

Symptom: Poor horizontal and vertical sync and *agc*

Cause: Resistors increase in value

What to Do:

Replace: *R194* and *R195* (both 6.8K)



Mfr: Arvin **Chassis No.** TE 276

Card No: AR276-6

Section Affected: Pix

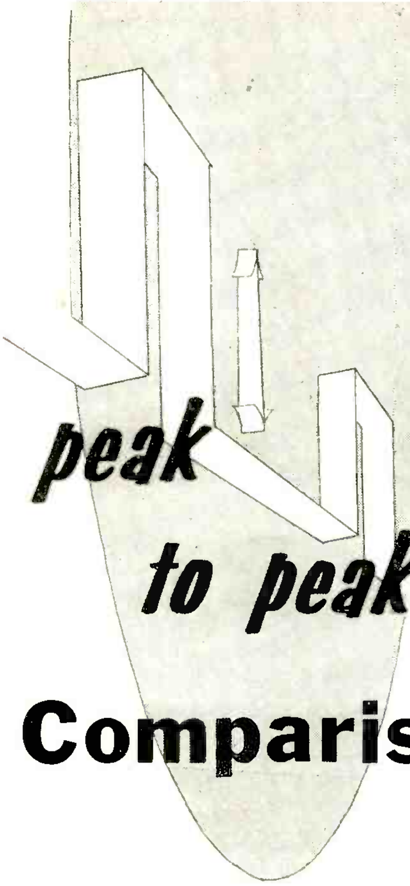
Symptom: Video overload on normal contact control setting

Cause: Leaky coupling condenser

What to Do:

Replace: *C145* (33 $\mu\mu f$)

Fig. 4—Peak-To-Peak meter connected to oscilloscope.



peak to peak Comparison Meter

by R. H. Bowden
Service Instruments Co.

WITH the advent of television, servicemen were confronted for the first time with measuring *ac* voltages, other than sine waves. Up to that time, the only *ac* voltages that were measured were audio and power line, and the peak to peak value was of little consequence. However, if it were required, it could have been easily derived by multiplying the *rms* voltage by 2.828. The *rms* voltage is merely measured with an *ac* meter. Signals and wave forms encountered in television receivers normally are not sine waves and cannot be measured by this simple device. Let us see why this is true.

In *Fig. 1A* is a square wave, such as would represent the synchronizing pulses in a TV receiver. If they measure 100 volts peak to peak, the average voltage would read somewhere around 5 volts due to the larger time duration between recurrences. In *Fig. 1B* the same pulses appear with little time duration between them. If these pulses were read on an *ac* meter, they would register approximately 40 volts. Both pulses represent the same driving voltage on a vacuum tube (such as a sync separator), and, therefore, only the peak to peak value is of any significance. Most television manufacturers realize the importance of peak to peak measurements, and they list the peak to peak value beside the wave form on their schematic. Others list the wave forms and peak to peak measurements separately in their service literature.

Gated sync separators, gated *agc* circuits, and gated circuits in color TV receivers present a problem to servicemen who do not have a definite method of measuring peak to peak voltages and, therefore, many hours are spent changing parts when the waveforms are of the proper shape, but their amplitude is not known. The gated *agc* circuit shown in *Fig. 2* is a typical example. If either the grid or plate waveform are of insufficient amplitude, the developed *agc* voltage will be inadequate and *if* amplifier overloading will result. This usually causes bending of the picture due to sync pulse clipping in the video amplifier. This circuit functions as follows: A driving voltage on the 6AU6 pentode tube is developed across the 3.9K video amplifier load resistor. This video waveform measures approximately 40 volts peak to peak. A grid bias of approximately 30 volts is also developed across the video amplifier load resistor. Subtracting the 30 volts *dc* from the video waveform of 40 volts, we deduce that the grid is being driven positive for the remaining 10 volts. If cut-off voltage on the tube is negative 3 volts, plate current would begin to flow at a point 13/40ths of the way down from the top of the driving waveform or at about the sync pulse level.

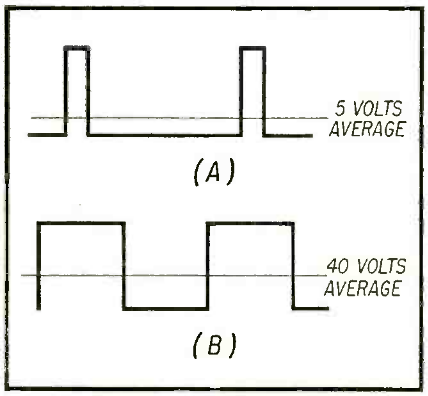


Fig. 1A—Waveform with long duration between recurrences. Fig. 1B—Waveform with short duration between pulses.

It is desirable to develop *agc* voltages during retrace time only so that noise pulses appearing between sync pulses do not develop a fictitious *agc* in fringe areas. Therefore, the plate does not have a conventional *dc* voltage applied but, rather, a peak voltage which is developed during the retrace period in the horizontal output circuit. If this plate voltage is low in amplitude, the effect is the same as lowering B plus in a conventional amplifier. Since a *dc* meter cannot be used to determine the plate voltage, a peak to peak device must be used.

Peak to peak voltages can be read in a number of ways. A simple peak reading *agc* circuit can be constructed such as shown in *Fig.* 3. Condenser *C1* charges to peak value and remains near peak as long as the *RC* time constant of *C1* and *R1* is many times the period of the waveform. The difficulties arising from this circuit are that the components must be very large for 60 cycle measurements, and that the loading on tuned circuits is prohibitive and that an expensive *dc* meter must be used. Another disadvantage is that waveform trouble shooting is normally done with an oscilloscope and it becomes cumbersome to change from the scope to the peak reading device as the trouble is being traced in the circuit.

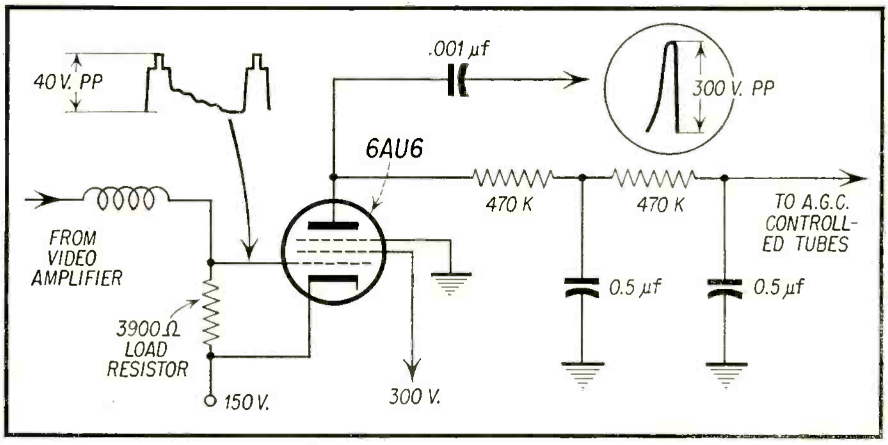


Fig. 2—Typical gated-agc circuit.

A very practical system is the "Comparison System" employing the oscilloscope and a calibrated waveform which can be compared in amplitude to the unkown. This procedure consists of viewing the television waveform on the

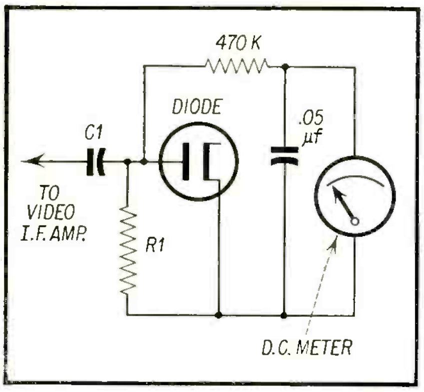


Fig. 3—Simple peak-reading circuit is shown in above figure.

oscilloscope and adjusting the vertical gain control of the scope until it fills a determined height. If a scope graph is handy, merely fill two or four divisions of it with the waveform. If it is not, the scope screen can be filled from top to bottom, provided the measured waveform is of sufficient amplitude. Two lines can be marked on the scope with a wax pencil with good results.

Next, disconnect the TV set and apply a known voltage, such as the power line that has been measured. When the line voltage measures 117 volts *ac* on an *ac* meter, its peak to peak value can be calculated to be 117 × 2.8 or 328 volts. Naturally, this does not serve too well for comparing voltages ranging from 1 to 50 volts such as are encountered in television receivers. The line can be calibrated by using an isolation transformer and potentiometer to provide the lower voltages. In laboratory equipment, this is done. For accurate measurements and to provide constant output, the 60 cycle waveform is squared by two clipping stages and, thus, the output is nearly a square wave rather than a sine. Since this accuracy is not required for service work, a calibrated line voltage waveform will do the trick and costs much less.

The procedure described in the preceding paragraph is the method employed in the peak to peak comparison meter shown in *Fig.* 4. This is also the same procedure employed in some new scopes with peak to peak measurements. It is only necessary to secure the meter to the vertical terminals of the scope with the two brackets provided. Connect the leads that were previously used with the scope to the terminals marked "INPUT." When the meter is turned off, the leads are connected straight through. There is no need to ever disconnect the peak to peak meter; merely switch it off when measurements are not being taken. When it is turned on, a calibrated sine wave voltage appears on the scope. Merely adjust this voltage to the same height as the

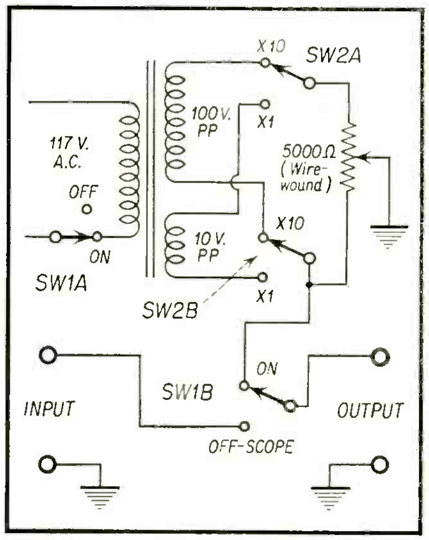


Fig. 6—Schematic diagram of Senco peak-to-peak comparison meter. Note simplicity.

unknown waveform and read the peak to peak measurements directly. See *Fig.* 5. This meter has excellent accuracy.

The Peak-to-Peak Comparison Meter has two ranges: 0 to 10 and 0 to 100. When measuring voltages over 100 volts, merely adjust the peak to peak meter output for 100 volts peak to peak and determine the number of times larger the unknown waveform is than the 100 volts. In other words, if it were four times the height, it would be 400 volts peak to peak.

Much time can be saved in servicing by using an oscilloscope and peak to peak reading device. A few new scopes have added these measurements but they constitute a very insignificant percentage of the scopes in use.

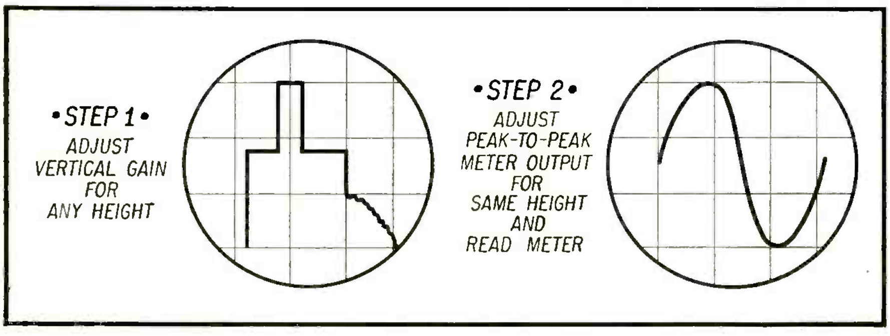


Fig. 5—Measuring peak-to-peak voltages by comparison method.

PACKARD BELL

Models

2742	2743	2744	2941
2842	2843	2844	3041

TUBE LIST

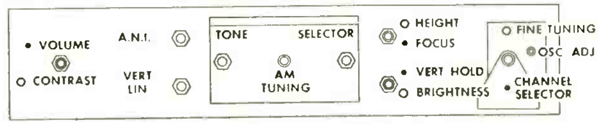
SYMBOL	TYPE	CIRCUIT FUNCTION
V1	6AU6	Sound I-F
V2	6CB6	Driver
V3	6AL5	Ratio Detector
V4	6AV6	1st Audio Amp.
V5	6V6-GT	Audio Output
V6	6CB6	1st Pix I-F
V7	6CB6	2nd Pix I-F
V8	6CB6	3rd Pix I-F
V9	6CB6	4th Pix I-F
V10	6AL5	Pix Detector
V11	6AU6	1st Video Amp.
V12	6K6-GT	2nd Video Amp.
V13	12AU7	Sync Separator and Amplifier
V14	6AL5	A.F.C. and Discriminator
V15	6SN7-GT	Hor. Oscillator
V16	6J5/6J5-GT	Hor. Discharge
V17	6AU5-GT	Hor. Output
V18	6AX4-GT	Damper
V19	1B3	H.V. Rectifier
V20	6AV6	Noise Inverter
V21	6AU6	Keyed A.G.C.
V22	6J5/6J5-GT	Vertical Oscillator
V23	6S4	Vertical Output
V24	5U4-G	L.V. Rectifier
V25	21YP4	Picture Tube

KEY VOLTAGES

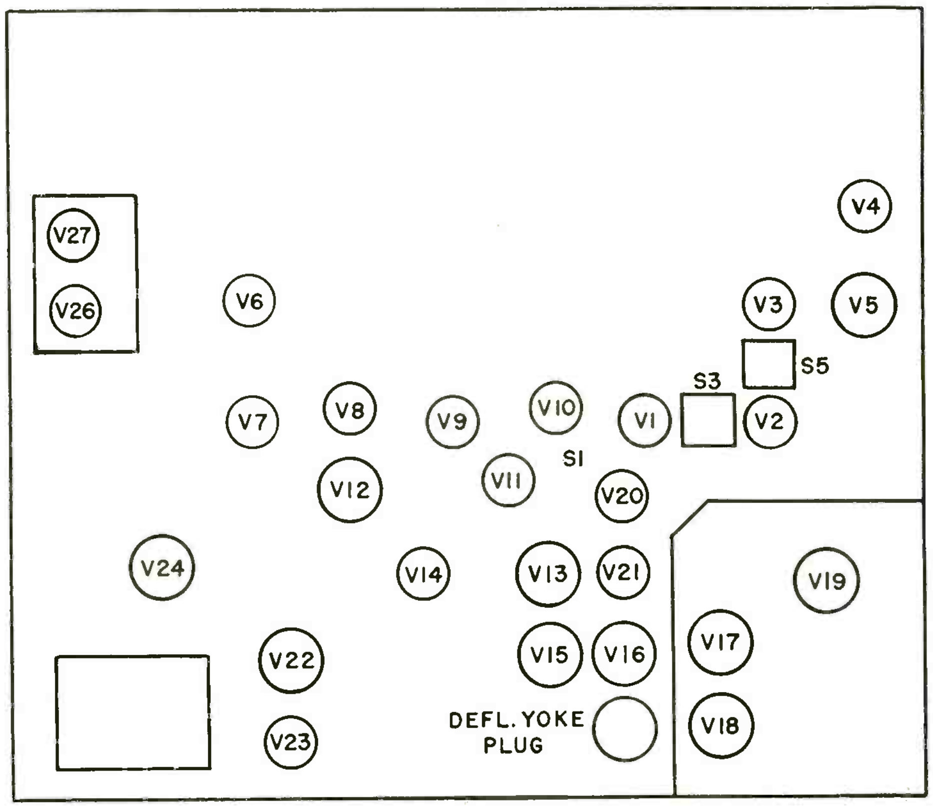
B+, plate of damper, V18 pin 5	335 vdc
Boosted B+, cath. of damper, V18 pin 3	570 vdc
Plate of VERT. OSC., V22 pin 3	140 vdc
Plate of Vert. Out. V23 pin 9	475 vdc
Plate(s) of Hor. Osc., V15 pin 2	115 vdc
pin 5	300 vdc
Grid of Hor. Out., V17 pin 1	0.1 vdc

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

REAR CONTROLS



FRONT CONTROLS



TOP VIEW

TV FIELD SERVICE
Pre-published from Rider "TV Field Service Manuals"
by Rider & Alsberg

ADJUSTMENTS

PICTURE TUBE ADJUSTMENTS:

The following picture tube adjustments are to be made upon installation or whenever the receiver is serviced.

1. DEFLECTION YOKE. Loosen deflection yoke adjustment screw and rotate yoke so that raster is square with picture tube frame. Make certain yoke is positioned firmly against cone of tube.
2. ION TRAP.
   a. Turn adjusting screw on ion trap fully counterclockwise, and position trap on neck of tube directly over space between grid 1 and grid 2.
   b. Set contrast control to minimum and brightness control approximately 80% clockwise.
   c. Rotate trap for maximum brightness, then turn adjusting screw, also for maximum brightness.
   d. Reduce brightness to point just below appearance of vertical retrace lines, and advance contrast to maximum. Then repeat step "c."
3. CENTERING. The centering magnet is a dual ring magnet. The centering of the picture is dependent upon the relation of the rings to each other and the relation of both to the tube. To adjust, position the magnet almost against the deflection yoke, then rotate the two sections in relation to each other, and as a whole, until proper centering is obtained. This adjustment is quite stable and will need little attention if not disturbed.

