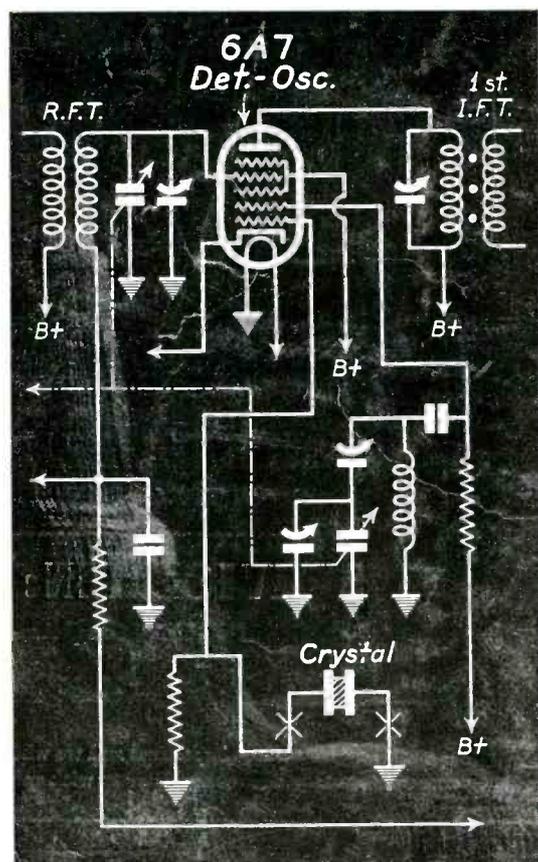


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Crystal Oscillator Circuit
(See Page 380)

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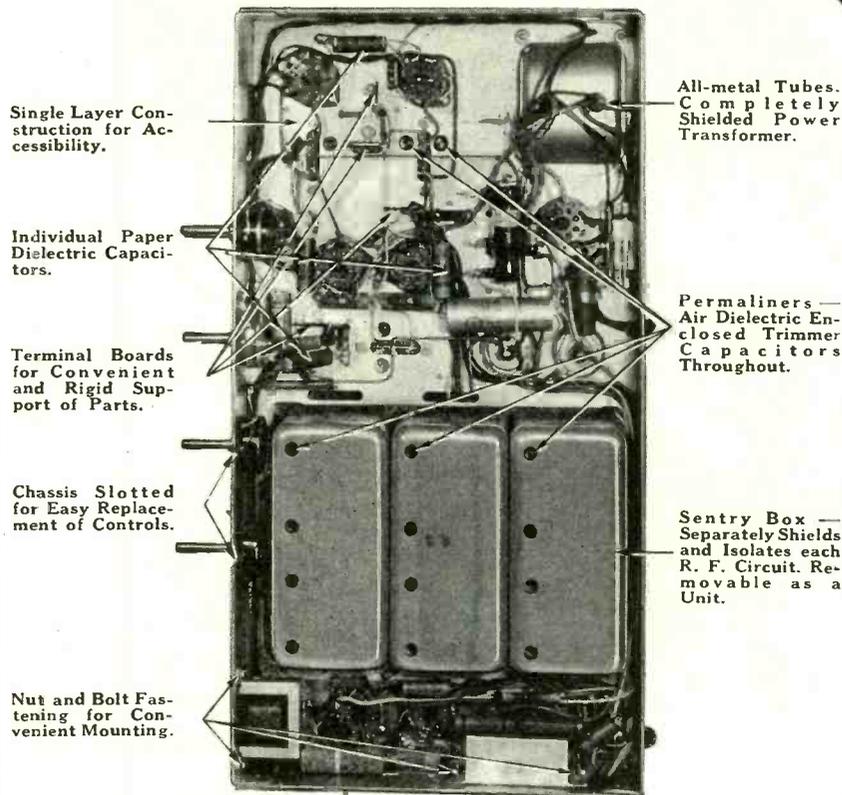
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SERVICE

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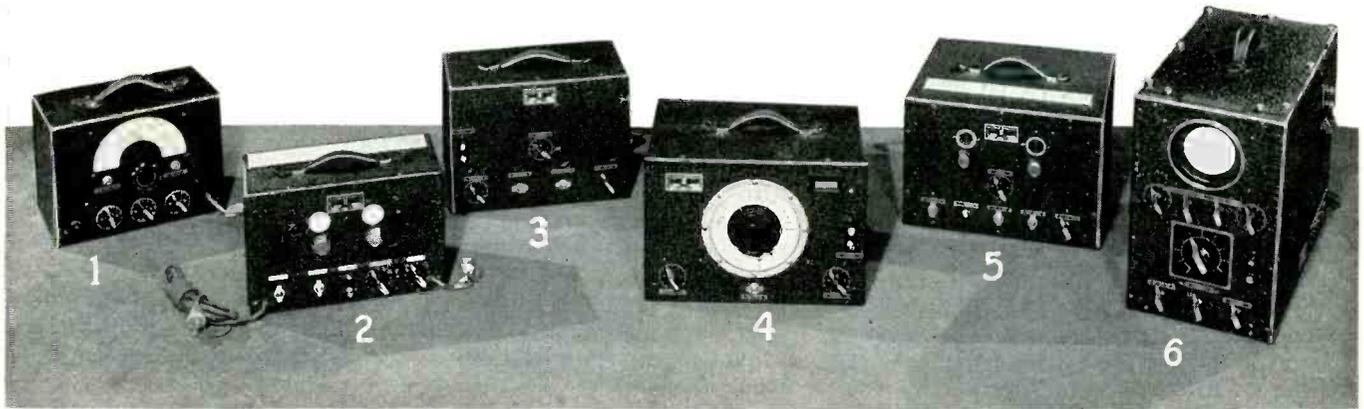
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THE ANTENNA . . .

Replacement Parts

WE have repeatedly stressed the importance to the Service Man of using standard parts whenever replacements are necessary. We may have brought up this subject so often that you are sick of hearing about it. The fact remains, however, that further discussion is appropriate at this time when the nature and quality of the original parts used in the fabrication of radio receivers have altered.

Two things have recently taken place—manufacturers are attempting to design the wiring and placement of parts in such manner that servicing may be conducted with the least amount of effort; chassis are being given “breathing space,” and though this movement has not gone very far as yet, there are a number of chassis which are a distinct improvement in this respect. There has also taken place a new conception with regard to permanency of circuit adjustments. This has called for better quality in parts and, in many cases, a complete redesign of such components as trimmer condensers, high-frequency coils, etc. For example, a number of manufacturers, faced with the problem of maintaining stability in all-wave receivers, have commenced to use variable air condensers for peaking the i-f transformers. Moreover, where, at one time, Litz wire was a luxury, and found only in the i-f coils of custom-built receivers, “stock” receivers are now using it.

We have pointed out in previous editorials that the new receivers may not come in for a great deal of actual repair work; if not the new receivers, at least the receivers introduced in the near future. For this reason, more servicing work may be in the line of adjustments rather than in the line of replacements. Nevertheless, there always will be replacement work, and for this reason it is high time that every Service Man reconsider his position with relation to the manufacturer and the customer.

The point is that if you fail to use quality parts as replacements, the good-will you have built up is going to take a sudden drop. You may be able to get away with cheap, “surplus” parts in old receivers, but you will never get to first base if you attempt to install in a new receiver parts that are below the standards set by the manufacturer. People will soon learn that the new receivers will stand up better than the old ones; therefore, they will expect that any parts you may replace should also last for a long time.

We believe that every Service Man should view each replacement job in the same light as a weld in a pipe. If a pipe breaks and it is repaired by welding, the point of the repair is infinitely stronger than any other portion of the pipe. If there are future breaks, they will not be at the point of the weld. It is true, of course, that a radio replacement unit cannot be likened to a pipe weld, but the fact remains that quality parts are not apt

to cause trouble. If you replace a resistor with one of high quality, the chances are that future difficulties will not be at the same spot. That clears you insofar as the customer is concerned.

Now, what about the price situation? Obviously, quality parts cost more than “bargain” parts. But it is customary in all business to charge the customer for what he gets. The fact that you pay more for replacement units does not mean that your profits must be shaved; most people have learned by this time that there is no saving in cheap products and consequently are willing to pay the few cents or dollars more in return for a lasting job.

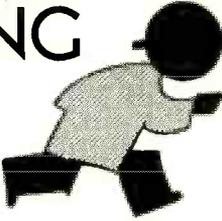
The Service Man who charges “quality” prices and installs cheap units, is pretty low. Aside from being low, he is also a fool. He is as much of a fool as the chap who, some years ago, tried the same sort of high-handed scheme in repairing our car. The repair job didn't last . . . neither did he.

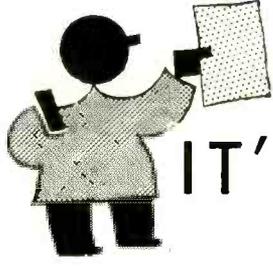
This sort of discussion always brings up the question of the “other fellow.” What if the other fellow under-sells by buying up large quantities of surplus parts? Should one follow suit in an attempt to hold clients and to gain new ones? The answer, we believe, is the answer most Service Men have found out for themselves—let the other fellow take care of himself—let him bait his own trap. If customers are lost, very well . . . they'll be coming back bye and bye.

It may also be said that as each season passes, the Service Man becomes, through necessity, just a bit more quality conscious. Technicalities account for this; each time the manufacturers add a bit more quality to the components they use the Service Man must use higher quality parts for replacement.

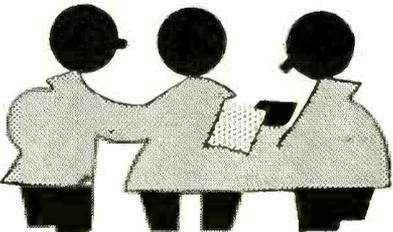
How may the Service Man judge the quality of parts sold him? Price is not always a true index of quality, though it is sufficiently accurate in most cases to employ as an indication of quality. A more accurate index—and this is true in all fields—is the responsibility and standing of the manufacturer.

You, as a Service Man, can judge the quality of components, whereas the layman cannot. The layman is your customer and he places his faith in your experience and superior judgment. Live up to that faith, and do not attempt to judge the quality of parts by experimenting on your clients' receivers to see how well and how long certain types and certain brands of replacement parts stand up. If you feel that price, together with the responsibility of a manufacturer, are not sufficient as indexes of quality, then place the components on test in your own shop. You have the equipment for doing this, and a bit of knowledge as to how much gaff a component will stand before breaking down, will serve you well in cases where there is doubt as to whether or not original parts had proper ratings to begin with.

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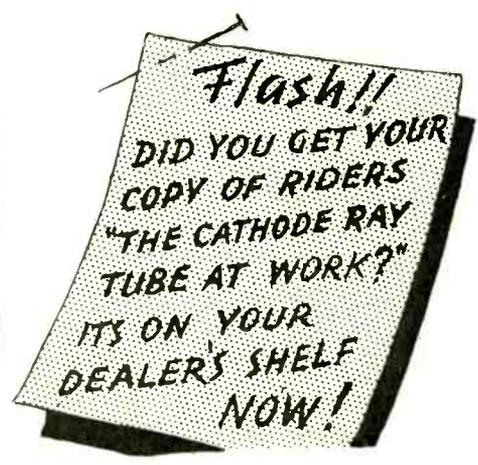
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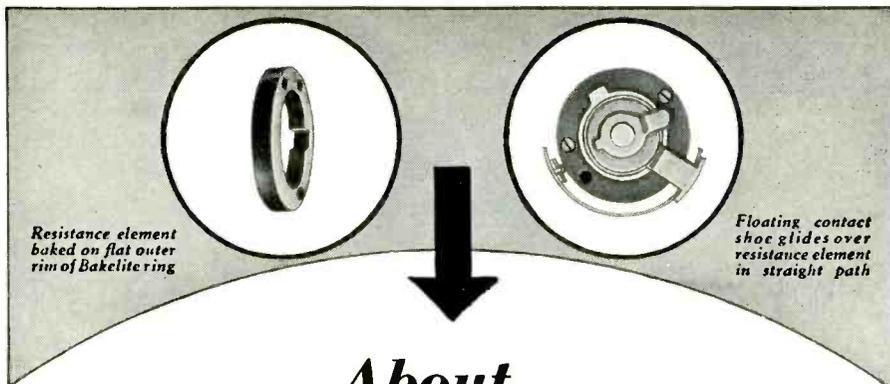
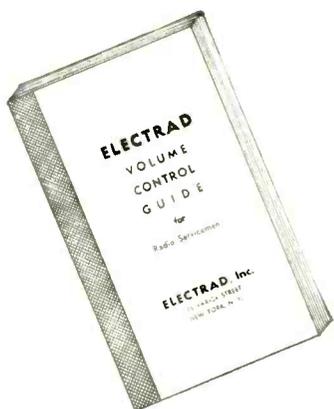
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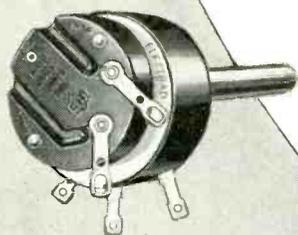
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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR SEPTEMBER, 1935

NEW ALL-WAVE, NOISE REDUCING ANTENNA SYSTEM

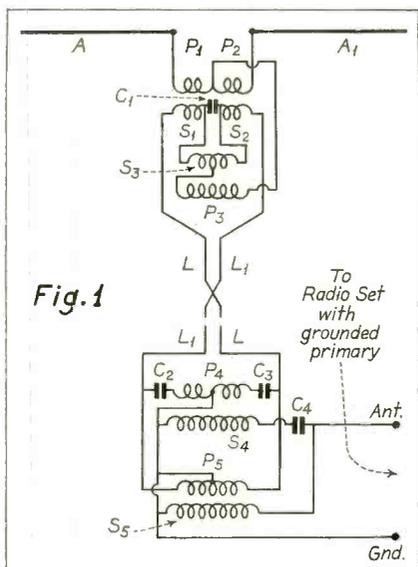
By T. LUNDAHL*

THIS system was designed to provide efficient, noise-free reception on both broadcast and short waves by means of a simple doublet type antenna, using two separate coupling devices, one in the antenna and one at the receiver, having no switches or plugs.

PHYSICAL SPECIFICATIONS

Briefly, a single physical aerial is used, 60 feet long, with a transformer inserted in the center, providing automatic separation of the horizontal wire into two ideal equivalent antennae with a common lead-in. For short waves the antenna acts as a doublet; for broadcast waves it acts as a 60-foot horizontal T antenna, the signals automatically selecting their own type of antenna for most efficient results on the basis of their respective frequencies. The an-

*Sales Engineer, Technical Appliance Corp.



Schematic diagram of the complete antenna system.

tenna transformer provides for the most efficient reception on either band. It supplies signal energy to the low-loss twisted-pair download, while the set coupling unit provides proper means for supplying this energy to the receiver free from all external electrical interference.

The important function of both the antenna and set coupling transformers is to provide means for the generation of "circulating" currents in the twisted-pair download for both short-wave and regular broadcast signal frequencies. Any currents which may be generated in the download conductors by outside potential-inducing sources, such as sparking motors or electrical equipment of any type, produce "parallel" currents instead of circulating currents and this special feature is taken advantage of in order to separate the two and provide noise-free reception.

THEORY OF OPERATION

Consider in Fig. 1 the action of a short-wave signal upon the doublet AA₁. Current will move to and fro along AA₁, but in passing through the winding P₁, P₂ of the antenna coupler, the magnetic field generated will induce a secondary voltage across the secondary S₁S₂ which is connected across the transmission line LL₁. This voltage will produce a current circulating up and down line LL₁ and traversing the primary windings P₄ of the set coupler, developing by induction a voltage across the secondary S₄, which feeds the radio set through a series condenser C₄, of low reactance for short waves, but of high reactance for broadcast frequencies.

It is obvious that the currents in the transmission line are induced only by the antenna coupler. Any induction from interference sources along LL₁ will

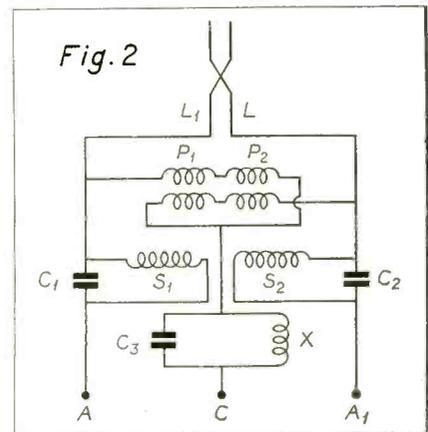


Diagram of set coupler designed for use with a receiver having a floating primary.

send currents along LL₁ simultaneously in the same direction; "parallel" currents, so to speak. These will come at once from opposite sides of winding P₄ and leave via the center tap to ground, producing equal and opposite magnetic fields, thereby inducing no voltage in the secondary S₄ which feeds the radio set.

BROADCAST RECEPTION

Separation of signal from interference is thus accomplished for short-wave reception. We must now produce "circulating" currents from a "T" antenna in the line LL₁ for the broadcast frequencies.

This is accomplished by the action of the second transformer P₃S₃ in the antenna coupler, as shown in Fig. 1.

Current will flow from the horizontal wire AA₁, by virtue of its effective height, towards ground via the following path: From AA₁ through the mid-point of P₁P₂ and through a primary winding P₃ to the mid-tap of S₃ into the ends of this winding and simultaneously down LL₁, entering from opposite

ends of the center-tapped winding P_5 of the set coupler and to ground. This current will produce no signal voltage in the secondary S_5 of the set coupler, but, in traversing the primary P_5 of the antenna coupler, the induced voltage across the secondary S_5 will produce a circulating current up and down LL_1 of exactly the same nature as that of the short-wave currents previously described. Hence, signal voltage across S_5 of the set coupler will be induced by the passage of the circulating current through P_5 .

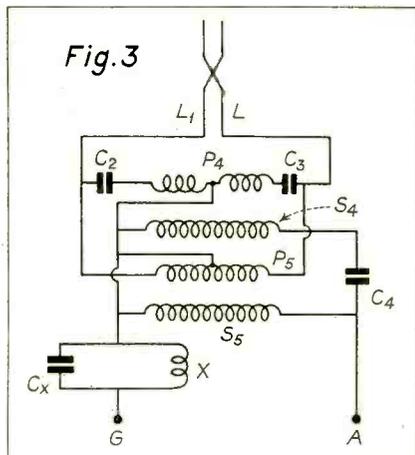
The condensers C_2 , C_3 and C_4 of the set coupler, as well as the inductances of the windings, perform the function of giving automatic selection of the most suitable transformer: P_4-S_4 or P_5-S_5 for the frequency of the signal.

Likewise, the condenser C_1 and the proper values of the inductances of the windings of the antenna coupler guide the currents according to their respective frequencies through the proper channels for most efficient energy transfer.

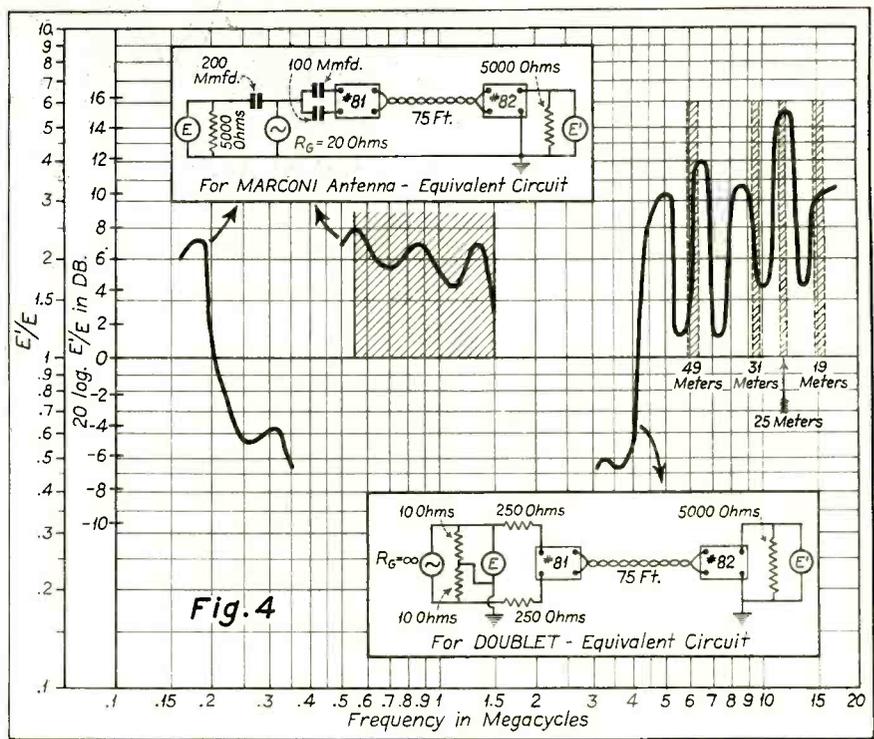
RECEIVER COUPLERS

The set coupler is the standard unit for most commercial radio receivers. There are, however, a few which have input circuits, consisting of a "floating" primary, *i. e.*, not grounded. For such sets, a special coupler has been designed (see Fig. 2). Its principle of operation is the same as the standard coupler, but its construction is made symmetrical with respect to ground potential.

For some receivers in which waves as long as 2100 meters are desirable, an "XC" circuit was added as shown in the diagram of Fig. 3. The function of the additional circuit "XC" is not only to receive signal voltage of very low frequency by virtue of the potential drop across this circuit, but it serves to "load" the antenna system and broadly tune it for frequencies between about 150 and 375 kc covering European reception for



Set coupler with circuit "XC" added for long-wave reception.



Transmission characteristics of the all-wave antenna system described, using 5,000 ohms resistance as load.

long waves, *i. e.*, 800-2100 meters, as well as for weather reports in the U. S.

TRANSMISSION CHARACTERISTICS

Laboratory tests were made to determine the transmission characteristics of the complete system at all the important wavebands (see Fig. 4). In these tests, reference is made to standard antenna equivalent circuits approximating actual conditions. These tests represent one of the best laboratory methods devised to date for testing all-wave aerial systems and the results have been found to simulate actual conditions. The zero decibel line refers to the signal level with the open "T" antenna, while the

graphs represent the gain in decibels above this level by the insertion of the standard set coupler. Further tests under actual conditions corroborate results of the performance characteristics shown in the right-hand graph. It will be noted that this graph shows the response over the short-wave band which is particularly high at the important foreign bands, namely, 49, 31, 25 and 19 meters. The curve also shows the response over the standard broadcast band. The third curve to the left indicates the response of the system using the special "XC" coil which is designed to operate up to 2100 meters.

