Successful SERVICING

JANUARY, 1951

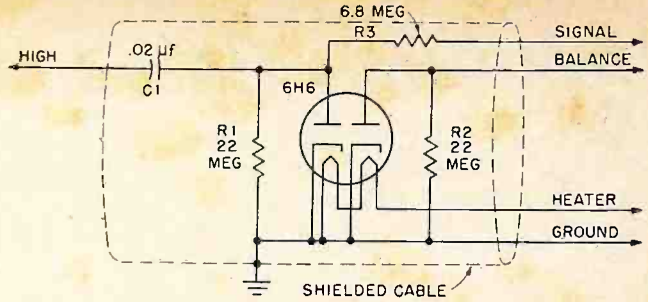

Fig. 1. The schematic of a typical probe used for the measurement of r-f voltages is shown here. One section of the 6H6 balances the contact potential of the other section.

RADIO FREQUENCY PROBES USED WITH VACUUM-TUBE VOLTMETERS

By JOHN F. RIDER

A probe is a device or circuit added to the input of an electronic voltmeter to facilitate the measurement of radio, intermediate, or video frequencies, and/or high voltages. There are various types of probes, each designed for a specific purpose. In general, probes are designed either to increase the input resistance or to decrease the input capacitance of the voltmeter.

Since a probe permits the use of very short connecting leads, its widest application is with high-frequency voltmeters. The development and improvement of such probes has been going on for over twenty years. Since early vacuum-tube voltmeters were single tube affairs in which rectification and d-c amplification or meter coupling were accomplished in a single tube, and since early tubes were large and awkward, early probes were more or less cumbersome affairs. The gradual development in the art has evolved smaller and smaller probes mounted on more and more flexible cables.

At frequencies above a few hundred kilocycles, long connecting leads to voltmeters or other measuring apparatus introduce errors and increase the circuit loading. At frequencies of the order of 100 megocycles, it is desirable to do away with connecting leads entirely, even to the extent of soldering the probe or rectifier terminals directly to the circuits under test.

The probe schematic shown in Fig. 1 is typical of most r-f probes used today. An equivalent circuit showing the four major components of the input impedance is shown in Fig. 2. These four components are R_E, which is equal to the parallel combination of $R1$ and $R3$ in Fig. 1 ($R3$ goes to ground through a coupling capacitor in the voltmeter proper), the diode shunt resistor $R2$, the equivalent shunt capacitance C_S, and the equivalent shunt resistance R_S.

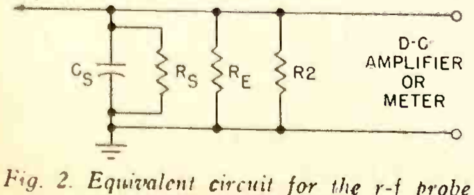

Fig. 2. Equivalent circuit for the r-f probe shown in Fig. 1.

The effective input capacitance C_S, consists of all the shunting capacitances of the probe. This includes the capacitance of the "high" terminal, the input coupling capacitor, the diode plate capacitance, as well as the capacitance of the diode socket (if one is used), the connecting leads, the high side of the shunt and filter resistors, and all other parts. The equivalent shunt resistance R_S, represents the shunt resistance component of the capacitor dielectric. At audio and low radio frequencies, R_S, is usually large compared to R_E and $R2$, so that the input impedance essentially consists of C_S, shunted by R_E and $R2$. With the values given in Fig. 1 for $R1$ and $R3$, we find that R_E is equal to:

$$R_E = \frac{6.8 \times 22}{6.8 + 22} = 5.2 \text{ megohms.}$$

The total input resistance, R_T, at low frequencies is, therefore, equal to:

$$R_T = \frac{R_E \times R2}{R_E + R2}$$

$$= \frac{5.2 \times 22}{5.2 + 22} = 4.2 \text{ megohms.}$$

The capacitive shunt resistance decreases linearly in value as the frequency increases. In the typical probe, this resistance becomes equal in value to the combination of R_E and $R2$ at about 1 megacycle. At higher frequencies, R_S rapidly becomes the predominant factor, so that a frequencies above 1 megacycle, the input impedance of the probe is almost entirely that of C_S shunted by the R_S.

A probe having an input capacitance of 5 $\mu\mu f$ will have a capacitive reactance of 3,185 ohms at 10 megacycles. (The reactance of a capacitor is equal to $1/2\pi fC$, where f is the frequency in cycles, and C is the capacitance in farads.) The shunt resistance component of this capacitor will be about 1 megohm at this frequency (Q times the reactance value). As the frequency increases, the capacitive reactance decreases and the shunt resistance assumes more and more importance.

When making voltage measurements across a tuned circuit, an estimate of the error caused by the voltmeter probe may be obtained by comparing the equivalent resistance of the probe to the tuned impedance of the circuit. The impedance of a parallel tuned circuit at resonance, Z_r, is purely resistive and is equal to:

$$Z_r = Q_r{}^2 R$$

where Q_r is the Q value of the circuit at resonance, and R is the equivalent series resistance of the circuit.

Since by definition, the Q of a series circuit is the ratio of its reactance to its resistance, we have:

$$Q_r = \frac{W_r L}{R}$$

or

$$R = \frac{W_r L}{Q_r}$$

where W_r is equal to 2π times the resonant frequency.

(Continued on page 14)

Editor's Note: This article is an abridgement of the section on r-f probes appearing in chapter 9, entitled "Probes for D.C. and R.F.," from the new and complete text VACUUM-TUBE VOLTMETERS, a book to be published soon by John F. Rider Publisher, Inc. This book is a revision of the former book VACUUM-TUBE VOLTMETERS by John F. Rider.

Television Changes

Wilcox-Gay G306, G402, G403, G404, G426, G427, G624, G914

Wilcox-Gay Model G306 is similar to Majestic Model 12T6. Model G402 is similar to Majestic 12C4. Model G403 is similar to Majestic 14T2. Model G404 is similar to Majestic 14C4. Model G426 is similar to Majestic 16C4, and Model G427 is similar to Majestic 16C6. Except for cabinet designs or picture tube size, Majestic Models 12T6 and 14T2 are the same as Majestic Model 12T2. Majestic Model 14C4 is the same as Majestic Model 12C4, and Majestic Model 16C6 is the same as 16C4.

Wilcox-Gay Model G624 is similar to Majestic Model 1674, and Model G914 is similar to Majestic Model 1974.

Mars Dartmouth, Hampton, Oriental, Versailles, Ch. K-2

The chassis layout for the K-2 chassis is shown in the accompanying figure. 6CB6 tubes can be substituted for the 6AG5 tubes shown marked with asterisks, and a 6W4GT can be substituted for the 5V4G reaction scanning tube. The rear chassis controls are shown at the bottom of the illustration.

Crosley 10-414MU, 10-416MU, 10-416MIU, 10-429MU

On later sets resistor R151, 150,000 ohm, 10%, ½ w (part No. 39374-51) was changed to 220,000 ohm, 10%, ½ w (part No. 39374-53). This change was made to increase the horizontal hold control range.

Associated Merchants 12T1, 12T2, 12T3, 120C1, 120C2, 120C3, 160C1, 160C2, 160C3

The service data for these models are the same as those for Bendix Models 2025, 3033, and 6002 except for the changes in the parts list that are shown below. For all service data and change notices see Bendix 2025, 3033, and 6002.

Stock No.	Description
FP0P07	Frame, paper, decorative (12½" table and console models)
FP0P08	Frame, paper, 12½" picture tube
FW0P05	Frame, wood, 16" picture tube
HP0M08	Plate, metal, decorative (12½" and 16" console models)
KC0B26	Knob, control, contrast
KC0B27	Knob, control, Off-On-Volume
ZW1T06	Cabinet, table model, mahogany
ZE1V08	Cabinet, console model, mahogany (12½")
ZW1V09	Cabinet, console model, mahogany (16")

Majestic 14CT4, 16CT5, 19C6, 19C7, 1671, 1672, 1673, 1674, 1675, 1900, 1974, 1975, 97 & 98 Series

Model 14CT4 is a consolette with a mahogany finish and employs a 14" rectangular picture tube. Model 1671 has a table cabinet with a mahogany finish and employs a 16" rectangular tube. Models 16CT4 and 16CT5 are consolettes using 16" round tubes. Model 16CT4 has a mahogany finish, while Model 16CT5 has a bleached finish. Model 1900 is also a consolette with a mahogany finish, although it employs a 19" round tube. A total of 20 tubes including the picture tube is used in these receivers.

The service data for these models in the 97 and 98 Series are the same as the data for the 94 and 97 Series except for the differences and additions mentioned in the following paragraphs.

Under the section titled "Picture Tube Installation in 16" Receivers," add:

For receiver Models 1672 or 1673, remove the two screws which hold the front mask assembly. These pass through the two corner blocks on the inside of the cabinet at the top. When these screws are removed, the front panel may be lifted out. For receiver Models 1671, 1674, or 1675, remove the four decorative screws which hold the front panel and mask assembly. These pass through the four corners of the picture frame. Carefully lift out the front panel and mask assembly. For Model 1671, loosen the two screws which fasten the metal picture-tube retaining band sufficiently so that the picture tube may be slipped through the opening. The high-voltage connector should be located on the right side of the chassis, as viewed from the front. Secure the metal band over the top of the tube by tightening the two screws alternately and evenly, so that the rectangular picture tube is not forced to rotate or twist in its mounting.

The picture tube installation in 19" receivers is as follows:

The bulblike glass separation between the neck of the picture tube and its metal cone is treated with an anti-corona coating to reduce high-voltage leakage under humid atmospheric conditions. Avoid touching this treated area since perspiration may reduce its effectiveness. If handled accidentally, wash with water or mild soap and water. Remove all traces of soap. Use no chemical solvents or abrasives for cleaning.

1. Remove the slotted head P.K. screws retaining the back and release with the interlocked line cord.

2. Remove the bag containing the beam bender, the hardware for deflection and focus coil assembly, and the front plug buttons, if used.

3. Remove the deflection and focus coil assembly which is fastened to a shelf for shipping purposes. Remove retaining wires that are wrapped around focus coil adjustment screws.

4. Carefully slide the deflection yoke and focus coil assembly over the neck of the picture tube, so that the deflection yoke adjustment thumb screw faces the top of the cabinet.

5. Assemble the deflection yoke and focus coil assembly to the support bracket using the

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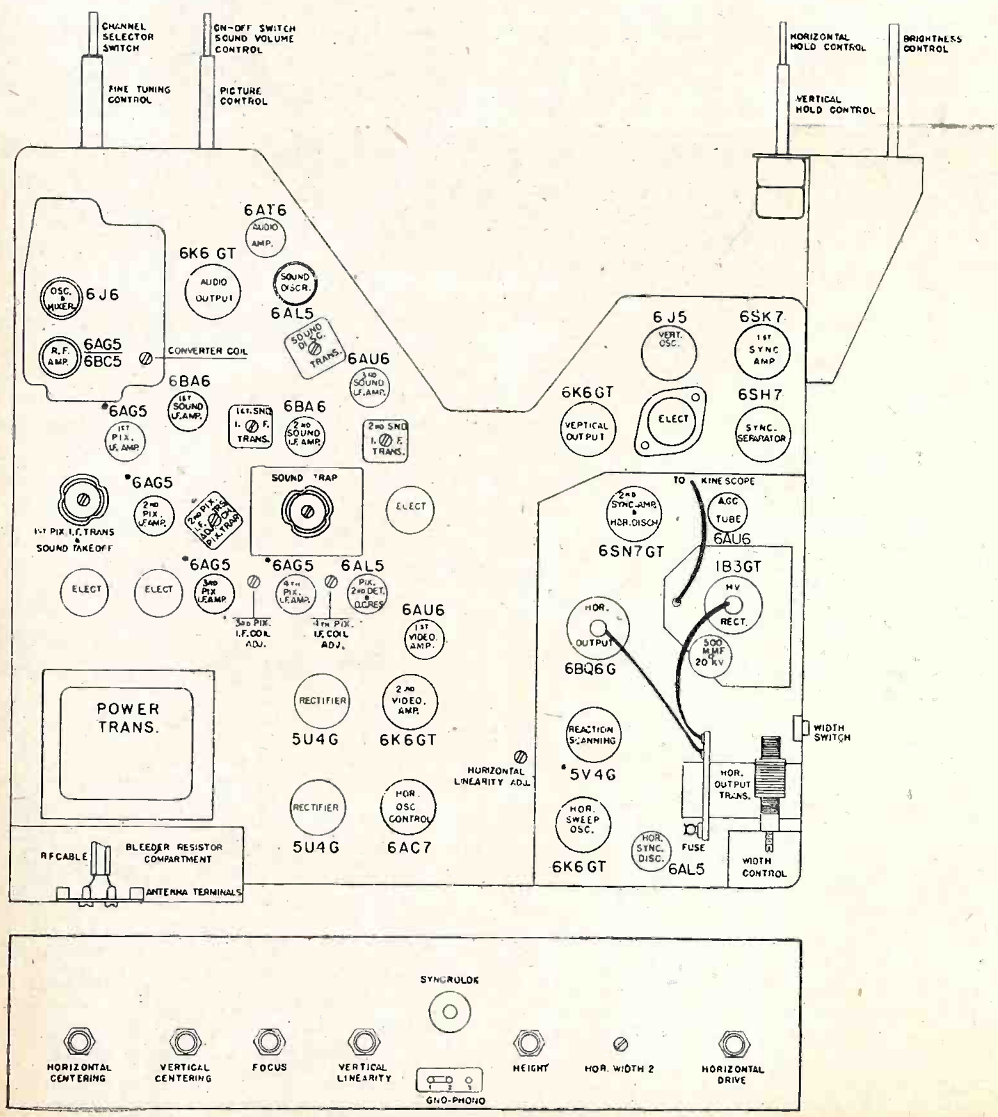
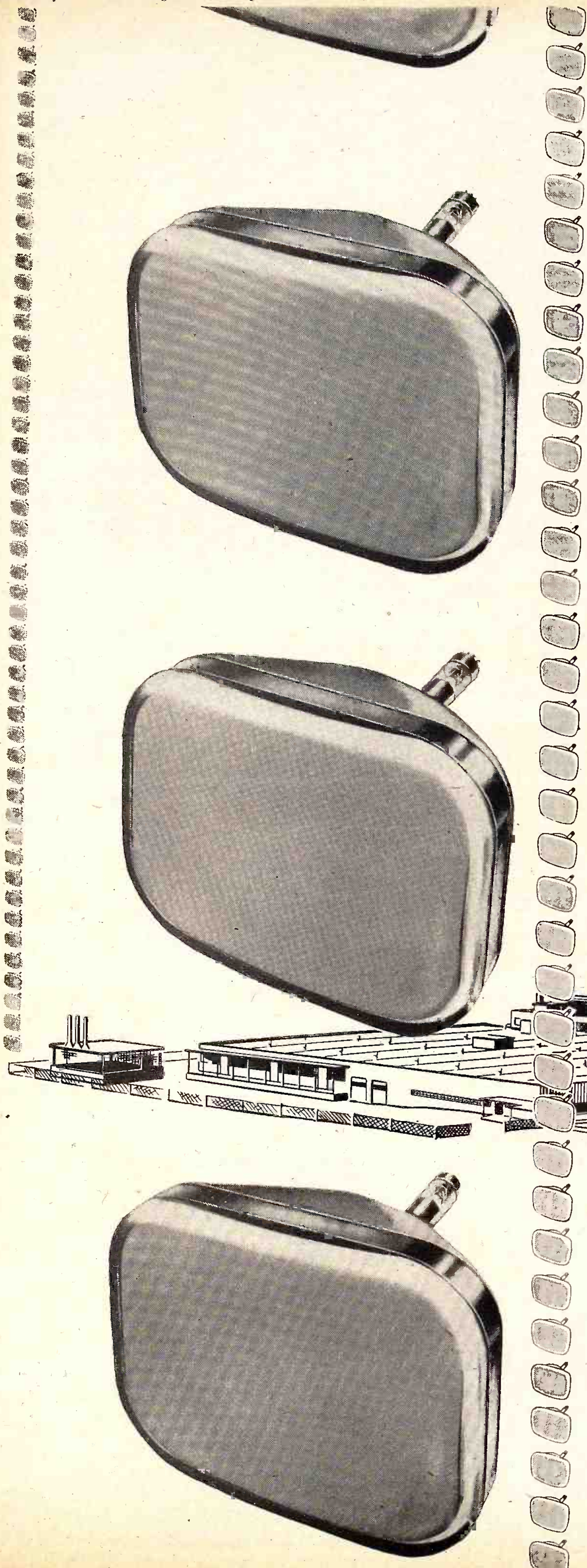


Chassis layout and rear chassis controls for Mars K-2.



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Vol. 12 JANUARY, 1951 No. 3

Dedicated to the financial and technical advancement of the Electronic Maintenance Personnel

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CURTAIN TIME

Five Billion Dollar Electronic Equipment Procurement

Defense orders to be placed for electronic equipment during 1951 will approximate 5 billion dollars. If this is the case, it is inevitable that some time during 1951 there will occur complete stoppage in the manufacture of electronic equipment for home use. It is reported that the first quarter of 1951 will still see a reasonable output of television and radio receivers because many manufacturers have the necessary components on hand, but it is our feeling that the second quarter will see remaining inventories directed to the production of defense equipment.

In view of the above, the servicing history of World War II will repeat itself—servicing will increase tremendously. Whether or not the public demand will be satisfied is still another question. From the way things look now, both manpower and components are destined to be in short supply. It is said that the curtailment of set production may make more parts available for the servicing industry. We hope so, but we aren't banking on it. Common sense dictates that it will be determined by how rapidly the defense program is put into effect and by the size of the orders sent to the manufacturers.

Inasmuch as home electronic equipment (radio and television receivers) must be maintained for public morale and for direct communication so that instantaneous contact between the government and the people of the nation is possible, the depletion of servicing personnel by the demands of the Armed Forces and industry deserves serious consideration. Every effort will have to be made to replenish the ranks of service technicians as they dwindle. Commercial schools, high schools, vocational schools, and even colleges, may be called upon to train personnel for duties in this activity as well as for industry and the Armed Forces. The Boards of Education in different parts of the country might well pay greater heed to the needs of the vocational schools. Perhaps electronics may soon become a subject in high schools. In view of the needs, it could well replace the conventional shop course. It might be well if the different educational boards in the nation inaugurated night classes to teach radio and television servicing. It would not create problems for the commercial schools because it is inevitable that the student strength in these institutions will increase in order to satisfy the needs of the various branches of the Armed Forces.

It is not beyond the realm of possibility that youngsters and oldsters who may gather a limited amount of electronic background from attendance at municipal schools may prove useful in local service shops, where they can work under the supervision of more competent personnel.

The curtailment of new set production will make the present-day TV set installer a prospect for servicing education. The manner of operation of the contract houses will no doubt be changed—they'll have to drop the contract idea completely and do cash and carry servicing. This will demand an increase in servicing personnel as compared to installation personnel. It may mean that each contractor will have to set up his own training program or maybe enroll his men at his own expense in some home study course. We might comment that this is being done right now by a very big service contract organization with advantage to the public, the men, and the company.

Rider's TV 6 AND TV 7

The impending curtailment of TV receiver production some time in 1951, as well as the very grave paper shortage, pose a problem for us in connection with the forthcoming Rider TV Manuals Volumes 6 and 7. Rider TV Manual Volume 6 will contain 2,300 pages (8½" x 11") of TV data. Accordingly, it is our plan to release Rider TV Manual 6 in March 1951 and TV Manual 7 soon thereafter. Each will be a full-size manual, if not an over-sized manual. In that way be can get into the hands of the servicing industry all of the information which is vital to its operation.

Things have reached such a pass, relative to paper and printing, that stocks must be accumulated in order to accomplish a printing. These two volumes will require approximately 200,000 pounds of paper. We have been successful in exacting promises for this amount in time for the printings. If you are in the TV servicing business, you will need these volumes. Contact your source of

(Continued on page 15)

Majestic 97 and 98 Series

(Continued from page 2)

hardware provided. See Fig. 1 for proper hardware assembly and mounting procedure.

6. Remove the 6-32 grounding screw from the yoke frame (see Fig. 1 for location). Attach the ground lug on the brown wire coming from the chassis, and replace the screw.

7. Slide the beam bender over the neck of the picture tube.

8. Connect the picture tube socket to the tube base.

9. Connect the male octal plug from the deflection yoke and focus coil assembly to the female octal socket from the chassis.

The rear panel adjustments that are illustrated for Models 1672, 1673, 1674, 1675, 19C6, 19C7, 1974, and 1975 apply to the other models mentioned in this article. The location of the front panel controls are shown for Models 1974 and 1975 in Fig. 2, and for the rest of the models in Fig. 3.

The circuit description for these models is the same as that for the 94 Series, except that in the section titled "Vertical Deflection Circuit (Block H)," the generated sawtooth voltage is amplified by the 6K6 output tube (V20), rather than the "other half of the 6SN7 duo-triode (V14)."

The Alignment Procedure, Video I-F and Sound Alignment, and the R-F and Oscillator Alignment for the 97 and 98 Series is the same as that found for the 94 Series. The Voltage Chart for all models except 14CT4, 1674, and 1900, is the same as that shown on page 5-13. The voltage readings for Model 1900 are the same as those shown on page 5-13, except for the following changes: Picture tube (V1)—pin 2 is 2 v, pin 10 is 230 v. Audio output (V4, 6V6)—pin 1 is N.C., pins 5 and 6 are —6 v. Ratio detector driver (V6, 6AU6)—pin 1 is 4.5 v, pin 7 is 5 v. The voltages on pins 5 and 6 of the 1st, 2nd, and 3rd video i-f tubes (V7 6AU6, V8 6AG5, V9 6AG5) are 115 v. Video amplifier (V11, 6AC7)—pins 3 and 5 are 0.2 v, pin 4 is —2 v, pin 6 is 145 v, and pin 8 is 115 v. D-c restorer-clipper-separator-amplifier (V12, 12AU7)—pin 1 is 90 v, pins 2 and 6 are 24 v, and pin 3 is 25 v. Vertical sweep oscillator (V14, 6C4)—no voltage on pin 1, pin 5 is 100 v, and pin 6 is —25 v. Horizontal sweep output (V16, 6BQ6-GT)—pins 3 and 4 are 155 v, pins 5 and 6 are —26 v, and pin 8 is 7 v. High-voltage rectifier (V17, 1B3)—pins 2, 6, and 7 are 11.5 kv. Horizontal damper (V18, 6W4)—pins 2 and 4 are N.C., pin 3 is 370 v, pins 5 and 6 are 210 v, pin 7 is 6.3 vac, and pin 8 is 0 v. Power rectifier (V19, 5U4G)—pins 2 and 8 are 380 v, and pins 4 and 6 are 365 vac. Vertical output (V20, 6K6)—pin 1 is 0 v.

The voltage readings for Models 14CT4 and 1674 are the same as those on page 5-13 except for the following changes: Picture tube (V1)—pin 2 is 4.3 v, pin 10 is 245 v, and pin 11 is 17 v. Oscillator-converter (V3, 6J6)—pin 1 is —0.7 v, pin 2 is 0 v. Audio output (V4, 6V6)—pin 1 is —138 v, pin 3 is 195 v, pin 4 is 210 v, and pins 5 and 6 are —9 v. Ratio detector-audio amplifier (V5, 6T8)—pin 6 is —0.5 v, pin 9 is 115 v. Ratio detector driver (V6, 6AU6)—pin 1 is 8 v, pin 2 is 8.5 v, pin 5 is 220 v, pin 6 is 105 v, and pin 7 is 9 v. Third video i.f. (V9, 6AG5/6BC5)—pin 7 is 1.2 v. D-c restorer-clipper-separator-amplifier (V12, 12AU7)—pins 2 and 6 are 160 v, pin 3 is 162 v. Horizontal phase detector (V13, 6AL5)—pin 1 is 6 v, pin 2 is —6 v. Horizontal sweep oscillator (V15, 6SN7)—pin 5 is 100 v. Horizontal sweep output (V16, 6BQ6-GT)—pins 3 and 4 are 210 v, pin 5 is 48 v, no voltage on pin 6, and pin 8 is 72 v. High-voltage rectifier (V17, 1B3)—pins 2, 6, and 7 are 10.1 kv.

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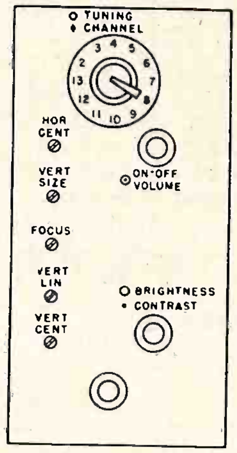

Fig. 2. Front panel layout for Models 1974 and 1975.

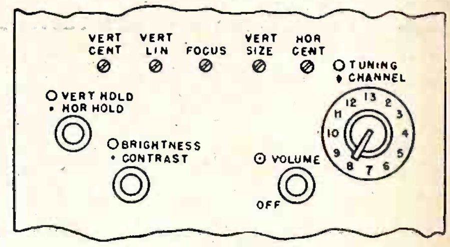

Fig. 3. Front panel layout for Series 97 and 98.

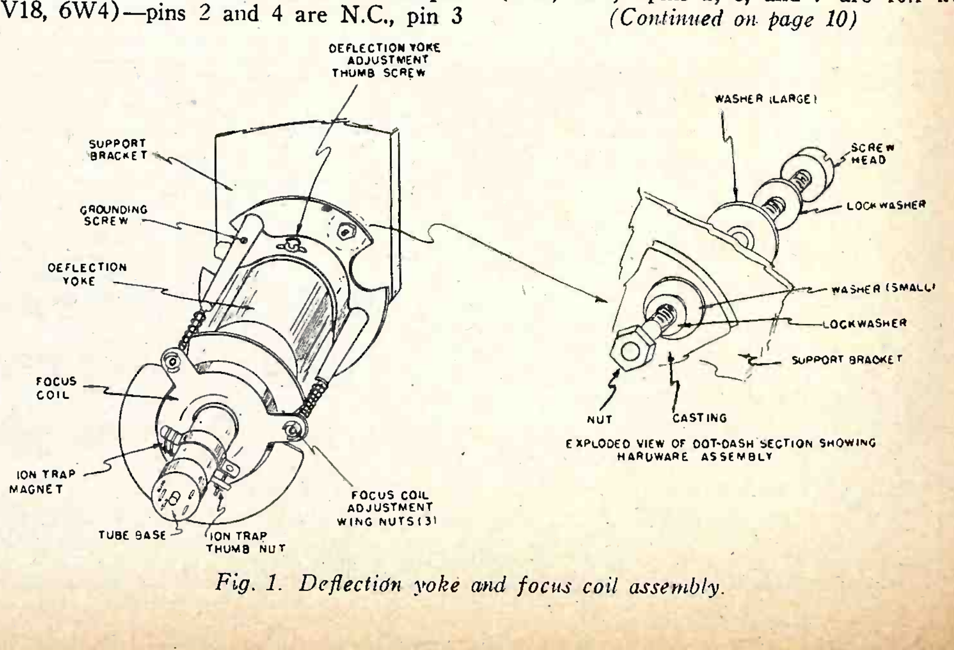

Fig. 1. Deflection yoke and focus coil assembly.

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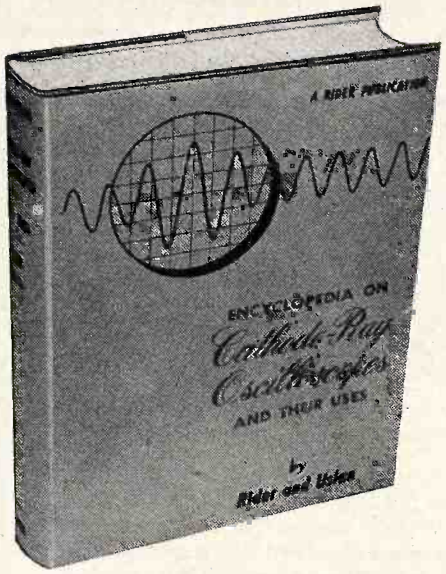

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High-Frequency Compensation
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Series Peaking
Shunt-Series Peaking
The Compensated Amplifier

Each and every chapter receives the same detailed treatment. All phases of the cathode-ray tube and oscilloscope are thoroughly discussed. Here's the complete listing of chapter headings. Note how complete and up-to-date the coverage is. In addition you are always guaranteed that a Rider text is *authentic, accurate,* and *authoritative.* Practical as well as theoretical applications to all fields assures you a working tool that will serve you continually in your daily work.

CHAPTER HEADINGS

EXPERT WITH ANTENNAS

The complete story of receiving antenna knowledge! Supplies all of the answers to WHICH type is best .... HOW to use it .... and WHAT each type can do!

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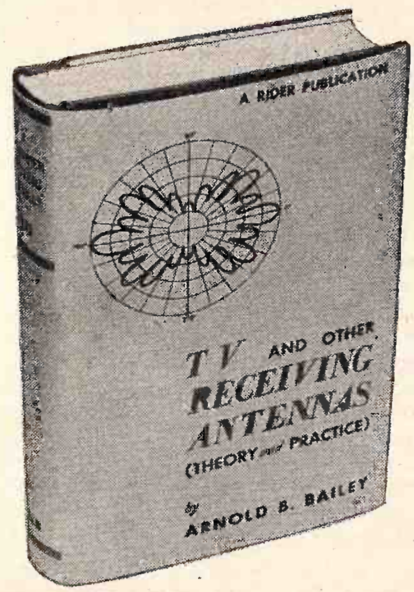

TV and Other Receiving Antennas (Theory and Practice)

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Majestic 97 and 98 Series
(Continued from page 6)

Horizontal damper (V18, 6W4)—pin is —85 v, pins 5 and 6 are 225 v.

Model 1671 uses a single 5" p-m speaker. Models 16CT4 and 16CT5 use a single 10" p-m speaker. The schematic for Series 97 and 98 is the same as that which appears on page 5-14 except for the following changes in the ratio detector driver stage. A 100-ohm resistor, R10, is inserted from the junction of R28 and C49 to pin 1 of V6, the 6AU6 ratio detector driver. Capacitor C55, the 0.02-μf capacitor connected from pin C of ratio detector transformer T6 to ground, has been relocated and now goes from pin C to pin 7 of V6, the ratio detector driver. The value of C55 has been changed to 5000 $\mu\mu$f. A 5000-$\mu\mu$f capacitor C32 has been added from pin 7 to pin 2 of V6. An 82-ohm resistor R26 has been inserted from pin 7 to R27, the 1,000-ohm grid resistor.

The schematic for models 14CT4 and 1674 is the same as that described above for Series 97 and 98 except for a change in the sweep circuit. Resistor R18, 390,000 ohms now goes from the junction of R83, 100,000 ohms, and C79, 13 $\mu\mu$f, 2 kv, to the junction of R48 (the 250-ohm resistor going from ground to pin 8 of the horizontal sweep output tube V16) and R80 (mentioned below), instead of from R83 and C79 to ground. Resistor R80, that was connected from ground to capacitor C92 (connected to pin 8 of V16), was relocated and now goes from the junction of R18 and R84 to R85 (mentioned below), and the value of R80 has been changed from 47 ohms to 470 ohms, 7 watts. Resistor R85, the 30,000-ohm resistor that was connected in parallel with R87 (30,000 ohms) going to the +360-volt buss, has been relocated. It noes goes from ground to R80, and the value has been changed to 100 ohms, 2 watts. The value of R87 has been changed from 30,000 ohms, 2 watts, to 12,000 ohms, 2 watts.

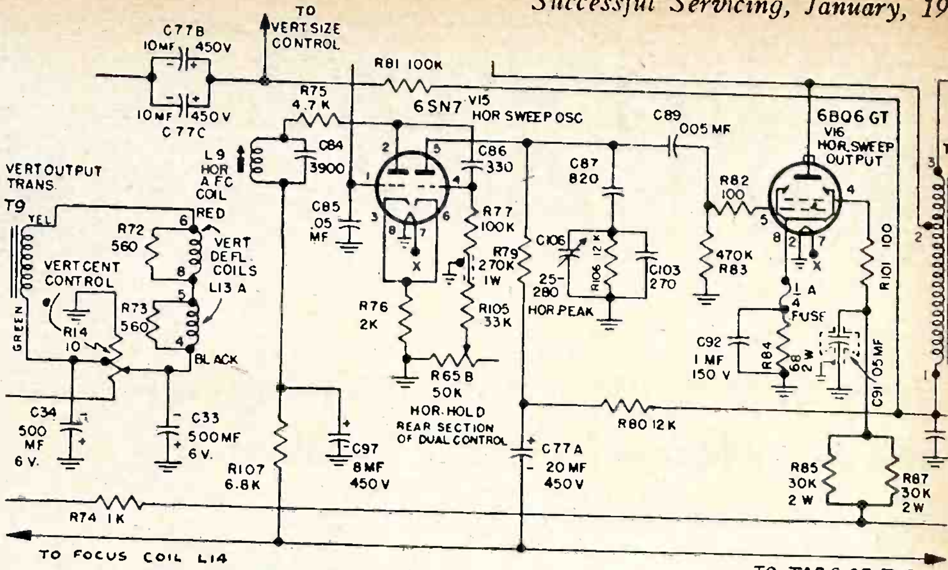


Fig. 4. Additional circuit changes for Majestic Series 97 and 98.

The schematic for Model 1900 is the same as that for the 97 and 98 Series appearing on page 5-14 except for the following changes. The value of C88, connected to pin 2 of V10A, the 1/2-6AL5 video detector, has been changed from 10 $\mu\mu$f to 15 $\mu\mu$f. Capacitor C67, 10 μf, 150 v, connected to pin 6 of the video amplifier V11 and ground has been removed, and C77C, 10 μf, 450 v, inserted in its place. The value of R108 connected to pin 8 of V12A, the 1/2-12AU7 d-c restorer sync clipper, has been changed from 8,200 ohms to 7,000 ohms; and the value of resistor R52, connected from R53 to the +360-volt buss in the same circuit has been changed from 12,000 ohms to 11,000 ohms. The value of resistor R100, connected from the junction of pin 2 of V12B and pin 6 of V12A to R116 has been changed from 1 megohm to 2.2 megohms. The 470,000-ohm resistor R116 has been deleted from the circuit and a direct connection used in its place.

Model 1900 is the only receiver which is not equipped with a built-in antenna. The two connections from the terminal strip go to the tuner. Since the built-in high-frequency antenna is not used, the 300-ohm transmission-line matching section, the two 5000-$\mu\mu$f capacitors C112 and C113 attached to this section, and the line choke L21 (that are shown in the schematic on page 5-14) are also omitted in this model. In place of C114 and C115, 5000 $\mu\mu$f, two 0.01 μf capacitors, C78 and C79 are connected from the terminals of the primary of T11 to ground. The vertical centering control R14, 10 ohms, has been relocated as shown in Fig. 4. On all other models in the 97 and 98 Series it goes from coil L12, connected to the power rectifier, to the yellow lead of focus coil L14. In Model 1900 L12 is connected directly to the junction of C81A and the yellow lead of the focus coil, and capacitor C89, 500 μf, that was connected in parallel across the vertical centering coil, has been deleted. The vertical centering coil is connected, as shown in Fig. 4, from ground to the 3.3-ohm resistor R60 (going to the —2.5-volt line). The taps from the vertical centering control are connected as in the 97 and 98 Series schematic.

Additional changes in Model 1900 are shown in Fig. 4. The lead from C77B and C goes directly to the green lead of the focus coil. The lead and the 270,000-ohm resistor R79, from the yellow lead of the focus coil to pin 5 of V15 the horizontal sweep oscillator, have been deleted. The lead from the horizontal size coil L10 and capacitor C79 to R83 have been deleted. Tap 2 or T12 goes to the 470,000-ohm resistor R96, the lead from pin 1 of V15 goes to the junction of C100 and R90, C74 goes to the red lead of the vertical oscillator transformer T8, R74 goes to the red lead of T9, and R85 and R87 go to the tap on the horizontal centering control R12.

Capehart-Farnsworth CX-33

Where vertical instability occurs, check capacitor C-230 from the cathode of the 12AU7 pre-sync separator. The lead may have been broken in shipment. Check the value of R-256 grid resistor of the 6SN7 sync-clipper to ground, and if it is higher than 3.9 megohms, replace. Check R-269, the 38,000-ohm temperature compensating resistor in series with the vertical hold control. Its normal value (at 25° C) is 38,000 ohms, plus or minus 20%. As the chassis operating temperature rises, its value will decrease to a minimum of 18,500 ohms, plus or minus 20% (at 65° C). Replace this resistor if it is out of these limits, and especially if it increases in value.

●

Emerson 66B, 86B; 611, Ch. 87B

In the Oscillator Alignment Chart, under the column headed VTVM, the VTVM goes to the junction of R41, C28 and C29 for Chassis 66B, only. For Chassis 86B and 87B, the VTVM should go to point *C*.

●

Associated Merchants 114C, 114T, 116C, 116CD, 16RCT

The service data for these models are the same as those for Bendix Models 2051, 3051, 6001, 6003, and 6100 except for the parts listed below:

Stock No.	*Description*
BZ0D50	Baffle, wood & grille cloth (16" console w/o doors)
BZ0D51	Baffle, wood & grille cloth (16" console w, w/o doors)
FW0P02	Frame, wood, 16" picture (16" console w, w/o doors)
FW0P03	Frame, wood, 16" picture (16" console comb.)
FW0P05	Frame, wood, 14" picture (14" table model)
FW0P07	Frame, wood, 14" picture (14" console)
HK0R21	Knob, door pull (16" console comb.)
HZ0H21	Handle, door (16" console w doors)
KB0B06	Knob, control channel indicator (all models)
KC0B24	Knob, control, fine tuning (all models except 16" console comb.)
KC0B24	Knob, control, fine tuning, radio tuning (16" console comb.)
KC0B25	Knob, control, hor. hold (all models except 16" console comb.)
KC0B25	Knob, control, hor. hold, TV Vol Radio Vol (16" console comb.)
KC0B26	Knob, control, contrast (all models except 16" console comb.)
KC0B26	Knob, control, TV contrast, radio tone, Radio-Off-TV (16" console comb.)
KC0B27	Knob, control, Off-On-Volume (all models except 16" console comb.)
KC0B29	Knob, control, radio bandswitch (16" console comb.)
S00D15	Socket, dial light (16" console comb.)
ZW1T09	Cabinet (14" table model)
ZW1V10	Cabinet (16" console model w/o doors)
ZW1V11	Cabinet (16" console model w doors)
ZW1V13	Cabinet (16" console comb.)
ZW1V17	Cabinet (14" console model).

Garod 12T6, 14C4, 14T2, 14T6, 16C6, Series 94

Except for cabinet designs or picture tube size, Models 12T6, 14T2, and 14T6 are the same as Model 12T2, Model 14C4 is the same as Model 12C4, and Model 16C6 is the same as 16C4.

●

Bendix 2025, 3033, 6002

These models use tuner assemblies AROTO4 (type 1), AROTO5 (type 2) and AROTO3 (type 3) as mentioned in the parts lists for the models. The schematic for AROTO4 and alignment notes are given in the service data for Models 2025, 3033, and 6002. The schematic and alignment notes for tuners AROTO3 and AROTO5 are given in the service data for Models 2051, 3051, 6001, 6003, and 6100.

RADIO FREQUENCY PROBES

(Continued from page 1)

Substituting this into the equation above:

$$Z_r = \frac{Q_r^2\ W_r\ L}{Q_r}$$

or

$$Z_r = Q_r\ W_r\ L.$$

Let us, for example, compute the resonant impedance of a tuned circuit having an inductance of 5 microhenrys, a Q of 200, and a resonant frequency of 10 megacycles. Using the equation above,

$$Z_r = 200 \times 2\pi \times 10^7 \times 5 \times 10^{-6}$$

or

$$Z_r = 62{,}800 \text{ ohms}.$$

Using the impedance just obtained and comparing it to that of the probe analyzed above, we find that the tuned-circuit impedance will be reduced by approximately 5 per cent when the probe is connected across it. The gain and selectivity of the circuit will be similarly affected.

Coil and capacitor circuits of conventional design have maximum Q values of from 200 to 300, so that a good 5-$\mu\mu$f input-capacitance probe is usable up to 100 megacycles or so. At still higher frequencies, circuits having very high Q values are encountered. A resonant line is an example of a circuit capable of building up a very high impedance at frequencies above 100 megacycles. Some newly developed high frequency diodes are available and accomplish significant reductions in the input capacitance. Some of these with their characteristics are listed in Table 1.

There are two additional considerations in the application of diodes to high-frequency measurements. In the above analysis, the effective series inductance of the probe input circuit has been neglected. Also, no mention was made of transit-time effects. Both of these limit the frequency range of a diode rectifier.

Neglecting resistance effects, a probe looks like a capacitance to the circuit across which it is connected, at all frequencies up to about several hundred megacycles, above that it looks like an inductance. This is due to the fact that, in addition to the above discussed shunt capacitance, there is always series inductance in the internal circuits of the probe. This inductance, composed of the inductance of the series leads, the series inductance of the input coupling capacitor, and the inductance of the leads inside the tube, usually varies from 0.01 to 0.1 microhenry.

As the frequency at which measurements are made is increased, the probe resonance (the frequency at which the capacitive reactance equals the inductive reactance) is approached, reached, and passed. The effect of resonance starts to show up as an increase in the reading of the voltmeter above approximately one-half the resonant frequency. The error gradually increases until, at resonance, the reading on the meter is 200 to 300 per cent higher than the actual voltage. After resonance, the error decreases rapidly and finally becomes a negative one. It should be emphasized that the resonant frequency of the whole probe is considerably below the resonant frequency of the tube alone. For instance, a tube may have a resonant frequency of 1,000 megacycles, yet the probe it is used in, even when of the best design, will resonate at 500 megacycles or less.

Other causes for error in the meter reading near resonance are the increased loading effect accompanying resonance and the transit-time effect of the diode. The transit time is the period it takes for an electron to move from the cathode to the plate of the tube. At high frequencies, the movement of electrons between the tube elements is not simultaneous with the change in grid voltage. Because of this, the relation between the plate current and the applied signal voltage is subject to error; the higher the frequency, the larger the error.

Large connecting clips and long leads may increase regeneration in circuits under test due to their inherent inductances and capacitances. At 10 megacycles, leads of No. 18 wire, or larger, and two or three inches long do not seriously disturb most circuits. At 50 to 100 megacycles, the shortest possible leads should be used as well as the smallest clips or, better still, the leads should be soldered directly to the circuit. Above 100 megacycles, even more stringent precautions should be taken such as extensive shielding of all components. Some probes have removable tips, etc., to improve their operation at very high frequencies.

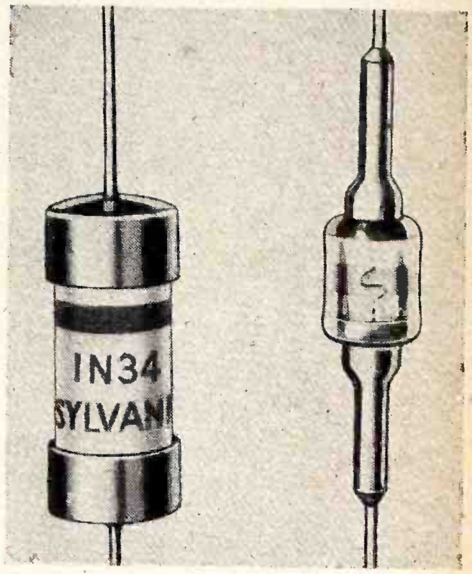
TABLE I
High Frequency Diodes Used in R-F Probes

Tube Name	Heater Voltage (volts)	Heater Current (amperes)	Input Capacitance (micromicrofarads)	Resonant Frequency (megacycles)	Tube Type
6AL5	6.3	0.3	3.2	700	Miniature
1247	0.7	0.065	0.6		Sub-Miniature
9004	6.3	0.15	1.6	850	Acorn
9005	3.6	0.165	1.0	1500	Acorn
9006	6.3	0.15	1.6	700	Miniature
2-01C	5.0	0.34	0.7	2800	Eimac

Crystal Probes

Germanium crystals are coming into considerable use for high-frequency probes. They have advantages of simplicity, freedom from contact potential, extended high-frequency response, low input capacitance, and small physical size. However, they have several serious disadvantages in that they are relatively unstable, show large variations in current due to temperature changes, are limited in voltage acceptance, and show wide variations in loss factor. The technique of manufacture as well as the general characteristics of germanium crystal diodes is being constantly improved. The best types available today are many times better than those which were available a few years ago.

Germanium crystal diodes are being made in increasingly smaller sizes. Some of the latest types are only about ½-inch in length and less than ¼-inch in diameter as shown in Fig. 3. The series inductance and shunt capacitance of these elements are correspondingly small, and the frequency response is uniform to hundreds and even thousands of megacycles. Many commercially available crystal probes do not approach the inherent frequency response of the crystal due to inadequate general probe design. This is unfortunate, since most of the real advantages of crystal probes are found only at the very high frequencies (50 megacycles and higher).



Courtesy Sylvania Electric Products Inc.

Fig. 3. Two crystal diodes of the type used in r-f probes. On the left is shown the ceramic type where the crystal is enclosed in a ceramic cartridge with metal caps. The one on the right consists of a crystal contained in a hermetically sealed glass container.

For frequencies less than 50 megacycles, the crystal probe is at best, equal to the vacuum-tube probe, and as the frequency is decreased, it becomes definitely inferior in several respects.

At low frequencies, the back resistance (the resistance at negative voltages), becomes an important characteristic. In most tube diodes it is at least high enough so that it can be neglected in comparison with the usual shunt resistance and other shunts in the circuit. That is to say, it is negligible compared to resistances of the order of 5 megohms. However, almost all germanium crystals have back resistances ranging from a few thousand ohms to a few megohms, and these must be taken into consideration at low radio and at audio frequencies. Since the back resistance is effectively in parallel with the probe input, it may seriously limit the input impedance of the probe at low radio frequencies and at audio frequencies.

It should be noted that there may be considerable variation in back resistance among crystals of the same type, even those made by the same manufacturer. The back resistance is also, generally, a function of applied voltage. A crystal which shows a relatively high back resistance on small signals may show a considerably smaller resistance on large signals. Therefore, crystals for voltmeter use should be tested carefully for back resistance and voltage tolerance.

One characteristic of crystal probes which make their use more convenient is that they have no contact potential. Thus, they may be used to feed directly into a single-ended d-c voltmeter without requiring special balancing provisions in the amplifier. They are, therefore, useful as a means for converting a d-c voltmeter of the electronic type having a high-impedance input into an a-c and r-f meter without circuit changes. Since crystal diodes are usually used as peak rectifiers, a special calibration may be necessary. For readings above a few volts, approximately correct rms voltages will be indicated by the d-c meter if a dropping resistor equal to 40 per cent of the d-c voltmeter input resistance is placed in series with the crystal probe. This resistor also functions effectively as a filter resistor to reduce the effects of a.c. or r.f. on the d-c voltmeter circuits.

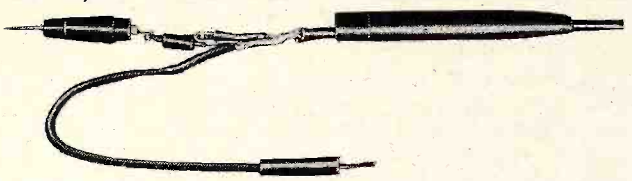
Figure 4A is an illustration of a typical crystal probe, and Fig. 4B is the circuit. The probe shown here has an input capacitance of 3.5 $\mu\mu$f, and an input resistance of approximately 0.25 megohms at 500 kc, and 25,000 ohms at 100 Mc, so that it will give accurate readings up to about 200 Mc. The probe is designed to withstand loads of 400 volts d.c. A short ground lead and prod is shown in the illustration; in most cases the ground lead ends in an alligator clip. It is important to note that when measuring high-frequency voltages. the ground lead should always be connected to a point as close to the point being measured as possible to make certain that there is an adequate return path.

The input capacitance of a crystal probe may be kept down to 1 or 2 $\mu\mu$f, so that in this respect they are inherently superior to vacuum-tube probes. Since the crystals have relatively low back resistances, no shunt load is required. This aids in keeping down the shunt capacitance and prevents detuning when they have a relatively large temperature co-measuring tuned circuits.

A serious disadvantage of crystals is that efficient of rectification efficiency. Although this affects their operation when the load resistance is low, it also shows up in high-impedance peak response circuits such as is found in a crystal-diode probe. Because the efficiency of rectification changes with the temperature of the crystal, the calibration of voltmeters using crystal probes is unreliable where relatively large changes of temperature are experienced.

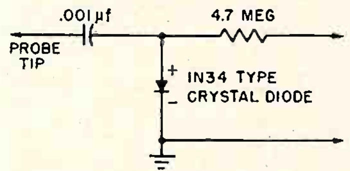
In addition to the characteristics of crystals noted above, two others should be mentioned. Crystal rectifiers have a tendency to drift under an applied voltage. Accompanying this drift there is usually a considerable change in back resistance. Also, crystals are limited in the voltage that can be safely applied to them. Some older types are permanently injured by the application of 20 to 30 volts of or more and will recover after momentary overload. Welded contracts appear to be ad-signal; some newer types will take 100 volts vantageous in helping a crystal to recover after overload.

The major considerations in the selection of a probe for any job or meter are the frequency range in which the probe will be used and the voltage the probe will be subjected to. Whereas crystal probes are useful in the upper frequencies (up to about 200 Mc), their voltage measuring range is limited to about 20-volts rms. Where it is expected that the r-f voltage to be measured exceeds this amount, it is necessary to use a probe with a conventional diode tube. In selecting a probe the features to look for are a ground lead with an alligator clip or some similar method for thoroughly fastening the ground lead to the chasis or ground, a body design which is thin and long enough to keep the hand away from high-voltage spots in the equipment being measured, accessibility of the probe to servicing, ruggedness of design, and durability.



(A)

Courtesy United Technical Laboratories



(B)

Fig. 4. In (A) is shown a breakdown photograph of a typical crystal diode probe used for r-f measurements. The input coupling capacitor is located in the head of the probe and is only partly seen. (B) is the circuit of the probe shown in (A).

Curtain Time

(Continued from page 5)

supply at once and place your order, because, judging by our experiences during the past three months, we cannot guarantee an adequate stock to every jobber.

We might mention to those men who have had some difficulty in securing their copy of our RECEIVING TUBE SUBSTITUTION GUIDE BOOK, that the first printing of 25,000 copies was completely sold out 21 days after publication. By the time this house-organ appears, the second printing will have reached our jobbers, but, as you can see, it was impossible to avoid the back-ordering situation and the delay between the first and second printings.

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John F. Rider

Erratum

In Rider's TV Manual Volume 4, Crosley pages 4-13 through 4-22 are corner carded 9-403, M3LD. These pages should read 9-409, M3LD.

Radio Changes

Farnsworth P71, P72, P73; Capehart-Farnsworth P77, P777

The failure of the changer to shut off after playing the last record may be caused by dust or foreign particles collecting between the inner tube (No. 11379) and the outer tube (No. 55334) or by corrosion on the two parts, making their movement sluggish. This may be checked easily. The weight of a 10″ record on the single speed changer and a 7″ record on the dual and triple speed changed should hold the spindle down. When the record is dropped to the turntable, the unloaded spindle should raise up approximately 1/16″. If the spindle does not raise freely, it should be disassembled and cleaned. If corrosion is discovered after disassembly of the spindle, it may be removed from the compression rod (part of No. 13674) and from the outer surface of No. 11379 by polishing with crocus cloth. The best way to remove corrosion from the inner wall of part No. 11379 is to use a pipe cleaner, rouge and a rust solvent. After cleaning thoroughly in this manner, an unused pipe cleaner should be inserted in order to remove any remaining rouge and rust solvent before re-assembly of the parts. *Do not use any lubricant.* The same will apply to the inner wall of the outer tube No. 55334. When re-assemblying, be sure that the small washer, No. 55345, between the spring collets and the rubber is installed cup side down. If installed with the cup side up, two or more records will drop. As a final note on this point, spindle corrosion has nothing whatsoever to do with failure to drop records properly, unless, of course, the spindle parts are completely "frozen."

Failure of the changer to drop records properly may be caused by a spring collet, or by improper adjustments. In checking for proper adjustment, there are three dimensions which must be observed closely. Adjusting nut No. 37344 on the bottom of No. 13674 spindle must be set so that rubber washer, part No. 62152, when fully compressed does not exceed 0.337 inches in diameter. Original engineering specifications on this part were 0.312 to 0.325. In order to operate more satisfactorily on older records, this was later increased to 0.335 to 0.337, although the original specifications should be entirely satisfactory on new records which are in good condition. If necessary to change adjusting nut No. 37344, be sure locknut No. 2015-002 is tightened securely.

●

Capehart-Farnsworth P-777

The rubber belt may run off the 78-rpm drive, due to the motor mounting frame being bent slightly, causing misalignment of the shafts. This should not be difficult to check, and if bent, to correct. If, for some reason, it proves impossible to effect permanent correction, then the only solution would obviously be replacement of the motor assembly.

Also check for excessive friction in the 45-rpm bearing. This pulley may be removed, and, if there is any tendency to excess friction, ream it out slightly, apply lubricant, wipe off the excess lubricant and replace. This may also be the correction for one of those hard to locate sources of "wow" or speed variation, noticeable especially on 33- and 45-rpm records.

RCA Ch. RC-1065C, RC-1065D

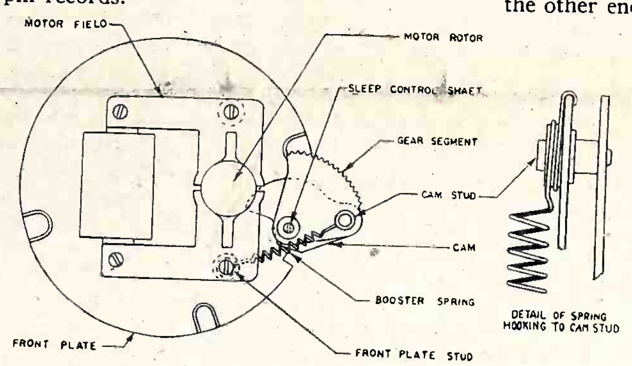
The value of capacitor C3 in these chassis is 9.1-113.8 $\mu\mu$f. C3 is located across oscillator coil L2.

●

General Electric 64, 65

Late production receivers incorporate a helical spring in the clock mechanism which provides a more positive trip action to the switch contact assembly when operating the sleep control. Failure of switch contacts to open may be due to the incomplete travel of the sleep control gear segment and cam assembly after its release by the segment gear's drive pinion. Normally, the spring action of the switch contacts through the sleep control switch lever should be sufficient to allow sleep control cam and gear segment to spring outward completely after it becomes disengaged from its pinion drive gear. However, if binding or position of control parts results in failure of segment gear and cam to swing completely outward properly releasing switch control lever and contacts, the addition of the booster spring (catalogue no. RMS-203) will provide the additional tension to correct segment gear and cam operation.

To install the booster spring, remove the case and draw the clock mechanism forward from the front of the radio cabinet, just far enough to permit installation of the booster spring. The accompanying illustration shows the position of the booster spring as viewed from the rear of the clock mechanism. One end of the spring is fastened to the cam stud, the other end to the brass front plate stud.



Rear view of clock mechanism in General Electric Models 64 and 65, showing position of booster spring.

Television Changes

Philco 10", 12", 16" Models

To greatly facilitate service bench work, cathode-ray-tube and deflection-yoke extension cables may be prefabricated from the following accessory parts:

1. Deflection plug and cable assembly, Part No. 41-3860-6 Octal Socket and Cable, Part No. 41-3777.
2. Cathode-ray-tube cable and socket assembly, Part No. 41-3772 CRT plug, Part No. 54-4571-1.

This cable is approximately 28" long.

Capehart-Farnsworth CX-33

Sometimes a "whistle" occurs in the sound and/or lines (similar to a Barkhausen effect) appear in the picture, although both symptoms do not always appear. The cause in most cases is due to the fact that C-242D (electrolytic, between —90-volt point and chassis ground) has a higher than normal impedance at the horizontal oscillator frequency. To improve by-passing at this frequency, a 0.1-μf, 200-volt capacitor is connected from the —90-volt point (junction of R-291 and R-290 near the 6BG6 tube) and chassis ground. This capacitor will be added in production.

If difficulty is encountered in accurately aligning the primary of transformer T-204, to the 4.5 Mc, it is possible that the tuning range has deviated, due to variations in material. A 5-$\mu\mu$f capacitor connected from terminals 3 and 4 of T-204 should correct this condition.

If the picture focus lacks sharpness, it may possibly be improved by connecting a 2,200-ohm 2-watt resistor in parallel with R-297 (focus control) and R-296B. This connection can be made at the terminals of the filter capacitors C-243C and C-264B. This change should be tried only after carefully making normal adjustment to obtain proper focus.

Automatic P-490, TV-707, TV-709, TV-710, TV-712, TVX313, TVX404

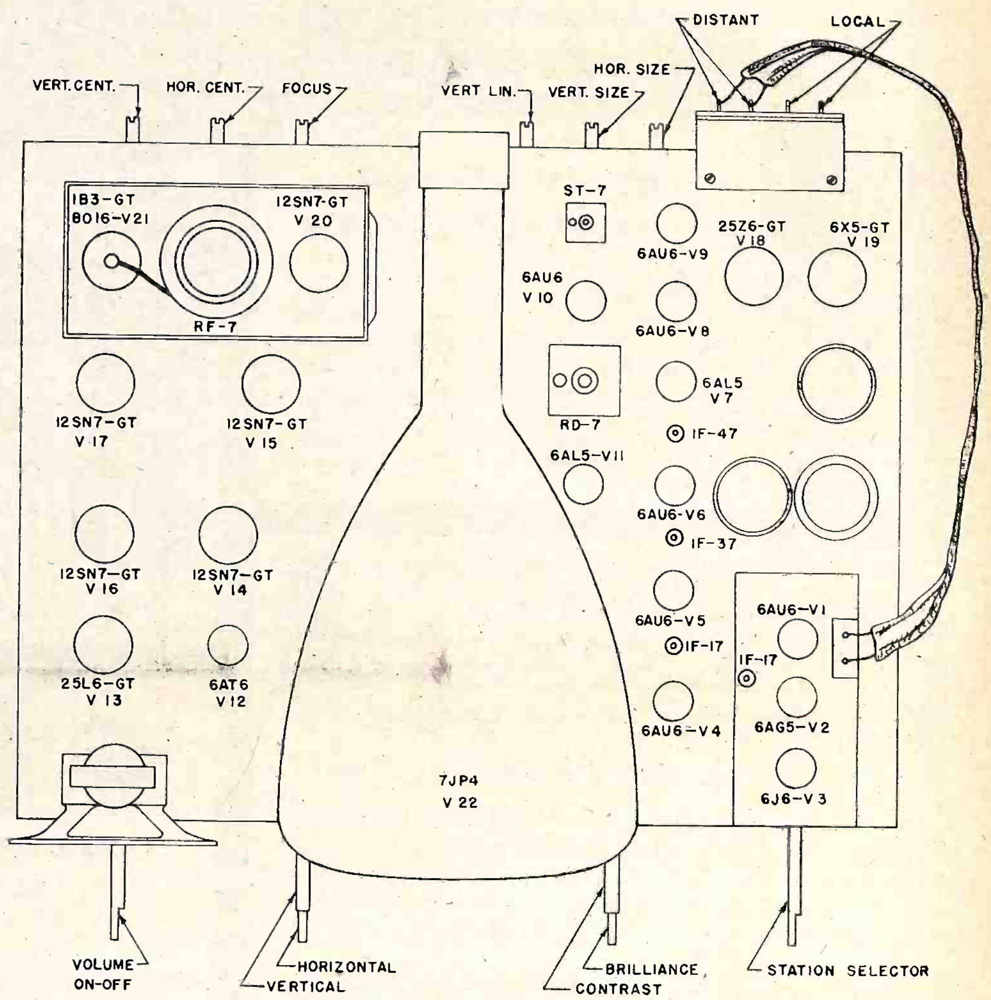
These models all use Chassis AR-TV-709. A final oscillator adjustment for each channel should be made on the receiver at the time of installation and whenever the 6J6 oscillator tube is changed. This oscillator adjustment can be made for each channel without removing the receiver from the cabinet. The following procedure should be followed in setting the oscillator frequency for each channel:

1. Turn channel selector to the required channel.
2. Remove channel selector knob.
3. Remove two wood screws securing channel selector indicating plate.
4. Locate oscillator coil to be adjusted by noting channel number on chassis around switch.
5. Insert fiber or bakelite-type screw driver carefully in slotted brass slug in oscillator coil.
6. Adjust for best compromise between picture and sound.

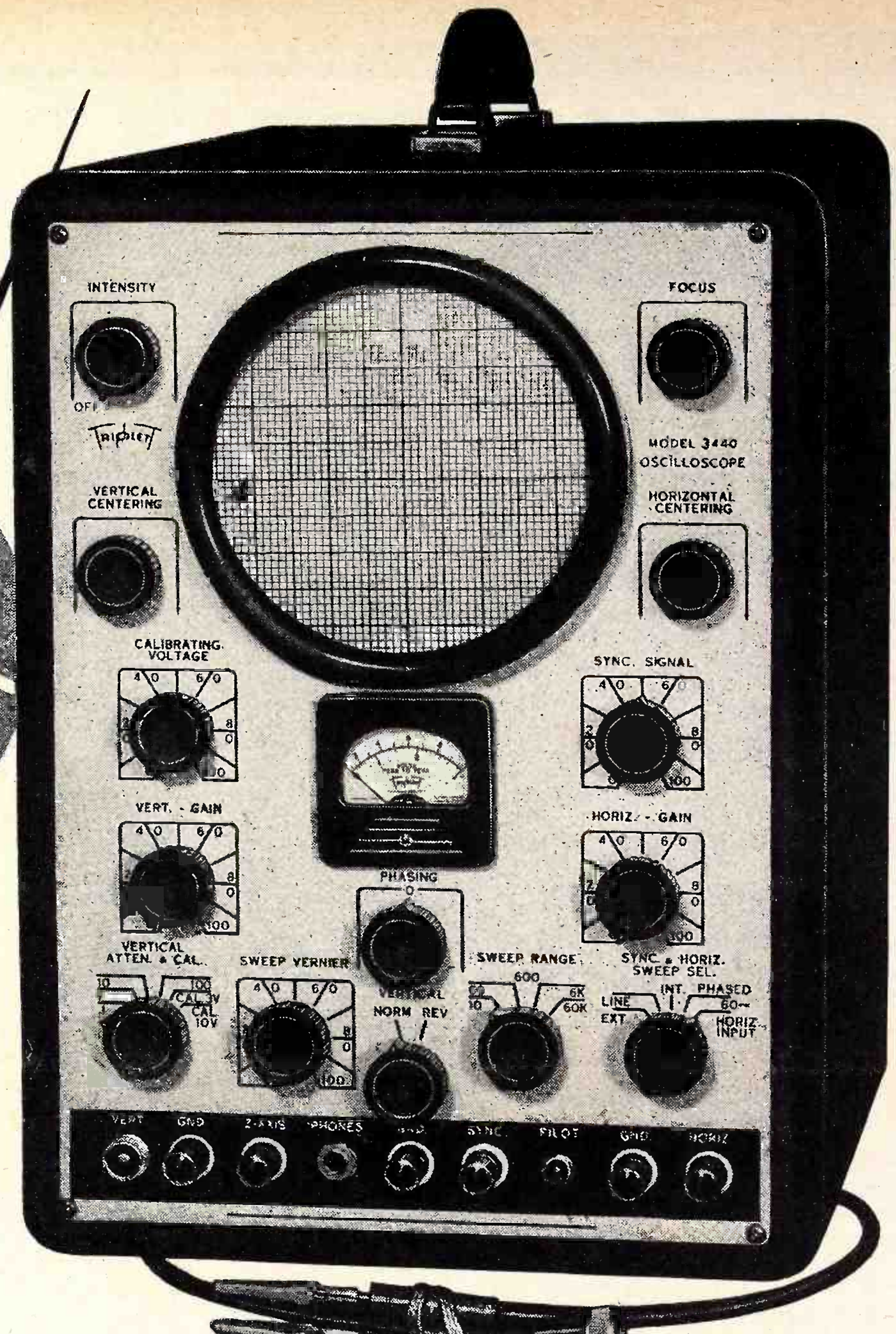
(Caution: Do not apply excessive pressure while adjusting!)

7. Turn Channel Selector switch to other channels and repeat above procedure.
8. Replace selector plate and knob.

The accompanying figure shows the tube layout.



Tube layout for Automatic Chassis AR-TV-709.



TAILORED FOR TV by TRIPLETT

WIDE RANGE 5-INCH

OSCILLOSCOPE

MODEL 3440

- *● **Provision for changing polarity—wave form shows in conventional manner.**
- *● **Calibration Meter—to measure voltage of complex wave forms in TV receivers.**
- *● **Vertical deflection sensitivity—.009 RMS volts/inch.**
- ● **Wide frequency range—20 cycles to 1 MC on Vertical—Services both TV & FM.**
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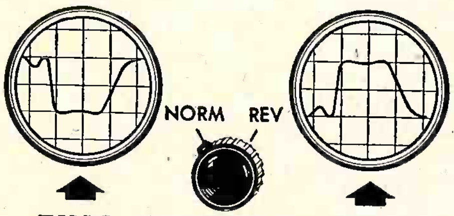

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Television Changes

Gamble-Skogmo 05TV1-43-8940B, 05TV1-43-9002B

These models are similar to Model 94TV1-43-8940A and Model 05TV1-43-9002A except for the following changes. Models 8940B and 9002B are 12½-inch television receivers, and the 9002B employs a 10-inch p-m speaker. A chassis identification number is assigned to each receiver in production. After identification number (group number) 14,200, a wiring change was made to improve the vertical sync, reduce "snow" in the picture, and to remove the tendency toward horizontal wavering. This wiring change was accompanied by a model number series change from A to B in both the 8940 and 9002 receivers.

The models 8940B and 9002B are identical to the 8940A and 9002A with the exception of the tuner input wiring and the changes listed for Model 94TV1-43-8940A. The changes in the parts lists are as follows:

Ref. No.	*Part No.*	*Description*
R4	C-9B1-74	10,000 ohms, ½ watt, 10%
	A-7M-15511-1	Trimmer plate
	A-2H-12337	Tube shield base
	A-7M-15510-1	Coil alignment strip
	A-2J-16310	Sliding contact
	A-5F-16311	Contact holder
	B-200-17086	Switch lever assembly
	C-2E-15486-1	Cover
	A-49A-15993	Take-up spring
	A-49A-15988	Tuner shaft spring
	A-55C-15496	Steel ball
	A-2C-16446	Retainer plate
	B-3B-18554	Vernier bushing
	N-23M-18571	Drive screw
	A-3C-18551	Vernier stud
	A-2M-18557	Vernier spring
	N-211-17078-1	Tuner assembly
C63	C-8F-18569	22 µµf
C85		.01 µf
C90	C-8D-17608	.005 µf
C93	C-8D-14461	.05 µf, 400 volts
C95	C-8D-17607	.02 µf
C105	C-8D-17785	.005 µf, 200 volts
C110	C-8G-11892	22 µµf, 500 volts, ceramic
C111	C-8F6-124	820 µµf
C116	A-5D-18507	.2 µµf (coil form)
C120	C-8G-11790	7 µµf, ceramic
R28-56	C-9B1-51	120 ohms, ½ watt, 10%
R32-61	A-10B-18441	Dual control, and switch
R35	C-9B1-74	10K ohms, ½ watt, 10%
R38	C-9B2-68	3300 ohms, 2 watts, 10%
R45-82, 92	C-9B1-90	220K ohms, ½ watt, 10%
R73	C-9B1-84	68K ohms, ½ watt, 10%
R50-81	C-9B1-66	2200 ohms, ½ watt, 10%
R63	C-9B2-60	680 ohms, 1 watt, 10%
R72	C-9B1-100	1.5 megohms, ½ watt, 10%
R79	C-9B1-13	1000 ohms, ½ watt, 20%
R87	C-9B1-96	680K ohms, ½ watt, 10%
R110	C-9B1-54	220 ohms, ½ watt, 10%
R103, R107, R108	C-9B4-71	5600 ohms, 2 watt, 10%
R109	C-9B1-77	18K ohms, ½ watt, 10%
R112	C-9B1-102	2.2 ohms, ½ watt, 10%
T6	C-12M-18689-1	Horizontal deflection transformer
T7	C-12A-18839	Power transformer
	B-15B-14274	Yoke socket
	A-19A-14275	Yoke plug
	A-15C-18735	1X2 tube socket
	A-5M-18733	Standoff insulator
	A-62D-18734	H-v ring
	B-201-16153	H-v cable assembly
	C-2B-18056	Shield can
	R-24D-18709	Cabinet (9002)
	C-18A-18157	10" PM speaker (9002)
	C-23J-18722	Back cover (9002).

National TV-1601, TV-1602, TV-1625, TV-1627

Models TV-1602 and TV-1627 are similar to Models TV-1601 and TV-1625. The following changes have been made in these National models.

In the audio output circuit (V-22), capacitor C-101, that went from pin 8 to the junction R-106, R-107 and R-108, has been relocated and is now inserted in the lead from pin 8 to R-109. The value of C-101 has been changed from 0.05 µf to 10 µf. R-106 has been removed from its position (from the junction of C-101, R-108, and R-107, to socket X-1 pin 6) and relocated in parallel with C-101. The value of R-106 has been changed from 330,000 ohms to 270 ohms. Resistor R-107, 180,000 ohms, has been removed. In the audio amplifier circuit, R-104, 470,000 ohms, connected from pin 8 of V-21B to R-105, 470,000 ohms, has been removed from the circuit. The value of resistor R-99 connected to pin E of transformer T-5, has been changed from 220 ohms to 120 ohms.

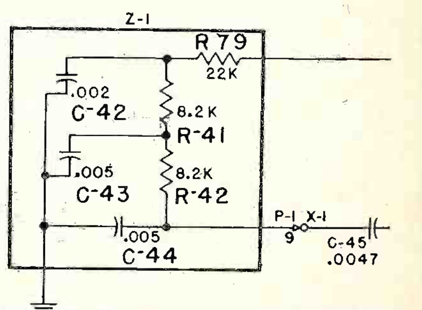
In the ratio-detector driver circuit resistor, R-96, that went from pin 7 of V20 to R-97, 1000 ohms, has been relocated and now is connected in parallel with capacitor C-89, 0.005 µf, from pin 6 to R-97. The value of R-96 has been changed from 68 ohms to 18,000 ohms. Capacitor C-88, 0.005 µf from pin 7 to R-97 has been removed from the circuit and pin 7 is tied directly to R-97.

The value of resistor R-13, connected to the junction of pin 6 of V-3 the first video i.f. and L-8, has been changed from 100 ohms to 220 ohms. The value of resistor R-31, connected to pin 4 of V-8 the video amplifier, has been changed from 120 ohms to 100 ohms. A centering control, R-41, 8200 ohms, has been added from L-18 to socket X-2, pins 2-10. Tap 6 of transformer T-4 is connected to pin 7 instead of to pin 5 of socket X-2. The pins for the X-2 P-2 connections (in the lead that goes to the horizontal deflection coil), are designated 2-10.

Resistor R-48, 470 ohms, has been removed from across the focus control. Capacitor C-58, 20 µf, connected to the vertical size control tap now goes to pin 7 of socket X-2, instead of to ground. A 47-µµf capacitor, C-44, has been added from pin 4 of the horizontal sweep oscillator to ground. Resistor R-62, 22,000 ohms, is now connected to pin 7 of socket X-2 instead of to fuse F-2. The value of R-64 connected to pin 5 of the horizontal sweep oscillator has been changed from 220,000 ohms to 150,000 ohms. The value of resistor R-68, connected to pin 8 of the horizontal sweep output, has been changed from 1500 ohms to 5600 ohms.

The 1000-µµf capacitor C-49, going from tap 5 to tap 8 of T-4, the horizontal output transformer, has been replaced by a direct connection. The value of R-73, connected to pin 2 of the horizontal phase detector, has been changed from 4700 ohms to 10,000 ohms.

The 22,000-ohm resistor, R-79, connected from pin 3 of the sync amplifier-splitter to pin 9 of socket X-1 is now included in Z-1 which is shown in the accompanying diagram.



Circuit changes in National Models.

Connection P-1 X-1 is now located as shown in the accompanying diagram, and pin of the sync amplifier-splitter is connected directly to the 22,000-ohm resistor of Z-1. The value of C-43 has been changed from 0.002 µf to 0.005 µf.

Crosley 1951 Models

To reduce hum or buzz, make certain that electrolytic capacitor C120 has a good ground connection by soldering a wire from the chassis to one of the ground lugs on the capacitor. This should be done on all sets contacted in the field to prevent trouble developing as the set ages. Later production sets have the capacitor grounded in this manner. Make certain that the sections of this electrolytic capacitor are properly connected as shown by the schematic. If the shield in back of the contrast control has been removed, be sure to replace it. On sets equipped with a resistor-capacitor unit (Part No. W-149881), dress the coupling capacitor C122 as far as possible away from the resistor-capacitor unit. If necessary, remove resistor R141. Adjust the ratio-detector transformer (T102) secondary for minimum hum or buzz, while the set is tuned to the station. Only a slight adjustment is required. If the screw is turned too far, the result may be weak or distorted audio output. Check over-all alignment.

To retard the accumulation of dust collecting on the glass area behind the metal bell of 16" and 19" (metal picture) tubes, this area was sprayed with silicon lacquer. In some cases this lacquer was hydroscopic, permitting moisture to be absorbed which resulted in corona on the glass portion of the tube, or arcing. When this condition is experienced, thoroughly clean all the silicon lacquer from the tube with acetone.

Motorola Ch. TS-67A

The TS-67A differs from the TS-67 in several tube types and tube functions. A 6AG5 sync segregator was added to replace the sync clipper V-6B (½ 6AL5). The latter became the first of a new two-stage agc circuit. The second stage is a 6AU6 which replaces the 12AX7 of the TS-67. In addition, a sensitivity control was added to the agc circuit. The control, located on the top of the chassis, permits the agc to be pre-set at the desired level. The function of V-15A ½ 6SN7GT) was changed from a squelch diode to a pulse shaper. The chassis contains 24 tubes plus a 19" picture tube.

Information on the TS-67 apply to television chassis TS-67A with the following addition:

Sensitivity Control

The sensitivity control determines the level of the agc curve and is adjusted as follows:

1. Turn receiver to channel on which the strongest signal is received.
2. Turn sensitivity control until the video amplifier overloads (picture starts to tear), and then back off until the picture is stable. The sensitivity control is located on approximately top center of chassis.
3. The audio should also be checked during this adjustment. Although there may be no evidence of tearing in the picture after step 2, the signal may still be strong enough to cause sync buzz. If this is the case, back off the sensitivity control until sync buzz disappears.

Alignment

The alignment procedure for chassis TS-67A is the same as that for TS-67, with the following exceptions:

4.5 Mc Trap Alignment

In step 1. Connect the signal generator to the grid, pin 2 or 5, of the 2nd video amplifier tube V-8 (6AS5).

In step 2. Remove the agc tube V-10 (6AU6).

In step 3. Connect 3 volts of battery bias between the plate, pin 5, of the agc tube V-10 (6AU6) and ground. The positive terminal of the battery is on the plate.

In step 8. Connect an oscilloscope between chassis and the plate, pin 5, of the 1st video amplifier V-7 (6BA6).

The following parts should be added to the parts list. For components not mentioned here, refer to TS-67 Replacement Parts List.

Ref. No.	*Part No.*	*Description*
C-6	21R2748	Mica, 220 μμf, 300v
C-14	20A18355	Trimmer, mica, 1.3-15 μμf
C-31	21K700671	Ceramic, 1.5 μμf, 500v (temp comp)
C-36, 68, 69, 72	21K77373	Ceramic, 47 μμf 500v
C-38	21K470329	Ceramic, 30 μμf 500v
C-65, 71	21R6642	Mica, 68 μμf 500v
C-107	23A790904	Electrolytic, 50 μf 25v
C-129, 130	8R9854	Paper, 0.1 μf 200v
C-132	23K700624	Electrolytic, 1 section; 140 μf, 150v
C-133	8R9856	Paper, 0.25 μf 200v
C-134, 140	8R9874	Paper, 0.1 μf 600v
C-135	21K792438	Ceramic, 100 μμf 3000v
C-136	8R9867	Paper, 0.002 μf 600v
C-137	8R9834	Paper, 0.01 μf 600v
C-138	8R9870	Paper, 0.01 μf 600v
C-139	8R9867	Paper, 0.002 μf 600v
C-141	21R6554	Mica, 100 μμf
R-2	6R3949	470, 20%, ½w
R-13	6R2013	27,000, 10%, 2w
R-18	6R6117	5600, 10%, ½w
R-35	6R6432	270, 10%, ½w
R-52	6R5660	180, 10%, ½w
R-97	6R2004	8200, 10%, ½w
R-100	6R6969	2200, 10%, ½w
R-101	6R6229	1000, 10%, ½w
R-104	6R6487	39,000, 10%, ½w
R-105	6R5697	560,000, 10%, ½w
R-111	6R5621	10, 10%, ½w
R-115	6R6299	10,000, 10%, 2w
R-120, 121	6R6004	1 megohm, 20%, ½w
R-122	6R6075	100,000, 20%, ½w
R-123	6R6056	47,000, 20%, ½w
R-124	6R2029	3300, 10%, 2w
R-125, 135	6R5631	120,000, 10%, ½w
R-126	18K700626	Sensitivity control, 2000 ohms
R-127	6R2098	22,000, 10%, 2w
R-128	6R6032	470,000, 20%, ½w
R-129	17K700623	Wire wound, 10,000, 10%, 5w
R-130	6R6080	4700, 10%, ½w
R-131	6R6320	10,000, 10%, ½w
R-132	6R6407	220,000, 10%, ½w
R-133	6R6429	820,000, 10%, ½w
R-134	6R6497	3.3 megohm, 10%, ½w
T-9	25C792563	Power Transformer (optional to 25K792564)

Part No.	*Description*
35A792756	Cushion, focus coil
14K700013	Insulator, high-voltage: small (on high voltage compartment shield)
13D792141	Mask, picture tube: rubber (for 19AP4 only)
13K700678	Mask, picture tube: rubber (for 19AP4A only)
2S7048	Nut, hex: 10-32 x 5/16 stl; cad pl (25K792564 power transformer mtg)
2S7003	Nut, hex: 8-32 x 5/16 stl; cad pl (25C792563 power transformer mtg)
5S7720	Rivet: .088 x ⅛ stl; pol nkl (sensitivity control mounting)
9K700041	Socket, picture tube: 5-pin; with leads
9A780011	Socket, tube: miniature 7-prong (V-10 and V-25)
31A791402	Strip, terminal: 6 ins, #4 gnd; ⅜" spacing
31K4573	Strip, terminal: 3 ins, #3 gnd; ½" spacing
31K31217	Strip, terminal: 1 ins, #2 gnd; ⅜" spacing
9K484579	Wafer, electrolytic mtg: cad pl
4K74579	Washer, fibre (R-91 mtg)
1X792530	Lead, phono: with plugs
1X600118	Lead, phono motor: with receptacle and plug
28K71775	Plug, 1-pin: insulated; ⅝" (short plug on phono lead)
28K22183	Plug, 1-pin: insulated; 15/16" (long plug on phono lead)
28K30736	Plug, 3-pin: 9/16" pins (on phono motor lead)
9A600040	Receptacle, plug: 0.640 diameter, 5/16" contacts (phono motor receptacle)
15K74443	Shell, receptacle: with insulator (on phono motor lead)
15A690616	Shell, receptacle: ⅝" diameter; with insulator on phono motor leads).

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Majestic 12T6, 14C4, 14T2, 14T6, 16C6, Series 94

Except for cabinet designs or picture tube size, Models 12T6, 14T2, and 14T6 are the same as Model 12T2, Model 14C4 is the same as Model 12C4, and Model 16C6 is the same as 16C4.

●

Crosley 1950 Models

To reduce carrier hum at high contrast, on some sets C122 was changed from 100 μμf, 500 v (Part No. C-137727-108), to 47 μμf, 500 v (Part No. 137727-112. R134 was changed from 220,000 ohms ½ w (Part No. 39373-80), to 47,000 ohms, ½ w (Part No. 39373-67). R138 was changed from 56,000 ohms, 10%, 1 w (Part No. 39374-134) to 27,000 ohms, 10%, 1 w (Part No. 39374-130).

This change will not show any great effect if the transmitting station is at fault, or the receiver is improperly aligned, or when receiver is operated at normal setting of the contrast control.

●

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† The Rider Manual Page Numbers given under Television Changes are for Rider TV Manuals. The volume number is the number preceding the dash. Volume numbers preceded by an asterisk (*) apply to the 8½" by 11" page size Manual only.

The Rider Manual Page Numbers given under Radio Changes are for Rider AM-FM Manuals. The volume number is the number preceding the dash.

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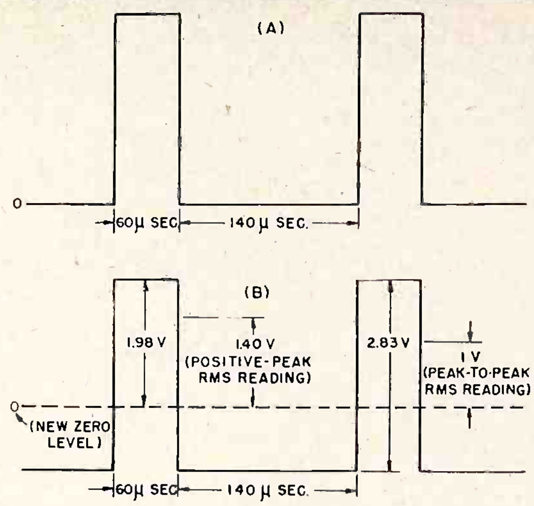


Fig. 1. (A) Shown here is a positive pulse of 2.83 volts amplitude and 5,000 cps repetition rate. (B) The relationship of the meter reading to the voltage waveform under measurement. The rms values are not accurate for this waveform because the meters were calibrated using the sine wave.

THE use of pulse signals for synchronization in television reception, in microwave and radar applications, and in industrial and scientific analysis calls for new techniques in voltage measurement. Vacuum-tube voltmeters are admirably suited for this work because of their fast response and freedom from lag, high input impedance, range flexibility, and low loss characteristics. The application of VTVM's for pulse measurements will be discussed here. The use of the slide-back v-t voltmeter for pulse measurements was covered in Chapter 7.

The most useful v-t voltmeters for pulse measurements are those having peak-to-peak response. Although the dials of these meters are generally calibrated to give rms values (for sine waves), they can be converted to give the peak values of the pulse being measured with relative ease. For example, to find the value of the pulse signal shown in Fig. 1A, which is a positive pulse of 2.83 volts with a repetition rate of 5,000 cycles per second, we need to remember that a positive-peak-response meter, calibrated to read in rms volts, gives the positive peak divided by 1.414. Similarly, the peak-to-peak-response meter calibrated for rms readings gives the peak-to-peak reading divided by 2.83. However, because the input to v-t voltmeters is capacitance coupled, the d-c component is removed, leading to a displacement of the zero level as shown in Fig. 1B. This does not affect the reading of the peak-to-peak voltmeter since it responds to the difference between the positive and negative peaks and not between the zero level and the positive peak as does the positive-peak-response meter.

To obtain the total amplitude of the pulse therefore, using the peak-to-peak voltmeter, it is only necessary to multiply the rms reading on the meter by 2.83. For the positive-peak meter however, we must consider the displacement of the zero level. To obtain the total amplitude of the pulse on such a meter, we must first find the positive pulse amplitude, then the negative pulse amplitude, and, finally, the sum of the two. For the example given (60 μsec pulse with 140 μsec interval between pulses), and by referring to Fig. 1B, we find that the *positive* amplitude is:

$$1.40 \times 1.44 = 1.98 \text{ volts.}$$

To find the negative peak we use the simple proportion: the pulse duration divided by the interval between pulses (both in similar time units) is equal to the negative peak value (unknown) divided by the positive peak value. For example:

$$\frac{60\ \mu\text{sec}}{140\ \mu\text{sec}} = \frac{\text{Negative Peak Value}}{1.98 \text{ volts}}$$

with the result that:

$$\text{Negative Peak Value} = \frac{60\ \mu\text{sec}}{140\ \mu\text{sec}} \times 1.98 \text{ v}$$

$$\text{Negative Peak Value} = 0.85 \text{ volt.}$$

Therefore, the total amplitude of the pulse is:

$$1.98 + 0.85 = 2.83 \text{ volts.}$$

Similarly, when measuring negative pulses allowance must be made for the rms calibration of the meter as well as for the characteristics of the meter itself. By this we mean the response of the meter, whether peak-to-peak or positive peak, and the capacitance-coupling effect. For example, in measuring the negative pulse shown in Fig. 2A, a positive-peak-response meter gives 0.5 volt, which is the positive-peak amplitude divided by 1.414.

(Continued on page 10)

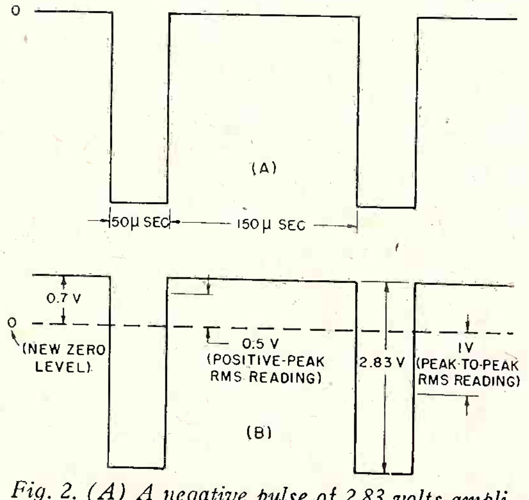


Fig. 2. (A) A negative pulse of 2.83 volts amplitude and 5,000 cps repetition rate. The pulse duration is 50 microseconds, the time between pulses is 150 microseconds. (B) Shown here is a negative pulse after passing the capacitor-coupled input of the v-t voltmeter. Note the displacement of the zero level due to the averaging action of the input capacitors.

Editor's Note: This article is an abridgement of the section on pulse measurements appearing in chapter 12, entitled "Applications of Vacuum Tube Voltmeters," from VACUUM-TUBE VOLTMETERS, a book to be published soon by John F. Rider Publisher, Inc. This book is a revision of the former book VACUUM-TUBE VOLTMETERS by John F. Rider.

Television Changes

DuMont Savoy, Winthrop, Ch. RA-103C; Wellington, Ch. RA-104A

The Winthrop model uses chassis RA-103C and is identical to the Savoy except for the cabinet. The a-m tuners used in these models are similar to that which is used with RA-103 except for the differences mentioned below. The accompanying diagram shows bottom view of the Wellington tuner, Chassis RA-104-A3.

Capacitor C419, has been deleted and a 0.005-µf capacitor C423 has been added in its place. The following table gives the resistance measurements (all readings to ground). An RCA Model 195-A Voltohmyst was used.

Tube	V401	V402	V403	V404	V405	V406
1	2M	20K	1.5M	0	0	Nc
2	0	0:5	0	10M	0	Inf
3	0	0	0	0	Inf	Inf
4	.05	.05	.05	600K	Inf	109
5	Inf	Inf	Inf	600K	470K	Inf
6	Inf	Inf	Inf	Inf	Nc	116
7	0	1.5M	0	.05	.05	Nc
8				0	220	Inf

All readings in ohms, K = thousand, M = million.

The resistance readings of the coils are as follows. All readings are in ohms and were taken with coils disconnected.

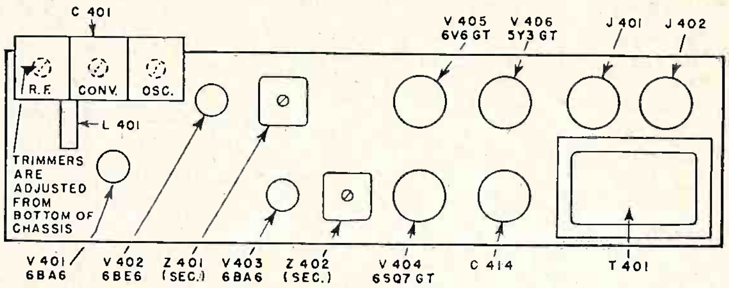
Ref. No.	Resistance Pri.	Resistance Sec.
L401	8.0	
L402	40.0	9.0
L403	.5	5.0
Z401	13.0	12.5
Z402	13.0	12.5
T401	5.5	200.0

The parts list is the same as that for the tuner in the RA-103 except for the following changes:

A-m Tuner RA-104-A3 Wellington

Ref. No.	Part No.	Description
C401	03018551	Capacitor, variable, 3 sections
C403	03012730	Capacitor, ceramic, 47 µµf, 10%, 500 v
C416, C417	03018570	Capacitor, fixed, paper, 0.02 µf, 20%, 600 v
C419	Delete	
C423	03001570	Capacitor, paper, 0.005 µf, 25%, 600 v
J403	09015921	Connector Asy
P402	09006472	Connector Asy
R422	01007070	Resistor, variable, 1 megohm, 20%, ¼ w
S401	05003821	Switch a-m tuner.

repaired with a small soldering iron with the tip turned down and filed into the shape of a small screw-driver blade. Run one-quarter inch of solder, a type that has a very small diameter, down the screw-driver blade to the eyelet. This operation should be done with the rotor blades turned out as far as possible, and should be necessary only for the oscillator and mixer coils. It is unnecessary to remove the tuner from the television chassis to carry out this soldering operation; however, with the round tube models, it may be necessary to bend the point of the iron at a right angle in order to place the tip of the iron in the correct position.



Bottom view of the DuMont Wellington tuner, Chassis RA-104-A3.

The parts list for the Savoy and Winthrop tuners are the same as for the Wellington except for the following:

A-M Tuner RA-103A

Ref. No.	Part No.	Description
C401	3C-12714	Capacitor, variable, 3 section
C419	3-1439	Capacitor, fixed, ceramic, 330 µµf, 20%, 350 v
J403	9-486	Connector, asy, female, 2 contact
P402	9-501	Cable asy, male, 2 contact
S401	5C-12914	Switch.

A-M Tuner RA-103C

Ref. No.	Part No.	Description
C401	3C-12714	Capacitor, variable, 3 section
J403	9A-13516	Connector asy
P402	9B-13514	Connector asy
S401	05003251	Switch.

If, after soldering, arcing occurs between the rotor plates, spring the rotor plates slightly away from the coil. Springing of this rotor plate slightly will not alter the operation of the tuner unit.

The above operation should be used only in those tuners exhibiting intermittent qualities or those tuners exhibiting insensitivity of either high or low bands.

A defective receiving tube in this tuner unit can also account for this intermittent condition.

Meck Service Hints

Failure of the 1X2 high-voltage rectifier is directly due to a variation of current demand of individual cathode-ray tubes. The operating potential of the 1X2 tube can be lowered by grounding the high-voltage filter capacitor. At the time of replacing a 1X2 with an open filament, remove the black lead from pin 5 (plate) of the 6W4 socket. This lead which ties to the base of the high-voltage capacitor should then be grounded on the 6W4 socket.

The TT-10006 tuner depends upon a variable inductance for its correct operation. This variable inductance unit consists of the carriage, mounted on top of the tuner, the stator coil assembly, and the rotor plate assembly. The carriage is the "U" shaped bracket which holds the copper rotor plate assembly and the rotor shaft. The stator coil assembly consists of six printed coils which are molded on linen bakelite strips. The center of each printed coil is terminated in a tinned eyelet which extends through the linen bakelite.

The tuner manufacturer used tinned dipped eyelets for this coil center; however, a small quantity of electro-tinned eyelets were inadvertently used in one production run of the tuners. Higher temperatures are required to flow solder on electro-tinned eyelets than on the dipped tinned eyelets.

Tuners in which this bond between the coil center and the eyelet is intermittent, can be

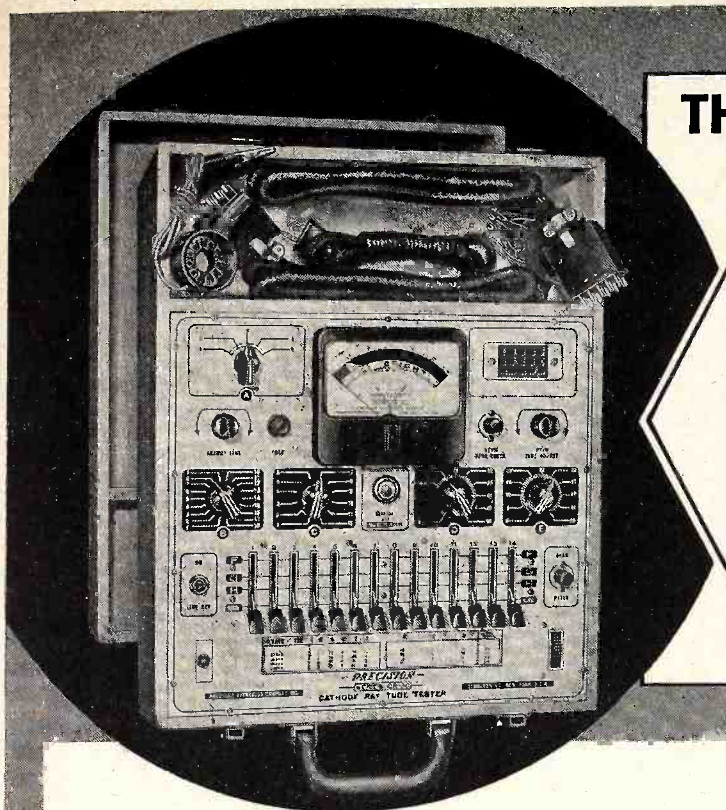
DuMont RA-105, RA-106

To reduce flicker the following changes have been made in the RA-105, RA-106 main chassis. The flicker referred to results from periodic line voltage fluctuations such as are produced by reciprocating pumps and like devices. This change is sometimes referred to as an "anti-flicker circuit."

Pins 6 and 7 on V206-B, the d-c restorer tube, are removed from ground. Pins 6 and 7 on V206-B are connected together and a lead is run from pin 6 of V206-B to pin 8 of V207, thus returning the d-c restorer to the cathode of the third video amplifier instead of to ground. Capacitor C224 is changed from 0.1 µf, 200 volts, ±25%, to 0.5 µf, 400 volts, ±25%. The part number of the new capacitor is 03014260. Capacitor C224 is connected between pin 11 of the cathode-ray tube and the junction of R235 and C220A. Resistor R347, 470 ohms, 1 watt, 10% (part number 02034730) is connected in series between R232 and R321.

Erratum

The following corrections should be made on page 57 of the RECEIVING TUBE SUBSTITUTION GUIDE BOOK under the section dealing with the 6A7 tube: Under the column headed Substitution, the 7J8 should be changed to read 7J7. Under the column headed Circuit Changes Necessary, cap to 6 should be added. The schematic of the original tube socket should have a grip cap.



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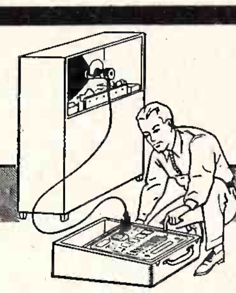

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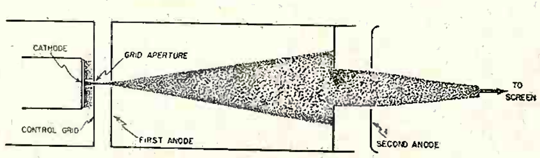

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Vol. 12 FEBRUARY, 1951 No. 4

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E. H. BEAUMONT, Associate Editor

CURTAIN TIME

TV Color

It is almost a certainty that the issue of color TV for the public is dead for the duration. As we see it, this means for quite a few years, although it is reasonable to suppose that some research will be carried on in connection with color television for Armed Forces activities. At the same time it makes sense to assume that rotating wheels will not be viewed with favor in Military or Naval installations where space and weight always are premium items.

As we have said once before, we are not concerned with who develops the final color system or whether it is the product of many brains from many different laboratories, but it is a certainty that when it does appear it is going to be all-electronic. If the technological advances made during the last war, are an indication, advances which gave birth to an acceptable television system in 1946 as demonstrated by the public's reaction during the four years which followed, it is safe to say that advance in research in connection with defense needs during the next few years will more than likely result in a completely finished color system for public use when these hectic days come to an end.

As far as the public is concerned, it is quite fickle. Their interest in color was strong when the discussion was rampant, but now that shortages of all kinds are developing, the draft is being stepped up, and the defense effort is advancing rapidly, these latter items have absorbed their interest and color television is secondary in their minds. Let it be that way—"Requiescat in Pace."

Civilian Defense

This does not bear any relation to the technical phases of the radio and television industry. Much is being said about the apathetic response to civilian defense recruiting. It seems to us that a very good advertising medium is going to waste. We are referring to the test patterns which appear on TV screens. As a rule these show a station pattern, and occasionally a product advertisement on a station pattern; and when station breaks are made they similarly display the station letters and sometimes feature a forthcoming program.

It seems to us that reference to civilian defense might well become the theme of all television station break picture, test patterns, and the like. A statement as "join your local civilian defense effort" would easily fit on all patterns or station call letter announcements. Since the time devoted to these kinds of images is not being timed except perhaps for what program advertising it may have, substituting a civilian defense pattern for a forthcoming program announcement could well prove fruitful to the civilian defense authorities in all communities located in TV areas. It would cost the station nothing to do so.

TV facilities exist in the majority of industrial areas; and it is reasonable to suppose that these regions form prime target areas, therefore civilian defense efforts in such places are extremely important. Since the population of these areas devote most of the TV hours to television viewing, television as a medium of recruiting personnel for civilian defense efforts in the industrial areas of the nation seems like a more expedient medium than radio.

Television Servicing Licensing in New York City

A new licensing bill covering television servicing in New York City has been introduced to the City Council. It arrived at our desk just as this issue was being closed. Inasmuch as the analysis of such a bill justifies more than a casual reading, we shall reserve our comments concerning it until the next issue. In a way it resembles a bill which was originally introduced in Detroit, Michigan, but never was passed because of an understanding which was reached by the television servicing industry and the City Fathers of that city. Let us hope that a similar situation will eventually develop in New York City.

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PRICE CHANGES

It has always been the policy of John F. Rider Publisher, Inc., to keep the prices of our manuals and textbooks as low as possible and still give our customers the soundest texts with greatest coverage of the subject. We depend upon volume to make up for the low list prices.

Since January 1946, we have tried to hold the line in prices as much as possible and we have had relatively few increases in the list prices of our publications. During the year 1950, especially since the start of the Korean situation, we have faced many serious price increases in production and labor costs. We have absorbed all of these but, since Korea especially, they have become very bad, so much so that we are forced to raise the list prices of our TV Manuals 1, 2, 3, 4, and 5. We are trying to hold the line on the regular AM and FM Rider Manuals. As much as we regret that the increase in prices is necessary— it is unavoidable and, beginning with February 1, 1951, Rider TV Manuals 2, 3, 4, and 5 are priced at $24.00. TV 6, which will appear in March 1951, is priced at $24.00. Rider TV 1 is priced at $19.80.

We do not know how long we will be able to maintain our regular prices on the AM-FM Manuals. There are no price changes scheduled at the moment on Rider textbooks, but if the price of production continues increasing as it has for the past year, a change in those prices is imminent.