NOTE: If centering magnet is adjusted, repeat adjustment 2d above.

REMOVING PICTURE TUBE:

CAUTION

WEAR GOGGLES OR A MASK AND USE GLOVES WHEN HANDLING TUBE. DO NOT STRIKE OR SCRATCH THE TUBE OR SUBJECT IT TO MORE THAN MODERATE PRESSURE.

The uncoated bulb surface of the picture tube should be kept clean and free from dust or fingerprints. This is to prevent electrical leakage from the high voltage connection.

It is not necessary to remove the picture tube to clean the tube face. Simply remove the three screws in the rail above the tube and remove the safety glass. Clean glass and face of tube with window cleaning fluid on a soft cloth.

The chassis must be removed from the cabinet in order to remove the picture tube. The procedure is as follows:

1. Disconnect power plug and antenna.
2. Remove back and pull out speaker plug (and on combination the phonomotor, phono, and compartment lamp plugs).
3. Remove control knobs on front panel.
4. Remove four chassis mounting bolts and slide chassis out of cabinet.
5. Remove picture tube socket, ion trap, and centering magnet.
6. Disconnect high voltage lead from picture tube, remove spring harness and unfasten strap over top of picture tube.
7. Pull tube forward and out of yoke.

ADJUSTMENT OF NON-OPERATING CONTROLS:

The following adjustments should be made while observing a station test pattern. Allow receiver to warm up for ten minutes.

The BRIGHTNESS control should be adjusted in conjunction with the CONTRAST control so that each step (usually five) from black to white in the shading blocks is separate and distinct.

The FOCUS control should be adjusted so that the separate lines in the vertical resolution wedge are distinct as far as possible in to the narrow edge of the vertical wedge.

The HORIZONTAL DRIVE control is adjusted by rotating it clockwise until a bright vertical bar appears, causing picture compression. Then the control is rotated counterclockwise until the compression just disappears. Recheck after adjusting horizontal linearity and width.

Adjust HEIGHT and WIDTH controls in conjunction with HORIZONTAL and VERTICAL LINEARITY CONTROLS so that the large circles in the test pattern are as round as possible, and so that the test pattern is slightly larger than the mask opening.

The VERTICAL HOLD control is adjusted so that the picture does not move up or down.

The HORIZONTAL HOLD control is set about halfway between the points where the picture tears.

The ANI (automatic noise inverter) control MUST be adjusted at the location where the receiver is to be used. Moreover, it must be adjusted using the weakest signal that will be received. The procedure is as follows:

1. Rotate the ANI control to its extreme counterclockwise position.
2. Advance the control clockwise until the picture begins to distort.
3. Return the control counterclockwise slightly beyond where the distortion disappears.
4. Check all channels for picture stability. If adjustment has not been made on the weakest signal, synchronization may be lost on another channel.

PACKARD BELL TROUBLE SHOOTING CHART

INSUFFICIENT RASTER HEIGHT:
- Vert. Size and Lin. con.
- V22, V23, V24
- Check 0.05 and 0.1 μf caps. connected to pin 3 of V22
- Vert. Out. trans.
- Low line voltage

NO VERT. DEFL.:
- V22, V23
- Check 0.05 and 0.1 μf caps. connected to pin 3 of V22
- Check 0.01 μf cap. connected to pin 9 of V23
- Vert. Defl. coils (yoke)
- Vert. Osc. trans.

NO VERT. SYNC.—HOR. SYNC. OK:
- Vert. Hold con.
- Vert. Int. network
- V13, V20, V22, V23
- Check 1200 $\mu\mu f$ cap. connected to pin 5 of V22
- Check 0.1 μf cap. connected to pin 6 of V23
- Check 200 $\mu\mu f$ cap. connected to pin 9 of V23

NO HOR. OR VERT. SYNC.—PIX SIGNAL OK:
- V13, V20, V21
- Check 1500 μf cap. connected to pin 2 of V13
- Check 1500 $\mu\mu f$ cap. connected to pin 7 of V14
- A.N.I. con.

NO HOR. SYNC.—VERT. SYNC. OK:
- Hor. Hold con.
- V14, V15, V16
- Check 1200 $\mu\mu f$ cap. connected to pin 1 of V15

DISTORTED SOUND:
- Tuner fine tuning
- V1, V2, V3, V4, V5, V21, V27
- Check 0.02 μf cap. connected to pin 5 of V5
- Sound and Vid. IF alignment S1, S2
- Det. alignment S5

NOISY SOUND—PIX OK:
- Vol. con.
- V1, V2, V3, V4, V5
- Check sound system for loose connections
- Speaker
- Sound IF and Det. alignment S1, S2, and S5

SYNC. BUZZ IN SOUND:
- Tuner fine tuning
- V1, V2, V3, V10, V21, V27
- Sound IF and Det. alignment S1, S2, and S5

ENGRAVED EFFECT IN PIX:
- Tuner fine tuning
- Contrast con.
- V6, V7, V8, V9, V10, V11, V12, V21, V27
- Check 0.05 μf cap. connected to pin 5 of V11
- Check Vid. Det. and Amp. peaking coils

VERT. BARS:
- Hor. Drive con.
- V17, V18
- Check 47 $\mu\mu f$ cap. connected to yoke terminals
- Defl. yoke ringing

PIX BENDING
- Hor. Hold con.
- V13, V14, V15, V16, V17, V20, V21
- Check 0.05 μf cap. connected to pin 4 of V15
- A.N.I. con.

NO PIX—SOUND WEAK—RASTER OK:
- Fine tuning
- V9, V10, V11, V21, V26, V28
- IF alignment

INSUFFICIENT BRIGHTNESS:
- Ion trap
- Brightness and Hor. Drive con.
- V15, V16, V17, V18, V19, V24, V25
- Low line voltage

RASTER BLOOMING:
- Hor. Drive con.
- V17, V18, V19, V24, V25
- Check HV Filter cap.
- Check 1 Meg. Res. connected to HV Filter cap.

INSUFFICIENT RASTER WIDTH:
- Hor. Drive and Size con.
- V16, V17, V18, V24
- Check 270 and 5000 $\mu\mu f$ caps. connected to pin 3 of V16
- Hor. Out. trans.
- Low line voltage

NO RASTER—SOUND OK:
- Brightness con.
- Check HV Fuse (0.25 Amps.)
- Ion trap
- V15, V16, V17, V18, V19, V25
- HV trans. Hor. yoke CRT connections

POOR HOR. LIN.
- Hor. Lin. and Drive con.
- V17, V18
- Check 0.068 μf cap. connected to Hor. Lin. coil
- Hor. Out. trans.

POOR VERT. LIN.
- Vert. Size and Lin. con.
- V22, V23
- Check 0.05 and 0.1 μf caps. connected to pin 3 of V22
- Check 100 μf Elec. cap. connected to pin 2 of V23
- Vert. Out. trans.

STEWART WARNER

Models
21C—9340E, K, KB, L, LB, M, MB, P
21T—9340B, D, R, RB, S, T

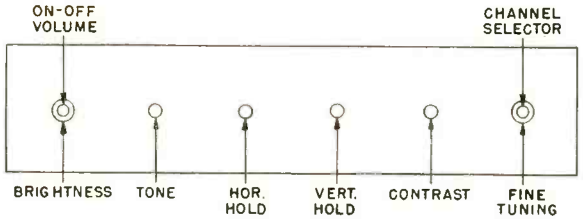
TUBE LIST

SYMBOL	TYPE	CIRCUIT FUNCTION
V1	6CB6	1st Vid. IF Amp.
V2	6CB6	2nd Vid. IF Amp.
V3	6CB6	3rd Vid. IF Amp.
V4	12BY7	Vid. Amp.
V5	6AU7	A.G.C. Keyer
V6	6BE6	Gated Sync. Separator
V7	12AU7	Sync. Amp.—Vert. Osc.
V8	6SN7GT	Hor. Osc.—Hor. Control
V9	6BQ6GT	Hor. Out.
V10	1B3GT	HV Rect.
V11	6AX4GT	Damper
V12	5U4G	LV Rect.
V13	6AU6	Sound IF Amp.
V14	6T8	Sound Discriminator—1st Sound Amp.
V15	6AQ5	Sound Out.
V16	6AH4GT	Vert. Out.
V17	21MP4	Picture Tube
V18	6BQ7 or 6BZ7	V.H.F. RF Amp. U.H.F. IF Amp.
V19	6U8	V.H.F. Mixer-Osc. U.H.F. IF Amp.
V20	6AF4	U.H.F. Osc.

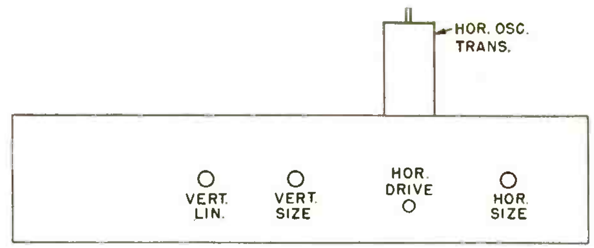
KEY VOLTAGES

B+, plate of damper, V11 pin 5	270 vdc
Plate of VERT. OSC., V7 pin 1	190 vdc
Plate of Vert. Out., V16 pin 5	300 vdc
Plate(s) of Hor. Osc. (and control), V8 pin 5	185 vdc
pin 2	130 vdc
Grid of Hor. Out., V9 pin 5	—18 vdc

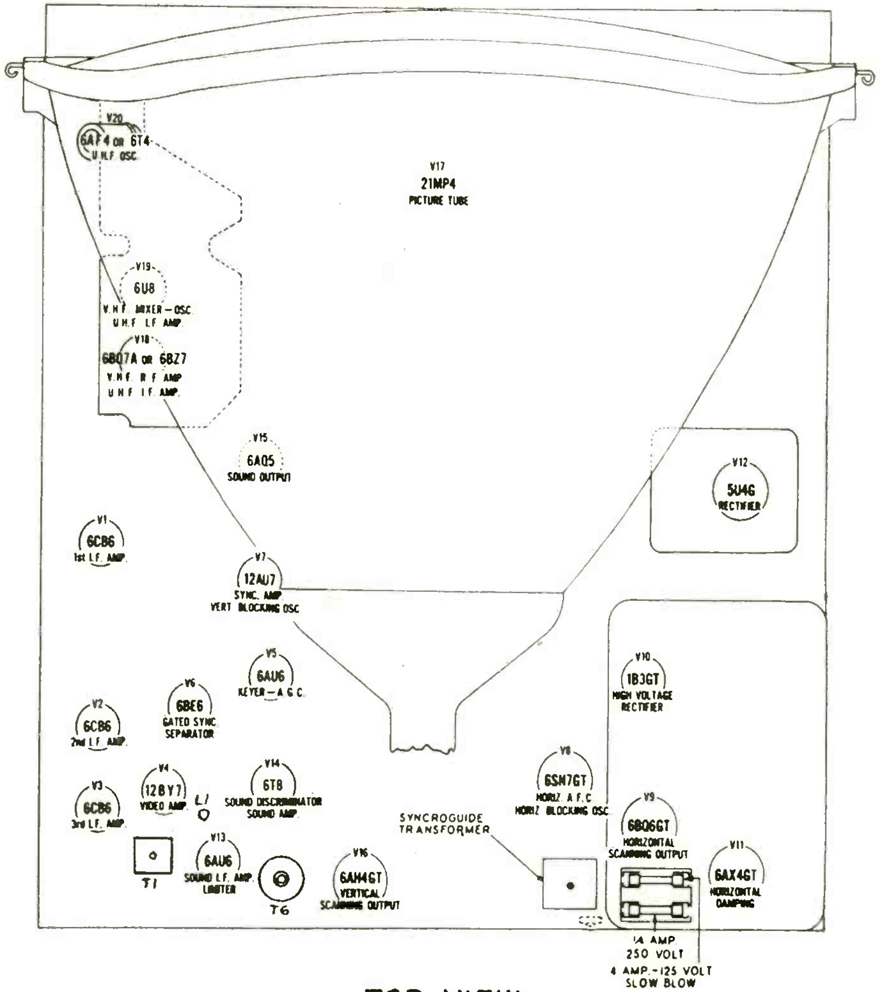
All voltages are measured with a VTVM connected between the tube pins and chassis.



FRONT CONTROLS



REAR CONTROLS



TOP VIEW

TV FIELD SERVICE

Pre-published from Rider "TV Field Service Manuals"

by Rider & Alsberg

STEWART WARNER TROUBLE SHOOTING CHART

INSUFFICIENT RASTER HEIGHT
Vert. Size and Lin. Con.
V7, V12, V16
Check 0.047 and 0.1 μf caps. connected to red Lead of Vert. Osc. trans.
Vert. Out. trans.
Low line voltage

NO VERT. DEFL.
V7, V16
Check 0.047 and 0.1 μf caps. connected to red Lead of Vert. Osc. Trans.
Vert. Defl. coils (yoke) and Vert. Osc. trans.
Vert. Out.

NO VERT. SYNC.—HOR. SYNC. OK
Vert. Hold con.
Vert. Int. network
V7, V16
Check 4700 $\mu\mu$f cap. connected to pin 2 of V7

NO HOR. OR VERT. SYNC.—PIX SIGNAL OK
V5, V6, V7
Check 0.01 μf cap. connected to pin 7 of V7
Check 0.047 μf cap. connected to pin 7 of V6

NO HOR. SYNC.—VERT. SYNC. OK
Hor. Hold con.
Hor. Osc. trans. adjustments
V7, V8
Check 200 $\mu\mu$f cap. connected to pin 4 of V8

DISTORTED SOUND
Tuner fine tuning
V13, V14, V15, V18
Check 0.01 μf cap. connected to pin 1 of V15
Sound and Vid. IF alignment T1
Det. alignment T2

NO SOUND—PIX OK
Tuner fine tuning
Vol. con.
V13, V14, V15
Speaker (open voice coil or defective connection)
Sound and Vid. IF alignment T1
Det. alignment T2

WEAK SOUND—PIX OK
Tuner fine tuning
Vol. con.
V5, V13, V14, V15, V18
Sound and Vid. IF alignment T1
Det. alignment T2

NOISY SOUND—PIX OK
Vol. con.
V13, V14, V15
Check sound system for loose connections
Speaker
Sound IF and Det. alignment T1, and T2

SYNC. BUZZ IN SOUND
Tuner fine tuning
Check Vid. Det. crystal
V4, V5, V13, V14, V18
Sound IF and Det. alignment T1, and T2

INTERMITTENT SOUND—PIX OK
V13, V14, V15
Poor connections in sound system

NO RASTER—NO SOUND
Power input circuit
Check Line Fuse (4 Amps Slow Blow)
V12

SNOW IN PIX
V1, V2, V3, V18, V19

NO RASTER—SOUND OK
Brightness con.
Check HV Fuse (0.25 Amps.)
Ion trap
V8, V9, V10, V11, V17
HV trans. Hor. yoke CRT connections

WEAK PIX—SOUND AND RASTER OK
Tuner fine tuning
Contrast con.
Check Vid. Det. crystal
V1, V2, V3, V4, V18

POOR HOR. LIN.
Hor. Drive con.
V9, V11
Check 0.022 and 0.047 μf caps. connected to terminal 2 of Hor. Out. trans.
Hor. Out trans.

POOR VERT. LIN.
Vert. Size and Lin. con.
V7, V16
Check 0.049 and 0.1 μf caps. connected to red Lead of Vert. Osc. trans.
Check 100 μf Elec. cap. connected to pin 8 of V16
Vert. Out. trans.