CRYSTAL OSCILLATOR CIRCUIT

(See Front Cover)

In order to prevent frequency drift and also eliminate the necessity for periodical retuning, Philco has included crystal-controlled oscillators in their Model 810PA and 810PB fixed frequency police radio receivers.

The crystal control holds the oscillator on the required frequency. This is a highly desirable feature in these receivers, since they are "fixed-tuned" to the frequency of the police radio transmitter.

The crystal-controlled oscillator circuit is shown on the front cover. The frequency of the crystal is between 210 and 310 kc higher than the frequency to which the receiver is to be fixed-tuned. Thus, with a crystal having a frequency

of 1875 kc, the tuning range of the receiver will be within the limits of 1565 and 1665 kc.

The i-f frequency used in the receiver is always the difference between the frequency of the crystal in the receiver and the frequency of the transmitter (also the fixed-tuned frequency of the receiver). For example, if the transmitter frequency is 2422 kc and the crystal used is 2710 kc, the i-f frequency will be 288 kc, the difference between the two.

It will be appreciated from the above that, to tune the receiver to any frequency within the limits of its range for a given crystal, not only is the input circuit tuned to the transmitter frequency, but the i-f transformers are tuned to a frequency equalling the difference between transmitter and crystal frequency.

TESTERS FOR THE 8-PIN TUBES

By FLOYD FAUSETT*

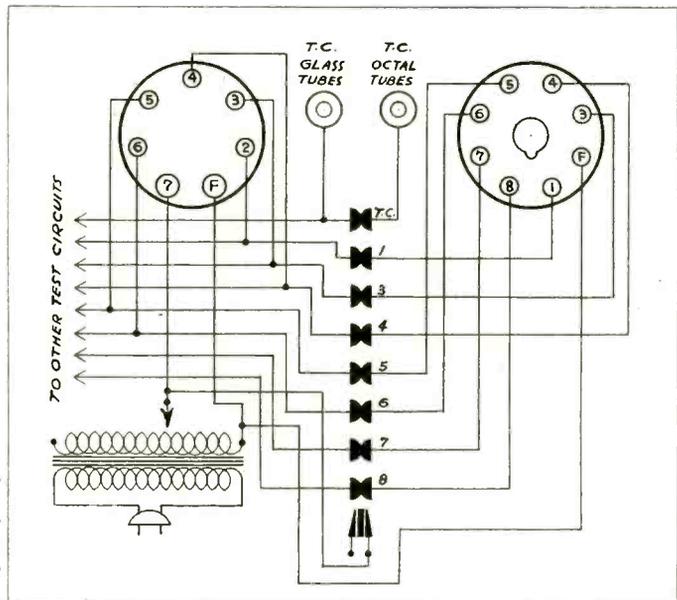
FOR a number of years, the design of tube-testing apparatus presented no serious problem insofar as the application of filament or heater potentials was concerned. This was because the filament pins of all popular types of tubes, prior to the advent of the new octal tubes, were adjacent to each other, were usually larger than the other pins, and served as the "guide" pins, so that one of the filament contacts of the tester sockets could be connected to the "common" terminal of the filament winding of the tester transformer, and the other filament contact of the sockets could be connected to the movable contact of a tap switch which enabled a selection of any required filament potential supplied by the transformer through the tap switch.

NEW PIN ARRANGEMENT

With the advent of the octal tube types, tube engineers have abandoned the idea of using adjacent pins as the filament or heater terminals and, instead of using the filament or heater pins as "guide" pins, a large keyed bakelite locator pin is used in the center of the

*Chief Engineer, Supreme Instruments Corp.

Circuit of 8-pin tube tester "filament return selector" arrangement.



tube base of octal tubes, and the pins are numbered from the key ridge of the bakelite locator pin. Looking at the base of an octal tube, with the guide key uppermost, the pins are numbered consecutively in a clockwise direction, be-

ginning with the first pin clockwise from the guide key.

Aside from the established practice of using the No. 1 pin to terminate the metal shield and the No. 2 pin as one of the filament or heater pins, the other filament terminal may be the top cap or any pin from No. 3 to No. 8. This means that, in addition to selecting filament potentials, it is also necessary to select a contact of octal sockets to which the one side of the filament potentials may be applied.

The filament or heater circuits terminate at what are known as the pins numbered 2 and 7 of the metal tubes which were included in the preliminary announcements of metal tubes. Subsequently, the metal tube type 5Z4 was announced with a filament circuit terminated by pins numbered 2 and 8, and a later type, 6P7, was announced with a heater circuit terminated by pins numbered 2 and 3, so that a tester socket in which the filament or heater potentials are applied to the contacts numbered 2 and 7, only, cannot be used for testing the later types in which the filament is terminated by pins numbered 2 and 3 or 2 and 8.

"FILAMENT RETURN SELECTOR"

If three 8-hole sockets were used in a tester, it would be possible for the user to insert an 8-pin tube in the wrong socket, and the tester would be partially obsolete in the event a metal tube were announced in which neither pin numbered 3, 7 or 8 were used as one of the fila-

(Continued on page 386)



The new tester for the 8-pin tubes, incorporating the "filament return selector."

General Data . . .

Stromberg-Carlson Nos. 62 and 63

All tubes in these receivers are metal, with the exception of the power rectifier, which is a 5Z3. Nos. 62 and 63 receivers are identical except that the No. 63 includes a visual tuning meter. The connection of the meter in the circuit is shown in the diagram of Fig. 1.

These receivers have three tuning ranges: A—540 to 1700 kc; B—1700 to 5400 kc; C—5.4 to 18 mc. The wattage rating is 105 watts. Receivers with "B" following the model number are for 25-60 cycle lines.

THE CIRCUIT

The complete circuit is shown in Fig. 1. There is an r-f stage using a 6K7 feeding a mixer-oscillator stage using a 6A8. The output of the mixer is coupled to the 6K7 i-f tube through an i-f transformer having a movable iron core. The core is controlled from the front panel of the receiver and its movement in and out of the i-f coils widens or narrows the band. This is the high-fidelity control.

The output of the 6K7 i-f tube is fed to an air-core i-f transformer which in turn feeds the paralleled diodes of the 6H6 detector and avc tube. The automatic bias control is placed on the r-f and mixer tubes, both of which are provided with initial bias through the voltage drop in cathode resistors. No bias is placed on the diodes of the 6H6.

The rectified output of the diode is

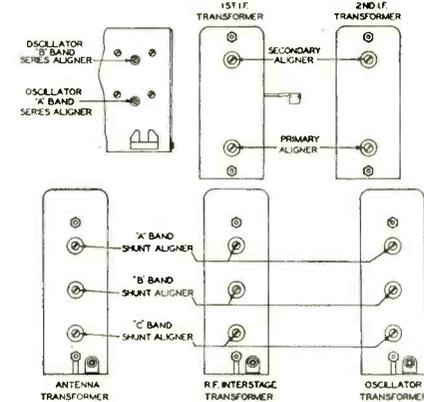


Fig. 2. Location of aligning condensers in Stromberg-Carlson Nos. 62 and 63.

fed through the volume control to the grid of the 6K7 a-f voltage amplifier. The plate circuit of this tube contains the tone control and also a high-frequency filter, L-24, C-42, C-43, C-44, which prevents possible station-carrier interference from reaching the power tubes when the receiver is operated with the fidelity control in the high-fidelity position.

The a-f signal from the output of the 6K7 tube is fed through condenser C-46 to a push-pull impedance. Signal voltages of equal and opposite values are induced in the two sections of this impedance through auto-transformer action.

The 6F6 output tubes are pentode

connected. The grids are grounded through the center tap of the input impedance and, since the cathodes of these two tubes are connected to a point on the power-supply voltage divider which is positive with respect to ground, the grids are negative with respect to ground by the same amount.

SERVICING

Voltage readings are given in the diagram of Fig. 1. They are based on a line voltage of 120 and should be measured with the set tuned to 1000 kc, but with no signal.

Fig. 2 gives the locations of the various aligning condensers. The i-f transformers are peaked at 465 kc. *Never attempt to align receiver with fidelity control set at any position other than the maximum counter-clockwise position.*

General Electric A-53

This is a two-band metal-tube receiver. It covers the broadcast band from 540 to 1600 kc and a short-wave band from 2400 to 6800 kc. The power rating is 65 watts and the undistorted power output 1.5 watts.

THE CIRCUIT

The signal from the antenna is applied to the mixer section of the 6A8 tube. The 465-kc output of the mixer is fed to a double-tuned i-f transformer and is amplified by the 6K7 i-f tube. The second i-f transformer has only its secondary tuned.

A biased power detector is used, the tube being a 6J7. A one-megohm resistor in the grid return circuit of this tube is also tied to the grid return cir-

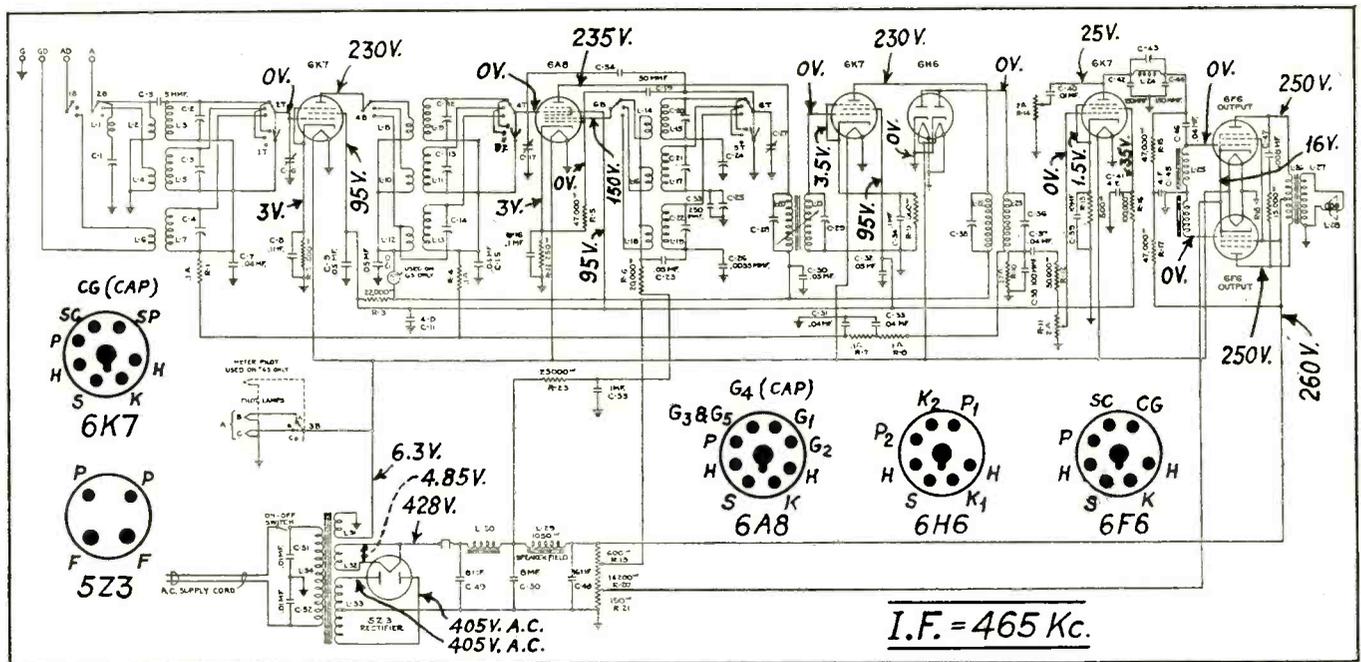


Fig. 1. Schematic of Stromberg-Carlson Nos. 62 and 63 metal-tube receivers.

GENERAL DATA—continued

cuit of the 6K7 i-f tube. This arrangement provides automatic overload control, for, if the 6J7 detector draws grid current, a voltage is developed across the one-megohm resistor (R-4) which increases the negative bias on the 6K7 i-f tube and thereby reduces its gain.

The cathodes of the 6A8 and 6K7 tubes are tied together and grounded through resistors R-7 and R-8. Resistor R-7 functions as the volume control.

The 6J7 detector is resistance coupled to a cathode-biased 6F6 power pentode. The power supply employs a 5Z4 rectifier the output of which passes through a filter network composed of condensers C-19, C-20 and the speaker field L-16.

ALIGNMENT

Before making any adjustments to the r-f circuits, it is wise to determine the correctness of the existing alignment. This may be done by supplying a signal from the test oscillator to the receiver and inserting a "tuning wand" into the antenna coil. The "tuning wand" consists of a bakelite rod having a brass cylinder attached to one end, and a small core of finely divided iron compacted into the opposite end. By inserting the brass cylinder end into the antenna coil, the inductance is lowered, increasing its resonant frequency. Inserting the iron-filled end into the coil raises its inductance, lowering its

resonant frequency. If the circuits are in exact alignment, inserting either end of the tuning wand in the coil will result in a decrease in output. When an increase in signal is obtained with the iron-filled end of the wand at the 1500-kc point or the 6.0-mc point, a decrease in resonant frequency of that circuit by increasing the antenna trimmer capacity is indicated. When an increase in signal is obtained with the brass cylinder, a decrease in antenna trimmer capacity is indicated. In the event that the brass cylinder end causes an increase in output at the 580-kc point when inserted in the antenna coil, it is necessary to increase the oscillator padder capacity, meanwhile rocking the tuning dial. An increase in output, resulting from inserting the iron-filled end, indicates a decrease in oscillator padder capacity.

Alignment Frequencies

I-F	Broadcast	Short-wave
465 kc.	580 kc.	6000 kc.
	1500 kc.	

In order to properly align this receiver, it will be necessary to have the following service tools:

- (1) Test oscillator capable of producing the above alignment frequencies.
- (2) Non-metallic alignment screwdriver.
- (3) Output meter.

Trimmer locations as well as socket voltages are illustrated in Fig. 2.

I-F ALIGNMENT

The i-f amplifier should be tuned to 465 kc; set the oscillator dial at this frequency. Set the volume control at maximum and short-circuit the antenna and ground leads. Tune the receiver to a point where no signal comes in and ground the chassis.

Connect the test oscillator output between the 6A8 mixer tube grid and the chassis. Connect the output meter across the cone coil of the speaker and adjust the oscillator output until a small deflection is observed in the output meter.

The three i-f trimmers are adjusted in the following sequence:

- (1) Secondary trimmer on second i-f transformer.
- (2) Secondary trimmer on first i-f transformer.
- (3) Primary trimmer on first i-f transformer.

Throughout all adjustments the output should be maintained at a low level by decreasing the test oscillator output as the various stages are brought in line. After these adjustments have been made the same procedure should be repeated as a final check. The i-f alignment will then be complete.

R-F ALIGNMENT

The r-f and oscillator transformers are aligned at 580, 1500, and 6000 kc. With the tuning condenser plates fully meshed, line up the pointer and dial by

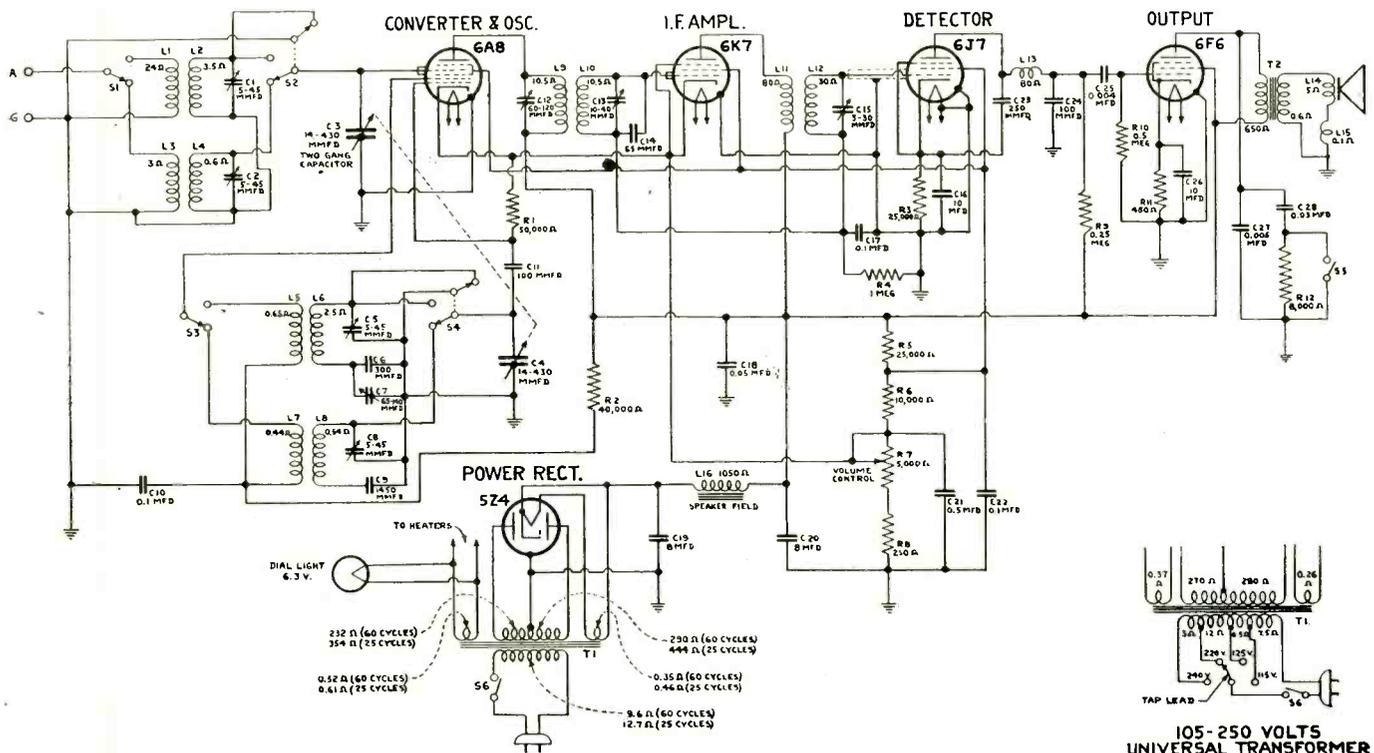


Fig. 1. Circuit of General Electric A-53 metal-tube receiver.

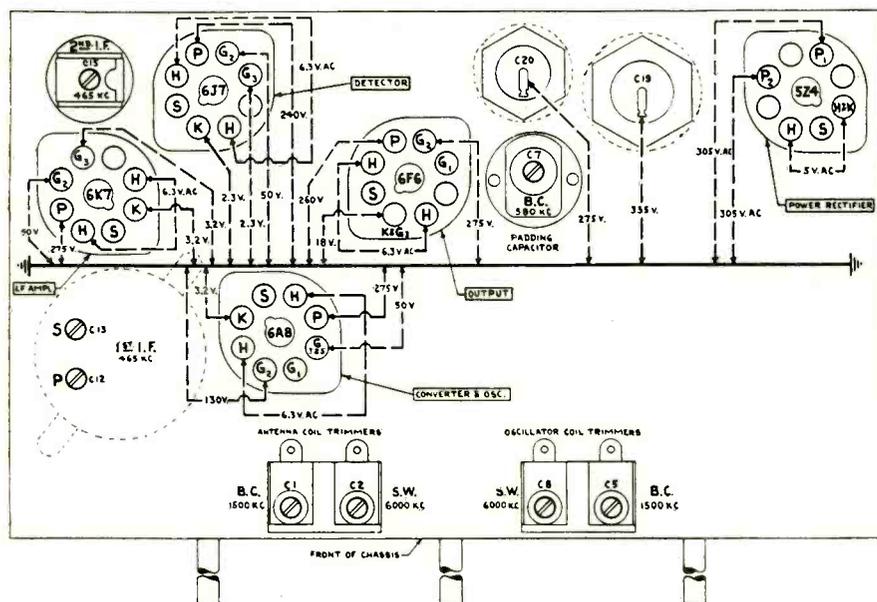


Fig. 2. Socket voltages and location of aligners in G.E. A-53.

adjusting the dial set screws so that the line at the extreme end of the dial is indicated.

Broadcast Band

With the band switch in the clockwise position, set the tuning dial to 1500 kc. Set the test oscillator at 1500 kc and adjust the oscillator trimmer for the broadcast band for maximum output. Next, set the r-f trimmer for maximum output, taking care that the output from the test oscillator is not high enough to overload any part of the set. After these adjustments, tune the set and the test oscillator to 580 kc. Adjust the broadcast padding capacitor for maximum output while rocking the tuning condenser back and forth until maximum output is obtained. The dial setting after this adjustment may not agree exactly with the frequency, but this is not important.

To complete the broadcast band lineup, repeat the adjustment at 1500 kc as before.

Short-Wave Band

With the frequency band switch in the counter-clockwise position, set the receiver dial at 6.0 mc. Set the test oscillator at 6000 kc and adjust the short-wave oscillator trimmer for maximum output. Next, set the short-wave r-f trimmer for maximum output. Repeat these adjustments a second time. After aligning the S. W. band, turn the test oscillator to approximately 6930 kc with the receiver dial still at 6 mc. Increase the test oscillator output until a signal is heard in the neighborhood of 6930 kc. This is the image frequency and if the set has been properly aligned the sensi-

tivity at this point will be much less than at 6000 kc. In the event the image frequency cannot be found, the alignment should be rechecked at 6.0 mc. It will be noticed that the oscillator trimmer will have two positions at which the signal will give maximum output. The position which gives the lower trimmer capacitance obtained by turning the trimmer screw counter-clockwise is the proper adjustment.

When these adjustments have been completed the receiver will be in alignment.

VOLTAGES

Voltage readings are given in Fig. 2. These are based on a line voltage of 120 and should be measured with no signal input and volume control in maximum position. Use a 1000-ohms per volt meter.

Stewart-Warner Model R-136 Chassis

This chassis is used in receiver Models 1361 to 1369. A temporary circuit diagram is shown in Fig. 1.

THE CIRCUIT

The antenna circuit is arranged with a jumper so that a doublet may be used. The band-selector switch has three positions—545 to 1750 kc in the broadcast band and 1850 to 18,000 kc in the short-wave bands. Separate coils are used for each of the three bands and the coils for the shortest waveband are in separate shields. We presume that in this manner it is possible to dispense with the usual coil-shortening band-selector switch since there can be no interaction between the shortest waveband coils and the others.