Television Changes

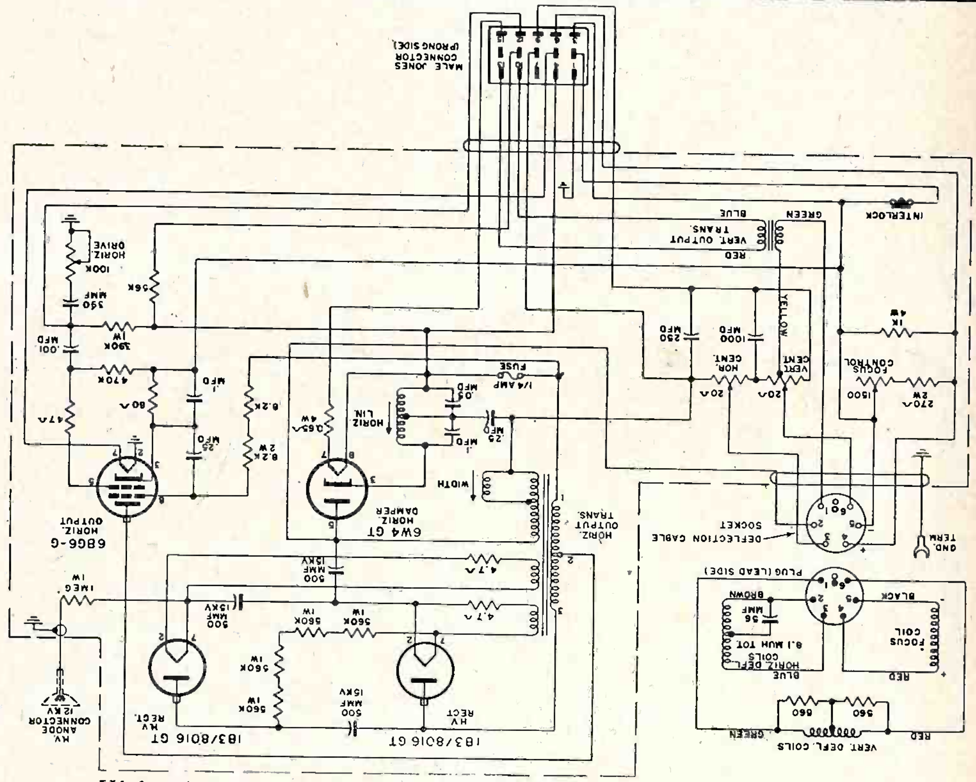
Farnsworth, Capehart 462P12, Ch. C-267

Model 462P12 is a television console receiver using a chassis which is essentially the same as the U-12 television chassis as used in Farnsworth Model 461P with exception that a 6K6 power output tube has been added to the main chassis. Pin 5 of the 6K6 is connected to capacitor C24, the 0.005-μf capacitor connected to the plate of V7, the 6T8 tube. A 270,000-ohm resistor is connected from pin 5 to the junction of ground and pin 8 and a 10-μf capacitor is connected from the same junction to pin 4. Pin 4 of the 6K6 goes to terminal 1 of the speaker socket. A 0.003-μf capacitor is connected from the plate of the 6K6 ground. Pin 3, the plate of the 6K6 also goes to terminals 2 and 3 of the speaker socket.

In addition to this change, the only other ways that this chassis differs from that of the 461P is that the a-c input to the audio amplifier A-13 and A-13 have been deleted, and a 4,700-ohm resistor has been added in parallel across R89, the 1,800-ohm cathode resistor for V22 (6V6 vertical output tube).

The cabinet used in this model is essentially the same as the 461P, with exception of the new "truncated circle" mask. The picture-tube aperture on these cabinets has been revised to accommodate the new mask. Another cabinet variation from the 461P is that the speaker panel is not hinged, since the new location of the h-v chassis (near the rear of the cabinet) permits adjustment of the secondary controls (on the h-v chassis) from the rear of the cabinet. The picture tube used in this model is the Farnsworth type "125" (12½ inch).

In current production of this model, the h-v supply chassis C-271 will be used. The C-271 chassis is electrically the same as the h-v supply C-263, used in the 461P. The only variation is that the power cable, deflection cable and the anode connector cable have all been shortened. This was brought about by the new mounting position of the h-v chassis in the cabinet. The chassis is located near the rear of the cabinet (looking at the cabinet back) in the lower right hand corner. Later production of this model will replace the C-271 h-v chassis with the new h-v chassis C-266, which is shown in Fig. 1.



High-voltage Chassis C-266 used in Capehart-Farnsworth Model 462P12.

The focus coil used in the 462P12 is a combination p-m and electromagnetic coil (part No. 650001A-2) in which the p-m section has been partially demagnetized. These coils will be stamped in red with the letter "D" to identify them as demagnetized. Other new parts in the 462P12 are:

Part No.	*Description*
850044B	Plastic truncated aperture mask
750059B	Safety escutcheon glass.

●

Wilcox-Gay G-414, G-614, G-624, G-914, Series 97 & 98

Wilcox-Gay Models G-414 and G-614 are the same as Majestic Models 14CT4 and 16CT4, respectively. Wilcox-Gay Models G-624 and G-914 are the same as Majestic Models 1674 and 1974, respectively. All data and change notices on the above mentioned Majestic Models also apply to the Wilcox-Gay Models.

Capehart-Farnsworth CX-33

The following component changes have been made in current production of these chassis:

1. C-253 has been changed from 0.0047 μf to 0.001 μf, and R-282 has been changed from 560,000 ohms to 100,000 ohms. This change was made to improve phasing in the horizontal afc circuit.

2. R-268 has been changed from 100,000 ohms to 47,000 ohms to improve the operation of the vertical hold control.

3. C-261, the h-v filter capacitor, incorrectly shown on the schematics as being connected to pin 2 of the 1B3GT/8016 h-v rectifier, should be shown connected to pin 7 of this tube.

4. C-257 has been changed from 0.001 μf to 0.0047 μf.

5. R-272 has been changed from 470,000 ohms to 560,000 ohms.

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MARCUS H. MOSES, B.S. (E.E.)

Electronical Technician
35 Hamilton Place, New York 31, N. Y.

January 18, 1951

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Television Changes

Bendix 2060, 2070, 7001

These models are similar to Models 2051, 3051, 6001, 6003 and 6100, with the exception of the changes to follow. A 0.01-μf capacitor C51 has been added from pin 2 of the 6AS5 audio output tube (V8) to the junction of R28 and pin 9 of V7. A resistor R78 (in some sets this is a 1.2-megohm resistor) has been added from pin 2 of V8 to R28. The value of R78 in some cases is 1.5 megohms. By changing R78 the grid bias to the 6AS5 tube is increased, causing a decrease in the plate current. This decrease in plate current decreases the cathode voltage. The cathode is connected directly to the B+ bus for the plates of the i-f stages, thereby maintaining B+ at approximately the correct value of 150 volts.

In some models a 6SQ7 is incorporated as a first audio stage. This change requires a slight physical modification to the main chassis, but no change in components. It is possible that some sets may use a 6AG5 as the sync limiter stage (V10), and a 6AG5 or 6BC5 as the second i-f amplifier stage (V4).

In code G and subsequent chassis, the 6T8 ratio detector (V7) is replaced by a 6AL5 and either a 6AQ6, 6AV6, or 6AT6 (1st audio amplifier). The circuit modifications that have been made for this change are shown in Fig. 1.

On a limited number of sets the 19T8 is to to be used as a ratio detector and first audio stage. This will necessitate using a special power transformer with a 19-volt filament winding. The part number for this transformer is NH265085-1. On the upper end bell of the transformer this number will be stenciled.

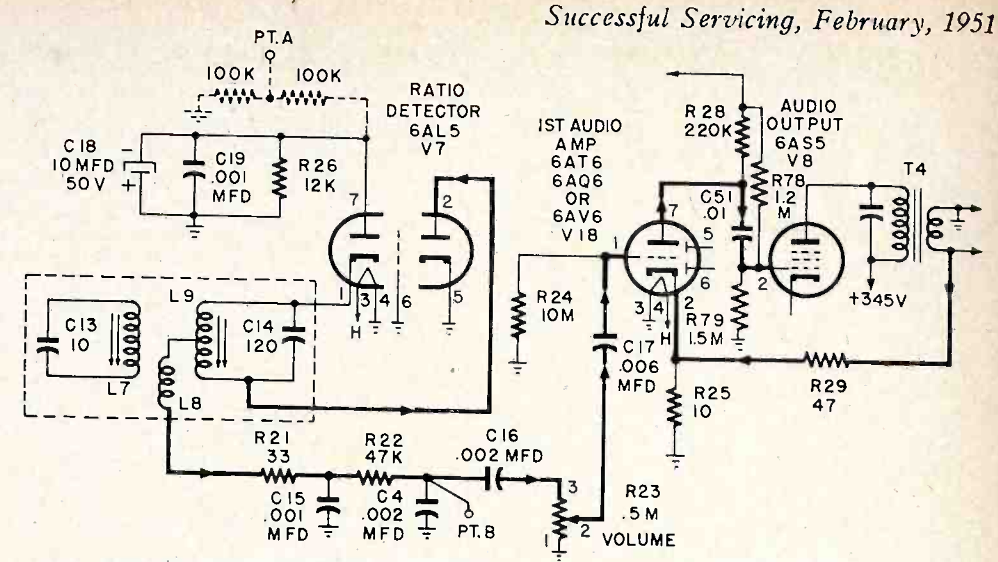

Fig. 1. Circuit modifications made in Bendix Models 2060, 2070, and 7001.

The i-f frequencies should be as follows: L452 should be 25.1 Mc, T1 should be 23.6 Mc.

The diagram for the adaptation of the color plug to these receivers is shown in Fig. 2. The contrast control must be at *minimum* when the converter is used.

The parts list for Models 2070 and 7001 is the same as that for Models 2051, 3051, 6001, 6003, and 6100 except for the parts lilsted below:

Ref. No.	*Part No.*	*Description*
C21	CE1T11	Capacitor, electrolytic, 2 μf, 50v
C34	CC6A30	Capacitor, ceramic, 47 $\mu\mu$f, 500v
C51	CP3S31	Capacitor, paper, 0.01 μf, 400v
R5	RC22A101M	Resistor, comp, 100 ohms, ¼ w
R6	RC22A103K	Resistor, comp, 10,000 ohms, ¼ w, ±10%
R8	RC22A155M	Resistor, comp, 1.5 megohms, ¼ w
R28	RC22A224M	Resistor, comp, 220,000 ohms, ¼ w, ±20%
R63	RC22A124K	Resistor, comp, 120,000 ohms, ¼ w, ±10%
R78	RC22A125M	Resistor, comp, 1.2 megohms, ½ w
R79	RC22A155M	Resistor, comp, 1.5 megohms, ¼ w
T2	T10D28	Transformer, i-f output detector
L12	LCOF06	Coil, focus.

Part No.	*Description*
BZOB33	Back, cabinet cover (7001)
BZOB40	Back, cabinet cover (2070)
BZOD48	Baffle, wood (7001)
BZOD52	Baffle, wood and grille cloth (2070)
DSOS01	Dial, scale, channel selector
FWOP10	Frame, wood, 17" picture (7001)
GZOS05	Glass, safety (7001)
GZOS08	Glass, safety (2070)
HCOM15	Cup, metal, back cover
HCOS92	Clip, spring, dial retainer
HWOS05	Washer, spur
HZOC12	Catch, bullet (7001)
HZOG01	Glide, metal (7001)
HZOH04	Hinge, door (7001)
HZOH22	Handle, door (7001)
JP2007	Jack, plug 2 contact
JP2011	Jack, plug 2 contact w/cable
KBOB07	Knob, control, channel selector
KCOB30	Knob, control, Off-On-Volume
KCOB31	Knob, control, contrast
KCOB32	Knob, control, hor. hold
KCOB35	Knob, control, fine tuning
SP4003	Speaker, 4 x 6 PM oval (2070)
SPOR02	Speaker, 10" PM round (7001)
ZW1V19	Cabinet, console with doors (7001)
ZW1T12	Cabinet, table model (2070).

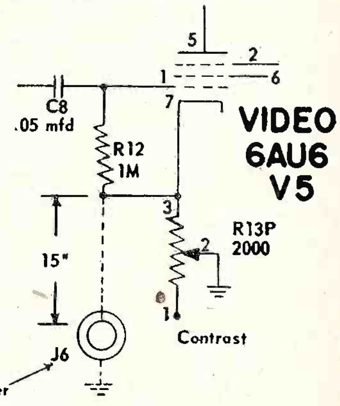

Fig. 2. Color converter connection for Models 2060, 2070, and 7001.

Westinghouse H-305C8, H-306C8, Ch. V-2137-4

The first two items in the parts list for these models should be changed to read as follows:

Part No.	*Description*
V-5982-2	Antenna assembly, a-m loop
V-598604	Antenna assembly, f-m loop.

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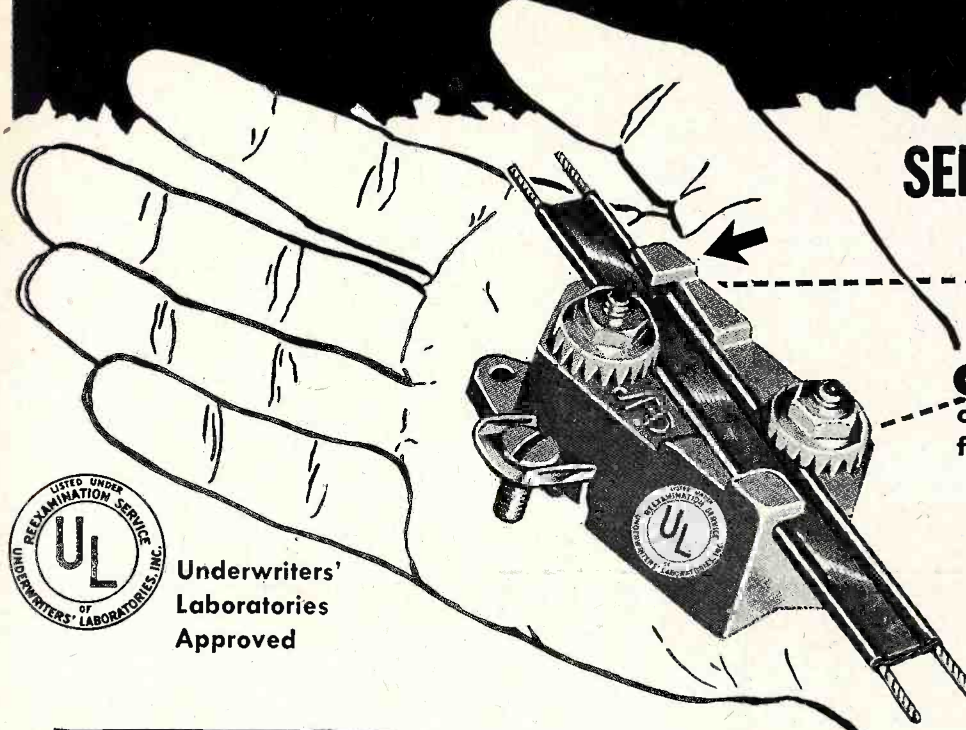

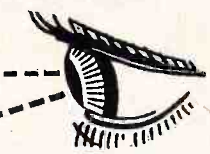

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PULSE MEASUREMENT WITH VACUUM-TUBE VOLTMETERS

(Continued from page 1)

This is not the rms value of the pulse since the pulse is of square wave form, whereas the rms values were calibrated according to the meter's response to a sine wave. The peak-to-peak amplitude of the negative pulse may be obtained from the reading on the positive-peak-response meter by first finding the positive peak as follows:

Positive Peak $= 0.5 \times 1.44 = 0.707$ volt.

Then the negative-peak value is obtained by equating the interval between pulses divided by the pulse duration to the negative peak value divided by the positive peak value. Using the values for these quantities from the above example, we get the equation:

$$\frac{150\ \mu\text{sec}}{50\ \mu\text{sec}} = \frac{\text{Negative Peak Value}}{0.707\ \text{volt}}$$

or:

$$\text{Negative Peak Value} = \frac{150\ \mu\text{sec}}{50\ \mu\text{sec}} \times 0.707\ \text{v.}$$

Negative Peak Value $= 2.12$ volts.

The peak-to-peak value equals the sum of the positive peak and the negative peak:

Amplitude of Negative Pulse $=$

$2.12 \times 0.707 = 2.827$ or 2.83 volts.

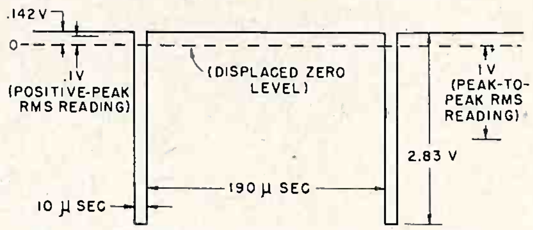


Fig. 3. A 5,000-cps negative pulse of 10 microseconds pulse duration. Note how close the positive-peak-response rms-calibrated reading is to the zero level.

If a peak-to-peak-response meter is used, the total amplitude of the negative pulse is found by multiplying the rms meter reading by 2.83 as in the case for the positive pulse.

It should be obvious from the above discussion that the peak-to-peak-response meter is preferable to the positive-peak-response meter not only because of the simplicity of calculation of peak-to-peak pulse amplitude associated with the former, but also because measurement with the positive-peak meter becomes inaccurate as the pulse duration time is decreased. This may be seen by comparing the rms readings of the positive-peak-response meters in Fig. 2B and Fig. 3. With the values shown in Fig. 3, the positive-peak meter would read 0.1 volt, which is generally the low limit of sensitivity of such meters. The shorter the pulse duration of a pulse signal, the smaller is the rms meter reading of the positive-peak vacuum-tube voltmeter, in other words, the zero line approaches the base line.

Figure 4 shows a simplified circuit of a "kickback" high-voltage power supply of the type found in many television receivers. A high-voltage pulse is developed in the primary of the transformer during the flyback period and is rectified by the high-voltage rectifier tube. Resistor *R1* and capacitors *C1* and *C2* filter the rectifier output to remove a-c ripple and supply a substantially pure d-c voltage to the second anode of the picture tube. *C2* may be an actual capacitor but is more likely to be the capacitance between the second anode and the external coating on the tube, which is grounded.

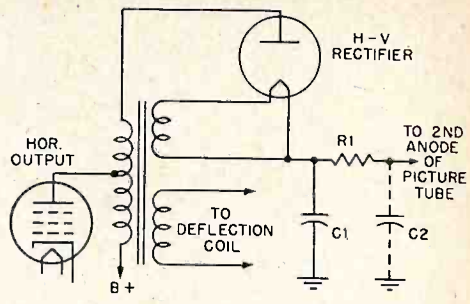


Fig. 4. Simplified schematic of a high-voltage power supply of the "kickback" type used in television receivers.

From the circuit it can be seen that the high-voltage pulse, shown in Fig. 5, will appear at the plate of the high-voltage rectifier and also at the plate of the horizontal output tube. The frequency of this pulse is 15,750 cycles per second and its amplitude is in the neighborhood of 5,000 volts. This type voltage is one that can be measured with a great degree of accuracy by a v-t voltmeter of the peak-to-peak type using a multiplier.

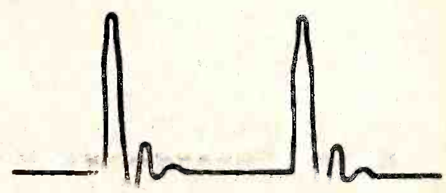
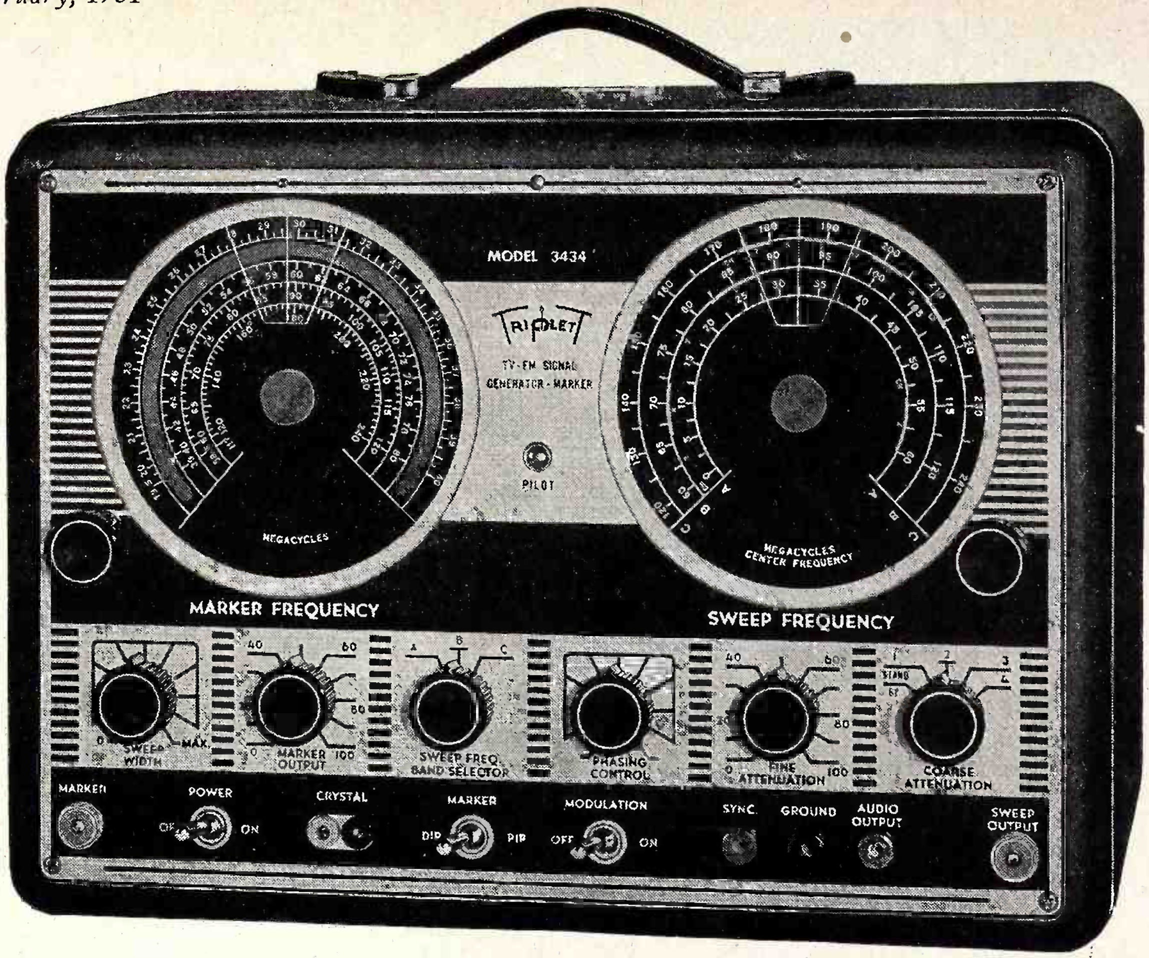


Fig. 5. High-voltage pulse obtained at the plate of the horizontal output tube and the plate of the high-voltage rectifier shown in Fig. 4.



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• **MARKER FREQUENCY** 19.5 to 40 MC (fundamental). 39 MC to 240 MC (harmonic)	• **AUDIO:** 400 cycles

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In the case of intermittent tuner trouble in 6J6 or early 12AT7 tuners, it has been found that the eyelet shown in Fig. 1 is not making a good electrical connection with the ground bracket at high frequencies and causes an intermittent condition. If the tuner is suspected

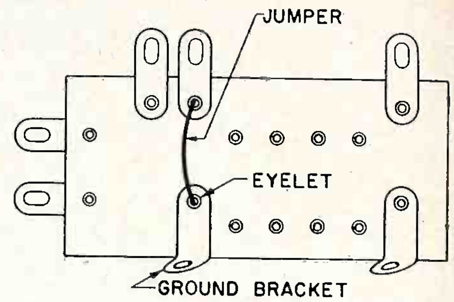

Fig. 1. Inside view of tuner terminal board.

to be causing an intermittent condition, it is suggested that the steps listed below be followed to eliminate the possibility of a poor ground connection:

1. Remove the tuner cover.
2. Place a hot soldering iron at the point shown in Fig. 2.

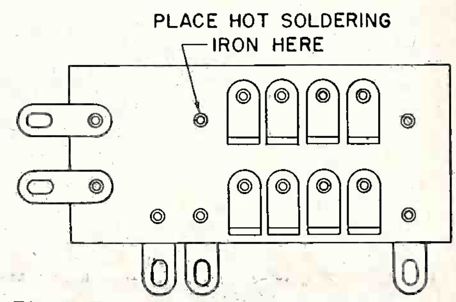

Fig. 2. Front view of tuner terminal board.

3. Allow sufficient time for heating.
4. Run solder between eyelet and ground bracket shown in Fig. 1.

An intermittent condition can also be caused by defective contacts and open or high resistance ground or coil solder connections.

Bendix 2070, 7001, T170

Model T170 is similar to Models 2070 and 7001. The following changes have been made in these models. A 0.02-μf capacitor (C52, Part No. CP4T34) has been added from the junction of pin 7 of V5 (6AU6 video) and R12 the 1-megohm resistor (going to pin 1 of V5) to the color converter jack J6. The value of R79, from ground to pin 2 of the audio output tube V8 (6AS5), has been changed from 1.5 megohms to 1.2 megohms.

The Parts List for Model T170 is the same as that for Models 2070 and 7001 except for the changes listed below:

Stock No.	*Description*
BZOB41	Back, cabinet cover
BZOD49	Baffle, wood and grille cloth
DSOS01	Dial, scale, channel selector
FPOP09	Frame, plastic, 17" picture
GZOS09	Glass, safety
HCOM15	Cup, metal, back cover
HCOS92	Clip, spring, dial retainer
HWOS05	Washer, spur
HZOG01	Glide, metal
JP2007	Jack, plug 2 contact
JP2011	Jack, plug 2 contact w/cable
KBOB07	Knob, channel selector control
KCOB30	Knob, off-on-volume control
KCOB31	Knob, contrast control
KCOB32	Knob, hor. hold control
KCOB35	Knob, fine tuning control
SP4003	Speaker, 4 x 6 p-m oval
ZWIT14	Cabinet, table model
JR1S00	Jack, receptacle & contact, color converter (J6).

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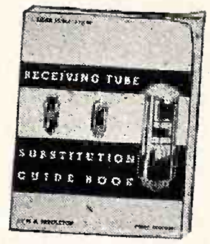

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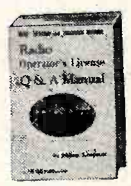

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Radio Changes

Westinghouse H-316C7, H-317C7, H-326C7, Ch. V-2136-1, V-2136-1A

Model H-317C7 is the same as Models H-316C7 and H-326C7 except that an additional by-pass capacitor of 0.003 μf, 0.004 μf, or 0.007 μf, is connected across the output section of the filter capacitor C36 in some chassis. This additional capacitor is used in cases where the output section of C36 has excessively high impedance at radio frequencies. The chassis parts are listed in the H-316C7 service data. The cabinet and miscellaneous parts are the same as those for Model H-316C7 except for the parts listed below:

Part No.	*Description*
V-5982-4	Antenna assembly, a-m loop
V-6120	Background, dial
V-1223-2	Cabinet (blond)
V-9075-2	Clip, spring (ball head strike)
V-8568	Doors (matched pairs)
V-8569	Drawer, record changer (complete less hardware)
V-9832-2	Grille assembly, panel
V-9091-3	Hinge, L.H.
V-9091-4	Hinge, R.H.
V-10122-1	Pull, door
V-3246	Socket, octal wafer
V-9076-2	Strike, ball head.

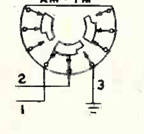
In later production of the V-2136-1 chassis, the following changes were incorporated:

1. The oscillator injection capacitor (C24), which is connected between the top of the f-m oscillator coil and the top of the f-m—r-f coil, is changed in value to 0.68 μμf (Part No. V-5658-4). This change improves the mixer efficiency and increases the sensitivity.

2. A 0.05-μf, 200-volt capacitor C44 (Part No. RCP10W2503M) is inserted in the line that extends between point "Y" on the schematic diagram and the selector switch SW2. In addition, R34 (Part No. RC20AE224M), a 220,000-ohm ½-watt resistor, is inserted between the selector switch side of C44 and ground. These changes improve the tuning characteristics of the f-m band.

Some chassis used in later production of the subject models are designated V-2136-1A. These chassis are the same as the V-2136-1 except for the differences mentioned in the following paragraphs. These chassis use a 19T8 tube in place of the 12AL5 and 12AV6 tubes used in the V-2136-1 chassis. Tap 1 of ratio detector transformer T3, that was connected to pin 1 of the 12AL5, is now connected to pin 3 of the 19T8; and tap 4 of T3 is connected to pin 1 of the 19T8. A 33,000-ohm resistor R35 (R5, 22,000 ohms which was in this position has been removed), is connected from pin 2 to pin 7 of the f-m detector 19T8. C30 is connected across R35, and the two 100,000-ohm resistors used for alignment purposes only are still connected to the junction of C30 and R35. R24, the 220,000-ohm resistor that was connected to C30 and the junction of R25 (4.7 megohms) and R2 (470,000 ohms), and the lead from R24 to SW2 have been deleted. Pin 6 of the 19T8 is connected to tap 1 of T6, the 2nd i-f—a-m transformer. Pin 7 is grounded; pin 9 goes to the junction of R31 and C19C and D; and pin 8 goes to the junction of R10 and C19A. R25, that was connected from R3 to the junction pin 6 of the 12AV6 and R24 and R2, has been deleted. R2, 470,000 ohms, is now connected from ground to the junction of R19 (the 2.2-megohm resistor going to tap 4 of 1st i-f—a-m transformer) and R6 (the 47,000-ohm resistor going to tap 2 of T6). C13, the 0.05-μf capacitor that went from terminal lug 4 of the antenna terminal board, is now located from tap 4 of T5 to ground, in place of C16, the 0.01-μf capacitor which has been removed. The positions of C31 and C19B have been reversed. Capacitor C31, 150-μμf, is now located from ground to tap 2 of T6, and capacitor C19B, 220 μμf, is now located from ground to the junction of R2, R6, and R19. A 470,000-ohm resistor R33 (Part No. RC20-AE484K) and a 100-μμf capacitor C43 (Part No. RCM20B101K) have been added in parallel from tap 3 of T2 to ground.

The accompanying diagram shows switch SW2. Only the middle wafer contains changes that have been made in the V-2136-1A chassis.



Switch SW2 used in Chassis V-2136-1A.

The first and last wafers are wired as shown in the schematic for V-2136-1. (The numbers in the illustration were added for reference only.) Contact 1 goes directly to B and A of C33, and thence to L10. Contact 2 goes directly to R20, 47 ohms, and thence to pin 7 of 12BE6. The 47,000-ohm resistor R26 and the 0.001-μf capacitor C2 connected to R20 have been deleted from the circuit, and contact 3 is grounded.

In the 50L6/GT output circuit capacitor C4, 0.005 μf, is connected to pin 8 rather than to pin 4. The 3.3-megohm resistor R27, that is connected from terminal lug 4 to SW2 in the V-2136-1 chassis, has been deleted in the V-2136-1A chassis.

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Sparton 130, 132, 135, 139, Ch. 5A10

Inability to procure type 12AV6 tubes in production quantities for the above models using radio chassis type 5A10 made it necessary to make the following production substitution. In the future, these models will use a 12AT6 tube in the 2nd detector and avc circuit in place of the original 12AV6 as shown in the schematic diagram. As these tubes are interchangeable, a change in other components of the circuit is not necessary.

Sparton 1080, 1081, Ch. 9L8A

Model 1080 in mahogany and Model 1081 in blond are radio-phonograph combinations using radio chassis type 9L8A. This nine tube-superheterodyne radio receiver incorporates f-m and a-m broadcast bands. Chassis 9L8A is used with television Model 4900TV and complete service data for this radio chassis were issued with the service data for the 4900TV.

INDEX OF CHANGES

† The Rider Manual Page Numbers given under Television Changes are for Rider TV Manuals. The volume number is the number preceding the dash. Volume numbers preceded by an asterisk (*) apply to the 8½" by 11" page size Manual only.

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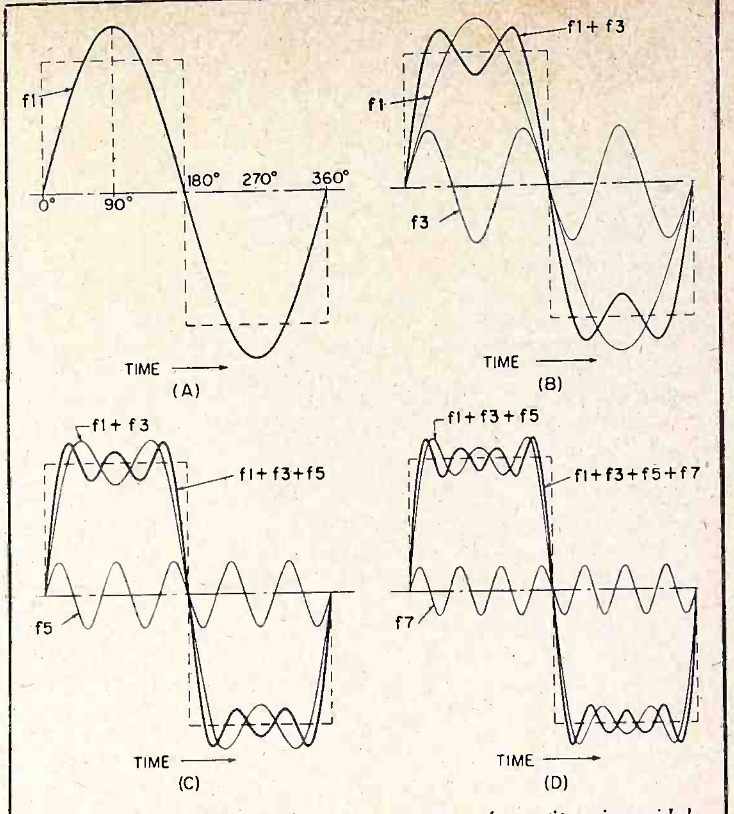

Fig. 2. Composition of a square wave from its sinusoidal components.

FREQUENCY REQUIREMENTS OF OSCILLOSCOPE VERTICAL AMPLIFIERS

by John F. Rider

AN IMPORTANT capability of the vertical amplifier is the frequency over which the amplifier will operate. Although not generally identified as such, every amplifier is, in a way, a filter system, because it will neither pass all frequencies, nor will it amplify equally those frequencies which it will pass. The pass-band of the vertical amplifier in an oscilloscope has a great bearing on the utility of the device. This is true, regardless of voltage waveshapes which will be fed into the amplifier, but most significantly relative to nonsinusoidal waves, the investigation of which is today one of the paramount fields of utility of the oscilloscope.

Equipment cost is very closely tied to bandwidth; the higher the bandwidth, usually the greater will be the cost of the device. One of the very significant changes which has taken place in the design of cathode-ray oscilloscopes during the past fifteen years has been a gradual increase in the bandwidth of the amplifiers in the device, especially the vertical amplifier. The need for this improvement originates in the waveforms which have become standard in many kinds of equipment. We are speaking about square, sawtooth, triangular waves, etc., or combinations thereof. Many modern devices and systems make use of such waveforms for operation or testing.

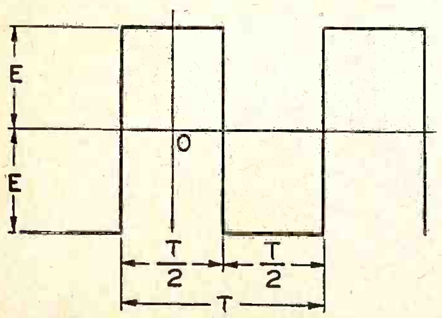

Fig. 1. Conventional square wave.

Importance of Harmonics

The amplification of a sine wave involves only one frequency at a time, and the frequency limits of an amplifier are dictated simply by the range of individual frequencies which are to be raised in level. It is not so when working with nonsinusoidal waves. The relationship between the fundamental frequency of a square wave (as indicated in Fig. 1), for example, and the frequency range of an amplifier is of some importance; of much greater import, however, is the frequency range of the harmonics of that fundamental and the pass-band of the amplifier. For example, in Fig. 2 note the makeup of the sine-wave harmonics used to approach the reproduction of a square wave. In other words, an amplifier capable of amplifying all frequencies between, for example, 10 cps and 1.0 Mc within 3 db, could be used for the amplification of sine waves substantially beyond this frequency band, but it would not be suitable for the amplification of square waves having fundamental frequencies above about 100,000 cps.

The importance of the frequency response in the amplification of nonsinusoidal waves lies in the ability of the amplifier to uniformly amplify the harmonics as well as the fundamental, in that way affording good *fidelity* of signal reproduction. Then, for oscilloscope amplifiers, what shall be considered the required frequency range? Unfortunately, the answer is not as simple as the question. We know that the ideal condition never can be satisfied, because the ideal square wave, triangular wave, or sawtooth wave requires the presence of an infinite number of harmonics. This is not attainable because it would require an amplifier with infinite bandwidth. So a compromise is forced on everyone, and it then becomes either a matter of individual preference, or the fulfillment of accepted specific standards, as to what shall be considered good quality of reproduction.

Different applications or measurements dictate different conditions. An order of quality acceptable for one application is not necessarily equally acceptable in another case. This is why it is possible to generalize, but not to set definite minimum requirements. There is no agreement among engineers as to the requirements, although there is general concurrence concerning a range of the *minimum* number of harmonics which should be present for a *reasonable* quality of reproduction of a nonsinusoidal wave. The absence of sufficient harmonics, nonuniform amplification of the harmonics, or a radical shift in relative phase of the frequency components of a wave during amplification can produce a very badly distorted reproduction of the input signal. This may be sufficient to destroy the utility of the device as a tool for study and comparison.

(Continued on page 12)

Editor's Note: This article is an abridged excerpt of the section on factors controlling the application of the basic oscilloscope appearing in Chapter 10, entitled "The Basic Oscilloscope and its Modifications," from ENCYCLOPEDIA ON CATHODE-RAY OSCILLOSCOPES AND THEIR USES by Rider and Uslan, published by John F. Rider Publishers, Inc.

Television Changes

Westinghouse H-196A, H-207A, Ch. V-2130-1

The V-2130-1 chassis used in Models H-196A and H-207A is basically the same as the V-2130 chassis used in Models H-196 and H-207. Several changes have been made in the V-2130-1 chassis, however, and the revised circuits are discussed below. The alignment procedure remains unchanged.

The reference numbers applied to the components in this chassis, V-2130-1, differ from those found in the V-2130. A list is given below, comparing the reference numbers for Chassis V-2130 with the new numbers for V-2130-1. All changes for Chassis V-2130-1 etc. will be written up using the new numbering system unless indicated otherwise.

SYNC SEPARATOR AND AMPLIFIER CIRCUITS (See Fig. 1)—The necessity for using a phase inverter (1st sync amplifier in the V-2130) is eliminated in the V-2130-1 by taking the sync voltage from the plate circuit of the 1st video amplifier. At this point the polarity is correct for separating the sync from the blanking pedestal and video signal.

Interaction between the vertical and horizontal components is reduced by using individual coupling networks and separator tubes. The upper network (R429, C412, and R414) is designed to favor the low-frequency vertical sync pulses, while the lower network (C402 and R415) favors the high-frequency horizontal pulses.

R436 (27,000 ohms) and R419 (10,000 ohms) form a voltage-divider network which drops the voltage on plate 1 of the sync separator to approximately 8 volts. R446 (68,000 ohms) and R422 (10,000 ohms) perform the same function for plate 6 of the same tube, dropping the voltage to approximately 30 volts. C403 (270 $\mu\mu f$) by-passes any video that might get by the separator tube.

C413 (0.05 μf) and R421 (100,000 ohms) form the coupling network for the vertical section of the 12AT7 horizontal-vertical sync amp, and C410 (0.01 μf) together with R434 (4.7M) form the coupling for the horizontal section. Bias for the separator and amplifier tubes is developed by the time constant network in each grid circuit.

D-C RESTORER (See Fig. 2)—The d-c restorer circuit used in the V-2130-1 is much simpler than the one used in the V-2130 chassis. This circuit functions as a simple clamper and operates as follows:

When the negative sync and blanking pulse is impressed on the grid of the cathode-ray tube, the cathode of the 12AU7 becomes negative with respect to the plate, and the diode (grid and plate are connected together) conducts. This effectively shorts out R324 (1M) which results in a short time constant. After the sync and blanking pulse passes, the diode becomes an open circuit, resulting in a much longer time constant. Thus, during the sync and blanking period, C337 (0.05 μf) can charge very rapidly due to the short time constant, but during the interval between the sync and blanking pulses, it cannot discharge very rapidly due to the much longer time constant. In this manner a constant charge is kept on the capacitor which will be approximately equal to the negative peak amplitude of the signal. The polarity of this charge is such that it opposes the negative portions of the signal and aids the positive, thereby letting the signal amplitude vary in the positive direction only. Thus the blanking pedestals are all lined up to a common reference point and the d-c component is restored.

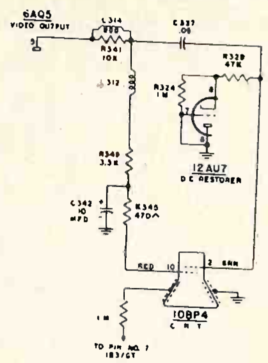

Fig. 2. D-c restorer circuit.

Additional changes that have been made are as follows: C348, a 5-$\mu\mu f$ capacitor, has been added from pin 2 of the 6AL5 video detector to ground. L320 has been inserted from pin 2 of the same tube to the video test jack. R342, 100 ohms, has been added from C334 to pin 3 of the 12AT7 1st video amplifier and ground. The lead from C333, 0.01 μf, connected to pin 1 of the 6AT6 agc amplifier, now goes to the junction of R435, 6,800 ohms, and R431, 540 ohms in the plate circuit for the 6AQ5 horizontal oscillator. Resistor R431,540 ohms, has been added from ground to R435. R458 the horizontal damping control is now 7,800 ohms and is tapped at 5,800 ohms.

The following parts were deleted from the Chassis V-2130 (the reference numbers used are those that were given for Chassis V-2130): R82, 18,000 ohms has been removed from the circuit. It was connected from pin 3 of the 12AU7 horizontal discharge tube to R30 which was connected to pin 5 of the 6BG6G horizontal output tube. Resistor R86, 22,000 ohms, has been removed from between ground and pin 6 of the 12AU7 d-c restorer. Capacitor C134, 0.05 μf, has also been deleted from between pin 6 of the same tube and pin 7 of the 12AT7 1st sync amplifier. The components in this circuit are shown in Fig. 1.

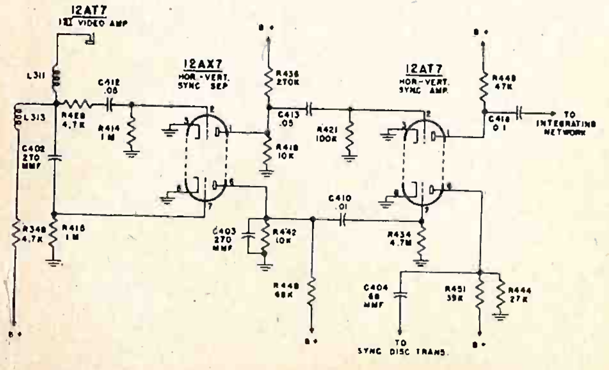

Fig. 1. Sync separator and amplifier circuit for Westinghouse Ch. V-2130-1.

The following list compares the new reference numbers for Chassis V-2130-1 and higher dash numbers with the reference numbers for Chassis V-2130:

Reference Numbers Chassis V-2130-1	Chassis V-2130
R101	R59
R102	R60
R103	R136
R104	R137
R105	R138
R106	R129
R107	R144
R109	R140
R110	R141
R111	R142
R112	R145
C101	C57
C102	C58
C103	C118
C104	C119
C105	C120
C106	C121
C107	C56
C108	C122
C109	C126
C110	C127
C111	C128
C114	C129
C115	C130
C116	C131
C117	C132
C118	C133
C119	C123
L101	L36
L102	L78
L103	L77
L104	L38
L105	L51
L106	L39
L107	L52
L108	L40
L109	L53
L110	L41
L111	L54
L112	L42
L113	L55
L114	L43
L115	L56
L116	L44
L117	L57
L118	L45
L119	L58
L120	L46
L121	L59
L122	L47
L123	L60
L124	L48
L125	L61
L126	L49
L127	L62
L128	L64
L129	L65
L130	L66
L131	L67
L132	L68
L133	L69
L134	L70
L135	L71
L136	L72
L137	L73
L138	L74
L139	L75
L140	L76
Section 2—Sound	
R201	R11
R202	R12
R203	R14
R204	R19
R205	R26
R206	R27
R207	R31
R208	R38
R209	R49
R210	R20
R211	R56
R212	R65
R213	R66
R214	R69
R215	R101
R216	R71
R217	R103
R218	R104
R219	R105
R220	R109
R221	R129
C201	C10
C202	C11
C203	C12
C204	C13
C205	C69
C206	C39
C207	C42
C208	C41
C209	C40
C210	C14

Reference Numbers Chassis V-2130-1	Chassis V-2130
C211	C78
C212	C140
C213	C141
C214	C59
C215	C63
C216	C65
C217	C64
C218	C72
C219	C66
C220	C95
C221	C142
C222	C99
C223	C111
C224	C112
C225	C1
C226	C2
C227	C3
C228	C4
L201	L1
L202	L2
L203	L3
L204	L4
L205	L5
L206	L6
Section 3—Viedo	
R301	R1
R302	R2
R303	R13
R304	R15
R305	R16
R306	R17
R307	R18
R308	R22
R309	R323
R310	R24
R311	R25
R312	R21
R313	R28
R314	R32
R315	R40
R316	R41
R317	R33
R318	R80
R319	R34
R320	R43
R321	R42
R322	R46
R323	R39
R324	R44
R325	R52
R326	R53
R327	R54
R328	R61
R329	R67
R330	R73
R331	R89
R332	R90
R333	R91
R334	R92
R335	R98
R336	R93
R337	R75
R338	R94
R339	R95
R340	R97
R341	R108
R342	—
R343	R113
R344	R114
R345	R121
R346	R51
R347	R123
R348	R128
R349	R134
C301	C15
C302	C32
C303	C16
C304	C19
C305	C17
C306	C18
C307	C34
C308	C20
C309	C114
C310	C22
C311	C21
C312	C23
C313	C24
C314	C26
C315	C25
C316	C27
C317	C28
C318	C29
C319	C30
C320	C31
C321	C38
C322	C43
C323	C44
C324	C45
C325	C46
C326	C47

(Continued on page 6)

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Vol. 12 MARCH, 1951 No. 5

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CURTAIN TIME

About the Industry

Reports indicate that the income of CBS during 1950 from a-m radio exceeded 1949. If it's true with this chain, then the probability is that the other chains did not suffer too badly, if at all. In all probability they, too, have made money. In view of the dire forecasts made about a-m radio when TV first appeared, it is very heartening to note that a-m broadcasting is far from being eliminated by TV. Some time ago, we commented that TV faces one problem, namely, that the viewer must be stationary in order to watch the picture, whereas in a-m radio, a number of receivers in a home enables the listener to hear the program and still carry on other necessary duties. This is a very, very important point. Moreover, the cost of air time on TV has already exceeded radio time for equal periods with fewer TV outlets than a-m radio outlets. So, for perhaps the sixth or eighth time we say that a-m radio is far from dead. About 60,000,000 a-m radio units have been produced during the past five years.

Just Thinking

This has nothing to do with the radio and television industry. It stems from exposure to security measures and classified documents during the last fracas. Just recently we read about the development of small A-bomb heads on projectiles. Orienting thinking on the part of the enemy in that direction may not be too grave a matter, but why disclose the use of the *reflector* as the means of accomplishing the solution to a problem of long standing. Was it necessary for public peace of mind?

Apparently it was a development of great importance, at least it was presented in that manner. If that is true, why save the enemy much time and effort? Why not let him go through the trials and tribulations of expensive and fruitless experimentation? Must we pinpoint the answer. Sure it's news, but what goal is achieved by stating those facts to the populace of the nation. The only purpose we can see, and we are not sure about this, is that it might tend to impress our might upon those who may eventually become embroiled in a war with us. Fine, but couldn't the same have been done without disclosing the *answer* to the problem of making small A bombs . . . By simply stating that small A heads have been developed for shells . . . Isn't the desire for news sort of jeopardizing our security?

Municipal Activity in TV Training

Of interest is the fact that the Service Committee of the Radio and Television Manufacturers Association (of which we are a member) is embarked upon a project of preparing a television technician's course outline for transmittal to vocational and other interested schools. The industry recognizes that shortages in trained electronics personnel are imminent. It is not expected that the course will be used as is, but it is hoped that the liaison which will be attempted by the Service Committee will be productive in creating interest among educators to develop such men as will meet the needs of the television servicing industry.

National Association

Recently, the National Electronic and Service Dealers Associations was formed in Washington. In the main, or rather at the moment, it is represented by television service personnel locally organized in Washington, D. C., throughout the states of Pennsylvania, New Jersey and New York. It is understood that representatives from local associations in other parts of the country also were present at the meeting.

We have had the good fortune to become familiar with the activities of the Federation of Radio Servicemen of Pennsylvania and the Empire State Federation of Electronic Technicians Association in New York State. They have done a great deal towards improving the welfare of their members, and, while it cannot be said that they have solved all of their problems, the fact remains that their existence has done a great deal for the betterment of the industry as a whole in those states.

The aims of this national organization are declared to be the following: 1) The furtherance and improvement of the electronic servicing industry; 2) To promote the welfare of servicing dealers and technicians; 3) To promote a better understanding between electronic service industry and the electronic industry; 4) To promote and secure better relations with the public; 5) To provide educational facilities for its members; 6) To

(Continued on page 16)

Westinghouse H-196A, H-207A

(Continued from page 2)

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C344	C113
C345	C7
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R439	R77

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R449	R116
R450	R119
R452	R117
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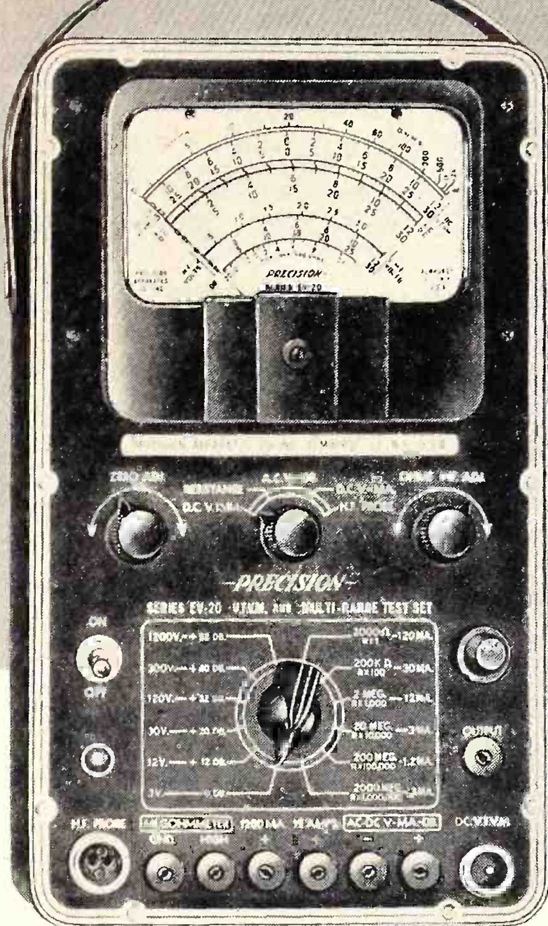
R454	R122
R455	R126
R456	R127
R457	R130
R458	R131
R459	R132
R460	R133
C401	C33
C405	C52
C406	C53
C407	C54
C408	C55
C409	C61
C411	C71
C414	C79
C415	C80
C416	C116
C417	C117
C418	C81
C419	C84
C420	C85
C421	C86
C422	C87
C423	C82
C424	C89
C425	C88
C426	C90
C427	C92
C428	C93
C429	C94
C430	C96
C431	C97
C432	C104
C433	C105
C434	C106
C435	C109
C436	C110
L401	L30
L402	L27
L403	L28
L404	L35
L405	L33
L406	L34
L407	L31
L408	L32
L409	L25
L410	L26
Section 5—Power	
R501	R50
C501	C35
C502	C36
C503	C37
C504	C98
C505	C102
C506	C103
C507	C107
C508	C108
L501	L29.

The parts list for Chassis V-2130-1 is the same as that for Chassis V-2130 except for the following changes (the reference numbers are those for Chassis V-2130-1):

Ref. No.	*Part No.*	*Description*
	V-5911	Tuner assembly, r-f
R113		Resistor, 1,000 ohms
C109		Capacitor, 680 μμf
R210	RC20AE103M	Resistor, 10,000 ohms, ½w
C206	RCM20C271K	Capacitor, 270 μμf
R215	R5CC21ZY471M	Capacitor, 470 μμf
C210	RC20AE103M	Resistor, 680,000 ohms, ½w
C348	R2CC30CK050D	Capacitor, 5 μμf
L320	V-5902-2	Coil assembly, video peaking
R408	RC20AE101K	Resistor, 100 ohms, ½w
R342	V-6304	Control, vertical hold, 2 megohms
R417	RC20AE105M	Resistor, 1 megohm, ½w
R431	RC20AE561K	Resistor, 560 ohms, ½w
R458	V-5963	Resistor, horizontal damping, 7,800 ohms.

Philco 49-1002, 49-1040 Code 121

The connection from the screen grid pin 8 of the 6BG6G horizontal output tube through R536 should be connected to the 320-volt bus that is the junction of R538 and C521, instead of to the point now shown, which is pin 6 of J501, R504, and R103.



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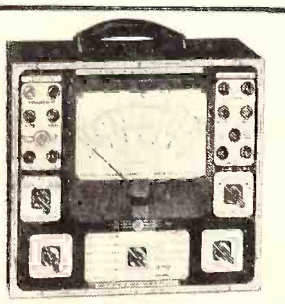
★ SIX DECIBEL RANGES from —20 to +63DB. Calibrated for 600 ohm, 1 mw., zero DB reference level.



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Television Changes

Sentinel 412, 413, 414, 415, 421, 422, 1U412, 1U413, 1U414, 1U415, 1U421, 1U422

Models 421, 422, 1U412, 1U413, 1U414, 1U415, 1U421, and 1U422 are similar to Models 412, 413, 414, and 415, except for the changes noted in the following paragraphs. The service notes for Models 412, 413, 414, 415, Series YA, YB, YC, and YD, also apply to the above models. The changes written up for the YG Series are changes that were made starting with Series YG.

L-7 and R-24, the video load choke assembly, Part No. 20E363-7, is used in Models 412, 413, 414, 415, Series YA, YB, and YC only. Starting with Series YD, in all models, Part No. 20E363-10 is used. R-24 is 10 megohms. R-29, connected from ground to pin 2 of the 1st i-f amplifier, is not used in Models 421 and 422.

The following changes have been incorporated in the above models starting with Series YE. R-106, from pin 6 of the video amplifier to ground, was 6000 ohms in Series YA through YD; the value is now 5000 ohms (Part No. 27E1016-4). The value of R-36 has been changed from 180 ohms to 270 ohms (Part No. 27E271-2). The value of R-103 the horizontal centering control has been changed from 30 ohms to 60 ohms (Part No. 28E54). The value of C-82, the dry electrolytic capacitor connected to R-103, has been changed from 500 μf to 1000 μf, 5 volts (Part No. 25E52). The B+ take-off point for the audio section has been moved to the variable tap on the horizontal centering control. A 1500-ohm, 2-watt carbon resistor (Part No. 27E104-5) has been added in series with the output side of the focus coil L-17. The focus control has been rewired across focus coil L-17 and R-114. The value of resistor R-102, connected to the junction of R-101 and R-114, has been changed from 2000 ohms to 1000 ohms 3-watts, carbon (Part No. 27E1016-7), with a 10,000-ohm, 10-watt bleeder resistor connected across the 250-volt line. The 10,000-ohm bleeder resistor was not used starting with Series YF.

The following changes have been made starting with Series YF. The value of the focus coil L-17 has been changed from 1300 ohms to 3000 ohms (Part No. 2E104). The value of R-114 has been changed to 3000 ohms, 3 watts (Part No. 27E1816-8).

In Models 412, 413, 414, 415, starting with Series YD, and Models 421 and 422, starting with Series YA, a 6CB6 or 6AG5 or 6BC5 is used in the r-f amplifier and modulator tube sockets. Always use the same type tube for replacement. Intermixing these tubes may result in loss in sensitivity caused by the differences in tube capacities detuning the circuits and making it necessary to realign the r-f amplifier and modulator stages by spreading or squeezing turns on the coils. The 6CB6 cannot be used in the video i-f amplifier stage. The alignment tables for these models are the same as those given for Models 412, 413, 415 (Series YA, YB, YC), and the changes on video alignment that were noted for Series YD, except that Step Nos. 1 and 2 for Discriminator and Sound I-F Alignment, under Connect Signal Generator should read: In series with .01μf to junction of L-4 and C-19 on pin 5 of the 6AU6 video amplifier tube. An r-f choke L-18, Part Number 2E29, has been added from pin 7 of the video amplifier to the junction of the plus terminal of C-31 and R-23. A 0.05-μf, 200-volt (Part No. 23E216) capacitor C-87 has been added from ground to the 140-volt bus. The 47,000-ohm resistor R-110, connected from fuse F-1 to the junction of C-64 and R-61, has been replaced by two 100,000-ohm, 2-watt resistors, R-110 and R-115 (Part No. 27E104-5). Resistor R-71, the 680,000-ohm resistor that was connected from pin 4 of the 1X2 h-v rectifier to R-57, has been deleted from the circuit and replaced with a direct connection. The value of R-57 has been changed from 470,000 ohms to 1.2 megohms, Part Number 27E1009-5. The 4700-ohm resistor R-97 across the horizontal linearity coil L-17 has been deleted from the circuit. R-53, connected to pin 2 of the 6SN7GT vertical oscillator, is no longer connected to the junction of R-88, R-102, and R-47, but now goes to the junction of R-98, C-81, and the vertical size control R-77.

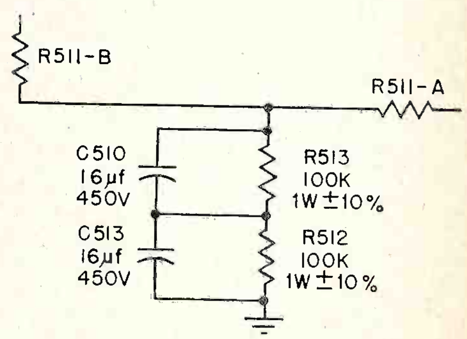
The following changes apply to Models 421 and 422 starting with Series A. R-106, mentioned previously, has been removed from ground and is now connected to pin 2 of the 12AU7. Resistor R-118, 150 ohms, ½ watt, carbon (Part No. 27E151-2), has been added from the junction of R-106 and pin 2 to ground. Resistor R-89, that was connected from the junction of pin 8 of the 12AU7 and C-62 to ground, is now connected from that junction to the junction of R-118, R-106, and pin 2.

The parts for Model 414 are given in the change notice for that model, the remainder of the Model 414 cabinet parts are the same as those mentioned for Model 413. The parts for the other models are the same as those appearing in the Parts List for Models 412, 413, and 415, except for the Miscellaneous and Cabinet Parts List for Models 421 and 422 given below:

Part No.	*Description*
20E580	Pulley assembly for contrast control
20E253-28	Drive cord for contrast control
65E2	Spring, tension for drive cord
20E585	Pulley assembly on channel switch shaft
65E39	Spring "C" type locks pulley assembly on channel switch shaft
20E546-8	Cabinet back assembly with line cord (Model 421)
20E546-9	Cabinet back assembly with line cord (Model 422)
9E25-3	Safety glass (Model 421)
9E40	Safety glass (Model 422)
36E56-3	Mask, picture tube (Model 421)
36E56-4	Mask, picture tube (Model 422)
33E85	Gasket, rubber, for mask-35 in.
20E544-3	Knob assembly, channel switch
20E545-3	Knob assembly, off-on-vol.
37E59	Knob, channel switch, less metal plate
37E59-5	Knob, off-on-vol., less metal plate
37E67	Knob, contrast
37E67-2	Knob, brightness
36E57-2	Metal plate for channel switch knob
36E58-2	Metal plate, for off-on-vol. knob
7E250	Cabinet table, mahogany (Model 421)
7E251	Cabinet console, mahogany (Model 422)
20E550	Built-in antenna assembly (Model 421)
30E154	Trimmer and shaft assembly, for 20E550 antenna, consists of 9" shaft assembled to trimmer capacitor
20E550-4	Built-in antenna assembly (Model 422)
30E154-4	Trimmer and shaft assembly, for 20E550-4 antenna, consists of 12⅜" shaft assembled to trimmer capacitor
37E61	Knob, antenna tuning (Model 422)
37E62	Knob, antenna tuning (Model 421).

DuMont RA-105

Capacitor C510 in the a-m tuner has been changed from 8 μf, 450 volts, to 16 μf, 450 volts. In addition, the filter has been changed, as shown in the accompanying figure, by the addition of C513, R513, and R512. The following parts have been added to the parts list.



Filter used in DuMont RA-105.

Ref. No.	*Part No.*	*Description*
C510, C513	03002050	Capacitor, electrolytic, 16 μf, 450 v
R512, R513	02045010	Resistor, fixed, 100,000 ohms, 10%, 1 w.

In the Video I-F Alignment Table, for step #9, in the column headed "Connect Generator Leads Across," add an asterisk as shown below:

Pin 1 (grid)*
V102 and chassis

In step #3 of the Sound I-F Alignment Table in the column headed "Connect Generator Leads Across" delete the asterisk.

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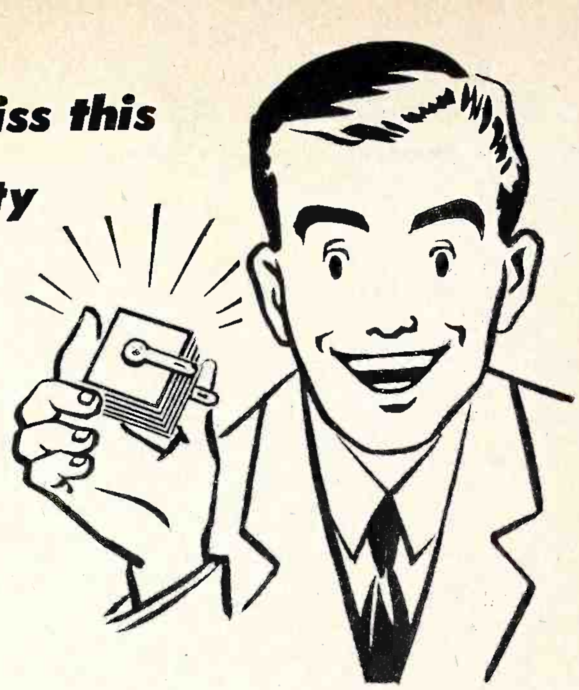

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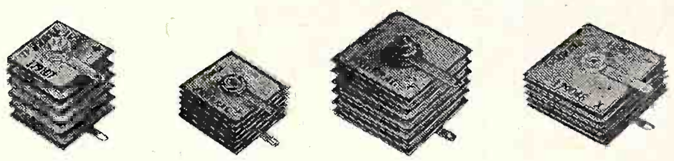

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Television Changes

Montgomery Ward 84HA-3010A, 84HA-3010B, 84HA-3010C

The following production changes have been made on these chassis:

1. Install a 47-μμf ceramic capacitor between pins 2 and 4 of V13, the 6SN7 horizontal oscillator tube.

2. Change R-83 in the horizontal oscillator circuit from 5600 ohms, ½ watt, to 6800 ohms, 1 watt.

Greater White-to-Black Ratio

1. Install 2,200-ohm, ½-watt decoupling resistor in the 2nd video amplifier (V10) circuit from the junction of R-66 and L-29 to the junction of C-56 and R-67. Change R-67 from 4700 ohms to 2,200.

Improved Horizontal Linearity

1. Install a 20,000- to 30,000-ohm, 10-watt resistor between pins 4 (or 6) and 8 of V21, the 5U4 rectifier tube, if a non-correctable bulge appears on left hand side of test pattern.

Improved Definitions and Focus

1. Some sets do not have C-92, a 470-μμf mica capacitor connected in parallel with R-64, the cathode resistor for V-10 the 2nd video amplifier. Install this capacitor if it is not in the set.

2. Improved range of the focus control, R-103 in the power supply chassis, may be secured by removing R-116, an 1800-ohm, 2-watt resistor.

Increased Sensitivity

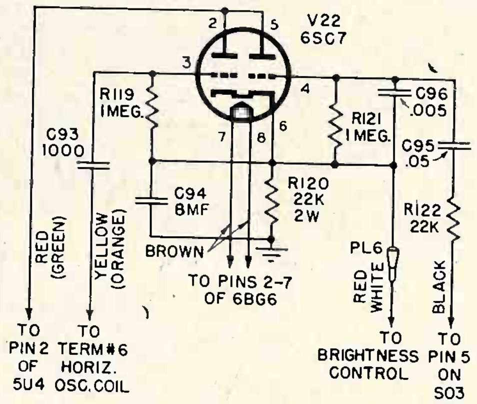
1. Increased sensitivity on the high-band channels may be secured by removing the grounding leads from socket terminal 4 of V-1 and socket terminal 7 of V-2 and grounding these leads directly to the chassis.

2. Capacitors C-9 and C-11 in the tuner assembly should also be removed when the above (1) change is made.

Reduction of 4.5 Mc Hash in Picture

1. 4.5-Mc signal hash in the picture may be reduced by installing a 1½" x 4" metal shield between the discriminator transformer and the tuner chassis. The discriminator coil slug also should be grounded.

After these sets reached the field, a picture tube protective circuit kit was made available for installation on these sets. The purpose of this circuit is to cut off the intense electron beam in the picture tube, in event of failure in either the horizontal or vertical sweep circuits. This prevents burning a line into the face of the picture tube and rendering the tube useless. Components in this circuit are assembled on a small sub-chassis that becomes a part of the power supply unit. The wiring diagram for the protective circuit is shown in the accompanying figure.



Protective circuit for Montgomery Ward 84HA-3010A, 84HA-3010B, 84HA-3010C.

In addition to the components added to the power supply chassis, the following alterations were made in the receiver chassis.

1. Resistor R-29, in series with the brightness control, was changed from 47,000 ohms to 150,000 ohms.

2. Resistor R-120, in the protective circuit, replaced R-30 in the receiver chassis. Therefore, R-30 is no longer used.

Following is a list of the additional parts used in this modification:

Ref. No.	*Part No.*	*Description*
C-93	CM20A102K	1,000 μμf, 500 v, mica
C-94	45A103	8 μf, 475 v, electrolytic
C-95	46AY503J	0.05 μf, 600-v, tubular
C-96	46AZ502J	0.005 μf, 600 v, tubular
R-119, R-121	RC20AE105M	1 megohm, ½ w, carbon
R-120	RC40AE223M	22,000 ohm, 2 w, carbon
R-122	RC20AE223K	22,000 ohm, ½ w, carbon
PL-6	10A287	Connector.

Stromberg-Carlson TC-19

In the R152 position, the 1000-ohm, 10-watt resistor (Part No. 149216) is being changed to a 1000-ohm, 20-watt value (Part No. 149369) to accommodate the required dissipation.

A greater "in-focus" picture area can be obtained if the focus coil assembly is separated by approximately three-quarters of an inch (¾") from the deflection yoke on the picture-tube neck. The separation distance is best determined by observing the picture while adjusting the focus coil position.

Loss of the anode high voltage to the kinescope tube often occurs because of poor contact at the junction of the male-female high-voltage connectors. These connectors should be firmly pressed together to assure positive contact. In addition, this connector lead should be dressed away from any miniature tubes to prevent heat deterioration of the connector-lead insulation, which could result in shorting of the high voltage. This high-voltage connector lead should be dressed on the side of the multi-lead cable away from the 12AU7 tubes. (This multi-lead cable is the one that plugs into the top of the main chassis.)

Early production of these receivers were subject to failure of the C231 and C232 (500 μμf, 15,000 volt, Part No. 110595) capacitors in the high-voltage supply, and short circuiting in the L3 deflection coil assembly (Part No. 114672) when internally developed heat deteriorated the insulation between windings. The subject capacitors have been replaced in production by a new type capacitor with smooth sides, a 500-μμf, 20,000-volt unit (Part No. 110680). When replacing capacitors in the field, this new part is being recommended.

A new deflection coil assembly (yoke) is now being used with better insulation properties as well as an open-type casing for better ventilation. The new yokes bear the same part number but are recognizable by the well-ventilated yoke body. When replacing yokes in the field, this ventilated yoke is recommended. In addition, it is recommended that the protective plastic funnel sleeve between the yoke and cathode-ray tube neck be removed entirely for better ventilation.

Because of current capacity requirements, the No. 22 conductor in the wiring of the primary circuit is being changed to No. 16 and the lead length is being shortened.

The following changes should be made on the schematic diagrams:

1. The connector pins labelled 4C, between the brightness control and the kinescope cathode should read 14C.

2. The connector pins labelled 8S, at the bottom end of the vertical deflection coil, should read 7S.

3. There should not be a connecting line from female 1P to the male 1P connector pin, in the X heater supply lead.

4. Pin 2 of V9, the 6AL5 second detector, is used in the chassis as a tie point for R240 and C240 of the agc line. This half of the tube has no circuit function.

5. The midpoint of R157 and R156 should be shown tied to the midpoint of C150 and C151, in the B plus power supply. Likewise, the midpoint of R151 and R159 ties to the midpoint of C152 and C153, in the same supply.

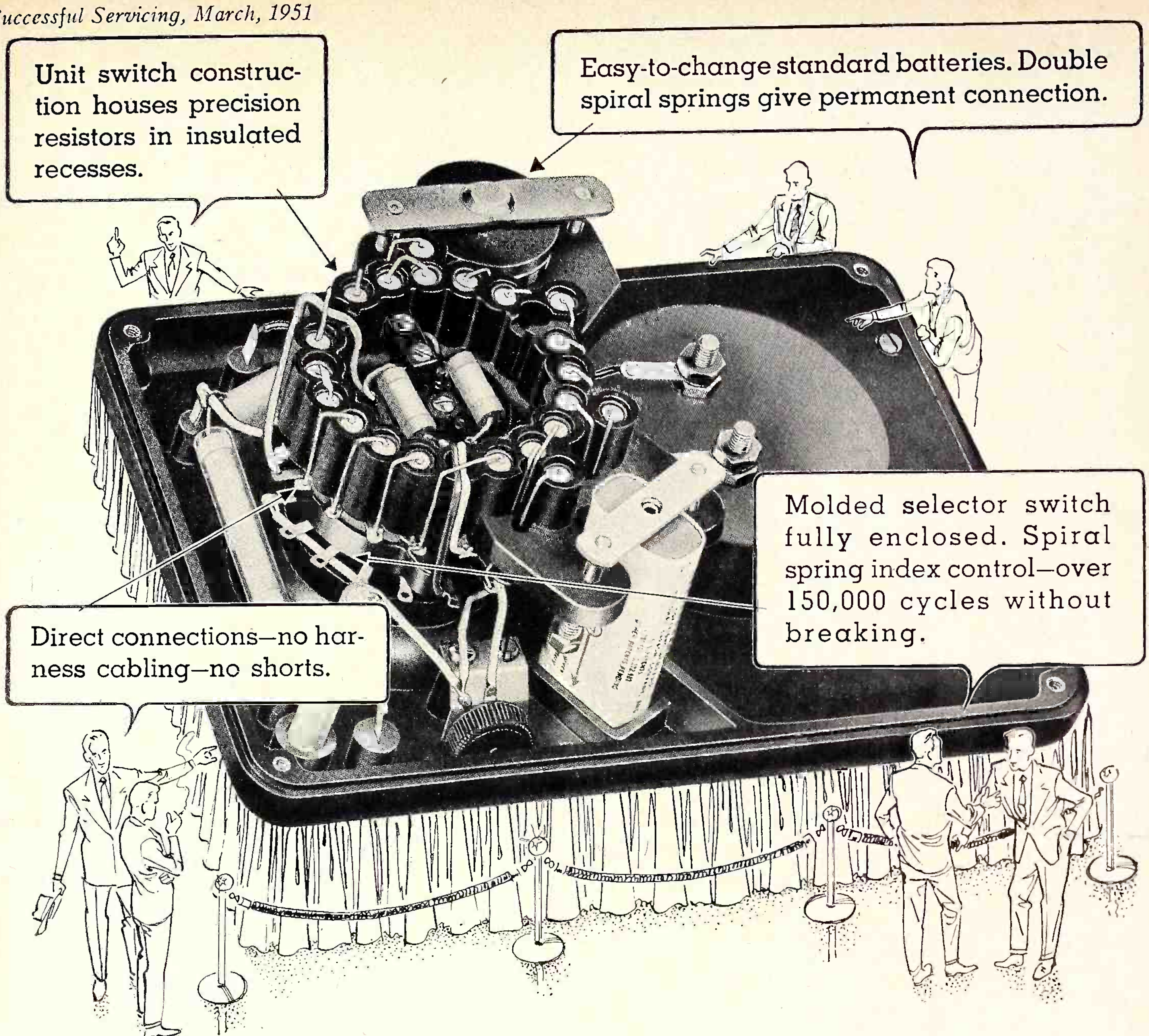
6. On the Trimmer Chart, the adjustment labelled L28, adjacent to the 6AU6 tube (V27), should read L30.

7. Schematic diagram connections around the V28, 6AU6 tube, should be corrected as follows:

a. Connect pin 2 to pin 3

b. Delete tie between pin 4 and pin 7

c. Connect pin 3 to ground end of R280 and remove ground connection.



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Frequency Requirements of Oscilloscope Vertical Amplifiers

(Continued from page 1)

It would do no harm at this time to devote some attention to the composition of the varieties of nonsinusoidal waves previously mentioned. These are but a few of the many which can be illustrated, but they will serve their purpose because they will convey the impression so necessary for the understanding of what will follow.

Composition of a Square Wave

In Fig. 1 is shown a conventional square wave with like positive and negative alternations. The letter E designates the amplitude of the wave. The wave shown is ideal, which means that the rise from zero to the maximum amplitude takes place in zero time. Practically speaking, this is impossible. In such a wave, the corners are perfectly square and the constant amplitude of the positive alternation and the negative alternation is shown by a perfectly straight line. Whatever the value of E, the voltage rises instantaneously to maximum, remains there for a while, and then falls in a straight line through zero to the maximum amplitude in the negative direction. This may be restated as saying that both the *rise time* and *decay time* are zero.

The period in which a cycle of amplitude change takes place is T, expressed in seconds; the reciprocal of this time, or $1/T$ corresponds to the *fundamental* frequency of the wave in cycles. If, for example, T is 0.0001 second, the fundamental frequency of this wave is 1/0.0001 or 10,000 cps.

The means of developing a square wave are numerous. It may be the simple expedient of controlling a d-c source, it may be the clipped output of a multivibrator, or it may be the process of successively amplifying and clipping a simple sine wave. While the fundamental frequency of such waves may be obvious because of the apparent association with time, the frequency requirements for proper reproduction are more obscure. The fact that a square wave, or any nonsinusoidal wave, may be resolved into a number of harmonically related sine waves, each of a certain amplitude and relative phase to form a square wave or some other nonsinusoidal wave, is a mathematical approach. This is the Fourier analysis whereby a wave is broken down into its components.

Let us select as our example a sine wave *f1* of 1,000 cps, shown in Fig. 2A. The choice of frequency is arbitrary; what will be said and shown applies to any frequency one may choose. We shall assume that the amplitude of this wave, which is the fundamental frequency, is unity. The starting point of the wave is at the time axis and it advances in the positive direction. We mention this because there is another starting point which is used in the usual mathematical equation for a square wave. This point is 90° later, at the point indicated by the projection from the time base.

We will now add a third harmonic *f3* in phase with the fundamental *f1* and with an amplitude equal to one-third of the fundamental. This is shown in Fig. 2B; the fundamental and the third harmonic are illustrated by the light lines, and the resultant by the heavy line. The ideal square wave is shown by the dotted lines. Several pertinent details warrant mention. A comparison of the sides of the resultant wave, composed of *f1* and *f3* and the fundamental, *f1*, discloses that adding the third harmonic very materially steepens the sides of the wave. A second effect is a modification of the top of the wave on the positive and the negative alternations. The area included by each alternation has been increased and the period representing maximum amplitude has been lengthened.

Let us add the fifth harmonic *f5* to the resultant of the fundamental and the third harmonic. This is done in Fig. 2C; the added harmonic has an amplitude equal to one-fifth of, and is in phase with, the fundamental. The result is shown by the heavy-line curve and a comparison with the dotted-line square wave illustrates the closer approach to the desired ideal: the sides of the wave have been made steeper; and, while the number of ripples on top have been increased, the area included by each alternation also has been increased; the maximum amplitude condition prevails for a longer time; and the top is flatter than before.

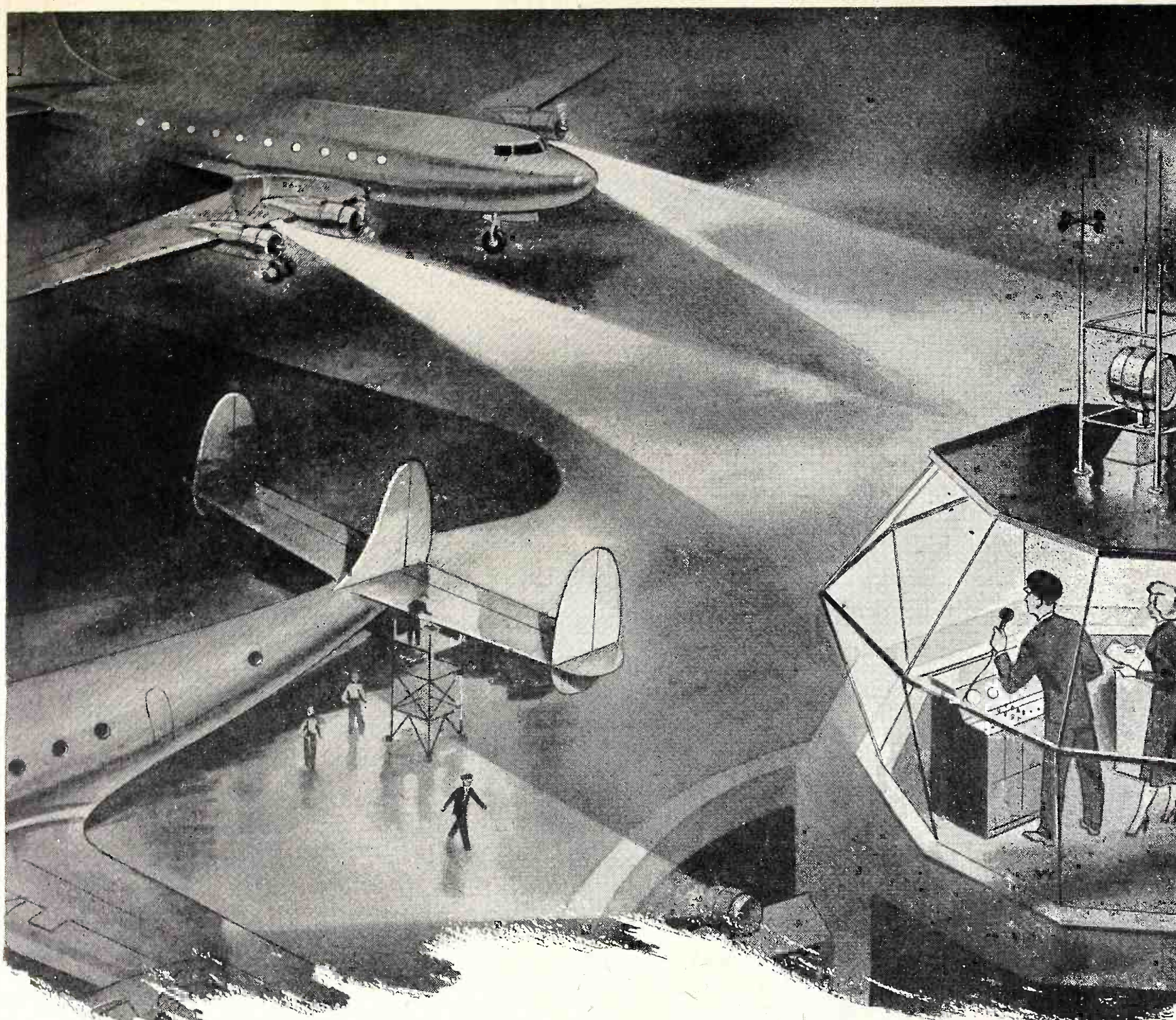
The addition of the seventh harmonic *f7*, equal to one-seventh the amplitude of, and in phase with, the fundamental is shown in Fig. 2D. An improved wave with steeper sides and flatter top is the result. We need not picture any more harmonics because what we have shown is ample to develop the proper line of thought. It is clearly evident that just as the addition of three consecutive odd harmonics to the fundamental transformed the simple sine wave into an approximation of a square wave, the further addition of a sufficient number of odd harmonics would cause very steep sides and a flat top.

Note that as the number of harmonics added to the fundamental increases, the magnitude of the amplitude variations at the top of the wave decreases. With a sufficient number of odd harmonics present, the ripples would approach an infinite number, thus forming a straight line. Two other very significant details can be seen from Fig. 2, namely, that as the wave contains more harmonics, the junction of the sides and the imaginary axis approaches a right angle; also that as the harmonics in the wave are increased in number, the curvature of the sides of the wave at top becomes smaller, ultimately forming a right angle when the number of harmonics contained in the wave is infinite. From the practical viewpoint, these ideal conditions are reached much sooner; that is, as far as the eye can see and equipment can perform, a good square wave is reached with relatively few harmonics.

Two other details deserve attention. One of these is the phase relation between the component frequencies; the other is the fixed amplitude relationship. Although the square wave of Fig. 2D is only an approach to a square wave, it nevertheless enables us to reach some conclusions. The phase is a fixed quantity based upon the mathematical analysis of such a wave. In the example chosen, we used in-phase sine-wave voltages. Exactly the same result will be obtained by the use of cosine waves, the point of origin of each component being 90° later. If you examine Fig. 2B, C, and D, and assume the starting point of each component as being located at 90°, as illustrated in Fig. 2A, it will be evident that the harmonics will alternately start in phase and 180° out of phase with the fundamental.

These references to phase lead to a very important conclusion. In our example, we showed the component phase conditions for the development of a square wave. In practice we are interested in the *reproduction* of a

(Continued on page 14)



Frequency Requirements

(Continued from page 12)

square wave which is fed into a circuit. Since a certain phase condition between the components is assumed to exist in the input voltage, it is *imperative* for proper reproduction that the *same phase condition between components exist in the output voltage.* This is the responsibility of the amplifier which is a part of the reproduction system; while it is amplifying the components of the wave, it must retain the phase relationship as well. A change in phase of a component or a group of components will very materially change the output waveshape. This is a matter of amplifier design, and also a matter of evaluating the constants of the amplifier which is used to amplify such waves.

United Motors 984570, Pontiac

A 7Q7 may be used as the oscillator modulator tube in place of the 6SA7. 7C5's may be used as output tubes in place of 6V6GT's. These substitutions do not require any circuit changes.

●

Capehart-Farnsworth 3001-B, 3001-M, 3002-B, 3002-M, Ch. C-272, Ch. CX-30, Early Version, Series A, A-2, A-3, A-4; 3007-B, 3007-M, Ch. C-276, Ch. CX-30, Early, Series A, A-2

Model 3007-B is similar to Model 3007-M. The control panel for Models 3007-B and 3007-M is given in Fig. 1.

The following information is presented as an aid in identifying production runs:

Chassis No. C-272 (12½" crt) used in Models 3001 and 3002:

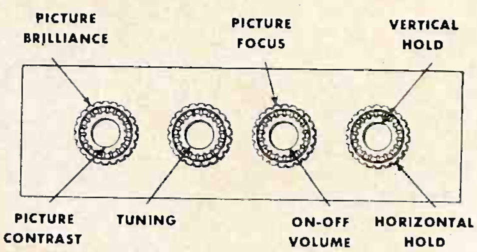
1st production run referred to as "Early Version."

2nd production run referred to as "A" Series.

3rd production run referred to as "A-2" Series.

4th production run referred to as "A-3" Series.

5th production run referred to as "A-4" Series.



Control panel for Models 3007-B and 3007-M.

Chassis No. C-276 (16" crt) used in Model 3007:

1st production run referred to as "Early 3007" (equivalent to A-2 above).

2nd production run referred to as "A" Series (equivalent to A-3 above).

3rd production run referred to as "A-2" Series (equivalent to A-4 above).

Early Version CX-30 chassis had no electrical centering controls and no 6H6 tube. The 12SN7 sync stage was used for d-c restoration and sync clipping.

The "A" series chassis may be identified by the letter "A" stamped on the rear chassis apron preceding the serial number. This chassis employs an improved video amplifier circuit, electrical horizontal centering control, a modified focus control circuit, a change in grid loading of the third and fourth pix i-f stages, a modification in the horizontal scanning circuits including the feedback loop which is a part of the afc circuit, and some changes in the high-voltage supply section.

The "A-2" series chassis has the letter "A" preceding the serial number and "-2" following the serial number (i.e. A666666-2). This chassis is the first to use the 6H6 tube for d-c restoration and sync clipping. The 12SN7 sync amplifier and clipper was modified to provide improved sync pulse amplification and shaping.

The "A-3" series chassis (i.e. A000000-3) is very similar to the A-2 series. The only changes were the addition of an electrical vertical centering control and a further modification of the focus control circuit.

The "A-4" series is the final version of the CX-30 chassis. The 6H6 d-c restorer has been modified to provide a pre-sync clipping action with sync being taken off at this tube rather than the video amplifier load circuit. Also, the 12SN7 sync amplifier and clipper has again been modified by some small changes in component values. The feedback loop from the horizontal output transformer back to the horizontal oscillator has been removed. An additional 80-μf filter capacitor has been added at the input of the filter, and the heater returns for V11 and V12, 6AU6 driver and 6T8 ratio detector—first audio, have been made directly to B minus.

The first 16" models were similar to the 12½" "A-2" models except for picture tube mounting, the arrangement of front panel controls, the negative power supply for the horizontal amplifier and the addition of the 6J5 tube in parallel with the output section of the vertical multivibrator tube. The "A" series 16" chassis is comparable to the A-3 series 12½" chassis on which the vertical electrical centering control was added.

The "A-2" series 16" chassis is the final production run and is comparable to the A-4 series 12½" chassis except for those differences noted above which adapt the chassis for 16" tube operation.

The schematic for Series A-3, Models 3001-M, 3002-B, and 3002-M, is the same as that for the A-2 Series.

The following parts should be added to the parts list:

Part No.	*Description*
	Models 3007-M & 3007-B
850067A-1	Speaker (12" e-m)
450540B-1	Brilliance, horiz. hold and focus knobs (3 required)
450541A-1	TV channel indicator knob
450542A-1	TV tuning knob (3007-M)
450542A-2	TV tuning knob (3007-B)
450543A-1	Vertical hold, volume & contrast knobs for 3007-M (3 required)
450543A-2	Vertical hold, volume & contrast knobs for 3007-B (3 required)
450836A-1	"Built-In" antenna phasing control knob (3007-M)
450836A-2	"Built-In" antenna phasing control knob (3007-B)
850062A-1	Safety glass escutcheon
450868A-1	Mounting strap for escutcheon
850060A-1	Plastic mask
750130A-G2	"Polatenna" assembly.

●

General Electric 509, 530

Catalogue items RWL-009 and RWL-106 should be deleted from the Parts List and replaced by the following items: RWL-025, Cord, power cord and plug (brown, heavy duty type) for Model 530; RWL-024, Cord, power cord and plug (white, heavy duty type) for Model 509.

TV AND OTHER RECEIVING ANTENNAS

The following review of Arnold B. Bailey's TV AND OTHER RECEIVING ANTENNAS appeared in the March 1951 issue of *Radio & Television News:*

"This book is a happy combination of both theoretical and practical material on the subject of receiving antennas, with special attention being given to the television antenna.

"Designed for television engineers, television technicians, antenna design engineers, students, teachers, hams, and broadcast station personnel, this text is a logical development of the subject matter. Treatment is straightforward and generally non-mathematical.

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"The author's tremendous grasp of his subject has not caused him to lose sight of the immediate problem of imparting this knowledge in an understandable fashion. The book should find wide audience among both beginning and advanced students of the subject."

Curtain Time

(Continued from page 5)

raise the standards of the electronic servicing profession; 7) To cooperate with federal, state, and municipal agencies.

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The address of this new association is Dorchester House, 1625 Kalorama Road, N.W., Washington, D. C.

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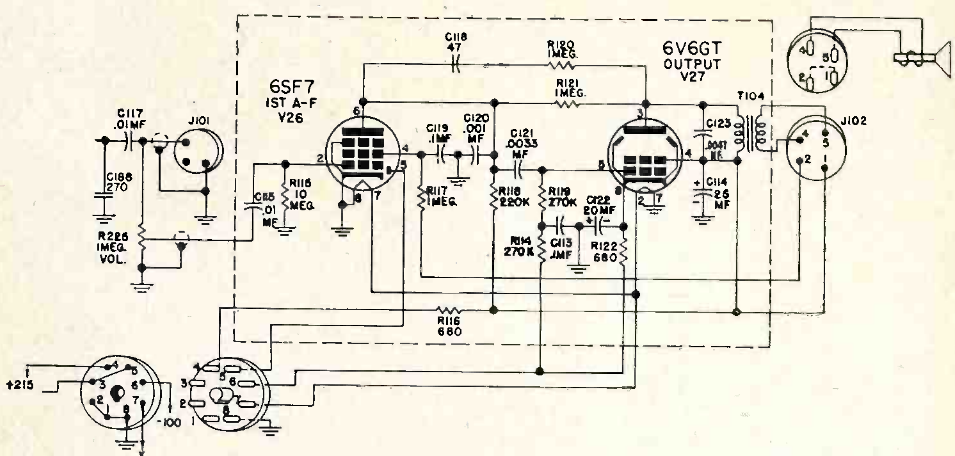
Magnavox CT254A, CT254B

These chassis are similar to Chassis CT224 and CT235. All of the data applicable to the CT224 and CT235 are applicable to the CT254A and CT254B except as noted below.

Chassis CT254A and CT254B are designed for use in models which feature television only. A #123B audio amplifier and a #220076 volume control have been added. The schematic for this amplifier with the volume control is shown in the accompanying illustration.

The CT254A uses type "S" tuner, #700320-8, which is the same as is used in Chassis CT224, except that a 6AB4 or a 6C4 may be used as the V3 oscillator. A 1000-ohm resistor, R15, has been added from the junction of C5 and R8 to pin 7.

Chassis CT254B uses type "R" tuner, #700317-2, which is the same as that used in Chassis CT235, except that a 680-$\mu\mu$f capacitor, C19, has been added from ground to the junction of L79 and the terminal pin, and resistor R14, 1000 ohms, connected to the converter transformer now goes to terminal pin 6.



Audio amplifier used in Magnavox CT254A and CT254B.

The 6T5 AGC delay has been deleted. Terminal pin 3 goes to the X filament leads, and the connection from pin 6 that went to the 6T5 now goes to pin 3 of the socket shown in Fig. 1. A 0.0015-$\mu\mu$f capacitor has been added from pin 3 of the 6AG5 4th video i.f. (V11) to ground. A 1000-ohm, 2-watt resistor has been added in parallel with the focus coil.

The parts list for the audio amplifier is as follows;

Ref. No.	*Part No.*	*Description*
R114, 119	230104-91	Resistor, carbon, 270,000 ohms, ½ w
R115	230104-110	Resistor, carbon, 10 meg-ohms, ½ w
R116, 122	230105-60	Resistor, carbon, 680 ohms, 1 w
R117, 120, 121	230104-98	Resistor, carbon, 1 meg-ohm, ½ w
R118	230104-90	Resistor, carbon, 220,000 ohms, ½ w
C113, 119	250201-13	Capacitor, paper, 0.1 μf, 600 v
C115	250201-7	Capacitor, paper, 0.01 μf, 600 v
C118	250159-96	Capacitor, mica, 47 $\mu\mu$f, 500 v
C120	250201-1	Capacitor, paper, 0.001 μf, 600 v
C121	250201-4	Capacitor, paper, 0.0033 μf, 600 v
C123	250201-5	Capacitor, paper, 0.0047 μf, 600 v
C114	270023-10	Capacitor, electrolytic, 25 μf
C122	270027-8	Capacitor, electrolytic, 20 μf
T104	320027-4	Output transformer
J102	180382-8	Speaker cable socket.

General Electric 505, 506, 507, 508

Catalogue items RWL-009 and RWL-016 should be deleted from the Parts List and replaced by the following items: RWL-025, Cord, power cord and plug (brown, heavy duty type) for Models 505, 507, 508; RWL-026, Cord, power cord and plug (ivory, heavy duty type) for Model 506.

WHAT REVIEWERS SAY ABOUT OUR BOOKS!

The following review of TELEVISION INSTALLATION TECHNIQUES by Samuel L. Marshall, appeared in the February, 1951, issue of *Proceedings of the I. R. E.*

"This outstanding book was written as a reference and handbook, primarily for the television service man, but it is of great interest to the experimenter, the engineer, and the service manager.

"The first four chapters of the book present a well-balanced discussion of the nature of television, radio propagation antenna and transmission lines, and transmission and special antenna systems, supported by a clear-cut discussion of the essential theory, and supplemented by specific design methods and practical design information to meet almost any installation requirement.

"The next two chapters entitled, 'Materials and Methods used in Installations' and 'High Mast and Tower Installations,' cover the installation of antennas in primary service areas, with particular regard to safety and best installation practices. In the case of the high mast and tower installations, the principles of construction design formulas and data to take care of wind and ice loadings, and special design considerations are discussed in detail for most types of masts and towers.

"Two chapters are devoted to problems arising from television installations and receiver adjustments in the home. Problems in connection with reflections, multiple installations, fringe area operations, television interference, TV filters, and the adjustment and servicing of sets in the home are covered in a most factual and satisfactory manner.

"The last chapter, 'Municipal Regulations,' covers safety precautions in general, and the National Board of Fire Underwriters Bulletin 275, the municipal codes and television ordinances of many of the cities of the United States.

"The Appendix includes a great deal of useful information in its ten tables and three charts pertaining to vhf TV stations on the air: Data on coaxial cables and transmission lines, data relative to the safe loads of anchors, bolts and guy cables, tape sizes, and a list of the various sizes and characteristics of cathode-ray picture tubes.

"This book includes authoritative information describing the best field practices in the installation of antennas to meet practical field problems and the installation and servicing of receivers to give maximum satisfaction to the customer, and points out the importance of attention to details in installations, both in the interest of the customer and of safety."

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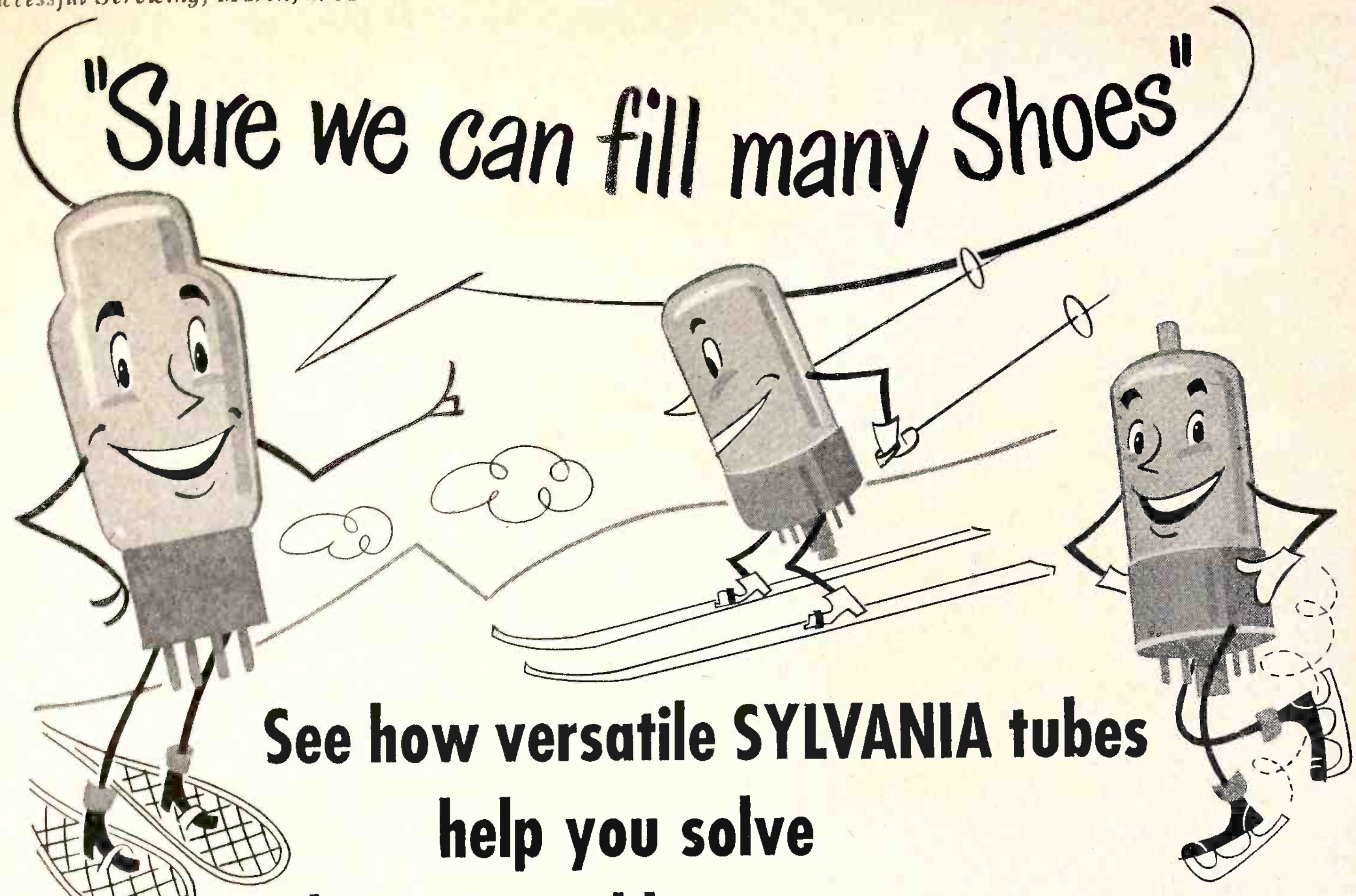

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Midwest KC-16

The mixer coil plate should be grounded to the front apron of the chassis with tinned copper braid to reduce f-m—r-f regeneration.

●

RCA T100, Ch. KCS38; T120, Ch. KCS34C

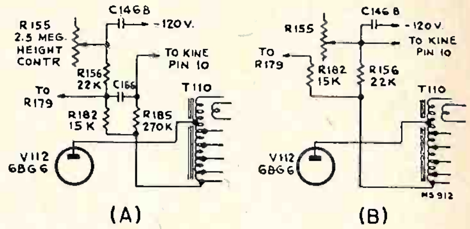
Current production of 10" and 12" television receivers are employing two different types of deflection yokes. One yoke is the older type, which had an iron wire wrap core. The new type yoke has a powdered iron core. The two yokes are easily identified in that the older iron wire wrap yoke has a cardboard outer housing, while the new powdered iron yoke has a molded bakelite housing.

The two yokes are not directly interchangeable, for while the iron wire wrap yoke will work in the circuit designed for the powdered iron core yoke, the powdered iron yoke would not be employed in the circuit designed for the iron wire yoke unless suitable circuit modifications are made.

In receivers employing the "electronic magnifier" deflection circuit, R191 was 470,000 ohms for the iron wire wrap yokes. This value has been changed to 220,000 ohms as a compromise value for both types of yokes.

Early T100 and T120 receivers with straight deflection systems employed a 1-megohm resistor for R181 when the iron wire wrap yoke was used. Later, some were built using a 150,000-ohm resistor which gave more width and high voltage with the wire wrap yoke. When the powdered iron yoke is employed, R181 should not be less than 470,000 ohms (which gives greatest width), nor higher than 1 megohm (which gives the best linearity). A 470,000-ohm resistor is now being used in production as a compromise which is suitable for either type yoke.

Vertical Non-Linearity: T120 receivers employing the powdered iron core yokes have another modification necessary to prevent poor vertical linearity, this showed up as cramping at the bottom of the picture. The non-linearity was corrected by raising the vertical oscillator plate voltage by changes in the B boost filter as shown in the accompanying figure.