PIX JITTER SIDEWAYS
Hor. Hold con.
Hor. Osc. trans. adjustments
V17, V18
Check 0.002 μf cap. connected to pin 1 of V18

PIX JITTER UP & DOWN
Vert. Hold and Contrast con.
V5, V7, V14
Check 4700 $\mu\mu$f cap. pin 2 of V7

SMEARED PIX
Tuner fine tuning
Contrast con.
V1, V2, V3, V4, V5
Check Vid. Det. and Amp. peaking coils
Check Vid. Det. crystal
IF and RF alignment

POOR PIX DETAIL
Tuner fine tuning
Focus con.
V1, V2, V3, V9
Check Vid. Det. and Amp. peaking coils
IF and RF alignment

SOUND BARS IN PIX
Tuner fine tuning
V1, V2, V3, V18, V19
Check adjustment of L1
IF and RF alignment

AC IN PIX (DARK HOR. BAR)
V1, V2, V3, V4, V5, V14, V18, V19

ENGRAVED EFFECT IN PIX
Tuner fine tuning
Contrast con.
V1, V2, V3, V4, V5, V14, V17, V18
Check Vid. Det. crystal
Check Vid. Det. and Amp. peaking coils

VERT. BARS
Hor. Drive con.
V9, V11
Check 56 $\mu\mu$f cap. connected to yoke terminals
Defl. yoke ringing

PIX BENDING
Hor. Hold con.
Hor. Osc. trans. Adjustments
V5, V7, V8, V9
Check 0.047 and 0.022 μf caps. connected to pin 3 of V8

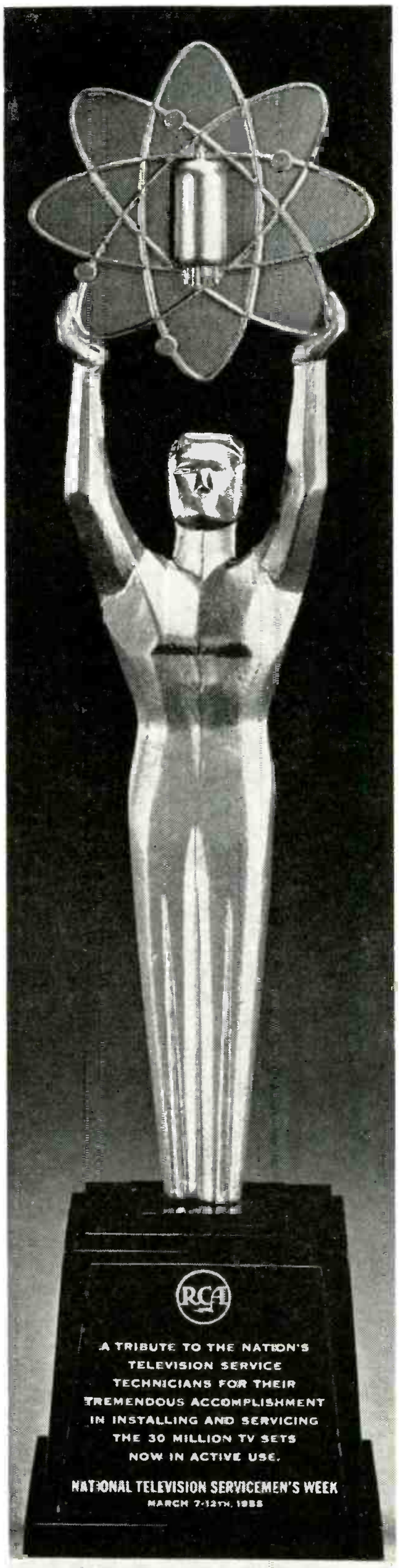
National Television
Servicemen's Week

THIS year TV servicemen have a publicity and merchandising opportunity of a magnitude previously considered impossible by the television servicing industry. During the week of March 7-12, dealers and service technicians throughout the country will be putting their best foot forward with the American public as the industry celebrates "National Television Servicemen's Week." The event is being sponsored by the Tube Division of the Radio Corporation of America. It has been registered officially with the Chamber of Commerce of the United States.

The event reflects a sincere commendation to dealers and service technicians for their technical proficiency and constantly increasing commercial stature. RCA is keynoting the event nationally by going on record publically with a "Tribute to the nation's television service technicians for their tremendous accomplishment in installing and servicing the 30 million TV sets now in active use." RCA will use a heavy schedule of television and spot radio to build up the event nationally, and in the March 7th issue of LIFE magazine, that company is sponsoring a full-page advertisement to herald the opening of National Television Servicemen's Week.

Just think of the many possible facets of local neighborhood activities where servicemen and dealers can use their talents to bring the full effect of this national promotion to bear in developing public interest, understanding and acceptance of the important role they play in bringing the popular medium of home television entertainment to the community. Their energy and diligence are the only limits to the success they can obtain locally in participating in this promotional event. This is the perfect opportunity for them to step up their public relations efforts. This may be done by approaching the local newspaper with items of interest concerning National Television Servicemen's Week; offering to make brief test equipment demonstrations before local clubs and groups; and preparing interesting in-store displays and exhibits. This is a chance to take a well-deserved bow.

The RCA Tube Division has prepared an excellent sales promotional plan with which to back up this publicity and promotion drive. To keynote the program, they are offering an Electronic Statuette as the symbol of National Television Servicemen's Week. This striking figure will receive such promotion as to become a powerful TV-Service salesman.



This gleamingly handsome representative figure is boldly carved in stark, modern lines and durably cast in a solid, golden material. With his hands stretched above his head, he supports the orbits of the electron, dominated dramatically at their center by an RCA Electron Tube. On the base, under the monogram signature of RCA, there is a tribute to the nation's service technicians.

Here's a great, new and easily identifiable television service symbol which will serve to instill immediate consumer recognition of the TV service shops in which it is displayed.

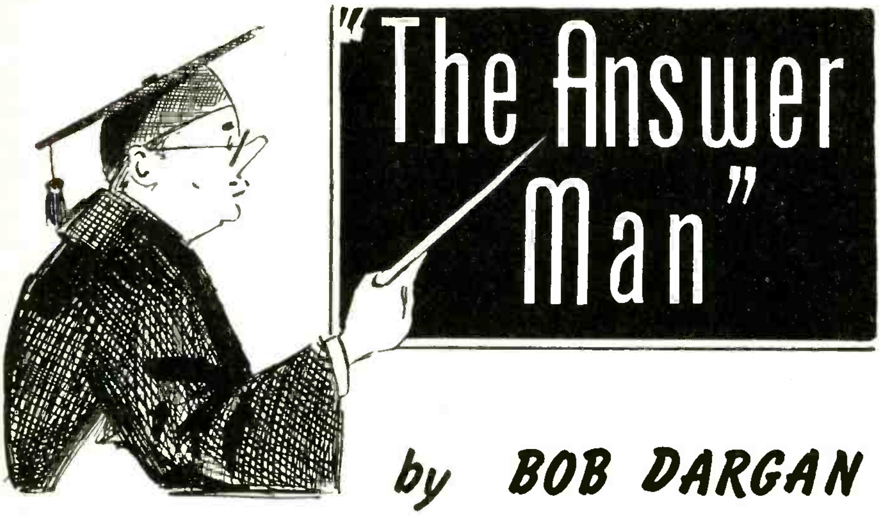
Special Participation Awards

To encourage aggressive service-dealer participation in National Television Servicemen's Week, RCA has posted eight Special awards of complete sets of RCA Test Equipment for Color TV Servicing worth $1337.00 which will be offered for the most interesting and original dealer participation in the event during the week of March 7 to 12. To qualify for the award, the dealer merely prepares a statement of 50 words or less describing how he promoted and publicized the event in his area. Any relative photographs, newspaper ads or clippings concerning participation in National Television Servicemen's Week may be attached to this statement which should be entered on an official entry form and countersigned by the RCA Distributor Salesman.

Backed by Promotional Materials

To bring the important story of the television service industry to the American public forcefully during National Television Servicemen's Week, RCA has prepared some excellent supporting sales promotional materials.

The Service Dealers' participation in National Television Servicemen's Week in his community can build new stature for his television service business. It will help him enjoy greater public acceptance and recognition, it will increase his sales and service business, identify his store or shop with a full-pledged national consumer promotion.



"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.

Motorola TV— Repeated 25BQ6 Burnouts

Dear Mr. Answer Man:

A Motorola TV chassis has required a number of 25BQ6 horizontal output tubes to be replaced because of open filaments. This tube type has failed in this manner more frequently than should have occurred. I have put in three new 25BQ6 tubes in the past couple of weeks and the customer feels that I am not servicing the receiver properly. Is there any particular cause of this repeated failure and if so what can I do to correct it.

T. F.
Los Angeles, Cal.

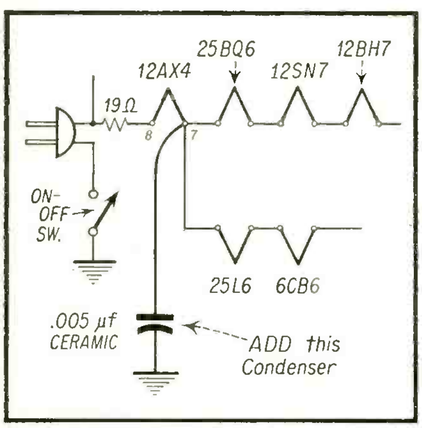


Fig. 1—Partial filament circuit of Motorola Chassis TS-326. Adding a .005 uf ceramic condenser will protect tubes from flashover.

Most probably the continued failure of the 25BQ6 tube filaments is being caused by pulses arcing over in the 12AX4 damper tube between cathode and filament. The pulses at the cathode circuit of the damper may flash over instantaneously to the filament of the tube and thereby appear on the filament line.

As shown in *Fig. 1*, by adding a .005 *uf* ceramic condenser at pin 7 of the 12AX7 damper tube any pulses that may appear at this point will be short circuited to chassis ground, thereby bypassing the filament string.

Also, it might be a good idea at the same time to put in a new 12AX4 damper tube because it is very likely that this tube is breaking down between filament and cathode.

Stromberg Carlson Model 24-24AP4 Cathode to Filament Short

Dear Answer Man:

A Stromberg Carlson Model 24 receiver using a 24AP4 picture tube on my test bench has no control over the brightness. The full raster and picture is there all the time and in checking I found that the filament of the picture tube is shorted to the cathode internally. Do you suggest using a filament booster with the picture tube so that the tube can be used without the customer having to buy a new one?

J. C.
Chicago, Ill.

There are two types of filament boosters that can be purchased. One type uses an autowinding design which would be of no value in this case because the cathode and filament of the picture tube would still have a *dc* path to ground. The type that is needed has a secondary winding to the transformers which will provide the *dc* isolation necessary.

However, it would not be desirable to operate the filament of the 24AP4 picture tube at 9 to 10 volts as provided by most filament boosters. This voltage can be reduced to the normal voltage of 6.3 volts by placing a 5 ohm resistor of at least 2 watts in series with one lead from the filament booster secondary winding as shown in *Fig. 2*.

Of course, separate small filament transformers are available that can also serve this purpose. The input to these transformers is 115 volts and the output is the desired 6.3 volts.

However, there is a simple method of adopting this Stromberg Carlson model 24 TV receiver to accommodate the shorted picture tube. The power transformer, T1, uses a separate winding for the filament voltage to the video amplifier, 1st sync clipper and keyed *agc* amplifier tube. Neither side of this filament line is grounded and it will therefore be suitable for operating the picture tube under the shorted conditions. There will be no *dc* path to chassis to short the cathode voltage applied by the brightness control.

One additional change is necessary to

(*Continued on page 53*)

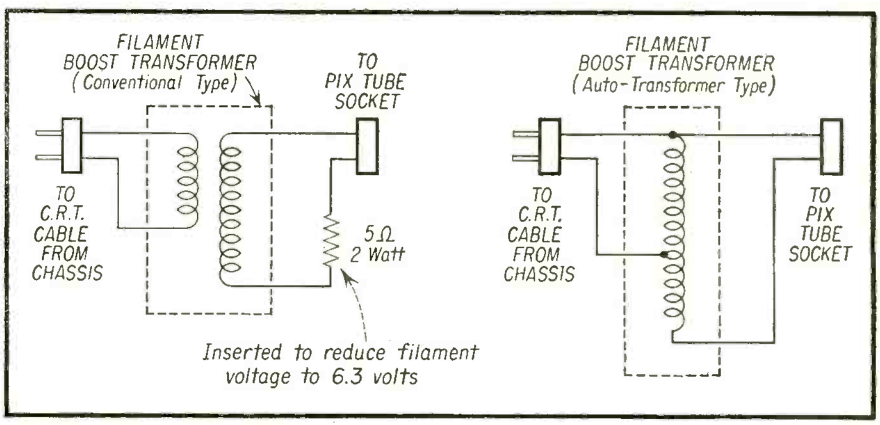


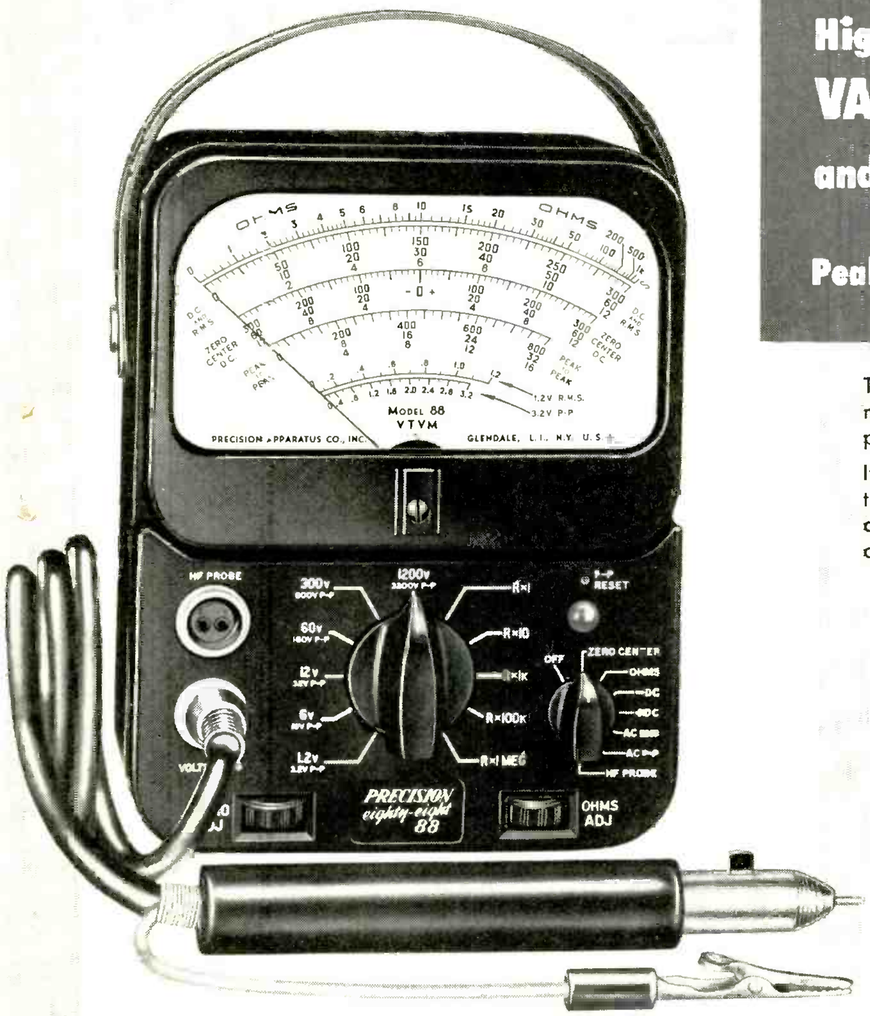
Fig. 2—Two types of filament boost transformers are shown above.

The *New* PRECISION MODEL 88

High Sensitivity VACUUM TUBE VOLTMETER and ELECTRONIC OHMMETER

Complete with 3-way Universal Test Probe.

Peak to Peak Voltage Ranges to 3200 volts



The Model 88 is a compact, wide range VTVM-Ohmmeter, for modern electronic circuit checking in the laboratory, on the production line and for general service-maintenance.

Its many advanced features include specially engineered Peak-to-Peak voltage ranges which afford a new high in P-P reading accuracy of pulsed wave-forms encountered in Color or Monochrome TV and similar applications.

THE MODEL 88 PROVIDES 7 DISTINCTLY SEPARATE FUNCTIONS 40 SELECTED, WIDE-SPREAD RANGES

- **TRUE-ZERO-CENTER DC VOLTAGE RANGES.** Eliminates need for test lead reversal or polarity switching: Constant 26⅔ Megohms input resistance. 0 ±1.2 ±6 ±12 ±60 ±300 ±1200 volts.
- **5 ELECTRONIC OHMMETER RANGES.** Covers wide range of resistance values encountered in modern electronic circuits, AM-FM-TV: 0—1000—10,000 ohms. 0—1—100—1000 Megohms.
- **6 (—) MINUS DC VOLTAGE RANGES:** (Left-Hand-Zero) constant 13⅓ Megs. input resistance. 0—1.2—6—12—60—300—1200 volts.
- **6 (+) PLUS DC VOLTAGE RANGES:** (Left-Hand-Zero) constant 13⅓ Megs. input resistance. 0—1.2—6—12—60—300—1200 volts.
- **6 HIGH IMPEDANCE RMS AC VOLTAGE RANGES:** 0—1.2—6—12—60—300—1200 volts.
  Input Characteristics: Up to 60V Range: — 3 Megohms, 90 mmfd.
  300V Range: — 1 Megohm, 70 mmfd.
  1200V Range: — 4 Megohms, 67 mmfd.
- **6 HIGH IMPEDANCE PEAK-TO-PEAK AC VOLTAGE RANGES:** Engineered for more accurate measurement of symmetrical and pulsed voltages: 0—3.2—16—32—160—800—3200 volts.
  Input Characteristics: Up to 160V Range: — 6 Megohms, 90 mmfd.
  800V Range: — 1 Megohm, 70 mmfd.
  3200V Range: — 4 Megohms, 67 mmfd.
- **5 SPECIAL HIGH FREQUENCY PROBE RANGES:** Extends AC RMS reading facility to 300 Mc. with minimized circuit loading:
  0—1.2—6—12—60—300 volts RMS. (Requires optional PRECISION RF-10A HF Probe). Probe input capacity: — approximately 5 mmfd.
- **ONE UNIVERSAL, COAXIAL AC-DC VTVM PROBE** serves all functions other than high frequency probe ranges.
- **PEAK-TO-PEAK "RE-SET" PUSH-BUTTON** for rapid "zero" return of special, electronically damped test circuit.
- **LARGE 5¼" RUGGED PACE METER:** 200 microamperes sensitivity, ±2% accuracy. Manufactured in PRECISION'S own modern meter plant.
- **1% MULTIPLIERS and SHUNTS:** wire-wound and deposited-film types.
- **CUSTOM-MOLDED PHENOLIC CASE and PANEL:** Compact, efficient, laboratory instrument styling.