The band-selector switch has three extra sections for altering bias and plate voltage. It will be noted from the diagram that when the switch is in either of the two short-wave positions, portions of the resistance in the cathode circuits of the r-f and i-f tubes are shorted out. This reduces the bias on these two tubes and consequently increases the gain of the r-f and i-f stages when receiving in the short-wave bands. When the band-selector switch is in the broadcast position, these cathode resistors are effective. The result is increased bias on the r-f and i-f tubes, and reduced gain. At the same time, switch section 27-D grounds bleeder resistor 23, which reduces plate and screen voltages.

The 6A8 is coupled to a single stage of i-f using a 6K7 tube. This tube in turn is coupled to a 6H6 duo-diode used as a full-wave detector. Automatic bias is placed on the r-f and mixer tubes. The avc line includes the potentiometer 20 and the condenser 8 which form the tone control.

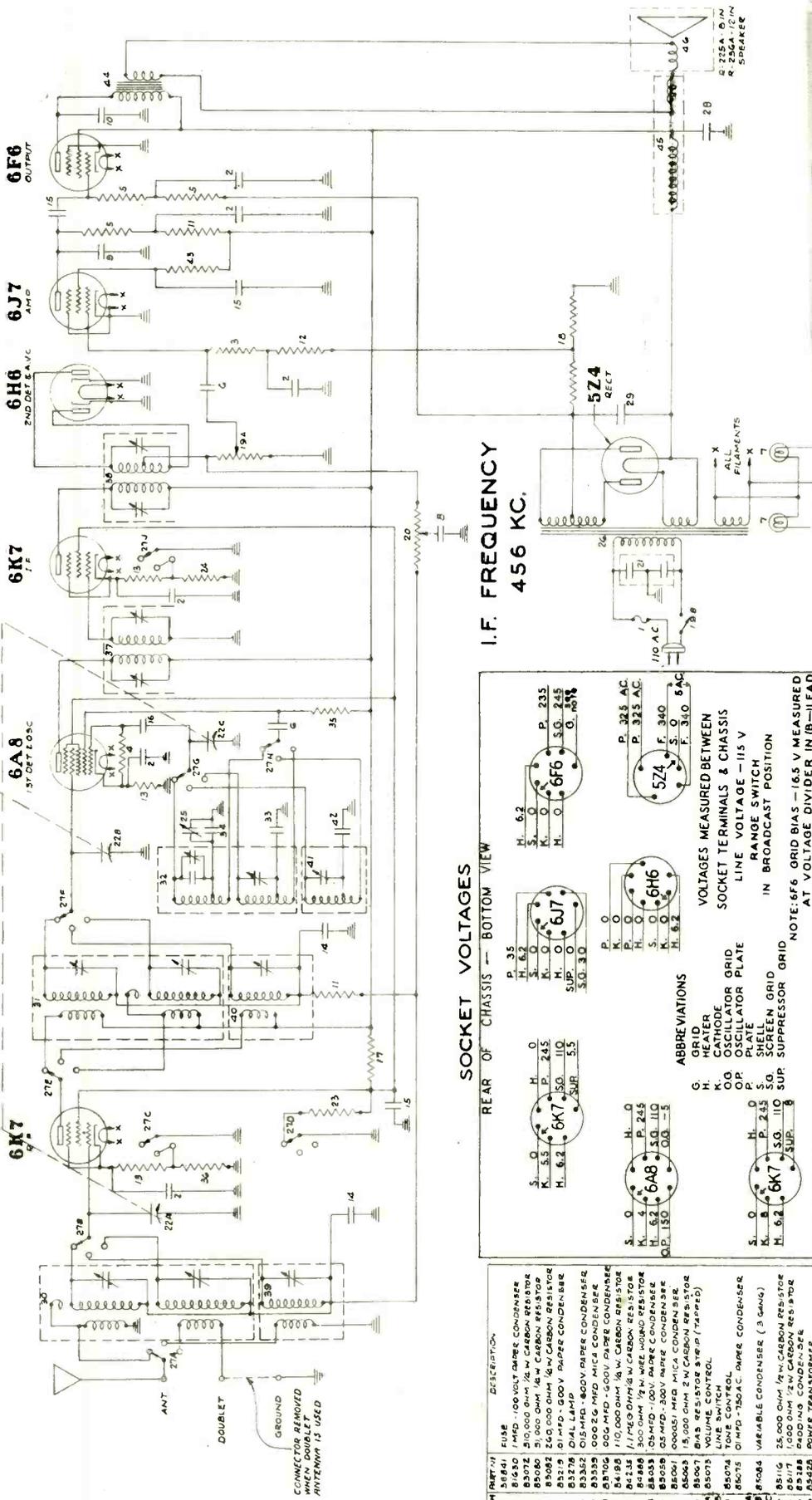
The a-f component of the signal appears across the volume control potentiometer 19-A and is fed through condenser 6 to the control grid of the 6J7 a-f tube. This tube is resistance coupled to the 6F6 power pentode. Both a-f tubes receive their bias from the voltage drop across the tapped resistor 18 in the negative leg of the power supply.

SERVICING

Any of the three bands may be aligned without affecting the alignment of the others. Alignment procedure for this model is conventional. The trimmer locations are shown in Fig. 2 and their order of adjustment is as follows:

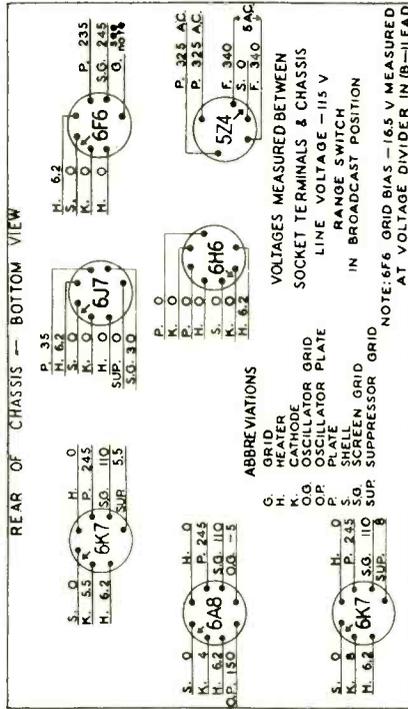
- (1) First i-f at 456 kc.
- (2) Second i-f at 456 kc.
- (3) Repeat (1) and (2) if set is appreciably out of line.
- (4) Calibrate the broadcast band by adjusting trimmer 3 at 1400 kc. Then align with trimmers 4 and 5.
- (5) Using a 600-kc signal, adjust r-f padding trimmer 6 for maximum response *while working condenser gang*.
- (6) Recheck trimmers 4 and 5 at 1400 kc.
- (7) Calibrate the first short-wave band by setting the tuning pointer of the set to 5.5 mc, feeding a 5.5-mc signal into the antenna input, and adjusting trimmer 7 for maximum response *at the lesser end of the two trimmer capacity settings* at which resonance may be obtained.

(Continued on page 386)



I.F. FREQUENCY
456 KC.

SOCKET VOLTAGES
REAR OF CHASSIS — BOTTOM VIEW



ITEM	PART NO.	DESCRIPTION
1	51864	FUSE
2	81630	1/4 MD. 100 VOLT TUBER CONDENSER
3	81000	10,000 OHM 1/2 W. CARBON RESISTOR
4	81002	250,000 OHM 1/2 W. CARBON RESISTOR
5	81008	250,000 OHM 1/2 W. CARBON RESISTOR
6	81219	0.1 MFD. 500 V. PAPER CONDENSER
7	81327	DIAL LAMP
8	81352	0.05 MFD. 1000 V. PAPER CONDENSER
9	81353	0.0025 MFD. MICA CONDENSER
10	81498	100,000 OHM 1/2 W. CARBON RESISTOR
11	81499	100,000 OHM 1/2 W. CARBON RESISTOR
12	81235	1/2 MFD. 500 V. PAPER CONDENSER
13	81286	300 OHM 1/2 W. WIRE WOUND RESISTOR
14	81003	0.5 MFD. 100 V. PAPER CONDENSER
15	81009	0.5 MFD. 100 V. PAPER CONDENSER
16	81001	1000 OHM 1/2 W. CARBON RESISTOR
17	81007	1000 OHM 1/2 W. CARBON RESISTOR
18	81007	BIAS RESISTOR (TAPED)
19	81007	BIAS RESISTOR (TAPED)
20	81007	BIAS RESISTOR (TAPED)
21	81007	BIAS RESISTOR (TAPED)
22	81007	BIAS RESISTOR (TAPED)
23	81007	BIAS RESISTOR (TAPED)
24	81007	BIAS RESISTOR (TAPED)
25	81007	BIAS RESISTOR (TAPED)
26	81007	BIAS RESISTOR (TAPED)
27	81007	BIAS RESISTOR (TAPED)
28	81007	BIAS RESISTOR (TAPED)
29	81007	BIAS RESISTOR (TAPED)
30	81007	BIAS RESISTOR (TAPED)
31	81007	BIAS RESISTOR (TAPED)
32	81007	BIAS RESISTOR (TAPED)
33	81007	BIAS RESISTOR (TAPED)
34	81007	BIAS RESISTOR (TAPED)
35	81007	BIAS RESISTOR (TAPED)
36	81007	BIAS RESISTOR (TAPED)
37	81007	BIAS RESISTOR (TAPED)
38	81007	BIAS RESISTOR (TAPED)
39	81007	BIAS RESISTOR (TAPED)
40	81007	BIAS RESISTOR (TAPED)
41	81007	BIAS RESISTOR (TAPED)
42	81007	BIAS RESISTOR (TAPED)
43	81007	BIAS RESISTOR (TAPED)
44	81007	BIAS RESISTOR (TAPED)
45	81007	BIAS RESISTOR (TAPED)
46	81007	BIAS RESISTOR (TAPED)

TUBE LOCATIONS
FRONT OF SET

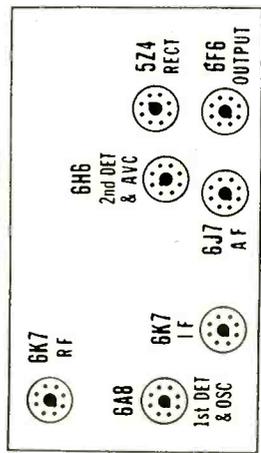
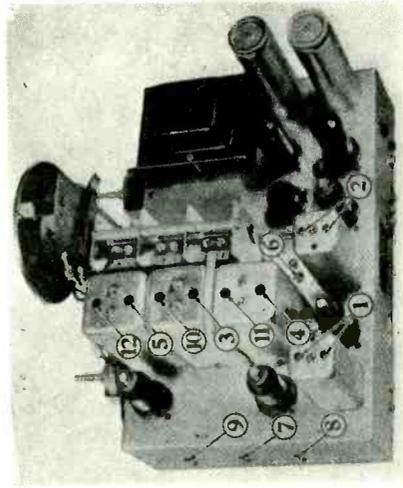


Fig. 1. (Above) Circuit diagram of Stewart-Warner R-136 Chassis. Fig. 2. (Right) Location of trimmers. They are as follows: (1) First i-f; (2) Second i-f; (3) Broadcast oscillator shunt; (4) Broadcast detector shunt; (5) Broadcast antenna shunt; (6) Broadcast oscillator series pad; (7) Band No. 2 oscillator shunt; (8) Band No. 2 detector shunt; (9) Band No. 2 antenna shunt; (10) Band No. 3 oscillator shunt; (11) Band No. 3 detector shunt; (12) Band No. 3 antenna shunt.



(8) Adjust trimmers 8 and 9 for maximum output.

(9) Calibrate the second short-wave band by setting the dial to 16 mc, feeding a 16-mc signal into the antenna input, and adjusting trimmer 10 for maximum response *at the lesser of the two trimmer capacity settings* at which a resonance peak may be obtained.

(10) Adjust trimmers 11 and 12 while rocking main condenser gang.

Atwater Kent Model 649

This is a three-band receiver, covering the broadcast wavelengths and the principal short-wave bands. The band-switching arrangement follows the usual form except for section "C" of the switch. The band-selector switch is shown in the shortest wave position in the diagram on the opposite page, and it will be noted that in this case switch section "C" is on contact C3. The arm of switch "C" connects to the avc line. In the position shown in the diagram the switch shorts out the antenna secondary coil 6-7 and at the same time disconnects the avc line from the secondary coil 4-5 which is in use. Terminal 4 of this coil is grounded with the result that the 6K7 r-f tube operates only with the normal initial grid bias provided by the cathode resistor R-1. When the band-selector switch is in the medium short-wave position, the arm of switch section "C" makes contact with point C2. In this case the broadcast-band secondary 3 is shorted while the coil 6-7 is in use. Likewise, terminal 7 of this coil connects to the avc line through the arm of switch "C" with the result that the r-f tube receives automatic bias control. With the band-selector switch in the broadcast position, and with the broadcast coil 3 in use, the r-f tube still receives automatic bias since the lower terminal of the broadcast coil also connects to the arm of switch section "C."

SELECTIVITY-FIDELITY SWITCH

The 6K7 r-f tube feeds a 6A8 mixer-oscillator. The output of the mixer is amplified by two i-f stages, using 6K7 tubes. The first and second i-f transformers have two secondary windings which connect to the "Selectivity High-Fidelity Switch." With this switch in the "selective" position, as shown in the diagram, the main secondaries of the two i-f transformers are grounded through the switch arm. The condenser C-22 which connects to the plate circuit of the first a-f tube, is also grounded with the result that there is slight high-frequency attenuation. When the switch

is in the "high-fidelity" position, condenser C-22 is ungrounded and the double secondaries of the two i-f transformers are placed in series by action of the switch, and grounded through the switch arm. The additional secondary windings offset the normal i-f peak so that the overall selectivity curve is broadened. In the case of the first i-f transformer, the inductance of the additional secondary opposes that of the normal secondary with the result that the circuit is tuned to a point slightly above the normal i-f peak; in the case of the second i-f transformer the inductance is additive (both secondary windings in same direction) with the result that the circuit is tuned to a point slightly below the normal i-f peak. This staggered tuning provides a broadening of the i-f amplifier resonance curve—the necessary condition for high-fidelity reception.

AVC DELAY BIAS

The third i-f transformer feeds the diodes P-1 and P-2 of the 6H6 second detector and avc tube. Diode P-2 is used for detection only and is at zero bias since its cathode, C-2, is also grounded. Diode P-1 is fed signal voltage through condenser C-20. This is the avc diode. There is a delay bias on this diode by virtue of the voltage drop in the resistor R-18 in series with the avc cathode C-1. Normally this delay bias would be present only when there was sufficient signal voltage on the avc diode to develop current in the cathode circuit . . . in which case the delay bias would be of no value. However, the delay bias is not dependent upon cathode current; it is created by the steady current flow through resistor R-18 from the high-voltage lead containing the bleeder resistance R-15. Consequently a delay of —2 volts is present on the avc diode at all times.

Automatic bias voltage is placed on the r-f tube (in two wavebands), on the mixer and on the first i-f tube. The avc line is isolated from the ground connection through the selectivity high-fidelity switch by the blocking condensers C-12 and C-13.

The detector diode feeds the grid of the 6C5 a-f tube through the volume-control potentiometer. The 6C5 is transformer coupled to a pair of push-pull 6F6 tubes pentode connected. The tone control is shunted across the input circuit of the power stage.

Socket layouts, voltage and parts values, etc., are given in the accompanying diagram.

Fada Models 150T, 150C

These were originally announced as glass-tube receivers. Two of the glass tubes have been replaced by metal types.

The 6D6 i-f amplifier has been replaced with a 6K7. The 6K7 has a lower grid-to-plate capacity and is therefore less subject to regeneration. The gain of the receiver is therefore maintained at a more uniform level.

The type 42 output tube has been replaced with a type 6F6. This tube has less distortion and more power output than the 42.

T-R-F Cigar-Box Sets

All t-r-f cigar-box sets depend upon regeneration for their sensitivity, and aging and loss of efficiency have a great deal of effect upon their performance. These sets may often be made nearly as good as new by placing a coil of several turns in series with the antenna lead. Place the coil near the detector coil, turning it and varying the position until the set works properly.

It is advisable to connect the indoor antenna to a cold water pipe as this will generally give better sensitivity and stability. These sets usually pick up considerable line noise anyway and this change will do no harm. Set may then hum on a carrier . . . reverse line plug if necessary.

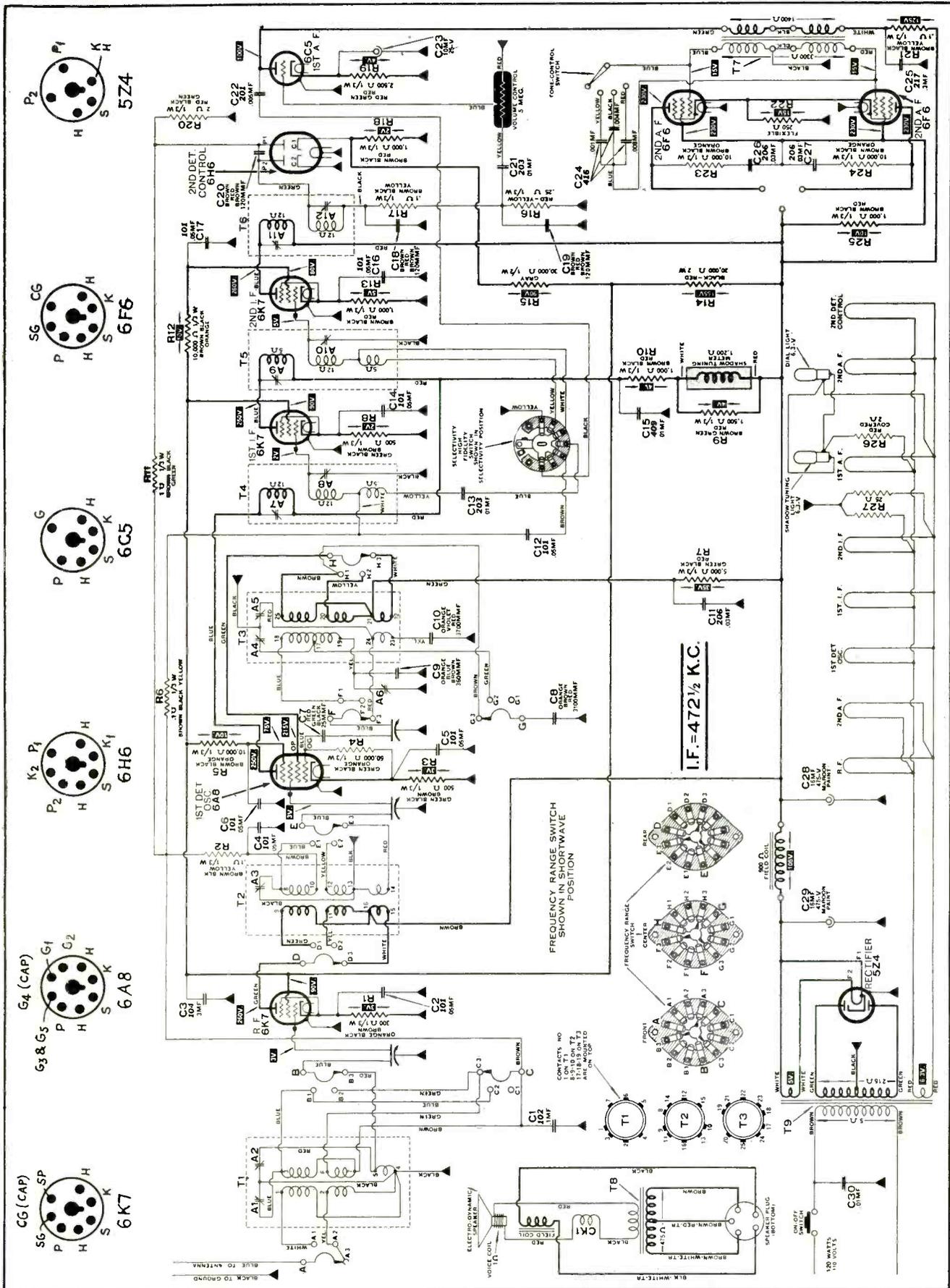
F. C. Wolven.

Eight-Pin Tube Testers

(Continued from page 381)

ment or heater pins. It was, therefore, deemed advisable to effect an arrangement in the new tube tester designs whereby the filament or heater current, which may be considered as entering the number 2 pin of the octal tubes, could return through the "top cap" terminal or through any one of the numbered pins of such tubes, and this arrangement has been accomplished with a "filament return selector" switch designed specifically for the new testers, and schematically illustrated in the accompanying drawing.

By incorporating the "filament return selector" switch, no adapters are required, and only one 8-hole socket is needed for all present types of octal tubes, and for all future octal tube types in which the filament currents may return through the top cap terminal or through any pin other than the number 2 pin through which the filament or heater currents may be considered as entering octal tubes.



Circuit diagram of Atwater Kent Model 649, with parts and voltage values.

Public Address . . .

METAL TUBES IN A P-A AMPLIFIER

By I. A. MITCHELL*

THERE is no doubt by this time that metal tubes will eventually replace glass tubes in most radio receivers. While the cost of metal tubes is at present about twice that of comparable glass tubes, the several valuable performance characteristics of these tubes have already taken the radio industry by storm. This does not mean that glass tubes should be retired to obsolescence, but reflects the general progressiveness of the radio field as a whole. The advantages of metal tubes in p-a work are readily enumerated:

- (1) Reduction in tube noise and microphonics.
- (2) Compactness, which lends itself to the modern trend toward simplified equipment.
- (3) Positive self-shielding.
- (4) Simplified, self-aligning base plug.
- (5) Increased strength.

Increased tube strength is of great importance in p-a work due to the great abuse tubes normally get in such service. In addition to the unbreakable shell, these tubes have a more rugged internal structure as the elements are supported by at least seven wires leading directly to the base pins. In addition to the physical advantages enumerated, we must also consider the psychological effect of

*Chief Engineer, United Transformer Corp.



Fig. 1. View of the completed metal-tube public-address amplifier.

this amplifier system, the requirements for a modern system were noted, namely:

- (a) High gain (sufficient for the new microphones).
- (b) High power output.
- (c) Low distortion (under 5%).
- (d) Low hum level.
- (e) Simplicity of construction.