Filter connections (A) for iron wire wrap yoke, (B) for powdered iron yoke.

This change also prevents the formation of an extremely bright spot on the screen immediately after the set is turned off. If C146B develops excessive leakage it will cause the picture to be cramped at the bottom.

Raster Ringing: In most cases, the iron wire wrap yoke, type 201D3, will be supplied under stock numbers 71420 and 74262. In the 201D3 yoke, the 56-$\mu\mu$f capacitor across a portion of the horizontal deflection coil is connected across yoke terminals 1 and 2. Before installing the yoke, check the schematic of the receiver in which the yoke is to be installed. Some models require that the capacitor be between terminals 1 and 2, and other models specify between terminals 2 and 3. In the latter case, the capacitor must be reconnected. Failure to connect the capacitor properly will result in bad raster ringing. Except for the connection of the capacitor, the type 201D3 is an exact duplicate of the iron wire wrap yokes used in production.

If excessive raster ringing occurs on the left side of the picture of current 10" and 12" receivers, and the yoke capacitor is correctly connected, and the circuit appears normal, then remove the yoke red lead from terminal 4 of T110 and reconnect it to terminal 5. This reduces the ring at the possible slight expense of linearity. This modification is applicable to regular and electronic magnifier deflection systems.

If raster ringing occurs near the center or right side of the raster, it may be caused by misadjustment of the linearity control coil. Proper coil adjustment is best made by turning the core counter-clockwise all the way and then clockwise until the ring just moves off the right side of the picture. Normally the core stud is just about flush with the outside of the chassis. This adjustment is applicable to both the regular deflection system and to the electronic magnifier system.

On receivers with electronic magnifier deflection system, if the raster rings on the left side with the picture in the normal size, it may help to change the *R-C* network (C178, R188) in parallel with the series width coil from 10,000 ohms and 330 $\mu\mu$f to 5,000 ohms and 470 $\mu\mu$f.

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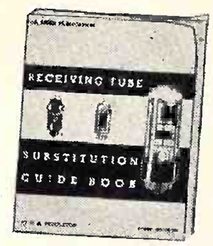

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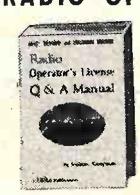

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Radio Changes

Emerson 672B, Ch. 120097-B

The 672B is similar to Model 634B in that both models use a 120097-B chassis. The service data and Parts List for 672B, Ch. 120097-B, are the same as those for the 634B except for the cabinet parts listed below:

Part No.	Description
140396	Cabinet
470092	Lid support
620145	Chassis mounting board
580138	Shielded lead wire (25")
450099S	Knob
450099	Knob
587011	Spring insert
700053	Loop antenna
410807-1	Dial back plate
530002	Drive cord (37")
525022-1	Pointer.

Crosley 11-100U, 11-101U, 11-102U, 11-103U, 11-104U, 11-105U, Ch. 330

Chassis 330 is similar to Chassis 301, which is also used with the above models, except that the 330 uses a 12SQ7GT (V3) in the detector—avc 1st a-f amplifier stage, whereas the 301 uses a 12AV6. The 12SQ7GT is connected in the following way: pin 1 goes to the shield; pin 2 goes to the junction of R5 and C8B; pin 3 goes to the junction of ground, pin 4, and C8A; pin 5 goes to tap 2 of the 2nd i-f transformer T2, pin 6 goes to the junction of R8, C8C, and C8D; pin 7 goes to pin 3 of V1, and pin 8 is grounded. The voltage readings are as follows: pins 1, 3, 4, and 8 are 0 volts; pin 2 is —0.8 volt; pin 5 is —0.6 volt; pin 6 is 52 volts; pin 7 is 12 volts a.c.

The following part should be added to the parts list: TS2, Part No. W-46447-1, Shield, tube (V3).

United Motors 980899, Buick

The value of the 7259128 (Illustration No. 35) electrolytic capacitor has been changed so that all sections are now 20 μf. Thus, the cathode bypass capacitance on the output tubes has been raised from 10 μf to 20, and the schematic should be altered to comply with this change.

The 470-ohm resistor (Illustration No. 63) in the cathode string of the 6R8 bucking diode circuit has been eliminated after Serial No. 94295.

General Electric 402

R2, shown connected to B+, should cross over the vertical B+ lead to pin 6 of V2, and a dot connection should be drawn at the vertical B— lead to pin 2.

Sparton 1080A, 1081A, Ch. 8L10

Model 1080A in mahogany and Model 1081A in blond are radio-phonograph combinations using radio chassis type 8L10. All of the information on Chassis 8L10 is contained in the service notes for this chassis.

Philco 50-621

This model completed production without change and appears as Run #1 only. The following corrections and additions have been made to the Parts List:

Part No.	Description
34-8003-1	Selenium rectifier, 100 ma, CR1
10761-3	Cabinet, brown
10761-4	Cabinet, beige
10761-5	Cabinet, green
54-4712-3	Back, brown
54-4712-4	Back, beige
54-4712-5	Back, green
Delete	Front
Delete	Shield base.

RCA RP-168 Series

The RP-168 Record Changer Series is used in the following instrument models:

Record Player Attachments 9JY, CP-5203, 45J, QJY

Record Players (without radio) 9EY3, 9EY31, 9EY32, 9EY35, 9EY36, 45EY, QEY3

Radio-Phonograph Combinations 9QV5, 9W51, 9W78, 9W101, 9W102, 9W103, 9W105, 9W106, 9Y7, 9Y51, A55, A78, A106.

Radio-Phonograph-Television Combinations 9TW309, 9TW333, 9TW390, TA128, TA129, TR126, S1000

Detailed drawings (see Fig. 1) and descriptions for the pickup arm assemblies are given below:

SUB-BASE ASSEMBLIES

Type I—Sub-base Stock No. 74070. Has staked studs for spring anchors and one-piece reject lever. Stamped or labelled RP168-1 or RP168-3.

Type II—Same as Type I, except it uses a two-piece reject lever. Use Stock No. 74743 Sub-base (Type III) for replacement.

Type III—Sub-base Stock No. 74743. Same as Type II, except that it has pickup-arm rest on sub-base (when motor-board rest is used, the sub-base rest is to be deformed).

Type IV—Sub-base Stock No. 74468. It uses an a-c input connector and audio output jack mounted on a separate bracket. Labelled RP168-2 and used only with Model CP-5203.

Type V—Sub-base Stock No. 74856. Has turned up lances for spring anchors. Idler wheel mounting plate (45B, Stock No. 74814) is removable. It is labelled RP168-1, RP168B-1, etc. It has pickup-arm rest on sub-base (when motorboard rest is used, the sub-base rest is to be deformed).

NOTE:—Two different main levers (director lever) are used, depending upon which turntable assembly is used. Lever (41), Stock No. 74076 has a long end (41C) and is used with Turntables Types I and II. Lever (41), Stock No. 74857 has a short end and is used with Turntable Type III.

Type VI—Stock No. 74803. Similar to Type V, but it does not bear any "RP168" identification. It has pickup-arm rest on sub-base. Idler wheel mounting plate (45B) is secured to the sub-base with a shoulder rivet.

Type VII—Same as Type VI, except it does not have pickup-arm rest on sub-base. Use Stock No. 74803 (Type VI) for replacement (the pickup-arm rest is to be deformed).

NOTE: Type VI and VII—Late production of these types have the idler wheel mounting stud (22) staked to its mounting plate. The idler wheel retainer (horeshoe washer) is Stock No. 75081.

PICKUP-ARM ASSEMBLIES (LESS PICKUP)

Type I—Arm Stock No. 74041. Stamped 970488. Pickup-arm stud (9A) is full diameter for entire length (do not use where pickup-arm rest is on sub-base). Lead counterbalance is riveted to arm. Arm Stock No. 74443. For Model CP-5203 only. Black finish, otherwise similar to No. 74041.

Type II—Arm Stock No. 74824. Same as No. 74041 except that stud (9A) has a flat on one side at bottom end. Can be used with either type of pickup rest. Arm Stock No.

(Continued on page 22)

RCA RP-168 Series
(Continued from page 20)

75058. For Model 45EY only. Two-tone finish, otherwise same as No. 74824.

Type III—Arm Stock No. 75073. Stamped 3R1. Similar to No. 74824 except that a different pivot (9B) is used and the lead counter-balance is fastened to the arm with a screw. Stud (9A) is of smaller diameter at bottom end. Can be used with either type of pickup rest. Use only with No. 74059 pivot arm.

Type IV—Same as Type III except that stud (9A) is of full diameter for entire length. Use No. 75073 for replacement.

Type V—Arm Stock No. 74796. Stamped 3R1. Similar to Type III except that a different pivot (9B) is used and the lead counter-balance is not used. A 5/8" o.d. counter-balance spring is used. Can be used with either type of pickup rest. Use only with No. 74799 pivot arm.

Type VI—Same as Type V except that stud (9A) is of full diameter for entire length.

REPLACEMENT OF STYLUS

Use No. 74796 for replacement.

When replacing a stylus, never bend the stylus support wire with crystal pickups (Stock Nos. 74067 and 74625) remove the two screws holding sapphire guard in place and remove the guard. Remove the small nut and washer on the threaded shaft of the sapphire holder and gently push the shaft through the hole in the armature shaft until the sapphire holder assembly comes free. Extreme care should be used when loosening the nut so that the twisting motion does not break the crystal. Take hold of the lower end of the shaft with a pair of pliers while loosening or tightening the nut, being very careful so as not to strip the threads or break the crystal. Insert threaded shaft of replacement sapphire holder through armature shaft and replace the washer and nut. Make sure that the sapphire is in the correct position. Replace the sapphire guard, positioning it by means of the oversize screw slots. Make certain that the sapphire and its supporting wire are centered in the guard. Tighten the guard screws. Before using, check to see that the sapphire projects far enough beyond the guard so that the guard will not touch the record. If necessary, bend the guard a little.

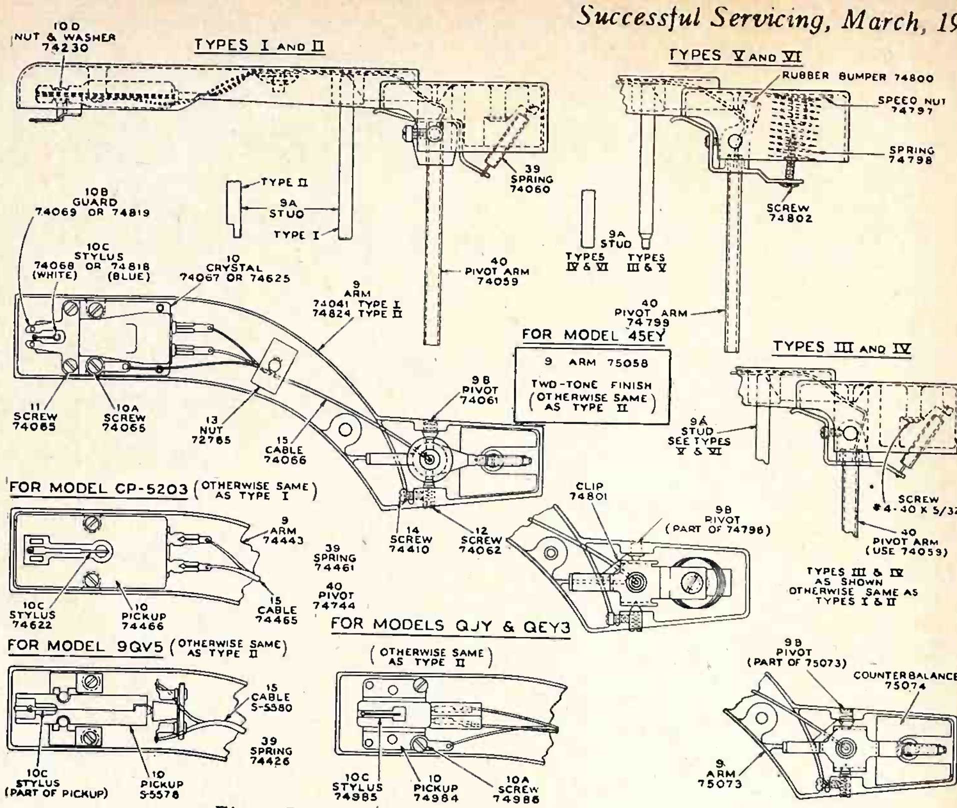

Fig. 1. Pickup arm assemblies for RCA RP-168 Series.

When using a variable reluctance pickup (Stock No. 74466) to remove the stylus assembly, insert a bent paper clip or equivalent tool into the stylus stud pin socket (see Fig. 2). Press the assembly out from the cartridge with the tool as shown by the arrow in the illustration. To replace the stylus assembly, insert the stud pin into the recess, with the locating tab positioned above the locating slot between the two pole pieces. Press assembly in firmly by applying pressure upon the stud pin with a blunt tool. Care must be taken to press assembly only at this point so as not to damage or distort the stylus arm.

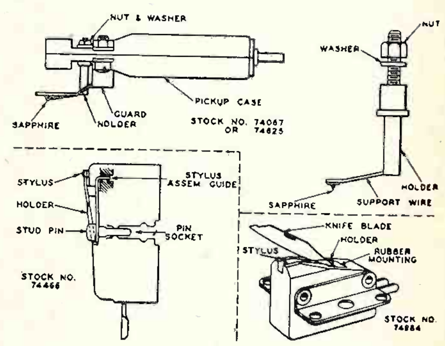

Fig. 2. Stylus replacement.

When using a ceramic pickup (Stock No. 74984) to remove the stylus insert the point of a knife blade between the stylus wire and the case. The stylus may be pried out of its rubber mounting with a twisting motion of the knife blade. To replace stylus, push end of stylus wire down into its rubber mounting. Be certain that the stylus is centered in the groove of the pickup case.


20"
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General Electric 752

A 47-$\mu\mu$f, silver mica capacitor, C3, was added to the circuit of later receivers to prevent parasitic oscillation. C3 has been added from ground to the junction of R6 and the f-m terminal of S1E. In the Visual Alignment Chart, Step 5 of FM-IF Alignment, change adjustment "Core of T4" to read "Core of T9."

Westinghouse H-210, H-211, Ch. V-2144, V-2144-1

For convenience in later production, capacitor C11 that is connected between the common negative line and the chassis is changed to 0.15 μf, 200 volts, part no. V-6066-2154M.

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The Rider Manual Page Numbers given under Radio Changes are for Rider AM-FM Manuals. The volume number is the number preceding the dash.

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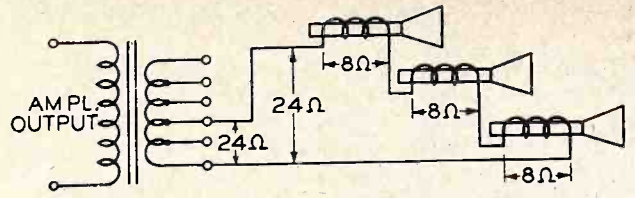


Fig. 1. When three 8-ohm loudspeakers are connected in series, the total impedance will match that of a 24-ohm tap.

LOUDSPEAKER MATCHING

by JOHN F. RIDER

Editor's Note: This article on Loudspeaker Matching is an excerpt from Chapter 3, entitled "Impedance Matching," of INSTALLATION AND SERVICING OF LOW POWER PUBLIC ADDRESS SYSTEMS by John F. Rider, published by John F. Rider Publisher, Inc. The May issue of SUCCESSFUL SERVICING will contain another article on the subject of impedance matching.

The *matching* of one component to another in a p-a system is very important. A bad match between a good amplifier and a loudspeaker will give poor results in terms of power output and fidelity.

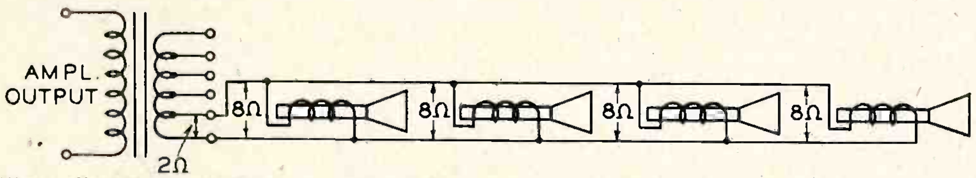


Fig. 2. Four 8-ohm loudspeakers connected in parallel will match the impedance of a 2-ohm tap.

Given an output tube having a stated plate circuit impedance, it is necessary that the loudspeaker voice-coil impedance match the impedance of the plate circuit. For the best possible fidelity, the source and load impedances should match within about 10 percent.

The impedance of a loudspeaker is the impedance of the voice coil and is always included in loudspeaker specifications. This impedance, which is equal to the voltage across the moving coil divided by the current through it, is given at a particular frequency, usually 400 cycles. Voice-coil impedances generally range from 2 to 16 ohms, with most between 6 and 8 ohms, however, in special loudspeakers it may be as much as 50 ohms. When loudspeakers are directly connected in various types of series, parallel, or series-parallel combinations, the impedance offered by the total load may be anywhere from 0.1 ohm to 500 ohms in commercial practice.

Generally when the distance between the amplifier output transformer and the loudspeaker is about 200 feet or less, the line can be run at the impedance of the voice coil. The term "line impedance" as used here does not refer to any characteristic which the line itself has but means that the conductors are connected to a load of that type impedance. Thus a low-impedance line means that the wires are connected to a low-impedance load. Any combination of loudspeakers can be connected by a low-impedance line.

Matching of Loudspeakers on Low-Impedance Lines

The total load impedance offered by two or more loudspeakers connected in series is the sum of their individual impedances. This total load can match the amplifier output by connecting it across the same value of tap impedances. Thus, if three 8-ohm loudspeakers are series-connected, matching is secured by connecting the entire load across a 24-ohm tap on the output transformer as shown in Fig. 1.

The total load impedance offered by two or more loudspeakers connected in parallel, when all have the same voice-coil impedance, is equal to the impedance of any one loudspeaker divided by the number of loudspeakers. Thus, if four 8-ohm loudspeakers are connected in parallel, the total load impedance $Zr=8/4=2$ ohms. For proper matching, the loudspeakers should be parallel-connected to a 2-ohm tap on the output transformer as shown in Fig. 2.

The total load offered by four or more loudspeakers connected in series-parallel, when all have the same voice-coil impedance, is equal to the impedance of any series branch line, divided by the number of such series lines that are in parallel. If four 8-ohm loudspeakers are series-parallel connected so that there are two loudspeakers connected in series in each branch and two branches in parallel, then the effective load is $16/2=8$ ohms. This load should be connected to an 8-ohm tap for proper matching, as shown in Fig. 3.

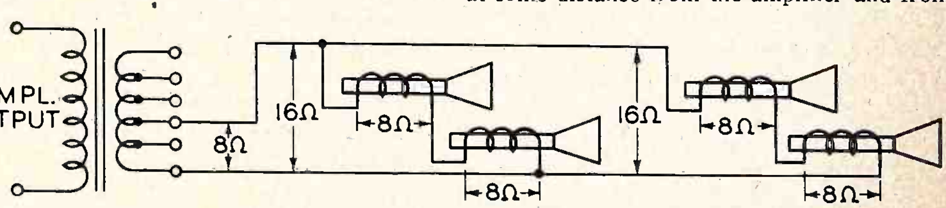


Fig. 3. When four 8-ohm loudspeakers are connected in two parallel branches of two series-connected loudspeakers each, the total load impedance will be 8 ohms.

Matching on High-Impedance Lines

Where several loudspeakers are situated at some distance from the amplifier and from each other, then each loudspeaker (or group of loudspeakers) can be matched to a 500-ohm

(Continued on page 10)

Television Changes

Sarkes Tarzian TT3

The following revisions have been made in the TT3: The 6AG5 has been changed to a 6CB6 with no change in the wiring; a 680-$\mu\mu$f capacitor has been added from ground to the junction of R1 and the agc lead.

Motorola 9L1

Model 9L1 incorporates a Chassis TS-18 or TS-18A and is electrically identical to the chassis published. The only difference is in the size of the picture tube and the hardware used with 9L1.

Affiliated Retailers AR-16CD, AR-16CD-3CR, AR-163CR, AR-216, AR-316, AR-316-3CM, AR-816-3CM

These models are similar to Models AR-16CX and AR-816-3CR, and employ 16-inch round picture tubes.

Muntz M159

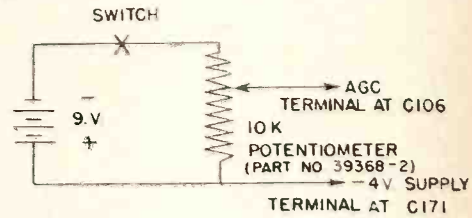
Sets below Serial No. 22,000 did not contain a high-voltage filter capacitor as the coating on the outside of the picture tube had a capacitance effect and the capacitor was not necessary. Since picture tubes now leaving the factory do not have an aquadag coating upon the outer surface of the tube, it will be necessary to add the high-voltage filter capacitor Part No. CC-0070, 500 $\mu\mu$f,, 20,000 volts d.c. (as shown in the schematic for Model M169), if a new picture tube is installed in chassis below 22,000.

Crosley 10-401, 10-414MU, 10-416MU

It has been found that on some receivers the horizontal oscillator exhibits a tendency to drift causing the receiver to fall out of horizontal sync after operating several hours, or, if the horizontal sync adjustment was made after the receiver has been operating for some time, the picture will not fall in sync when the receiver is cold. This trouble may be attributed to the 0.01-μf capacitor, C160. This capacitor, if it is of the molded type (Type 487), may change capacitance with temperature change sufficiently to cause the receiver to fall out of horizontal sync. To make correction, replace the 0.01-μf molded capacitor C160 with a 0.01-μf, 600-v, paper-type capacitor (Part No. 39001-13).

If trouble is experienced with the above models in centering the picture and reducing the neck shadow, it may be caused by reversed polarity of the focus coil. If this is suspected, the polarity can be changed by reversing the current through the coil. To do this, interchange the leads to the focus coil at the points where they are soldered under the chassis. Try centering the picture again. If the centering action is easier and the neck shadow diminished, and if the angle the focus coil makes with the neck of the picture tube is almost a right angle, the connection is correct. The reason for difficulty in centering, when the focus coil polarity is incorrect, lies in the fact that the magnetic field from the focus coil interacts unfavorably with the field from the ion trap. When the coil is connected correctly, the current flow will produce a "North Pole" on that face of the coil nearest to the tube socket.

Picture and sound separation can be caused by a narrow bandpass of the i-f stages, narrow bandpass of the r-f tuner, or a combination of both. Check the i-f bandpass with a sweep generator, marker, and scope. The response curve should appear as shown for Model 10-401. Check the r-f tuner by substituting it with a unit that is known to be in good alignment.



Battery pack arrangement used as bias for agc circuit.

In some cases, when using test equipment to align the above models, or when the gain of the receiver may be affected by another section of the receiver such as improper functioning of the horizontal deflection circuits, it is advisable to substitute a bias for the agc circuit which can be adjusted manually to any desired setting. It is suggested that the battery pack arrangement shown in the accompanying diagram be used for this purpose by clipping the two external leads into the chassis wiring at the points indicated. No wiring changes are necessary. A spst switch is employed to break the circuit when the battery pack arrangement is not in use. In order to prevent a run down battery, due to the switch being left turned on, it is suggested that a micro-switch be incorporated in one side of the unit. When the unit is placed on the chassis with the switch down the switch contact will close. When the unit is removed from the chassis the switch will open automatically.

Westinghouse H-605T12, Ch. V-2150-101

In some deflection yokes used in this model, the nut for the deflection yoke adjustment wing-screw may bind with the metal channel in which it rides. The binding makes it difficult to position the yoke snugly against the bell of the cathode-ray tube. If the yoke is not fitted snugly against the bell, shadows may appear around the edge of the crt face. To correct this condition, loosen the deflection yoke adjustment wing-screw and carefully force the deflection yoke forward as required. In extreme cases, it may be necessary to remove the deflection yoke and pry the nut toward the rear of the yoke using a screwdriver.

Tele King MST14, 14TR, 17CA, 17RO, 114A, 117, 117C, 117CA, 117LO, 162, 173, 516A

These models are similar to Models 116 and 516. Models MST14, 14TR, and 114A employ 14-inch picture tubes. Models 162 and 516A employ 16-inch rectangular picture tubes. Models 17CA, 17RO, 117, 117C, 117CA, 117LO, and 173 employ 17-inch rectangular picture tubes.

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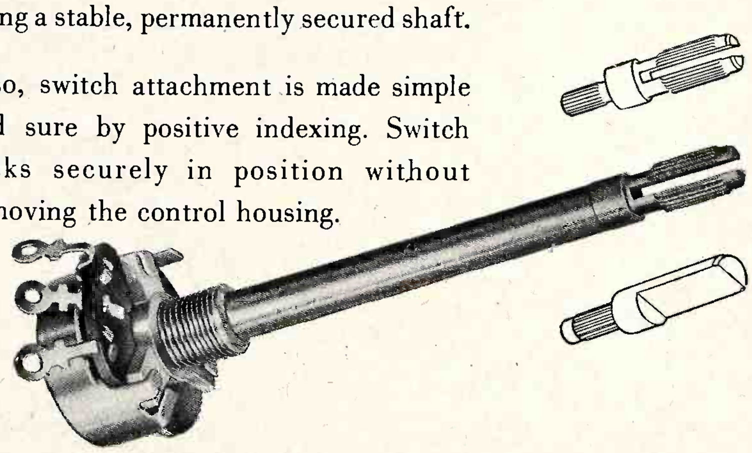

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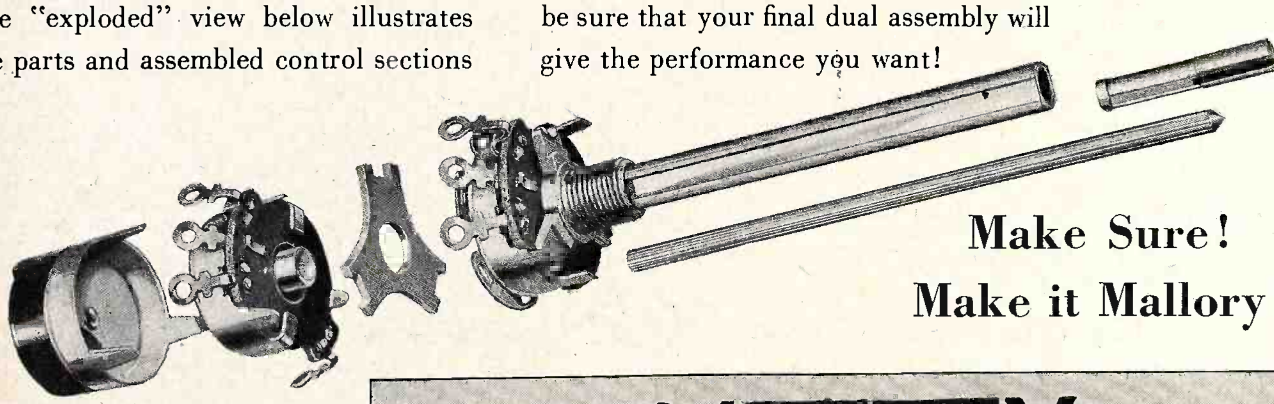

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CURTAIN TIME

Time is of the essence in the servicing industry! It is a certainty that it will become even more important as the days and months pass. One of the gripes that is being voiced by many service technicians is the time required to *untwine* leads wound around a connecting point as a part of the unsoldering operation. The loss of time, however, is not the only source of aggravation. An equally important sore spot is the frequent need for changing the lead dress of adjacent wires and circuit components in order to unwind the connection. Sometimes this is voluntary and, quite frequently, involuntary.

Considering the importance of correct lead dress in TV receivers, and for that matter in r-f, oscillator, and i-f systems of all receivers, it is only natural that the service technician be anxious to keep all unnecessary changes in wiring and component location to a minimum. To be forced to deliberately alter component conditions and then be certain that they are returned to their original locations so that resonance conditions and feedback conditions be normal, is a problem. Of that there is no doubt. We have had the experience ourselves.

Admittedly, a simple expedient when a connection is to be interchanged or a defective part is to be removed, is to clip a connecting wire at the junction point or soldering lug. This is quick, but it is messy and, strangely enough, is viewed with disfavor by meticulous service technicians. Isn't it possible to adapt a standard procedure of hooking the wire through a hole in the soldering lug or around the connecting point and then soldering? This would make the unsoldering operation very much simpler than having to untwist several turns. Quite frequently the solder cools and hardens before the untwisting job is completed, and it becomes necessary to re-heat the junction. If the soldering is done properly during the manufacturing stage, it makes for an equally good connection and a perfectly safe mechanical joint. Above all, it will be a boon to the servicing industry.

Changes

Quite a few of the changes relating to radio and television receivers contained in Rider Manuals and published in Successful Servicing make direct reference to servicing problems being solved by the circuit change. This is very important information, and we seriously recommend that if time does not permit a complete reading of each circuit change, the change should be glanced at prior to filing. The trouble being eliminated will be remembered even though the exact procedure may not always be retained in the mind. Quite a few of these troubles are obscure and, while tied specifically to one receiver in the reference, may be duplicated in some other receiver. The remedy as given may not be applied "in toto," but at least some direction of approach will be indicated.

The Self-Made Man

Many of the practicing servicemen of America are self-made men. By this we mean that their technical background has been gained by exposure to literature, by continued reading of theory, and, finally, by daily work at the bench. Expanding the storehouse of knowledge in this manner is nothing to be ashamed of for, after all, it is the practice of all people who have had a formal education and must keep up to date with the changing technology. A formal education can do nothing more than lay the foundation upon which more and more knowledge may be piled. As far as the servicing industry is concerned, the circuit descriptions which are contained in Rider Manuals, especially the TV Manuals, are vital sources of technical information. They comprise an education because they explain what happens in the TV receivers which are sold to the public. It is wrong for the serviceman to feel that he does not have time to read circuit descriptions. He *must* find time. The servicing industry is not a static industry. It is continually on the move, and the technical background of every TV technician must expand with it.

John F. Rider

Sarkes Tarzian TT2

The following revisions have been made in the TT2: L213 is now .180 (was .173); L313 is now .155 (was .160); and L401 is now .165 (was .170).

●

Tele King 16C03CR, 16CX, 162, 216, 316, 416CAF, 916, 916C, 916CAF, 3163CM

These models are similar to Models 416 and 716 and employ 16-inch round picture tubes.

Television Changes

DeWald DT-160

The focus coil has been deleted from the circuit. This information was omitted inadvertently from the change notice on this model that appeared in the February 1950 issue of SUCCESSFUL SERVICING.

●

Affiliated Retailers AR-MST14, AR-MST16, AR-16ATR, AR-114A

Models AR-MST14 and AR-114A are similar to Model AR-14TR and employ 14-inch picture tubes. Models AR-MST16 and AR-16ATR are similar to Model AR-16TR and employ 16-inch rectangular picture tubes.

RCA 8T241 Series

Check to see that the receiver antenna transformer T115 is connected properly and that no windings are open. Remove 8T241 r-f unit and change R11 to 10,000 ohms.

If the receiver is to work in weak signal areas and never to receive a strong signal, then maximum r-f gain can be obtained by installing a small bleeder just to supply —0.5 volts for the r-f amplifier grid. R12 should be disconnected from its present position and reconnected to this —0.5-volt point. Check oscillator injection into mixer. This should read at least —2.5 volts on all channels when measured by a VoltOhmyst at test connection R13. If this is not achieved, adjust the link between L2 and L3 until such injection is obtained.

Realign r-f unit for peak performance on the channels to be received.

Change R102 to 68 ohms. Realign the picture i-f making sure that the high frequency slope of the response curve is broad as specified in the service data. If receiver is to be operated in a very weak signal area, place the picture carrier at 60%, or even 80% on the slope. Check to see that the receiver retains proper response at low signal input levels, and —1.0-volt i-f bias. Some change in response is normal, but the picture carrier should remain high on the curve. This alignment causes the picture to be smeared on strong signals but produces the best pictures on signals of less than 100 microvolts.

Make sure that the a-c line feeding the receiver is at least 115 volts at all times, as this radically effects the kinescope anode voltage. If the horizontal deflection system is operating improperly or is incorrectly adjusted, there may be insufficient high voltage on the kinescope. When a "snow flake" occurs, this causes the tube to bloom, making the snow more pronounced. Make sure that all +B voltages are normal, especially the 6BG6 screen. Change R181 to 150,000 ohms. Adjust the drive trimmer as far counterclockwise as possible. It should be possible to have at least 9000 volts on the kinescope at this point.

Adjust the focus coil carefully so as to obtain best focus in white areas of the picture. Modify the video amplifier to saturate on whites, thus reducing the prominence of the "snow." Disconnect R124 from —120 volt bus and return it to ground. This causes adjustment of the picture control to affect brightness, however, once set, these adjustments can be left alone.

Adjust the agc threshold control counterclockwise from the normal position to provide the best signal to noise (snow) condition. Unfortunately, this makes the sync more susceptible to impulse type interference such as ignition, etc.

Cut the antenna transmission line length to provide maximum signal. This effect is most noticeable on the high channels.

In general, use the highest gain antenna array that can be had, place it as high in the air as possible and above all surrounding obstacles, especially power lines. In some cases, however, if the electric field is distorted, a simple antenna may produce more signal than an elaborate array, and the height may become critical. In selecting an antenna for gain, make sure that high gain occurs on the channel or channels to be received. Some antennas, in order to reduce size, cut off badly on channel 2, and on some, the response is slightly down even on channel 3. In general, the best antenna or array for any particular channel is one cut for that channel.

Unless bothered with an extremely high noise level (ignition, etc.) the antenna transmission line should be the 300-ohm open type. Coaxial and twinex have higher losses than the open line, which in weak signal areas cannot be tolerated. In time, however, open wire line may foul up and have to be replaced. This fouling shows up as a loss of signal in wet weather.

The above modifications make these receivers so "hot," that a booster is not likely to be of help in the receiving of weak signals.

●

Tele King MST12, 312

These models are similar to Model 812 and employ 12½-inch picture tubes.

Television Changes

General Electric 12T3, 12T4, 12T7, 12C107, 12C108 and 12C109

Late production receivers incorporated the following change to increase the horizontal sweep width: Add a 220-$\mu\mu$f, 1500-volt capacitor (Stock RCU-295) between terminals #6 and #8 of the horizontal sweep output transformer, T351. Either two 390-$\mu\mu$f capacitors (Stock UCU-1042) in series or two 470-$\mu\mu$f capacitors (Stock UCU-1044) in series may be substituted for the 220-$\mu\mu$f capacitor.

Early production receivers made use of a 41.25-Mc trap coupled to the 2nd video i-f coil. This caused "buzz" in audio on some receivers when the receiver was properly tuned for best picture detail at low contrast setting or when operating on a rather weak signal. This trap was removed on all late production receivers and was made less effective on receivers in process of fabrication, by shunting the trap by a 5100-ohm, ½-watt resistor by connecting it across the trap trimmer C281. If this change is desired in the field, the shunting of C281 by the resistor does not require a realignment of the video i-f.

To improve the "pull-in" range of the horizontal synchronizing circuit in the above receivers, a late production change was made which changes the value of R379 from 180,000 ohms, to 270,000 ohms, ½ watt. This resistor is in the circuit which supplies bias to the afc control tube. In some receivers, a 220,000-ohm resistor was substituted until an adequate supply of the recommended value was obtainable.

●

Westinghouse H-242, Ch. V-2150-31

The schematic diagram of the service notes for this chassis shows a capacitor, C336, and a resistor, R339, in the cathode circuit of the 6AH6 video output tube. These components were not incorporated in some of the early production chassis. In early chassis that do not contain C336 and R339, a sharper picture can be obtained in strong signal areas by adding the two components as shown on the schematic. It should be noted, however, that insertion of the two components will reduce the gain of the stage somewhat, and in weak signal areas the reduced gain may overbalance the improvement in sharpness.

Steps 5 to 7 of the "High-Voltage Oscillator Adjustment Procedure" should be changed to read as follows:

5. Turn off the receiver, disconnect the 13 megohms of resistance, and connect the high-voltage lead to the crt.
6. Connect the kilovoltmeter between the h-v lead and the chassis.
7. Turn on the receiver and adjust R466, which controls the d-c supply voltage to the h-v oscillator, so that the voltage indicated on the kilovoltmeter is 10.5 kilovolts, plus or minus 0.5 kv.

The frequencies specified in steps 5 to 8 of the alignment procedure should be changed to read as follows:

Step 5—22.6 Mc; Step 6—25.9 Mc; Step 7—25.6 Mc; Step 8—23.8 Mc.

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Westinghouse H-603C12, H-608C12, Ch. V-2152-01

The schematic diagram of the V-2152-01 chassis (Figure 14 in the service notes) should be changed to include later production changes as follows:

1. The value of C408, which is connected from pins 5 and 7 of the 6AL5 horizontal afc tube to ground, has been changed from 0.0033 μf to 0.002 μf. This change is made to improve the horizontal hold.
2. Add a 0.0-μf capacitor C439 from the junction of R441 and R433, located in the pin 7 grid circuit of the 12AU7 horizontal multivibrator, to ground. This change is made to improve the horizontal hold.
3. Change the resistance of R456 in the cathode circuit of the 6BQ6/GT horizontal output tubes from 33 ohms to 150 ohms.
4. Change the resistance of R431, located in the pin 6 plate circuit of the 12AU7 horizontal multivibrator, from 10,000 ohms to 33,000 ohms. This change stabilizes the operation of the multivibrator.
5. Add a 0.01-μf capacitor C511 and a 100-ohm resistor R506 connected in series from the junction of L501 and R501 to ground. These components suppress arcing at the selector switch contacts.

The following changes and additions should be made to the Parts List:

Ref. No.	*Part No.*	*Description*
C408	V-6023-6202M	Capacitor, 0.002 μf
C439	V-6023-4104M	Capacitor, 0.1 μf, 440 v
R431	RC30AE333K	Resistor, 33,000 ohms, 1 w
C511	V-6023-4223K	Capacitor, 0.01 μf, 400 v
R506	RC20AE101K	Resistor, 100 ohms, ½ w.

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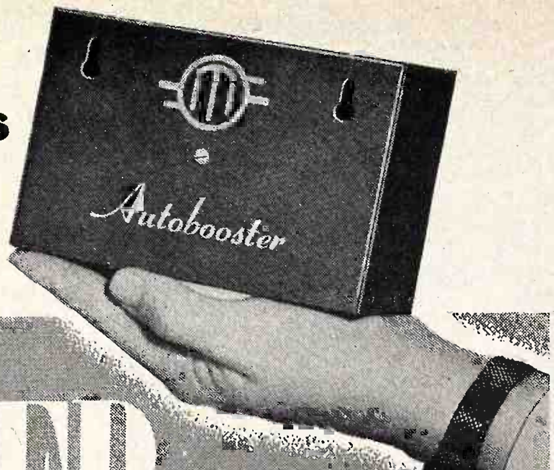

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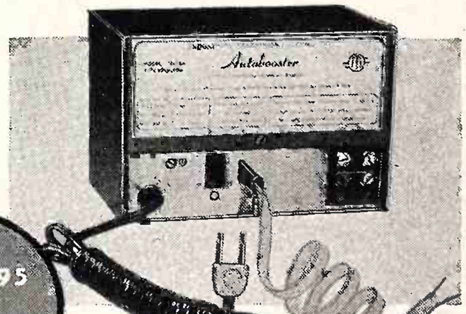

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Amplifies FM Band	YES	YES	NO	NO	YES	NO	NO
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LOUDSPEAKER MATCHING

(Continued from page 1)

line (or other high impedance) by means of an individual transformer having a primary impedance such that in combination with the other individual transformer primary impedances the total load is 500 ohms (or equal to the amplifier tap impedance used). Four loudspeakers in series-parallel using two matching transformers, or nine loudspeakers in three series-parallel groups using three matching transformers, can each be connected so as to offer an impedance equal to that of the line. Fig. 4 illustrates line matching of the above-mentioned series-parallel connected loudspeakers. It will be noticed that the matching transformer secondary impedance equals the load connected across it.

(More next issue)

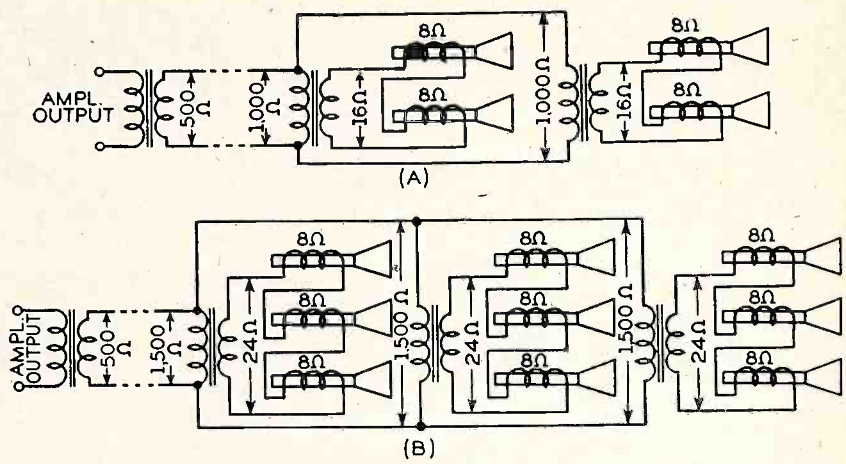

Fig. 4. Low-impedance loudspeakers can be connected to a high-impedance amplifier in many ways using line matching transformers. Parts (A) and (B) illustrate two such possible configurations.

Belmont C-1602 Series C

Model C-1602 Series C is similar to Model C-1602 Code 8 except for the differences mentioned below:

Resistor R3, the 470,000-ohm resistor connected from lug 2 (antenna input) to ground has been deleted. Lug 2 is connected directly to lug 4, 1 and 3 are connected to the antenna input terminals. The value of resistor R4, going to pin 1 of the 6AG5 r-f amplifier, has been changed from 100,000 ohms to 10,000 ohms. Resistors R2, R5, R8 and R10, that were tied to lug 10 of the tuner, are now grounded. Capacitor C33, 1000 $\mu\mu$f, that went from R10 to ground, has been deleted. Capacitor C32, the 200-$\mu\mu$f capacitor going from ground to the junction of pin 4 of 6AG5 r-f amplifier and tuner lug 6, has been deleted. Capacitor C31, the 220-$\mu\mu$f capacitor going from ground to the junction of pin 3 of the 6J6 converter and tuner lug 7, has been deleted. Capacitor C30, the 220-$\mu\mu$f capacitor that was connected from pin 4 of the 6J6 converter and tuner lug 8 to ground, now is connected from pin 3 of the converter to ground. Pin 3 of the 6AG5 and pin 3 of the 6J6 are tied directly to lug 8, which goes to the heater, pins 4 of both tubes are grounded. R4, mentioned above, now goes from pin 1 to lug 9, instead of to ground, and lug 9 is connected to agc at the junction of the low side of capacitor C55 (5 μf, 50 volts) and the 2200-ohm resistor R53. The value of resistor R54 has been changed from 220,000 ohms to 68,000 ohms, and R54 is now inserted in the line going to tuner lug 9, instead of going from ground to tap 7 of T8. A 33,000-ohm resistor R110 has been added from ground to the junction of lug 9 and R54. The 0.2-μf capacitor connected from ground to tap 7 of T8 has been deleted from the circuit.

In the tuner chassis, the 0.5-$\mu\mu$f capacitor C10, connected in parallel with C11, 1.5 μf, has been deleted. The 51-$\mu\mu$f capacitor C28, connected from L9 to C29 has been deleted. The 7-$\mu\mu$f capacitor C27, connected in parallel with L9, has been deleted from the circuit, and capacitor C24, the 7-$\mu\mu$f capacitor connected in parallel with C26, has been substituted in place of C27. The 51-$\mu\mu$f capacitor, C25, connected from the junction of C24 and C26 to pin 5 of the 6J6 converter, has been deleted from the circuit.

Gamble-Skogmo 94RA33-43-8135

The 94RA33-43-8135 is the same as Models 94RA33-43-8130C and 94RA33-43-8131C except for the differences mentioned below. The physical difference is the cabinet, larger drum on the tuning gang, speaker bracket, dial glass, dial bracket and power-cord strain relief. The parts list for Model 94RA33-43-8135 is the same as that for the 8130C and 8131C except for the following parts.

Part No.	*Description*
E81650-2	Tuning gang
E81645-S2	Speaker
M1607-2	Dial bracket
P1602-2	Dial glass
SR-2P	Strain relief
P1601A-2	Cabinet, walnut
M1605-2	Chassis.

Crosley 11-100U, 11-101U, 11-102U, 11-103U, 11-104U, 11-105U

The following procedure should be used when installing an idler spring (part no. 151085) on the drive shaft:

1. Remove cotter from end of shaft under chassis.
2. Pull drive shaft straight out from chassis being careful to keep drive cord on shaft and pulley.
3. Remove spring washer from shaft.
4. Place idler spring on shaft and then hook one end of the spring under the chassis. The other end of the spring hooks around the portion of drive cord that is between the drive shaft and the tuning capacitor pulley.
5. Place spring washer on the drive shaft, insert drive shaft in chassis, and insert cotter on end of shaft.

Radio Changes

General Electric P15

To further clarify the identity of the three spindles for the record speeds for which they are to be used, the following descriptions have been added to the Parts List for record changer P15: RMU-060 Spindle, offset spindle for 7 inch, 33-1/3 rpm records; RMX-162 Spindle, for 10 or 12 inch, 33-1/3 or 78 rpm records; RMX-163 Spindle, for 7 inch, 45 rpm records.

●

Admiral 6RT41, 6RT42, 6RT43, Ch. 5B1-PH

Models 6RT41, 6RT42, and 6RT43 use radio chassis 5B1-PH. The 6RT41 is a plastic table combination using record changer RC160 or RC160A. The 6RT42 and the 6RT43 are wood table combinations using radio chassis 5B1-PH and record changers RC160 or RC160A. In addition to the RC160 and RC160A, the 6RT42 may use an RC150 record changer.

●

Admiral 6C71-71A, Ch. 10A1; 7C62-62A, Ch. 6M1; 7C63-63A, Ch. 7C1

Model 6C71-71A is a console combination using radio chassis 10A1 and record changer RC200. Model 7C62A-62A, Ch. 6M1, and Model 7C63A-63A, Ch. 7C1, are console combinations and use either record changer RC170 or RC170A.

●

Gamble-Skogmo 94RA4-43-8129A, 94RA4-43-8130A, 94RA4-43-8130B, 94RA4-43-8131A, 94RA4-43-8131B, 94RA4-43-8132A

Model 94RA4-43-8129A is the same as Model 43-8129A. Models 94RA4-43-8130A and 94RA4-43-8130B are the same as Models 43-8130A and 43-8130B, respectively. Model 94RA4-43-8131A is the same as Model 43-8131A. Model 94RA4-43-8131B is the same as Model 43-8131B. Model 94RA4-43-8132A is the same as Model 94RA4-43-8131A except that it employs a maroon cabinet.

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Motorola BKOA, CT8A, GM9TA, GMOT, HNO, ILOTC, KR9A, OEO, PCO, PC9A, SR9A, Ch. 10A

The above models all use Chassis 10A. Model BKOA is used in 1950 Buick Special, Super and Roadmaster cars. It will also accommodate 1949 Buick Super and Roadmaster; also the 50-70 Series 1948, '47, '46, and '42 Buick cars. Model CT8A is used in 1948 Chevrolet. It will also accommodate 1947, '46, '42, and '41 Chevrolet cars. Model GM9TA is used in 1949 and 1948 GMC and Chevrolet trucks. Model GMOT is used in 1950, '49, and '48 GMC and Chevrolet trucks. Model HNO is used in 1950 Hudson (Pacemaker, Super, and Commodore). Model ILOTC is used in International L-Line trucks. Model KR9A is used in 1949 Kaiser and Frazer. Model OEO is used in 1950 Series 76 and 88, all 1949 and 1948 Futuramic Oldsmobile cars. Model PCO is used in 1950 and 1949 Pontiac cars. Model PC9A is used in 1949 Pontiac cars. Model SR9A is used in 1949 Studebaker cars.

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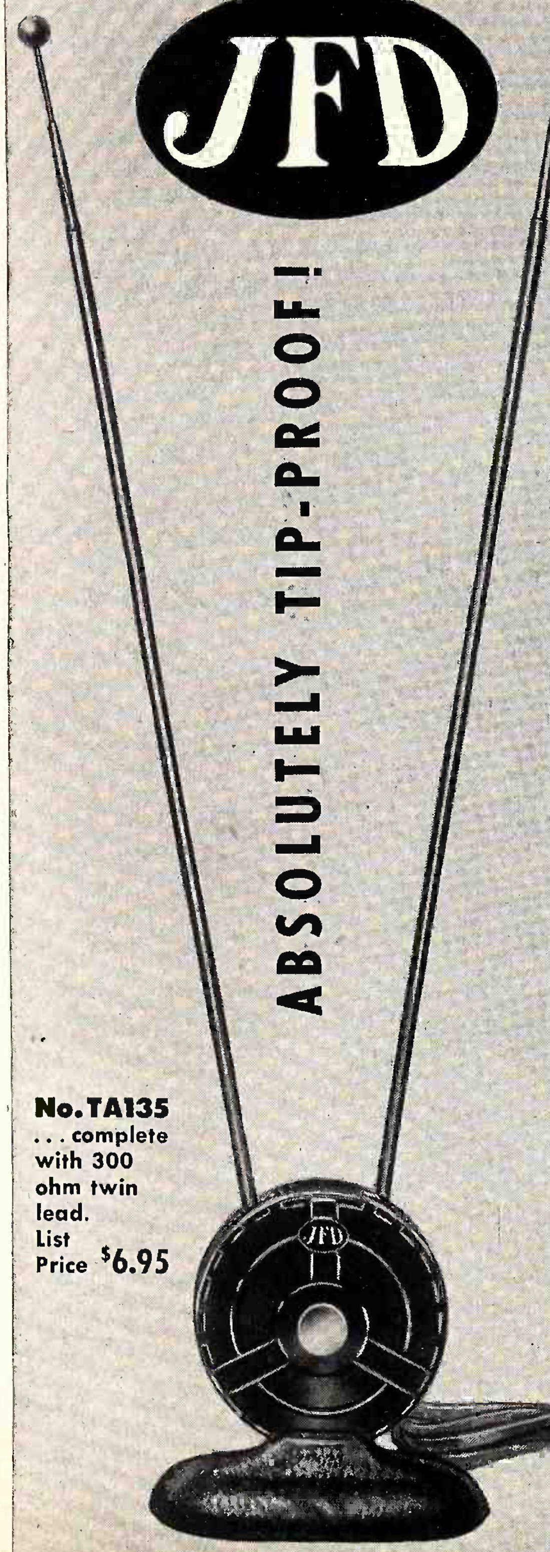

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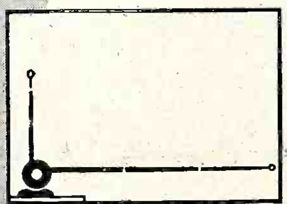

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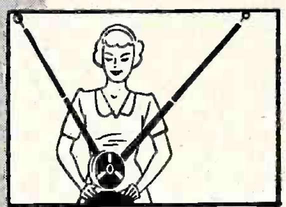

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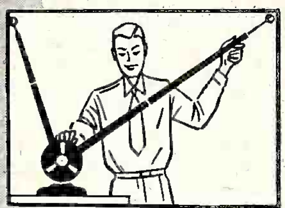

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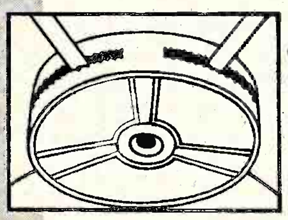

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Radio Changes

Admiral 6T06, 6T07, Ch. 4A1

Models 6T06 and 6T07, Ch. 4A1, are wood table models using a farm battery.

●

Admiral 6T01, 6T05, Ch. 6A1

Model 6T01 is a plastic table model using chassis 6A1. Model 6T05 is a wood table model using chassis 6A1.

●

RCA 8X541, Ch. RC-1065L; 8X542, 8X547, Ch. RC-1065M

These instruments are almost identical to the previous production of these instruments which used Chassis RC-1065J and RC-1065K.

Admiral 6T02, 6T04, Ch. 5B1

Models 6T02 and 6T04 are table models using chassis 5B1. Model 6T02 has a plastic cabinet, while Model 6T04 has a wood cabinet.

●

RCA A-82, Ch. RC-1094; A-91, Ch. RC-1095; A-108, Ch. RC-1096; 45-W-9, Ch. RC-1095A

The original carriage in all of the above models used a pull-out handle on the top front, the carriage now in use has a handle under the lower front edge. The same plastic frame may be used for all models. A plug button (supplied with each plastic frame) is used to cover a center hole which is unused on all models except A-108.

Frame—Stock No. 76161 is used as a replacement for frame Stock No. 75549 or 75571 (maroon).

Frame—Stock No. 76162 is used as a replacement for frame Stock No. 75683 or 75684 (light brown).

The new type of pull-out handle (lower front) is available as Stock No. 76125. If the original pull-out handle (top front) is desired it will be necessary to drill two holes in the frame. The holes are .203" diameter and are located .625" each side of the center line and 13/64" down from the top.

In Models A-91 and A-108 the color of wire used in the connecting cable has been changed. A black-white wire has been used as a substitute for the black wire (pin 1 to speaker) and a brown-white wire has been used as a substitute for the brown wire (pin 8 to speaker). A brown wire goes from pin 2 to the jewel lamp and a black wire goes from pin 3 to the jewel lamp.

In Model A-82 a substitute speaker (stamped 92569-9B) has been used in some instruments. It requires a different speaker cone than the one listed in the A-82 Parts List. Speaker 92569-9B uses Stock No. 75875 cone. Speaker 92569-9W uses Stock No. 74901 cone.

●

Admiral 6RT41A, 6RT42A, 6RT43A, Ch. 5B1A

Model 6RT41A is a plastic table combination using radio chassis 5B1A and record changers RC160 or RC160A. Models 6RT42A and 6RT43A are wood table combinations using radio chassis 5B1A and record changer RC160 or RC160A.

Gamble-Skogmo 43-8101, 165, 197, 197U

Model 165 is the same as Model 94RA31-43-8115A. Model 197 is the same as Model 94RA31-43-8115B. Model 197U is the same as Model 94RA31-43-8116A. Model 43-8101 is electrically the same as Models 94RA31-43-8115A, -8115B, and -8116A.

●

Gamble-Skogmo 43-7661, 43-7852

Model 43-7661 is the same as Model 43-7660 except that the 7661 uses a blond cabinet. Model 43-7852 is the same as Model 43-7851 except that it uses a blond cabinet.

●

Westinghouse H-312P4, H-312P4U, H-313P4, H-313P4U, H-314P4, H-314P4U, H-315P4, H-315P4U, Ch. V-2153-1

The following part should be added to the parts list for these models: R13 (Part No. RC30AE332K), 3300 ohms, 1 watt.

●

United Motors 982421, Oldsmobile

Capacitance drift of the 0.0012-μf mica capacitor used in the oscillator tank circuit (Illustration No. 20) sometimes occurs. This appears as intermittent oscillator frequency drift which seems to be the result of high temperature which may be caused by high input voltage or other extreme conditions. It may be necessary to cover the set or run at a high input voltage when bench testing in order to have the intermittent condition reappear. Since a fixed mica capacitor is usually considered a very stable unit, this condition is not a common occurrence. However, when oscillator frequency drift is encountered this capacitor should be considered as a possible source.

Westinghouse H-217, H-217A, Ch. V-2146-11DX; H-217B, Ch. V-2146-35DX

In the schematic diagram of the V-2146-11DX chassis (Fig. 6 of the service notes), the high-frequency oscillator tube should be a 6C4 rather than a 6AB4. In the schematic diagram of the V-2146-35DX chassis (Fig. 7 of the service notes) the 0.05-μf capacitor C338 in the d-c restorer circuit should connect to the top (cathode) of the 1N34 rather than to the bottom (anode).

In later production of Model H-217B, a built-in TV antenna is incorporated. Replacement parts for the antenna are as follows:

Part No.	Description
V-9358-2	Antenna assembly, TV
V-5574	Bearing, shaft (TV antenna)
V-6146-5	Knob, TV antenna
V-9323-1	Pulley and shaft assembly (short shaft)
V-9324-3	Pulley and shaft assembly (long shaft)
V-9328-1	Sleeve, rubber (TV antenna)
V-4057	Spring, TV antenna drive
V-3752S	Washer, felt (TV antenna knob).

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† The Rider Manual Page Numbers given under Television Changes are for Rider TV Manuals. The volume number is the number preceding the dash. Volume numbers preceded by an asterisk (*) apply to the 8½" by 11" page size Manual only.

The Rider Manual Page Numbers given under Radio Changes are for Rider AM-FM Manuals. The volume number is the number preceding the dash.

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MAY, 1951

LOUDSPEAKER MATCHING

by JOHN F. RIDER

Unequal Power Distribution—Low-Impedance Lines

Proper matching of several loudspeakers connected across the same output transformer requires that the output or secondary impedance of the transformer equal the combined impedance of the loudspeakers. Assume that an amplifier with an output of 40 watts has a single output impedance of 6 ohms. It is desired to connect two loudspeakers, one rated at 15 watts and the other at 25 watts, in parallel across the output. What should each voice coil impedance be? The following equation will help solve this problem:

$$Zsec = (\%\ P_T)\ Z_L \qquad (1)$$

That is, the impedance of the secondary winding is equal to the percentage of the total power taken by one parallel load ($\%\ P_T$) times the impedance of that load (Z_L). Thus, in the example cited, for the 15-watt loudspeaker, $6 = 40\%$ (approx.) Z_L; for the 25-watt loudspeaker, $6 = 60\%$ (approx.) Z_L. The respective voice-coil impedances are 15 ohms for the 15-watt loudspeaker and 10 ohms for the 25-watt loudspeaker.

The portion of power delivered to a single loudspeaker connected in parallel with other loudspeakers, expressed as a percentage of the total power in the network, is the ratio of the line impedance (total parallel impedance, Z_T) to the loudspeaker impedance (Z_{VC}), times one hundred. That is:

$$(\%\ P_T)_{VC} = \frac{Z_T}{Z_{VC}} \times 100. \qquad (2)$$

The loudspeaker impedance is, of course, the voice-coil impedance, while the parallel-line impedance is given by the equation for parallel impedances:

$$Z_T = \frac{1}{\dfrac{1}{Z_1} + \dfrac{1}{Z_2} + \dfrac{1}{Z_3}} \qquad (3)$$

If, for example, four loudspeakers which have voice-coil (vc) impedances of 2, 4, 8, and 16 ohms are in parallel, the parallel line impedance is then 1.07 ohms. When this parallel network is connected to a 1-ohm tap on the output transformer, the percentage of power delivered to each loudspeaker, using equation (2) is:

$$(\%\ P)_{2\ ohms} = \frac{1.07}{2} \times 100 = 53.4 \text{ percent}$$

$$(\%\ P)_{4\ ohms} = \frac{1.07}{4} \times 100 = 26.7 \text{ percent}$$

$$(\%\ P)_{8\ ohms} = \frac{1.07}{8} \times 100 = 13.3 \text{ percent}$$

$$(\%\ P)_{16\ ohms} = \frac{1.07}{16} \times 100 = 6.6 \text{ percent.}$$

The slight mismatch (1.07-ohm line to 1-ohm tap) does not affect the relative power distribution and does not have to be considered in making these calculations.

In a series-connected loudspeaker system, the percentage of the total power which one loudspeaker receives is the ratio of its voice-coil impedance ((Z_{VC}) to the series-line impedance (Z_T) times 100. That is:

$$(\%\ P)_{VC} = \frac{Z_{VC}}{Z_T} \times 100. \qquad (4)$$

If four loudspeakers having voice-coil impedances of 2, 4, 8, and 16 ohms are connected in series, the series-line impedance is the sum of the series impedances, or 30 ohms. The percentages of power delivered to each loudspeaker when the network is connected across a 30-ohm transformer tap, are approximately as follows:

$$(\%\ P)_{2\ ohms} = \frac{2}{30} \times 100 = 6.7 \text{ percent}$$

$$(\%\ P)_{4\ ohms} = \frac{4}{30} \times 100 = 13.3 \text{ percent}$$

$$(\%\ P)_{8\ ohms} = \frac{8}{30} \times 100 = 26.6 \text{ percent}$$

$$(\%\ P)_{16\ ohms} = \frac{16}{30} \times 100 = 53.4 \text{ percent.}$$

The percentage of the total power delivered to a loudspeaker connected in a series-parallel network of loudspeakers is a product of two ratios: the ratio of the loudspeaker impedance (Z_{VC}) to the series branch line impedance (Z_S) and the ratio of the total series-parallel impedance (Z_{SP}) to the series branch line impedance (Z_S), that is:

$$(\%\ P)_{VC} = \frac{Z_{VC}}{Z_S} \times \frac{Z_{SP}}{Z_S} \times 100. \qquad (5)$$

Each series branch line impedance is considered as a single impedance connected in parallel with other impedances (each of which may be a series of loudspeaker impedances). If four loudspeakers having voice-coil impedances of 2, 4, 8 and 16 ohms are connected so that the 2- and 4-ohm loudspeakers are in series and the 8- and 16-ohm loudspeakers are in series, and the two series branches are in parallel across a transformer, then the series branch line impedances are 6 ohms and 24 ohms, and the total series-parallel impedance is 4.8 ohms. The power percentages delivered to the loudspeakers when the network is connected to a 5-ohm transformer tap are as follows:

$$(\%\ P)_{2\ ohms} = \frac{2}{6} \times \frac{4.8}{6} \times 100 = 26.6\%$$

$$(\%\ P)_{4\ ohms} = \frac{4}{6} \times \frac{4.8}{6} \times 100 = 53.4\%$$

$$(\%\ P)_{8\ ohms} = \frac{8}{24} \times \frac{4.8}{24} \times 100 = 6.7\%$$

$$(\%\ P)_{16\ ohms} = \frac{16}{24} \times \frac{4.8}{24} \times 100 = 13.3\%.$$

If, on the other hand, the same loudspeakers were connected so that the two series branches consisted of the 2- and 8-ohm loudspeakers and the 4- and 16-ohm loudspeakers, then the power would be distributed as follows: 2-ohm loudspeaker—13.3 percent; 8-ohm loudspeaker—53,4 percent; 4-ohm loudspeaker—6.7 percent; and 16-ohm loudspeaker—26.6 percent. If the loudspeakers were connected so that the two branch lines consisted of the 2- and 16-ohm loudspeakers and the 4- and 8-ohm loudspeakers, then the power distribution would be as follows: 2-ohm loudspeaker—4.4 percent; 16-ohm loudspeaker—35.6 percent; 4-ohm loudspeaker—20 percent; and 8-ohm loudspeaker—40 percent.

(Continued on page 8)

Editor's Note: This is the second of two articles on Loudspeaker Matching, and is taken from INSTALLATION AND SERVICING OF LOW POWER PUBLIC ADDRESS SYSTEMS by John F. Rider, published by John F. Rider Publisher, Inc. The first article, which appeared in the April issue of SUCCESSFUL SERVICING, discussed the matching of loudspeakers on low and high impedance lines. Loudspeaker matching is only one of the many topics pertaining to low power public address systems covered in the book, INSTALLATION AND SERVICING OF LOW POWER PUBLIC ADDRESS SYSTEMS. Other topics include fundamentals of sound, microphones, phonograph pickups, amplifier specifications, loudspeakers, installation (covering indoor and outdoor installations), and the servicing of public address systems.

Television Changes

Freed 54, 55, 56, 68, Ch. 1620B

The following service hints apply to these models:

Short sweep:

1. Check pins of deflection plug for partial shorts or carbonization. Leakage paths will absorb sweep energy and shorten the sweep.
2. Increase the value of C229 (across width coil) with about a 500-$\mu\mu$f, 1000-volt capacitor.

High-voltage fuse continually blows:

1. Check pins of deflection plug for shorts or carbonization.
2. Yoke shorted.

Small or trapezoidal picture:

1. Shorted turns in yoke.

Fine tuning very critical—sound bars:

1. Modify agc circuit as follows: Move tuner agc lead R137 and C134 from the intersection of R135 and R136 and connect these items to the plate (pin 9) of the 6T8 agc tube.

Wiggle in the vertical wedges of the test pattern:

1. Install attenuator pad between antenna and receiver.
2. Replace 6T8 agc amplifier and 6AL5 agc detector.
3. Make agc change as noted under Fine Tuning Very Critical—sound bars.
4. Place a 4-$\mu\mu$f capacitor from agc bus to ground.
5. Connect R171 (vertical linearity control) to ground instead of to minus 120 volts. Also connect R230 (vertical output grid resistor) to ground instead of to minus 120 volts.

Picture linearity changes with setting of brightness or contrast control:

1. Incorrect setting of the horizontal linearity control may cause this. Screw horizontal linearity control all the way out (counterclockwise), then turn this slug in until first linear picture is obtained.

Noisy or intermittent tuner:

1. Clean tuner contact points with carbon tetrachloride or other suitable cleaning fluid.
2. Replace tuner tubes (6AG5, 6J6).
3. Install tuner bearing support (Freed-Eisemann Part #AA-308).
4. Replace tuner.

Sound bars in picture at high volume: (Compression and expansion of raster sweep lines)

1. Replace microphonic vertical output tube 6S4 (V122).

Square picture or bad vertical linearity:

1. Replace 6S4 vertical output tube (V122).

●

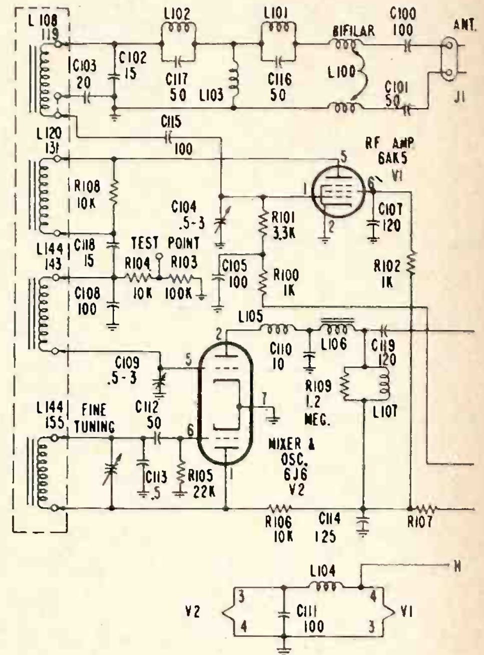
RCA 9TW390, Ch. KCS31-1

Model 9TW390 uses radio Chassis RC617A. A 0.05-μf capacitor designated C389 has been added between terminal 8 of S304 (front) and tuning capacitors C303 and C304 in Chassis RC617A. Early production models of this receiver will not have this capacitor in the radio chassis.

When the radio function switch is in the TV position, the filament voltage is present on the high side of the tuning capacitors (C303 and C304) due to the function switch design. Any shorting of the tuning capacitors to ground causes L314 to burn out. The insertion of the capacitor removes filament voltage from the tuning capacitor without affecting its operation.

Interstate Stores (Plymouth) 250, 350, 750

The schematic for AROT03 tuner, type 3, is shown in the accompanying illustration. The alignment notes for the above models using



Schematic for AROT03 tuner.

tuner AROT04 apply to the models using tuner AROT03 except that the parts mentioned should be changed as follows: C300 in tuner AROT04 is C104 in tuner AROT03, C303 is now C106, and C305 is now C109.

In order to improve electrical centering of the raster and to facilitate easier mechanical adjustment of the focus coil, a revision of the horizontal oscillator and phase detector circuit has been made.

1. Remove lead of capacitor C39 from the junction of capacitors C40 and C41.
2. Connect this lead of capacitor C39 to the junction of resistors R59, R60, and R61.
3. Remove lead of resistor R58 from pin 3 of V14, 6SN7GT, horizontal oscillator and phase detector.
4. Connect this lead of resistor R58 to the junction of resistor R55 and capacitor C36.

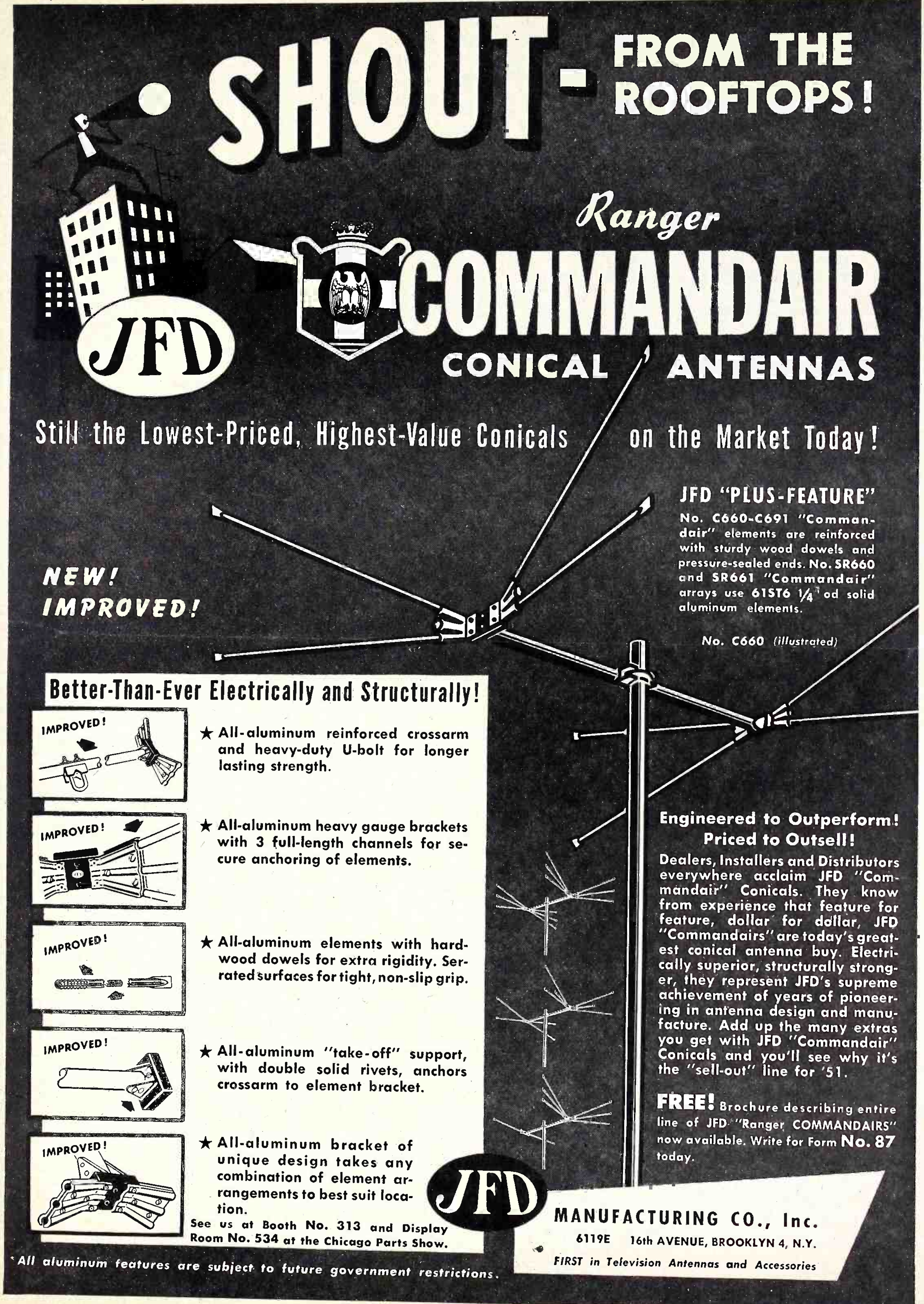
The following parts should be added to the parts list:

Stock No.	Description
FPOP07	Frame, paper, decorative (12½" table and console models)
FPOP08	Frame, paper, 12½" picture tube
FWOP01	Frame, wood, 16" picture tube
HPOM08	Plate, metal, (12½" and 16" console models)
KCOB26	Knob, control, contrast
KCOB27	Knob, control, Off-On-Volume
ZW1T06	Cabinet, table model, mahogany
ZW1V08	Cabinet, console model, mahogany
ZW1V09	Cabinet, console model, mahogany,

●

Errata

The following corrections should be made in the RECEIVING TUBE SUBSTITUTION GUIDE BOOK: On page 47, under the substitution of a 1S4 for a 1T5, the "Circuit changes necessary" column should read, "Same as 3Q5 to 3S4." On page 77, under the substitution of a 7G7 for a 6J7, the "Circuit changes necessary" column should read, "Same as 6J7 to 7L7." On page 109, the substitution of the 12AV6 for the 12BA6 should be omitted. The 12AW6 can be substituted for the 12BA6 by reversing the 12AW6 to 12AU6 procedure.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Vol. 12 MAY, 1951 No. 7

Dedicated to the financial and technical advancement of the Electronic Maintenance Personnel

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JOHN F. RIDER, Editor
E. H. BEAUMONT, Associate Editor

CURTAIN TIME

We recall reading about the shortage of cobalt in the U. S., resulting in limited p-m speaker production and all things magnetic for civilian needs. How come a recent solicitation from an outfit in Pa. offering unlimited quantities of p-m speakers made in France? 'Tis said (in a copy of a cable) that the supply of cobalt in France is *unlimited*. Hm!

Every so often a service association attempts to secure parts directly from manufacturers, thus by-passing the electronic parts jobber. This is nothing new. Its been tried for years, and unsuccessfully at that. Virtually all parts manufacturers deal through electronic parts jobbers and there is little doubt that the practice will continue. The parts jobber has been a reliable source of supply to the servicing industry and also a good source of credit. Why bite the hand . . .

Is it true that W. U. is going in for TV installations? How come? What next? What's the connection between being a communication facility and selling TV installation and service?

We have a new distributor sales manager. It's going to give us more time for research and writing—we have big plans for some real hot books and some good papers for several magazines. We're happy about the whole set-up.

Everybody complains about the TV serviceman. All right, here are a few incidents to ponder. A car repair shop is commissioned to change the oil in a new car. They remove the old oil but forget to put in new oil. Result—a new bearing job. Another auto service shop is asked to reline the brakes, so they simply tighten them and charge for new brakes. A tailor presses a suit and tears a button off the coat. A cleaner dry-cleans a dress, and shrinks it three sizes so that it cannot be worn at all.

Politics is not our forte, but somehow or other we just can't develop that feeling of complacency which is besetting many people we know. Television receivers and many other items are in plentiful supply. So, immediately everyone asks where are the shortages—and applies the question to everything and for all time.

As we see things Russia is committed to a program. Nothing which has come to light indicates a departure from the road they elected to walk. The pattern is set—its just a matter of time. What we are going through now is a respite—a relatively short one—a confusing one. Don't permit yourself to develop a false sense of security.

JOHN F. RIDER

●

General Electric 521, 522

Delete items RDK-217, RDS-090 and RWL-009 from the Parts List, and add the following items: RDK-237, Knob, tuning dial wheel with scale embossed; RWL-025, Cord, power cord and plug (brown, heavy duty type).

●

Firestone 4-A-86, 4-A-95, Westmoreland

Chassis 4-A-95 is the same as Chassis 4-A-86, except that the former has a white oak cabinet and the latter has a mahogany cabinet. In later production models, two 6AB4's (as r-f amplifier and mixer) have been substituted for the 12AT7. The only changes that have been made circuit-wise are the following:

Resistor R2, going from the junction of C4 and pin 6 of the 6BE6 to the junction of C5 and terminal 4 of T3, has been changed from 1000 ohms to 5600 ohms. The value of capacitor C24, connected from terminal 3 to terminal 2 of T7, has been changed from 20 μμf to 10 μμf. The value of C33, connected from ground to the junction of tone control R23 and R20, has been changed to 0.01 μf. The 6AB4 r-f amplifier is connected as follows: pin 1 goes to the junction of C32A and choke L4; pins 2 and 3 go to ground; pin 4 goes to H; pin 7 goes to the junction of choke L3 and C30; pin 6 goes to the junction of C27 and R16 (R19, 470,000 ohms, that was connected from ground to this junction, has been deleted). The 6AB4 mixer is connected as follows: pin 1 goes to L2; pins 2 and 3 go to ground, pin 4 goes to H; pin 6 goes to the junction of C32B and R18; pin 7 goes to the junction of R18 and C39.

The following changes have been made in the Parts List:

Ref. No.	Part No.	Description
C24	47X523	10 μμf, ceramic
C33	B66103	0.01 μf, 200 v, tubular
R2	B85562	5600 ohms, 0.5 watts, carbon
T6	9A2161	Discriminator transformer
T10	9A2209	Dipole antenna
T11	53X322	Power transformer
	10A765	Knob (white oak).

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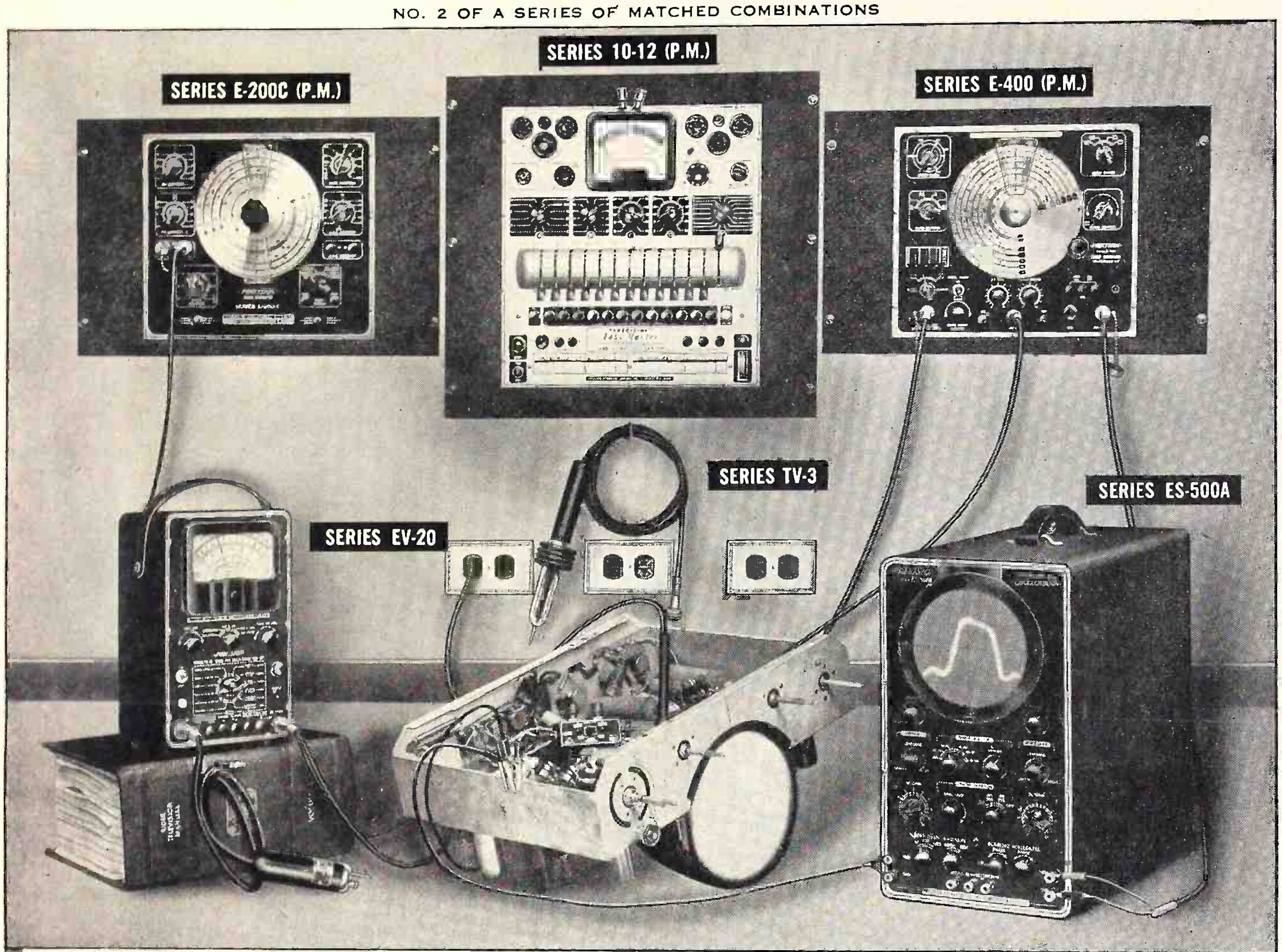

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LOUDSPEAKER MATCHING

(Continued from page 1)

Thus, by properly connecting loudspeakers in series, parallel, or series-parallel circuits, not only can proper impedance matching be secured, but also the proper division of power may be obtained to provide the required sound level at each loudspeaker location.

Special Distribution Problems

Power distribution problems can often be solved by the insertion of a resistor of the proper ohmic and wattage values. To give a very simple example, assume that an installation requires three loudspeakers of equal output. Assume that the loudspeaker voice coils have impedances of 8 ohms each, and it is necessary to use the amplifier 8-ohm tap. These requirements can be met by a setup such as shown in Fig. 1. The dummy load

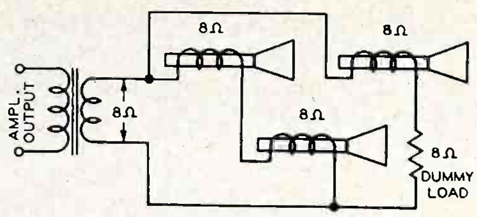

Fig. 1. Setup using an 8-ohm dummy resistor.

absorbs the same power as the other loudspeakers and permits proper and uniform output.

Of course this is only one example of meeting power distribution and impedance matching problems between loudspeakers and the output of some amplifier system. Other types of examples and methods regarding these problems are discussed further in INSTALLATION AND SERVICING OF LOW POWER PUBLIC ADDRESS SYSTEMS.

Belmont Console C-1104B, Suburban M-1105B, Rover M-1106, Belmont M-1107, Ch. 12AX27

A new RMA date code numbering system is now being used to number the chassis used in the above models. This new code system, consisting of six numbers and starting with 124023, will be stamped on the rear flange of the chassis. The first three numbers designate the manufacturer, the fourth number is the year, and the last two numbers represent the week number of the year.

The following changes apply to all chassis stamped with the RMA date code number 124023 and above. The video amplifier tube (12AU7) was changed to a 12AT7. Due to this change the video amplifier stage has been redesigned, although with the exceptions listed below, the wiring has remained the same. Coil L30, 410 μhy, is now located from pin 7 of the 12AT7 to R37. The value of R37 has been changed from 8200 ohms to 3900 ohms. The value of resistor R35, connected to pin 6 of the 12AT7, has been changed from 6800 ohms to 4700 ohms, and the value of capacitor C60 connected in parallel across R35, has been changed from 68μμf to 100 μμf. Resistor R38, connected from the junction of C60, R35, and C62, to C94-A and R123, has been changed in value from 3300 ohms to 1500 ohms. The 5600-ohm resistor R122, connected from the junction of R38, C94-A, and R123, to the 155-volt bus has been deleted, and the line is no longer connected to the 155-volt bus. Resistor R123 is now connected to the junction of R101, R102, and R39, instead of to ground. Peaking coil L20, 165 μhy, is now located from pin 1 of the 12AT7 to the junction of L21 and C64.

Capacitor C24, 7 μμf, has been removed from its position in parallel with C26 (connected to pin 5 of the 6J6 oscillator) and is now located in parallel with L9 and capacitor C29. The value of R82, connected from C99 in the afc circuit to pin 5 of the agc amplifier and tap 6 of transformer T6, has been changed from 220,000 ohms to 470,000 ohms.

The parts list shown below lists the component changes that apply to these models.

Ref. No.	*Part No.*	*Description*
Tube 8	12AT7	Video amplifier
L-19	A-201-19363	Video trap and coil assembly
L-20	A-16A-19366	Peaking coil
L-21	A-16A-19367	Peaking coil
L-30	A-16A-19365	Peaking coil
C-60	C-8F1-113	100 μμf x 300 volts
R-35	C-9B1-70	4700 ohms, ½ w, 10%
R-37	C-9B1-69	3900 ohms, ½ w, 10%
R-38	C-9B2-64	1500 ohms, 1 w, 10%.

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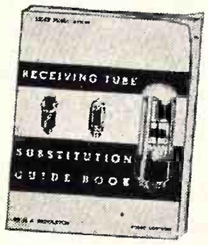

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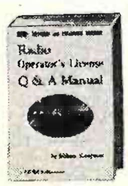

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Television Changes

Westinghouse H-600T16, Ch. V-2150-61; H-601K12, H-602K12, Ch. V-2150-41; H-604T10, H-604T10A, Ch. V-2150-91A, Ch. V-2150-94, Ch. V-2150-94A

When these models are operated in weak signal areas, an improvement in the vertical hold characteristic may be desirable. An improvement can be obtained at the expense of increased susceptibility to noise pulses by changing the value of the resistor that is shunted across the integrating network input. This resistor is designated R419 in Models H-600T16, H-601K12, and H-602K12, and R416 in Models H-604T10 and H-604T10A. This resistor is normally 1000 ohms. To obtain the effects noted above, the resistor should be changed to 1800 ohms.

A 33-ohm resistor and a 0.033-μf capacitor in the cathode circuit of the 6AH6 video output tube provide a sharper picture in these models. However, the sharper picture is obtained at the expense of video gain, and it may be desirable in weak signal areas to sacrifice the sharpness in favor of increased gain. The gain of the video amplifier can be increased by connecting a wire between pin 7 of the 6AH6 video output tube and the high side of the contrast control so as to short across the resistor and capacitor described above. A further increase in gain can be obtained at the expense of picture definition by changing the value of the plate load resistor for the 6AH6 video output tube. This resistor, which is normally 3600 ohms, can be replaced by a 3900-ohm, 1-watt resistor.

Capehart-Farnsworth, Ch. CX-33, CX-33A, CX-33F, CX-33K, CX-33L, CX-33LH, CX-33M, CX-33N, CX-33P, CX-33R, CX33S

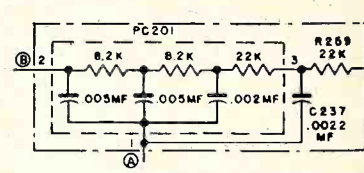
The following list shows the models that use the CX-33 series chassis:

Chassis No.	*Size CRT*	*Used in Models*	*Prod. Runs*
CX-33 (C-281)	16" Rect.	3011-M & B, 321-M & B, 322-M & B, 325-F	1, 2, 3, 4 & 5
CX-33F (C-286)	16" RD.	323-M, 332-M & B, 334-M	2, 3, 4 & 5
CX-33L (C-289)	17" Rect.	320-M & B, 321-AM & AB, 322-RAM & RAB, 324-M & B, 325-AF, 326-M	3, 4 & 5
CX-33LH (C-304)	17" Rect.	333-M & B	3, 4 & 5
CX-33N (C-298)	17" Rect.	320-M & B, 321-AM & AB, 322-RAM & RAB, 324-M & B, 325-AF, 326-M	5
CX-33S (C-303)	20" Rect.	335-M & B	5
CX-33A (C-285)	16" Rect.	327-M	3, 4 & 5
CX-33M (C-290)	17" Rect.	328-M, B, AB	3, 4 & 5
CX-33P (C-299)	17" Rect.	328-AM	5
CX-33K (C-292)	19" Rd.	337-M & RM	4 & 5
CX-33R (C-302)	20" Rect.	337-RAM	5

Chassis CX-33, CX-33F, CX-33L, CX-33LH, CX-33N and CX-33S are used in "TV only" instruments. Chassis CX-33A, CX-33M, CX-33P, CX-33K and CX-33R are used in "combination" instruments.

Production run No. 1 (the original CX-33 production) chassis were not coded, and the run was confined to sets using a 16" rectangular picture tube. Therefore, uncoded chassis employing a 16" rectangular crt can be considered as run No. 1. Production runs Nos. 1 and 2 were confined to sets using a 16" rectangular or 16" round picture tube. Production Runs Nos. 1 and 2 employed the Sarkes-Tarzian r-f unit, while runs Nos. 3, 4, and 5 employ the Standard Coil r-f unit. Chassis used in combination instruments (less audio section) do not employ V-209 and V-210, the 1st audio amplifier and power output tubes, respectively, and their circuits.

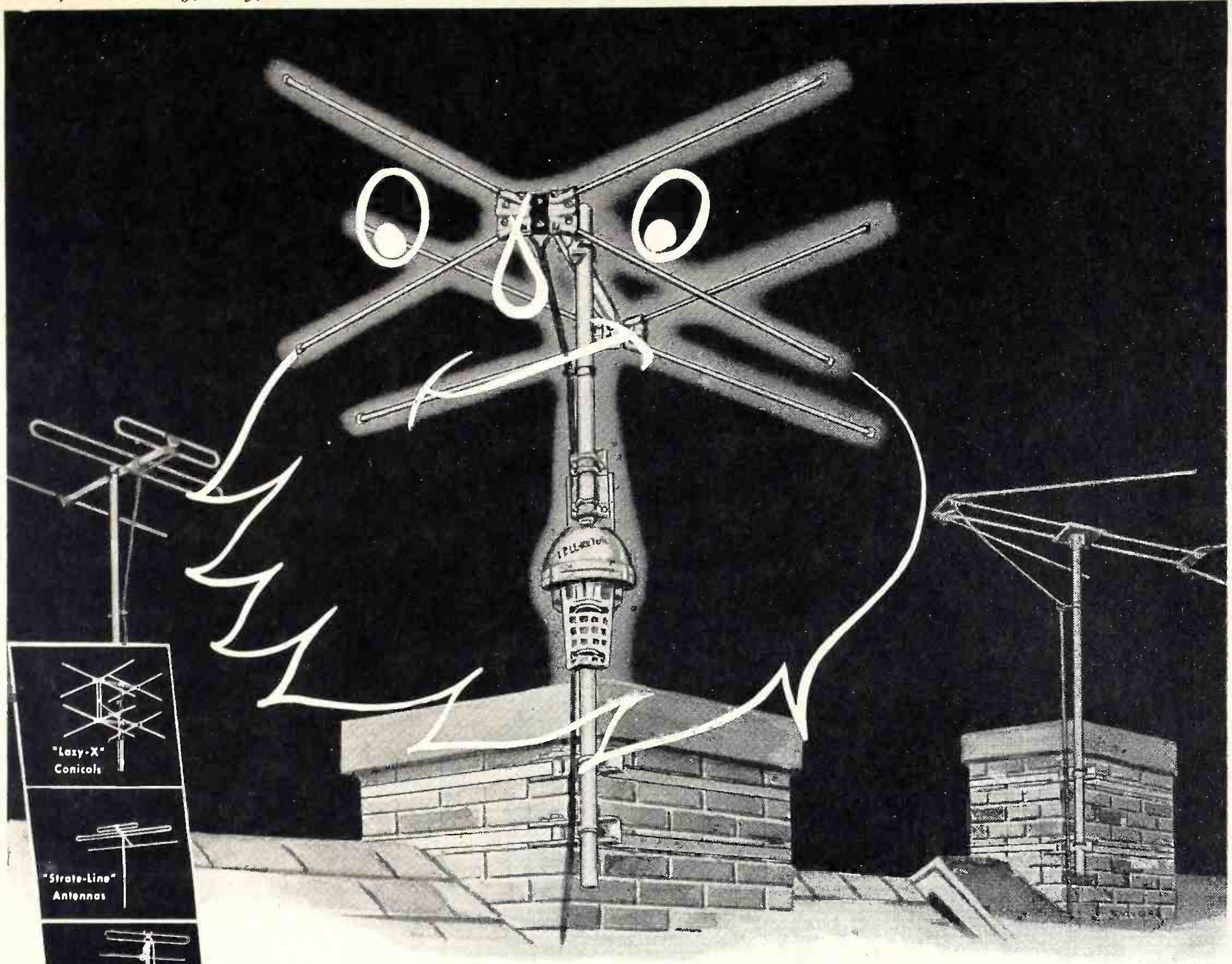
The schematic diagram for Production Runs Nos. 4 and 5 is similar to that for Run No. 3 except for the following changes. A printed circuit vertical integrator PC-201 is used in some chassis replacing R261, R260, C239 and C238. The printed circuit is shown in the accompanying illustration, showing the change in value of R259 and C237. B is connected to C240, A is connected to the —90-volt line, and C is connected to the cathode pin 3 of the 6SN7GT sync clipper.

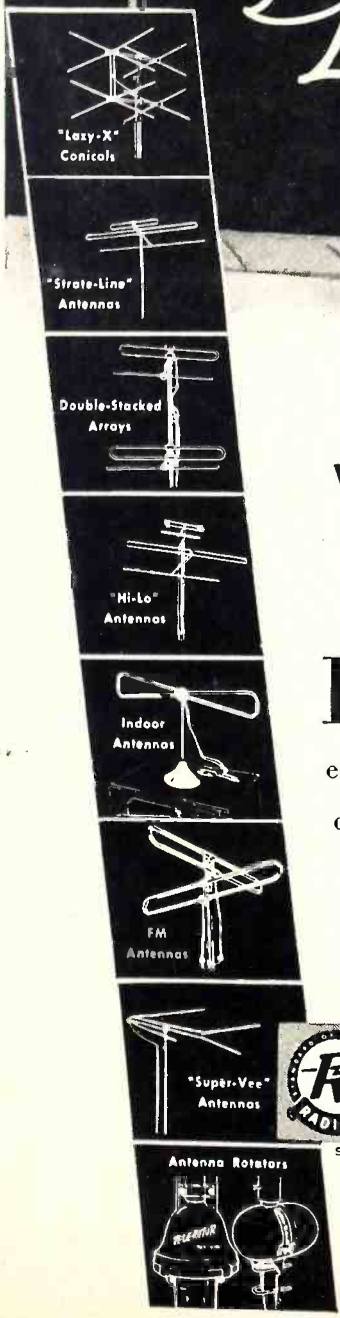


Printed circuit vertical integrator PC-201.

V203, the 3rd i-f stage has been changed from a 6AG5 to a 6CB6 tube. The socket wiring has been changed so that pin 7 (suppressor grid) is grounded. A 6AG5 tube cannot be used as a replacement in this socket unless the ground is removed from pin 7 and tied to pin 2 as shown on the schematic for Run No. 3. In connection with this tube change, R210, the grid resistor for V203, has been changed from 5600 ohms to 8200 ohms. A revised focus coil (Part No. 750249B-3) is incorporated in run No. 5 chassis. The construction of this coil has been revised to prevent breakdown. In the revised focus-coil-assembly mounting arrangement, the centering lever has been removed and the focus coil bracket has been provided with a wing screw

(Continued on page 12)





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Capehart-Farnsworth Ch. CX-33 Series

(Continued from page 10)

at the side and also at the bottom. By loosening these two screws, the focus coil can be tilted in both the horizontal and vertical plane, thus providing picture centering. When the picture is properly centered, the wing screws can be tightened so that proper centering will be maintained.

The 10,000-ohm resistor R316, connected from the junction of focus control R297 and the plus side of capacitor C243C to the minus side of C243C, has been removed from the circuit. Capacitor C242B, connected to the junction of R298A and R298B, has been relocated and is now connected in the picture tube circuit (described below). A 20-μf capacitor C285 is now connected from the junction of R298A and R298B to ground. A 0.1-μf, 200-volt capacitor C286 has been added from the plus side of C242D to the —90-volt line. The value of R252, connected from the junction of the +235-volt line, R201 and C282 to the junction of R302 and R250, has been changed from 2.4 megohms to 2 megohms.

In the picture tube circuit the following changes have been made. A 100,000-ohm resistor R317 and a 0.1-μf capacitor C284, connected in parallel, have been added from the junction of L207 and R232 to pin 11 of the picture tube, replacing a direct connection. R307, connected to pin 6 of the video amplifier, is no longer connected to +135-volt line, but is connected directly to the junction of C229 and R236 (connected to the shading control R235). The connection from C229 and R236 to the +135-volt line also has been removed. The value of R236 has been changed from 27,000 to 68,000 ohms. R306, the 5000-ohm resistor that was connected to the +235-volt line, is no longer connected to this line but now connected directly to the junction of C229, R236 and R307. A 5000-ohm resistor is connected from this junction to the +235-volt line. The minus side of C242B (mentioned previously) is connected to shading control R235 and the —90-volt line and the plus side is connected to the junction of R306 and R318. The value of R235 has been changed from 50,000 ohms to 200,000 ohms.

The value of C257, connected from pin 5 of V218 to the junction of R289 and R290, has been changed from 0.001 μf to 0.0047 μf. The 500-$\mu\mu$f, 20-kv capacitor C261 that was connected from ground to pin 2 of the h-v rectifier is now connected from ground to pin 7 of the same tube. The value of R268, connected to pin 4 of V214B, has been changed from 100,000 ohms to 470,000 ohms. R315, part of the deflection yoke L216, is used only in RCA, Sickles & Joyner yokes which have a coil resistance of 3.3 ohms. R308, connected to pins 3 and 4 of the 6K6GT tube V215 is 56,000 ohms on Chassis CX-33S. C270, the 270-$\mu\mu$f capacitor in the deflection yoke is omitted on the CX-33S Chassis.

The following parts should be added or changed in the Parts List for Chassis CX-33 series and are specifically for Production Run Nos. 4 and 5:

Ref. No.	*Part No.*	*Description*
R317	3229A-104	100,000 ohms, ½ w, 10%, ins. carb.
R318	650101A-8	5000 ohms, 7 w, 10%, ww
C284	2246A-1040	0.1 μf, 200 v, paper
C285	650228A-2	20 μf, 450 v, electrolytic
PC-201	452265A-1	Printed circuit
R210	3229A-822	8200 ohms, ½ w, 10%, ins. carb.
R259	3229A-223	22,000 ohms, ½ w, 10%, ins. carb.
R252	3228A-205	2 megohms, ½ w, 5%, ins. carb.
R235	452226A-1	200,000 ohms, shading pot.
R236	3229A-683	68,000 ohms, ½ w, ins. carb.
C237	2248A-2220	0.0022 μf, 600 v, MOPT
L215	750149B-3	Focus coil, revised.

Stromberg-Carlson TC19LX

The schematic diagram and service data for Model TC19LX is the same as for the TC19 Revised. The general assembly parts list for Model TC19LX is given below.

Part No.	*Description*
108147	Cabinet assembly, mahogany
108148	Cabinet assembly, avodire
155129	Speaker
1382029	Lens
134081	Knob (tone and volume)
134081	Knob (focus and brightness)
134081	Knob (vertical and horizontal)
134083	Knob (contrast)
134108	Knob (tuning)
134084	Knob (range selector)
101122	Back panel assembly
29956	Pilot lamp
801401	Lamp cap, red
801400	Lamp cap, white
101123	Tube mounting shelf
113065	Kinescope clamp assembly
105214	Focus coil support assembly
105110	Deflection yoke bracket
133074	Tube ring (plastic)
174010	Mask
165016	Anode connector, male
165017	Anode connector, female
143013	Plug assembly, 8 prong male
133075	Kinescope insulating sleeve, plastic
133078	Focus coil gasket (rubber)
133079	Kinescope clamp insulation
133080	Kinescope mounting block insulation
125046	Escutcheon assembly
125045	Escutcheon, front panel
105211	Bracket, flexible shaft (front panel)
150061	Flexible control shaft (contrast)
150062	Flexible control shaft (range)
150063	Flexible control shaft (tuning)
129023	Gear assembly (tuning)
150059	Shaft assembly (tuning)
122038	Dial assembly (tuning)
142105	Plate, flexible shaft mounting
142108	Plate, potentiometer mounting
150064	Flexible control shaft (focus)
152065	Pilot lamp socket assembly
29956	Pilot lamp ¼ amp
151108	Shield, focus potentiometer.