MODEL 88: complete with detachable AC line cord, internal ohmmeter battery, 3-way coaxial VTVM probe and detailed operating manual. Over-all case dimensions 5⅜ x 7 x 3⅛".

Net Price **$69.75**

ACCESSORIES FOR THE MODEL 88

RF-10A	High Frequency vacuum tube probe	**$14.40 net**
TV-8	60 Kilovolt safety probe	**14.75 net**
ST-1	Snap-on foldaway tilt-stand	**1.00 net**

WILL COLOR TELEVISION MAKE PRESENT TEST EQUIPMENT OBSOLETE?

THE ANSWER IS NO! There is nothing in Color TV that will nullify good present-day monochrome equipment or render it obsolete. It will create even more uses for the ***PRECISION*** instruments you have always owned. Color servicing will merely require one or two special-purpose instruments . . . which you can rely on ***PRECISION*** to produce at the proper time . . . when field requirements are clearly defined.

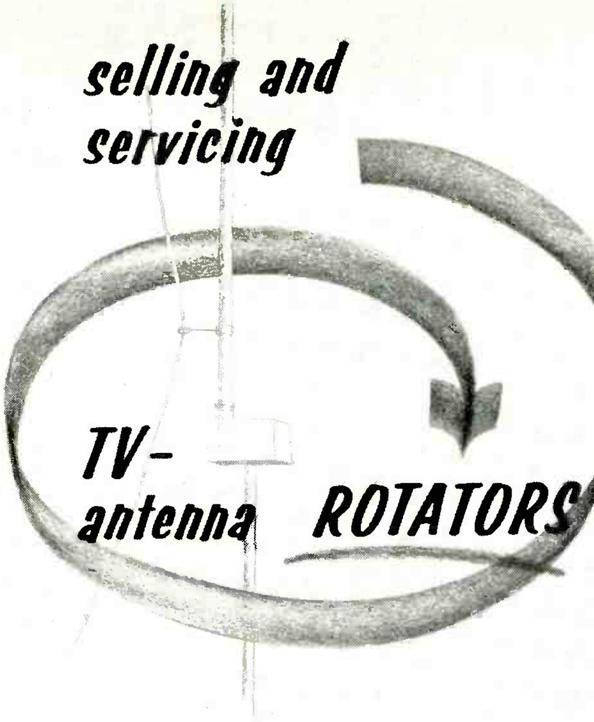
As for V.T.V.M.'s — a volt is a volt, an ohm is an ohm and a mil is a mil . . . whether it is being measured in color TV, monochrome or plain ordinary radio!

PRECISION TEST EQUIPMENT
Standard of Accuracy
PACE
THE METER OF PRECISION

PRECISION **Apparatus Company, Inc.**
70-31 84th STREET, GLENDALE 27, L. I., N. Y.

Export Division: 458 Broadway, New York 13, U.S.A. Cables: Morhanex
Canada: Atlas Radio Corp., Ltd., 560 King Street W., Toronto 2B

selling and servicing TV-antenna ROTATORS



by **Clifford P. Shearer**
Director of Advertising
Radio Merchandise Sales, Inc.

TODAY . . . right now . . . profits that should be going to the serviceman and service dealer are going down the drain. The reason for this is that the tremendous potential market for antenna rotator sales has been, and still is being overlooked.

You may or may not know of certain new developments that make antenna rotators economically acceptable and practically necessary. In any event the following facts should point up that the time is ripe and ready for rotator installations.

What a Rotator Does

To begin with, an antenna rotator directs an antenna so that it produces the sharpest clearest possible TV picture. Since the clearest possible picture is the desire of every TV set owner, then it logically follows that an antenna rotator is the piece of TV equipment so necessary to every TV set owner. This bit of logic makes sense . . . and what's more it makes profit sense.

Sales Areas

There are millions of people who now reside in heavily populated areas who are plagued with poor reception because of blocked signals. In such cases a reflected signal in a particular direction will often provide satisfactory reception. With an antenna rotator such as the Rotor Queen by RMS, these people can now enjoy reception they never thought possible.

In order to perform to their best ability antennas should be oriented towards the incoming TV signal. However, there are ever so many multi-signal areas where the signals arrive from different directions that a permanently oriented TV antenna cannot possibly provide maximum picture reception on all stations. As a rule the antenna is adjusted to a "mean" direction, for the various incoming signals. In any event, the set owner has to make a choice on *what he will have to do without!* This should not be the case. The customer, and he now can become your customer, does not buy an expensive TV set to compromise on reception. He wants the best, and in this case the best can be had for just a few extra dollars.

Color

With the advent of color television the need for an optimum operating antenna system has been spotlighted. Possibly a ghost-distorted picture on a black and white set could be tolerated . . . but a ghost on color TV is almost intolerable. Not only that, but in areas where color signal reception is poor it is very easy to lose the color signal. Therefore, a rotator is an added item of insurance in this direction.

Selling Rotators

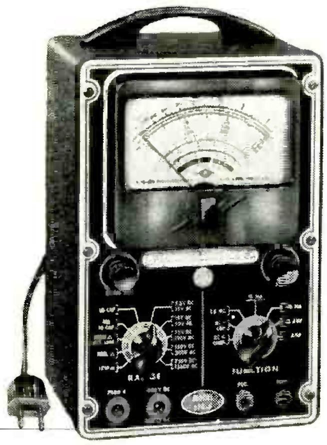
Merchandising antenna rotators for profits is no different than the merchandising of any other saleable product. The sale of the items is just dependent on the initiative of each individual serviceman and service dealer. The following are just a few of the many ways you can merchandise antenna rotators for profits:

When demonstrating a new TV set to a prospective customer try and sell a complete package . . . set plus antenna plus rotator. Chances are your customer has never heard of a rotator. Here's where merchandising enters the picture. You should have hooked up in your shop two separate antenna installations. One, a permanent installation and the other a rotator with antenna installation. By demonstrating . . . by showing the customer the values of this completed package . . . by convincing the customer that the ultimate in picture presentation is due him . . . in this way can you add profits to your business.

Another suggested way of merchandising antenna rotators is by having one set up on top of a floor set. The browsing customer can himself try . . . watch . . . and convince himself of its merit. Chances are when handled correctly you can turn this shopper into a potential customer.

Perhaps you have been called to install an antenna, or perhaps to repair a present installation. Take a rotator along with you and try and sell its merits and plus performances to your customers. Show them what they are now getting . . . convince them of what they can get. Since they are interested in top performance which is evident by their service call to you, a bit of salesmanship on your part may turn this customer into a rotator customer. Keep in mind that a successful rotator installation may bring you many more customers. The reason for this is that visitors to the home in which the rotator has been installed will be sold on the same unit by its actual performance and by the set owner. The proof of top grade viewing is on view to them.

You can devise many many more ways of selling rotators. These have been just a few suggested methods. However, the most important thing in selling antenna rotators is that you . . . the serviceman or service dealer must be convinced of the merits and performance of rotators.



Superior's new Model 670-A

SUPER METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers.)
REACTANCE: 50 to 2,500 Ohms 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: −6 to +18 +14 to +38 +34 to +58

ADDED FEATURE:

Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes house, in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

$28.40 NET

Superior's new Model TV-11

TUBE TESTER

★ Tests all tubes, including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.

★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because *all elements are numbered according to pin-number in the RMA base numbering system*, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.

★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus *it is impossible to damage a tube by inserting it in the wrong socket.*

★ Free-moving built-in roll chart provides complete data for all tubes.

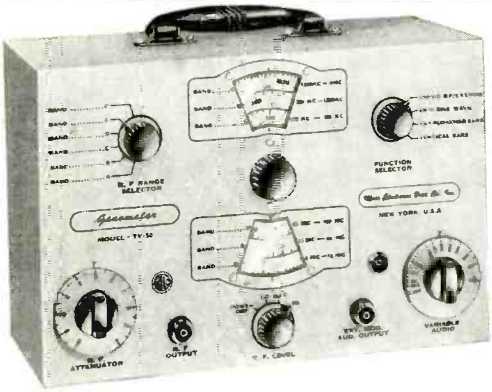
★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.

★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

The model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover

EXTRA SERVICE—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

$47.50 NET



THE NEW MODEL TV-50

GENOMETER

A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:

A.M. Radio · F.M. Radio · Amplifiers · Black and White TV · Color TV

7 Signal Generators in One!

- ✓ R. F. Signal Generator for A.M.
- ✓ R. F. Signal Generator for F.M.
- ✓ Audio Frequency Generator
- ✓ Bar Generator
- ✓ Cross Hatch Generator
- ✓ Color Dot Pattern Generator
- ✓ Marker Generator

R. F. SIGNAL GENERATOR: The Model TV-50 Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: In addition to a fixed 400 cycle sine-wave audio, the Model TV-50 Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

BAR GENERATOR: The Model TV-50 projects an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

CROSS HATCH GENERATOR: The Model TV-50 Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

DOT PATTERN GENERATOR (FOR COLOR TV) Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.

MARKER GENERATOR: The Model TV-50 includes all the most frequently needed marker points. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

THE MODEL TV-50 comes absolutely complete with shielded leads and operating instructions. Only ....

$47.50 NET

SHIPPED ON APPROVAL

NO MONEY WITH ORDER—NO C.O.D.

Try any of the above instruments for 10 days before you buy. If completely satisfied *then* send down payment and pay balance as indicated on coupon. **No Interest or Finance Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-102, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

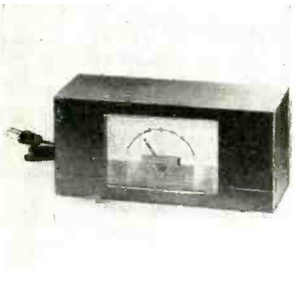
Name ....
Address ....
City .... Zone .... State ....

☐ Model 670-A ....Total Price $28.40 $7.40 within 10 days. Balance $3.50 monthly for 6 months.

☐ Model TV-11 ....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

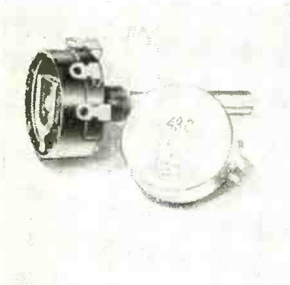
☐ Model TV-50 ....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

New Products



Trio Rotator

Trio Manufacturing Co., Griggsville, Illinois, has just announced the new TRIO "Aristocrat" TV rotator. The control unit is entirely new — both in design and appearance. A new, large illuminated indicator dial is the only visual indication that this is a rotator control unit. There are no knobs or switches on the front to mar the appearance of the ultrasmart, tip-proof cabinet; the on-off switch and directional switch are located on the rear panel of the cabinet.



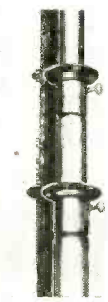
Clarostat Control

By reducing the basic design of the 1-21/32" dia. wire-wound controls, a 1⅛" control is announced by Clarostat Mfg. Co., Inc., Dover, N.H.

Designated as Series 43c, this new version is distinguished from the previous Series 43 by an improved wiper arm that contacts the edge rather than the side of the resistance winding. This contact allows higher resolution, more intricate tapers and closer tolerances.

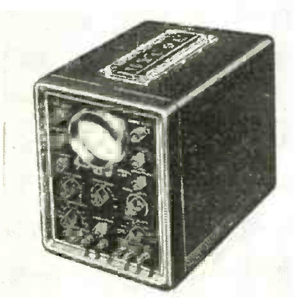
JFD Color-Tenna

JFD Manufacturing Company, 6101 - 16th Avenue, Brooklyn, New York, announces a new "Color-Tenna" VHF-UHF indoor antenna model TA150. The UHF center section is adjustable in length allowing it to be accurately resonated to the desired UHF signal; in other switch positions, the same adjustable center section acts as a variable stub on VHF, balancing the signal and canceling unwanted reactances. At the same time, the stub matches the impedance of the antenna to the transmission line and set tuner.



Channel Master ALUMast

The introduction of a line of aluminum TV masting has been announced by Channel Master Corporation, Ellenville, N.Y. Known as ALUMast, the new masting is made in a wide variety of sizes, in both telescoping sections and straight lengths. Its light weight, ⅓ that of steel, makes it easier to handle, and permits one-man installation in cases where this would not be possible with masting of heavier material. Aluminum can never rust, and the consumer is permanently protected against the possibility of rust streaks staining his home.

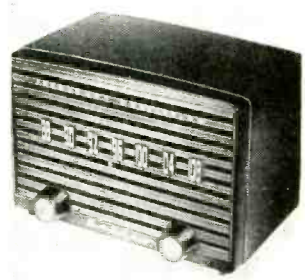


Hycon Oscilloscope

The Hycon oscilloscope, Model 617, by Hycon Mfg. Co., 2961 E. Colorado St., Pasadena, incorporates a specially designed 3" tube, delivering a full 3" undistorted trace from edge to edge. Specifications include 4.5 MC bandpass (plus or minus 1 DB, vertical amplifier), high deflection sensitivity (.01 V/RMS per inch), internal calibrating voltages, and edge lighted bezel.

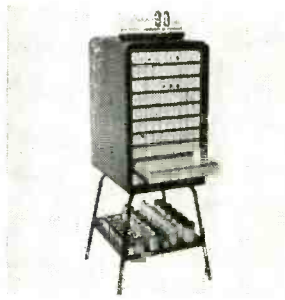
Granco Coaxial-Tuned FM Set

A complete FM set no bigger than the usual table-model radio and in the same price class, is announced by Granco Products Inc., 36-17 20th Ave., Long Island City 5, N. Y. Despite compactness and low cost, the Granco Model 610 FM radio, with self-contained antenna, purportedly gives fine FM performance. The plastic cabinet is available in walnut, blond or ebony. The horizontally-slotted slightly conclave panel mounts two control knobs.



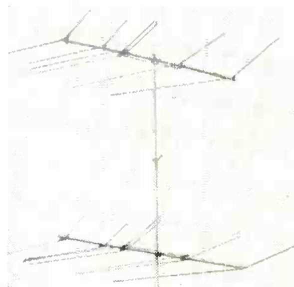
Walsco "Eye Level" Display

A new, modern merchandising display for the Walsco 99 Line of hardware and chemicals has just been introduced to the trade. The display houses the entire 99 line at *eye level*. Stock is kept in sliding drawers, completely covered and free from dust. Each drawer has automatic feeding with individually spring loaded tracks. When one box is removed, the others slide forward automatically. For info, write Walsco Electronics, 3225 Exposition, Los Angeles, Calif.



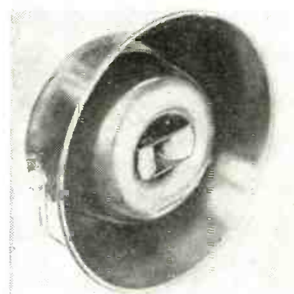
Taco "Shark" Antenna

Technical Appliance Corporation, Sherburne, N.Y., announce development of a new twelve channel VHF antenna. The new antenna, developed with an eye to the requirements for color reception, is specifically applicable to areas receiving a number of VHF channels, both high and low band. The Shark is a twelve channel, 2 through 6, antenna with emphasis on the low-band channels, and provides UHF reception in primary service areas.



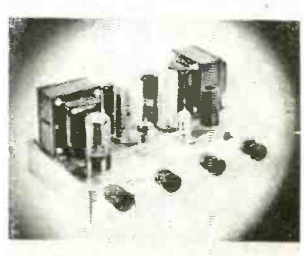
University BLC

University Loudspeakers, Inc., 80 South Kensico Avenue, White Plains, New York, announces a new full range weatherproof coaxial loudspeaker, Model BLC; which measures 22½" in diameter with a depth of only 9". It features true dual range design, and comprises a low frequency woofer coupled to a balanced compression type of exponential horn. A feature of the horn is that it starts with a large 8" throat which extends to a 22½" diameter mouth, giving highly efficient low frequency response.



Regency Hi-Fi Amplifier

A new high fidelity amplifier, Model HF-80, is now in production by Regency, 7900 Pendleton Pike, Indianapolis. Weighing 10½ pounds and housed in a brass-plated steel chassis, it meets all requirements for a moderate output level high fidelity amplifier.



ASSOCIATION NEWS

ESFETA—New York

A lecture series for Radio and TV servicemen of New York State will be initiated February 17 in New York City. The first lecture, on a transistor portable and presented by representatives of the major parts manufacturers concerned with its development, will be accompanied by slides and working demonstrations.