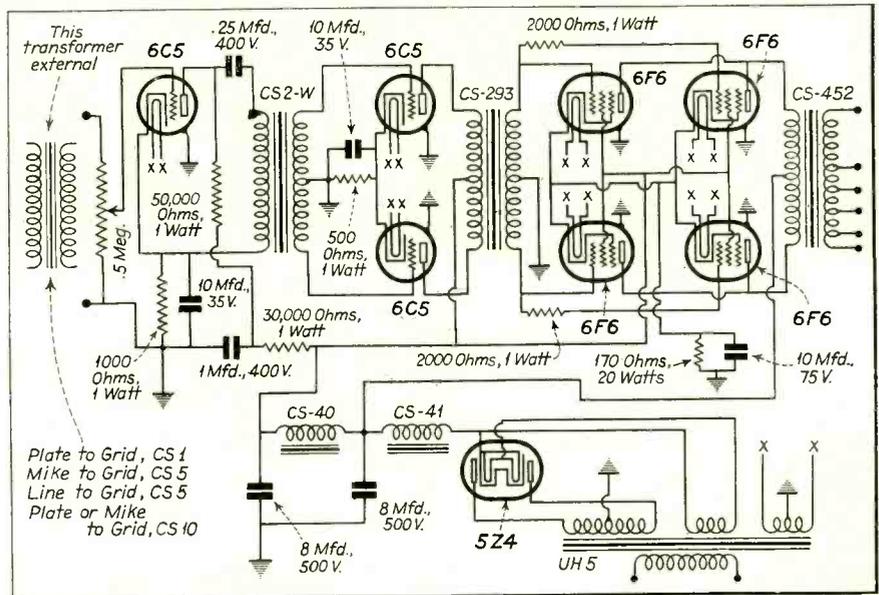


Fig. 2. Complete diagram, with parts values, of the metal-tube public-address amplifier.

metal tubes and their obvious, "the latest," effect on the ultimate purchaser or user of p-a equipment.

Keeping in mind all the aforementioned metal tube advantages, the p-a amplifier described below was designed and developed to form an inexpensive unit ideal from the engineering standpoint.

As a starting point in the design of

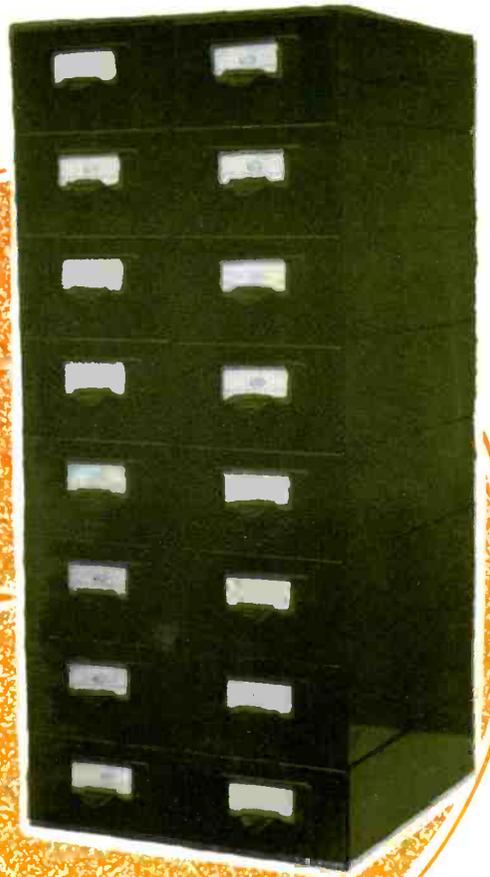
To take care of the low-level microphones encountered today, it was found that a gain of about 95 db would be necessary. While this gain will take care of crystal and high-level velocity and dynamic microphones, a pre-amplifier should be used with the extremely low-level unit. To take care of the varied power requirements met up with in p-a work, a power output of 35 watts was decided upon. The average amplifier available in the past to meet the specifications in the preceding paragraph would be quite a complex unit. However, through proper application of the new metal tubes, it was found possible to accomplish all this with only three stages, and on a single compact chassis incorporating newly developed chromshield audio filter and power component.

THE CIRCUIT

Fig. 1 illustrates the appearance of the final amplifier. Fig. 2 is the corresponding wiring schematic. The unusual simplicity of construction and wiring is apparent at a glance. There is nothing tricky in the entire circuit. An input transformer is not mounted on the chassis due to the strong tendency towards the use of crystal microphones and high-impedance velocity mikes.

The input feeds directly into the first grid, with a 0.5 meg grid volume control. The first tube is a 6C5. This tube is an ideal voltage amplifier as it has

(Continued on page 394)



MADE OF HEAVY GAUGE STEEL
FINISHED IN attractive OLIVE GREEN
COMPLETE WITH DRAWER PULL and CARD



ASSEMBLE THESE *Strong* METAL
CABINETS *yourself* QUICKLY and EASILY
BY USING THE INDIVIDUAL —

TOBE ADD-A-UNIT CABINETS

Here's how to obtain *Free!*
these cabinets



ONE TOBE ADD- IS GIVEN AWAY OF THE POPULAR



TOBE Condenser Kit No. 1

Consists of the following
most popular sizes
of the very latest
1936 construction

each
TOBE ADD-
cabinet
easily
\$2.00

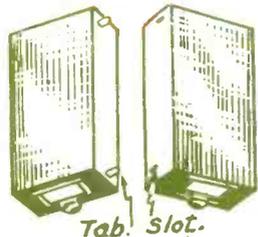
What we mean by "SURGPROOF" and "OPENPROOF"

TOBE Tubular Condensers are now manufactured to result in as high a quality product as the present state of the art will permit. Windings are made up of the finest paper dielectric obtainable, impregnated in purest wax, cooled under a fine grade of oil and then given a secondary impregnation in a moisture proof compound. Such unusual construction gives the condenser the ability to withstand peak voltage surges of several thousand volts.

The use of the metal end piece, illustrated, provides a path for the radiation of heat from the solder iron, preventing this heat from melting the pigtail connection and causing the condenser to become "open".

Thus, TOBE Condensers will withstand severe peak surges and are insured against opening.

JUST FIT THEM TOGETHER!



Tab. Slot.

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The cabinets may be stacked one on top of the other in the same manner. A pair of end holes are provided on the bottom of each unit so that the units may be fastened to the bench supporting the entire cabinet.

As can be seen by the photographs, there are many possibilities in the arrangement of these units in accordance with the space available on the serviceman's bench.



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Amt.	Cap. MFD	D. C. Volts Working	Type	Price List	Total
3	.001	600	M - 1 @	.18	.54
2	.002	600	M - 2 @	.18	.36
3	.005	600	M - 5 @	.18	.54
5	.01	600	M - 10 @	.18	.90
5	.02	600	M - 20 @	.20	1.00
5	.05	400	M - 50 @	.22	1.10
5	.10	400	410 T @	.25	1.25
3	.25	400	425 T @	.35	1.05
3	.50	400	450 T @	.50	1.50

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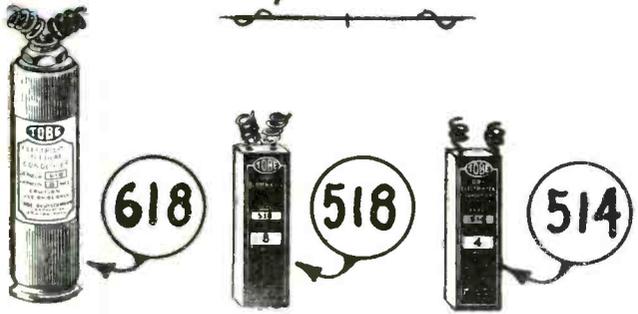
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Amt.	MFD Cap.	Peak Volts D. C.	Type	List Price	Total
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2	4	500	514	.75	1.50

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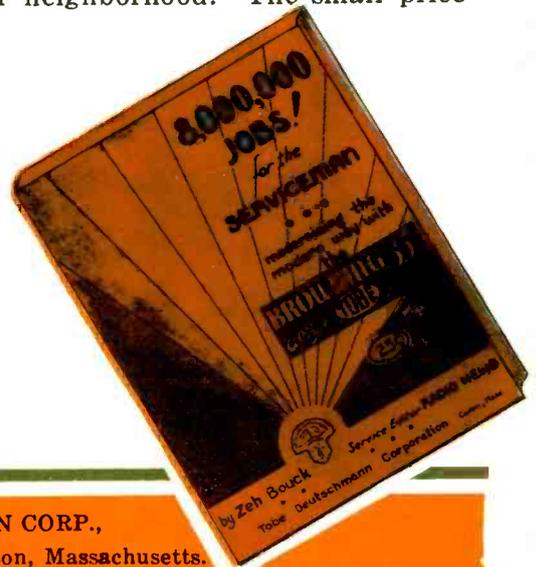
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VIBRATORS—THEORY AND PRACTICE

By ALLEN S. NACE*

PART III

The final article on auto-radio power-supply units. This deals with an extension of the vibrator-type device into the field of 32-volt supply where special design problems are encountered.

A NUMBER of problems are encountered in the design of the 32-volt vibrator not found in the 6-volt type and it is necessary to make some provision in the 32-volt power supply for these changes.

LOW AND HIGH POWER

There are two general applications of the 32-volt vibrator. One is the conversion of 32-volt direct current into high voltage a-c and then rectifying it to be used as a plate supply for radio receivers. This application was designed primarily for batteryless radio reception on farms and in rural homes where 32-volt battery electrical systems are in common usage. The second application is to convert 32-volt direct current into 110-volt a-c for the operation of standard household electrical appliances such as radio receivers, vacuum cleaners, washing machines, etc. Because of the high current output required for such applications, designing a vibrator that will function efficiently over a long period is considerably more difficult than constructing a vibrator for a 32-volt radio receiver power supply.

METHODS USED

Common practice among 32-volt radio set manufacturers is to design a power supply to supply a maximum of 150 to 225 volts at 30 to 40 mils, which is below the average for 6-volt receivers. Both synchronous and non-synchronous types of vibrators are used. Where an 84 rectifying tube is employed in conjunction with the non-synchronous vibrator, the filament supply may be taken from the battery in series with other tubes in the receiver, or it may be obtained from a special winding on the transformer. This, of course, places an additional drain on the vibrator.

VIBRATOR-TRANSFORMER COMBINATION

Considerable trouble was encountered

*Director of Vibrator Research, The Radiart Corporation.

in a number of the first 32-volt power-supply units placed on the market, due largely to improperly designed transformers. The basis of the well designed, efficient 32-volt power supply for a radio receiver is the vibrator-transformer combination. The primary of the transformer must, of course, have two 32-volt windings, where a full-wave vibrator is to be used.

The chief danger in any vibrator application is arcing at the points. In 6-volt applications the voltage is so low this danger is considerably minimized, but at 32 volts the voltage is approaching a degree, 50 volts, where the natural tendency is toward an arcing or spark-jumping effect even without taking into consideration the surges that follow the breaking of the contact at the vibrator points. This will be readily seen when it is remembered that the difference in potential across the two outside windings of the primary is 64 volts (center tapped for the two 32-volt windings).

ARCING OF CONTACTS

The result is that, without careful attention to transformer design, when contact is broken at the vibrator point, the relatively high voltage winding of the primary, coupled with the surge of current backing up from the secondary, will cause current to jump across the points in the form of a spark. This will become a continuous burning arc across both points and the points on the vibrator reed. The temperature of this arc is so great that the vibrator is ruined in a short time. The solution to this problem is a generous primary on the transformer with a sufficient amount of resistance to dampen or decrease the voltage surge that follows the break at the contact points. The recommended minimum number of turns for the primary of a 32-volt transformer is 406.

CURE

This factor was not taken into con-

sideration in designing several early 32-volt radio receivers, and the result was an extremely high percentage of vibrator and power-supply failures. When radio and vibrator engineers had time to put in sufficient research to determine the cause of these failures, much of this early trouble was eliminated by compensating for the small primary used on the transformer by inserting a resistance of from 6 to 10 ohms in series with the battery and center tap of the transformer primary.

As there is little difference in the secondary operation of the transformer from that of the standard 6-volt practice, the latter may be followed satisfactorily in 32-volt design.

HIGH-VOLTAGE DESIGN

In applying the vibrator principle to obtaining 110 volts a-c from a 32-volt direct-current source, the problem of a vibrator design capable of a sufficiently large output becomes serious.

In order to furnish current capable of operating a practical number of household devices, the vibrator must be able to stand up under a continuous load of approximately 200 watts, rating the vibrator and transformer combination at 50 percent efficiency.

While the secondary winding is comparatively small for the 110-volt output, the heavy current reacts in the primary, shooting a surge of considerable proportions that must be dampened, or the life of the vibrator and power supply will be very brief.

BUFFER CONDENSER

In addition to a large primary of about 400 turns, which, in this case, must have large enough wire to carry the heavy current, an extremely large buffer condenser across the secondary of the transformer is necessary. Conventional practice is to make the value of this condenser approximately 1 mfd in order to reduce the peaks caused by the breaking of contact at vibrator points.

It should be stated here that a particularly well-designed vibrator of critical construction and sufficient ruggedness to stand up under the pressure of the heavy load, will be necessary for efficient operation in an application of this type.

A number of these 32-volt converters have been placed on the market and vibrator failures have been frequent because all of these factors have not been given as much attention in the past as they might have.

In theory it is quite possible to build a thoroughly workable and efficient converter of this type, but mechanical limitations and the relatively small amount of research that has been done in this field have handicapped development.

The spread of 32-volt household equipment and perfection of the 6-volt and 32-volt household receivers have narrowed the field for the 32-volt-110-volt a-c converter to such an extent that no great amount of future development may be expected unless some broader field is opened for this application.

SYNCHRONOUS VIBRATOR POSSIBILITIES

As fundamental design and construction of the vibrator have continued to improve to the point where its life and service are comparable to that of the vacuum tube, auto-radio power supply engineers are devoting more and more time to the synchronous vibrator.

The possibilities of this self-rectifying unit have long been recognized but its development has been retarded for several reasons.

When public demand for an economical all-electric auto-radio forced the manufacturer to turn to the vibrator as a method of power supply, the vibrator was still in the experimental stage. There was no background for either design or construction. Consequently the early vibrator was far from a trouble-free device. While the public appeared willing to put up with the inconvenience of frequent servicing in

order to have all-electric receivers in their cars, naturally neither the engineer nor the manufacturer was satisfied until a trouble-proof, long-lived power supply could be devised. Since the non-synchronous vibrator in combination with the 84-type rectifying tube offered the simplest method of obtaining such a power supply, the majority of engineering effort and research was confined to this type of vibrator.

EARLY EXPERIMENTS

Some early experiments were made with the synchronous vibrators and a half-wave series unit was included in one of the first popular sets placed on the market. The results were not encouraging, and influenced other manufacturers to concentrate largely on the non-synchronous vibrator. The limitations of the series vibrator were, of course, only amplified in the synchronous unit.

TUBE LIMITATIONS

The limitations of the type 84 rectifying tube have had much to do with the increased interest in the synchronous vibrator. The public at first was willing to put up with most anything as long as it could receive radio programs in an automobile. Then came the

demand for better service from their receivers, then better sensitivity, selectivity, and now tone quality is becoming paramount. To produce this combination, a good many engineers and set manufacturers believe is not practical with the current limitations of the 84 tube. Also a few are requiring six and sometimes seven tubes in the receiving circuit, which, with the half ampere required for the rectifying tube, makes the drain on the car battery perhaps objectionable.

Better circuit design and better application of filtering and shielding have eliminated the "hash" bugaboo from the synchronous vibrator.

CONCLUSION

A number of fine receivers utilizing the synchronous vibrator were placed on the market this year and their efficient service, which you may be certain has been carefully observed by the entire auto-radio industry, will result in an increased number of synchronous vibrator power-supply receivers being introduced for the 1936 season.

The synchronous power supply also is expected to be used extensively in the 6-volt home receiver field next year.

METAL-TUBE AMPLIFIER

(Continued from page 388)

an appreciably higher amplification factor than the 56 or 76 (20), and has a plate resistance of only 10,000 ohms, which means that practically the entire amplification factor is made available. This tube is parallel-fed and transformer coupled to a pair of 6C5's which in turn drive the output tubes through a special driver transformer.

POWER STAGE

Four 6F6's in push-pull parallel are used in the output stage. It was found that these tubes can deliver more power and at less distortion connected as pentodes, rather than as triodes. In the circuit shown, the available power output is 35 watts at 5% distortion, and 40 watts at 7%. The 6F6's in A Prime operate somewhat differently than the 42 glass tubes, and appreciably more power can be obtained from these tubes as pentodes rather than as triodes, and at low distortion. Due to the higher μ of the tubes operated as pentodes, low bias is required (21 volts) for A Prime operation, and also less driving power is necessary. A pair of 6C5's were found capable of driving the four pentodes to maximum output with *self-bias*.

It will be noted that 1000-ohm re-

sistors are used in series with one pair of grids to stabilize the push-pull parallel combination. The input and output transformers are very important in this A Prime circuit and should be perfectly matched, or the power output will be reduced considerably. The output transformer shown is universal in nature, having both a 500-ohm line termination and also a tapped voice coil winding which will take care of up to twenty speakers. The hum level is kept at a negligible value through the use of a good two-stage, choke-condenser filter and an additional resistance-capacitance filter in the first stage.

All in all, it is apparent that the metal tubes lend themselves well to the construction of high-quality p-a equipment. With proper precautions in the amplifier construction and the choice of good transformers, together with quiet resistors and stable condensers, the amplifier described will be found foolproof for any p-a work.

Tire Static

We recently experienced an uncommon case of tire static occurring in the rear tires of a Plymouth car. We were able to completely lick this difficult problem of interference by connecting a

bond from the rear axle housing to the frame of the car, allowing sufficient slack to provide for the flexing of the rear springs.

FRANK CRAIG, *Courtesy Motorola*

Installing Motorola 75 and 57

If it is necessary to install Motorola Models 57 and 75 to the left of the steering column—mount them in an inverted position to avoid sharp bends in the control shafts. The performance of the sets will not be affected in any way.

Do not mount them on their side as this will result in short tube life. No tube built can stand this abuse.

Motorola—Excessive Antenna Capacity

After installing any model Motorola, be sure to trim the antenna condenser. Make certain that the trimmer peaks sharply. If it does not, it indicates too much capacity in the car antenna.

Check it with a Motorola antenna capacity bridge.

It is very important that it be not over 300 mmfd. If you find the capacity higher but indications are that it is otherwise satisfactory, connect a .00025 mica condenser in series with the lead-in. This condenser may be conveniently installed in the antenna junction box.

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RECEIVER CASE HISTORIES

Balkeitt 41A

Oscillation: Caused by tube shields working loose or not fitting properly. Tube shields on all tubes must fit firmly and connections between control grid and diode plates of 75 should be kept as far apart as possible. Solder flexible wire leads to all tube shields and ground to chassis.

Geo. F. Baptiste.

Belmont 41, 42A

Failure to operate: Common cause is shorted primary of output transformer. Replace with new unit.

Geo. F. Baptiste.

Bosch 350

Hum, especially when set is first turned on: Also, dial light bulb will flicker and all heater voltages will be low. The cause is poor soldering lug ground at 2A6 socket. Solder heavy wires from ground lugs at all sockets to chassis.

Poor image-frequency selection: Move aerial wire away from first detector r-f coil and shield wire by telescoping a piece of metal braid over aerial wire's cambric insulation, grounding the shielding. A bottom plate of sheet metal may be placed over this end of the chassis to minimize pickup by the coils and wiring.

Paul D. Shields.

Colonial 36, 36-P, 114

Excessive hum: Caused by open or very high values of the 400,000-ohm resistors in series with the leads from the push-pull 245s to the hum-balancing potentiometer. Remove dual resistor unit. Solder new 400,000-ohm half-watt resistors to the grid terminal of each 45 socket and the "outside" leads from the potentiometer, and the "center" lead directly to the 245 biasing resistor. Note that center lead is tap and does not go to potentiometer arm. A. E. Lindner.

Colonial 136

25Z5 flashes: Caused by electrolytic condenser in power supply. This unit is rated at 175 volts. Replace with 225- or 250-volt condenser. Replace 0.02-mfd condenser across plates of 25Z5 rectifier with unit rated for 400 volts. original unit being rated at 300 volts.

In a-c, d-c models check antenna series condenser. If particular model does not have this condenser, put in 0.001-mfd unit. Geo. F. Baptiste.

Columbia C-100-A

Cutting off: This occurs at irregular intervals and only during passage of

strong signals. Voltage tests showed that when set cut out the voltage next to the rectifier would drop about 50 volts, at the output of the filter, about 150 volts, and at plate of power pentode, about 175 volts. The trouble was traced to a defective 47, the insulation of which would break down on strong signals.

F. C. Wolven.

Crosley 54

Low volume: Replace 0.1-mfd condenser between detector plate and audio grid, if it shows more than 50 to 75 megohms leakage. Considerable increase in sensitivity may be obtained by changing the 150,000-ohm detector plate resistor to 300,000 or 400,000 ohms.

F. C. Wolven.

Eveready 50

Voltage divider: In case proper resistors are not at hand to replace voltage divider, discard old divider and connect a 5,000-ohm, 25-watt resistor between B positive and ground. Feed screens through 12,500-ohm, 2-watt resistor with a 25,000-ohm, 1-watt bleeder. The screen voltages may be 10 or 15 volts too high, but this does no harm and increases sensitivity. This applies only to the run using a 2500- and 2250-ohm resistor combination as voltage divider.

F. C. Wolven.

Fada KW Chassis 48, 49

Low volume, tendency towards audio oscillation: Set will play a little with one test prod touching plate terminal of second i-f stage. There is a pronounced tendency towards audio oscillation and set emits steady whistle with tone control in "high" position. Rotor arm of volume control does not make contact with resistance element. This should not be confused with worn out or burned out volume control. When control increases its resistance due to these causes, the automatic volume control becomes over-effective and cuts down signal. Since volume control is part of avc system, its value must be exact.

F. C. Wolven.

Freed-Eismann NR-80, NR-85

Noisy volume control: These sets use a special volume-control strip. Use a 2000- or 3000-ohm potentiometer arrangement "a la Radiola 18" across the antenna choke. There is always plenty of room to the lower right of the tuning drum for a control. Enclose leads in grounded shield and adjust third neutralizing condenser to a point just below oscillation at 1500 kc. F. C. Wolven.

General Electric A-53 (Metal)

Noise: Set develops a high, thin, hissing sound which gradually changes to a "birdie" whistle on all stations. The cause is a faulty r-f 6K7 tube.

F. C. Wolven.

General Electric A-65 (Metal)

Noise at high volume levels causing interference in other sets: Trouble due to filings in air gap of speaker.