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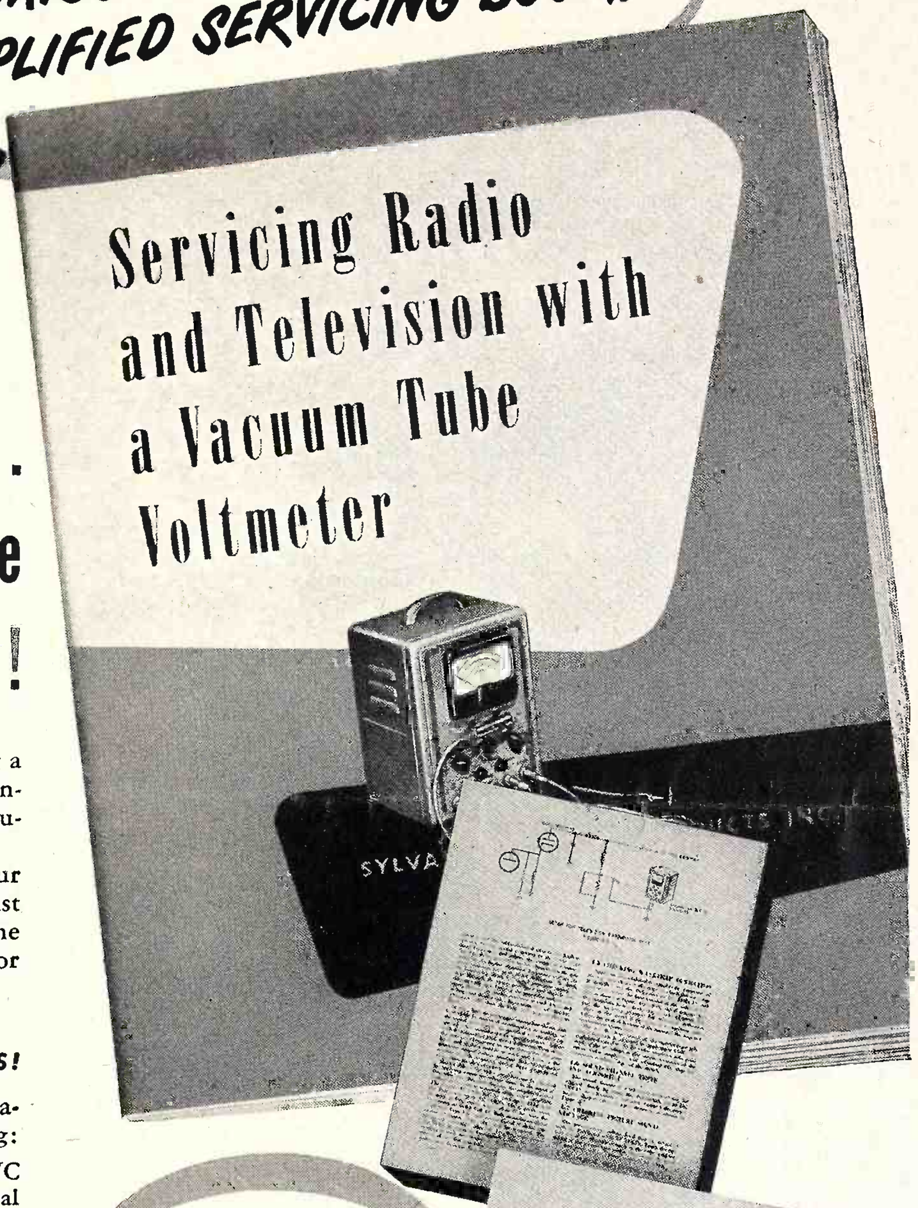

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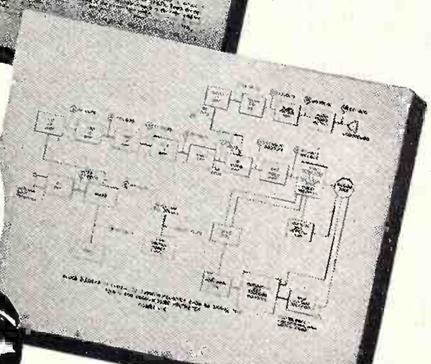

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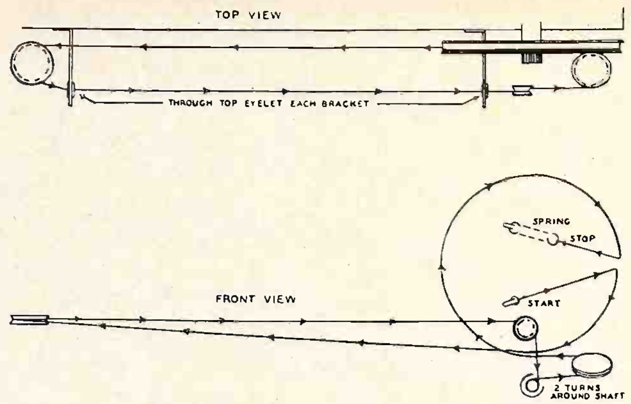
Radio Changes

Sparton 141XX, 142XX, 1040XX, 1041XX, 1085, 1086, 1090, 1091, Ch. 8W10

Chassis 8W10 is similar to Chassis 8M10, and the service notes for the 8M10 apply also to the 8W10. The schematic diagram for the 8W10 is the same as that for the 8M10 except that a 68-ohm resistor, R38, has been added from the junction of C1B and C2B to pin 7 (a.m.) of switch S1-R. Models 141XX in mahogany and 142XX in blond are straight table model radio receivers. A new dial, front panel, and control knobs distinguish these models from Models 141X and 142X. Models 141XX and 142XX are equipped with a 6" x 9" p-m oval speaker.



Dial stringing for Sparton Chassis 8W10.

Models 1040XX in mahogany and 1041XX in blond are radio-phonograph combinations. The models also have new dials, front panels, and control knobs and are equipped with a three-speed record changer. The cabinet styling is the same as Models 1040X and 1041X. The receiver chassis is mounted to the tilting front panel in the right-hand cabinet compartment. A 10-inch p-m speaker is standard equipment.

Models 1085 in mahogany and 1086 in blond are radio-phonograph combinations. The receiver chassis is mounted in the top center compartment with the record changer directly below. A compartment either side of the units has been reserved for record album storage. The record changer is stationary mounted. These models employ a 10-inch p-m speaker.

The accompanying illustration shows the dial stringing for these models.

The Chassis Parts List for these models is the same as the Parts List for the 8M10 Chassis. The following parts apply to Chassis 8W10 and the models which use this chassis:

Part No.	Description
PA5654	Knob, maroon, 4 req'd (1085 only)
PA5625-1	Knob, black, 4 req'd (1086 only)
PA5654-1	Knob, volume (all other models)
PA5654-2	Knob, tone, on-off
PA5654-3	Knob, f-m, a-m, ph.
PA5654-4	Knob, tuning
PB30017	Dial scale
PB40150	Escutcheon, black (1086 only)
PB40150-1	Escutcheon, maroon (1085 only)
PD93012-1	Escutcheon, maroon and gold (141XX, 1040XX, 1090)
PD93012-2	Escutcheon, gold (142XX, 1041XX, 1091)
PC63000-12	Speaker, 10" round p-m (all consoles)
PC63000-19	Speaker, 6" x 9" oval p-m (table models)

Emerson 559, Ch. 120059A

The schematic diagram for Chassis 120059A shows two resistors marked R15. The one going to pin 6 of the 117Z3 should be marked R10.

General Electric 218, 218H

Stock No. RLI-088 has been deleted from the Parts List and Stock No. RLI-084, Coil, f-m antenna choke, L2, added in its place.

Jewel 920A

The Alignment Procedure and Parts List for Model 920A is the same as that for Models 921, 935, 936.

RCA X551, Ch. RC-1089B; X552, Ch. RC-1089C

R4, the 3.3-megohm avc filter resistor previously connected to the junction of R12, 47,000 ohms, and the phono jack J1, is now connected to the junction of R12 and terminal 2 of the 2nd i-f transformer T2.

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Affiliated Retailers AR-MST12

Model AR-MST12 is similar to AR-TV-12X and employs a 12½-inch picture tube.

United Motors 980980, Buick

The 1951 Buick Model 980980 is identical to the 1950 Model 980899 except that the antenna trimmer compensation is for antennas between 0.000061 and 0.000088 μf. The parts list is identical to that for the 980899 except for the following service parts. The service part numbers are the same as the production part numbers except where the service part number is shown in parenthesis.

Illus. No.	Production Part No.	Description
63	1219487	470 ohms, ½ w, insulated (removed)
85	1211118 (A104)	100,000 ohms, ½w, insulated (removed)
119	7260856	Transformer, output
128	7260454	Escutcheon assy
129	7260455	Dial
130	7260422	Dial backplate
133	7260456	Pointer backplate
134	1219847	Pointer tip pkg.
	1219846	Station selector bar pkg.
139	7260709	Station selector bar.

TROUBLE SHOOTING

The serviceman, radio or TV, is most frequently called upon to act as a trouble shooter—to repair a radio or television set. In order to service any set efficiently and profitably, he must have a thorough knowledge of symptoms, causes, and remedies so that he can analyze, localize and correct the trouble as rapidly as possible. Because of the thousands of radio and television sets in existence today (there are 28,341 Models and 14,966 Chassis covered in Rider's AM-FM Manuals, and 2,486 Models and 1,227 Chassis covered in Rider's 6 TV Manuals), it is impossible to become completely familiar with each individual set. However, it is possible to continually increase ones working knowledge by reading the circuit analyses and service hints (which are compiled from the analyses of service reports from the field) that manufacturers, and, consequently, Rider Manuals, offer to the servicemen.

Considerable experience has been gained through the years in recognition of the symptoms and causes of, and remedies for, receiver failures. By careful reading of *all* service hints, the serviceman can first apply the material to the specific set, and then, by correlating the various service hints, can use the general information when trouble shooting other sets.

Trouble shooting hints given in this issue, for example, are found on page 2 for Freed Models 54, 55, 56 and 68, and for RCA Model 9TW390; on page 10 for Westinghouse Models H-600T16, H-601K12, H-602K12, H-604T10, and H-604T10A; and the Westinghouse notice on this page. Read these and all service hints and remember that circuit analyses and service hints are published in Rider Manuals and SUCCESSFUL SERVICING so that *you*, the serviceman, can profit from the manufacturer's experience!

Admiral 6P32, Ch. 6E1; 7P35, Ch. 5H1

Model 6P32 uses chassis 6E1 and Model 7P35 uses chassis 5H1. These models are leatherette portables using an a-c—d-c battery.

Westinghouse H-217, H-217A, Ch. V-2146-1 Ch. V-2146-11DX; H-226 Ch. V-2146-21DX, V-2146-25DX

With early production versions of the models listed above, it may be desirable to increase the picture width. Check the voltage divider (R501, R502, R503, R504) in the voltage doubler circuit of the high-voltage supply. In original production, the plate of the 1B3GT doubler tube was connected to the junction of R501 and R502. To increase the picture width, move the plate connection down to the junction of R502 and R503. This has been done in later production.

INDEX OF CHANGES

† The Rider Manual Page Numbers given under Television Changes are for Rider TV Manuals. The volume number is the number preceding the dash. Volume numbers preceded by an asterisk (*) apply to the 8½" by 11" page size Manual only.

The Rider Manual Page Numbers given under Radio Changes are for Rider AM-FM Manuals. The volume number is the number preceding the dash.

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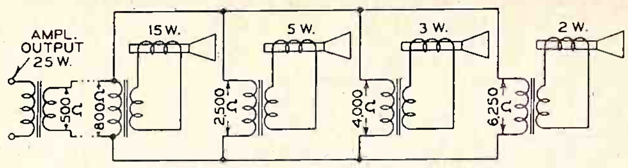


Fig. 1. A possible configuration for connecting loudspeakers requiring unequal power distribution. The individual matching transformer primaries must be so chosen that the correct power distribution is made to the various speakers.

LOUDSPEAKER MATCHING

by JOHN F. RIDER

Unequal Power Distribution—High-Impedance Lines

Although most loudspeakers have equal power distribution, there are many cases, such as in churches, schools, hospitals, factories, etc., where each loudspeaker must handle a different amount of power. The individual matching transformer primaries must then be of such impedance as to distribute the available power correctly among the various loads.

Assume that a 25-watt amplifier feeds four loudspeakers, rated at 15, 5, 3 and 2 watts, through a 500-ohm line. The primary impedance of the loudspeaker matching transformers may then be computed from the following formula: loudspeaker matching transformer primary impedance (Z_P) equals the line impedance (Z_{line}) times the ratio of amplifier power output (P_T) over rated loudspeaker power P_L,

> *Editor's Note:* This is the last of three articles on Loudspeaker Matching, and is taken from INSTALLATION AND SERVICING OF LOW POWER PUBLIC ADDRESS SYSTEMS by John F. Rider, published by John F. Rider Publisher, Inc. Previous articles, which appeared in the April and May issues of SUCCESSFUL SERVICING, discussed the matching of loudspeakers on low and high impedance lines and unequal power distribution on low impedance lines. Loudspeaker matching is only one of the many topics pertaining to low power public address systems covered in the book, INSTALLATION AND SERVICING OF LOW POWER PUBLIC ADDRESS SYSTEMS. Other topics include fundamentals of sound, microphones, phonograph pickups, amplifier specifications, loudspeakers, installation (covering indoor and outdoor installations), and the servicing of public address systems.

$$\text{or } Z_P = Z_{line} \times \frac{P_T}{P_L}$$

Thus the matching transformer primary impedance for the 15-watt loudspeaker is

$$Z_P = 500 \times \frac{25}{15} = 833 \text{ ohms}$$

The primary impedances for the other loudspeakers may be similarly found and are respectively 2,500 ohms, 4,170 ohms, and 6,250 ohms. Figure 1 illustrates how a close approximation to the desired power distribution is obtained. The impedances of the matching transformer primaries are in parallel so that the total load impedance approximately matches the line impedance. In actual practice, line or output transformers are used whose primary impedances are as close as possible to the calculated values.

In computing the primary impedances needed to secure power distribution, if any of the matching transformer primary impedances come to a value of 20,000 or more ohms, then the combination of loudspeakers must be changed or a lower line impedance used, since transformers having such high primary impedances do not have secondary impedances in the voice-coil impedance range. It will be necessary then to recompute the entire impedance problem using a lower impedance tap on the amplifier output transformer or by connecting the loudspeakers in different combinations. If the transformer primary impedance for the loudspeaker requiring the lowest power is computed first, it can then be determined whether or not this impedance is too great before proceeding with the rest of the computations.

An example of a more elaborate installation requiring unequal power distribution is given below. Ten 3-watt loudspeakers, three 5-watt loudspeakers, and one 15-watt loudspeaker are to be fed by a 60-watt amplifier in a school or factory sound system. The use of a high-impedance line is necessary since most of the loudspeakers will be located at some distance from the amplifier. All the loudspeakers are connected in parallel with their individual matching transformers across a 500-ohm line fed by the 500-ohm tap of the amplifier output transformer. The primary impedances of the matching transformers can be determined by using the equation where Z_L is the effective load impedance:

$$Z_L = \frac{Z_{tap}}{\% \, P}$$

Substituting the known factors, we obtain three different loads for the three different powers required:

Z_L (for the 3-watt loudspeakers) =

$$\frac{500}{.50} = 1{,}000 \text{ ohms}$$

Z_L (for the 5-watt loudspeakers) =

$$\frac{500}{.25} = 2{,}000 \text{ ohms}$$

Z_L (for the 15-watt loudspeaker) =

$$\frac{500}{.25} = 2{,}000 \text{ ohms}$$

Since there are ten 3-watt loudspeakers in parallel and their effective load is to be 1,000 ohms, then each 3-watt loudspeaker requires a 10,000-ohm primary impedance-matching transformer. Since there are three 5-watt loudspeakers in parallel and their effective load is to be 2,000 ohms, then each 5-watt loudspeaker requires a matching transformer having a 6,000-ohm primary impedance. The single 15-watt unit requires a 2,000-ohm matching transformer.

To check that the total loudspeaker distribution system matches the 500-ohm tap, use the equation for parallel impedances. Since the impedances of the three types of loudspeakers are 1,000 ohms, 2,000 ohms and 2,000 ohms, then:

$$Z_T = \frac{1}{\frac{1}{1000} + \frac{1}{2000} + \frac{1}{2000}} = 500 \text{ ohms}$$

The voice coil impedances need not enter into any of the computations because most line or output transformers have secondary taps to match the more common voice-coil impedances.

(Continued on page 14)

Television Changes

Belmont Ch. 12AX27

If a squegging condition (parasitic oscillation) is noticed, the following wiring changes should be made. This change has been incorporated in group numbers above 7100.

Reroute the black a-c leads from the a-c input socket to the switch on the dual contrast and volume control. Disconnect the two black a-c leads at the switch terminals. Pull out the a-c leads from the side of the chassis and reroute them along the tuner side and bring them down to the switch. Cut off four inches from the longest lead and add eighteen inches to the shortest lead. Reconnect the leads to the switch terminals, making sure that they do not short to the chassis and will not tangle with the tuner or cam. It is suggested that a cable clamp be soldered to the tuner side of the chassis to hold the a-c leads in place.

If additional width is required in early code chassis, do not replace the horizontal deflection transformer, but replace the 6BG6 pulse amplifier tube.

●

Andrea CVK19 Normandy, Ch. VK-19

The following changes have been made in Chassis CVK19: Coil L1, that was connected to the junction of C2 and the antenna terminal board, is now connected from the junction of the antenna terminal board (the lug going to the shield) and the shield. The value of resistor R1, that was connected from ground to pin 7 of the 6J6 V1, has been changed from 220 ohms (GRC-218) to 68 ohms (GRC-214). R1 is no longer connected to pin 7 but to the junction of L2 and C3 (L2 is connected to pin 7). In early chassis, R2, 100 ohms (GRC-216), was connected from the junction of pins 5 and 6 of V1 to ground. In later chassis R2 has been removed from this position and pins 5 and 6 are grounded. The value of R2 has been changed to 10 ohms, ±5% (GRC-253), and R2 now goes from pin 1 to pin 2 of V1. Capacitor C4, that was also connected from the junction of pins 5 and 6 to ground, has been removed from the circuit. The value of resistor R3, that is connected from the junction of pin 1 of V1, R2 and C6 to the junction of C5, C16 and R101, has been changed from 10,000 ohms (GRC-263) to 6800 ohms, 2 watts (GRC-257). Resistor R4 has been relocated and now goes from the junction of C5, C16 and R101 to R3, and the value has been changed from 12,000 ohms to 3300 ohms, 1 watt. R4 formerly went from the junction of C6, C7 and L5 to ground. Resistor R5, which in early models went from the junction of C9, C10 and L8 to ground, is now located from the junction of C6, C7 and L5. No change was made in its value. The resistor in late models going from the junction of C9, C10 and L8 to ground is now designated R8, and its value is 12,000 ohms (GRC-272).

V3, the 6AG5 modulator, has been changed to a 6AK5. No wiring changes have been made. The 100,000-ohm resistor that goes from pin 1 of V3 to R65, and was designated R8, is now designated R9, with no change in value. Pin 7 of V3 is grounded. In the early chassis, a resistor designated R9, 47 ohms (GRC-211), went from pin 2 of V3 to ground. In later sets this resistor has been removed (the reference number 9 was given to another resistor as mentioned previously) and pin 2 is now grounded. In early sets capacitor C24 went from pin 6 of V5, the 6AG5 2nd video i-f, to pin 2 of the same tube. In later sets C24 is no longer connected to pin 2 but goes directly to ground. Capacitor C133, 0.005 μμf (HCC-1926), has been added from ground and the shield of T4 to the junction of R24 (22,000 ohms) and R23 (47,000 ohms). The value of resistor R26, which is connected in parallel with C32, has been changed from 100 ohms (GRC-216) to 560 ohms (GRC-250). The value of R40, connected from pin 7 of V11 to ground, has been changed from 220,000 ohms (GRC-270) to 330,000 ohms (GRC-301).

The value of R7, connected from C14 to pin 1 of V2, the 6J6 oscillator, has been changed from 10,000 ohms (GRC-267) to 22,000 ohms, 2 watts (GRC-238). The value of C12, connected from pin 6 of V2 to the junction of C11, L10 and L19, has been changed from 5.5 to 3.5 μf. The value of C46, going to pin 1 of V12A, has been changed from 0.1 to 300 μμf. The 3300-ohm resistor R64, connected from the junction of C56 and ground to contrast control R63, has been deleted from the circuit, and R63 is now connected directly to ground. The 100,000-ohm resistor that is connected from the center tap of R63 to C56, has been deleted from the circuit, and C56 is connected directly to the center tap of R63.

●

DuMont RA-105, RA-106

In certain areas where television signals are received on two adjacent channels (such as halfway between two cities having television stations) adjacent channel video interference may occur. When tuned to the lower frequency of two such adjacent channels, interference is experienced from the higher frequency channel. This interference is usually seen as horizontal sync running back and forth through the desired signal.

This may be corrected by the addition of a series-parallel resonant trap in the third video i-f amplifier as illustrated in Fig. 1. The latest RA-105 and RA-106 chassis include this trap.

The trap will be tuned to 20.4 Mc. This 20.4 Mc is obtained when the local oscilator beats with the video carrier of the channel above the desired channel. Consider a location where both Channel 5 and Channel 6 can be received. With the set tuned to Channel 5, 76-82 Mc, the local oscillator is tuned to 77.25 Mc (video carrier of Channel 5) plus 26.4 Mc or 103.65 Mc. The local oscillator signal also beats with the video carrier of Channel 6 (83.25 Mc) and produces a frequency equal to the difference between 103.65 Mc and 83.25 Mc which is 20.4 Mc.

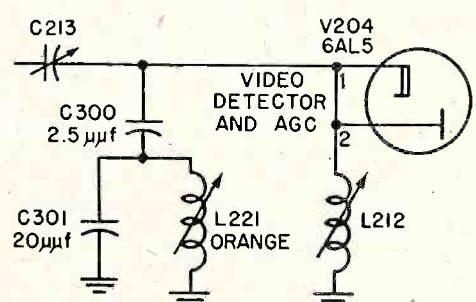


Fig. 1. Series-parallel resonant trap.

The parts used are as follows:

Ref. No.	Part No.	Description
C300	03002720	Capacitor, ceramic, 2.5 μμf, ± 0.5 μμf, 500 v
C301	03013800	Capacitor, ceramic, 20 μμf, ± 5%, 500 v
L221	21003971	Variable inductance

Connect the 2.5-μμf capacitor to the lug to which the end of the winding closest to the lug is soldered, leaving ½" of wire between the body of the capacitor and the lug. Connect a 2½" length of #18 bare-tinned copper wire to the other lug of the inductor. Connect the 20-μμf capacitor across both of the lugs of the inductor, as shown in Fig. 2.

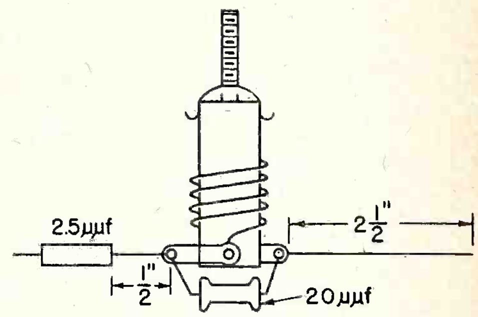


Fig. 2. Capacitor connection for series-parallel resonant trap.

Carefully enlarge the "keyhole," to 13/32 diameter, in the video i-f amplifier shield plate, using a Parker-Kalon metal punch XX. (See Fig. 3.) Use extreme caution when punching this hole so that alignment will not be disturbed. Insert the trap assembly in the hole so that the lugs are parallel to the main chassis and with the bare wire away from the main chassis. Solder the bare-tinned wire to the ground lug directly beneath on the main chassis. Solder the free end of the 2.5-μμf capacitor to the junction of L212, C213, and pins 1 and 2 of V204.

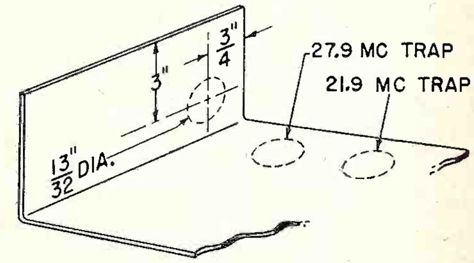


Fig. 3. Mechanical layout for series-parallel resonant trap.

The trap may be tuned, using a signal generator or by utilizing the interfering station.

1. Setting the trap by signal generator: Turn the contrast control to the extreme right. Connect a signal generator, 30% modulated at a carrier frequency of 20.4 Mc, to pin 1 (grid) of V201 and chassis. Connect an oscillograph between pin 4 (grid) of V205 and ground. Adjust coil for minimum deflection of the oscillograph.

2. Setting trap, using two adjacent stations: Tune receiver to sound of lower channel. Adjust contrast and watch for the interference. Tune trap from maximum inductance toward minimum inductance until the interference disappears. Rock trap tuning back and forth to be certain that the trap is correctly set.

Emerson 629D, 651D, 658B, Ch. 120124-B

The voltage and resistance measurements listed below are for chassis 120124-B stamped with triangle code 1A. Voltages may vary slightly from tables shown here if chassis is not coded as shown above. The conditions for taking voltage and resistance readings are listed below:

1. Antenna disconnected and antenna terminals shorted.

TABLE I
VOLTAGE READINGS

SYMBOL	TUBE PIN NO.								
	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V1	-1	0	0	6.3 A.C.	96	96	0.3		
V2	-1	0	0	6.3 A.C.	96	96	0.3		
V3	0	0	0	6.3 A.C.	120	97	1.2		
V4	0	0	0	6.3 A.C.	130	97	1.2		
V5	0	-0.3	0	6.3 A.C.	0	0	-0.7		
V6	-170	-170	-170	-170	0	0	-170		
V7	-170	-170	-170	-170	-2.5	-130	-170		
V8	-0.8	-0.8	0	0	0	-1	0	-1.0	56
V9	N.C.	-170	38	48	-160	-170	-170	-160	
V10	-140	-170	-170	-170	-170	N.C.	N.C.	N.C.	-170
V11	100	-160	-165	-170	-170	110	-0.3	0	-170
V12	-210	-58	-170	-170	-67	-170	-170	-170	
V13	N.C.	-170	175	175	-160	170	-170	-130	
V14	N.C.	N.C.	400	N.C.	75	N.C.	390	390	
V15	HIGH VOLTAGE -- DO NOT MEASURE								
V16	N.C.	-175	-165	-185	-185	N.C.	-170	66	
V17	-180	3	-185	-260	6.3	-175	-175	-175	
V18	-92	-175	-175	-175	-175	-43	-190	-175	-175
V19	N.C.	200	N.C.	360 A.C.	N.C.	360 A.C.	N.C.	200	

2. Line voltage 117 volts.
3. All controls in position for normal picture.
4. All measurements taken with a vacuum tube voltmeter and ohmmeter.
5. All readings taken between points and chassis.
6. Resistance readings are given in ohms unless otherwise noted.
7. N.C. denotes no connection.

The voltage readings for V20 are as follows: pin 1 is —170, pin 2 is —160, pin 10 is 180, pin 11 is —135, and pin 12 is —170 volts. The resistance readings for V20 are as follows: pin 1 is 4.4K, pin 2 is 1.2K, pin 10 is 9K, pin 11 is 55K, and pin 12 is 4.4K.

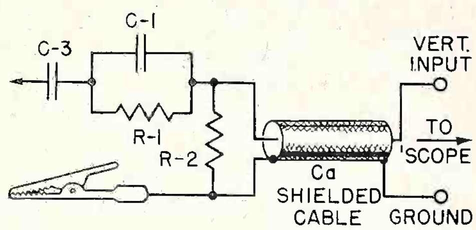
A low capacity probe must be used in order to faithfully reproduce high-frequency waveshapes (15 kc and higher) and to prevent loading of the circuit under observation. Such a probe (see Fig. 1) can be readily constructed with parts on hand. Mount parts on a small sheet of bakelite, preferably inside a paper or mica tube. A shielded cable must be used because it prevents stray pickup. The length of this cable is very important since its capacitance is used in the design of the probe. The high capacitance of this cable (140 $\mu\mu$f) and R-2 (100,000 ohms, ±5%) minimizes the effect of different input impedances in various oscilloscopes. *Ca* is actually 4 feet of cable with 35 $\mu\mu$f per foot capacitance. C-1, 15 $\mu\mu$f, should have a tolerance of ±10%. C-3 is 0.1 μf, 600 volts, and R1 is 1.2 megohms, ±5%. With 10% tolerance in the cable and in C-1, the peak-to-peak voltages at 15 kc can be measured with 10% accuracy, provided the oscilloscope is calibrated on a 60-cycle sine wave. Due to the construction of the probe, the signal at the oscilloscope terminals is approximately 1/12 of its actual value. This means that a scope with at least 0.05 rms volts-per-inch vertical sensitivity is required. The average scope will meet these requirements. Since the scope is calibrated on a 60-cycle sine wave through the probe, the attenuation of the probe will not effect the accuracy of the peak-to-peak voltage readings. In trouble-shooting, it is of great value to know the peak-to-peak voltages of the various wave shapes. The oscilloscope can be easily calibrated to read these voltages. For information on calibrating the oscilloscope, see items listed below.

TABLE II
RESISTANCE READINGS

SYMBOL	PIN NUMBER								
	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V1	1.2M	0	0	0	10K	10K	56		
V2	1.2M	0	0	0	10K	10K	56		
V3	0.8	0	0	0	13K	9K	180		
V4	0	0	0	0	9K	9K	170		
V5	28K	5.6K	0	0	0.3	0	95K		
V6	4.4K	4.4K	4.4K	4.4K	0.8	0	4.4K		
V7	60K	4K	4.4K	4.4K	1.2K	10K	4.4K		
V8	110K	110K	220K	0	0	1.2M	0	11M	0.5M
V9	N.C.	4K	10K	11K	0.5M	4.4K	4.4K	4.6K	
V10	23K	3.4M	4.4K	4.4K	4.4K	N.C.	N.C.	N.C.	4.4K
V11	15K	1M	5K	4.4K	4.4K	11K	6K	0	4.4K
V12	1M	1.6M	6.5K	70K	158K	6.5K	4.4K	4.4K	
V13	N.C.	4.4K	10K	10K	4M	240K	4.4K	7K	
V14	N.C.	N.C.	0.5M	N.C.	9K	N.C.	0.4M	0.4M	
V15	PLATE 0.4M, FILAMENT INFINITY								
V16	N.C.	4.4K	4.4K	0.8M	0.8M	N.C.	4.4K	20K	
V17	1.4M	70K	0.5M	0.5M	110K	4.4K	4.4K	4.4K	
V18	12K	0.5M	4.4K	4.4K	4.4K	3.5K	1.2M	6K	4.4K
V19	N.C.	9K	N.C.	4.4K	N.C.	4.4K	N.C.	9K	

For taking wave shapes proceed as follows:

1. Observe the signal under test on the oscilloscope and set the gain control so that the whole signal is well within the screen limits.
2. Observe different 60-cycle voltages (12v, 25v, 117v, 350v a.c., etc.) on the oscilloscope with the same gain setting as before until one is found that is of the same peak-to-peak value, or less than the formerly observed signal. By measuring the 60-cycle voltage with a common a-c meter, and then comparing the two signals on the oscilloscope, a good estimation can be made as to the peak-to-peak voltage of the signal.
3. An a-c voltmeter is calibrated to read the rms value of one-half a sine wave and not the peak value. To convert from an rms value to a peak value, use the correction factor 1.4. The peak-to-peak value will therefore have a correction factor of 1.4 × 2, or 2.8.



Probe used with Emerson Ch. 120124-B.

4. With a squared celluloid face mask on the screen, it is very easy to obtain accurate measurements.

For example: Take the 6.3-volt filament voltage, set the vertical gain control on the oscilloscope so that the wave covers 17.6 (6.3 × 2.8) boxes vertically from peak to peak. If the gain control is not moved, the oscilloscope will read 1 volt peak-to-peak per box on any signal. For a very weak signal, the calibration on a 6.3-volt a-c wave can be made with the vertical distance from peak to peak to 176 boxes instead of 17.6 boxes. The oscilloscope will then read 0.1 volt peak-to-peak per box instead of 1 volt peak-to-peak per box. If a stronger signal is encountered, the 117v a-c line can be used. The peak-to-peak value of this voltage is 117v × 2.8 = 328 volts.

G. E. 818

The following replacement part has been added to the Parts List: RDE-055, Overlay, metal overlay for picture tube masking.

Successful
SERVICING
REG. U.S. PAT. OFF.

Vol. 12 — JUNE, 1951 — No. 8

Dedicated to the financial and technical advancement of the Electronic Maintenance Personnel

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JOHN F. RIDER, Editor

CURTAIN TIME

This is a hurried editorial. We are in the midst of reviewing the TV service situation in different sections of the country and hoped that it would be ready for this issue of SUCCESSFUL SERVICING. One condition bothers us greatly. It is the practice of some TV servicemen to charge for parts replacements which they *do not make*. Regardless of what the circumstances may be, this practice is inexcusable. It is downright larceny and it must stop if TV servicing is to survive.

There are no situations which warrant such malpractice! Unwillingness on the part of the public to pay a rightful price for good TV service does not warrant out-and-out theft. Numerous problems surround the relationship between the public and the servicing industry. They make the life of the service technician very difficult. The public is nontechnical and does not appreciate a fair and just price. This limits the earning capabilities of the honest servicemen. However, it is no excuse for outright stealing. Charging for replacements which are not made is just that, and the serviceman who does it is subject to arrest.

Some servicemen—fortunately only a relatively few by comparison—feel that any means to an end is justified. These same groups would be the first to yell to high heaven if a jobber charged for a dozen tubes and delivered only ten, or if the garage mechanic charged for new brake linings and did not install them. Joe Blow, the serviceman who charges for a horizontal output transformer replacement which he does not make must be put out of the TV servicing business. He doesn't belong in society any more than the pickpocket who takes money out of your pocket.

On the other hand, the fact that dishonest people operate in the TV and radio service business should not indict the entire industry. There are more honest servicemen than dishonest servicemen. It is unfair for a newspaper to publish sensational copy by exposing the TV gyp without also devoting an equal amount of space to the honest operators in the area. It may not be equally lurid copy, but if newspapers are interested in the welfare of Mr. and Mrs. John Q. Public, it is their duty to advise TV owners where to go and the kind of organization to patronize in order that they may obtain the most for their money. We're not naive about this. Rackets deserve to be exposed—but editors should not hang everybody indiscriminately. Give the honest man a break. Make him known to the public. If an honest TV service association exists in the community, call it to the attention of the public. Give them a little publicity. They deserve it. Help them grow and they will overwhelm the racketeer—they'll put the gyp out of business by honest effort.

More next month.

JOHN F. RIDER

Olympic 752, 752U, 753, 753U, 755, 755U, 764, 764U, 766, 766U, 767, 769

If erratic horizontal hold, distortion, or picture tearing in strong signal areas occur, remove resistor R26, the 330,000-ohm ½-watt resistor located on peaking coil terminal strip adjacent to V11. Removal of this resistor provides higher agc voltage for the picture i-f tubes. Weak or gassy picture i-f tubes (V8, V9, or V10) will cause similar trouble.

If the picture is dark or shaded on the left side of the screen, change the value of R57 from 100,000 ohms to 47,000 ohms, ½ watt. This resistor is located between 2 lugs on the horizontal linearity control L18. Make certain that the red lead to pin 10 on the kinescope socket is free and clear of the other leads to the socket.

The following change applies only to Models 752U, 753U, 755U, 764U, and 769, schematic drawing #DG-2346-2. If there is poor vertical linearity, that is stretching of the picture in the center and compression of the top of the picture, the following changes should be made:

1. C47 (4 μf/450 v electrolytic) connected to the red lead of the vertical output transformer should be changed to a 20-μf, 450-v, electrolytic capacitor. If 20 μf is not available, use a 50-μf electrolytic.
2. R55 (3300 ohms, 2 w) connected to the red lead of the vertical output transformer should be changed to 1000 ohms, 1 watt, ±20%.
3. R54 (3300 ohms) and C46 (0.05 μf, 600 v) peaking network. Disconnect ground side of the network and connect pin 6 of the 6SN7 (V14).
4. Check the 6SN7 (V15).

It is important that if one of the four changes mentioned above is made, all changes must be made. These changes are effective on chassis with serial numbers R584500 or S612800 and above.

General Electric 16C110, 16C111, 16C115, 16T1, 16T2

Capacitor C378, connected across the horizontal deflection coil D351, was changed from 56 $\mu\mu$f to 47 $\mu\mu$f. This change was made to reduce the possibility of vertical light bars appearing on the left side of the raster. On the Parts List, remove Stock RCU-297 and add Stock RCN-037, capacitor, 47 $\mu\mu$f, 1500 v, mica.

Television Changes

Zenith Ch. 22H20Z

The 22H20Z chassis is identical in all respects to the 22H20, with the exception that a 12LP4B glass picture tube is used in place of the 12UP4B metal tube, resulting in the small differences in mounting outlined below.

Part No.	*Description*
	OMIT
19-207	Cathode-ray tube mtg. clip
80-838	Cathode-ray tube retaining spring
S-17409	Insulator strip & terminal
S-17428	Anode lead & eyelet assy.
12UP4B	Picture tube.
	ADD
19-177	Anode clip
22-4	0.004 µf, ceramic disc (or 22-1706), 500 v
57-1692	Strap clamping plate (2 used)
80-841	Ground spring
82-27	Cathode-ray tube retaining strap
83-1879	Rubber strip (crt)
114-201	#8 x 5/16 hex hd. s.t. (2 used on each 57-1692)
S-17447	Anode clip & wire assy.
S-17773	Strip & gasket assy.
12LP4B	Picture tube.

●

Belmont C-1602 Series C, Ch. 16AX29

For the tuner replacement parts list of the continuous tuner used in Model C-1602 Series C, refer to the tuner parts list given with Chassis 12AX27. Only 16AP4 metal tubes are used in the C-1602 Series C receiver.

●

Trav-ler 14B50, 14C50, 16R60, 16R70

Model 16R60 is the same as 16R70. The alignment procedure and service information given for Models 16G50, 16G50A, 16R50, 16R50A, 16T50, and 16T50A also applies to Models 14B50, 14C50, 16R60, and 16R70.

●

Capehart-Farnsworth 335B, 335M, Ch. CX-33S, C-303

When installing a Model 335M television receiver the following revisions to the Installation and Set-Up Instructions for Chassis CX-33 must be taken into consideration.

The procedure for removal of the escutcheon is as stated for CX-33 except that Model 335M employs brass pressure clips to secure the wood mounting strip instead of screws. To remove these clips, insert a screwdriver beneath the head and pry out. Wrap a cloth around the screwdriver to prevent scratching the cabinet. To replace the clips, merely press in.

Model 335M does not employ the red shipping bracket mentioned to secure the focus coil. Instead, the focus coil is demounted from the crt and fastened to the rear of the cabinet chassis shelf for shipment. Upon installation the coil assembly will have to be properly mounted. To do this, first remove the ion trap from the neck of the crt and then remove the large bolt which secures the focus coil assembly to the cabinet. Slide the coil assembly over the neck of the crt (the proper direction of the coil is with the side of the coil with the four mounting ears facing toward the bell of the crt) and fasten it to the mounting bracket on the chassis using the hardware furnished. The lock washer fits next to the bolt head, then a flat washer goes between the lock washer and the coil bracket. On the underside of the mounting bracket, place the flat washer on first and then the remaining lock washer, followed by the wing nut. Slide the coil forward until it is approximately ⅜" from the deflection yoke and tighten the wing nut. Place the ion trap magnet on the neck of the crt (in case of double magnet traps with the arrow pointing toward the bell of the crt) and connect the crt socket. Turn the receiver on and adjust the ion trap magnet until a raster is seen. If a raster is not obtained, adjust the shading and agc set controls. Upon obtaining a raster, adjust the magnet (by sliding back and forth and rotating about the neck of the crt) to obtain maximum brightness. With just the raster present (no picture), adjust the focus control for good focus and check to see if focus is good over entire tube; if it is not, adjust the focus coil assembly. To do this, loosen the wing nut which fastens the coil assembly to the mounting bracket and slide the coil back and forth until optimum focus is obtained, as evidenced by clear separation of the raster lines across the entire picture. The focus control must be readjusted each time the coil is moved. Readjust the ion trap magnet to insure maximum brightness.

Model 335M employs a focus coil assembly which does not include the adjustment handle. Therefore, to center the picture in the crt mask, loosen the wing screw at the left side of the focus coil assembly and also the wing nut which fastens the coil assembly to the mounting bracket. The coil can then be tilted in both the vertical and horizontal planes to provide horizontal and vertical centering. After the picture is properly centered, secure the coil assembly in place by tightening the wing screw and nut. After any adjustment of the focus coil, always readjust the ion trap magnet to insure maximum brightness and prevent damage to the crt.

The list of cabinet parts for Models 335B and 335M is given below:

Part No.	*Description*
850082A-1	Speaker assembly, 12" pm
850162A-1	Safety glass escutcheon
950118A-1	Picture tube mask
650345A-1	Balance knob
650345A-2	Shading knob
650342A-1	Channel knob
650344A-1	Sound knob.

●

Garod 14CT4, 16CT4, 16CT5, 19C6, 19C7, 1671, 1672, 1673, 1674, 1675, 1900, 1974, 1975, Series 97 and 98.

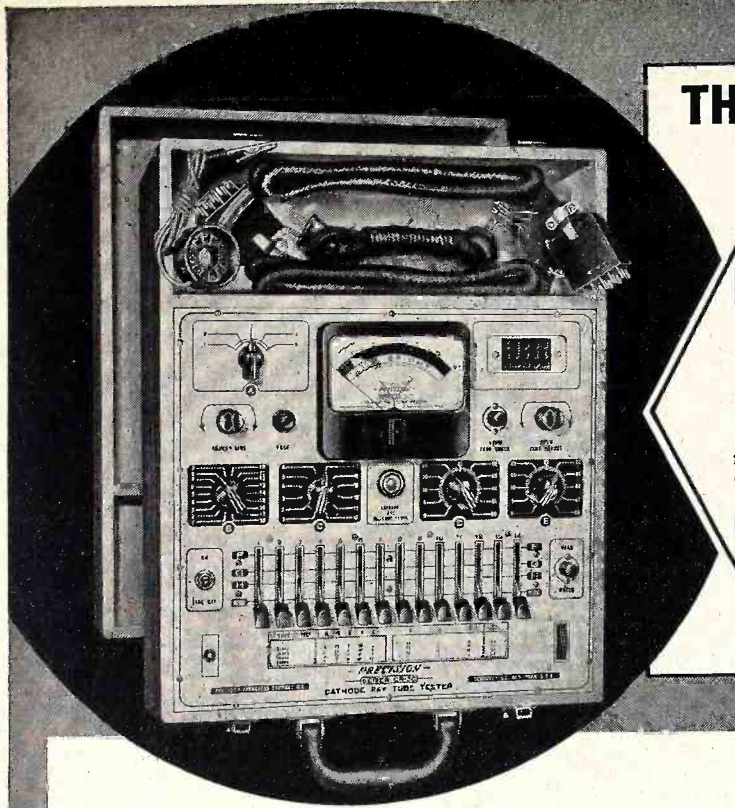
Model 14CT4 is a consolette with a mahogany finish and employs a 14" rectangular picture tube. Models 16CT4 and 16CT5 are consolettes using 16" round tubes. Model 16CT4 has a mahogany finish, while Model 16CT5 has a bleached finish. Model 1900 is also a consolette with a mahogany finish, although it employs a 19" round tube. A total of 20 tubes including the picture tube is used in these receivers.

The service data for these models in the 97 and 98 Series are the same as the data for the 94 and 97 Series except for the differences and additions mentioned in the following paragraphs.

Under the section titled "Picture Tube Installation in 16" Receivers," add:

For receiver Models 1672 or 1673, remove the two screws which hold the front mask assembly. These pass through the two corner blocks on the inside of the cabinet at the top. When these screws are removed, the front panel may be lifted out. For receiver Models

(Continued on page 8)



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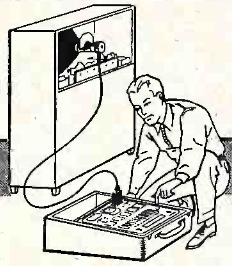
'SCOPE TUBES AND INDUSTRIAL CR TYPES

for True Beam Current (Proportionate Picture Brightness)

Tests ALL CR Tube Elements—Not Just a Limited Few



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Tests CR Picture Tubes Without Removal from TV Set or Carton!

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The Precision CR-30 should not be confused with mere adapters connecting to ordinary receiving tube testers which were never designed to meet the very specialized needs of CR tube checking. Similarly, it is not to be confused with neon-lamp units or similar devices of limited technical merit and which do not check all CR tubes or all tube elements.

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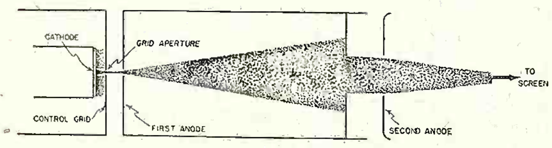
Total cathode emission can be very high and yet Beam Current (and picture brightness) unacceptably low. **The CR-30 will reject such tubes** because it is a true **Beam Current** tester. Conversely, total cathode emission can be low and yet Beam Current (and picture brightness) perfectly acceptable. **The CR-30 will properly pass such tubes** because it is a true **Beam Current** tester. The significance of the above rests in the fact that Beam Current (and picture brightness) is primarily associated with the condition of the **center** of the cathode surface and not the overall cathode area. (See illustration below)



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Garod Series 97 and 98
(Continued from page 6)

1671, 1674, or 1675, remove the four decorative screws which hold the front panel and mask assembly. These pass through the four corners of the picture frame. Carefully lift out the front panel and mask assembly. For Model 1671, loosen the two screws which fasten the metal picture-tube retaining band and evenly, so that the rectangular picure tube is not forced to rotate or twist in its mounting.

The picture tube installation in 19" receivers is as follows:

The bulblike glass separation between the neck of the picture tube and its metal cone is treated with an anti-corona coating to reduce high-voltage leakage under humid at-

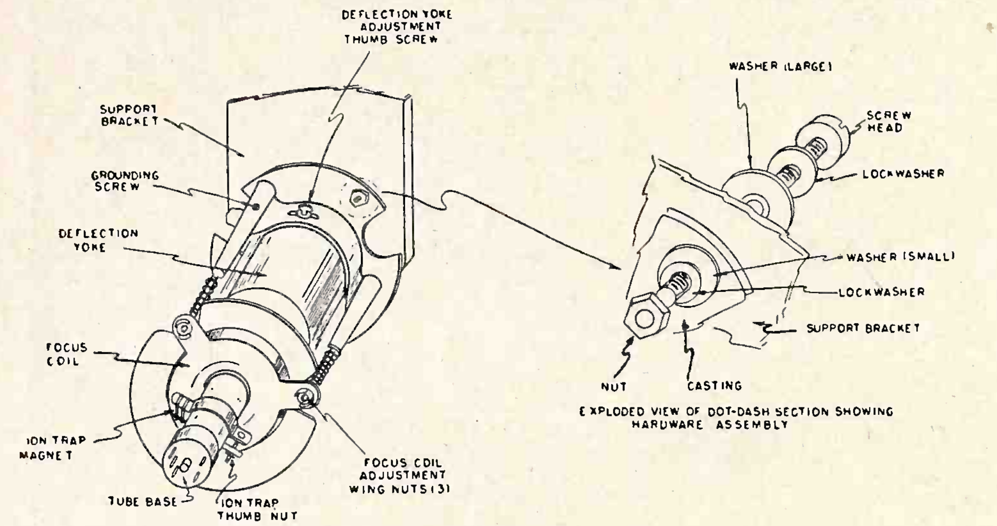

Fig. 1. Deflection yoke and focus coil assembly.

sufficiently so that the picture tube may be slipped through the opening. The high-voltage connector should be located on the right side of the chassis, as viewed from the front. Secure the metal band over the top of the tube by tightening the two screws alternately

mospheric conditions. Avoid touching this treated area since perspiration may reduce its effectiveness. If handled accidentally, wash with water or mild soap and water. Remove all traces of soap. Use no chemical solvents or abrasives for cleaning.

1. Remove the slotted head P.K. screws retaining the back and release with the interlocked line cord.
2. Remove the bag containing the beam bender, the hardware for deflection and focus coil assembly, and the front plug buttons, if used.
3. Remove the deflection and focus coil assembly which is fastened to a shelf for shipping purposes. Remove retaining wires that are wrapped around focus coil adjustment screws.
4. Carefully slide the deflection yoke and focus coil assembly over the neck of the picture tube, so that the deflection yoke adjustment thumb screw faces the top of the cabinet.
5. Assemble the deflection yoke and focus coil assembly to the support bracket using the hardware provided. See Fig. 1 for proper hardware assembly and mounting procedure.
6. Remove the 6-32 grounding screw from the yoke frame (see Fig. 1 for location). Attach the ground lug on the brown wire coming from the chassis, and replace the screw.
7. Slide the beam bender over the neck of the picture tube.
8. Connect the picture tube socket to the tube base.
9. Connect the male octal plug from the deflection yoke and focus coil assembly to the female octal socket from the chassis.

The rear panel adjustments that are illustrated for Models 1672, 1673, 1674, 1675, 19C6, 19C7, 1974, and 1975 apply to the other models mentioned in this article. The location of the front panel controls are shown for Models 1974 and 1975 in Fig. 2, and for the rest of the models in Fig. 3.

The circuit description for these models is the same as that for the 94 Series, except that in the section titled "Vertical Deflection Circuit (Block H)," the generated sawtooth voltage is amplified by the 6K6 output tube (V20), rather than the "other half of the 6SN7 duo-triode (V14)."

The Alignment Procedure, Video I-F and Sound Alignment, and the R-F and Oscillator Alignment for the 97 and 98 Series is the same as that found for the 94 Series.

The Voltage Chart for all models except 14CT4, 1674, and 1900, is the same as that shown on page 5-19. The voltage readings for Model 1900 are the same as those shown on page 5-19 except for the following changes. Picture tube: pin 2 is 2, pin 10 is 230 v, pin 11 is 10 v. Audio output (6V6): pin 1 is N.C. Video amplifier (6AC7): pins 3 and 5 are 0.2 v, pin 8 is 115 v. Vertical sweep oscillator (6C4): no reading for pin 1, pin 5 is 100 v.

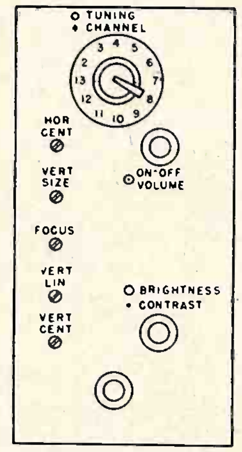

Fig. 2. Front panel layout for Models 1974 and 1975.

Horizontal sweep oscillator (6SN7): no reading for pin 8. Horizontal sweep output (6BQ6-GT): no reading for pin 1, pins 3 and 4 are 155 v, pins 5 and 6 are —26 v, pin 8 is 7 v. High-voltage rectifier (1B3): pins 2, 6 and 7 are 11.5 kv. Horizontal damper (6W4): pin 2 is N.C., pins 5 and 6 are 210 v. Power rectifier (5U4G): pins 2 and 8 are 380 v, pins 4 and 6 are 365 vac. Vertical output (6K6): pin 1 is 0 v. 6AG5's only are used as r-f amplifier, and 2nd and 3rd video i.f.

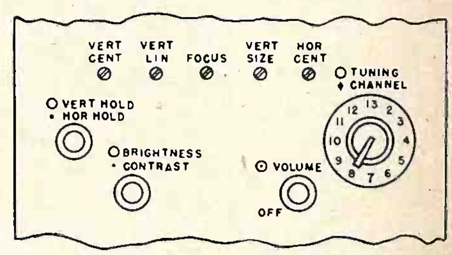

Fig. 3. Front panel layout for Series 97 and 98.

The voltage readings for Models 14CT4 and 1674 are the same as those shown on page 5-19 except for the following changes. Picture tube: pin 10 is 245 v. Oscillator-converter (6J6) pin 1 is —0.7 v, pin 2 is 0 v. Ratio detector-audio amplifier (6T8): pin 6 is —0.5 v, pin 8 is —1.5 v. Ratio detector driver (6AU6): pin 1 is 8 v, pin 2 is 8.5 v, pin 5 is 220 v, pin 6 is 105 v, pin 7 is 9 v. D-c rest.-clip-sep.-amp. (12AU7): pins 2 and 6 are 160 v, pin 3 is 162 v. Horizontal sweep oscillator (6SN7): pins 3 and 6 are 12.5 v, pin 4 is —4-7 v, pin 5 is 100 v. Horizontal sweep output (6BQ6-GT): pins 3 and 4 are 210 v, pin 5 is 48 v, pin 8 is 72 v. High-voltage rectifier (1B3): pins 2, 6 and 7 are 10.1 kv. Horizontal damper (6W4): pin 2 is —85 v, pins 5 and 6 are 225 v.

(Continued on page 10)

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Five-element beam, **custom-cut** to exact wavelength of channel, delivers more **powerful** forward gain with **high** front-to-back ratio rejecting co-channel interference.

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LOW BAND	HIGH BAND
No. 5Y2 (Channel 2)	No. 5Y7 (Channel 7)
No. 5Y3 (Channel 3)	No. 5Y8 (Channel 8)
No. 5Y4 (Channel 4)	No. 5Y9 (Channel 9)
No. 5Y5 (Channel 5)	No. 5Y10 (Channel 10)
No. 5Y6 (Channel 6)	No. 5Y11 (Channel 11)
	No. 5Y12 (Channel 12)
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Garod Series 97 and 98

(Continued from page 8)

Model 1671 uses a single 5" p-m speaker. Models 16CT4 and 16CT5 use a single 10" p-m speaker. The schematic for Series 97 and 98 is the same as that which appears on page 5-20 except for the following changes in the ratio detector driver stage. A 100-ohm resistor, R10, is inserted from the junction of R28 and C49, to pin 1 of V6, the 6AU6 ratio detector driver. Capacitor C55, the 0.02μf capacitor connected from pin C of ratio detector transformer T6 to ground, has been relocated and now goes from pin C to pin 7 of V6, the ratio detector driver. The value of C55 has been changed to 5000 $\mu\mu$f. A 5000-$\mu\mu$f capacitor C32 has been added from pin 7 to pin 2 of V6. An 82-ohm resistor R26 has been inserted from pin 7 to R27, the 1,000-ohm grid resistor.

The schematic for Models 14CT4 and 1674 is the same as that described above for Series 97 and 98 except for a change in the sweep circuit. Resistor R118, 390,000 ohms, now goes from the junction of R83, 100,000 ohms, and C79, 13 $\mu\mu$f, 2 kv, to the junction of R84 (the 250-ohm resistor going from ground to pin 8 of the horizontal sweep output tube V16) and R80 (mentioned below), instead of from R83 and C79 to ground. Resistor R80, that was connected from ground to capacitor C92 (connected to pin 8 of V16), was relocated and now goes from ground to the junction of R18 and R84 to R85 (mentioned below), and the value of R80 has been changed from 47 ohms to 470 ohms, 7 watts. Resistor R85, the 30,000-ohm resistor that was connected in parallel with R87 (30,000 ohms) going to the +360-volt bus, has been relocated. It now goes from ground to R80, and the value has been changed to 100 ohms, 2 watts. The value of R87 has been changed from 30,000 ohms, 2 watts, to 12,000 ohms, 2 watts.

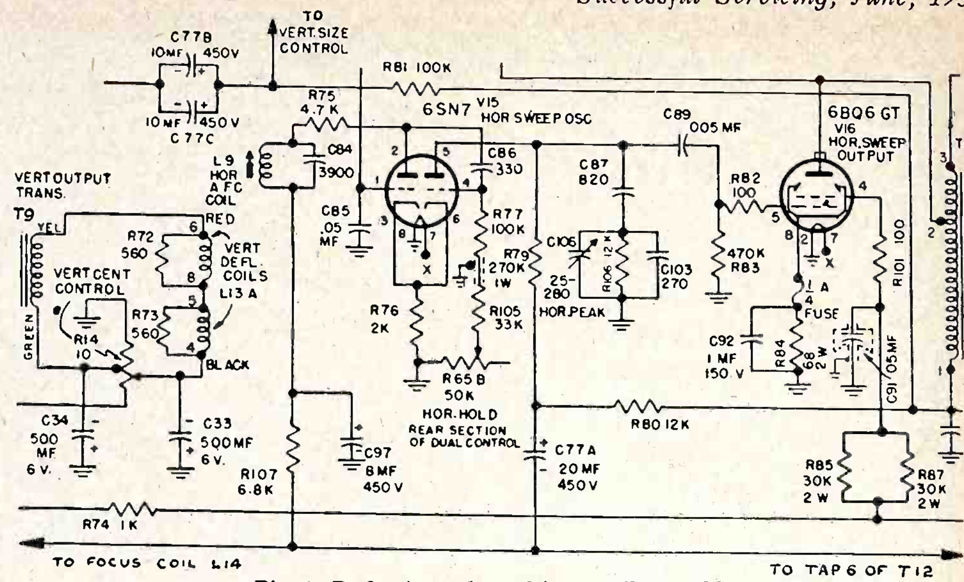

Fig. 4. Deflection yoke and focus coil assembly.

The schematic for Model 1900 is the same as that for the 97 and 98 Series appearing on page 5-20 except for the following changes. The value of C88, connected to pin 2 of V10A, the 1/2-6AL5 video detector, has been changed from 10 $\mu\mu$f to 15 $\mu\mu$f. Capacitor C67, 10 μf, 150 v, connected to pin 6 of the video amplifier V11 and ground has been removed, and C77C, 10 μf, 450 v, inserted in its place. The value of R108 connected to pin 8 of V12A, the 1/2-12AU7 d-c restorer sync clipper, has been changed from 8,200 ohms to 7,000 ohms; and the value of resistor R52, connected from R53 to the +360-volt bus in the same circuit has been changed from 12,000 ohms to 11,000 ohms. The value of resistor R100, connected from the junction of pin 2 of V12B and pin 6 of V12A to R116 has been changed from 1 megohm to 2.2 megohms. The 470,000-ohm resistor R116 has been deleted from the circuit and a direct connection used in its place.

Model 1900 is the only receiver which is not equipped with a built-in antenna. The two connections from the terminal strip go to the tuner. Since the built-in high-frequency antenna is not used, the 300-ohm transmission-line matching section, the two 5000-$\mu\mu$f capacitors C112 and C113 attached to this section, and the line choke L21 (that are shown in the schematic on page 5-20) are also omitted in this model. In place of C114 and C115, 5000 $\mu\mu$f, two 0.01 μf capacitors, C78 and C79 are connected from the terminals of the primary of T11 to ground. The vertical centering control R14, 10 ohms, has been relocated as shown in Fig. 4. On all other models in the 97 and 98 Series it goes from coil L12, connected to the power rectifier, to the yellow lead of focus coil L14. In Model 1900 L12 is connected directly to the junction of C81A and the yellow lead of the focus coil, and capacitor C89, 500 μf, that was connected in parallel across the vertical centering coil, has been deleted. The vertical centering coil is connected, as shown in Fig. 4, from ground to the 3.3-ohm resistor R60 (going to the —2.5-volt line). The taps from the vertical centering control are connected as in the 97 and 98 Series schematic.

Additional changes in Model 1900 are shown in Fig. 4. The lead from C77B and C goes directly to the green lead of the focus coil. The lead and the 270,000-ohm resistor R79, from the yellow lead of the focus coil to pin 5 of V15 the horizontal sweep oscillator, have been deleted. The lead from the horizontal size coil L10 and capacitor C79 to R83 have been deleted. Tap 2 or T12 goes to the 470,000-ohm resistor R96, the lead from pin 1 of V15 goes to the junction of C100 and R90, C74 goes to the red lead of the vertical oscillator transformer T8, R74 goes to the red lead of T9, and R85 and R87 go to the top on the horizontal centering control R12.

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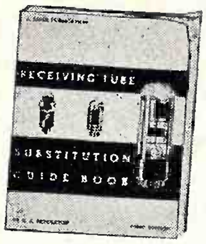

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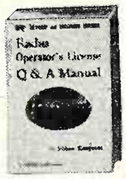

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Television Changes

Industrial 248, 348, Ch. IT-35R, Ch. IT-48R

The IT-48R sweep chassis is used in Models 248 (16") and 348 (19"). The general description of the circuit is as follows:

Video

The video signal from the control unit is brought into the picture unit chassis through pins 1 and 8 of the octal socket J1. R1 serves to terminate the interconnecting cable at its characteristic impedance of 75 ohms. R2 (omitted in home receivers) is the auxiliary contrast control, which should be adjusted at the time of installation to equalize picture contrast between multiple viewer installations. V1 and V2, a 6AG5-6AQ5 combination, form a two-stage direct-coupled video amplifier, with a bandwidth of approximately 4.5 Mc, and a gain of about 100, with an output of 75 volts peak-to-peak. The amplified video signal is applied to the grid of the picture tube V4. A portion of the video signal is also applied to the d-c restorer and sync clipper (one-half of V3, a 12AU7) which separates the sync pulses from the composite signal, and which derives, from the composite video, a d-c potential which provides a constant black-level reference for the video signal.

Sync

The clipped sync pulses from the sync separator are fed to the grid of the sync amplifier (the other half of V3) which amplifies and further clips the sync, and also serves as a phase inverter to provide positive and negative sync pulses to the horizontal phase detector V5. A portion of the sync signal is picked off the cathode of the sync amplifier and integrated to provide sync pulses for the vertical. These vertical sync pulses are further amplified by the first half of V11 (12AU7) before being applied to the vertical BTO.

Horizontal

The horizontal oscillator (V6) is a 12AU7 in a Potter type circuit, which is essentially a cathode-coupled multivibrator with a ringing coil L4 in one plate circuit. The other plate circuit has appropriate *R-C* networks to generate a peaked-sawtooth waveform suitable to drive the 6BG6 horizontal output amplifier, V7, that is coupled to the yoke through the output transformer T1. The 6W4, V10, serves to damp out any ringing or undesired transients in the yoke circuits. High voltage is obtained by rectifying the boosted primary pulse in a voltage doubler circuit using two 1B3's (V8 and V9) which provide about 14 kv of accelerating potential for the picture tube. A portion of the output pulse is picked off the secondary of T1, shaped, and fed back to the 6AL5 phase detector, V5, where it is compared with the incoming sync pulses, generating a proportional d-c potential that is applied to the grid of the horizontal oscillator, V6, to synchronize its frequency with that of the transmitter.

Vertical

The integrated and amplified vertical sync pulse is applied to the grid of the vertical BTO, the other half of V11, and locks it in sync with the transmitter. The plate supply circuit of the BTO has an integrating network which derives a saw from the BTO pulse to drive the 12AU7 vertical output amplifier V12, coupled to the vertical windings of the yoke through the vertical output transformer T3.

Audio Amplifier

The audio amplifier is a two-stage push-pull resistance-coupled amplifier, using a 12AU7 as voltage amplifier and phase inverter (V13) and two 6AQ5's (V14 and V15) as push-pull output amplifiers. V14 and V15 are also used as a voltage divider and regulator to provide a 200-volt supply for the sync clipper, amplifier, and horizontal oscillator circuits.

Power Supply

The power supply is relay controlled by the control unit, and provides 400 volts d.c. at 200 ma, and also the necessary heater power to operate the chassis. It is fused at 5 amps, and interlocked with the speaker plug to protect the input filter capacitor from excessive surge voltages.

The adjustments are as follows:

Auxiliary Contrast Control (not provided in Models 248 or 348).

This control, located on the chassis apron next to the octal input socket, should be left at maximum except when the installation includes more than one viewer on a single control unit. If two or more viewers are used with a single control, one of the viewers may require slightly reduced contrast to equalize the pictures to their individual locations. For instance, a viewer in a darker location may need less contrast for a perfect picture than one in a location with high ambient light on the tube face.

Brightness Control

This control, located on the chassis apron next to the contrast control mounting hole, serves to adjust the background or average picture brightness. This control should be adjusted so that with no picture the raster just disappears, and it should be rechecked with the picture to make sure that the retrace lines do not appear on any station.

Vertical Size

Located on the chassis apron next to the brightness control, the vertical size control serves to adjust the vertical height of the picture. It should be used in conjunction with the vertical linearity to adjust the picture to fill the frame with good vertical linearity.

Vertical Hold

This control, situated next to the vertical size control on the chassis apron, serves to adjust the vertical oscillator frequency so that it may be locked into synchronization with the incoming video signal. The picture will remain locked-in over a considerable range of this control, however, the control should be set at the middle of the locked-in range.

Vertical Linearity

On the chassis apron next to the vertical hold control is the vertical linearity control, which varies the relationship of the size of the top half of the picture with respect to the bottom half. This control should be adjusted in conjunction with the vertical size control as outlined above.

Horizontal Hold

This control, located on the chassis apron next to the vertical linearity control, acts in conjunction with the horizontal frequency adjustment L4 to set the frequency of the horizontal oscillator to synchronization with the incoming video signal. It is interdependent with the horizontal drive control, so that it is necessary to readjust the hold if the drive is changed. The hold should be set so that the picture is locked in, and so that adjustment of the control will expand the picture both ways. If this cannot be done, or if there is a "pull" or curvature in the vertical wedges of the test pattern, the horizontal frequency control should be reset to correct this condition. Several interrelated changes of these two controls may be necessary to properly adjust the horizontal setting.

Horizontal Drive

This control varies the amount of sawtooth voltage applied to the grid of the horizontal output amplifier, and is located on the apron of the chassis next to the horizontal hold control. Its purpose is to set the horizontal width of the picture to fill the mask. As mentioned under horizontal hold, adjustment of this control usually necessitates resetting of the hold control.

Horizontal Positioning

The next control after the horizontal drive is the horizontal positioning control. This control moves the entire picture to the left or right so that it may be centered in the mask opening.

Vertical Positioning

This control, the next to last control on the chassis apron, serves to vertically center the picture in the mask area.

Focus

The focus control, the last control on the apron, controls the magnetic field of the focus coil, thereby focusing the electron beam of the picture onto the screen. It should be adjusted for the maximum over-all picture sharpness, especially at the center of the picture.

Video Amplifier Bias

This control is located on top of the chassis close to the octal input socket, and is provided to adjust the bias on the second video amplifier V2 to the proper operating point. This control need be used only if V1 or V2 is replaced, in which case, it would be adjusted so that the grid-cathode potential of V2 is 6.0 volts measured between pins 1 and 2 of its socket.

Cathode-ray-tube Drive

This control provides adjustment of the cutoff potential of the picture tube. It should need adjustment only if the picture tube is replaced. With no picture and the Brightness control set so that the grid-cathode bias of the picture is 45 volts, it should be set so that the raster just disappears.

Horizontal Frequency (L4)

This is a screw adjustment located on top of the chassis between the 6BG6 horizontal output amplifier, V7, and the chassis apron. (For use see horizontal hold above.)

Horizontal Linearity

This adjustment provides a variation of the horizontal sweep linearity near the center of the picture. It should never need adjustment in the field.

●

General Electric 12C107, 12C108, 12C109, 12T3, 12T4

In the above receivers using a type 6AB4 tube as the 1st r-f amplifier, the Stock No. RLA-035 input transformer is no longer available. The Stock No. RLA-036 is a direct substitution for it and is now being furnished with these receivers.

On late production receivers, the value of resistor R379, which goes from V12B to pin 7 of V11, has been changed from 180,000 ohms to 270,000 ohms. On the Parts List, remove R379 from Stock No. URD-103, and add URD-107, 270,000 ohms, ½ w, carbon, R379.

LOUDSPEAKER MATCHING

(Continued from page 1)

Simultaneous Use of Several Taps—High-Impedance Lines

Assume that an installation requires very unequal distribution of power to several different groups of loudspeakers. To connect them through matching transformers in such a manner that their total load equals one of the high impedance taps available at the amplifier output may be impossible. To connect the low-powered loudspeakers directly across a tap on the output transformer is not usually possible, since the tap impedance required will be so low as not to be available. The simplest solution to this problem is to connect the various loads through the proper individual matching transformers to *several* taps on the output transformer so that power distribution is as desired and the amplifier is properly matched to the total loudspeaker distribution system.

A detailed example will clarify the above. The calculations required to design a p-a system for a church will be explained in detail. Figure 2 is a schematic of the loudspeaker distribution system.

The church uses a 75-watt amplifier having output tap impedances of 4, 8, 125, 250 and 500 ohms. Four 8-ohm, 15-watt loudspeakers are series-parallel connected to provide 60 watts to the belfry. One 8-ohm loudspeaker receiving 2 watts is used for the choir. Two 8-ohm loudspeakers receiving 4 watts each, are placed on the walls flanking the altar, facing the congregation. The power required is thus 70 watts, leaving 5 watts reserve power. An additional 8-ohm, 5-watt loudspeaker located in the recreation room, for example, can take this 5 watts reserve power.

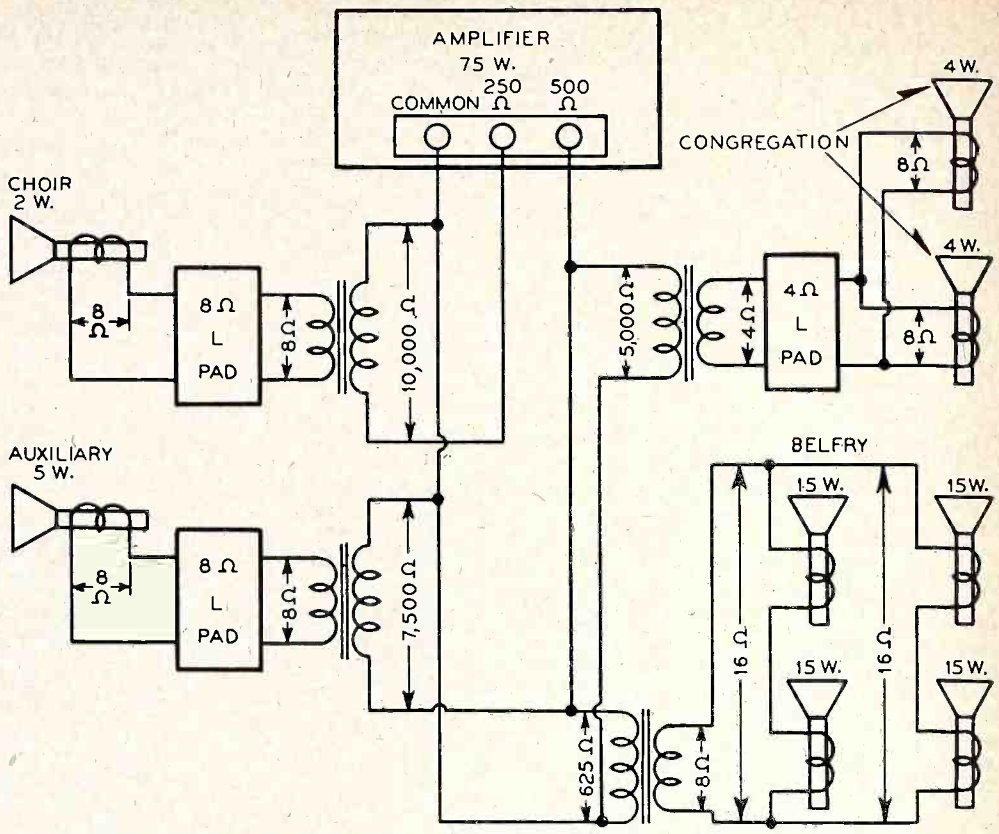


Fig. 2. Schematic representation of a church loudspeaker system. A 75-watt amplifier is used to feed all the loudspeakers.

Since the belfry and congregation loudspeakers are at some distance from the amplifier, the loudspeaker lines feeding them will be run at high impedance and thus matching transformers are required. The choir and auxiliary loudspeakers must also use matching transformers because less than 1-ohm impedance would be necessary to get the required power if these loudspeakers were connected directly across part of the output transformer impedance. An impedance this low is not available, so these loudspeakers cannot be connected directly to the output transformer but must use matching transformers. The belfry and congregation loudspeakers use a 500-ohm line since they are some distance from the amplifier. To compute the values of the matching transformer primary impedances (the secondaries are 4 ohms in one and 8 ohms in the other), the equation given previously can be used.

$$Z_L = \frac{Z_{tap}}{(\%\,P)}$$

Since the belfry loudspeakers take 80 percent of the amplifier power applying the above equation we get

$$Z_L = \frac{500}{.8} = 625 \text{ ohms.}$$

Thus the impedance of the primary winding of the matching transformer for the belfry loudspeaker is 625 ohms.

Similarly the congregation loudspeakers use 10.6 percent of the total power and the primary impedance required for the matching transformer is

$$Z_L = \frac{500}{.106} = 4{,}710 \text{ ohms.}$$

Since this value is not available in commercial matching transformers, a primary impedance of 5,000 ohms may be used.

$$\text{Mismatching} = \left(\frac{\text{Actual load impedance}}{\text{Required load impedance}} \times 100\right) - 100.$$

therefore,

$$\text{Mismatching} = \frac{5{,}000}{4{,}710} \times 100 - 100 = 106 - 100 = 6\%.$$

This will result in about 6 percent mismatching which probably would not be noticed.

Since the two primary windings (625 ohms and 5,000 ohms) are in parallel, then their effective impedance is 555 ohms.

$$Z_T = \cfrac{1}{\cfrac{1}{Z2} + \cfrac{1}{Z1}}$$

$$= \frac{Z1Z2}{Z1+Z2}$$

$$= \frac{625 \times 5{,}000}{625+5{,}000}$$

$$= 555 \text{ ohms.}$$

This will give a mismatch of 11 percent. The installation will work satisfactorily with the above computed values, but if the 5-watt auxiliary loudspeaker were also connected by means of a matching transformer across the 500-ohm tap this would result in an even closer match. Thus, with the auxiliary loudspeaker taking 6.67 percent of the available power, the primary impedance of its matching transformer is

$$Z_L = \frac{500}{.0667} = 7{,}500 \text{ ohms.}$$

A matching transformer having a primary impedance of 7,500 ohms can be used.

Since the three matching transformers are in parallel, their effective load is 517 ohms which closely matches the 500-ohm output transformer tap. Of course, the auxiliary loudspeaker could be connected to any other tap if the primary impedance of the matching transformer used is calculated to provide overall matching. The table below indicates this.

TABLE I

Output Transformer Tap Impedance	Primary Impedance of Matching Transformer
4	60
8	120
125	1,875
250	3,750

The best over-all match is obtained when this auxiliary loudspeaker is connected across the highest impedance tap (500 ohms), but if a 7,500-ohm matching transformer is not available then the other choices are available.

The primary impedance of the matching transformer for the 2-watt choir loudspeaker can be similarly found. This loudspeaker utilizes 2.67 percent of the total power so that

$$Z_L = \frac{250}{.0267} = 9{,}360 \text{ ohms.}$$

A matching transformer with a 10,000-ohm primary can be used. A separate line and tap are used for this loudspeaker because, if fed from the 500-ohm line, the matching transformer would require a primary impedance of 20,000 ohms which is not available.

Since the matching transformer for each loudspeaker or group of loudspeakers has been calculated, the question arises, "Will the set-up as illustrated in Fig. 2 match the output impedance of the amplifier?" The proper value of the reflected load impedance at the primary of the output transformer is usually unknown. The recommended plate load impedance as given in tube manuals is rarely used without some change due to various

(Continued on page 16)

LOUDSPEAKER MATCHING

(Continued from page 15)

practical design considerations. It is unnecessary to know the value of the reflected load impedance, but is important that the proper value be obtained.

When the reflected impedance is unknown, the following formula may be used to determine if the desired reflected impedance has been obtained:

$$1^* = \frac{Ztap1}{Zload1} + \frac{Ztap2}{Zload2}$$

Thus in the installation cited:

$$1 = \frac{250}{10,000} + \frac{500}{517} = .025 + .968 = .993$$

The two sides of the equation balance *very* closely so that the computed values will give correct matching.

Where it is desired to feed two different loads at the same time with equal power, the two loads should be connected to taps having half the impedance of the connected load. Thus, if the amplifier power is to be divided equally between a 250-ohm line and a 16-ohm loudspeaker, the 250-ohm line is connected to a 125-ohm tap and the 16-ohm load to an 8-ohm tap as shown in Fig. 3.

Checking this to see if the correct loading on the amplifier tubes is obtained, we get:

$$1 = \frac{125}{250} + \frac{8}{16}$$

so that matching is maintained.

Similarly three taps can be used to obtain equal division of power output if each tap load is connected to a tap impedance equal to one-third the load impedance. For example,

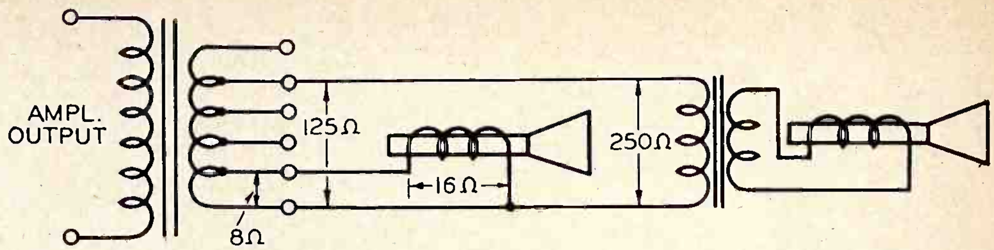


Fig. 3. If the amplifier power is to be divided equally between two different impedance loads, these loads should be connected to taps having half the impedance of the connected load, as shown.

a 600-ohm load, an 18-ohm loudspeaker, and a 6-ohm loudspeaker can be connected across taps whose values are 200 ohms, 6 ohms and 2 ohms, respectively.

A simple but common use of two taps is when it is desired to connect most of the output across one load (say a 500-ohm line) and a small part of the output across another load (15-ohm voice coil) such as a monitor loudspeaker. In this case the 500-ohm line is connected to its matching impedance, the 500-ohm tap, while the 15-ohm load is connected across a tap whose impedance is 20 percent or less of the impedance of the load. This will be 3 ohms or less, so the 15-ohm monitor can be connected to a 2.5-ohm tap.

Matching With Available Transformers

There are occasions when the exact type of line transformer required is not available. In many of these cases it will be possible to use a line transformer with different ratings and still obtain a match. When a transformer is rated as having a certain primary and secondary impedance, that transformer will properly match those impedances, but it does not mean that it can not be used for matching other impedances.

For example, let us assume that an 8-ohm loudspeaker has to be matched to a 250-ohm tap on the amplifier output and that the only line transformer available is rated as having a 500-ohm primary and multiple secondary taps. This rating indicates that when a load is connected to the proper tap on the secondary (as an 8-ohm loudspeaker connected to the 8-ohm tap), the primary of the transformer will present a 500-ohm load to the amplifier. By connecting the 8-ohm loudspeaker to a tap other than the 8-ohm tap, it may be possible to have the transformer present a 250-ohm load to the amplifier, which is desired in this particular case. To determine the tap to which the loudspeaker is connected, this equation can be used:

$$\frac{Zp1}{Zp2} = \frac{Zs1}{Zs2}$$

where: Zp1 = rated primary impedance.
Zp2 = desired primary impedance.
Zs1 = rated secondary impedance, or tap.
Zs2 = desired secondary impedance.

Since the secondary tap is desired, the equation can be rearranged by solving for Zs1, giving:

$$Zs1 = \frac{Zp1 Zs2}{Zp2}$$

Substituting the known values we have:

$$Zs1 = \frac{500 \times 8}{250} = 16$$

Therefore, when the 8-ohm loudspeaker is connected to the 16-ohm tap on the secondary of the line transformer, the primary of the transformer will present a load of 250 ohms to the amplifier and a proper match will be obtained. This method of matching is shown in Fig. 4.

$^*\frac{\text{Actual reflected load}}{\text{Desired reflected load}} = 1$

Multi-Secondary Output Transformers

Transformers having two separate secondary windings may be used to feed different loudspeakers through frequency-discriminating circuits. This is one means of obtaining high- and low-frequency outputs from different loudspeakers. Sometimes three secondary windings can be obtained so that a middle-frequency output can also be obtained. Not all multi-secondary output transformers, however, are designed for simultaneous loading on all the secondaries. In many cases several windings are offered instead of a winding with several taps, to avoid any problems that might arise from unused taps. In such a case correct loading on any one winding will give the correct reflected impedance. Unless properly compensated for, the use of several windings where design does not permit, will result in improper loading in the output stage of the amplifier.

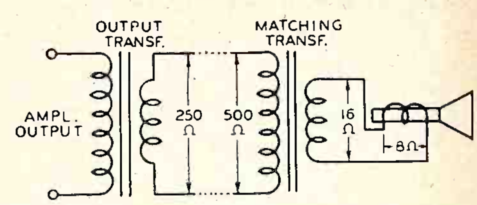


Fig. 4. A method for impedance matching when the proper line-matching transformer is not available.

Matching of Volume Controls and Pads

Ordinary volume controls such as potentiometers and rheostats cannot be used to control the level at loudspeakers, as any variation in the setting of the potentiometer will cause the load on the amplifier to change. The amplifier then will be properly matched at only one setting of the control. In order to keep the amplifier matched to the load at all settings of the control, a constant-impedance type of volume control, such as the L- or T-pad is necessary.

Pads, being resistive networks, will dissipate some power when in the circuit. This power is wasted, as it merely heats the pad and does not produce any sound. When an L- or T-pad is set for full volume output from the loudspeaker, there is no power loss in the control, but when it is at zero volume all the power is dissipated in the control. For settings between zero and full volume, the power supplied by the amplifier is split up between the pad and the loudspeaker. In other words, the full power must appear across the line at all times whether or not it is present at the loudspeaker.

(Continued on page 18)

LOUDSPEAKER MATCHING

(Continued on page 16)

From the point of view of impedance matching, however, the pad is the best type of individual (or group) loudspeaker level control, since it presents a constant impedance to the power source. Pads are available in many of the more common voice coil and line impedance values. In the design of a distribution system where a pad matching a voice coil or line is used, the computations can be made on the basis of the voice coil or line impedance and the presence of the pad can be ignored. An example of the use of L-pads is shown in the p-a system illustrated in Fig. 2.

Fixed pads can be inserted before loudspeakers to introduce a constant loss in signal level. This may be done to limit the maximum output of a particular loudspeaker or group of loudspeakers. Another use of fixed pads can be to obtain proper power distribution where particular taps or matching transformers are not available. This method is rather inefficient because of the loss in the pads and should not be used in high-power p-a systems.

Checking Load Impedance

After a distribution system has been designed and the loudspeakers and associated transformers connected, a check may be made on the impedance of the entire load. This is done by measuring the impedance of a voice coil, except that in this case the voice coil is replaced by the loudspeaker line which is disconnected from the amplifier.

The variable resistance should have a large enough range to cover the load impedance of the loudspeaker system. When the load impedance has been measured, this value can be used to check the computations that have been made, and in determining to which tap on the amplifier output the load should be connected.

Westinghouse H-251, Ch. V-2150-81, V-2150-82, V-2150-84

The -81 chassis utilizes a V-6771-2 tuner assembly. If the 6C4 h-f oscillator tube is replaced in this tuner, the different interelectrode capacitance of the new tube may change the oscillator frequency enough to necessitate re-alignment of the oscillator. The oscillator adjusting screws are located on the front of the tuner assembly, and this procedure should be followed for their adjustment:

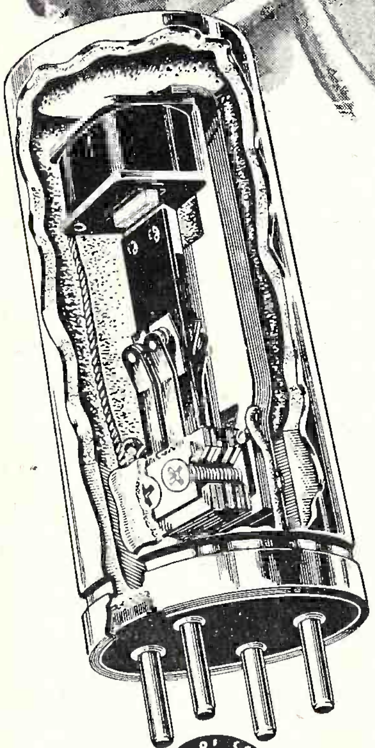
1. Remove the channel selector and fine tuning knobs. Remove the selector escutcheon plate and escutcheon mounting plate by removing the Phillips head screws securing them to the cabinet. The adjustments are accessible through the hole in the cabinet.
2. Set the fine tuning control to the middle of its range, and leave it in this position during the following adjustments.
3. Set the channel selector switch to the highest of the low band (Channels 2 through 6) stations operating in your locality.
4. Peak the appropriate oscillator slug for the best picture detail.
5. Repeat step 4 for each progressively lower channel on which a station transmits in your area.
6. Set the channel selector switch to the highest of the high band (Channels 7 through 13) stations operating in your locality.
7. Peak the appropriate oscillator slug for the best picture detail.
8. Repeat step 7 for each progressively lower channel in the high band on which a nearby station transmits.
9. Check the previously made low-band adjustments, and if the tuning has changed repeat steps 3 through 8.

The -82 chassis uses a V-6850 tuner assembly. In this tuner no adjustments are provided. Therefore, when a tube replacement is being made, different tubes should be tried until one is found that matches the characteristics of the original tube and provides normal operation.

The V-6238 tuner assembly used in the -84 chassis has several screw-adjusted slugs and trimmers located on the top and rear of the tuner. These adjustments affect the r-f bandpass of the tuner and are provided for production purposes only. They should not be used by the service technician. The h-f oscillator slugs are accessible through the front of the tuner and are the only adjustments that should be used when servicing the tuner. Replacement of the 6C4 h-f oscillator tube may, in some instances, necessitate readjustment of the h-f oscillator slugs. All of the channels should be checked, and if the stations cannot be tuned-in correctly within the range of the fine tuning control, the oscillator slugs on the front of the tuner assembly should be adjusted as follows:

1. Remove the channel selector and fine tuning knobs. Remove the selector escutcheon plate and escutcheon mounting plate by removing the Phillips head screws that secure them to the cabinet. The adjustments are then accessible through the hole in the cabinet.
2. Set the fine tuning control to the middle of its range, and leave it in this position during the following adjustments.
3. Set the channel selector switch to the highest channel on which a station transmits in your area.
4. If in the preceding step the channel selector was set to a high band (Channels 7 through 13) station, adjust the slug marked "13" for best picture detail. Note: If stations in your locality transmit on more than one of the high-band channels, a compromise setting of slug "13" must be made that will allow all high-band stations to be tuned-in using the fine tuning control. Slug "13" is the only adjustment for high-band stations. If in the preceding step the channel selector was set to a low band (Channels 2 through 6) station, adjust the appropriate (3, 4, 5, or 6) slug for best picture detail.
5. Set the channel selector to the next lower channel on which a station transmits in your area, and adjust the appropriate oscillator slug for best picture detail. Note: Since there is no adjustment labeled "2", a compromise setting of slug "3" must be made to allow Channels 2 and 3 to be tuned-in using the fine tuning control.
6. Repeat step 5 for each progressively lower channel used in your area.
7. Check back at the highest channel and then each progressively lower channel to make certain that the slugs are still correctly adjusted. There is some interaction between coils, and "touch-up" adjustments may be required during the checking procedure.

Replacement of the 6AG5 r-f amplifier tube may change the characteristics of the tuner. To compensate for this, different tubes should be tried until one that matches the characteristics of the original tube and functions normally is found.



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★ Thick, black smoke blots out the sky as the sickening hiss and crackle of scorching flames race man in the fight against destruction. Every ounce of skill and strength trained men can muster is pitted against the scourge of destructive fire. The equipment used in this never-ending battle is the finest known. Two-way radio, now standard equipment on all modern fire-fighting apparatus, must stand alert and ready for each critical assignment. The vibrator, although small, is a tremendously important factor in fire-fighting communication. It has helped save lives . . . and dollars, too. It must answer each call with peak performance. NO MARGIN FOR ERROR HERE . . . that is why RADIART is specified. Reputation built up over the years for dependable performance has stemmed from superiority in engineering design and controlled manufacture. This same skill of design and manufacture is basic in every RADIART automotive vibrator — it pays to put this skill to work for you.

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Crosley 9-409M3-LD, 9-419M1-LD, 9-422M-LD

The LD models on the '49 series receivers such as the above were designed especially for fringe area reception. In some cases when these sets are operated in areas where the signals from one or more stations are exceptionally strong, the strong signals may cause the contrast control to operate very critical, the sound output may be weak, picture fading may occur, or there may be critical vertical sync. Since these sets were built, other factors may have caused stronger signals: some local stations may have gone into operation, the earlier stations may have increased their power, or the receiver may have been moved into a strong signal area producing this condition. This strong signal condition can be corrected without the receiver losing sensitivity by adding a variable bias to the 3rd picture i-f stage, in the following manner:

1. Disconnect the 3rd i-f grid coil (L205 in Model 9-422M-LD, L206 in Models 9-409M3-LD and 9-419M1-LD) from ground.
2. Connect a 1000-$\mu\mu f$ capacitor (Part No. 160034) between the low side of the 3rd i-f grid coil and ground.
3. Connect a 1-megohm resistor (Part No. 39374-61) between the low side of the 3rd i-f grid coil and the center tap of the contrast control.

If picture brightness fluctuation is still encountered due to line voltage changes, disconnect the 470,000-ohm picture tube grid resistor from the cathode of the d-c restorer tube (6AL5) and connect to chassis.

Radio Changes

United Motors 980979, Buick

Model 980979 is used in all 1951 Buick cars, and is identical to the 1950 Model 980869 Buick except for the parts listed below. The antenna trimmer compensation is for antennas between 0.000061 and 0.000088 μf. In the Parts List given below, the service part number is identical to the production part number except where the service part number is given in parenthesis.

Illus. No.	Production No.	Description
4	7260499	Oscillator coil
13	7258221 (G390)	Capacitor 0.000039 μf molded
49	7234563	Resistor 360 ohms, 1w, ww
62	7259502	Speaker, 8", round p.m.
64	7260855	Transformer, output
81	7260421	Backplate pointer
90	7260420	Pointer assembly
	1219845	Pointer tip pkg.
92	7260416	Escutcheon Assy.
93	7260423	Dial
94	7260422	Dial backplate
98	1219840	Push button and slide assy "B"
99	1219841	Push button and slide assy "U"
101	1219842	Push button and slide assy "I"
102	1219843	Push button and slide assy "C"
103	1219844	Push button and slide assy "K"
104	7260414	Worm gear and bracket assy.

General Electric 600, 601, 603, 604

The description "maroon for Models 600 and 601" should be added to Stock items RAB-096, RAU-308, RHY-010, and RHB-006. The following additional replacement parts have been added to the Parts List for Models 600, 601, 603, and 604.

Part No.	Description
RAB-125	Back, cabinet back, tan, less hinges (603)
RAB-126	Back, cabinet back, green, less hinges (604)
RAU-327	Cabinet, cabinet body, tan (less back, handle and hardware) (603)
RAU-328	Cabinet, cabinet body, green (less back, handle and hardware) (604)
RDK-204	Knob, volume or tuning, green (604)
RDK-205	Knob, volume or tuning, tan (603)
RHB-014	Button, plug button, tan, in cabinet over alignment trimmers (603)
RHB-015	Button, plug button, green, in cabinet over alignment trimmers (604)
RHM-052	Clip, for rim-mounting speaker
RHM-062	Clip, for hole-mounting speakers
RHW-024	Cup washer, retaining washer for item RMS-217, handle shock spring
RHY-016	Handle, cabinet handle, tan (603)
RHY-017	Handle, cabinet handle, green (604)
RJP-028	Plug, battery connecting plug P1
RMS-216	Guide spring, used with item RMC-040
RMS-217	Spring, shock spring for cabinet handle
UCG-022	Capacitor, 56 $\mu\mu f$, mica, C15.

Chevrolet 986067

Model 986067 is designed expressly for 1947, '48, '49, and '50 Chevrolet trucks. In checking voltages of the 986067, it will be necessary to remove the rear cover of receiver and remove radio chassis from the case. Hook up radio on the service bench to a 6-volt power unit or a fully charged battery. The master selector switch of the volt-ohm-milliammeter should be set to the 12 position and the voltage selector switch to D.C. 1K/v position. Place test leads in jacks marked "test leads," ground the negative lead to the radio chassis for ground, with the red lead check all tube pins marked "H" which show a reading on voltage chart. Now set the Master selector switch to the 600 position and the voltage selector switch to A.C. 1K/v position. With red lead check the two terminals marked "P" on the OZ4 tube, both should read 270 to 280 volts a.c. each. If incorrect or no voltage check the following:

1. Check or replace capacitors (Illus. Nos. 31 and 32).
2. Check or replace resistor (Illus. No. 47).
3. Check or replace power transformer.
4. Check or replace vibrator.
5. Check or replace OZ4 tube socket.

Now change the Master selector switch to the 300 position and the voltage selector switch to D.C. 1K/v position. Pin "K" on OZ4 should read 245 to 255 volts d.c. If incorrect or no voltage, check or replace OZ4 tube.

Pin "P" on the 6V6GT tube should read 235 to 245 volts d.c. If incorrect or no voltage, check the following:

1. Check or replace electrolytic capacitor (Illus. No. 24B).
2. Check or replace resistors (Illus. Nos.

Pin "S" on the 6V6GT tube should read 200 to 210 volts d.c. If incorrect or no voltage, check the following:

1. Check or replace electrolytic capacitor (Illus. No. 24C).
2. Check or replace resistors (Illus. Nos. 48 and 49).

Pin "K" on the 6V6GT tube should read 10 to 14 volts. If incorrect or no voltage check the following:

1. Check or replace electrolytic capacitor (Illus. No. 25A).
2. Check or replace resistor (Illus. No. 45).

Pin "P" on 6SQ7 tube should read 65 to 75 volts d.c. If incorrect or no voltage check the following:

1. Check or replace capacitors (Illus. Nos. 25, 26, and 32).
2. Check or replace resistor (Illus. No. 43).

Pin "P" on 6SK7 intermediate frequency amplifier tube should read 200 to 210 volts d.c. If incorrect or no voltage, check or replace the intermediate frequency transformer.

Pin "S" on 6SK7 i-f amplifier tube should read 60 to 70 volts d.c. If incorrect or no voltage, check the following:

1. Check or replace resistor (Illus. No. 38).
2. Check or replace capacitor (Illus. No. 17).

Pin "P" on the 6SA7 tube should read 200 to 210 volts d.c. If incorrect or no voltage, check or replace intermediate frequency transformer.

Pin "S" on the 6SA7 tube, should read 60 to 70 volts d.c. If incorrect or no voltage check the following:

1. Check or replace capacitor (Illus. No. 17).
2. Check or replace resistor (Illus. No. 38).

Pin "P" on the radio frequency amplifier 6SK7 tube should read 155 to 165 volts d.c. If incorrect or no voltage check the following:

1. Check or replace capacitor (Illus. No. 18).
2. Check or replace resistor (Illus. No. 39).

Pin "S" on r-f amplifier 6SK7 tube should read 60 to 70 volts d.c. If incorrect or no voltage check the following:

1. Check or replace resistor (Illus. No. 38).
2. Check or replace capacitor (Illus. No. 17).

If the tubes, vibrator, and voltages are correct and radio does not play, the trouble will

(Continued on page 22)

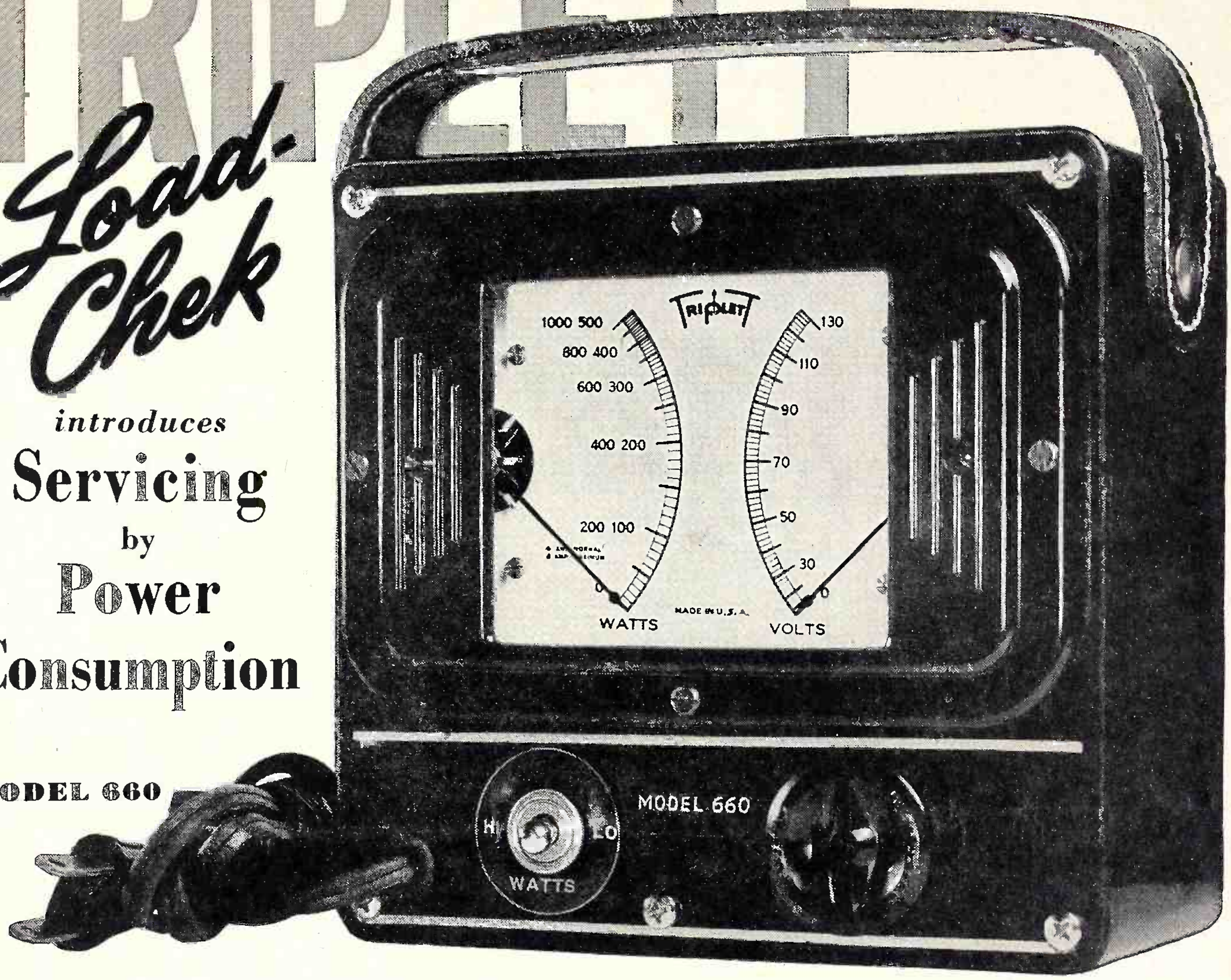
TRIPLETT

Load-Chek

introduces

Servicing by Power Consumption

MODEL 660



LOAD-CHEK *for the first time* makes it possible for every technician to utilize what is perhaps the simplest and quickest of all service methods—Servicing by Power Consumption Measurements.

Power consumption measurement has long been proved by auto-radio servicemen as a rapid method of localizing troubles in auto radios. But Triplett's new LOAD-CHEK is the *first* Wattmeter to be produced *at moderate cost*, and with the *proper ranges*, to bring this short-cut method within the reach of *every* radio and TV service man.

Basis of the LOAD-CHEK method is the tag or label on every radio and TV chassis which shows the normal power consumption. The following examples are only two of many time-saving uses of this new instrument.

LOCATING A SHORT—The chassis tag may show a normal consumption of 225 Watts. Simply plug the power cord of the chassis into LOAD-CHEK (there are no loose ends to connect or be in the way). Note the reading—which should be possibly 350 Watts. By removing the rectifier tube you can determine at once which side of the tube the short is on. With a soldering iron and long-nosed pliers you can check through the chassis, locate and correct the trouble without having to lay down tools or to check with lead wires!

REPLACING BURNED OUT RESISTORS—With the chassis to be repaired plugged into a LOAD-CHEK MODEL 660, note the wattage reading with the burned out resistor circuit open. Now replace the resistor. Should the increase in watts be greater than that of the resistor rating being installed, it indicates that an extra load has caused the trouble which has not been cleared.