Radio & TV Servicemen's Association of Pittsburgh, Penna.

We are also pleased to note of the above association's aggressive efforts in the formation of an RTSA Chapter in the Beaver Valley District. Servicemen in this district may obtain further information by calling:

ESsex 8-1316, Kenneth E. Briggs—Aliquippa, Pa.; ROchester 2277, Valley TV—East Rochester, Pa.; FEderal 1-2142, John F. Cochran, President RTSA —Pittsburgh, Pa.

Syracuse TV Technician Association

In reply to a letter from this Association, dated October 8th, inquiring as to the picture tube warranty status, STVTA has received the following replies:

CBS Hytron, Dumont, National Union—No written reply.
G.E.—6 months warranty to user, effective Dec. 1, 1954.
R. C. A.—3 months warranty pro rated 1 year, effective July 15, 1954.
Westinghouse—3 months warranty pro rated 1 year, effective Dec. 1, 1954.
Tung Sol—3 months warranty pro rated 1 year, in future.
CBS Hytron—verbal phone, 6 months to user, in future.
Sylvania—3 months warranty pro rated 1 year, effective October 5, 1954.
Raytheon—One year until new sets change.

Associated Radio & Television Servicemen, Chicago, Ill.

The Executive Committee of the ASSOCIATED RADIO & TELEVISION SERVICEMEN, Illinois, submitted the following resolution to its members:

"The individual members of ARTS, Illinois, who are independent radio and television service shop owners and dealers have long known of and suffered from the practice of indiscriminate selling at wholesale prices to any and all of the consuming public by the radio and electronics parts jobbers and/or wholesalers.

"They are also aware of the indiscriminate distribution by these same jobbers or/wholesalers of catalogs containing wholesale prices of electronics parts and supplies.

"Therefore the members of ARTS, Illinois have expressed themselves in opposition to these unfair trade practices.

"Further, the members of ARTS, Illinois requested their Officers and Executive Committee to make known the feeling and the position of the members regarding this 'BACK DOOR SALES POLICY' ".

Radio TV Guild of L.I.

RTGLI has an outstanding Public Relations Program which gives promise of becoming excellent foundation material along these lines. Servicement and associations interested in its program and progress should write to RTGLI, Guild News, Box 87, Bethpage, N.Y.

Federation of Radio Servicemen's Association, Penna.

Election of officers for the year 1955 was held at the December 12 meeting of the Federation of Radio Servicemen's Associations Inc. The following were the successful candidates, for Chairman, B. A. Bregenzer, RTSA of Pittsburgh; Vice Chairman, Charles Knoell, TSA of Philadelphia; Corresponding Secretary, Leon J. Helk, LRTA of Carbondale; Recording Secretary, Wm. Lansberry, of Hollidaysburg, Pa.; Treasurer, L. B. Smith, Hershey, Pa. Vigorous action was taken on the matter of wholesale selling to the retail trade.

TISA of Illinois

The local network outlet in Chicago, WBKB (Channel 7) is showing the TISA seal and telling the viewers that television service companies which display the seal are best qualified to render efficient and courteous service.

Radio and TV Association of Springfield, Ohio

Marvin A. Miller was elected president of the Springfield Radio and Television Association at a meeting of the Organization Friday January 14, at the Carpenters Union Hall, 240 Ludlow Avenue.

George Reiling, district representative of the RCA tube Division was guest speaker, discussing the forthcoming nationwide campaign to honor television technicians.

CONVERGENCE

[from page 30]

Convergence Alignment Procedure

The color receiver should be adjusted for proper reception of an air signal with brightness and contrast controls set for moderately high levels and the *horizontal hold* control adjusted for the middle of its pull-in range. Remove the antenna and connect a white dot generator to the receiver input. Synchronize the dot pattern and adjust the tuning for sharply defined dots.

Experience in convergence alignment will make it possible to diagnose the trouble and decide which of the several adjustments require alignment. Patterns such as those shown in *Figs.* 3 through 7 give clues to the type of convergence trouble and also provide a definite system for convergence alignment. Thus the serviceman has a choice of trying to diagnose the trouble and make one or two adjustments or of starting from the very beginning and going through the full convergence procedure. As a means of conveying the method of complete convergence as well as the proper order of adjustments, the full procedure will be briefly presented in conjunction with the patterns of *Figs.* 3 through 7.

If a complete convergence job is to be performed, the first step is to turn the horizontal and vertical *dynamic amplitude* controls to minimum and adjust the *dc convergence* control to produce dot triangles similar to the one shown in *Fig. 3a.* The pattern of dot triangles which you will now see will have poor uniformity. This shows the effect of the uncompensated beam deflection, the yoke positioning and the setting of the beam magnets (or the setting of the *dc* convergence controls in some new designs for 19" and larger kinescopes).

The first step in convergence alignment or troubleshooting is to be sure that the three beam magnets located on the neck of the kinescope are correctly adjusted to make the dot group in the center of the screen a perfect triangle having equal sides, as shown in *Fig. 3a.* See *Fig.* 7 for this adjustment in 19" and larger color kinescopes. When the color dot triangle is correct, adjustment of the *dc* convergence control should produce a white dot free of color fringes.

Yoke Positioning

Color TV receiver yokes may have several positioning adjustments. Unless the yoke is properly located around the neck of the tube it may be impossible to converge the dots on the edges of the kinescope screen. To test for yoke trouble, adjust the *dc* convergence to make sure that the dot in the center of the screen converges properly. After obtaining a perfect center dot adjust the *dc* convergence to try to make dot triangles near the edges of the screen converge. A good rule to remember is that if any *one* dot triangle cannot be converged by adjusting the *dc* convergence then it will not be possible to converge that triangle in the final alignment of the dynamic convergence controls. Now if this test shows the edge convergence to be too far off it indicates that there is something wrong in the picture tube assembly. This could be due to a number of things, including incorrect beam magnet adjustment, poor yoke positioning, defective yoke or—last but not least—a defective picture tube. Adjustment of the yoke should be attempted only as a last resort. It should be kept in mind that a slight mis-convergence in the corners of the present color tubes must be considered normal. The 15" color kinescope operating with available yoke designs, is said to permit approximately 80% perfect convergence, with the larger kinescopes giving considerably better results. *Fig. 6a* shows faulty convergence in the corners of the screen due to improper positioning or poor design of the yoke.

Vertical Dynamic Convergence

To prepare for dynamic convergence set the *dc* dynamic amplitude control to minimum. The pattern showing incorrect vertical dynamic adjustment is illustrated in *Fig. 4a.*

1. Set the vertical shape control according to *Fig. 4b.*
2. Adjust the vertical dynamic amplitude to make all triangles in the vertical center row the same size, as in *Fig. 4c.*

Horizontal Dynamic Convergence

With the *dc* convergence set to give dot triangles, turn the horizontal dynamic amplitude to minimum. *Fig. 5a* shows the effect of incorrect horizontal dynamic adjustments.

1. Set the horizontal phase control (usually a coil adjustment) according to *Fig. 5b.*
2. Adjust the horizontal dynamic amplitude to make all triangles in the horizontal center row the same size, as in *Fig. 5c.*

If the above adjustments produce a pattern in which all the triangles are the same size and shape, as in *Fig. 6b,* merely adjusting the *dc* convergence control should make all dot triangles converge to produce the pattern of *Fig. 6c.* However, *Fig. 6a* shows an exaggeration of what may be expected in practice. It is up to the serviceman and the customer to decide just how good the edge and corner convergence must be in respect to time and money involved, recognizing that it can never be perfect. Furthermore, when the proper viewing distance is used a certain amount of misconvergence in the corners will not be objectionable.

Convergence With Horizontal Oscillator Having Large Pull-In Range

Some of the new color TV receivers make use of a horizontal oscillator having a very great pull-in range. These receivers usually employ a balanced *afc* circuit and a multivibrator. Good dynamic convergence on this type receiver may be very difficult to achieve unless steps are taken to reduce the pull-in range while making convergence adjustments.

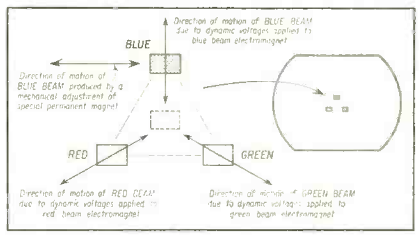


Fig. 7—Adjustments to accommodate system of convergence in which dynamic adjustment of each beam can be controlled independently of other beams. Electromagnetic coils replace permanent magnet beam magnets except for blue beam which is retained to provide lateral motion of the blue gun electron beam.

When making convergence adjustments with the white dot generator, it is advisable to set the receiver horizontal hold control on a weak or "snowy" transmitted signal and not alter this adjustment during the convergence alignment. This will minimize any tendency of the generator to "pull" the horizontal sweep circuit away from its optimum operationg point and will provide a more satisfactory convergence result. However, this will not completely solve the problem for receivers using very large horizontal pull-in ranges. The procedure for best results is to disable the pull-in action completely so that the horizontal oscillator runs "free" with no synchronization.

The best method for removing the sync to the horizontal oscillator is to short the sync injection grid to ground (before this is done, make sure that there are no *dc* voltages which will be shorted out). A simple jumper wire can be connected between the sync grid and a grounded pin on the horizontal oscillator tube.

Set-Up Procedure For Convergence

1. Disable the horizontal *afc* to make the horizontal *run "free"* as described above.
2. After the color TV receiver has warmed up, tune in a picture and adjust the Horizontal Hold control for best sync operation (the picture will drift back and forth slightly).
3. Leave the Horizontal Hold set on 15,750 CPS during the entire convergence procedure. It may be rechecked periodically by momentarily switching the channel selector to a broadcast signal.
4. Connect the White Dot Generator to the receiver antenna and couple the external sync lead to the receiver horizontal sweep circuit by clipping the lead on the insulated yoke cable, or by some other means which provides loose coupling.
5. Synchronize the dot pattern by adjusting the controls on the Generator and the Vertical Hold of the TV receiver. Do not adjust the receiver's horizontal hold control.
6. Proceed with convergence adjustments according to manufacturer's instructions.
7. After obtaining satisfactory convergence, restore the horizontal circuit to its normal condition by removing the jumper.

ANSWER MAN

[from page 47]

complete this alteration. This is the removal of the connection of the 6AU6 keyed *agc* amplifier filament at pin #3 to the screen and cathode connections at pin #2 and #7. The 6AU6 tube can

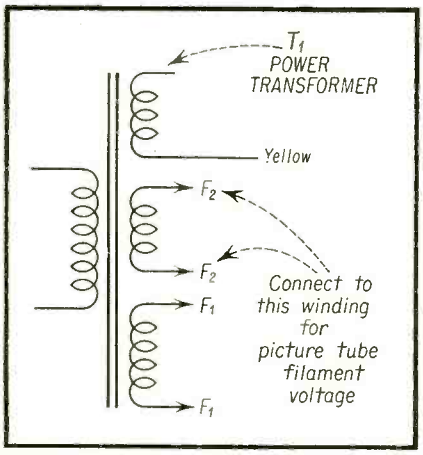


Fig. 3—The use of the F_2 filament winding permits operation of a 24AP4 picture tube with a cathode-filament short.

usually withstand the pulse voltage present in this circuit if this connection is removed. Many other receivers operate the 6AU6 tube in the same fashion.

This change connects up filament winding F2 to the picture tube filament as can be noted in *Fig.* 3. Filament winding F1 would have been suitable except that the damper tube fed by this winding has its cathode connected to it so as to avoid this same trouble in the damper tube, that of a short occurring between cathode and filament. With neither side of the damper filament winding connected to ground there is no *dc* path to ground and therefore the cathode of the damper tube can be connected directly to the filament. If one filament lead were grounded there would exist a potential difference between cathode and filament with breakdown quite possible.

WORK BENCH

[from page 23]

control had no effect. The high voltage was checked and found to be okay. After studying the diagram, it was noted that the grid, pin #2, of the 12KP4 picture tube was fed directly by the plate, pin #8, of the 6AC7. Thus, if the plate voltage dropped low enough on the 6AC7, the 12KP4 plate current would be cut off (no brightness). The 6AC7, V8, was then immediately replaced but had no effect. A voltage measurement was then taken at the grid of the 12KP4. The meter read 30 volts positive instead of 178 volts positive. Here was the trouble. The service notes states that when the brightness control is varied from maximum to minimum, the cathode voltage of the 12KP4 should vary from 120 volts positive to 250 volts positive. Therefore, the maximum brightness setting, corresponding to a 12KP4 cathode voltage of 120 volts positive and a grid voltage of 30 volts positive was now more than enough to cut off the brightness of the picture tube.

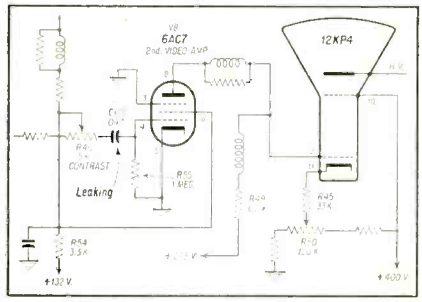


Fig. 2—Partial schematic of Zenith Chassis 27F20 output circuit showing method of controlling brightness.

It has been previously stated that it takes from 45 to 50 volts negative on the grid with respect to cathode, screen and second anode voltages being normal, to cut off picture tube brightness. Knowing these facts, a resistance measurement was next taken of *R49*, 6.2K, the plate load which measured correctly. The 12KP4 socket was then removed to see if the picture tube was possibly shorted. But the voltage remained the same at the grid of the 12KP4 and the plate of the 6AC7 (+ 30 volts). *C60*—.047 μf was now clipped from pin #4, of V8, and checked for voltage leakage. The condenser was found to be leaking badly. When *C60* was replaced the receiver functioned properly. Thus a positive grid voltage on V8, 6AC7, caused the plate voltage to drop to 30 volts which was low enough to cut off the brightness of the 12KP4.

BRILLIANCY DEFECTS

[from page 13]

observed signal can thus be compared with the peak-to-peak voltage indicated in the service notes. The signal which appears at the grid should have good blanking and sync amplitude. The general appearance of the composite video signal will be as shown in *Fig.* 3 when the input probe to the oscilloscope is connected to the grid of the picture tube and the ground lead attached to the chassis. If cathode input is employed as shown in *Fig. 2*, the input probe is attached to the cathode and the chassis. Insufficient sync amplitude with good video signal amplitude may indicate improper tuner tracking or video *if* alignment. If the video carrier is set too low on the response curve, the low frequency sideband signals which cluster around the carrier will be attenuated. Thus, the vertical and horizontal blanking and sync pulses will be diminished. On the other hand, if the sync amplitude has a much higher level in

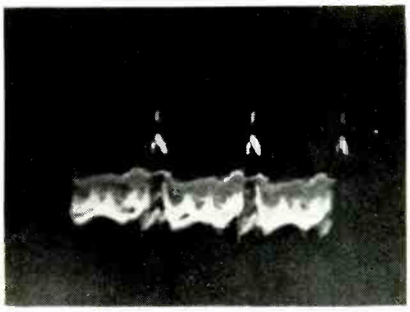


Fig. 3—Scope pattern of composite pix at picture tube grid.

relation to the video signal, it would indicate that the response curve is abnormal and attenuates the low frequency signals while boosting the high.

Other Circuits That May Affect Brilliance

Correction of contrast faults must be made before evaluating the final brilliancy level. Often when good contrast is restored, brilliancy control function becomes normal.

The retrace eliminating circuit shown in *Fig. 2* can also be a contributing cause to abnormal brilliancy. In this receiver only a simple resistor and capacitor are employed (*R459* and *C439*) but in some receivers several resistors and capacitors are utilized (both in shunt and in series). An open or shorted component can load down the brilliancy control circuit and affect performance. For this reason a check should also be made of the retrace elimianting circuit components as well as the brilliancy control system when trouble exists.

Another circuit which can affect the overall brilliancy of the televised scene is the *agc* system. *Fig. 4* illustrates an excessively dark picture which results from an incorrectly adjusted *agc* circuit. In receivers which have an *agc* regulating control, the control should be adjusted for a good picture for the strongest station to be received in the area. If the *agc* control does not eliminate the excessively dark picture shown in *Fig. 4*, or if no *agc* control circuit is checked thoroughly. Initially, the *agc*

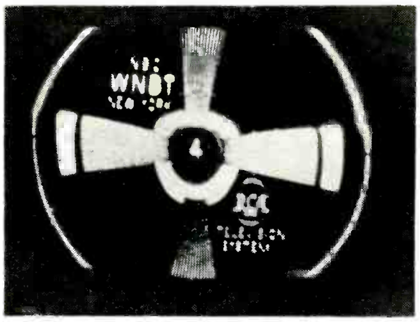


Fig. 4—No agc control can cause excessively dark pix as shown.

employed, the *agc* system should be rectifier tube should be replaced and if this does not help, the series resistors and shunt capacitors should be tested. An open series resistor or a shorted shunt capacitor will remove all the negative bias from the *rf* and *if* stages and in consequence the tubes will have full gain and overload for the strong stations in this area. The result is a picture such as shown in *Fig. 4* which is abnormally dark and cannot be corrected by adjustments of either the contrast or the brilliancy control.