F. C. Wolven.

General Electric M-81, M-86

Choosing second detector avc tubes: Great care should be exercised in choosing these tubes. I saw one very interesting case of double leakage in one of these tubes (75). The tube showed a leakage of 50,000 ohms and 55,000 ohms from respective diode plates to heater at time leakage was detected. As tube aged, this resistance decreased until set would hardly operate at all. When set was received from factory, the avc action was somewhat ineffective; set would overload with volume control one-fourth on. A very slight leakage will produce this effect, and the gradual decrease in resistance resulted in the later lack of sensitivity.

Another 75 worked fine except that set was noisy when warming up. This did not occur when 75 was out of its socket, but was considerably louder when control-grid clip was removed from cap of tube. The set should hum loudly when control-grid circuit is open, but in this case no hum was present. Trouble was traced to a leakage of about 100 megohms between control grid and plate. High plate voltages during warm-up period accentuated the trouble. Tube checkers will not detect these faults. I use a source of 450-475 volts dc in series with 500-volt, 1000-ohm-per-volt voltmeter. The power pack of set will do nicely in a pinch. Test tubes cold and use only best test prods to avoid stray leakage.

F. C. Wolven.

G. E. Little General

Open or off-value resistors: These resistors do not stand up well. Replace with good units according to data in Rider's 3-1.

F. C. Wolven.

Kolster K-131, K-132

Poor sensitivity or insufficient avc control: Generally due to resistor associated with avc system having changed value.

Geo. F. Baptiste.

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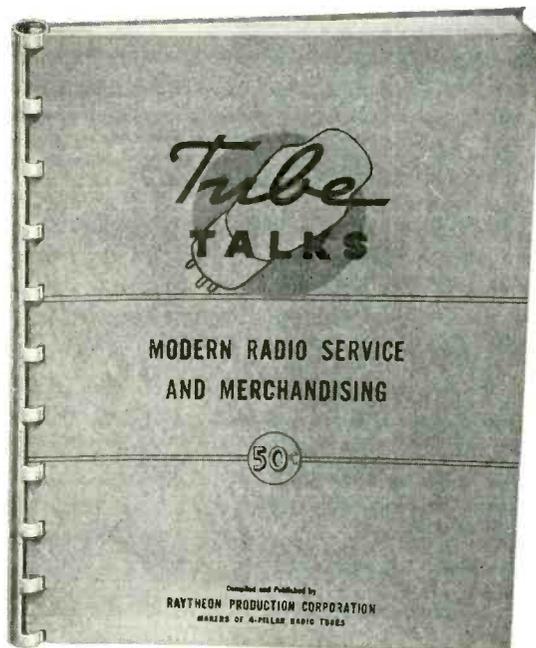
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RECEIVER CASE HISTORIES—continued

Majestic 300

Low volume; distortion: Very low volume with severe distortion with volume control in center position. Advancing or retarding control resulted in set cutting out entirely, distortion increasing considerably before set stopped. Found condensers C-17 and C-24 leaking badly. Replacement resulted in too much volume, distortion still being present. This was caused by leakage in C-18. C-13 also proved leaky. Set now played normally with 18- to 24-inch antenna. On standard antenna a faint whistle, variable with dial setting, could be heard on strong stations. This was diagnosed as forced oscillation due to ineffective AVC system, since set still had too much volume and trouble would disappear if circuit was thrown slightly off balance. Replacement of C-19, C-20 and C-21 cured the difficulty. All condensers should be of 600-volt type.

Condenser testing: To speed up testing of condensers in this and other sets, first check to see if one side of condenser is connected to ground or returns to ground through less than 500,000-ohm to 1-megohm resistance. Then disconnect opposite side from circuit and connect a 500-volt, 1000-ohm-per-volt meter from the rectifier filament to the open side of the condenser. Discard any condenser under 0.5-mfd that shows the slightest measurable leakage. Even 4-mfd paper types should show practically no leakage, though old. For really accurate work a 100-volt, 10,000-ohm-per-volt meter in series with two B batteries, is preferable, as it is then possible to detect even the slightest charging current.

F. C. Wolven.

Montgomery Ward 40, 40A, 62-11, 62-14

Oscillation, especially on low-frequency stations and extending to all but very highest if condensers are not in good alignment: Caused by open 40,000-ohm resistor connecting to center tap of one oscillator coil winding and in ground return circuit of 27 oscillator's grid.

Paul D. Shields.

Philco 45

Pickup: The early models must be re-balanced before they will have the proper pickup. The i-f is 460 kc.

Keith F. Martin.

Philco 54

Low d-c voltage: Look for open 12-mfd electrolytic condenser (part No. 30-2001). Replace with new unit.

Keith F. Martin.

Philco 65

Oscillation: All cathode bypass condensers tend to become intermittent, particularly the cathode bypasses. It may also be necessary to connect a 0.00025- or 0.0005-mfd mica condenser from low side of detector plate choke to ground. In very stubborn cases bond both ends of the condenser rotor shaft to the condenser frame and then to ground. The detector tube should be perfect—even a slightly weak tube will cut the volume greatly. Some sets work better with a 56 in this position.

F. C. Wolven.

Sparton 26

Intermittent: Replace 1-mfd round, metal-clad condenser Number 831. Following condensers generally leaky and should be replaced: Three 0.2-mfd, 200-volt; 0.05-mfd, 400-volt; 0.006-mfd, 600-volt.

E. M. Prentke

Sparton Models and I-F Peaks

The i-f peaks for recent Sparton receivers are given in the following table.

Model	I-F Peak
58	456
594	456
655	456

The Model 58 is a battery-operated set, while the 594 and 655 are ac/dc units.

Stewart-Warner Series 108

Insufficient volume: The 36 detector tube plate resistor has changed value. The rating for this resistor is 0.25 watt, 2.1 megs. Also, check 36 detector cathode resistor and bypass condenser. Replace the 38-power amplifier.

Geo. F. Baptiste.

Stromberg-Carlson No. 82

This is a ten-tube, four-range receiver. No. 82 is for 105 to 125-volt, 50-60 cycle line, and uses Chassis P-22723 with Loudspeaker P-22738.

The No. 82-B is for 105 to 125-volt, 25-60 cycle line, and uses Chassis P-22724 with Loudspeaker P-22738.

U. S. Apex 12, 120 (Chassis 1200)

Audio end of set alive, r-f and i-f tubes dead: Plate-to-cathode voltages on tubes about 10 volts. Voltage across output of power pack slightly below normal. Cathode-to-chassis voltage on r-f and i-f tubes about 250 volts. The 4600-ohm section of speaker No. 2 tested 100 ohms due to shorted turns.

F. C. Wolven.

U. S. Radio & Television Radiotrope 27

Oscillation: Usually due to open or defective cathode bypass condenser (one of 0.4-mfd sections in metal-clad unit). Replace with 0.5-mfd, 200-volt condenser.

No plate voltage on 27 and no screen voltage on 24's: The 8,400-ohm section of voltage divider is open.

E. M. Prentke

Wells-Gardner 40, 40A

Oscillation: (See Montgomery Ward 40, 40A, 62-11, 62-14.)

Paul D. Shields.

Wells-Gardner S-732 Series 06Z Auto Radios

Repair data: For the Wells-Gardner S-732 Series 06Z auto-radio receivers is given in Table I. This data includes symptoms, their cause and repair, as well as the preventative measures used to guard against similar future troubles.

P. R. Kendall

TABLE I

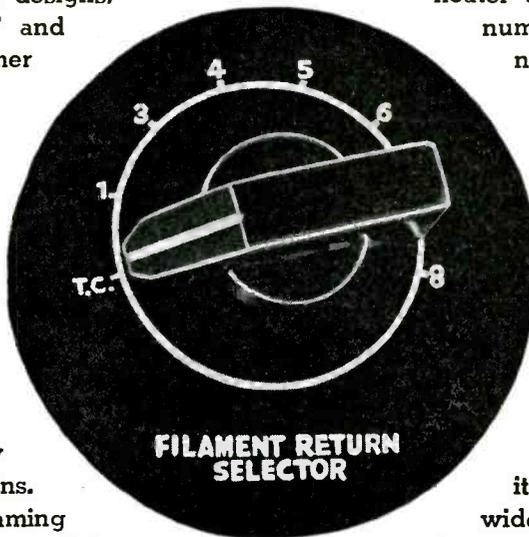
Symptoms	Findings	Repair	Prevention of Future Trouble
Set dead	No plate voltages	Replace filter condenser	
Set dead	No plate voltages. Shorted .02-mfd condenser across secondary of power transformer		Replace condenser
Set dead	Vibrator not operating	Replace vibrator and power transformer with new type	
Excessive vibrator noise in speaker		Ground pigtail on ant. lead	
Excessive vibrator noise in speaker	*One lead of .02-mfd condenser across secondary of power transformer broken off	Solder broken lead	Anchor bulk of condenser to power transformer
Oscillation	*One lead of .25-mfd r-f cathode condenser broken off	Solder broken lead	Anchor bulk of condenser to frame of gang condenser
Speaker rattle	Dirt in speaker	Replace speaker	Re-install set so that speaker is facing down or out—NOT UP
Set locked in both the locked and unlocked key position	Cast aluminum strip warps, thus locking volume control in both key positions	Bend strip so as to clear set-screw in unlocked position only	
Excessive vibrator noise in speaker	Look for cathode leakages or shorts in any of the tubes. Replace tubes one at a time and note difference in vibrator noise		

*This trouble caused by excessive vibration—usually in 4-cylinder cars.

“Roaming Filaments”

The first all-metal tubes announced had the filament or heater circuits terminate at pins numbered 2 and 7. Subsequently, the metal tube 5Z4 was announced with a filament circuit terminated by pins number 2 and 8, so that two 8-prong sockets or an extra switch had to be incorporated in tube tester designs, unless socket contacts No. 7 and No. 8 were connected together within the tester, thereby providing incomplete test of ALL octal tubes.

Supreme engineers, however, foresaw at the time that other tubes would be announced in which a filament circuit would not necessarily terminate at pins No. 2 and No. 7 or No. 2 and No. 8, but that the filament COULD terminate at any one of eight possible positions. Supreme anticipated “Roaming Filaments” and incorporated in 1936 Models an exclusive feature “Filament Return Selection” whereby the filament current,



which may be considered as entering the No. 2 pin of octal tubes, could return through the “top cap” or through ANY of the tube base prongs.

This development enables Supreme owners to immediately take care of such new tubes as the type 6P7, just announced, in which the heater circuit is terminated by pins numbered 2 and 3 or any other new tube which may be announced in the future in which the filament (or heater) current returns through any pins other than those specified in the original series of octal tubes.

Remember, “Filament Return Selection” is found only in 1936 Supreme Instruments. An exclusive development of Supreme engineers, it is just one more reason most wide-awake servicemen are choosing new Supreme models in preference to any other make.

● **NEW SUPREME CATALOG NOW READY—FREE** ●
Practically all good jobbers now have these instruments in stock for demonstration and for your inspection—Supreme’s new complete catalog, just off the press and sent to you without obligation, tells you more about “Roaming Filaments.”

SUPREME INSTRUMENTS CORPORATION

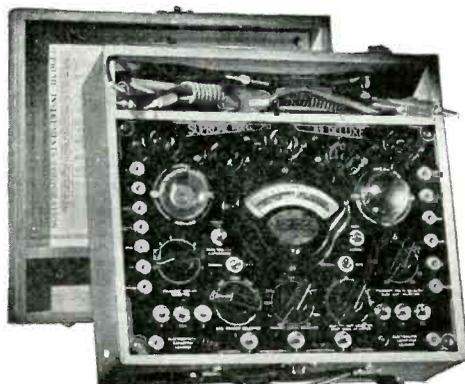
538 Supreme Bldg.
Export Dept., Associated Exporters Co., 1457 Broadway, New York City.

Greenwood, Mississippi
Cable Address, LOPREH, New York



SUPREME 89—STANDARD TUBE TESTER

A new low priced Tube Tester, featuring Supreme’s famous Neonized leakage test. \$34.95



SUPREME 89 DELUXE TUBE TESTER
The 7-in-1 instrument. Resistance ranges to 20 megohms are with self-contained power supply \$45.95. Available also in beautiful Tri-Toned Walnut counter display model.



SUPREME 385—AUTOMATIC
A multi-unit instrument, combining features of 339—DeLuxe Analyzer and 89—DeLuxe Tube Tester, plus other flexibility features possible only through Supreme’s exclusive uni-construction \$77.95

ON THE JOB . . .

An Efficient Accounting System for the Radio Service Man

There are many useful and necessary articles written to cover the technical and sales portion of the radio service industry, but there seems to be very little written about that equally important end of the business, namely, the accounting records and books of the Service Man. It must be remembered that this part of the business is the means of determining success or failure, and to insure success a clear-cut comprehensive system must be kept—one which will not take much time and expense to maintain. It has been my observation that a great many radio Service Men have a tendency to give more attention to the technical and sales sides of their business and to neglect their books which record the great principles of investment and expenses. Too much is taken for granted and the result is not proper control of their business to preserve success. It is believed by the writer that one reason for this condi-

tion is either a lack of an efficient accounting system furnishing all necessary facts with as little work as possible, or to a system not selected to meet the needs and the problems of the radio Service Man.

ADVANTAGES OF SYSTEM

The object of this article is to give in as plain and as clear as possible manner an effective and efficient system of accounting, easy to apply to the radio service business and involving little time and effort to record the necessary facts. The system to be described is designed to meet the needs of the small business having the records kept by the radio Service Man himself, who, wanting to spend as little time as possible in this phase of his business, will yet have a useful, complete and necessary record of his daily business. It can be equally well applied to the larger business and requires only a few minutes each day, with little expense for stationery. It has been in use in our

business for over two years and is found to be very flexible. Its automatic totals afford us with all information desired for controlling advertising, expenses and expansion.

FORM NO. 1

This system is centered around the printed Form No. 1. This form is used as the customer service bill; accounts receivable ledger; to obtain complete information pertaining to each sale; and as a file for future reference. As can be seen the bill is divided by a perforation. The top part forms the customer bill and is given to the customer, when the set is delivered, to be used by him as the receipt. This part of the form has space for showing as follows: Name, address, date, amount of bill and a description of the service performed.

The lower half of the form is detached and retained in the store as a complete record of the service sale. It shows the name, address, date, kind of set and serial number. The service done is listed in the top space and under it is shown each part used with its *cost price* and *selling price*. These prices are extended and totaled at the bottom of the bill. As the customer never obtains this part of the bill, these *cost prices* are not seen by him, and accurately furnish us with that very important item *cost accounting* of parts sold. Also on this form provisions are made to check whether the sale is a cash sale or charge transaction. These tickets are made up at each sale during the day and filed. At the end of each day, all the tickets are entered on the journal (to be described later). On the lower left corner of this form is the *ledger account* for this customer to be used in case it is a charge sale. The date and amount of each charge and credit is entered here and the bill is filed in a separate *unpaid* file, where it will remain until it is fully paid—at which time it is credited and placed in the paid or permanent file in alphabetical order. Thus this one form (No. 1) provides a bill for the customer, a complete recorded transaction of the sale furnishing a customer ledger account until it is paid and is then used as a permanent file for future reference.

FORM NO. 2

Before these tickets are filed each day they are entered in the journal shown in Form No. 2, using one line for each customer. The charge is made either to the customer or to cash for the total bill, and the credits are entered for each

ARDMORE, OKLAHOMA, _____, 193__			
IN ACCOUNT WITH			
DIBRELL'S RADIO SERVICE			
803 C ST., N. W.		PHONE 1497	
AMATEUR RADIO STATION W5BLW		MEMBER RADIO MANUFACTURERS SERVICE	
DATE _____			
Make of Set	Model	Serial No.	
RADIO SERVICE PERFORMED			
PARTS USED		Cost Us	Sell
Charges	Credits	Parts Total	
		RADIO SERVICE - - - - \$ _____	
		TOTAL BILL - - - - - \$ _____	
		CHARGE (____) PAID (____)	

Reproduction of "Form No. 1" described in article.

A FRANK MESSAGE

from

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8

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- ALWAYS to cooperate with the dealer, serviceman, amateur and experimenter.
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Service Man

Classification

"Ham"

Instructor

We should thank the radio industry but they're thanking us...for "G" Tubes!

For the trade's very splendid reception of "G" tubes (glass counterpart of metal tubes) that has caused our plant to work at capacity, we say "Thank You."

Deluging us, however, are thousands of "Thank You's" from:

Set Manufacturers—because they are enabled to go into quantity production of sets that can use metal tubes, but using "G" Tubes—built on tried and proved principles;

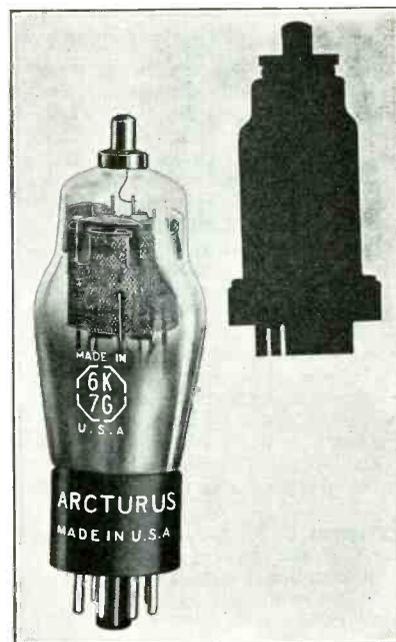
Jobbers, Dealers, Servicemen—for placing them in a position to cash in, now, on the public's great interest in this development.

"G" Tubes embody all the merits of metal tubes but are built on time-

tested, experience-proved principles. A few important features of "G" Tubes include:

1. Characteristics identical to all-metal tubes.
2. Pin connections and base same as all-metal tubes.
3. Type numbers correspond to all-metal tubes (except our 5Y3 is a counterpart of the 5Z4).
4. Positively interchangeable with all-metal tubes.
5. Proved efficiency; built along conventional manufacturing practices; not an experiment.
6. Available now in quantities.
7. Currently used as initial equipment by several leading set manufacturers.

Characteristic Chart on "G" Tubes available on request. Arcturus Radio Tube Co., Newark, N. J.



Showing general appearance of the "G" Line Tubes, with all-metal tube base connections and guide pin.

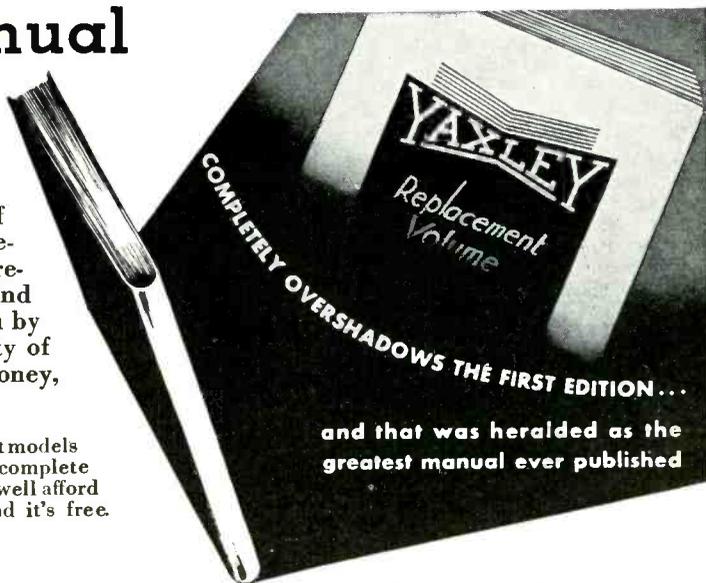
ARCTURUS RADIO TUBES

Pioneer of 6 out of the 7 Fundamental Developments in a. c. tubes.

THE YAXLEY 1936 Replacement Volume Control Manual

Yaxley doesn't believe in resting on its laurels. Its constant advances in volume control development prove that! The latest and greatest edition of the Yaxley Replacement Volume Control Manual proves it, too! Twenty-four months were devoted to the production of this invaluable book. Five radio service engineers—specially trained for the task—compiled, checked and re-checked the data that makes it the most complete and comprehensive manual of its kind ever offered to you by anyone. Its preparation took plenty of time and plenty of work. And it will save you plenty of time, plenty of money, and plenty of grief.

The 1936 Yaxley Replacement Volume Control Manual lists more set models than any other. It provides more factual data. It contains a complete catalog of Yaxley approved radio products. No service man can well afford to do without it. It's complete—authoritative—up-to-date! And it's free.



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Indianapolis, Indiana

Gentlemen: Please send me—absolutely free—a copy of the
1936 Yaxley Replacement Volume Control Manual.

Name _____

Address _____ My Jobber's Name is _____

ASSOCIATION NEWS . . .

INSTITUTE OF RADIO SERVICE MEN REPORTS

CONVENTION AND TRADE SHOW

Extensive preparations are being made for the Third Annual Convention and Trade Show to be held at the Hotel Pennsylvania in New York City on Friday, Saturday and Sunday, October 25 to 27.

The Executive Office of the Institute announces that more than a third of the space provided for exhibit had been absorbed prior to Labor Day, a most unusual occurrence due to the customary delay in taking care of such matters until the vacation period has passed. Those who are familiar with the layout of the Roof Garden and the Salle Moderne at the Pennsylvania will visualize the arrangement when we say that the exhibit spaces will be arranged in two rows throughout the length of the center of the Roof Garden (nearly a city block long). The Salle Moderne will be used for the technical sessions and for other meetings.

The program is being arranged by the Committees of the Second Region. They promise outstanding events and personalities for the entire three days.

Distributors' Meeting

Among other meetings that will have an important bearing on industry affairs is that of the Parts Distributors. Maurice Depres, a prominent parts distributor in New York City, operating as the Dale Radio Company, has consented to take charge of the affairs as they concern the visiting Parts Distributors. He is engaged in developing an agenda for the meetings and other gatherings in which the distributors will participate. Distributors from all parts of the country are being invited to attend.

RMA Service Section

The Service Section of the RMA, too, will hold its regular meeting for the Eastern Division, and there may be a general meeting comprising both the Western and Eastern Divisions. F. B. Ostman, Service Manager of RCA Manufacturing Company, is Chairman of the Division and will have charge of all arrangements.

Entertainment

Acting on the theory that "all work and no play makes Jack a dull boy" the committees of the Second Region are working up entertainment for each evening of the Convention. Coupled with the entertainment provided by the committees there is promised, too, a lively time for those who yearn to know the meaning of SOHARSM, and if plans go through there will be a lot of Service Men who will tread the burning sands. If the experiences of the Chicago Convention are any criterion, the natives will stare in wonder as the waters of the Hudson turn bluer and bluer.