LOAD-CHEK is made-to-order for the busy service man and can help stop costly "come back" repair jobs. It's a profit-maker because it's a Time-Saver. And at its moderate cost LOAD-CHEK can be standard equipment on *every* service bench. *By all means*, inspect this versatile instrument at your distributor and place your order, for under present conditions we must fill all orders on a basis of "First Come, First Served."

SEE MODEL 660 LOAD-CHEK AT YOUR DISTRIBUTOR'S

FOR THE MAN WHO TAKES PRIDE IN HIS WORK

Triplett

TRIPLETT ELECTRICAL INSTRUMENT COMPANY • BLUFFTON, OHIO, U.S.A.

Chevrolet 986067

(Continued from page 20)

be in the grid circuit of the radio. To continue, it will be necessary to check the grid circuit by means of signal tracing.

Turn on signal generator on and off switch, place the modulation switch in the modulated position, set signal generator tone control to 0.5 and place shielded lead assembly in jack marked "audio." Ground the black lead to the radio chassis. Turn on radio receiver with volume to maximum position.

With red lead touch pin marked "P" on the 6V6GT tube. If you have no signal, check the following:

1. Check or replace speaker.
2. Check or replace audio transformer.

Touch pin "G" on 6V6GT tube. If no signal check or replace 6V6GT tube.

Touch pin "P" on the 6SQ7 tube. If no signal check the following:

1. Check or replace capacitors (Illus. Nos. 25, 26, 27, and 28).
2. Check or replace tone control.

Touch pin "G" on 6SQ7 tube. If no signal, check or replace 6SQ7 tube.

Touch the two pins marked "DP" on 6SQ7 tube. A signal should be heard on each one. If no signal check or replace 6SQ7 tube.

Change the signal generator shielded lead to the intermediate frequency "I.F." jack. Tune signal generator to exactly 262 and set band switch in "A" position. Turn the signal generator volume control about one-third open and touch pin "P" on intermediate frequency 6SK7 amplifier tube. If no signal, check the following:

1. Check or replace intermediate frequency transformer.
2. Check or replace volume control.
3. Check or replace capacitor (Illus. No. 23).
4. Check or replace resistor (Illus. No. 44).

Touch pin "G" on i-f 6SK7 amplifier tube. If no signal check or replace 6SK7 tube.

Touch pin "P" on 6SA7 tube. If no signal check the following:

1. Check or replace intermediate frequency transformer.
2. Check or replace sensitivity control.

Touch pin marked "G" on 6SA7 tube. If no signal check or replace 6SA7 tube.

Change the signal-generator shielded lead to the radio frequency "R.F." jack, tune signal generator to exactly 1000 kc and set band switch to "B" position. Tune radio to 1000 kc. Touch pin "P" on 6SK7 amplifier tube. If no signal check the following:

1. Check or replace radio frequency coil (Illus. No. 3).
2. Check or replace oscillator coil (Illus. No. 4).
3. Check or replace capacitors (Illus. Nos. 18, 19A, 19B, 20 and 21).

Touch pin "G" on r-f 6SK7 tube. If no signal check or replace 6SK7 tube.

Place a 0.000075-μf capacitor on the end of red lead and plug in antenna socket. If no signal check the following:

1. Check or replace antenna coil (Illus. No. 1).
2. Check or replace choke coils (Illus. No. 2).
3. Check or replace antenna trimmer (Illus. No. 16).
4. Check or replace resistors (Illus. Nos. 37 and 42).

the Du Mont type 20CP4

For the set that follows the "seventeen" in rectangular pictures, Du Mont supplies the "twenty" all-glass rectangular Type 20CP4.

Another in the series of Big-Picture Teletrons employing the NEW Bent-Gun for edge-to-edge sharpness that makes the difference in picture tubes of this size. The gray filter face plate improves contrast.

The first picture tube designed with the industry "standard" neck length of 7³⁄₁₆".

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DUMONT

*Teletrons**

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VACATION TIME

The office of John F. Rider Publisher, Inc. will be closed for vacations from July 21 through August 5. Please try and anticipate your needs and send your orders and requests for schematics in to us before July 21 or after August 5. We'll be back all sunburned and rested on August 6, ready to serve you again.

Jewel 349, 949

Model 349 is the same as Model 949. The Alignment Procedure for these models is the same as that for Models 921, 935 and 936, except that "Reduce input as needed to keep output near 1.28 volts (0.5 watt)" should read "to keep output near 0.4 volt (0.5 watt)," and in the third column, 12BE6 grid (mentioned twice) should read 1R5 grid. The Parts List for Models 349 and 949 is given below:

Ref. No.	*Part No.*	*Description*
C1	30-17A	Variable capacitor, 2 gang, 420 & 162 μμf
C2, 3, 11	32-4	Tubular paper capacitor, 0.05 μf, 200 v
C4, 6	32-29	Tubular paper capacitor, 0.01 μf, 200 v
C5, 7	32-17	Tubular paper capacitor, 0.002 μf, 200 v
C8	32-20	Tubular paper capacitor, 0.005 μf, 200 v
C9	32-5	Tubular paper capacitor, 0.05 μf, 400 v
C10	32-32	Tubular paper capacitor, 0.2 μf, 200 v
C12, 13	35-4	Mica capacitor, 100 μμf, 500 v
C14	31-16A	Electrolytic capacitor, 50 x 30 μf, 150 v
C15	31-17	Electrolytic capacitor, 200 μf, 15 v
R1	20-49	100K, ¼ w, 20%
R2	20-46	3.3M, ½ w, 20%
R3	20-6	2.[illegible], ½ w, 20%
R4	20-42	[illegible], ½ w, 20%
R5	20-57	[illegible]M, ¼ w, 20%
R6	20-53	4.7M, ¼ w, 20%
R7	20-74	220K, ¼ w, 20%
R8	20-14	1M, ½ w, 20%
R9	20-31	47 ohms, 1 w, 10%
R10	20-143	2.5K, 8 w, 5% ww
R11	20-134	2.7K, 1 w, 10%
R12	20-109	1.5K, ½ w, 10%
R13, 14	20-67	1K, ½ w, 10%
R15	50-17	Volume control, 1 megohm, DPST switch (S2)
T1	61-12	Input i-f transformer
T2	61-13	Output i-f transformer
L1	62-16	Loop
L2	60-10	Oscillator coil
S1	65-4	Manual slide switch, DPDT
	73-3	Selenium rectifier, 65 ma
	80-15	4" p.m. speaker with output transformer
	120-28	Leatherette cabinet
	120-29	Front panel and baffle board
	W122-24	Volume knob
	W122-19	Selector knob
	123-9	Plastic dial.

INDEX OF CHANGES

† The Rider Manual Page Numbers given under Television Changes are for Rider TV Manuals. The volume number is the number preceding the dash. Volume numbers preceded by an asterisk (*) apply to the 8½" by 11" page size Manual only.

The Rider Manual Page Numbers given under Radio Changes are for Rider AM-FM Manuals. The volume number is the number preceding the dash.

Admiral Ch. 20Z1

Microphonics in television tuner 94C21-2 can be due to vibration of loose wires or loose components. In some instances, the ceramic stator plate M118 (tuning stator) has been a source of microphonics since the rivets which fasten this part to the tuner chassis may be loose. This can be remedied by soldering the plate mounting bracket to the tuner chassis. To solder the plate mounting bracket to the tuner chassis, remove the bakelite tuner shaft bearing plate at the front of the chassis and also the grounded tuning stator plate M107, and move the tuner shaft M104 forward.

Intermittent or noisy operation noticeable when the channel selector knob is "rocked" is commonly due to a broken coil section, or dirty or loose coil contacts (see information for 20X1, 20Y1 chassis). In some instances it has been found that the turret retainer springs M125, holding the turret in the housing, do not have sufficient pressure on the turret shaft to hold the turret firmly enough to insure good contact. A heavier spring made from .057 stock was used in later tuners. The old spring was made from .049 stock. All replacement springs are made of the heavier stock, although the part number remains the same, 98A45-85.

●

Trad TT-63-SH

The following changes have been made in Model TT-63-SH. Resistor R181, the 1200-ohm resistor going to the red lead of T109, is now connected to the +290-volt line, instead of to the +270-volt line. The value of resistor R203, connected from pin 8 of V123 to the +270-volt line, has been changed from 1800 ohms to 3000 ohms. A connection to the +290-volt line has been added at the junction of C160A, C158A and L120.

●

Emerson 621, 628, Ch. 120098B; 622, Ch. 120098P; 630, Ch. 120099B

The 1500-ohm cathode resistor R91 should go from pin 3 of V20 to the B— line, and not to the junction of R90 (horizontal hold control) and R92 as shown on the schematic for Ch. 120098B.

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Successful SERVICING

IT'S KNOW-HOW THAT COUNTS

BY JOHN F. RIDER

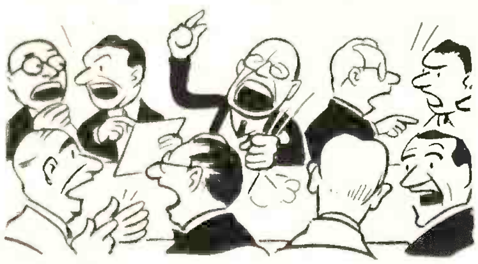
The Public Howls

In our travels around the nation, we hear more and more about licensing the television servicing industry. Two issues are involved. One of these is safeguarding the people's funds when they pay in advance for service to be delivered in the future. The second is technical competency. If one is to judge by lurid tales which appear almost daily in different newspapers throughout the nation, it is safe to forecast that regulation of television servicing is inevitable in several major television centers before the end of 1951. How far the program will spread is indefinite, but the patterns set by large cities can well become the basis for state-wide regulation.

But this is not the story of television licensing or regulation, although what we have to say is related to it. We are interested in the question of technical competency in TV servicing. Most certainly it is an important subject. While we have the utmost confidence in the survival of AM radio, if not FM, it is pretty certain that the financial future of the servicing industry lies in television.

Technical Competency — How?

How does one achieve technical competency? Not by any one thing alone. Rather, it is a combination of a number of things, a result of complete understanding of the entire activity. It would be so much pleasanter and simpler for all, if the development of television receivers were at a static level so that everyday servicing operations would be conducted on receivers which contained similar circuitry. In other words, if nothing but experience were necessary to increase competency. Such is not the case, however, and in that respect television servicing is not comparable to any other kind of service activity.



Television receiver circuit design is in a state of flux and will more than likely remain that way for quite a while. Competition demands that costs be reduced and the market enlarged; that the effective range of television receivers be increased, thereby creating more viewers for a station; that the number of controls be reduced to make operation easier; that receivers be made more stable, more sensitive. All of this forces never-ceasing research for new tubes, new component designs, and new combinations of circuits to achieve these ends. The differences in end product resulting from research may not be too evident when things function properly, but the moment a television technician is called upon to probe the innards of a receiver, he is face-to-face with the many artifices of communication equipment engineering.

Research Never Ceases

Many servicemen state that it would not be half so bad if the new designs were known beforehand. One can understand, however, that this is impossible, for then a manufacturer who has spent much time and money in research would be orienting the thinking of his competitors, defeating his own efforts. Of course, in many cases, coming events cast their shadows before, as in the contents of numerous research papers which appear in the different engineering publications. But even these do not always disclose the commercial end product, the specific circuit which eventually appears in the receiver. Frequently, this circuit may not see the light of day until perhaps two or three years after the preliminary disclosure.

Training Must Go On

Under such circumstances how does one achieve technical competency in television servicing? Is it just schooling? Obviously the answer is in the negative, for, after all, even the finest school is limited in the length of its course and the scope of its training. The school lays the foundation; it is then up to the graduate to perform the labors necessary to build on that foundation. No school course can be so broad in its coverage as to

(Continued on page 7)

Television Changes

Montgomery Ward 94WG-3022A, 94WG-3026A, 94WG-3029A

The following information supplements the Picture I-F and Trap Adjustment Alignment Table and replaces the Retouching of Picture I-F adjustments and Response curves sections.

Checking Picture I-F Adjustments—The response curve, secured after completing steps 5 through 12 may be observed by connecting the sweep generator to the TEST POINT (as shown in Fig. 1) which is the junction of R-6 and R-7, and by connecting the oscilloscope to the junction of L-8 and R-51. The marker signal generator should be loosely coupled to the sweep generator output leads.

With the Contrast control set at —3 volts (Step 5) the response curve should be approximately flat topped as shown in Fig. 2. A 25.75-Mc (picture carrier) marker signal should appear approximately 45% down, and a 23.0-Mc marker approximately 10% down. A 21.25-Mc signal (sound carrier) and a 27.25-Mc signal (adjacent sound carrier) should have zero response. Some final adjustment of T-1 (bottom), L-5, T-10 (top), and L-7 may be required to secure an ideal response curve. The portions of the curve affected by these adjustments are shown in Fig. 2. Do not change trap adjustments T-1 (top), T-5 or T-10 (bottom) after they have been set according to steps 6, 7 and 8.

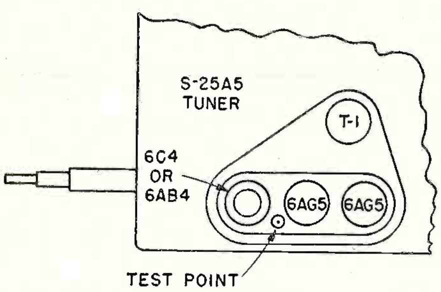


Fig. 1. Test point for Montgomery Ward Models 94WG-3022A, 94WG-3026A, 94WG-3029A.

In areas of low signal strength it may be desirable to increase the i-f sensitivity by aligning the i-f with a —1 volt setting of the contrast control. If this is done the response curve will be approximately as shown in Fig. 3. The marker signals should have the same relative positions as for —3 volt alignment.

R-F Response Curves—The response curves shown in Figure 18 for the "A" Series may be observed by connecting the sweep generator and the marker signal generator (loosely coupled) to the antenna input and by connecting the oscilloscope to the TEST POINT (junction of R-6 and R-7) on the tuner as shown in Fig. 1.

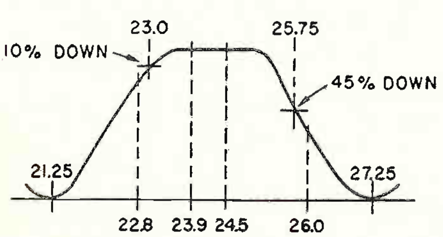


Fig. 2. I-f response for –3 volts on contrast control.

The response curves obtained in this check indicate the accuracy of adjustment of the r-f and converter coils. Any appreciable variation from the curves shown in Figure 18 indicate coil misalignment. If such a condition is found the entire tuner unit should be returned to the factory for repair. To check for correct oscillator coil adjustment on each channel connect the sweep generator and the marker signal generator (loosely coupled) to the antenna input. Connect the oscillator to the junction of L-8 and R-51. The response

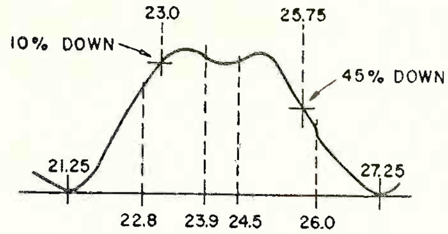


Fig. 3. I-f response for –1 volt on contrast control.

curve should be approximately the same as for the i-f response check. The picture carrier marker should be approximately 45% down and the sound carrier at zero level. To adjust each oscillator coil, set the Fine Tuning control in the center of its range and adjust each coil screw to properly position the markers.

The following miscellaneous parts have been added. Most of these parts are required because of the addition of brown and white cabinets.

Ref. No.	*Description*
RAB-093	Cover, back cover (white)
RAB-094	Cover, back cover (brown)
RAC-063	Cover, loop cover (maroon) substitute for RAC-057
RAC-069	Cabinet, main body (brown) includes hinge
RAC-070	Cabinet, main body (white) includes hinge
RAC-071	Cover, front cover (white) includes hinge
RAC-072	Cover, front cover (brown) includes hinge
RAC-075	Cover, loop cover (white)
RAC-076	Cover, loop cover (brown)
RAI-007	Stop, cover stop
RDK-173	Knob, brown control knob
RHR-004	Rivet, tube socket rivet
RHY-009	Handle, cabinet handle
RSW-070	Switch, power, operates in conjunction with lid.

Belmont C-1602, M-1601, Ch. 16AX23, 16AX25, 16AX26

In early production of the above chassis, the 6V6 plate supply voltage was connected through the fuse. If the fuse happened to blow, the 6V6 plate supply voltage (350 volts) would be cut off leaving the screen at 240 volts, a condition which will cause damage to the tube. It is suggested that whenever a 16-inch set is received for repair the following change be made: Disconnect the red lead of the vertical output transformer from the B+ point and reconnect to pin 5 of the power jumper socket. If the fuse blows after the change is made, the plate will remain at 350 volts and the 6V6 tube will not be damaged by excessive screen current.

The following modification has been made on all chassis starting with group numbers 7500 and up, and it is suggested that it be made on all chassis with group numbers below 7500. The modification will limit the 1X2 filament voltage and prevent tube failures. A 10-ohm, ½-watt, 10% resistor (Part No. C-9B1-38) is added in parallel with each of the two 1X2 tube filaments. The resistor should be connected from pin 1 to pin 5.

Admiral Ch. 20T1, 20V1

A circuit change has been made in these chassis as follows: Resistor R314 (680,000 ohms) is no longer connected to pin 7 of V304, the 6AL5 video detector and agc, but now goes from pin 1 of V304 to the junction of R317 (4700 ohms) and L303. Remove the tuner agc lead (white) from the agc lug and ground the wire to the chassis.

A new p-m focus assembly is being used in some of the 20T1 and 20V1 chassis. The following information is a supplement to the "Installation and Service" notes for these chassis and is to be used only for those chassis employing the p-m focusing assembly. This assembly consists of a mounting bracket, a picture positioning lever, and a permanent magnet focusing control. Three alternate types of p-m focus assemblies are used. These assemblies (Part Nos. 94C33-1, 94C33-2, 94C33-3) are electrically and physically interchangeable. However, they differ slightly in location of adjustments and methods of adjusting. Part No. 94C33-1 has the picture centering lever mounted between the focus assembly mounting plate and the focus magnet, and has the focus control shaft located below the picture tube socket. Part Nos. 94C33-2 and 94C33-3 have the picture centering lever extending from the back of the focus magnet, and have the focus control shaft located above the picture tube socket. The parts eliminated from the B+ (filter) circuit when the p-m focus control is used are focus coil L404, focus control R445, and resistor R444. Electrically these parts have been replaced with resistor R505 (200 ohms, 10 w, Part No. 61A7-20). Resistor R505 is connected between filter capacitor C409B and C409C. The screen R438 (6800 ohms, 2 w) formerly connected to the junction of fuse M401 and C430 (0.1 μf) is now connected to the opposite side of C430 (junction of white lead from deflection yoke T403B and C430).

Focus adjustment can be made without removing the cabinet back from the receiver. Set the picture control for normal picture and the brightness control at slightly above average brightness. Insert a screwdriver through the hole near the center of the cabinet back. When the screwdriver blade engages the slot at the end of the focus control shaft, rotate the control to the right or to the left until the picture is in sharp focus. Slight rotation in either direction generally should bring the picture into focus.

If the picture is off center, it can be centered by using the picture positioning lever, and, when necessary, repositioning the p-m focus assembly around the picture tube neck. Follow the instructions given below:

To center the picture: (1) Adjust ion trap as instructed in the "Installation and Service Notes." (2) Center the picture by adjusting the picture positioning lever. Note that the picture positioning lever can be moved sideways, and up and down. It may be necessary to reduce picture height and width to determine correct centering unless a test pattern is used. (3) Readjust the ion trap.

For difficulty in centering the picture: (1)

Adjust the ion trap as above. (2) Slightly loosen the two screws which mount the p-m focus assembly to the yoke bracket. Facing the back of the chassis, move the p-m focus assembly fully to the left while rotating it counterclockwise (to the left as far as possible). Then tighten the two mounting screws. (3) Center the picture with the picture positioning lever. If the picture cannot be centered with the lever, it may be necessary to repeat Step 2, resetting the focus assembly slightly off center in another direction and then centering the picture with the picture positioning lever. (4) Readjust the ion trap.

Admiral 32X15, 32X16, 32X26, 32X27, 32X27A, 32X35, 32X35A, 32X36, 32X36A, Ch. 20Z1

Models 32X27A, 32X35A and 32X36A are the same as Models 32X27, 32X35 and 32X36 in that they use a 94C21-2 tuner, a 5B2 radio chassis, a 2PA1 power supply, and a 20Z1 television chassis. They differ, however, in that the locations of the radio-phono unit and the television receiver are reversed. Models 32X27A, 32X35 and 32X36 have the tv compartment on the right side of the cabinet, and Models 32X27, 32X35A and 32X36A have the tv compartment on the left side of the cabinet facing the front of the set. Consequently, with the exception of the cabinet parts listed below, the Parts List for Models 32X27A, 35A and 36A are identical to those given for Models 32X27, 35 and 36, and Chassis 20Z1 and 5B2. The following parts should be added to the Cabinet Parts List for Models 32X15, 32X16, 32X26, 32X27, 32X35 and 32X36.

Description	*Part No.*
Back, cabinet (for radio-phono and album compartment)	
32X15, 32X16	43C 128-1
32X26, 32X27, 32X35, 32X36	43C 128-2
32X27A, 32X35A, 32X36A	43C 129-1
Back, cabinet (for television compartment)	
32X27A, 32X35A, 32X36A	A3225
Base, cabinet	
Blond (32X27A)	35E 123-55
Walnut (32X35A)	35E 124-57
Mahogany (32X36A)	35E 124-58
Cabinet, wood	
Blond (32X27A)	35E 123-6
Walnut (32X35A)	35E 124-4
Mahogany (32X36A)	35E 124-5
Walnut (32X35)	35E 115-1
Mahogany (32X36)	35E 115-2
Carton and fillers	
32X35A, 32X36A	44B 172
32X27A	44B 173
Decal, cabinet refinishing (consists of 2 panel decals and 7 decal strips)	
32X35, 32X35A (walnut)	35E 116-63
32X36, 32X36A (mahogany)	35E 116-64
Door catch and strike plate	
Walnut (32X35A), mahogany (32X36A)	35E 124-56
Blond (32X27A)	35E 123-59
Door, record compartment complete	
Blond (32X27A), 16" x 14"	35E 123-53
Walnut (32X35A), 14¾" x 14"	35E 124-53
Mahogany (32X36A), 14-4/5" x 14"	35E 124-54
Doors, tv and radio-phono compartment (matched pair)	
Blond (32X27A) tv door: 18" x 16¾", radio door 16" x 15½"	35E 123-51
Walnut (32X35A) tv door 18" x 16¾", radio door 15" x 15¾"	35E 124-50
Mahogany (32X36A) tv door 18" x 16¾", radio door 15" x 15¾"	35E 124-51
Gasket, sponge rubber (for back of picture window, includes cardboard backing)	
32X26, 32X27, 32X27A, 32X35, 32X35A, 32X36, 32X36A	98A 61-7
Hinge, knife door (pair)	
32X27A (blond)	35E 123-57
32X35A (walnut), 32X36A (mahogany)	35E 124-55
Socket, pilot light (with 50" lead)	82A 11-60
Socket, cable and plug, pilot light	A3192.

Westinghouse H-216A, Ch. V-2146-45DX

The chassis used in this model incorporates provisions for phono operation which are not indicated on the schematic diagram. A DPDT switch is inserted between point "D" on the schematic and the 0.01-µf capacitor C213. The switch is connected so that in one position, the output of the ratio detector (point "D") is connected to C213 as shown on the schematic for this chassis, while in the other position point "D" is grounded and C213 connects instead to a phono connector on the chassis. Parts for this circuit are as follows: V-3254S Connector, phono; V-5406 Switch, TV-phono.

Westinghouse H-242, Ch. V-2150-31A

In later production of Model H-242, a V-2150-31A chassis is used. The differences between this chassis and the original V-2150-31 chassis are in the high-voltage power supply. As shown in Fig. 1, a 6Y6G high-voltage oscillator tube is used instead of a 6V6/GT, and the high-voltage power supply circuit is different. The physical appearance of R463, which is connected in series with the focus control, is different in later production chassis. The new resistor is covered with asbestos, and the assembly of resistor and asbestos is designated part No. V-8214. The electrical ratings of the old and new resistors are identical. The red wire that runs from the tie point for the old resistor to the tie point for the new resistor should be clipped from the circuit when the new resistor is installed.

It may be noted that the 3rd i-f amplifier screen dropping resistor R348 is designated 100,000 ohms in the service notes. This is the correct value for the resistor. However, in early chassis a 47,000-ohm resistor is used. In chassis containing the 47,000-ohm resistor, it may be possible to reduce noise at the cathode-ray tube grid by increasing the value of R348 to 100,000 ohms.

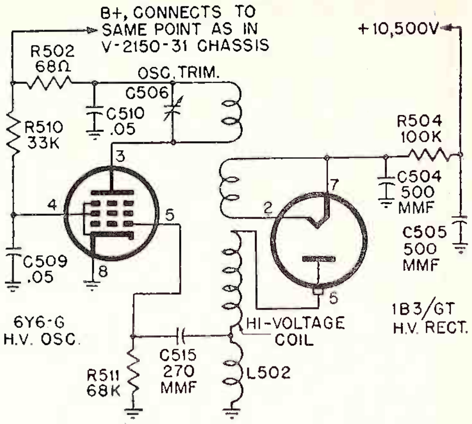


Fig. 1. High-voltage power supply Westinghouse Ch. V-2150-31A.

The parts list for Chassis V-2150-31A is the same as that for Chassis V-2150-31 except for the following changes and additions. Change the part numbers of C204 to C212, inclusive, to read "V-6023-" rather than "V-6203-." Change R463 to read as follows: R463, V-8214, Resistor assembly, 110 ohms, 3 w, Focus coil shunt.

Ref. No.	*Part No.*	*Description*
C515	RCM20B271K	Capacitor, grid coupling, 270 µµf
R510	RC40AE333K	Resistor, screen dropping, 33,000 ohms, 2 w
R511	RC20AE683K	Resistor, grid bias, 68,000 ohms, ½ w
L502	V-9279-1	Coil, r-f choke (V-2150-31A chassis)
—	V-9278	Coil, hi-voltage (V-2150-31A chassis).

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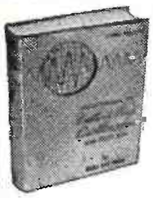

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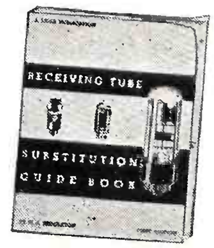

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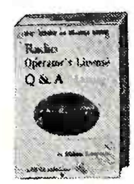

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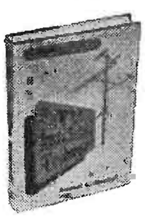

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CURTAIN TIME

The TV Factory Service Manager

No one can deny that much is to be desired in TV servicing. The public is not yet receiving the satisfaction it deserves in connection with maintenance. This cannot be placed in the lap of servicemen only. Some of the responsibility rests on the shoulders of other groups in the TV industry. Many TV servicemen have voiced opinions concerning TV servicing which warrant a great deal of attention among those who produce the nation's receivers. Granted that a TV receiver manufacturer tries hard to produce a good receiver and to make his parts available, the fact remains that there is still much to be done at the manufacturing level.

For instance, some TV receiver manufacturers provide very convenient test points at different places on the chassis. Others do not. These test points are very important to the individual who ultimately services the receiver. It speeds up the operation, reducing the cost to both the serviceman and the public. The presence or absence of test points is most probably decided by those who engineer the receiver. It is understandable that every penny saved in the construction of a TV receiver is important, but it seems to us that giving recognition to the servicing phase during the design of the equipment is equally important. Frankly, we believe that the service managers of the different TV receiver manufacturers should have a greater say in the output of the nation's TV factories. Their suggestions may add slightly to the cost of a TV receiver but what they will save the public and the servicemen will in the long run more than repay the added cost. We'll hazard the statement that all factory service managers will recommend test points in TV receivers.

Sales as well as engineering management in TV manufacturing organizations must realize that word-of-mouth advertising by the TV servicemen of the nation can be favorable or unfavorable. It can defeat or aid the magazine, newspaper, radio and TV sales efforts of the receiver manufacturers. The relationship between the TV set owner and the servicing group is very close—much more tightly linked than in the case of radio. This is so because the public generally has only one TV receiver and does not wish to part with it for even a day. The public lends a willing ear to all statements about a receiver, especially when the device has developed a failing which is difficult to remedy.

The service managers of the manufacturing companies are the ones who receive the comments of the trade and the public. Their shoulders are broad and we know from personal contact that they are capable of carrying the load. But that is not the answer. The practice of some TV manufacturer should be the practice of all—approval of the receiver design by the service manager prior to production. Then and only then will TV receiver manufacturers save themselves many headaches and servicing problems. The suggestion is not extraordinary. It is being done today! Unfortunately, however, it is not being done by enough manufacturers.

There are good reasons why a TV receiver should be designed in such a way that the physical layout lends itself most effectively to future service operations. To provide adequately for service is not a reflection upon the engineering capabilities of the organization. On the contrary, it denotes a complete understanding of the numerous conditions which surround the operating life of the receiver. The more easily a TV receiver can be repaired, the greater is the return received by a customer on his investment, for the receiver will then be out of use for the least possible amount of time.

In this respect the service manager can be of utmost aid. He knows what is happening in the field. He knows what is needed servicewise. He is the one who hears the gripes and is able to give valuable counsel about their elimination. Exposing the engineering department to the thinking of the service department cannot help but prove beneficial. The engineer has a choice of many designs for one receiver—the one which is most effective for future servicing is the one which should be chosen.

There is no conflict between service and engineering. It is simply a meeting of the minds with the same goal in view—most rapid service with maximum satisfaction to the public. Mr. Manufacturer—give your service manager a greater voice in your TV receiver design and production, and be happier in the long run!

John F. Rider

Radio Changes

General Electric 140

The rectifier assembly, REX-004, is no longer stocked riveted to a mounting bracket. The new rectifier may be screw mounted to the original rectifier bracket as follows: remove wires at the connecting lugs of the old rectifier; using screwdriver blade between plates of rectifier to be removed, pry plates off from rectifier mounting bracket; assemble new rectifier to bracket, using a #6-32 x 1 inch long screw through rectifier and bracket hole and fasten using lock washer and nut; replace wire connections to new rectifier.

●

General Electric 505, 506, 507, 508, 509, 530

Change Step 1 (column 2) of the Alignment Chart to read "12BA6 grid pin (1)," and Step 2 (column 2) to read "12SA7 grid pin (8)." Change the tube type numbers of the I-F Stage Gains to read: 12SA7 grid to 12BA6 grid—50 at 455 kc; 12BA6 grid to 12SQ7 diode plate—50 at 455 kc.

●

Jewel 955

The Alignment Procedure for Model 955 is the same as that given for Model 964. Model 955 also uses 12SA7, 12SQ7, 50L6, and 35Z5. The Parts List is as follows:

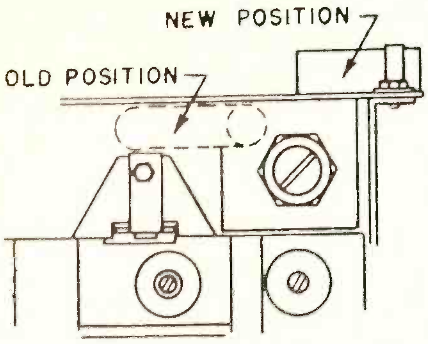
Ref. No.	*Part No.*	*Description*
C1, 3	32-17	Tubular paper capacitor, 0.002 μf, 200 v
C2	32-4	Tubular paper capacitor, 0.05 μf, 200 v
C4, 5	32-29	Tubular paper capacitor, 0.01 μf, 200 v
C6	32-5	Tubular paper capacitor, 0.05 μf, 400 v
C7	35-4	Mica capacitor, 100 μf, 500 v
C8	31-20	Electrolytic capacitor 50 x 30 μf, 150 v
C9	30-18	Variable capacitor, 420 & 162 μμf
R1	20-3	22K, ½ w, 20%
R2	20-7	4.7M, ½ w, 20%
R3	20-8	10M, ½ w, 20%
R4	20-19	470K, ½ w, 20%
R5	20-14	330K, ½ w, 20%
R6	20-73	1.5K, 1 w, 20%
R7	20-93	22 ohms, ½ w, 20%
R8	20-96	22 ohms, 1 w, 20%
R9	50-11B	Volume control, 2 megohms, SPST switch
	60-12	Oscillator coil, with spring clip
	61-5 or 61-14	I-f transformer, with solder tabs
	62-17	Antenna coil
	47-3	Antenna hank, 15'
	80-17	4" p.m. speaker with output transformer
	120-30A	Cabinet (specify color)
	122-15	Knob (2) (specify color).

Jewel 964

In later Model 964 receivers, pin 5 of the 12AT6 is connected to the junction of the i-f transformer and pin 6, instead of to the junction of the antenna coil and the 4.7-megohm resistor (going to the i-f transformer). The Alignment Procedure is the same as that given for Models 921, 935, and 936, except that 1500 kc, under Coupling Capacitor, should read 50 μμf; under Connection to Receiver should be Antenna (Disconnect antenna hank by unsoldering), and under Ground Connection should be B—. The seven markings on the dial represent 550 kc, 650 kc, 750 kc, 900 kc, 1100 kc, 1400 kc, and 1600 kc, respectively.

United Motors 982582, 982583, Oldsmobile

The tuner solenoid capacitor (Illustration No. 43) has been moved to a new position and is now secured by a circular mounting bracket. The new location is directly above the solenoid on the top of the tuner frame, as shown in the accompanying diagram, and eliminates any tendency for the rear cover to bind on this capacitor when located on the rear of the tuner.



New position of tuner solenoid capacitor on United Motors Models 982582, 982583.

The clamp fastens around the capacitor approximately ½-inch from the ground end and this lead is soldered to the clamp for grounding. A self tapping screw secures the clamp to the liner frame. The hot lead to the capacitor is insulated by a heavy sleaving to the tuner return switch.

The value of the 7259128 electrolytic capacitor (Illustration No. 35) has been changed so that all sections are now 20 μf. Thus, the cathode bypass capacitance on the output tubes has been raised from 10 μf to 20 μf and the schematic should be altered to comply with this increase.

The oscillator coil is now the same as that which is used on both the Cadillac and Buick signal seeking tuner type radios. The part number for this coil is now 7259184.

•

RCA BX55, Ch. RC-1088; BX57, Ch. RC-1088A

Capacitor C11, 0.047 μf, must be dressed away from the metal chassis and in such position that inserting the chassis into the case will not change its position. The side of C11 which may short to chassis is the side which connects directly to the selenium rectifier. If this side contacts the chassis it will place the chassis at power line potential.

The 2600-ohm, 6-watt resistor R13 now being used in Model BX57 is of improved design. The original resistor was a ceramic type and the type now being used is a flat armored type. When the new type is used to replace the original type, it is necessary to drill a .120" diameter hole in the front apron of the chassis to accommodate a self-tapping screw for mounting purposes.

•

General Electric 515, 516, 517, 518

Catalogue items RWL-009 and RWL-016 should be deleted from the Parts List and replaced by the following items: RWL-025, Cord, power cord and plug (brown, heavy duty type) for Models 515, 517, 518; RWL-026, Cord, power cord and plug (ivory, heavy duty type) for Model 516.

IT'S *KNOW-HOW* THAT COUNTS

(Continued from page 1)

encompass all of the practical circuit realities which issue from the manufacturing plants of the various companies.

Every Repair Job Must Teach

Unhappy though the situation may be, the practicing TV service technician is forced to expose himself daily to the many technical ideas which underlie operations in the field. Since there is no compromise with competency, there can be no compromise with the steps which must be taken to attain it. If the correction of a defect in a television receiver is accomplished as a mechanical act without regard to what can be learned from it, it is a fruitless effort. Every repair job is capable of teaching something. It may involve a new phenomenon or a repetition of an old and known one, but, whatever it is, it can teach. It may be that an old defect manifests itself in a new fashion; if so, a new symptom has been learned for future recognition. Or it may be an old symptom but one that stems from a malfunctioning new circuit. The demands of the television servicing business are such that more than just pay must be realized from every repair job.

Reading, Studying — Ad Infinitum

Reading and studying is the lot of the television serviceman. It simply cannot be avoided. Many men feel that they are so preoccupied with the actual labor of effecting the diagnosis and then the repair, that not a minute is left for other duties. Possibly this is true in some cases, but even then we wonder if there isn't a way out. Our experience of over twenty-five years shows that there is a means of improving the situation. Technical competency is nourished by experience, but it grows much more rapidly when the food is ever-increasing knowledge. The more one learns about what is inside a television receiver, the more rapidly will a defect be diagnosed. In light of the varieties to be found in the different production runs of the same model, and then in the end product, knowing how the circuits of a receiver function will save a tremendous amount of time. As a matter of fact, it is one of the most effective ways of becoming familiar with new circuit designs, and becoming more competent as a service technician.

Know Your Circuits

The reading of technical articles that appear in the different journals circulating in the servicing industry is important, but it is even more important to read the circuit description or circuit analysis found in receiver service data. When we say this, we have Rider Manuals in mind, and we can not stress too strongly that every owner of these publications could well profit by devoting time to such reading.

The suggestion that circuit descriptions contained in service data be read, does not

(Continued on page 8)

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VACATION TIME

The office of John F. Rider Publisher, Inc. will be closed for vacations from July 21 through August 5. Please try and anticipate your needs and send your orders and requests for schematics in to us before July 21 or after August 5. We'll be back all sunburned and rested on August 6, ready to serve you again.

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† The Rider Manual Page Numbers given under Television Changes are for Rider TV Manuals. The volume number is the number preceding the dash. Volume numbers preceded by an asterisk (*) apply to the 8½" by 11" page size Manual only.

The Rider Manual Page Numbers given under Radio Changes are for Rider AM-FM Manuals. The volume number is the number preceding the dash.

● *KNOWLEDGE* IS OF TWO KINDS: WE KNOW A SUBJECT OURSELVES, OR WE KNOW WHERE WE CAN FIND INFORMATION UPON IT.

Samuel Johnson

IT'S *KNOW-HOW* THAT COUNTS

(Continued from page 7)

imply that each and every service operation must be preceded by a reading session. Far from it. We know only too well that a program of that kind is impractical. We do, however, recommend, and seriously so, that an hour each day be devoted to reading and studying, and if more time than that is available, it can well be spent in that way. It is the road to increased technical competency.

What is technical competency in television servicing? It is the ability to "read" the trace which appears on the picture tube of the receiver and a proper understanding of the contribution made by each section of the television receiver to the end product that appears upon the picture tube. This leads to a rapid diagnosis. If one listens to complaints of the public concerning technical incompetency, the story is always the same. The service technician did not completely repair the defect. This may or may not be so, but in many cases one defect may mask the other and improper interpretation leads to incomplete diagnosis.

Service Notes Help

The explanation of circuit functioning contained in service data is a deliberate attempt on the part of the receiver manufacturer to *teach* in the service notes—to expose each and every television technician, no matter how extensive or meagre his background, to explanations of circuit operations. Reading these explanations may be viewed as nonprofitable time. That is farthest from the truth. One of the most progressive steps towards achieving technical competency is to follow up one's tentative diagnosis of a receiver by reading the appropriate circuit description. Quite frequently, it will be found that tremendously valuable facts are gleaned during the two or three minutes required to read such data. Equally frequently, the solution to the problem at hand becomes evident or measurement short cuts are indicated—to say the least, the time is not wasted. Every time even a small fraction of what is read is retained, more and more is learned, and little by little, diagnosis becomes easier and familiarity with television circuit design becomes broader.

It's A Tough Road

The road to technical competency is paved with work and demands perseverance and constancy of purpose. There are many who look at service information as simply reference information. It is more than just a means to an end. Complete service information such as that which issues from receiver manufacturers and Rider Manuals has tremendous educational value, as well as reference value. Wave forms are not just pictures which are presented for comparison purposes. Each tells a story of what is happening in a portion of the circuit. Each carries a message, especially when the test oscilloscope shows something other than what is correct.

Every service technician is interested in saving time. That is the function of test equipment and service data, but the saving of time stems basically from recognition of the fault indicated by an incorrect trace or an improper reading on a test device. A sign of technical competency is knowing where to look for the fault and instantly recognizing circuit reorganization when examining a schematic. This does not come easily. It takes time, patience and the desire to learn. It is not an easy road, but it is a worthwhile one. Even today, a really competent television serviceman can name his own price. Even with all the criticism being heaped on the television industry, the public shows signs of recognizing ability. However, it has every right to expect those who service television receivers to really know what they are doing.

For Easier Servicing

RCA'S NEW FINGERTIP WRENCH SET solves the problem of holding, placing, and adjusting nuts in hard-to-reach corners of radio and television sets. These wrenches are worn on the finger, as shown, and are used to steady the nut or bolt as the screw is driven in place. Each set consists of five wrenches for the most commonly used nut and bolt sizes—3/16", 1/4", 5/16", 11/32", and 3/8".

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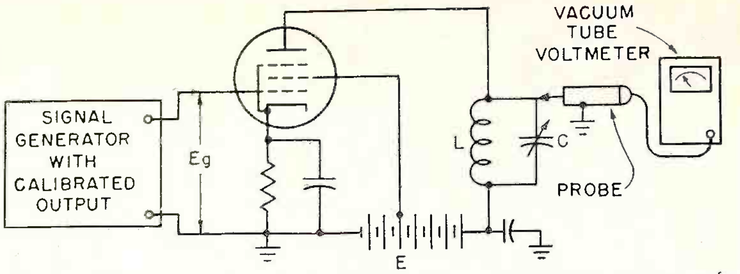


Fig. 1. Test setup for single-stage gain measurements on an r-f amplifier using a v-t voltmeter.

Using the VTVM for Amplifier Stage Measurements

by John F. Rider

One of the most important measurements for which the vacuum-tube voltmeter is particularly suitable is the r-f stage-gain measurement. The object is to find the voltage gain of an r-f amplifier stage under various conditions. Stage gain measurements may be made on a stage by itself, as in design, or with the stage as part of a circuit. The gain of a given stage may be considerably modified in an actual complete circuit by over-all regenerative or degenerative effects.

Figure 1 shows a typical setup for single-stage gain measurements. The gain is a function of the tube characteristics, operating voltages, and resonance conditions (tuned impedance) of the plate circuit. If the signal generator has a known output (calibrated in microvolts) the value of the grid voltage E_g is known and it is only necessary to measure the signal voltage across the tuned circuit by means of the VTVM. The stage gain is then the voltage across the tuned cricuit as read on the v-t voltmeter divided by the grid voltage as shown on the signal generator output attenuator dial.

To explain the significance of the stage gain in terms of the circuit components, refer to the equivalent circuit of the single stage shown in Fig. 2. The grid voltage E_g is effectively multiplied by μ, the amplification factor of the tube, and this amplified signal voltage appears in series with the dynamic plate re-

(Continued on page 5)

GENERAL PRECAUTIONS IN USE OF VTVM

Before using a vacuum-tube voltmeter, it is important to check several things.

1. **Is the frequency of the voltage to be measured within the range of the instrument?** If the frequency is near or beyond the primary range limits, a correction may be required.

2. **What is the effect of the voltage being measured on the voltmeter reading?** Sine-wave voltage is assumed in most voltmeter calibrations; an input with a waveform other than sine-wave will cause varying errors. An oscilloscope is useful in such cases for interpreting the voltmeter reading.

3. **What is the effect of the voltmeter input impedance upon the circuit under test?** If detuning and loading is to be kept to a minimum in making measurements on tuned and other high impedance circuits, the highest possible input impedance meter must be chosen.

4. **Is the voltmeter range switch set for the highest voltage?** The ranges are then progressively reduced until there is a sufficient deflection of the pointer to allow a convenient reading. It is conceivable that two settings of the voltage range switch may result in two different voltage readings. If the error on either range exceeds the rated accuracy of the instrument, it indicates a defect in the instrument on one of the two ranges. It must be remembered that the rated accuracy applies to full scale readings.

The higher the frequency of operation the greater the possibility of errors in excess of the manufacturer's rating. Generally speaking, accuracy ratings are a compromise. No device is absolutely flat in its response over a wide frequency range; as the outlying portions of the frequency range are approached the greater will be the possible departure from the rated accuracy.

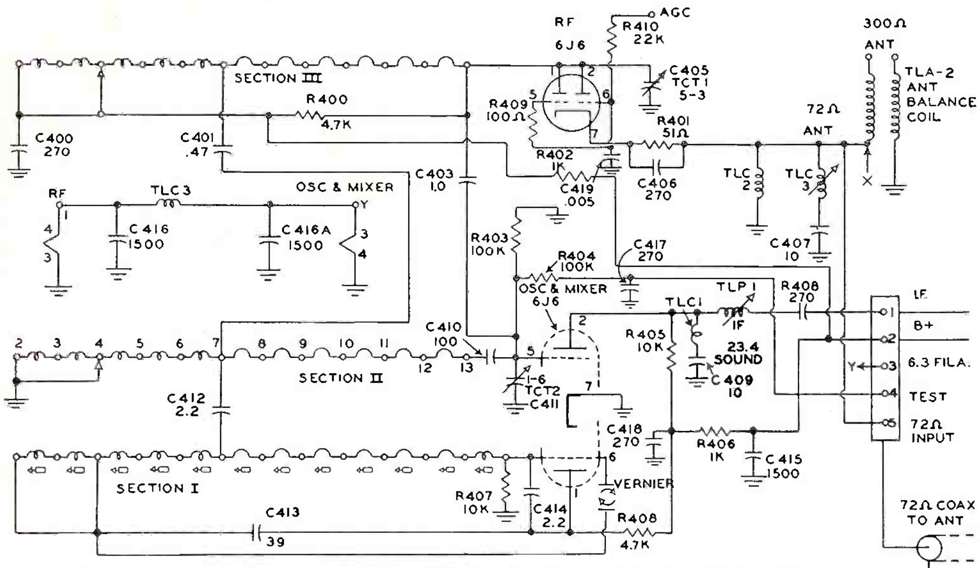
5. **Has the position of the probe ground been altered while making r-f measurements on two voltage ranges?** If so, changes in readings may be expected, first, because the difference of potential between the probe tip location and the ground point may be different due to standing waves; second, because resonance conditions are subject to change along a ground bus at high frequencies; and third, because the new "ground" may be ineffective as a ground. Signal voltages are often present at "grounded" points decreasing the effectiveness of the point as a ground. In the final analysis, the importance of such variations depends upon the criticalness of the measurement. Whenever possible, the high side of the voltmeter input system should be joined to the exact point where the voltage is to be measured, particularly at high frequencies. A very substantial difference in indication results if the input tip makes contact with the plates or the control grid of a tube rather than with the high side of the tuned circuit located in these systems. This is a very important precautionary note because many systems contain circuit elements between the tube electrodes and the tuned circuits, so that the signal voltage at the tuned circuit is not the same as will be found at the tube electrodes. When the aforementioned circuit elements are absent, it is quite satisfactory to measure at the tube electrode terminals.

Editor's Note: The above precautions and the accompanying article are abridged from chapter 12, entitled "Applications of Vacuum-Tube Voltmeters," from VACUUM-TUBE VOLTMETERS, 2nd Edition, recently published by John F. Rider Publisher, Inc. This book is a revision of the former book VACUUM-TUBE VOLTMETERS by John F. Rider.

Television Changes

Tele King MST14, 14TR, 17CA, 17RO, 114A, 116, 117, 117C, 117LO, 162, 516A, 516

The tuner used in these revised models is shown in the accompanying diagram. The lead from terminal 1 goes to the junction of pin 1 of V4, the 6AU6 1st video i-f, and R201. Terminal 2 goes to pin 2 of the 6AQ5 audio output tube V1.



Tele King tuner for models MST14, 14TR, 17CA, 17RO, 114A, 116, 117, 117C, 117LO, 162, 516A, 516.

has been added from ground to the junction of pin 6 of V6, L11 and R231. The 100-µµf capacitor C215 that was connected from the junction of pin 5 of V6 and L11 to the junction of L11 and pin 2 of V7 has been deleted and replaced by a direct connection. A 22,000-ohm resistor R232 has been added from the junction of pin 2 of V7 and L11 to the junction of C225 and L11. The value of C225 has been changed from 0.002 µf to 0.001 µf. The value of C213 (mentioned previously) has been changed from 0.002 µf to 0.001 µf.

The revised models contain the changes given in the following paragraphs.

The value of R201 has been changed from 10,000 ohms to 8200 ohms. In the filament circuit of V4, L5 has been deleted. R204, the 100-ohm resistor that goes from the junction (of the tuner used in early sets), has been of pin 6 of V4, L6, and R208, to terminal 3 deleted. The value of C203 has been changed from 0.002 µf to 0.001 µf. C205, the 0.002-µf capacitor that went from ground to the junction of R201, R205, and terminal 1 (of the tuner used in early sets) has been deleted.

The 2nd and 3rd video i-f tubes, V5 and V6, have been changed from type 6AU6 to type 6CB6. The cathode of the 6CB6 tube is pin 2. Pin 7 of the 6CB6 is grounded. Except for these changes in pin numbers, V5 and V6 are connected as in early models. The value of resistor R207, connected to the cathode of V5, has been changed from 82 ohms to 47 ohms. Resistor R230, 330 ohms, has been inserted from the junction of pin 6 of V5, L8, and C209, to the junction of R208 and R211, replacing a direct connection between these two points. The value of resistor R209 going to pin 1 of V6 has been changed from 8200 ohms to 6800 ohms. The value of R210, the resistor connected to the cathode (pin 2) of V6 has been changed from 82 ohms to 180 ohms. The value of C211, connected in parallel with R210, has been changed from 0.002 µf to 0.005 µf. A 330-ohm resistor R231 has been inserted from the junction of pin 6 of V6 and L11 to the junction of R211, C213 and R214, replacing the direct connection between these two points. A 0.001-µf capacitor C227

The value of R341, connected from the focus control to the junction of the focus coil L17 and filter choke L16 has been changed from 100 ohms to 750 ohms. The 1200-ohm, 2-watt resistor R342 that was connected in parallel with focus coil L17 has been removed from the circuit. The value of C310, connected from pin 1 of V13 to T3, has been changed from 0.005 µf to 4700 µµf, 800 v. A 0.1-µf capacitor C342 has been added in parallel with the vertical deflection yoke L19. The primary of the width coil now goes from tap 5 (red) to tap 4 of T5 (black) instead of from tap 8 to tap 5.

DuMont RA-105, RA-106

The procedure for eliminating vertical jitter or bounce in these chassis is identical to the method suggested for Chassis RA-101B, RA-102, and RA-103, except that the last step (#9) should read "Remove resistor R340 (12,000 ohms) for Chassis RA-105 and RA-106."

It has been found desirable to use impregnated vertical blocking oscillator transformers to prevent failure of this transformer usually caused by very humid weather. The opening of the primary results in loss of vertical sync. The impregnated transformers, identified by a black wax coating on the outside, should be used whenever it becomes necessary to make a replacement.

Sylvania 5150M, Ch. 1-274; 7150M, 7160B, Ch. 1-357

The following changes have been incorporated in the 1-274 and 1-357 chassis under change codes as listed below:

	1-274	1-357
C146 from 0.1 µf to 0.005 µf	CO3	CO2
C147 from 0.05 µf to 0.005 µf	CO3	CO2
R169 from 47 ohms to 180 ohms	CO3	CO2
V13, V18 from 12AU7 to 6SN7GT (12AU7's not available)	CO4	CO4
Revised wiring (improves sync circuit)		CO3

Picture contrast control R168 (formerly connected to R169) is now connected directly to the —135-volt line. R169 has been relocated and is now connected from the —135-volt line to R164. The connection from C195 goes to the junction of R169 and R164.

The revised wiring changes include a direct connection from C146 to the junction of C147 and ground. C146 formerly went to the —135-volt line. A direct connection has been made from pin 2 of V8 (the 6BF5 video amplifier) to the junction of R145, R146 and C145. Pin 2 formerly was connected to the —135-volt line.

The pin connections for the 6SN7GT V13 are as follows: pin 1 goes to the junction of C170, C172 and R186; pin 2 goes to the junction of R187 and R188; pin 3 is connected as before; pin 4 goes to the agc control; pin 5 goes to the junction of R176 and C168; and pin 6 goes to the junction of R163 and R164. The connections of the 6SN7GT V18 are as follows: pin 1 goes to the junction of C200 and R223; pin 2 goes to the junction of R224, R226 and C203; R3 goes to R223 and the —135-vole line; pin 4 goes to the junction of R221 and C196; pin 5 goes to the junction of R222, C200 and L63; and pin 6 goes to T62.

In code CO1 for Chassis 1-357, the value of R192 (going to the vertical hold control) was changed from 1.5 megohms to 1 megohm. The value of the vertical hold control R193 is now 1.5 megohms instead of 1 megohm.

The change in Parts List is as follows:

Ref. No.	Part No.	Description
C146, C147	166-5000D	Capacitor, ceramic, 0.005 µf, 450 v
R169	181-01815	Resistor, 180 ohms, ½ w
V13, V18	622-0005G	Tube, 6SN7GT.

Belmont Ch. 12AX26, 14AX21

Microphonic i-f amplifier tubes may cause sound bar shadings of the picture when the volume control is advanced past the normal listening level. To determine which tube is microphonic, gently tap each of the first three i-f amplifier tubes while viewing the picture. If this condition is noticed, interchange the sound i-f amplifier, agc amplifier and fourth i-f amplifier tubes with the first three i-f amplifier tubes (interchange tubes 6, 10, 11 with tubes 3, 4, 5).

Emerson 629D, 651D, 658B, Ch. 120124-B

The Emerson low capacity probe as outlined in the June issue of SUCCESSFUL SERVICING is not adaptable for use with different oscilloscopes since it cannot be calibrated.

To revise this probe, change C1 from a fixed capacitor to a trimmer capacitor which is variable from 4 µµf to 30 µµf. The value of R1 must be changed from 1.2 megohms to 1.5 megohms, 5%. The method of calibrating the revised Emerson probe can be found in service notes for Ch. 120133-B.

Radio Changes

Sears 8260, Ch. 101.823 series

The loop antenna lead wires in the front cover of the above portable have continued to break despite careful assembly and inspection at the source. An analysis of a large number of these radios on life test showed that variations in the spring tension which takes up the slack in the leads is the greatest contributing factor in these failures.

It is recommended that this spring be disconnected on every model 8260 in store stock prior to sale and delivery to the customer. The only purpose of the spring is to hold the wires taut for better appearance. The slightly different appearance of slack wires is more desirable than the potential complaint due to broken leads.

Open the back cover and find the lug in the outer case (in line with the loop leads) to which the small spring is attached. With a small screwdriver or knife bend the lug out enough to slip off the spring loop. Use a paper clip bent to form a hook, if necessary. It is not essential to remove the spring, but merely to disconnect one end as described. When this spring is disconnected the possibility of broken loop leads is reduced to a minimum.

General Electric 218, 218H

A 15,000-ohm, ½-watt resistor R33 has been added between the high side of the volume control and the arm of the band switch S1D. This improves receiver stability. The following changes should be made in the Parts Lists for these models:

Delete Stock No. RLI-084; Add RLI-088, Choke, f-m antenna (L2), used in 218 only; Add URD-077, Resistor, 15,000 ohms, ½ w, carbon.

General Electric 60, 62, 64, 65, 66, 67

The stock item RAB-054, Cabinet back and loop, is no longer available and Stock No. RAB-097, Cabinet back and loop, is substituted in its place. For those receivers produced, employing RAB-054 with connections made to the primary antenna winding, the black wire to chassis ground is removed when RAB-097 is substituted for replacement.

Sears 220, Ch. 528.173

A quantity of model 220 portable radios was shipped on which a corner boss in the cabinet body became broken. Breakage of either or both bosses released the spring (Littlefuse) clip preventing the secure latching of the back in the closed position. When this condition is found a new case (cabinetless back) should be used. Follow instructions below to prevent repetition of the same trouble.

Remove the handle from the case. Save all parts. Discard the case with the broken bosses, the support brackets and the screws that held the Littlefuse clips in place. Retain the Littlefuse clips and screws, flat washers and grommets that secured the brackets at the bottom to the rear apron of the chassis.

Replace the items that were discarded with the following new items. Order from source number 528.

Part No.	*Description*	*Amount Required*
T42-467	Case	1
T97-147	Screw - No. 4-24 x ½ thread cutting	2
T11-420	Bracket - chassis support	2
T47-118	Grommet - 5/16 pure gum rubber	2
T86-74	Washer - flat ⅜" O.D.	2

The new support bracket has a larger diameter hole at the top for the new grommet. The mounting screw is longer and a flat washer has been added.

Reassemble the brackets on the chassis as before, using the hardware saved from the original mounting. Place the new grommets in the holes at the top of the brackets. When the chassis is in place, place the new screws through the holes in the Littlefuse clips saved from original installation; then place the new washer on the screw and secure the top of the bracket to the boss in the upper corner of the cabinet.

Arvin 540T, Ch. RE-278

Model 540T is the same as model 440T, chassis RE-278, except for the part numbers listed below.

Ref. No.	*Part No.*	*Description*
R3	C23068	Resistor, Volume Control, 2 meg.
C2A, C2B	A20375	Condenser, I. F. Trans. Trimmers
T2	C22878-1	Output Transformer
T1	C22863-1	I. F. Transformer
L1	C22864-1	Antenna Coil
L2	C22865-1	Oscillator Coil
—	E24328-1	Cabinet with grille cloth, Ivory
—	C24096-1	Ivory cabinet, rear cover
—	E24328-1	Cabinet with grille cloth, citron
—	C24096-8	Citron cabinet, rear cover
—	E24328-7	Cabinet with grille cloth, flame
—	C24096-7	Flame cabinet, rear cover
—	E24328-9	Cabinet with grille cloth, cherry
—	C24096-9	Cherry cabinet, rear cover
—	E24328-10	Cabinet with grille cloth, Avocado, green
—	C24096-10	Cabinet rear cover, Avocado, green
—	E24328-11	Cabinet with grille cloth, Pebble
—	C24096-11	Cabinet, rear cover, Pebble
—	A24372-1	Arvin Name—on cabinet
—	A24084	Couplate
—	A24330-1	Knob, volume
—	C24331-1	Knob, dial
—	A18136	Antenna hank

General Electric 123, 124, 125

A self-tapping screw, #4 x ¼ inch, Cat. No. RHS-044, Shakerproof type 25, has been added to the Parts List for the above models. Cabinets of later production receivers were tapped for these screws to mount the loudspeaker in lieu of the Tinnerman clip, RHM-061, used in earlier speaker mountings.

Gamble-Skogmo 43-9841A

Model 43-9841A is the same as Model 94RA31-43-9841A.

Regal 7151

Model 7151 is electrically the same as Model 205.

Successful SERVICING

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JOHN F. RIDER, Editor
H. YUSEM, Associate Editor

CURTAIN TIME

Since Mr. Rider is on vacation, his customary editorial, "Curtain Time," does not appear this month.

AMPLIFIER STAGE MEASUREMENTS

(Continued from page 1)

sistance, R_p, and the tuned circuit L-C. At resonance, the plate load L-C is equivalent to a resistance having a value of $2\pi QLf$, and the signal current, I, around the loop will be μE_g divided by $R_p + 2\pi QLf$. The signal voltage across the tuned circuit at resonance will be $2\pi QLf \times I$ (the signal current times the load of the tuned impedance), and the stage gain will be this output signal voltage divided by E_g, the input signal voltage:

$$\text{Stage Gain} = \frac{2\pi QLfI}{E_g} = \frac{2\pi QLf\mu}{R_p + 2\pi QLf}.$$

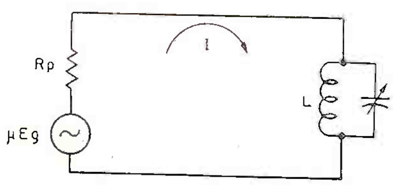

Fig. 2. Equivalent circuit of a single r-f amplifier stage.

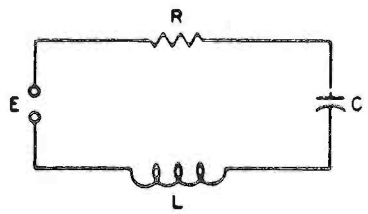

Fig. 3. Series-tuned circuit with R, C and L components. At resonance, the total impedance equals R.

While the stage gain is always taken at resonance, that is, with L-C tuned to the frequency of the signal generator output, the off-resonance gain may also be measured. A resonance curve will give both the resonance and off-resonance gain.

The gain of a stage is a function of the Q values of each of the tuned circuits in the stage. To understand the resonance curve it is necessary at this point to discuss the factors upon which the Q of a tuned circuit depend.

For series-tuned circuits of the type shown in Fig. 3, when resonance is reached, X_L, the inductance reactance, equals X_C, the capacitive reactance, so that the impedance of the circuit is R. At this value the current in the circuit is greatest, for as the frequency changes, the balance between X_L and X_C is destroyed and the total impedance consists of R plus some value of reactance as is seen from the following equation for the impedance of a series circuit:

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

where Z is the total impedance of the circuit.

Since the current at resonance is largest, the voltage drop across L and C will be largest. (The total effect of the voltage drops is zero since they are 180° out of phase, so that only the voltage across R, equal to the applied voltage, is effective.)

Q is defined as the ratio of reactance to resistance in a series circuit at resonance. The reactance is equal to:

$$X_L = \frac{E_L}{i_{res}}$$

where X_L is equal to the inductive reactance at resonance.

E_L is equal to the voltage across the inductance at resonance.

i_{res} is the current flowing in the circuit at resonance.

The resistance is:

$$R = \frac{E_R}{i_{res}} = \frac{E}{i_{res}}$$

where E_R is the voltage across R at resonance and is equal to the applied voltage E.

Q, therefore, may be found from the following equations:

$$Q = \frac{X_L}{R}$$

(Continued on page 6)

AMPLIFIER STAGE MEASUREMENTS

(Continued from page 5)

$$Q=\frac{\frac{E_L}{i_{res}}}{\frac{E}{i_{res}}}=\frac{E_L}{E}.$$

Since X_L is equal to $2\pi fL$ we get from the last equation:

$$E_L=EQ=E\frac{2\pi f_L}{R}.$$

From these equations we see that the Q of a tuned circuit increases as the resistance of the tuned circuit decreases. Also, if the applied voltage is held constant, and the frequency is varied, the voltage across the inductance will vary as shown in Fig. 4. This is a resonance curve for the L-C circuit. Note how sharply the voltage rises for a small difference in frequency about the resonance frequency. The higher the Q value of the circuit, the sharper is this rise.

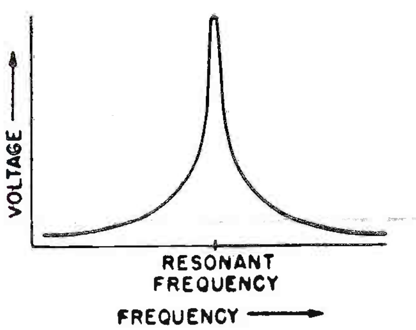

Fig. 4. Graph showing the variation of voltage across L in Fig. 3 with the frequency of the input voltage.

For parallel circuits of the type shown in Fig. 5, the current flow is smallest at resonance. (This is so because at resonance $X_L=X_C$ so that the only branch drawing current is R.) This may be expressed in another way by saying that the impedance of the circuit is greatest at resonance. Actually, if we plotted the impedance of the circuit vs. the frequency, we would obtain an impedance curve of the kind shown in Fig. 6. Any parallel L-C circuit, with or without a resistance branch will give the same type results as those described for the circuit of Fig. 5. To actually plot an impedance curve, we measure the voltage across the circuit and the current in the circuit for various values of frequency. For parallel circuits, the higher the Q value, the sharper the impedance curve.

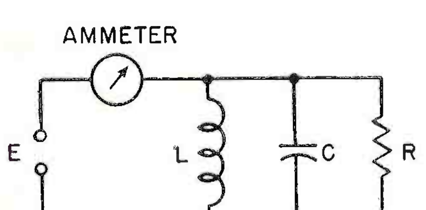

Fig. 5. Parallel-tuned circuit. At resonance only R draws appreciable current while the L-C combination offers maximum impedance.

Since for both types of circuits, the gain is a function of the Q value, we see that the selectivity curves (which are plots of the gain of a stage versus the frequency of the signal output), will be roughly similar to the resonant impedance curves of the tuned circuits of the stage.

The selectivity of the single stage is obtained by measuring the gain for several frequencies as the generator frequency is varied above and below resonance. The effect of the cathode, screen and plate voltages on the stage gain may be found by varying these voltages independently.

In making these measurements, the probe is usually connected from the high side of the plate load circuit to ground as shown in Figs. 1 and 7. This places a considerable d-c voltage across the probe. If therefore, the probe input coupling capacitor has leakage, an initial reading will be observed on the voltmeter with no signal present. If the reading is small, it may be corrected by resetting the voltmeter zero adjust. If it is large, a low leakage capacitor should be placed in series with the probe input, or the probe capacitor should be changed.

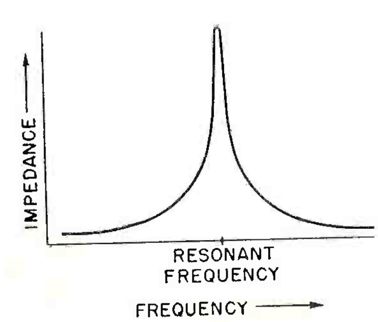

Fig. 6. An impedance vs. frequency curve for the circuit in Fig. 5. The steepness of the curve about the resonant frequency depends on the Q of the circuit.

In making stage gain and selectivity measurements, care should be taken not to overload the tube. This may be especially important when a calibrated signal generator is not available and gain is obtained by measuring E_o and L-C voltages with a voltmeter. A good rule to follow is never to allow the peak of the signal voltage on the grid to exceed the cathode or grid steady-bias voltage.

The above technique applies as well to gain measurements in a mixer or converter stage, except that a second r-f signal is required in the case of the mixer to represent the local oscillator voltage.

Another important design factor which may be measured by means of the stage gain setup is called "regenerative rise." When both plate and grid circuits of an amplifier stage are tuned to the same frequency there may be feedback which causes the gain to increase above that normally expected in the stage. It is more useful to look at this as an increase in grid signal voltage due to tuning the plate circuit. The ratio of this voltage increase to the initial signal voltage on the grid is then the regenerative rise. If the rise voltage is greater than the initial signal voltage, that is, if the ratio is greater than 1, the stage will oscillate. A conservative design, for example, might dictate that the regenerative rise be not more than 20 per cent (or 1 : 5).

Figure 7 shows the circuit for measuring regenerative rise. Tuned circuits are placed in series with both the plate and the grid. The signal generator is loosely coupled to the grid circuit through a small capacitor C (of the order of $2\mu\mu f$). The VTVM is placed across the signal-grid tuned circuit which is tuned to the frequency of the signal generator. The signal voltage at the grid is noted. Then the plate circuit is tuned to resonance and the increase in signal voltage at the grid is observed. This increase divided by the amplitude of the original signal is the regenerative rise.

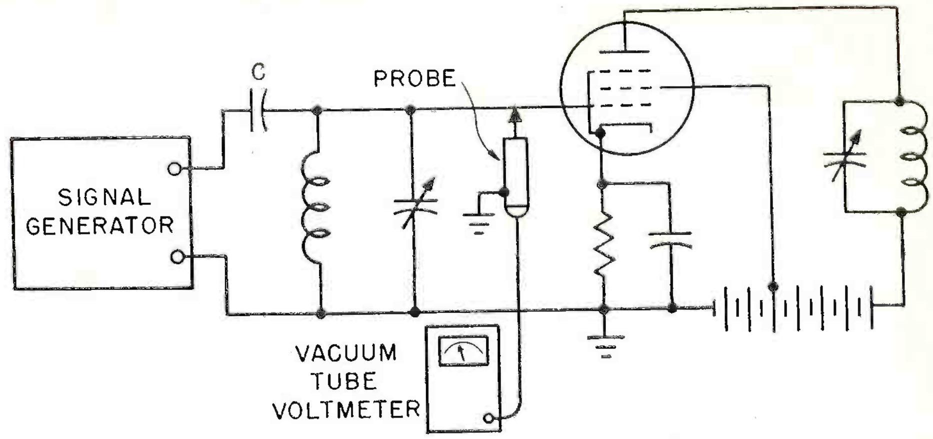

Fig. 7. Test setup for measuring the regenerative rise of an r-f amplifier. This effect is one of the causes of oscillation in amplifiers.

The measurements outlined above as well as others may be made in actual circuits utilizing r-f amplifier stages as in radio and television receivers. Care should be taken when making such measurements that short leads are used to connect the v-t voltmeter probe to the circuit under test, and that the voltmeter input connecting lead does not increase regenerative coupling effects in the circuit. For accurate measurements, the circuit across which the probe is connected should be tuned with the probe connected, and returned after the probe is removed.

A typical outline for the measurement of stage-by-stage gain for an a-m receiver follows:

1. Connect an unmodulated signal generator to the antenna terminals of the set.
2. Adjust the signal generator for maximum voltage output. A generator output of at least 0.1 volt is desired for satisfactorily determining the gain of the *first* r-f stage.
3. Tune the receiver to the signal generator. Short out the receiver avc.
4. Set the v-t voltmeter range switch to the most sensitive scale in the a-c range, the selector switch to "A-C Volts."
5. With the probe shell grounded, measure the voltage at the plate of the r-f tube. Similarly, measure the grid voltage of the r-f tube. The ratio of the voltages gives the gain of the r-f stage, as previously stated.
6. Reduce signal generator to zero output and check receiver oscillator voltage at oscillator grid and plate, and at converter tube injector grid.
7. Restore signal generator to output level which gives *readable* signal level at r-f tube plate. Measure the signal generator output voltage and voltage at converter tube plate. The ratio of these voltages is the conversion gain of converter tube.
8. Measure voltage at the plate of first i-f tube. This voltage is divided by the voltage at the plate of the converter tube for the stage gain.
9. Repeat for succeeding stages, reducing signal generator output to keep from overloading stages under test or adjacent stages, since avc is not operating.
10. Restore avc voltage.

As an example of what may be expected in the r-f portion of a small ac-dc receiver, the following figures are given. With 0.1 volt of rf fed to the receiver thru a standard IRE dummy antenna, the avc on the control grid of the 12SA7 tube was 5.8 volts dc. Rf appeared on the various tubes as follows:

12SA7 converter grid	0.13 volts rf
12SA7 converter plate	0.7 volts rf
12SK7 i-f grid	0.2 volts rf
12SK7 i-f plate	6.4 volts rf
12SQ7 diode plate	3.6 volts rf

These figures will, of course, vary with different receivers and circuits, but in general, a minimum of 3 volts should always be found at the diode plate of the second detector.

For triode-detector circuits, the gain may be found from the following equation:

$$\text{Gain} = \frac{\text{Audio Output Voltage across Detector Load}}{\text{Input Carrier Voltage} \times \%\ \text{Modulation}}$$

(Continued on page 8)

Service Hints

Belmont

Improper dressing of the 1X2 filament leads may cause frequent 1X2 tube failures or poor high-voltage regulation (blooming, picture expansion as brightness or contrast is increased). The 1X2 filament leads should be dressed as far away from the coil as possible. The leads should overlap and be tight against the terminal board. Coil dope should be used to secure the leads in place. The coil leads to terminals 1, 2, 4, and 6 should be dressed as far away from the filament leads as possible.

Video buzz can be eliminated by simply following the instructions listed below:

1. Dress the white leads from the volume control switch as close to the chassis as possible.
2. Dress the green lead from the center tap of the volume control as far away from the switch as possible.
3. Adjust the sound pick-off coil for maximum gain.
4. Adjust the ratio detector coil, both primary and secondary for maximum sound and minimum buzz.
5. Adjust the video trap coil L19 for minimum buzz and smooth continuous horizontal scanning lines. This coil when misadjusted will cause video buzz and "sand" in the picture.
6. Video buzz may also be caused by a defective audio detector tube or capacitor C-83.

If the sound and picture do not come in simultaneously, adjust i-f transformer T-1 manually until both the sound and picture come in together.

If resistor R97 is open or partially opened, a squegging condition may occur. If the 0.002-μf capacitor (C105) is open, the effects will be a shaky or saw-tooth pattern. Low high voltage and a narrow raster can be caused by either an open 0.25-μf capacitor (C114) or an open mica capacitor across terminals 1 and 3 of the horizontal deflection transformer in the 14AX21 chassis. If the agc windings are reversed or defective the symptoms will be either poor or no horizontal sync.

●

Belmont

The following adjustments listed below are suggested for the improvement of reception for those sets to be used in the fringe area. The adjustments are to be made only on the 16 and 17 inch sets which will be used in the fringe area. If this adjustment is made in the local signal area a definite decrease in picture quality will be noticed.

1. A-13A-19514 sound pick-off coil (T-8) must be in set. If not, change.
2. Turn 2nd (L-12) and 4th (L-14) i-f coil cores ¼ turn into coil.
3. If the above step does not produce enough improvement follow steps 5, 6 and 7.
4. If the sound pick-off coil was removed and the A-13A-19514 coil was added, follow steps 5, 6 and 7.
5. Peak the sound pick-off coil (T-8) for maximum sound.
6. Adjust the ratio detector (T-2) primary (bottom of coil) for maximum sound.
7. Adjust the ratio detector (T-2) secondary (top of coil) for best noise rejection.

The above adjustments are *not* to be used on the 20 inch sets.

AMPLIFIER STAGE MEASUREMENTS

(Continued from page 7)

Stage-by-stage gain measurements for f-m receivers are made in the same way as those described above for a-m receivers, since the sets are similar up to the limiter and discriminator. F-m i-f circuits will probably be found to be less sensitive to detuning caused by the application of the r-f probe.

For each measurement be sure that the shell of the r-f probe makes contact with the receiver chassis, or that it is connected to the chassis by an alligator clip, or short lead.

It is not always appreciated that while the vacuum-tube voltmeter is a high impedance device, its input capacity should not in many cases be neglected. As an illustration, a probe having an input capacitance of 5 $\mu\mu$f was placed across a tuned circuit with a 200-$\mu\mu$f capacitor, a Q of 160, and a resonant frequency of 600 kc. The probe caused a drop in voltage due to detuning of 73 per cent. When the circuit was returned, however, with the probe as part of the circuit, the error introduced was of a minor magnitude.

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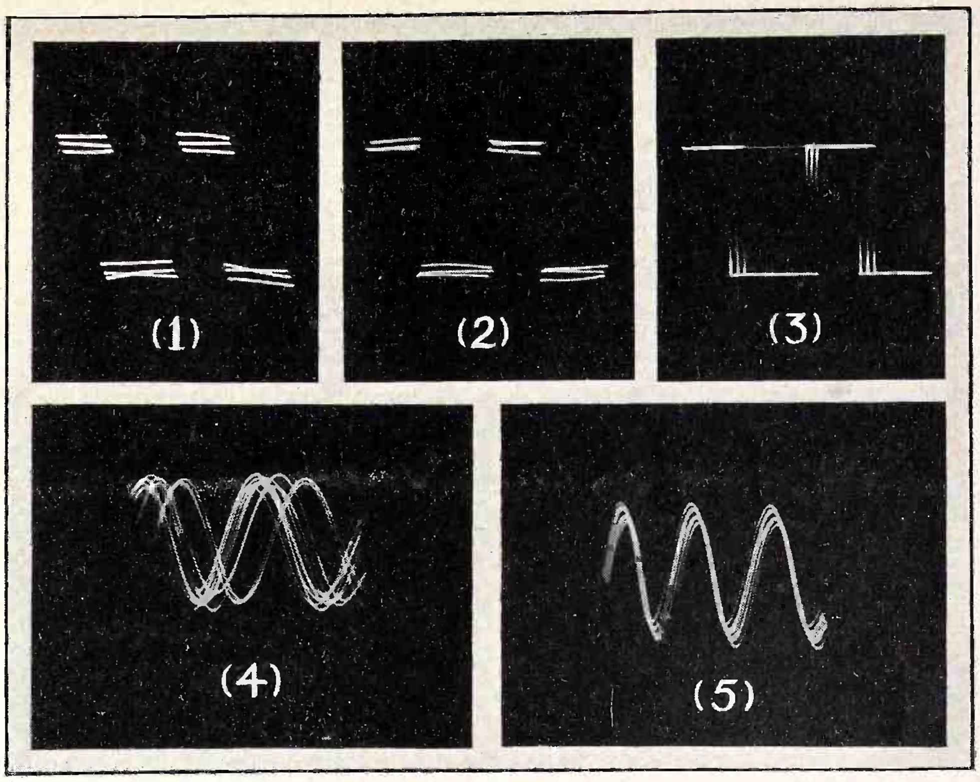


DISTORTION OF SCOPE TRACES

BY JOHN F. RIDER

Every so often conditions of operation result in distorted test oscilloscope traces, interfering with the application of the scope and proper interpretation of the pattern.

When this happens, it is not necessarily because anything is wrong with the equipment being checked, or with the test oscilloscope; quite often the difficulty lies in the physical arrangement of the test setup and the behaviour of some of the equipment.

It therefore becomes necessary to recognize the possible origin of the distortion by proper interpretation of the trace. Included here are several scope patterns extant under certain conditions of test. In each instance the remedy is simple, but unless the cause is known, the cure cannot be effected.

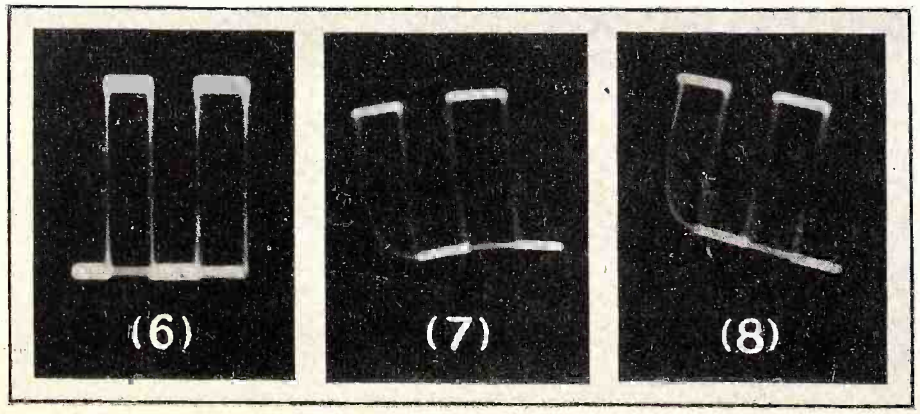
All scopes are contained inside metal cabinets. The cathode-ray tube is usually mounted within a high permeability metal shield to protect the electron beam from external fields. This arrangement is effective, but at times not sufficiently so to keep the trace free from external influences.

It is quite natural for current-carrying transformers to be in the proximity of a test setup. These may vary from small to large voltage regulating units, and can cause surprisingly strong fields which will materially effect the electron beam inside the scope.

Patterns 1, 2 and 3 show the effects of a transformer carrying several amperes of current which was located near a cathode-ray scope while tests were being made on square waves. Pattern 1 shows the effect of the external field when the transformer was located on top of the scope cabinet. Pattern 2 shows the effect when the transformer was located adjacent to the scope cabinet, all other conditions remaining the same. (Both of these locations for auxiliary equipment are commonplace when bench space is not too plentiful.) When the transformer in the latter instance was rotated by 90° the trace shown in pattern 3 resulted.

The a-c field issuing from the transformer resulted in the multiple traces of patterns 1 and 2, with evident vertical displacement. In addition, the sinusoidal nature of the current responsible for the field caused the curvature in the flat portions of these traces. In the case of pattern 3 a multiple trace also occurred, but was not very obvious because in this instance the displacement was horizontal. The horizontal traces overlap each other and therefore can only be detected by careful observation of the retraces of the square wave in this pattern. (The traces appearing in pattern 3 have been made more obvious by retouching.)

Similar effects displayed on a sine wave trace are shown in patterns 4 and 5. In the former the displacement is in the horizontal direction, in the latter, in vertical.



Pattern 6 is a reference pattern for a square

(Continued on page 24)

INTERCARRIER RECEIVER NOISE:

CAUSES AND CURES

by Bob Middleton

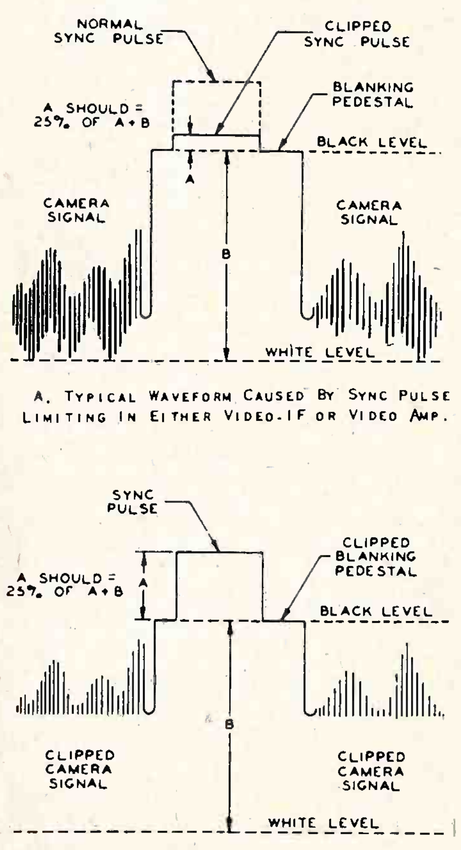
Buzz May Be Caused by Faulty Station Transmission

In a few cases, intercarrier TV receivers produce buzz in the sound because of technical difficulties at the transmitter. To check this possibility, tune in another channel to see if the buzz persists. If the buzz disappears, the trouble may be due to faulty transmission. But it may also be caused by receiver overloading on the first channel, as explained below.

Check the Latest Service Data for the Receiver

Receiver manufacturers frequently issue supplementary service data which includes minor design changes for eliminating or minimizing buzz. For example, instructions may have been issued for the addition of a large electrolytic capacitor between the screen of the audio output tube and ground; insertion of a series resistance capacitance network between the output of the AGC tube and ground; a high-frequency decoupling network in the filament circuit to the r-f tuner; change of grounding points; reversal of capacitor connections to reverse the outer foil; or a change in capacitor values.

These design changes are representative and they emphasize the absolute necessity of checking the latest factory service data before work is started.



A. Typical Waveform Caused By Sync Pulse Limiting In Either Video-IF or Video Amp.

B. Typical Waveform Caused By Camera Signal Limiting In Video Amp.

Fig. 1. Typical waveforms caused by limiting action.

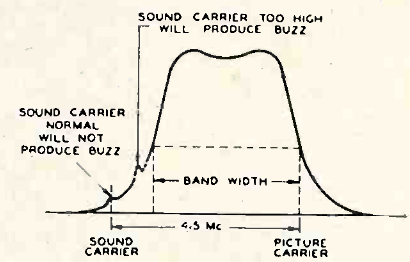


Fig. 2. Picture and sound carrier positions.

Is the Receiver Overloading?

Buzzes are generated in intercarrier receivers when the input signal is excessive. Make sure that the AGC system is working, and that all capacitors and resistors in the AGC circuit are O.K. Some receivers have an attenuator pad at the antenna terminals, and the antenna should be connected to the attenuator if the signal level is high. (See attenuating pad in upper left corner of figure 5 at end of article.)

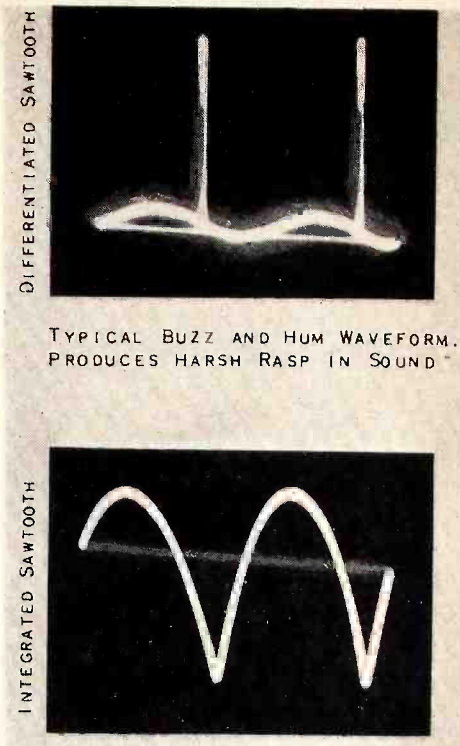
Investigate the Operation of the Volume Control

Buzz may or may not change in intensity, when the volume control is turned. This test is valuable in localizing the injection point of the buzz. If the buzz does not change in level, it is evidently getting into the audio section at a point following the volume control.

Most Buzz Is Tunable

Observe whether the buzz or hum persists when the TV station is not tuned in. If so, the problem is greatly simplified because the buzz must then originate in the vertical sweep circuit, power supply, or heater string. Vary the vertical-hold control to see whether the buzz changes in pitch; if so, the vertical-deflection circuits are the source of buzz; if not, the filter sections and the heater circuits must be investigated.

However, if the buzz is tunable, the source can be in the tuned circuits, such as the r-f tuner, i-f amplifier, or the 4.5-Mc sound amplifier. The source can also be in the video amplifier or in the sync circuits. Accordingly, tunable buzz is much more difficult to localize than untunable buzz.



Typical Buzz and Hum Waveform. Produces Harsh Rasp in Sound

Typical Buzz and Hum Waveform. Produces Less Harshness in Tone

Fig. 3. Typical buzz waveforms.

Discriminator, Ratio Detector, or Gated-Beam Detector

First tune in a weak signal, and tune for maximum volume. Then tune in a strong signal, and tune for minimum buzz. The primary of the discriminator and ratio-detector transformers controls the volume, while the secondary controls the buzz. Note that in the case of gated-beam detectors, the bias (or buzz) control should be set for minimum buzz during alignment. The buzz control is a part of the limiting system, which clips the 4.5-Mc signal to eliminate amplitude modulation.

In the case of a discriminator circuit, limiting is accomplished by a separate limiter stage; check the dc voltages of this stage, as incorrect electrode potentials will cause faulty limiting.

Ratio detectors accomplish limiting by virtue of the large electrolytic capacitor connected across the ratio-detector load resistors. Check this capacitor.

Any of these limiting circuits can be tested for a.m. rejection by applying a modulated 4.5-Mc signal to the sound-takeoff point of the receiver, and listening to the output from the speaker with the volume control set to maximum.

If a.m. rejection is found throughout the sound i-f band, the limiter section can be dismissed. On the other hand, if rejection is not complete throughout the band, it is well to check the electrode potentials of the limiter tube against the manufacturer's service data.

The operation of the limiter can be more closely checked with the use of a vacuum-tube voltmeter and diode probe. With this tool, the output of the limiter tube can be measured as the r.f. input from the generator is varied.

Clipping or Limiting in the Video and Video-i-f Amplifiers

It should be understood that the i-f amplifier can cause buzz when unwanted clipping or limiting occurs. All intercarrier type receivers are provided with AGC circuits to avoid this possibility.

The best way to check for limiting is to observe the composite video signal at the sound-takeoff point with a good oscilloscope. Watch the waveform for evidence of clipping, as shown in Figs. 1A and 1B.

Common causes for sync pulse limiting (Fig. 1A) are:

1. Overloading due to excessive antenna signal.
2. Overloading due to faulty AGC circuit.
3. Overloading due to inadequate plate or screen voltages on i-f tubes.

Common causes for camera signal limiting (Fig. 1B) are:

1. Excessive output from picture detector.
2. Incorrect bias on video-amplifier tubes.
3. Incorrect plate and screen voltages on video-amplifier tubes.

Note: Limiting is required in the 4.5-Mc sound section to remove amplitude modulation. *But,* limiting must be avoided in the picture i-f amplifier, or in the video amplifier, to minimize introduction of buzz modulation.

I.f. or I.f.-R.f. Alignment Difficulties

Buzz can be caused by a misaligned i.f. or i.f.-r.f. system, causing the sound carrier to ride too high on the response curve. If this cause is suspected, use a sweep-signal generator, marker generator, and scope to check

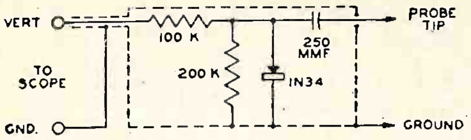


Fig. 4. High-frequency signal tracing probe.

the response curve. A response of the form shown in Fig. 2 will not produce buzz. However, the local oscillator must operate at the correct frequency to beat-in the carriers at the proper points. Touch up the local-oscillator trimmer, as required. In rare cases, the r-f tuner distorts the over-all response curve sufficiently to produce buzz; in such cases, realign r-f coils as required.

Remove Tubes Progressively for Further Clues

To localize the source of the buzz from a different angle, remove the vertical-oscillator tube, and observe whether the buzz disappears. Then replace the tube, and remove the video output tube, observing whether the buzz disappears. If tube removal cures the trouble, study the circuit diagram to see why.

Note: In the case of receivers utilizing series filament strings, you will have to maintain filament continuity by using dummy tubes having all but filament pins clipped off.

Analyze the Waveshape of the Buzz with a Scope

A scope is very useful, not only to trace the buzz through the circuits, and sometimes to localize the source by this means, but also to display the waveshape of the buzz. This waveshape is frequently important, because the shape is a clue to the kind of circuits the buzz is traveling through.

Fig. 3 shows the result of stray coupling effects such as that which occurs between volume control leads and vertical sweep leads. Various values of resistance and capacitance in the TV circuits produce varying degrees of wave shaping.

How to Check the 4.5-Mc Amplifier

The envelope of the 4.5-Mc signal should be fairly uniform, without any sudden large pulses or dips. To check whether the buzz is entering with the 4.5-Mc signal, an oscilloscope is most useful. However, most service scopes will not respond to an input frequency of 4.5-Mc, and therefore a detector probe must be used to make this test. Probe details are shown in Fig. 4.

To get the "feel" of this device, observe the waveform in the 4.5-Mc amplifier of a receiver in normal operating condition. Then compare the waveform in the 4.5-Mc amplifier of the receiver which has buzz in the sound. The high-frequency signal-tracing probe will show immediately whether the buzz voltage is present in the 4.5-Mc amplifier.

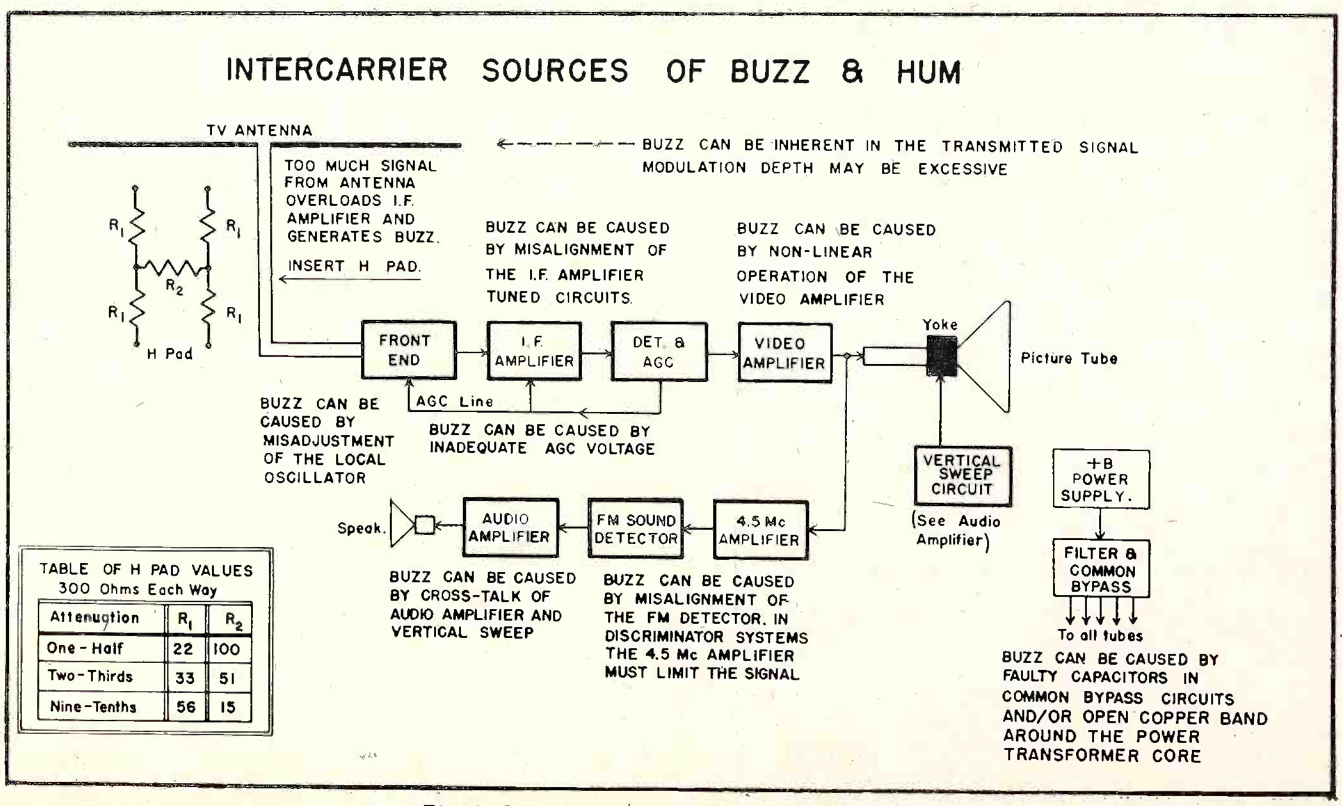


TABLE OF H PAD VALUES
300 Ohms Each Way

Attenuation	R_1	R_2
One-Half	22	100
Two-Thirds	33	51
Nine-Tenths	56	15

Fig 5. Sources of intercarrier receiver noise.

Successful SERVICING
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CURTAIN TIME

New SS

Effective with this issue, several changes are under way in SUCCESSFUL SERVICING. They are aimed at producing a better publication—one which will afford the utmost benefit to the reader. More articles, solicited from outside authors, will be published in each issue. To do this requires a change in presentation. Text will be terse and to the point, using a maximum of illustrations whenever possible. Advertising is no longer restricted to not more than two manufacturers of similar products per issue. Several monthly features deemed of interest to radio, television, and allied maintenance activities will be added. The fundamental theme throughout will be maintenance of electronic equipment. We are sure that you will like SS even more in the future than you have in the past.

About Sports

Maybe we're all wet in our belief, but somehow or other we are gradually arriving at the conclusion that maybe sport telecasts are not as important any more as they were at one time. What we're leading up to is that theater television for the purpose of showing sporting events may not, in the long run, prove as significant as the present hullabaloo indicates. If you're looking for a reason for the above, it is simple—women represent the buying power in radio and they represent the major audience and buying power in television too. They're not too partial to sports telecasts—if partial at all.

A Word to City Fathers

We don't like licensing. We're certain that the majority of the servicing industry feels the same way. But you, City Fathers the nation over, are adamant on the point and licensing will be with us. So, when the bills come up for decision, please consider the following:

a. Don't set up an inspection bureaucracy. It can prove very bad.

b. Don't place the whole financial responsibility in the lap of the company who accomplishes the service contract. Make certain, if you can, that the vendor of the contract, the guy who gets his kickback or commission, is responsible also. Then he will see to it that the service contractor he selects is reliable.

c. Don't place the full authority of control over the licensee in the hands of only one individual. Set up a board of competent advisors representing all facets of the television industry and the municipal authorities. Make the License Commissioner work with this board and take its advice before revoking licenses. Make the Commissioner state in writing why he refuses to accept their advice, if that does happen.

d. Don't make the technical requirements of the license too stringent without giving the men now practicing an opportunity to bone up on technical details. If you do, your city's population will be without servicing facilities. The bill before the New York City Council calls for permits for all, at present, and licenses 2 years hence, after qualification examinations. It makes much sense.

e. Don't burden the TV service facilities with high financial costs. Your public pays in the long run.

f. Don't form the impression that licensing will make a man more honest or more competent. Examine the operations of those facilities which you already have licensed.

Mr. City Fathers, pay some heed to these don'ts. If you do, your licensing bill will be more beneficial to your population and to the TV servicing industry.

Mr. TV Serviceman, see to it that your local city administrators know about some of these don'ts. If you need extra copies to send to them—ask us; we'll send them to you as long as they are available. If we run out, you can photostat this editorial.

JOHN F. RIDER

Air King Service Hint

For a short while, Air King placed the chassis identification plates on the back apron of the chassis rather than on the dog house, where they were originally placed. When used on the back apron, the mounting screws may short out the B plus causing the rectifier tube and resistor to burn up. If any models are found with the chassis identification plate on the back apron they should be changed to this previously used position on the dog house cover.

Belmont 16- and 17-inch Chassis

A production change was incorporated in Raytheon 16 and 17 inch television receivers to prevent the possibility of the picture tube sliding forward or shifting in shipment.

The rubber sponge pad was cemented only to the front mounting brackets in the past. At the present time the rubber sponge pads are being cemented both to the brackets and the glass of the cathode-ray tube.

If removal of the cathode-ray tube is necessary, use care to loosen the tube from the pad before removing the tube from the chassis. In most cases a slight amount of pressure between the chassis and the tube will release the adhesion.

The serviceman is cautioned: Do not force removal of the tube as an implosion may result.

ATTENTION AUTHORS:

We are soliciting articles concerning radio, television, and allied electronic maintenance. All aspects are of interest. Articles of 1,000 to 2,000 words are desired. Preference is given to subject matter which reflects practical work rather than theory. The presentation should be *direct*, to the *point*, and amply illustrated. Finished art work will be prepared by us from the roughs submitted. Photographs are welcome. The rate of payment is on a word basis—and, needless to say, good writing rates good pay!

Submit all articles and inquiries to Editor, *Successful Servicing*.

JOHN F. RIDER PUBLISHER, Inc.
480 CANAL STREET
New York 13, N. Y.

Television Changes

DuMont RA-103

The following production changes have been made on the RA-103. A 6AL7-GT tube has been substituted for the 6U5/6G5 tuning indicator tube, V225, and connected as shown in Fig. 1. A 1-megohm resistor has been added from pin 4 of this tube to pin 4 of J201. Capacitor C288, 1.6 $\mu\mu$f, has been inserted in place of C214 and L211, which have been deleted from the video i-f circuit. Capacitor C289, 2 $\mu\mu$f, has been inserted in the video i-f circuit in place of C205 and L205, which have been deleted. Capacitor C90, 0.005 μf, is inserted in parallel across R209 which is connected to pin 7 of the 2nd video i-f tube V202. Capacitor C291, 2.5 $\mu\mu$f, has been added from pin 7 of V209, the 6AL5 sound detector to ground. Resistor R270, 6800 ohms, has

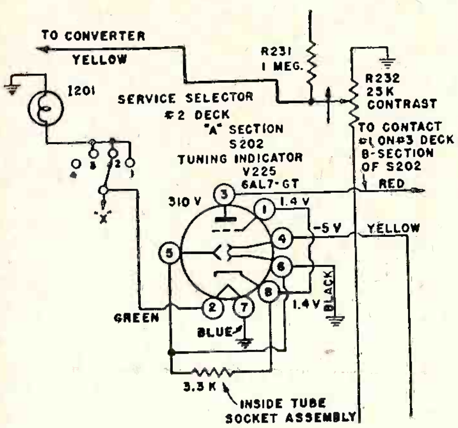


Fig. 1. New tuning indicator tube, DuMont RA-103.

been deleted from pin 6 of V216-A, the vertical buffer. Resistor R277, the vertical size control from R276 to the red lead of T202, has been changed in value from 2 megohms to 4 megohms. The value of resistor R278 which went to pins 3 and 6 of V217, the 6SN7-GT vertical deflection amplifier, has been changed from 3900 ohms to 4700 ohms. Two resistors R326, 1800 ohms, and R327, 3300 ohms, have been connected in series from R278 to pins 3 and 6 of the above mentioned tube V217. The value of resistor R304, from tap 4 of T204 to pin 8 of tube V223, has been changed from 6000 ohms to 8500 ohms. The position of the contacts have been relocated so that they now go from pin 8 of V219, and 5U4 rectifier, to the junction of L217 and R316. Resistor R205, connected to pin 6 of the 1st video i-f, has been changed to 6800 ohms.