Figure 5 illustrates another condition which affects brilliancy. Here, the washed-out picture also shows evidences of blooming, because the inner circle is expanded above and below the mask, while the outer white circle which is usually transmitted is not visible.

Picture blooming is usually caused by a decline in the high voltage applied to the second anode of the picture tube. When the high voltage drops below normal for the picture tube, it decreases beam velocity. With decreased beam velocity the magnetic fields of the yoke have a greater effect in sweeping the beam, and hence the beam is swept to an abnormal degree both vertically and horizontally. The decline in high voltage also reduces the brilliancy. Initially, tube replacement should be tried. Tubes which often contribute to a decline in the high voltage include the horizontal output tube, the high voltage

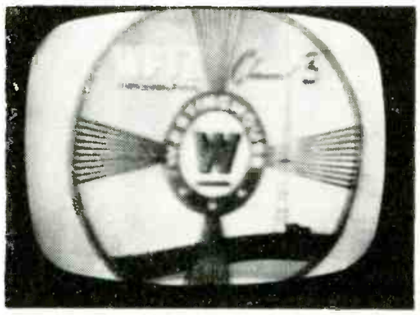


Fig. 5 — Blooming gives picture a washed-out effect.

rectifier, and the damper. On occasion a low output from the horizontal oscillator tube also causes a decline in brilliancy because it reduces the drive to the horizontal output tube.

A check should also be made of the drive control setting. The drive control should be advanced to the point where maximum brilliancy is available. The control should not be advanced, however, to the point where left hand stretch or center compression of the picture occurs.

If tube replacements do not help, the components associated with the horizontal sweep system and flyback high voltage section must be checked. If a high voltage probe is available, the voltage at the picture tube anode can be tested to ascertain the degree of voltage decline.

A contributing factor to low brilliancy is, of course, an improper setting of the ion trap on the neck of the picture tube. Check the setting by rotating the ion trap and sliding it forward and back on the neck of the picture tube. Leave it at the setting which produces maximum brilliancy. If corner shadows occur, adjust the centering lever on the focus magnet assembly (in old receivers a focus magnet coil would have to be adjusted). Readjust the ion trap after the focus assembly has been adjusted. If two points of maximum brilliancy occur for repositioning of the ion trap, select a

[Continued on page 58]

RTMA Establishes Upgrading Program for Technicians

"The first and most important step toward establishing a radio-TV training and upgrading course for service technicians is the organization of a (local) industry advisory committee," according to a new publication released by the Radio-Electronics-Television Manufacturers Association. Publications are available upon request from RETMA Headquarters, 777 14th St., N. W., Washington 5, D. C.

Telrex-Channel Master Litigation

Telrex, Inc. and Channel Master Corporation announced the conclusion of a licensing agreement on Telrex, Inc. Reissue Patent 23,346 covering Conical Antennas. This agreement resulted from a settlement of the litigation between the two concerns. Mr. Michael D. Ercolino, President of Telrex, Inc., and Mr. Harold Harris, Vice-President of Channel Master Cororation, pointed out that this agreement would be the cornerstone of a stabilizing patent system within the T-V antenna industry.

Admiral Makes 21-Inch Color TV

A 21-inch color television receiver providing a 245-square inch picture and featuring a cabinet more compact than that of any other color set on the market was announced by Admiral Corporation. The new all-channel color receiver is priced at $895.00.

Marcus Celebrates 20th Year With Rider

William J. "Bill" Marcus, popular representative for Rider publications, celebrates his 20th year at the "only job he's ever had." Since joining the famous publisher in 1934, Bill has served in such diversified capacities as production manager, merchandising specialist, and sales manager. With the expansion of the Rider line, Bill now concentrates on parts jobber sales, covering the metropolitan New York and northern New Jersey territories.
1953.

Stewart-Warner Ceases TV & Home Radio Operations

The following are excerpts from a letter which was mailed December 23, 1954 to all United States distributors of Stewart-Warner Electric television, radio and phonograph products: "The Stewart-Warner Electric Division has decided to withdraw from the manufacture and sale, within the United States, of home radio and television receivers and phonographs." "In pursuance of these purposes, we have signed an agreement with the Hoffman Radio Corporation which, as you know, has an outstanding reputation for product quality and excellent field service, whereby Hoffman is assuming the warranty and service on these Stewart-Warner products."

Victor E. Jenkins

With profound sorrow we learn of the death of Mr. Victor E. Jenkins, on Tuesday, December fourteenth, 1954. Mr. Jenkins had recently been with John M. Forshay, Inc., and was at one time Job Sales Manager for Weston Co.

[from page 56]

point which is nearer the tube base. If maximum brilliancy only occurs when the ion trap is near the focus magnet ring, it indicates the ion trap magnet is weak and should be replaced.

Another cause for insufficient brilliancy is a decline in the voltage from the low voltage power supply. The decrease in low voltage will decrease the anode voltages of the vertical and horizontal rectifier tubes and in consequence both the vertical and horizontal sizes are affected. Since the horizontal output amplifier is unable to produce a maximum signal, the flyback voltage declines and so does the high voltage to the picture tube. While beam velocity may also be down because of the high voltage decline, the inability of the vertical and horizontal systems to sweep fully results in the reduced picture such as shown in *Fig. 6*. Corrective measures consist of replacing the low voltage rectifier tubes as well as checking the

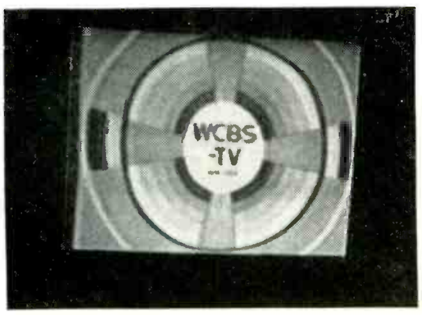


Fig. 6—Reduced horizontal and vertical sweep due to low B+.

filter capacitors for leakage. Leaky filter capacitors act as shunt resistors and the increased current flow through the filter capacitors loads down the power supply and decreases its output.

Finally, inadequate brilliancy can also be caused by a defective power tube. When all other checks disclose no defect, the picture tube will have to be checked. If no picture tube checker is available, the oscilloscopes can be utilized in conjunction with the vacuum tube voltmeter for tests of an *elimination process* nature. If the oscilloscope shows a normal picture at the picture tube input and the VTVM discloses no circuit faults or abnormal voltages, the picture tube may be the offender. One of the commercially available picture tube brighteners can be employed. These usually contain a small autotransformer to boost the filament voltage to the picture tube and thus increase the emission. If this does not help, picture tube replacement will be necessary.

Defective picture tubes are characterized by poor brilliancy, poor contrast, as well as a *silvery* appearance to the images of the televised scene when the contrasts in brilliancy control are advanced. Before attempting picture tube replacement, however, make sure that a negative and variable bias is established between grid and cathode when the brilliancy control is rotated. Also make sure that adequate high voltage is present at the second anode terminal of the picture tube. Also check to see that the video signal level is adequate at the grid (or cathode) input to the picture tube. Finally, test the picture tube socket for loose or open connections and inspect the base pins of the picture tube. Sometimes the thin wires inside the tubular pins (which connect to the internal elements) become loose and require resoldering. The soldering iron or soldering gun should be held on the tube prong ends and solder permitted to flow into the opening.

CHROMINANCE SYSTEMS

[from page 20]

Fig. 11. Here we show two possible pairs of 3.58 *mc* signals for use with either an R-Y/B-Y or an I/Q receiver.

Two-Phase Demodulation

We are now ready to analyze how a chrominance signal and a pair of 3.58 *mc* local oscillator reference signals are processed in the demodulator to recover the original color-difference signals. In two-phase demodulation we reverse the process of modulation and mix or heterodyne the locally generated 3.58 *mc* signal against the sidebands in the

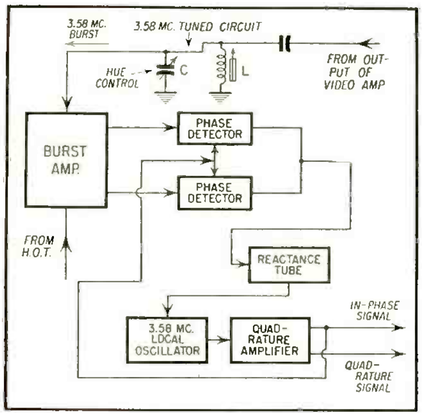


Fig. 10—Automatic phase control (APC) loop of typical color receiver. In-Phase and quadrature 3.58 *mc* are derived as shown.

chrominance signals. This results in the re-establishment of Signal A in demodulator A and Signal B in demodulator B as shown in *Fig. 12*. The following paragraphs will explain why.

One of the first hurdles to clear in demodulator action is to understand how the chrominance signal is processed

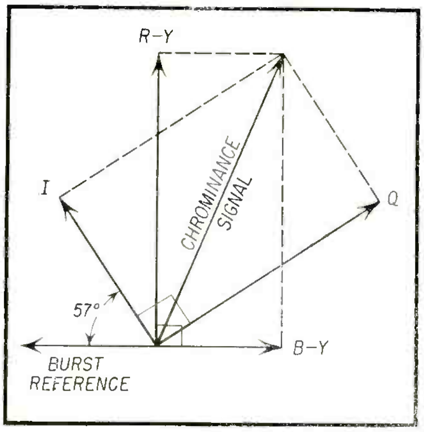


Fig. 11—Color signal axes.

so that signal A is developed at the output of the A demodulator and not at the output of the B demodulator, the same applying to Signal B and its development in the B demodulator. To begin with let us analyze one of the demodulators (A) of *Fig. 12* to which a chrominance signal is being applied such as in *Fig. 13*.

An effective explanation of demodulation may be illustrated with the aid of *Fig. 14* for four signal conditions on the control grid (G1), these being:

(a) No signal on G1

(b) Signal on G1 in phase with 3.58 *mc* oscillator signal

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(c) Signal on G1 is 180° out phase with 3.58 *mc* oscillator signal

(d) Signal on G1 is 90° out phase with 3.58 *mc* oscillator signal.

In *Fig. 14 (a)* the first and second rows of figures from the top indicate no chrominance signal on G1. In the third row we observe a 3.58 *mc* oscillator signal being applied to G3. It is general practice in circuits of this type to operate the tube so that plate current flows for periods much less than a half cycle duration of the 3.58 *mc* oscillator signal. However, for purposes of illustration we will assume that in *Fig. 14* plate current flows during the positive excursions of the 3.58 *mc* signal and is cut off during the negative excursions. Thus, in the 4th row, plate current pulses, which flow during the positive cycles of the 3.58 *mc* signal, provide an average no-signal plate current as shown.

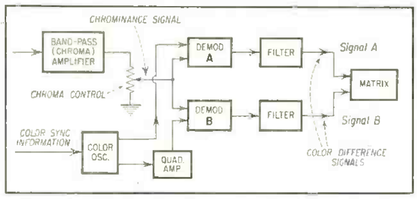

Fig. 12—General demodulation block diagram for either I/Q or R-Y/B-Y signals.

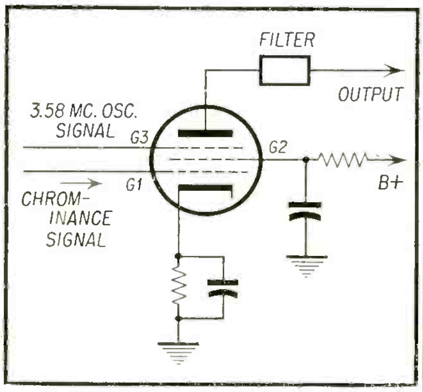

Fig. 13—Simplified schematic of one of the demodulator tubes. Output contains in-phase or quadrature signal depending on phase of 3.58 mc oscillator signal.

The effect of this average no-signal plate current in the output circuit following the low pass filter is a zero signal as shown in the 5th row of signals.

It is evident that the circuit is one in which the demodulator tube has a certain conduction time. This conduction is determined by the bias on the suppressor grid and the other tube voltages. Before the tube can be driven into conduction the 3.58 *mc* signal must overcome this bias. Thus, the 3.58 *mc* signal can be considered as a *gating* or *sampling* signal which permits plate current in the tube to flow during a certain period of the signal cycle; in the above case for ½ cycle. It must be borne in mind that at no time does plate current flow during the negative excursions of the 3.58 *mc* oscillator signal on the suppressor grid. As a result of these plate current pulses, an average no-signal plate current condition exists. This may be considered as the "no-signal" level. It is around this level that the output signal swings.

Now let us consider the action taking place in one of the demodulators when a chrominance signal (2nd Row) applied to the control grid is *in phase* with the 3.58 *mc* oscillator signal as shown in *Fig. 14 (b)*, the positive portion of the chrominance voltage increases the plate current pulses (4th Row) depending on the amplitude of the chrominance signal applied. Thus, the overall action may be considered as one in which the amplitude of the chrominance signal is sampled, thereby causing an increase in average plate current to flow in proportion to the increase in chrominance signal amplitude. The signal appearing at the output of the filter (5th Row) is a *positive going* signal.

[Continued on next page]

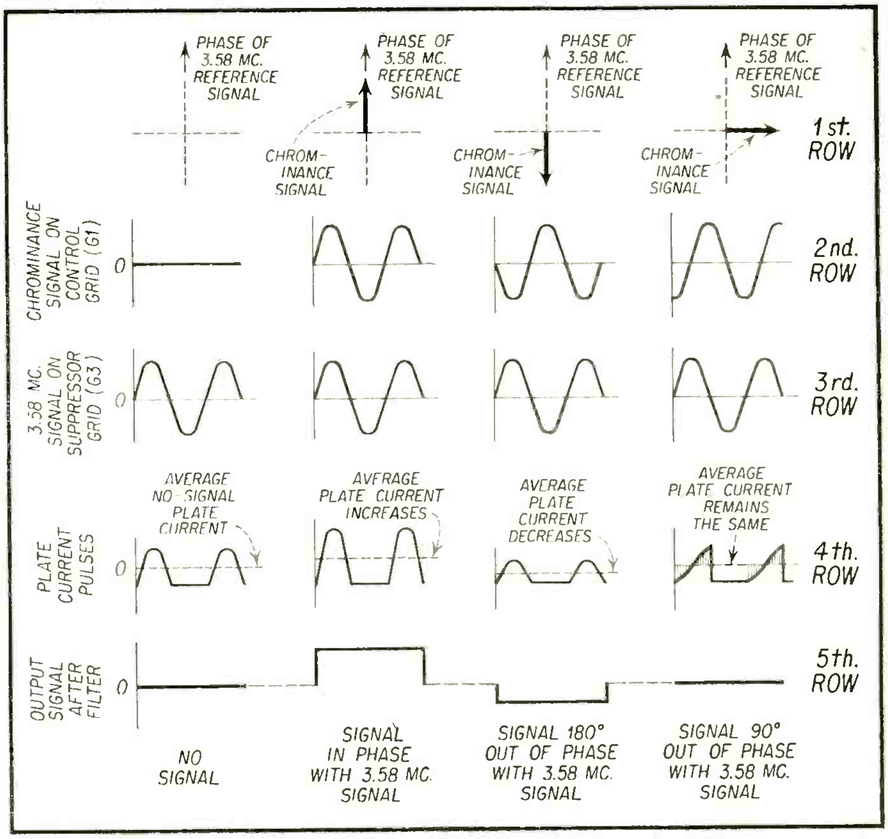

Fig. 14—Input and output signal waveforms for various signal conditions at control grid (G_1) of demodulator tube. This set of waveforms applies to one of the demodulator tubes only.

When the chrominance signal, as in (c), is 180 degrees out of Phase with the oscillator signal (1st and 2nd Row), less conduction takes place through the tube, and the average plate current is reduced, as shown in the 4th Row. Notice that the signal appearing in the output circuit following the filter is a *negative going signal.*

We are now ready to discuss the condition where the chrominance signal is 90° out of phase with the 3.58 *mc* oscillator signal. We pointed out previously that with no chrominance signal on the control grid the plate current assumes an average value which we indicate as the "no-signal plate current level." Also, if the chrominance signal goes positive, the plate current pulses increase, and if the chrominance signal goes negative, the plate current decreases. Again it must be recalled that no plate current flows during negative excursions of the 3.58 *mc* oscillator signal.

Referring to the 1st and 2nd Rows of *Fig. 14 (d)*, we show a chrominance signal 90° out of phase with the 3:58 *mc* oscillator signal being applied to the control grid of the demodulator. During the negative portion of the chrominance signal grid swing, the plate current pulses will be reduced. During the positive portion of the chrominance signal grid swing, the plate current pulses will increase. Under properly balanced circuit conditions, the increase in plate current, as shown in the shaded area (4th Row), is equal to the decrease in plate current, and the average plate current remains the same. The significance of the above is that when the chrominance signal is 90° out of phase with the 3.58 *mc* oscillator signal, it has no effect on the output of the demodulator (5th Row). It can easily be shown by a similar analysis that when the chrominance signal is 270° out of phase with the 3.58 *mc* oscillator signal, there is likewise no effect on the output of the demodulator.