Preliminary surveys indicate an enormous increase in attendance over that of last year when there was the largest gathering of Service Men New York had ever witnessed. Chapters of the Institute in outlying areas as far distant as Cleveland and the upper New York points have already signified their intention to be among those present.

No Registration Fee

As has been customary in the Conventions and Trade Shows conducted by the IRSM there will be no registration fee. An open invitation is extended to the Radio Trade, Manufacturers, Broadcasters, Engineers, Amateurs, Distributors, Service Men, Publishers, and anyone connected with the radio business in any manner whatsoever.

Qualification Plan—Meeting of the Board

The Convention is not the only matter that is absorbing the attention of the IRSM these days. Another equally important venture is the meeting of the Board of Trustees that will have been held in Rochester before you receive this issue of SERVICE, no doubt. At least it is scheduled to be held on Sunday, September 15.

The principal subject to be discussed is the "Qualification Plan," a program that has been in the process of development for a period of more than three years. Under this plan Service Men will submit themselves to an examination to determine their ability to service radio apparatus, and upon satisfying a National Board of Radio Service Standards, a new body to be formed and to consist of representatives of each of the different branches of the radio industry, will be given a certificate showing that they have fulfilled the requirements, and will be permitted to take advantage of the benefits that will be afforded—which will be many and varied.

It is not possible to give the full details of the plan until it has been definitely approved by the Board of Trustees, and everything is set forth specifically. At any rate, contrary to any rumors that may have been spread, the "Qualification Plan" is not to be operated by the IRSM; the "Qualification Plan" is to be made available to all Service Men.

The Committee on Professional Status of the IRSM has worked diligently on the project for months. It has been assisted ably by committees in most of the Chapters that have cooperated by furnishing data for use in the Questions and Answers Handbook, and in editing and revising the manuscript.

The members of the Institute have already signified their approval of the "Qualification Plan" in general and have instructed the Board by ballot to effectuate it by giving it Board approval.

It is believed that full details of this most important project—a most important step towards the stabilization of the service profession and in behalf of the welfare of the reputable manufacturing and distributing firms in the radio industry, as well as the broadcasters and the radio audience—will be ready for dissemination in the next issue. When the "Qualification Plan" is put into motion, it will quickly and effectively answer the time-worn question, "Who is a Service Man?" to which there has been no reply in the past.

A.R.S.M.A. CONFERENCE

The Eastern District of the Affiliated Radio Service Men's Association will hold their third round-table conference in Bedford, Pa., on Saturday, September 14. The first session will open at 4:00 and ad-

journal at 6:30 p. m. for dinner. At 7:30 p. m. they will again come to order until all business has been transacted.

Here are some of the problems which will be worked out—planning a circuit for factory engineers to give service talks before service organizations so that when an engineer leaves the factory he can jump from city to city overnight and complete New York, Pennsylvania, Maryland, Delaware, Washington and Virginia in about a week. This will save factories money and time and the organizations will change their meeting nights to suit the engineer. All organizations are planning to join the National Affiliated Association. The National by-laws and constitution will not interfere with local rules, as they will have their own set-up. The National Conference will be held once a year and the various Districts will meet four times a year with two delegates representing each organization, and one representative from each District will be sent to the National Conference once a year. The districts will be planned as Eastern, Great Lakes, New England, North West, Pacific North West, South West, West.

M.R.S.M.A. News

The Maryland Radio Service Men's Association, with the cooperation of various dealers, has placed used all-electric radio sets in various hospitals, homes and institutions and they will be kept in service by the Association. We feel this step should be taken all over the country.

We also wish all publications to start a Lost and Found column. Our members have lost many instruments which could be located through the medium of a column such as this.

A. O. RABASSA, *Publicity Chairman.*

P. R. S. M. A. SECOND ANNUAL SHOW

Twice as much space as last year has been reserved at the Philadelphia Electrical Association's Annual Radio and Electric Show for the Philadelphia Radio Service Men's Association exhibit. Vice-President Haas, Chairman of the Show Committee, has promised us a first-class exhibit that is expected to open the eyes of the public to the fact that they have a live-wire service organization in town.

Metal Tubes

At the September 3rd meeting metal tubes were again brought to the fore. Mr. M. A. Feldstein of the General Electric Company gave an introductory talk and presented Mr. H. R. Shaw, also of General Electric Company, who carried on with the technical discussion. Mr. Shaw's presentation was exceptionally clear and concise, starting with the early conception of metal tubes, through their stages of development.

Mr. Craig, the Philadelphia Weston Representative, then took up the trend of the talk by showing how Weston Test Equipment is used in servicing metal-tube receivers.

At the close of the meeting the writer circulated among the men to ascertain their opinions regarding business for the Fall. It was surprising to note that the vast majority were in a very optimistic frame of mind concerning the coming season.

H. R. DELONG.



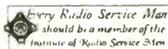
Centralab SAVES THE DAY

Not a rough and tumble player, either . . . but a smooth article, this hero of a million touchdowns.

If it's tough going in the "service game", change to CENTRALAB and watch your score go up.

For CENTRALAB Controls (a mere handful) do the trick with practically every set ever built.

Centralab smoothness results from the patented Centralab non-rubbing contact whereby a strip of polished metal rocks on the resistor so that the only rubbing action is between an oilless wood bearing and the polished metal.



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**RADIOHMS SUPPRESSORS
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SELL the Parts USED by Leaders

Customers for replacement parts may insist on low price. But just try to keep them coming back without quality. The sure way to build permanence in your business—to make profits that you can keep is to sell parts which you can stand behind—parts used by more manufacturers of leading sets than any others.

Jefferson Replacement Parts are far from being high priced to begin with. And when they are put in service they satisfy. You *keep* the nice profit allowed in your margin. Jefferson is one of the oldest names in radio, making the first successful radio transformers and making transformers for wireless telegraphy even before that.

Leading jobbers stock Jefferson Replacement Parts and can supply you with Jefferson Circuits—including the latest: High Gain 2A-3 Amplifier. If your jobber does not yet have these circuits and the complete catalog write us, giving his name.

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Circuits
to Jobber

JEFFERSON ELECTRIC COMPANY

Bellwood (Suburb of Chicago) Illinois

Canadian Factory: 535 College Street, Toronto

JEFFERSON *Radio* Transformers

THE FORUM . . .

"STICK TO YOUR OWN KNITTING"

Editor, SERVICE:

We wish to comment on SERVICE by stating that we read it from cover to cover, and especially the short cuts which have been very helpful, and hope that you continue them.

The ones that are complaining about the cut-price artists are not by themselves as we have plenty of them here. However, we are not paying any attention to them; in fact, they are making business good for us as we are continually getting work that they have failed on and the result is that we get more compensation than if we had received the job in the first place. The reason is that we always find that some free Service Man has been called in and the client has not been satisfied; consequently, we are in a position to charge for what we know.

We are two of the oldest exclusive Service Men in Springfield, Missouri, and since starting in business eight years ago we have been in one location. While everybody (legitimate Service Men) has been complaining about business being bad, ours has been on the increase. We are in the radio service business for our "bread and butter." We are running our business to suit ourselves and are not worrying about the other fellow as we don't have time for it. If some of the other fellows would pay more attention to themselves instead of what the other fellow is doing, hustle for the business and also keep posted on the new developments, they would not have time to worry about the "Gyps."

J. W. ARNOLD,
The Radio Repair Co.,
Springfield, Mo.

MORE TECHNICAL DESCRIPTIONS

Editor, SERVICE:

There are several radio publications and house organs, which come to the attention of the Service Man, that have sections devoted to specific faults of receivers. However, bear in mind that most of these faults were discovered by the Service Man as a result of his experience in analyzing receivers, and therefore represent a knowledge gained through a highly specialized training along this line. The impression that I have received from such data is that it is not conclusive and does not apply to every receiver of this model number, but rather represents an unusual and difficult problem that can be looked for and solved by other Service Men when their routine tests fail to show the trouble . . . in other words, a non-technical note for the technical man.

The notes on changes in circuits of current-model receivers are necessary for the Service Man. But, they are not the same as short, non-technical notes on receiver faults, due to breakdown of parts, as requested by the pseudo mechanic. It is true that the service industry is demoralized by the screw-driver mechanic who is causing so much grief to the highly-trained Service Man. However, I cannot understand how the publishing of non-technical notes on receiver troubles will be of help to the novice, for if he is not equipped to know the function of the parts, how is he going

to know what to do when a knowledge of the parts' purposes will be necessary to make changes and replacements?

In my opinion, SERVICE should be divided into sections and all notes pertaining to receivers placed in one section, alphabetically arranged. Continue your high standards of dealing with the various subjects.

Also, the section devoted to receiver notes should have, if possible, a technical discussion of the faults listed. As an illustration, if a certain condenser breaks down or leaks and results in poor tone, explain why the defect produces this result, rather than merely stating that it does produce certain effects. This should apply to all defective parts, though naturally in some cases a discussion would be unnecessary.

Further, I would like to see a section added which would give detailed technical analysis of avc systems, r-f stages, oscillator, i-f, and audio outputs with the appropriate graphs. This section might also include the relationship of the tube input and output circuits to the tubes. So far your descriptions are too meager and do not have sufficient attention given to detail.

However, these are my own personal opinions and may not be representative.

RUDOLPH POTTKAMP,
St. Joseph, Mo.

(Regarding your last paragraph, we hope to do just this in the "Serviceman's Notebook" section. This is getting under way.—EDITOR.)

NOISE ELIMINATION

Editor, SERVICE:

Our shop is located in an extremely noisy (from electrical standpoint) location. We know and recognize the various types of noises, but sometimes when we repair a set and try to demonstrate it to the customer he is extremely skeptical of our claims that the noise is not in the set and that most likely it will be greatly improved when re-installed in his home.

We have been figuring on how to get around this situation for some time and know that whatever is done will have to be done in our own shop without the cooperation of the various noise-producing agencies. We have come to the conclusion that a small screened booth will be about the only thing we can build that will help us out.

The plans we have in mind call for a small booth about three feet wide and six long, high enough for a man to stand erect in. The sides, top and bottom to be covered with copper screen, well bonded together and grounded. Door to be bonded to the side wall and means to be provided to also bond the free edge of the door, in two or more places, to the side wall when door is closed. A false wooden floor would be placed over the screen on the floor to protect it from wear. In this booth we will install a bench large enough to hold a set, an RCA phono-oscillator and a turntable with a pickup. Power supplies would have to be thoroughly filtered and the power wires would be the only connection with the "outside world."

Knowing that you are in touch with the servicing profession at large and have a good idea of our troubles and ways of curing and avoiding them, we would appreciate

having your opinion of this scheme. Perhaps some of your readers have already experimented along these lines. We would be glad to have your comments.

FRYE RADIO SERVICE,
906 13th St.,
Modesto, Calif.

(Your idea is ace. This practice is more or less standard in radio laboratories, and has proven effective. Possibly our readers have suggestions to offer.—EDITOR.)

CASE HISTORIES

Editor, SERVICE:

As requested in July SERVICE, I am giving you my impressions of your department, "Receiver Case Histories."

As they appear on page 308 and continued on page 310, they are fine and fill a long-felt need, but I have a suggestion that, if carried out, would make them so much more worth while to me and make them so much easier in filing away and indexing for future use.

Why split the two pages as you have? Why not on both sides of one page and near the binding of the magazine have a tear-out line so that this double page may be pulled out of the book each month and filed away in a binder. If the pages were numbered consecutively so much the better. Considering these pages 1 and 2, the next page will be 3 on one side and 4 on the other. Then, when filed in a binder, the card index will say, for example, "Majestic—66 Auto Radio" Page 1 "Receiver Case Histories—SERVICE."

Please give this consideration, that is, especially putting them on both sides of one page and making it possible to tear this page out. I can number them myself, of course.

HORACE R. PERRY,
Belmont, Mass.

(We would certainly prefer doing it this way, but many readers object to this method. We should like to have more opinions.—EDITOR.)

WANTS INDEX MORE OFTEN

Editor, SERVICE:

I have been a subscriber to SERVICE since its initial issue. I like it and think it is the best service paper published. I appreciate the circuits published on the front cover with the accompanying explanation in the text section of the magazine. I think this is one of the best features of SERVICE. Keep it up.

I am keeping my issues intact without cutting or mutilating. I wish you could publish a complete index every three or six months, covering the principal articles, General Data, Receiver Case Histories, and other features of interest to Service Men. This index should be in such form that we could file it away for reference independent of the magazine and without having to mutilate the magazine to get it. At present we have to look through every issue to find what we want. A separate index would solve the problem very nicely.

I would like to see published in SERVICE a circuit and explanation of some all-wave receiver, such as the Philco Model 116 or
(Continued on page 408)

HIGHLIGHTS . . .

"THE CATHODE-RAY TUBE AT WORK" . . . AN EVENT

To the Service Man has been given the cathode-ray oscillograph—the testing instrument par excellence. To the Service Man it has been said, "This magic device will simplify your work, speed up trouble-shooting, and permit you to turn out properly-adjusted receivers." But, to the Service Man has not been given the means for using this device effectively.

The cathode-ray oscillograph is strange and complicated. Its functions and applications—to say nothing of the way of connection for testing purposes—are little known and less understood. For want of practical information regarding its use, for want of concise explanations of the meanings of the various patterns produced on the screen, the cathode-ray oscillograph has collected dust on the shelf of the test bench.

The Service Man has been asked to change his ways of doing things . . . he has been asked, specifically, to learn a new way of interpreting the electrical conditions of a circuit—not by reading voltages or following the needle of an output meter, but by translating through the medium of the eye the strange patterns on a circular disc of glass.

Is it surprising, then, that with no previous experience upon which to base conclusions, the Service Man should be unable to perceive, for instance, that an image appearing for all the world like Aunt Minnie's figure, is an indication of unbalance in an a-f output stage? Certainly not!

It is, therefore, an event, to have received for review a book which firstly, is based not on theory, but on practical research, and secondly, is written to dispel once and for all the "Cathode-Ray Bugaboo." Such a book is "The Cathode-Ray Tube at Work," by John F. Rider.

Let it be said that your reviewer saw with his own eyes the equipment and set-ups used to obtain the practical "meat" for this book. He knows, for example, that Mr. Rider followed the only logical course in preparing the material—by actual step-by-step tests under the same sort of conditions that confront the Service Man. The illustrations in the book are actual photos of the patterns obtained in these tests.

The first chapter deals with the theory of the cathode-ray tube. From this data may be gained a clear understanding of tube design. There follows chapters on sweep circuits, a-c voltages on both sets of plates, and commercial cathode-ray oscillographs. These chapters serve to make clear not only the functioning of a cathode-ray oscillograph, but also its many applications.

The four "groundwork" chapters are followed by practical applications. Here the reader commences to perceive the significance of various patterns, their relation to circuit conditions and the story they have to tell. Thus are the doors opened to a new perception of patterns and images; the mystery is cleared.

Then, with knowledge to back up application, the succeeding chapters get right down to practical work . . . alignment of tuned circuits, a-f measurements, auto-radio vibrator testing, etc. Chapter IX deals with

transmitter adjustment, which will be of special value to the amateur, and Chapter X with other applications of the cathode-ray oscillograph, such as beat patterns, cw reception and detection, etc.

There is an Appendix and an Index. There are 322 pages; cloth-covered board cover; over 435 illustrations. Price \$2.50.

OHMITE UNITS PASSED BY UNDERWRITERS' LABS.

It is announced that the entire line of Ohmite all-porcelain, vitreous enameled rheostats has been inspected and passed by the Underwriters' Laboratories of the National Board of Fire Underwriters.

It is stated that all of the units, from the 25-watt Model H to the 500-watt Model R were tested for temperature rise and breakdown voltage. As a result of these tests, the Models H, J, K, and L have been passed for use on circuits having potentials up to 300 volts above ground; Models N and R for circuits up to 600 volts above ground. The voltages of 150, 300 and 600 are the standards for Underwriters' tests.

NEW COUCH BULLETIN

The S. H. Couch Company, Inc., of North Quincy, Mass., has issued Bulletin No. 97, dealing with their complete line of Centralized Sound Telephones, Fire Alarms and Program Signalling Equipment for use in schools.

The Bulletin includes data on complete centralized sound systems, rack and panel equipment, loudspeakers, microphones, telephone switchboards, telephones, and fire alarm devices.

NEW INSULINE CATALOGUE

The Insuline Corp. of America, 25 Park Place, New York, N. Y., has released its new 1936 Radio Catalogue No. 188.

Among the items covered are dials, completely wired transceivers, transmitting parts, high-frequency constant "Q" tuning coils, transmitting sockets and octal adapters.

RAYTHEON "TUBE TALKS"

The Raytheon Production Corp., Newton, Mass., has prepared a valuable brochure of the loose-leaf folder type, for the radio dealer and Service Man. The title of the brochure is "Tube Talks" and deals with modern radio service and merchandising.

The forepart of the brochure is given over to merchandising as it applies to both the dealer and Service Man. This is followed by a 29-page "Tube Complement Section" which provides the types and number of tubes for each model receiver.

The price of "Tube Talks" is 50 cents.

NEW RADIO LIGHT REMOVES NOISE

Noise, the kind caused when a dial-light bulb jars loose from vibration and sets up electrical interference, can now be eliminated with a new radio-panel lamp that "stays put" in its socket, according to John H. Kurlander, engineer of the Westinghouse Lamp Company, Bloomfield, New Jersey.

Speaking before the Institute of Radio Engineers recently, Mr. Kurlander present-

ed a technical paper on the new lamp and at the same time voiced a plea to radio manufacturers to devise some means of replacing dial lights easily and quickly.

"When radio dial lights were first developed they were made with a screw base just like those on our household lighting lamps, only much smaller," says Kurlander.

"Recently it has been found that vibration in the set itself and sometimes from street traffic will gradually loosen the light until it sets up an electrical interference. A low, growling static is usually the result.

"The new dial light eliminates this condition. It has a bayonet base as on automobile lamps. This base locks the light in a fixed position. Vibration cannot jar it loose."

URGES EASY REPLACEMENTS

With the translucent dial used almost universally in radios today, the panel lamp must be installed behind the dial so that the station numbers are readily visible. Everytime a new lamp is installed it means that the entire chassis must be removed first.

"Making radio cabinets with some simple means of inserting new dial lights from the front or top is highly desirable," adds Mr. Kurlander.

BRUSH PIEZO-ELECTRIC HEADPHONES

The Brush Development Company, Cleveland, Ohio, have recently announced their Type A piezo-electric headphones. These are high-impedance units that are said to possess high current sensitivity and to find ready application in a wide variety of uses, being especially well adapted for monitoring work.

The piezo-electric drivers used in these Brush headphones are bimorph elements of typical Brush assembly. Plates used in the bimorph elements are cut from Rochelle Salt crystals, in accordance with the methods developed by Brush technicians. In standard Type A headphones the two plates in the bimorph element are $\frac{5}{8}$ inch square by 0.010 inch thick. They are cemented together in opposition and provided with silver electrodes. The unit is then water-proofed. Three corners of the bimorph element are cemented to thin rubber pads and secured in the case . . . leaving the fourth corner disengaged.

FORUM

(Continued from page 406)

some of the all-wave Atwater Kent units, whichever seems to be the most complicated and hardest to "figure out." This should include a full explanation of the circuit preceding the first i-f tube, describing the manner in which each switch works, what part of the circuit is brought into use when a switch is thrown to a certain position, how the signal is fed from the oscillator tube back into the first detector, etc. I would appreciate this very much and I believe that there are many other Service Men who would also appreciate this kind of information.

GEORGE C. ANDERSON,
St. Louis, Missouri.

(We'll look into the index problem, but those things eat space.—EDITOR.)

A great tube salesman!



**THE NEW
WESTON
MODEL 770
TUBE
SELLER!**

for
**COUNTER OR
PORTABLE
USE**

Here's real *merchandising* appeal in a *real* tube checker. This new Weston Model 770 sets a new standard in tube selling and servicing; yet, it's priced so every dealer and serviceman can afford it. In fact, with its striking design and rich three-color combination, no dealer selling tubes can afford to be without its customer appeal. And as a tube checker, it's a perfected emission type which actually tests tubes under load . . . provides a neon short check . . . a neon indication of condenser leakage if desired . . .

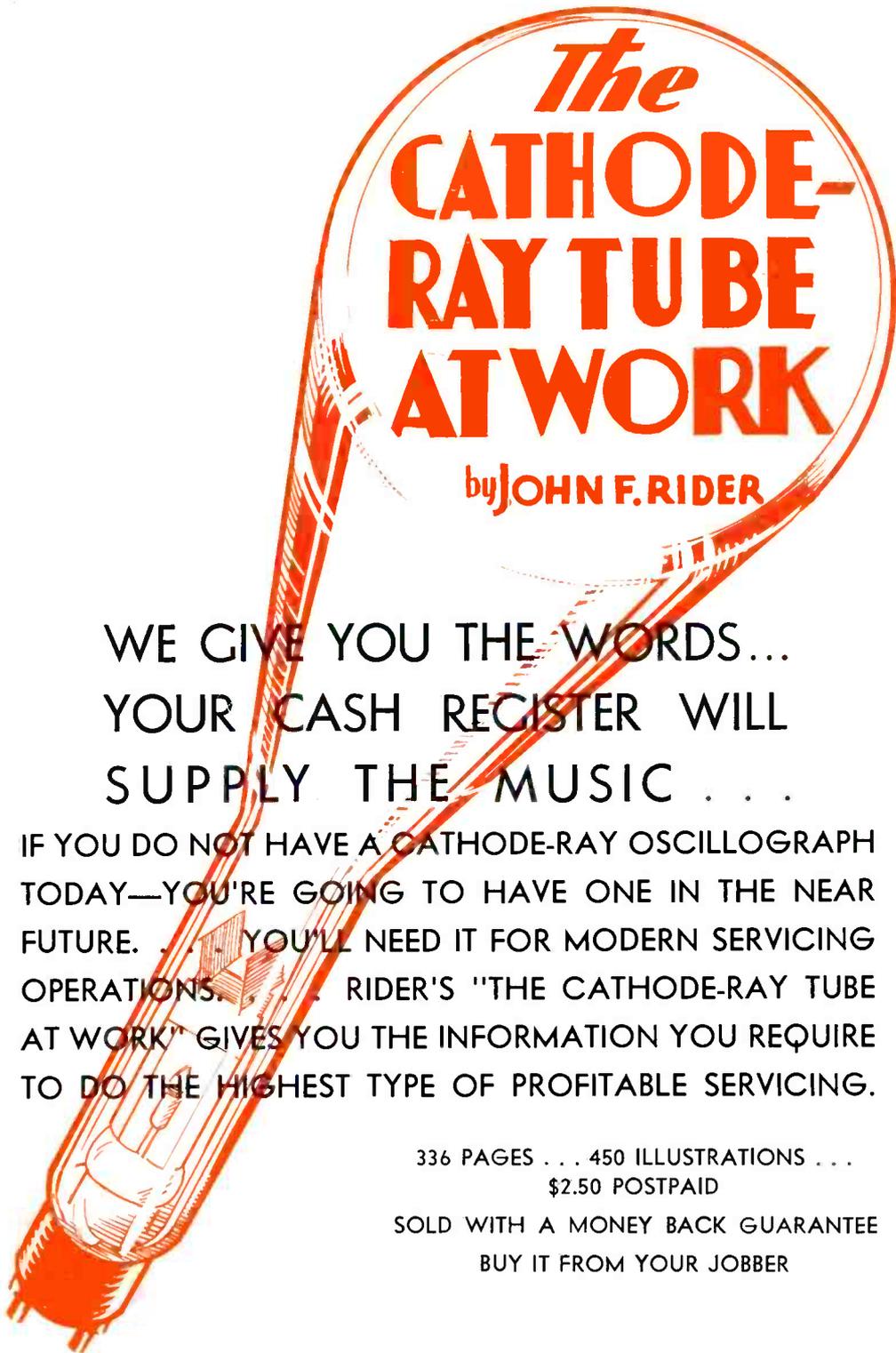
makes individual tests on all plate circuits . . . tests all tubes, including the metal tubes, and has many other exclusive features. *Ready for immediate delivery.* Get the facts on Model 770 before you buy. See it at your dealer's, or return the coupon for complete data . . . Weston Electrical Instrument Corporation, 604 Frelinghuysen Avenue, Newark, N. J.