The vertical sync circuit modifications given below are recommended for use in areas where noise causes loss in vertical sync.

1. Replace V205, the 6AC7 video amplifier, with a type 6AG7 tube as shown in Fig. 2.

2. Disconnect the low side of R219, the 4700-ohm resistor in the grid circuit of V205, from the junction of R216, 120 ohms, and R220, 15 ohms.

3. Connect a 12,000-ohm, ½-watt resistor from the low side of R219 (just disconnected) to ground. Place a 25-μf, 25-volt capacitor in parallel with this resistor. Be sure to connect the positive side of the capacitor to ground.

4. Add a 27,000-ohm, ½-watt resistor between the junction of R219 and the 25-μf, capacitor and 12,000-ohm resistor added in step 3 and the junction of the —12.5-volt line and R216.

5. Remove R223 (3.6 ohms), the plate load resistor of the video amplifier, and replace with the two 6800-ohm 2-watt resistors connected in parallel. Connect one end of this combination to the low end of L215 and run a lead from the other end of this combination to the junction of R288, the focus control, and R286B, the candohm strip resistor.

6. Remove R222, 3300 ohms connected to C216B.

7. Add an 1800-ohm, ½-watt resistor from the junction of L215, C217, and L216, to capacitor C283.

8. Remove capacitor C282, connected from pin 7 of V204B to ground. Remove capacitor C219, located between pin 7 of V204B and pin 1 of V212A, and replace with a short lead, using pin 7 terminal lug to which C219 was connected.

(Continued on page 9)

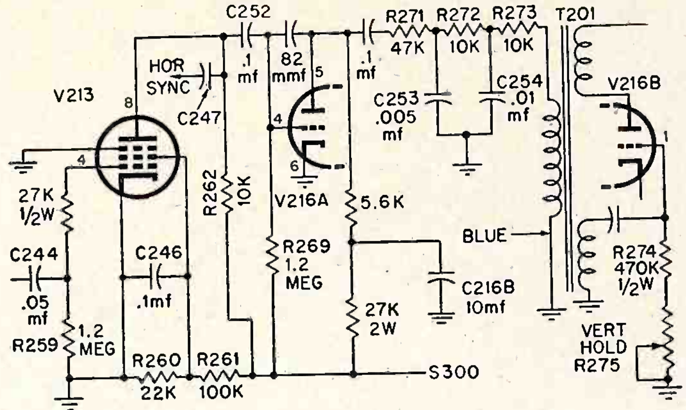


Fig. 3. Horizontal sync modifications, DuMont RA-103.

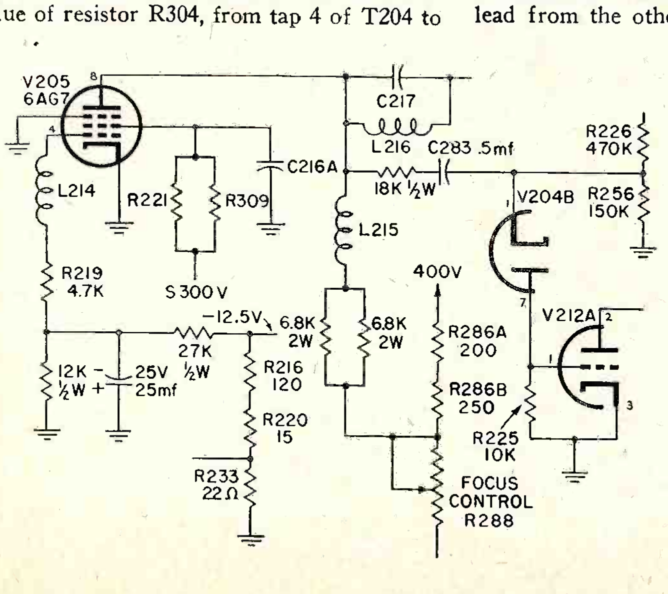
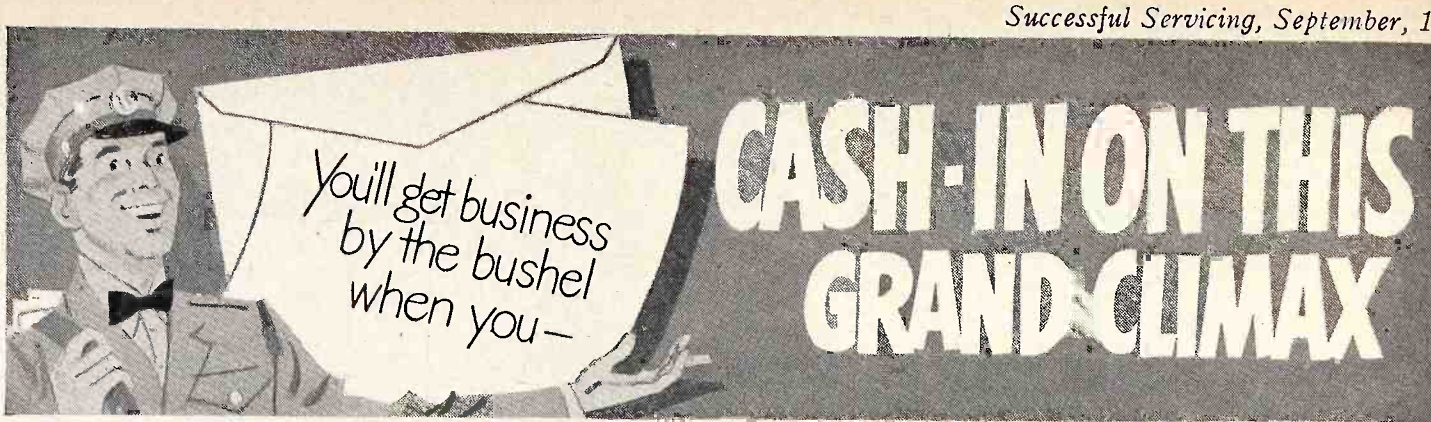


Fig. 2. Vertical sync modifications, DuMont RA-103.



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DuMont RA-103

(Continued from page 7)

9. Remove resistor R224, located between pin 1 of V212A and ground.

For the following steps refer to Fig. 3.

10. Add a 27,000-ohm, ½-watt resistor from the junction of C244 and R259 to pin 4 of V213.

11. Change the value of capacitor C252 (from pin 8 of V213 to pin 4 of V216A) to 0.1 μf.

12. Disconnect the ground side of R269, in the grid circuit of V216A. This will be connected in step 17.

13. Connect an 82-$\mu\mu$f capacitor between pins 4 and 5 of V216A.

14. Disconnect R271, 10,000 ohms, from pin 5 of V216A. This resistor will be replaced in step 18.

15. Connect a 5600-ohm, ½-watt resistor to pin 5 of V216A.

16. Connect the other end of the 5600-ohm resistor just added to a 27,000-ohm, 2-watt resistor. Run a lead from the junction of these two resistors to C216B.

17. The other end of the 27,000-ohm resistor is to be connected to the junction of R262 and R261 and to the low side of R269 (the 1.2-megohm resistor in the grid circuit of V216A).

18. Replace R271 with a 47,000-ohm, ½-watt resistor.

19. Connect a 0.1-μf capacitor between pin 5 of V216A and 47,000-ohm resistor just added.

20. Disconnect the blue lead of the primary of T201 from the +175-volt line and run directly to ground.

DuMont RA-104A, RA-108A, RA-110A

To eliminate the condition in RA-104A and RA-110A chassis, known as Barkhausen Oscillation (the indication of this trouble is one or more vertical black lines on the left-hand side of the raster) the following procedures should be observed.

Use only coax transmission lines (RG-11/U in the fringe areas and RG-59/U in strong signal areas). Make sure that the shield of the coax is properly grounded to the antenna connector shield. Keep the coax transmission line away from the power supply chassis. Place a metal plate (preferably copper) under the power supply chassis and main chassis. This plate need only be large enough to act as a bond between the two chassis. If the above suggestions do not cure the condition, replace the 6BG6 and ascertain that the drive control is properly adjusted.

"Thumping" sometimes occurs in RA-108A and RA-110A chassis using the 19AP4 metal picture tube. This condition may be described as an "electrostatic pendulum," the pendulum consists of a swinging back and forth in a definite rhythm of the tag tied to the high-voltage lead. This warning tag makes a resounding "thump" each time it strikes the metal. To prevent this condition, change the position of the tag.

Television Changes

Gamble-Skogmo 94TV1-43-8940A

As changes were made in the production of Model 94TV1-43-8940A, code numbers were assigned to distinguish the differences in the sets. The differences between the different code numbers are explained below:

Code 1. Code 1 chassis are wired as shown in the schematic diagram in Volume 4, except for the tuner chassis filament wiring. Only terminals 6 and 7 should be connected to H. Terminals 5, 8, and 10 should be grounded. There should be no direct connection between C32 and C31, as indicated in Volume 4, C32 should go directly to terminal 6, and C31 should go directly to terminal 7.

Code 2. A 1,000-μμf capacitor is used in place of C111. The value of resistor R92 is changed from 270,000 ohms to 220,000 ohms, and the lead from R92 now goes to the +350-volt line instead of to the +250-volt line. The value of R63 is changed from 560 ohms to 680 ohms, 1 watt.

Code 3. This is similar to Code 2 except that capacitor C109, 47 μμf has been deleted from pin 1 tube 16 to ground.

Code 4. This is similar to Code 3 except that C117 is no longer connected to terminal 1 of T6. It is now grounded.

Code 5. C111, 680 μμf, and C109, 80-480 (A-8E-18508) are now connected in parallel from the junction of C110 and R95 to ground.

Code 6. C116, 0.2 μμf (coil form, A5D 18507) has been added from pin 3 to tube 9-B, the 6SL7 agc amplifier, to pin 5 of tube 18, the 6W4.

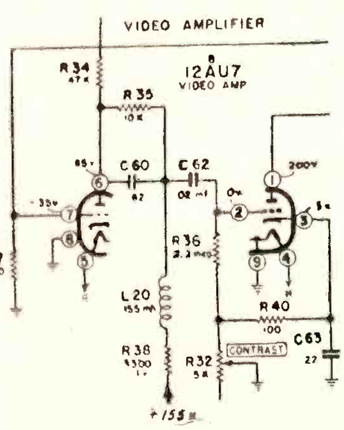

Fig. 1. Changes in the video amplifier circuit of the Gamble-Skogmo 94TV1-43-8940A.

Code 7. R48 is no longer connected to the +350-volt line, instead it now goes directly to tap 3 of T6.

Code 8. R98 now goes to the +350-volt line, instead of to tap 3 of T6. C113 is grounded instead of going to the junction of C114 and the +350-volt line. Capacitor C119, 1,000 μμf, has been added from ground to the junction of C118-A and the lead from C114 that goes to tap 3 of T6.

Code 9. The value of R73 is changed from 100,000 ohms to 68,000 ohms.

The following additions have been made to the parts list in Codes 1 through 9:

Parts No.	Description
B-55P-18282	Focus magnet
A-19A-14275	Yoke plug
B-15B-14274	Yoke socket
C-2B-18056	Power-supply shield can
A-5B-18446-74	Knob (5 used)
A-6M-18412	Indicator plate.

The deflection-yoke socket is now numbered in the following way: pin 1 is now designated as pin 4, 2 is now 5, 3 is now 1, 4 is now 2.

Code 10. The value of R47 is changed to 68,000 ohms (C-9B1-84), and a switch-on volume-contrast control has been added from R47 to the +250-volt line. R73 is changed to 18,000 ohms (C-9B1-77). R76 is changed to 560,000 ohms (C-9B1-95). R100 has been removed from its position at pin 6 of tube 19 and is now located from the junction of pin 11 of tube 10 and C67 to the tap of R46, brightness control. The value of R100 is 100,000 ohms. R103 is changed to 5,600 ohms, 2 watts (C-9B4-74). R108, 5,600 ohms, 2 watts (C-9B4-74), has been added from C61-D to the +350-volt line. R105 and F-1 have been deleted from the circuit. C118-A is now located from pin 1 of the power-jumper plug to ground; C119 goes from ground to pin 1 of the jumper plug and C114. A ¼-amp fuse has been inserted from pin 6 to pin 1 of the jumper plug.

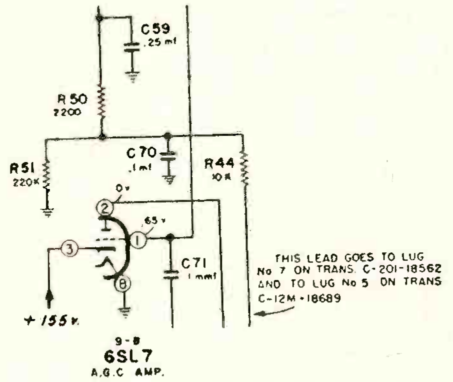

Fig. 2. Changes in the agc circuit of the Gamble-Skogmo 94TV1-43-8940A.

Code 11. Resistor R107, 3,900 ohms, 2 watts (C-9B4-69) is added from pin 3 of tube 18, the 6W4, to the minus side of C115. The horizontal-deflection transformer T6 has been changed from C-12M-18285 to C-201-18530.

Code 12. Capacitor C120, 7 μf (ceramic, C-8G-11790) has been added in parallel across coil L10.

Code 13. Capacitor C56 has been deleted. R32, contrast control, and R34 are now located as shown in Fig. 1. Additional changes in component location in this circuit are also shown in Fig. 1. The lead from R34 goes to pin 1 of tube 9-B, the agc amplifier. The lead from R37 goes to L16. The lead from pin 1 goes to the junction of C64 and L21. R37 has been relocated, as shown in Fig. 1, and its value is changed from 1,000 ohms to 8,200 ohms. C61-A has been deleted. R35 and C60 have been added. R32, R38, R40, and C63 are changed to 5,000 ohms, 3,300 ohms, 100 ohms, and 22 μμf, respectively. Since the contrast control was moved to a new location after Code 12, the output connection of an oscilloscope or meter will not be connected across the contrast control, but now across resistor R37 (pin 7 of tube 7 to ground).

R53 has been deleted and C59 has been added. Additional changes in component location are shown in Fig. 2. The lead from R50 and C59 goes to the agc line. The lead from C71 goes to C116, and the other side of C116 goes to pin 4 of tube 9-A, the 6SL7 sync amplifier. The lead from pin 2 goes to tap 6 (an additional winding which is de-

(Continued on page 13)

Gamble-Skogmo 94TV1-43-8940A

(Continued from page 11)

scribed below), of T6. C71 is now 1 $\mu\mu$f, and R50 is 2,200 ohms.

R54, which went from R17 to pick-off coil T8, has been deleted. C72 has also been deleted. R99, to tap 5 of T6, has been deleted. T6 has been changed (see parts-list changes listed below), and now has an additional winding which is located between the winding for the filaments on the 1X2 and the winding going to the plate of the 1X2.

The value of R82 is changed from 1 megohm to 220,000 ohms, and the lead goes to tap 6 of T6, instead of to tap 5. C98 is changed from 75 $\mu\mu$f to 82 $\mu\mu$f. R87 is changed from 1.5 megohms to 680,000 ohms. C110 has been relocated and now goes from R87 to the junction of C112, R96, and R97. The value of C110 is changed from 220 $\mu\mu$f to 22 $\mu\mu$f, 500 volts. R95 has been deleted and the value of C111 is changed from 680 ohms to 820 ohms. Pin 8 of tube 17, the 6BQ6 pulse amplifier, is now tied to pin 2 of the same tube.

The change in parts list is as follows:

Ref. No.	Part No.	Description
C60	C-8F3-112	82 $\mu\mu$f, mica
C63	C-8F-18569	22 $\mu\mu$f, mica
C70	B-8D-18491	0.1 μf, paper
C71	A-8G-12495-2	1 $\mu\mu$f, ceramic
C98	C-8F3-112	82 $\mu\mu$f, mica
C110	C-8G-11892	22 $\mu\mu$f, 500 volts, ceramic
C111	C-8F6-124	820 $\mu\mu$f, mica
R34	C-9B1-82	47,000 ohms, ½ watt
R35	C-9B1-74	10,000 ohms, ½ watt
R37	C-9B1-73	8,200 ohms, ½ watt
R38	C-9B2-68	3,300 ohms, 1 watt
R40	C-9B1-74	100 ohms, ½ watt
R50	C-9B1-66	2,200 ohms, ½ watt
R82	C-9B1-90	220,000 ohms, ½ watt
R87	C-9B1-96	680,000 ohms, ½ watt.

Code 14. R44 is changed from 3.3 megohms to 10,000 ohms, ½ watt (C-9B1-74).

Code 15. The value of R56 is changed from 68 ohms to 120 ohms, ½ watt (C-9B1-51).

Ref. No.	Part No.	Description
C61	A-8C-18487	30-30 μf x 450 volts, 125 μf x 25 volts
	B-5B-18552-85	Tuning knob (vernier)
	B-2M-18553	Vernier disk
	B-55P-18638	Focus magnet
	A-51A-15713	Iron core, for L4, 8, 9
	A-10B-18794	Vertical size control (screwdriver shaft)
	A-10B-18795	Linearity size control (screwdriver shaft).

In later production, group numbers (chassis identification numbers) were assigned to each set. The production changes made are explained below:

Code 16 or Group Numbers 6,700 to 8,999. Video trap coil L19 was relocated and connected to pin 7 of the 12AU7 video amplifier, tube 8, and L16. Peaking coil L21 (A-16A-17961) was replaced with A-16A-18685 (white dot). The high-voltage capacitor and socket assembly (N-201-18161) was removed and replaced with a wafer tube socket (A-15C-18735), high-voltage ring (A-62C-18734), two insulators (A-5M-18733), and mounting hardware. A 2.2-ohm, ½-watt, wire-bound resistor (C-9C1-1067) or a filament choke (A-16A-18785) was added in series with the 1X2 filament lead as shown in Fig. 3.

Code 17 or Group Numbers 9,000 to 12,399. To reduce capacitor failures, capacitor C64 is replaced with a 0.01-μf, 600-volt capacitor (C-8D-11128).

Code 18 or Group Numbers 12,400 to 14,199. To reduce horizontal size, the white and black leads to the horizontal-deflection transformer T6, lugs 2 and 3, respectively, were interchanged, black to lug 2 and white to lug 3.

Code 19 or Group Numbers 14,200 and above.

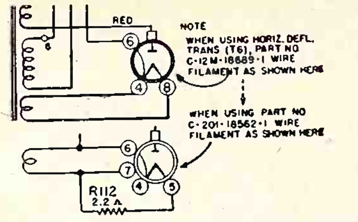

Fig. 3. Wiring for the 1X2 filament lead of the Gamble-Skogmo 94TV1-43-8940A.

Both the C-12M-18689 and C-201-18562 horizontal-deflection transformers were removed and replaced with new transformers. The part numbers are the same with the addition of a dash one (—1). The black and white horizontal-deflection-transformer leads are connected as in Code 17. Resistor R4 is changed to 10,000 ohms. Resistors R8 and R10 are grounded, C33 has been deleted, and the tuner chassis filament wiring has been changed. Pin 4 of the 6AG5 is grounded, pin 3 of the same tube and pin 3 of the 6J6 are tied to tuner terminal 8 and go to H. Pin 4 of the 6J6 is grounded. C30, C31, and C32 have been deleted. C25, C27 and C28 have been deleted. The value of R45 is changed to 220,000 ohms (C-9B1-90), and a resistor R110, 220,000 ohms, ½ watt (C-9B1-90) has been added from pin 5 of the 6SL7 sync amplifier, tube 9-A, to ground. R28 is changed to 120 ohms.

Resistor R109 has been added across transformer T1, from pin 5 to pin 6 of the 6AU6 3rd i.f. The value of resistor R107 (see Code 11) has been changed from 3900 ohms to 5600 ohms. To eliminate vertical jitters, R73 is changed to 68,000 ohms (C-9B1-84). R72 is changed to 1.5 megohms (C-9B1-100). C95 is changed to 0.02 μf (C-8D-17607). C106 is changed to 0.1 μf (C-8D-10771). Capacitor C91 is deleted. C90 has been relocated to between R77 and C95, and its value has been changed to 0.005 μf (C-8D-17608). A dual control and switch (A-10A-18441) has been added to the parts list. Resistor R3 has been deleted from lug 2 (antenna input). Lug 2 is now connected directly to lug 4, 1 and 3 are connected to the antenna input terminals.

Five different horizontal deflection transformers T6 have been used on the various production runs.

1. Chassis Coded 1 through 12. These chassis use part number C-12M-18285 transformer. This is a laminated iron core transformer with a 5-lug terminal board. This transformer should be used for replacement. The C-12M-18689 transformer can be used for replacement if the agc leads are removed from lugs 5 and 6 (left hanging free) and a 1-megohm, 1-watt resistor is added from lug 5 to the blue 6BQ6 plate lead terminal. If horizontal non-linearity (left-hand bulge) is noticed on any of these chassis, it may be corrected by reversing the leads connected to terminals 2 and 3.

2. Chassis Coded 13 through 15 and Group Numbers to 14,200. These chassis use either part number C-12M-18689 or part number C-201-18562 transformers. The C-12M-18689 is a laminated iron core transformer with a 6-lug terminal board, and the C-201-18562 is a molded iron core transformer (racetrack shape) with 5 lugs on one side of the terminal

(Continued on page 15)

Television Changes

Gamble-Skogmo 94TV1-43-8940A

As changes were made in the production of Model 94TV1-43-8940A, code numbers were assigned to distinguish the differences in the sets. The differences between the different code numbers are explained below:

Code 1. Code 1 chassis are wired as shown in the schematic diagram in Volume 4, except for the tuner chassis filament wiring. Only terminals 6 and 7 should be connected to H. Terminals 5, 8, and 10 should be grounded. There should be no direct connection between C32 and C31, as indicated in Volume 4, C32 should go directly to terminal 6, and C31 should go directly to terminal 7.

Code 2. A 1,000-$\mu\mu$f capacitor is used in place of C111. The value of resistor R92 is changed from 270,000 ohms to 220,000 ohms, and the lead from R92 now goes to the +350-volt line instead of to the +250-volt line. The value of R63 is changed from 560 ohms to 680 ohms, 1 watt.

Code 3. This is similar to Code 2 except that capacitor C109, 47 $\mu\mu$f has been deleted from pin 1 tube 16 to ground.

Code 4. This is similar to Code 3 except that C117 is no longer connected to terminal 1 of T6. It is now grounded.

Code 5. C111, 680 $\mu\mu$f, and C109, 80-480 (A-8E-18508) are now connected in parallel from the junction of C110 and R95 to ground.

Code 6. C116, 0.2 $\mu\mu$f (coil form, A5D 18507) has been added from pin 3 to tube 9-B, the 6SL7 agc amplifier, to pin 5 of tube 18, the 6W4.

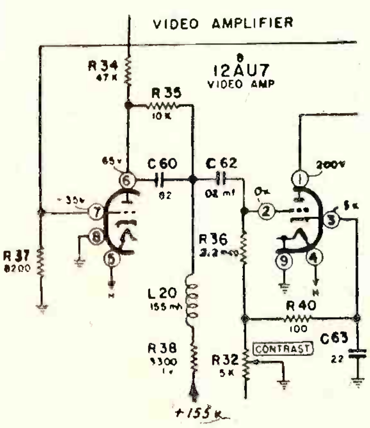

Fig. 1. Changes in the video amplifier circuit of the Gamble-Skogmo 94TV1-43-8940A.

Code 7. R48 is no longer connected to the +350-volt line, instead it now goes directly to tap 3 of T6.

Code 8. R98 now goes to the +350-volt line, instead of to tap 3 of T6. C113 is grounded instead of going to the junction of C114 and the +350-volt line. Capacitor C119, 1,000 $\mu\mu$f, has been added from ground to the junction of C118-A and the lead from C114 that goes to tap 3 of T6.

Code 9. The value of R73 is changed from 100,000 ohms to 68,000 ohms.

The following additions have been made to the parts list in Codes 1 through 9:

Parts No.	*Description*
B-55P-18282	Focus magnet
A-19A-14275	Yoke plug
B-15B-14274	Yoke socket
C-2B-18056	Power-supply shield can
A-5B-18446-74	Knob (5 used)
A-6M-18412	Indicator plate.

The deflection-yoke socket is now numbered in the following way: pin 1 is now designated as pin 4, 2 is now 5, 3 is now 1, 4 is now 2.

Code 10. The value of R47 is changed to 68,000 ohms (C-9B1-84), and a switch-on volume-contrast control has been added from R47 to the +250-volt line. R73 is changed to 18,000 ohms (C-9B1-77). R76 is changed to 560,000 ohms (C-9B1-95). R100 has been removed from its position at pin 6 of tube 19 and is now located from the junction of pin 11 of tube 10 and C67 to the tap of R46, brightness control. The value of R100 is 100,000 ohms. R103 is changed to 5,600 ohms, 2 watts (C-9B4-74). R108, 5,600 ohms, 2 watts (C-9B4-74), has been added from C61-D to the +350-volt line. R105 and F-1 have been deleted from the circuit. C118-A is now located from pin 1 of the power-jumper plug to ground; C119 goes from ground to pin 1 of the jumper plug and C114. A ¼-amp fuse has been inserted from pin 6 to pin 1 of the jumper plug.

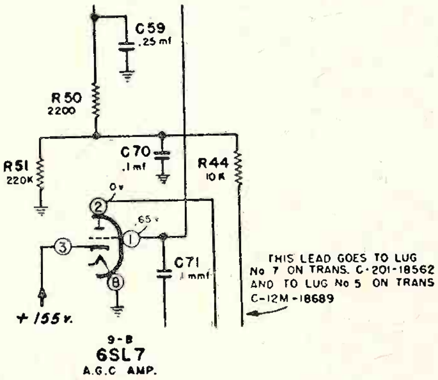

Fig. 2. Changes in the agc circuit of the Gamble-Skogmo 94TV1-43-8940A.

Code 11. Resistor R107, 3,900 ohms, 2 watts (C-9B4-69) is added from pin 3 of tube 18, the 6W4, to the minus side of C115. The horizontal-deflection transformer T6 has been changed from C-12M-18285 to C-201-18530.

Code 12. Capacitor C120, 7 μf (ceramic, C-8G-11790) has been added in parallel across coil L10.

Code 13. Capacitor C56 has been deleted. R32, contrast control, and R34 are now located as shown in Fig. 1. Additional changes in component location in this circuit are also shown in Fig. 1. The lead from R34 goes to pin 1 of tube 9-B, the agc amplifier. The lead from R37 goes to L16. The lead from pin 1 goes to the junction of C64 and L21. R37 has been relocated, as shown in Fig. 1, and its value is changed from 1,000 ohms to 8,200 ohms. C61-A has been deleted. R35 and C60 have been added. R32, R38, R40, and C63 are changed to 5,000 ohms, 3,300 ohms, 100 ohms, and 22 $\mu\mu$f, respectively. Since the contrast control was moved to a new location after Code 12, the output connection of an oscilloscope or meter will not be connected across the contrast control, but now across resistor R37 (pin 7 of tube 7 to ground).

R53 has been deleted and C59 has been added. Additional changes in component location are shown in Fig. 2. The lead from R50 and C59 goes to the agc line. The lead from C71 goes to C116, and the other side of C116 goes to pin 4 of tube 9-A, the 6SL7 sync amplifier. The lead from pin 2 goes to tap 6 (an additional winding which is de-

(Continued on page 13)

SHURE

2 New phono pickup cartridges to help simplify cartridge replacement

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TURNOVER CARTRIDGE

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A high quality extended range "Vertical Drive" Cartridge complete with positive turnover mechanism. Has sapphire tipped fine-groove and osmium tipped standard-groove needle.

WHAT IT DOES:
Offers greatly improved performance when used as replacement for single-needle all purpose cartridge. Also recommended for replacement of other types of turnover and dual-needle cartridges. Replaces not only cartridge but turnover mechanism as well.

SPECIAL FEATURES:
1. Extended frequency response to 10,000 c. p. s.
2. Tracks at low needle point pressure —only 8 grams.
3. Sturdy construction guarantees long life of turnover mechanism.
4. Standard ½" bracket mount has elongated holes for versatility and quick easy installation.

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LIST PRICE $10.00

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3. Equipped with pin jacks and pin terminals.
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Gamble-Skogmo 94TV1-43-8940A

(Continued from page 11)

scribed below), of T6. C71 is now 1 $\mu\mu$f, and R50 is 2,200 ohms.

R54, which went from R17 to pick-off coil T8, has been deleted. C72 has also been deleted. R99, to tap 5 of T6, has been deleted. T6 has been changed (see parts-list changes listed below), and now has an additional winding which is located between the winding for the filaments on the 1X2 and the winding going to the plate of the 1X2.

The value of R82 is changed from 1 megohm to 220,000 ohms, and the lead goes to tap 6 of T6, instead of to tap 5. C98 is changed from 75 $\mu\mu$f to 82 $\mu\mu$f. R87 is changed from 1.5 megohms to 680,000 ohms. C110 has been relocated and now goes from R87 to the junction of C112, R96, and R97. The value of C110 is changed from 220 $\mu\mu$f to 22 $\mu\mu$f, 500 volts. R95 has been deleted and the value of C111 is changed from 680 ohms to 820 ohms. Pin 8 of tube 17, the 6BQ6 pulse amplifier, is now tied to pin 2 of the same tube.

The change in parts list is as follows:

Ref. No.	*Part No.*	*Description*
C60	C-8F3-112	82 $\mu\mu$f, mica
C63	C-8F-18569	22 $\mu\mu$f, mica
C70	B-8D-18491	0.1 μf, paper
C71	A-8G-12495-2	1 $\mu\mu$f, ceramic
C98	C-8F3-112	82 $\mu\mu$f, mica
C110	C-8G-11892	22 $\mu\mu$f, 500 volts, ceramic
C111	C-8F6-124	820 $\mu\mu$f, mica
R34	C-9B1-82	47,000 ohms, ½ watt
R35	C-9B1-74	10,000 ohms, ½ watt
R37	C-9B1-73	8,200 ohms, ½ watt
R38	C-9B2-68	3,300 ohms, 1 watt
R40	C-9B1-74	100 ohms, ½ watt
R50	C-9B1-66	2,200 ohms, ½ watt
R82	C-9B1-90	220,000 ohms, ½ watt
R87	C-9B1-96	680,000 ohms, ½ watt.

Code 14. R44 is changed from 3.3 megohms to 10,000 ohms, ½ watt (C-9B1-74).

Code 15. The value of R56 is changed from 68 ohms to 120 ohms, ½ watt (C-9B1-51).

Ref. No.	*Part No.*	*Description*
C61	A-8C-18487	30-30 μf x 450 volts, 125 μf x 25 volts
	B-5B-18552-85	Tuning knob (vernier)
	B-2M-18553	Vernier disk
	B-55P-18638	Focus magnet
	A-51A-15713	Iron core, for L4, 8, 9
	A-10B-18794	Vertical size control (screwdriver shaft)
	A-10B-18795	Linearity size control (screwdriver shaft).

In later production, group numbers (chassis identification numbers) were assigned to each set. The production changes made are explained below:

Code 16 or Group Numbers 6,700 to 8,999. Video trap coil L19 was relocated and connected to pin 7 of the 12AU7 video amplifier, tube 8, and L16. Peaking coil L21 (A-16A-17961) was replaced with A-16A-18685 (white dot). The high-voltage capacitor and socket assembly (N-201-18161) was removed and replaced with a wafer tube socket (A-15C-18735), high-voltage ring (A-62C-18734), two insulators (A-5M-18733), and mounting hardware. A 2.2-ohm, ½-watt, wire-bound resistor (C-9C1-1067) or a filament choke (A-16A-18785) was added in series with the 1X2 filament lead as shown in Fig. 3.

Code 17 or Group Numbers 9,000 to 12,399. To reduce capacitor failures, capacitor C64 is replaced with a 0.01-μf, 600-volt capacitor (C-8D-11128).

Code 18 or Group Numbers 12,400 to 14,199. To reduce horizontal size, the white and black leads to the horizontal-deflection transformer T6, lugs 2 and 3, respectively, were interchanged, black to lug 2 and white to lug 3.

Code 19 or Group Numbers 14,200 and above.

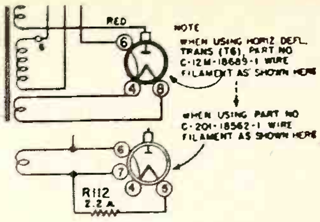

Fig. 3. Wiring for the 1X2 filament lead of the Gamble-Skogmo 94TV1-43-8940A.

Both the C-12M-18689 and C-201-18562 horizontal-deflection transformers were removed and replaced with new transformers. The part numbers are the same with the addition of a dash one (—1). The black and white horizontal-deflection-transformer leads are connected as in Code 17. Resistor R4 is changed to 10,000 ohms. Resistors R8 and R10 are grounded, C33 has been deleted, and the tuner chassis filament wiring has been changed. Pin 4 of the 6AG5 is grounded, pin 3 of the same tube and pin 3 of the 6J6 are tied to tuner terminal 8 and go to H. Pin 4 of the 6J6 is grounded. C30, C31, and C32 have been deleted. C25, C27 and C28 have been deleted. The value of R45 is changed to 220,000 ohms (C-9B1-90), and a resistor R110, 220,000 ohms, ½ watt (C-9B1-90) has been added from pin 5 of the 6SL7 sync amplifier, tube 9-A, to ground. R28 is changed to 120 ohms.

Resistor R109 has been added across transformer T1, from pin 5 to pin 6 of the 6AU6 3rd i.f. The value of resistor R107 (see Code 11) has been changed from 3900 ohms to 5600 ohms. To eliminate vertical jitters, R73 is changed to 68,000 ohms (C-9B1-84). R72 is changed to 1.5 megohms (C-9B1-100). C95 is changed to 0.02 μf (C-8D-17607). C106 is changed to 0.1 μf (C-8D-10771). Capacitor C91 is deleted. C90 has been relocated to between R77 and C95, and its value has been changed to 0.005 μf (C-8D-17608). A dual control and switch (A-10A-18441) has been added to the parts list. Resistor R3 has been deleted from lug 2 (antenna input). Lug 2 is now connected directly to lug 4, 1 and 3 are connected to the antenna input terminals.

Five different horizontal deflection transformers T6 have been used on the various production runs.

1. Chassis Coded 1 through 12. These chassis use part number C-12M-18285 transformer. This is a laminated iron core transformer with a 5-lug terminal board. This transformer should be used for replacement. The C-12M-18689 transformer can be used for replacement if the agc leads are removed from lugs 5 and 6 (left hanging free) and a 1-megohm, 1-watt resistor is added from lug 5 to the blue 6BQ6 plate lead terminal. If horizontal non-linearity (left-hand bulge) is noticed on any of these chassis, it may be corrected by reversing the leads connected to terminals 2 and 3.

2. Chassis Coded 13 through 15 and Group Numbers to 14,200. These chassis use either part number C-12M-18689 or part number C-201-18562 transformers. The C-12M-18689 is a laminated iron core transformer with a 6-lug terminal board, and the C-201-18562 is a molded iron core transformer (racetrack shape) with 5 lugs on one side of the terminal

(Continued on page 15)

SHURE 2 New phono pickup cartridges to help simplify cartridge replacement

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Gamble-Skogmo 94TV1-43-8940A

(Continued from page 11)

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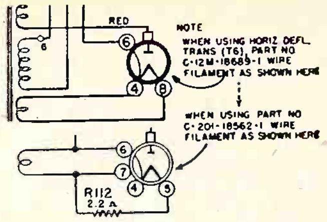

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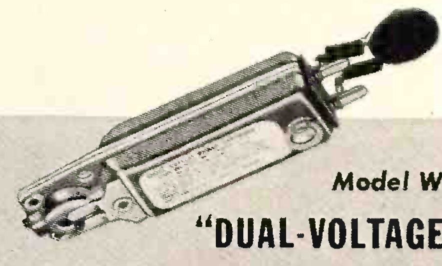

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scribed below), of T6. C71 is now 1 μf, and R50 is 2,200 ohms.

R54, which went from R17 to pick-off ɑl T8, has been deleted. C72 has also been ·-leted. R99, to tap 5 of T6, has been deletl. T6 has been changed (see parts-list chans listed below), and now has an additiol winding which is located between the wi-ing for the filaments on the 1X2 and e winding going to the plate of the 1X2.

The value of R82 is changed from 1 m-ohm to 220,000 ohms, and the lead goes o tap 6 of T6, instead of to tap 5. C98 s changed from 75 μμf to 82 μμf. R87 is chan d from 1.5 megohms to 680,000 ohms. C110 s been relocated and now goes from R87 to e junction of C112, R96, and R97. The va e 110 is changed from 220 μμf to 22 μ, lts. R95 has been deleted and the va e 111 is changed from 680 ohms to 0 ohms. Pin 8 of tube 17, the 6BQ6 pulse am-fier, is now tied to pin 2 of the same tube.

The change in parts list is as follows:

Ref. No.	Part No.	Description
	C-8F3-112	82 μμf, mica
	C-8F-18569	22 μμf, mica
	B-8D-18491	0.1 μf, paper
	A-8G-12495-2	1 μμf, ceramic
C98	C-8F3-112	82 μμf, mica
C110	C-8G-11892	22 μμf, 500 volts, ceram
C111	C-8F6-124	820 μμf, mica
R34	C-9B1-82	47,000 ohms, ½ watt
R35	C-9B1-74	10,000 ohms, ½ watt
R37	C-9B1-73	8,200 ohms, ½ watt
R38	C-9B2-68	3,300 ohms, 1 watt
	C-9B1-74	100 ohms, ½ watt
	C-9B1-66	2,200 ohms, ½ watt
	C-9B1-90	220,000 ohms, ½ watt
	C-9B1-96	680,000 ohms, ½ watt.

Code 14. R44 is changed from 3.3 megohms to 10,000 ohms, ½ watt (C-9B1-74).

Code 15. The value of R56 is changed fim 68 ohms to 120 ohms, ½ watt (C-9B1-51)

Ref. No.	Part No.	Description
C61	A-8C-18487	30-30 μf x 450 volts, 25 μf x 25 volts
	B-5B-18552-85	Tuning knob (vernier)
	B-2M-18553	Vernier disk
	B-55P-18638	Focus magnet
	A-51A-15713	Iron core, for L4, 8,
	A-10B-18794	Vertical size control (screwdriver shaft)
	A-10B-18795	Linearity size control (screwdriver shaft).

In later production, group numbers (chassis identification numbers) were assigned to each set. The production changes made are ex-plained below:

Code 16 or Group Numbers 6,700 to 8,9. trap coil L19 was relocated and c-ed to pin 7 of the 12AU7 video amplifier, tube 8, and L16. Peaking coil L21 (A-1-17961) was replaced with A-16A-1835 (white dot). The high-voltage capacitor nd socket assembly (N-201-18161) was remcd and replaced with a wafer tube socket -18735), high-voltage ring (A-C-4), two insulators (A-5M-18733), nd unting hardware. A 2.2-ohm, ½-w t, wire-bound resistor (C-9C1-1067) or a -ment choke (A-16A-18785) was addec in series with the 1X2 filament lead as sh n in Fig. 3.

Code 17 or Group Numbers 9,000 to 12,9. To reduce capacitor failures, capacitor 54 is replaced with a 0.01-μf, 600-volt capacor (C-8D-11128).

Code 18 or Group Numbers 12,400 to 14,9. To reduce horizontal size, the white and b k leads to the horizontal-deflection transforer T6, lugs 2 and 3, respectively, were inr-changed, black to lug 2 and white to lug

Code 19 or Group Numbers 14,200 and ab e.

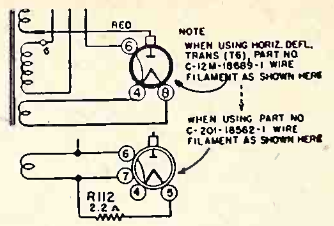

Fig. 3. Wiring for the 1X2 filament lead of the Gamble-Skogmo 94TV1-43-8940A.

Both the C-12M-18689 and C-201-18562 horizontal-deflection transformers were removed and replaced with new transformers. The part numbers are the same with the addition of a dash one (—1). The black and white horizontal-deflection-transformer leads are connected as in Code 17. Resistor R4 is changed to 10,000 ohms. Resistors R8 and R10 are grounded, C33 has been deleted, and the tuner chassis filament wiring has been changed. Pin 4 of the 6AG5 is grounded, pin 3 of the same tube and pin 3 of the 6J6 are tied to tuner terminal 8 and go to H. Pin 4 of the 6J6 is grounded. C30, C31, and C32 have been deleted. C25, C27 and C28 have been deleted. The value of R45 is changed to 220,000 ohms (C-9B1-90), and a resistor R110, 220,000 ohms, ½ watt (C-9B1-90) has been added from pin 5 of the 6SL7 sync amplifier, tube 9-A, to ground. R28 is changed to 120 ohms.

Resistor R109 has been added across transformer T1, from pin 5 to pin 6 of the 6AU6 3rd i.f. The value of resistor R107 (see Code 11) has been changed from 3900 ohms to 5600 ohms. To eliminate vertical jitters, R73 is changed to 68,000 ohms (C-9B1-84). R72 is changed to 1.5 megohms (C-9B1-100). C95 is changed to 0.02 μf (C-8D-17607). C106 is changed to 0.1 μf (C-8D-10771). Capacitor C91 is deleted. C90 has been relocated to between R77 and C95, and its value has been changed to 0.005 μf (C-8D-17608). A dual control and switch (A-10A-18441) has been added to the parts list. Resistor R3 has been deleted from lug 2 (antenna input). Lug 2 is now connected directly to lug 4, 1 and 3 are connected to the antenna input terminals.

Five different horizontal deflection transformers T6 have been used on the various production runs.

1. Chassis Coded 1 through 12. These chassis use part number C-12M-18285 transformer. This is a laminated iron core transformer with a 5-lug terminal board. This transformer should be used for replacement. The C-12M-18689 transformer can be used for replacement if the agc leads are removed from lugs 5 and 6 (left hanging free) and a 1-megohm, 1-watt resistor is added from lug 5 to the blue 6BQ6 plate lead terminal. If horizontal non-linearity (left-hand bulge) is noticed on any of these chassis, it may be corrected by reversing the leads connected to terminals 2 and 3.

2. Chassis Coded 13 through 15 and Group Numbers to 14,200. These chassis use either part number C-12M-18689 or part number C-201-18562 transformers. The C-12M-18689 is a laminated iron core transformer with a 6-lug terminal board, and the C-201-18562 is a molded iron core transformer (racetrack shape) with 5 lugs on one side of the terminal

(Continued on page 15)

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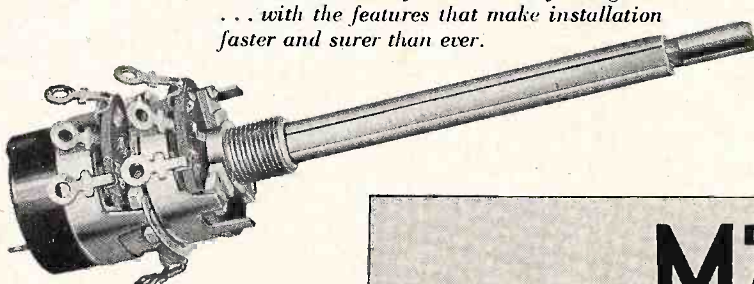
There are three big reasons why the Midgetrol 15/16″ control does a better job . . . because the *permanently fixed tubular brass shaft* can be adapted for any popular knob in a few seconds . . . because AC switch attachment is simple and positive . . . because the precision-controlled carbon element gives smoother taper, quieter operation, more accurate resistance value and less drift in TV sets.

These same advantages are available in the Dual Concentric Midgetrol, tailor-made on the job to match each specific requirement. It is assembled in five easy steps, in less than five minutes, using complete, *factory-inspected* control sections. You can make over 10,000 different combinations from sub-assemblies available in distributor stocks.

Make it Mallory and make sure! Ask your distributor to show you the Mallory Midgetrol . . . with the features that make installation faster and surer than ever.



Complete Dual Concentric Midgetrol illustrated. Single section control available in complete line of resistance values.

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Gamble-Skogmo 94TV1-43-8940A

(Continued from page 13)

board and two on the other. These transformers are interchangeable except for resistor R-107 (3900 ohms, 2 watts). Resistor R-107 is used only with the C-201-18562 transformer. If horizontal non-linearity is noticed on any of these chassis, reverse the leads connected to terminals 2 and 3 or add a 2900-ohm resistor. If the C-12M-18689 transformer is used, the 3900-ohm, 2-watt resistor should be added, and if the C-201-18562 transformer is used, another 3900-ohm, 2-watt resistor should be used in parallel with the one wired in the chassis. These changes have been made in receivers that were converted. Converted receivrs can be identified by a dot behind the Model No. on the decal or chassis.

3. Chassis with Group Numbers 14,200 and up. These chassis use either part number C-12M-18689-1 or a C-201-18562-1 transformer. The dash one transformers are identical, except they have fewer turns on the output section. These transformers are interchangeable.

Crosley 11-442M1U, 11-444MU, 11-453MU, 11-460MU, 11-470BU, 11-472B1U, 11-474BU, 11-483BU, Ch. 331, 331-1, 331-2; 11-443MU, 11-454MU, 11-458MU, 11-473BU, 11-484BU, Ch. 323, 323-1, 323-2

Chassis 331-1 and 331-2 are similar to Chassis 331 except for the changes noted below. Chassis 323-1 and 323-2 are similar to Chassis 323 except for the changes noted below.

Chassis 323-1 and 331-1 are equipped with a 6T8 tube (V110A, V110B) mounted on a plate and socket assembly (Part No. AB-150226). A 0.005-µf, 500-volt ceramic disc capacitor (Part No. 144675-2) is connected from lug 2 of the socket to ground. All other parts and connections to the socket for Chassis 323-1 and 331-1 are identical to those shown in the schematic wiring diagrams for Chassis 323 and 331, respectively.

Chassis 323-2 and 331-2 are equipped with a 6AL5 tube (V110A) and a 6AV6 tube (V110B), which have their sockets mounted on a socket and plate assembly (Part No. AB-150227). This assembly consists of the parts and wiring shown in the accompanying illustration. Capacitor C183 is a 0.005-µf, 500-volt, ceramic disk capacitor (Part No. C-144675-2). Resistor R147 is a 3.9-megohm, 10%, ½-watt resistor (Part No. 39374-75). The Part No. of the socket is 146966.

The following changes apply to Chassis 331, 331-1, and 331-2, only. The main chassis Parts List for Chassis 331 should include an audio output transformer T103, Part No. 149460. It is used on models equipped with the 5¼", 50-ohm, e-m speaker SP101 (Part No. AD-149502). The audio output transformer T110 (Part No. 149654) is used on all models equipped with 10 p-m speakers. The Part No. of the fuse F101 should be W-150431 instead of W-150065. The Part No. of the power cable and plug assembly CA102, used on Models 11-444MU and 11-474BU, should be AW-149652 instead of C-132300-6. The C-132300-6 cable is used on the models that are not equipped with radio and record changer. The Part No. of the springs used on the control access doors is W-149095.

Gamble-Skogmo 94TV1-43-8940A

(Continued from page 11)

scribed below), of T6. C71 is now 1 $\mu\mu f$, and R50 is 2,200 ohms.

R54, which went from R17 to pick-off coil T8, has been deleted. C72 has also been deleted. R99, to tap 5 of T6, has been deleted. T6 has been changed (see parts-list changes listed below), and now has an additional winding which is located between the winding for the filaments on the 1X2 and the winding going to the plate of the 1X2.

The value of R82 is changed from 1 megohm to 220,000 ohms, and the lead goes to tap 6 of T6, instead of to tap 5. C98 is changed from 75 $\mu\mu f$ to 82 $\mu\mu f$. R87 is changed from 1.5 megohms to 680,000 ohms. C110 has been relocated and now goes from R87 to the junction of C112, R96, and R97. The value of C110 is changed from 220 $\mu\mu f$ to 22 $\mu\mu f$, 500 volts. R95 has been deleted and the value of C111 is changed from 680 ohms to 820 ohms. Pin 8 of tube 17, the 6BQ6 pulse amplifier, is now tied to pin 2 of the same tube.

The change in parts list is as follows:

Ref. No.	*Part No.*	*Description*
C60	C-8F3-112	82 $\mu\mu f$, mica
C63	C-8F-18569	22 $\mu\mu f$, mica
C70	B-8D-18491	0.1 μf, paper
C71	A-8G-12495-2	1 $\mu\mu f$, ceramic
C98	C-8F3-112	82 $\mu\mu f$, mica
C110	C-8G-11892	22 $\mu\mu f$, 500 volts, ceramic
C111	C-8F6-124	820 $\mu\mu f$, mica
R34	C-9B1-82	47,000 ohms, ½ watt
R35	C-9B1-74	10,000 ohms, ½ watt
R37	C-9B1-73	8,200 ohms, ½ watt
R38	C-9B2-68	3,300 ohms, 1 watt
R40	C-9B1-74	100 ohms, ½ watt
R50	C-9B1-66	2,200 ohms, ½ watt
R82	C-9B1-90	220,000 ohms, ½ watt
R87	C-9B1-96	680,000 ohms, ½ watt.

Code 14. R44 is changed from 3.3 megohms to 10,000 ohms, ½ watt (C-9B1-74).

Code 15. The value of R56 is changed from 68 ohms to 120 ohms, ½ watt (C-9B1-51).

Ref. No.	*Part No.*	*Description*
C61	A-8C-18487	30-30 μf x 450 volts, 125 μf x 25 volts
	B-5B-18552-85	Tuning knob (vernier)
	B-2M-18553	Vernier disk
	B-55P-18638	Focus magnet
	A-51A-15713	Iron core, for L4, 8, 9
	A-10B-18794	Vertical size control (screwdriver shaft)
	A-10B-18795	Linearity size control (screwdriver shaft).

In later production, group numbers (chassis identification numbers) were assigned to each set. The production changes made are explained below:

Code 16 or Group Numbers 6,700 to 8,999. Video trap coil L19 was relocated and connected to pin 7 of the 12AU7 video amplifier, tube 8, and L16. Peaking coil L21 (A-16A-17961) was replaced with A-16A-18685 (white dot). The high-voltage capacitor and socket assembly (N-201-18161) was removed and replaced with a wafer tube socket (A-15C-18735), high-voltage ring (A-62C-18734), two insulators (A-5M-18733), and mounting hardware. A 2.2-ohm, ½-watt, wire-bound resistor (C-9C1-1067) or a filament choke (A-16A-18785) was added in series with the 1X2 filament lead as shown in Fig. 3.

Code 17 or Group Numbers 9,000 to 12,399. To reduce capacitor failures, capacitor C64 is replaced with a 0.01-μf, 600-volt capacitor (C-8D-11128).

Code 18 or Group Numbers 12,400 to 14,199. To reduce horizontal size, the white and black leads to the horizontal-deflection transformer T6, lugs 2 and 3, respectively, were interchanged, black to lug 2 and white to lug 3.

Code 19 or Group Numbers 14,200 and above.

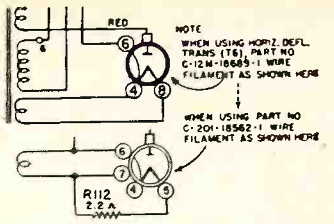

Fig. 3. Wiring for the 1X2 filament lead of the Gamble-Skogmo 94TV1-43-8940A.

Both the C-12M-18689 and C-201-18562 horizontal-deflection transformers were removed and replaced with new transformers. The part numbers are the same with the addition of a dash one (—1). The black and white horizontal-deflection-transformer leads are connected as in Code 17. Resistor R4 is changed to 10,000 ohms. Resistors R8 and R10 are grounded, C33 has been deleted, and the tuner chassis filament wiring has been changed. Pin 4 of the 6AG5 is grounded, pin 3 of the same tube and pin 3 of the 6J6 are tied to tuner terminal 8 and go to H. Pin 4 of the 6J6 is grounded. C30, C31, and C32 have been deleted. C25, C27 and C28 have been deleted. The value of R45 is changed to 220,000 ohms (C-9B1-90), and a resistor R110, 220,000 ohms, ½ watt (C-9B1-90) has been added from pin 5 of the 6SL7 sync amplifier, tube 9-A, to ground. R28 is changed to 120 ohms.

Resistor R109 has been added across transformer T1, from pin 5 to pin 6 of the 6AU6 3rd i.f. The value of resistor R107 (see Code 11) has been changed from 3900 ohms to 5600 ohms. To eliminate vertical jitters, R73 is changed to 68,000 ohms (C-9B1-84). R72 is changed to 1.5 megohms (C-9B1-100). C95 is changed to 0.02 μf (C-8D-17607). C106 is changed to 0.1 μf (C-8D-10771). Capacitor C91 is deleted. C90 has been relocated to between R77 and C95, and its value has been changed to 0.005 μf (C-8D-17608). A dual control and switch (A-10A-18441) has been added to the parts list. Resistor R3 has been deleted from lug 2 (antenna input). Lug 2 is now connected directly to lug 4, 1 and 3 are connected to the antenna input terminals.

Five different horizontal deflection transformers T6 have been used on the various production runs.

1. Chassis Coded 1 through 12. These chassis use part number C-12M-18285 transformer. This is a laminated iron core transformer with a 5-lug terminal board. This transformer should be used for replacement. The C-12M-18689 transformer can be used for replacement if the agc leads are removed from lugs 5 and 6 (left hanging free) and a 1-megohm, 1-watt resistor is added from lug 5 to the blue 6BQ6 plate lead terminal. If horizontal non-linearity (left-hand bulge) is noticed on any of these chassis, it may be corrected by reversing the leads connected to terminals 2 and 3.

2. Chassis Coded 13 through 15 and Group Numbers to 14,200. These chassis use either part number C-12M-18689 or part number C-201-18562 transformers. The C-12M-18689 is a laminated iron core transformer with a 6-lug terminal board, and the C-201-18562 is a molded iron core transformer (racetrack shape) with 5 lugs on one side of the terminal

(Continued on page 15)

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These same advantages are available in the Dual Concentric Midgetrol, tailor-made on the job to match each specific requirement. It is assembled in five easy steps, in less than five minutes, using complete, *factory-inspected* control sections. You can make over 10,000 different combinations from sub-assemblies available in distributor stocks.

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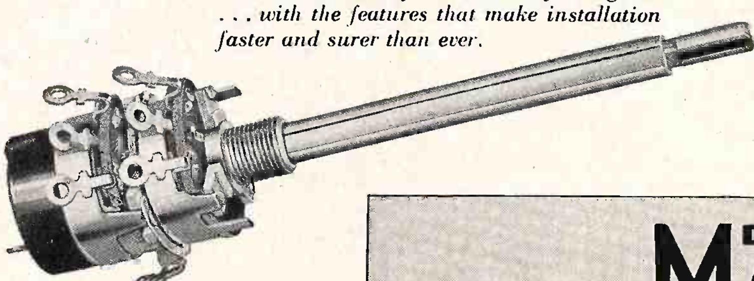

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(Continued from page 13)

board and two on the other. These transformers are interchangeable except for resistor R-107 (3900 ohms, 2 watts). Resistor R-107 is used only with the C-201-18562 transformer. If horizontal non-linearity is noticed on any of these chassis, reverse the leads connected to terminals 2 and 3 or add a 2900-ohm resistor. If the C-12M-18689 transformer is used, the 3900-ohm, 2-watt resistor should be added, and if the C-201-18562 transformer is used, another 3900-ohm, 2-watt resistor should be used in parallel with the one wired in the chassis. These changes have been made in receivers that were converted. Converted receivrs can be identified by a dot behind the Model No. on the decal or chassis.

3. Chassis with Group Numbers 14,200 and up. These chassis use either part number C-12M-18689-1 or a C-201-18562-1 transformer. The dash one transformers are identical, except they have fewer turns on the output section. These transformers are interchangeable.

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Crosley 11-442M1U, 11-444MU, 11-453MU, 11-460MU, 11-470BU, 11-472B1U, 11-474BU, 11-483BU, Ch. 331, 331-1, 331-2; 11-443MU, 11-454MU, 11-458MU, 11-473BU, 11-484BU, Ch. 323, 323-1, 323-2

Chassis 331-1 and 331-2 are similar to Chassis 331 except for the changes noted below. Chassis 323-1 and 323-2 are similar to Chassis 323 except for the changes noted below.

Chassis 323-1 and 331-1 are equipped with a 6T8 tube (V110A, V110B) mounted on a plate and socket assembly (Part No. AB-150226). A 0.005-μf, 500-volt ceramic disc capacitor (Part No. 144675-2) is connected from lug 2 of the socket to ground. All other parts and connections to the socket for Chassis 323-1 and 331-1 are identical to those shown in the schematic wiring diagrams for Chassis 323 and 331, respectively.

Chassis 323-2 and 331-2 are equipped with a 6AL5 tube (V110A) and a 6AV6 tube (V110B), which have their sockets mounted on a socket and plate assembly (Part No. AB-150227). This assembly consists of the parts and wiring shown in the accompanying illustration. Capacitor C183 is a 0.005-μf, 500-volt, ceramic disk capacitor (Part No. C-144675-2). Resistor R147 is a 3.9-megohm, 10%, ½-watt resistor (Part No. 39374-75). The Part No. of the socket is 146966.

The following changes apply to Chassis 331, 331-1, and 331-2, only. The main chassis Parts List for Chassis 331 should include an audio output transformer T103, Part No. 149460. It is used on models equipped with the 5¼", 50-ohm, e-m speaker SP101 (Part No. AD-149502). The audio output transformer T110 (Part No. 149654) is used on all models equipped with 10 p-m speakers. The Part No. of the fuse F101 should be W-150431 instead of W-150065. The Part No. of the power cable and plug assembly CA102, used on Models 11-444MU and 11-474BU, should be AW-149652 instead of C-132300-6. The C-132300-6 cable is used on the models that are not equipped with radio and record changer. The Part No. of the springs used on the control access doors is W-149095.

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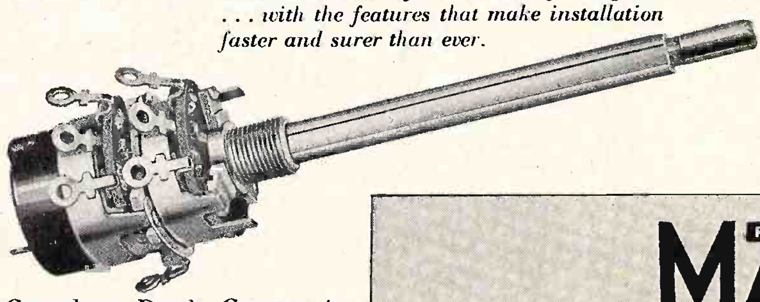

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(Continued from page 13)

board and two on the other. These transformers are interchangeable except for resistor R-107 (3900 ohms, 2 watts). Resistor R-107 is used only with the C-201-18562 transformer. If horizontal non-linearity is noticed on any of these chassis, reverse the leads connected to terminals 2 and 3 or add a 2900-ohm resistor. If the C-12M-18689 transformer is used, the 3900-ohm, 2-watt resistor should be added, and if the C-201-18562 transformer is used, another 3900-ohm, 2-watt resistor should be used in parallel with the one wired in the chassis. These changes have been made in receivers that were converted. Converted receivrs can be identified by a dot behind the Model No. on the decal or chassis.

3. Chassis with Group Numbers 14,200 and up. These chassis use either part number C-12M-18689-1 or a C-201-18562-1 transformer. The dash one transformers are identical, except they have fewer turns on the output section. These transformers are interchangeable.

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Crosley 11-442M1U, 11-444MU, 11-453MU, 11-460MU, 11-470BU, 11-472B1U, 11-474BU, 11-483BU, Ch. 331, 331-1, 331-2; 11-443MU, 11-454MU, 11-458MU, 11-473BU, 11-484BU, Ch. 323, 323-1, 323-2

Chassis 331-1 and 331-2 are similar to Chassis 331 except for the changes noted below. Chassis 323-1 and 323-2 are similar to Chassis 323 except for the changes noted below.

Chassis 323-1 and 331-1 are equipped with a 6T8 tube (V110A, V110B) mounted on a plate and socket assembly (Part No. AB-150226). A 0.005-μf, 500-volt ceramic disc capacitor (Part No. 144675-2) is connected from lug 2 of the socket to ground. All other parts and connections to the socket for Chassis 323-1 and 331-1 are identical to those shown in the schematic wiring diagrams for Chassis 323 and 331, respectively.

Chassis 323-2 and 331-2 are equipped with a 6AL5 tube (V110A) and a 6AV6 tube (V110B), which have their sockets mounted on a socket and plate assembly (Part No. AB-150227). This assembly consists of the parts and wiring shown in the accompanying illustration. Capacitor C183 is a 0.005-μf, 500-volt, ceramic disk capacitor (Part No. C-144675-2). Resistor R147 is a 3.9-megohm, 10%, ½-watt resistor (Part No. 39374-75). The Part No. of the socket is 146966.

The following changes apply to Chassis 331, 331-1, and 331-2, only. The main chassis Parts List for Chassis 331 should include an audio output transformer T103, Part No. 149460. It is used on models equipped with the 5¼", 50-ohm, e-m speaker SP101 (Part No. AD-149502). The audio output transformer T110 (Part No. 149654) is used on all models equipped with 10 p-m speakers. The Part No. of the fuse F101 should be W-150431 instead of W-150065. The Part No. of the power cable and plug assembly CA102, used on Models 11-444MU and 11-474BU, should be AW-149652 instead of C-132300-6. The C-132300-6 cable is used on the models that are not equipped with radio and record changer. The Part No. of the springs used on the control access doors is W-149095.

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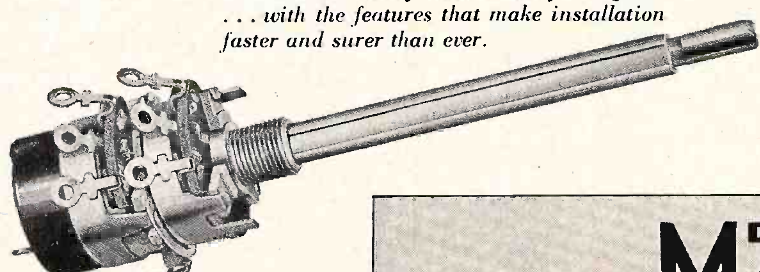

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Gamble-Skogmo 94TV1-43-8940A

(Continued from page 13)

board and two on the other. These transformers are interchangeable except for resistor R-107 (3900 ohms, 2 watts). Resistor R-107 is used only with the C-201-18562 transformer. If horizontal non-linearity is noticed on any of these chassis, reverse the leads connected to terminals 2 and 3 or add a 2900-ohm resistor. If the C-12M-18689 transformer is used, the 3900-ohm, 2-watt resistor should be added, and if the C-201-18562 transformer is used, another 3900-ohm, 2-watt resistor should be used in parallel with the one wired in the chassis. These changes have been made in receivers that were converted. Converted receivrs can be identified by a dot behind the Model No. on the decal or chassis.

3. Chassis with Group Numbers 14,200 and up. These chassis use either part number C-12M-18689-1 or a C-201-18562-1 transformer. The dash one transformers are identical, except they have fewer turns on the output section. These transformers are interchangeable.

Crosley 11-442M1U, 11-444MU, 11-453MU, 11-460MU, 11-470BU, 11-472B1U, 11-474BU, 11-483BU, Ch. 331, 331-1, 331-2; 11-443MU, 11-454MU, 11-458MU, 11-473BU, 11-484BU, Ch. 323, 323-1, 323-2

Chassis 331-1 and 331-2 are similar to Chassis 331 except for the changes noted below. Chassis 323-1 and 323-2 are similar to Chassis 323 except for the changes noted below.

Chassis 323-1 and 331-1 are equipped with a 6T8 tube (V110A, V110B) mounted on a plate and socket assembly (Part No. AB-150226). A 0.005-μf, 500-volt ceramic disc capacitor (Part No. 144675-2) is connected from lug 2 of the socket to ground. All other parts and connections to the socket for Chassis 323-1 and 331-1 are identical to those shown in the schematic wiring diagrams for Chassis 323 and 331, respectively.

Chassis 323-2 and 331-2 are equipped with a 6AL5 tube (V110A) and a 6AV6 tube (V110B), which have their sockets mounted on a socket and plate assembly (Part No. AB-150227). This assembly consists of the parts and wiring shown in the accompanying illustration. Capacitor C183 is a 0.005-μf, 500-volt, ceramic disk capacitor (Part No. C-144675-2). Resistor R147 is a 3.9-megohm, 10%, ½-watt resistor (Part No. 39374-75). The Part No. of the socket is 146966.

The following changes apply to Chassis 331, 331-1, and 331-2, only. The main chassis Parts List for Chassis 331 should include an audio output transformer T103, Part No. 149460. It is used on models equipped with the 5¼", 50-ohm, e-m speaker SP101 (Part No. AD-149502). The audio output transformer T110 (Part No. 149654) is used on all models equipped with 10 p-m speakers. The Part No. of the fuse F101 should be W-150431 instead of W-150065. The Part No. of the power cable and plug assembly CA102, used on Models 11-444MU and 11-474BU, should be AW-149652 instead of C-132300-6. The C-132300-6 cable is used on the models that are not equipped with radio and record changer. The Part No. of the springs used on the control access doors is W-149095.

Radio Changes

Farnsworth 100P Series, 400P Series, Capehart; RCD. CH. 41E-MP

The Farnsworth "P" Series (Models 406P, 410P, 413P, 414P, and 115P2), Capehart, instruments are similar to the Farnsworth "N" Series, Capehart. The 400P models use a P1-A amplifier which is identical to the N1 amplifier with the exception of the tone filter circuit, shown in Fig. 1, inserted from the plate of the 6J5 tube 4 to the grid of the 6J5 tube 5. The 100P models use a P2-A amplifier which is identical to the N2 amplifier with the exception of the tone filter circuit, shown in Fig. 1, inserted from the plate of the 6J5 tube 3 to the grid of the 6J5 tube 4.

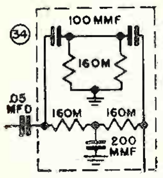


Fig. 1. Tone filter circuit, Farnsworth P series.

The P series use a 41E-MP automatic record changer. This changer retains the basic principles of the 41-E changer used in the N series. It incorporates, however, a number of changes from the 41-E changer, as listed below:

1. Different external appearance.
2. Weighs 40 pounds.
3. Rollers in the record magazine and chrome-plating on surfaces which contact the record, facilitate record handling during the record change cycle.
4. Separate rim-drive motor eliminates wows due to gearing. A second motor powers all record-changing functions.
5. Independent adjust screws are provided for setting the tone-arm landing.
6. A chrome-plated turntable cover that insures that records, including those having knife-edges, properly center on the turntable spindle.
7. Automatic play control turns off the changer after the desired number of selections have been played.
8. Uses the "Magnetic True Timbre" pickup, which is of the variable reluctance type. The 41-E uses the variable resistance-type pickup. Frequency reproduction from both pickups is approximately 30 to 10,000 cps.

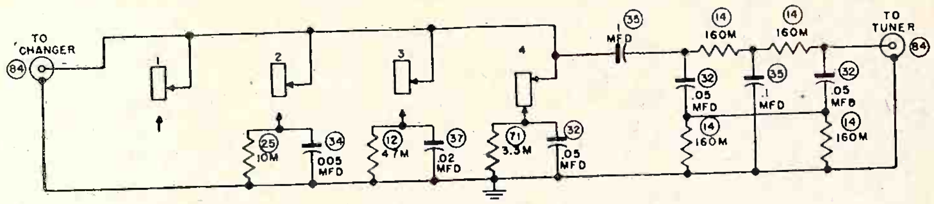


Fig. 3. Noise eliminator circuit, Farnsworth P series.

The changeover from the variable resistance type pickup to this new pickup, has necessitated the following revisions in the phono-preamplifier circuit. The 6J7 tube is now used in a 1st phono-preamplifier pentode stage, the input circuit to which has been revised to comply with the impedance of the new pickup, as shown in Fig. 2. The 6H6 a-m detector tube has been replaced by a 6SR7, the diode sections of which are used in the same circuit as was used with the 6H6. The triode section of this tube, however, is used as a 2nd phono-preamplifier, thereby, furnishing the needed gain for the variable reluctance type pickup whose maximum output is approximately 11 millivolts. Voltage and resistance readings of the 6SR7 and 6J7 tubes are shown below.

	6SR7		6J7	
Pin	Volts	Ohms	Volts	Ohms
1	0	0	0	0
2	—4.1	1meg	3.1ac	15
3	0	0	38	0.6meg
4	—4	170M	26	2.3meg
5	—6	0.9meg	0	0
6	84	160M	190	8M
7	3.1ac	15	3.1ac	15
8	3.1ac	15	0	0
			CAP —1	CAP 0.8meg

A 2.2-megohm resistor has been added from pin 5 of the 6SR7 to the junction of the 1-megohm resistor, which goes to pin 4 of the 1st i-f amplifier, and the 0.1-μf capacitor in the grid circuit of the 1st i-f amplifier. A 100-$\mu\mu$f capacitor is connected from pin 5 of the 6SR7 to pin 8 of the 2nd i-f amplifier. A 0.1-μf capacitor has been connected from pin 6 of the 2nd i-f amplifier to ground. The 100,000-ohm resistor goes to pin 2 of the 15-prong connector. The 15,000-ohm resistor goes to pin 3 of this connector. The 47,000-ohm resistor goes to the 2.2-megohm resistor connected to the f-m connection on section 1A Rear and to the junction of the two 80-$\mu\mu$f capacitors connected to pins 8 and 3 of the 6H6 discriminator. An additional change that has been made in the P series tuner is that the 15,000-ohm resistor, connected in the N series to the junction of the 10-μf capacitor and the 100,000-ohm resistor going to pin 5 of the 6SN7 audio amplifier, has been deleted.

A 56,000-ohm resistor has been added from the junction mentioned in the preceding sentence to pin 2 of the audio amplifier.

The noise eliminator circuit diagram is shown in Fig. 3. The unit is housed in a metal control box containing a four-section push-button switch. The first, or No. 1, push-button is the "open" position. In this position,

(Continued on page 19)

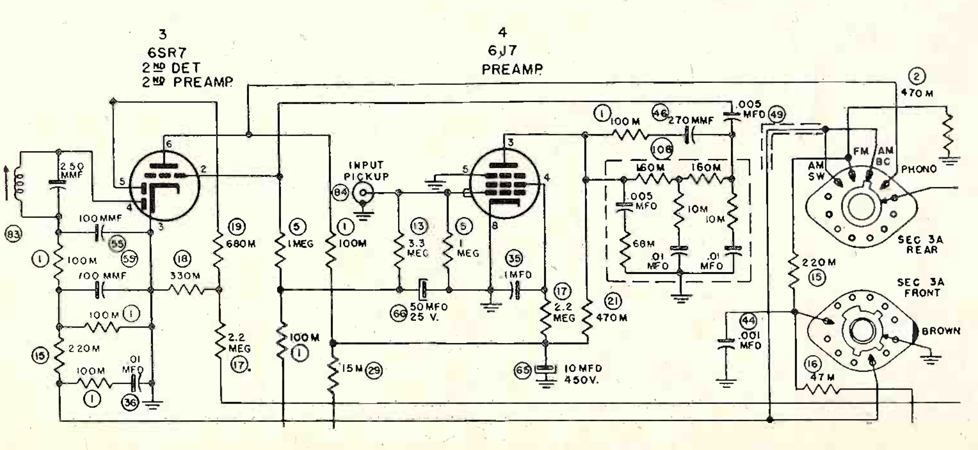
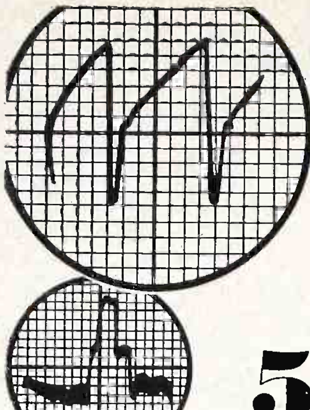
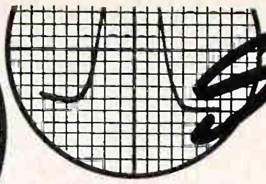
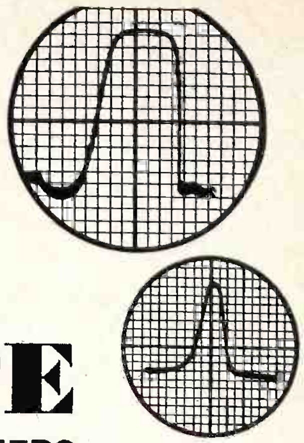


Fig. 2. Changes in phono-preamplifier circuit, Farnsworth P series.

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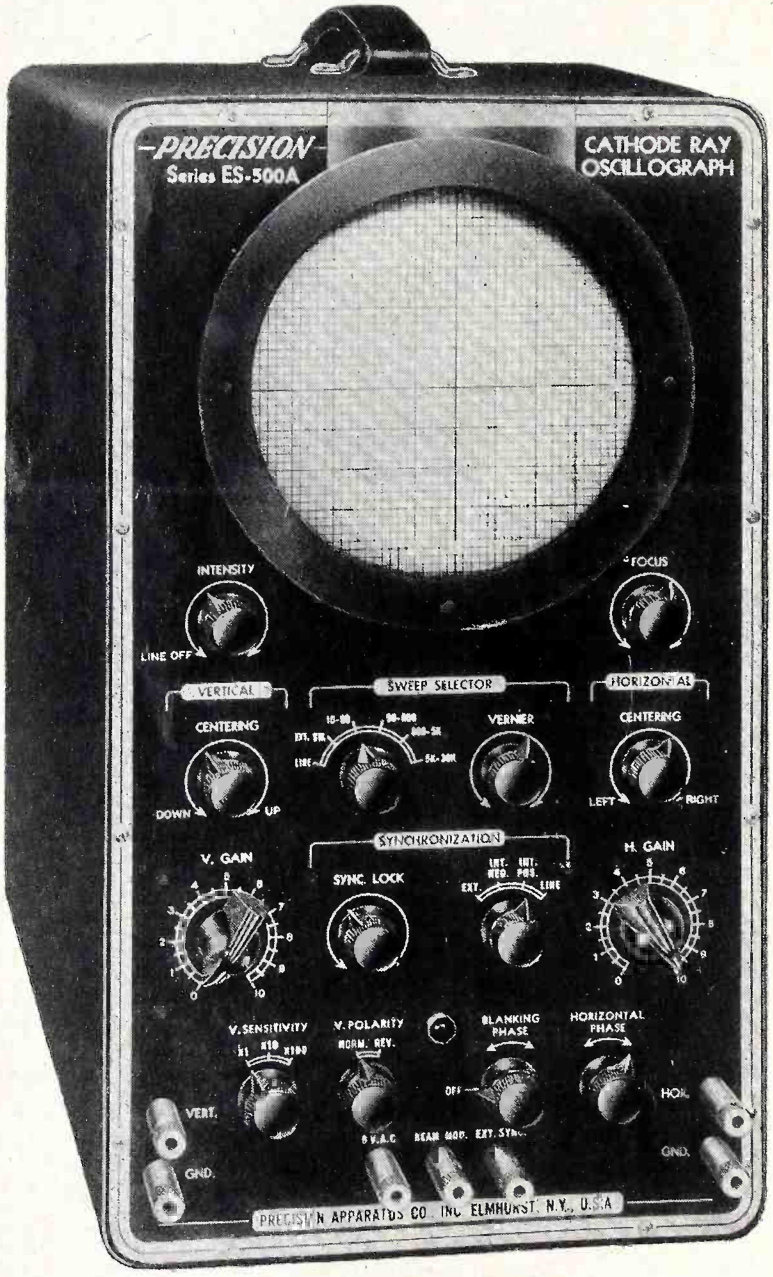

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* **Vertical Phase-Reversing Switch** permits inversion of all patterns at will. Non-frequency discriminating.
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Farnsworth 100P Series, 400P Series, Capehart; RCD. Ch. 41E-MP

(Continued from page 17)

the entire frequency response of the pickup is allowed to pass on to the preamplifier without any compensation other than that presented by the low-frequency "rumble filter." The "rumble filter" is a circuit designed to eliminate the undesirable effects of low-frequency resonance. The circuit is designed so that its resonant frequency is within the range of frequencies causing the undesirable rumble. In this case, the resonant frequency is approximately 19 cps. Positions 2, 3, and 4, shunt the pickup with parallel *R* and *C* combinations.

General Electric Model P15

To convert the model P15 record changer, RBH-015 motor, to 110, 50-cycle operation motor, the following steps are advised:

Connect a 70-ohm resistor (RRW-005) in series with the motor leads to reduce the voltage to approximately 95 volts to prevent the motor from over-heating. Replace the 60-cycle bushing on the rotor shaft, with a 50-cycle bushing (RMS-231).

The following items should be added to the replacement parts list:

RRW-005 Resistor-70 ohms, 25 watt
RMS-230 Bushing 60 cycle spring type bushing
RMS-231 Bushing-50 cycle spring type bushing.

Add to the Index Remedy: A few early P15 changers may occasionally index the tone arm for 10" records while playing 7" records. To remedy this, bend the small half-round tab on the discriminator lever (item 160, ER-S-P15) about 30° so that it will limit the downward travel of the lever.

General Electric Models 752, 753

To reduce "radio talk" when models are operated on phono, late production models have the following changes incorporated:

1. C59 which was originally grounded on the rear apron of the chassis should now be grounded to the same ground as C60. This ground point can be found near the end of the terminal board.
2. C42 should be dressed towards the end of the chassis and away from V5 as far as the leads will permit.
3. Dress the blue lead from pin 5 and green lead from pin 6 of V8 (phono preamp), in front of the terminal board instead of in back.

General Electric Models 14T2, 14T3, 14C102, 14C103, 16T1, 16T2, 16C110, 16C111 and 16C115

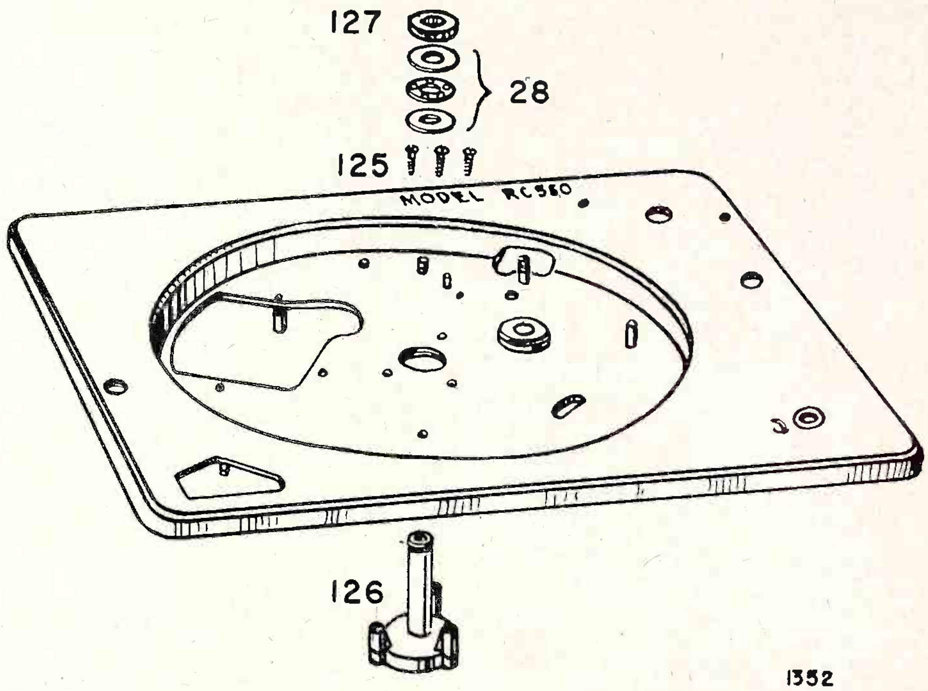
The following items should be added to the replacement parts list: Spacer part RHJ-006; Capacitor C227, 800 $\mu\mu f$; 350v (stock RCW-3037).

Place metal spacer sleeve over deflection yoke clamp screws. To reduce Channel #4 smear (4.5 Mc harmonic interference) and Channel #6 oscillations, connect C227, 800 $\mu\mu f$, 350 v, (stock RCW-3037) across the isolating gap between receiver chassis and rear edge of head-end chassis. Using as short leads as possible, solder one end of C227 to the soldered head-end chassis connection of C206 mounting clip. The other lead may be soldered to a lug fastened securely at the punched receiver chassis hole adjacent to tube socket V21. Change C227 on the schematic from a head-end chassis ground symbol to a main-chassis ground symbol.

Admiral RC550 record changer

Production changes in the RC550 record changer are listed below, coded RUN 1, RUN 2, etc. Run number stamped on model label indicates this changer has had the change(s) incorporated which are explained under that particular run number below, as well as all changes (lower run numbers) made prior to

(Continued on page 21)



1352

(Continued from page 19)

that time. At the start of production, chassis were stamped RUN 1.

RUN 1—Change in Push-Off Link and Stud Assembly (86). In early changers, push-off link and stud assembly (86) is made from .060″ stock; washer (94) used with it is 1/16″ thick. (Previous parts list erroneously gives the washer (94) thickness as 1/6″.) In later changers the link (86) was made from .074″ stock, and the washer (94) used is 1/32″ thick. The .074″ stock was used to reduce the possibility of bending of the push-off link with resulting push-off and/or trip failure. All service replacements are made from the .074″ stock. Be sure to use correct washer (94).

RUN 2—The Selector Cam (89) was modified slightly; cams are directly interchangeable, however.

RUN 3—Change in Turntable Support Hub (126). The turntable support hub (126), which was staked to the changer pan in earlier production, is now mounted to the underside of the changer pan with three drive screws. See accompanying diagram. This part is now replaceable and has part number 404A35. The screw has part number 402A68. A spacer washer (127), part number 401A364, is also added. Note that this washer was omitted when the later turntable and thrust bearing were used; see Run 4 below.

RUN 4—Change in Turntables. The original turntable, part number G400B507, has been replaced with a slightly different turntable, part number G400B585. Part number G400B585 turntable has a longer hub, and consequently a "thinner" thrust bearing, part number 415A29, is used with this turntable. The turntable support hub (126), mentioned in Run 3 above, must be used with this new turntable. *It is not necessary to stock the new turntable,* since the G400B507 turntable can always be used if suitable washers are used with either thrust bearing (28) to provide proper turntable clearance.

The parts listed below are additions and corrections to the original parts list.

Ref. No.	*Part No.*	*Description*
28	415A11	Thrust Bearing (early type; total thickness 9/32″)
28	415A29	Thrust Bearing (late type; total thickness 3/16″) (415A29 can be used in place of 415A11 if a 3/32″ spacer washer is used.) See RUN 1 in production changes.
52	G400B507	Turntable (early type: ¾″ hub): Use with 415A11 (28)
52	G400B585	Turntable (late type: 1″ hub): Use with 415A29 (28) See RUN 4 in production changes. G400B507 can always be used for replacement if suitable washer(s) are used with either thrust bearing (28) to provide proper turntable clearance.
94	4B1-78-47	Washer (early type) .196″ ID x ½″ OD x 1/16″ thick.
94	4B1-68-47	Washer (late type) .196″ ID x ½″ OD x 1/32″ thick. See RUN 1 in production changes.
125	402A268	Drive Screw, #6 x ⅜″.
126	404A35	Turntable Support Hub. See RUN 3 in production changes.
127	401A364	Spacer Washer, 13/16″ OD x 29/64″ ID x 5/32″ thick. See RUN 3 in production changes.

The following service hints are offered:

1. Record Slipping — 45 RPM. (a) The adaptor nibs may be deformed, may not fit tight enough in the record, or may be cocked. Be sure that the records are not warped. A new type of plastic adaptor will be available soon; this new adaptor will fit in the record better and will have sharper nibs. (b) Needle force may be too great for this type of record. Try removing a tone arm weight (121), part number 414A45. Two of these weights were used with the Electro-Voice cartridge, 409A13-1, and one weight was used with the Shure cartridge, 409A13.

2. Groove Skipping. Anything that may cause a drag on the tone arm will contribute to groove-skipping. For example, a worn needle will tend to skip grooves. Another possibility is that the Lubriplate (lubricant) between the gear engagement pawl (33) and the trip motion arm (32) may become excessively tacky after the changer has been in use for some time. The Lubriplate is applied between these two parts, strictly as a safety measure, to insure a friction load if the friction washer becomes loose. If the trip friction washer (34) has the correct tension, the changer will function properly with the Lubriplate removed. Therefore, we suggest that you remove all of the Lubriplate from between these two parts and leave them dry. It may be necessary to bend the washer (34) to get proper friction, but don't add too much tension. Do *NOT* remove lubricant from any other place in the changer.

3. Erratic Trip Action. This may be caused by failure of the trip slider return spring (102B) to return the trip slider (36) to proper position as the changer goes through its cycle.

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Antennas and accessories—TV, FM, AM

ALPRODCO: Model S-12R, rotating standoff TV Tower has been discontinued. Model TV Tower AT-6 has been replaced by model AT-6W. In addition two new Towers and six accessories have been added to their line.

EASY-UP TOWER: TV Tower with accessories (model 400) has been discontinued.

HI-LO ANTENNA: The dealer discount schedule has been revised to include a 25 to 49 quantity.

PHOENIX ELECTRONICS: The 10' coil and 100' coil of perforated steel strap has been discontinued. One new antenna, model PAR-6, has been added to the line.

TECHNICAL APPLIANCE: The Taco TV Master Antenna Distribution System has been revised to incorporate additional units. Also, two additional antennas have been added to the Taco line, models Super 980 and 981. Both are 5 element twin driven antennas. The former is two bay, while the latter is single bay.

TELREX: The Metro or Universal Series of conical antennas has been discontinued, while the Vanguard and Telrex "Yagi" Antennas were introduced.

Miscellaneous radio, TV, and electronic parts

BELDEN: The popular HF Formvar and Cotenamel Magnet Wire are now on 1 lb. spools.

DRAKE, R. L.: A new model High Pass TV Receiver Filter has been added to the Drake line of TV filters. Model number, TV-300-54HP.

DUOTONE: Prices for the Kolor-Vision Screen, sizes 7" to 20", decreased.

EBY SALES: Prices of two screw terminals, numbers 56-7 and 56-9 have been revised downward, while two others, numbers 56-6 and 56-8 increased.

GON-SET: A new converter, 1.6-6.0 has been introduced to the Gon-Set line at $46.00 net.

INDUSTRIAL TELEVISION: Announced production of new Cascode Autobooster, Model IT-90A. Retains all the features of IT-75A Autobooster plus higher gain and improved signal to noise factor. Made especially for sub-fringe applications and community antenna systems.

INTERNATIONAL RESISTANCE: A Precision Type Resistor (WW10) and the new LC1 type Loudness Control and Base Elements have been added to their Resistor line. Type BT2 insulated composition 2 watt resistor and assortments 10 and 11 cabinets have been discontinued.

J-B-T: Prices on an adjustable stop molded switch, model MAS-14-6 and a molded switch MS-14-6 were decreased.

MERIT TRANSFORMER: Three new transformers, models HVO-8, MDF-30 and P-3046 have been added to the company's line of transformers.

NATIONAL CARBON: Prices increased on the Eveready Air Cell "A" Batteries for 2 Volt Receivers and type A-1300 for 1.4 Volt Receivers.

RADIART: Model 5YG Antenna and Wire types ATX-9 and 10A have been added to the company's lines. Prices on No. AK-85 TV Accessory and Wire types ATX-8 and 10 have been decreased and increased respectively.

RADIO RECEPTOR: Type F1B1S1B, F2B1S1B, WF6B1S1B and WF7B1S1B industrial type Selenium Rectifiers have been discontinued, while types W1B1S1B, W2B1S1B, WW6B1S1B and WW7B1S1B were added.

RCA: Type VS016C Battery has been added to the Portable "B" series at $2.28 net.

SANGAMO: Prices on 20 items in their Type 30 Molded Tubular Paper Capacitors line have been reduced.

SPRAGUE: Printed circuits types 100C1 and 101C1 have been added to their line. Also, the Ceramic capacitors are now being listed under their new numbers, series 5GA, 5HK, 5TCC and 5TCU.

STANDARD TRANSFORMER: Stancor now producing the following components for the Williamson Amplifier: output transformer A-8054, power transformer PC 8412 and filter choke C-1411. Bulletin 382 available describes construction of amplifier with drawings and parts list.

STANWYCK: Two new G. E. type coils, numbers 980 linearity coil, and 981 width coil were introduced.

TRIPLETT: Type 3434 TV-FM Sweep Signal Generator with built-in markers, has been discontinued and replaced by model 3434A. DC Microammeters, models 521, 524, 626 and 726, in O-20 range have been discontinued. Price adjustments have been made on the DC Ammeter Switchboard Shunts, 1000 and 2000 amps., and model 325 DC Voltmeter in 1000 ohms, ranges 0-100 and 0-150.

Recording equipment, microphones, speakers, turntables, cartridges, etc.

ALTEC-LANSING: Model 820A Corner Speaker System Complete, 821A Cabinet, A-333A Amplifier and A-433A Pre-Amplifier have been added to the Altec-Lansing line of equipment.

ASTATIC: Five mikes have been added and one Switch Connector, model SC-12.

AUDIO-DEVICES: The line of Audiotape has been expanded to include two smaller reels of 150' and 300' which will be ready about the first of September.

BELL: Numerous additions and deletions to the company product line were made effective July 2, 1951. Nevertheless, a small quantity of inter-office communication systems, models 350, 351-M and B-23, is still on hand. Also Public Address Systems, models PA-3715-A, PA-3725-A and PA-3750-A are now listed less microphones, which are to be ordered separately as in the case of Stands and other accessories.

GENERAL ELECTRIC: Model RPX-009 is now available as model RKP-009, as a replacement parts kit for Triple Play Cartridge at $.15 net, less stylus assemblies.

JENSEN MFG.: Stock number ST-768, blonde mahogany finish Cabinet with 15" speaker, has been dropped and replaced with ST-838. ST-788, cordovan mahogany with 15" speaker has been changed to stock number ST-858. Also two Cabinets have been added, stock number ST-863 consisting of cordovan leg assembly and number ST-843 with a blonde leg assembly. In addition, Viking Loudspeakers, 10J12 with overall dimensions of 10⅛", depth 3 11/16", and 12J12 (overall 12 3/16", depth 4 7/16") have been discontinued. However, the 10J11 alternate design may be substituted for the 10J12 and the 12J11 alternate design may be substituted for the 12J12.

LOWELL MFG.: Models RS8-A and RS12-A, Recessed Wall Type Directional Speaker Baffles decreased in price.

MINNESOTA MINING: Have added to their line of Scotch Brand Recording Tape (both paper and plastic) a new size, ¼" tape x 300 feet.

RECOTON: Number 450, Replacement Phoneedle Kit and 36 other Recoton Replacement Needles have been added to the company's line.

STEPHENS MFG.: Prices of speakers, models 52-N (natural) and 52-S (Silver) were adjusted upward to a list of $79.00.

Test equipment

HICKOK: Two new Oscilloscopes, models 640 HA with UP-11 high actinic type CR tube and 640 LP with 5UP-7 long persistance CR tube; and model CRT Adapter for tube testers to test CR Tubes (at $9.90 net) have been added.

NATIONAL UNION: Portable picture tube checker now available at $28.75 dealer net. Can be used either in shop, customer's home or can even test the tube while in shipping carton.

Tools and hardware

KESTER SOLDER: Prices of Kester Solder were revised downward to conform with their lower tin cost.

MULTICORE: Prices of Ersin Multicore Solder were decreased.

Tubes—TV, receiving, special purpose, etc.

EUREKA TV and TUBE: Prices decreased on Picture Tubes ranging in size from 14" to 20".

GENERAL ELECTRIC: Three new types of 12" and 16" Picture Tubes have been added to the GE TV tube line.

HYTRON: Reduced prices on 6 TV picture tubes, sizes 16", 17" and 20".

RAULAND: Added to their TV Picture Tube line a new 10", 20", 21" and 24" tubes. Also reduced prices on several of their 16", 17" and 20" tubes.

RCA: Kinescope types 20CP4 and 21AP4 decreased in price to $59.00 and $61.00 respectively.

SHELDON: Prices for Sheldon TV Tubes have been revised to show prices under a 12 month warranty and a differential under a 7 month warranty.

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† The Rider Manual Page Numbers given under Television Changes are for Rider TV Manuals. The volume number is the number preceding the dash. Volume numbers preceded by an asterisk (*) apply to the 8½" by 11" page size Manual only.

The Rider Manual Page Numbers given under Radio Changes are for Rider AM-FM Manuals. The volume number is the number preceding the dash.

TV AND ELECTRONICS AS A CAREER

To the many young men and women who have asked, time and again, "How can I get into the TV and electronics industry?", John F. Rider is proud to be the first to offer definitive answers in a forthcoming publication, TV AND ELECTRONICS AS A CAREER. By Kamen and Dorf.

Both the newcomer embarking on a career and the electronics "oldtimer" who wishes to change his specialty will now be able to learn first-hand just what the electronics industry has to offer and what they must offer it in return.

Roughly speaking, the electronics industry is composed of seven branches of activity: engineering, broadcasting, manufacturing, servicing, parts and receiver distributing, sales representation, and retailing. Each of these special fields is discussed in the text by an acknowledged authority currently active in the field.

The men who have collaborated to make this book a valuable guide to the individual seeking employment in the electronics industry are J. R. Poppele, vice-president, WOR-TV, R. W. Peterson, assistant manager, Electronics Division, Admiral Corporation; W. H. Bohlke, manager, custom service operation section, RCA Service Corporation; Ira Kamen, director of TV development, Brach Manufacturing Corporation; and R. H. Dorf, television consultant.

In addition to the eight chapters covering the various phases of activity in the electronics industry, useful appendices include typical salaries for operating personnel in small and large radio stations, the curriculum of electrical engineering courses at Illinois Institute of Technology, and a listing of public and private schools teaching radio and TV courses.

The authentic, behind-the-scenes stories of such men as Benjamin Abrams, Allen B. Dumont, David Sarnoff, Ross Siragusa, Russell Sprague, Vladimir Zworykin, etc., reveal the qualities that lead to success in the industry.

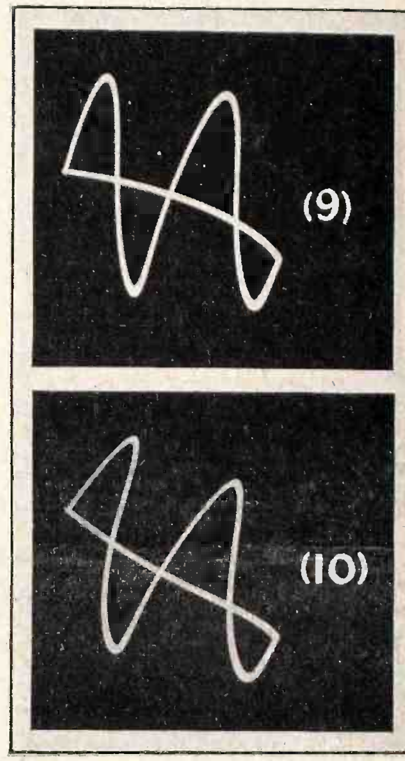
TV AND ELECTRONICS AS A CAREER will contain 130 illustrations of the industry at work and approximately 325 pages. It is priced at $4.95.

Watch for this new "Rider first" to roll off the press!

DISTORTION OF SCOPE TRACES

(Continued from page 1)

wave. (Excessive exposure thickened the trace.) Pattern 7 shows distortion in this trace when subjected to a very strong, steady magnetic field issuing from a powerful, permanent magnet (that of a magnetron assembly) which happened to be in front of the tube screen. Pattern 8 is the effect of the same magnet moved to one side of the cabinet housing. The extent of the tilt in patterns 7 and 8, and the direction of the tilt, is a function of the intensity of the external interfering field and its direction.



The effects of similar interfering field conditions on a sine wave trace are shown in patterns 9 and 10.

The solution in each case is simple: removal of the source of the interfering field. Sometimes the interference of the external field can be minimized by reorientation, but this merely shifts the plane in which the displacement of the electron beam occurs. The best remedy is increasing the distance between the scope and the device creating the field. Grounding has no effect.

More traces will be shown next month.

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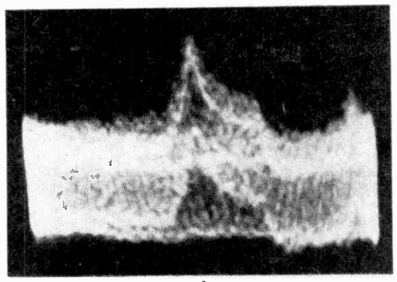
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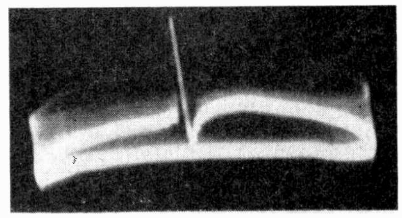
Fig. 1. Buzz waveform caused by cross-modulation in the r-f amplifier.

Fig. 2. Buzz waveform caused by horizontal and vertical crosstalk.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TV RECEIVERS

ALIGNMENT HINTS *and* INTERCARRIER RECEIVER NOISE *

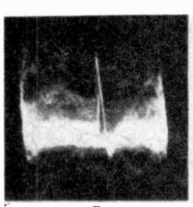
by Bob Middleton

Buzz Caused by Vertical-Output Transformer

In some intercarrier TV receivers, the vertical-output transformer will cause buzz in the sound unless the core of the transformer is securely connected to the chassis of the TV receiver. This transformer can also produce buzz because of stray field coupling. This can occasionaally be lessened by re-orienting the vertical-output transformer so that the stray field does not produce crosstalk in the audio components. Shielding the transformer with an iron case will also help in such instances.

Cross-Modulation Buzz

Buzz generated in the high-frequency circuits, video circuits, or 4.5-Mc driver, must pass through the f-m detector before it becomes an audio-frequency wave. Accordingly, it is evident that the buzz-producing circuits produce a spurious frequency modulation of the sound carrier, since amplitude modulation is normally rejected by the f-m detector. However, the fact that an improperly aligned ratio detector will respond to a-m must not be overlooked. In such cases, a-m buzz will become audible in the audio output. Also, an improperly biased gated-beam detector or an improperly operated limiter-discriminator system will pass a-m buzz.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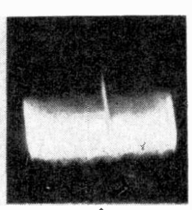
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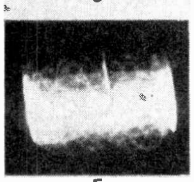
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Figs. 3, 4, 5. Buzz waveforms with various amounts of sound modulation.

Cross-modulation is produced in non-linear amplifiers. In the typical cases encountered in TV servicing, such cross-modulation will contain both a-m and f-m components. Therefore, to minimize this type of buzz, the r-f, i-f, video, and 4.5-Mc amplifiers should be operated as linear Class A amplifiers.

It should be noted that the local oscillator tube in a split-sound type of receiver may introduce hum into the audio signal if the tube develops heater-cathode leakage. The grid (cathode) bias in such cases becomes modulated at a 60-cycle rate. This produces both frequency modulation and amplitude modulation of the sound carrier. The frequency-modulation component alone is audible under normal circumstances.

Vertical Sweep Crosstalk vs. Carrier Cross-Modulation

Practically all TV receivers show some crosstalk between the vertical sweep circuit and the audio channel. This crosstalk shows up on the scope as a narrow triangular pip, riding on an elliptical baseline. This baseline is produced by the residual 60-cycle hum of the audio circuits. If the buzz and hum is below the threshold of audibility, the service engineer need not concern himself about it although the scope will show these low voltages. If the crosstalk is coming from the vertical sweep circuits, the pip will appear to revolve around the ellipse when the vertical-hold control is changed. In addition, the tone of the buzz as heard in the speaker will change. Furthermore, the pip will appear whether the receiver is tuned to an active channel or not.