A similar analysis may be applied to Demodulator B (*Fig. 12*) which is sampled by the quadrature component of the 3.58 *mc* local oscillator. In this case color-difference signals appearing in the output of Demodulator B are those corresponding to the chrominance signal component in phase with the quadrature 3.58 *mc* signal (see *Fig. 11*). Thus, in spite of the fact that the same chrominance signal is applied to the control grids of both demodulators, the sampling function of the suppressor grid in each modulator permits *only* R-Y or I signals in the output of the In-Phase Demodulator A, and B-Y or Q signals in the output of the Quadrature Demodulator B. This, in its essence, is the technique of two-phase demodulation.

"Watch that old dame. She uses a JENSEN NEEDLE."

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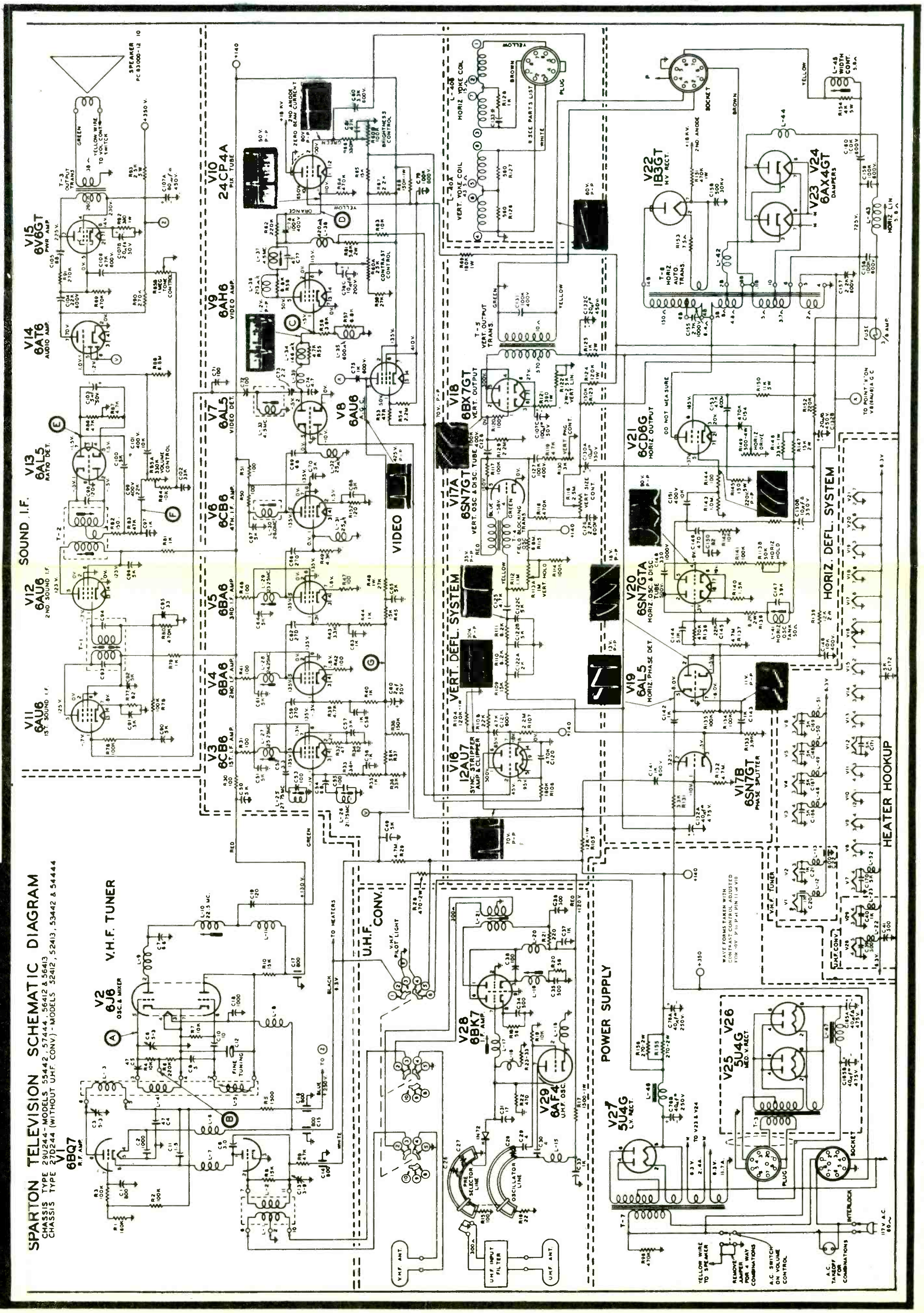

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MISCELLANEOUS SERVICE HINTS

VHF R.F. AND MIXER ALIGNMENT

1. Set station selector to Channel 12.
2. Connect oscilloscope thru 10,000 ohms to test point T (Wire loop on top of tuner.)
3. For negative bias connect -3volts DC to A.G.C. lead (white covered wire) from tuner.
4. Feed sweep generator into antenna terminals, sweeping Channel 12.
5. Adjust C3, C6 and C13 (upright screws on top of tuner) for flat top response curve and maximum gain. Check markers on all channels. They should fall in automatically on all channels.

VHF OSCILLATOR ALIGNMENT

1. Turn on set and select channel to be viewed.
2. Center fine tuning control.
3. Place a non inductive screwdriver through opening, and adjust oscillator coil for best picture and sound.
4. Repeat this adjustment for each channel that can be viewed in the area.

ADJUSTMENT SUGGESTIONS FOR PM FOCUS UNIT

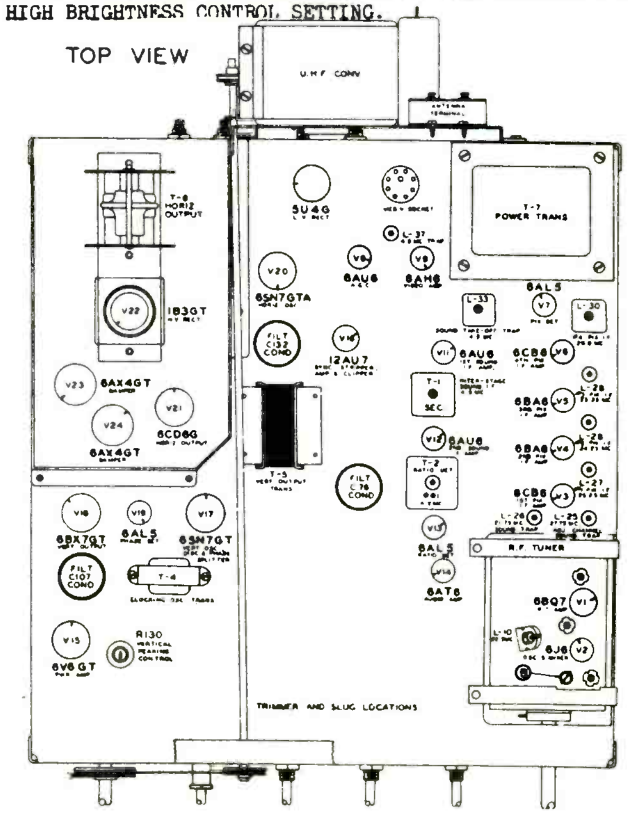
UNDER NORMAL CONDITIONS, ALL FOCUS ADJUSTMENTS CAN BE MADE BY INSERTING A SCREWDRIVER THRU THE HOLE IN THE BACK OF THE CABINET AND INTO THE SLOTTED END OF THE FOCUS CONTROL SHAFT. ROTATE THE SHAFT EITHER CLOCKWISE OR COUNTER-CLOCKWISE UNTIL BEST OVERALL FOCUS IS OBTAINED.

1. IT IS RECOMMENDED THAT THE PHYSICAL POSITIONING OF THE PM FOCUS UNIT BE PLACED SO THAT THE MOUNTING BRACKET HAS THE TWO SELF-TAPPING SCREWS IN THE CENTER OF THE SLOT.

2. IN THE EVENT THE BRIGHTNESS VARIES WHILE ADJUSTING THE FOCUS UNIT FOR BEST OVERALL FOCUS, MOVE THE FOCUS UNIT ASSEMBLY FORWARD (TOWARD THE YOKE) APPROXIMATELY 3/8" AND RESET THE ION TRAP FOR MAXIMUM BRIGHTNESS THEN REFOCUS (PM) UNIT.

3. FOR BEST COMPROMISE, TO OFFSET VARIATIONS IN FOCUS WITH DIFFERENT BRIGHTNESS SETTINGS, MAKE ALL FINAL FOCUS ADJUSTMENTS AT A HIGH BRIGHTNESS CONTROL SETTING.

TOP VIEW



MISCELLANEOUS SERVICE HINTS

Horizontal Drive Adjustments:

With 125V.A.C. line adjust vertical deflection for 10% over-scan with best linearity then adjust horizontal linearity control for best linearity and follow with adjustment of horizontal width control for maximum width. Adjust horizontal hold control to its maximum counter-clockwise position. Decrease horizontal drive control resistance until the compression near the center of the picture disappears. Reset horizontal hold control to its mid-position.

With 117 A. C. line volts, the cathode current of the 6CD6 must not exceed 140 Ma. with zero beam current.

Hor. Oscillator Adjustment:

With 117 A. C. line volts and the horizontal hold control set at the mid-point of its range, adjust L-41 for synchronization with approx. zero volts from Pin #1 of V20 to ground as measured with a vacuum tube or other high impedance voltmeter.

Vertical Peaking Control R130 (Part No. PA4465-1)

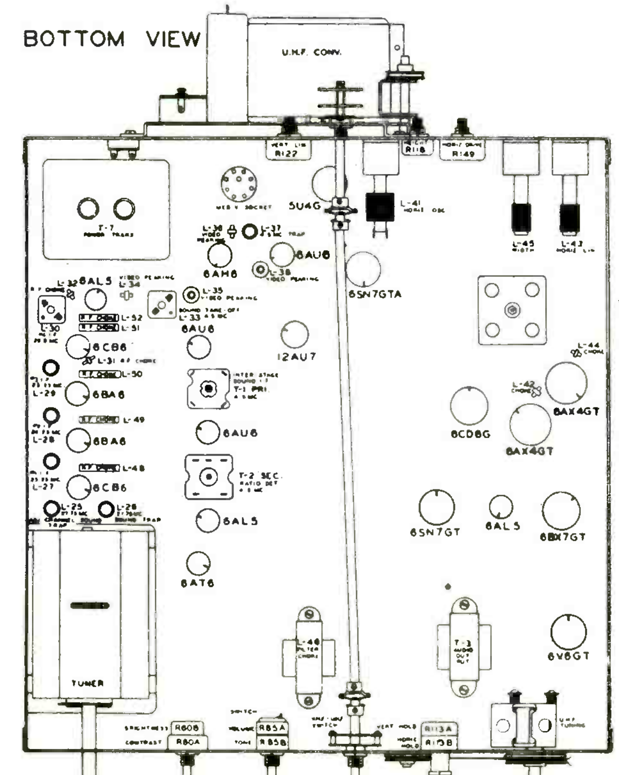
This control has been added on later models due to variation in 6BX7GT tubes. The control is adjusted for best vertical linearity at the top of the raster.

Adjustment of Anti-Pin Cushion Corrector Magnets:

These magnets are mounted on the deflection coil mounting bracket and can be moved in and out by first loosening the mounting screws. Under certain conditions it may be necessary to form, or bend the flexible arms which support the magnets. The above adjustment is made at the factory and should not require re-adjustment unless the original position of the magnets is accidently disturbed. Adjustment can be made in the following manner:

1. With the size controls reduce the size of the raster until the sides are visible.
2. Adjust the corrector magnets for straightest possible raster edges. Restore the picture to normal size.

BOTTOM VIEW



VOLTAGE TEST SPECIFICATIONS:

1. All Voltages & Current measured with VHF - UHF Switch in VHF Position.
2. Channel Switch Position - Channel #2.
3. Line Voltage - 117 Volts A.C. No signal input applied to set.
4. Brightness & Contrast Control Position - Maximum Clockwise.
5. Horizontal & Vertical Hold Control Positions - Set correct position to lock in picture.
6. Width Control Position - Set for normal size.
7. Vertical Size & Linearity Control Position - Set for normal size best linearity.
8. Focus Control Position - Properly focused.
9. Volume Control & Tone Control Position - Maximum Counter - Clockwise.
10. Instrument (Meter) Used - (VTVM) Vacuum Tube Volt Meter.
11. Unless otherwise designated all voltages measured in respect to Chassis Ground.

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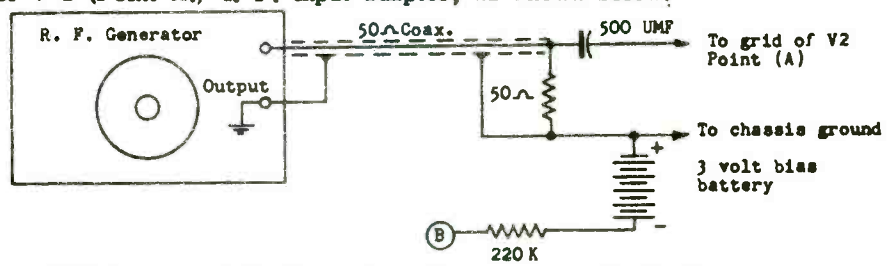
ALIGNMENT PROCEDURE UNMODULATED (CW) GENERATOR METHOD

Step One: SOUND TRAP ALIGNMENT

A. Adjust all controls to normal operating position. Connect the R. F. Signal Generator to the grid of V-2 (Point A.) I. F. input adapter, as shown below.



B. Connect VTVM across R56 (Point C.) Use low volts D. C. Scale.
C. Connect a 4.5 volt bias battery between Point G and ground. (Positive terminal of battery to chassis ground.) Remove 6AU6 (V8).
D. Set R. F. Tuner to channel which gives minimum indication of voltmeter.
E. Adjust L25 and L26 for minimum indication on voltmeter at the specified frequency:

L25	=	27.75 mc
L26	=	21.75 mc

Step Two: PIX I F ALIGNMENT

A. Adjust L10, L27, L28, L29, L30, for maximum indication on voltmeter at the specified frequency.

L10	22.5 mc
L27	25.25 mc
L28	24.25 mc
L29	23.25 mc
L30	26.0 mc

Step Three: SOUND IF ALIGNMENT

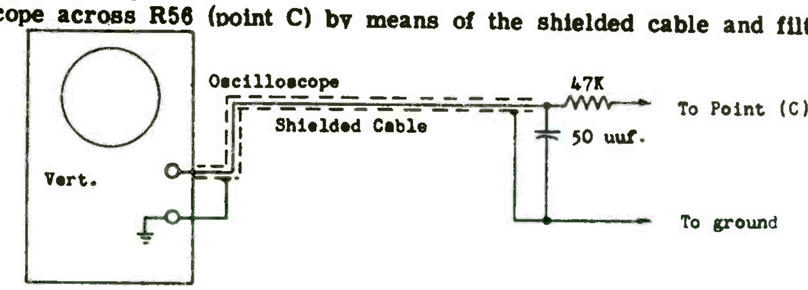
A. Connect the R. F. Signal Generator to Point C.
B. Inject the 4.5 mc signal. (Frequency accuracy important.)
C. Connect VTVM from Point E to ground. Use - 10 volt DC Scale.
D. Adjust L33, T1, and T2 primary for maximum indication of voltmeter.
E. Connect VTVM from Point F to ground. Use lowest D. C. Scale. Adjust secondary of T2 for zero output, as indicated by voltmeter. Note: It is possible to produce a positive or negative voltage indicated by varying this adjustment. The point where the voltage swings from positive to negative is zero output and indicates correct alignment. (If Ratio Detector is seriously misaligned repeat alignment of primary and secondary until no improvement can be made.)
F. Connect VTVM with detector probe from Point D to **ground. Use lowest DC Scale**
G. Adjust L37 for minimum indication on voltmeter.

ELECTRICAL SPECIFICATIONS

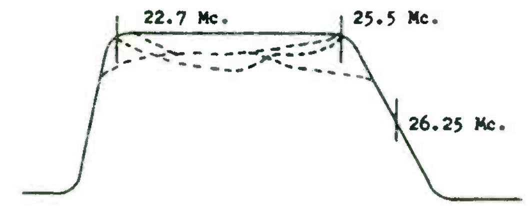
Power supply....................105-125 Volts AC 60 Cycle only
Power Consumption....................325 Watts
Audio Power Output....................Maximum Undistorted 2.5 Watts
Tuning Range....................T. V. Channels 2 thru 83
Antenna Input Impedance....................300 Ohms Balanced
Intermediate Frequencies....................Picture 26.25 Mc.
Intercarrier Sound System....................4.5 Mc.
Voice Coil Impedance....................3.2 Ohms at 400 Cycles

VISUAL ALIGNMENT CHECK USING SWEEP GENERATOR, MARKER GENERATOR, AND OSCILLOSCOPE.

A. Adjust all controls to normal operating position. Connect the sweep generator to the grid of V2 (point A). Connect a 4.5 volt bias battery between point G and ground. (Positive terminal of battery to chassis ground).
B. Connect the oscilloscope across R56 (point C) by means of the shielded cable and filter system shown below.