WESTON ELECTRICAL INSTRUMENT CORPORATION
604 Frelinghuysen Ave., Newark, New Jersey
Send me complete data on Model 770 and other WESTON radio instruments.

Name _____

Address _____

WESTON *Radio Instruments*



The
**CATHODE-
RAY TUBE
AT WORK**

by **JOHN F. RIDER**

WE GIVE YOU THE WORDS...
YOUR CASH REGISTER WILL
SUPPLY THE MUSIC . . .

IF YOU DO NOT HAVE A CATHODE-RAY OSCILLOGRAPH TODAY—YOU'RE GOING TO HAVE ONE IN THE NEAR FUTURE. . . . YOU'LL NEED IT FOR MODERN SERVICING OPERATIONS. . . . RIDER'S "THE CATHODE-RAY TUBE AT WORK" GIVES YOU THE INFORMATION YOU REQUIRE TO DO THE HIGHEST TYPE OF PROFITABLE SERVICING.

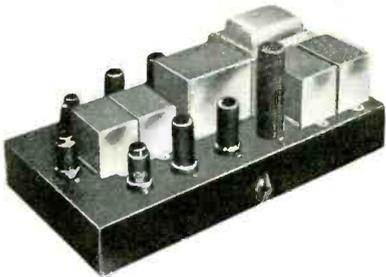
336 PAGES . . . 450 ILLUSTRATIONS . . .
\$2.50 POSTPAID

SOLD WITH A MONEY BACK GUARANTEE
BUY IT FROM YOUR JOBBER

John F. Rider, Publisher, 1440 Broadway, New York, N. Y.



New CHROMSHIELD METAL TUBE AMPLIFIER KITS



CK-8 High Power Amplifier Kit

EMPLOYS NEW METAL TUBE CIRCUIT FEATURES

- 35 WATTS UNDISTORTED OUTPUT; WILL HANDLE UP TO 20 DYNAMIC SPEAKERS.
- 8 TUBES USED: 3 6CS triodes, 4 6F6 in Pentode A prime connection, 1 5Z4 rectifier.
- 95 DB gain.
- Input of amplifier will match crystal or ribbon mike outputs, also adapted for carbon or dynamic mikes through external transformer input.
- Output will match 500 ohm line and 15, 8, 4 or 2 ohm voice coils.
- All audio transformers and filter units enclosed in heavy chromium plated cases.

Dealer Net Price for Complete Transformer Kit, including All Accessories. Ready to Wire..... **\$26.70**

CK-8 Transformer kit mounted on chassis.....	LIST \$33.50	NET \$20.10
AK-8 Accessory kit for above—includes all necessary resistors, condensers, sockets, terminal strips, AC cord and plug, hardware, wire.....	11.00	6.60



CK-7 Metal Tube Preamplifier Kit

The CK-7 preamplifier kit has been designed specifically for use with the new metal tubes. While the circuit is equally well suited for glass tubes, the low microphonic effects and excellent shielding of the metal tubes make them exceptionally well suited for operation at the low levels encountered in preamplifier work. A specially designed rectifier circuit and careful placement of component parts is responsible for the extremely low

Dealer Net Price for Complete Transformer Kit, including All Accessories. Ready to Wire..... **\$13.20**

hum and noise level in the CK-7 preamplifier. Three identical tubes are used, one being connected up as a rectifier; so that no fear need be had regarding misplacement of tubes in the uniform 8 prong sockets. The preamplifier has a gain of 55 DB.

Overall Amplifier Dimensions— $8\frac{3}{8} \times 7 \times 4\frac{1}{8}$

KC-7 Transformer kit including chassis.....	LIST \$16.00	NET \$9.60
CK-7 Accessory kit—includes all necessary resistors, condensers, sockets, AC cord and plug, hardware—ready to wire.....	6.00	3.60

For further details on seven types of UTC CHROMSHIELD Power Amplifier Kits write for CS-1 Bulletin

UNITED TRANSFORMER CORP.

76-78 SPRING STREET NEW YORK, N. Y.

Export Division: 15-19 Laight St., New York City

CASH IN NOW ON



THE NEW BROWNIE ALL-WAVE ANTENNA

Today the craze in radio is short wave. People everywhere are buying the new all-wave radios. Most of them are disappointed in results, because they lack a really good antenna.

CASH IN on this tremendous market. Sell the Brownie All-Wave Antenna. There's a real profit for the dealer on every Brownie sold. And you'll be making real friends too.

The Brownie All-Wave Antenna has been tested repeatedly. These tests proved the Brownie to be unsurpassed in quality and performance. It is sensitive to the faintest signals, bringing them in with astonishing volume regardless of the hour or location of the set. Man-made interference is eliminated. Local stations attain new high fidelity.

The Brownie is made by an old line manufacturer in the electrical field. It is constructed on the Balanced Doublet System with a new type, super-efficient, matching transformer, and comes complete with quality parts for a quick, easy installation.

Backed by a national advertising campaign starting soon in the Saturday Evening Post and Colliers, the Brownie will soon become one of your best profit items. Mail the coupon today for details of our attractive, money-making offer.

PORCELAIN PRODUCTS, INC., FINDLAY, OHIO

Mail this Coupon Today

Porcelain Products, Inc. Dept. B Findlay, Ohio
If there's real merit to your antenna, I'm interested. If there's a real profit for me, I want to make it. Rush me your proposition

Name _____
City _____ State _____
My Jobber is _____

NEW YAXLEY REPLACEMENT MANUAL AND SERVICE GUIDE

The Yaxley Manufacturing Division of P. R. Mallory & Co., Inc., Indianapolis, Indiana, announces that the 1936 edition of its Replacement Volume Control Manual is now on the press and will soon be ready for distribution to radio Service Men the country over. Company executives report that twenty-four months were devoted to the preparation of this new book, that five radio service engineers—especially trained for the task—compiled, checked and re-checked the data it contains.

The first edition of the Yaxley Replacement Volume Control Manual, issued in 1934, was recognized as the most complete and comprehensive manual of its kind ever published. The new edition, we are told, is even better. It lists over 5000 set models. It provides more factual data and contains a complete catalog of Yaxley approved radio products. Any authorized radio Service Man can obtain a copy of this authoritative, up-to-date book by addressing the Yaxley Division of P. R. Mallory & Co., Inc., Indianapolis, Indiana.

LITTELFUSE EXPANDS

After September 1st, 1935, the address of Littelfuse Laboratories will be 4238 Lincoln Avenue, Chicago.

Increased business in Radio Fuses and Fuse Mountings, the Neon Potential Fuses and Indicators, and other new products is responsible for the necessary expansion. The new space measures about 6000 square feet.

RADOLEK IDENTIFICATION CARDS

It has been announced that protection for the legitimate radio technicians of the Chicago area is provided by the Radolek Company, 601 West Randolph Street, in the form of Identification Cards. A new customer, it is stated, must fill out an extensive questionnaire which contains certain catch questions that only an experienced radio technician can answer without disclosing his true position in the trade. It is not unusual for the "chiseler" type of retail customer to state that he makes 50 service calls a week and carries 35 power transformers in stock and 25 tubes. The obvious inconsistency of such replies usually causes a rejection of his application for wholesale prices. In doubtful cases, an established nearby dealer is consulted or a private investigator is sent out to verify the applicant's statements.

This care protects the legitimate dealers and protects the Radolek Company in regard to the retail sales tax of 3 percent effective on retail, but not wholesale sales of merchandise in Illinois.

Presentation of the registered Identification Card is required when making all wholesale purchases. Mr. W. C. Braun says: "This is a sound constructive policy, now in force for the third consecutive year. Our customers like it and we appreciate their confidence and cooperation."

HERTZBERG JOINS WHOLESALE

Robert Hertzberg, who has been identified with publicity and sales promotion activities in the radio field since the inception of broadcasting, has been appointed advertising manager of Wholesale Radio Service Co., Inc., 100 Sixth Avenue, New York, N. Y.

NEW RADOLEK CATALOG

The Radolek Company states that their new catalog is one of the most complete Radio Service Men's "Buying Guides" ever published, 165 pages in all. It has 16 pages of exact replacement volume controls enumerating over 5,000 separate volume controls in its listings, and three pages of exact duplicate electrolytic replacement condensers covering replacements for practically every receiver now in use. Each condenser is listed separately with all the necessary data, including manufacturer's part number—capacity—voltage rating—fibre or aluminum container—size—list and wholesale prices. There are also seven



pages of general condenser listings and three pages of exact replacement auto-ratio vibrators—over 1,000 separate vibrators are listed and 13 pages of all the latest test equipment including the testing of metal tubes, it is said.

The Radolek Profit Guide will be sent to all qualified Radio Dealers and Service Men by addressing the Radolek Company, 601 West Randolph Street, Chicago, Illinois.

STATEMENT BY POLYMET

Mr. J. H. Herrick, President of the Polymet Manufacturing Corporation, wishes it known that the investigations and recent indictments relative to the sale of the corporation stock, as currently published in some of the newspapers, in no way involve the present management.

The management has fully cooperated with the Federal authorities. They wish to emphasize that they are solely concerned with the commercial pursuits of their corporation.

P-A AND RECORDING EQUIPMENT WANTED

We have been informed that Louis A. Fishoff, Film-Radio, 5 Rue Denis-Poisson, Paris 17, France, is interested in public-address and recording equipment of American manufacture.

NEW ELECTRAD VOLUME CONTROL GUIDE AND RESISTOR CATALOG

Electrad, Inc., New York resistor specialists, offer a new 100-page Volume Control Guide free to bona fide radio and electrical Service Men, who will mail in the carton flap (showing specifications) from one of this company's new-type Carbon Volume Controls, together with business letterhead or business card.

This guide lists alphabetically all radio receiver model numbers, makers' names, catalog numbers of proper Electrad re-

placement controls, resistance values and list prices. Such information should be of practical, time-saving value to busy Service Men.

The new 1936 Electrad General Catalog of resistors for all purposes is now off the press. A copy will be mailed free to any one who will write for it to Electrad, Inc., 175 Varick Street, New York City.

NATIONAL UNION TUBES DON NEW DRESS

National Union radio tubes are being shipped to the trade in a new carton of modernistic design and incorporating a radically different method of sealing.

The package construction, instead of following the lead of hollow end staple sealed cartons which have swept the radio tube industry, was perfected with the idea in mind that a tube could readily be extracted from the package and replaced without tearing, mutilating or destroying the general appearance of the box. Sealing is accomplished by a simple turn-back of the end flap lift and insertion of a wire staple by means of a specially constructed mandrel.

MATHEMATICS OF RADIO SERVICING, by M. N. Beitman, published by Supreme Publications, 3727 West 13 Street, Chicago, Illinois, 17 sheets mimeographed on one side. Price \$0.50.

The author of *Mathematics of Radio Servicing* writes: "The man engaged in radio service work and possessing a working knowledge of arithmetic and elementary algebra sometimes fails to connect his knowledge of mathematics to everyday radio problems. This booklet attempts to clarify some points of elementary mathematics and interconnect it with radio and allied applications."

Chapter I is entitled "Numbers, Fractions, Decimals, Simple Formulas Explained as a Tool." It begins with a brief discussion of the electrical quantities of voltage, current and resistance, leading naturally, into the usual Ohm's law formula of $E = I \times R$; and following this comes a similar elementary discussion of fractions, squares, square roots, and a simple example using Ohm's law.

Chapter II gives an explanation of how the units of current, voltage, and resistance are subdivided. This chapter also deals briefly with the color coding of resistors, meter scales and accuracy.

The following chapter gives two simple examples of calculating IR drops and introduces the reader to alternating current.

Next comes a discussion of wattage ratings, and series and parallel connections, including a table of wattage, current and resistance.

Chapter V deals with condensers and gives their applications, formulas for series and parallel connections, etc.; while Chapter VI treats in a very brief manner with inductance.

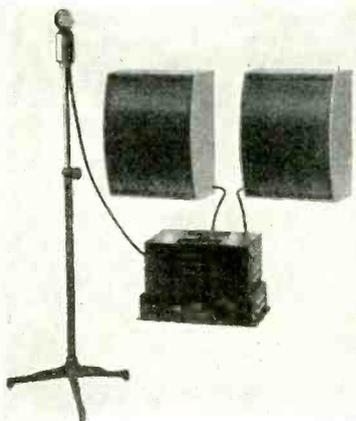
The last three chapters are headed "Reactance, Impedance, Combined Circuits, Transformers," "Vacuum Tubes, Voltage and Power Amplification, Output Coupling," and "The Decibel, Handy Table, Examples, When Applicable," respectively.

The material in this booklet is quite elementary and has evidently been intended for the beginner. However, it appears to have no advantage over material appearing in standard texts.

Sensationally Priced

REMLER

PUBLIC ADDRESS SYSTEM



- Highest Fidelity
- Eliminates Batteries
- Condenser Microphone
- Dynamic Speakers
- Plug-in Connectors
- Easily installed
- Acoustically equalized
- Easily operated

List Price **197.50**

Designed for non-technical operators who demand foolproof simplicity and professional tone quality. Plugs in like any other electrical appliance and as easy to operate as a home radio! Wide adaptability makes it ideal for rentals. Costs no more than ordinary assemblies with carbon or crystal microphones. Complete as illustrated with latest type amplifier; professional CONDENSER MICROPHONE and floor stand; tone equalized dynamic speakers; acoustical baffle cabinets; all necessary cables and lock type connectors. Ready to plug in. Write for further details. Complete broadcast and public address catalogue on request.

REMLER COMPANY, Ltd.

2101 Bryant Street

San Francisco, Calif.

Small . . . Smaller . . . Smallest . . .



AEROVOX MIDGET ELECTROLYTICS



FOR assemblies where space is limited . . . or as replacements in midget sets. Remarkably compact . . . yet safety factor remains adequate.

Aerovox engineers have achieved a positively startling reduction in bulk. Compare the new Midget Electrolytic at left with previous Ultra-Compact and original cardboard case electrolytics, all of same capacity and voltage rating. New units available in 200-volt and 450-volt ratings, 2 to 16 mfd. Use them in those tight places . . . and forget your condenser headaches!

Aerovox offers a complete line of metal can, cardboard case, and tubular electrolytics.

Cardboard case electrolytics for economy in first cost. Sturdy cases. Leak-proof. Neat. Convenient mounting.

Metal can electrolytics for heavy-duty, constant operation, longest life. Hermetically sealed.

DATA: Send for latest catalog covering complete condenser and resistor line. Also sample copy of Research Worker.

AEROVOX

CORPORATION

80 Washington St. Brooklyn, N. Y.

NOW... DAYRAD OFFERS



Series 20 TUBE TESTER

With Patented Index System

PORTABLE For SERVICE WORK!

This is more than a TUBE TESTER—it's a Tube Salesman. It honestly finds faults in tubes that your present testing equipment "okays." It will sell enough MORE TUBES to pay for itself in a month of ordinary operation! And from then on it's clear profit!

This Series 20 has our *new* patented Index System that ends all errors. It is quick and it eliminates necessity of referring to charts, because it gives immediate settings for all types of tubes, including the new metal "G" tubes. And it is flexible enough to take care of all future developments.

There's nothing like this tester on the market because it is an exclusive Day-Rad development. It has so simplified tube testing that anyone who can read English can test a tube in seconds.

Checks Resistors up to 40,000 ohms. Voltmeter range up to 400 DC. Checks ballast tubes, dial lights and condensers. Day-Rad Micro-Leak Shorts and Leakage Tester actually picks out noisy and leaky tubes that you previously could not find.

Only

\$31.75

complete

Size 12 x 11 x 5 1/2. Weight, 9 lbs. Highly finished, enclosed in Walnut carrying case.

Saves time. Saves bother. SELLS TUBES!

CLIP-MAIL

THE RADIO PRODUCTS CO.

125 Sunrise Pl., Dayton, Ohio

Send me complete information regarding your NEW SERIES 20 TUBE TESTER, also your new catalog of Day-Rad RADIO SERVICE INSTRUMENTS.

Name

Street

City..... State

Jobber's Name.....

THE MANUFACTURERS . . .

BELDEN ALL-WAVE AERIAL SYSTEM

After a study of the elements necessary in the construction of a noise-reducing antenna system for all-wave reception, the Belden Manufacturing Company, 4689 W. Van Buren St., Chicago, announces the new 8917 doublet-antenna system. This new aerial is said to be virtually noiseless, and while it is intended primarily for short-wave reception, it makes the doublet-type aerial suitable for broadcast receivers.

The unit is pre-assembled, both arms of the aerial being securely soldered to the doublet lead-in at the triangular transposition block. Insulators are attached and cor-



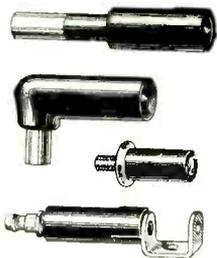
rected lengths are provided to give most efficient service with the Belden variable all-wave receiver antenna coupler which is included with the set. The Belden variable coupler provides a tuneable doublet-antenna system. This unit eliminates the need for double or multiple-span antennas that occupy large areas and are hard to install. It is completely shielded to assure freedom from noise pickup.

The Belden all-wave antenna system is provided in an attractive display carton. The same equipment is also furnished unattached in Belden No. 8918 aerial kit for those who prefer to make the complete assembly themselves.

ERIE SUPPRESSORS

Erie Resistor Corporation offers a complete line of suppressors for eliminating high-tension ignition interference in auto radios.

Sturdily constructed to withstand road



shock, engine heat and grease, these units will fit any make of car. Six different types are manufactured.

It is stated that laboratory tests conducted by leading automobile manufacturers prove that Erie Suppressors do not adversely affect motor operation.

Further information, prices and samples may be obtained by writing Erie Resistor Corporation, 640 West 12th St., Erie, Pa.

NEW TOBE CONDENSER KITS

Two Tobe Condenser Kits have just been released intended for the use of radio

Service Men and Dealers. Each kit contains the fastest moving condenser items in accordance with the company's stock movement records, and are therefore useful daily by Service Men everywhere.

The most important feature to these kits is that each one comes in a heavy steel cabinet section called the "Tobe Add-A-Unit" cabinet, which section is given away free with each kit of condensers.

These sections may be clamped together by means of an ingenious system of tongues and slots so that eventually by buying condensers in kit form this way, the Service Man will have enough individual sections to make up a large useful cabinet containing a number of drawers. Each drawer has an individual pull and name card for noting the contents. The cabinet sections are finished in an attractive olive green.

A cabinet of these individual sections would unquestionably, it is said, add considerably to the attractiveness and appearance of a Service Man's bench.

CONVERSION RESISTOR PLUGS

Continental Carbon, Inc., of 13900 Lorain Ave., Cleveland, Ohio, announces production of seven special resistor plugs which may be substituted for the ballast tube in battery receivers which are converted from dry-cell operation to air-cell operation. The conversion resistor plugs



fit the standard four-prong socket intended for the ballast tube and serve to reduce the 2.53-volt potential of the air cell to the current operating voltage of the tubes. Conversion resistors 1, 2, and 3 are for use with certain types of Sears' battery sets having two filament circuits. The remaining resistors may be used in any circuit of the designated current drain.

Plugs Nos. 1, 620 ma; 2, 300 ma; 3, 500 ma; 4, 540 ma; 5, 520 ma; 6, 620 ma; 7, 720 ma. Note: No. 7 is for use only with Air Cell SA600.

PHILCO HEADPHONE ADAPTOR KIT

Service Men will find in the Philco Headphone and Adaptor Kit a product that is ideally suited for the short-wave fan, the late-hour "D-Xer," and the individual listener, it is announced by officials of the Philco Radio & Television Corporation. The new Philco product enables the radio owner to listen in comfortably, at any time of the day or night, without disturbing anyone.

Its extremely lightweight DeLuxe headphones can be worn for hours without discomfort, and they provide maximum sensitivity to weak signals from distant stations. Many persons who are hard-of-hear-

ing can enjoy headphone reception although unable to hear the radio when operated in the usual way.

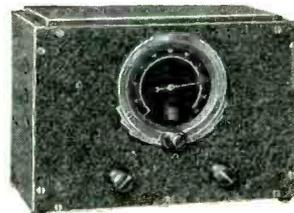
The Philco Headphone and Adaptor Kit is claimed to have numerous features which make it attractive to Service Men and radio dealers.

They are: 1. Easy to connect, just plug into tube socket; 2. Speaker automatically cut out while headphones are in use; 3. Light weight, highest quality headphones give maximum comfort and finest tone; 4. Can be left connected permanently—does not effect tone of speaker; 5. Operates on radios with either a single output tube or a driver tube ahead of the output.