Almost the same shape of pip is seen on the scope when the picture and sound carriers cross-modulate each other. This cross-modulation may take place in the r-f tuner, for example, if the grids are returned to ground instead of to a negative bias source and a strong signal is applied to the tuner. A buzz is heard in the speaker and the typical pip-on-ellipse appears on the scope screen (60-cycle line sweep used). This pip changes in height as the fine tuning control is varied. It may even go through zero and reverse in polarity (extend down instead of up) as the fine tuning control is adjusted.

The buzz waveform, as it appears on a scope connected to the discriminator output, is shown in Fig. 1. The buzz pulse rises above the tone from a TV station during the transmission of the test pattern. This buzz is caused by overloading and the resulting cross-modulatiton in the r-f amplifier. The display was obtained with a 60-cycle sine-wave sweep.

The cross-modulation pip does not revolve on the curve in response to a change in the vertical-hold control as is the case with the pip due to vertical sweep crosstalk. The pip usually stands still, because the transmitter frequently operates at the same line frequency as the receiver. However, if the pattern is observed with a relayed signal, the pip may revolve slowly on the ellipse. This rate of revolution is unchanged as the vertical-hold control is varied.

Since the horizontal-sweep circuits also crosstalk with the audio channel in most receivers, a close picket-fence of horizontal pips is usually seen with the vertical pip. This picket-fence will revolve on the elliptical baseline in accordance with the setting of the horizontal-hold control. A scope pattern showing the result of vertical and horizontal crosstalk is seen in Fig. 2. The vertical pulse shows up as a pip on the elliptically distorted baseline. The horizontal pulses appear close together around the ellipse. Only the vertical pulse is audible. The display was obtained with a 60-cycle sine-wave sweep.

(Continued on page 15)

Television Changes

DuMont RA-103

Power-line voltage fluctuation can be the cause of flickering of the picture. The indication observed on the screen of the picture tube is similar to the effect seen when an airplane flies overhead. In a number of cases where flicker was encountered, it was found to be caused by a faulty installation or a bad 6AG5 in the video i-f strip. An undamped a-c voltmeter having a range suitable for measuring 117 volts can be used to check the a-c line voltage. Once it has been established that fluctuating line voltage is causing the flicker, it is recommended that the following changes be made:

1. Connect a 0.5-μf capacitor from the cathode of the crt (arm of potentiometer R227) to the junction of R222, R223 and C216B.

2. On chassis which have not had the sync noise immunity change, involving the change of V205 from 6AC7 to 6AG7, disconnect R219 from the junction of R216, C215 and R220, and connect to a bleeder of a 27,000-ohm, ½-watt resistor connected to —12-volt line, a 8200-ohm, ½-watt resistor connected to ground, and a 25-μf, 6-volt capacitor connected to ground.

This change will make a considerable reduction of the flicker for small amounts of line variation (well under one volt). For larger amounts of line variation, size fluctuation becomes as objectionable as brightness fluctuation and the only effective solution is to use a regulated transformer.

●

Westinghouse H-226, Ch. V-2146-21DX, Ch. V-2146-25DX

The part numbers of the cabinets should be changed in the Parts List to read V-1179-1 for the mahogany cabinet and V-1179-2 for the blonde cabinet. Later production chassis have a 100,000-ohm resistor (RC20AE104M) inserted in series with the brown wire that extends from the cathode of the CRT to the rotor of the brightness control. The purpose of the added resistor is to correct for "blooming."

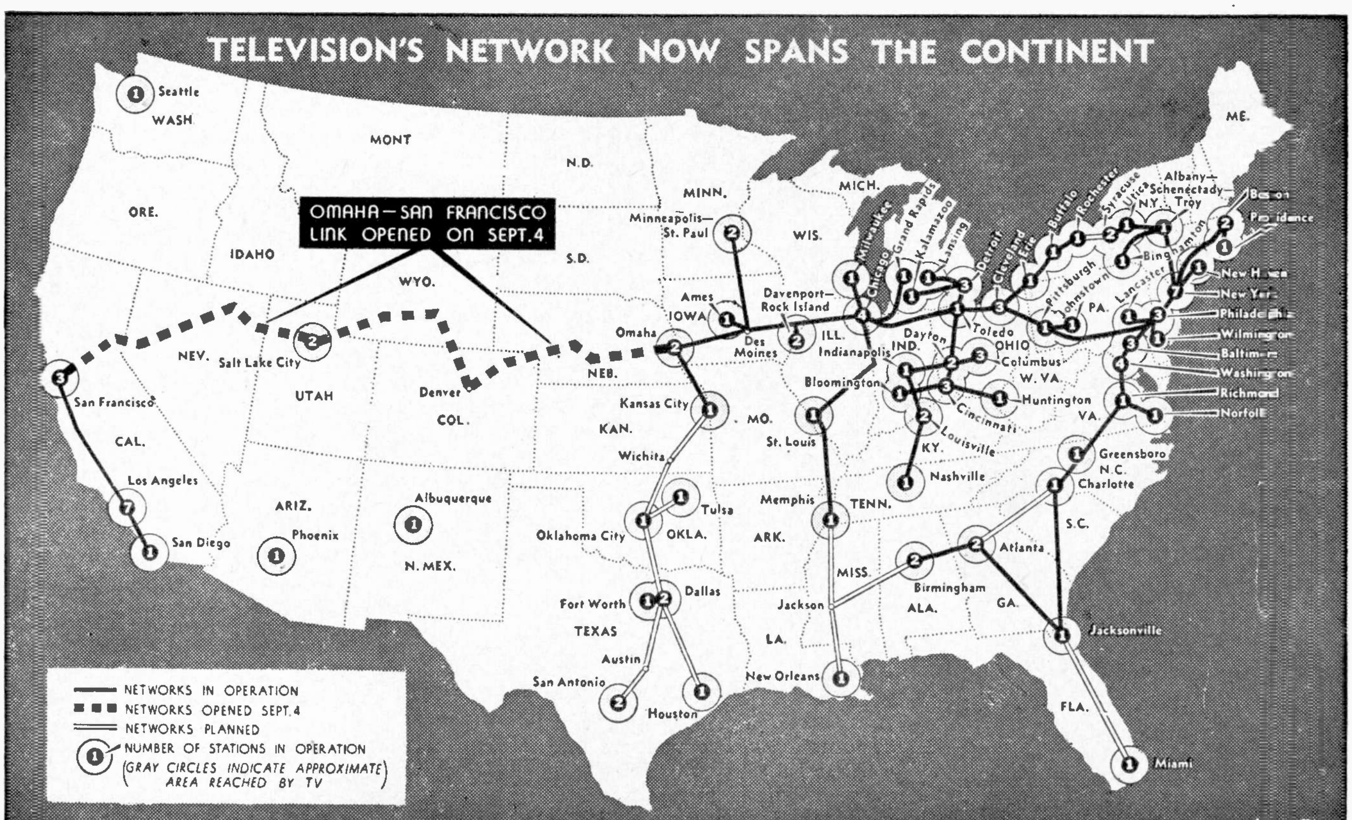
TRANSCONTINENTAL TV

Extension of the TV network westward to San Francisco brings both new opportunities and new problems to the industry. The opportunities are immediately apparent. The number of families within range of the network is now approximately 13,100,000, nearly 30 per cent of the country's total of 44,167,000. This brings the number of families now in range of all TV services, network and non-network, up to some 27,400,000. Since only 13,800,000 families, or about half the possible total, have TV sets at present, it is plain that the industry's potential market has been tremendously increased.

From the standpoint of entertainment value, another immediate benefit is the ability to interchange East and West Coast programs. The World Series coverage, relayed to the West Coast this month, and the Hollywood-originated programs sent to the East are obvious examples. Moreover, the cost of the new coast-to-coast facilities is not expected to be exorbitant. The rate by the American Telephone and Telegraph Company is approximately 10 cents per mile per half hour. Thus, for the total A. T. and T. network of about 6,000 miles, (that is, the 3,000 miles of transcontinental network plus the loops and spurs serving the East and Midwest), the cost of relaying facilities is only about $1,200 per hour, a moderate item compared to the cost of time on the network stations themselves.

Inevitably, with this great increase in facilities, there are new technical and administrative problems. The facilities of the network between San Francisco and Omaha, a distance of 1,700 miles, provides for only one "road" in each direction. This means that the four TV systems, NBC, CBS, ABC, and Dumont, must split up the time somehow between them.

Then too, there are new problems due to the difference of time between the East and West coasts. For instance, Hollywood programs timed to reach New York at night are only afternoon shows in California. The answer to this problem is still being debated. Two performances, one for each coast, the use of films, kinescoping, or a combination of all three, are possible solutions. Future experience will decide which is the most satisfactory answer. However, with all its problems, the new coast-to-coast network marks an all-important stage in the television industry.



Courtesy Mr. Manditch and N. Y. Times

IS MY SCOPE IN GOOD CONDITION?

by M. Snitzer

An oscilloscope is a pretty useful piece of test equipment, especially in these days of TV receiver servicing. However, the scope is not very helpful if it does not operate properly or if it does not operate at all. Like the scope's big brother, the TV set, much of what ails it on the inside is disclosed by the appearance of the pattern on the screen. Just as the manipulation of the operating and adjustment controls shows by its effect on the screen pattern that the circuits of the TV receiver are doing their job, so does the operation of the scope controls show whether or not the scope is operating properly. Many troubles are readily disclosed by using the cathode-ray tube itself as the trouble shooting device. Some of the checks on the scope can be performed without even applying an external signal to the scope.

Residual Hum

One check the serviceman can make is for the residual hum in his scope. This can be done by a close examination of the bright spot produced by the undeflected electron beam of the cathode-ray tube. The spot should be perfectly round with no sweep applied to the horizontal circuits and with no signal being applied through the vertical channel. Both horizontal and vertical gain controls should be at minimum setting. If the spot is elongated either vertically or horizontally, the presence of some deflecting voltage is indicated. If the input terminals of the scope are shorted (using the shortest possible length of lead) and if the sweep generator is turned off, then this elongation can be the result of residual hum in the scope.

This residual hum may be examined by turning the sweep generator on and by advancing the horizontal gain control. The pattern seen in Fig. 1 may be produced in which the slight waviness of the baseline indicates the presence of hum voltage. Residual hum may be caused by a faulty component, especially one of the power supply filter capacitors, or it may be caused by stray fields from the power transformer or power wiring within the scope itself. Heater-to-cathode leakage may also produce residual hum. If, with maximum vertical gain, the hum pattern is no worse than is shown in Fig. 1, it can be disregarded in most cases. This is true since the ordinary stray field coupling in most scopes is sufficient to produce this type of pattern at low sweep frequencies. At higher sweep frequencies, the effect is to increase the thickness of the trace.

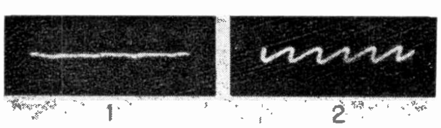


Fig. 1, 2. Residual hum waveforms.

On the other hand, if patterns such as are shown in Figs. 2 and 3 are seen with no vertical signal input, then this represents a condition that cannot be tolerated. Actually these patterns represent the result of insufficient low-voltage power supply filtering. Fig. 2 shows the effect of an open input filter capacitor while Fig. 3 shows the effect of an open output filter capacitor. In both cases a bad ripple voltage is acting to produce vertical deflection. Needless to say, the faulty components should be replaced. If the serviceman were to try to use his scope under these conditions, let us say, for example, to look at a 20 cycle sine wave, then the pattern seen in Fig. 4 would result. The sweep frequency is set to 10 cycles in this case and 2 cycles of the sine-wave signal are seen, but with 12 cycles of the 120 cps ripple voltage superimposed on the pattern.

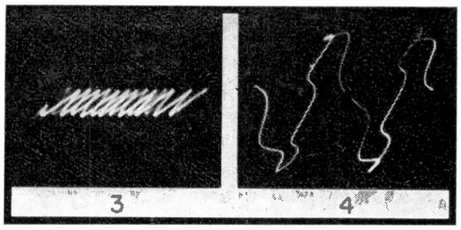


Fig. 3, 4. Waveforms with open filter capacitor.

Intensity and Focus Controls

Having determined that the residual hum is within the allowable limits, the serviceman can proceed to check the operation of the scope front panel controls. First, consider the *intensity* or *brightness control.* With an undeflected spot of light on the screen, this control should be rotated through its entire range. When this control is at its minimum setting, the screen should be absolutely dark without any sign of the light spot being visible. When the control is advanced to its maximum setting, the spot should be so bright that considerable halation occurs. A dim circle of light surrounds the intense spot of light. The control is then reduced until the halation ring disappears. The intensity control should then be reasonably close to its mid-position setting.

The *focus control* can then be adjusted to determine whether or not its operation is proper. When this control is set to either its minimum or maximum positions, a large, poorly defined, defocused spot should be seen. The control is then adjusted for minimum spot size. A sharply focused pinpoint of light should appear on the screen with this control set reasonably close to its mid-position.

If either of these controls do not operate properly, the scope should be removed from its cabinet and their related components and circuits checked. The controls themselves should be checked with an ohmmeter first for opens, shorts, and for smooth variations in resistance. To check the intensity control further, the intensity-grid voltage of the cathode-ray tube should be measured as the intensity control is varied. If this voltage does not fall within its normal limits or the values specified by the manufacturer, the reason for the incorrect reading should be investigated by checking back into the power supply, the voltage dividers, and the associated components. If the measured voltage is correct, then the cathode-ray tube should be suspected.

To check the focus control, the focus-anode voltage of the cathode-ray tube should be measured as the control is varied. If the voltage is not normal, the power supply and voltage divider should be checked into. A normal voltage reading indicates that the cathode-ray tube may be at fault. Sometimes, with a pattern on the screen and the focus control properly set, it is found that the trace is out of focus over a *portion* of the screen. To correct this condition, some scopes have an internal astigmatism control that must be readjusted along with the focus control.

Positioning Controls

Both horizontal and vertical *positioning* or *centering controls* can be checked by operating with the undeflected spot still showing on the screen. The vertical positioning control should have sufficient range of operation so that the spot is moved completely off the top and bottom of the screen. The horizontal positioning control should be able to move the spot completely off the screen both to the right and to the left. Both these controls should be near their mid-settings when the spot is at the exact center of the screen.

The spot motion may be sluggish and may lag behind the controls. This is a normal condition in many scopes and should not be considered a fault. It is caused by the very large time constants of the deflection plate coupling circuits. This means that when the d-c positioning voltage is varied, a second or more must elapse before the large coupling capacitors can change their charge accordingly.

If the positioning controls do not operate as mentioned above, the controls themselves should be checked by measuring the deflection plate voltages as the controls are varied. If the voltage is incorrect, the scope power supply should be checked. If the voltage is normal, the cathode-ray tube is probably at fault.

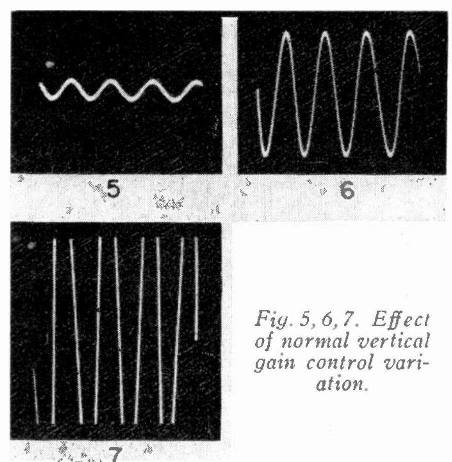


Fig. 5, 6, 7. Effect of normal vertical gain control variation.

Gain and Attenuator Controls

The vertical and horizontal *gain* or *amplitude controls* and the *attenuators* (if used) should also be operated to determine whether these controls and their associated circuits are operating properly. Before using these controls, apply deflecting signals to the cathode-ray tube. The horizontal signal can be obtained from the internal sawtooth genera-

(Continued on page 20)

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Please rush me details on the Hytron Easy Budget Plan.

Name .... (please print)

Street ....

City .... *State* ....

Successful SERVICING
REG. U.S. PAT. OFF.
Vol. 12 OCTOBER, 1951 No. 12
Dedicated to the financial and technical advancement of the Electronic Maintenance Personnel

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JOHN F. RIDER, Editor

CURTAIN TIME

Unfair Press

We have before us a vivid example of what we deem to be "unfair press" for the television technician. We gave a talk to several hundred servicemen in Pittsburgh on the evening of September 19th. A reporter from the *Pittsburgh Sun-Telegram* was there. We gave examples of malpractices by some *few* television technicians and contended that it was unfair to indict the whole industry for the actions of these few. We also stated that licensing was inevitable because the City Fathers in many communities had come to the conclusion that policing of the industry was required—especially after some of them had some unfortunate experiences.

We stated that we were wholly opposed to licensing, as was the entire radio servicing industry, but that the day had come when the industry is face to face with the issue—namely, licensing in many parts of the United States. That being the case, we asked the listeners to become *active* in the preparation and the contents of the licensing bills, to find out what their city or state legislators were doing about it! We warned them that if they did not take a hand in the formation of the regulations, they would be forced to operate under some very stringent and very unfair ordinances. We pleaded that the men not be apathetic in their efforts—that no service shop was *too busy* to attend city council hearings on TV servicing bills.

We have before us the article written by the reporter who attended the meeting. It represents the rankest of journalism tactics. He selected those parts of the talk which suited his fancy and omitted everything else. He deliberately chose those fractions of sentences which were uncomplimentary to the television servicing industry, omitting those ideas which were favorable. Fortunately the entire talk was recorded. In every way his article was a deliberate attempt to hurt rather than help. It is a sad commentary on this segment of the fifth estate.

Passive Attitude Prevails

A passive attitude has prevailed concerning unfair press of this kind. The television servicing industry is here to stay—small shop and big shop. The public needs them and the industry needs every one of these facilities. To allow newspapers and magazines to ride the pants off the industry as a whole is very bad. Every television set distributor—every television set dealer—every television receiver manufacturer—every television parts manufacturer has a duty to the television servicing industry and to himself. . . . These wrong quotations, wholesale indictments, and tricked gimmicks, must be stopped.

We have a free press it is true, but it must be a *fair* press. The fact that dishonest servicemen practice, and a sensational article based on 5 or 10 cases can be proved, does not mean that all who practice the trade are dishonest. The television servicing industry's voice is a weak one shouting in the wilderness. Help must come from the producers of receivers and all the vendors of receivers. This aid must stop the *unfair* press. Fair and honest press is all right—but an unfair press defeats everything which everyone is trying to attain.

Every dollar spent by the receiver manufacturers, set distributors, parts manufacturers, and parts distributors, to help raise the technical level of the servicing industry by lectures and demonstrations, is money thrown into a drain as long as the unfair press exists. What good are all these efforts if newspapers and magazines make life, for the industry as a whole, very difficult? Why should men attend lectures and make an effort to become better qualified when they start out with two strikes against them—a bad name! Why should men enter the television servicing business when, no matter how good they are, they face the threat daily of sensational headlines; when good and bad are treated alike—and all are called bad.

There is no reason why a newspaper which indicts the whole television servicing industry because of the malpractices of a few should carry advertising of television receivers. We understand that several television manufacturers have withdrawn their advertising from one weekly publication which published an unfair and obviously biased article on the television serviceman. Congratulations to those manufacturers!

State All the Facts

Fair press is fine. It can be as critical as it wants to be, but state *all* the facts—not only those which are unfavorable and therefore make sensational copy. The newspaper or magazine which publishes an article hounding the television servicing industry is not helping the industry, nor is it aiding its readers. Somewhere along the line these readers' television receivers will require service. Where shall they go for such work? Do newspapers and magazines determine which shops are good? . . . No, they seek out the bad ones, and then, imply that all are bad. Who then, repaired those millions of TV receivers which are functioning properly? Newspaper reporting and magazine editing of this kind are a disgrace.

Advertisers Must Aid

The television servicing industry needs help. It does not have the funds to carry a fight to the public. Those organizations who advertise to the public at large *must* aid the television serviceman. The unfair press must cease—it is a dangerous press. All it takes is a line or two at the bottom of each ad. How about it, Mr. Manufacturer, Distributor, Set Dealer?

JOHN F. RIDER

ATTENTION AUTHORS:

We are soliciting articles concerning radio, television, and allied electronic maintenance. All aspects are of interest. Articles of 1,000 to 2,000 words are desired. Preference is given to subject matter which reflects practical work rather than theory. The presentation should be *direct*, to the *point*, and amply illustrated. Finished art work will be prepared by us from the roughs submitted. Photographs are welcome. The rate of payment is on a word basis—and, needless to say, good writing rates good pay!

Submit all articles and inquiries to Editor, *Successful Servicing*.

**JOHN F. RIDER PUBLISHER, Inc.
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New York 13, N. Y.**

Television Changes

Belmont 10AXF44, Ch. 10AX21, M-701; Ch. 10AX22

Hum in the picture, evidenced by snake-like wavering, or a horizontal displacement of a portion of the picture or raster in the 10AX series chassis, can easily be corrected after first determining the cause. To determine the cause, follow the procedure given below:

1. Momentarily short pins 1 and 2 (horizontal winding) of the deflection yoke socket and quickly notice the white vertical line on the face of the picture tube.
2. If the line wavers or is displaced horizontally, remove the power transformer mounting bolts and replace the insulated washers with metal lock-washers.
3. If the vertical line did not waver in the above check, then short the grid of the horizontal multivibrator (pin 4 of tube 16) to ground, and manually sync the horizontal hold control and notice if hum continues to exist.

If in step 3 the hum does not displace the picture horizontally, the cause may be a cathode-to-filament leakage in tube 15 or tubes 1 through 9, or improper 155-volt or 250-volt B+ filtering; or, the cause may be one of the following:

1. Shorted resistor R-103.
2. Improper 350-volt filtering.
   a. Faulty input or output filtering capacitors, C-118A or C-118B.
   b. Shorted choke L-25.
   c. Defective 5U4 tube.
3. Faulty power transformer.
   a. Secondary winding connected wrong, making the windings in phase giving half-wave rectification. This condition can be identified by placing a voltmeter between pins 4 and 6 of the 5U4 and obtaining a zero reading instead of 700 volts a.c.
   b. Secondary windings different or a shorted portion will give different voltages at pins 4 and 6 of the 5U4 to ground. This condition can be checked by measuring the voltages or checking the ripple content with an oscilloscope (60 cycles).

●

Westinghouse H-231, Radio Ch. V-2137-3, V-2137-3S

The tone compensating capacitor (C21 on the V-2137-3 radio chassis schematic; C24 on the V-2137-3S radio chassis schematic) is correctly shown as 0.01 μf in the service notes. However, a 0.002-μf capacitor was used in some of the early production chassis. In these chassis, the tone control range can be increased by inserting a 0.01-μf capacitor in place of the 0.002-μf capacitor.

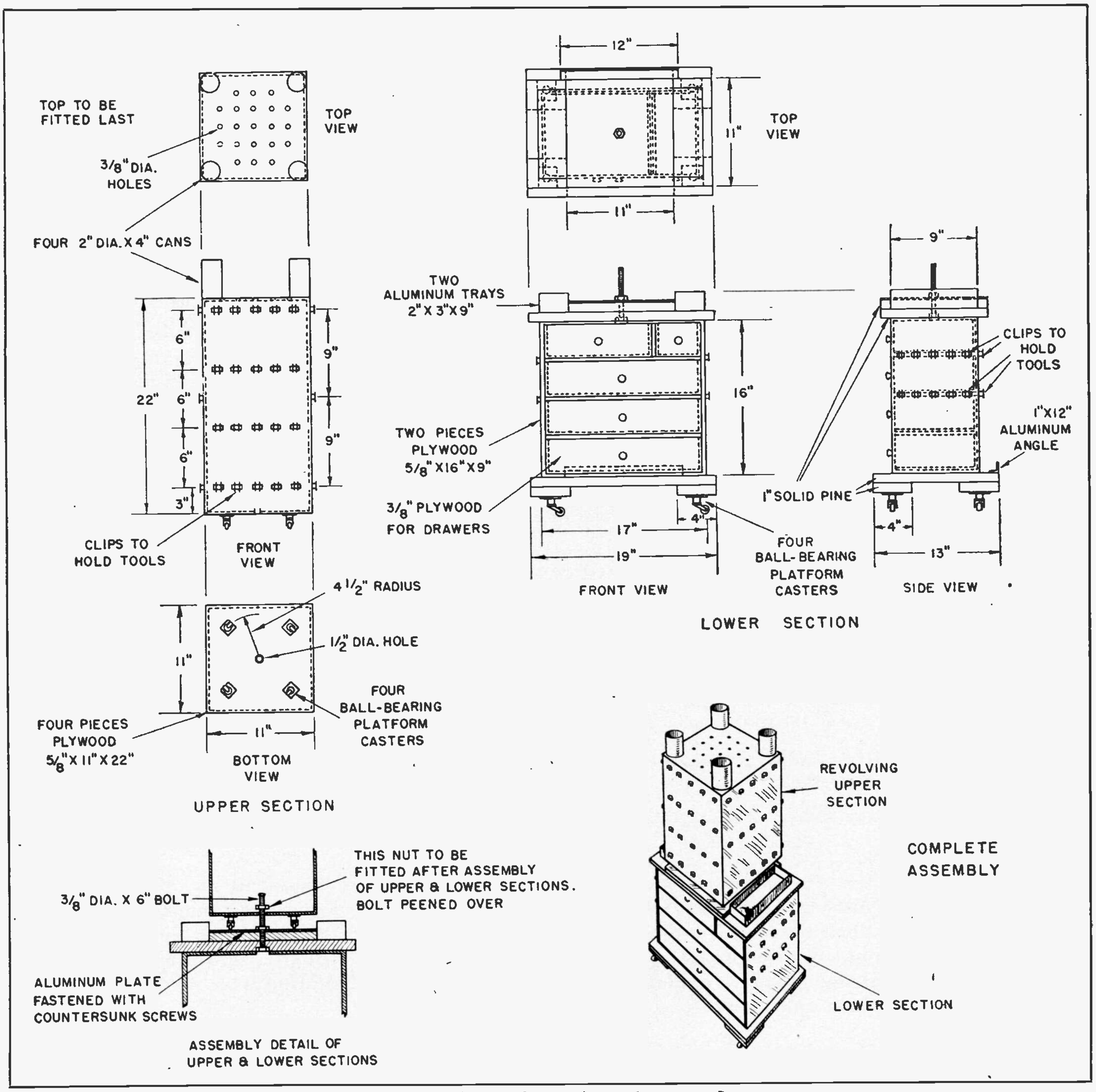
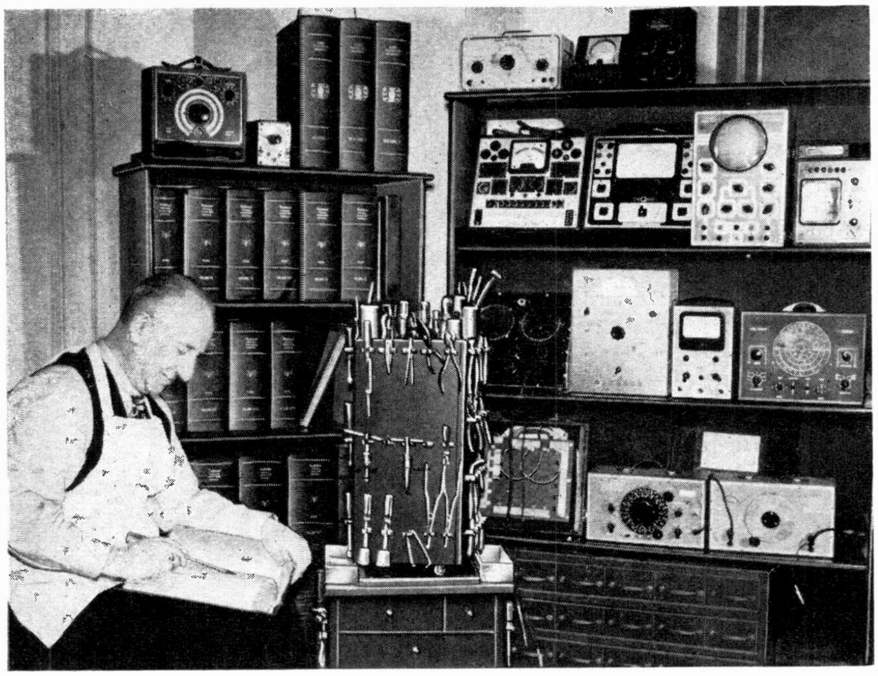


Diagram of Lazy Susan discussed on page 7.

YOUR WORK—HIS HOBBY



Marcus Moses at work—his "Lazy Susan" within easy reach.

Marcus Moses' approach to the radio servicing field is an unusual one. He is a 59 year old New Yorker who "plays" around with equipment—just for fun! The finest servicing publications, meters and tools are accumulated by him with the same avidity that others collect rare antiques or baseballs hit into the bleachers by a favorite batter.

As a fascination for his hobby grew, he found that it began absorbing more and more of his time and interest, and now, he is eagerly looking forward to his retirement so that he can work at it full time. Mr. Moses became interested in electronics about 10 years ago and he set out to learn theory by attending night courses and correspondence schools. He gained practical experience by working on his friends' sets in his spare time.

Much of this work was done during the second World War when electronic equipment was scarce and often unprocurable. Mr. Moses surmounted this obstacle by salvaging old parts and using them. He built his own multimeter, audio signal generator and set analyser, and adapted an obsolete tube checker and r-f signal generator. Nowadays, of course, as we see in the photograph of his shop, Mr. Moses has the most modern equipment and—we are glad to see in the background—a full set of Rider Manuals.

He assures us he is as intensely interested in servicing now as when he first took up the hobby that grew to a full-time job.

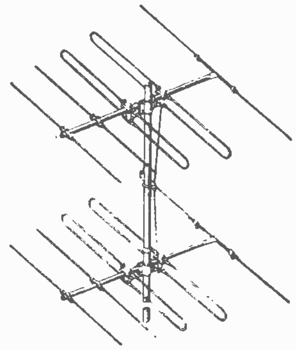
However, one home-made contraption that Mr. Moses considers too valuable to discard for something more modern, is his "Lazy Susan." This gadget has been so helpful to him in keeping his tools within easy reach that he is passing along the tip to other servicemen. He assures us that with the help of his blueprint anyone with a mechanical bent will find its construction easy. In his own "Susan," Mr. Moses keeps a comprehensive assortment of wrenches, pliers, files, clamps, wire strippers, screwdrivers, etc. To get at any of them, he simply spins his "Susan" and picks out what he needs without moving from his work.

You will find a mechanical drawing of his "Lazy Susan" on page 6. Why don't you take his friendly tip—and if you have played at being a "gadgeteer," won't you pass your ideas and designs on to us? If we feel that they might be helpful to other servicemen, we will be glad to publish them.

NEW PRODUCTS

5-Element Twin-Driven Yagi Antenna

A new antenna designed for extreme fringe area is announced by Technical Appliance. The new antenna, known as Super 980, is a 5-element twin-driven Yagi design and is

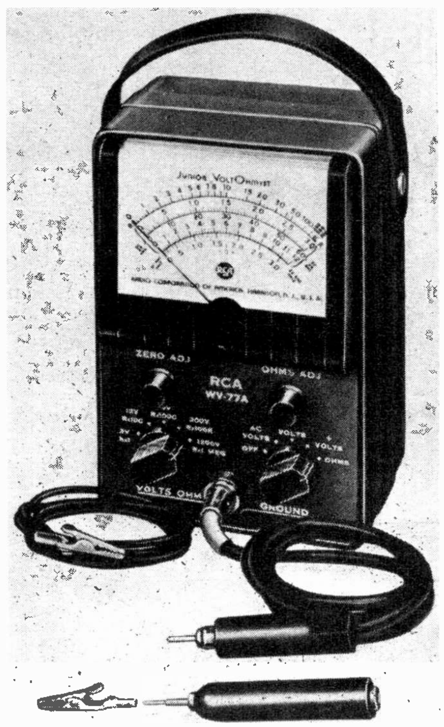


available either as a single bay or stacked array. Tuned for any one of the low-band channels, the Super 980 features a gain greater than the 4-element, twin-driven design. The antenna consists of three parasitic elements, two directors, one reflector and two driven elements. These driven elements are folded-dipoles connected in parallel with a terminal impedance matching the 300 ohm twin lead line.

●

Multi-Test Junior Voltohmyst

The latest addition to RCA's test equipment line is a junior voltohmyst meter which measures a-c volts, d-c volts, and resistances



in five different ranges. This all-electronic meter features a high-impedance diode tube as a signal rectifier, an electronic bridge circuit, a 200-microampere movement, and carbon-film multiplier resistors.

Because
Break is Fast and Clean...

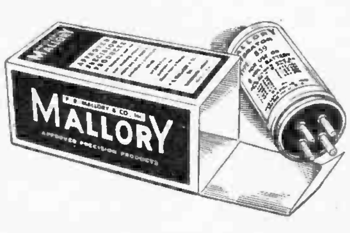
Mallory Vibrators Give Peak Performance!

Fast, clean break of contacts minimizes arcing and pitting. It teams up with gentle contact impact for less wear, and high contact pressure for low resistance—to produce a combination of features attainable only with the patented, tuned mechanism in Mallory Vibrators. That's the secret of their peak performance.

Mallory Vibrators are a result of Mallory's unique facilities in electronics, electro-chemistry and metallurgy. The perfect tuning is accomplished by an exclusive design and individual adjustment by skilled technicians. The contacts are made by Mallory's Contact Division, among the largest in the world. They possess an unusual "self-cleaning" action which prevents oxidation in service.

That's why more Mallory Vibrators are used in original equipment than all other makes combined. When you use Mallory Vibrators for replacement you can be sure of long life, dependable starting and high output efficiency. See your Mallory distributor now!

More Mallory Vibrators Are Used in Original Equipment Than All Other Makes Combined.



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Television Changes

Andrea Ch. VK-15-16

Fig. 1 shows the tube location for this chassis. Fig. 2 shows tube location for the 2nd anode high-voltage supply.

●

Crosley 10-404MU, 10-404M1U, 10-412MU, 10-418MU

The change notice on the prevention of breakdown due to arcing, and horizontal sweep sing, that appeared for Model 10-401 in the December 1950 issue of SUCCESSFUL SERVICING also applies to the above models.

In the change notice for Model 10-401 that appears in the April 1951 issue of SUCCESSFUL SERVICING the sections on drift, neck shadow, and picture and sound separation apply to Models 10-404MU, 10-404M1U, 10-412MU, and 10-418MU.

●

DuMont RA-103D, RA-104A, RA-110A

The following corrections should be made in the service notes for these chassis.

1. Connect pin #4 of V211, the 2nd sound amplifier, to the positive side of capacitor C208B. Without this connection, the plate of the 1st sound amplifier and the screen grid of the 2nd amplifier would be without B+ power.

2. Westwood Teleset RA-110A (Miscellaneous Parts List)

Component	*Incorrect Part No.*	*Correct Part No.*
Deflection yoke	21004241	21004971

The following changes have been made:

1. C308 in the plate circuit of V202, the 2nd video i-f stage was deleted. This reduces regeneration caused by the incorporation of the "bottom-coupled inputuner." If the inputuner is changed on early RA-103D or RA-104A chassis to a "bottom-coupled inputuner," this change should also be made.

2. The specification of capacitor C315, used in the local distance switch circuit, was changed to 0.8 to 7 $\mu\mu f$. The part number is not affected.

Changes 3 and 5, which follow, apply to RA-110A main chassis only. Change 4 applies to RA-104A and RA-110A main chassis.

3. R304, 50,000 ohms, has been deleted from Chassis RA-110A, to improve the horizontal linearity. The horizontal J206-1 has been deleted; and, because of this deletion, the four-prong cable assembly P206 has been changed from part number 50016842 to part number 50016843. The only difference between these two cable assemblies is that the white wire has been removed from pin 1, since it is no longer necessary when R304 is deleted.

4. The linearity coil L219 has been changed from part number 21004771 to part number 21004752, improving the horizontal linearity.

5. The part number of T204 has been changed from 2004521 to 20004581. The high-voltage output obtained with this new transformer is approximately 9000 volts, which is 1000 volts lower than that obtained from part number 2004521. The change reduces the high voltage and produces a greater picture size.

The letter "D" stamped on the rear of the chassis, identifies it as containing changes 3, 4, and 5.

6. The values of the line filter capacitors C260 and C261 have been changed from 0.05 μf, 600 v, to 0.02 μf, 600 v. These parts are described as follows:

Ref. No.	*Part No.*	*Description*
C260, C261	03018570, 03018560	Capacitor, paper, 0.02 μf, 20%, 600 v.

This change reduces shock hazard between chassis and ground. A large letter "K" stamped on the rear of the main chassis also identifies it as containing these changes. The first chassis affected by this change are identified as follows:

Model No.	*Serial No.*
RA-103D	033565
RA-104A	0411020
RA-110A	1016691.

7. C312 has been added between S202 Sec. 2 rear, terminal 10 and R246, to remove the d-c component of discriminator from volume

(continued on page 11)

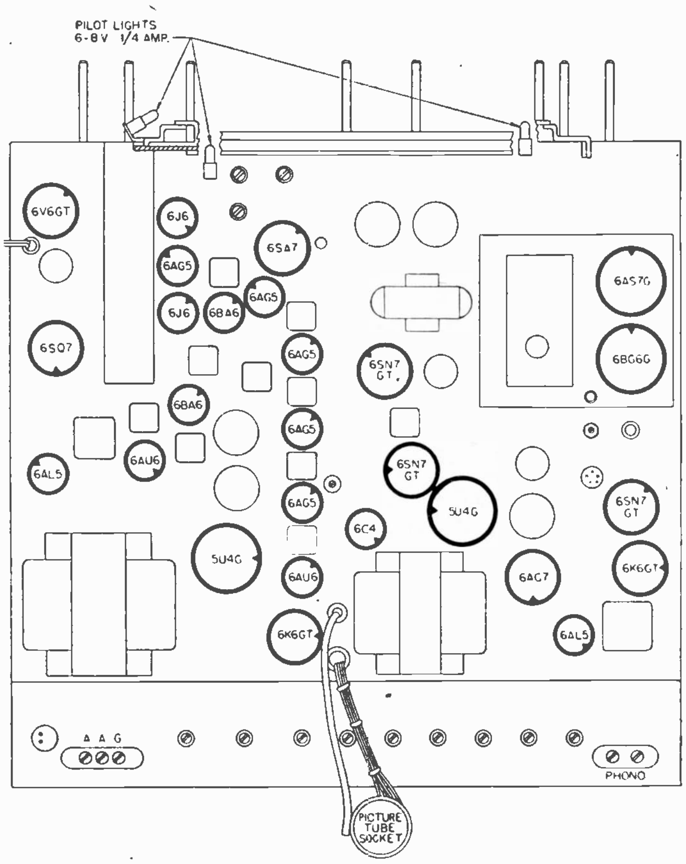


Fig. 1. Tube location for Andrea Ch. VK-15-16.

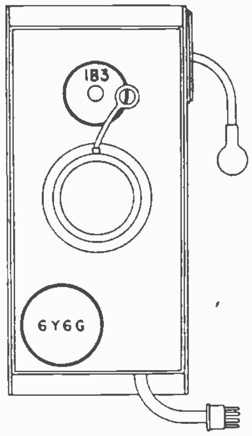
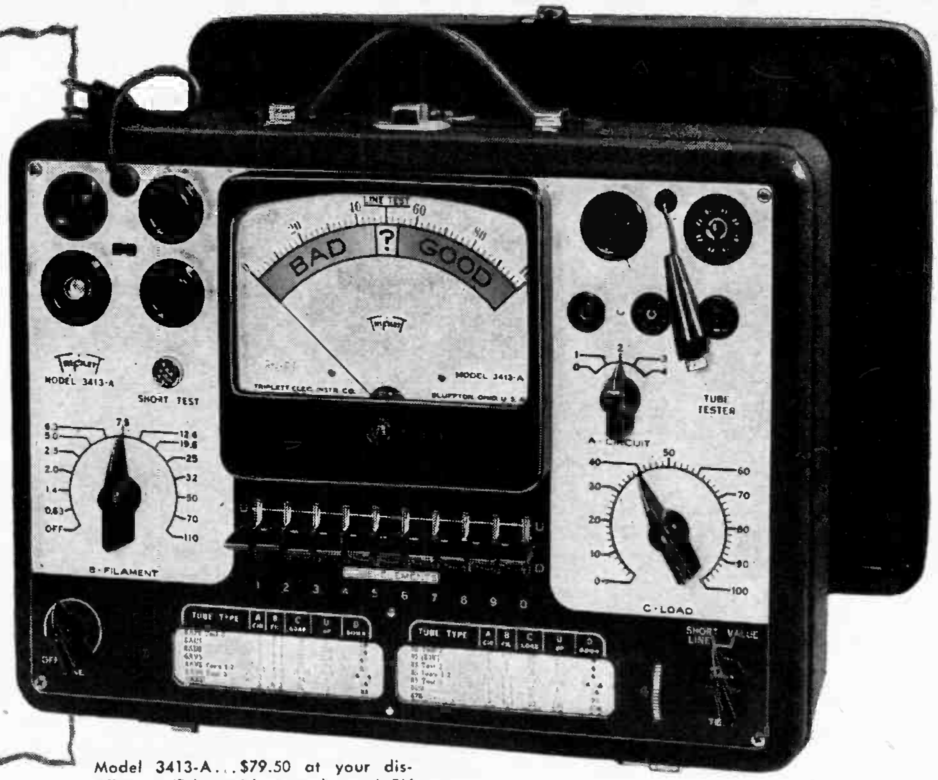
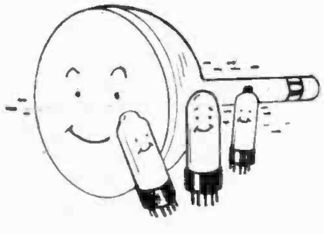


Fig. 2. Tube location of second anode high voltage supply for Andrea Ch. VK-15-16.

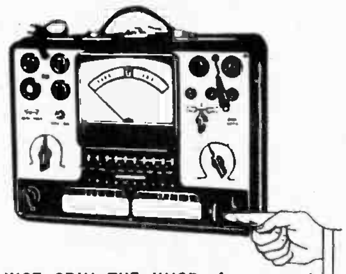
For accurate flexible and quick tube testing at low cost... model 3413-A



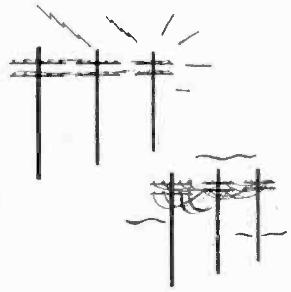
Model 3413-A . . . $79.50 at your distributor. (Price subject to change.) BV Adapter, $7.90 Add'l.



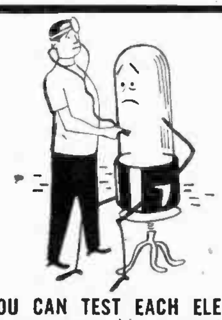
1. YOU CAN TEST MORE TYPES of tubes, also appliances for shorts and open circuits.



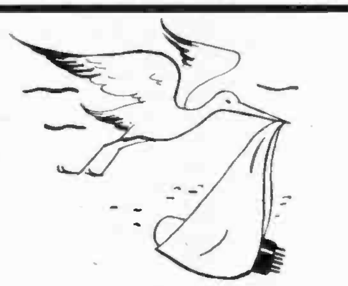
2. JUST SPIN THE KNOB—for correct, last-minute data, on the speed roll chart. Lists 700 tubes.



3. YOU CAN COMPENSATE for line voltage—just throw snap-action switch.



4. YOU CAN TEST EACH ELEMENT in each tube—by a simple flip of the switch.



5. YOU CAN TEST THE NEW TUBES—including those with low cathode current.

6. YOU GET NEW TUBE DATA—immediately, while it is still news. No waiting.

Nearly Half a Century of Service to the Service Man

TESTS PICTURE TUBES, TOO! *With this BV Adapter, Model 3413-A tests every tube in a TV receiver,* including *the Picture Tube—without even removing tube from receiver or carton! Saves time!*

FOR THE MAN WHO TAKES PRIDE IN HIS WORK

Triplett

TRIPLETT ELECTRICAL INSTRUMENT CO., BLUFFTON, OHIO, U. S. A.

DuMont RA-103D, RA-104A, RA-110A

(Continued from page 9)

control in order to prevent the control from becoming noisy. The new part is described as follows:

Ref. No.	Part No.	Description
C312	03000950	Capacitor, paper, 0.05 μf, 25%, 200v.

8. Tubes V201, V202 and V203 have been changed from 6AG5 to 6BC5 to obtain increased gain. The 6BC5 has G_m=6000, compared to the 6AG5, G_m=5000. When it is necessary to replace a 6AG5, it is recommended that it be replaced with a 6BC5. If V203 is replaced with a 6BC5, C213 should be changed from 0.005 to 470 $\mu\mu$f, 600 v, part number 03016480.

The first chassis affected by this change are identified as follows:

Model No.	Serial No.
RA-103D	0340724
RA-104A	0413334
RA-110A	1022236.

9. The following changes have been made in the capacitor specifications.

Ref. No.	New Part No.	New Description
C217, C276	03014770	Capacitor, paper, 0.1 μf, 20%, 400 v
C218	03019120	Capacitor, paper, 0.047 μf, 20%, 400 v
C221	03014820	Capacitor, paper, 0.1 μf, 20%, 600 v
C224	03019110	Capacitor, paper, 0.047 μf, 20%, 200 v
C257, C275	03019130	Capacitor, paper, 0.1 μf, 10%, 400 v
C258	03014770	Capacitor, paper, 0.1 μf, 20%, 400 v
C263	03014910	Capacitor, paper, 0.01 μf, 20%, 400 v.

The critical paper-cased paper capacitors are replaced by plastic-moulded paper capacitors to eliminate possible failure under humid conditions.

10. Change specifications as follows:

Ref. No.	New Part No.	New Description
C255	03015940	Capacitor, paper, 0.02 μf, 10%, 400 v
R274	02032070	Resistor, f.c., 330,000 ohms, 10%, ½ w
R276	02032140	Resistor, f.c., ½ megohm, 10%, ½ w
R279	02032130	Resistor, f.c., 2 megohm, 10%, ½ w
R326	02031750	Resistor, f.c., 680 ohms, 10%, ½ w

These changes have been made to eliminate high-voltage arcing in the vertical output tube, since such arcing disturbs the raster vertically. The first chassis affected by these changes are identified as follows:

Model No.	Serial No.
RA-103D	0336701
RA-104A	0411701
RA-110A	1017121.

11. A 560-ohm, ½-watt resistor R355 (part number 0203170) has been added between L221-4 and L221-5 (of deflection yoke L221). Resistor R356, 560 ohms, ½ watt, has been added between L221-5 and L221-6.

12. J204-8 and J204-1 were connected in series from the junction of C296 and R233 to the junction of C266 and pin 3 of V220, the reactance tube. Delete the connection from the junction of R233 and C296 to J204-8 and ground the junction of R233 and C296. Delete J204-9 and J204-1 from the position mentioned above. "Break" the connection from pin 2 of V224 to K201 and insert J204-8 and J204-1 so that J204-8 goes to K201 and J204-1 goes to pins 2 and 7 of V224.

The value of capacitor C213 has been changed from 5000 $\mu\mu$f to 470 $\mu\mu$f, 600 volts, part number 02016480.

●

Regal 1731-1736, 1931-1936, 2031-2036, 2431-2436

Schematic diagrams of the above models are identical to that of Model 17HD31, Chassis Code No. 77, except that DX models use two 6CB6 tubes in place of 6AG5s. Note that the suppressor grids, pin 7, of the 6CB6 tubes must be grounded.

●

Capehart-Farnsworth 3001-B, 3001-M, 3002-B, 3002-M, Ch. C-272, Ch. CX-30; 3007-B, 3007-M, Ch. C-276, Ch. CX-30

The following service suggestions are given as an aid to servicing CX-30 chassis:

Hum

1. Improper tuning of receiver.
2. Defective circuit tube (6T8 or 25L6).
3. Insufficient capacitance at input of filter. See also "A-4" series production changes.
4. Heater return wiring from 6AU6 driver and 6T8 ratio detector. See also "A-4" series production changes. The small B minus choke may be shorted out to quickly make this correction.
5. Series-heater string wiring should be altered to place 25L6 heater at B minus end of circuit.
6. Defective speaker. Hum-bucking coil may be shorted or, leads reversed. Test by substitution.

Inability to Focus

1. Improper position of deflection yoke and focus coil. Yoke should be tight against bell of picture tube.
2. Defective focus coil or leads to coil reversed.
3. Operating range of focus control may be increased by the following changes:
   a. Reduce current limiting resistance in series with focus control from 1000 ohms to 220 ohms, ½ watt.
   b. Remove the two 10,000 ohm 2-watt resistors which are connected in series between B plus and the focus coil, if used.

Distorted Sound

1. Improper tuning of receiver.
2. Defective circuit tube 6AU6, 6T8, 25L6.
3. Defective speaker.
4. Ratio detector transformer misaligned.
5. Improper i-f alignment.

Picture Detail

1. Improper tuning of receiver.
2. Improper focus.
3. Touch up 1st picture i-f coil by carefully adjusting the slug from ½ to 1½ turns while observing a test pattern.
4. In "Early" CX-30 chassis, change 4th i-f grid resistor from 47,000 to 22,000 ohms.

Inability to Center Picture—Early Production Chassis

1. Deflection yoke must be pushed fully forward.
2. Beam bender (or ion trap) magnet must be of proper strength. Proper magnet will have red dot painted on side.
3. Focus coil must be tilted to center raster. Tilting to the side moves picture up or down, tilting forward or back moves picture side to side.
4. A fixed d-c "bias" may be applied to the horizontal deflection coils of "Early" CX-30 chassis to assist in horizontal centering, by the following operations:
   a. Remove jumper from pin 1 of speaker socket to end terminal of height control.
   b. Connect a new wire from terminal of height control where jumper was removed to the free center terminal on the terminal strip mounted on the side of the chassis under the horizontal scanning circuits.
   c. Connect a 470-ohm, 1-watt resistor from this terminal on terminal strip to the adjacent terminal where white wire from deflection yoke connects.
   d. Connect a 4-μf, 50-volt electrolytic capacitor from the B plus terminal of the height control to pin 1 of the speaker socket.

   Note: To prevent "buzz" remove from the end terminal of the height control the red lead which passed around the corner of the chassis and carried B plus voltage to the audio stages. This lead should be connected directly to pin 1 of the speaker socket.

Instability—Horizontal Oscillator Drift

1. Check 12SN7 horizontal oscillator tube by substitution.

(Continued on page 13)

Capehart-Farnsworth 3001-B, 3001-M, 3002-B, 3002-M, Ch. C-272, Ch. CX-30; 3007-B, 3007-M, Ch. C-276, Ch. CX-30

(Continued from page 11)

2. Check 12SN7 sync amp and 6H6 sync clamp by substitution.

3. Check by substitution the 240-$\mu\mu f$ grid blocking capacitor in the horizontal oscillator stage.

Vertical White Lines—Left Side of Raster

1. Reduce horizontal drive consistent with necessary brightness and width.

2. Check by substitution the 19BG6 horizontal amplifier tube.

Foldover—(Bright white shadows reaching in from left side of picture.)

1. Remove feedback circuit from terminal 4, horizontal output transformer back to junction of the 6-$\mu\mu f$ capacitor and the 150,000-ohm resistor in the horizontal oscillator circuit. Remove this feedback circuit completely, including the two 6-$\mu\mu f$ capacitors, the two 560,000-ohm resistors, and the brown lead to the output transformer terminal. The 150,000-ohm resistor should be left in place.

2. Check, by substitution, the 25W4 damper tube.

Instability—Horizontal Sync ("A-2" and "A-3" chassis only)

1. These series chassis may be modified to correspond with the "A-4" final production chassis by the following changes:

   a. Remove 1 megohm resistor between picture tube grid and B minus.

   b. Reconnect this resistor from pin 3 to pin 4 of the 6H6 tube.

   c. Disconnect pin 3 of the 6H6 tube from the B minus circuit.

   d. Connect a 470,000-ohm resistor from pin 3 of the 6H6 tube to B minus.

   e. Disconnect the 0.05-μf sync coupling capacitor from the junction of the 3,900-ohm and 1,000-ohm resistors in the 12AU7 second plate load circuit.

   f. Reconnect the capacitor to pin 3 of the 6H6 tube.

   g. Change coupling capacitor from pin 2 to pin 4 of 12SN7 sync amp. and clipper from 600-$\mu\mu f$ to 100-$\mu\mu f$.

   h. Remove the 350-$\mu\mu f$ bypass capacitor from pin 6 of same tube to B minus.

   i. From the junction of the 240-$\mu\mu f$ capacitor and the 0.002-μf capacitor between pin 6 of the same tube and pin 1 of the 12SN7 horizontal oscillator and afc tube, connect a 100-$\mu\mu f$ capacitor to B minus. (Note: This 100-$\mu\mu f$ capacitor may be increased in value to 200-$\mu\mu f$ if traces of instability persist.)

2. Check by substitution the following circuit tubes:

   12SN7 Sync amplifier
   12SN7 Horizontal oscillator
   6H6 D-C Restorer and sync clamp.

Insufficient Height—Vertical Scan

1. Check by substitution, the 12SN7 vertical multivibrator tube.

2. Check the 4.7-megohm resistor between height control and pin 1 of vertical m.v. tube. If resistance is too high, replace with correct value.

Radio Changes

Philco 50-920, 50-921, 50-922

The following changes have been made in the replacement parts list:

New service part numbers:

Symbol	*Description*	*Part Number*
C4	Condenser, fixed trimmer, temp. comp., 20 $\mu\mu f$	30-1224-42
C6	Condenser, d-c blocking, 47 $\mu\mu f$	60-00475417
C15	Condenser, line by-pass, .047 μf	45-3505-45
LA1	Loop aerial, 50-920	32-4052-39
	Drive Shaft (Codes 123 and 124)	76-3671-6
	Socket, loctal	27-6207

Additions:

	Cabinet (mahogany) 50-920	10770-2
	Dial scale (mahogany)	54-5070-3
	Cabinet (gray) 50-920	10770-3
	Dial scale (gray)	54-5070-4
	Baffle and cloth assembly	40-7892
	Clip (scale mtg.)	56-7886FE7

It should be noted that if an old cabinet, service part number 10770 or 10770-1, is being replaced by a new one listed above, a new dial scale and a new baffle and cloth assembly must also be ordered.

For these models, 50-920, 50-921, 50-922, Code 121, the following production changes have been made:

Run 5: The neutralization network in the i-f amplifier circuit has been removed. The capacitors, C7 and C8, have been taken out of the circuit and pin 3 of the 7B7 i-f amplifier tube is connected to pin 5 of the 7A8 converter tube. The resistor, R6, has also been taken out and the B+ lead of the transformer, Z3, is connected directly to the low side of the resistor, R14.

For these models, Code 122, the following production changes have been made:

Run 1: The output tube has been changed to a 50C5.

Run 2: The same changes as in Run 5 for Code 121.

Run 3: To reduce low volume hum, the black wire from the 7B7 tube socket to the low (B—) side of the volume control, R10, should be removed from the volume control and wired to the set side of the A-C switch.

For these models, Code 123, the following production changes have been made:

Run 1: The output tube is changed to a 50C5 and the rectifier tube is a 35Y4.

Run 2: The same changes as in Run 5 for Code 121.

Run 3: The same changes as in Run 3 for Code 122.

For these models, Code 124, the following production changes have been made:

Run 1: The output tube is changed to a 50B5 and the rectifier is a 35Y4.

Run 2: The same changes as in Run 5 for Code 121.

Run 3: The same changes as for Run 3 for Code 122.

●

Philco 50-1424

The following changes, new service part numbers, have been made in the replacement parts list:

Symbol	*Description*	*Number*
R9	Volume control (with on-off switch) 1 megohm	33-5566-22
R13	Resistor, cathode bias, 130 ohms	66-1128340

There has also been added:

	Stud, tapped, hinge mtg.	56-6296

In Run 2, to reduce minimum hum, a wire has been added between pin 7 of the 14B6 detection and 1st amplifier tube socket and the low side of the volume control resistor, R9.

Philco 50-925, Code 123, 50-926

In the schematic diagram, a .01 μf capacitor, part number 61-0120, should be added, leading from the filament, pin 5, of the 12AT7 oscillator mixer tube to ground. The values for the capacitors, C13, C24, and C25, and the resistor, R12, have also been changed. The proper substitutions, with their service part numbers are as follows:

Symbol	*Description*	*Number*
C13	Condenser, cathode by-pass, 51 $\mu\mu f$	30-1224-2
C24	Condenser, de-emphasis, 47 $\mu\mu f$	30-1224-2
C25	Condenser, de-emphasis, .004 μf	61-0179
R12	Resistor, plate dropping 2200 ohms	66-2228340

For Model 50-925, Code 123, only, several production changes have been made.

Run 2: In order to increase f-m sensitivity, the resistor, R14, the 12BA6 2nd i-f tube cathode resistor, is increased in value from 47 ohms to 68 ohms. The service part number is now 66-0688340.

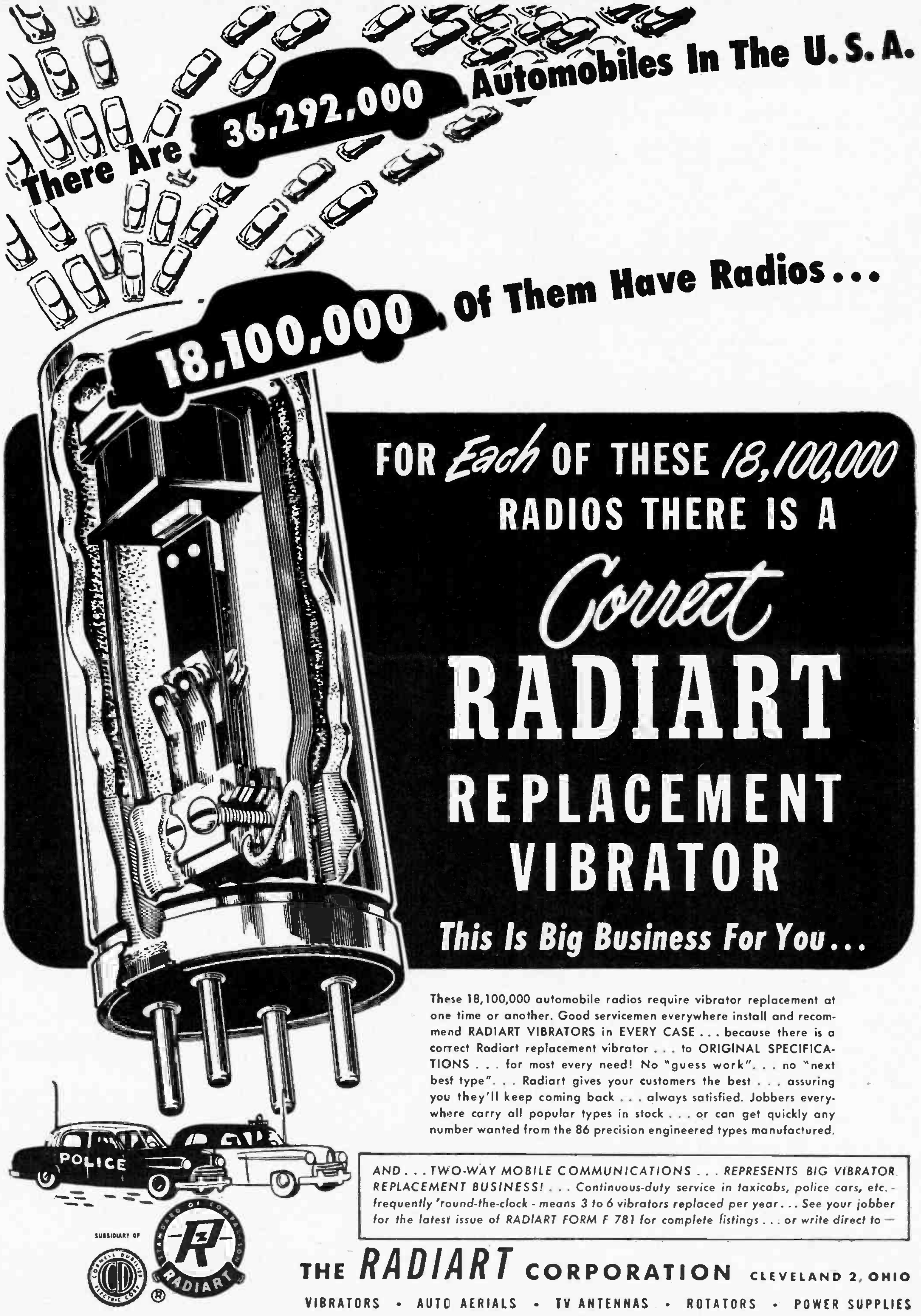
Run 3: The wiring panel connections of the resistor, R2, the screen-dropping resistor in the 12BA6, f-m, r-f amplifier tube circuit, and the coil, L1, are interchanged from those given in the manual base view.

Capacitor C44, the filament by-pass condenser, is removed.

The .01 μf condenser, part number 61-0120, added above, is changed to wire from pin 3 of the 12BA6 f-m, r-f amplifier to the ground lug of the nearest wiring panel.

Run 4: To reduce oscillations the capacitor C43, the ceramic button filament by-pass con-

(Continued on page 17)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TV RECEIVERS

(Continued from page 1)

Buzz in the I-F Amplifiers

Buzz can be traced through the high-frequency circuits of the TV receiver by use of a signal-tracing crystal probe. Figs. 3, 4 and 5 show different displays of buzz as found in the sound i-f amplifier. When the sound modulation is at a low level, the buzz pulse is seen very plainly (Fig. 3). Even when the modulation is relatively high, the buzz pulse can still be seen, as shown in Figs. 4 and 5. It must be observed, however, that extremely strong sound modulation will mask the buzz so that it becomes temporarily invisible on the scope.

Checking Oscillator-Injection Voltage During Alignment

When a front end is being aligned, operation or non-operation of the local oscillator is determined readily. In case of doubt, the technician can check the signal-developed bias across the oscillator grid-leak resistor with a VTVM. This check must be made with an isolating resistor in the d-c test lead. The amount of bias is a fairly reliable guide to the amplitude of the r-f output of the oscillator.

However, the fact that the oscillator is operating at its normal level does not necessarily indicate that the oscillator-injection voltage to the mixer is adequate. In case of persistent low gain, this value should be checked at the injection grid of the mixer. A typical value of injection voltage as measured at the injection grid of the mixer is about 2.5 volts. However, the manufacturer's service data should be consulted, to obtain specific values. Insufficient oscillator injection voltage results in reduced conversion gain and a weak picture.

Alignment by Alternate Loading

Some TV receivers have overcoupled picture i-f transformers. The slugs in the primary and secondary windings can be adjusted for the proper double-humped response by means of a sweep generator and markers but sometimes the technician must do the job with a conventional signal generator and VTVM.

The overcoupled transformer can be peaked somewhat like a stagger-tuned stage if the method of alternate loading is used. In this method, a 1,000-ohm carbon resistor is shunted across the primary winding and the secondary is then tuned for maximum response at the center frequency of the required double-humped response curve. Next, the 1,000-ohm resistor is removed from the primary and shunted across the secondary winding. The primary is then tuned for maximum response at the center frequency. Finally, the resistor is removed and the over-coupled transformer is in alignment.

This method depends for its operation on the fact that resistance loading of either primary or secondary of an over-coupled transformer causes the double-humped stage to show a single-humped response at the center frequency.

A note of caution should be added in case the manufacturer utilizes stagger tuning as well as overcoupling. In such a case, the method of alternate loading cannot be used and a sweep generator with markers and a scope represents the only practical approach.

Contrast Control Producing Ghosts

If ghosts appear in the picture as the contrast control is advanced, the cause is usually due to changes in the shape of the i-f response curve as the bias varies. At higher gains the curve may become excessively peaked, which leads to transient ringing. The effect is to produce ghosts on the screen. The resultant response curves are shown in Fig. 6B. A normal response curve (Fig. 6A) is shown for comparison.

Curve peaking occurs because of regeneration in one or more of the i-f stages. Steps must be taken to stagger the stages properly, to replace faulty bypass capacitors, or to correct the lead dress.

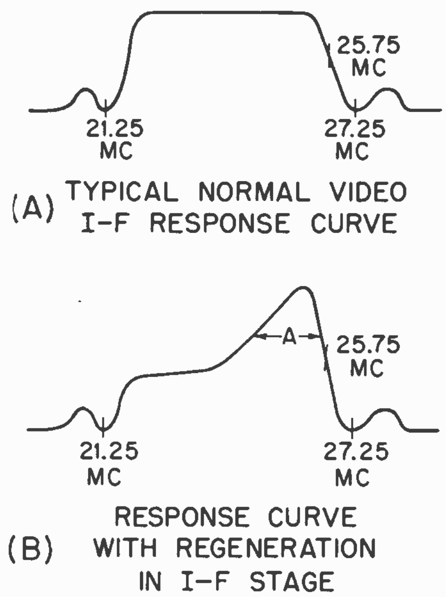

Fig. 6. Video—i-f frequencies falling in region (A) will ring, producing an artificial ghost on the screen.

Test for Regeneration During Alignment

A peaked visual-response curve which cannot be flattened out by slug adjustments is usually caused by regeneration. Under these conditions, the response curve will change shape markedly when the hand is brought near the offending stage.

Checking for Low-Level Hum

When checking with a scope for low-level hum in the sweep circuits, switch the receiver to a no-signal channel. The vertical oscillator will speed up slightly, and the hum (if present) will roll and become much more visible.

**These trouble shooting data are abridged from a forthcoming TV Troubleshooting Guide Book. This is a brand new type of book relating to television servicing to be published soon by John F. Rider, Publisher, Inc.*

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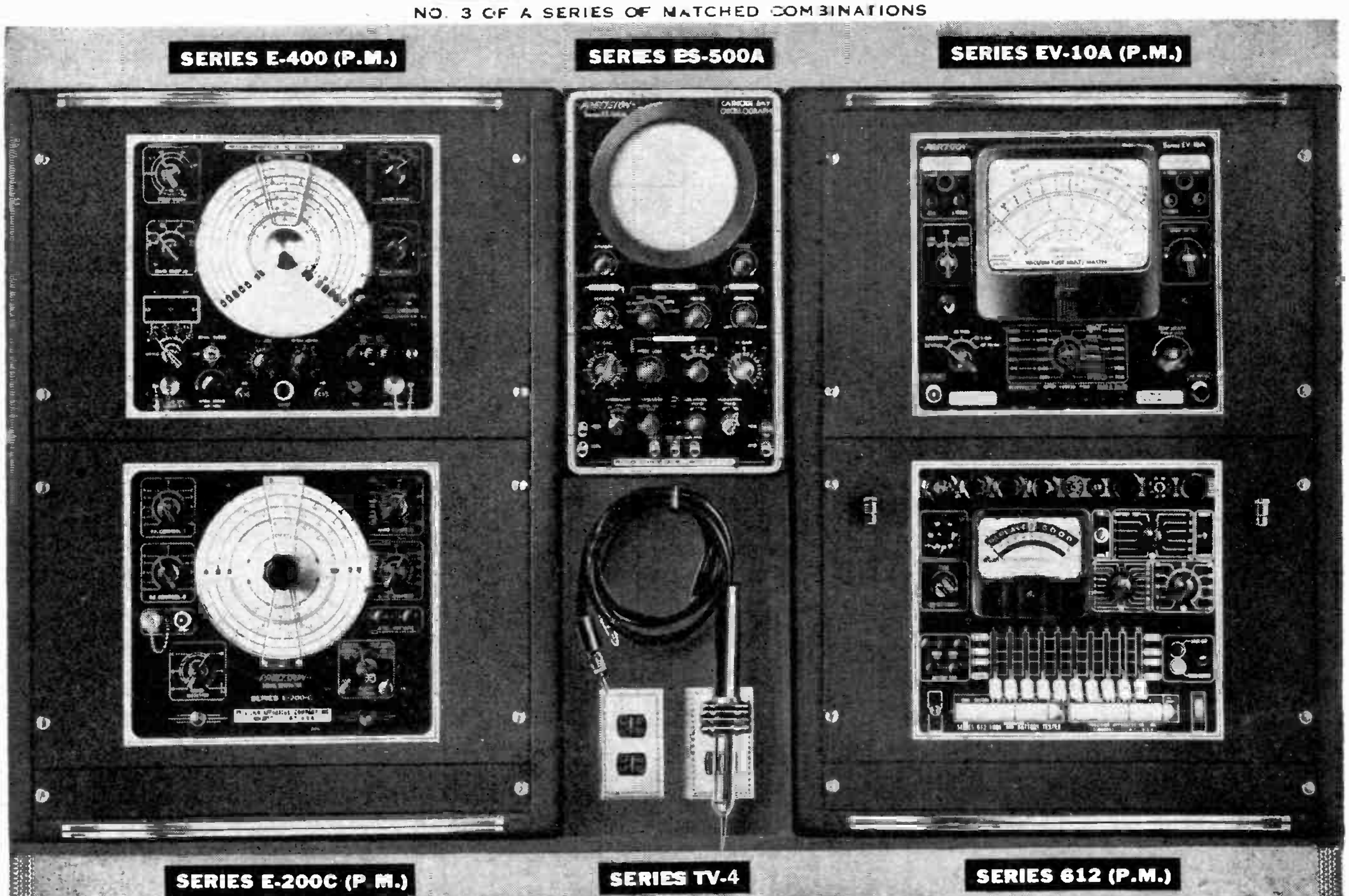

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Philco 50-925, Code 123, 50-926

(Continued from page 13)

denser of .005 μf value, is changed from pin 4 of the 12BA6 f-m, r-f tube to ground to pin 3 of the 12BA6 1st i-f tube to the adjacent ground lug.

Lead 2 of the capacitor, C39, the two-section ceramic button, filament by-pass condenser, is changed from the ground lug of the 3-lug wiring panel at the rear of the set to the ground lug of the 3-terminal wiring panel parallel to the tuning gang. Lead 3 of C39 is changed from pin 3 of the 12BA6 1st i-f amplifier tube to the rear lug of the wiring panel parallel to the tuning gang (the same lug to which the coil, L7, is wired).

The capacitor, C42, the filament by-pass condenser of 100 μμf, is removed from the wiring panel near the tuning gang and wired from lug 7 of the switch, WS1-2(F) to the ground lug by the 12BA6 f-m, r-f tube socket. The switch lead of this condenser should be kept as short as possible.

Run 5: To stabilize the a-m, i-f stage, the capacitor C22, the .002 μf screen by-pass condenser in the 12BA6 2nd i-f amplifier tube is changed in value and type from a .002 μf paper condenser to a .0022 μf paper moulded one. The service part number of the substituted condenser is 45-3505-5.

Run 7: To reduce delay hum on f-m, the wiring of pins 4 and 5, the filament pins of the 19C8 a-m, f-m detector tube, is interchanged. Pin 5 now goes to ground (with the wiring grounding the resistor R19) while pin 4 is now connected to the .004 μf filament by-pass condenser, C38B.

For Model 50-926, the production changes for various runs are as follows:

Run 2: The by-pass condenser, C20, is changed in value from 100 μμf to 51 μμf. The service part number for the new condenser is 30-1224-2.

The plate-dropping resistor, R1, is changed in value from 4700 ohms to 2200 ohms. The new service part number is 66-2228340.

The grid return resistor, R13, is changed from 4700 ohms to 1 megohm. The new service part number is 66-5108340.

Run 3: The same changes as in Run 4 for Model 50-925, Code 123.

Run 4: The same changes as in Run 5 for Model 50-925, Code 123.

Run 5: The same changes as in Run 6 for Model 50-925, Code 123.

Run 6: The same changes as in Run 7 for Model 50-925, Code 123.

Note: To preserve service life, the filter resistor, R27, should be changed from a 150 ohm, 1 watt resistor to a 150 ohm, 2 watt resistor, service part number 66-1155340. In order to minimize grid-to-plate capacity and remove regeneration, a tube base shield, service part number 56-3978-1FA3, was added to the 12BA6 1st i-f amplifier tube socket. The 50C5 tube base shield has the same service part number.

●

Philco 50-1721, 50-1723, 50-1724

The negative voltage readings of the grid bias supply in the schematic diagram for the above models should be corrected. The value of —67 volts, on the high side of the resistor, R46, is correct; the value of —56 volts on the high side of the resistor, R47, should read —14 volts; the value of —52 volts on

(Continued on page 19)

Philco 50-1721, 50-1723, 50-1724

(Continued from page 17)

the high side of the resistor, R37, should read —13 volts; and the value of —38 volts on the high side of the resistor, R36, should read —12 volts.

In the f-m alignment chart, the value of the condenser used in step 1 should be changed from .1 µf to read .01 µf. Under the heading, Special Instructions and Adjust, TC4B should read TC10; TC4A should read TC9; TC3A should read TC7; TC1B should read TC4; and TC1A should read TC3.

The following production changes have been made for various runs:

Run 2: To provide for a longer life for the pilot lamp, a 1 ohm, ½ watt, dropping resistor, service part number 66-9108340, has been wired between pin 1 of the 6Y6G output tube and pin 1 of J3, the changer power socket. Also the strap connecting pins 1 and 2 of the 6Y6G socket has been removed.

Run 3: To reduce parasitic oscillation in the 6Y6G output stage, a 10 ohm resistor, part number 66-0104340, has been added to the 6Y6G plate lead. It is wired between pins 1 and 3 of the 6Y6G socket. In addition, the red lead from the transformer, T1, has been moved from pin 3 to pin 1; the two brown leads and the 1 ohm resistor added in Run 2 are removed from pin 1 and wired to pin 6, and the ground point of C50 is changed from pin 8 of the 6Y6G socket to the center lug, ground, of the 3-lug wiring panel that lies in front of the rectifier and output tube sockets.

Run 4: In order to reduce phonograph distortion when playing high modulation records, the following changes have been made:

a. The cathode bias resistor, R9, is changed from 4700 ohms to 6800 ohms, part number 66-2688340.

b. The plate lead resistor, R7, is changed from 10,000 ohms to 18,000 ohms, part number 66-3188340.

c. The tone compensation condenser, C11, is changed from 100 µµf to .001 µf, part number 43-3500-5.

d. A 100 µµf condenser, part number 62-110009001, is added in parallel with the cathode bias resistor, R9, to serve as a cathode by-pass for phonograph frequencies in the 7F8/5 oscillator, mixer and phono pre. amplifier tube circuit.

e. A 330,000 ohm resistor has been added as a grid return in the phonograph position of the switch. This added resistor is wired from lug 5 to lug 10 of the switch, W5-2 (F).

●

Spiegel 459.5015, 459.5015.1

Model 459.5015 is the same as 5015, except for the following changes:

There is no longer a 0.1-µf capacitor, C1, connected between pin 4 of tube 12SA7 and ground. The 0.25-µf capacitor, C11, connected between oscillator coil L2 and ground, has been replaced by 0.1-µf, 400-v capacitor C1. The 0.05-µf capacitor C2 connected, between the primary of the output transformer T3 and pin 5 of the power supply tube 35Z5 has been deleted. There is now a 33-ohm resistor, R7, connected between pin 8 of the same tube and the primary of T3. There is now an 0.05-µf, 400-v capacitor, C2, connected between pin 2 of tube 35Z5 and pin 3 of tube 12SK7.

The following changes in value occur: R2 from 3.9 megohms to 3.3 megohms; R4 from

(Continued on page 24)

IS MY SCOPE IN GOOD CONDITION?

(Continued from page 3)

tor and the vertical signal from the *test* or 6.3-volt terminal which is on the panel of many scopes. The effect on the screen pattern of varying the vertical gain control under these conditions is shown in Figs. 5, 6 and 7. The potentiometer control was set to about one-tenth of its maximum setting in Fig. 5, to about one-fifth in Fig. 6, and to about one-half in Fig. 7. A variation in the horizontal gain control should produce the same sort of effect except that the pattern is expanded horizontally instead of vertically as shown in the figures. In cases where part of the pattern is off the screen (as in Fig. 7), the positioning controls can be used to move the patterns so that all portions of it can be examined.

A faulty gain control potentiometer may produce the pattern shown in Fig. 8 when the control is operated. Random, erratic noise voltages are superimposed on the pattern as shown. In addition, the pattern usually jumps as the faulty control is operated. These conditions may disappear once the control is set to a definite position. However, the control should still be replaced since its condition usually gets worse.

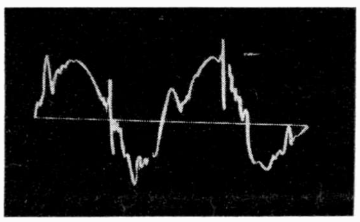


Fig. 8. Pattern produced while adjusting a noisy vertical gain control.

A good method of checking the gain of the scope amplifiers to determine whether it is normal or not is by means of the deflection factor as given in the instruction book. In one particular scope, the deflection factor through the vertical amplifier is given as 0.8 volt (rms)/inch. This means that if a sine wave whose rms value is 0.8 volt, or whose peak-to-peak value is 2.26 volts, is applied to the input of the vertical amplifier, then a vertical line whose length is exactly one inch will be produced (see Fig. 9). Since it is

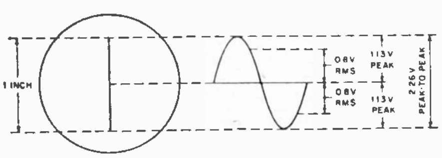


Fig. 9. Measurement of deflection factor.

necessary that the amplifier introduce no attenuation under these conditions, the attenuator and gain controls should be set for maximum gain. The required input voltage can be obtained from a voltage calibrator. Lacking this, a simple voltage calibrator can be constructed from a 6-volt heater transformer, a potentiometer, and an accurate, low-range a-c voltmeter as shown in Fig. 10.

If the vertical line is much shorter than one inch, the next problem is to determine whether the gain of the amplifier is low or the sensitivity of the cathode-ray tube not up to par. To localize the fault, the deflection factor of

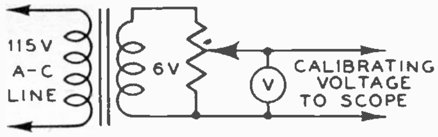


Fig. 10. Simple voltage calibrator for scope.

the cathode-ray tube itself is measured as described above. Once the factor of low cathode-ray sensitivity is eliminated, we can assume that the amplifier gain is low.

This may be the result of a defective amplifier tube. If the vertical amplifier tube is burned out, the screen shows only a horizontal line because of lack of vertical deflection (see Fig. 11). If the horizontal amplifier tube is burned out, the screen shows only a vertical line because of the lack of horizontal deflection (see Fig. 12).

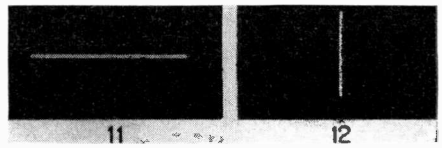


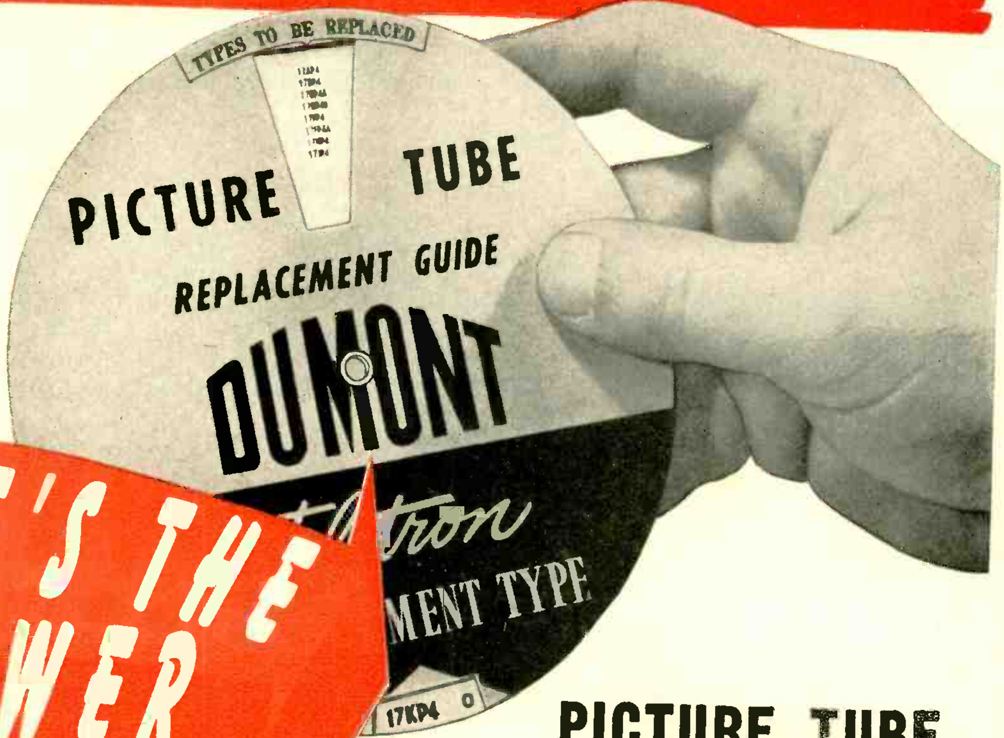
Fig. 11, 12. Screen patterns with burned out amplifier tubes.

Sweep Oscillator Controls

The sweep circuit oscillator can be checked by operating the *sweep* and *sync controls* and

(Continued on page 24)

JUST DIAL THE TYPE...



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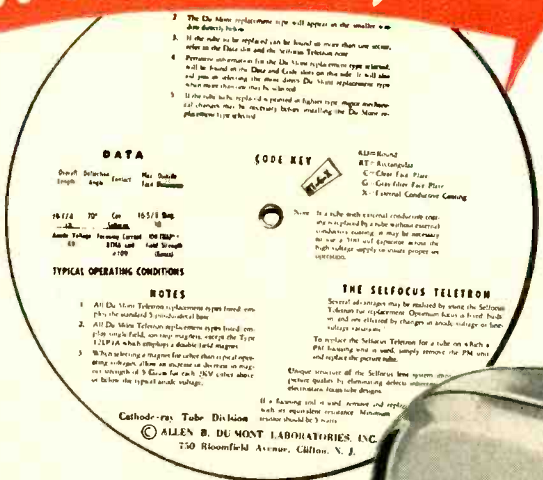

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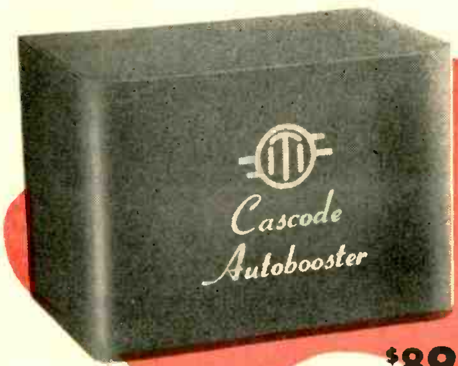

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Whether you BUY or SELL or SPECIFY, these REPORTS will help in your purchasing and inventory problems. Obsolete items on your shelves cut into your profits. Keep your inventory up to date by following these monthly REPORTS of product developments including price changes, new and discontinued items as supplied by RADIO'S MASTER, published by United Catalog Publishers, Inc., New York City.

Antennas and accessories—TV, FM, AM

BUD—Mast coupling model AM-69 replaced by AM-66. Assembled antenna tower model TA-8043 temporarily discontinued.

CAMBURN—Video Beam Indoor antenna model VB21 now $6.95 list.

COPPERWELD STEEL—3 No. 12 Guy Strand types GY-3122, 3124, 3126 replaced by 3 No. 14 Guy Strand types GY3144, 3145 at $11.00 and $20.00 list.

LA POINTE (Vee-D-X)—Discontinued Antennas JR-13, RLFY, SEC, SRLYF; packaged Towers PTGA, Mast Sections MS-1 to 31 and Transmission Lines TA-1, 2, 3. Added model RLYH 300 Ohm low channel $3.50 list, high channel $2.50 list. Packaged tower accessory, PTSA increased to $21.45 list.

PORCELAIN PRODUCTS—Antenna insulators, air-plane type, models 8130, 8131 added.

PREMAX—Standoff insulators #3SB-52 and #3SG-52 discontinued. 9 new items added to their line.

Communication receivers, TV chassis

HALLICRAFTERS—Introduced 3 new Communication Receivers, models S-80, S-81, S-82.

TECH-MASTER—Added TV chassis models 2430 at $189.50 and 2431 C and 2431 P at $199.95. Chassis 1930 D and 1930 T redesigned to 1931 D and 1931 T, respectively.

Miscellaneous radio, TV and electronic parts

ASTRON—Capacitor MRF-2-2M reduced to $2.60 list. Also prices decreased on 11 capacitors in EY series and 4 capacitors in MM series.

BUD—Panels in "PM" series discontinued. Also assembled Antenna Tower TA-8043 temporarily discontinued.

BURGESS BATTERIES—5 portable "A" and "B" batteries discontinued. Also, Ignition Battery 8FH and Portable "A" pack F4A60 discontinued. Flashlight batteries, types 151 and 350 added at $1.25 and $1.90 list.

BURLINGTON—10 Current Transformers in A series reduced approximately 10%.

CHICAGO TRANSFORMER — 25 transformers added. Type F-633 discontinued.

CLAROSTAT—Added TV components RTV 283 to 293. Also added Controls SWB, SWB1 and series "AG," "AK," "G," "K."

ERIE RESISTOR—General Purpose Ceramicons style GP2M replaced by GP2-333 with 6 additional capacities. Also added .01 Mmf. to #811 at $.25 list.

FEDERAL TELEPHONE—Price revised on miniature Selenium Rectifiers. Added a quantity discount for dealers. Also, type numbers and prices revised on their Cables.

INDUSTRIAL CONDENSER — Electrolytic condenser MS1191 reduced to $3.90 list.

JAMES VIBRAPOWR—2 Volt Battery Vibrators 2J70 and 2J71 increased to $11.20 and $10.25 list.

PLANEL MFG.—16 new dry electrolytics added.

RADIO RECEPTOR—Selenium Rectifiers, types 1M1, 5S1 and 6S2 reduced.

TRIAD TRANSFORMER—21 new transformers added.

STANDARD TRANSFORMER (STANCOR)—Deflection yoke DY-7 reduced to $8.95 list. Focus coil FC-11 and Transformer A-8124 added at $10.75 and $3.75 respectively.

SUPERIOR ELECTRIC (SECO) — Discontinued Powerstat Variable Transformers in "MT" series. Now available on special order only.

Recording equipment, speakers, amplifiers, needles, tape, etc.

ALTEC-LANSING—Discontinued amplifier A-323C, tuner ALC-101B and Equalizer TQ-910.

GARRARD—Dual speed motor model number changed from 201V to 201 B/3. New price $54.00 dealer net.

LANSING SOUND—9 new speaker enclosures added.

MILLER, M. A.—Added 4 replacement needles for G.E. cartridges. Discontinued No. 15 assortment and coin machine needle #544. Needle PH-13(S) decreased to $2.25 list. Revised prices on Assortment Combinations Nos. 1 to 4.

MINNESOTA MINING (SCOTCH)—Recording tape (plastic or paper base) ¼" x 300 ft. in plastic reel added. Also, empty Plastic Reel 4" (300 ft.) with box added at 65¢ list. New size splicing tape 7/32" x 66 ft. added at 57¢ list.

NATIONAL HOLLYWOOD—Paper magnetic recording tape KIR discontinued. Polystyrene reels for paper tape discontinued.

RADIO CRAFTSMEN—Introduced model C 500 tuner.

RECOTON—Added replacement needles type 366, 367 and 368.

SHURE BROS.—3 new cartridges added. Cartridge W56R reduced to $7.50 list.

SIMPSON MFG. (MASCO)—Discontinued amplifiers, models LV, LVP, MA-200, MB-200, MB-200P, MCA-2; Phonograph models RP-1, 2, 3; and Transcription players models T-16 and TD-16.

STEPHENS—Diaphragm model 15D reduced to $5.50 dealer's net. Diaphragm model 3040 D changed to 35D and reduced to $8.10 net. Mike C-1A changed to C-1. Speaker #112 added at $40 list, and Driver P-35 added at $130, list. Discontinued Speakers #100, P-22FR; High Frequency Drivers P-30 and P-40.

WALCO—10 replacement needles added. Also, "All-Groove" needle #WA-100-2 added at $1.00 list. Needle W-8A discontinued.

WHARFDALE — Increased prices on all their speakers.

Test equipment

CHICAGO INDUSTRIAL—Discontinued model 451B AC-DC Volt-Ohmmeter and model 452 high sensitivity Volt-Ohmmeter.

HICKOK—Added adaptor model 75 for Model 610A Television Alignment Generator at $4.50 net. Also increased model 650 Television Videometer to $310.90 net.

JACKSON ELECTRICAL—RF probe #645-P and Vacuum-Tube Meter model 109 discontinued.

WESTON—VU meter model 862 added at $50.00 list.

Tools and hardware

KRAEUTER—Line of multiple action industrial snips added.

PHILLIPS MFG.—Versa-Tool soldering guns and accessories added.

SCHOTT (WALSCO)—Wonder tools 555 and 555D discontinued. Pickup lead wires #3040 and 3045 will be discontinued after present stock is exhausted.

Tubes—receiving, television, special purpose, etc.

AMPEREX—Electronic tube 1701 (FG-17) discontinued.

DUMONT—Added 6 TV Picture tubes size 14", 20", 21" and 30". Decreased prices on all other TV tubes.

GENERAL ELECTRIC—5 receiving tubes decreased. Industrial tube 5R4GY increased to $2.20 and type GL-2C39A decreased to $34.00; and types GL-1Q26 and 12AY7 added. 4 Picture tubes 17" size decreased also 20CP4/A decreased to $57.50 list.

GENERAL ELECTRIC—Added receiving tube 6BK7 at $3.20 list. Nine pin miniature twin triode tube for low noise "cascode" r.f. amplifier service in VHF television receivers.

HYTRON—29 receiving tubes decreased in price. 2 Special Purpose tubes discontinued. 6 TV picture tubes decreased in price and 11 picture tubes discontinued. Introduced new Service-aid tool, Hy-tron-CBS pick-up stick at 5¢.

NATIONAL UNION—52 receiving tubes decreased. 4 receiving tubes added.

RAYTHEON—Picture tubes 17BP42, 17CP4 reduced to $37 list. 20 CP4 and 20 DP4A reduced to $58.50 list. Added 16KP4A at $50. list for immediate shipment.

RAULAND—8 TV picture tubes decreased. 5 picture tubes added.

RAYTHEON—43 receiving tubes decreased. 3 receiving tubes added.

THOMAS ELECTRONICS — Completely revised line of Picture Tubes to include new and discontinued items, also decreased prices.

TAYLOR TUBES—12 Triode tubes and 1 Pentode tube type 813 discontinued. Added, Twin-triode types 829B and 832A, Triode type 8000, Rectifier type 249-S and Diathermy types 218 and 468.

INDEX OF CHANGES

Spiegel 459.5015, 459.5015.1

(Continued from page 19)

2 megohms to 22 megohms; R7 from 39 ohms to 33 ohms; R8 from 2000 ohms to 2200 ohms.

Model 459.5015.1 includes all of the above changes plus the following:

Oscillator coil, L2, shown in the accompanying schematic, now consists of a primary across the oscillator capacitor, C9, and a secondary across pin 6 of tube 12SA7 and the high side of capacitor C1; note deletion of C10.

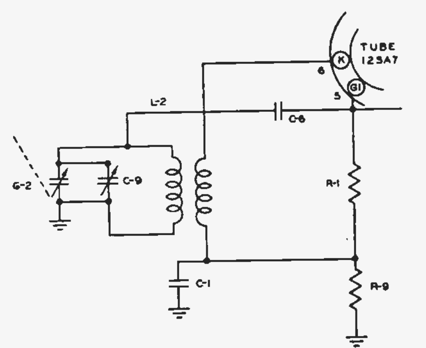

Fig. 1. Oscillator section of Speigel Model 459.5015.

The following values are changed: C6 from 100 $\mu\mu f$ to 220 $\mu\mu f$; C7 from 500 $\mu\mu f$ to 220 $\mu\mu f$.

Alignment and service data for 459.5015 remain the same as for 5015. However, on 459.5015.1 the ANT trimmer is located on the side of the ANT section of the gang condensor, instead of on the top of the ANT section, as in 459.5015 and 5015.

RADIO CHANGES

† The Rider Manual Page Numbers given under Television Changes are for Rider TV Manuals. The volume number is the number preceding the dash. Volume numbers preceded by an asterisk (*) apply to the 8½" by 11" page size Manual only.

The Rider Manual Page Numbers given under Radio Changes are for Rider AM-FM Manuals. The volume number is the number preceding the dash.

IS MY SCOPE IN GOOD CONDITION?

(Continued from page 21)

by observation of the screen pattern. The linearity of the sawtooth sweep can be noted easily by looking at a pattern consisting of several cycles of a periodic waveform, such as the line voltage. With a linear sweep, the width of each cycle on the screen will be the same. However, if the sweep speed is greater at the beginning of the trace than near the end, a pattern such as is shown in Fig. 13 will result. The use of a transparent ruled scale over the screen pattern permits an easy measurement of the width of each cycle. All you need do is simply count the squares. For example, in the figure the first cycle is 10 squares wide, the second cycle is about 6 squares wide, and the third cycle is about 4 squares wide.

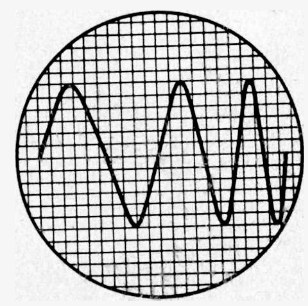

Fig. 13. The effect of a non-linear sweep.

If it is necessary to determine the accuracy of the sweep frequency calibration as given by the settings of the coarse and fine frequency controls on the operating panel, this can be done readily by applying a known frequency (such as 60 cps) to the vertical input terminals of the scope. The sweep frequency controls are then adjusted so that a single cycle of the applied signal appears on the screen. If the control calibrations are accurate, then, as now set, they should indicate a sweep frequency that equals the applied signal frequency. When the sweep frequency controls are readjusted so that two cycles appear, the sweep frequency is one-half the signal frequency and under these conditions, the control calibrations should indicate this frequency. This process can be repeated until the sweep frequency is a tenth or less of the input signal. In this way, the accuracy of sweep calibration can be checked over a fairly wide range.

Note: This is the first of a series of such articles dealing with test instruments.

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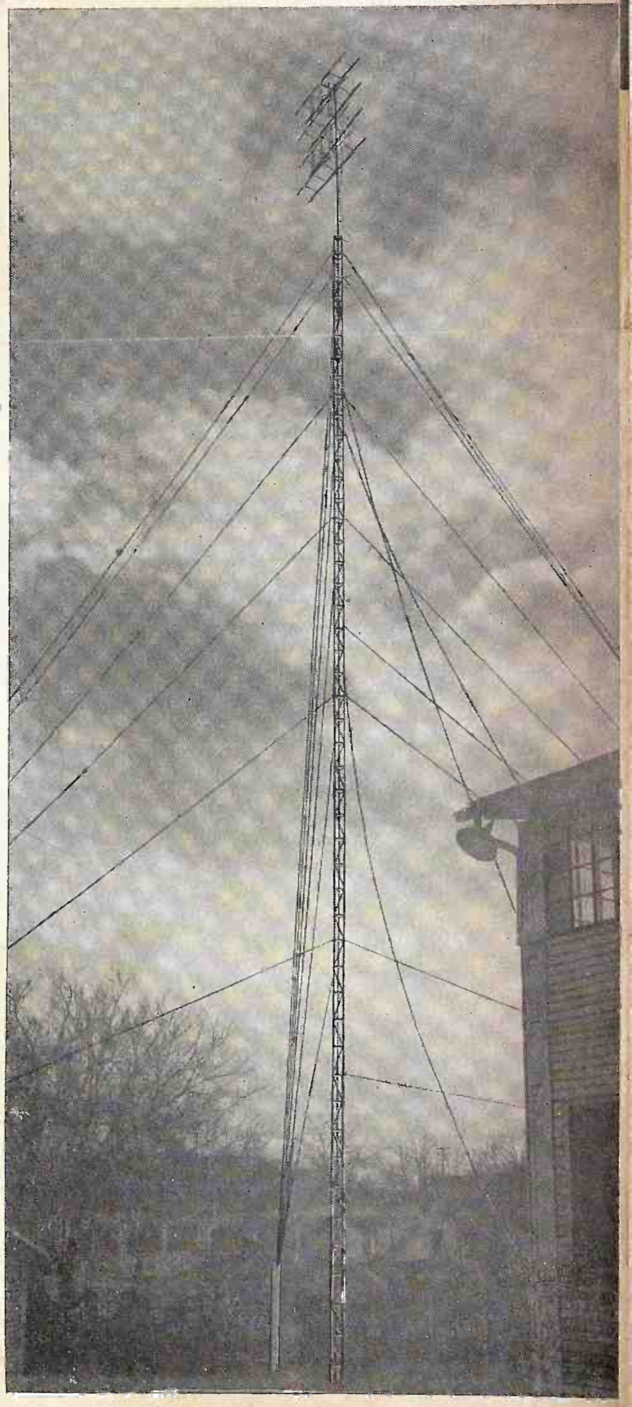

Fringe Area TV

ANTENNA TOWER

by Gerald Wilson

TV viewers in metropolitan centers do not appreciate their good fortune. Not only do they have numerous stations to choose from, but also the signal strength from all these stations is so high that elaborate antenna systems are not necessary. Occasionally some receiving difficulties do arise but, even in the worst cases, these cannot approach the varied situations that the fringe area viewer faces. Oftentimes for him to get decent reception in fringe areas, special antenna installations are necessary costing more than the tv receiver itself.

An antenna structure which is capable of consistent reception of stations within a 100 mile radius, is located in Jackson, Michigan. It has withstood the ravages of four very severe winters, standing up to some of the strongest winds in the United States. This point is not to be ignored; it is bad enough to be forced to lay out a substantial sum of money for a tower-type antenna installation, but it is doubly worse if inadequate planning necessitates replacement once a year or perhaps every two years. This well made and planned structure is shown in Fig. 1. It has on occasion picked up stations more than 1,000 miles away. The antenna is one that is capable of high gain over the desired tv channels and is used with a rotator for maximum directional response. As important as the antenna proper is to signal reception however, it is the tower upon which the antenna is mounted that is of paramount importance in fringe area reception.

(Continued on page 13)

Fig. 1. Fringe area tv antenna tower located in Jackson, Michigan, showing the seven different sets of guy wires used to help support the structure.

To Our Readers:

As evident herein, SUCCESSFUL SERVICING again is the house-organ of John F. Rider Publisher, Inc. and will continue to serve the servicing industry in that fashion.

Our desire to maintain a free circulation and so reach the greatest number of individuals concerned with radio and television servicing each month dictates the return to our original publishing policy. In view of the rapidly expanding circulation and other controlling factors, it is deemed impractical to continue publishing SUCCESSFUL SERVICING as a free circulation magazine with the format contained in the November issue. So, henceforth, it will continue as a free circulation house-organ.

Servicing Hints for TV RECEIVERS

by Bob Middleton

Phase Modulation of Picture and Sound Signals

Phase modulation (pm) and frequency modulation (fm) are two aspects of the same modulating process, and both are demodulated by the discriminator or ratio detector. In a properly adjusted tv receiver, pm of the received signals is negligible. The possibility however, of generation of spurious signals due to pm in a faulty receiver should not be disregarded. The following illustrations show the operating conditions which generate a maximum amount of pm.

The region at A in Fig. 1 (i-f response curve) is known as the sound shelf, and this is where the sound carrier should fall. The sound carrier rides too high on the curve at B, causing excessive buzz intermodulation with the picture carrier.

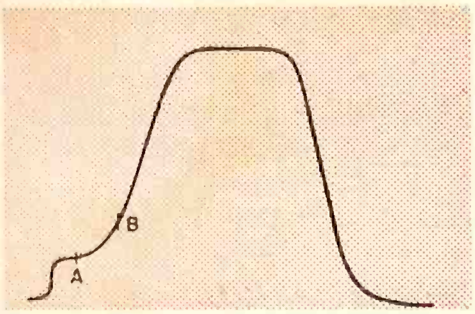

Fig. 1. Sound carrier should fall at A rather than B if amplitude and phase modulation are to be minimized.