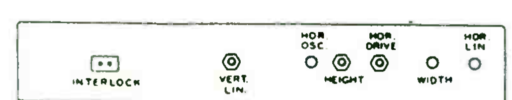


C. Adjust the R. F. sweep generator so that it sweeps from approximately 20 to 30 mc.
D. Adjust the oscilloscope so that the I.F. response is visible. (Set tuner to channel where rotation of Fine Tuning does not change observed response.)
E. Inject proper marker signals as recommended by manufacturer of R. F. sweep generator used.
F. Observe the band width, relative position of the picture carrier, and flatness of the overall I.F. response curve. If necessary, slightly vary the tuning of the picture I.F. coils L10, L27, L28, L29, L30 until the picture I.F. response shown is obtained The solid curve depicts the ideal I.F. response while the dotted curves show permissable variations.

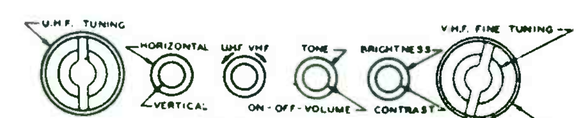


NOTE:
The points indicated by the letters A,B,C,D,E,F & G are the alignment test points referred to in the alignment procedure.
(A) Pin #6 of V2 (6J6) Osc. & Mixer Tube.
Apply signals here for spot I.F. Alignment or I.F. Sweep.
(B) Apply minus 3 volts through 220K Ohms to test terminal, located between the tubes on top of R.F. Tuner (See Suggested input adapter.)
(C) Diode Load Resistor
Read D.C. output here for spot I.F. Alignment.
Connect scope here for visual I.F. Alignment.
(D) Cathode of Picture Tube
Read A.C. output here for overall sensitivity.
Read 4.5Mc output here for aligning 4.5 Mc. Trap.
(E) Ratio Detector Output
Read D.C. here for alignment of sound take-off trap, inter-stage sound I.F. trans. and primary of ratio det. trans.
(F) Ratio Detector Balanced Output
Read D.C. here for alignment of secondary of ratio det. trans.
(G) A.G.C. Line
Apply 4.5 volts bias here for visual check of I.F. or overall with oscilloscope.

Note: Adjustment of Contrast, Brightness, Focus, Vertical Size, Horizontal Hold and Horizontal Drive Controls will change voltages from those indicated in their respective associated circuits.



CHASSIS BACK VIEW



CHASSIS FRONT VIEW

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PARTS LIST

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	CAPACITORS	
C1 thru 25	IN VHF TUNER UNIT	
C26 thru 41	IN UHF CONVERTER	
C49	5K CERAMIC DISK	PA4334-1
C50	5K CERAMIC DISK	PA4334-1
C51	5K CERAMIC DISK	PA4334-1
C52	3.3 CERAMIC	PA4326-4
C53	100 CERAMIC	PA4332-3
C54	6.8 CERAMIC	PA4328-13
C55	100 CERAMIC	PA4332-3
C56	1K CERAMIC	HK36M-102
C57	5K CERAMIC DISK	PA4334-1
C58	1K CERAMIC	HK36M-102
C59	270 CERAMIC	HK36M-271
C60	2 mf. 50V. ELECTROLYTIC	PA4303-14
C61	5K CERAMIC DISK	PA4334-1
C62	270 CERAMIC	HK36M-271
C63	1K CERAMIC	HK36M-102
C64	5K CERAMIC DISK	PA4334-1
C65	5K CERAMIC DISK	PA4334-1
C66	270 CERAMIC	HK36M-271
C67	5K CERAMIC DISK	PA4334-1
C68	5K CERAMIC DISK	PA4334-1
C69	6.8 CERAMIC	PA4328-13
C70	5K CERAMIC DISK	PA4334-1
C71	100 CERAMIC	PA4332-3
C72	100 CERAMIC	PA4332-3
C73	2.2 CERAMIC	PA4326-1
C74	4.7 CERAMIC	PA4328-11
C75	1K 600V. TUBULAR	PC42GM-102
C76A	40 mf. 250V. ELECTROLYTIC	PA4307-21
C76B	40 mf. 250V. ELECTROLYTIC	PA4307-21
C76C	10 mf. 200V. ELECTROLYTIC	PA4307-21
C77	47 CERAMIC	CC30A-470F
C78	100K 400V. TUBULAR	PC42GL-104
C79	100K 600V. TUBULAR	PC42GM-104
C80	3.3K 600V. TUBULAR	PC42GM-332
C81	47K 400V. TUBULAR	PC42GL-473
C90	5K CERAMIC DISK	PA4334-1
C91	5K CERAMIC DISK	PA4334-1
C92	5K CERAMIC DISK	PA4334-1
C95	33 MICA	MC60E-330
C96	5K CERAMIC DISK	PA4334-1
C97	1K CERAMIC	HK36M-102
C98	120 CERAMIC	PA4332-4
C99	22K 400V. TUBULAR	PC42CL-223
C100	5K CERAMIC DISK	PA4334-1
C101	10K 400V. TUBULAR	PC42GL-103
C102	33K 200V. TUBULAR	PC42GK-333
C103	5 mf. 50V. ELECTROLYTIC	PA4308-2
C104	22K 600V. TUBULAR	PC42CM-223
C105	68 MICA	MC60E-680
C106	4.7K 600V. TUBULAR	PC42GM-472
C107A	80 mf. 450V. ELECTROLYTIC	PA4307-23
C107B	20 mf. 50V. ELECTROLYTIC	PA4307-23
C107C	100 mf. 50V. ELECTROLYTIC	PA4307-23
C120	470K 200V. TUBULAR	PC42DK-474
C121	47K 600V. TUBULAR	PC42GM-473
C122A	2K CERAMIC	PA4339-4
C122B	5K CERAMIC	PA4339-4
C122C	5K CERAMIC	PA4339-4
C125	4.7K MICA	MC61F-472
C126	2.2K 600V. TUBULAR	PC42GM-222
C127	100K 400V. TUBULAR	PC42FL-104
C128	100K 400V. TUBULAR	PC42GL-104
C130A	10 mf. 350V. ELECTROLYTIC	PA4304-3
C130B	10 mf. 350V. ELECTROLYTIC	PA4304-3
C131	100K 400V. TUBULAR	PC42GL-104
C132A	40 mf. 475V. ELECTROLYTIC	PA4307-22
C132B	20 mf. 450V. ELECTROLYTIC	PA4307-22
C132C	20 mf. 450V. ELECTROLYTIC	PA4307-22
C133	130 2KV CERAMIC DISK	Pur. with Defl. Yoke
C141	1K 600V. TUBULAR	PC42GM-102
C142	1K MICA	MC61E-102
C143	1K MICA	MC61E-102
C144	5.1K MICA	MC61E-512
C145	22K 200V. TUBULAR	PC42GK-223
C146	10K 400V. TUBULAR	PC42FL-103
C147	3.9K SILVER MICA	MC63F-392
C148	330 1KV MICA	PA4340-12
C149	470 MICA	MC60E-471
C150	82 MICA	MC60G-820
C151	10K 400V. TUBULAR	PC42GL-103
C153	47K 600V. TUBULAR	PC42GM-473
C154	470K 200V. TUBULAR	PC42GK-474
C155	2.7K 1000V. TUBULAR	PC42FN-272
C156	500 30KV CERAMIC	PA4348
C157	2.2K 600V. TUBULAR	PC42GM-222
C158	100K 600V. TUBULAR	PC42FM-104
C159	100K 600V. TUBULAR	PC42GM-104
C160	100K 600V. TUBULAR	PC42GM-104
C165A*	40 mf. 475V. ELECTROLYTIC	PA4307-13
C165B*	40 mf. 475V. ELECTROLYTIC	PA4307-13

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	CAPACITORS	
C166	5K CERAMIC DISK	PA4334-1
C167	5K CERAMIC DISK	PA4334-1
C168	5K CERAMIC DISK	PA4334-1
C169	5K CERAMIC DISK	PA4334-1
C170	5K CERAMIC DISK	PA4334-1
C171	5K CERAMIC DISK	PA4334-1
C172	5K CERAMIC DISK	PA4334-1
	RESISTORS	
R1 thru 10	IN VHF TUNER UNIT	
R15 thru 23	IN UHF CONVERTER	
R28	470 2 WATT	DR12S-471
R29	4.7 Meg. 1/2 WATT	BR12S-475
R30	100 1/2 WATT	BR12N-101
R31	100 1/2 WATT	BR12N-101
R32	47 1/2 WATT	BR12G-470
R33	3.6K 1/2 WATT	BR12G-362
R34	82 1/2 WATT	BR12G-820
R35	1K 1/2 WATT	BR12N-102
R36	33K 1/2 WATT	BR12S-333
R37	56K 1/2 WATT	BR12S-563
R38	150K 1/2 WATT	BR12S-154
R39	4.7K 1/2 WATT	BR12G-472
R40	1K 1/2 WATT	BR12N-102
R41	100 1/2 WATT	BR12N-101
R42	100 1/2 WATT	BR12G-101
R43	3.3K 1/2 WATT	BR12G-332
R44	1K 1/2 WATT	BR12N-102
R45	15K 1/2 WATT	BR12G-103
R46	100 1/2 WATT	BR12N-101
R47	100 1/2 WATT	BR12G-101
R48	27K 1 WATT	CR12S-273
R49	4.3K 1/2 WATT	BR12G-432
R50	100 1/2 WATT	BR12N-101
R51	100 1/2 WATT	BR12N-101
R52	120 1/2 WATT	BR12S-121
R53	47K 1/2 WATT	BR12S-473
R54	2.2 Meg. 1/2 WATT	BR12S-225
R55	4.7K 1/2 WATT	PA4203-9
R56	3.9K 1/2 WATT	BR12G-392
R57	6.8K 1/2 WATT	BR12S-682
R58	6.8K 1/2 WATT	PA4203-10
R59	27K 1/2 WATT	BR12S-273
R60A	25K CONTRAST CONTROL	PA4457
R60B	100K BRIGHTNESS CONTROL	PA4457
R61	5.6K 2 WATT	DR12G-562
R62	220K 1/2 WATT	BR12S-224
R63	10K 1/2 WATT	BR12S-103
R64	470K 1/2 WATT	BR12S-474
R65	15K 1/2 WATT	BR12S-153
R66	330K 1/2 WATT	BR12N-334
R67	2.2K 1/2 WATT	BR12G-222
R68	150K 1 WATT	CR12S-154
R69	180K 1 WATT	CR12S-184
R76	100K 1/2 WATT	BR12S-104
R77	82 1/2 WATT	BR12G-820
R78	100K 1/2 WATT	BR12N-104
R79	1K 1/2 WATT	BR12N-102
R80	470K 1/2 WATT	BR12S-474
R81	1K 1/2 WATT	BR12N-102
R82	150 1/2 WATT	BR12G-151
R83	47K 1/2 WATT	BR12S-473
R84	10K 1/2 WATT	BR12S-103
R85A	330K VOLUME CONTROL	PA4450-2
R85B	1 Meg. TONE CONTROL	PA4450-2
R85A	330K VOLUME CONTROL	PA4450-4
R85B	1 Meg. TONE CONTROL	PA4450-4
R86	4.7K 1/2 WATT	BR12G-472
R87	4.7K 1/2 WATT	BR12G-472
R88	6.8 Meg. 1/2 WATT	BR12N-685
R89	470K 1/2 WATT	BR12N-474
R90	270K 1/2 WATT	BR12S-274
R91	270K 1/2 WATT	BR12S-274
R92	390 1 WATT	CR12S-391
R93	2.5K 5 WATT	PA4200-24
R104	120K 1 WATT	CR12S-124
R105	12K 1 WATT	CR12S-123
R106	180K 1/2 WATT	BR12S-184
R107	2.2 Meg. 1/2 WATT	BR12N-225
R108	22K 1/2 WATT	BR12S-223
R109	15K 1/2 WATT	BR12S-153
R110	8.2K 1/2 WATT	BR12S-822
R111	8.2K 1/2 WATT	BR12S-822
R112	1.1 Meg. 1/2 WATT	BR12G-115
R113A	1.0 Meg. VERTICAL HOLD CONTROL	PA4456
	DEFLECTION YOKE ASSEMBLY	AO69088-1
	MAGNETIC FOCUSING UNIT	PB40387
	ION TRAP	PA1248
	RF TUNER ASSEMBLY UHF	PC70021
	RF TUNER ASSEMBLY VHF	PD93174-5
	FUSE 3/8 AMP	PA1248

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	RESISTORS	
R113B	50K HORIZONTAL HOLD CONTROL	PA4456
R114	100K 1/2 WATT	BR12S-104
R115	6.8 Meg. 1/2 WATT	BR12S-685
R116	470K 1/2 WATT	BR12N-474
R117	100K 1/2 WATT	BR12S-104
R118	2.5 Meg. VERTICAL SIZE CONTROL	PA4431
R119	4.7K 1/2 WATT	BR12S-472
R120	100 1/2 WATT	BR12N-101
R121	390 1 WATT	CR12S-391
R122	2.5K VERTICAL LINEARITY CONTROL	PA4464
R123	150K 1/2 WATT	BR12S-154
R124	120K 1 WATT	CR12S-124
R125	1K 2 WATT	DR12S-102
R126	560 1/2 WATT	Part of Defl. Yoke
R127	560 1/2 WATT	Part of Defl. Yoke
R128	1K 1/2 WATT	Part of Defl. Yoke
R129	2.2 Meg. 1/2 WATT	BR12S-225
R130	3K VERTICAL PEAKING CONTROL	PA4465-1
R131	3.3K 1/2 WATT	BR12G-332
R132	4.7 Meg. 1/2 WATT	BR12S-475
R133	3.9K 1/2 WATT	BR12G-392
R134	100K 1/2 WATT	BR12G-104
R135	100K 1/2 WATT	BR12G-104
R136	470K 1/2 WATT	BR12S-474
R137	4.7 Meg. 1/2 WATT	BR12N-475
R138	8.2K 2 WATT	DR12G-822
R139	12K 2 WATT	DR12S-123
R140	1.5K 1/2 WATT	BR12G-152
R141	100K 1/2 WATT	BR12S-104
R142	10K 1/2 WATT	BR12S-103
R143	1 Meg. 1/2 WATT	BR12S-105
R144	100 1/2 WATT	BR12N-101
R145	150 5 WATT	PA4200-22
R146	180K 1 WATT	CR12G-184
R147	15K 2 WATT	DR12S-153
R148	33K 1 WATT	CR12S-333
R149	500 HORIZONTAL DRIVE CONTROL	PA4448
R150	11K 5 WATT	PA4200-27
R152	220K 1/2 WATT	BR12N-224
R153	7.5 1/2 WIREWOUND	BRW12S-75
R154	4K 5 WATT	PA4200-25
R155	270 2 WATT	DR12S-271
R156	270 2 WATT	DR12S-271

REF. SYMBOL	DESCRIPTION	SPARTON PART NO.
	COILS	
L1 thru 13	IN VHF TUNER	
L15 thru L23	IN UHF CONVERTER	
L25	27.75 MC TRAP	AB43523-13
L26	21.75 MC TRAP	AB43523-12
L27	25.25 MC P. I. F. (1)	AA6408-1
L28	24.25 MC P. I. F. (2)	AA6408-1
L29	23.25 MC P. I. F. (3)	AA6408-1
L30	26.0 MC P. I. F.	AA6364-1
L31	25 UH CHOKE	AA6650-1
L32	25 UH CHOKE	AA6650-1
L33	4.5 MC TRAP	AA6364-2
L34	146 UH CHOKE	AA6402-8
L35	600 UH CHOKE	AA6613-8
L36	213 UH CHOKE	AA6402-7
L37	4.5 MC TRAP	AA6407-1
L38	420 UH CHOKE	AA6613-10
L40A	DEFLECTION YOKE ASSEMBLY	AC6088-1
L40B	DEFLECTION YOKE ASSEMBLY	AC6088-1
L41	HORIZONTAL OSCILLATOR	AA6403-2
L42	CHOKE	AA6650-9
L43	HORIZONTAL LINEARITY	AA6400-3
L44	CHOKE	AA6650-9
L45	WIDTH CONTROL	AA6400-3
L46	FILTER CHOKE	AB47009-1
L47*	FILTER CHOKE	AB47012-1
L48	HEATER CHOKE	AA6651-1
L49	HEATER CHOKE	AA6651-1
L50	HEATER CHOKE	AA6651-1
L51	HEATER CHOKE	AA6651-1
L52	HEATER CHOKE	AA6651-1
	TRANSFORMERS	
T1	SOUND I. F.	AA6667-5
T2	RATIO DETECTOR	AA6684-4
T3	AUDIO OUTPUT	AB44066-3
T4	FIELD BLOCK OSC.	AB47006-4
T5	VERTICAL OUTPUT	AB44070-1
T6	HORIZONTAL OUTPUT	PC70019
T7	POWER	AB44033-1
T8*	POWER	AB44034-1


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