MILLER PRE-SELECTOR

For use ahead of a short-wave receiver to raise weak DX signals, a high-gain, two-stage, radio-frequency amplifier has been designed by engineers of the J. W. Miller Company, 5917 S. Main Street, Los Angeles.

The model 302 pre-selector is available



completely wired and housed in a metal cabinet with black crackle finish. There is also available a kit which includes antenna coil, r-f coil, r-f choke coil, switch and three dual trimmer condensers.

In addition to increasing signal strength, the Miller pre-selector reduces both atmospheric disturbances and tube noises, it is said.

The chassis layout has provision for self-contained power supply, relieving the receiver from the extra load. Provision is also made to switch the antenna from the pre-selector to the receiver without disconnecting the antenna leads.

The coils are designed to cover the full range of the high-frequency bands from 12 to 200 meters, and provision is made on the band switch to facilitate the incorporation of broadcast or long-wave coils if desired. The last position on the switch is the "antenna through" position, in which the antenna is coupled directly to the receiver.

The Miller pre-selector cabinet measures 12-in. wide by 6 $\frac{3}{8}$ in. deep by 8 $\frac{3}{4}$ in. high. The lid is hinged for ready access to tubes, while louvers on side and back provide ventilation.

CHASSIS FOR MODERNIZING RECEIVERS

The Shelburne Manufacturing Company, 1814 East 40 Street, Cleveland, Ohio, has developed a special chassis for Service Men's use in modernizing old radio receivers . . . especially those whose cabinets are highly prized by the owner. The chassis incorporates eleven tubes in its design and may be used for either long- or short-wave reception. Short-wave stations can be accurately logged. Tone quality is said to be an outstanding feature of this unit.

Every Radio Service Man should be a member of the Institute of Radio Service Men

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By Those Who Pride Themselves in Being "Up-to-the-
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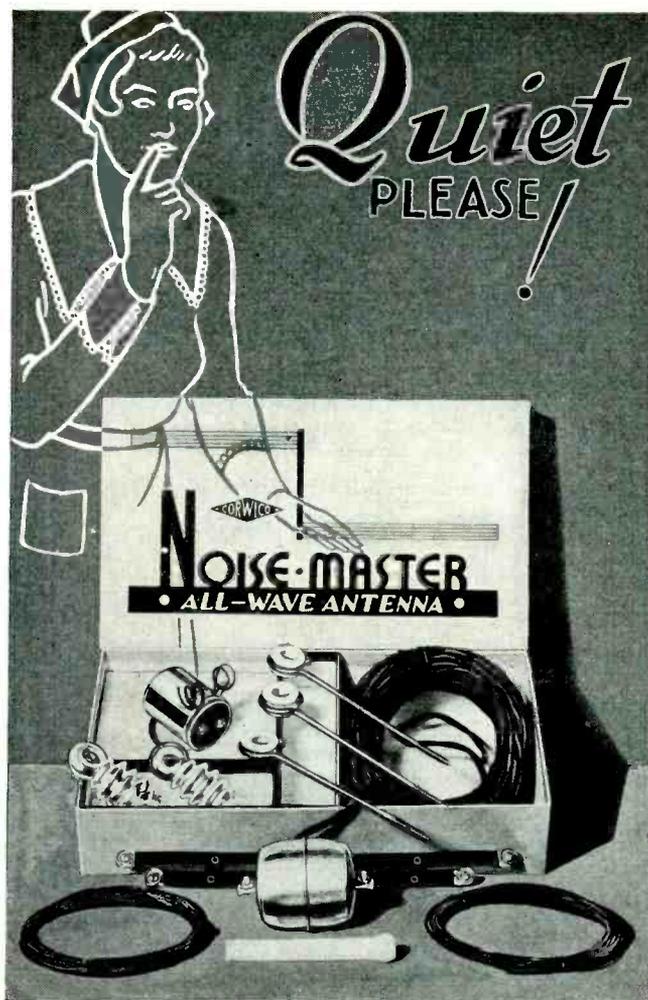
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"NOISE-MASTER" picks up and strengthens feeble overseas signals, straining out the "man made" static that sometimes seems to make radio a curse instead of a blessing. Minimizing the noises caused by household appliances near the set, "NOISE-MASTER" improves broadcast as well as shortwave reception. It successfully operates more than one set from a single aerial. We guarantee that "NOISE-MASTER" will eliminate noise when properly installed, and urge you to recommend it at every opportunity.

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List Price

Send for latest complete literature describing this and other up-to-the-minute antenna units.



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NEW CARBON RESISTORS

A new line of carbon resistors, obtainable in values as low as .04 ohm and in ratings from .25 watt to 10 watts, is now being manufactured by The Ohio Carbon Co., 12508 Berea Road, Lakewood, Ohio. They are known as the "Ohiohm LV" series and they conform to the same standards of load, voltage, life, overload and humidity characteristics already set by the company's regular line of Ohiohm carbon resistors of higher ohmic values. In fact, extended laboratory tests show that these "LV" units will react satisfactorily under humidity conditions much more severe than those specified in the RMA tests, it is stated.

Special attention has always been given to this "heat-humidity" characteristic because of the considerable export business done by the company, as well as in completed radio receivers by its customers. Thus these resistors are often required to function correctly under tropical conditions where the moisture and heat are exceptionally severe.

NEW VELOCITY MICROPHONE

Although 6 db higher in output than they formerly obtained in velocity microphones, the new 7-Point Microphones by Amperite are more compact. This was in part made possible by the use of the new nickel aluminum chrome magnets which are said to have found their first American application in the 7-Point Microphone.

These mikes are said to possess the



following features: Operation without background noise, a flat response over the audible range, suitable for either speech or music, and acoustic feedback and hum pickup eliminated in public-address or station installations.

The flexibility of the microphone, which is shown in the accompanying illustration, has been increased by the addition of a swivel bracket. It is thoroughly shielded and has a rugged mechanical construction.

SPACE-SAVER DRY ELECTROLYTICS

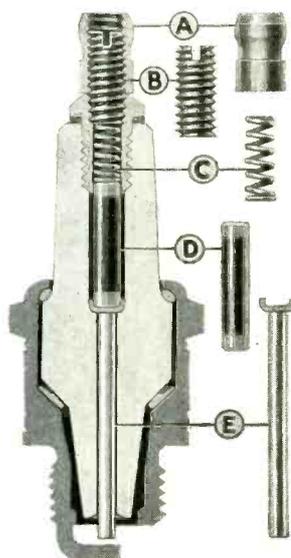
Without sacrificing working voltage, full capacity value or service life, yet taking full advantage of a new development in the treatment of the aluminum foil, Aerovox engineers announce a reduction in the bulk of dry electrolytic condensers. Known as "Midget" electrolytics, these units are available in 200-volt and 450-volt ratings, and in capacities of 2 to 16 mfd. They average approximately half the bulk of the ultra-compact units heretofore available, it is said. The 8-mfd, 450-volt unit, for example, measures but 2 7/16 x 1 1/8 x 11/16 inches. These units are proving popular in new assemblies where space is at a premium, and again in the replacing of worn-out condensers with units of greater capacity or higher working voltage.

Midget electrolytics are described and

listed in a bulletin dealing with a number of recently added items, available to anyone addressing Aerovox Corporation, Brooklyn, N. Y.

NEW SUPPRESSOR SPARK PLUG

A new type spark plug for cars equipped with radio has been developed by engineers of the AC Spark Plug Co. The new development makes possible better radio recep-



tion along with good engine performance, AC engineers declare.

The new spark plug is designed with a resistor unit built into the insulator. The resistor unit can be removed and replaced when it becomes ineffective without replacing the entire spark plug.

FORD V-8 SUPPRESSOR RESISTOR

Continental Carbon, Inc., 13900 Lorain Avenue, Cleveland, Ohio, has developed a special suppressor resistor for quieting the radio disturbance which originates in the distributor of Ford V-8 cars. This suppressor is made in the shape of the brush-contact in the ignition coil circuit of a Ford V-8 distributor and replaces this brush-contact. The resistance thus introduced in the ignition circuit has the effect of damping the oscillatory discharge with-



out appreciably weakening the intensity of the spark, it is said.

A marked improvement in radio reception results from the installation of this suppressor. The suppressor contains a certain amount of graphite which gives it long wearing qualities. A spiral spring serves to maintain a constant pressure on the brush and assures good contact in the circuit. The solid molded resistance does not deteriorate with heat, humidity, or moisture. Only one suppressor of this type is required in a car in addition to the regular spark plug suppressors.

WESTON VACUUM TUBE VOLTMETER

A vacuum tube voltmeter for radio servicing has just been announced by the Weston Electrical Instrument Corporation, Newark, N. J. The new voltmeter, known as Model 669, augments the group of standardized servicing units previously available, operating directly from any 115-volt, 60-cycle, a-c line. Six full-scale ranges (1.2, 3, 6, 8, 12, 16 volts) permit measurements from 0.1 to 16 volts.

The instrument uses two tubes, a type 1V and a type 78. A neon regulator bulb keeps line fluctuations out of the meter and holds plate and grid potentials constant. This regulation is of extreme importance when making measurements below 1 volt. The input capacity of the voltmeter has been kept at a minimum by bringing the tube up through the top panel so that the grid lead is one inch or more from any grounded surface. In this way, very short leads can be run to the circuit to be measured, and the shunt capacity kept at a minimum.

In the new voltmeter, only the grid-to-cathode impedance of the tube is placed in the circuit to be measured. All ranges have

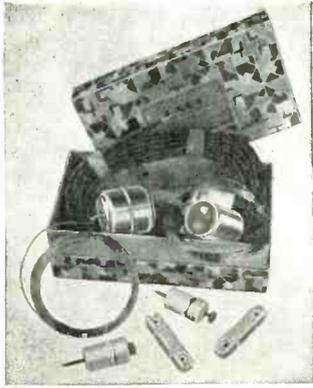


an input impedance equal to that of the 78 tube itself, no resistance divider being used in the input circuit. This arrangement permits use of the unit to measure all a-c circuits without placing any load on the circuit being tested, since in certain cases two or three megohms in an a-c circuit may upset it by as much as 50 percent.

The new voltmeter is expected to meet the increasing need for an instrument of this type in connection with a test oscillator for measuring gain-per-stage; for checking the pre-selector or first i-f stage in superheterodynes; for measuring the r-f amplitude in the oscillator circuit of superheterodynes; for checking impedance of chokes, condensers, etc., and other voltage measurements where the ordinary meter interferes with the characteristics of the circuit being tested. Dimensions of the meter are 8 3/4 in. x 5 1/2 in. x 5 3/4 in., and the weight is 6 1/2 pounds.

Tune in on those

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Give your customers the all-wave thrills they expect. Make good on all-wave promises. Install TACO profit makers . . . maximum signal strength . . . minimum background noise.

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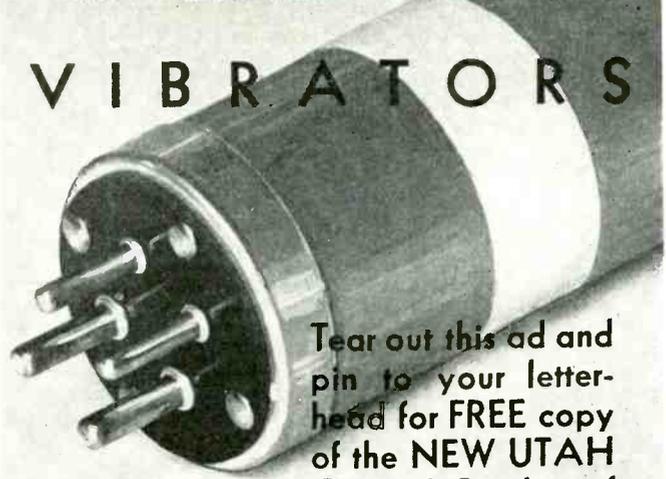
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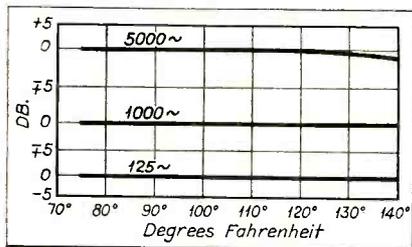
TEMPERATURE—DB

For many years the Audak Company has been manufacturing pickups of the magneto-induction type. It is said they have been, and are being, used throughout the world—in the Tropics, the Frigid Zones, etc., and have successfully stood the test of time, under any and all climatic conditions and temperature changes.

However, during the past year and a half there has been quite a bit of talk of "performance under large temperature changes." For example, in the past no one would have thought of asking for a "Temperature—DB" curve on an electric pickup. Yet, it is stated that when one of the well-known radio manufacturers was ready to again switch back to using Audak pickups, he insisted on a test being run to determine the performance under temperatures up to 140° F.

To the best of our knowledge, no such test has ever been carried out before or, at least, no curves of that kind have ever been published.

The curves shown were made with a thermocouple inserted directly inside the



Audak pickup head, so that the temperatures shown are those actually existing inside the head. It will be noted that the curves shown are flat. In other words, the performance of Audak pickups does not change with temperature variations, be they small or large.

During the test a reading was also taken at 168° F. and the performance was still unchanged, it is said.

PACENT HIGH-FIDELITY AMPLIFIER

The Pacent Engineering Corporation, of 79 Madison Avenue, New York City, N. Y., announces a new High-Gain High-Fidelity Amplifier. Although designed primarily for theatre use, it is suitable for public-address work and has many other special applications.

The overall dimensions are 20 inches long, 17 inches high and 6 inches deep. The heavy metal case of unique design is compact and intended for wall mounting. Shielding is complete, layout systematic and construction is of the latest unit type, with condensers and resistors grouped in units in separate shield cans and sealed with wax. Wiring is cabled and covered with black varnished cambric tubing. The amplifier will operate continuously in an ambient atmosphere of 120 degrees and a humidity of 98 percent, it is said. Auditorium resonance or other low-frequency difficulties may be reduced by opening several links in the circuit designed to reduce the bass response, a unique feature. Fader or volume control, range control, which ad-

justs both the high- and low-frequency response, magnetic pickup switch, line switch and pilot light are all located conveniently on the front panel.

Five standard tubes are used, and total output of amplifier is 23 watts, although manufacturer claims only 10 watts undistorted. The gain is 108 db, sufficient to operate directly from photocell or standard microphone. When operated with its associated speaker system, the overall response is said to be flat from 40 to 10,000 cycles.

WEBSTER A-317 AND A-27

These two Webster Chicago amplifiers are units that have been designed for microphone or phonograph reproduction. A few minor connections also make these amplifiers applicable to radio reproduction.

A microphone input transformer is incorporated in the amplifier and button current is provided. Input for standard high-impedance phonograph is also made, although low-impedance pickups can be fed into the microphone terminals.

The volume-control system includes a separate volume control for microphone and phonograph, and one can be faded into the other. A tone control for tone correction and an ac switch completes the control system.

The A-317 is a three-stage unit giving 17 watts of Class A Prime power output. This unit uses one 57, three 2A5's, and one 5Z3 tubes. Field excitation is provided for two 10,000-ohm dynamic speakers.

The A-27 is a two-stage amplifier using one 79, two 42's and one 82. Field excitation is provided for one 1,000-ohm and one 10,000-ohm dynamic speakers.

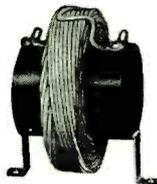
The A-317 amplifier has been incorporated in the PA-17 Portable Public-Address System of the Webster Company, 3825 West Lake Street, Chicago, Illinois.

MILLER LINE FILTER CHOKE

Elimination of high-frequency disturbances from power-supply lines is accomplished by a new line filter choke developed by the J. W. Miller Company, 5917 S. Main Street, Los Angeles, for use with receivers, transmitters or any source of interference.

Duo-lateral wound for minimum distributed capacity, the newly designed choke is available in various wire sizes of 2, 5, 10 and 20-ampere carrying capacity.

Use of a duo-lateral wound choke makes



a radio receiver more selective by bypassing the station signals picked up through the electric wiring. Used with a transmitter, the Miller line filter keeps the signal in the antenna and out of the a-c line, it is said.

In general, the filter choke may be used for radio receivers, transmitters, vibrating and rotating machinery, mercury arc, mercury rectifiers and wherever it is desired to eliminate interference from either a-c or d-c supply lines.

NEW PORTABLE P-A SYSTEM

A new portable public-address and sound-reinforcement system for moderate-sized public places, compactly self-contained in a carrying case and weighing only 28-½ pounds has been introduced by the RCA Victor Commercial Sound Sales Department.

This unit is suited to the steadily growing market for an inexpensive, portable sound system. It has been designed for such applications as window demonstrations in dealers' stores, counter-to-kitchen restaurant call systems, and for local fairs and carnivals. The new sound system is to be known as Model PG63-B and will be made available to radio and electrical supply dealers and service organizations through the regular RCA Victor Distributors . . . and in some cities through RCA Victor Commercial Sound Distributors as well.

Exceptional tone quality and simplicity of operation are two of the principal features which distinguish this low-cost system, according to Mr. W. L. Rothenberger, Manager of RCA Victor Commercial Sound Sales. The equipment has been designed so that actual operation is as convenient and fool-proof as that of an ordinary radio receiver, he said. It is only necessary to connect the power plug to the 110-volt, 50/60-cycle house-current supply, and plug in the microphone and speaker cables to set the system in operation. The loudspeaker, which is embedded in the cover, may be separated from the rest of the carrying case and suspended from a hook within a 25-foot radius of the speaker cable. The microphone is of the close-talking type with 12 feet of extension cord. The complete unit measures 8½ by 16½ by 16 inches.

PHILCO MODEL 088 ALL-WAVE SIGNAL GENERATOR

The Philco Radio & Television Corporation has just announced the development of the Philco Model 088 All-Wave Signal Generator. It has five separate scales, each of which is accurately calibrated and easy to read. The scales range continuously in frequency from 110 kc to 20 megacycles. In each case the individual scale is a fundamental oscillator frequency range. In other words, no harmonics are used to get additional ranges, because in each case the oscillator circuit is operating on a fundamental frequency at all times. The attenuator is continuously variable, but is calibrated in ten points, making it possible to obtain a measurement of sensitivity when testing the receiver.

The panel of the Model 088 is furnished in attractive chromium plate or polished brass. It is made in both styles so that it will match the Philco Model 025 Circuit Tester and thus afford Service Men who possess one of those instruments a complete set of test equipment all in one unit. A special wooden case is available to accompany this set as a special item so that the Model 088 and Model 025 can both be carried together as a complete unit.

The circuit of the Philco Model 088 is a highly stabilized electron-coupled oscillator arrangement using the Philco type 1C6 tube. This tube operates on two 22½-volt "B" batteries and two 1½-volt flashlight cells. The 8-ohm resistor in series with one side of the flashlight battery produces the filament voltage of the proper value for the 1C6 tube.

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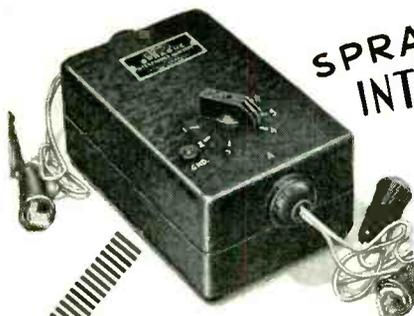
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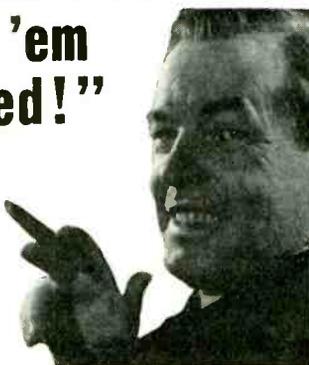
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“You won't catch me putting low wattage resistors in my service jobs. My time is worth more than the difference in price between cheap resistors and BROWN DEVILS. I use BROWN DEVILS because I know the vitreous enamel coating will stand up, and because these units maintain constant resistance values.”



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MACY DEFLECTOR Baffle & Floor Stand

The answer to all speaker mounting problems, stadiums, sound-truck, indoor, outdoor, etc. The well balanced stand weighing 32 lbs. is finished in a durable shrivelled black. The deflector baffle is an aluminum spinning finished in a brilliant aluminum color. It can be directed and easily locked in any position desired. Overall height, 6 ft. A weatherproof snap-on cover for bell opening included. Will accommodate all speakers of sizes not exceeding an overall outside diameter of 12½ in.

Complete as illustrated—Model MFB-10, dealers' net price, \$23.52. Deflector, Baffle alone—Model MB-10, Dealers' net price, \$8.82. Mounting Fixture, as illustrated—Model SA-10, Dealers' net price, \$5.20.

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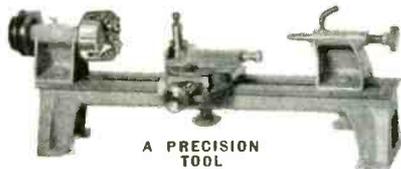


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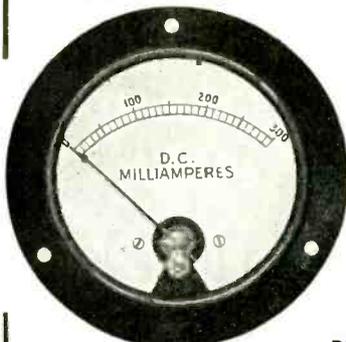
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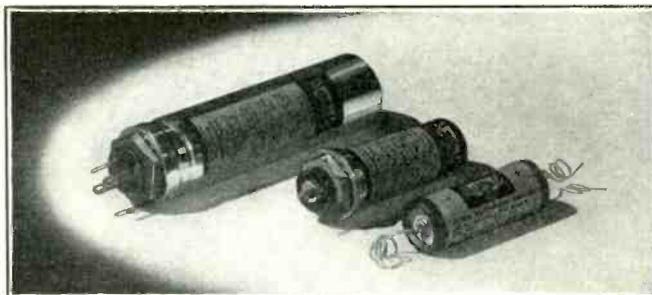
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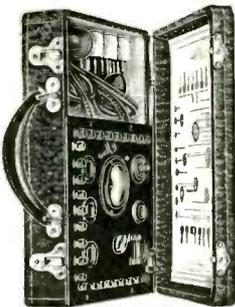
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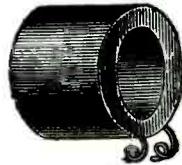
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