From considerations of the seldom used method of slope detection of fm signals, it is known that the steeper the portion of the curve on which the carrier rides, the greater will be the conversion of fm to am. Less generally recognized, perhaps, is the fact that placement of the carrier on a steep portion of the response curve gives rise to phase modulation.

Four and one-half megacycles away, on the other side of the response curve, is the picture carrier, C, as indicated in Fig. 2.

As shown in the figure, the picture must necessarily ride on the side slope of the response curve. As a result, there is an irreducible minimum of phase modulation introduced into the picture signal, even when the receiver is aligned as well as possible. If the slope of the curve is gradual through C, the phase modulation will be sufficiently small so as to be down below the threshold of audibility. However, it is well to note that the amount of phase modulation can be made to rise without limit as the steepness of the slope through C is increased. In general, the limited number of tuned circuits provided in the intercarrier receiver make it unlikely that this slope will be excessive, *unless a misadjusted trap should cut a steep slope into the picture-carrier side of the curve.*

Buzz Due to Differential Signal Attenuation

Due to interfering reflections in the path of propagation, the transmitted tv signal may arrive at the receiving antenna with a picture carrier which is substantially attenuated with respect to the sound carrier. Such propagation phenomena can cause 60-cycle buzz, even in properly adjusted receivers.

The sound carrier is normally placed at 10% on the overall response curve so that the picture carrier will never fall below the level of the sound carrier during picture modulation. Consider, however, the situation which arises when the picture carrier is attenuated due to propagation effects. Under these conditions, if a modulation trough at the transmitter dips down to 10% of peak response, this trough will fall below 10% at the receiver. If the picture carrier should be attenuated 50% (as is not at all impossible), the troughs of picture modulation will then dip down to 5%, leaving severe troughs in the 4.5 mc beat signal. The obvious remedy is to place the sound carrier at 5%, or even lower, on the overall response curve.

Buzz Due to Intermodulation

An understanding of the process of intermodulation in the intercarrier receiver makes possible a more direct attack on sources of buzz. Because fm buzz cannot be eliminated from the sound signal by ordinary processes of limiting and fm detection, it is well to get at the source of fm buzz intermodulation in intercarrier receivers.

Buzz frequently results from consecutive intermodulation, that is, the picture signal may intermodulate with the sound signal in the last i-f stage and again in the first or second video stage. Not only is the am of the picture signal impressed upon the sound carrier during the first intermodulation, but the fm of the sound signal is also impressed upon the picture signal.

Here we have a situation which may lead to a 60-cycle fm buzz on the sound carrier, if a second intermodulation occurs. This is quite possible in present-day receivers. Although a limiter will remove the a-m buzz introduced in the first intermodulation, it is quite unable to cope with the fm buzz introduced in the second intermodulation. This shows the importance of confining nonlinear operation to one stage only if nonlinearity cannot be avoided.

Loss of Sync Due to Buzz

There is a common fallacy that if an i-f amplifier is generating buzz by limiting the sync pulse, then this production of buzz must be accompanied by a loss of sync. This is not necessarily true because partial limiting, in which perhaps one-third of the sync pulse is lost, permits the sync circuits to operate almost in normal fashion on strong signals. However, this partial limiting involves operation on the nonlinear portion of the i-f amplifier's characteristic curve.

Due to the fact that the vertical sync pulse is not amplified by a linear class A circuit, intermodulation of sound and picture signals occurs. Both amplitude and frequency intermodulation can occur under such conditions. The am can be removed by a good limiter,

(Continued on page 9)

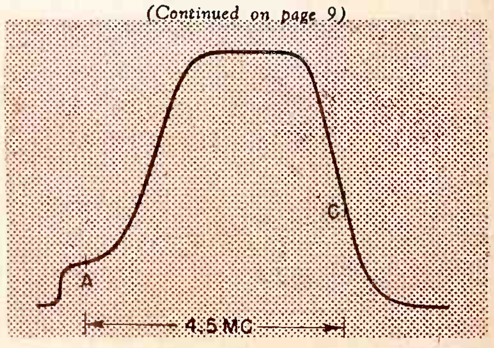

Fig. 2. Picture carrier C normally falls on the side slope of the i-f response curve.

Successful SERVICING

REG. U.S. PAT. OFF.

Dedicated to the financial and technical advancement of electronic maintenance personnel

Volume 13 Number 2 December, 1951

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Charles Tepfer, *Editor*

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MEMBER

Curtain Time

Test Equipment Instruction Manuals

We had occasion recently to discuss service equipment instruction manuals with a test equipment manufacturer. He had received advice from several of his distributors that he should not make his instruction manuals too lengthy because they created the impression in the minds of the service technician that the equipment was difficult to handle. It was implied that a detailed manual acted as a deterrent to the sale of the device. With this we do not agree.

We feel that by and large, television and radio technicians want bigger and better test equipment instruction manuals. Admittedly some service technicians do not read the literature which accompanies the apparatus they buy. This does not justify instruction manuals of very limited scope. Maybe the buyer doesn't read everything immediately, but it is well known that the moment he runs into a snag he grabs for the instruction manual and looks for the answers. That is when the detail pays off.

Of course it's wrong not to read the instruction manual before using the equipment for the first time, especially when the equipment costs several hundred dollars or more. But regardless of the habits of the buyer — and these can not be dictated by the seller — the fact remains that each equipment instruction manual should be as complete as possible, whether it is or is not read by the buyer. He must have the information when he wants it.

We realize that instruction manuals are related to dollars and cents of costs; that every word and page represents money in writing, artwork, paper, printing, and binding. On the other hand, it is the contents of the manual which enable the equipment buyer to get the most out of his investment, this in turn means an enhancement of the product in the mind of the user. Quite frequently the information contained in a manual is the key to the solution of a problem, and in the mind of the equipment user, all the credit is reflected on the equipment. So a good equipment manual helps rather than hinders the reputation of a product.

Fighting Unfair Press

We have on hand a release from the advertising agency handling the Sprague Products account. It is a window streamer intended for service shop distribution, carrying a message to the public concerning the servicing industry. It is an attempt to fight back against unfair press. We hope that other manufacturers will see fit to take similar or other steps to wage this battle. This editorial page is open to all who do so, and we hope that these comments will not be construed as undue publicity for the manufacturer mentioned herein. The service industry need this and every other possible aid in their effort to build public confidence.

E. W. Merriam

The radio industry moves fast. Only last month we announced the appointment of "Al" Merriam as the service coordinator of the RTMA. Well, at the time of this writing he is no longer with the Manufacturer's Association. His replacement has not yet been announced. His new job is Service Manager for Sylvania Electric Products.

So once more, the best of luck to you, Al.

John F. Rider

SUCCESSFUL SERVICING is published monthly by JOHN F. RIDER PUBLISHER, INC., 480 Canal Street, New York 13, N. Y. Telephone: Worth 4-8340.

We Asked For It!

OUR READERS' VIEWS ON LICENSING.

The response to our request for letters in connection with the two articles we ran on tv service licensing in the November issue of Successful Servicing, was immediate. We cannot reprint all the letters we received, we don't have the space. However, here are some representative views, and we will print more from time to time.

George B. Weigel, Rome, N. Y.

In reference to the article "License TV Technician?" which appeared in the November issue of Successful Servicing, I should like to register a negative vote. Following are a few of the reasons.

Licensing is just a step away from unionizing us, and that step will surely follow. The technician that doesn't sign up will have sets wrecked in his shop, equipment ruined, and possibly physical violence inflicted upon his self or family, until he does or will sign up.

A union can throw weight in many directions. The jobber and supplier to the servicing industry would certainly, sooner or later, feel adverse effects.

Tell me, what percentage of the pro's in the industry are actually thinking of CUSTOMER benefit? Stew it, boil it, dry it, and sift it, and it all comes down to elimination of competition.

What has become of the idea "There is plenty of room at the top?" Individuality would soon be lost. You are licensed and you are unionized, so you are as good as the next man. You can hire, but you get into difficulty when you fire.

As it is, who calls the technician or agency that has duped him or a friend on a previous service call? Who could afford to keep a technician who couldn't sell himself to a customer? *Under licensing and unionization which would follow, you would have no choice.*

No sir, let the serviceman stand on his own record and ability. Keep politicians and unions out of it.

We don't get a better haircut simply because the barber is licensed and unionized.

A Newark, N. J. Serviceman

It is heart warming that there is so much discussion among servicemen about licensing. If nothing else, it will set our fellow technicians to thinking. Naturally everyone has an axe to grind in this matter; I am trying to grind the axe of the individual serviceman.

We as a group are notoriously underpaid. *Therefore, because we will have a license in common and therefore be a recognized group, we will be able to form a union.* This will result in increased rates for the use of a personal car and tools, and an adequate wage in proportion to the cost of living.

At present there is only chaos. Look at the prices for the sets themselves in the stores! Compare the cost of repair parts to the initial cost of the set. Add the cost of labor to that of the parts and try to make the bill attractive to the customer.

Overselling of sets, and poor workmanship and parts in the factory also cry for policing, and licensing.

Licensing may not be the cure all, or even the best possible way out. However, we tried it the other way, why not give this a chance.

John J. Hancock, Union Supply Co., Burlington, Iowa

Having read both articles "Yes," and "No," on licensing of tv technicians, I must cast my vote as "Yes."

Mr. Haas expends a lot of good argument on the "No" side, but the whole question boils down to the incompetence of quacks and their curtailment, and the raising of public opinion of the electronic servicing industry. The only practical solution is licensing.

Too long the radio service man has been in the same category as the grocery delivery boy and the ditch digger, which though honorable endeavor, has relegated his compensation accordingly.

The advent of television has lifted the whole servicing industry to a higher plane, and no longer can the screw driver mechanic fool the public. *The public however, needs educating to the fact that today the radio-tv technician must be a highly trained individual,* with an expensive education, expensive equipment, and enormous endeavor to attain the necessary qualifications to service their electronic devices. He is entitled to equitable compensation.

Black's Radio Service, Burlington, Iowa

The November issue of Successful Servicing was received today and both articles on the licensing of radio, television, and electronic service technicians were read. Both have presented very good points as they see it but I agree most heartily with Mr. Haas. I will touch on a few points.

Licensing will not assure the customer of a good job being done on his or her set.

Licensing will not keep the repair cost down as there is too much red tape to go through and that always increases the cost to the consumer.

A license does not necessarily build up one's reputation as a reliable technician. Quality workmanship and fair prices are more desirable than a license.

This letter may seem a little unusual from a territory that is not affected as yet by the threat of licensing, but I couldn't let this subject go unheeded.

D. L. Johnson, Commercial Trading Co., Tucson, Arizona

License TV technicians? My answer is NO! In the first place the plan proposed is undemocratic, nowhere does the serviceman have the right to elect his representative to the proposed board—the board members are all appointed by a political officer and the only purpose of this bill is to provise more plums for a political machine.

If it is desired to raise the general standard of ability it would be far wiser to institute a series of service training schools or classes and make them available at reasonable rates with competent staffs and up to date methods and materials.

I strongly suspect that the self employed technician would suffer from this measure.

Gilbert Grossinger, Brooklyn, N. Y.

Licensing may have its good points, but from my viewpoint the consumer will pay for it in the end.

Let us say that licensing will get rid of some, even many incompetent servicemen, by eliminating those unable to pass the exam or those who will not buy the license. Consequently, those of us who maintain our status will be busier; thus we will be able to charge more for a service call. After all, we now have a license and may feel we deserve more. Secondly, those men who would sell the consumer equipment he does not need will still do so, only this time they will have a license to do it. It's legal now?

It is my contention that those men who sell contracts should be required to maintain a minimum bank account to protect the consumer from fly-by-night businesses. Aside from this, the entire idea of licensing is ridiculous.

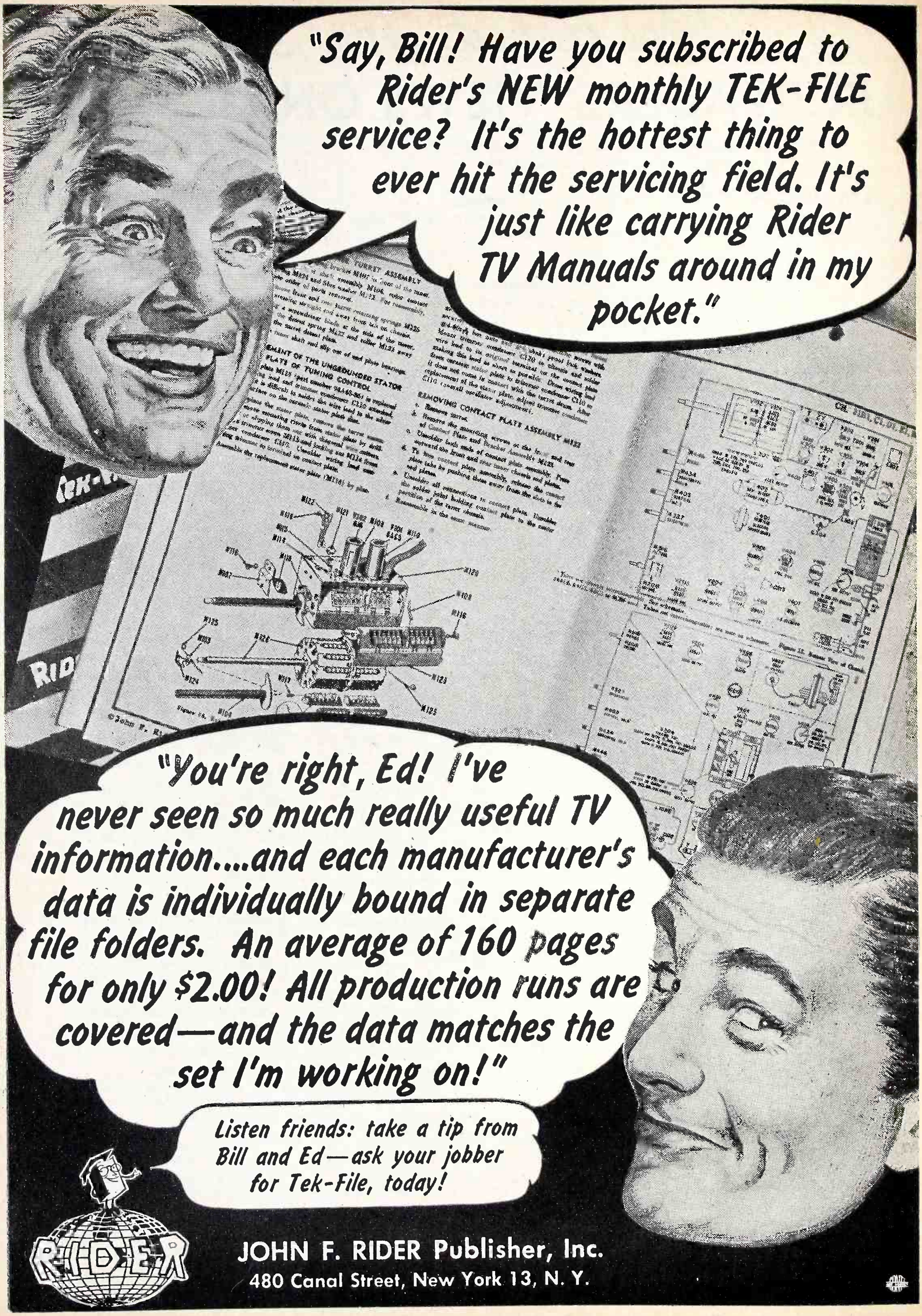
Leonard E. Markle, Mark's Radio Service, Greenfile, Indiana

In regard to the article on "License TV Technicians," I think the repairman or technician has beat himself over the head enough already with all the hellabeloo about the license. He can either fix a set or he can't—the customer will be the controlling factor in any town or city.

I do believe that all the technicians should get together once a month or so and talk over their problems and agree on service call prices, etc. This would work the same as the industry's Net and List prices.

I believe more pressure should be put on the manufacturers of tv sets. Sets should be designed so that they would be easier to work on. Some sets require that the chassis be pulled out simply to replace a tube. This costs the customer extra money and doesn't make for good technician-customer relations.

P.S. I still say NO!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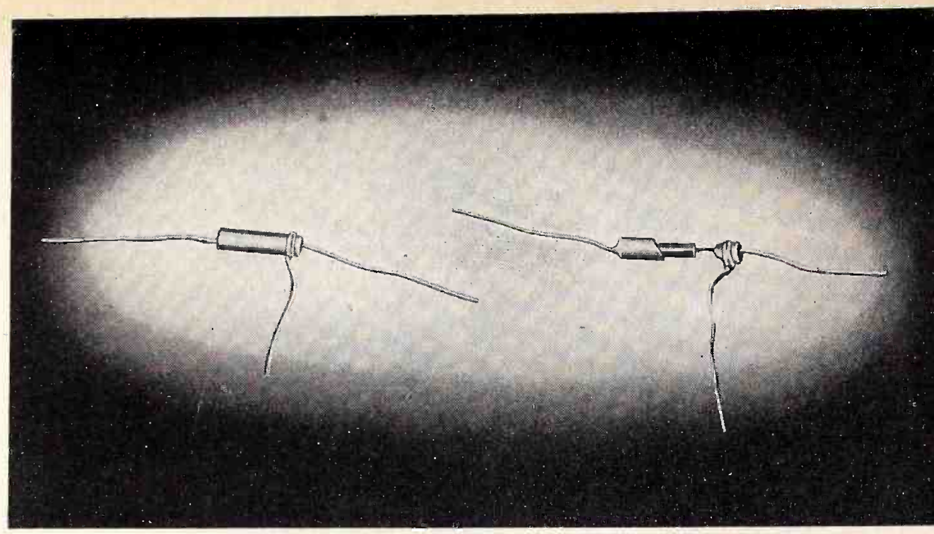

Fig. 2C. Photograph of a resistor-capacitor combination unit showing on the left, the whole unit, and on the right, a broken one with the resistor inside the ceramic capacitor.

COMPONENT COMBINATIONS in Radio Receivers

by Seymour D. Uslan

From the point of view of the man who traces out the troubles in radio receivers and repairs them, variations in electrical and mechanical design always present a problem. He must acquaint himself with these innovations so that he can do a better job. The trend toward the use of new circuit constructions in the electronic equipment of today is on the increase.

It is the purpose of this article to acquaint the reader with those special constructions that are used in the radio receivers of today.

In the Lear portable radio chassis P-10B for example, there are employed specially constructed resistance and capacitance units, called "C and R units." Most of these units are shown schematically as representing a single resistor and capacitor, but there are some that are shown representing two capacitors and one resistor. These units are not printed circuits but rather, separate resistors and ceramic capacitors so mechanically arranged into a single unit that it might at first be difficult for the radio serviceman to realize that more than one circuit element is represented by this unit.

The schematic diagram for a section of the P-10B chassis is illustrated in Fig. 1. The units of interest to us are shown enclosed in dashed boxes and are represented by the resistor-capacitor combinations of R8-C32, R12-C31, R14-C34, R15-C35, and R6-C29-C30. The relationship between the schematic representation and the physical unit is somewhat puzzling. In order to visualize the tie-in between the schematic drawing and the unit itself, we will study the construction of these units.

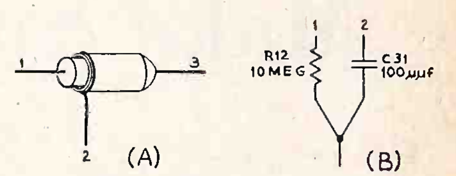

Fig. 2. (A) Drawing of the R12-C31 unit as it appears in the receiver. (B) Schematic representation of this unit.

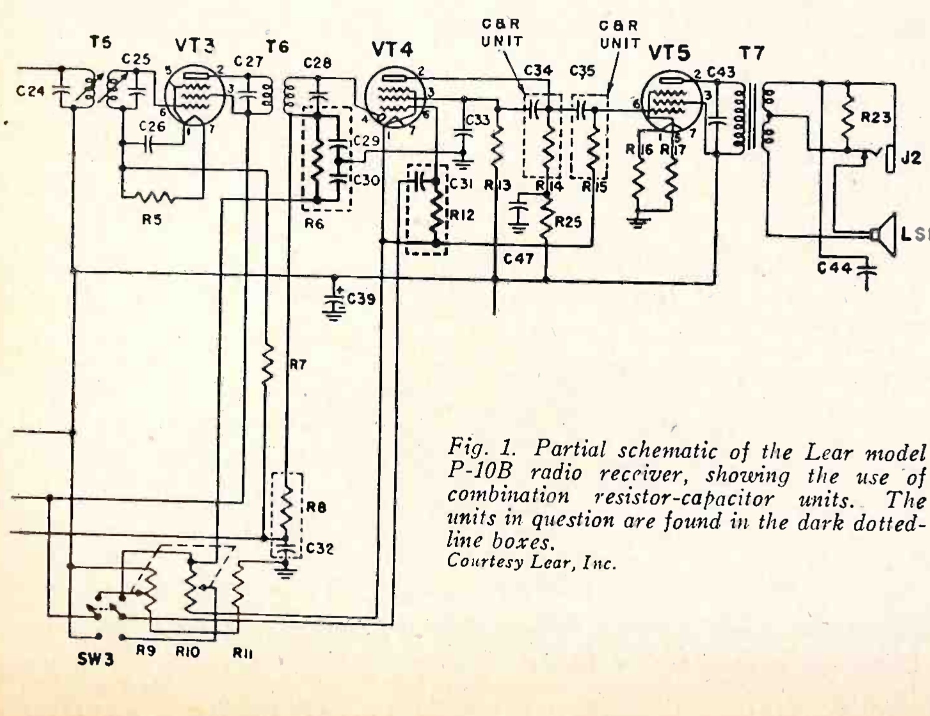

Fig. 1. Partial schematic of the Lear model P-10B radio receiver, showing the use of combination resistor-capacitor units. The units in question are found in the dark dotted-line boxes.
Courtesy Lear, Inc.

Single Resistor-Capacitor Combinations

Each unit consists of a single carbon resistor in conjunction with a ceramic capacitor. A drawing of the R12-C31 unit (R8-C32, R12-C31, R14-C34, and R15-C35 are identical) as it appears in the receiver is illustrated in Fig. 2(A), and the schematic representation for this unit is shown in Fig. 2(B). An actual photograph of two of the units is shown in Fig. 2(C). This unit consists of a 10-megohm carbon resistor inserted inside a ceramic capacitor. One end of the resistor is soldered to one plate of the capacitor and this connection is brought out as a single lead, number 3 in Fig. 2(A). Lead number 1 acts as the other end of the resistor and lead number 2 is the other end of the capacitor.

In the circuit of Fig. 1 the common lead (3) of the R12-C31 unit is connected to the control grid of VT 4, the other end of the resistor is connected to the cathode of VT 4 and R15; the other end of the capacitor is connected to Switch 3 (Direction Finder

(*Continued on page 14.*)

Servicing Hints for TV RECEIVERS

(*Continued from page* 3.)

but the residual fm inevitably proceeds to the speaker as audible buzz.

Sync Pulse Normal But Retrace Lines Appear

If the sync pulse and blanking pedestals appear normal, visible retrace lines may be the result of a weak or misadjusted ion trap. This forces the brightness control to be set too high. If the ion trap is all right, check the high voltage. The filter resistor may be excessively high in value. Another cause is a faulty picture tube which may be gassy, have low beam current, or may have a failing screen.

The guiding thought behind these checks is that the brightness control is being advanced abnormally for some reason. As a result, the picture tube does not operate far enough down on its Eg-Ip characteristic. This causes black and blacker-than-black signals to appear as grays on the screen.

New Yoke Does Not Cure Keystoning

If a new yoke does not cure keystoning, the trouble may be caused by the use of the former capacitor and resistors across the yoke terminals (see Fig. 3).

It occasionally happens that an apparent short in the yoke is actually being caused by defective resistors or capacitors. *Check also the condition of the insulation on the yoke leads, especially where they come through the chassis.* Occasionally the insulation is frayed, thus causing a partial or complete short at this point.

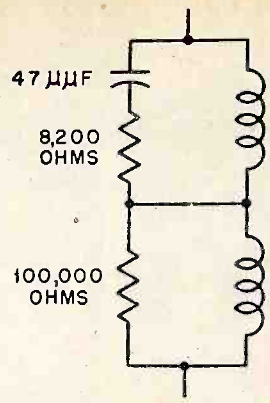

Fig. 3. RC circuit used in conjunction with horizontal deflection coils in yoke.

Readjust Ion Trap with Increase of High Voltage

Several methods are available to raise the high voltage supply to the second anode of the picture tube in order to obtain a brighter picture. It is worth noting that the optimum position of the ion trap changes with a change in accelerating potential. Accordingly, the adjustment of the ion trap should be checked if the high voltage is raised. This will not only insure the maximum brilliance of picture, but also will avoid possible damage to the picture tube.

Measurement of D-C Voltage with High A-C Voltage Present

Many technicians are familiar with the danger of damage to a multimeter or to a VTVM when an attempt is made to measure the plate voltage of the horizontal-output tube. The d-c voltage present at this point is about 300 volts. However, this is accompanied by a sharp pulse of approximately 6,000 volts peak-to-peak.

While the pulse voltage does not affect the indication on the d-c voltmeter directly, this pulse may draw a large current pulse through the attenuator of the voltmeter. This can cause serious damage by overheating or burning out of the precision resistors.

Now it is quite practical to measure the d-c plate voltage at the plate of the horizontal-output tube without damage to the voltmeter if a high-voltage probe is used. In this case, the probe is used not to attenuate the measured voltage, but to serve as a filter which keeps large pulse currents from flowing. The attenuation of the d-c voltage is incidental to the protection afforded.

Since about 300 volts are to be measured, a 100-to-1 high-voltage probe is most convenient. The range switch of the voltmeter can be turned to the 3-volt range, and the scale is then read as 300 volts, full scale.

Consider how much the pulse voltage is attenuated at the meter terminals. Assume that a VTVM having an input resistance of 12 megohms is used. The 100-to-1 multiplier resistor has a value of 1,188 megohms. Accordingly, 1/100 of the applied d-c voltage appears at the VTVM input terminals. However, the attenuation factor for the unwanted pulse voltage is very much greater. The total input capacitance of the shielded cable plus the VTVM input capacitance is typically 150 μμf. At the fundamental frequency of the pulse, this capacitance has a reactance of about 70,000 ohms. This causes a pulse attenuation of about 18,000-to-1. In other words, only 1/3 volt ac appears across the VTVM input terminals.

— END —

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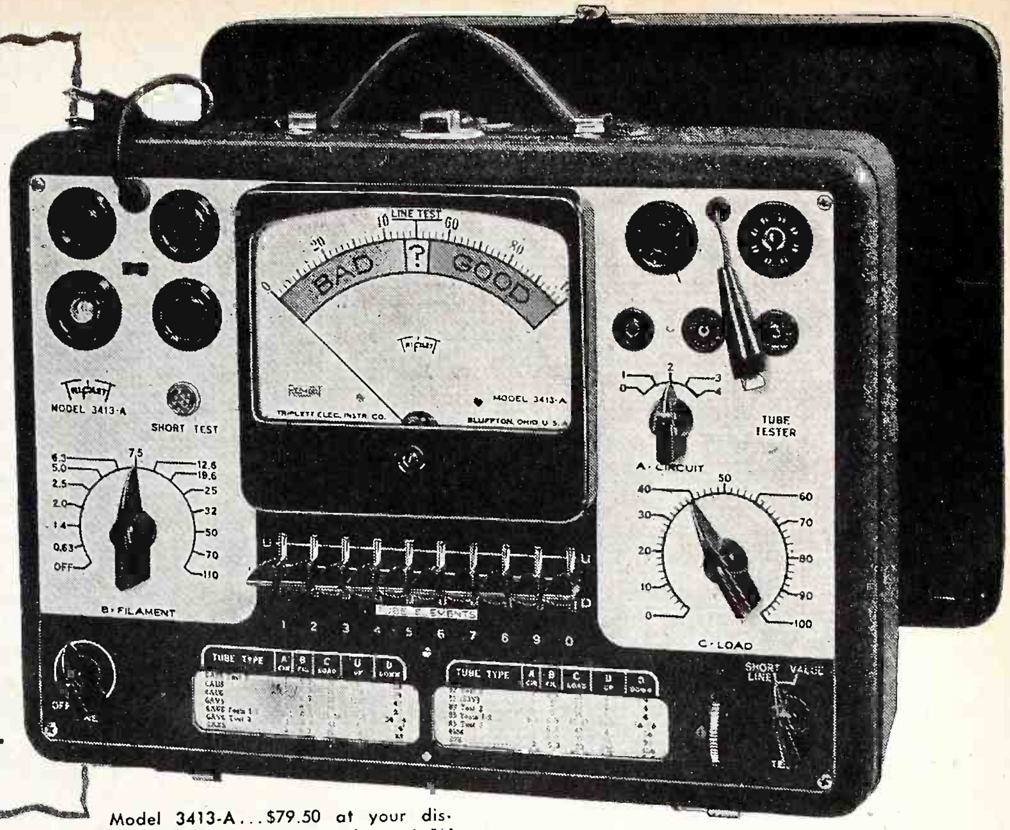

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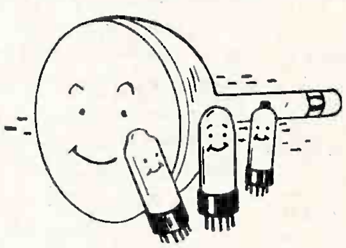

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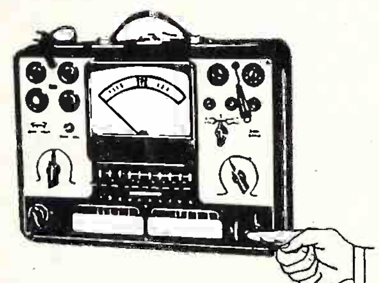

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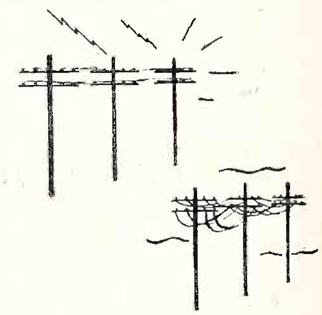

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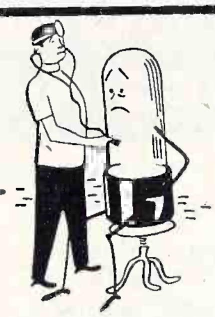
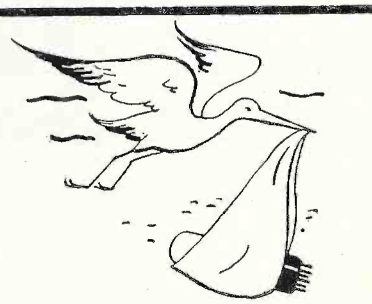


4. **YOU CAN TEST EACH ELEMENT** in each tube—by a simple flip of the switch.



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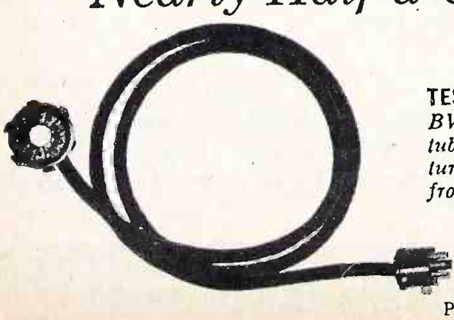

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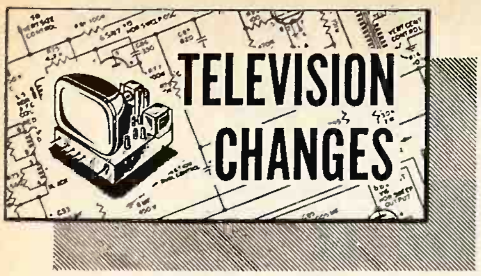


Sylvania 5130B, 5130M, 5130W, 5140B, 5140M, Ch. 1-290

The following changes with change codes as noted have been made in the 1-290 chassis.

Code 2. The value of R183, connected to pins 2 and 3 of V14 sync separator has been changed from 2.2 megohms to 1 megohm. The value of R192, connected to T60, has been changed from 1.5 megohms to 1.2 megohms. The value of R-193 is now 1.5 megohms.

Code 3. An audio socket has been added as shown in Fig. I to VII, the 6T8 ratio detector and 1st a-f stage. Pin 3 goes to C106; pin 2 goes to T53; pin 9 goes to the junction of C112, C113 and R113; R111 and C118 go to the junction of C105, R108 and C107; C118 and R112 are connected to R119. R169, which was located from R168 to the –135-volt line, has been relocated and now goes from the –135-volt line to R164 (3,600 ohms). R168 is connected directly to the –135-volt line. The lead from the junction of C195 and the 6AU6 horizontal control pins 2 and 7 goes to the junction of R164 and R169. The value of R169 has been changed from 47 ohms to 180 ohms. The value of C146, connected to pin 6 of the 6BF5 video amplifier, has been changed from 0.1 µf to 0.005 µf, and C146 is connected to the junction of C147 and ground instead of to the –135-volt line. The value of C147 has been changed from 0.05 µf to 0.005 µf. Pin 2 of the video amplifier is connected to the junction of R145 (3,300 ohms), C145 and R146, instead of to the –135-volt line.

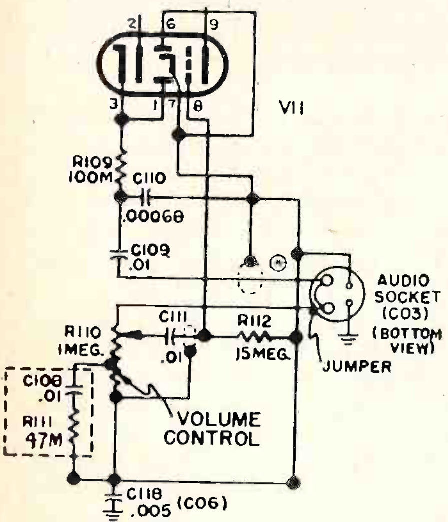


Fig. 1. Partial schematic of the Sylvania chassis 1-290 showing addition of audio socket.

Code 4. This is a factory change and does not affect field service.

Code 5. Tubes V13 and V18 have been changed from 12AU7 to 6SN7GT. No wiring changes are necessary.

Code 6. A 0.005-µf capacitor C118 has been added from the junction of R110 (volume control), R119, and R111 to ground. C112, the 0.0001-µf capacitor connected to pin 9 of V11 6T8, and C116, the 0.005-µf capacitor connected to R116 in the audio output circuit, have been returned to ground.

●

Emerson Ch. 120134-H

With the exception of the tuner, chassis 120134-H and 120134-B are the same electrically. Chassis 120134-H uses continuous type tuner #470662. Video i-f and sound i-f alignment for chassis 120134-H is the same as that for models 661B, 667B and 668B using chassis 120134-B.

1. Disconnect the antenna hank by unsoldering. Connect the signal generator. The receiver connection is to the antenna; the ground connection, to B minus.

2. With the tuner rotor full open (plates out of mesh), apply a signal frequency of 1,650 kc and adjust first the r-f trimmer A2, then the antenna trimmer A1 to maximum output.

3. With the tuner adjusted to 1,500 kc, apply a signal frequency of 1,500 kc and again adjust the r-f trimmer A2, then the antenna trimmer A1 to maximum output. (Note that the seven markings on the dial bracket of the tuner represent respectively 550 kc, 660 kc, 700 kc, 900 kc, 1,000 kc, 1,400 kc, and 1,600 kc reading from left to right. These points are to be used for the alignment of the receiver.)

●

Du Mont RA-105B, RA-108A

In the grid (pin 1) circuit of the 1st video i-f tube V201, the 10,000-ohm resistor R208 and the video i-f coil L206, wired in parallel, have been inserted in the agc lead.

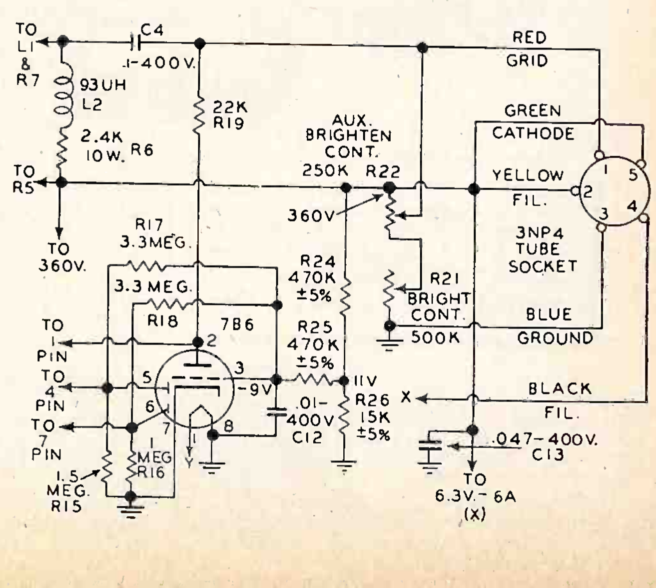
In the 1st sound amplifier stage, terminal 3 of the tone control R281 should be connected to the junction of the resistor R277 and the capacitor C252 in the volume control circuit.

●

North American Philips (Norelco) Model PA-2A Duovue

Figure 1 is a partial schematic diagram of this model showing the circuit changes made.

Fig. 1. Partial schematic of the North American Philips Model PA-2A tv receiver. This circuit incorporates the changes made in the most recent production models of this receiver.



Belmont Model 7DX21, Series C

The Series C model has the following changes from the Series B model.

The i-f amplifier tubes, V6, V7 and V8, have been changed from 6BA6s to 6AG5s. The 6AG5 tubes have the suppressor grid tied to the cathode internally so that R27 and C51, R32 and C54, R36 and C60, the components that formed the external connections of the suppressor grid (pin 2) to the cathode (pin 7) of the 6BA6s, have been deleted.

A choke, L27, has been added in the B+ supply for the 1st i-f amplifier, V6, and the tuner chassis; that is, the junction of the red lead from the tuner chassis, R23, and R29, is now wired to L27 which is connected to the B+ power supply.

A 10,000-ohm resistor, R36, has been added, connecting the suppressor grid (pin 6) to the plate (pin 5) of the 2nd i-f amplifier tube, V7. The part number of the new R36 is C-9B1-74.

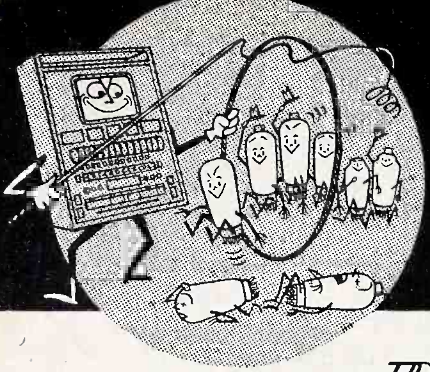
The resistor R108, the capacitor C115, and the choke coil L9, which formerly connected the plate (pin 6) of the 1st audio tube, V4, to the minus side of the capacitors C27 and C73, have been deleted.

The 2.2 megohm resistor, R95, has been deleted from the voltage divider system just before the focus control.

The capacitor C119, which connected the red lead from the transformer to the minus side of the capacitors C27 and C73, has been deleted.

The following resistors and capacitors were changed in value as shown below. The new parts numbers are also given.

Symbol	*Part Numbers*	*Description*
R24	C-9B1-56	Resistor, 3,300 ohms, ½ w, 10%
R26, 34, 35	C-9B1-127	Resistor, 47 ohms, ½ w, 5%
R31	C-9B1-83	Resistor, 56,000 ohms, ½ w, 10%
R78	C-9B1-90	Resistor, 220,000 ohms, ½ w, 10%
R80	C-9B1-100	Resistor, 1.5 megohms, ½ w, 10%
R82, 99	C-9B1-107	Resistor, 5.6 megohms, ½ w, 10%
R97	C-9B1-242	Resistor, 3 megohms, ½ w, 10%
R98	C-9B1-103	Resistor, 2.7 megohms, ½ w, 10%
R105	C-9B1-104	Resistor, 3.3 megohms, ½ w, 10%
R106	C-9B1-86	Resistor, 100,000 ohms, ½ w, 10%
C45, 46, 60 100, 113	A-8G-13962	Capacitor, 5,000 µµf, ceramic
C49	C-8G-17349	Capacitor, 330 µµf, ceramic
C93	C-8F3-241	Capacitor, 470 µµf, 500 v, 5%
C101	B-8D-17699	Capacitor, .04 µf, 1,600 v.
C102	C-8G-13201	Capacitor, 1,000 µµf, ceramic
C103	C-8D-17555	Capacitor, .08 µf, 400 v, 10%.



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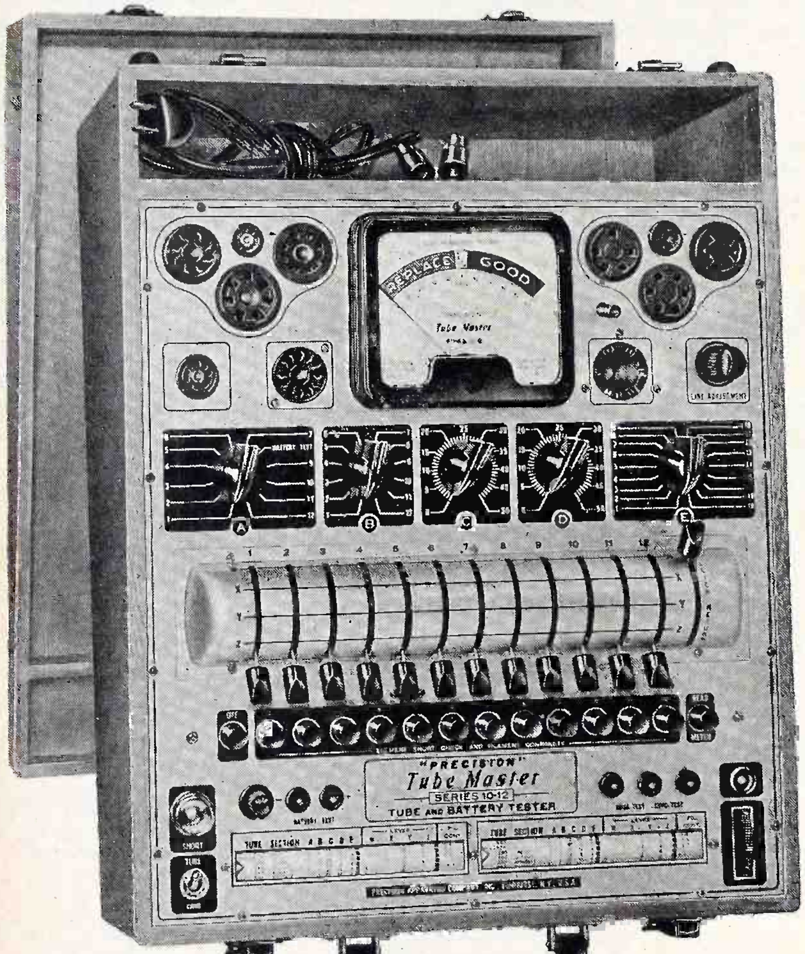

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Fringe Area TV ANTENNA TOWER

(*Continued from page 1.*)

The Tower

The overall height of the antenna tower plus the antenna mast is 101 feet. The tower proper rises to 85 feet above the ground surface, and is constructed of ten-foot sections. It is triangular in shape, using three 1″ o.d. steel tubes with ⅛″ walls as uprights on 9″ centers. Steel straps ½″ by ⅛″ are welded crosswise and diagonally to the uprights.

The base of the tower extends for five feet into a sunken concrete block, 8 feet deep. This mounting block tapers from 30″ by 30″ at the bottom to 18″ by 18″ at the top (see Fig. 2). Approximately 2½ cubic yards of cement were used for this base.

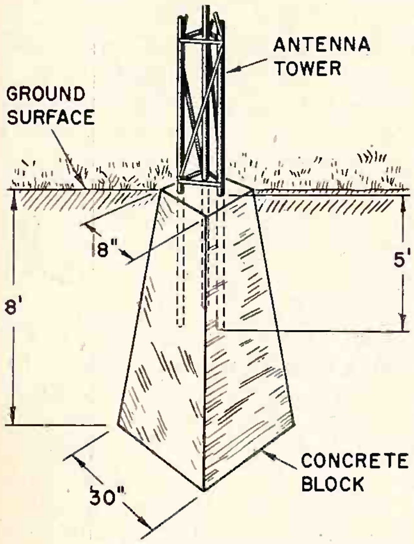

Fig. 2. Shown here is the concrete base into which the antenna tower is set. The concrete block itself is entirely under ground.

Guying

The tower under discussion in this article had to be built to withstand winds which may have a velocity of 100 to 125 miles per hour. Such velocities are not uncommon in Jackson, Michigan; it is interesting to note that the tower described here actually stayed up in storms which carried away the anemometers at nearby airports. The most important factor in keeping this tower up under severe windstorms and snowstorms is the guying.

Seven sets of guy wires are used; each guy wire is 7 x 36 Roebling steel bridge cable with 60,000 pounds strain rating. The first set (consisting of three guy wires, one from each upright) join the tower 30 feet above the ground level. Interlocking Johnny Balls are located at nonresonant lengths for the tv and f-m frequencies. The next six sets of guy wires are attached to the tower at seven foot intervals along its height. Each set consists of three guys segmented by additional interlocking Johnny Balls. The uppermost set of guys is attached to the tower ten feet from the top. The various sets of guys and their relative positions may be seen in Fig. 1. A total of 2,400 feet of guy wire is used with this tower.

The ground ends of the guys terminate in three anchor posts. These are located at the three apexes of an isosceles triangle, each apex 38 feet from the center of the tower. The plan is shown in Fig. 3. All guys from the same tower upright go to the same anchor post.

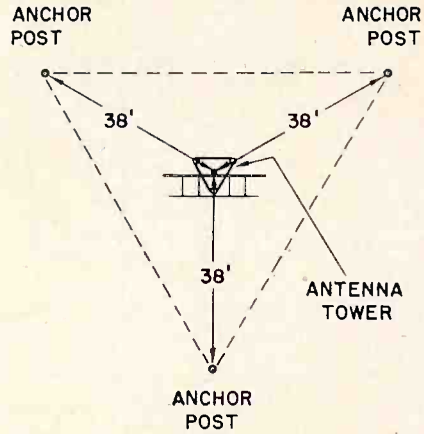

Fig. 3. Anchor post location plan, showing the equilateral triangle formed by the three anchor posts.

The anchor posts are 6″ x 8″ x ½″ I beams, 16 feet long. Each post is buried 8 feet in a concrete anchor block. These blocks have the same dimensions as the one used for the tower base.

Each guy wire contains a turnbuckle near its anchor post; each turnbuckle is rated at 1,000 pound pull. Figure 4 shows one anchor post and the various guy wires connected to it.

Assembly of Tower

As was stated earlier, the tower is constructed of 10-foot sections. The sections are joined by means of 12″ lengths of cold-rolled steel rods. These extend 6 inches into each of the uprights of the sections that are joined. The latter are kept in place by ¼″ machine bolts inserted in holes through the tower uprights and connecting rods.

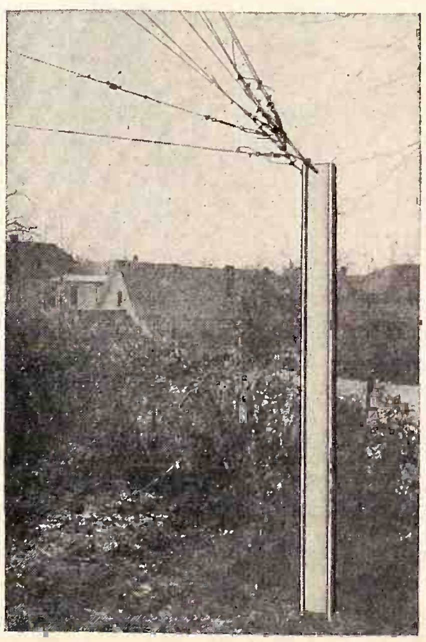

Fig. 4. Closeup of one of the anchor posts showing the turnbuckles found on each guy wire.

Actual erection of such towers depends upon the facilities available. In most cases one of two methods is used: either the tower is completely assembled on the ground (except for the bottom section) and then raised with a derrick and set upon the base section; or the tower is assembled one section at a time in the correct vertical position. The latter method requires the use of a steeplejack. As a matter of fact, the services of a steeplejack are required annually to clean and paint the tower with a rustproof paint.

The 85-foot height of the antenna tower was the result of a month of experimentation to find the exact height within practical limits which gave the maximum reception. Two hydrogen-filled balloons were used to keep aloft an experimental antenna. The height of this combination was raised from 10 feet above the ground to the 85-foot height in 1-foot steps. The antenna was kept at each testing height for about two hours, and a field strength test was made using a television receiver located on the ground.

Atop the antenna is a glass ball which serves as a light reflector to warn away approaching aircraft. From the ground it resembles an airplane beacon light. Two lightning arrestors are used: one is located where the leadin from the antenna approaches the tower; the other, at the point where the transmission line enters the house. Each leg of the tower is grounded and has ¼″ drain holes drilled slightly above the ground level.

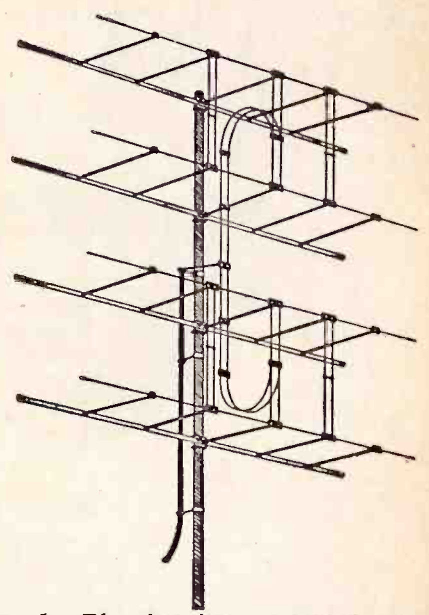

Fig. 5. The four-bay, co-lateral antenna mounted on the tower. Some such antenna is usually necessary in fringe areas to obtain maximum directional response.

The Antenna

The antenna proper is a Model 400 Finco co-lateral (see Fig. 5). It is a 4-bay array with 12 driven elements for the high band and 8 driven elements for the low band. It re-

(*Concluded on page 20.*)

Component Combinations in Radio Receivers

(Continued from page 7.)

switch). In order to understand fully the way the capacitor and resistor are combined, let us refer to the enlarged drawing of this C and R unit as illustrated in Fig. 3. From this isometric cross-sectional drawing the individual resistor and capacitor are readily evident.

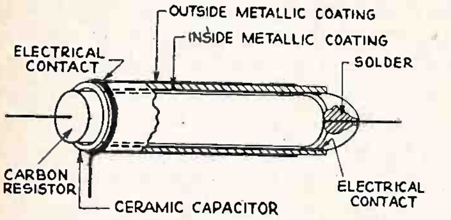

Fig. 3: Enlarged isometric cross-section of the R12-C13 unit.

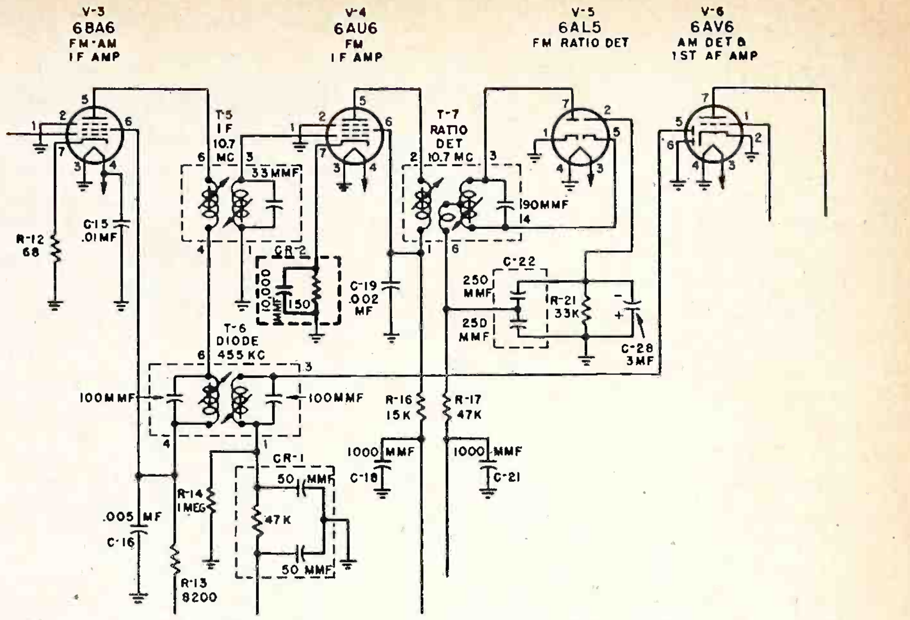

Fig. 4. Partial schematic of the Motorola radio chassis HS-211 and HS-230 with "CR" units.
Courtesy Motorola, Inc.

The interesting constructional details of this unit, as well as of the others, is the ceramic capacitor. The capacitor has two separate metallic coatings. One coating is on the inside of the ceramic cylinder and the other coating on the outside of the ceramic. These two metallic coatings represent the plates of the capacitor. The exact amount of capacitance represented by this capacitor is determined by a number of factors. One factor is the dielectric material separating the two metallic coatings, which in this case is, of course, the ceramic material. The distance of separation between the metallic plates is another factor—the smaller the distance, the greater the capacitance. For the capacitor under discussion this means the smaller the thickness of the ceramic cylinder, the larger the capacitance. The final factor in determining the value of the capacitance is the common area between the two metallic plates; the greater this area, the higher the capacitance. Since we are dealing with a cylindrical capacitor, this area is dependent upon two dimensions—the length of the metallic coatings that are common to each other and the diameter of the ceramic cylinder. The greater this length and the larger the diameter, the greater the area will be and, hence, the larger the capacitance.

Coming back to Fig. 3, it can be seen that the resistor is not inserted all the way into the ceramic capacitor. At the right-hand end of the unit some solder is inserted into the ceramic cylinder and takes on the approximate shape shown in the drawing. This solder is used to make electrical contact between the metal end of the resistor and the inside metallic plate of the capacitor. In this manner one end of the resistor and one end of the capacitor are tied together. At the left-hand side of the ceramic, a piece of wire is wrapped around the outside of the capacitor a few times and then soldered to the outside metallic plate of the ceramic cylinder. This connection serves as the other lead of the capacitor. The metallic plates do not necessarily cover the whole length of the ceramic. The exact length is determined by the amount of capacitance desired.

In the drawing of Fig. 3, the heavy lines indicate the metallic coatings of the capacitor. After assembly this completed C and R unit is covered with a white coating of some insulating material.

Two Capacitor—One Resistor Combinations

The second unit of interest to us electrically consists of two capacitors and one resistor composing *CR-1,* in the partial schematic of the Motorola radio chassis HS-211 and HS-230 shown in Fig. 4. From the drawing of this unit as shown in Fig. 5(A), and the photograph shown in Fig. 5(C), it is difficult

(Continued on page 16.)

Thank you

SIGNAL CORPS PUBLICATIONS AGENCY

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18 September 1951

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John F. Rider Publisher, Inc.
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Dear Mr. Rider:

It gives me a great deal of pleasure to write this letter in appreciation of the magnificent job accomplished by your company in the preparation of literature contracted for under Order No. 5251-Phila-51.

As of this date, we have received seven complete manuscripts. The eighth and final manuscript has been scheduled for delivery to us not later than 1 October 1951. Five manuscripts have been shipped to The Adjutant General for printing and publication by the Government Printing Office, as official Department of the Army technical manuals.

As a former Signal Corps officer, you are well aware of the vital and urgent need for accurate and adequate fundamentals training publications for use by military students in all phases of communication. The books prepared by you reflect a complete understanding of the problems involved in simplifying complex technical material, yet retaining the basic concepts required to "put over" the essential facts. Although all of the books are superior, two are particularly outstanding: TM 11-662, "Basic Theory and Application of Electron Tubes," and TM 11-671, "Cathode Ray Tubes and Their Associated Circuits."

The whole-hearted cooperation extended by you and the members of your organization who participated in this program; the inclusion in the books, without charge to the Government, of considerable material not originally contemplated; the completion of eight manuscripts one month prior to the scheduled contract date, are deeply and sincerely appreciated. The part played by your firm in meeting a "challenge of the time" has been vital and significant. Please accept my sincere thanks and the recognition by the Signal Corps Publications Agency for an outstanding performance.

Very truly yours,

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Component Combinations in Radio Receivers

(*Continued from page 14.*)

to conceive how it is equivalent to these three circuit components. The schematic diagram of this unit appears in Fig. 5(B). This three-element unit only has three external leads. Lead number 1, around the middle of the unit, represents the common connection between the two capacitor components. Each of the other two leads represents the connection between one end of the resistor and one plate of the capacitor. Thus, there is a capacitance of 50 μμf between leads 1 and 2 and also between leads 1 and 3 of the drawing of Fig. 5(A). A 47,000-ohm resistance can be measured between leads 2 and 3.

This unit is employed as the diode filter in the a-m detector circuit of the receiver, as

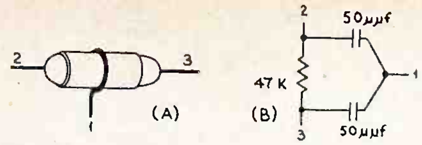
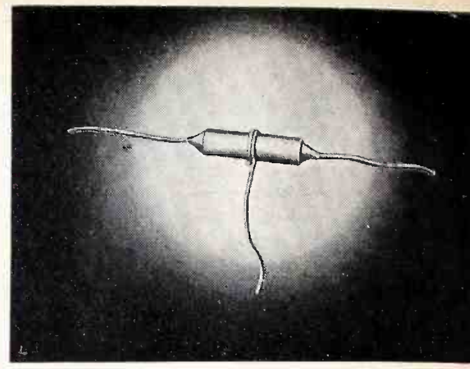


Fig. 5. (A) Drawing of a unit composed of two capacitors and one resistor. (B) Schematic representation of this unit. (C) Photograph of this unit.

can be seen in Fig. 4. When wiring this special construction into the circuit, lead number 1 must be grounded. Since each capacitor is 50 μμf in value, it does not matter which of the other leads is connected to the detector transformer; even if leads 2 and 3 were interchanged, the circuit of this unit would still be the same.

Let us examine the construction of this



double capacitor and resistor combination. A detailed isometric cross-sectional drawing appears in Fig. 6. A single carbon resistor and one ceramic cylinder is used to form this special filter network. The interesting thing about this unit is the method of plating the ceramic.

The outside of the ceramic is covered with a metallic coating, as shown by the heavy solid line in the drawing. The inside of the ceramic also has a metallic coating, as indicated by the heavy lines; however, this coating is not continuous but is split at the center. Considering the ceramic capacitor as is we find that we have three separate plates.

Centered inside the ceramic cylinder is the carbon resistor. At each end of the unit some solder is inserted. Each end of the resistor, therefore, makes electrical contact with a separate metallic plate at the inside of the ceramic. A piece of wire is wound around the outside of the ceramic and soldered to the metallic coating. This latter wire is centered on the unit. From the drawing of Fig. 6 we find:

1. That the outside metallic coating represents the common plate of the two capacitors, with the center wound wire as its connecting lead.
2. That a capacitance exists between either end of the unit (which represents a connection between one end of the resistor and one of the other plates of the capacitor) and the center lead. This capacitance is determined primarily by the common area of the two metallic plates of the capacitor, the distance between the plates, and the length of the inside metallic plate.

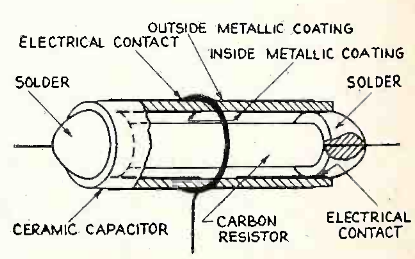


Fig. 6. Detailed isometric cross-section of the unit composed of two capacitors and one resistor.

After assembly this unit is covered with a white insulating coating similar to the other C and R unit.

Parallel Capacitor-Resistor Unit

A drawing of the *CR-2* unit in the Motorola schematic as it normally appears is shown at (A) in Fig. 7, in conjunction with its schematic diagram which appears in part (B). It consists of a single carbon resistor inserted

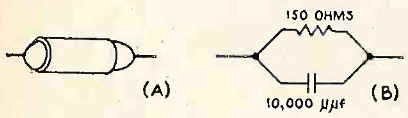


Fig. 7. Drawing and schematic of the Motorola CR-2 unit.

inside a ceramic capacitor. In this unit, however, there are only two exposed leads indicating that the resistor and capacitor are already in parallel. Each end of the resistor is soldered to a different plate of the capacitor. A detailed isometric cross-sectional drawing of this unit appears in Fig. 8. The heavy lines on the ceramic indicate the metallic plate of the capacitor. The interesting detail about this unit is the method of making contact between each end of the resistor and the plates of the capacitor.

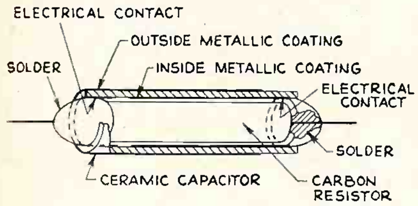


Fig. 8. Cross-sectional diagram of the CR-2 unit.

At the right-hand end, the solder which is inserted inside the capacitor makes electrical contact between the inside plate of the capacitor and the resistor. The left-hand end of the unit has the same physical appearance as the right end. However, from Fig. 8 we see that the outside metallic plate of the capacitor is *flush* to the left-hand end of the ceramic and continues for a short distance on the inside of the ceramic, but does not make contact with the inside metallic coating. By placing some solder inside this end of the capacitor, there is effectively an electrical contact between the outside plate and the other end of the resistor. The capacitance of the capacitor is determined in the same manner as that of Fig. 3.

Units such as these will probably be used in greater quantities as time goes on. From the manufacturing viewpoint, their use saves time in assembly operations. For example, the three components of the diode filter of Fig. 5 would normally require 6 separate connections, 2 for each component; but only 3 are required with this special unit.

This also means that the serviceman would have less work to do if all of the components have to be changed. However, this is not the usual case. Thus, if any one element in these special C and R units were to become defective, the complete unit would have to be changed. If these special units are not available, then standard components of proper size and ratings can be used if there is enough space for them.

— END —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How to Save on Aspirin in TV Servicing

What protection exists for the tv service shop when, after it pulls a defective tv chassis containing an old picture tube, the picture tube burns out while the set is being serviced, without any negligence on the part of the service technician. How can the shop owner convince the set owner that the tube went West, and still be free from responsibility? It's going to take a lot of arguing to convince the customer who must buy a new tube that the shop is not at fault.

Maybe these incidents do not occur too frequently, but even isolated cases may be extremely annoying, if not expensive. If possible every tv shop should carry insurance against costs of this kind. Insurance is a part of the overhead and should be figured as such. Another protective measure is the use of a release form which the set owner signs when the chassis is taken to the shop. This in turn means giving the customer a receipt for the chassis showing the serial number of the picture tube.

Records for the Customers

While on the subject of receipts, it may be wise to give some thought to a receiver operating record which is left with the customer at the time the receiver is pulled. Many service calls are made to remedy defects in the receiver which show up on a single tv channel while the receiver operates satisfactorily on the other channels. In such cases, much future argument can be avoided by checking the performance of the set on all available channels and leaving a written record of the performance with the customer. A duplicate is delivered to the service department with the defective chassis.

When the receiver is returned and installed the improvements in reception are called to the attention of the set owner. If the receiving conditions are such that the pictures on some channels are not all they should be because of effects external to the receiver, the written record left with the customer will prove that this condition existed before servicing and is not attributable to the serviceman.

Understandably, such records can not be left when the receiver is completely dead, but even then it does no harm to leave a report of the condition of the set. Such a report would state which tubes indicate active heaters by glowing or a rise in temperature of the metal housing, and which do not.

In recording the preserviced condition of a receiver make certain to examine the picture-tube screen for ion spots and record the visible condition of the screen. Somehow or other the public is always more critical after a repair job than before the service technician is called. In more than one case, the customer will notice a brown spot on the tube of his set after it has been serviced and accuse the serviceman of switching his tube, when in reality the spot had been there all the time.

It is also wise to record any damage that is noticed on the cabinet or the receiver housing, even if only the chassis is pulled. Why make repairs on the cabinet if they are not brought on by your handling?

There are several methods by which the details of record making may be handled; whichever way is selected depends upon personal preference. The important point is to leave some sort of a record. Incidentally, the record should show the serial number of the receiver, and the manufacturer.

Above all, the service shop should absolve itself of all responsibility relative to the condition of any of the components contained within the chassis at the time that the chassis is pulled. A word-of-mouth statement is insufficient protection against future difficulties. Have everything in writing, if possible. It requires a few more minutes of time in the home but it's worth it in the long run.

Techni-Quiz

Here are some questions you may use to test yourself on your electronics know how. The correct answers to these questions are on page 20.

1. Appearance of a scanning raster on the tv picture tube but no image, accompanied by sound from the loudspeaker, indicates probable failure in the:
   (a) r-f stages .
   (b) vertical sync system
   (c) video i-f system
   (d) low-voltage supply.
2. When the background shading of the picture becomes darker and the larger objects smear, first check the:
   (a) video low-frequency compensating network
   (b) high-frequency compensating network
   (c) horizontal sync system
   (d) video i-f system.
3. If a choice must be made it is preferable to match a transmission line to the antenna rather than to the receiver. True or False?
4. A light vertical strip down the left hand edge of the picture probably means a:
   (a) bad horizontal output tube
   (b) defective damping tube
   (c) faulty horizontal drive control.
5. To what frequency should the signal generator be adjusted when aligning the limiter stage of an f-m receiver?
6. The minimum required bandwidth of the i-f circuits of an f-m receiver is:
   (a) 50 kc (b) 4 mc (c) 150 kc.

Fringe Area TV ANTENNA TOWER

(*Continued from page 13.*)

ceives channels 2, 4, and 7 from Detroit, channel 3 from Kalamazoo, channel 5 from Chicago, channel 6 from Lansing, channel 9 from Cleveland, and channel 13 from Toledo.

The transmission line feeding the antenna is home-constructed open-wire line designed for three-hundred ohms.

The antenna mast is approximately 24 feet long and is made of 1½" o.d. spring steel tubing, the type used for making still coils.

A rotator is used with the antenna to obtain the maximum directional response. This rotator is located 4 feet below the top of the tower, on a shelf welded to the tower inside the triangle formed by the uprights. A thrust bearing located at the top of the tower supports the weight of the antenna mast. The shell of the antenna rotator is grounded.

—END—

AIEE to Present Basic TV Lectures

The American Institute of Electrical Engineers (AIEE) will present a series of six lectures on "TV Servicing Fundamentals for Engineers," in New York City on Monday evenings at 7 P.M. starting on January 14, 1952. The course will be given on a basic level and is intended primarily for engineers with a slight knowledge of electronics who wish to learn about television receivers and home servicing.

Each lecture will be presented by a different speaker who is well qualified on his subject. The speakers are Mr. Seymour D. Uslan, Managing Editor of John F. Rider Publisher, Inc.; Mr. Eugene Anthony, Products Service Manager, General Electric Co.; Mr. Archer H. Smith, Senior Instructor, RCA Institutes, Inc.; Mr. Carl J. Quirk, Technical Supervisor, Allen B. Du Mont Laboratories, Inc.; Mr. Bron Kutny, Assistant Manager Field Engineering, Emerson Television Corp.; and Mr. Walter H. Buchsbaum, TV Consultant, "Radio and Television News."

The individual topics to be discussed at the various meetings and the speakers presenting them are listed below:

- General tv receiver, block diagram (Mr. Anthony)
- Antennas, transmission lines, front end and sound system (Mr. Uslan)
- Video i-f, detector, and amplifier circuits (Mr. Kutny)
- Sync, sweep, and power supply circuits and picture tube (Mr. Buchsbaum)
- TV receiver troubles (Mr. Smith)
- Troubleshooting external interference, UHF and color television (Mr. Quirk).

For further information regarding this course write to Mr. R. Y. Atlee, Engineering Supervisor, A.D.T. Company, Inc., 155 Sixth Avenue, N. Y., N. Y.

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Please mention Successful Servicing when answering advertising.

Answers to TECHNI-QUIZ on page 19.

1. (c)
2. (a)
3. False
4. (b)
5. i-f of receiver
6. (c)

High-Voltage Tubular Ceramic Capacitors

Electrical Reactance Corporation (an Aerovox subsidiary) has just added a new type of high-voltage tubular ceramic capacitor to their Hi-Q brand line. The type name of these new capacitors is SI-TV. They are available in eleven capacitance values from 4.7 to 47 μμf, all with a 6,000 volt rating.

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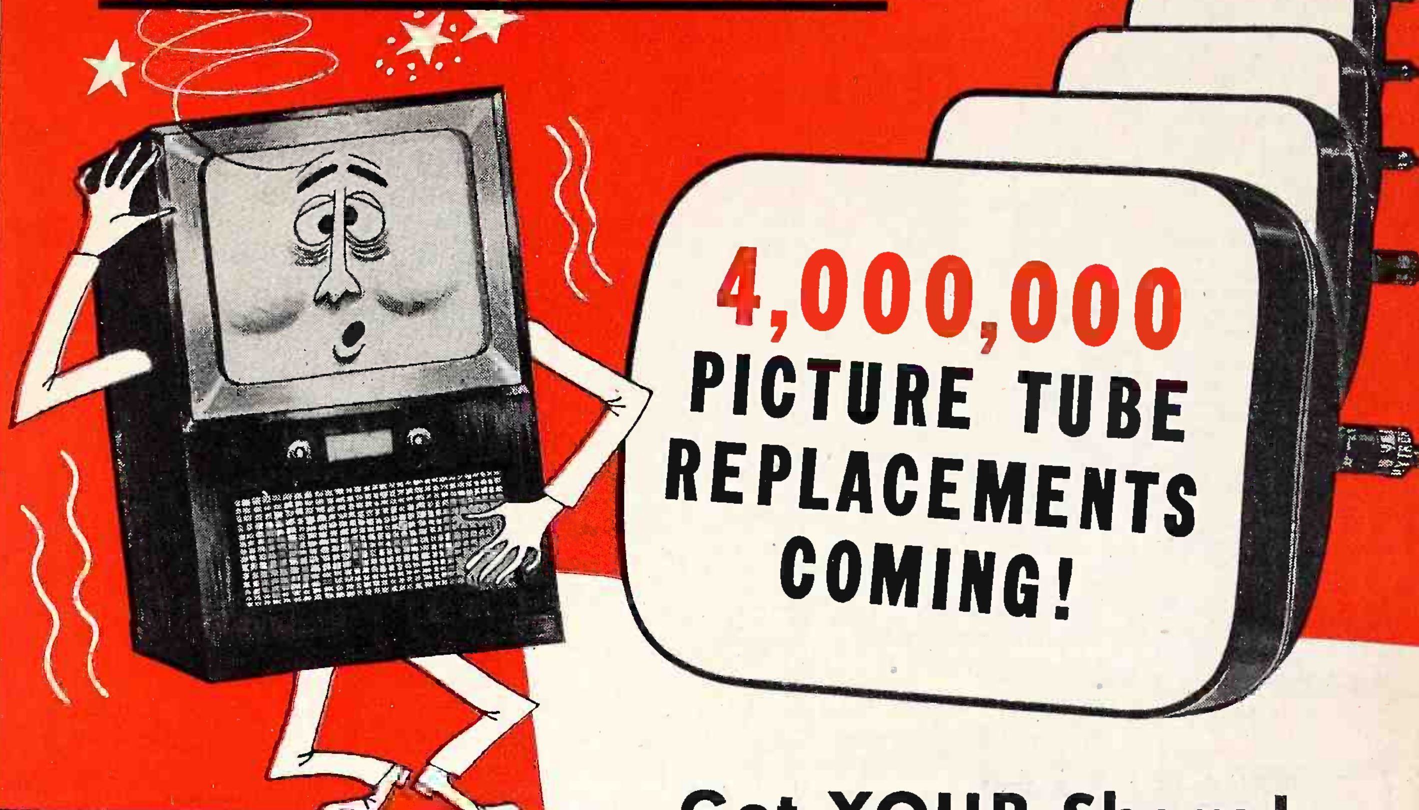

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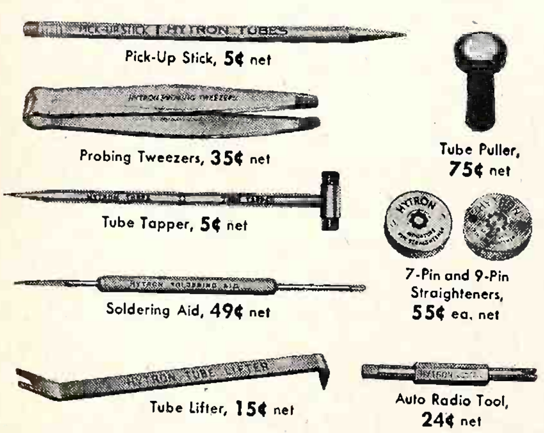

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GAMBLE-SKOGMO (CORONADO)
Model Pack 32
94TV2 - 43 - 8972A, 95TV2 - 43 - 8973A
94TV2 - 43 - 8987A, 94TV2 - 43 - 8993A, 94TV2-43-8994A, 94TV2-43-8995A
94TV6-43-8953A
Model Pack 31
05RA4-43-8935A
05TV1-43-9014A (CH. 16AY210)
05TV2 - 43 - 8950A, 05TV2 - 43 - 9010A
05TV6-43-8935A
15RA2-43-9105A (CH. 16AY210)
15TV1 - 43 - 8958A, 15TV1 - 43 - 9020A, 15TV1-43-9021A

GAROD
Model Pack 19
12C4, 12C5, 12T2, 12T3, 12T6 (94 SERIES)
14C4 (94 SERIES)
14CT4 (97, 98 SERIES)
14T2, 14T6, 16C4, 16C5, 16C6 (94 SERIES)
16CT4, 16CT5 (97, 98 SERIES)
16T2, 16T3 (94 SERIES)
19C6, 19C7 (97, 98 SERIES)
1042, 1042G Late, 1042GU, 1042T Late
1043, 1043G Late, 1043GU, 1043T Late
1142 Late, 1143 Late
1244, 1244G Late, 1244GU, 1244T Late, 1244TX
1245, 1245G Late, 1245GU, 1245T Late, 1245TX
1344 Late, 1345 Late, 1348
1546, 1546G Late, 1546GU, 1546T Late
1547, 1547G Late, 1547GU, 1547T Late
1548, 1548G Late, 1548GU, 1548T Late
1549, 1549G Late, 1549GU, 1549T Late
1646 Late, 1647 Late, 1648 Late, 1649 Late, 1671 (97, 98 SERIES)
1672, 1673, 1674, 1675 (97, 98 SERIES)
1900 (97, 98 SERIES)
1974, 1975 (97, 98 SERIES)
2042T Late, 2043T Late
2546T Late, 2547T Late, 2548T Late, 2549T Late

GENERAL ELECTRIC
Model Pack 19
10C101, 10C102, 10T1, 10T4, 10T5, 10T6, 12C101, 12C102, 12C105
12C107, 12C108, 12C109 (B VERSION)
12K1, 12T1, 12T3, 12T4; 12T3, 12T4 (B VERSION)
16C113, 16C116, 16T3, 16T4
17C101, 17C102, 815
RCD. CH. GE P14
Model Pack 31
12T7
14C102, 14C103, 14T2, 14T3
16C110, 16C111, 16C115
16K1, 16K2, 16T1, 16T2

GENERAL INSTRUMENT
Model Pack 31
45, ELECTUNER

HALLICRAFTERS
Model Pack 28
745, 747, 748, 750, 751, 760, 761 (CH. D919120)
818
832, 833 (CH. L919120)
810A, 815, 822, 870, 871, 880
14808B, Preliminary

HOFFMAN
Model Pack 29
TUNER
630, 631 (CH. 159)
630, 631 (CH. 170)
632, 633 (CH. 160)
632, 633, 634, 635 (CH. 171)
866, 867, 868 (CH. 171)
866A, 867A, 868A (CH. 173)
870, 871, 872 (CH. 170)
876, 877, 878 (CH. 171)
876A, 877A, 878A (CH. 173)
890, 891, 892 (CH. 175)
RF-6, RF-7, RF-8, TUNERS
24B707, 24M708 (CH. 187, 187B, 187C)
836, 837, 840 (CH. 153)
847, 848, 849 (CH. 156)
856, 857, 858 (CH. 153)
860, 861, 862 (CH. 157)
946, 947, 948 (CH. 164)
950, 951, 952 (CH. 172)
950A, 951A, 952A (CH. 174)
960, 961, 962 (CH. 176)

KAYE-HALBERT
Model Pack 30
231, 232, 233 (CH. 231, 242)
234, 239, HIDEAWAY (CH. 231, 242)
235, 240, WINDSOR (CH. 231, 242)
236, NORMANDY (CH. 231, 242)
237, CAMBRIDGE (CH. 231, 242)
238, 731, 733 (CH. 231, 242)

MAGNAVOX
Model Pack 30
CT-232, CT-236, CT-239, CT-240, CT-244, CT-245, CT-246, CH.
CT-247, CT-248, CT-249, CH.
CT-250, CT-251, CH.
CT-252, CT-253, CT-255, CH.
CT-257, CT-258, CT-259, CT-260
CT-262, CT-263, CT-264, CT-265, CT-266, CT-267, CT-269 (SERIES 103 CH.)
CT-270, CT-271, CT-272, CT-273, CT-274, CT-275, CT-276, CT-277, CT-278, CT-279, CT-280, CT-281, T-282
CT-283, CT-284, CT-285, CT-286, CT-287, CT-288, CT-289, CT-290, CT-291, CT-293, CT-294, CT-297 (SERIES 103 CH.)
CT-295, CT-296

MAJESTIC
Model Pack 30
7P1, 7P2, 7P3, 7P10, 7P11 (CH. 101A)
7PR12, 7PR13 (CH. 101C)
9P4, 9P5 (CH. 103)
9PR8, 9PR9 (CH. 103A)
17DA, 17GA, 17HA (CH. 101D)
120, 121, 121B (CH. 99)
141, 141B (CH. 100)
141C (CH. 101B)
142, 142B (CH. 100)
143
160, 160B, 162, 163 (CH. 101)
170 (CH. 101A)
173
902, 903, 910, 911 (CH. 103)
1400, 1400B (CH. 100)
1401 (CH. 105)
1600, 1600B (CH. 101)
1605, 1605B, 1610, 1610B (CH. 102)
1700C, 1701C, 1720, 1721
1710 (CH. 101A)

PHILCO
Model Pack 22
50-T1483
50-T1600, 50-T1632, 50-T1633 (CODE 122)
50-T1630 (CODE 121)
50-T1630 (CODE 122)
51-T1443B, 51-T1443L, 51-T1443M
51-T1443PL, 51-T1443PM, 51-T1443PW
51-T1443X, 51-T1443XL
51-T1601, 51-T1601T, 51-T1602 (CODES 121, 122)
51-T1634 (CODES 123, 124)
52-T1810, 52-T1812, 52-T1840, 52-T1842, 52-T1844, 52-T1882, 52-T2110, 52-T2142 (CODES 122, 123)
RCD. CH. M-22

PHILHARMONIC
Model Pack 22
C-6161, T-616, 1116, 5816

PILOT
Model Pack 20
TV-125, TV-161, TV-163, TV-165

RCA
Model Pack 20
9T256 (CH. KCS38C)
9TW309 (CH. KCS41-1)
9TW390 (CH. KCS31-1)
S1000 (CH. KCS31-1)

SPARTON
Model Pack 24
5025, 5026, 5076 (CH. 26SS160)
5025BA, 5075BA (CH. 26SS170)
5029, 5030 (CH. 26SD160)
5035, 5036, 5037 (CH. 26SS160L)
5076BA, 5077BA (CH. 26SS170)
5076BB (CH. 26SS160B)
5077 (CH. 26SS160)
5077B (CH. 26SS160B)
5078BB, 5079BB, 5080BB (CH. 26SD170, DELUXE)
5079, 5080 (CH. 26SD160)
5079B (CH. 26SD170, DELUXE)
5082, 5083 (CH. 26SD170)
5082, 5083 (CH. 26SD170X, 26SD170XP)
5085, 5086 (CH. 25RD190)
5088, THE WESTMONT (CH. 26SD170)
5089 (CH. 26SD170)
5090, THE SPARCRAFT (CH. 26SD170)
5101, 5102, 5103 (CH. 26SS170, 26SS170P)
5104, 5105 (CH. 26SS170D, 26SS170DP)
5152, 5153, 5154 (CH. 26SS170, 26SS170P)
5155, 5156, 5157 (CH. 26SD170X, 26SD170XP)
5158 (CH. 26SD170, 26SD170P)
5170, 5171 (CH. 25SD201)
5182, 5183, 5188, 5189 (CH. 26SD170, 26SD170P)

STEWART-WARNER
Model Pack 24
9120-A, 9120-B, 9120-C, 9120-D, 9120-E, 9120-F
9121-A, 9121-B
Model Pack 25
9203-A

STROMBERG-CARLSON
Model Pack 23
24C, 24CM (CH. 112126)
24RP, 24RPM, 24 SERIES (CH. 112119)
119CM, 119CDM (CH. 112107)
119M5A, 119M5D, 119M5G, 119M51, 119M5M, 119M5R (CH. 112114)
119M51, 119M5M, 119M5R
321CD2M, 321CD20, FUTURA, 321 SERIES (CH. 112127)
321CF, 321C2M, CAVALIER (CH. 112127)
RCD. CH. WEBSTER 100

SYLVANIA
Model Pack 25
25M (CH. 1-387-1)
71M-1, 72B-1, 72M-1 (CH. 1-502-1)
74B-1, 74M-1 (CH. 1-437-1)
75B, 75M (CH. 1-437-1)
RCD. CH. VM-950
Model Pack 23
72M, 73M (CH. 1-366)
4120M, 4130B (CH. 1-260, 1-261)
4130E (CH. 1-260)
4130M, 4130W (CH. 1-260, 1-261)
6110X (CH. 1-261)
6120B, 6120M, 6120W (CH. 1-260, 1-261)
6130B, 6130M, 6130W (CH. 1-260, 1-261)
7110X (CH. 1-366)
7110XB (CH. 1-441)
7110XF (CH. 1-366-66)
7110XFA (CH. 1-442)
7111M (CH. 1-441)
7111MA (CH. 1-366)
7120B, 7120M, 7120W (CH. 1-366)
7120BF, 7120MF, 7120WF (CH. 1-366-66)
7120MFA (CH. 1-442)
7130B, 7130M, 7130W (CH. 1-366)
7130BF, 7130MF, 7130WF (CH. 1-366-66)
7130MFA (CH. 1-442)
7140MA, 7140WA (CH. 1-437)

WESTINGHOUSE
Model Pack 21
H-618T16 (CH. V-2150-186, V-2150-186A, V-2150-186C, V-2150-186CA)
H-620K16, H-622K16 (CH. V-2150-186, V-2150-186A, V-2150-186C, V-2150-186CA)
H-625T12 (CH. V-2150-197)
H-626T16 (CH. V-2172)
H-627K16, H-628K16, H-629K16 (CH. V-2171)
H-630T14 (CH. V-2176)
H-636T17 (CH. V-2175)
H-637T14 (CH. V-2177)
H-638K20 (CH. V-2178)
H-643K16 (CH. V-2179, V-2179-1)
H-648T20, H-652K20 (CH. V-2201-1)
H-660C17, H-661C17 (CH. V-2203-1)
H-662K20 (CH. V-2201-1)

ZENITH
Model Pack 21
J2026R (CH. 20J22)
J2027E, J2027R, J2029E, J2029R, J2030E, J2030R (CH. 20J21)
J2040E, J2042R, J2043R, J2044E, J2044R (CH. 20J21)
J2051E, J2053R, J2054R, J2055R (CH. 20J22)
J2126R (CH. 21J21)
J2127E, J2127R, J2129E, J2129R, J2130E, J2130R (CH. 21J20)
J2140E, J2142R, J2143R, J2144E, J2144R (CH. 21J20)
J2151E, J2153R, J2154R, J2155R (CH. 21J21)
J2868R, J3069E (CH. 20J21)
J2968R, J3169E (CH. 21J20)
RCD. CH. S14029

JOHN F. RIDER PUBLISHER, Inc. . . . 480 CANAL STREET, NEW YORK 13, N. Y.

A monthly summary of the price changes of electronic components and materials on the market, as well as information about new and discontinued items. These reports are supplied by RADIO'S MASTER, published by the United Catalog Publishers, Inc., New York City. These reports are furnished in the hope that they may help you in purchasing, and in keeping your inventory up to date. A complete description of each product is found in RADIO'S MASTER 16th Edition.

Price Increases

ALTEC LANSING—Price increase on their items in following categories: racks; blank panels; transformers; diapragm & voice coil assemblies; horn throats; "Voice of the Theatre" speaker systems; amplifiers; low frequency horns; high frequency multicellular horns (less speaker) and power supplies.

SCHAUER MFG. CORP.—Advised of a rise in price on most of their line.

SYLVANIA ELECTRIC—Increased prices of all sub-miniature tubes except 6AD4, 6BA5, and 6K4.

TRIAD TRANSFORMER—G-2 Input Geoformers, increased to $20.08 Net.

Price Decreases

ALTEC LANSING—21B Microphone and 28A Lapel Microphone reduced in price.

AMERICAN PHENOLIC CORP.—Lightning arrestors No. 155-338 reduced to $1.50 each.

DUOTONE CO.—Reduced shockproof nylon needles No. 25 to $10.50, and No. 25M (micro-groove) to $8.75, both dealer price.

G. E.—Reduced receiving tube 6BF5 to $2.00 List, and tv picture tube 24AP4 to $76.00 Net.

HYTRON RADIO—Reduced prices on tv picture tubes 17BP4A, 20CP4, and 20DP4A.

NATIONAL UNION—Reduced prices on Videotron picture tubes as noted: 17" rectangular to $27.25 Net; 19FP4 to $49.00 Net; 20" rectangular to $41.00 Net and 21" rectangular to $43.25 Net.

RAULAND CORP.—TV tubes 17AP4, 17BP4A, 17HP4, 20CP4, and 20HP4 reduced.

REINER ELECTRONICS CO.—Advised reduction of No. 5 Type Z, and No. 7 Type Z "Leads" to $9.95 Net.

SYLVANIA ELECTRIC—Reduced 5 tv picture tubes. 6AG5 radio receiving tube reduced to $2.40 list.

TUNG-SOL ELECTRIC—Reduced prices about 20% on cathode-ray picture tubes 16RP4, 17BP4A, and 20DP4A.

VAN CLEEF BROS.—Reduced prices on quantity purchases of 30 and over for No. 10 plastic electrical tape.

WEBSTER-CHICAGO CORP.—Nylon phonograph needles Model NE-37 reduced to $.80 Catalog Price.

New Items

CENTRALAB—Added trimmer 822-EZ at $.90 Net; controls BB-105 at $1.50 Net and capacitors TV4-502 and TV5-502 at $1.35 Net.

CLAROSTAT MFG. CO.—Introduced new Belmont tv ballast tube No. B917571 at $1.80 Net, 2 watt rating wire wound controls, No. 43-1500 & 43-2500 at $1.25 and No. 43S-1500 & 43S-2500 (with switch) at $1.85. Also added 3 watt rating wire wound controls, No. 58-1500 & 58-2500 at $1.25 and 58S-1500 & 58S-2500 (with switch) at $1.85. All prices are Net.

ELECTRONIC MEASUREMENTS CORP.—Added Tube, Battery, Ohm and Capacity Tester, Model 204 at $55.90 and Vacuum-Tube Volt-Ohmeter, Model 106 at $35.90.

ELECTRO-VOICE—Model 3002 self-tuning tv booster introduced at $23.70 Net.

FEDERAL TELEPHONE—Added complete new line of selenium rectifier stacks.

GARRARD SALES CORP.—3-Speed record players, Model "M" and "MC" added at $24.50 and $29.65 Net respectively.

GENERAL CONTROL CO.—To their line of switches and controls have been added No. A.C.O. at $10.00 Net and DU.OP at $1.90 Net.

G. E.—Added dual stylus assembly No. RPJ-013 at $18.60 Net for use with G. E. triple-play cartridges, and I.F. interference eliminator model RLW-008 at $4.50 Dealer Net. Also added glass rectangular tv tubes: 17VP4 at $36.50 list; 20LP4 at $54.50 list; 21EP4, with cylindrical face at $57.50 list and 21LP4, with cylindrical face at $57.50 list. "Inasmuch as there has been very little, if any, sales to set manufacturers of the above 4 new types, there will be undoubtedly little demand for replacement business in the next few months."

HYTRON RADIO—Added new tv picture tubes: 17HP4A; 19QP4; 20HP4A; 21EP4A and 21FP4A.

INDUSTRIAL PRODUCTS SUPPLIERS — Now marketing 6 new tv glare reducers.

INSULINE CORP.—Added No. 424 silver-plated beryllium plug; No. 327 & 328 Clip-on, and 329 Prod Test Leads; #867 insulated spade lugs; #1899 high voltage tip jack; #4086 rack dolly, and #6113 and #6114 lightning arrestors.

JFD—For use with open wire transmission lines, a new lightning arrestor No. AT 107 at $2.25 Net.

LANSING SOUND—9 new cabinets added to their "C" series, and Model 1217-1290 horn-lens assembly added at $31.50 Net and Model 175 DLH, a complete driver, lens, and horn assembly added at $114.00 Net.

POTTER & BRUMFIELD—5 new "MT" relays added to their line.

RCA—Added test and measuring equipment types WG-220, direct probe cable at $3.75; WG-291, crystal diode demodulator probe at $7.95; WP-25A, tv Isotop, topped auto-isolation transformer at $17.95; WV-77A, Junior Voltohmyst at $47.50, all suggested dealer prices. Also added No. 213A1, Antenna Harness Kit at $1.20; No. 215A1, tv antenna (channel 2-13) less mast $8.10; 215X1, lightning arrestor (outdoor and indoor) at $.75 each; 229A1, FM folded dipole antenna and reflector (less mast) $4.56 all suggested dealer prices. Added tubes 6BQ7 at $3.20 list, 6X8 at $2.65 list and kinescope 19AP4-A at $65.00 list.

RIDER, John F.—Introduced TEK-FILE, new monthly data service, at $2.00 per Pack.

SYLVANIA ELECTRIC—Added 7 tv picture tubes to their line.

TRICRAFT PRODUCTS CO.—Antenna T-52 introduced at $9.95 list.

TV DEVELOPMENT CORP.—Added to their line of conversion mask escutcheons and kits, model ME-20 at $4.87 Net and MEK-20 at $12.26 Net.

WEBSTER-CHICAGO — Added recording wire album Model 2916 at $.60 Catalog Price.

WESTINGHOUSE—Added electronic tubes WL-5934 at $15.00 Net and WL-5974 at $220.00 Net.

Discontinued Items

BAKER MFG. CO.—TV self-supporting towers No. 22, 35, 48, 62 have been discontinued due to difficulty in securing materials.

BELDEN MFG. CO.—Temporarily discontinued the following items for the duration of the emergency. 8000 and 8002, bare aerial wire; 8008 and 8009 solid beld aerial; 8011, 8012 and 8013 solid tinned; 8200, leadin wire, 8235, 300 Ohm (heavy duty) transmission line and 8782 and 8783, juke box cable.

CENTRALAB—Discontinued dual concentric controls SBB-518-S.

G. E.—Due to a lack of demand, discontinued picture tubes 8AP4, 12LP4, 12KP4, 16AP4 and 19AP4.

HYTRON RADIO—Discontinued special purpose tubes 10Y and 864.

INDUSTRIAL PRODUCTS SUPPLIERS—4 TV "Gla-Reducer" models discontinued.

LANSING SOUND—Discontinued Model 175H high frequency unit and horn.

PENN BOILER & BURNER—Telecote paint has been dropped from their line.

POTTER & BRUMFIELD—Discontinued relays SM5DG and SM5LG.

REK-O-KUT — Temporarily discontinued Models T-12H and T-43H, dual speed 12" transcription turntables due to lack of materials.

TRIMM, INC.—Discontinued 26 items on their line of headsets and accessories. Also discontinued their complete line in their "V" series of wire wound controls.

WEBSTER-CHICAGO—Discontinued 5 items in their line of phonographic equipment.

Miscellaneous Changes

EBY SALES CO.—Revised their entire line of radio, television and electronic products adding items and revising prices.

JFD—Revised their line of mounts, accessories and wire to include new items and price revisions.

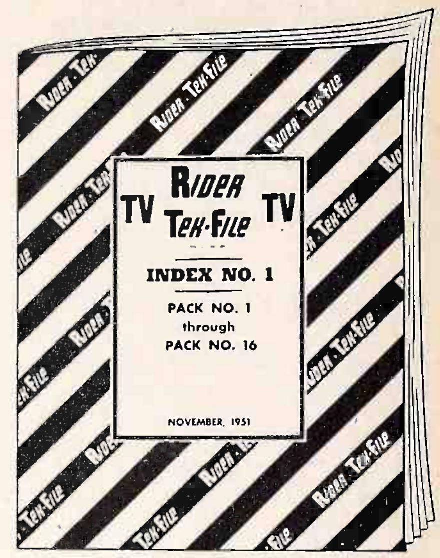
MIDDLETOWN MFG. CO.—Revised their entire price line of metal products.

PENN BOILER & BURNER—Prices revised on their Penn Teletowers.

WESTINGHOUSE—Revised prices on 25 industrial replacement tubes.

Rider TV TEK-FILE Cumulative Index Now Available!

The Rider TV TEK-FILE Cumulative Index, a FREE, 8-page, 8½ x 11 inch booklet listing the tv receiver manufacturers and models in TEK-FILE with their pack and file numbers, is now available at radio and tv



parts distributors all over the country. The index, which is just as easy to use as the Rider radio and tv indexes, also lists for each model its Rider Manual page number.

In addition to the TEK-FILE listing, the index contains simplified instructions on how to file TEK-FILE in a filing cabinet or binder.

RADIO CHANGES

Emerson 646A, 646B

Figure 1 is a schematic diagram showing the circuit modifications to be made, when a 5-pole, 2-position power transfer switch is used instead of the original 6-pole, 2-position switch.

General Electric Models 600, 601, 603, 604

On early receivers, oscillator instability may be caused by the defective coupling winding on the L2 oscillator transformer. To remedy this, connect C15, a 56-μμf capacitor, as shown by the dotted line in the schematic to replace coupling winding, which should be disconnected.

Loose speakers which are due to broken cabinet studs may be repaired by heating the ends of the studs with a soldering iron and spreading them against the speaker frame.

General Electric, 740

In the schematic diagram, add an antenna primary to loop L1, connecting it to the external antenna terminal through a 0.005-μf capacitor, C23, and to the chassis through another 0.005-μf capacitor, C33. A convenient chassis connection for C33 is the chassis ground terminal on the phono jack. Item RLL-041 (L1, loop) which is no longer available, should be deleted from the Replacements Parts List, and item RLL-044, (L1 loop with antenna primary) added. The symbols C-23 and C-33 should be added under the stock item UCC-039.

General Electric, 752, 753

In the schematic diagram, add an antenna primary to loop, L3. One side of this loop is connected to the chassis ground and the other side to the antenna terminal. Item RLL-039 (L3, loop) which is no longer available, should be deleted from the Replacement Parts List and RLL-042 (L3, loop with antenna primary) added in its place.

RCA 8V90, Ch. RC-618; RC-618A, 8V91, Ch. RC-616A, RC-616H

A resistor R35 has been added in the mixer grid circuit, inserted between pin 3 of the selector switch (S2 front) and connection F of the A oscillator coil. For chassis RC-618 and RC-618A, the resistor is 560 ohms (in some sets, two 1,000-ohm resistors in parallel). For chassis RC-616A and RC-616H, the resistor is 390 ohms.

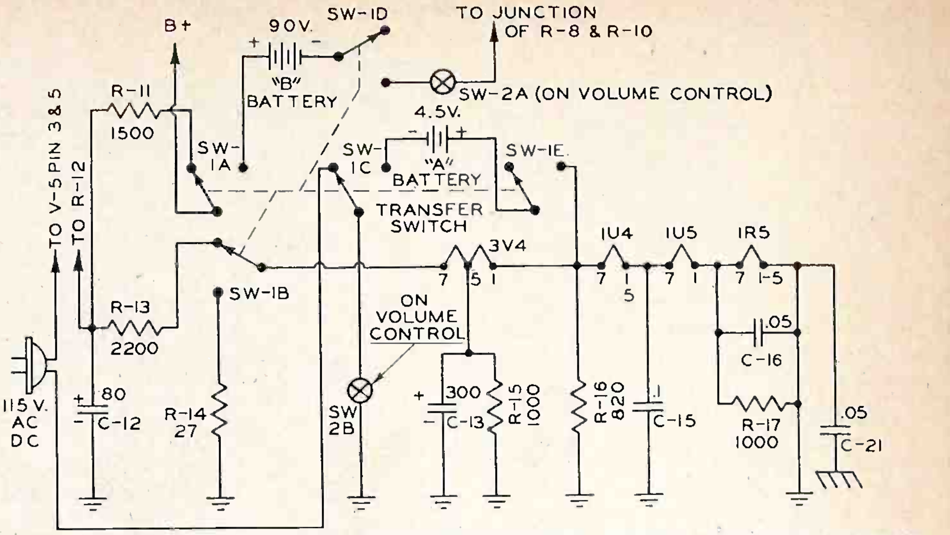


Fig. 1. Circuit of the Emerson 646A and 646B, showing modifications required when changing the power transfer switch.

Westinghouse H-316C7, H-317C7, H-326C7, H-328C7, Service Hint

The above models are equipped with built-in antennas for a-m and f-m reception and terminals are provided for connecting an external antenna for f-m reception in weak signal areas. In special cases where it is desired to receive weak a-m signals, an external a-m antenna can be connected as follows.

Solder a 3-lug terminal board (part no. V-3376) to the r-f tuner plate so that new components will not extend beyond rear of chassis.

Connect a 2,200-ohm, ½-watt resistor (part no. RC20AE222M) and a .0005-μf capacitor (part no. RCM20A501K) in series as shown in Fig. 1.

Connect the resistor to terminal 3 on the chassis with a rubber or thermoplastic covered wire of suitable length.

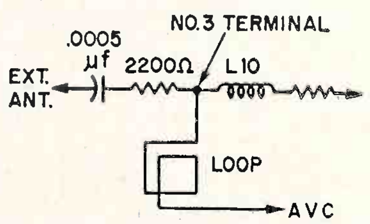
Connect approximately 9″ of the same kind of wire to the capacitor as shown in Fig. 2.

Tie knot #1 approximately 3″ from the capacitor.

Run a lead through a hole near the left end of the back cover and tie knot #2 close to cover. (The knots are for strain relief).

Below, Fig. 1. Circuit required for reception of weak a-m signals on Westinghouse H-316C7, H-317C7, H-326C7, and H-328C7.

Right, Fig. 2. Actual method for adding circuit.



United Motors, 416387 Packard

The value of the cathode resistor grounding the cathode of the i-f amplifier tube, 6SK7, has been changed from 390 ohms to 270 ohms. In the Service Parts list, the service part number should now read A271 and the description is now 270 ohms, ½ watt insulated resistor. The illustration number is still 48.

United Motors Service (Delco), R-1408, R-1409, R-1410

Although the dry cell batteries for the Delco household radios models R-1408, R-1409, and R-1410 are no longer available through United Motors Service, a satisfactory service battery is available from other sources for each of the models.

For the R-1408 and R-1409 models the Eveready battery 754 or the Ray-o-vac battery AB878 will adequately provide the voltages required and mount in the cabinet. In the case of the R-1410 radio the Eveready battery 753 or the Ray-o-vac battery AB878 is a satisfactory replacement.